STULZ

CLIMATE. CUSTOMIZED.

E^2 Series Microprocessor Controller

Conditioners Operation Manual
Precision Air

QUICK START INSTRUCTIONS

FOR INITIAL START-UP,
SEE SECTION 3.3
Starting the A/C System

Notice

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1.0 GENERAL INFORMATION

1.1 Forward

The microprocessor based, STULZ E^2 Series Controller covered by this manual is designed and manufactured by STULZ Air Technology Systems, Inc. (STULZ) using the latest, state-of-the-art control technology.

Recognized as a world leader, STULZ provides precision A/C systems and controllers manufactured with the highest quality craftsmanship using the finest materials available in the industry.

The controller will provide years of trouble free service if it is operated and maintained in accordance with this manual. Damage to the unit from improper installation, operation or maintenance is not covered by the warranty.

This manual is applicable to the STULZ E^2 Series Controller software versions for CyberAir family systems up to v3.24, released in July, 2015 and after. It contains information for the operation of the controller. STUDY the instructions contained in this manual.

They must be followed to ensure proper operation. Spare parts are available from STULZ to ensure continuous operation. Using substitute parts or bypassing electrical components in order to continue operation is not recommended and will VOID THE WARRANTY. Due to technological advancements, components are subject to change without notice.

STULZ E^2 Series Controllers are designed primarily to precisely operate, control and monitor STULZ precision air conditioning systems. Any use beyond this is deemed to be not intended. STULZ is not liable for any damage from improper use.

1.2 Safety Summary

Read and understand all instructions in this manual relating to the specific function to be performed prior to starting the task.

Carefully read and understand all notes, cautions and warnings contained in this manual that pertain to the task to be performed. Warnings indicate potential threat to personnel safety. Cautions indicate potential threat of damage to equipment.

Carefully read and understand all WARNING and/or CAUTION labels located on the unit.

1.3 Warnings and Cautions

A bold text **WARNING** safety alert appears with information that is important for protecting personnel from harm and the equipment from damage. Pay very close attention to all warnings that apply to the application.

A safety alert symbol ⚠ accompanies a general WARNING or **CAUTION** safety statement. A safety alert symbol accompanies an electrical shock hazard WARNING or CAUTION safety statement.

The following statements are general guidelines followed by warnings and cautions applicable throughout the manual.

CAUTIONS ⚠

Prior to operating the unit, read and understand all instructions, recommendations and guidelines contained within this manual.

All adjustments, maintenance and/or repairs must be performed by a qualified technician.

Equipment may contain components subject to Electrostatic Discharge (ESD). Before attempting to mount or service these electronic devices, ensure you have no charge built up by touching a ground source. When possible, use a wrist-grounding strap when working on or near electronic devices

NOTE: We recommend contacting STULZ Product Support for assistance with adjusting or servicing the A/C unit.

WARNING

If a fault occurs when operating the A/C unit or adjusting control parameters, it must be corrected immediately in accordance with the troubleshooting instructions for the A/C unit.

2.0 DESCRIPTION

The advanced microprocessor based, STULZ E^2 Series controller is a highly versatile and flexible A/C system controller. It is designed primarily for STULZ Precision Air Conditioners.

The controller is equipped with flexible software capable of meeting the specific needs of the application. The controller is completely programmed at the factory and therefore, most applications will require no field set-up.

However, the default setpoints and their ranges are easily viewed and adjusted from the user interface display. The program and operating parameters are permanently stored on flash memory in case of power failure.

The controller is designed to manage temperature and humidity levels to a user defined setpoint via control output signals to the A/C system. Control parameters have variable outputs from 0 to 100% of the full rated capacity.

The controller receives inputs for the measurable control conditions (temperature and relative humidity) via return air or room mounted sensors. The internal logic determines if the conditions require cooling, heating, humidification or dehumidification. Control setpoints are established to maintain the room's designed conditions.

The controller responds accordingly to changes and controls the output(s) to the air conditioning system so temperature/ humidity conditions reach the user defined control setpoints.

The STULZ E^2 Series controller continually monitors conditions and maintains setpoints using STULZ's unique psychrometric control method.

The controller logically examines the combination of temperature and relative humidity (dewpoint) and determines the proper control of cooling, heating, humidification and dehumidification to move the actual conditions to within the boundaries of the temperature/ humidity setpoints as they would appear on a psychrometric chart.

It avoids scenarios where the cooling unit might both cool and humidify the air when cooling alone will achieve the desired result. This control method results in higher operational efficiency and shorter component run-times.

2.1 Features

2.1.1 Field Configurable

The program for the STULZ E^2 Series controller is field configurable. Operator interface for the STULZ E^2 Series controller is provided via a door mounted user interface display panel. The display panel has a backlit LCD graphical display and function keys giving the user complete control and monitoring capability of the precision cooling system.

The menu driven interface provides users the ability to scroll through and enter various menu screens.

Monitoring of room conditions and A/C system operation is allowed without entering a password. Modifications to the control setpoints require the use of a password.

2.1.2 Password Protection

Access to the Info menu and Alarms log is allowed without the use of a password. The controller is programmed to recognize predetermined security levels before allowing access to display screens containing critical variables. Four secured menu levels (Control, Service, Factory and Configuration) support unique passwords that must be entered to access the menu screens so only authorized personnel may perform modifications to the settings. This Manual covers Information, Control and Service levels only. The Factory and Configuration levels are covered in a separate manual.

Restorable Setpoint Parameters

Upon initial start-up the A/C system operates using the setpoints programmed by the factory. New operating parameters may be entered in the Control level and the system will then operate accordingly. The new setpoints may be stored as Customer default setpoints in the Service>Save Cfg menu screen. The primary setpoints entered by the factory still remain stored in the controller's memory as Factory setpoints.

The setpoints for the system may be re-adjusted in the Control level at any time. Use the Service>Save Cfg menu screen to restore the setpoints to the Customer Default setpoint values or to the original Factory setpoint values.

Weekly Timer Feature

The weekly timer allows the user to set up an operating schedule to automatically scale back or shut down the air conditioner during low demand or unoccupied periods. This is an energy saving feature offering the user the ability to create an operating schedule tailored to the needs of the building. An evening (night-setback) schedule may also be created, allowing the A/C unit to operate at night with relaxed temperature/ humidity setpoints and offsets.

A/C Grouping pLAN Operation

Multiple A/C units, consisting of up to eight (8) STULZ precision air conditioners equipped with STULZ E^2 Series controllers, can be connected (grouped) through the pLAN. The pLAN puts all displays and controllers on a single RS-485 connection to allow information to be exchanged among all the controllers.

Each display and controller have a unique, predefined address. Each controller in a group can be configured as Active, Assist or Standby. Units that are Active are used to maintain the setpoints.

Units that are Assist are used to step in if the Active units are unable to maintain the setpoints. Units that are Standby are used as backup units in case of a failure of either an Active or Assist unit. The role of lead controller can be assigned to one of the Active AC units. Rotation of the lead unit function to the next Active unit can be set to occur hourly, daily at a specific time or weekly on a specific day at a specific time.

This allows the units within the group to be operated for equal times on a periodic time basis. See section 7.0 for more details

2.1.3 BMS Interface

The STULZ E^2 Series controller may incorporate a communication interface port (Table 1) that can be field connected to a Building Management System via Modbus, BACnet, SNMP or HTTP protocol as configured by the factory. A controller interfaced to a network must be configured for BMS communication.

Table 1. BMS Interface Ports

Item	Description
	BMS Interface
	BACnet NS/TP
	Modbus RTU
	BACnet IP, BACnet Ethernet HTTP, SNMP and Modbus IP

2.1.4 User Interface Terminals

Several user interface terminals are available with STULZ E^2 Series controllers. The A/C unit may be equipped with a large bezel terminal typically mounted on the door of the unit or a small bezel terminal (termed graphic terminal) which may be door mounted or remotely mounted to a wall or control panel. See the following sections for an overview of the user interface display panels available.

2.1.5 Graphic Terminal

The STULZ graphic terminal features an easy to read, backlit liquid-crystal alphanumeric display equipped with LED illuminated function keys. The screens that appear on the display present data that originates from the controller. The controller is operated via 6-key menu-driven loop structure and offers an alarm log plus four different interface menu levels to the operator: Information, Control, Service, and Factory. These menus permit the user to easily view, control and configure operating parameters for the A/C unit .

As an option, the graphic terminal may be shipped loose for remote mounting. It may be located directly on a wall or control panel using the mounting kit provided. Install the terminal in a secure area where it cannot be tampered with. A 30-foot long RJ11 telephone type cable harness is provided for interconnecting the display to the controller. Refer to the electrical drawing supplied with the unit for details on the interconnecting field wiring.

2.1.6. Function Keys

Table 2. BMS Function Keys

KEY	FUNCTION
	Accesses the active alarm screen(s) Silences audible alarms Resets active alarms in the alarm menu
Prg	Accesses the main menu Illuminates yellow when unit is on
Esc	Returns to the previous menu level Cancels a changed entry
	Steps back to the previous screen in display menu Changes (increases) the value of a modifiable field
	Starts/Stops operation (if Auto-On Powerup isn't enabled) Moves the cursor into a modifiable field Accepts current value of a modifiable field
	Steps to the next screen in display menu Changes (decreases) the value of a modifiable field

2.1.7 Alarms

Alarm conditions activate a red LED indicator that backlights the alarm function key. As an option, an alarm condition may also be enunciated by an audible alarm signal. An alarm is acknowledged by pressing the alarm key. This calls up alarm display screen(s) that provide a text message detailing the alarm condition(s). After an alarm condition is corrected, the alarm can be cleared by pressing the alarm key.

2.1.8 Contrast Adjustment

Press and hold the () and (Prg) keys; then use the Up (↑) and Down (↓) keys to adjust the contrast.

2.1.9 Large Bezel Terminal

Figure 1- Large Bezel Terminal

The large bezel terminal is typically mounted on the door of the A/C cabinet. It features the same backlit liquid-crystal alphanumeric display screens that the graphic terminal uses. A round membrane type keypad is provided to the right of the display screen to navigate through the controller menus and adjust operating parameters.

The symbols on the round keypad are operationally identical to the function keys on the graphic terminal (see section 2.3.1.1).

When the A/C unit is on, a soft blue light illuminates the Status region on the right side of the terminal indicating normal operation. If the color of the Status region changes to red, it indicates an alarm condition. As with the graphic terminal, an alarm is acknowledged by pressing the alarm symbol on the round keypad.

After an alarm condition is corrected, the alarm can be cleared by pressing the alarm symbol again. This resets the A/C system and turns the color in the status region back to blue.

2.1.10 Large Bezel Touch Screen Terminal

Your STULZ air conditioner has an easy-to-use, touch screen, user interface display panel. The touch screen display panel features a high-resolution LCD graphical display E² controller menu (see Figure 1).

Figure 2- E² Touch Screen Display Panel

The display panel, mounted to the door of the air conditioning(A/C) unit, enables you to precisely control and monitor the operation of your A/C unit. When the A/C unit is on, a soft blue light illuminates the Status region on the right side of the panel indicating normal operation.

See the E² Controller Operation Manual for detailed information on operating the system controller, adjusting control parameters and acknowledging alarm messages.

To control parameters, when power is applied to the A/C unit, an operator interface is available through the controller display panel.

2.1.11 Alarms

If the color of the Status region on the display panel changes to red, it indicates an alarm condition has been detected. Press the alarm symbol on display to view active alarm messages. Then use the Up or Down arrows to scroll for any additional active alarms.

Once the current alarm condition(s) are corrected, press the alarm symbol on the display to reset the controller. This restarts the A/C system and turns the color in the Status region back to blue. If the alarm condition was a critical alarm such as a fire/smoke alarm, a message Off-manual restart reqd appears in the bottom of the screen.

Press Enter to restart the A/C system.

Review the E² Controller Operation Manual sections 5.3.1 for a detailed overview of system alarms.

2.1.12 LCD Display Screen

Touch anywhere on the display screen to illuminates it and to view the screens. The first screen to appear is the Main screen (see Figure 2). It displays:

- Current date
- Time
- Relative humidity
- Dewpoint conditions

All are described in Section 3.3 of the *E*² Controller Operation Manual.

Icons for navigating the menus are arranged along the right side of the screen. They indicate the current operating mode(s) of the A/C system. Some navigating icons replicate the symbols positioned in the round keypad.

By default, the screen illumination dims if you do not touch the screen for 1 minute. The screen will remain dimmed for an additional 15 minutes and then turns off while the controller continues to operate.

Icon	Description
	Alarm key
	Access Main Menu, return to previous menu level
	Step to next screen in menu loop, increase a modifiable value
	Program key
	Step back to previous screen in menu loop, decrease a modifiable value

2.1.13 Navigating Menu Screens

From the Main screen, press Prg to access the Main menu. The Main menu displays icons that when touched, take you to the menu loops indicated. The menu loops are described in detail in section 5.0 of the E^2 Controller Operation Manual.

The touch screen user interface display panel presents menu screens that appear in the same sequential order. It shows the same information as described in the manual.

2.1.14 Graphs Menu

In addition to the menu loops described in the E^2 Controller Operation Manual, a graphs menu loop is available with the E^2 touch screen display panel. Press the GRAPH icon in the Main menu screen to enter a menu loop to view the history of the following graphs are recorded by the E^2 Controller.

- Temperature
- Humidity
- Dewpoint conditions.
- Fan operating history

Press the Up and Down arrows on the screen to scroll through the available graph screens. The following graphs are available to view.

Control Temperature Graph — The first graph to appear is the Control Temperature Graph. The current control temperature always appears at the top of the screen.

The date and time appearing at the bottom of the graph coincide with the point-in-time displayed. You may use the navigating keys described below, to scroll back and forth through time or move the temperature scale (y-axis) up and down.

Control Temperature Graph — The first graph to appear is the Control Temperature Graph. The current control temperature always appears at the top of the screen.

Control Temperature vs. Humidity Graph
In the Control Temperature vs. Humidity graph, the humidity scale and graph line are superimposed in blue over the temperature graph. This enables you to view both temperature and relative humidity history for various times.

Control Temperature vs. Dewpoint Graph — In the Control Temperature vs. Dewpoint graph, the dewpoint scale and graph line are superimposed in blue over the temperature graph. This enables you to view both temperature and dewpoint history together for various points in time.

1. Fan Speed Graph — In the Fan Speed graph, the fan speed graph line is shown in white. The fan speed is defined as a percentage of the fan's full rated speed.
2. CW Valve Graph —If your unit is configured for CW operation, this graph appears.
3. In the CW Valve graph, the valve position graph line is shown. The valve position is defined as a percentage of the valve's fully open position.
4. CW Valve vs. Fan Speed Graph— If your unit is configured for CW operation, this graph appears. In the CW Valve vs. Fan Speed graph, the fan speed scale and graph line are superimposed over the CW Valve graph. The fan speed is defined as a percentage of the fan's full rated speed.

2.1.15 Graph Navigating Icons

Navigating icons are arranged along the bottom- and right-hand side of the graph screens. These icons enable you to:

- Scroll the X and Y axis
- Enlarge or shrink the screen view
- Select a point in time to display the recorded temperature and humidity

Table 3 – Graph Navigating Icons

Icon	Description
	Pan mode
	Pan to oldest recorded data
	Pan left
	Pan right
	Pan up
	Pan down
	Pan to latest
	Pan auto-latest (updates each minute)
/	Show/hide graph line 0
/	Pan touch enabled/disabled
	Zoom mode
	Zoom x-axis in (range 1 minute to 60 months)
	Zoom x-axis out (range 1 minute to 60 months)
	Zoom y-axis in
	Zoom y-axis out
	Reset x-axis default (beginning of time scale)
	Reset y-axis default (normal viewing range)
	Reset all x & y-axis defaults

A large bezel terminal with touch screen is available with certain A/C models. If the A/C unit is equipped with a touch screen terminal, refer to the addendum OZU0074 (provided under separate cover) for supplemental instructions.

2.4 Controller Models

The controller is a microprocessor with I/O modules mounted inside the A/C system electric box (see Figure 2 and Figure 3). The controller contains the software that manages the operating parameters of the A/C system. Several I/O module types are available depending upon the options that are needed with the air conditioning system.

2.4.1 GEN1 Controller Layout

The GEN1 controller is shown in Figure 2.

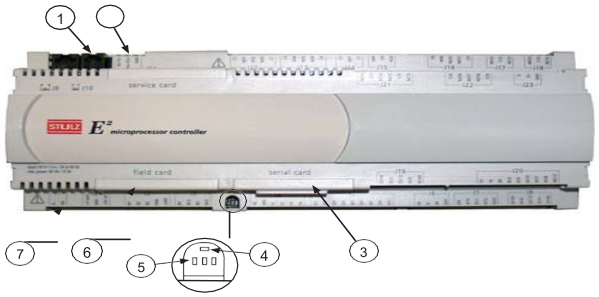


Figure 1. GEN1 Controller

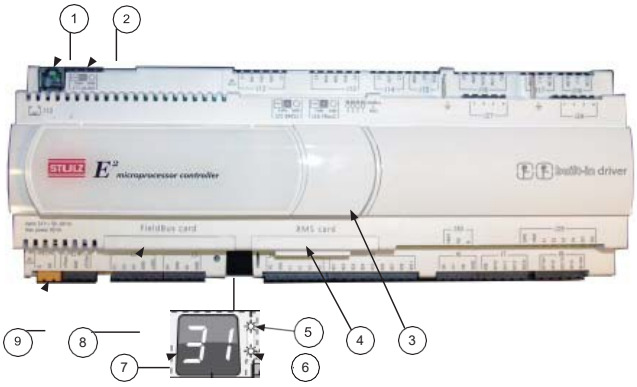


Figure 2. GEN2 Controller

The controller features called-out in Figure 2 are:

1. RJ11 telephone connector (J10) for display panel.
2. RS485 Connection for pLAN (J11).
3. Hatch for BMS or network interface port (see Figure 1).
4. Power on LED (Yellow).
5. Signal LEDs (Red, Yellow, Green). See Section 8.4.
6. Hatch for expansion I/O module(s).
7. Power connector (J1).

2.4.2 GEN2 Controller Layout

The GEN2 controller has additional input/output terminals for expanded capability. It may be expanded with a built-in EVD driver, used when electronic expansion valve(s) are provided. The GEN2 controller is shown in Figure 3.

The controller features called-out in Figure 3 are:

1. RJ11 telephone connector (J10) for display panel.
2. RS485 Connection for pLAN (J11).
3. Hatch for USB ports.
4. Hatch for BMS or network port.
5. Power on LED.
6. Overload LED.
7. Controller pLAN Address Display.
8. Hatch for expansion I/O module(s).
9. Power connector (J1).

2.4.3 Expansion I/O Modules

The controller's capabilities may be enhanced by the addition of expansion I/O modules which are DIN rail mounted in the electric box. They are typically used when selected optional features are purchased. Expansion I/O modules are used to enable additional alarms, additional blowers, air speed monitoring or air pressure monitoring.

2.4.4 Constant Contact UPS Module

An optional Constant Contact UPS module provides short term power for the controller should there be an interruption to, or inconsistency with, the main power source. If main power is lost, the Constant Contact module provides 32 VDC control power to the controller.

The controller will not have to reboot due to a power interruption. This allows the controller to continue monitoring sensor input signals and maintain communications with a BMS for up to one minute. The Constant Contact module requires no routine maintenance as there are no batteries that need to be replaced.

CAUTION 

When the power supply to the equipment has been shut off to service the unit, be aware that the Constant Contact UPS module in the electric box still contains stored electric power up to 32 VDC. This voltage will also be present in circuits that are electrically common to the constant contact module.

2.4.5 EVD Module

An electronic expansion valve (EEV) may be used on certain compressor-based models. Control of the EEV is accomplished with an electronic valve driver module (EVD). The EVD may be a separate expansion module or it may be incorporated into a GEN2 controller, depending on the I/O configuration.

3.0 STARTUP

3.1 Navigating Controller Screens

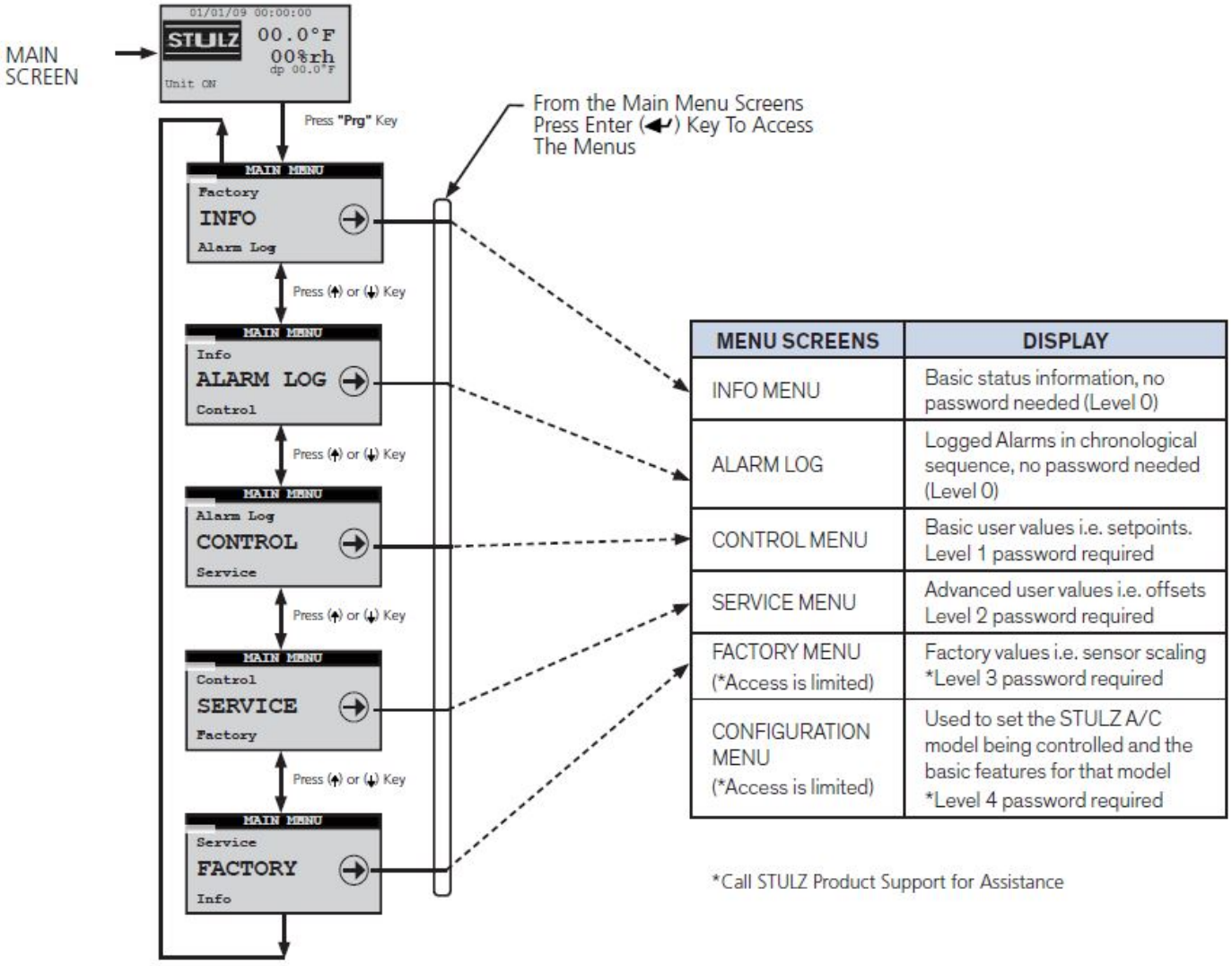
3.1.1 Menu Selection

The STULZ E^2 Series controller provides five user selectable menus needed to view operating data and enter setpoints for the system (see Figure 4). These menus may be accessed from a scrolling Main menu screen by pressing the Program key. Scroll between adjacent menu selections within the Main menu by use of the Up and Down arrow keys.

When the desired menu is centered in the screen with bold capital letters and an arrow symbol pointing towards the Enter ( ) key, press the Enter key to access that menu. Menu screens located within the designated menu selection may be accessed using the Up and Down arrow keys. Access to some menus are protected by a built-in security protocol and requires the use of a pass word to gain access.

3.1.2 Menus

From the Main screen press the Program key to select from among the five menus shown in Figure 4.



MENU SCREENS	DISPLAY
INFO MENU	Basic status information, no password needed (Level 0)
ALARM LOG	Logged Alarms in chronological sequence, no password needed (Level 0)
CONTROL MENU	Basic user values i.e. setpoints. Level 1 password required
SERVICE MENU	Advanced user values i.e. offsets Level 2 password required
FACTORY MENU (*Access is limited)	Factory values i.e. sensor scaling *Level 3 password required
CONFIGURATION MENU (*Access is limited)	Used to set the STULZ A/C model being controlled and the basic features for that model *Level 4 password required

*Call STULZ Product Support for Assistance

Figure 4. Menu Selections

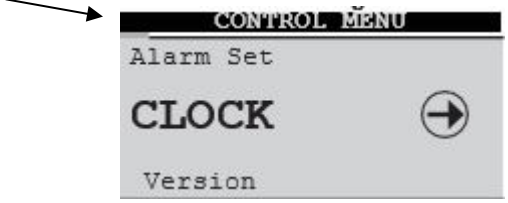
3.1.3 Display Variables

The user interface display panel provides screens with three different forms of both the read only and the modifiable variables:

- Integers are displayed either as signed or un-signed numbers.
- Analog values are displayed either as signed or un- signed numbers with 1 decimal point of precision.
- Dual-State can be toggled between two values for example, On/Off, Yes/No, and so on.
- Word Variables have a unique text message for each of the variable's possible choices.

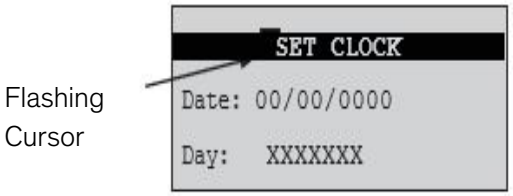
3.1.4 Cursor Position in Screens

The following display screen is shown as an example after accessing a new menu using the function keys. The name of the menu is the line in the upper-most field of the screen. A flashing window also appears in the left side of the upper-most field indicating you're in the top level of that menu.



From this position the Up and Down arrow keys access additional selections within the current menu.

Each screen supports specific functions. Pressing the Enter key allows access to the selected display screens to adjust any of the modifiable fields. If a screen with modifiable values is accessed, the Enter ( ) key may be pressed to insert a flashing cursor in the modifiable fields within that screen.



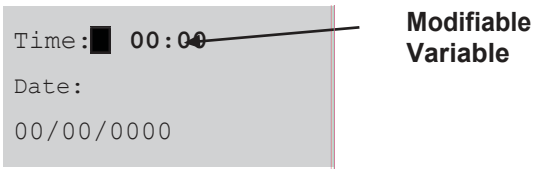
If the flashing cursor is located in a modifiable field, the value of the field will be changed with the use of the Up and Down) arrow keys. When the Enter ( ) key is pressed, the new value is saved and the cursor moves to the next modifiable field.

After entering the last modifiable field within a screen, pressing the Enter key removes the cursor and the flashing window reappears in the left-hand corner of the upper-most field of the current screen. From here, advancement to the next adjacent menu screen occurs when the Up or Down key is pressed. Successive use of the Enter key will advance the cursor through the various modifiable fields of the display screen eventually returning to the first field.

Values that are already correct may simply be skipped over by using the Enter key without modification of the variable. The current value, if not changed, will be retained after pressing the Enter key**.** Values for fields being adjusted will automatically wrap when adjusted beyond the high or low limit established for that field.

Whenever the flashing cursor is located in a modifiable field, pressing the Escape key one time returns the user to the next menu level up. Each successive use of the Escape key returns the operator to the next menu level up until the Main screen is reached.

3.1.5 Modifiable Variables



For the purpose of this manual the examples of user modifiable variables within display screens will be denoted by bold text. (Please note the actual display may not use bold text.) Pressing the Enter key accepts the value displayed and advances the cursor to the next modifiable field. The Up or Down key may be used to modify the values of these fields.

If the modifiable field is a positive number, the positive value is indicated by the absence of a negative symbol. The negative symbol will be displayed to the left of the first digit for negative numbers.

3.1.6 Password Authorization Levels

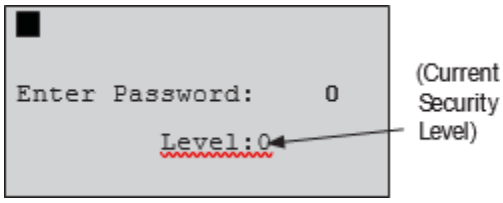
Access to a menu may be requested from the main menu. Modifiable control screens have variables that affect system performance. Improper settings may result in erratic operation and possible system failure or damage. Anyone is allowed direct access to the Info and Alarm log display menus with no security password

Only authorized personnel who possess a thorough understanding of the system operation should perform modifications to secured menu settings (Control, Service, Factory and Configuration). The screens must have accurate variables entered otherwise erratic operation may occur. These menus are configured with password protection, thus requiring a higher level of authority to access them.

3.1.7 Password Protected Screens

Upon first attempting to select a secure menu in a given session, the Enter Password screen will be displayed. This screen displays the current security level authorized in the lower field.

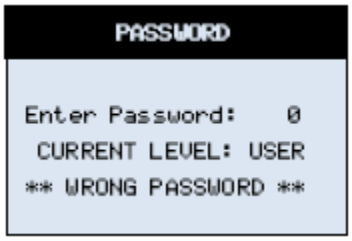
A session is defined as from the time access is gained to a secure menu until 300 seconds (five minutes) elapses with no key activity. Security access will be terminated at this point and the password will have to be re-entered to gain access. The menus that may be password protected by the user are the Control and Service menus. The Factory level menu screens are also password protected however the password is set at the factory to limit access.



It is intended that access to the Factory menu screens only be granted while the user is working with the guidance of STULZ Product Support (see Section 9.0) because incorrect settings made at that level could unintentionally damage the equipment. The level of authority is established by entering the proper password for a given security level. The controller is shipped from the factory with preset passwords for all of the security levels.

Operators who are allowed access to the Service menu (level 2) for example, must know the password to enter that level. If the entered password equals or exceeds the level requested during a given session, the operator is allowed to access the requested menu. For example, if the entered password allows access to level 2 and the Control menu (level 1) is requested, access will be allowed. If the entered password authority level is lower than the level requested, the words WRONG PASSWORD will appear for several seconds at the bottom of the screen.

3.1.8 Wrong Password



The **WRONG PASSWORD** message is displayed any time an incorrect password is entered and the Enter key is pressed. If the "Wrong Password" message appears, use of the Enter key will return the operator to the **Enter** Password field. A requested menu is displayed any time a valid password is entered and the Enter key is pressed.

3.1.9 Starting the A/C System

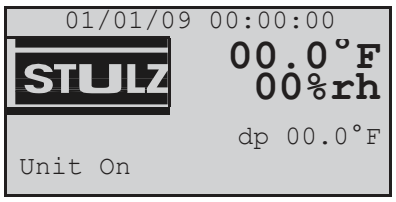
3.1.10 Setting the Passwords

The initial passwords are set by the factory to **1** for the Control menu and to **2** for the Service menu. In the Service>Save Cfg menu, the operator is allowed to change the passwords. Ensure all system hookups to the air conditioner(s) are the Control and Service menus. If changed, from that point on, access may only be gained to that menu by personnel who know the new password completed and that power is available.

Turn the main power disconnect switch for the A/C unit to ON. Upon applying control power, the controller display function keys illuminate and the controller begins con- ducting internal diagnostics to confirm functionality. The controller monitors the alarm inputs and alarm logic to determine if it's safe to start the unit. After about 30 seconds the Main screen is displayed. The Main Screen is a status screen displaying the current date, time, temperature, relative humidity and dewpoint conditions. It also indicates the current system operating status.

1. If the controller is configured for **Automatic On** operation (standard), a status message **Unit On** then appears in the display and the controller begins the startup sequence.

   Note: The A/C unit may be turned off at any time by pressing and holding the Enter key for 3 seconds.



Main Screen

2. If the status message **OFF - Manual Restart Req** appears instead of **Unit On**, turn the air conditioner on by pressing the Enter ( ) key. In this case the Automatic On feature may not be enabled in the Service>Options menu (see Section 5.5.7.1).

   Other status messages that may appear at the bottom of the screen are:

   Off by Remote Shutdown - Indicates the Remote Start/Stop feature is enabled and requires a remote start switch to be turned On.
   Off by Clock - Unit is off by time clock schedule.
   Off by Network - Indicates the unit is part of a group and is off due to a grouping priority command such as a compressor alarm or loss of air flow, or,
   the BMS communication feature is enabled and the unit received a network signal to pause operation.

Off by Internal Alarm - Unit is off due to a group alarm condition. (Only active with grouped units.)

Unit on CL Lockout – This indicates cooling has been locked out while there is a demand for dehumidification because the temperature is below the minimum temperature allowable for dehumidification (factory default setting is 4°below setpoint).

Off by Loss of Power - Displayed on units with dual power sources and a power loss occurs. It is removed when a switch over to a good power source occurs.

Off by Damper Failure - If equipped with a damper and the damper failed to open.

Off by Shadow - If configured to be a shadow unit and the main unit is off.

Off by Water Alarm- Water alarm as configured (I.E. leak detected, CW/WG alarm, humidifier alarm).

3. If damper control is enabled, a delay occurs to allow the dampers to open before starting the blower(s). The blower(s) are allowed to begin operating 20 seconds after **Unit On** appears, or after the damper enable delay expires (if applicable). The STULZ logo in the display is replaced with a blower symbol and a message **Unit ON NO Airflow** appears.

   Airflow is monitored by an air proving sensor. Appropriate airflow must be detected before the controller outputs are enabled to perform cooling, heating, humidification and dehumidification. Upon detecting a loss of airflow, the controller shuts down all system outputs (except the blowers and damper enable) and signals an alarm.

4. When adequate airflow is detected, the status message "No Airflow" disappears and the message Unit On remains in the display. The controller automatically enables the control outputs as defined by the A/C system configuration and records the date and time power is re- initialized in the alarm history log.

5. If the actual room conditions are not within the range of the programmed setpoints, the system will begin operating in the mode(s) needed to reach the setpoints (cooling heating, humidifying or dehumidifying). Symbols (shown below) appear in the display to indicate the active operating mode(s).

   = Blower On

   = Cooling Enabled (Compressor 1)

   = Cooling Stage 2 Enabled (Compressor 2)

   = Cooling Stage 3 Enabled (Compressors 1b +2)*

   = Cooling Stage 4 Enabled (Compressors 1a+1b +2)*

   (* Tandem compressor applications; see Section 4.11)

   = Cooling Enabled (CW Based Units)

   = Cooling Enabled (FC/AWS Based Units)

   = Heating

   = Two Stages of Heating

   = Three Stages of Heating

   = SCR Heat

   = Humidifying

   = Dehumidifying

   = Compressor/Humidifier/Heater Locked Out

   = Compressor/Humidifier/Heater Locked Out by BMS

   = CW Coil Flush Cycle On

   Bar graph icons are used to indicate certain proportionally controlled operating modes such as (CW Cooling, SCR Heat and FC Cooling). The number of bars appearing in the icon vary and provide a general indication of the magnitude of the proportional output signal controlling that mode. That is, four bars) indicate a high output, two bars) indicate a lower output.

6. Temperature and humidity alarms are masked out for 30 minutes to allow for conditions to stabilize without triggering nuisance alarms.

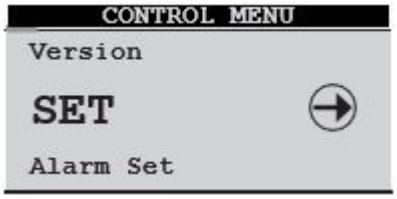
7. Operator interface to the display menu screens is available from the Main screen by pressing the Program ***(Prg)*** key. The controller starts a timer whenever a key sequence is initiated. Every time a button is pressed, the timer is reset. If there is no key activity for 60 seconds, the controller will return to the Main screen.

3.4 Setpoint Adjustment

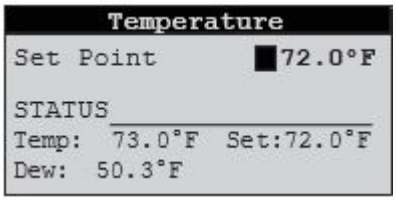
1. From the Main screen, access the Main menu screen by pressing the program key.
2. Scroll through the Main menu selections with the Up and Down arrow keys and select the Control menu by pressing the Enter ( ) key when **CONTROL** appears in bold letters in the center of the screen. If no password is active that allows the Control menu to be entered, a password entry screen will be displayed.
3. To access the Control menu, press the Enter key to insert a flashing cursor in the Enter Password field.

Change the 0 to 1 (or to the current Control menu password if it was changed in the Service menu) with the Up arrow key and then press the Enter key to accept the password. Press the Enter key again to access the Control menu screens.

4. From the Control menu, select Setpoints by scrolling through the menu selections with the Up and Down arrow keys and pressing the Enter key when **SET** appears in bold capital letters in the center of the screen.

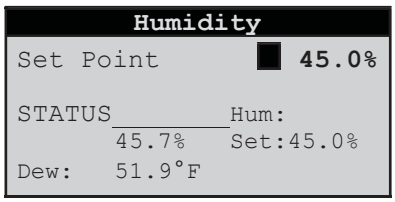


5. After entering the Setpoints screens, select the Temperature setpoint screen by scrolling through the menu selections with the Up and Down arrow keys until the word "Temperature" appears in the field at the top of the screen.



Pressing the Enter key places the flashing cursor in the setpoint value field. Increase or decrease the Temperature Setpoint with the Up and Down arrow keys until the desired temperature value is shown. Press the Enter key again to accept the setpoint (this removes the cursor from the field).

6. From the Temperature setpoint screen, select the Humidity Setpoint screen by scrolling with the Up or Down arrow key. When the word Humidity appears, press the Enter key to move the cursor into the setpoint value field.



Increase or decrease the Humidity Setpoint with the Up and Down arrow keys until the desired humidity value is shown. Press the Enter key again to accept the setpoint and then press the Escape key to return to the Control >Setpoints (**SET**) menu screen.

7. Press the Escape (Esc) key twice to exit the Control>Setpoints screens and return to the Main menu screen.
8. Observe the indicator symbols in the Main screen to determine if the unit is operating in the required mode(s).
9. One to six hours may be required to see the desired temperature/humidity level in the conditioned space. Once room conditions have been programmed or set, a repeat visit to the conditioned site may be required to ensure the air conditioner is meeting the room's requirements.

3.5 Saving and Restoring Setpoint Parameters

Upon initial start-up the system operates using the setpoints programmed by the factory(primary setpoints) as the operating setpoints. As described in Section 3.4, new operating parameters may be entered in the Control menu anytime and the system will then operate accordingly. The new setpoints may be stored in the Service>Save Cfg>Customer Save menu screen. The primary setpoints entered by the factory still remain stored in the controller's memory as the Factory setpoints.

At any time, setpoints for the system may be re-adjusted to any value and the system will operate accordingly. If it becomes necessary however, the Service>Save Cfg menu may be entered and the setpoints to the saved Customer operating setpoint values may be restored. The original Factory (primary) setpoint values may also be restored from the Service menu. Whichever setpoints are restored (Factory or Customer), become the current operating setpoints.

3.6 Alarms

As programmed into the system controller, an alarm condition activates the summary alarm logic which illuminates the alarm key and energizes an audible alarm. Some alarms are programmed by the factory to automatically shut down the A/C unit until the alarm condition is remedied and the alarm is cleared by pressing the alarm key. Alarm conditions that shut down the A/C unit are termed "Critical Alarms". Some of the alarms that may be enabled by the factory are listed in Section 5.3.

3.6.1 Summary Alarm

A summary alarm will activate when the controller senses any programmed alarm condition. This illuminates the alarm key and a N.O./N.C. summary alarm contact is energized for remote monitoring of alarm conditions.

3.6.2 Customer Alarms

A customer provided digital (on/off switching) alarm sensor may be connected to terminals provided in the electric box. This may be for any site specific alarm condition the user wishes to monitor that may or may not be provided in the standard A/C alarms menu; i.e. gas detection, intrusion alarm, etc. Upon detection of a customer alarm, the controller will activate the summary alarm contact and display a screen message indicating a customer alarm message.

The screen message "Customer Alarm 1" will appear in the controller display by default or, the user may reconfigure the controller to display any alpha-numeric message desired, up to 20 characters long. (see Section 5.5.7.7.1, Service>Options>Custom menu).

3.6.3 Custom Alarms

A custom (user configured) alarm is activated upon detection of one or more programmed alarm conditions as set by the operator in the Service>Options>Custom menu (see Section 5.5.7.7.2). When a custom alarm condition is detected, a summary alarm is signaled and a designated set of N.O. & N.C. Custom Alarm relay contacts may be energized to provide remote indication of the specific alarm condition(s).

For example, a custom alarm may be activated when a dirty filter alarm is detected, giving notice that the air filters need to be replaced. That way an alert is provided before the filters are so badly clogged that airflow is reduced to a point where a "Loss of airflow" alarm is activated.

The controller may be factory configured to activate up to three custom alarms depending on controller size and the enabled options. One custom alarm with relay contacts is provided as a standard and up to 2 additional custom alarms may be provided as an option.

4.0 OPERATION

4.1 General

The STULZ E^2 Series controller is designed to control an air conditioning system in a space or process application to temperature and humidity levels as defined by the user. Conditioned air is supplied to the space as needed to maintain the temperature/humidity control setpoints.

The controller is factory configured and manages inputs and outputs based on the specific application and equipment being controlled. Sensor(s) may be located in the process air inlet to monitor return air conditions and/or located in the process air outlet to monitor the discharge air or, installed in the conditioned space to monitor room air conditions. The controller uses the sensor inputs to determine the demand for cooling, heating, humidification and dehumidification based on the control setpoints. The controller determines the appropriate response (output signals) against the sensor input signals to operate the A/C system components.

The controller includes inputs and outputs as depicted in the unit schematic drawing supplied with the unit. Not all the inputs and outputs shown are used, therefore, only the inputs/outputs needed for the specific A/C system type and application are indicated on the drawing as enabled.

4.2 Temperature/Humidity Sensors

The controller is equipped with analog input positions for monitoring temperature and humidity sensor(s) for automatic operation of the air conditioner. Sensor(s) may be duct mounted to monitor return air conditions and/or located to monitor the supply or room air conditions for the controller to determine the demand for heating, cooling, humidifying and dehumidifying against the control setpoints. The controller determines the appropriate response output signal(s) to operate the A/C system.

4.2.1 Economizer Air Sensors

The controller may be configured to monitor an outside air temperature and humidity sensor and a room return air temperature and humidity sensor. The premixed air sensor values are used by the controller to activate and control an air-side damper for economizer operation.

4.3 Control Signals

Control and alarm recognition are through the controller analyzing signal inputs from return air temperature and humidity sensor(s).

4.3.1 On/Off Digital Control

Based on control inputs, the controller provides an on/off signal to activate certain modes of operation for the air conditioner(i.e. heater, blower, humidifier, pump, compressor or annunciate an operating condition status i.e. alarm condition).

4.3.2 Proportional/Integral (P/I) Control

The controller calculates proportional control output signal(s) based on the analysis of input signals which then determines the air conditioner's required mode(s) of operation. Signals representing temperature and humidity are each compared by the controller as a percentage value to the maximum control setpointvalue resulting in control output values that are directly proportional to the input signal.

The integral value is used to gradually adjust the proportional output when the calculated output does not move the process variable closer to setpoint in a given period of time. Decreasing the integral value decreases the interval for the output corrections (speeding the rate of adjustment). Increasing the integral value increases the interval for corrections (slowing the rate of adjustment).

4.4 Temperature/Humidity Control

The method of operation depends on the controller's programmed operating mode. Control takes place by means of the controller analyzing signal inputs from return air temperature and humidity sensor(s).

Any sensor values the controller receives from are mote temperature and/or RH sensor are prioritized as secondary to those received from are turn temperature/ RH sensor if controlling to the return air, or a supply temperature/RH sensor if controlling to the supply air.

4.4.1 Dewpoint Control

The STULZ E^2 Series controller may be configured for temperature and relative humidity or dewpoint control for dehumidification and humidification functions. When enabled for traditional relative humidity control, the controller continuously monitors the selected humidity control sensors (outdoor air or return air) to determine when to activate the humidification or dehumidification modes.

When enabled for dewpoint control, the controller logically examines the combination of temperature and relative humidity (dewpoint) and determines the proper control of cooling, heating, humidification and dehumidification to move the actual conditions to within the boundaries of the temperature/humidity setpoints as they would appear on a psychrometric chart (see Figure 5). It avoids scenarios where the A/C unit might both cool and humidify the supply air when cooling alone will achieve the desired result.

The calculated dewpoint property is used to enable the humidification or dehumidification modes which results in higher operational efficiency and shorter component run-times.

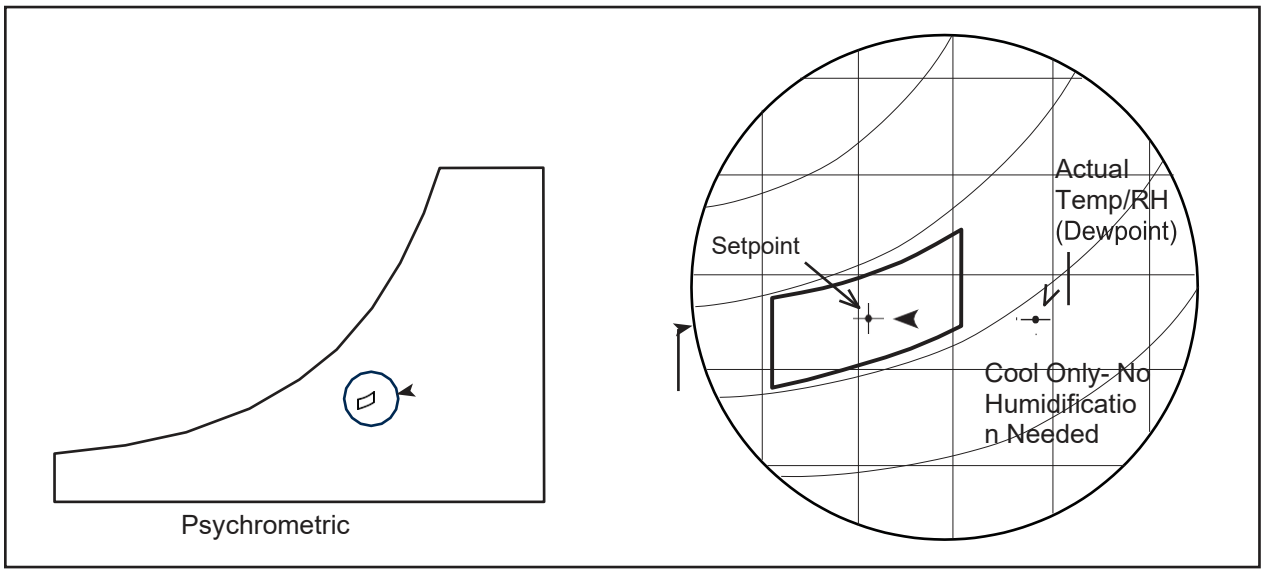


Figure 4. Dewpoint Control

On dual compressor systems, equipped with a remote condenser and enabled for hybrid control, the second stage of

cooling (compressor 2) is turned on when the measured dewpoint is above the dewpoint cut-in setpoint for the second stage. When the dewpoint drops below the cut-out setpoint for the second stage, the second stage of cooling is turned off.

4.5 Operating Configurations

The operating configuration for the controller depends on what type of air conditioner is being controlled (i.e. AR, AHU, CW, W/G) and what features are selected. The operating configuration is preset by the factory according to the application. If certain features discussed in this manual are not factory enabled, no screens for that feature will be shown.

4.5.1 Cooling

4.5.1.1 Chilled Water/AWS/FC

Upon a call for cooling, the controller activates a chilled water control valve with a 0-10 VDC signal. The valve opens proportionally to the demand for cooling based on air temperature. The control settings consist of the return temperature setpoint (in the Control>Set>Temperature menu), the integration time (in Factory>Cool>Energy Savings menu), and the CW Cut-in/Out offset and cooling band (in the Service>COOL>CW1, AWS, FC menu). The chilled water valve closes to the minimum position and remains at that position when the return air temperature is less than the return temperature setpoint plus the CW Cut-in/Out offset.

When the actual return air temperature rises above the return air temperature setpoint plus the CW control cut-in value, the CW valve position begins to increase proportionally from the minimum position to the maximum, fully open position at the return air temperature setpoint plus the cooling band. The integration time allows the rate the valve position changes to increase over a period of time as long as the difference between the actual return air temperature is higher than the sum of the return temperature setpoint plus the CW control cut-in and cut-out offset (see Figure 6).

The starting voltage for the valve to be 0% open and ending voltage for the valve to be 100% open varies and is set in the Configuration level. For a valve that is fully closed at 2.5V and fully open at 10V, the controller sends 2.5V to the valve when 0% opening is called for and ramps to 10V when the demand increases to 100%.

For AWS and FC units the entering water temperature must be colder than 55 °F (default value) for the unit to enter the cooling mode and below 45 °F (default value) to enter the dehumidification mode. (This does not apply to CW systems.)

4.5.1.2 Compressor Based Direct Expansion (DX)

The controller cycles compressor(s) on and off for capacity control when it is determined that a stage of cooling is called for. A stage of cooling is turned on based upon the controller's cooling response to temperature and humidity inputs from the air sensors.

For systems with dual compressors, each cooling stage will turn on following a time delay, once the programmed “Cooling Stage Enable” setpoint value for that stage has been reached (see Figure 6). When a compressor is turned on, it remains on until the "minimum on" time has expired regardless of temperature or humidity conditions. When a compressor is turned off, it remains off until the "minimum off" time has expired regardless of temperature or humidity conditions.

The compressor(s) are turned off in stages when the control setpoint for each stage is achieved. To promote equal run times, the controller is programmed in the Factory level menu to rotate which compressor operates for the first cooling stage after each duty cycle.

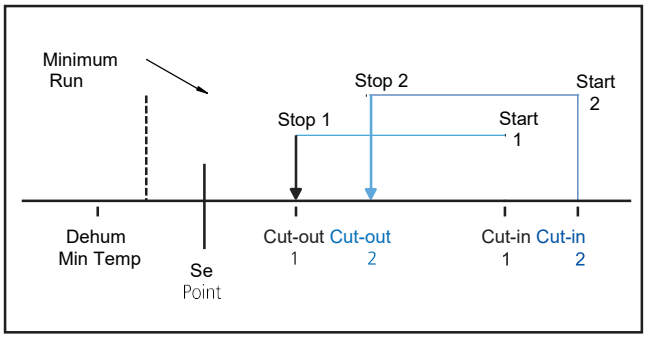


Figure 6. Cooling On/Off Cycle

The cooling cut-in and cut-out setpoints should be set with a minimum span of 2.0 °F.

If the cooling cut-in/cut-out setpoints are set too closely together when adjusting setpoints, the compressor could run below the setpoint temperature during periods of light heat loads because of the minimum run time cycle.

4.5.1.2.1 Electronic Expansion Valve

The Electronic Expansion Valve (EEV) controller may be programmed to manage the operation of into the evaporator. By controlling superheat, the EEV keeps nearly the entire evaporator surface active while preventing liquid refrigerant from returning to the compressor. Adjustments may be made by entering the Service>Sensors menu.

4.5.2 Energy Savings Configurations

an EEV for each refrigeration circuit. The controller manages the EEV based on input signals from suction pressure and temperature sensors. The EEV maintains constant superheat at the outlet of the evaporator by metering the flow of refrigerant

4.5.2.2 Alternate Water Source Cooling (AWS)

An AWS system (set at the Configuration Level) uses an independent chilled water source to provide coolant to an AWS cooling coil which is located in the AC unit with the DX cooling coil. When the Energy savings monitor option is set to "Yes" in the Factory>Cool>Energy Savings menus, the entering water temperature to the AWS coil is monitored and when that temperature falls below the minimum value to use the AWS coil, the AWS logic is enabled.

When the return temperature rises above the temperature set point by the value set in Cut-out (0.3 °F by default), the valve begins to open from the closed or 0% position. As the temperature rises, the valve opens further in a manner that makes it reach 100% open when the return temperature is at set point plus the Band (20.0 °F by default) due to the proportional component of the PID control of the CW valve. The Cut-out and Band values are adjustable in the Service>Cool>CW,AWS,FC menu.

Note that the actual voltage output to the valve for 0% and 100% are settable in the Factory>AnalogOut menu. The defaults are 0.0 Volts for 0% and 10.0 volts for 100%.

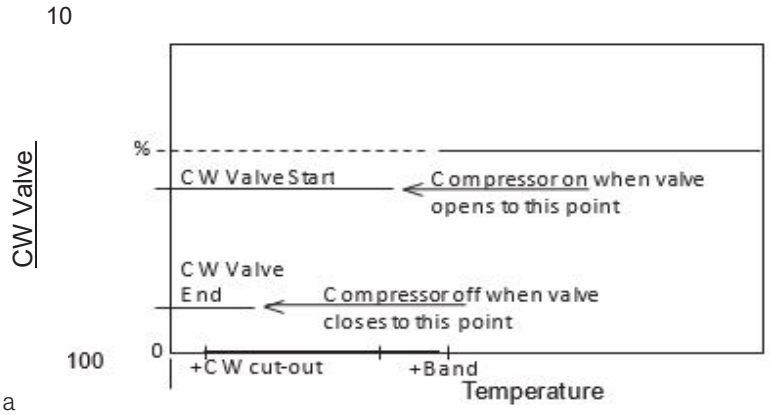


Figure 7. AWS/FC/DX Operation

There are several types of energy savings configurations available: Economizer, Free-cooling (FC) and Alternate Water Source (AWS). A W/G unit, where the condenser is cooled by a liquid, can have an optional free cooling (FC) feature that takes advantage of low temperatures of the W/G source. On AWS DX (Alternate Water Source Direct Expansion) systems, there is a separate W/G cooling coil that is used for cooling provided the entering W/G temperature is low enough for it to be used.

4.5.2.1 Economizer

The economizer option enables the E^2 controller to minimize or eliminate chilled water or compressor operation by using outside air when possible to satisfy temperature and humidity demand and maintain the programmed setpoints. See Section 6.0 for an overview of economizer operation.

The compressor assist works off of the valve position, thus it is indirectly controlled by the return if the return air temperature remains constant CW values temperature, not directly. When the valve opens due to the return temperature rising and reaches the value set by CW Valve Start (100% by default) and the time after reaching the CW Valve Start value has exceeded the Start DX delay, the compressor is enabled.

When the valve closes due to the return temperature dropping and reaches the value set by CW Valve End (10% by default), the compressor is disabled.

The CW Valve Start value does not have to be 100%; it can be lowered to assist sooner in the CW valve stroke. If the CW valve control has an integral component, it is best to leave CW Valve Start value at 100% as the CW valve position will increase over time to reach 100%

are adjustable in the Factory>Cool>Energy Savings menus above the Cut-Out value or continues to rise. The Valve Start, Start DX delay and CW Valve End.

These may be set to **AWS/FC Primary**, **DX Primary** and **DX only** in the Factory>Cool>Energy Savings menus. There are three ways the AWS and DX circuits interact

1 In **AWS/FC Primary**, the DX circuits are operational when the energy savings logic requests the DX logic to operate or the conditions in section 4.5.1.2 are met. The CW valve remains fully operational based on the return air temperature and setpoint.

2 In **DX Primary**, the DX circuits are operational when the energy savings logic requests the DX logic to operate or the conditions in paragraph 4.5.1.2 are met. The CW valve remains fully operational.

3 The **DX Only** mode essentially disables the AWS logic. The DX circuits are operational based on the normal DX logic and the CW valve is closed at all times.

4.5.2.3 Free Cooling (FC)

The free cooling option (set at the Configuration Level) is available on Water/Glycol cooled DX systems. It is used to minimize compressor operation during low ambient conditions for system energy savings. A FC unit uses a remote dry cooler to provide water/glycol coolant to a free-cooling coil which is located in the AC unit with the DX cooling coil. The operation of the FC logic is identical in all other respects to the AWS logic.

NOTE: The call for DX cooling is not disabled from its normal logic when the AWS/FC option is selected. When the return air temperature rises above its threshold (setpoint plus 3.0 °F as a default) to start DX cooling or dehumidification, the DX logic is enabled regardless of the state of the FC logic.

4.5.3 Heating

Electric resistance heating element(s) are used for heating the process air. The controller sends digital output signal(s) to turn the element(s) on or off as required to reach setpoint. Up to 3 stages of electric heat may be provided with individually selectable setpoints.

Proportional control for Silicon Controlled Rectifier (SCR) heating may be provided as an option for more precise control of heating energy. With this option the controller transmits analog output signals to the SCR's that are proportional to the demand for heat.

4.5.4 Humidifying

If this option is selected, an on-board steam humidifier may be turned on or off by the controller to maintain relative humidity to a control setpoint. Once the controller enables humidification, the humidifier will operate at 100% capacity until the humidity setpoint is reached. An on-board control module manages the humidifier operation, i.e. humidity production, fill cycles, drain cycles.

4.5.4.1 Humidifying With Proportional Control

If this option is selected, proportional control of humidification may be provided as an option for even more precise control of the relative humidity. With this option the controller transmits an analog output signal to the humidifier that is proportional to the demand for humidification.

4.5.5 Dehumidifying

When dehumidification is called for the blower speed automatically changes to the dehumidification fan speed setting. The controller will operate the system in the cooling mode to strip moisture from the air. If the system is equipped with dual compressors, only one compressor stage will operate when in the dehumidification mode unless the system is equipped with a remote condenser and enabled for hybrid control (see Section 4.4.1). In a CW system, the control valve is factory set to be fully opened for dehumidification provided the inlet water temperature is 45 °F or cooler. It may be set to be less than fully open for dehumidification, if desired, in the Service>Humidity menu (see Section 5.5.3).

The system will remain in the cooling mode until the actual relative humidity (or dewpoint) reaches the control setpoint plus the dehumidification cut-out offset. If room temperature drops below the low temperature cut-out setpoint for the dehumidification mode (temperature setpoint minus 4°F default), cooling operations will be stopped (see Figure 6).

4.5.5.1 Reheat

During dehumidification the space temperature may decrease below the desired value due to the cooling being run at full output. When the temperature decreases below the temperature setpoint plus the reheat cut-in offset, the system will enter the reheat mode. While in this mode **Reheat** will be displayed at the bottom of the Main screen instead of Heat to alert the user that the system is in the dehumidification mode and reheat is required. Control for reheat will follow the same control algorithms as described in the Heating Section 4.5.3 and the available heaters will be activated as required.

If the temperature drops below the dehumidification low temperature cut-out setpoint, dehumidification will be stopped but the reheat mode remains on until the temperature setpoint plus reheat cut-out offset is reached. Reheat during dehumidification can use the return air temperature sensor or the remote air temperature sensor as the basis for control.

4.6 Airflow/Fan Speed Control

In DX based systems, the STULZ E^2 controller treats the EC fan as a 3-speed fan (Min., Max. and Dehumidification). The minimum fan speed is used whenever the A/C unit has no heating or cooling operations running. The maximum fan speed setting is used during times when the A/C unit is heating, cooling or humidifying. When the system is in the dehumidification mode, the fan speed is reduced to the dehumidification fan

speed setting. The fan speed settings are adjustable in the Service>Blower menu (see Section 5.5.6).

For CW/AWS/FC based systems the controller is configured to control fan speed from 100% (full speed) to a minimum setting based on the total system air flow volume. Minimum and maximum fan speed settings are user adjustable in the Service menu. EC fan speed is automatically varied along with the CW/ AWS/FC control valve position based on temperature. There are mechanisms to trade-off the control valve opening versus fan speed (see Section 5.5.6.2 for details). When the system enters the dehumidification mode, the blower speed automatically changes to the dehumidification blower speed setting.

The STULZ E^2 controller's software is equipped with an operational fail-safe mode. Upon a return air or supply air sensor failure, the system goes to the temperature setpoint plus a programmable temperature offset while the humidity stays at the setpoint. This allows a wide range of solutions per the requirements of the space to be conditioned. If the offset is small, the CW valve opening and fan speed are operated at their minimum settings. If the offset is larger, the CW valve and fan speed may be operated up to 100%.

In the event of an EC fan failure, the speed of the remaining operable fans will increase to provide the same airflow. For example, if three fans are called to operate at 30% of full speed and one fan fails, the remaining two fans will operate at 45% of full speed.

4.6.1 Anti-Backdraft Mode (Optional)

The controller may be programmed to allow the fans to run at a pre-selected, adjustable speed (30% default) whenever the A/C unit is turned off via the operator interface display panel, via the Remote On-Off feature or after receiving a BMS Off command. When the Anti-Backdraft mode occurs, a message appears in the Main Info screen indicating the fans are currently operating in the Anti-Backdraft mode.

4.6.2 Underfloor/Cold Aisle Pressure Control

The control of under floor static pressure is used as a mechanism for Down flow units to ensure the constant flow of air across the heat load in the room. The static pressure is either directly read by the controller as an analog in put or provided to the controller from a BMS. See Section 5.5.6.4 for detailed instructions on setting underfloor pressure control.

4.6.3 Modbus Fan Control (Optional)

The controller may be equipped with an optional Modbus field expansion network card. With this, the controller may be programmed to monitor and control multiple operational aspects of the EC fans via Modbus communications protocol. Operator interface to control parameters is available through a controller interface display panel or through a BMS via the network card when power is applied to the A/C unit.

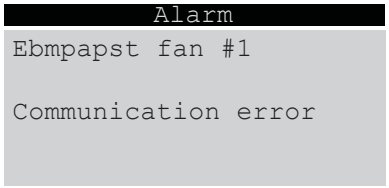
The controller software monitors sensor values and uses PI control to modulate fan speed. The STULZ E^2 controller manages the starting and the speed of the EC fans via Modbus protocol. The software allows internal communication with each fan via Modbus protocol, and external communication through Modbus protocol for the BMS to monitor and control fan operation. Additionally, the software allows the controller to detect and report specific alarms indicating critical or non- critical operating conditions.

EC fans feature an integrated monitoring function to protect the motor and electronics against damage from jamming, phase loss or overheating. The STULZ E^2 controller monitors each fan via the Modbus and if any of the following failure conditions occur, the motor automatically stops and an alarm is signaled:

a. Locked rotor
b. Low main supply voltage
c. Loss of a phase
d. Over-heating of electronics
e. Over-heating of motor

Upon correction of these failure conditions, the motor will automatically reset.

If a Modbus communication loss occurs (wire breaks or Modbus link opens), the controller provides a communication alarm and the fans will run at their last received output command until a new command is received (Modbus communication is back online).



If a power cycle occurs, (dual power changeover or power outage) the fans will begin to run immediately to their last received command once power is restored. Once the controller reboot cycle is completed (and the Modbus network is online), the fans will run to the commanded output signal from the

STULZ E^2 controller. See Section 5.3.4 for fan alarm messages that may be provided.

The STULZ E^2 controller is programmed with additional user interface display screens in the Service>Blower menu which may be used to view and adjust the Modbus operating parameters controlling the fans and view operating data (see Section 5.5.6.4).

4.6.4 Suction Pressure Fan Speed Control (Optional)

Suction pressure may be controlled for DX based units by modulating fan speed if optional suction pressure transducers (sensors) are used. If suction pressure is normal (between 57.5 psi to 127.0 psi for R407C, between 112.5 psi to 185.0 psi for R410A), the fan speed is controlled by the normal fan speed algorithm based on static pressure, return temperature, or dehumidification fan speed. If suction pressure rises above the high suction pressure limit, the fan speed decreases, reducing airflow to the evaporator coil to decrease the suction pressure. If the suction pressure falls below the low suction pressure limit, the fan speed increases to increase suction pressure. A message **`Suct Press Limit Active`** will appear in the Info>Fans and CW menu screen.

On dual compressor systems, a suction pressure transducer is used for each circuit. In this case the controller will respond to the lower suction pressure value to increase fan speed and to the higher suction pressure value to decrease fan speed.

4.7 Communication With the Controller

It is possible for the controller to communicate in a variety of ways. Multiple A/C unit controllers may be connected together using a pLAN. This enables the operation of multiple A/C units to be managed from a lead controller's interface display panel (see Section 7.0).

Using a comm card, the controller(s) may also be connected to a BMS for monitoring and control of data points using a choice of available serial communication protocols.

In the event of a BMS monitoring/control signal failure, the E² controller will default to local operation at the current setpoints for the fan, external economizer damper and chilled water control valve. The local sensors have priority over the BMS system.

4.8 Remote On/Off

Terminal positions are provided to connect a remotely located, On/Off switching control device for Remote On/Off operation. If the A/C unit is turned on and the E² controller receives a remote 24V input signal via the remote switching device, the system will operate. If the switching device opens, removing the 24V input to turn off the A/C unit, the controller disables all control outputs and a message Off by Remote Shutdown appears in the main display screen. The A/C system will automatically be re-enabled when the 24V Remote On/Off signal is restored for the A/C unit to turn back on.

As an example, the control device may be an On/Off switch, thermostat or a humidistat. If customer provided, the remote On/Off control contacts must be sized appropriately. The Remote On/Off contacts must have a rating of 15 mA @24 VAC. Refer to the electrical drawing included with the A/C unit for the wiring details.

4.9 Weekly Timer

The weekly timer may be used to set up an operating schedule to automatically scale back or shut down the air conditioner during low demand or unoccupied periods. This is an energy saving feature offering the ability to create up to seven operating schedules tailored to the needs of the building. For example, a five day (Monday-Friday) weekday and two-day (Saturday and Sunday) weekend operating schedule may be set-up. Each operating schedule may be set-up with its own setpoints for temperature and humidity and offsets which will replace the current temperature and humidity setpoints during that operating schedule's time period. An evening (night-setback) schedule may also be set allowing the A/C unit to operate at night with relaxed temperature/humidity setpoints and offsets.

4.10 Dual Power Transfer Switching

Dual power transfer switching is optionally available for critical operations. With this option, two power service disconnect switches are provided to connect two independent power sources. Each power source is monitored by a phase monitoring relay. If the user selectable primary power source is interrupted or, if a phase loss or imbalance occurs, the power transfer circuitry switches operation of the A/C system to a secondary power source. Switching is accomplished using open transition, break-before-make contactors.

The dual power transfer switching sequence may be controlled by one of two methods: 1) The phase monitor relays in the air conditioner manage the power transfer sequence and provide input signals to the system controller for monitoring purposes or, 2) the phase monitor relays provide input signals to the system controller which manages the power transfer sequence and sends control signals to the switching relays in the air conditioner.

4.10.1 Power Transfer Performed by Phase Monitors

Each power source is monitored by a phase monitor relay, one output of which goes to the power switching circuit and the other output sent to the system controller for monitoring purposes. Upon an interruption to the user selectable primary power source, the system controller de-energizes along with the fans and compressor and/or chilled water valve, and the alternate power phase monitor relay starts a built-in timer (adjustable). After an auto transfer sequence delay period which ensures the switch to power source is stable, the air conditioner is switched to the alternate power source.

When power is transferred, the system controller re-boots and after approximately 30 seconds, it provides an alarm signal. The controller also displays an alarm message indicating which power source failed. This alarm message may be conveyed through an optional BMS serial communications link. When the controller reboots, it re-establishes the control sensor inputs and restarts the operating sequence it was in at the time of the switch over as described in Section 3.3. If the AC system uses a compressor, and it was running at the time power is

transferred, it will not be allowed to re-start until the "minimum compress or off" time delay period has elapsed. The A/C system will operate using the alternate power source until the primary power source is functionally restored.

When the primary power source is restored, the built-in timers in the phase monitor relays delay the switch over to ensure the power is actually stable before activating their output. After the delay, operation of the A/C system is automatically transferred back to the primary power source. The system controller must again re-boot and restart the operating sequence as described in the previous paragraph. The automatic power transfer time from one power source to the other is factory set at 10 seconds. The power transfer timers may be adjusted on the phase monitor relays in the A/C system electric box. See STULZ addendum ZU0005,"Operation of Automatic Transfer Switch "for details.

4.10.2 Power Transfer Performed by System Controller

If the system controller is programmed to manage the dual power transfer sequence, an optional Constant Contact UPS module is provided (see Section 2.4.4). It keeps the controller online while the power transfer sequence takes place. This allows the controller to continue monitoring sensor input signals and maintain communications with a BMS for up to one minute. The controller will not have to reboot due to a power interruption. It stays operational to indicate an alarm condition and re-initiate the operating sequence after an automatic power transfer occurs.

The system controller begins the start-up sequence after approximately 10 seconds elapsed time which ensures the "switch to" power source is stable. If the compressor and fans were running at the time an automatic power transfer takes place, they will restart as described in Section3.3.Whenprimary power is restored, an automatic power transfer sequence occurs again, returning the A/C system back to the primary power source. The automatic power transfer delay time may be adjusted using the system controller in the Service>Options>Dual Power Setup menu screen (see Section 5.5.7.6).

4.11 Tandem Compressors Operation

The STULZ E^2 controller provided with the A/C unit may be programmed to efficiently manage the staging and rotation of three compressors. In the example of a system with three compressors, two small compressors are paired together as one tandem circuit (1a and 1b) with a shared liquid line and shared discharge line. The compressor suction and discharge ports are equipped with back pressure isolation valves so one compressor may operate independently or both may operate together, as required by the demand for capacity staging. One larger compressor is also provided as circuit 2.

The STULZ E^2 controller manages operation of the three compressors with a unique method of staging to conserve energy by incrementally matching compressor capacity against the load. The three compressors are turned on in various combinations to provide a total of 4 stages of cooling. Each stage is assigned an offset to the temperature setpoint for turning the compressors on. The controller turns each stage on and off as needed based on the temperature setpoint plus offset values (reference Section 4.5.1.2).

The offsets for each stage may be adjusted in the Service>Cool menu (see Section 5.5.1.1). The DX Cooling menu display screens discussed in Section 5.5.1.1 depict values relevant to cooling stages rather than to individual compressors.

See Table 1 that follows. In the example of a 20 ton (240,000 BTU) system with three compressors, two small (5 ton) compressors 1a and 1b are paired together as one tandem circuit with a shared liquid line and shared discharge line. One large (10 ton) compressor is also provided as circuit 2. The following table shows how the compressors are staged according to the capacity demand.

Table 4 . Tandem Compressor Operation Example

Stage	Cut-in Set-point Offset	Compressor(s)	Capacity
1	+2° F	1a	5 tons
2	+3° F	2	10 tons
3	+4° F	1b+2	15 tons
4	+5° F	1a+1b+2	20 tons

4.12 Shadow Units

If the unit does not use an external EVD, the STULZ E^2 controller may be used to control up to three units as one with a common display(set to pLAN address 17-24). Shadow control logic is used specifically for STULZ MCS systems which consist of multiple STULZ CyberONE units integrated together to operate as a multi-compressor cooling system. Refer to STULZ Addendum #OCC0061 for detailed information.

The main unit controls the start and stop of the shadow units and is in the pLAN address range of 1-8. The one or two shadow units use pLAN addresses 9-16 to keep them out of the group rotation logic. The shadow units follow the main unit in the rotation process. The shadow units monitor the pLAN status of the main unit to determine when to start and stop. They are Off by Network when the main unit is not running due to conditions such as waiting on a manual restart or other event like a BMS pause. There is an option to allow the shadow units to run if they see that the main unit is powered down, but the default is for them to go to Off by Network.

The main unit does not normally monitor the shadow units for starting and stopping, but it does monitor alarms coming from the units. If the shadow unit is turned off manually or by a critical alarm to then place it in manual restart mode, the main unit continues to run and the shadow unit will not restart until the critical alarm is addressed.

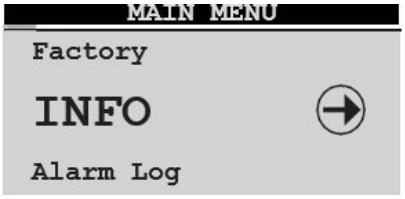
The major exceptions to this are the smoke and remote shutdown alarms which will cause all three units to shut down if they occur on any of the main or shadow units.

Major alarms like smoke or remote shutdown will require a manual restart. The lead unit alarm must be cleared and the unit started first. This will allow the shadow units to start after their alarm is cleared and each is manually restarted.

Shadow units will use whatever sensor arrangement the workgroup is using first and then the lead unit sensors in the case where there is no workgroup. They will use their local sensor only if the lead unit is powered off.

5.0 MENU SCREENS

5.1 Main Menu



The Main menu is accessed from the Main screen by pressing the ***Prg*** key. The Main menu screen provides a listing of the menus that are available. Scroll through the menu categories using the Up and Down arrow keys. From the Main menu screen select from among the following standard menus:

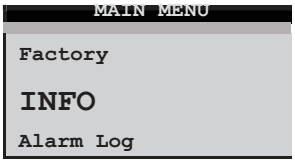
Info- Displays basic read-only status information. Allows the monitoring of system operational parameters. No password is needed at this level.

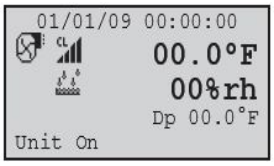
Alarm Log- Displays all alarms and power-ups in sequential order with a time and date stamp. No password is needed at this level.

Control- Allows modification of basic control parameters such as setpoints and clock. Level 1 password is needed to enter this menu.

Service- Allows modification of advanced control parameters such as offsets, blower speed, BMS set-up and permits the user to save customer parameters and reset the controller to the customer or factory default values. Level 2 password is needed to enter this menu.

Factory- Allows modification of more advanced control parameters such as sensor scaling, start-up delays, grouping parameters and night setback schedules. Level 3 password is needed to enter this menu. Entry to the Factory menu is intended for qualified technicians working under the guidance of STULZ Product Support during start-up and commissioning of the A/C system. The password to enter this menu may be obtained by contacting Product Support. (See section 9.0 of this manual).





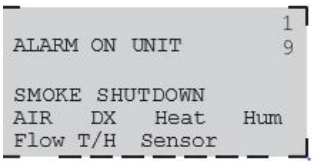
5.2 Information Menu

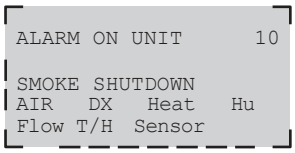
The Info menu screens may be accessed from the Main screen by simply scrolling with the Up and Down arrow keys. The same screens may also be viewed if the Info menu is entered by pressing the "Prg" key. The Info menu displays screens that provide current temperature and relative humidity conditions and shows the modes the A/C system is currently operating. There are no adjustable parameters in this menu. From the Info menu, the following display screens may be viewed as they apply to the unit configuration:

5.2.1 Operating Conditions

The first Info screen displays the current Date, Time and provides State of Operation icons. Actual Temperature, Relative Humidity and Dewpoint conditions are also displayed. The values displayed are used by the controller to develop control output signals for managing system operations.

5.2.2 Shadow Unit Alarms

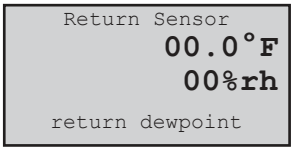




Shadow unit alarm messages appear in the controller display of the main unit when an alarm occurs to a unit in the shadow group assigned to the main unit. The top line of the first menu screen is the display number assigned to the shadow group. The next line is the unit number of the first shadow unit in the shadow group. The remaining messages shown are alarm conditions which appear only if the particular alarm has occurred on the first shadow unit.

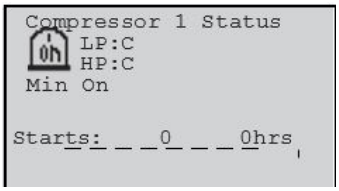
The top line is the unit number of the second shadow unit in the shadow group. The remaining messages shown are alarm conditions which appear only if the particular alarm has occurred on the second shadow unit.

5.2.3 Return Sensor

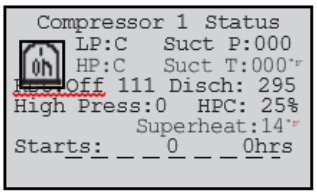


This screen displays Temperature and Relative Humidity as measured by the return temperature and RH sensor inputs. The return dewpoint is calculated by the controller based on the return sensor inputs and shown at the bottom of the display screen.

5.2.4 Compressor Status- (DX based systems)



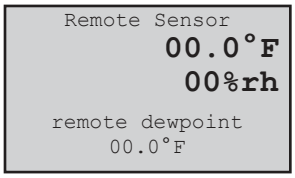
This screen displays the On or Off status icon for the A/C system compressor(s) and shows the status of the Low Pressure and High Pressures witches (Open or Closed). The field beneath the status icon indicates if the compressor is in the "minimum time on" or "minimum time off" delay period. The field at the bottom of the screen shows the number of compressor starts since power was applied and the total compressor run-time during the period since the last reset was performed in the Service>Run Hours menu. If the system has more than one compressor, similar compressor status display screens are provided for each compressor.



5.2.4.1 Optional Compressor Status Fields

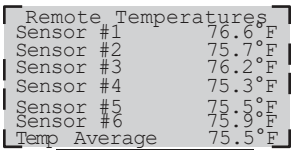
If the controller is configured for optional High Pressure With Auto Reset (see Section 5.4.1.1), it will be programmed to monitor an analog discharge pressure sensor. With this option, a restart (Rst) value appears instead of Min Off if the compressor turns off due to a high discharge pressure condition. The restart value is a countdown timer showing the compressor minimum off delay time remaining before it is allowed to restart again.

The controller will also display the current discharge pressure value (Disch). A value in the field (High Press) indicates how many times the controller has attempted to restart the compressor after a high pressure shutdown.



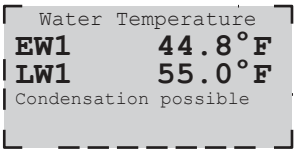
5.2.4 Remote Sensor

If the unit is equipped with an optional remote temperature and relative humidity sensor, this screen displays temperature and relative humidity inputs as measured by the sensor. The remote dewpoint is calculated by the controller based on the remote sensor inputs and shown at the bottom of the display screen.



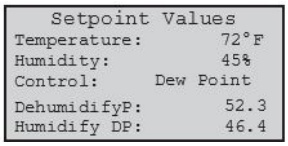
5.2.5 Remote Temperatures

If temperature averaging is enabled and supply temperature sensor is enabled, up to 5 additional supply temperature sensors may be connected to the E² Controller. This menu is enabled under those conditions, showing the temperature of each remote sensor enabled and the average of those sensors.



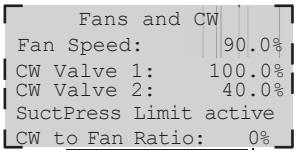
5.2.6 Water Temperature

This Water Temperature (CW/FC/AWS-based systems) screen displays the temperature of the water entering the coil (EW1) and the temperature of the water leaving the coil (LW1). If the system has dual CW circuits, a similar screen is provided for coil 2 displaying EW2 and LW2. The controller compares the entering water temperature with the leaving water temperature and signals a temperature flow alarm if the difference between the two values is less than 2 °F (adjustable default value) during cooling operation. The corresponding valve must be open more than the minimum valve open value of 35.0% (adjustable default value) set in the Factory>Options>Water Flow Setup menu. A warning message, “Condensation possible”, appears if the dewpoint of the return air is equal to or higher than the entering water temperature.



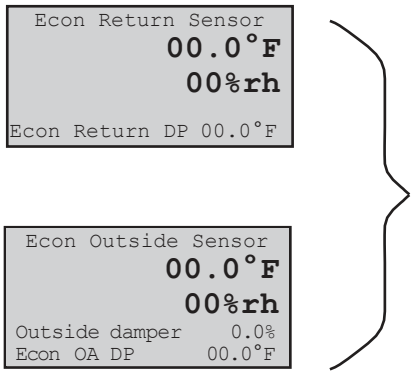
5.2.7 Setpoint Values

This screen displays the current operating Temperature and Humidity setpoints and control method. If configured for Dewpoint or Hybrid control, the controller displays the calculated dewpoint setpoints for dehumidification and humidification as derived from the operating temperature and humidity setpoints.



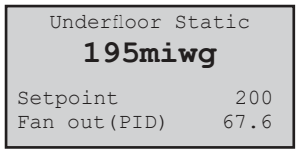
5.2.8 Fans and CW Valve

If the unit is configured for either voltage or Modbus controlled EC fans, the commanded speed of the fans is displayed, the commanded position of the chilled water valve is displayed and if there is a second CW valve, the commanded position of the second valve is displayed. If the fan speed suction pressure limit is active, that message is displayed. On the last line, the chilled water to fan ratio is displayed (modifiable in the Service>Fan>CW Fan Setup menu to between -25 to +25 with 0 being the default).



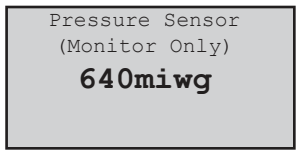
5.2.9 Economizer Information Menu Screens

If economizer temperature and humidity sensors are enabled, the Econ Return Air Sensor and the Econ Outside Air sensor values are displayed on the designated screens. See section 6.0 for details on the operation.



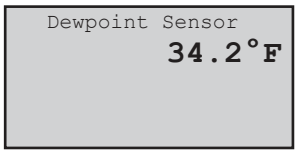
5.2.10 Under Floor Pressure

If the unit is equipped with an under floor pressure sensor, the function of the sensor is displayed on the first line. This configurable to be Underfloor Static Pr, Underfloor Diff Pr, Cold Aisle Static Pr, or Cold Aisle Diff Pr. The next line shows the measured value displayed in milli-inches water gauge (1 miwg = 0.001 iwg). The under floor pressure setpoint and the commanded fan speed are displayed as well.



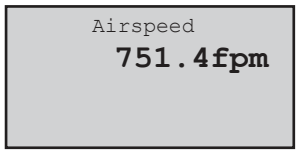
5.2.11 Differential Air Pressure Sensor

If the unit is equipped with a differential air pressure sensor, the difference between the entering and leaving air pressure is displayed in milli-inches water gauge (1 miwg = 0.001 iwg).



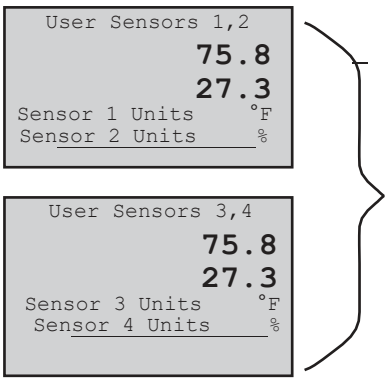
5.2.12 Dewpoint Sensor

If the unit is equipped with a dewpoint sensor, it is used in place of the dewpoint calculated from the return air temperature and humidity sensors. The value of the dewpoint sensor is displayed.



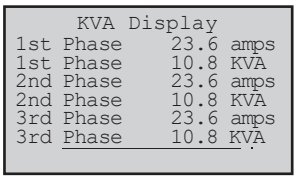
5.2.13 Air Speed Sensor

If the unit is equipped with an airspeed sensor, the value of the air speed sensor is displayed.



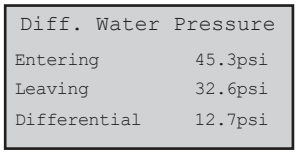
5.2.14 User Sensors

This screen appears only if the unit is configured with additional user specified sensors. It displays the current values read by sensor 1 (line 1) and sensor 2 (line 2). Beneath the sensor values are the units of measure assigned for each sensor. An additional "User Sensors" screen will appear if the controller is configured to use a 3rd or 4th user sensor. The user sensors are for monitoring purposes and will initiate a Customer alarm upon sensor failure.



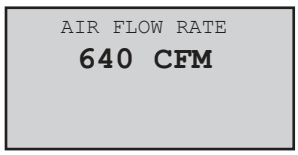
5.2.15 KVA Display

If the unit is equipped with a KVA meter, the current and KVA values for each phase is displayed. The second and third phases are displayed only if the unit has three phase power.



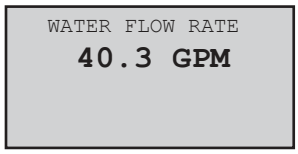
5.2.16 Differential Water Pressure

If the unit is equipped with water pressure sensors on the entering and leaving water ports, the pressures of each are displayed and the difference between the two is displayed.



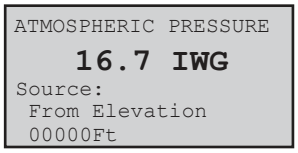
5.2.17 Air Flow Rate

If the unit is equipped with an airflow meter, the airflow rate is displayed.



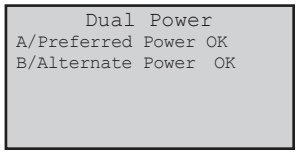
5.2.18 Water Flow Rate

If the unit is equipped with a water flow meter, the water flow rate is displayed.



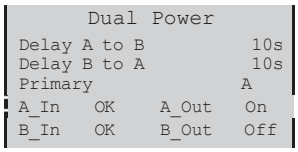
5.2.19 Atmospheric Pressure

If the special sensors are enabled and Airflow Rate (No GPM) is selected in Factory>Options>Enb Special Sensors, this screen appears displaying the source selected in Factory>Options>BAROMETRIC PRESSURE (From Elevation, Manual, Barometer, or Network) which is shown on the next to last line. The value of the source is displayed on the second line and the unit of measure is either mbar or iwg. If the source is elevation, the bottom line shows the altitude.



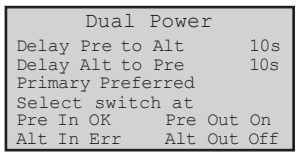
5.2.20 Dual Power

If the controller is programmed to monitor dual power operation, a display screen is provided which indicates the status of the power sources. The screen message "OK" indicates the controller senses that both sources of power are available.



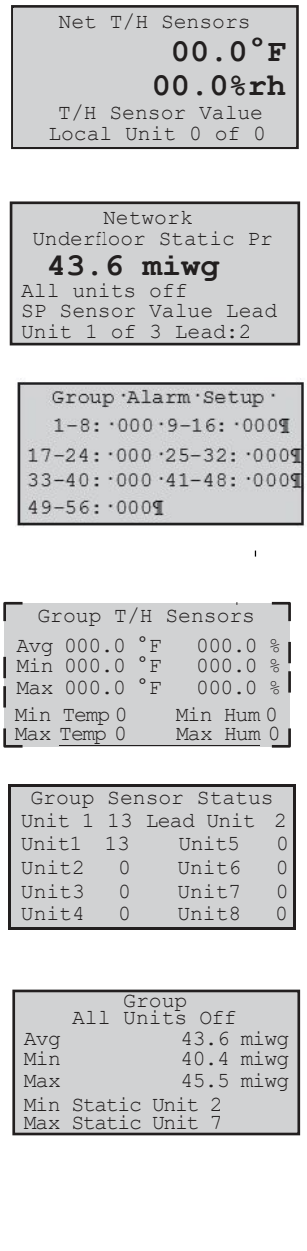
5.2.20.1 Dual Power with UPS

If the controller is programmed to manage the dual power auto transfer sequence, a display screen is provided which indicates the programmed delay periods for the auto power transfer sequence to begin. This screen also indicates which power source is currently operating the unit. The status of the power sources appears at the bottom of the display. The On/Off status of the control output signals to the switching relays also appears.



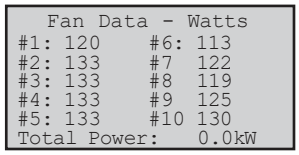
5.2.20.2 Special Dual Power

An alternate menu may be selected in Factory>Options>Misc. Config. The only difference is the text displayed: Preferred or Alternate instead of A or B. Otherwise, the values are one for one to5.2.21.1.



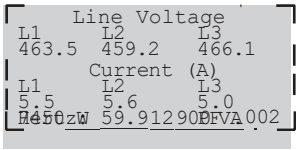
5.2.21 Group Information Menu Screens

The Group Information menu screens only appear if the controller is set up to operate multiple A/C unit work group. See Section 7.2.6 for a detailed description of these screens.



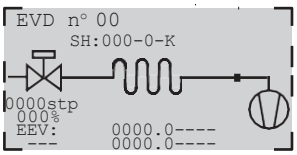
5.2.22 Modbus Fan Data

If the unit is equipped with Modbus controlled fans, the wattage being used by each fan is displayed along with a total kW usage. Only those fans that are configured to be present will appear on this menu.



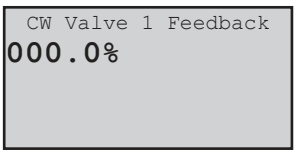
5.2.23 Power Meter Data

If the unit is equipped with Modbus controlled fans, the wattage being used by each fan is displayed along with a total kW usage. Only those fans that are configured to be present will appear on this menu.



5.2.24 Electronic Expansion Valve (EEV) Status

If EEV valve(s) are used (for compressor-based systems), this screen displays current operating parameters. The current superheat temperature, suction pressure and suction temperature are shown. The proportional output control signal to the valve is also shown. If the system has more than one compressor circuit, a similar display screen is provided for each circuit.



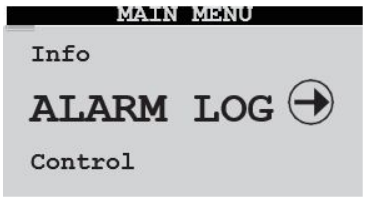
5.2.25 CW Valve Feedback

Proportional valve actuators provide a 0-10 VDC feedback signal to confirm the valve's travel position. The is available as an output from the valve actuator. A value of 100% indicates the valve is 100% open. A value of 000.0% indicates the valve is 0% open (or closed). If the system has more than one CW valve, a similar display screen is provided for each valve.

5.2.26 Software Version/Date

Displays the type of A/C system the controller is configured for (CW, AHU, AR), the STULZ software version and its release date.

5.3 Alarm Log



No password is required to view alarm display messages. If an alarm condition occurs, the first active alarm may be displayed by pressing the Alarm ( ) key. The alarm screen display text message will remain unchanged until the alarm condition is cleared. Once the alarms log is entered, any other active alarm message(s) may be viewed by using the Up and Down arrow keys to scroll through alarm messages.

5.3.1 Alarms

The red LED backlight within the alarm key will illuminate any time an alarm condition is present or previous alarms existed without having been reset or cleared. An audible alarm will also activate when an alarm condition occurs. The audible alarm may be enabled or disabled in the Service>Options menu. The first active alarm screen may be displayed by pressing the Alarm ( ) key.

The Alarm display provides a text message describing the abnormal operating condition. Use the Up and Down arrow keys to scroll for any additional alarm messages. Only active alarm screens will be displayed when the Alarm ( ) key is pressed. The alarm screen display will remain unchanged until the alarm condition is corrected and the alarm key is pressed

Non-Critical Alarms

A Non-Critical alarm will activate the alarm screen with which it is associated. These alarms are to clear the alarm.

The alarms log may be cleared in the Service>Alarm log menu. The application software supports two (2) types of alarms:

Non-Critical and Critical. Any alarm may be programmed to activate the user configured Custom alarm relay contacts. programmed to activate the Summary Fault alarm and close the Summary Fault relay contacts without stopping unit operation. Some examples of the factory programmed, Non-Critical alarms are:

- High Temperature
- High Airflow
- Low Temperature
- Dirty Filter
- High Humidity
- Sensor Failure
- Low Humidity
- Communication Failure
- Leak Detection
- Condensate Pan Full
- Low Airflow(Velocity Sensor)
- CW Flow Failure

5.3.3 Critical Alarms

Critical Alarms will coincide with automatic shutdown of the A/C unit(s) equipment as needed to prevent possible system damage. The A/C unit(s) equipment will remain shut down until the alarm condition(s) are no longer sensed and the controller has been reset. Some examples of *Critical* alarms are:

- High Humidity
- Low Suction Pressure
- Fire/Smoke Detection
- High Head Pressure
- No Airflow (Air Proving Switch
- Off by Internal Alarm (Only for grouped systems)

5.3.4 Alarm Screen Messages

ALARM MESSAGE	DESCRIPTION OF ALARM CONDITION
High Temperature	Temperature is above user defined alarm setpoint.
Low Temperature	Temperature is below user defined alarm setpoint.
High Humidity	Humidity is above user defined alarm setpoint
Low Humidity	Humidity is below user defined alarm setpoint.
Sensor Failure	Sensor is disconnected or faulty.
Communication Failure	External and/or internal communication lost (BMS or pLAN)
Condensate Pan Full	Water level in condensate pan is reaching an unsafe level.
Water	Water leak sensed by leak detector.
High Airflow	Air velocity is above user defined setpoint.
Low Airflow	Air velocity is below user defined setpoint.

ALARM MESSAGE	DESCRIPTION OF ALARM CONDITION
No Airflow	Airflow is inadequate for detection by the air proving switch.
Filter Clogged	Filter needs to be replaced.
True No Flow	Insufficient flow of cooling fluid detected by flow switch (CW/WG units).
No Flow Water Temp	Insufficient flow of cooling fluid detected by temperature sensors (CW/WG units).
Smoke/Fire	An alarm condition detected by the smoke detector or firestat.
High Head Pressure	Head Pressure is above user configured alarm threshold (DX units).
Low Suction Pressure	Suction Pressure is below user configured alarm threshold (DX units).
Fan 1, 2, 3, 4, ...10	Fan Failure.
pCOe Disconnected	No communications with the controller.
pCOe Mismatch Alarm	No output pattern confirmation for more than 10 seconds.
Customer Alarm	Customer supplied signal indicates an alarm.
Heater Failed	The heater has an over temp or other condition.
Pump	The pump has failed due to overcurrent or other conditions.
Power Source Lost	The indicated power source is not present.
Humidifier	An alarm in the humidifier is present.
Blower Failure	The indicated blower has failed to run.
Damper End Switch	The damper end switch failed.
Fan Lockout	The fan has failed too many times and is locked out.
EVD offline	The Expansion Valve controller is offline.
Ebmpapst Fan#_- Fan Fault	The indicated alarm has been received from the fan.
Ebmpapst Fan#_- Device Offline	The indicated alarm has been received from the fan.
Ebmpapst Fan#_- Phase Fault	The indicated alarm has been received from the fan.
Ebmpapst Fan#_- Motor Blocked	The indicated alarm has been received from the fan.
Ebmpapst Fan#_- Mains Under Voltage	The indicated alarm has been received from the fan.
Ebmpapst Fan#_- Mains Over Voltage	The indicated alarm has been received from the fan.
Ebmpapst Fan#_- DC Link Over Voltage	The indicated alarm has been received from the fan.
Ebmpapst Fan#_- DC Link Under Voltage	The indicated alarm has been received from the fan.
Ebmpapst Fan#_- Motor Superheating	The indicated overheat alarm has been received from the fan.
Ebmpapst Fan#_- Intern. Circ. Superheat	The indicated overheat alarm has been received from the fan.
Ebmpapst Fan#_- Output Stage Superheat	The indicated overheat alarm has been received from the fan.
Ebmpapst Fan#_- Hall Sensor Error	The indicated alarm has been received from the fan.

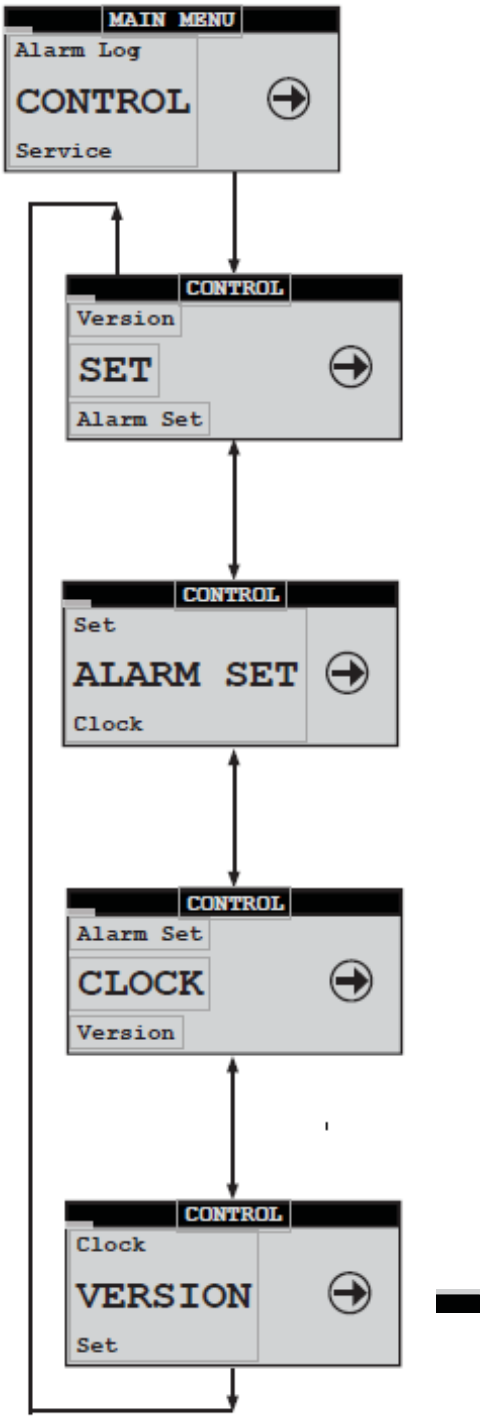
ALARM MESSAGE	DESCRIPTION OF ALARM CONDITION
Ebmpapst Fan#_- Communication Error	The indicated alarm has been received from the fan.
Ebmpapst Fan#_- Generic Error	The indicated alarm has been received from the fan.
Ebmpapst Fan#_- Out Stage High Temp.	The indicated warning has been received from the fan.
Ebmpapst Fan#_- Intern. Circ. High Temp.	The indicated warning has been received from the fan.
Ebmpapst Fan#_- Motor High Temperature	The indicated warning has been received from the fan.
Ebmpapst Fan#_- DC Link Voltage Low	The indicated warning has been received from the fan.
Ebmpapst Fan#_- Limited Mains Power	The indicated warning has been received from the fan.
Ebmpapst Fan#_- Limited Mains Current	The indicated warning has been received from the fan.
Ebmpapst Fan#_- Brake mode	The indicated warning has been received from the fan.

5.3.5 Control Menu

From the Control Menu the operator may select from four sub-menus: Setpoints, Alarm Setpoints, Clock and Version. The controller is programmed to require level 1 password authorization to enter this menu (see Section 3.2.1).

Once password access is granted, the setpoints controlling the performance of the unit may be selected and adjusted, alarms may be enabled, alarm setpoints may be entered and the clock may be set to establish an operating schedule for the A/C unit.

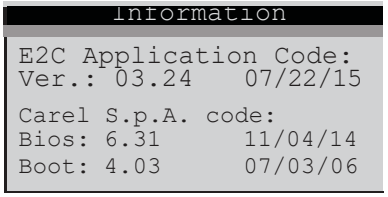
The Setpoints (**SET**) screens allow the operator to view and adjust the temperature and humidity setpoint control parameters and compare them to system level operating data derived from the various Sensor/Transmitter inputs. See Section 5.4.1.

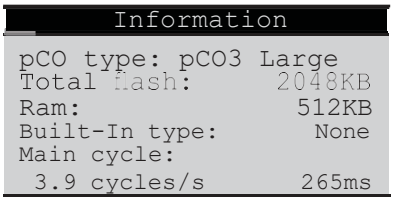


The Alarm Setpoints (**ALARM SET**) screens allow the operator to enable and adjust the high and low temperature and humidity alarm setpoints and offsets and compare them to the control setpoints and to the system level operating data derived from the Sensor/Transmitter inputs. See Section 5.4.2.

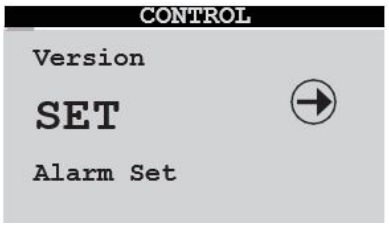
The Clock screens allow the operator to view and adjust the current time, date and day and set-up operating schedule(s) and setpoints for the A/C system. See Section 5.4.3

Two Version screens are provided for information only. They show controller hardware and software details that are useful to STULZ Product Support if technical assistance is needed.

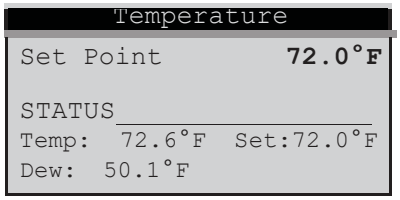


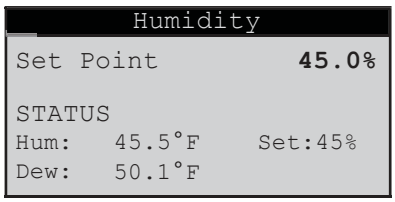


5.4.1 Setpoint Screens



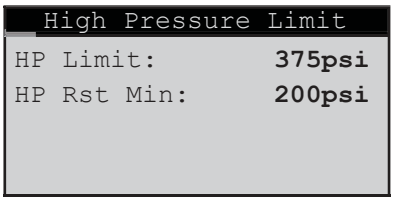
The Setpoints (SET) screens below may be accessed from the Control menu.

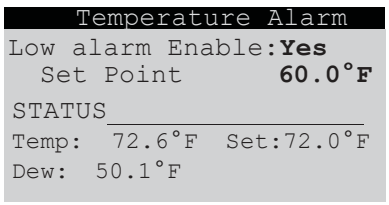




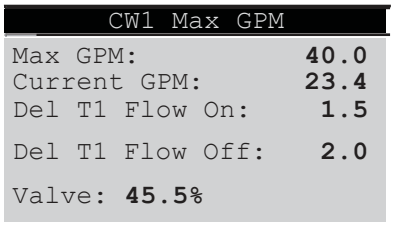
The Temperature and Humidity setpoint screens allow the operator view and adjust the control setpoints and compare them to system level operating data derived from the various Sensor/Transmitter inputs.

5.4.1.1 High Pressure Auto Reset (Optional)





5.4.1.2 Max GPM



If the customer sensor(s) are set for Calculate GPM in Factory>Options>Enb Special Sensors, then the GPM menus for CW circuit 1 and 2 (if appropriate) are enabled. The maximum GPM is used to limit the CW valve opening. The current GPM is the calculated GPM. Del T1 Flow ON is the number of degrees below the leaving water temperature that the entering water temperature must be to enable GPM calculations. Del T1 Flow OFF is the number of degrees below the leaving water temperature that the entering water temperature must be to disable GPM calculations. The bottom field in the screen (Valve) is the current position of the valve as a percentage of fully open.

5.4.2 Alarm Setpoint Screens

The Alarm Setpoints screens are accessed from the Control menu. They allow the operator to enable the High and Low temperature and humidity alarms, adjust their setpoints and compare them to the control operating setpoints and to the system level operating data derived from the Sensor/ Transmitter inputs.

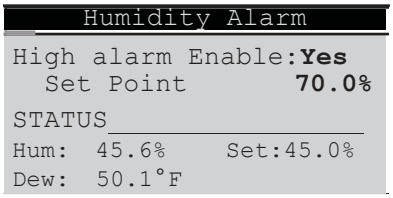
If the compressor discharge pressure rises to the limit value entered, the compressor turns off.

After the compressor minimum off time delay expires, the controller polls the discharge pressure sensor to determine if it is safe to start again. If the pressure is below the high pressure reset minimum (HP Rst Min) value entered, the compressor restarts.

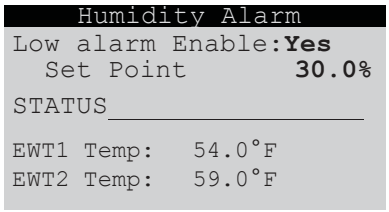
If the discharge pressure is not below the high pressure reset minimum value, the compressor remains off.

The controller polls the sensor a total of three times to attempt to start the compressor, each time following the compressor minimum off time delay period. If the discharge pressure is still not below the high pressure reset minimum value after three attempts, the compressor is disabled and a high-pressure alarm is signaled.

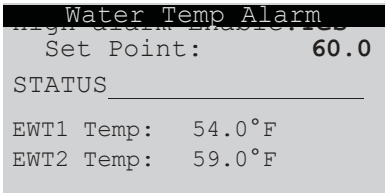
This is a critical alarm requiring the controller to be manually reset by pressing the alarm key on the user interface display panel.



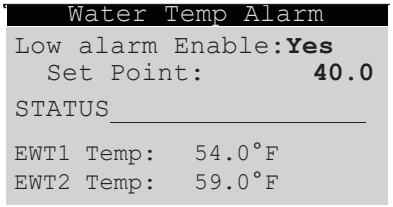
High Humidity Alarm



Low Humidity Alarm



High Water Temperature Alarm



Low Water Temperature Alarm

Following the temperature and humidity alarm enable screens are the alarm offset screens. From these screens the operator may adjust offsets for the high and low alarm setpoints at which the alarm will be cancelled. The entered offset applies to both the upper and lower values entered in the Alarm Setpoints Screens. The offset is subtracted when its applied to the high alarm setpoint and it is added when its applied to the low alarm setpoint.

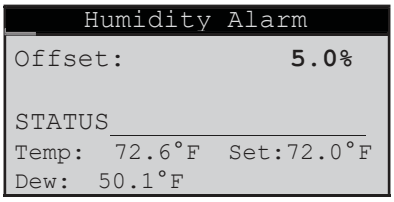
EXAMPLE 1: Temperature Alarm Offset

If the offset for the temperature alarm is set at 5.0 °F (default), the high temperature alarm will cancel when the actual temperature drops to the High Temperature Alarm setpoint (80.0 °F) - the Offset (5.0 °F) or, 80.0 °F - 5.0 °F = 75.0 °F

The High Temperature Alarm will cancel at 75 °F.

Conversely, the low temperature alarm will cancel when the actual temperature rises to the LowTemperature Alarm setpoint (60.0 °F) + the Offset (5.0°F), or, 60.0 °F + 5.0 °F = 65.0 °F. The Low Temperature Alarm will cancel at 65.0 °F.

EXAMPLE 2: Humidity Alarm Offset

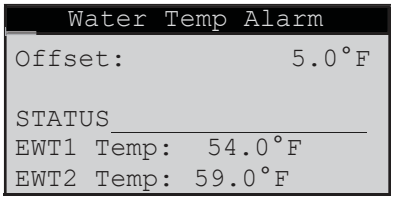


If the offset for the humidity alarm is set at 5% (default), the high humidity alarm will cancel when the actual humidity drops to the High Humidity Alarm setpoint (70.0%) - the Offset (5.0%), or, 70.0% - 5.0% = 65.0%

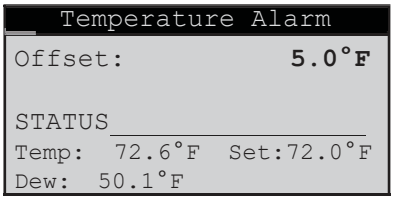
The High Humidity Alarm will cancel at 65%.

Conversely, with the default offset at 5.0%, the Low Humidity Alarm will cancel at 35%. (Setpoint 30.0% + Offset 5.0%)) 30.0% + 5.0% = 35.0%

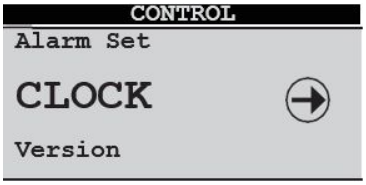
EXAMPLE 3: Water Temp Alarm Offset



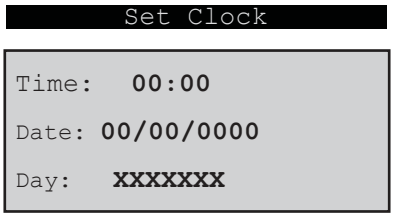
If the offset for the water temperature alarm is set at 5 °F (default), the high water temperature alarm will cancel when the actual temperature drops to the High Water Temperature Alarm setpoint (60.0 °F) - the Offset (5.0 °F), or, 60.0 °F - 5.0 °F = 55.0 °F. The high water temperature Alarm will cancel at 55 °F.



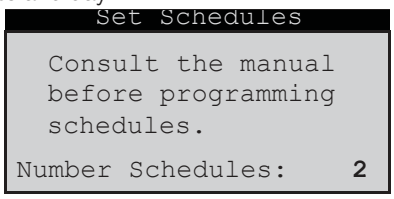
5.4.3 Clock Screens



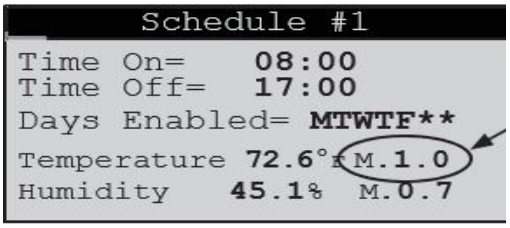
The Clock screens may be accessed from the Control menu. From these screens the operator may set the time, date and day and may choose to set-up an operating schedule for the A/C system.



The Set Clock screen allows the operator to set and/or adjust the current time, date and day.



The Set Schedules screen allows up to seven operating schedules to be enabled.



Offset Multiplier

As an example, the above schedule may be set for normal workday operations with selected on/off times (ex. 8:00 AM to 5:00 PM) and with the temperature set at 72.6 °F and humidity set at 45.1%. The M value adjacent to the entered setpoint parameter is for applying a multiplier to scale both the cut-in and cut-out offsets.

The multipliers are factored to the system offset values set in the Service menu (see Sections 5.5.1, 5.5.2 and 5.5.3), only for the schedule time period being set.

Default Cut-in/Cut-out Offsets

Temp. Cut-in Offset= 2.0 °F; Cut-out Offset= 0.3 °F

Humidity Cut-in Offset= -5.0%; Cut-out Offset= -2.0%

EXAMPLE 1: Temperature Offset Multiplier

With the default cut-in offset for temperature at 2 °F, a multiplier of M.1.0 × 2 °F= 2 °F. This means the unit will begin operating in the cooling mode at 74.6 °F (Setpoint 72.6 °F + Offset 2 °F). Conversely, with the default cut-out offset at 0.3 °F, the cooling mode will turn off at
72.9 °F. (Setpoint 72.6 °F + (M.1.0 × Cut-out Offset 0.3 °F))
72.6 °F + 0.3 °F = 72.9 °F.

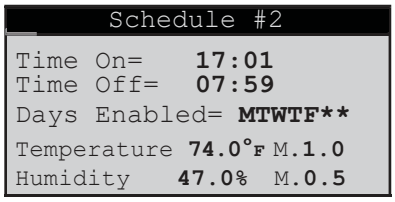
EXAMPLE 2: Temperature Offset Multiplier

If M.2.0 is entered, the off set for temperature is multiplied by 2.0. (M.2.0 × 2 °F= 4 °F). This means the unit will begin operating in the cooling mode at 76.6 °F (Setpoint 72.6 °F + Offset 4 °F). Conversely, the cooling mode will turn off at 73.2 °F (Setpoint 72.6 °F + (M.2.0 × Cut-out Offset 0.3 °F)).

EXAMPLE 3: Humidity Offset Multiplier

With the default cut-in offset for humidity at -5%, a multiplier of M.0.7 × -5% = -3.5%. This means the humidifier will begin operating at 41.6% RH (Setpoint 45.1% + Offset -3.5%). Conversely, with the default cut-out offset at -2% the humidification mode will turn off at 43.7%RH.

From the Schedule #1 screen, press the up or down arrow keys to access additional enabled schedules (2-7).



Schedule number 2 may be set with higher temperature and humidity setpoints for scaling back operation during the evening hours (night setback).

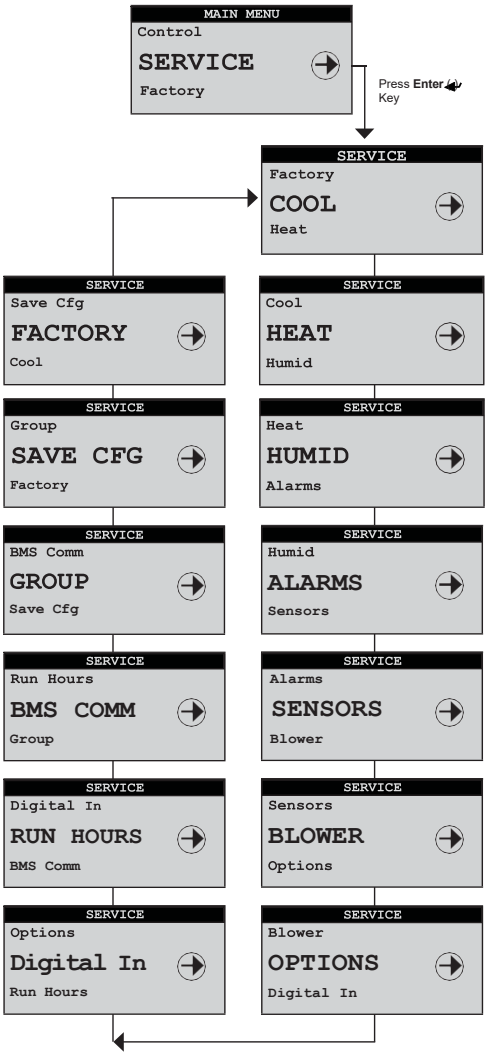
In these examples the unit is scheduled to not operate at all on Saturday and Sunday. Those days may be added to schedules 1 and 2 or a separate schedule may be set up for weekend operation if different temperature and humidity setpoints are preferred.

5.5 Service Menu

The Service menu screens allow the user to enter cut-in and cut-out values, calibrate the system control sensor(s), save and restore parameters and view the event log. The Service menu may be entered and programmed by the user via the password menu (requires level 2 password). Once password access is granted, the user may access the service menu screens.

It allows the operator to adjust the number of days for switching the lead cooling circuit duty and select an hour of the day for this to occur. The current lead circuit may also be changed at the display

Figure 8. Service Menu Selections



5.5.1 Cool

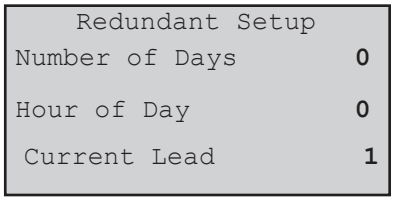
The Service>Cool menu screens differ depending upon whether the A/C unit is configured for DX operation and/or CW/WG/AWS operation.

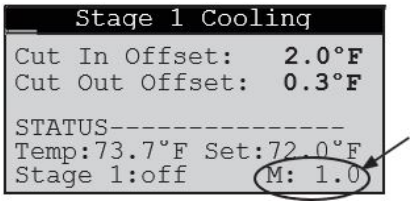
5.5.1.1 DX Cooling Screens

If the A/C unit has compressor(s), the cut-in/ cut-out offsets for each compressor stage may be adjusted from the Service>Cool menu. The offset values are added to the temperature setpoint and establish the temperatures for the compressor to turn on (Cut-in) and off (Cut-out). This screen displays the current air temperature and setpoint temperature. The On/Off status of the compressor (Stage 1) is shown along with the offset multiplier (M). The offset multipliers may be set in the Service>Options>T/H Scaling menu screen

If the A/C unit is configured for operation as a dual compressor or tandem compressor system, additional screens are provided for viewing and adjusting parameters for the additional stages. Ordinarily, A/C units equipped with multiple compressors stage the operation of the compressors based on rising air temperature. The compressors rotate after each run cycle.

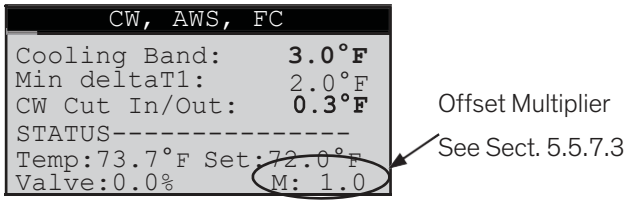
A Redundant Set-up screen appears next for units equipped with dual compressors (STULZ models VFS and CFS), if the unit is configured for redundant operation.





Offset Multiplier

5.5.1.2 CW Cooling Screens

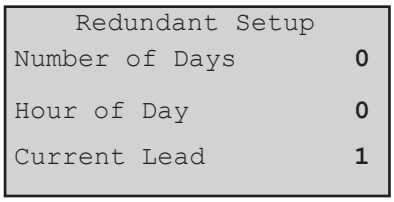


If the A/C unit is configured for CW, AWS or FC operation, the cooling band may be adjusted in the Service>Cool menu. The **Cooling Band** establishes the number of degrees above setpoint (+ the **CW Cut In/Out** value described below) for the valve to reach the fully open position.

The **Min deltaT1** is the minimum temperature rise expected between the entering and leaving water temperature. A flow alarm is activated if the temperature difference falls below this value while the unit is actively cooling. The **CW Cut In/Out** value is the offset added to the temperature setpoint and establishes the temperatures for the control valve to open (Cut-in) and close (Cut-out) as well as the P/I dead band.

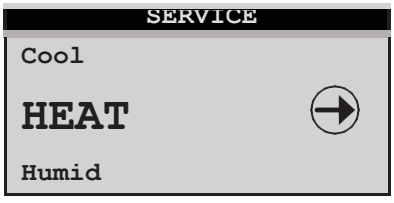
This screen also displays the current air temperature and setpoint temperature. The position of the flow control valve is shown at the bottom of the screen along with the offset multiplier. If the A/C unit is configured for operation as a dual CW system, a second screen is provided for viewing and adjusting parameters for the second cooling circuit (CW2).

The Redundant Set-up screen appears next if a dual CW unit is configured for redundant operation (see Section 5.5.1.1).

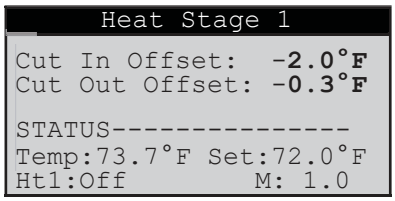


The A/C unit is equipped with an optional valve selector switch on the front door, a field appears in the bottom of the screen that allows it to be enabled. When enabled, the valve switch takes priority over the entries in the display.

5.5.2 Heat



▼

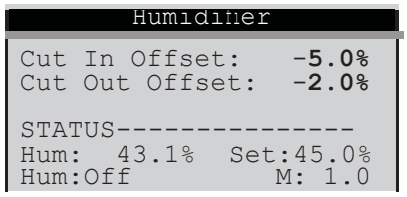


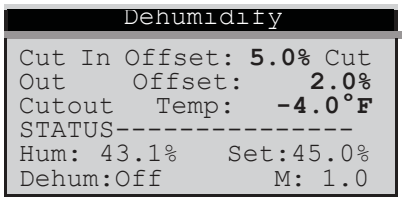
The cut-in/cut-out offsets for each heating stage (up to three stages) may be adjusted from the Service>Heat menu.

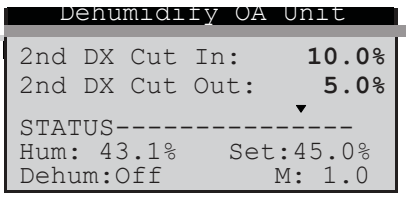
5.5.3 Humidity

The cut-in/cut-out offsets for the Humidify, Dehumidify and Reheat modes may be adjusted from the Service>Humid menu.

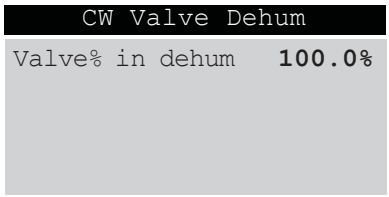
NOTE: The Humidifier screen only appears if the A/C unit is equipped with a humidifier at the factory.





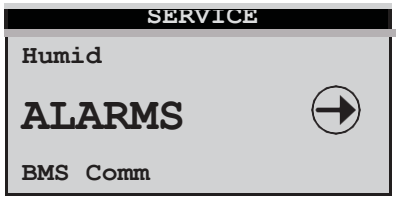


The following screen is provided for CW/ AWS or FC based units only.

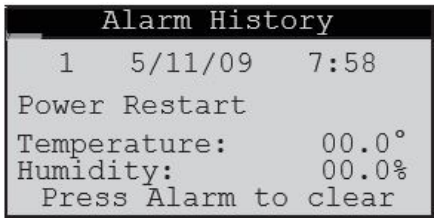


The maximum position to open the CW valve, while in the dehumidification mode, may set. This may be used when the heat load is low to reduce possible setpoint temperature overshoot while the unit is dehumidifying the air in the CW, AWS or FC mode.

5.5.4 Alarms



Sensors Offset screen (example).



A log of events is stored for view from the Service>Alarms menu. This menu displays the last 50 events sequentially numbered in order of occurrence. The alarm log is cleared by pressing the Alarm key while in this menu.

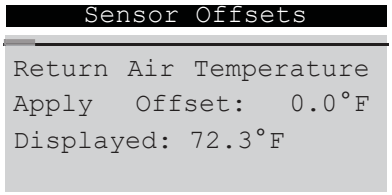
If the Alarm key is pressed when in any of the Service>Alarms screens, all stored alarm messages will be permanently erased from the controller's memory.

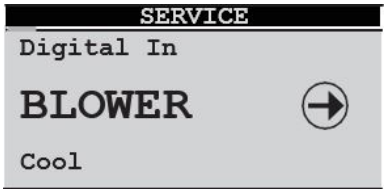
5.5.5 Sensors

When calibrating sensors, an offset at one extreme may produce an error at the other extreme. Always verify that any offset is valid over the entire range of the sensor.

5.5.6 Blower

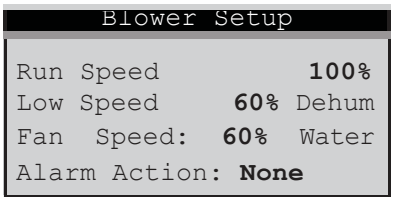
From the Service>Sensors menu, multiple display screens may be accessed to enter offsets for calibrating the unit's various sensors.





From the Service>Blower menu, screens may be accessed to view and adjust the blower speeds, set the CW to Fan ratio and set-up the underfloor static pressure if applicable.

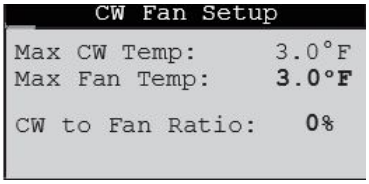
5.5.6.1 Blower Set-up



The fan runs at the low speed setting whenever there isn't call for heating, cooling, dehumidification or humidification. The fan speed increases directly to the run speed during heating or ramps up to that speed during cooling or humidification based on the air temperature (see next Section 5.5.6.2). The fan speed during dehumidification can be controlled in conjunction with the CW valve opening to limit the potential for over-cooling (see CW Valve Dehum screen in Section 5.5.3).

The lower field (**Water Alarm Action**) maybe used to set the action of the blower(s) in response to a CW or WG flow alarm condition. The selections are None, Off, Min(speed) or Max(speed).

5.5.6.2 CW Fan Set-up



This screen is provided for CW based units. The max CW temperature is the offset above the temperature setpoint

at which the CW valve is fully open, or 100%. The max fan temperature is the offset at which the fan speed reaches the Run Speed value (typically 100%). At the default values of 3 degrees each, the CW valve position will be 50% open at 1.5 degrees above setpoint and the fan speed will be 85%, as in halfway between 70% and 100%.

The CW to Fan ratio is to be used as a method of tuning in the interaction of the fan and CW valve after the temperature offsets are determined. A positive ratio value between 0% and 25% increases the CW valve position by that amount while decreasing the fan speed by the same amount. A negative value decreases the CW valve position while increasing the fan speed.

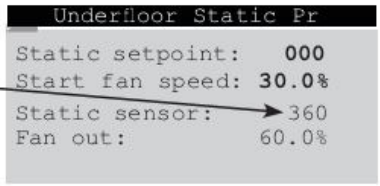
For the setting of above 50% CW valve and 85% fan speed, a 10% ratio will increase the CW valve to 55% and decrease the fan speed to 76.5%. A -10% ratio will decrease the CW valve to 45% while increasing the fan to 93.5%. The regular limits on the CW valve and fan still apply. If the unit is in the dehumidification mode, the fan speed will be limited to the **Dehum Fan Speed** parameter.

5.5.6.3 Static Pressure Set-up

On units equipped for static pressure control, static pressure should be set-up and enabled when commissioning the A/C unit. The operating static pressure can only be set correctly after the A/C unit is installed and operable in its intended location.

To set the static pressure, turn on the A/C unit and allow the blower(s) to reach full speed. Then, call up the Service menu. Enter the Service level password and scroll to the Blower>Underfloor Static Prg screen. This screen is only available when the controller is configured by the factory to

Make note of the current miwg static pressure value shown in the display



Next, scroll up to the Service>Blower>Blower

Setup screen (See Section 5.5.6.1). Adjust the Low Speed value up or down accordingly to raise or lower the current static pressure. Return to the Service> Blower>Underfloor Static Pr screen and observe the resultant Static sensor value.

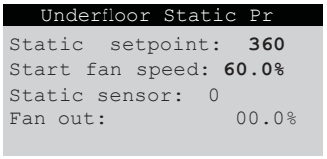
The static pressure is the square of the fan speed. A small change in fan speed will have a large effect on the underfloor static pressure.

It will be necessary to fine tune the static pressure by repeating the steps of setting the Low Speed

value in the Service>Blower>Blower Setup screen and then checking the static pressure result in the Service>Blower>Underfloor Static Pr screen. When the adjusted **Low speed** value produces the desired static pressure, write down both the **Low Speed** value

Re-enter the Service menu and scroll to the Service>Blower>Underfloor

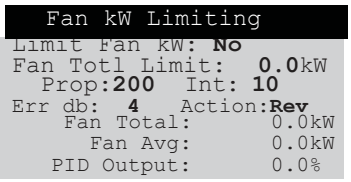
Static Pr screen. Enter the **Static setpoint** value that appeared in the **Static sensor** field and enter the S**tart fan speed** value that was the final **Low Speed** value.



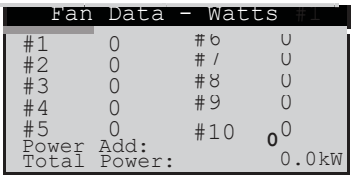
The A/C unit will now operate using proportional control to maintain the static pressure at the setpoint entered.

If the speed values are adjusted in the Service>Blower Setup screen (Section 5.5.6.1), it will have no effect on the operating fan speeds as they are now controlled by static pressure.

5.5.6.4 Modbus Fan Control and Data Monitoring

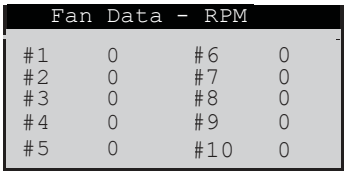


This screen appears if the controller is configured for Modbus fan control with a Field bus expansion card. It allows adjustments to fan kW limiting parameters. Limits total kW of all fans (sum). P/I control parameters may also be adjusted.



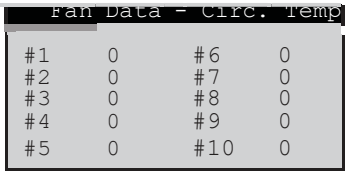
Modbus Data – Watts

The real time power consumption in kW is displayed for each fan. It may be used to estimate the total power consumption for the system while it operates. First enter a Power Add value which will be added to the real time power consumption of both fans. The Power Add value is the estimated sum (in watts) for the balance of the system loads. I.e. power transformer, etc. The result is displayed in the lower field Total Power:

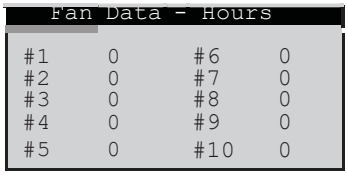


Modbus Data – Fan RPM (view only)

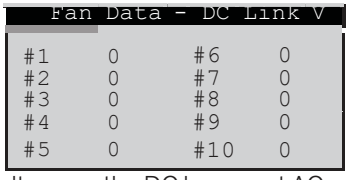
Additional view only Modbus fan data screens appear after the Fan RPM data screen. These data screens provide the following information for each fan:



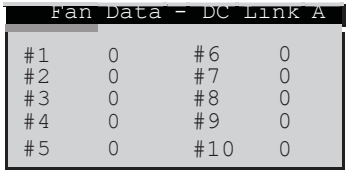
Circuit Temperature, in degrees Celsius, of fan motor housing



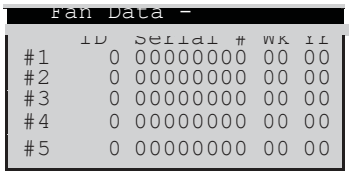
Fan Run hours



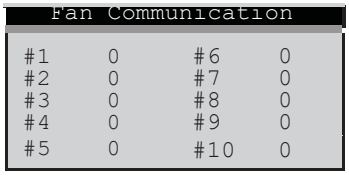
DC Link Voltage (Voltage on the DC bus – not AC supply voltage)



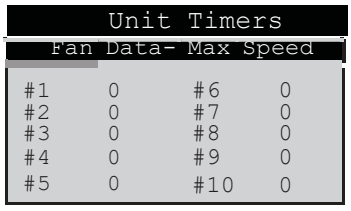
DC Link Amperage (Amps on the DC bus – not AC supply voltage)



Fan ID/Serial number/Week and year of build



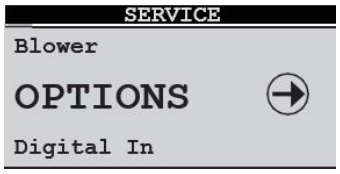
Status of fan communication with STULZ E^2 controller

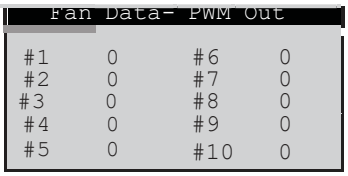


Fan Max speed – Maximum allowed speed in RPM

Pulse Width Modulation (PWM) being sent to the motor.

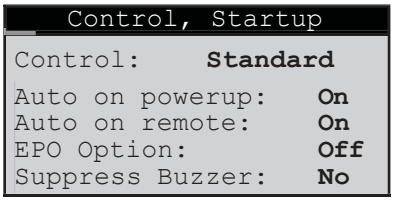
5.5.7 Options Menu





From the Service>Options menu, the Enter ( ) key may be pressed to access a sub-menu with screens used to set-up and adjust various options.

5.5.7.1 Control, Startup



The Service>Options>Control, Startup screen allows the operator to select the control method (Standard, Dewpoint or Hybrid).

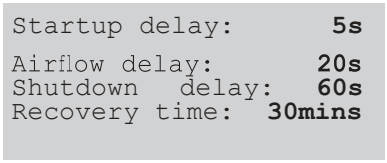
Auto on powerup - If set to **On**, the A/C unit turns on automatically when main power is applied.

Auto on remote - If set to **On**, the A/C unit may be turned on via a remote On/Off switch.

EPO Option (Emergency Power Off) - If set to **On**, the off delay timers are bypassed so compressors, blowers etc. stop operating immediately when the unit is turned off by a remote On/Off signal or a critical alarm.

Suppress Buzzer - Allows the operator to enable or disable the alarm signal buzzer.

5.5.7.2 Unit Timers



The Service>Options>Unit Timers screen allows the operator to adjust the unit timers controlling various start-up or shut down delay periods.

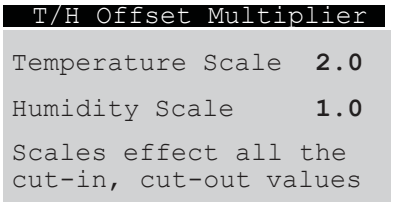
Startup delay - Time delay before blower(s) begin operating after pushing the Enter key or after turning the unit on with a remote on command.

Airflow delay - Time delay for allowing the blowers to reach adequate speed before the air proving sensor actively monitors an airflow alarm condition.

Shutdown delay - Time delay before unit stops operating after pressing the Enter key for three seconds or after turning it off with a "remote off" command.

Recovery time - Time period after startup that temperature and humidity alarms are masked from signaling nuisance high or low temperature and humidity alarms.

5.5.7.3 T/H Offset Scaling



The Service>Options>T/H Offset Multiplier screen allows the operator to enter a multiplier to apply to scale both the temperature and humidity cut-in/cut-out offsets. The multipliers are factored to the system offset values set in the Service menu (Sections 5.5.1, 5.5.2 and 5.5.3).

Default Cut-in/Cut-out Offsets

Temp. Cut-in Offset= 2.0 °F; Cut-out Offset= 0.3 °F

Humidity Cut-in Offset= -5.0%; Cut-out Offset= -2.0%

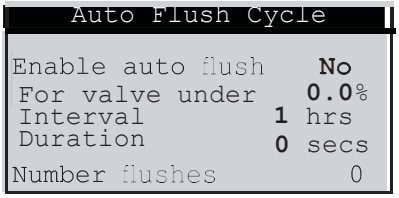
EXAMPLE: Temperature Offset Multiplier

With the default cut-in offset for temperature at 2.0 °F, a multiplier of 2.0 × 2 °F = 4 °F. This means the unit will begin operating in the cooling mode at 76.0 °F (Setpoint 72.0 °F + Offset 4 °F). Conversely, with the default cut-out offset at 0.3 °F, the cooling mode will turn off at 72.6 °F.

(Setpoint 72.0 °F + (2.0 × Cut-out Offset 0.3 °F))

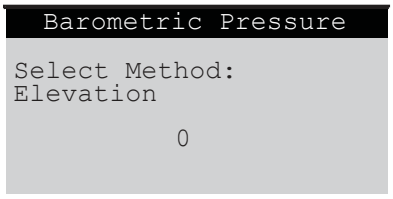
72.0 °F + 0.6 °F = 72.6 °F

5.5.7.4 Auto Flush Cycle



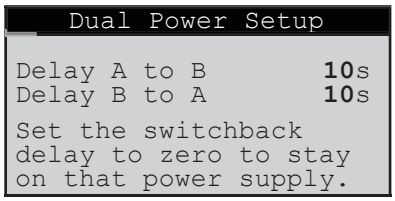
The Service>Options/Flush Cycle screen may be used to enable a periodic flushing of the CW, FC or AWS coils with the control valve in the fully opened position. This is used to remove any sediment that may have collected while the A/C unit is actively cooling. (This does not operate if the A/C unit is off or in valve position ever exceeds the percentage entered since the last flush cycle, the scheduled flush cycle will be skipped and a new interval will begin. If the valve does not reach the minimum open position entered, aflush cycle will occur when the interval since the last flush cycle expires. The interval between flushes may be varied from 1 hour to 720 hours (30 days). The duration of the flush cycle may be varied from 30 to 300 seconds. The number of flushes displayed at the bottom of the screen is the total number of flush cycles since the A/C unit was initialized.

5.5.7.5 Barometric Pressure

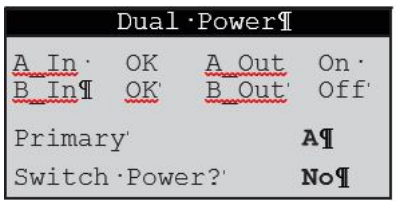


The barometric pressure set-up menu is enabled when the special sensors are selected to be “Airflow rate (no GPM)” or “Calculate GPM” in the Factory>Options>Enb Special Sensors menu. Select Elevation (default), Manual, Local Sensor, or Network. The elevation defaults to sea level (0). Manual selects a fixed barometric pressure in millibars. Local Sensor selects an analog input to provide the barometric pressure in millibars. Network selects a BMS supplied value for the barometric pressure in millibars.

5.5.7.6 Dual Power



The Service>Options>Dual Power Setup screens appear only if the controller is programmed to manage the automatic dual power transfer sequence. The controller uses its onboard timers for power switch over, not the relay timers in the A/C unit. This screen allows the delay timers for automatic dual power switch over to be adjusted.



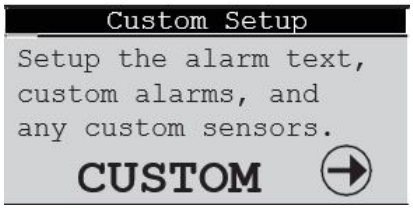
If enabled, a minimum valve opening threshold may be set below which a periodic flush cycle is required. That is, if the control

The next Service>Options>Dual Power screen allows the status of the dual power sources to be viewed if the controller is

programmed to manage the dual power auto transfer sequence. The ability to select primary power sources and manually switch them is available with this screen.

The identifiers A and B may be replaced with Pre and Alt as an option when the controller is configured at the factory. In such case, power source A is termed Pre (Preferred); power source B is termed Alt (Alternate).

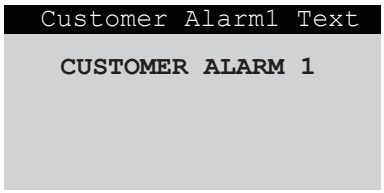
5.5.7.7 Custom Alarm Setup

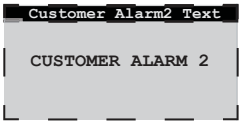


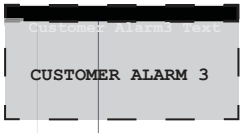
From the Service>Options>Custom Setup screen, press the Enter key to access a menu to set-up the custom alarms and sensors. Any controller alarm or signal failure will activate the summary alarm output. Upon receiving an alarm indication, the user may press the alarm key and call up alarm screen messages. The E² controller may also monitor a customer supplied alarm input device. One set of Customer Alarm input terminals is standard and up to two more may be added as an option.

5.5.7.7.1 Customer Alarms

A Customer Alarm input may be used to activate the Summary Alarm relay and show a Customer Alarm message in the alarm display screen. A Customer Alarm message may simply be displayed as CUSTOMER ALARM # as shown below, press and use the and arrow keys to construct a specific alpha/numeric message in the line stating the specific alarm condition in their own terms; for example, **GAS DETECTION, INTRUSION ALARM**, etc. The Customer Alarm message may be set-up on one line with up to 20 characters.



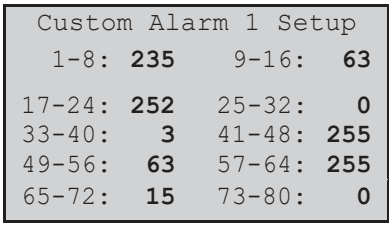


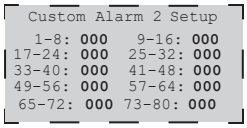


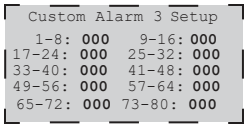
E² controllers may be equipped with up to 2 additional Customer Alarms as an option.

5.5.7.7.2 Custom Alarms

In addition to the Summary Alarm, the ***E²*** controller may activate a Custom Alarm output and energize a designated n.o./n.c. relay. A custom alarm output is set up by adding the binary bitmask numbers assigned to the specific alarms and signal failures that need to be monitored and then entering them in the Custom Alarm Setup screen shown below:







E² controllers may be equipped with up to 2 additional Custom Alarms as an option.

The operator can select any mix of the 80 alarm variables as shown in the tables that follow. As an example, for a custom alarm based only on the occurrence of water detection, condensate pan, pump, failure of the return temperature and humidity sensors the operator would enter the following bitmask values for the applicable alarm numbers and enter 0 for the rest:

Custom Alarm number 1 - 8: Water detection (No. 7) = 64
Custom Alarm number 9 - 16: Condensate pan (No. 9) + Pump (No. 14) = 33 (1+32)
Custom Alarm number 41- 48: Return temperature (No. 41) + Return humidity (No. 42) = 3 (1+2)

The custom alarms are set up by entering the bitmask totals developed from the following tables.

Alarms 1 to 8

No.	Description	Bit mask	Default
1	***Emergency shutdown***	***1***	***1***
2	***Remote shutdown***	***2***	***2***
3	Customer alarm 1	4	0
4	***Airflow***	***8***	***8***
5	Filter	16	0
6	***Fire/smoke***	***32***	***32***
7	***Water detection***	***64***	***64***
8	***Heater over temperature***	***128***	***128***

Factory Default Bitmask Total 235

Alarms 9 to 16

No.	Description	Bit mask	Default
9	***Condensate pan***	***1***	***1***
10	***Circuit 1 low pressure***	***2***	***2***
11	***Circuit 1 high pressure***	***4***	***4***
12	***Circuit 1 low pressure***	***8***	***8***
13	***Circuit 1 high pressure***	***16***	***16***
14	***Pump***	***32***	***32***
15	Dual power input A	64	0
16	Dual power input B	128	0

Factory Default Bitmask Total 63

The default values (shown in ***bold italics***) are factory set to generate a custom alarm output on any of the major alarms and any sensor failure. Only the enabled sensors can generate an alarm. To enable an additional custom alarm, add the alarm bitmask number to the factory default total and enter the new total for the applicable alarm numbers in the Custom Alarm Setup screen. If an alarm condition appearing in the following tables is detected, it needs to be reset at the unit's display terminal or via the BMS.

Alarms 17 to 24

No.	Description	Bit mask	Default
17	Customer alarm 2	1	0
18	Customer alarm 3	2	0
19	***Humidifier***	***4***	***4***
20	***Flow alarm CW1***	***8***	***8***
21	***Flow alarm CW2***	***16***	***16***
22	***Fan alarm 1***	***32***	***32***
23	***Fan alarm 2***	***64***	***64***
24	***Fan alarm 3***	***128***	***128***

Factory Default Bitmask Total 252

Alarms 25 to 32

No.	Description	Bit mask	Default
25	High temperature	1	0
26	Low temperature	2	0
27	High humidity	4	0
28	Low humidity	8	0
29	High water temperature CW1	16	0
30	Low water temperature CW1	32	0
31	High water temperature CW2	64	0
32	Low water temperature CW2	128	0

Factory Default Bitmask Total 0

Alarms 33 to 40

No.	Description	Bit mask	Default
33	***Loss of power***	***1***	***1***
34	***Fan alarm 4***	***2***	***2***
35	Damper Feedback	4	0
36	Pre Filter	8	0
37	Pre HP C1	16	0
38	Pre HP C2	32	0
39	Reserved	64	0
40	Reserved	128	0

Factory Default Bitmask Total 3

Alarms 41 to 48- (Sensor Failure Alarms)

No.	Description	Bit mask	Default
41	***Return temperature***	***1***	***1***
42	***Return humidity***	***2***	***2***
43	***Remote temperature***	***4***	***4***
44	***Remote humidity***	***8***	***8***
45	***EWT1 temperature***	***16***	***16***
46	***LWT1 temperature***	***32***	***32***
47	***EWT2 temperature***	***64***	***64***
48	***LWT2 temperature***	***128***	***128***

Factory Default Bitmask Total 255

Alarms 49 to 56- (Sensor Failure Alarms)

No.	Description	Bit mask	Default
49	***Circuit 1 discharge pressure***	***1***	***1***
50	***Circuit 1 discharge pressure***	***2***	***2***
51	***Economizer return temperature***	***4***	***4***
52	***Economizer return humidity***	***8***	***8***
53	***Economizer outdoor temperature***	***16***	***16***
54	***Economizer outdoor humidity***	***32***	***32***
55	***Reserved***	***64***	***64***
56	***Reserved***	***128***	***128***

Factory Default Bitmask Total 255

Alarms 57 to 64- (Sensor Failure Alarms)

No.	Description	Bit mask	Default
57	***Static air pressure***	***1***	***1***
58	***Differential air pressure***	***2***	***2***
59	***Dewpoint***	***4***	***4***
60	***Airspeed***	***8***	***8***
61	***Circuit 1 suction pressure***	***16***	***16***
62	***Circuit 1 suction pressure***	***32***	***32***
63	***Circuit 1 suction temperature***	***64***	***64***
64	***Circuit 2 suction temperature***	***128***	***128***

Factory Default Bitmask Total 255

Alarms 65 to 72

No.	Description	Bit mask	Default
65	***Custom Sensor 1***	***1***	***1***
66	***Custom Sensor 2***	***2***	***2***
67	***Custom Sensor 3***	***4***	***4***
68	***Custom Sensor 4***	***8***	***8***
69	Reserved	16	0
70	Reserved	32	0
71	Reserved	64	0
72	Reserved	128	0

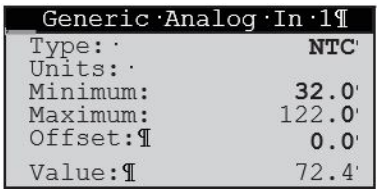
Factory Default Bitmask Total 15

Alarms 73 to 80

No.	Description	Bit mask	Default
73	System off	1	0
74	BMS Keep alive off	2	0
75	Reserved	4	0
76	Reserved	8	0
77	Reserved	16	0
78	Reserved	32	0
79	Reserved	64	0
80	Reserved	128	0

Factory Default Bitmask Total 0

5.5.7.7.3 Custom Sensors Screens



If the controller is configured to monitor custom sensors (optional), a display screen is provided to set-up the parameters for each custom sensor the controller is configured to use (up to 4). Each screen allows the selection of parameters specifically for the sensor to which it's assigned.

Type = NTC, 4-20mA, 0-1volt or 0-5volt.

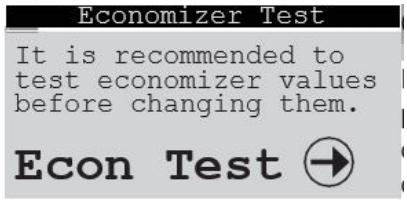
Units = °F, °C, %, psi, miwg, fpm, mbar, m/s or none (default).

From these screens sensors are also assigned a Minimum and Maximum range for the unit of measure selected. For example, if a 0-50 °C sensor is being used, enter 0 for Minimum and 50 for Maximum. To display the units of measure as °F instead of °C in the Information menu screens, convert the minimum and maximum values (0-50 °C = 32-122 °F) and enter the values to be displayed in °F (32 for Minimum and 122 for Maximum). Sensor values outside of the minimum and maximum values will generate a sensor failure alarm.

The current value being read by the sensor appears at the bottom of the screen.

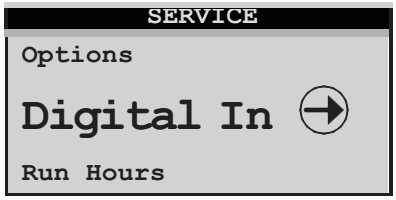
5.5.7.8 Economizer Test

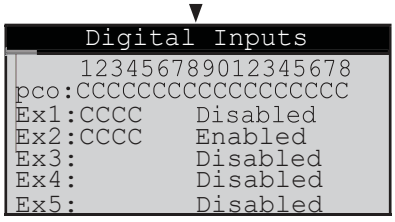
The Service>Options>Economizer Test screen appears only if the controller is equipped for Economizer operation.



If the Enter key is pressed, it allows the operator to enter a sub-menu to perform a functionality test of the economizer mode and experiment with different settings of temperature and dewpoint. Pressing the Down arrow key advances the display to the Options>Economizer Option screen which allows the Economizer mode to be enabled. See Section 6.0 for a detailed description of Economizer operation and see Section 6.3 for information on setting the operating parameters available in these screens.

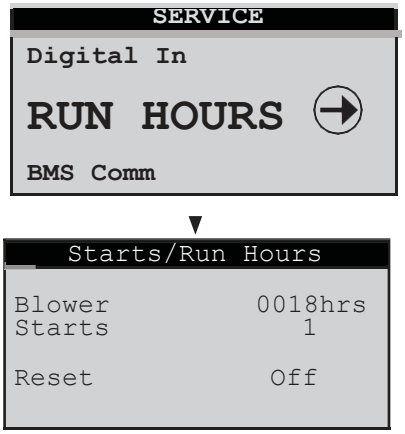
5.5.8 Digital In





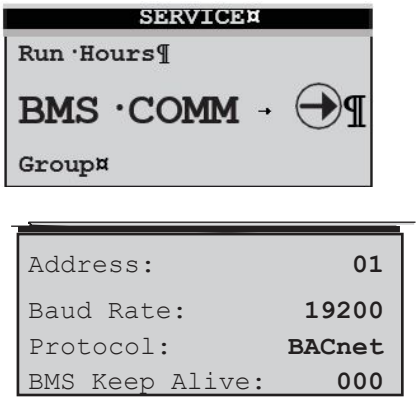
The Service>Digital In screen is provided for information only. It shows the state of each digital input as either Closed (+24 V) or Open (Gnd). Ex1 to Ex5 are the expansion I/O modules. To the right is Disabled or Enabled to show which expansion I/O modules are active.

5.5.9 Run Hours



From the Service>Run Hours menu, use of the Up and Down (arrow keys to access a menu of the component run hours display screens that are applicable to the A/C unit. Each screen displays the number of run hours and number of starts logged for the component (i.e. blower, pump, compressor, heater, humidifier, etc.). The run hours and starts values may be reset to 0. The values displayed in each screen are the values logged since the last time the screen was reset.

5.5.10 BMS Communication

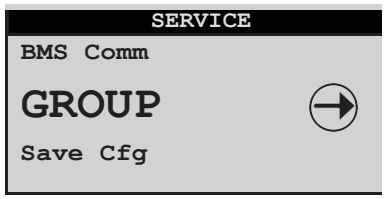


The Service>BMS Comm menu is used to set-up parameters to allow a BMS (BAS) to interface with the controller. See Section

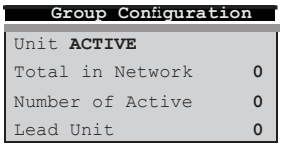
7.3 for a description of this screen and instructions for setting up BMS communication.

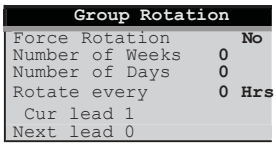
5.5.11 Work Group Screens

The Service>Group display screens, shown below, appear but are only functional if the controller is configured to manage two or more units together as a group. They allow configuration of the parameters that apply to how the A/C units interact in the work group.

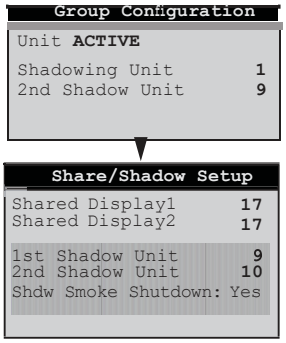


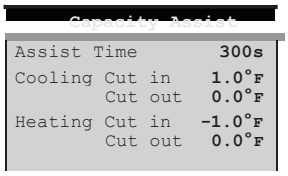
Assist>Group





Shadow>Group Menu

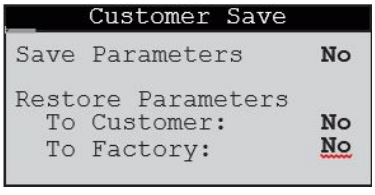




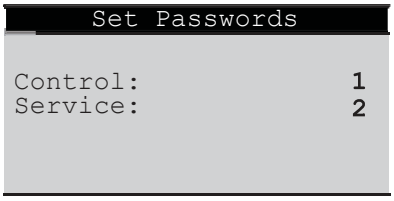
See Section 7.2.6 for additional Service>Group screens and for a detailed description of how work groups are set up and information on setting the operating parameters available in these screens.

5.5.12 Save Configuration

The default setpoints may be restored and passwords may be changed from the Service>Save Cfg menu.



The first Service>Save Cfg menu screen allows the operator to save any adjustments made in Service level menu screens as the new "Customer" parameters or, restore the controller to the previously saved "Customer" parameters. The user may also restore the controller to original factory default parameter values shown in Table 2.



Use the Enter key to move the flashing cursor to the applicable field and confirm by pressing the Up or Down arrow key. The word **No** will momentarily change to **Yes**, indicating the command has been accepted. Then press the Enter key sequentially until the flashing cursor returns to the top left corner of the screen.

The table that follows are some of the Factory default parameters.

Table 5. Factory Default Setpoints

PARAMETER	DEFAULT VALUE
Temperature Setpoint	72 °F
Cool Stage 1 Cut-in	74 °F
Cool Stage 1 Cut-out	72.3 °F
Cool Stage 2 Cut-in	75 °F
Cool Stage 2 Cut-out	73 °F
Heat Stage 1 Cut-in	70 °F
Heat Stage 1 Cut-out	71.7 °F
Heat Stage 2 Cut-in	69 °F
Heat Stage 2 Cut-out	71 °F
Heat Stage 3 Cut-in	68 °F
Heat Stage 3 Cut-out	70 °F
Humidity Setpoint	45% RH
Humidify Cut-in	40% RH
Humidify Cut-out	43% RH
Dehumidify Cut-in	50% RH
Dehumidify Cut-out	47% RH

The second Service>Save Cfg menu screen allows new passwords to be set for entering the Control and Service menus.

5.5.13 Factory Menu

The Factory menu may be accessed from the Service>Factory screen. The factory level password must be entered to gain access to the menu. Contact STULZ Product Support for the password and for guidance when adjustments must be made at this level.

6.0 ECONOMIZER OPERATION

An economizer mode is available for applications using outdoor air-side economizing. The E^2 controller manages the economizer mode to use outside air and minimize the need for conventional cooling. It also monitors the outside air dewpoint so as to not introduce air that is either too wet or dry for the desired conditions.

To enable economizer operation, an outside air temperature/humidity sensor and a return air temperature/humidity sensor are provided to control the economizer damper system (see Figure 9).

The economizer mode is to be used with an opposing pair damper set-up, i.e. when the external outside air intake damper is set at 30% open, the room return damper moves to 70% open.

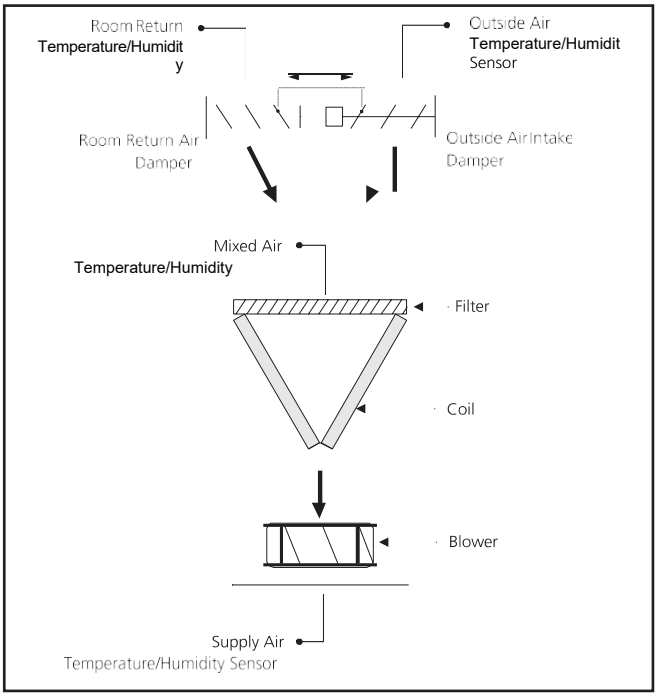


Figure 9. Economizer Operation

The controller only provides a single output signal intended to control the outside air damper. It is up to the designer of the damper system to use that signal to control a reverse-acting room return air damper. If the room return air damper is not interlocked to run in reverse or if it is missing altogether, true 100% outside air cannot be achieved.

NOTE: The mixed air sensor is the return air sensor inside the A/C unit.

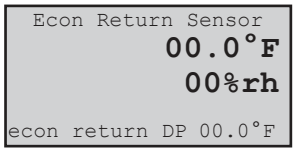
A proportional control signal (1-10 VDC) allows the external outdoor air intake damper and room return air damper to modulate their positions between 0-100% open to maintain user supply air setpoints. The controller seeks to achieve the most energy efficient mixture of outside air and return air to satisfy the temperature/humidity demand and maintain the setpoints.

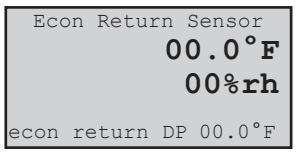
Damper control settings are determined by examining both the temperature and dewpoint properties of the outdoor air and the return air. The outdoor air damper output signal will lockout if the outdoor air temperature or dewpoint lie outside of the user adjustable setpoint values. A return air (mixed air) sensor is included to limit economizer function if low limit alarms are reached.

The economizer damper signal can be adjusted to a minimum output value to allow only the least amount of outside air to enter for meeting air quality ventilation requirements.

6.1 Economizer Information Menu Screens

The following display screens are available in the Information menu (Section 5.2) only if the unit is equipped for economizer operation by the factory. The screens display key operating parameters for the economizer mode.





6.1.1 Economizer Return Air Sensor

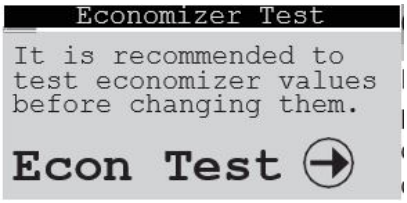
If the controller is configured for economizer operation, a display screen indicates the temperature and relative humidity as measured by the return air temperature and RH sensor inputs. The return dewpoint is calculated by the controller based on the return air temperature/humidity sensor inputs.

6.1.2 Economizer Outside Air Sensor

This screen indicates the temperature and relative humidity as measured by the outside air temperature/humidity sensor. The display also indicates the degree to which the outside air damper is opened as a percentage. The outside air dewpoint is calculated by the controller based on the Outside Air temperature/humidity sensor inputs.

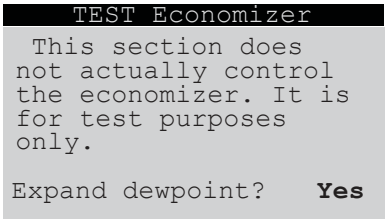
6.2 Economizer Service Menu Screens

The screens that follow allows economizer operation to be set up and tested and setup. They are available in the Service menu only if the economizer option is enabled by the factory.



6.2.1 Economizer Test

From the Service>Economizer Test screen, press the Enter key to enter a sub-menu to perform a functionality test of the economizer mode and experiment with different settings of temperature and dewpoint. Press the Down arrow key to advance the display to the Service>Economizer Options screen where the economizer mode is actually enabled (see Section 6.3.1).



It is recommended to use the regular dewpoint settings first to familiarize oneself with the economizer operation. Using the factory default settings, the dehumidification dewpoint is 52.3 degrees, the humidification dewpoint is 46.4 degrees, and the dewpoint through the setpoints is 49.5 degrees. Figure 10 depicts the default economizer zone as bounded by the rectangle A B C D.

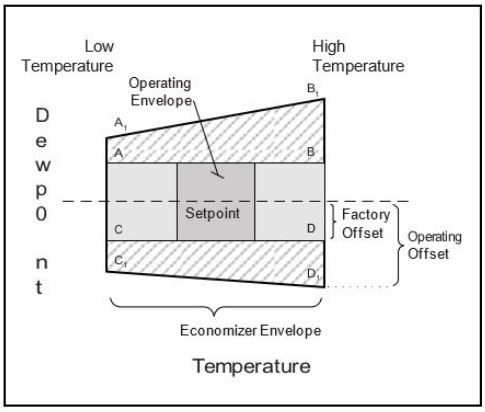


Figure 10. Default Economizer Zone

The factory default offsets may be adjusted to expand the operating zone as represented by $A_1 B_1 C_1 D_1$. The TEST Limits screen is used to adjust the high and low temperature and if enabled, modify the four dewpoint offsets. The starting dewpoint offset values shown are drawn from the default ones of +2.8 (49.5 + 2.8 = 52.3) and two arbitrary ones (-3.3 and -5). The offset values do not need to match nor does the resultant shape have to be a rectangle.

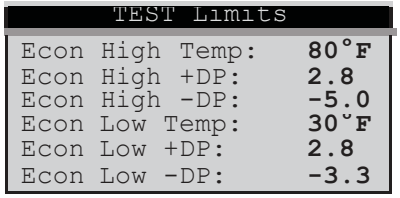


Figure 8 depicts the expanded dewpoint where the lower dewpoint offsets of C and D have been replaced by C and D_1.

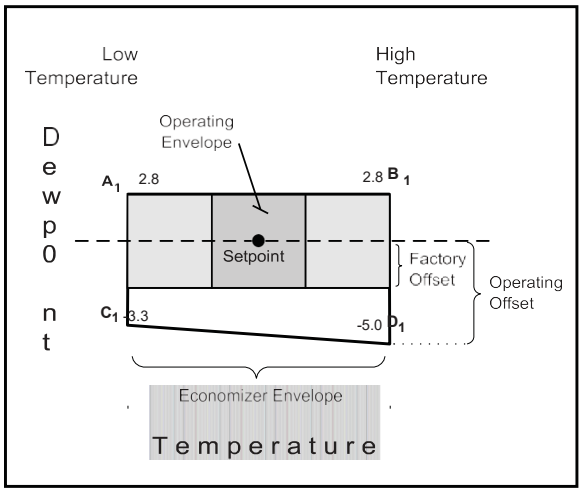
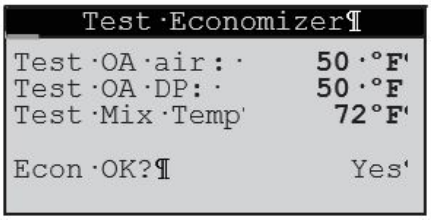
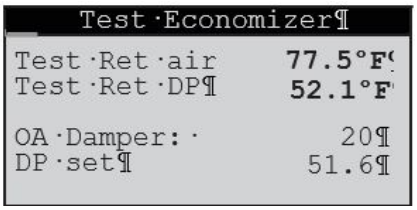
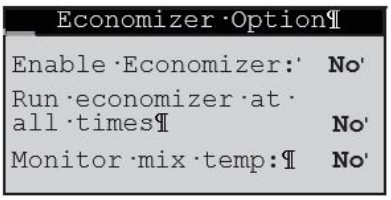


Figure 11 . Example Economizer Zone





The temperature setpoint and dewpoint may be changed in the Control menu if desired. The controller displays the damper setting for the input conditions (20%) and the resulting dewpoint (51.6). The operator can vary the damper setting to see how it effects the overall mixed air temperature and dewpoint coming into the A/C unit.



From the Service>Economizer Option screen the economizer mode is enabled by entering **Yes** in the field of the first line. If **Yes** is entered in the second line it allows economizer damper control to continue operating even when the A/C unit is turned off. In the third line the economizer mixed air monitoring function may be selected by the user.

The controller monitors the outdoor air and ceiling return air conditions and adjusts the damper setting to get the mixed air conditions as close as possible to the desired temperature setpoint. If the outdoor air conditions are outside of the user adjustable setpoints, the damper remains closed at 0%.

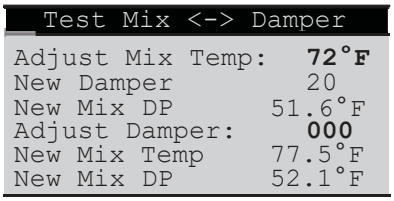
In the simple case where both the outdoor air and ceiling return air temperatures are above the temperature setpoint and outdoor conditions are within the economizer operating envelope, the colder of the two temperatures is selected which then drives the damper to 0% (full ceiling return air) or 100% (full outdoor air). Temperatures on either side of the setpoint cause the damper to open to a "New Damper" position such as 20% as shown in the above screen.

The damper position is determined by the air temperatures, but the resultant mixed air dewpoint is also taken into account. In this example, the ceiling return (room conditions) started at

52.1 degrees dewpoint and the outdoor air is at 50 degrees dewpoint. The incoming mix is at 51.6 degrees dewpoint. If the A/C unit or the overall conditioned space has no mechanism for humidification, the ceiling return dewpoint will drop which then causes the mixed dewpoint to drop even lower. Eventually, the room dewpoint will match the dewpoint of the outside air. The speed at which the dewpoint drops depends on the airflow rate and the size of the room.

6.3 Enabling Economizer Operation

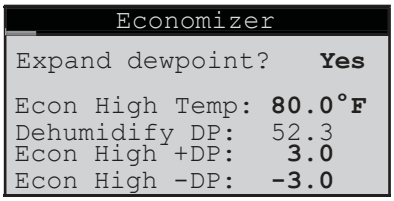
6.3.1 Economizer Option Screen



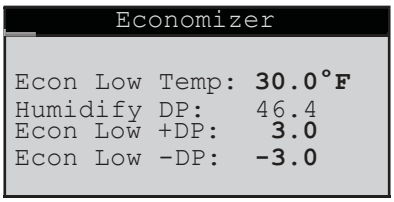
With the **Monitor mix temp** economizer selection set to **Yes**, the controller modulates the damper according to the external sensors and adjusts it accordingly if the mixed air sensor is not at the setpoint. This is intended for use in closed duct systems and allows for any inaccuracies in the damper system to be accounted for.

If **Monitor mix temp** is set to **No**, the controller will simply move the damper based on the external sensors and the desired setpoint. This is used for an open duct system where the external air comes into the room, but not solely through the A/C unit.

6.3.2 Economizer Screen Two



6.3.3 Economizer Screen Three



The third Service>Options>Economizer screen allows the operator to change the economizer high temperature value and expand the dewpoint boundaries. The **Econ Low +DP** and **Econ Low –DP** are offsets from the dewpoint value that passes through the temperature and humidity setpoint.

7.0 COMMUNICATION WITH THE CONTROLLER

It is possible for the STULZ E2 controller to communicate in multiple ways. The controller may be set up to use a pLAN network to link with additional E² controllers to create a work group consisting of multiple A/C units (see Figure 12 and Section 7.1).

Using a BMS interface port, the controller may also be connected to a BMS for monitoring and control of data points using a multitude of different serial communication protocols (see Section 7.3).

The second Service>Options>Economizer screen allows the operator to change the economizer high temperature value and expand the dewpoint boundaries. The Econ High +DP and Econ High –DP are offsets from the dewpoint value that passes through the temperature and humidity setpoint.

7.1 Work Groups

The controller may be networked with a group of A/C unit controllers via an RS485 connection to manage their outputs as a system in an N+M (M = number of standby units) group. The controllers from up to seven additional A/C units may be tied to a Lead controller. The number of units to be assigned as Active, Capacity Assist or Standby duty is to configured by the factory however, they may configured in the field (see Section 7.2.6) with assistance from STULZ Product Support. A unit may also be designated as "Out of Service" (see Section 7.1.4).

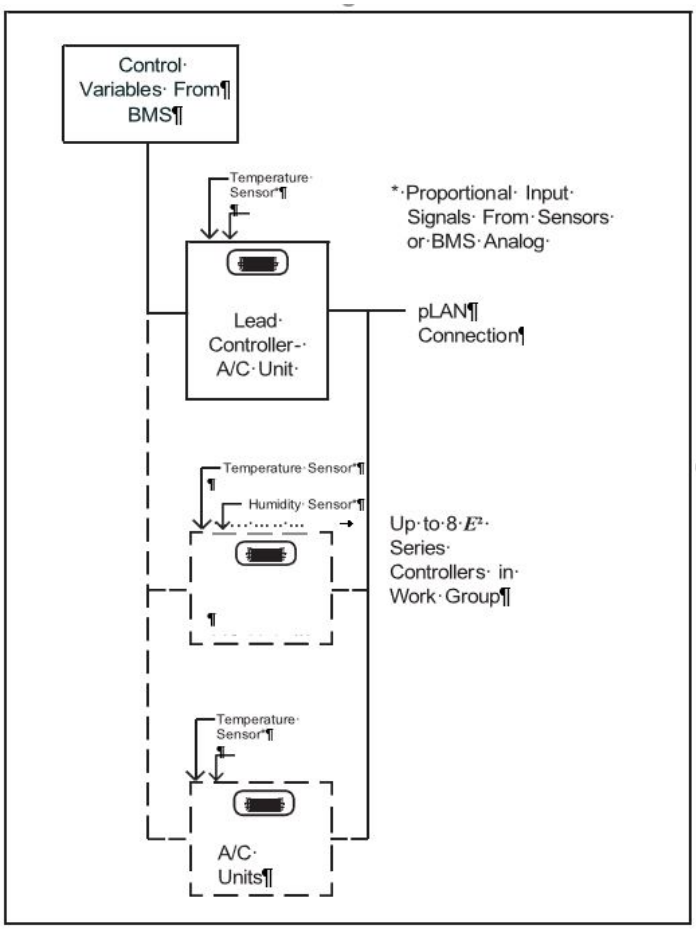
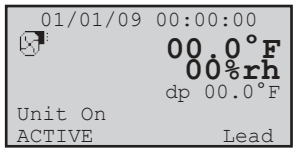


Figure 12. Configuring Multiple A/C Units

The Main screen of each unit in the work group indicates that unit's duty assignment in the bottom field. If the controller is the group Lead, it is indicated in the bottom field also.



Multiple Unit Display Screen

One controller may be designated as the work group lead and networked with the controllers from a series of up to 7 additional A/C units. If configured for multi-unit operation, the work group lead controller display panel allows access to the same data and group control sensor choices that are available from networked system controller display panels.

The controller for each A/C unit in a group may be manually called up from the Main display of the Lead unit via the PLAN network. From the Main display, simultaneously press the Up and Down arrow keys. This allows the Main display to access the controller in the adjacent A/C units in the group. From the Main screen, press the Up arrow key to view the Software Version/Date display screen to verify the accessed shadow unit's PLAN address appearing in the upper left corner of the screen.

From there, scroll through the menu screens as described in Section 3.4. Each time the Up and Down arrow keys are simultaneously pressed it sequences the display to the next grouped unit's controller. Again, access this screen to verify the PLAN address of the unit that has been interfaced with.

7.1.1 Capacity Assist

The Capacity Assist option can be used to maximize efficiency for conservation of energy and to more precisely control capacity at low demand. This feature enables Active A/C units to handle the demand up to a certain temperature/humidity setpoint and then enables additional units to begin operating gas needed. If the Active A/C units are running and unable to satisfy the demand, Capacity Assist A/C unit(s) may be programmed to turn on to assist the Active units.

Each Capacity Assist unit may set to control operation based on its local temperature/humidity sensor values or control operation based on network sensor values transmitted from the Lead controller. Multiple capacity assist units are typically set with each unit in the group assigned incrementally increasing/ decreasing offsets for cooling, heating, humidifying and dehumidifying so they will turn on one at a time only if the unit(s) currently operating are unable to satisfy the demand. They should incrementally turn off as each unit reaches its cut-out setpoint, while active A/C unit(s) continue to maintain room conditions at the desired level.

7.1.2 Standby

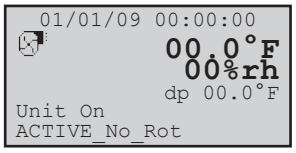
If the lead controller in the work group loses a signal acknowledgement from an active A/C unit in the group, that A/C unit is deemed as failed or taken out of service. The failed unit will be replaced with the first available standby unit from the work group. The standby unit is cycled on and designated as the new active unit in place of the failed unit.

7.1.3 Unit Rotation

In this mode, the Lead controller will rotate duty between the grouped A/C units to promote equal run time and will rotate the role of group lead. When set-up for unit rotation, the A/C units will rotate duty in order of their group addresses. Active, Capacity Assist and Standby units are all in the rotation cycle so even a standby unit will be cycled into active duty on a scheduled basis. The rotation time period is typically 1-week; however it may be set by the user via the Factory menu. Call STULZ Product Support for assistance when accessing the Factory menu.

7.1.4 No Rotation

A/C units in the group may have their duty assignments locked so they do not join the rotation cycle (capacity assist and standby no-rotation units cannot take the lead). In this case the message **No_Rot** appears after the duty assignment displayed in the main screen.



An Active_No_Rot unit is always On. It will never be capacity assist or standby. An Active_No_Rot unit may take the role as lead controller when the rotation puts it as the first active unit. Units designated as "Out of Service" do not rotate nor can the controller take the role of lead.

7.1.5 Out of Service

A unit may be removed from the group entirely by placing it Out of Service. In this mode, the unit will not operate. A unit may be placed in this mode as a safety measure to prevent it from unexpectedly starting when performing maintenance or repairs.

7.2 Setting Up a Work Group

A workgroup can consist of up to eight controllers (I/O boards) with pLAN addresses 1 to 8. Their corresponding display terminals will be assigned pLAN addresses from 32 down to 25. The E^2 controller program is defaulted with the controller address set to 1 and its terminal (display) address set to 32. As such, a normal stand-alone controller does not need any changes made to either the controller or the terminal address. The method to setting up work groups is to retain the first (group lead) controller's pLAN address as #1 and terminal address as #32 so that the sum of the addresses equals 33. The first controller added to the group is assigned pLAN address #2 and its terminal is assigned address #31, the sum of which again equals 33..The sum of the controller and terminal address numbers must always equal 33.

The A/C units in a work group should ALWAYS start with controller address 1 and go up from there. DO NOT skip over controller addresses. The list of suitable controller/display terminal address pairs is shown below:

Corresponding A/C Unit Controller to Terminal pLAN Addresses								
Controller (I/O board)	1	2	3	4	5	6	7	8
Display Terminal	32	31	30	29	28	27	26	25

Assign the terminal and controller I/O board addresses for each controller to be grouped. Review Sections 7.2.1 to 7.2.3 first, before turning power on and the assigning addresses. Do not interconnect the controllers together before assigning their terminal and I/O board pLAN addresses.

The first step is to change the terminal address of each controller to 0 referring to Section 7.2.1. Set the terminal address to 0 before assigning the controller (I/O board) address.

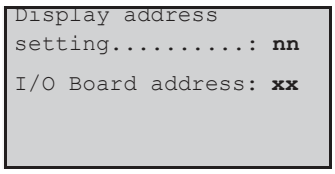
Note: If the terminal remains inactive (no key is pressed) for more than 30 seconds, the group set-up procedure is exited automatically, without saving any changes. Configure the Terminal Address.

7.2.1 Configure the Terminal Address

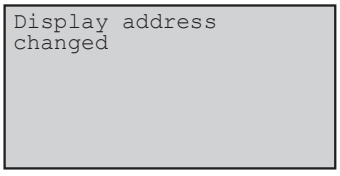
The address of the terminal (display) can only be configured if its RJ11 telephone jack is connected to the I/O control module in the electric box and power is turned on. The factory default value for the display terminal address is 32. To reassign the terminal address, press and hold the Up, Down and Enter keys simultaneously for five seconds until the Address Configuration screen shown below appears with the flashing cursor in the top left corner:

1. To change the address of the terminal (Display address setting), press the Enter key once. The cursor will move to the address field (nn).
2. Using the Up, Down keys, select 0 and confirm by pressing Enter .

   The Display Address Changed screen will appear indicating the display address selected is not the same as the one saved and the new value will be saved to memory.
3. Once the terminal address is set to zero, cycle the power to the unit Off and then back On. If the **`Display address setting`** field is set to **0**, the terminal will communicate with the controller using point-to-point protocol (not pLAN). The display field **`I/O Board address`** will disappear as it has no meaning until the controller I/O board pLAN address is set.



Address Configuration



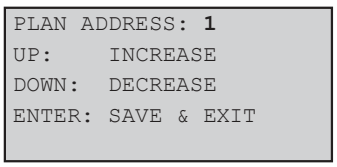
Display Address Changed

7.2.2 Configure the I/O Board pLAN Address

Immediately after turning power back on, press and hold the Alarm and the Up) Arrow keys Simultaneously for 10 to 15 seconds. First a display message self-test. Please wait will appear then the pLAN Address Configuration screen shown below will appear. Don't press the) key, the cursor is already in the modifiable field.

Press the key to set the pLAN address (#1 – 8) for the controller (I/O Board). The pLAN address #1 is already assigned by default to the first (Lead) controller in the group. Address

2 is to be assigned to the first controller added to the group (address #3 is to be assigned to the second controller added and so on). Then press the key to confirm the selection. A message **`NO LINK`** will appear.



Controller Address Configuration

Next, press the Up , Down and Enter keys simultaneously. Reconfigure the terminal address following the steps in Section again. This time set the terminal address to match the corresponding controller I/O board address. If the controller is assigned address 2, then the corresponding terminal address should be set to 31 as shown in the table on the preceding page. If the next controller is assigned address 3, the corresponding terminal should be set to 30.

After setting the correct terminal address, press the key once to confirm the selection. A message **NO LINK** will appear. At this point, the terminal has been set with the correct address for the controller and the controller has been set for the terminal, but now they need to be assigned to each other.

7.2.3 Assign the Terminal to the Controller

1. Access the Terminal Address Configuration screen again using the Up , Down and Enter keys.
2. Press the key until the cursor moves to the field **I/O board address**.
3. Using the keys, enter the address (1 – 8) for the controller I/O board.
4. Press the key twice to display the Terminal Configuration screen.
5. Here too, the key moves the cursor from one field to the next, and the Up and Down keys change the value of the current field. The field **P:0_** depicts the pLAN address (1 – 8) assigned to
   the I/O board. In the example shown, the controller has been assigned address 2.
6. Press the key to move to the field **Trm1 xx**. The field represents the address of the

```
P:02 Adr   Priv/Shared
Trm1 31       Pr
Trm2 None     --
Trm3 None     -- Ok?No
```

Terminal Configuration

terminal associated with the controller. Using the keys enter the address (25 – 32) of the terminal assigned to the controller (I/O board). In the example shown, address 31 has been entered for the first A/C unit added to the group.

7. The Priv/Shared column indicates the type of terminal. The workgroup is setup using private terminals.
8. Do not change the value (**Pr**). Press the key to move to the last field
9. Select the field Ok? **No**, choose **Yes** using the Up and Down keys and confirm by pressing to save the data and exit the group set-up procedure.
10. Referring to the wiring diagram provided with the A/C units, interconnect the units together with the pLAN cable(s) provided.

7.2.4 Fault messages

If the terminal detects the status of the I/O board it is associated with is off-line, the display shows the message:

I/O Board xx fault. If this appears, check the Signal LEDs on the controller (see Figure 3) for an error signal.

See Section 8.4 for guidelines on analyzing the signal LED's.

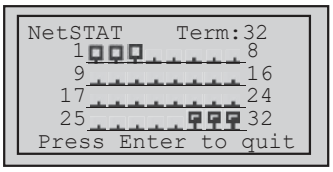
On the other hand, if the terminal receives no signal from the network, the display shows the following message:

NO LINK. If this appears, check the pLAN cables and ensure they are connected properly. Also, check the addressing (refer to Section 7.2).

7.2.5 Displaying the Network Status and Firmware Version

Once each A/C unit is configured with its new controller and terminal pLAN address, the entire network set up may be examined. Press the group set up keys together as done to access the Address Configuration screen but continue holding after the Address Configuration screen appears for at least 5 seconds until the Network Status (NetSTAT) screen appears.

The Network Status screen, shown below, provides overview of the pLAN group indicating which and how many devices are connected and the corresponding pLAN addresses.



Network Status

: Controllers (I/O Boards) active in network

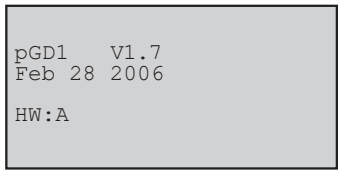
: Terminals active in network : No device connected

The example shown represents:

Controllers active in network, addresses: 1, 2, 3. ...

Terminals active in network, addresses: 30, 31, 32The terminal for controller 1 is always addressed 32; the terminal for controller 2 is always addressed 31, and so on such that the sum of the controller address number and the terminal address number always equals 33. Therefore, when viewing controller number 1, its terminal address will be 32. When viewing controller number 2, its terminal address will be 31, and so on.

Press a or arrow key to display the next screen showing the version of the firmware residing in the terminal.



Firmware Version

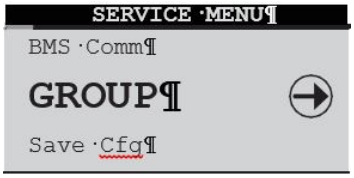
To exit the Network Status menu, press Enter.

The next step is to access the Service>Group screens used to configure the work group parameters (Section 7.2.6).

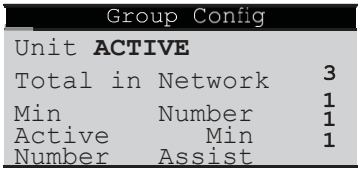
7.2.6 Configure Work Groups

Enter the Service>Group menu screens when multiple A/C units are grouped. These menu screens allow grouping parameters (duty, rotation, offsets, etc.) to be defined for the A/C units in the work group. These screens should be accessed after setting up the work groups (Section 7.2). The Service>Group menu screens may be accessed from the main screen by pressing the **Prg** key and scrolling through the menu selections until the word SERVICE appears in the center of the screen.

Press the Enter ( ) key twice and a screen will appear to enter the password for the Service level. Once the Service level password is accepted, press Enter to call up the menu screens. From here, press the Up ( )) or Down arrow keys to scroll through the Service menu selections.



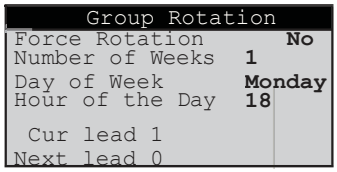
When the word GROUP appears in the center of the screen, press the Enter key to access the Service>Group menu screens. From here, use the Up ( ) or Down ( ) arrow keys to scroll through the Service>Group menu selections.
Service>Group>Group Config (Screen 1) See table below.



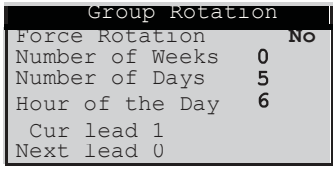
NOTE: Standby units are added to the number appearing in the Total in Network field although no field id provided in this screen indicating the number of stand by units that are part of the group. To determine the number of standby units, subtract Min Number Active + Min Number Assist from Total in Network. In the example shown there is one standby unit.

Display	Description	Variables	Default
Unit	Assign the duty of the A/C unit within the group. The duty must be assigned for each A/C unit at its local display terminal.	• Out of Service • Active • Standby • Assist • Active_No_Rot • Standby_No_Rot • Assist_No_Rot	Active
Total in Network	Enter the total number of A/C units in the group.	0 to 8	0
Min Number Active	Enter the total number of active A/C units in the group.	0 to 8	0
Min Number Assist	Enter the total number of assist A/C units in the group.	0 to 8	0
Lead Unit	Identifies which A/C unit controller is currently the lead unit in the group.	1 to 8	0

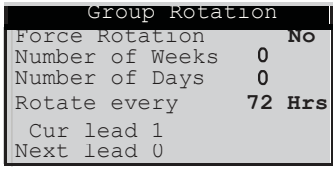
From the Group Rotation screen, program the controller to rotate operation of the A/C units in the group to promote equal run times. Three methods are available for the rotation: Multi-week basis, multi day basis and multi hour basis.



1) On a multi-week basis



2) On a multi-day basis



3) On a multi-hour basis

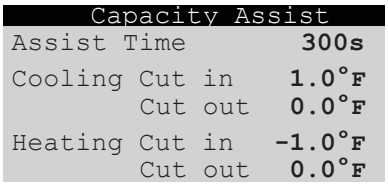
Service>Group>
Group Rotation
(Screen 2)

1) The multi week basis is selected by setting the number of weeks to a value from 1-99. This will be the number of weeks between rotations. The next line will show "Day of Week" which may be set to Monday through Sunday. The Hour of the Day is the hour of the day at which rotation occurs. A setting of 1/Mon/18 will rotate every week on Monday at 6 PM (18:00 hours).

2) The multi day basis is selected by setting the number of weeks to zero and the number of days to one or more. Now the number of days becomes an elapsed number of days between rotations. The Hour of Day is the hour of the day at which rotation occurs. A setting of 0/5/6 will rotate every 5 days at 6:00AM.

3) The multi hour basis is selected by setting the number of weeks to zero and the number of days to zero. The rotation will occur after the number of hours has elapsed. A setting of 0/0/72 would rotate every 72 hours

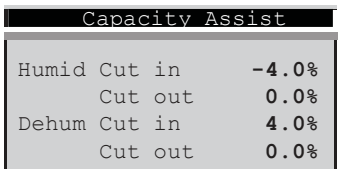
4) The first two are based on the internal calendar and will survive power losses of the lead unit. If the lead unit is powered off, the other units will assume temporary roles until the lead unit is powered back up. Upon the lead unit powering back up, the correct role of each unit is recalculated based on the current calendar date. The hourly basis is not based on the internal calendar and restarts at zero hours elapsed if the lead unit is powered off and then back on.



Service>Group>Capacity Assist (Screen 3)

Each A/C unit in the group may be assigned local cut-in and cut-out setpoints for its capacity assist operation. The values entered are offsets which are applied to the control setpoints established at the lead controller. Each unit in the group should be assigned incrementally increasing/decreasing offsets for cooling, heating, humidifying and dehumidifying so they will turn on one at a time only if the unit(s) currently operating are unable to satisfy the demand.

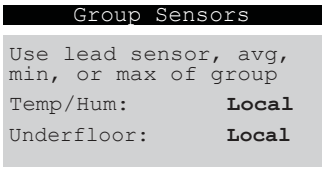
Display	Description	Variables	Default
Assist Time	Enter the delay period for capacity assist unit(s) to begin operating if it is in the capacity assist mode.	0 to 999	300
Cooling Cut-In	Enter a temperature setpoint offset for cooling capacity assist operation to begin.	-99.9 to 99.9	1.0
Cut-out	Enter a temperature setpoint offset for cooling capacity assist operation to stop.	-99.9 to 99.9	0.0
Heating Cut-In	Enter a temperature setpoint offset for heating capacity assist operation to begin.	-99.9 to 99.9	-1.0
Cut-out	Enter a temperature setpoint offset for heating capacity assist operation to stop.	-99.9 to 99.9	0.0



Service>Group>Capacity Assist (Screen 4)

The second Service>Group>Capacity Assist screen allows the adjustment of local capacity assist humidification and dehumidification setpoints.

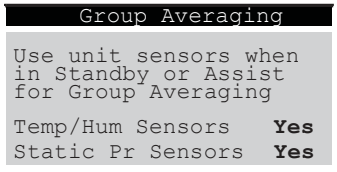
Display	Description	Variables	Default
Humid Cut-in	Enter relative humidity setpoint offset for humidifying capacity assist operation to begin	-99.9 to 99.9	-4.0
Cut-out	Enter relative humidity setpoint offset for humidifying capacity assist operation to stop	-99.9 to 99.9	0.0
Dehum Cut-in	Enter relative humidity setpoint offset for dehumidifying capacity assist operation to begin	-99.9 to 99.9	4.0
Cut-out	Enter relative humidity setpoint offset for dehumidifying capacity assist operation to stop	-99.9 to 99.9	0.0



Service>Group>Group Sensors (Screen 5)

The lead controller polls the controllers from all the A/C units in the work group and calculates the averaged value of their Temperature sensors, Humidity sensors and optional Underfloor Pressure sensors. It also determines the minimum (lowest) temperature sensor value and the lowest humidity sensor value in the A/C group and conversely, determines the maximum (highest) temperature sensor value and maximum humidity sensor value in the A/C group.

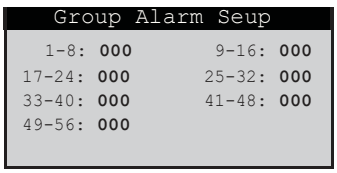
Display	Description	Variables	Default
Temp/Hum	Control the work group using the sensors connected to individual A/C units (Local) or control the work group using network sensor values transmitted from the lead controller. To control by network sensors, select from the network sensor values to be Lead, Average, Min or Max values. The selections made in this screen will affect all the controllers in the work group no matter which controller the screen is accessed from.	• Local • Lead • Average • Minimum • Maximum	Local
Underfloor		• Local • Average	Local



Service>Group>Group Averaging (Screen 6)

Each unit in the group may be individually set to allow the lead controller to include its sensors for determining the group average value when it is configured for Standby or Capacity Assist operation. If set to no, the lead controller will not poll that unit's sensors when calculating the averaged values

Display	Description	Variables	Default
Temp/Hum Sensors	Enter **Yes** for the unit to respond to its local sensors to enable Standby or Capacity Assist operation. Enter **No** for unit to respond to the Group sensors.	No Yes	Yes
Static Pr Sensors		No Yes	Yes



Service>Group>Group Alarm Setup (Screen 7)

The Group Alarm Setup screen may be accessed on the controller for each unit to be grouped. Bitmask numbers may be entered to establish which alarm conditions for that particular unit will initiate a group internal alarm. The group alarms may be set before the A/C units are wired together.

When a group alarm condition is detected by a unit, it causes that unit to temporarily switch over from "Active" to "Off" and if another unit is available in the group, it will rotate into its place. A status massage **Off by internal**

Alarm will appear in the Main screen of the unit that detected the group alarm and switched off.

See Section 5.5.7.7 for an overview of how to select alarms using bitmask values. The Group Alarms bitmask values are shown in the following tables. The settings may be viewed at the Info level (see Section 5.2.22). If an alarm condition appearing in the following tables is detected, it needs to be reset at the unit's display terminal or via the BMS for the unit to return to "Active" and resume operation.

Group Alarms 1 to 8

No.	Description	Bit mask	Default
1	Heater over temperature	1	0
2	Humidifier	2	0
3	Pump	4	0
4	Flow alarm CW1	8	0
5	Flow alarm CW2	16	0
6	Customer alarm 1	32	0
7	Customer alarm 2	64	0
8	Customer alarm 3	128	0

Group Alarms 9 to 16

No.	Description	Bit mask	Default
9	Circuit 1 low pressure	1	0
10	Circuit 1 high pressure	2	0
11	Circuit 2 low pressure	4	0
12	Circuit 2 high pressure	8	0
13	CW1 Valve Error	16	0
14	CW2 Valve Error	32	0
15	Damper End Switch	64	0
16	Reserved	128	0

Group Alarms 17 to 24

No.	Description	Bit mask	Default
17	Fan alarm 1	1	0
18	Fan alarm 2	2	0
19	Fan alarm 3	4	0
20	Fan alarm 4	8	0
21	Water detection	16	0
22	Condensate pan	32	0
23	Filter	64	0
24	Reserved	128	0

Group Alarms 25 to 32

No.	Description	Bit mask	Default
25	High temperature	1	0
26	Low temperature	2	0
27	High humidity	4	0
28	Low humidity	8	0
29	High water temperature CW1	16	0
30	Low water temperature CW1	32	0
31	High water temperature CW2	64	0
32	Low water temperature CW2	128	0

Group Alarms 33 to 40

No.	Description	Bit mask	Default
33	Return temperature	1	0
34	Return humidity	2	0
35	Remote temperature	4	0
36	Remote humidity	8	0
37	EWT1 temperature	16	0
38	LWT1 temperature	32	0
39	EWT2 temperature	64	0
40	LWT2 temperature	128	0

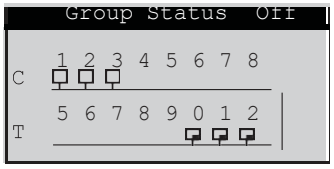
Group Alarms 41 to 48

No.	Description	Bit mask	Default
41	DX1 discharge pressure	1	0
42	DX2 discharge pressure	2	0
43	Economizer return temperature	4	0
44	Economizer return humidity	8	0
45	Economizer outdoor temperature	16	0
46	Economizer outdoor humidity	32	0
47	Circuit 1 high pressure Pre-alarm	64	0
48	Circuit 2 high pressure Pre-alarm	128	0

Group Alarms 49 to 56

No.	Description	Bit mask	De-fault
49	Static air pressure	1	0
50	Differential air pressure	2	0
51	Dewpoint	4	0
52	Airspeed	8	0
53	Circuit 1 suction pressure	16	0
54	Circuit 1 suction pressure	32	0
55	Circuit 2 suction temperature	64	0
56	Circuit 2 suction temperature	128	0

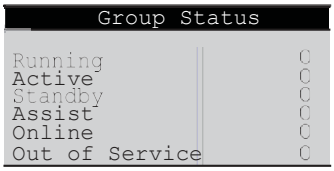
There are several automatic crossover signals that will cause a switch over from Unit Active to Unit Off. They are the occurrence of a remote shutdown command, unit shutdown from a group alarm, clock schedule or BMS command, fire/smoke detection, loss of all cooling (all compressors or all CW valves) or loss of airflow.



Service>Group>Group Status (Screen 8)

This screen provides an overview of pLAN work group.

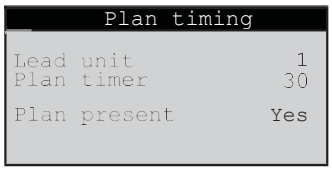
Display	Description	Variables	Default
Group Status	Indicates if multiple A/C unit grouping is enabled.	On Off	On
C 1 2 3 4 5 6 7 8	Indicates the address (1-8) of each controller in the pLAN.		1
T 5 6 7 8 9 0 1 2	Indicates the address (25-32) of the terminal for each controller in the pLAN. The terminal address numbers range from 25 to 32 but only the last digit appears in the screen.		32



Service>Group>Group Status (Screen 9)

This screen provides an overview of the current duty status for all the A/C units combined in the group.

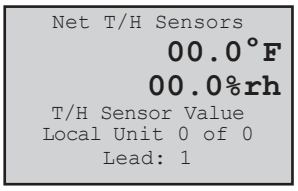
Display	Description	Variables	Default
Running	Display indicates how many units in the group are currently operating	0 to 9	0
Active	Display indicates how many units in the group are currently active	0 to 9	0
Standby	Display indicates how many units in the group are currently in standby	0 to 9	0
Assist	Display indicates how many units in the group are currently operating in the capacity assist mode	0 to 9	0
Online	Display indicates how many units in the group are currently available to operate	0 to 9	0
Out of Service	Display indicates how many units in the group are not available to operate	-	0



Service>Group>Plan timing (Screen 10)

The final step is to access the Service>Options>Group Setup screens used to configure parameters that apply to how individual A/C units interact in the work group.

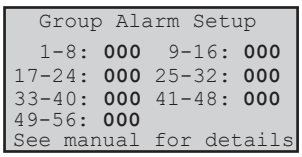
Display	Description	Variables	Default
Lead unit	Display indicates which unit is currently the lead.	0 to 8	0
Plan timer	Display indicates the time delay (in seconds) between the detection of a communication failure and the annunciation of a Comm alarm.	0 to 60	30
Plan present	Display indicates if a pLAN is detected by the controller.	No Yes	No



7.2.6.1 Group Sensor Values

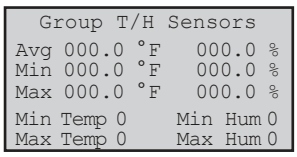
This displays the current group temperature and humidity control values transmitted from the Lead controller. The field below displays the selected control T/H sensor arrangement (lead, avg, min, max, local) depending upon how the group is set-up. See Service>Group screens, Section 7.2.6.

The last field shows the unit group address assigned to the controller within the group and the address of the current lead controller.



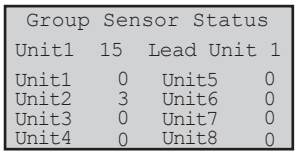
7.2.6.2 Group Alarms

This screen only appears when the controller is wired with additional A/C unit controllers. It displays bit mask values indicating the alarm conditions that will initiate a group internal alarm causing the unit to switch over from "Active" to "Unit Off". See Service>Group (Alarms Set) earlier in Section 7.2.6.



7.2.6.3 Lead Controller Group Sensors

This screen appears only in the display of the controller that is designated as the Lead in a multi-unit work group. The lead controller polls the Temperature and Humidity sensors from all the A/C units in the work group and displays the averaged values. It also displays the value of the minimum (lowest) temperature sensor and the value of the minimum humidity sensor in the A/C group and conversely, displays the value of the maximum (highest) temperature sensor and maximum humidity sensor in the A/C group. The fields at the bottom are the addresses of the controllers in the group that have the min. (lowest) and max. (highest) temperature and humidity sensor readings.



7.2.6.4 Group Sensor Status

This screen appears only in the display of the controller that is designated as the Lead in a multi-unit work group. It shows what sensors exist on each A/C unit for the Lead controller to perform the group sensor averaging calculation. The numbers are the sums of index values assigned to the sensors as shown in the following key:

1 = Return Temperature Sensor

2 = Return Humidity Sensor

4 = Remote Temperature Sensor

8 = Remote Humidity Sensor

16 = Static Pressure Sensor

To determine which sensors are enabled and operable for each unit, determine which index numbers, derived from the key above, will produce the number shown in the screen.

In the example shown, the number for the lead unit is 15. This results from adding 1 Return Temperature + 2 Return Humidity + 4. Remote Temperature + 8 Remote Humidity together, confirming those sensors are operable.

The number shown for unit number 2 is three, the result of adding 1 + 2. This confirms unit number 2's Return Temperature and Return Humidity sensors are detected by the Lead controller. If a one appeared instead for unit number 2, it would indicate the signal for the Return Humidity sensor is not present. That sensor is either not enabled or it has failed.

7.3 BMS Communication

When BMS communication is used, the controller must be equipped with an optional expansion card designed for one of a variety of serial communication protocols available. A communication port on the expansion card (see Section 2.2.6) allows the controller to be field connected to a central Building Management System (BMS) for monitoring and control of data points.

An RS-485 serial port is for Modbus or BACnet MS/ TP protocols and a 10BaseT port is available for TCP/IP based protocols such as BACnet over IP, BACnet over Ethernet, SNMP or HTTP.

Supported Protocols	Media	Connections
BACnet IIP	10BaseT	RJ45 direct
BACnet over Ethernet	10BaseT	RJ45 direct
HTTP	10BaseT	RJ45 direct
SNMP V1, V2c	10BaseT	RJ45 direct
Modbus over IP	10BaseT	RJ45 direct
SNMP V1, V2	10BaseT	RJ45 direct
Modbus over IP	10BaseT	RJ45 direct
BACnet MS/TP	twisted pair	daisy chain

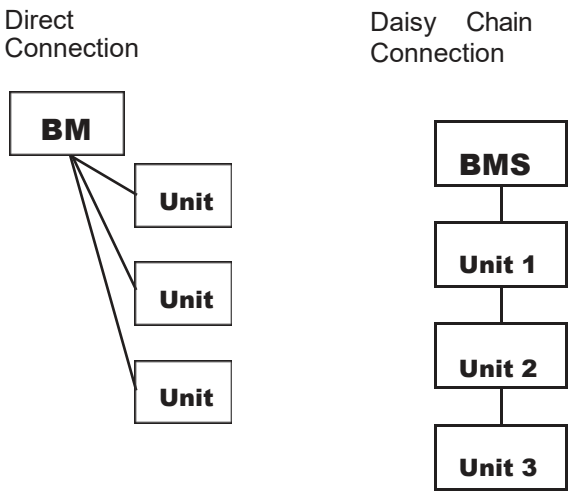


Figure 13. BMS Connection Types

If multiple A/C units are grouped together, each controller added to the group must be configured with a CPU address for BMS communication. In the daisy chain configuration an RS-485 twisted-pair connection is made from the BMS to the first controller and an RS-485 connection from each controller to the next; the connections form a common bus and each E^2 controller listens on the bus and has a unique address. The direct connection example is via TCP/IP over Ethernet.

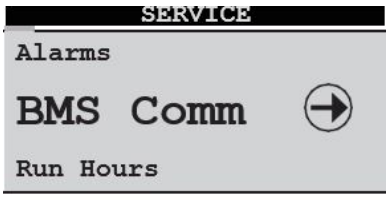
For complete details on using BMS control, contact STULZ Product Support (see Section 9.0) and refer to STULZ Controller Communications Manual, OCU0147.

7.3.1 Direct BMS Control

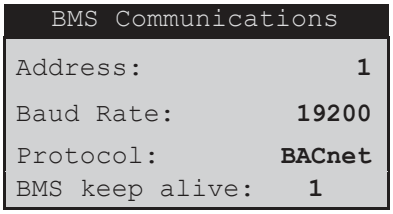
he controller may be configured to accept proportional analog signals that mimics a sensor. The controller will act on that signal whether it comes from a real sensor or a BMS analog output.

See the Addendum to the E2 Series Controller Manual For CyberAiR (CFS) Systems, OCS0108 for the E² controller's BMS parameters. Note that STULZ now publishes a point list addendum whenever a new version of CyberAir E^2 software is released, regardless of whether the points list has changed since the previous software version.

7.3.2 BMS Communication



The Service>BMS Comm menu is used to set-up the parameters to allow a BMS (BAS) interface for monitoring controller operation for the serial-based networks such as BACnet MS/TP. Units using the BACnet over IP, BACnet over Ethernet, or HTTP protocols do not need to change anything in this menu.



The BMS address and baud rate have meaning only on RS-485 networks and with the serial protocols of Modem, Modbus RTU, Commission, and Carel. The baud rate is fixed for BACnet. Systems using a 10BaseT interface should use the defaults of address 1, baud rate 19200, and protocol IBACnet.

Certain Integer and Digital variables that start with BMS (see Section 10.0) require that the BMS "keep alive" parameter changes between 1 and 2 within a 10-minute span. The general procedure is to set up variables like the BMS low fan speed and then write a 1 to the BMS keep alive address.

8.0 MAINTENANCE AND REPAIRS

8.1 General Maintenance

Because conditions vary greatly, individual maintenance schedules must be determined for each location, based upon periodic examination of the controller.

1. Check for corrosion on electrical connections.
2. Clean corrosion and apply anti-corrosion grease.
3. Periodically, check and tighten all terminal connections.

A system should be established for trend analysis. Record all problems, defects and deficiencies noted by operators and discovered during maintenance inspections together with the corrective actions taken. For maintenance assistance, contact STULZ Product Support.

8.2 Troubleshooting

The STULZ E^2 Series controller is designed for continuous and dependable operation. In the event that a problem is encountered with the A/C system, the system controller may be used to diagnose the cause. The controller signals an alarm condition when the red backlight LED is illuminated behind the alarm function key.

An alarm indication is accompanied by a screen text message with a brief description of the cause (See "5.3.4 Alarm Screen Messages"). Often the remedy is simple to determine by reading the alarm message Dirty Filter Alar (replace filter, for example).

The following guidelines are included to assist in troubleshooting the controller due to operational or performance problems. If the problem can't be resolved using the alarm screens and these guidelines, contact STULZ Product Support for assistance (See Section 9.0).

WARNING

Turn off all power to the unit before conducting any troubleshooting procedures, unless the procedure specifically requires the system to operate. Keep hands, clothing and tools clear of the electrical terminals.

Problem: Control Is Erratic

1. Wiring improperly connected or broken. Check wiring against the schematic diagram included with the unit.
2. Wires shorted. Check all wire connections to ensure they are tight and that no shorts are present.

Problem: Alarm Lamp is ON

1. Use the system controller to check the Alarm display message(s).
2. Identify and correct cause of alarm condition.
3. Reset if necessary.

8.3 Repair Procedures

8.3.1 General

Under normal operating conditions and with the proper preventive maintenance, the unit should provide excellent service for many years. If necessary, the unit may be returned to the manufacturer for major overhaul and refurbishment. All work must be performed by qualified technicians.

8.3.2 Component Replacement

Replaceable components may be removed and replaced from the controller using common hand tools. Ensure power is disconnected from the controller before removing or replacing components.

WARNING

Power may still be present inside the controller when the On/Off switch on the A/C unit door is OFF.

8.4 Control I/O Module Signal LED's

The GEN1 STULZ E^2 controller includes 3 signal LED's (red, yellow and green) that provide information on the operation of the control module and status of the connection to the pLAN. These signal LED's are positioned adjacent to the yellow, "Power On" LED (see Figure 2). The signal LED's may be used for diagnostic purposes if a problem arises with the controller.

Key: ● **LED off** ○ **LED on** ⊖ **LED flashing**

RED LED	YELLOW LED	GREEN LED	
○	●	●	Application with error or no pLAN table.
○	○	○	Application with error or no pLAN table. Controller connected to ONLY one terminal.
●	○	○	Application with correct pLAN table.
●	○	○	Correct operation in pLAN.
●	⊖	●	Awaiting communication with WinLoad (factory configuration software). Check address.
●	⊖/●	●/⊖	(LED flashing alternately) Communication with WinLoad not valid. No power supply or wrong driver.
●	●	⊖	Communicating with WinLoad (in low level operation).
●	⊖	⊖	Communication with WinLoad on hold.
⊖	⊖	⊖	WinLoad not suitable or incorrect software protection password.
●	○	⊖	Communicating with WinLoad (in normal operation).
●	●	○	Controller supervisor protocol (slave) active on serial 0.

9.0 PRODUCT SUPPORT

STULZ Product Support provides aftermarket technical and field support, warranty authorization and part sales to contractors and end users. Factory authorized services are available by request and include:

- Factory Authorized Start-up/Warranty Inspection
- Commissioning Assistance
- Break/Fix Repair
- Preventive Maintenance Contracts
- Performance Evaluations
- Technician and Owner Training

9.1 Factory Authorized Start Up/ Warranty Inspection

STULZ recommends purchasing Factory Authorized Start Up/Warranty Inspection for all new STULZ precision cooling equipment. Factory Authorized Start Up/Warranty Inspection ensures that your equipment is installed and operating per STULZ recommended guidelines. This essential service guarantees that STULZ equipment has the best warranty coverage available.

STULZ precision cooling equipment is covered by an industry leading 24 Month Upgraded Parts Warranty and 90 Day Labor Warranty once Factory Authorized Warranty Inspection/Start- Up is performed and Start Up Checklists are returned and validated by STULZ Product Support.

A Limited 12 Month Parts Only Warranty applies if Factory Authorized Start Up/Warranty is not purchased and Start Up Checklists are received from an unauthorized party and validated by STULZ Product Support.

The STULZ Product Support coordinates all Factory Authorized Services and ensures only STULZ certified technicians are dispatched to perform your Factory Authorized Start Up/Warranty Inspection.

Contact the STULZ Product Support with field service requests at (888) 529- 1266 Monday through Friday from 8:00 a.m. to 5:00 p.m. EST.

9.2 Technical Support

The STULZ Technical Support Department is dedicated to the prompt reply and resolution of issues experienced with supplied equipment. Call (888) 529-1266 Monday through Friday from 8:00 a.m. to 5:00 p.m. EST. After hours support is also available. Provide your name and contact information. A support technician will return your call.

When calling to obtain support, it is important to have the following information readily available, (information is found on the unit's nameplate):

- Unit Model Number
- STULZ Sales Order Number
- STULZ Item Number
- Unit Serial Number
- Description of Problem

9.3 Obtaining Warranty Parts

All Warranty Parts Authorizations are validated and processed through the Technical Support Department at (888) 529-1266 Monday through Friday from 8:00 a.m. to 5:00 p.m. EST. A support technician at STULZ will provide troubleshooting assistance over the telephone. If it can be determined that apart may be defective, a warranty authorization for a replacement part will be processed by STULZ Technical Support.

The replacement part will then be shipped via UPS ground. If the customer requests that warranty part(s) be sent by any other method than UPS ground, the customer is responsible for the shipping charges. If you do not have established credit with STULZ you must provide a freight carrier account number.

A written (or faxed) purchase order is required on warranty parts and must be received prior to 12:00 p.m. for same day shipment. The purchase order must contain the following items:

- Purchase Order Number
- Date of Order
- STULZ Stated Part Price
- Customer Billing Address
- Shipping Address
- Customer's Telephone and Fax Numbers
- Contact Name
- Unit Model Number
- Serial Number
- STULZ Item Number

The customer is responsible for return shipping costs. Return of defective part(s) must be within 30 days at which time an evaluation of the part(s) is conducted and if the part is found to have a manufacturing defect a credit will be issued.

When returning defective part(s), complete the Return Material Authorization Tag and the address label provided with the replacement part. For prompt processing, please affix the RMA in a prominent place on the external packaging of the returned part.

9.4 Obtaining Spare Parts.

Spare and replacement parts requests are to be made through Product Support by:

Fax: (301) 620-2606

Phone: (888) 529-1266

E-mail: (parts@stulz-ats.com)

Quotes are given for specified listed parts for a particular unit.

STULZ accepts Visa and MasterCard. STULZ may extend credit to its customers; a credit application must be pre- pared and approved (this process could take up to one week).

A 25% minimum restocking charge will be applied on re- turned stocked parts that were sold as spare/replacement parts. If the returned part is not a stocked item, a 50% restocking charge may be applied.

A Return Material Authorization Number (RMA) is required when returning parts. To receive credit for returned repair or replacement parts, the parts must be returned to STULZ within 30 days of the purchase date. Spare part sales over 30 days old will be considered final and the parts will remain the sole property of the ordering party.

STULZ System Types

Term	Definition
AHU	Air Handling Unit
AHU AWS	Air Handling Unit with Alternate Water Source option
AR	Remote (split) Air cooled system
AR CH	Remote (split) Air cooled Chiller
AR AWS	Remote (split) Air cooled system with Alternate Water Source option
AS	Self-contained air-cooled system
AWS	Water Source option
CMU	Coolant Modulating Unit
CW	Chilled Water system
DAHU	Dual Air Handling Unit
DAHU	Dual Air Handling Unit with Alternate
DAR	Dual Remote (split) Air cooled system
DAR AWS	Dual Remote (split) Air cooled system with Alternate Water Source option
DAR OA	Dual Remote (split) Air cooled system with Outside Air option
DCW	Dual Chilled Water system
DW/DG	Dual Water or Dual Glycol cooled system
DW/DG FC	Dual Water or Dual Glycol cooled system with Free-cooling option
DW/DG OA	Dual Water or Dual Glycol cooled system with Outside Air option
W/G	Water or Glycol cooled system
W/G AWS	Water or Glycol cooled system with Alternate Water Source option
W/G FC	Water or Glycol cooled system with Free-cooling option

Glossary

Term	Definition	Term	Definition
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers	IT	Information Technology
BTUH/Hr	British Thermal Units Per Hour	IOM	Installation, Operation, and Maintenance Manual
CCD	Compact-CWE	Kw	kilowatt
CFM	Cubic Feet Per Minute	kVA	Kilo Volt Amps
CNDCT	Conductor	LWT	Leaving Water Temperature
CRAC	Computer Room Air Conditioner	MAX CKT BKR	Maximum Circuit Breaker
CRAH	Computer Room Air Handler	MAX FUSE	Maximum Fuse
CW	Chilled Water	MCA	Minimum Circuit Ampacity
DB	Dry Bulb	NEC	National Electric Code
DF	Downflow	NFPA	National Fire Protection Agency
E^2	Energy Efficiency	PH	Phase
EC	Electronically Commutated	PSI	Pounds Per Square Inch
DP	Dewpoint	PSIG	Pounds Per Square Inch Gauge
DX	Direct Expansion Systems	RLA	Run Load Amps
ESD	Electrostatic Discharge	RMA	Return Material Authorization
EST	Eastern Standard Time	R-Value	Thermal Resistance
°F	Degrees Fahrenheit	SATS	STULZ Air Technology Systems, Inc.
FLA	Full Load Amps	SDS	Safety Data Sheet
FOB	Freight on Board	SPDT	Single Pole, Double Throw
HGBP	Hot Gas Bypass	UF	Upflow
HACR	Heating, Air Conditioning, Refrigeration	UL	Underwriters Laboratories
HP	Horsepower	UPS	Uninterruptible Power Supply
HVAC	Heating, Ventilation and Air Conditioning	V	Volt
HX	Heat Exchanger	VA	Volt-Amperes
Hz	Hertz	VAC	Volt, Alternating Current
IAQ	Indoor Air Quality	VFD	Variable Frequency Drive
in. w.g.	Inches of Water Gauge	W	Watt(s)

STULZ Sales and Service

User Driven | Custom Designed | Purpose Built

Advice | Maintenance | Implementation | Test Center | Technical | Climate Customized | Service-Portal

For general questions about our products and services, contact your local STULZ expert.
You can find your local representative at: www.stulz-usa.com/sales-support/sales-representatives

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