Large Systems

iCOM Microprocessor

Environmental Training and Service Manual

TM-10098: Rev. 02/06

Liebert®

EMERSON
Network Power

iCOM
Training & Service Manual

Disclaimer of Warranties and Limitations of Liabilities

The authors and editors have taken every precaution to ensure accuracy and completeness in this manual. The authors and editors make no expressed or implied warranty of any kind with regard to the documentation in this manual. Liebert Corporation assumes no responsibility, and disclaims all liability for incidental or consequential damages resulting from the use of this information or from errors or omissions. Liebert Corporation may make improvements and/or changes in the product(s) described in this manual at any time. Information in this manual is subject to change at any time and does not represent a commitment on the part of Liebert Corporation.

Printed in the United States of America

Table of Contents

Chapter 1

Temperature and Humidity Control Programs

This section provides details on how your Liebert *iCOM* control responds to the user programmed inputs values and room conditions. Refer to this section when you need specific information control operation. This section includes details on four (4) user selectable temperature control programs and two (2) user selectable and humidity control programs.

Cooling and/ or Heating Required, in Percent (%)

The temperature control programs for the *iCOM* microprocessor is based on a calculated percent (%) requirement for cooling and/ or heating. This percent (%) requirement is determined by the control type (algorithm) selected by the user.

The four (4) user selectable temperature control programs are:

- Intelligent
- Proportional (P)
- Proportional + Integral (PI)
- Proportional + Integral + Derivative (PID)

Temperature Control Program Types

Intelligent Control – Factory Default Setting

The Intelligent Control operates from a set of general rules that defines how the control output should be adjusted for different system conditions. The rules are designed to duplicate the actions that an experienced human operator would take if manually controlling the system.

Basically, this is done in a three-function process that differs from earlier mathematically defined strict type data, hence, fuzzy logic. The on and off, true or

untrue type of statement is not used. The consideration now is how to set the input value into a membership set, qualify this membership with rules, then decide on the output consequence for action. It is not really that simple, but it is basically how it works. The process:

Membership

- Measure value of input variables
- Map and transfer data into range of set domain
- Assign input membership into sets

Knowledge Base/Decision Making

- Provide a data base of definitions for rules base
- Provide a rules base and define function and domain
- Simulate human decision making based on concepts and actions defined by implications and rules

Consequence

- Convert defined range of knowledge to a corresponding output variable
- Define a non-intelligent action from a deduced intelligent action

Just as an operator might take several things into consideration before making a temperature control decision, the intelligent control can be programmed to do likewise. For example, not only is the current temperature used in making temperature control decisions, but also conditions such as:

- How fast is the temperature changing?
- What direction is the temperature changing?
- What is the cooling output now?
- What was the cooling output in the past?
- How long ago was the cooling output changed?
- Other factors

Any number of rules can be used in an intelligent control to define the controls operation under various operating conditions. Hence, several advantages are gained from this type of control over a more standard control approach that uses a fixed mathematical equation to define the operation of the control for all conditions (such as a Proportional or PID Control). You can expect Intelligent Control to be

more efficient and precise for most applications, but system performance based on room conditions is not as predictable as standard approaches that use a fixed equation.

The Liebert Intelligent Control includes rules that significantly enhance the performance of the system, both from a standpoint of precision control and system reliability.

Rules are included that:

- Cause the control to ignore very small or temporary temperature/ humidity deviations. This eliminates unnecessary control adjustments that contribute to control instability.
- Help limit the frequency of control adjustments thus extending the life of system components that are susceptible to mechanical wear or cycling.
- Recognize undesired modes of control operation such as hunting, and make adjustments to the control response to eliminate them.
- Estimate the present load on the system and then tend to force the control output to the appropriate state.
- Recognizes conditions, which indicate a large load change and allows the control to temporarily respond more quickly than normal.
- Cause the control to anticipate the need for reheat during dehumidification and activates reheats when overcooling occurs.

Proportional (P) Control

The proportional control is the standard control method that maintains the room at a temperature proportional to the load. The temperature maintained increases as the room load increases. At full load the room would be controlled at a temperature equal to the temperature set point (TSP) plus ½ of the temperature proportional band (PB). The operator programmed inputs are the temperature set point (TSP) and temperature proportional band (PB) adjustments. The operator may also program a temperature dead band (DB) adjustment.

Proportional + Integral (PI) Control

The PI control combines two (2) individual terms to determine the control output for a given set of conditions. Note that PI control is used only for temperature. If PI control is selected, the humidity control will be in percent relative humidity (%RH).

The proportional (P) term is determined by the difference between the current temperature and the control set point. This term is expressed in % cooling (heating desired for each degree above (below) the set point. It is adjustable from 0% to 100% per degree. The purpose of this term is to adjust the control output for any deviation between the current temperature and the control set point.

The integral (I) term is determined by two things: the difference between the return air temperature and control set point and the amount of time this difference has existed. This term is expressed in % cooling (heating) desired for each minute and degree above (below) the set point. It is adjustable from 0% - 100% per degree/minute. The purpose of this term is to force the control to maintain the temperature around the set point by slowly but continuously adding (subtracting) a small amount of cooling (heating) to the total control output until the temperature is at the set point.

Proportional + Integral + Derivative (PID) Control

The PID control combines three (3) individual terms to determine the control output for a given set of conditions. Note that PID control is used only for temperature. If PID control is selected, the humidity control will be in percent relative humidity (%RH).

The proportional (P) term is determined by the difference between the current temperature and the control set point. This term is expressed in % cooling (heating desired for each degree above (below) the set point. It is adjustable from 0% to 100% per degree. The purpose of this term is to adjust the control output for any deviation between the current temperature and the control set point.

The integral (I) term is determined by two things: the difference between the return air temperature and control set point and the amount of time this difference has existed. This term is expressed in % cooling (heating) desired for each minute and degree above (below) the set point. It is adjustable from 0% - 100% per degree/minute. The purpose of this term is to force the control to maintain the temperature around the set point by slowly but continuously adding (subtracting) a small amount of cooling (heating) to the total control output until the temperature is at the set point.

The derivative (D) term is determined by the rate of change of temperature. This term is expressed in % cooling (heating) desired for each degree per minute rise (fall) in temperature. It is adjustable from 0% to 100% per degree/minute. The purpose of this term is to adjust the control output for quickly changing temperatures, thus providing an anticipation control.

All three terms are adjusted by selecting the “Setpoints” icon in either the USER or SERVICE Menu screen. If PID control is selected, the temperature proportional band value (and optional temperature dead band value) is not used by the control. For optimum performance, a PID control must be adjusted or tuned according to the characteristics of the particular space and load to be controlled. Improper tuning can cause the control to exhibit poor response and/ or hunting. The characteristics of the space and load may change seasonally, so occasional returning is required for optimum performance.

A suggested tuning procedure is as follows:

1. Initially adjust the integral and derivative settings to 0% / degree-min and 0% / degree / min..
2. Starting with 20% / degree, adjust the proportional setting in small increments (10% steps) until the control sustains a constant hunting action (the temperature swings are approximately the same amplitude from one peak to the next).
3. Note the time in minutes between peaks of adjacent temperature swings and the amplitude of the temperature swing (degrees above the set point).
4. Adjust the proportional control setting to about l/2 the value obtained in Step 2.
5. Adjust the integral setting to a value calculated by the following equation: approximate room load (in % full load) time between peaks x peak amplitude x 4.

   Note: If calculation results in a value of less than 1%, then set the integral to 1%.
6. Adjust the derivative to a value calculated by the following equation: time between peaks x 5%.

The above tuning procedure is only an approximation for an initial set of adjustments and are based on the "average" room characteristics. Your particular settings may need to be further adjusted for optimum PID control performance.

Some suggestions for additional tuning are as follows:

- If cooling output overshoot is occurring on load changes, decrease the proportional setting or the derivative setting.
- If system hunting occurs with constant room load, decrease the integral setting.
- If the control responds too slowly, resulting in large temperature excursions on a load change, increase the proportional setting or the derivative setting.
- If a constant temperature deviation exists between the temperature and set point, increase the integral setting.

Temperature Control

Operations and Charts

The temperature proportional control band value is divided into two parts: the temperature set point plus ½ of the temperature proportional band for cooling operation and the temperature set point minus ½ of the temperature proportional band for heating operation. A temperature dead band can also be programmed into the control to shift the cooling and/ or heating on/ off operations away from the temperature set point.

This programmed temperature dead band value is divided into two parts: the temperature set point plus ½ of the dead band – no cooling operation and the temperature set point minus ½ of the band – no heating operation.

The temperature set point range is adjustable from 41 - 104°F in increments of 1°F. The temperature proportional band range is adjustable from 2 - 54°F in increments of 1°F. The temperature dead band range is adjustable from 0 - 36°F in increments of 1°F.

Standard 2 Stage Compressorized Cooling

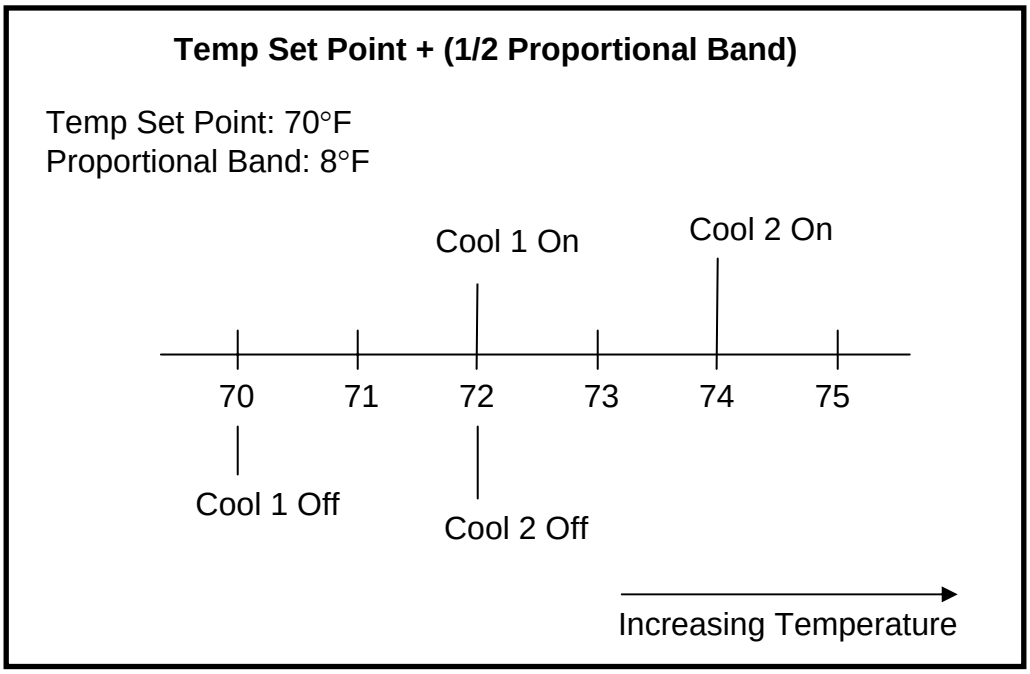
The basic temperature cooling control band is established at the temperature set point with the length equal to ½ of the programmed temperature proportional band divided by the number of cooling stages.

The Liebert DS units are supplied with two (2) compressors, each compressor is rated at ½ of the unit capacity. The two (2) compressors will be either the semi-hermetic or scroll type and will operate in an on/ off configuration to cool the space.

The temperature controller activates the first cooling stage (lead compressor) when the return air temperature increases to 50% of the cooling proportional band and the second cooling stage (lag compressor) at 100% of the cooling proportional band. The optional hot gas bypass solenoid valve, supplied with each compressor when ordered, is also energized on a call for cooling.

The temperature controller deactivates the second stage of cooling (lag compressor) when the return air temperature decreases to 50% of the cooling proportional control band value. The first cooling stage (lead compressor) is deactivated when the return air temperature decreases to the temperature set point value or 0% of the cooling proportional control band value.

2 Stage Compressorized Cooling – No Dead Band

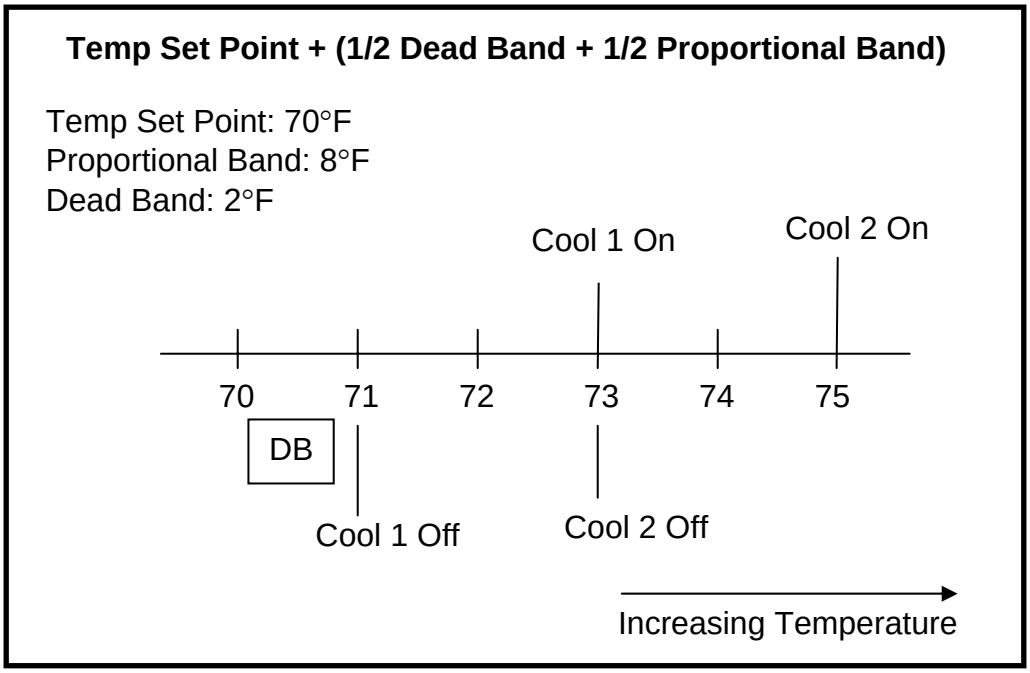


Note: in the above example that the control band begins at the 70°F temperature set point and has a length of 4°F, which is ½ of the programmed temperature proportional band value.

As the return air temperature increases Cooling 1 (lead compressor) is activated at 72°F or 50% of the cooling control band. If the return air temperature continues to increase Cooling 2 (lag compressor) will activate at 74°F or 100% of the cooling control band.

When the return air temperature starts to decrease, Cooling 2 (lag compressor) is deactivated at 72°F or 50% of the cooling control band and Cooling 1 (lead compressor) is deactivated at the temperature set point of 70°F or 0% of the cooling control band.

2 Stage Compressorized Cooling – With Dead Band



Note: in the above example that the control band begins at the 70°F temperature set point and has a length of 5°F, which is ½ of the programmed temperature dead band value plus ½ of the programmed temperature proportional band value.

As the return air temperature increases Cooling 1 (lead compressor) is activated at 73°F or ½ of the dead band value plus 50% of the cooling control band. If the return air temperature continues to increase Cooling 2 (lag compressor) will activate at 75°F or ½ of the dead band value plus 100% of the cooling control band.

When the return air temperature starts to decrease, Cooling 2 (lag compressor) is deactivated at 73°F or ½ of the dead band value plus 50% of the cooling control band and Cooling 1 (lead compressor) is deactivated at 71°F or ½ of the dead band value plus 0% of the cooling control band.

Remember the temperature dead band value is used by the control to shift the cooling on/ off operations away from the temperature set point.

Optional 4 - Stage Cooling, Two (2) Compressors with Unloaders

The basic temperature cooling control band is established at the temperature set point with the length equal to ½ of the programmed temperature proportional band divided by the number of cooling stages.

The Liebert DS units are supplied with two (2) compressors, each compressor is rated at ½ of the unit capacity. Each compressor will be the semi-hermetic type

and will be supplied with an electrical cylinder unloader valve. The electrical solenoid valve used to unload or reduce the cooling capacity of the compressor. The compressors will operate in an on/ off - loaded/ unloaded configuration method to cool the space. The hot gas bypass solenoid valve option is not available on 4 stage systems.

The temperature controller activates the first cooling stage, lead compressor unloaded, when the return air temperature increases to 25% of the cooling proportional band. The second cooling stage, lag compressor unloaded, is activated when the return air temperature increases to 50% of the cooling proportional band.

The temperature controller activates the third cooling stage, the lead compressor loaded, when the return air temperature increases to 75% of the cooling proportional band. The fourth cooling stage, the lag compressor loaded, is activated when the return air temperature increases to 100% of the cooling proportional band.

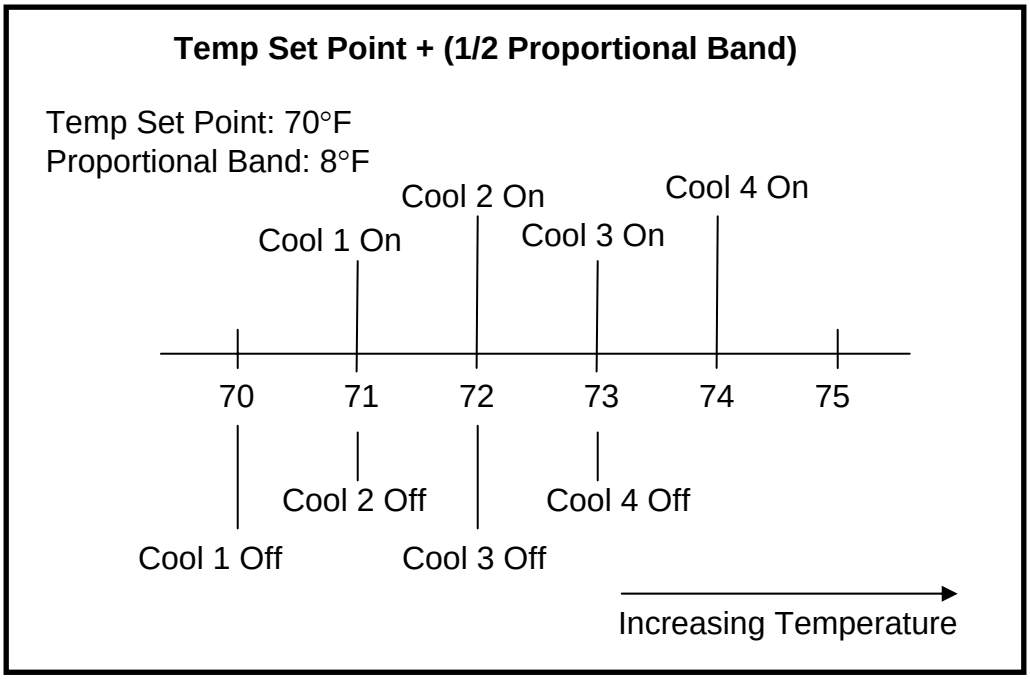
The temperature controller deactivates the fourth cooling stage, lag compressor loaded, when the return air temperature decreases to 75% of the cooling proportional control band value. The third cooling stage, lead compressor loaded, is deactivated when the return air temperature decreases to 50% of the cooling proportional control band value.

The temperature controller deactivates the second cooling stage, lag compressor unloaded, when the return air temperature decreases to 25% of the cooling proportional control band value. The first cooling stage, lead compressor unloaded, is deactivated when the return air temperature decreases to the temperature set point value or 0% of the cooling proportional control band value.

The table below shows the devices activated by each of the four cooling stages.

STAGE	**COMPRESSORS, UNLOADER STATE**
1	Compressor 1 On, Unloader On (Energized) Compressor 2 Off, Unloader Off (De-Energized)
2	Compressor 1 On, Unloader On (Energized) Compressor 2 Off, Unloader On (Energized)
3	Compressor 1 On, Unloader Off (De-Energized) Compressor 2 On, Unloader On (Energized)
4	Compressor 1 On, Unloader Off (De-Energized) Compressor 2 On, Unloader Off (De-Energized)

4 Stage Compressorized Cooling – No Dead Band



Note: in the above example that the control band begins at the 70°F temperature set point and has a length of 4°F, which is ½ of the programmed temperature proportional band value.

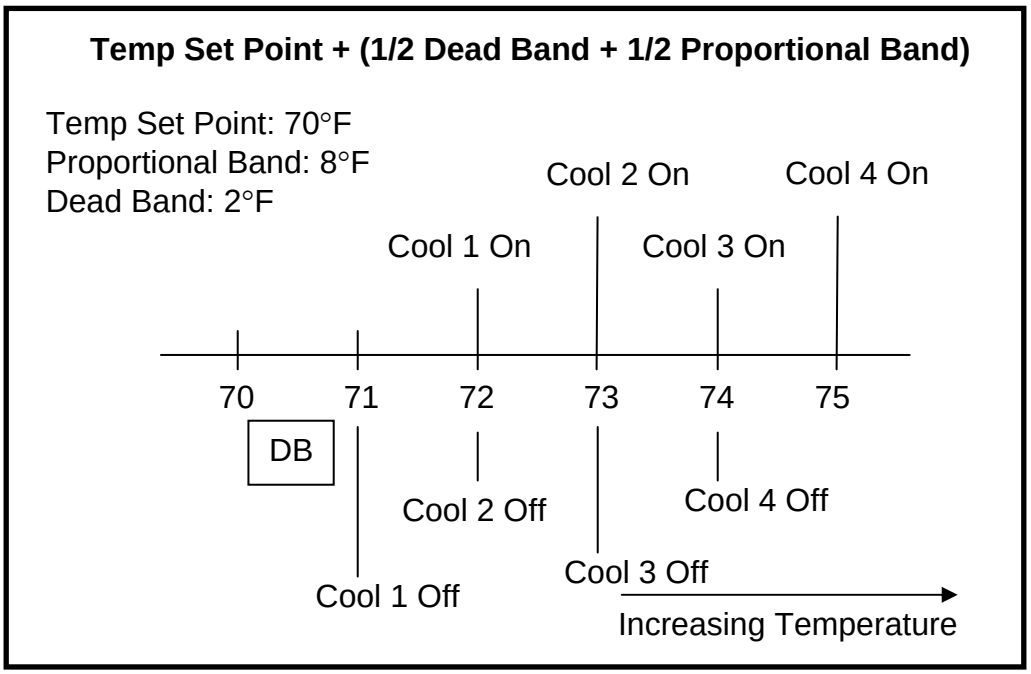
As the return air temperature increases Cooling 1, the lead compressor unloaded, is activated at 71°F or 25% of the cooling control band. If the return air temperature continues to increase Cooling 2, the lag compressor unloaded is activated at 72°F or 50% of the cooling control band. If the return air temperature continues to increase Cooling 3, the lead compressor is loaded at 73°F or 75% of the cooling control band. If the return air temperature continues to increase Cooling 4, the lag compressor is loaded at 74°F or 100% of the cooling control band.

When the return air temperature starts to decrease, Cooling 4 is deactivated at 73°F or 75% of the cooling control band. If the return air temperature continues to decrease Cooling 3 is deactivate at 72°F or 50% of the cooling control band. If the return air temperature continues to decrease Cooling 2 is deactivate at 71°F or 25% of the cooling control band and Cooling 1 is deactivated at the temperature set point of 70°F or 0% of the cooling control band.

The example below is based on a temperature set point of 70°F with a control band length of 4°F, which is ½ of the programmed temperature proportional band value.

STAGE	TEMPERATURE
Cool 1 ON	Set point plus 1°F
Cool 2 ON	Set point plus 2°F
Cool 3 ON	Set point plus 3°F
Cool 4 ON	Set point plus 4°F
Cool 4 OFF	Set point plus 3°F
Cool 3 OFF	Set point plus 2°F
Cool 2 OFF	Set point plus 1°F
Cool 1 OFF	Set point

4 Stage Compressorized Cooling – With Dead Band



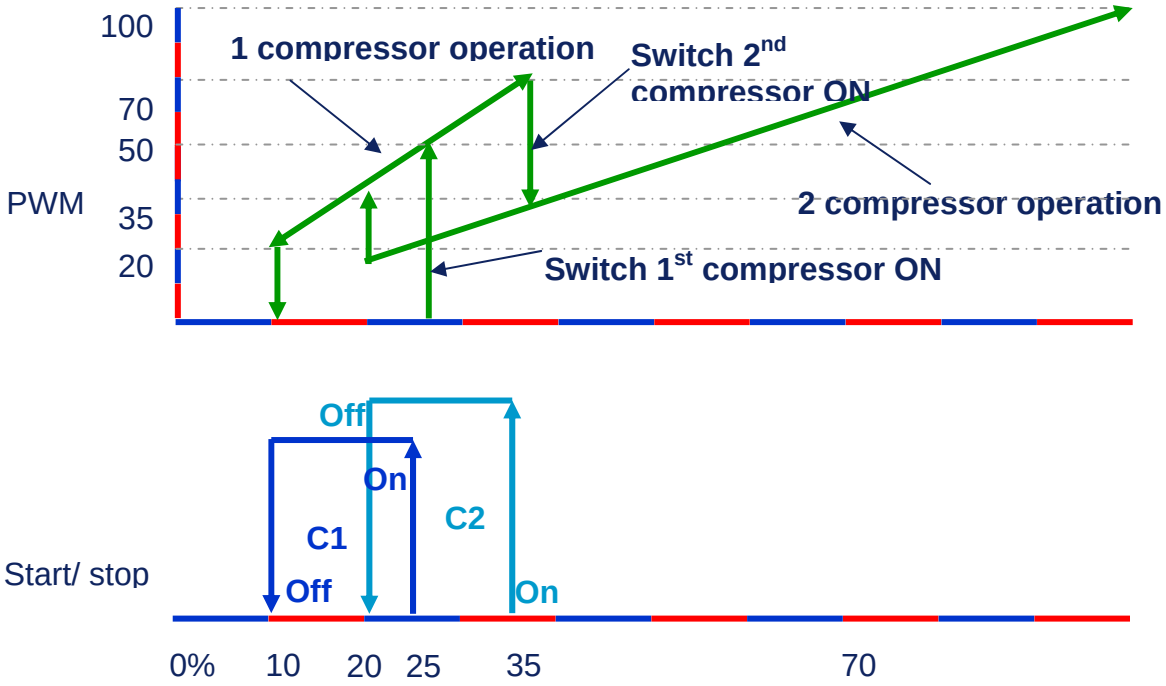
Note: in the above example that the control band begins at the 70°F temperature set point and has a length of 5°F, which is ½ of the programmed temperature dead band value plus ½ of the programmed temperature proportional band value.

As the return air temperature increases Cooling 1, lead compressor unloaded, is activated at 72°F or ½ of the dead band value plus 25% of the cooling control band. If the return air temperature continues to increase Cooling 2, lag compressor unloaded, will activate at 73°F or ½ of the dead band value plus 50% of the cooling control band. If the return air temperature continues to increase Cooling 3, lead compressor unloaded, is activated at 74°F or ½ of the dead band value plus 75% of the cooling control band. If the return air temperature continues to increase Cooling 4, lag compressor loaded, will activate at 75°F or ½ of the dead band value plus 100% of the cooling control band.

When the return air temperature starts to decrease, Cooling 4 is deactivated at 74°F or ½ of the dead band value plus 75% of the cooling control band. If the return air temperature continues to decrease Cooling 3 will be deactivate at 73°F or ½ of the dead band value plus 50% of the cooling control band. If the return air temperature continues to decrease Cooling 2 will be deactivate at 72°F or ½ of the dead band value plus 25% of the cooling control band and Cooling 1 is deactivated at 71°F or 1/2 the dead band value plus 0% of the cooling control band.

Remember the temperature dead band value is used by the control to shift the cooling on/ off operations away from the temperature set point.

Optional Dual Compressor Digital Scroll Operation



In the chart above we are defining the Digital Compressor start and stop at the capacity need and how the compressors load and unload with the PWM from the controller and the unit setting for temperature control.

Note that the Digital Scroll will run continuously while the head is raised and lowered as the need for cooling is required from 10% to 100% and vise versa.

Optional Glycool (Econ-O-Cycle) Cooling

When supplied with the Glycool option, the basic unit is supplied with an additional coil, piping, valve and a Glycol Fluid Sensor (AQ), which is mounted to the unit supply fluid line and serves as control interface in determining the system operation. Selection of the glycool or compressorized operation is controlled by microprocessor using this aquastat to sense the glycol temperature.

The Glycool (Econ-O-Cycle) Cooling program establishes two distinct control bands for cooling control operation. The first band controls the operation of the chilled glycol valve and the second controls the operation of the compressors, either 2-stage or 4-stage.

The microprocessor checks the return air temperature and the entering glycol fluid temperature to determine a cooling capacity. In order to reduce compressor cycling and to prevent chilled glycol valve hunting, Glycool (Econ-o-Cycle) cooling capacity does not become available until the entering chilled glycol fluid

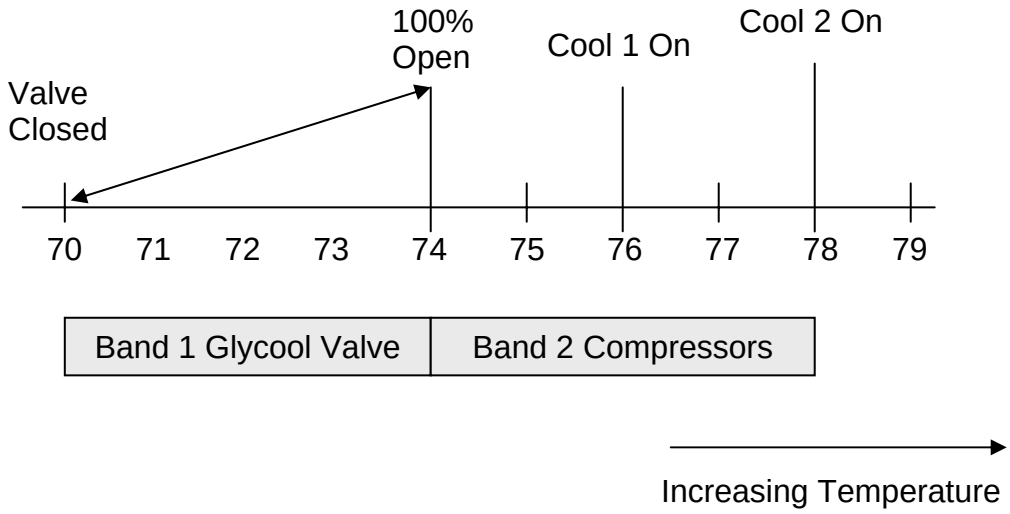
temperature is at least 8°F below the return air temperature, or 3°F lower than the return air temperature for two consecutive hours.

When the microprocessor decides that the return glycol fluid temperature is cold enough the first cooling band is the modulating valve control method, and the second band, added to the first band, is for the compressors as in the normal 2-Stage or 4-Stage control method. If the chilled glycol fluid temperature is not cold enough the valve control band is replaced by the compressor band. If the chilled glycol cooling capacity is reduced by a rise in the glycol fluid temperature, the control band shrinks proportionally. This allows the compressor band to move down as well. The following shows the Glycool operation at 100% capacity and the Glycool at 50% capacity.

Glycool at 100% Capacity – No Dead Band

Temp Set Point + (1/2 Proportional Band + 1/2 Proportional Band)

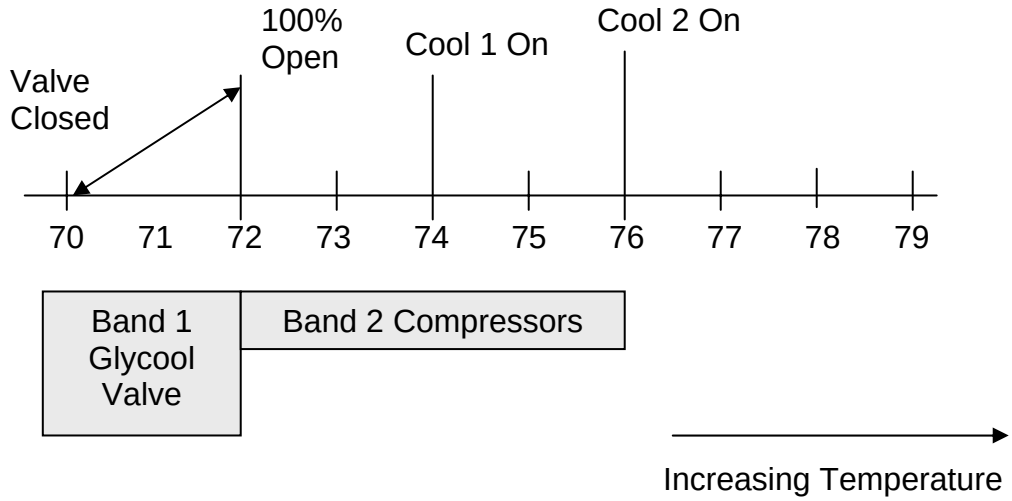
Temp Set Point: 70°
Proportional Band: 8°



Glycool at 50% Capacity – No Dead Band

Temp Set Point + (1/2 Proportional Band + 1/2 Proportional Band)

Temp Set Point: 70°
Proportional Band: 8°



Dual Source Cooling

When supplied with the Dual Cooling option, the basic unit is supplied with an additional coil, piping, valve and a Glycol Fluid Sensor (AQ), which is mounted to the unit supply fluid line and serves as control interface in determining the system operation. Selection of the chilled water or compressorized operation is controlled by microprocessor using this aquastat to sense the water temperature.

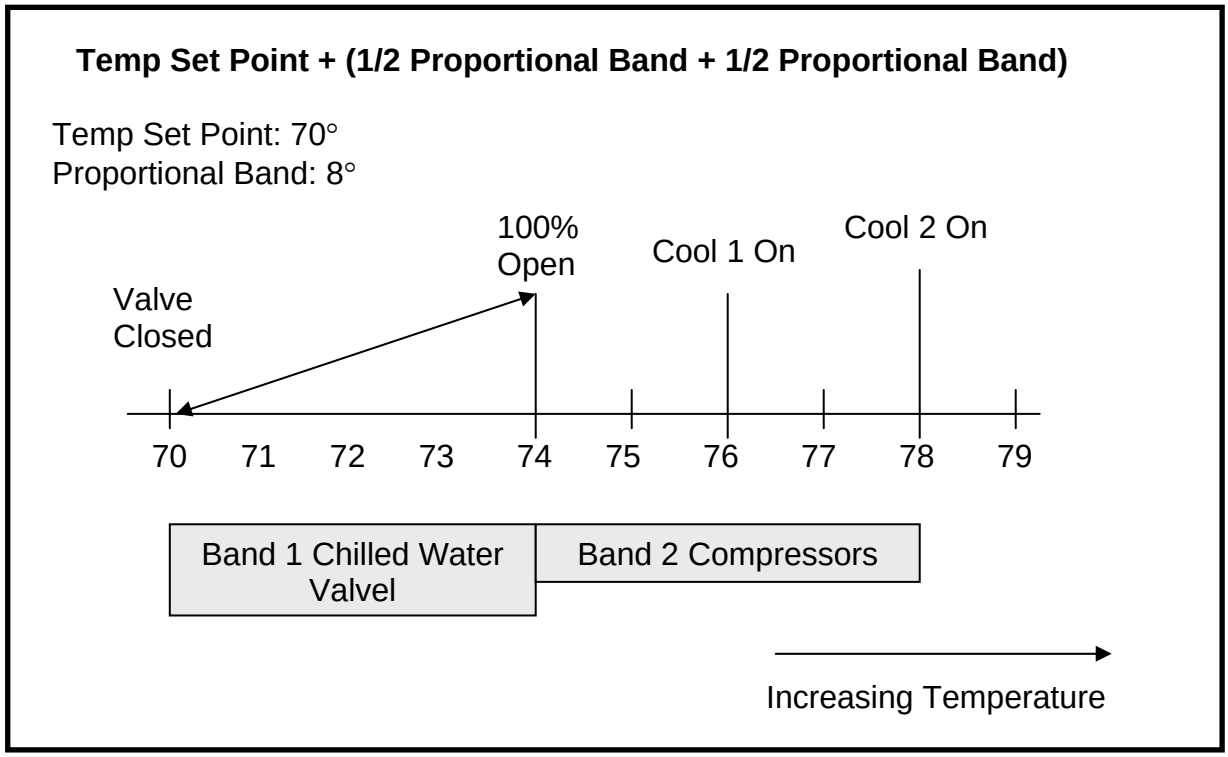
The Dual Source Cooling program establishes two distinct control bands for cooling control operation in the same method as Glycool. The first band controls the operation of the chilled water valve and the second controls the operation of the compressors, either 2-stage or 4-stage.

The microprocessor checks the return air temperature and the entering chilled water fluid temperature to determine a cooling capacity. The chilled water cooling capacity is considered to be 100% if the entering Chilled Water fluid temperature is 8°F lower than the return air temperature.

When the microprocessor decides that the return chilled water temperature is cold enough the first cooling band is the modulating valve control method, and the second band, added to the first band, is for the compressors as in the normal

2-Stage or 4-Stage control method. If the chilled water temperature is not cold enough the valve control band is replaced by the compressor band.

Dual Cooling at 100% Capacity – No Dead Band



An addition program available with the Dual Cooling option is called Minimum Chilled Water Temperature. This program allows the end user to select the minimum chilled water temperature that permits simultaneous operation of the chilled water control and compressor control. When the supply chilled water temperature decreases to this programmed value ONLY the chilled water valve control is operational, the compressors are locked out.

Staged Electric Reheat

The basic temperature heating control band is established at the temperature set point with the length equal to ½ of the programmed temperature proportional band divided by the number of reheat stages.

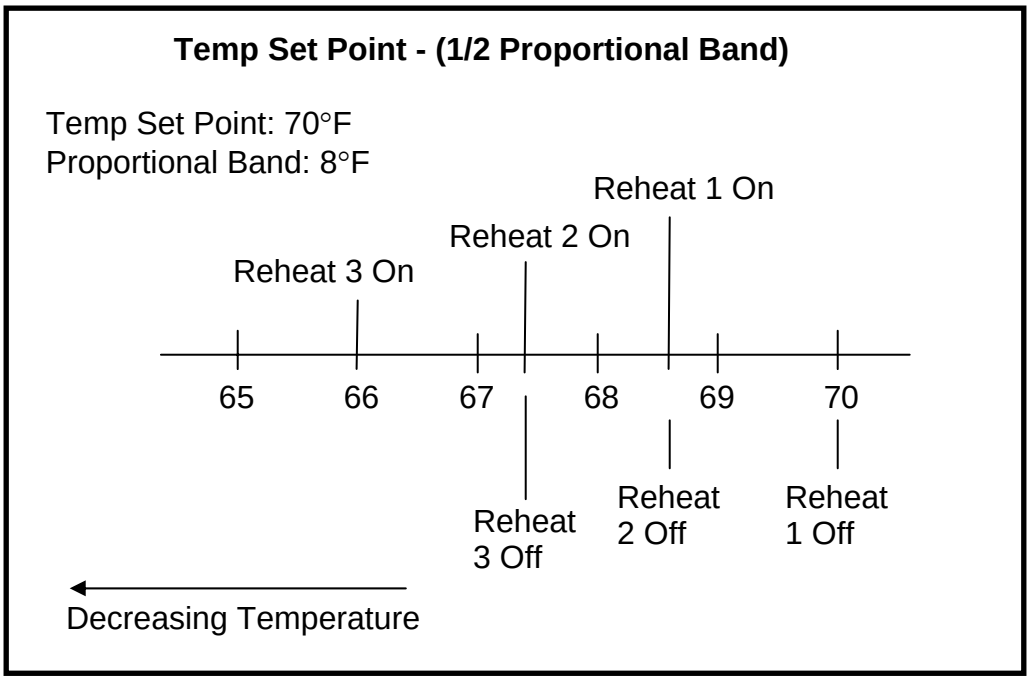
The Liebert DS units are supplied with three (3) reheat stages (elements), each stage is rated at 1/3 of the unit capacity. The three (3) stages will operate in an on/ off configuration to reheat the unit discharge air as it enters the space.

The temperature controller activates the first electric heating stage when the return air temperature decreases to 33% of the heating proportional band. The second electric heating stage activates when the return air temperature decreases to 66%

of the heating proportional band. The third electric heating stage activates when the return air temperature decreases to 100% of the heating proportional band.

The temperature controller deactivates the third heating stage when the return air temperature increases to 66% of the heating proportional control band value. The second heating is deactivated when the return air temperature increases to 33% of the heating proportional control band value. The first heating stage is deactivated when the return air temperature increases to the temperature set point value or 0% of the heating proportional control band value.

3 Stage Electric Reheat – No Dead Band

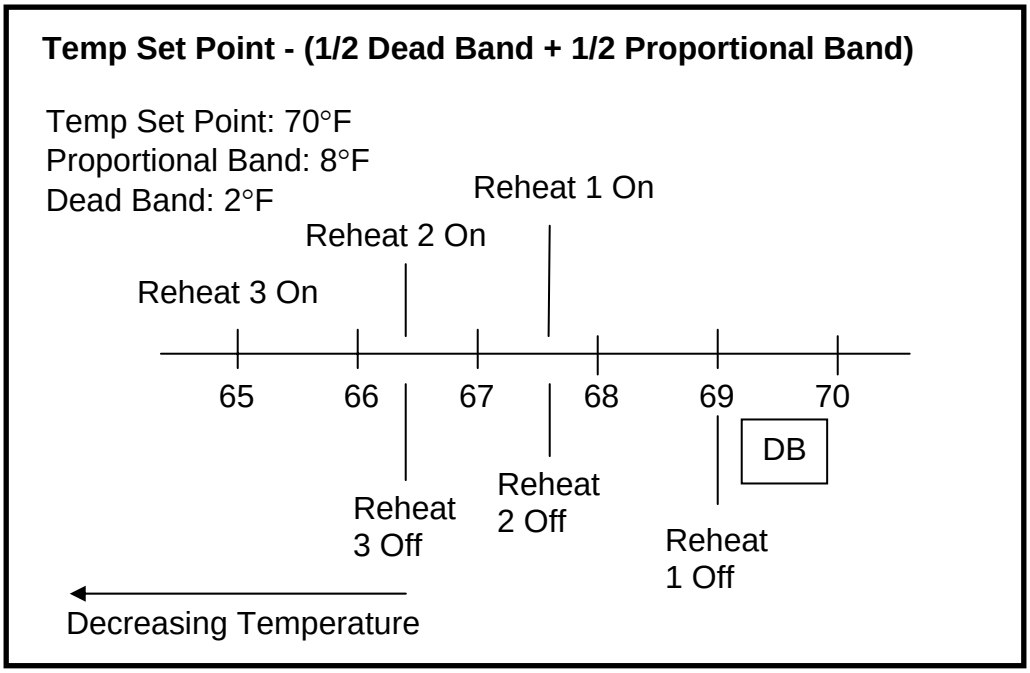


Note: in the above example that the control band begins at the 70°F temperature set point and has a length of 4°F, which is ½ of the programmed temperature proportional band value.

As the return air temperature decreases Reheat 1 is activated at 68.7°F or 33% of the heating control band. If the return air temperature continues to decrease Reheat 2 will activate at 67.4°F or 66% of the heating control band. If the return air temperature continues to decrease Reheat 3 will activate at 66°F or 100% of the heating control band.

When the return air temperature starts to increase, Reheat 3 is deactivated at 67.4°F or 66% of the heating control band, Reheat 2 is deactivated at 68.7°F or 33% of the heating control band and Reheat 1 is deactivated at the temperature set point of 70°F or 0% of the heating control band.

3 Stage Electric Reheat – With Dead Band



Note: in the above example that the control band begins at the 70°F temperature set point and has a length of 5°F, which is ½ of the programmed temperature dead band value plus ½ of the programmed temperature proportional band value.

As the return air temperature decreases Reheat 1 is activated at 67.7°F or ½ of the dead band value plus 33% of the heating control band. If the return air temperature continues to decrease Reheat 2 will activate at 66.4°F or ½ of the dead band value plus 66% of the heating control band. If the return air temperature continues to decrease Reheat 3 will activate at 65°F or ½ of the dead band value plus 100% of the heating control band.

When the return air temperature starts to increase, Reheat 3 is deactivated at 66.4°F or ½ of the dead band value plus 66% of the heating control band. Reheat 2 is deactivated at 67.7°F or ½ of the dead band value plus 33% of the heating control band. Reheat 1 is deactivated at 69°F or ½ of the dead band value plus 0% of the heating control band.

Remember the temperature dead band value is used by the control to shift the cooling on/ off operations away from the temperature set point.

Humidity Control

Humidification and/ or Dehumidification Required, in Percent (%)

The humidity control programs for the *iCOM* microprocessor is based on a calculated percent (%RH) requirement for humidification and/ or dehumidification. This percent (%RH) requirement is determined by the control type (algorithm) selected by the user.

The two (2) user selectable humidity control programs are:

- Absolute Humidity, grains of moisture in the air
- Relative Humidity (%RH)

Humidity Control Program Types

Absolute (predictive) Humidity Control – Factory Default Setting

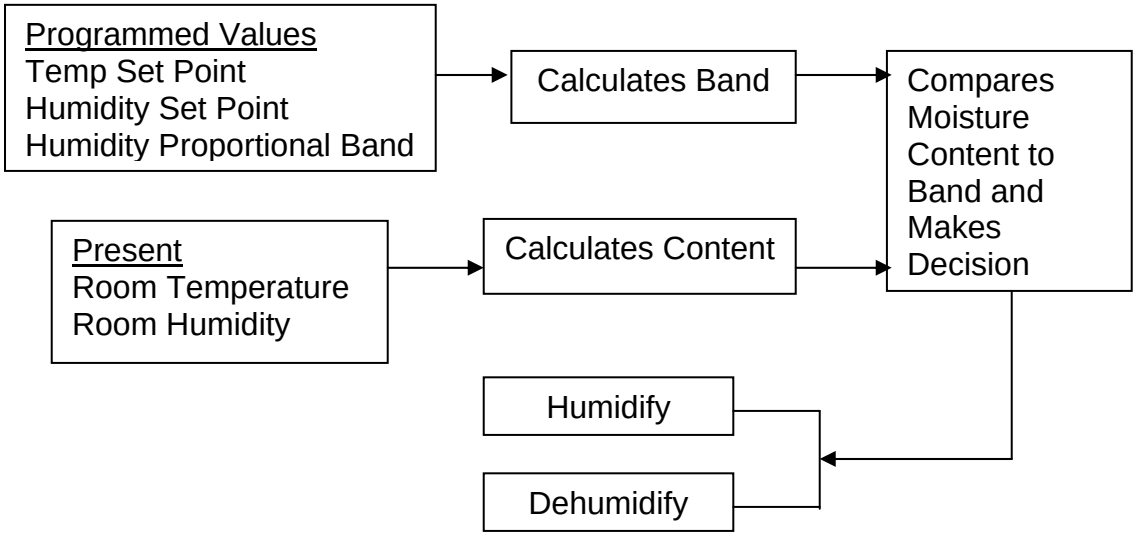
Absolute (predictive) humidity control is based on the moisture content in the return air. The *iCOM* microprocessor control automatically adjusts the humidity control as the return air temperature deviates from the programmed temperature set point. This calculation converts the return temperature and humidity values to a moisture content value defined as either grains per cubic foot or grains per pound. This recalculated content value is compared to the content control band that is determined by the:

- Programmed temperature set point
- Programmed humidity set point in %RH
- Programmed humidity proportional band in %RH

This automatic adjustment results in a predictive humidity control response. With absolute humidity control, the humidity control program is automatically adjusted approximately 2% RH for each degree difference between the return air temperature and the temperature set point. Note the following example:

Temperature Set Point	**Humidity Set Point**	**Humidity Proportional Band = 6%**	**Content Level Grains per LB.**
75°F	50%	+3%	59.2
75°F	50%	-3%	52.5

The Absolute (Predictive) Humidity Control Flowchart shows what the program is doing and why.



The program can be analyzed using the Moisture Content Charts supplied in a later chapter of this manual. It is important to remember that the display provides the humidity value in %RH, not moisture content. The moisture content (grains) values are used only in the internal control program calculation. The LCD display will indicate relative humidity percentage for both methods of control. If the absolute method of control is selected, the adjusted humidity reading will be shown.

When utilizing the absolute (predictive) humidity control program feature, the humidity level is automatically adjusted ~ 2% RH for each degree difference between the return air temperature and the temperature set point.

When absolute humidity control is used, over dehumidification is avoided in the space. When overcooling occurs, causing an increase in the relative humidity reading, the humidity control program "predicts" what the RH will be when the dehumidification cycle ends and the temperature returns to the programmed set point. This allows the dehumidification cycle to end at the proper time.

Relative Humidity Control

Relative humidity control is based on the humidity content in the return air. The iCOM microprocessor control determines the unit humidification/ dehumidification operation by comparing the return air humidity value to the control band that is determined by the:

- Programmed humidity set point in %RH
- Programmed humidity proportional band in %RH

Operations and Charts

The humidity proportional control band value is divided into two parts: the humidity set point plus ½ of the programmed humidity proportional band for dehumidification operation and the humidity set point minus ½ of the programmed humidity proportional band for humidification operation.

A humidity dead band can also be programmed into the control to shift the humidification and/ or dehumidification on/ off operations away from the humidity set point.

This programmed humidity dead band value is divided into two parts: the humidity set point plus ½ of the dead band – no dehumidification operation and the humidity set point minus ½ of the band – no humidification operation.

The humidity set point range is adjustable from 1 – 80% RH in increments of 1% RH. The humidity proportional band range is adjustable from 1 – 20% RH in increments of 1% RH. The humidity dead band range is adjustable from 0 – 50% RH in increments of 1% RH.

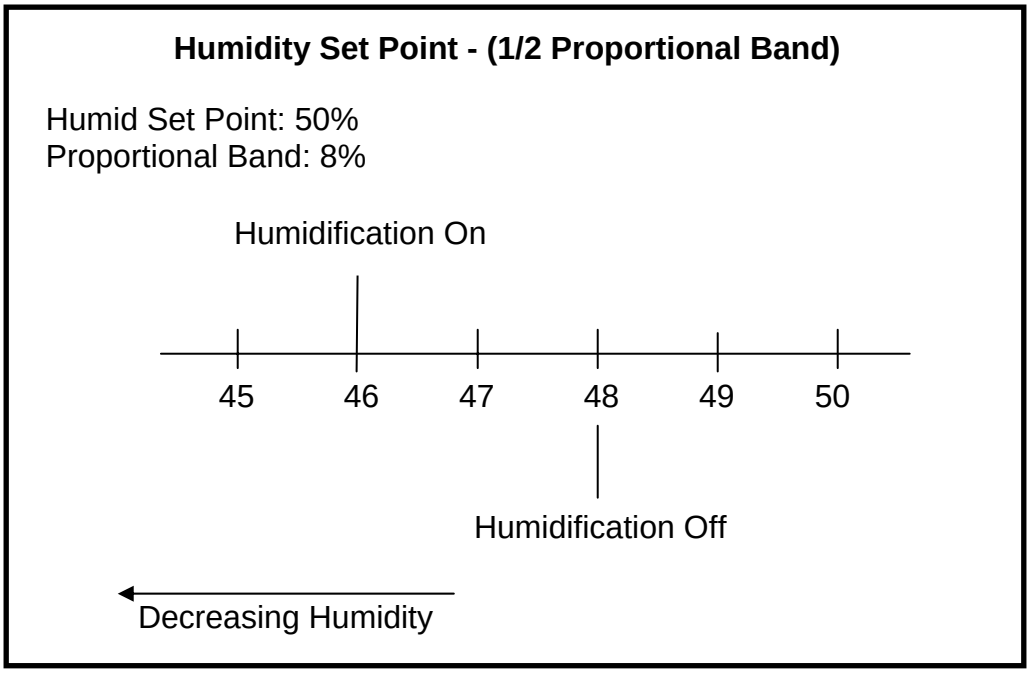
Humidifier Operation

The Relative Humidity control program is used to illustrate the humidification operation in the following examples. The basic humidification control band is established at the humidity set point with the length equal to ½ of the programmed humidity proportional band value. The Liebert DS units are supplied with an infrared humidifier rated at the unit capacity.

The humidity controller activates the infrared humidifier when the return air humidity level decreases to 100% of the humidity proportional band. The humidifier makeup water solenoid valve also operates during humidification operation based on a timing sequence.

The humidity controller deactivates the infrared humidifier and makeup water solenoid valve when the return air humidity level increases to 50% of the humidity proportional control band value.

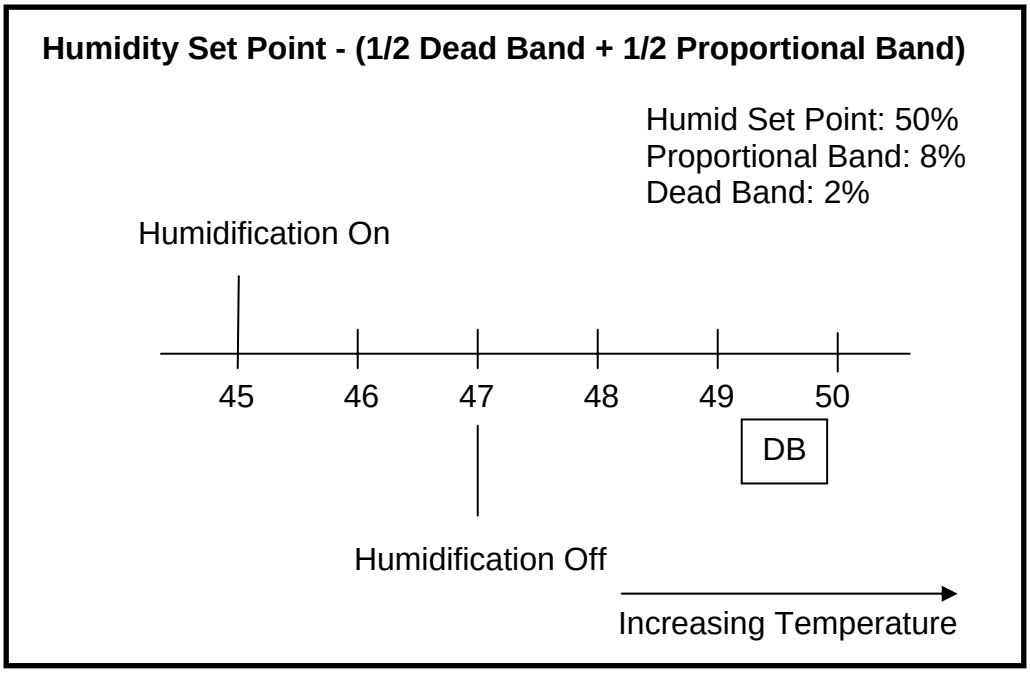
Infrared Humidification – No Dead Band



Note: in the above example that the control band begins at the 50% humidity set point and has a length of 4%, which is ½ of the programmed humidity proportional band value.

As the return air humidity decreases the infrared humidifier is activated at 46%RH or 100% of the humidification control band. When the return air humidity starts to increase, the infrared humidifier is deactivated at 48%RH or 50% of the humidification control band.

Infrared Humidification – With Dead Band



Note: in the above example that the control band begins at the 50% humidity set point and has a length of 5%, which is ½ of the programmed dead band value plus ½ of the programmed humidity proportional band value.

As the return air humidity decreases the infrared humidifier is activated at 45%RH or ½ of the dead band value plus 100% of the humidification control band. When the return air humidity starts to increase, the infrared humidifier is deactivated at 47%RH or ½ of the dead band value plus 50% of the humidification control band.

Autoflush Control for Infrared Large (IFL) or Small (IFS) Pans

The Autoflush Water-Level Control software program is an integral part of the infrared humidifier system. The program automatically controls a water makeup valve to maintain the proper water level in the humidifier pan during operation. When a call for humidification exists, the program performs a series of checks.

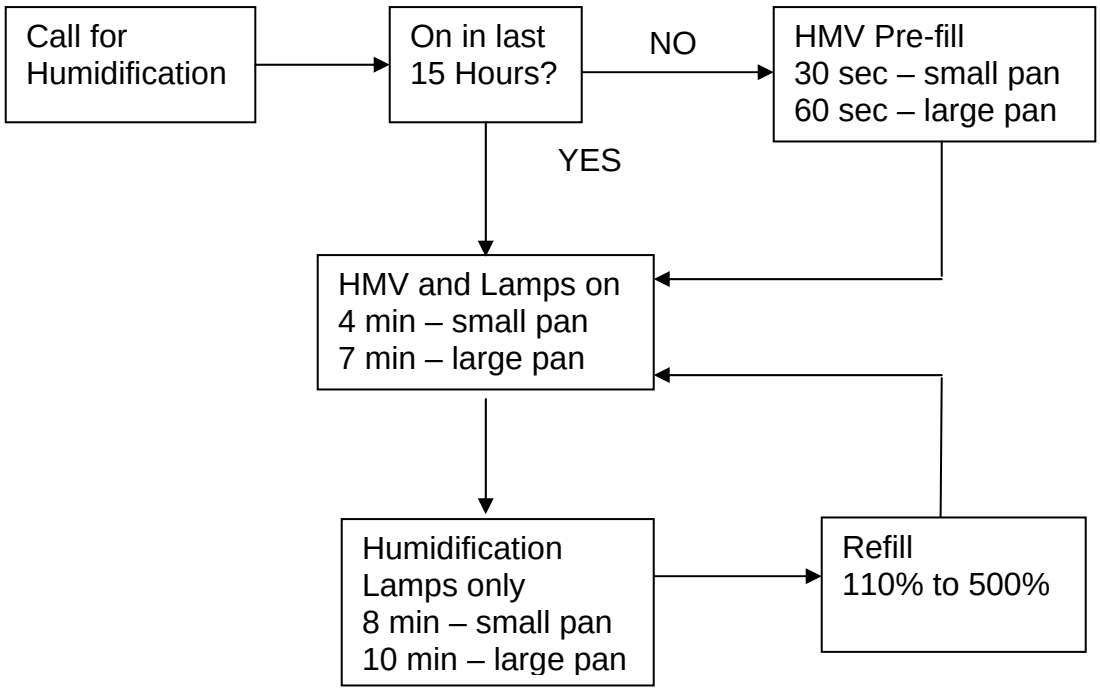
The first check to see how long the infrared humidifier has been off. If the off time is equal to or greater than the programmed value (factory default is 15 hours), it is assumed that the pan is dry and a program called pre-fill is initiated to add water to the pan. During the pre-fill operation the infrared lamps are inactive. The pre-fill time is programmable with an adjustable range of 1 to 120 seconds for either pan size. The factory default for a large (IFL) pan is 60 seconds and for a small (IFS) pan is 30 seconds.

If the off time is less than 15 hours (or user programmed value) the pre-fill program is bypassed and the infrared lamps and water valve are activated at the same time to fill the pan to the proper water level and initiate humidification.

During normal infrared humidification operation the water makeup valve is periodically closed (no pan fill) and opened (pan fill) based on a timing sequence to allow for the evaporation of water from the pan (see flow chart below).

With the humidifier water flush rate set at the factory default value of 150% the water makeup valve will open for 7 minutes of fill time with an off time of 45 seconds between fill cycles for a small pan. For a large pan water makeup valve will open for 10 minutes of fill time with an off time of 80 seconds between fill cycles. The user can modify the percentage from 110% to a maximum of 500% in 1% increments.

Autoflush Control Flow Chart



Notes:
1. IFL: Infra-red Large and IFS: Infra-red Small
2. Last 15 Hours is programmable from 1-120hours.
3. Pre-fill time is programmable from 1-120 seconds on Large or Small pans
4. Normal Fill is programmable from 1-120 seconds
5. Refill is programmable in 1% increments

Dehumidification Operation

The Relative Humidity control program is used to illustrate the dehumidification operation in the following examples. The basic dehumidification control band is established at the humidity set point with the length equal to ½ of the programmed humidity proportional band value.

The humidity controller activates dehumidification operation when the return air humidity level increases to 100% of the humidity proportional band. The humidity controller deactivates dehumidification operation when the return air humidity level decreases to 0% of the humidity proportional control band value.

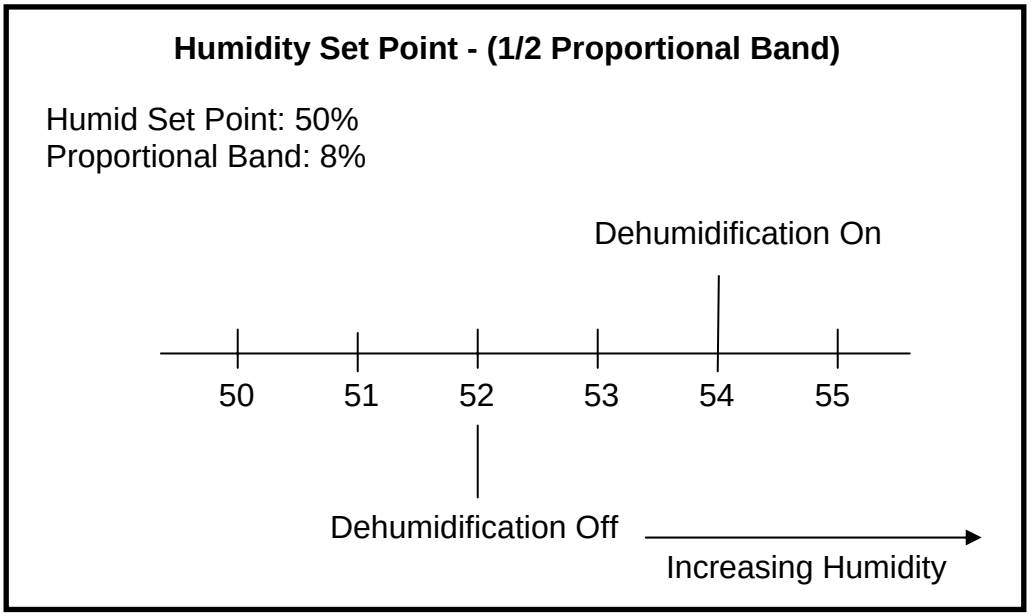
1-Stage Dehumidification, Compressorized Direct Expansion (DX) Systems

The Liebert DS unit is supplied with two (2) compressors. Under normal operation, the lead compressor is used for sensible cooling and the lag compressor is used for either additional cooling or for dehumidification control. The optional hot gas bypass solenoid valve is de-energized during dehumidification.

If single compressor dehumidification is selected, the lag compressor is activated by the humidity controller when the return air humidity level increases to 100% of the humidity proportional band.

The humidity controller deactivates the lag compressor when the return air humidity level decreases to 50% of the humidity proportional control band value.

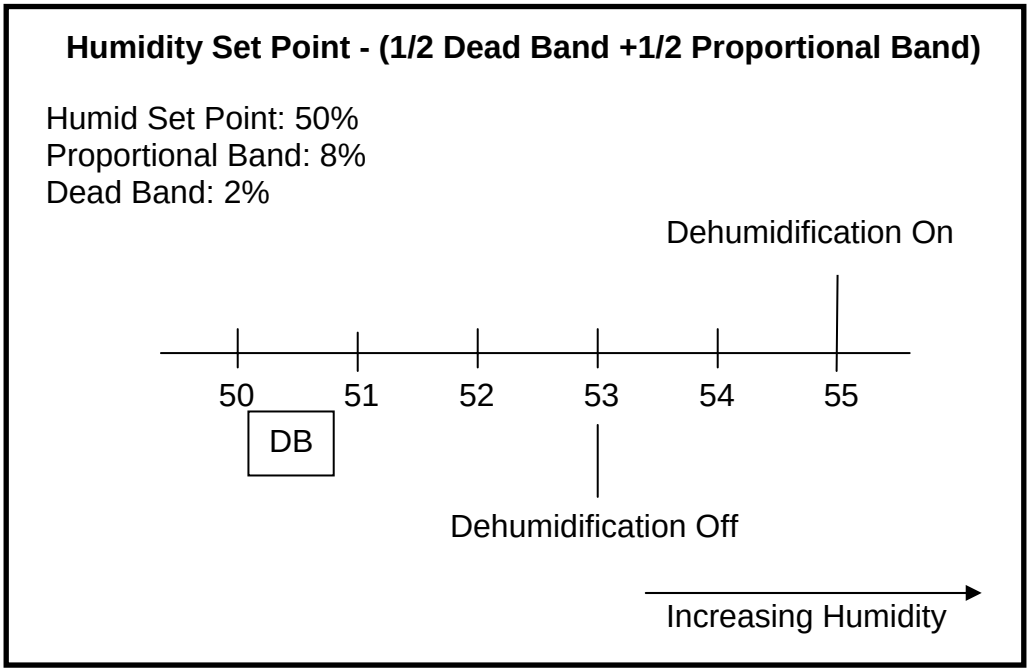
1 Stage Compressorized Dehumidification – No Dead Band



Note: in the above example that the control band begins at the 50% humidity set point and has a length of 4%, which is ½ of the programmed humidity proportional band value.

As the return air humidity increases, dehumidification operation is activated at 54%RH or 100% of the dehumidification control band. When the return air humidity starts to decrease, dehumidification operation is deactivated at 52%RH or 50% of the humidity proportional control band.

1 Stage Compressorized Dehumidification – With Dead Band



Note: in the above example that the control band begins at the 50% humidity set point and has a length of 5%, which is ½ of the programmed dead band value plus ½ of the programmed proportional band value.

As the return air humidity increases, dehumidification operation is activated at 55% RH or ½ of the dead band value plus 100% of the dehumidification control band. When the return air humidity starts to decrease, dehumidification operation is deactivated at 53%RH or ½ of the dead band value plus 50% of the humidity proportional control band.

2-Stage Dehumidification, Compressorized Direct Expansion (DX) Systems

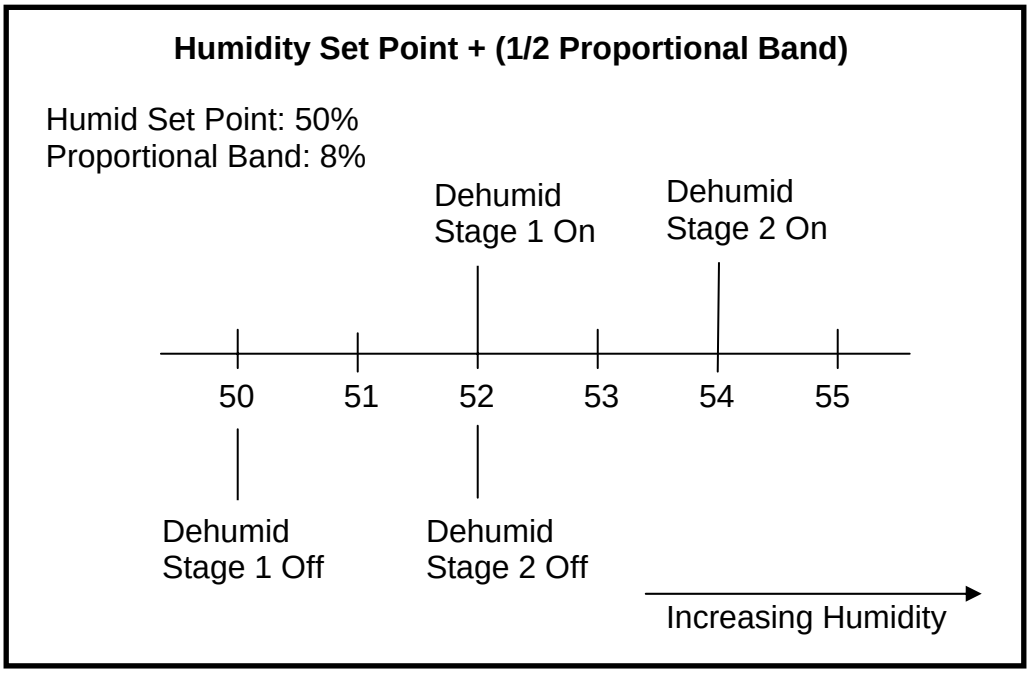
The basic dehumidification control band is established at the humidity set point with the length equal to ½ of the programmed humidity proportional band value. When 2 stage dehumidification is selected, the controller works as follows.

The humidity controller activates the first stage of dehumidification operation when the return air humidity level increases to 50% of the humidity proportional band. The second stage of dehumidification is activated when the return air humidity level increases to 100% of the humidity proportional band.

The humidity controller deactivates the second stage of dehumidification operation when the return air humidity level decreases to 50% of the humidity proportional control band value. The first stage of dehumidification is deactivated when the return air humidity level decreases to the humidity set point of 50% or 0% of the humidity proportional band.

If the compressors have unloading capability (4-stage cooling), then the compressors are activated in the fully loaded condition for each stage of dehumidification.

2 Stage Compressorized Dehumidification – No Dead Band

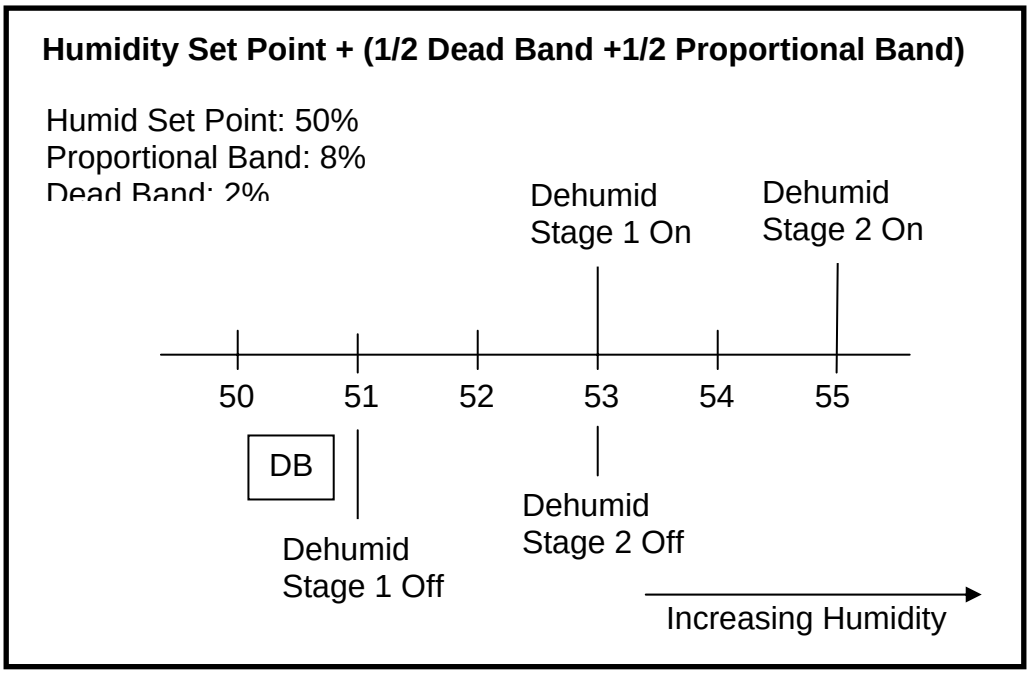


Note: in the above example that the control band begins at the 50% humidity set point and has a length of 4%, which is ½ of the programmed humidity proportional band value.

As the return air humidity level increases, first stage dehumidification operation is activated at 52%RH or 50% of the dehumidification control band. If the return air humidity level continues to increase the second dehumidification stage actives at 54%RH, which 100% of the dehumidification control band.

When the return air humidity level decreases to 52%RH or 50% of the dehumidification control band the second dehumidification stage is deactivated. When the return air humidity level decreases to the humidity set point of 50% or 0% of the humidity proportional band the first dehumidification stage is deactivated.

2 Stage Compressorized Dehumidification – With Dead Band



Note: in the above example that the control band begins at the 50% humidity set point and has a length of 5%, which is ½ of the programmed dead band value plus ½ of the programmed humidity proportional band value.

As the return air humidity level increases, first stage dehumidification operation is activated at 53%RH or ½ of the programmed dead band value plus 50% of the dehumidification control band. If the return air humidity level continues to increase the second dehumidification stage actives at 54%RH or ½ of the programmed dead value plus 100% of the programmed humidity proportional control band.

When the return air humidity level decreases to 53%RH or ½ of the programmed dead band value plus 50% of the programmed proportional control band the second dehumidification stage is deactivated. When the return humidity level decreases to 51%RH or ½ of the dead band value plus 0% of the programmed proportional control band the first stage dehumidification deactivated.

Reheating during Dehumidification

The Parameter Electric Reheat Enabled defines how the reheats react when the return air temperature decreases below the temperature set point during the

dehumidification process. The end user can choose to select from the following selections:

Parameter	Operation
No	No electric reheat allowed during compressorized dehumidification operation.
Normal	Electric reheat operates as normal. A decrease in return air temperature below set point will start reheats as described previously in his chapter.
Delayed	No low limit reached / low limit reset: heaters disabled. Only one of two compressors operating in dehum or low limit 1 reached: heaters enabled

Normal or Delayed Reheat (2-Stage Dehumidification Only)

When normal reheat (factory default) control is selected, the unit reheats are not disabled during dehumidification, even if both compressors are operating. As the return air temperature decreases below the temperature set point the reheats will stage on and off as described earlier in this chapter.

If delayed reheat is selected and both compressors are operating for dehumidification control, the reheats are disabled until only one compressor is required. If, during reheat disable, the return air temperature decreases far enough below the temperature set point to require 150% total available reheat capacity, then dehumidification is disabled and reheats are activated.

When the return temperature raises to the point where reheat is no longer required, then dehumidification operation is re-enabled. However, if the amount of time that both compressors were operating prior to being disabled by the low temperature condition was less than 10 minutes, then only one compressor is allowed to operate for subsequent dehumidification requirements. This prevents excessive system cycling, which can occur if the room heat load is small. Once the requirement for dehumidification is no longer present, then both compressors are enabled.

Caution:

Dehumidification with normal reheat allows for operating both compressors and reheats simultaneously. It is very important that the electrical service to the unit be sized and wired for this option if selected. If not sized properly the electrical service could experience nuisance trips and or possible damage to building circuit breakers (or Fuses) and wiring.

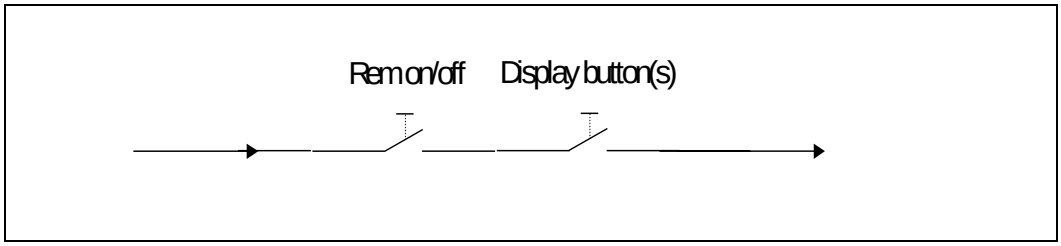
Additional Programs

Start

The unit fan is activated. The unit can be switched on/ off from 2 inputs:

1. Remote on/ off input (RSD – Remote Shutdown Device)
2. Display button

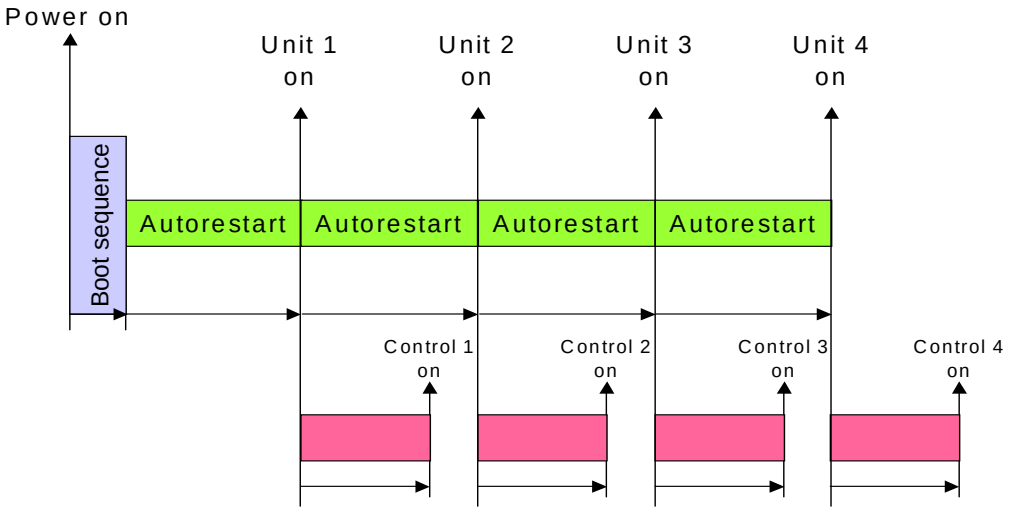
Note: Switches 1 and 2 are in series; the unit will start only if both switches are in the on position. If either switch is in the off position the unit will stop



Auto restart

When there is a power outage the unit will provide an automatic restart on power restoration when programmed. The unit will start and the loads will sequence on with the Fan first, the first Cooling need and so forth until all loads are on as the room requirement demands.

The **Unit Auto Restart Sequence** (customer programmable) takes place. Each unit will restart by this program, however, with a network of units, the start loop will start the next unit at each individual time when elapsed beginning with unit number ID #1. The unit control start sequence will start at this point as well.



Fan Alarm / Fan settings

The fan operation is controlled by two (2) digital devices: the **Loss of Airflow** differential pressure switch and the **Main fan Overload** motor protection. The time delay at the unit start is always 5 seconds shorter than the control delay.

High Pressure Cutout

The control uses high head lockout functionality. If one compressor trips or is locked out on high head, the other compressor turns on when the space temperature increases 1°F. Pressing the alarm button on the display twice can reset high head Alarm. A lockout condition occurs on the third trip and must be reset by turning the main power switch to off then back on.

Suction Pressure Transducer

The suction pressure transducer operation is only on air conditioning products (not chiller applications). Transducer measurements are made **at least once every 1** second. With all other operating times for all compressors, additional measurements, shall be taken based on **operation "at limit conditions" for 5 seconds** and shall not include readings taken during **Pumpdown or Winter Start Kit (WSK)** timeout.

Call for Cooling

The following applies for both R22 and R407C systems and applies to all compressor types. The call for cooling opens the **Liquid Line Solenoid Valve (LLSV).** Note: on units with Digital Scroll Compressors the unloader is energized 0.1 second before the compressor contactor is energized. On air-cooled units with **fan speed type condenser (FSC)** the low pressure start threshold is 35psiG (50psiA). On air-cooled units with **lee-temp control (LT) and all fluid cooled units** the low-pressure start threshold is 60psiG (75psiA).

All compressorized units use the following start sequence:

Open LLSV, if WSK is set to 0, wait for suction pressure to reach setting, then start compressor and freeze protection timer.

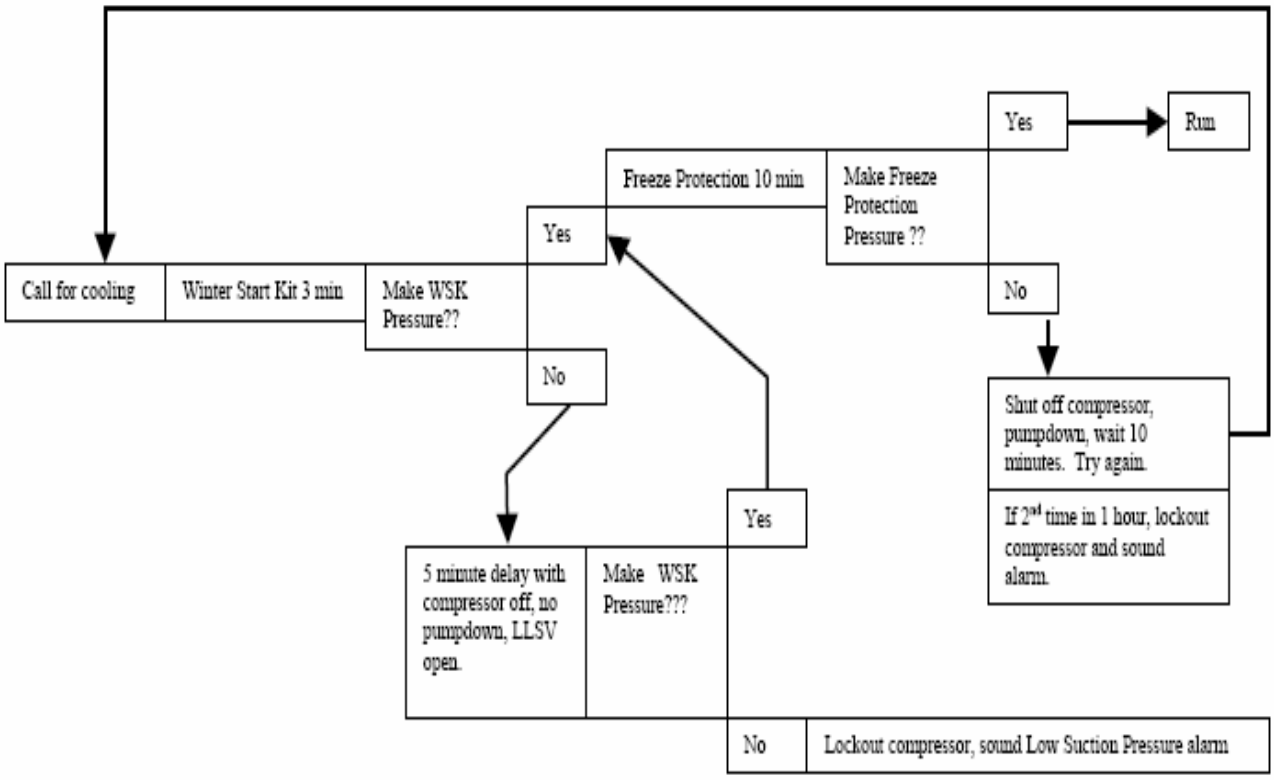
If WSK is set greater than 0, operate the compressor for the WSK override time and monitor suction transducer value.

If pressure is achieved the compressor is allowed to operate, and the freeze protection timer is started.

If pressure is not achieved, turn compressor off and leave LLSV open.

If pressure is achieved within next 30 seconds the compressor is allowed to operate, and the freeze protection timer is started.

The Startup and Freeze Protection Program



The sequence for the call for cooling with the program features is as follows:

The need for cooling is defined by the control setting for the temperature setpoint, proportional band, and deadband (if used). At this point the Winter Start Kit (WSK) time delay is the wait period for the compressor to run without the indication of the low-pressure condition (also known as LP bypass). The WSK time delay is programmable with a range of 0 - 5 minutes. If the LP switch setting is achieved in this time then full cooling is in process with the Freeze Protection (FP) now watching the LP for an additional 10 minutes (fixed). If the LP remains closed the cooling process continues.

If the WSK is not made in the set time period the cooling process stops and waits an additional 5 minutes with the compressor off (no pumpdown). The liquid line solenoid valve will remain open during this time period. If the LP switch is made the control will now advance and wait for the freeze protection time delay as stated as above. If the LP switch does not prove in the WSK time delay period plus the 5 minute wait period, the compressor is locked off and the Low Suction Pressure Alarm will activate. A power off/ on reset is required to reset the cooling function.

If the WSK is made and the control is in the 10 minute Freeze Protection (FP) wait time period and this function does not prove the LP the control will go into additional 10 minute wait (fixed), with the compressor off (no pumpdown) and the liquid line solenoid valve to remain open. If the freeze protection does not make

during the second time frame the cooling process locks off and will require a power off sequence.

Next Maintenance Calculation

Foreword
The next maintenance calculation will help run the Liebert Environmental unit in an optimum way, to ensure minimum components stress resulting in increased reliability.

Calculation of next Maintenance Parameters
The following components are included in the calculation individually:

- Fan(s)
- Compressor 1
- Compressor 2
- Electric Heaters
- Humidifier

For **each individual component** the next maintenance will be calculated from following parameters:

1. Standard service interval (1, 2, 4 or 6 times a year, to be programmed).
2. Working hours (counted).
3. Number of starts (counted).
4. Average running time (calculated).
5. Optimum number of starts per hour (to be programmed).
6. Maximum number of starts per hour (to be programmed).
7. Maximum bonus to enlarge time to next maintenance (to be programmed).
8. Maximum penalty to reduce time to next maintenance (to be programmed).

The Maintenance Calculation is done as follows:
Basic: maintenance frequency (1). The control counts the working hours of the component, as well as the number of starts.

The working hours and the number of starts are compared with the programmed optimum / maximum starts per hour. This results in “Wellness Factor”.

This factor, in accordance to the service interval, will add a “Bonus” to increase the time before the next maintenance, or will add a “Penalty” to decrease the time before the next maintenance. In simple words: If a component starts very often, the time to next maintenance will be decreased, if it starts rarely, the time to next maintenance will be increased.

The control always takes the component with the most on/ off (cycling) as the reference component, which asking for the nearest maintenance (example: if the fan runs continuously, but the compressor switches on/off all the time, the next maintenance will be calculated from the compressor).

Alarms or warnings (like clogged filter, high or low pressure, fans alarm etc.) will decrease the time to next maintenance immediately to 0. If the alarm was reset, the original situation will be displayed again, but the alarm will be counted in the diagnostics window.

The display's main window provides information about the next maintenance: a bar graph (graphical display screen) will fill in, as the next maintenance gets closer (the width of the graph equals to the standard maintenance Interval (1, 2, 4 or 6 times a year). The date of the next maintenance is also displayed.

Parameters for next Maintenance Calculation:

General Maintenance Settings:

Maintenance Frequency: can be set at 1, 2, 4 or 6 times a year. "NO" means the maintenance calculation program is disabled.

Maximum Bonus: this value increases the time to next maintenance with the set value, if all components run in optimum way (number of starts, average running time).

Maximum Penalty: this value decreases the time to next maintenance with the set value, if some components run in non-optimum way (number of starts, average running time).

Last Maintenance: this date can be will be set by the calculations and the service-engineer and others to view.

Service-Engineer: name can be added and edited.

Reset: puts all counters of all components (fans, compressors, ect.) to 0, and starts new maintenance calculation (always reset after maintenance is completed).

Fans / Heaters / Humidifier Settings / Compressor 1 /2 Settings

Number of starts and **Working hours:** counted from the last maintenance. Total working hours can be read in the standard working hours window (customer window).

Average Working Hours: calculated by the number of starts and working hours of each component.

Starts per Day Optimum: the number of individual component starts that is considered as good or optimum. To be set by Service Engineer.

Starts per Day Worst: the number of individual component starts that is considered as "hunting" or worst case. To be set by Service Engineer.

Number of Alarms: counts the number of alarms occurring between service intervals.

Actual Bonus: calculated from "number of starts" and "average working time" values. The result can be positive (for a bonus) or negative (for a penalty). This value influences the time remaining to the next maintenance.

Shared Parameters an understanding

If we have multiple units in the same room (zone) they will need to communicate with each other to avoid opposite operational functions. This will prevent the cooling and heating functions from operating at the same time on different units. This condition called "fighting " often exists in the room due to imbalanced loads and the crossing of airflow conditions. This is also considered when using the Lead/ Lag and Cascade functions.

When a system is setup the parameters are shared by all units. The unit selected as the Lead Unit (#1 unit) is used to program the system, if program parameters are not set in this unit they will be ignored. This is true for all of the active units in the system. However, if a unit in the system is not active it will be ignored until it is active and the parameters will be shared within 2 minutes of activation.

Shared Temperature and Humidity parameters example:
Two units share the master Temperature Control (1/2) Proportional Band Setting such as 10°F, and then each unit will use the master band divided by 2 (units) or 5°F proportional bands. To avoid the cooling hunting process or compressor cycling too quickly, the primary temperature proportional band needs to be set wide enough to compensate for the number of units in the system setup. Note that shared parameters are not used on single unit applications.

Heating, humidification, and dehumidification will follow the same example with each function starting in each unit one after the other or in sequence.

In Chilled Water units all valves operate are in parallel but this operation may be overridden by the setting and use of the Supply Limit sensor. This parameter is controlled by the individual unit. Here we may see uneven valve positioning (operation) in some of the units.

Freecooling and Dual cooling will operate in the same manner as chilled water with the supervision of the Supply Limit, again showing different valve positions on the units

If in a Freecooling or Dual Cooling unit if the limit of the coil operation is detected (no free cooling or no CW available) the valve will close off and unit will become DX operation in the system.

Networking and Functions

Unit 2 Unit (U2U) Communications by networking will allow the following functions to be placed into operation when the requirements exist. The user must install the correct hardware and properly program the units for the functionality.

In the iCOM Network the owner may perform the following functions:

The **Teamwork Mode** functions, which allow multiple stages of Cooling/ Heating and/ or Humidification/ Dehumidification. The ability to prevent the units fighting is included in this feature.

The **Lead/ Lag** function, which allows one or more units to be set as “Running and Standby” for activation in case of an alarm. This also has the ability to be programmed in a rotation for assurance of functional standbys.

The **Cascade** function, which allows additional units to be staged on based on the temperature or humidity requirement.

Understanding the iCOM Network setup process:

To setup a system network with the iCOM control requires a complete understanding of the control processes and parameter programming to insure the proper functional operation without incident. To insure the setup is correct and that the operation will function as selected you need to map both the room layout and the unit setup. First, read and record all programmed settings in all of the single units. Second, document the network parameter settings that are needed and identify the numerical order of the units to be networked. The order of the setup process is very important.

The Basics for Cooling Unit Placement:

Installation instructions are found in the product manuals for the Cooling units. Networking setup should include these additional factors for planning.

- Locations of heat loads in conditioned space.
- Air distribution for cooling.
- Number of operating units versus standby.

The Basics for Hardware:

Multi-unit networking requires the following hardware:

Minimum Network Switch Requirements:

- IEEE 802.3, IEEE 802.3u
- 10/100 Mbps speed
- Multiple RJ-45 ports – one shared RJ45 uplink

CAT 5 patch cables (straight through) in the proper lengths not to exceed 150 ft. maximum length each. One for each board and display added into the *iCOM* network. Cable management will apply.

The Basic for Programming:

An IP address number will be used to identify each receiver/ sender of information. (See Computer and Network Terms in Training and Service Manual)

The *iCOM* Network is a Class C Private Network and will use the 192.168.254.xxx series of static IP address. This has nothing to do with the local building or owner network. The *iCOM* Network may only be attached to these networks through a WEB Card or 485 Card using the Liebert Intellislot.

A series of basic rules must be followed to connect and program the units for this private *iCOM* Network. See the following rules.

1. Small Displays are CAN connections only, programming of single unit parameters is required.

2. Small Displays CANNOT look at or program other *iCOM* Network functions.

3. Small Displays may be networked with a CAT 5 crossover cable (2 units).

4. All Large Displays and Control Boards will use a CAT 5 or greater straight through (patch) cables to connect to the switch.

5. One large Display (Wall Mount) with a separate power adapter may be used with multiple units (Control Boards and Small Displays) through the network switch.

6. Each set of unit control boards must be set up individually, then connected to the network switch and checked before the next board can be setup

6a. Large Displays and Control Boards must each be programmed with a different IP Address.

Example: Display: 192.168.254.001
Example: Control Board: 192.168.254.010

6b. Each Display and Control Board in the iCOM network must have the same Gateway IP address.

Example: Gateway IP: 192.168.254.75

6c. Each Display and Control Board in the iCOM network must have the same Netmask IP address.

Example: Netmask IP = 255.255.255.000

6d. The Unit to Unit (U2U) address must be programmed in the necessary order for setup.

Example: Unit Display: 33 – 64 and Unit Control Board: 1 - 32

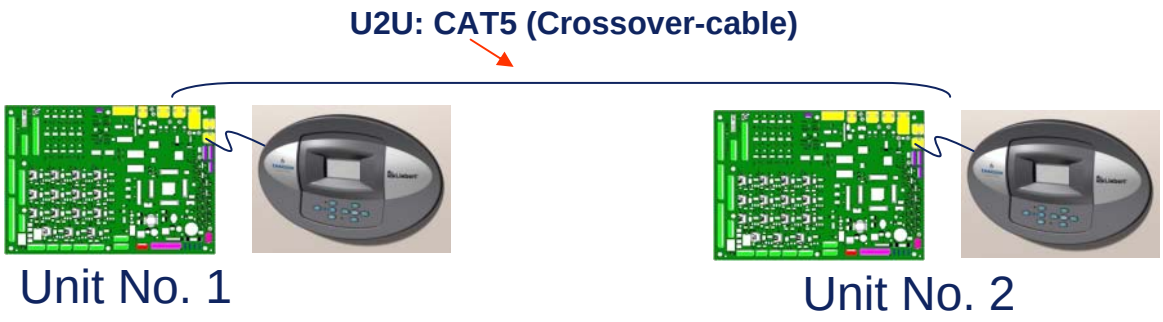
Setting Parameters

Example: 2 Units with Small Display's

All Network parameters are viewed and programmed using the Service Menu function and by selecting the Network Setup Icon

The following example references menu lines on the Network Setup screen:

Line S802: Number units connected: xx (2)
Line S803: Teamwork: xx (No, 1, 2)
Line S804: Control Board IP Address: 192.168.254. xxx (010, 011)
Line S805: Control Board Netmask IP the same for all units
Line S806: Control Board Gateway IP the same for all units
Line S808: U2U address Control Board #: xx (1-2)
Line S810: U2U group #: xx (1)

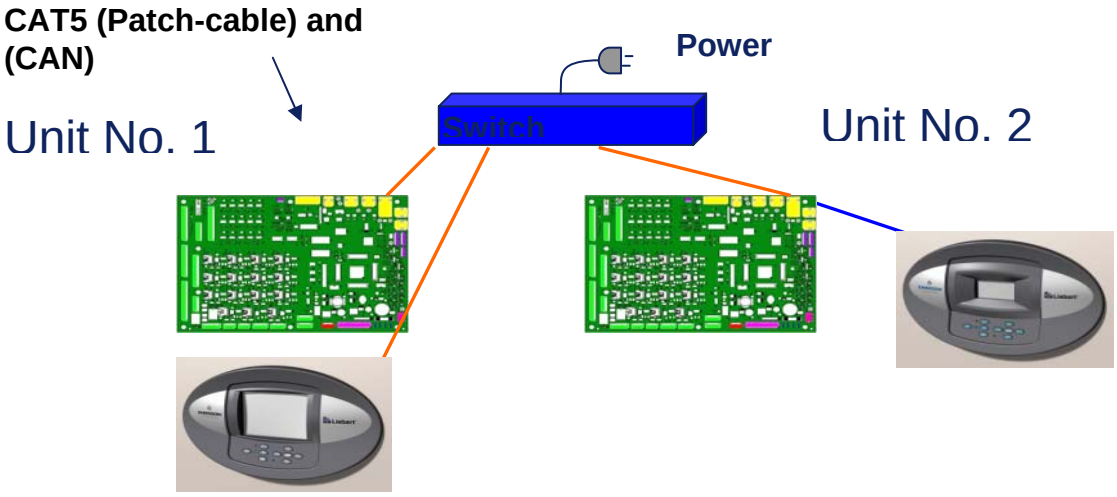


Example: 2 Units, One Large Display and One Small Display

All Network parameters are viewed and programmed using the Service Menu function and by selecting the Network Setup Icon

The following example references menu lines on the Network Setup screen:

Line S802: Number units connected: xx (2)
Line S803: Teamwork: xx (No, 1, 2)
Line S804: Large Display Board IP Address: 192.168.254. xxx (001 - 049)
Line S804: Control Board IP Address: 192.168.254. xxx (050 - 099)
Line S805: Large Display Board Netmask IP: 255.255.255.000
Line S805: Control Board Netmask IP: 255.255.255.000
Line S806: Large Display Board Gateway IP: 192.168.254.255
Line S806: Control Board Gateway IP: 192.168.254.255
Line S808: U2U address Display #: xx (33 - 64)
Line S808: U2U address Control Board #: xx (1 - 32)
Line S810: U2U group #: xx (1 - 99)

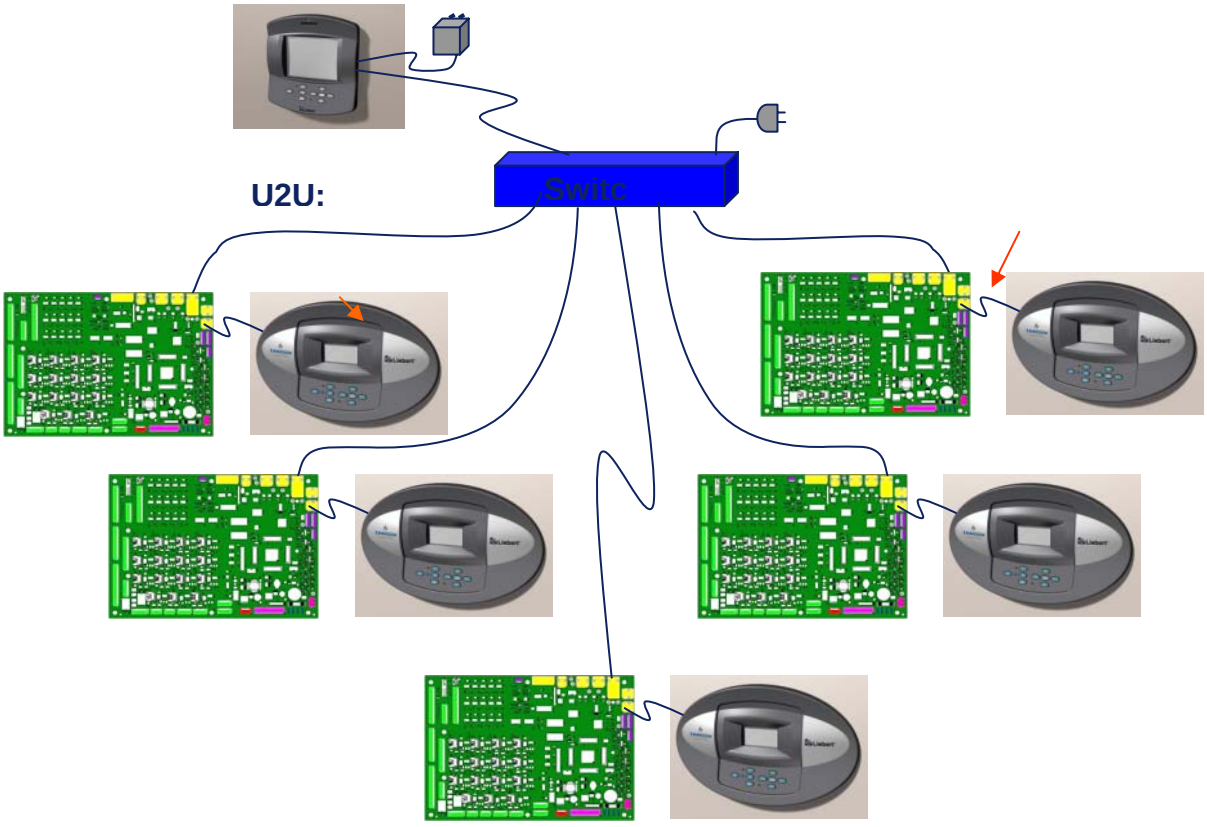


Example: Large Wall Display and Five Units with Small Displays

All Network parameters are viewed and programmed using the Service Menu function and by selecting the Network Setup Icon

The following example references menu lines on the Network Setup screen:

Line S802: Number units connected: xx (01 - 32)
Line S803: Teamwork: xx (No, 1, 2)
Line S804: Large Display Board IP Address: 192.168.254. xxx (001 - 049)
Line S804: Control Board IP Address: 192.168.254. xxx (050 - 099)
Line S804: Wall Mount (LBB) IP Address: 192.168.254. xxx (100 - 149)
Line S806: Large Display Board Gateway IP: 192.168.254.255
Line S806: Control Board Gateway IP: 192.168.254.255
Line S808: U2U address Display #: xx (33 - 64)
Line S808: U2U address Control Board #: xx (01 - 32)
Line S810: U2U group #: xx (01 - 99)

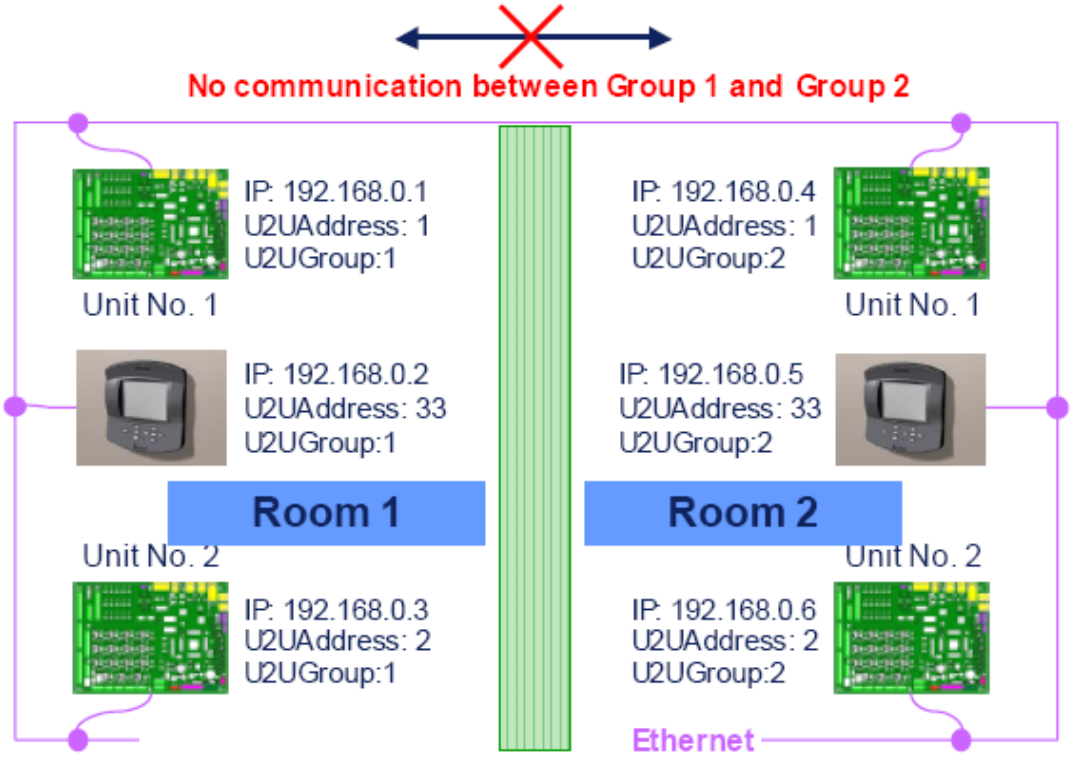


Example: 4 Units in 2 Groups with 2 Large Displays

All Network parameters are viewed and programmed using the Service Menu function and by selecting the Network Setup Icon

The following example references menu lines on the Network Setup screen:

Line S802: Number units connected: xx (01 - 32)
Line S803: Teamwork: xx (No, 1, 2)
Line S804: Large Display Board IP Address: 192.168.254. xxx (001 - 008)
Line S804: Control Board IP Address: 192.168.254. xxx (010 - 080)
Line S806: Large Display Board Gateway IP: 192.168.254.xxx (000 – 254)
Line S806: Control Board Gateway IP: 192.168.254.xxx (000 – 254)
Line S808: U2U address Display #: xx (33 - 64)
Line S808: U2U address Control Board #: xx (01 - 32)
Line S810: U2U group #: xx (01 - 99)



Using GROUP addresses to differentiate between units inside the same LAN

Teamwork

Teamwork Modes

Teamwork is the ability to group unit functionality, while connected in a network, to provide the ability to work together as a team and address control functions in three different teamwork modes:

"No" Teamwork

In this mode all units are working independently for control and functionality. No values or sensors are shared. While in this mode units may be setup to provide the Lead/ Lag function and rotation, however, units may not be setup in the Cascade functionality.

Teamwork Mode 1

In this mode unit parameters (system settings) are shared if the system value is set in any of the units, all units will follow with same settings. (See Glossary of Unit and System parameters section).

The return air temperature and humidity sensed by each unit in the network will be averaged and used for control by the lead unit.

The Lead Unit designation #1 and will provide the calculations for the system requirements and will provide the calculated divisions of the proportional band to each of the units to start the required operations. The width of the proportional band in multiple unit configurations is shown as normal, but internally the lead unit (unit #1) sends the requests to the other units and multiplies this width by the number of available units in the program.

To be an available unit for operations in this mode:

a) The unit cannot be in a standby (lead/lag) configuration: all units must be on

b) The units in the cascade function are not off or set with alarms functions to be switch off.

This mode of control will drive all Chilled Water or FreeCooling actuators in parallel for all units operating in the teamwork mode. The individual unit will control its own Dual Cooling switchover functions, the low temperature functions and low discharge air functions.

Teamwork Mode 1 will rotate the lead unit by 1 unit every 24 hours.

Teamwork Mode 2

In teamwork mode 2 all system parameters are shared equally as in teamwork mode 1. The lead unit will define the temperature and humidity averages for the operational needs if there is a request for cooling, heating, dehumidification or humidification.

If there is a temperature control request because of a need for either cooling or heating (determined by highest or lowest temperature of all the units), teamwork mode 2 activates all of the connected units. Each unit will operate in the cooling or heating mode using their individual temperature control settings. If in the cooling mode the heating function is disabled in all units. If in the heating mode the cooling function is disabled in all units.

If there is a humidity control request because of a need for either humidification or dehumidification (determined by highest or lowest humidity of all the units), teamwork mode 2 activates all of the connected units. Each unit will operate in the humidification or dehumidification mode using their individual humidity control settings. If in the humidification mode the dehumidification function is disabled in all units. If in the dehumidification mode the humidification function is disabled in all units.

Teamwork Mode 2 does not allow unit rotation (lead/ lag), unbalanced unit working hours are to be expected.

Unit Lead/ Lag or Running/ Standby Function

This program will allow the user to select the multi-unit function of Lead and Lag, or as sometimes stated Running and Standby, by selecting the number of running and standby units to provide the redundancy needed in the space.

Typical Lead/ Lag (Running/ Standby) Function

The lead/ lag operational sequence has a lead (running) unit operating and an alarm becomes active (selected by alarm programming). The active alarm in the lead unit will cause the first lag (standby) unit to active and maintain the space conditions. If multiple units are selected as lag (standby) the units will continue to rotate on active alarms as long as a lag unit is available. If there are no lag (standby) units left in the sequence the first failed will restart (if not in a critical alarm state i.e. fan overload, etc).

Note: The unit with the active alarm will operate in the fan only mode for 3 minutes before going into a standby mode to stabilize conditions, then it will turn off.

The Lead/ Lag function may be used in the either the No Teamwork Mode, in Teamwork 1 Mode and in Teamwork 2 Mode. One or more units can be defined as lag (standby), the normal status of the lag (standby) unit(s) is off.

The lag or standby function can be performed as a daily rotation (setting the time), weekly rotation (setting the day of the week and time) or as a monthly rotation. The units will rotate based on the programmed number of units:

Example A: if the rotation is set in the "Rotate by 1" parameter, the standby units will rotate from 1 to 2 or 2 to 3 or 3 to 4 or 4 to1 in a basic 4 unit configuration.

Example B: if the rotation is set in the "Rotate by 2" parameter, the standby units will rotate from 1 - 2 to 3 - 4 or 3 - 4 to 1 - 2 in a basic 4 unit configuration.

Standby & Cascade

This program function will activate the lag (standby) unit(s) when an active alarm in a running unit is detected. This program parameter will also provide for unit staging. With an increase or decrease in either the temperature and/ or humidity conditions is sensed in the operating units the additional standby unit(s) will be activated to aid in the control of the space requirements.

The Cascade function operates in Teamwork Mode 1 only. The Cascaded units are not part of the system temperature and humidity average.

Settings are:

Cascade Active	Yes/ No
Cascade Cool/ Heat and Humid./ Dehumid.	Yes/ No
Cascade for Cooling and Heating	Temp
Cascade for Cooling only	Cool

Notes:

Chapter 2

Programming Functions

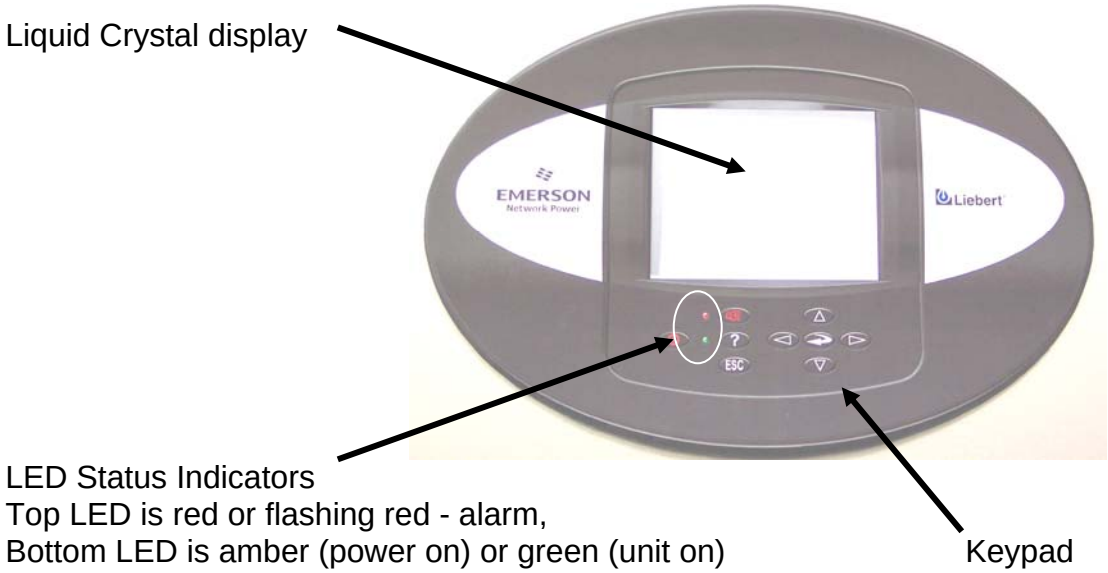
The standard *iCOM* control is supplied with a front panel mounted small display screen display which features a 128 x 64 dot matrix graphics. The display provides both descriptive text readouts and two (2) menu icons. The optional large screen display features a 320 x 240 dot matrix graphic display that shows user and service icons as well as descriptive text and graphics. The information provided visually on either of these displays is: room temperature and humidity, temperature and humidity set points, alarm status and settings, event histories and the current time. All programming functions will be done through the supplied display.

Small Graphic Display with Panel Mount Bezel

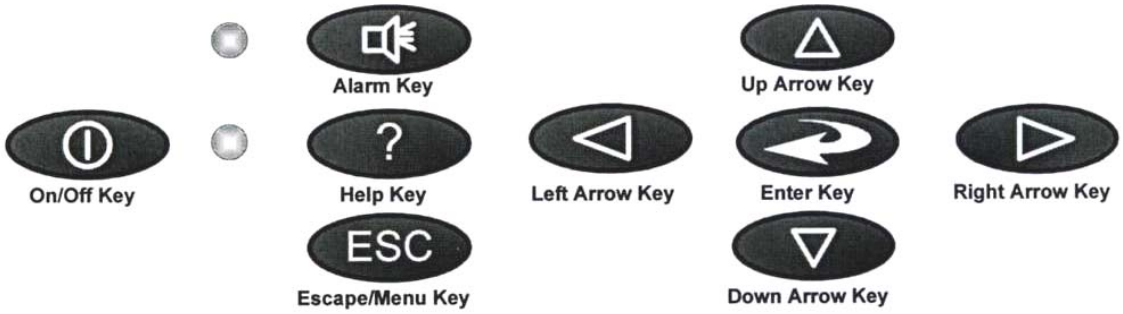
Optional Large Graphic Display with Panel Mount Bezel

iCOM Display Components and Functions

The large display is shown for reference. The keypad and LEDs are identical on all displays.



iCOM Keyboard Layout:

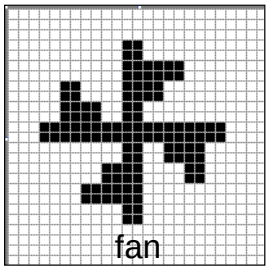


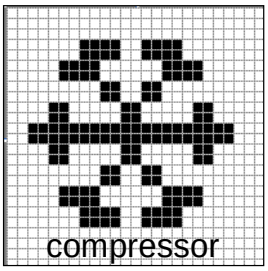
The *iCOM* control screen displays text and icons for monitoring and programming your Liebert unit and/ or network of units. The number of icons and the amount of text shown depends upon the display type supplied on your unit. From the default menu, the user menu may be accessed by pressing the enter key. When the user selects an icon the various submenus, set points, status, thresholds and service information is displayed. The following defines the various keyboard icons and functions.

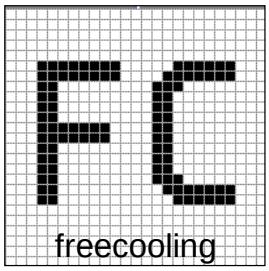
iCOM Keyboard Layout:

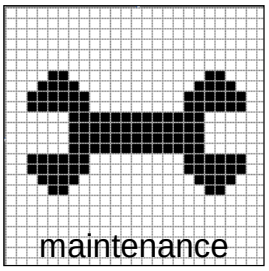
Icon	Key Name	Function
	On/ Off Key	Controls the operation state of the unit.
	Alarm Key	Silences the audible alarm.
	Help Key	Accesses the integrated help menus.
	ESCape Key	Returns to the previous display.
	Enter Key	Confirms all selections, icons and text.
	Increase Key (Up Arrow)	Moves upward through the menu or increases the value of the selected parameter.
	Decrease Key (Down Arrow)	Moves downward through the menu or decreases the value of the selected parameter.
	Left Arrow Key	Navigates through text and selections of the display.
	Right Arrow Key	Navigates through text and selections of the display.
	Upper LED	Blinking Red: Active, unacknowledged alarm exists. Solid Red: Active, acknowledged alarm exists.
	Lower LED	Amber: Power available to the unit, unit NOT operating. Green: Power available to the unit, unit is operating.

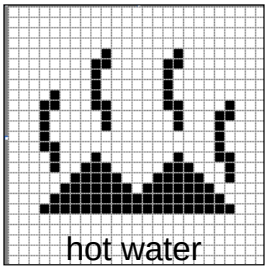
iCOM Display Symbols/ Icons

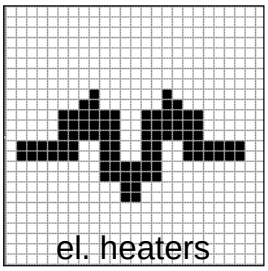

fan

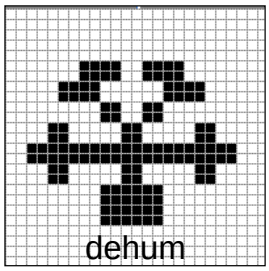

compressor

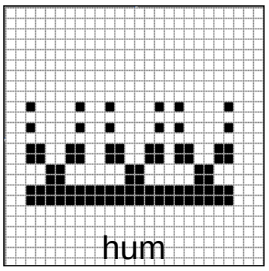

freecooling

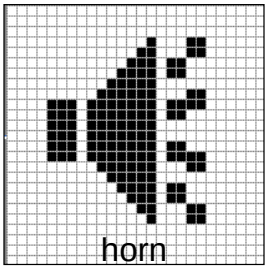

maintenance


hot water


el. heaters


dehum


hum


horn

The *iCOM* programming functions are separated into three (3) basic menus:

- User Menu
- Service Menu
- Advanced Menu

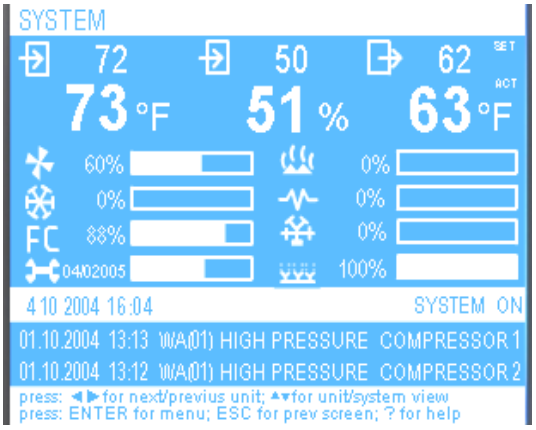
When the desired icon has been selected, press the enter key. If the selected menu item has submenus, they are now revealed. If there are no submenus, the function or setting or command level text is displayed. User and Service menu settings are readable without a password, changing the programmed values requires a password. When a password is required to perform a programming function, the *iCOM* displays a password prompt. Advanced menu setting requires a password to read and program.

Programming Functions

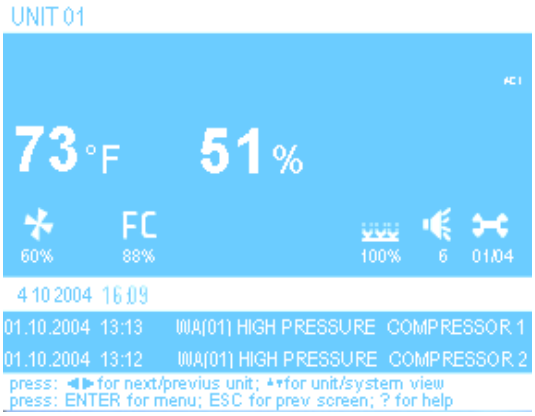
Status Display

The unit display will show the unit operational mode(s), return air temperature/ humidity readings and if active present alarm conditions. The end user can select from two (2) display types, graphical or simple.

System View Screen Graphic



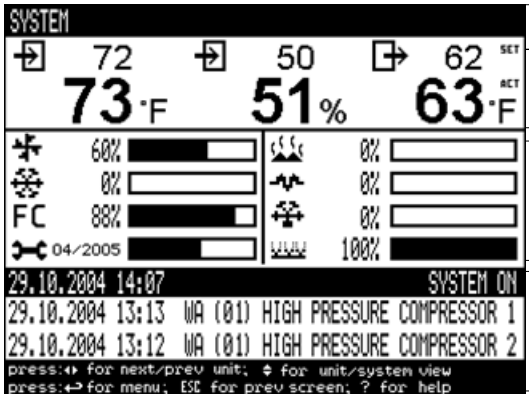
Unit View Screen Simple



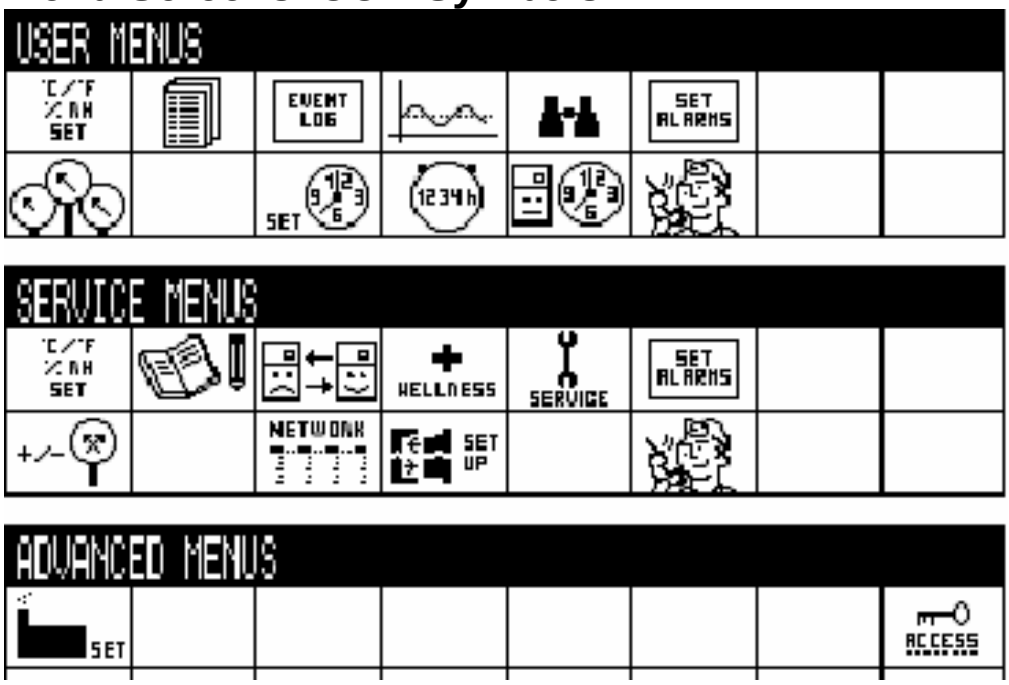
The **Large and Small Display's** have the ability to present information in two formats; the **Graphic** format will show the set points and/or the actual values of the return air temperature and humidity readings. The operational functions of the components are displayed with an icon and a bar graph to indicate to amount of the required function. The bottom of the screen will indicate date, time, on/off status and events. The message area below will provide additional information and provide some basic navigation help. The **Simple** format will reduce the amount of graphics displayed and offers a not so busy display of the same information. The displays will provide the **System** and **Unit** views

The end user can also select from dark background with white text or light background with dark text.

Graphic Screen with reversed Contrast



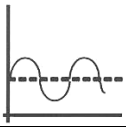
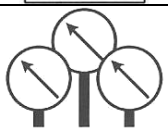
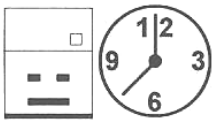
Menu Screens ICON Symbols



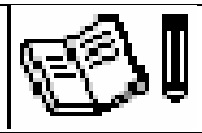
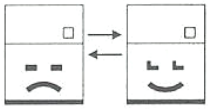
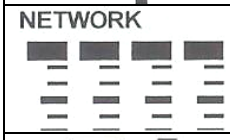
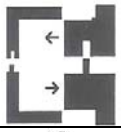
Menu Parameters Names

	Level 1: User	**Level 2: Service**	**Level 3: Advanced**
	Readable w/o password PW required to program	Readable w/o password PW required to program	PW required to read or program
1	Setpoints	Setpoints	Factory Settings
2	Spare Parts List	Unit Diary	
3	Events Log/ Status Report	Standby Settings/ Lead-Lag	
4	Graphics	Maintenance/ Wellness Settings	
5	View Network	Diagnostics/ Service Mode	
6	Set Alarms	Set Alarms	
7			
8			Change Passwords
9	Various Sensors	Sensor Calibration/ Sewtup	
10			
11	Display Setup	System/ Network Setup	
12	Total Run Hours	Options Setup	

User Menu Icons and Descriptions:

Icon	Name	Descriptions	Available Display
°C/ °F % RH SET	Set Points	To view and change temperature and humidity set points	Small and Large
	Spare Parts List	Displays the spare parts list of the unit	Large
EVENT LOG	Event Log	Contains a log of the last 400 events	Small and Large
	Graphic Data Record	Displays the temperature and humidity graphs	Small and Large
	View Network	Shows the status of all connected units	Large
SET ALARMS	Set Alarms	Allows the enabling, disabling and setting of the alarm parameters	Small and Large
	Sensor Data	Shows readings for the standard and optional sensors	Small and Large
	Display Setup	Change the settings for display, language, time and simple or graphic display	Small and Large
	Total Run Hours	Records the run time of all components and allows for setting the limits on run time	Small and Large
	Sleep Mode	Allows for setback programming for non-peak operation	Small and Large
	Service Contacts	Contains key contact information for local service, including names and phone numbers	Large

Service Menu Icons and Descriptions:

Icon	Name	Descriptions	Available Display
°C/ °F % RH SET	Set Points	To view and change temperature and humidity set points	Small and Large
	Unit Diary	Is a notepad containing notes from the service person or customer	Large
	Standby Settings	Programs lead/ lag setup when multiple units are connected together	Small and Large
	Maintenance/ Wellness Settings	Allows programming of the maintenance interval reminder, maintenance messages, number of unit starts and stops, time since last maintenance	Small and Large
	Diagnostic/ Service Mode	Allows for troubleshooting, manual mode and viewing of the analog and digital inputs	Small and Large
	Set Alarms	Allows the enabling, disabling and setting of the alarm parameters	Small and Large
	Sensor Calibration/ Setup	Allows for the calibration of the various sensors	Small and Large
	System/ Network Setup	Allows for setup and unit-2-unit communication for multiple units	Large
	Options Setup	Allows for the setup of component operation	Small and Large
	Service Contacts	Contains key contact information for local service, including names and phone numbers	Small and Large

Advanced Menu Icons and Descriptions:

Icon	Name	Descriptions	Available Display
	Factory Settings	Factory configuration files. **Do Not Change Settings Consult the Factory First**	Small and Large
	Change Passwords	Allows the user to change the various passwords	Small and Large

Menu Parameters

All of the various parameters and program ranges are shown in tables located in this chapter. The following sections highlight the various parameters and programs in the *iCOM* control.

User Menu Parameters

The User menu displays the various unit operating values and status icons. The factory default password to access the user menu items for programming is “149”. The User Menu selections include the following choices in the order shown:

- Set Point Parameters
- Spare Part List
- Event Log
- Graphics Log Parameters
- View Network Parameters
- Set Alarm Parameters
- Sensor Parameters
- Active Alarms
- Display Setup Parameters
- Total Run Hours
- Sleep Mode Timer Parameters
- Service Contacts Information

User Menu: Set Point Parameters U100 series

Menu Line	Parameter	Default	Range
U101	Password	-	-
U102	Temperature Setpoint	73ºF	41 - 104ºF
U103	Humidity Setpoint	50%	1 – 80%
U104	Humidity Control Type	Yes	Yes or No
U105	Supply Limit	Disabled	Disabled or Enabled
U106	Supply Limit Temp Value	41°F	41 - 77°F
U107			
U108			
U109			
U110			
U111			

User Menu: Spare Parts List, Large Display Only

Parameter
Unit spare parts list

User Menu: Event Log

Parameter
Stores the last 400 events (messages, warnings and alarms a that have occurred

User Menu: Graphics Parameters

Parameter	Default	Range
System Temperature Time Scale	24 Hours	8, 32 min or 1, 12, 24 hours or 2, 4, 8, 16 days
System Temperature Graph Height	9ºF	±36ºF
System Humidity Time Scale	24 Hours	8, 32 min or 1, 12, 24 hours or 2, 4, 8, 16 days
System Humidity Graph Height	10%	±20%
Unit Temperature Time Scale	24 Hours	8, 32 min or 1, 12, 24 hours or 2, 4, 8, 16 days
Unit Temperature Graph Height	9ºF	±36ºF
Unit Humidity Time Scale	24 Hours	8, 32 min or 1, 12, 24 hours or 2, 4, 8, 16 days
Unit humidity Graph Height	10%	±20%

User Menu: View Network Parameters

Parameter
User to select and view status of all units connected together (only Large Display)

User Menu: Set Alarm Parameters U200 series

Menu Line	Parameter	Default	Range
U201	Password	-	-
U202	Return Sensor Alarms	Enabled	Enabled or Disabled
U203	High Return Temperature	80ºF	33 - 210ºF
U204	Low Return Temperature	60ºF	33 - 210ºF
U205	High Return Humidity	60%	1 – 99%
U206	Low Return Humidity	40%	1 – 99%
U207	Sensor A Alarms	Disabled	Disabled or Enabled
U208	High Temperature Sensor A	90ºF	33 - 210ºF
U209	Low Temperature Sensor A	55ºF	33 - 210ºF
U210	High Humidity Sensor A	70%	1 - 99%
U211	Low Humidity Sensor A	30%	1 - 99%

User Menu: Sensor Data U300 series: Page 1 of 2

Menu Line	Parameter	Range
U301	Actual Temperature Setpoint	41 – 104ºF
U302	Actual Humidity Setpoint	20 – 80%
U303	Optional Sensor A Temperature	32 - 122ºF
U304	Optional Sensor A Humidity	20 – 80%
U305	Optional Sensor B Temperature	32 - 122ºF
U306	Optional Sensor B Humidity	20 – 80%
U307	Optional Sensor C Temperature	32 - 122ºF
U308	Optional Sensor C Humidity	20 – 80%
U309	Freecooling Fluid Temperature	4 - 113ºF
U310	DigiScroll 1 Temperature	84 - 313ºF
U311	DigiScroll 2 Temperature	84 - 313ºF
U312	Freecooling Status	Off, Start, On

User Menu: Sensor Data U300 series: Page 1 of 2

Menu Line	Parameter	Time/ Value
U313	Daily High Temperture	
U314	Daily Low Temperature	
U315	Daily High Humidity	
U316	Daily Low Humidity	

User Menu: Active Alarms Parameters

Parameter
User to view all active alarms of all units connected together (only Large Display)

User Menu: Display Setup Parameters U400 series

Menu Line	Parameter	Default	Range
U401	Language	English	English . . .
U402	Date (Month/Day/Year)	MM/ DD/ YYYY	MM/ DD/ YYYY
U403	Time (Hrs:Min:Sec)	-	HH/ MM/ SS
U404	Temperature Indication	ºF	ºF/ ºC
U405	Display Contrast	80%	0 – 100%
U406	Buzzer Frequency	On at 80%	On, Off, 0 – 100%
U407	Backlite Off After x Hours	5 minute	5 min – 12 hours
U408	Screen	Simple	Simple or Graphical
U409	Display Shows	Set + Act	Set + Act, Set, Act
U410	Display Colors	Normal	Normal or Inverted
U411	Date Format	dd.mm.yyyy	yyyy-mm-dd dd.mm.yyyy mm/dd/yyyy

User Menu: Total Run Hours Parameters U500 series

Menu Line	Parameter	Range (Hours)
U501	-	Actual
U502	Fan motor(s)	0 - 32000
U503	Compressor 1	0 - 32000
U504	Compressor 2	0 - 32000
U505	Chilled Water/ Free Cool	0 - 32000
U506	Hot Gas / Hot Water	0 - 32000
U507	Electrical Heater 1	0 - 32000
U508	Electrical Heater 2	0 - 32000
U509	Electrical Heater 3	0 - 32000
U510	Humidifier	0 - 32000
U511	Dehumidification	0 - 32000

User Menu: Sleep Mode Parameters U600 series

Menu Line	Parameter	Default	Range
U601	Password	-	-
U602	Sleep On	-	-
U603	Mon, Tue, Wed, Thu, Fri, Sat, Sun	No	No or Yes
U604	Sleep Every Day (1)	-	-
U605	From / To	00:00 / 00:00	Time (hh:mm)
U606	Sleep Every Day (2)	-	-
U607	From / To	00:00 / 00:00	Time (hh:mm)
U608			
U609	Timer Mode	No	No, Yes, Auto
U610	Timer Mode Type	System Off	Sys off, Deadband
U611	Dead Band	4ºF	4 - 27ºF

User Menu: Service Contacts U700 series

Menu Line	Parameter	Range
U701		
U702		
U703	Address Line 1	Text String
U704	Address Line 2	Text String
U705	Address Line 3	Text String
U706	Address Line 4	Text String

Service Menu Parameters

The Service menu display allows the user to customize the various unit settings for site specific operation. The factory default password to access the service menu items for programming is "501". The Service Menu selections include the following choices in the order shown:

- Set Point Parameters
- Unit Diary
- Standby Settings Parameters
- Maintenance / Wellness Setting Parameters
- Diagnostic / Service Mode Parameters
- Set Alarm Parameters
- Sensor Calibration / Setup Parameters
- System / Network Setup Parameters
- Operations Setup Parameters
- Service Contacts Parameters

Service Menu: Set Point Parameters S100 series: Page 1 of 2

Menu Line	Parameter	Default	Range
S101	Password	-	-
S102	Temperature Setpoint	73ºF	41 - 104ºF
S103	Humidity Setpoint	50%	1 – 80%
S104	Humidity Control Type	Yes	Yes or No
S105	Supply Limit	Disabled	Disabled or Enabled
S106	Supply Limit Temp Value	41ºF	41 - 77ºF
S107	Autoset Enable	Yes	Yes or No
S108	Temperature Proportional Band	7ºF	2 - 54ºF
S109	Temperature Integration Time	0	0 – 5 minutes
S110	Temperature Deadband	0	0 - 36ºF
S111	Short Cycle Control	Yes	Yes or No

Service Menu: Set Point Parameters S100 series: Page 2 of 2

Menu Line	Parameter	Default	Range
S112	Password	-	-
S113	Humidity Proportional Band	10%	1 – 20%
S114	Humidity Integration Time	0	0 – 5 minutes
S115	Humidity Deadband	0	0 – 50%
S116	DT Between Room / FC Type	Disable	Disable, Contact, Value
S117	DT Between Room Air / FC Fluid	8ºF	0 - 36ºF
S118	Minimum CW Temp	Disable	Enable / Disable
S119	Minimum CW Temp Value	45ºF	32 - 68ºF
S120			
S121			
S122			

Service Menu: Unit Diary Log

Parameter
Displays changes to the unit as performed and entered by the service person or customer

Service Menu: Standby Setting / Lead-lag Parameters S500 series

Menu Line	Parameter	Default	Range
S501	Password	-	-
S502	Number of Standby Units	0	0 – 15
S503	Rotation Frequency	No	No, Daily, Every M, T, W, Th, F, S, Su
S504	Rotate at (hour)	0	0 – 23
S505	Rotate at (minute)	0	0 – 59
S506	Rotate by	1	1 – 8
S507	Perform one rotation	-	No or Yes
S508	Cascade units	No	No, Yes, Cool, Temp
S509	Start All Standby Units by HT	No	No or Yes
S510			
S511			

Service Menu: General Settings Maintenance / Wellness Parameters S000 series: Page 1 of 8

Menu Line	Parameter	Default	Range
S001	Password	-	-
S002	Maintenance Frequency Per Year	1	0 – 12 per year
S003	Max Bonus	0	0 – 12
S004	Max Penalty	0	0 – 12
S005	Last Maintenance	-	Date
S006	Service Engineer	-	Name
S007	Confirm PM	-	No or Yes
S008	Calculated Next Maintenance	-	Date

Service Menu: Fan Settings Maintenance / Wellness Parameters: Page 2 of 8

Menu Line	Parameter	Default	Range
S012	Password	-	-
S013	Number of Starts	-	0 – 32000
S014	Run Hours	-	0 – 32000
S015	Average Working Time	-	0 – 999 minutes
S016	Starts per Day Optimum	1	1 – 240
S017	Starts per Day Worst	24	1 – 240
S018	Number of Alarms	-	0 – 32000
S019	Actual Bonus	-	0 - 12

Service Menu: Compressor 1 Settings Maintenance / Wellness Parameters: Page 3 of 8

Menu Line	Parameter	Default	Range
S023	Password	-	-
S024	Number of Starts	-	0 – 32000
S025	Run Hours	-	0 – 32000
S026	Average Working Time	-	0 – 999 minutes
S027	Starts per Day Optimum	12	1 – 240
S028	Starts per Day Worst	240	1 – 240
S029	Number of HP Alarms	-	0 – 32000
S030	Number of LP Alarms	-	0 – 32000
S031	Number of OL Alarms	-	0 – 32000
S032	Number of DS HT Alarms	-	0 - 32000
S033	Actual Bonus	-	0 - 12

Service Menu: Compressor 2 Settings Maintenance / Wellness Parameters: Page 4 of 8

Menu Line	Parameter	Default	Range
S034	Password	-	-
S035	Number of Starts	-	0 – 32000
S036	Run Hours	-	0 – 32000
S037	Average Working Time	-	0 – 999 minutes
S038	Starts per Day Optimum	12	1 – 240
S039	Starts per Day Worst	240	1 – 240
S040	Number of HP Alarms	-	0 – 32000
S041	Number of LP Alarms	-	0 – 32000
S042	Number of OL Alarms	-	0 – 32000
S043	Number of DS HT Alarms	-	0 - 32000
S044	Actual Bonus	-	0 - 12

Service Menu: Electric Heater 1 Settings Maintenance / Wellness Parameters: Page 5 of 8

Menu Line	Parameter	Default	Range
S045	Password	-	-
S046	Number of Starts	-	0 – 32000
S047	Run Hours	-	0 – 32000
S048	Average Run Time	-	0 – 999 minutes
S049	Starts per Day Optimum	24	1 – 240
S050	Starts per Day Worst	240	1 – 240
S051	Number of Alarms	-	0 – 32000
S052	Actual Bonus	-	0 - 12

Service Menu: Electric Heater 2 Settings Maintenance / Wellness
Parameters: Page 6 of 8

Menu Line	Parameter	Default	Range
S056	Password	-	-
S057	Number of Starts	-	0 – 32000
S058	Run Hours	-	0 – 32000
S059	Average Run Time	-	0 – 999 minutes
S060	Starts per Day Optimum	24	1 – 240
S061	Starts per Day Worst	240	1 – 240
S062	Number of Alarms	-	0 – 32000
S063	Actual Bonus	-	0 - 12

Service Menu: Electric Heater 3 Settings Maintenance / Wellness
Parameters: Page 7 of 8

Menu Line	Parameter	Default	Range
S067	Password	-	-
S068	Number of Starts	-	0 – 32000
S069	Run Hours	-	0 – 32000
S070	Average Run Time	-	0 – 999 minutes
S071	Starts per Day Optimum	24	1 – 240
S072	Starts per Day Worst	240	1 – 240
S073	Number of Alarms	-	0 – 32000
S074	Actual Bonus	-	0 - 12

Service Menu: Humidifier Settings Maintenance / Wellness Parameters: Page 8 of 8

Menu Line	Parameter	Default	Range
S078	Password	-	-
S079	Number of Starts	-	0 – 32000
S080	Run Hours	-	0 – 32000
S081	Average Run Time	-	0 – 999 minutes
S082	Starts per Day Optimum	24	1 – 240
S083	Starts per Day Worst	240	1 – 240
S084	Number of Alarms	-	0 – 32000
S085	Actual Bonus	-	0 - 12

Service Menu: Diagnostics / Service Mode S300 series: Page 1 of 5

Menu Line	Parameter	Range
S301	Password	-
S302	Manual Mode	Yes or No
S303	Motor(s)	Off or On
S304	Compressor 1	Off or On
S305	Compressor 1 Capacity	Off or On
S306	Compressor 1 Cycle Ramp	0-100%
S307	Compressor 1 LLSV	Off or On
S308	Compressor 2	
S309	Compressor 2 Capacity	Off or On
S310	Compressor 2 Cycle Ramp	0 – 100%
S311	Compressor 2 LLSV	

Service Menu: Diagnostics / Service Mode: Page 2 of 5

Menu Line	Parameter	Range
S312	Password	-
S313	HP 1 Alarm Counter	0
S314	HP 2 Alarm Counter	0
S315	HT 1 Alarm Counter	0
S316	HT 2 Alarm Counter	0
S317		
S318		
S319		
S320	Electric Heat 1(or HG/ HW)	Off or On
S321	Heat 2 (or E.Heat 1)	Off or On
S322	Heat 3 (or E.Heat 2)	Off or On

Service Menu: Diagnostics / Service Mode: Page 3 of 5

Menu Line	Parameter	Range
S323	Password	-
S324	Humidifier Fill	Off or On
S325	Humidifier	Off or On
S326	Alarm Relay	Off or On
S327	FC Relay	Off or On
S328	3P Actuator Open	Off or On
S329	3P Actuator Close	Off or On
S330	Analog Out 1	0 – 100%
S331	Analog Out 2	0 – 100%
S332	Analog Out 3	0 – 100%
S333	Analog Out 4	0 – 100%

Service Menu: Diagnostics / Service Mode: Page 4 of 5

Menu Line	Parameter	Range
S334	Password	-
S335	Status Remote Shutdown	Off or On
S336	Status Airflow Loss	OK or Active
S337	Status Motor Overload	OK or Active
S338	Status Filter	OK or Active
S339	Status Customer Input 1	OK or Active
S340	Status Customer Input 2	OK or Active
S341	Status Customer Input 3	OK or Active
S342	Status Customer Input 4	OK or Active

Service Menu: Diagnostics / Service Mode: Page 5 of 5

Menu Line	Parameter	Range
S345	Password	-
S346	Status HP1	OK or Active
S347	Status LP1	OK or Active
S348	Status C1 OL	OK or Active
S349	Status HP2	OK or Active
S350	Status LP2	OK or Active
S351	Status C2 OL	OK or Active
S352	Status Humidifier Problem	OK or Active
S353	Status DT2	Off or On
S354	Status Min CW	Off or On
S355		

Service Menu: Set Alarm Parameters S200 series: Page 1 of 6

Menu Line	Parameter	Default	Range
S201	Password	-	-
S202	Return Sensor Alarms	Enabled	Disabled or Enabled
S203	High Return Temperature	80ºF	34 - 210ºF
S204	Low Return Temperature	65ºF	34 - 210ºF
S205	High Return Humidity	60%	1 – 99%
S206	Low Return Humidity	40%	1 – 99%
S207	Sensor A Alarms	Disabled	Disabled or Enabled
S208	High Temperature Sensor A	90ºF	34 - 210ºF
S209	Low Temperature Sensor A	55ºF	34 - 210ºF
S210	High Humidity Sensor A	70%	1 – 99%
S211	Low Humidity Sensor A	30%	1 – 99%

Service Menu: Set Alarm Parameters: Page 2 of 6

Menu Line	Parameter	Default	Range
S212	Password	-	-
S213	Customer Input 1	Water alarm	See note
S214	Customer Input 1 Active When	Closed	Open or Closed
S215	Customer Input 2	Water alarm	See note
S216	Customer Input 2 Active When	Closed	Open or Closed
S217	Customer Input 3	Water alarm	See note
S218	Customer Input 3 Active When	Closed	Open or Closed
S219	Customer Input 4	Water alarm	See note
S220	Customer Input 4 Active When	Closed	Open or Closed
S221	Warning Activates Alarm Relay	Yes	Yes or No
S222	Reset Disabled Alarms	No	Yes or No

Note: Customer Inputs 1, 2, 3 and 4 messages may be selected from Smoke Detected, Water Alarm, Condensate Pump Alarm, Flow Alarm, Standby Pump, Standby Unit.

Service Menu: Set Alarm Parameters: Page 3 of 6

Menu Line	Parameter			
S223	Password			
S224		DELAY	EN-DIS	TYPE
S225	Main Fan Overload	10 Sec	En	Alarm
S226	Loss of Airflow	10 Sec	En	Alarm
S227	Clogged Filters	60 Sec	En	Warning
S228	High Room Temperature	10 Sec	En	Warning
S229	Low Room Temperature	10 Sec	En	Warning
S230	High Room Humidity	10 Sec	En	Warning
S231	Low Room Humidity	10 Sec	En	Warning
S232	High Temp Sensor A	10 Sec	En	Warning
S233	Low Temp Sensor A	10 Sec	En	Warning
S234	High Humid Sensor A	10 Sec	En	Warning
S235	Low Humid Sensor A	10 Sec	En	Warning

Service Menu: Set Alarm Parameters: Page 4 of 6

Menu Line	Parameter			
S236	Password			
S237		DELAY	EN-DIS	TYPE
S238	Comp 1 Overload	10 Sec	En	Alarm
S239	Comp 2 Overload	10 Sec	En	Alarm
S240	Comp 1 High Pressure	-	En	Alarm
S241	Comp 1 High Pressure	-	En	Alarm
S242	Comp 1 Low Pressure	-	En	Alarm
S243	Comp 2 Low Pressure	-	En	Alarm
S244	Comp 1 Pumpdown Fail	-	En	Alarm
S245	Comp 2 Pumpdown Fail	-	En	Alarm
S246	Dig Scroll1 High Temp	-	En	Alarm
S247	Dig Scroll2 High Temp			Alarm

Service Menu: Set Alarm Parameters: Page 5 of 6

Menu Line	Parameter			
S249	Password			
S250		DELAY	EN-DIS	TYPE
S251	Working Hours Exceeded	-	En	Warning
S252	Smoke Detected	5 Sec	En	Alarm
S253	Water Under Floor	5 Sec	En	Alarm
S254	Cond Pump-High Water	5 Sec	En	Alarm
S255	Loss of Flow	5 Sec	En	Alarm
S256	Standby Glycol Pump On	5 Sec	En	Alarm
S257	Standby Unit On	5 Sec	En	Alarm
S258	Humidifier Problem	5 Sec	En	Alarm
S259	No Connection w/ Unit 1	-	En	Alarm
S260	Unit X Disconnected	-	En	Alarm

Service Menu: Set Alarm Parameters: Page 6 of 6

Menu Line	Parameter			
S262	Password			
S263		DELAY	EN-DIS	TYPE
S264	Customer Input 1	5 Sec	En	Alarm
S265	Customer Input 2	5 Sec	En	Alarm
S266	Customer Input 3	5 Sec	En	Alarm
S267	Customer Input 4	5 Sec	En	Alarm
S268	Call Service	5 Sec	En	Message
S269	High Temperature	5 Sec	En	Message
S270	Loss of Air Blower 1	5 Sec	En	Alarm
S271	Reheat Lockout	5 Sec	En	Message
S272	Humidifier Lockout	5 Sec	En	Message
S273	Humid + Reheat Lockout	5 Sec	En	Message
S274	Compressor(s) Lockout	5 Sec	En	Message

Service Menu: Sensor Calibration/ Setup Parameters S600 series: Page 1 of 3

Menu Line	Parameter	Range
S601	Password	-
S602	Return temperature	±17ºF
S603	Calibrated return temperature	32 - 122ºF
S604	Return humidity	±9.9%
S605	Calibrated return humidity	20 – 80%
S606	Digital Scroll 1 NTC	±17ºF
S607	Calibrated digital scroll 1 NTC	84 – 313ºF
S608	Digital Scroll 2 NTC	±17ºF
S609	Calibrated digital scroll 2 NTC	84 - 313ºF

Service Menu: Sensor Calibration/ Setup Parameters: Page 2 of 3

Menu Line	Parameter	Range
S612	Password	-
S613	Temperature sensor A	±17ºF
S614	Calibrated temperature sensor A	32 - 122ºF
S615	Humidity sensor A	±9.9%
S616	Calibrated humidity sensor A	20 – 80%
S617	Temperature sensor B	±17ºF
S618	Calibrated temperature sensor B	32 - 122ºF
S619	Humidity sensor B	±9.9%
S620	Calibrated humidity sensor B	20 – 80%

Service Menu: Sensor Calibration/ Setup Parameters: Page 3 of 3

Menu Line	Parameter	Default	Range
S623	Password		-
S624	Glycol sensor PTC or NTC	NTC	NTC or PTC
S625	Glycol sensor	-	±17ºF
S626	Calibrated glycol sensor	-	4 – 113ºF
S627	Supply sensor PTC or NTC	NTC	NTC or PTC
S628	Supply sensor	-	±17ºF
S629	Calibrated supply sensor	-	32 - 122ºF
S630	Temperature sensor C	-	±17ºF
S631	Calibrated temperature sensor C	-	32 - 122ºF
S632	Humidity sensor C	-	±9.9%
S633	Calibrated humidity sensor C	-	20 – 80%

Service Menu: System / Network Setup Parameters Series S800: Page 1 of 2, System View

Menu Line	Function	Default	Range
S801	Password	-	-
S802	Number of connected units	-	1 – 16
S803	Teamwork mode	No	No, 1, 2
S804			
S805	U2U group	-	1 - 99
S806			
S807			
S808			
S809	Configuration Safe Status	No	No, Save, Load
S810	Network Safe Status	-	No, Save, Load
S811	SW version:	-	

Service Menu: System / Network Setup Parameters Series S800:
Page 2 of 2, System View

Menu Line	Function	Default	Range
S812	Password	-	-
S813	IP Address	-	IP Address
S814	Netmask	-	Netmask Range
S815	Gateway	-	Gateway Range
S816	MAC	-	MAC Range
S817	U2U Protocol	-	-
S818	U2U Address	-	33 - 64
S819		-	-
S820		-	
S821	Bootloader Variables Status	-	Changed, Updating
S822	Bootloader Variables Control	-	No, Save + Reboot

Service Menu: System / Network Setup Parameters Series S800:
Page 1 of 2, Unit View

Menu Line	Function	Default	Range
S823	Password	-	
S824	Monitoring Address	3	
S825			
S826	U2U Group		1 – 99
S827	Unit Name	Unit	6 Digits
S828			
S829			
S830			
S831	Configuration Safe Status	No	No, Save, Load
S832	Network Safe Status	No	No, Save, Load
S833	SW version:	-	

Service Menu: System / Network Setup Parameters Series S800:
Page 2 of 2, Unit View

Menu Line	Function	Default	Range
S834	Password	-	
S835	Monitoring Protocol	-	-
S836	IP Address	-	IP Range
S837	Netmask	-	Netmask Range
S838	Gateway	-	Gateway Range
S839	MAC	-	MAC Range
S840	U2U Protocol	-	33 - 64
S841	U2U Address	-	-
S842		-	
S843	Bootloader Variables Status	-	Changed, Updating
S844	Bootloader Variables Control	-	No, Save + Reboot

Service Menu: Option Setup Parameters S400 series: Page 1 of 2

Menu Line	Function	Default	Range
S401	Password	-	-
S402	Compressor Sequence	Auto	1, 2, Auto
S403	Low Pressure Delay (WSK)	3	0 – 5 Minutes
S404	Actual LP1 Pressure	-	14.5 – 87.0 psiA
S405	Actual LP2 Pressure	-	14.5 – 87.0 psiA
S406	Electric Stages	-	0, 1, 2, 3
S407	Hot Water Heat On / Off	No	No or Yes
S408	Hot Gas Heat	No	No, Comp. 1, Comp. 2
S409	Total Heat Stages	No	0, 1, 2, 3l
S410	3P Actuator Runtime	165 Seconds	50 – 400 seconds
S411	3P Actuator Direction	Direct	Direct or Reverse

Service Menu: Option Setup Parameters S400 series:: Page 2 of 2

Menu Line	Function	Default	Range
S412	Password	-	-
S413	Humidification Enabled	Yes	Yes or No
S414	Infrared Flush Rate	150%	110 – 500%
S415	Dehumidification Enabled	Yes	No or Yes
S416	Electric Reheat Operation	No	No, Normal, Delayed
S417	Single Unit Auto Restart	5 Seconds	0 – 999 seconds
S418	On – Off Enabled	Yes	Yes or No
S419			
S420	CW Flush	No	No, 1 – 99 Hours
S421	Freecooling Flush	No	No, 1 – 99 Hours
S422	Hot Water Flush	No	No, 1 – 99 Hours

Service Menu: Service Contacts Parameters S700 series:

Menu Line	Function	Default	Range
S701	Password	-	-
S702	Country	USA	None, United States
S703	Address line 1	-	Text-string
S704	Address line 2	-	Text-string
S705	Address line 3	-	Text-string
S706	Address line 4	-	Text-string

Advanced Menu Parameters

The Advanced menu displays allows the service technician to set the unit configuration code and to customize the various unit settings for site-specific operation. The factory default password to access the advanced menu items for programming is “221”. The Advance Menu selections include the following choices in the order shown:

- Factory Settings
- Access Levels

Advanced Menu: Factory Settings Parameters A001 series: Page 1 of 6

Menu Code	Parameter	Range
A001	Password	-
A002	Unit field code (R)	(01 – 06)
A003	Set code (W)	(01 – 06)
A004	Unit field code (R)	(07 – 12)
A005	Set code (W)	(07 – 12)
A006	Unit field code (R)	(13 – 18)
A007	Set code (W)	(13 – 18)
A008	Unit Code Control	No Load+Execute Save+Execute
A009	Unit Code Status	No Load+Execute Save+Execute
A010	Exception List Control	No, Load
A011	Exception List Status	No Load+Execute Save+Execute

Advanced Menu: Factory Settings Parameters A100 series: Page 2 of 6

Menu Code	Function	Default	Range
A101	Password	-	-
A102	Refrigerant Type	R22	R22, R407C
A103	Main Fan Overload	Shut down	Shut down, Disable
A104	Loss of Airflow	Shut down	Shut down, Disable
A105	Number of Compressors	2	0, 1, 2
A106	Compressor Delay Time	0	0 - 120 Sec
A107	Compressor Minimum On Time	3 Min	0 - 5 Min
A108	Compressor Minimum Off Time	3 Min	0 - 5 Min
A109	Pump Down	Yes	No, Yes
A110	Capacity Control Type	Unloader	No, Unloader, HGBP, Digital, Digital + TH

Advanced Menu: Factory Settings Parameters A100 series: Page 3 of 6

Menu Code	Parameter	Default	Range
A112	Password	-	-
A113	Digi Scroll Cycle	15	No, 10 - 30 Sec
A114	High Temperature Digi Scroll	268°F	33 - 392°F
A115	Digi Scroll Switchback	250°F	33 - 392°F
A116	Low Pressure Device Type	Analog	Analog, Switch
A117	Low Pressure Threshold Phase 1	* See Note 1	0.0 - 145 psiA
A118	Low Pressure Threshold Phase 2	* See Note 2	0.0 - 145 psiA

Advanced Menu: Factory Settings Parameters: Page 4 of 6

Menu Code	Parameter	Default	Range
A123	Password	-	-
A124	LP1 Sensor	10%	0 - 100%
A125	LP1 Signal	150 psiA	-87.0 to +725 psiA
A126	Actual LP1 Signal	-	0 - 100%
A127	LP2 Sensor	10%	0 - 100%
A128	LP2 Signal	150 psiA	-87.0 to +725 psiA
A129	Actual LP2 Signal	-	0 - 100%
A130	Pumpdown Cutout	35 psiA	0.0 - 145 psiA
A131	Pumpdown Recycle	80 psiA	0.0 - 145 psiA
A132	Heat Rejection Control Type	Fan Speed	Fan Speed / Lee-Temp / Glycol

Advanced Menu: Factory Settings Parameters A100 series: Page 5 of 6

Menu Code	Parameter	Default	Range
A134	Password	-	-
A135			
A136	CW flush Duration	0	No, 1 - 3 min
A137	Freecooling	No	No, Yes
A138			
A139	Freecooling Flush Duration	0	No, 1 - 3 min
A140	Freecooling Flush Starts R5	Yes	No, Yes
A141	CO + FC simultaneously	Yes	No, Yes
A142			
A143	Hot water flush duration	0	No, 1 - 3 min

Advanced Menu: Factory Settings Parameters: Page 6 of 6

Menu Code	Parameter	Default	Range
A145	Password	-	-
A146	Humidifier Model	No	No, external, IFS, IFL
A147	Humidity in Last xx Hours	15hr	1 - 120 hours
A148	Prefill Time	IFS 30 IFL 60	1 - 120 seconds
A149	Fill Time	IFS 30 IFL 50	1 - 120 seconds
A150	Humidifier On Time	IFS 8 IFL 10	1 - 60 minutes
A151	Dehum with Compressor	2	1, 2, both
A152	Analog Output 1	Not used	* See note 3
A153	Analog Output 2	Not used	*See note 3
A154	Analog Output 3	Not used	* See note 3
A155	Analog Output 4	Not used	* See note 3

Note 1: LP threshold Phase 1 (**A117**):
If **condenser ctrl (A132)** = fan speed then setting is 50 psiA ; otherwise 75 psiA.
If the condenser control setting changes, the setting for A117 will be updated automatically. If any of the sources (Refrigerant, Freecooling, Hotwater) changes, the setting for A118 will be updated automatically.

Note 2: LP threshold Phase 1 (**A118**):
R22 (A102) + **NO** FC (A137) + **NO** Hotwater (S408) = 63 psiA
R22 (A102) + **YES** FC (A137) + **NO** Hotwater (S408) = 68 psiA
R22 (A102) + **NO** FC (A137) + **YES** Hotwater (S408) = 75 psiA
R22 (A102) + **YES** FC (A137) + **YES** Hotwater (S408) = 75 psiA
R407c (A102) + **NO** FC (A137) + **NO** Hotwater (S408) = 70 psiA
R407c (A102) + **YES** FC (A137) + **NO** Hotwater (S408) = 75 psiA
R407c (A102) + **NO** FC (A137) + **YES** Hotwater (S408) = 83 psiA
R407c (A102) + **YES** FC (A137) + **YES** Hotwater (S408) = 83 psiA

Note 3: The following components may be controlled with the Analog Outputs and labeled as: Hot Water Reheat, 3P Valve, Fan Speed, Cooling, Cooling 1, Cooling 2, Heating and Not Used.

Advanced Menu: Factory Access Parameters A200 series:

Menu Code	Parameter	Default	Range
A201	Password Level 1 (User)	149	4 digits
A202	Password Level 2 (Service)	501	4 digits
A203	Password Level 3 (Advanced)	221	4 digits

Events Notifications Parameters

ID	Type	Description (Large Display)	Description (Small Display)
000	Alarm	GENERAL ALARM	GENERAL ALARM
001	Alarm	COMP. 1 HIGH PRESSURE	COMP. 1 HIGH PRESSURE
002	Alarm	COMP. 1 LOW PRESSURE	COMP. 1 LOW PRESSURE
003	Warning	HIGH CHILLED WATER	HIGH CHILLED WATER
004	Warning	LOW CHILLED WATER FLOW	LOW WATER FLOW
005	Warning	EL. HEAT. OVERHEATED	EL. HEAT. OVERHEATED
006	Alarm	MAIN FAN OVERLOAD	MAIN FAN OVERLOAD
007	Alarm	LOSS OF AIRFLOW	LOSS OF AIRFLOW
008	Warning	CLOGGED FILTERS	CLOGGED FILTERS
009-017	Future	Future	Future
018	Warning	HIGH ROOM TEMPERATURE	HIGH ROOM TEMPERATURE
019	Warning	LOW ROOM TEMPERATURE	LOW ROOM TEMPERATURE
020	Warning	HIGH ROOM HUMIDITY	HIGH ROOM HUMIDITY
021	Warning	LOW ROOM HUMIDITY	LOW ROOM HUMIDITY
022	Warning	HIGH ROOM TEMPERATURE	HIGH ROOM TEMPERATURE
023	Warning	LOW ROOM TEMPERATURE	LOW ROOM TEMPERATURE
024	Warning	HIGH ROOM HUMIDITY	HIGH ROOM HUMIDITY
025	Warning	LOW ROOM HUMIDITY	LOW ROOM HUMIDITY
026	Warning	UNIT HOURS EXCEEDED	UNIT HOURS EXCEEDED
027	Warning	C1 HOURS EXCEEDED	C1 HOURS EXCEEDED
028	Warning	HUMIDIFIER HOURS EXCEEDED	HUM. HOURS EXCEEDED
029	Warning	SUPPLY SENSOR FAILURE	SUPPLY SENSOR FAILURE
030	Future	Future	Future
031	Alarm	ROOM SENSOR FAILURE	ROOM SENSOR FAILURE
032	Warning	SENSOR "A" FAILURE	SENSOR "A" FAILURE
033	Future	Future	Future
034	Warning	NETWORK FAILURE	NETWORK FAILURE
035	Future	Future	Future
036	Message	UNIT ON	UNIT ON

Events Notifications Parameters (continued)

ID	Type	Description (Large Display)	Description (Small Display)
037	Message	UNIT OFF	UNIT OFF
038	Message	SLEEP MODE	SLEEP MODE
039	Message	STANDBY MODE	STANDBY MODE
040	Message	POWER ON UNIT LOGIN	POWER ON UNIT LOGIN
041	Message	POWER OFF	POWER OFF
042	Warning	Unit 1 disconnected	Unit 1 disconnected
043	Warning	Unit 2 disconnected	Unit 2 disconnected
044	Warning	Unit 3 disconnected	Unit 3 disconnected
045	Warning	Unit 4 disconnected	Unit 4 disconnected
046	Warning	Unit 5 disconnected	Unit 5 disconnected
047	Warning	Unit 6 disconnected	Unit 6 disconnected
048	Warning	Unit 7 disconnected	Unit 7disconnected
049	Warning	Unit 8 disconnected	Unit 8 disconnected
050	Warning	Unit 9 disconnected	Unit 9 disconnected
051	Warning	Unit 10 disconnected	Unit 10 disconnected
052	Warning	Unit 11 disconnected	Unit 11 disconnected
053	Warning	Unit 12 disconnected	Unit 12 disconnected
054	Warning	Unit 13 disconnected	Unit 13 disconnected
055	Warning	Unit 14 disconnected	Unit 14 disconnected
056	Warning	Unit 15 disconnected	Unit 15 disconnected
057	Warning	Unit 16 disconnected	Unit 16 disconnected
058	Alarm	COMP. 2 HIGH PRESSURE	COMP. 2 HIGH PRESSURE
059	Alarm	COMP. 2 LOW PRESSURE	COMP. 2 LOW PRESSURE
060	Warning	C2 HOURS EXCEEDED	C2 HOURS EXCEEDED
061	Future	Future	Future
062	Warning	GLYCOL TEMP. SENSOR	GLYCOL TEMP. SENSOR
063	Future	Future	Future
064	Warning	ON-OFF KEY DISABLED	ON-OFF KEY DISABLED
065-069	Future	Future	Future

Events Notifications Parameters (continued)

ID	Type	Description (Large Display)	Description (Small Display)
070	Warning	NO CONNECTION TO UNIT 1	NO CONN. TO UNIT 1
071	Alarm	C1 MOTOR PROTECTION	C1 MOTOR PROTECTION
072	Alarm	C2 MOTOR PROTECTION	C2 MOTOR PROTECTION
073-078	Future	Future	Future
079	Message	UNIT DISABLED	UNIT DISABLED
080	Message	UNIT SHUT DOWN	UNIT SHUT DOWN
081-084	Future	Future	Future
085	Message	UNIT SYNCHRONISATION	UNIT SYNCHRONISATION
086	Warning	HUMIDIFIER PROBLEM	HUMIDIFIER PROBLEM
087	Future	Future	Future
088	Message	DEHUM HOURS EXCEEDED	DEHUM HOURS EXCEEDED
089	Warning	FC. HOURS EXCEEDED	FC. HOURS EXCEEDED
090	Future	Future	Future
091	Alarm	PUMP DOWN FAILURE C1	PUMP DOWN FAILURE C1
092-095	Future	Future	Future
096	Alarm	PUMP DOWN FAILURE C2	PUMP DOWN FAILURE C2
097	Alarm	DIGISCROLL 1 HIGH TEMP.	D.SCROLL 1 HIGH TEMP.
098	Alarm	DIGISCROLL 2 HIGH TEMP.	D.SCROLL 2 HIGH TEMP.
099 102	Future	Future	Future
103	Message	SHORT CYCLING	SHORT CYCLING
104	Alarm	SMOKE DETECTED	SMOKE DETECTED
105	Alarm	WATER UNDER FLOOR	WATER UNDER FLOOR
106	Alarm	COND. PUMP-HIGH WATER	COND. PUMP-HIGH WATER
107	Alarm	LOSS OF FLOW	LOSS OF FLOW
108	Alarm	STANDBY GLYCOL PUMP ON	STBY GLYCOL PUMP ON
109	Alarm	STANDBY UNIT ON	STANDBY UNIT ON
110	Warning	HW/HG HOURS EXCEEDED	HW/HG WORKING HOURS

Events Notifications Parameters (continued)

ID	Type	Description (Large Display)	Description (Small Display)
111	Warning	EL.HEAT 1 HOURS EXCEEDED	EL.HEAT 1 HOURS EXC.
112	Warning	EL.HEAT 2 HOURS EXCEEDED	EL.HEAT 2 HOURS EXC.
113	Warning	EL.HEAT 3 HOURS EXCEEDED	EL.HEAT 3 HOURS EXC.

Event ID number, Description and Function

ID	Description	Event explanation	Default Type	Shut down single unit	Rotate stand by	restart if duty unit fails also
000	GENERAL ALARM	Warning or Alarm was acknowledged or reset	Reset	-	-	-
001	COMP 1 HIGH PRESSURE	Compressor 1 stopped because of high pressure	Alarm	no	yes	yes (broken co will remain off)
002	COMP 1 LOW PRESSURE	Compressor 1 stopped because of low pressure	Alarm	no	yes	yes (broken co will remain off)
003	HIGH CW TEMP	chilled water temperature too high (input from thermostat)	Warning	no	no	-
004	LOSS OF CW FLOW	chilled water flow too low (input from flow switch)	Warning	no	no	-
005	EL HEAT HIGH TEMP	electric heaters stopped because of too high temperature on the safety thermostat	Warning	no	no	-
006	MAIN FAN OVERLOAD	fan motor protection has stopped the fan due to overload. this event can be set to switch off the unit or to disable hum and electric heat.	Alarm	yes, if set to shut down	yes	yes, only if set to "disable"

007	LOSS OF AIRFLOW	not enough airflow through the unit. this event can be set to switch off the unit or to disable hum and electric heat.	Alarm	yes, if set to shut down	yes	yes, only if set to "disable"
008	CLOGGED FILTERS	air filters are dirty	Warning	no	no	-
018	HIGH ROOM TEMP	actual return air temperature (value from std. sensor) is higher than the threshold	Warning	no	no	-
019	LOW ROOM TEMP	actual return air temperature (value from std. sensor) is lower than the threshold	Warning	no	no	-
020	HIGH ROOM HUM	actual return air humidity (value from std. sensor) is higher than the threshold	Warning	no	no	-
021	LOW ROOM HUM	actual return air humidity (value from std. sensor) is lower than the threshold	Warning	no	no	-
022	HIGH TEMP SENSOR A	actual temperature (value from optional sensor A) is higher than the threshold	Warning	no	no	-
023	LOW TEMP SENSOR A	actual temperature (value from optional sensor A) is lower than the threshold	Warning	no	no	-
024	HIGH HUM SENSOR A	actual humidity (value from optional sensor A) is higher than the threshold	Warning	no	no	-
025	LOW HUM SENSOR A	actual humidity (value from optional sensor A) is lower than the threshold	Warning	no	no	-
026	UNIT HRS EXCEEDED	actual working hours of the fan are higher than the threshold set.	Warning	no	no	-
027	COMP 1 HRS EXCEEDED	actual working hours of compressor 1 are higher than the threshold set.	Warning	no	no	-

028	HUM HRS EXCEEDED	actual working hours of the fan are higher than the threshold set.	Warning	no	no	-
029	SUPPLY SENSOR FAILURE	sensor faulty or not present, but needed from control (supply limit control enabled).	Warning	no	no	-
031	ROOM SENSOR FAILURE	no valid data from the std. sensor	Alarm	yes	yes	no
032	SENSOR A FAILURE	no valid data from sensor A	Warning	no	no	-
034	NETWORK FAILURE	the unit showing this event has no connection to the unit #1.	Warning	no	no	-
036	UNIT ON	fan motor in operation	Message	-	-	-
037	UNIT OFF	unit shut down	Message	-	-	-
038	SLEEP MODE	unit is in sleep mode: according to the settings it is switched off or working with a selectable deadband.	Message	-	-	-
039	STANDBY MODE	unit is in standby (fan off), waiting for a call to start from the system (if a unit fails or there is a bus interruption).	Message	-	-	-
040	POWER ON	control is powered again after a power off.	Message	-	-	-
041	POWER OFF	no power to the control: this message will appear at the next power on.	Message	-	-	-
042	Unit 1 disconnected	this event is created from a coldfire display only: the display doesn't find unit #1	Warning	no	no	-
043	Unit 2 disconnected	"	Warning	no	no	-
044	Unit 3 disconnected	"	Warning	no	no	-
045	Unit 4 disconnected	"	Warning	no	no	-
046	Unit 5 disconnected	"	Warning	no	no	-
047	Unit 6 disconnected	"	Warning	no	no	-

048	Unit 7 disconnected	"	Warning	no	no	-
049	Unit 8 disconnected	"	Warning	no	no	-
050	Unit 9 disconnected	"	Warning	no	no	-
051	Unit 10 disconnected	"	Warning	no	no	-
052	Unit 11 disconnected	"	Warning	no	no	-
053	Unit 12 disconnected	"	Warning	no	no	-
054	Unit 13 disconnected	"	Warning	no	no	-
055	Unit 14 disconnected	"	Warning	no	no	-
056	Unit 15 disconnected	"	Warning	no	no	-
057	Unit 16 disconnected	"	Warning	no	no	-
058	COMP 2 HIGH PRESSURE	Compressor 2 stopped because of high pressure	Alarm	no	yes	yes (broken co will remain off)
059	COMP 2 LOW PRESSURE	Compressor 2 stopped because of low pressure	Alarm	no	yes	yes (broken co will remain off)
060	COMP 2 HRS EXCEEDED	actual working hours of compressor 2 are higher than the threshold set.	Warning	no	no	-
062	FREECOOL TEMP SENSOR	sensor faulty or not present, but needed from control (freecooling control enabled).	Warning	no	no	-
064	ON-OFF KEY DISABLED	the display on-off button was set disabled but somebody pressed it.	Warning	no	no	-
070	NO CONNECTION w/Unit1	the unit showing this event has no connection to the unit #1.	Warning	no	no	-
071	COMP 1 OVERLOAD	Compressor 1 stopped because of overload	Alarm	no	yes	yes (broken co will remain off)

072	COMP 2 OVERLOAD	Compressor 2 stopped because of overload	Alarm	no	yes	yes (broken co will remain off)
079	UNIT DISABLED	this message appears after a critical alarm (airflow, main fan overload) and indicates that the unit is operating w/o humidifier or electrical heaters.	Message		-	-
080	UNIT SHUT DOWN	this message appears after a critical alarm (airflow, main fan overload) and indicates that the unit is shut down due to the alarm.	Message		-	-
085	UNIT SYNCHRONIS ATION	a unit came back into the network.	Message	-	-	-
086	HUMIDIFIER PROBLEM	humidifier overtemperature or high water level	Alarm	no	yes	
088	DEHUM HRS EXCEEDED	actual working hours of dehumidification are higher than the threshold set.	Warning	no	no	
089	FC HRS EXCEEDED	actual working hours of freecooling are higher than the threshold set.	Warning	no	no	-
091	COMP 1 PUMPDOWN FAIL	Pump down of circuit 1 was not completed (pressure value not reached).	Alarm	no	yes	yes (broken co will remain off)
096	COMP 2 PUMPDOWN FAIL	Pump down of circuit 2 was not completed (pressure value not reached).	Alarm	no	yes	yes (broken co will remain off)
097	DIG SCROLL1 HIGH TEMP	Digital Scroll compressor #1 shut off because of high temperature (sensor is inside the compressor).	Alarm	no	yes	yes (broken co will remain off)

098	DIG SCROLL2 HIGH TEMP	Digital Scroll compressor #1 shut off because of high temperature (sensor is inside the compressor).	Alarm	no	yes	yes (broken co will remain off)
103	SHORT CYCLE	compressors are requested from control to start too often - control is unstable.	Message	-	no	-
104	SMOKE DETECTED	customer input is active.	Alarm	no	yes	yes (if not disabled externally)
105	WATER UNDER FLOOR	customer input is active.	Alarm	no	yes	yes (if not disabled externally)
106	COND PUMP-HIGH WATER	customer input is active.	Alarm	no	yes	yes (if not disabled externally)
107	LOSS OF FLOW	customer input is active.	Alarm	no	yes	yes (if not disabled externally)
108	STBY GLYCOL PUMP ON	customer input is active.	Alarm	no	yes	yes (if not disabled externally)
109	STANDBY UNIT ON	customer input is active.	Alarm	no	yes	yes (if not disabled externally)
110	HW/HG HRS EXCEEDED	actual working hours of hot water heat / hot gas reheat are higher than the threshold set.	Warning	no	no	-
111	EL HEAT1 HRS EXCEEDED	actual working hours of electrical heater stage 1 are higher than the threshold set.	Warning	no	no	-
112	EL HEAT2 HRS EXCEEDED	actual working hours of electrical heater stage 2 are higher than the threshold set.	Warning	no	no	-
113	EL HEAT3 HRS EXCEEDED	actual working hours of electrical heater stage 3 are higher than the threshold set.	Warning	no	no	-

114	UNIT CODE MISSING	this alarm appears if a totally new board was started the very first time in its life. the unit code must be set in order to let the board know in which type of unit it is mounted, which component it shall drive and how to map the inputs and outputs.	Alarm	yes	yes	no
115	UNIT CODE 01 MISMATCH	this digit of the unit code has been set to a value out of range (no code logic available for this number)	Alarm	yes	yes	no
116	UNIT CODE 02 MISMATCH	"	Alarm	yes	yes	no
117	UNIT CODE 03 MISMATCH	"	Alarm	yes	yes	no
118	UNIT CODE 04 MISMATCH	"	Alarm	yes	yes	no
119	UNIT CODE 05 MISMATCH	"	Alarm	yes	yes	no
120	UNIT CODE 06 MISMATCH	"	Alarm	yes	yes	no
121	UNIT CODE 07 MISMATCH	"	Alarm	yes	yes	no
122	UNIT CODE 08 MISMATCH	"	Alarm	yes	yes	no
123	UNIT CODE 09 MISMATCH	"	Alarm	yes	yes	no
124	UNIT CODE 10 MISMATCH	"	Alarm	yes	yes	no
125	UNIT CODE 11 MISMATCH	"	Alarm	yes	yes	no
126	UNIT CODE 12 MISMATCH	"	Alarm	yes	yes	no
127	UNIT CODE 13 MISMATCH	"	Alarm	yes	yes	no
128	UNIT CODE 14 MISMATCH	"	Alarm	yes	yes	no
129	UNIT CODE 15	"	Alarm	yes	yes	no

	MISMATCH					
130	UNIT CODE 16 MISMATCH	"	Alarm	yes	yes	no
131	UNIT CODE 17 MISMATCH	"	Alarm	yes	yes	no
132	UNIT CODE 18 MISMATCH	"	Alarm	yes	yes	no

Chapter 3

iCOM

Control Board Connections

Introduction

This section describes the basic connection points on the Liebert Deluxe System 3 units. Each sub-section describes the standard electrical connections supplied with the iCOM controls. The detail is as follows:

Display Assembly: Large and Small

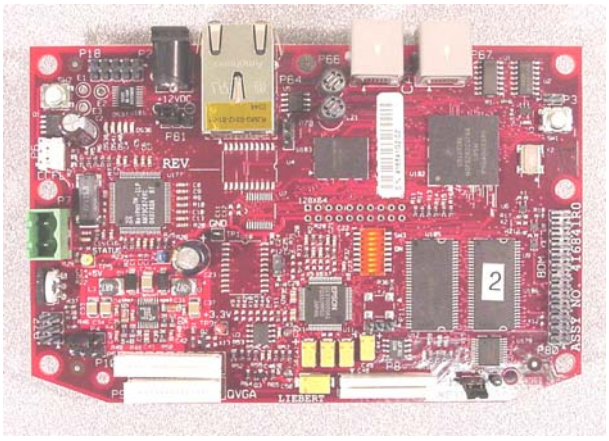
Plug and Terminal Block Connections

Fuse Board: All Units

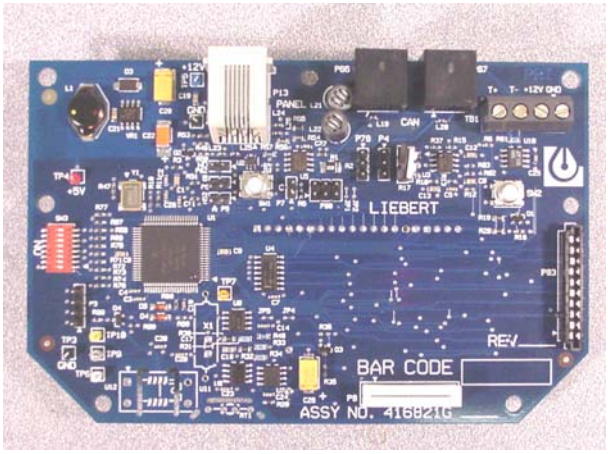
LCD Display Board

The Advanced and Advanced with Graphics LCD display board is mounted to the system unit accent panel. The LCD display board connection to the system control board is identified as ribbon connector P26.

Large Disdplay

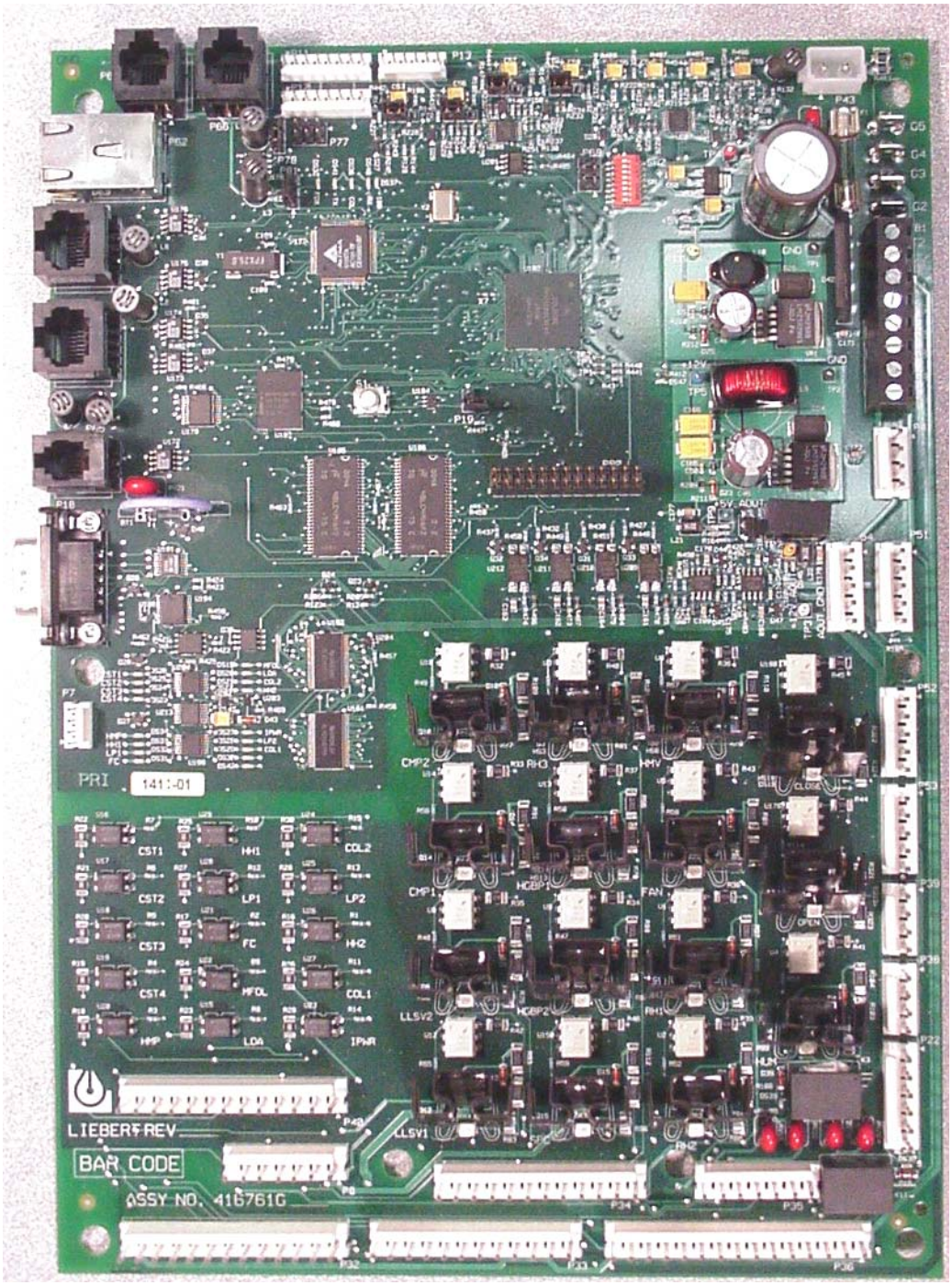


Small Display



Control Board DIP Switches and Plug Connectors

This section deals with the 20 plug connections and the terminal block located on the unit control board. The tables in this section show all of the pin connections and the reference points for signal flow through these connections.



Unit Mounted Control Board

iCOM Control Board DIP Switch #2 Settings

Connector	Input/ Output Type	Setting
P7-1 (+)/ P7-2 (-)	NTC Thermistor	* Software (ASW1 = 1)
	PTC Thermistor	Software (ASW1 = 0)
P11-1 (+)/ P11-2 (-)	Analog Voltage: 0 to +10V	* Sw2-1: Off/ Sw2-2: Off
	Analog Voltage: 0 to +5V	Sw2-1: On/ Sw2-2: Off
	Analog Current: 4 to 20mA	Sw2-1: On/ Sw2-2: On
P11-3 (+)/ P11-4 (-)	+5V Output	None
P11-5 (+)/ P11-6 (-)	Analog Voltage: 0 to +10V	* Sw2-3: Off/ Sw2-4: Off
	Analog Voltage: 0 to +5V	Sw2-3: On/ Sw2-4: Off
	Analog Current: 4 to 20mA	Sw2-3: On/ Sw2-4: On
P11-7 (+)/ P11-8 (-)	+5V Output	None
P12-1 (+)/ P12-2 (-)	Analog Voltage: 0 to +10V	* Sw2-5: Off/ Sw2-6: Off
	Analog Voltage: 0 to +5V	Sw2-5: On/ Sw2-6: Off
	Analog Current: 4 to 20mA	Sw2-5: On/ Sw2-6: On
P12-3 (+)/ P12-4 (-)	+5V Output	None
P12-5 (+)/ P12-6 (-)	Analog Voltage: 0 to +10V	* Sw2-7: Off/ Sw2-8: Off
	Analog Voltage: 0 to +5V	Sw2-7: On/ Sw2-8: Off
	Analog Current: 4 to 20mA	Sw2-7: On/ Sw2-8: On
P12-7 (+)/ P12-8 (-)	+5V Output	None
P13-1 (+)/ P13-2 (-)	NTC Thermistor	* Software (ASW2 = 1)
	PTC Thermistor	Software (ASW2 = 0)
P13-3 (+)/ P13-4 (-)	NTC Thermistor	Sw2-9: On
	NTC Scroll Thermister	* Sw2-9: Off
P13-5 (+)/ P13-6 (-)	NTC Thermistor	Sw2-10: On
	NTC Scroll Thermister	* Sw2-10: Off

*** Default Setting**

iCOM Control Board Jumper Settings

Jumper	Type	Setting
P19	Watchdog	* On: Shunt on Pins 1 & 2 Off: No Shunt
P78	CAN Bus Terminator	On: Shunt on Pins 2 & 3 * Off: Shunt on Pins 1 & 2
P83	Bootloader	Enabled: Shunt on Pins 1 & 2 * Disabled: No Shunt

*** Default Setting**

Large Display DIP Switch #3 Settings

Position	Type	Setting
1	CAN Address	Off
2	CAN Address	Off
3	CAN Address	Off
4	CAN Address	Off
5	CAN Address	Off
6	CAN Address	Off
7	CAN Baud	Off
8	CAN Baud	Off

Large Display Jumper Settings

Jumper	Type	Setting
P3	Watchdog	* Shunt on Pins 1 & 2
P4	Manual Contrast (Rev. 1)	* Shunt on Pins 2 & 3
P8	open	* open
P13	open	* open
P78	CAN Termination	* Shunt on Pins 2 & 3
P82	Watchdog (Rev. 2 Only)	* Shunt on Pins 1 & 2
P83	Bootloader	* Shunt on Pins 2 & 3

*** Default Setting**

Small Display DIP Switch #3 Settings

Position	Type	Setting
1	CAN Address	Off
2	CAN Address	Off
3	CAN Address	Off
4	CAN Address	Off
5	CAN Address	On
6	CAN Address	On
7	CAN Baud	Off
8	CAN Baud	Off

Small Display Jumper Settings

Jumper	Type	Setting
P4	Manual Contrast (Rev. 2 only)	* Shunt on Pins 2 & 3
P78	CAN Termination	* Shunt on Pins 2 & 3
P80	BDM Header	* open
P82	Watchdog (Rev. 2 Only)	* Shunt on Pins 1 & 2

*** Default Setting**

Temperature/ Humidity Board DIP Switch #1 Settings

Position	Type	Setting	Notes
1	CAN Address	Off	On (if Sensor A)
2	CAN Address	Off	On (if Sensor B)
3	CAN Address	Off	On (if Sensor C)
4	CAN Address	Off	open
5	CAN Address	On (Normal & Constant Operation)	Off (Analog Mode)
6	CAN Address	Off (Normal Operation)	On (Analog Mode & Constant Operation)
7	CAN Baud	Off	open
8	CAN Baud	Off	open

Temperature/ Humidity Board Jumper Settings

Jumper	Type	Setting
P2	BDM Header	* open
P3	CAN Termination	* Shunt on Pins 2 & 3
P4	Programming	* open

*** Default Setting**

DS Systems:

P3: Not Used

P4: 24 VAC Power

P4-1:	Fuse 1 (24 VAC)	P4-3:	Fuse 3 (24 VAC)
P4-2:	Fuse 2 (24 VAC)	P4-4:	Fuse 4 (24 VAC)

P7: Fluid Sensor

P7-1: Aquastat Sensor
P7-2: Aquastat Sensor

P8: 24 VAC Alarm Inputs

P8-1:	24 VAC (RAD1/ TS 50)	P8-5:	24 VAC (HWA)
P8-2:	24 VAC (RAD2/ TS 51)	P8-6:	24 VAC Out (TS 24)
P8-3:	24 VAC (RAD3/ TS 55)	P8-7:	24 VAC Out (HWA)
P8-4:	24 VAC (RAD4/ TS 56)	P8-8:	no connection

P11: Low Pressure Switch Circuits

P11-1: DCV Signal to LPT1
P11-2: Cold Start Bypass 1 Signal
P11-3: LPT1 Input to MP
P11-4:
P11-5: DCV Signal to LPT2
P11-6: Cold Start Bypass 1 Signal
P11-7: LPT2 Input to MP
P11-8:

P12: Analog Sensor Inputs

P12-1:	T+ Analog 1 (TS 41)	P12-5:	T+ Analog 3 (TS 45)
P12-2:	T- Analog 1 (TS 42)	P12-6:	T- Analog 3 (TS 46)
P12-3:	T+ Analog 2 (TS 43)	P12-7:	T+ Analog 4 (TS 47)
P12-4:	T- Analog 2 (TS 44)	P12-8:	T- Analog 4 (TS 48)

P13: DCV Thermistor Signals

P13-1: DCV Signal to Digital Scroll Thermistor 1
P13-2: DCV Signal from Digital Scroll Thermistor 1
P13-3: DCV Signal to Digital Scroll Thermistor 2
P13-4: DCV Signal from Digital Scroll Thermistor 2
P13-5: DCV Signal to Customer Thermistor
P13-6: DCV Signal from Customer Thermistor

P22: Glycool Valve (Std. Pressure Actuator)

P22-1:	24 VAC Out (Close Q18)	P22-4:	DCV Signal
P22-2:	DCV Signal	P22-5:	E2 (24 VAC Gnd)
P22-3:	24 VAC Out (Open Q17)	P22-6:	+5 VDC

P32: Compressor Devices

P32-1:	24 VAC Out (LLSV1)	P32-8:	24 VAC
P32-2:	E1 (LLSV1)	P32-9:	24 VAC (HP1 Alarm)
P32-3:	24 VAC Out (LLSV2)	P32-10:	24 VAC Out (C1)
P32-4:	24 VAC Out (OL/ KL1/ HP1)	P32-11:	E1 (C1)
P32-5:	24 VAC Out (OL/ KL2/ HP2)	P32-12:	24 VAC Out (C2)
P32-6:	24 VAC (HP1)	P32-13:	E2 (C2)
P32-7:	24 VAC (HP2)		

P33: Compressor Devices

P33-1:	24 VAC Out (CUV1/ DSV1)	P33-7:	24 VAC (OL/ KL2 Alarm)
P33-2:	E1 (CUV1/ DSV1)	P33-8:	24 VAC
P33-3:	E2 (LLSV2)	P33-9:	24 VAC (HP2 Alarm)
P33-4:	24 VAC Out (CUV2/ DSV2)	P33-10:	
P33-5:	E2 (CUV2/ DSV2)	P33-11:	
P33-6:	24 VAC (OL/ KL1 Alarm)	P33-12:	

P34: Reheat Devices

P34-1:	24 VAC Out (RS1/ RS2/ RS3)	P34-7:	no connection
P34-2:	E3 (RS1/ RS2/ RS3)	P34-8:	24 VAC Out (RH3)
P34-3:	E3 (GCD/ BR)	P34-9:	no connection
P34-4:	24 VAC Out (RH1/ HGRS)	P34-10:	E3 (RH1/ HGRS/ RH2/ RH3)
P34-5:	no connection	P34-11:	no connection
P34-6:	24 VAC Out (RH2)	P34-12:	24 VAC Out (GCD/ BR)

P35: Infrared Humidifier Devices

P35-1:	24 VAC Out (H)	P35-4:	E4 (HMV)
P35-2:	E3 (H)	P35-5:	E3 (HS3)
P35-3:	24 VAC Out (HMV)	P35-6:	24 VAC Out (HS3)

P36: Basic Unit Connections

P36-1:	24 VAC Out (Filter Clog)	P36-9:	no connection
P36-2:	24 VAC (Filter Clog Alarm)	P36-10:	E2
P36-3:	24 VAC Out (MF)	P36-11:	No connection
P36-4:	24 VAC Out (AS Switch)	P36-12:	No connection
P36-5:	24 VAC (AS Alarm)	P36-13:	K3 (Common: TB75)
P36-6:	24 VAC (MF Ovld Alarm)	P36-14:	K3 (N.O.: TB76/ R3)
P36-7:	24 VAC	P36-15:	K3 (N.C.)
P36-8:	E4 (MF)		

P38: Smoke Detector

P38-1:	24 VAC Out SDC)	P38-3:	24 VAC (RAD1)
P38-2:	E4 (SDC)	P38-4:	no connection

P39: Firestat & Remote Shutdown

P39-1:	24 VAC Out (HTS)	P39-3:	24 VAC Out (RDS1)
P39-2:	24 VAC Return (HTS)	P39-4:	24 VAC Return (RSD1)

P40: Basic Unit Connections

P40-1:	no connections	P40-8:	E4 (Opt. CPAR)
P40-2:	no connections	P40-9:	no connection
P40-3:	no connections	P40-10:	E4
P40-4:	24 VAC Out (Opt. CPAR)	P40-11:	no connection
P40-5:	no connections	P40-12:	24 VAC Out (MF Ovld)
P40-6:	no connections	P40-13:	24 VAC
P40-7:	no connections		

P43: T6 Transformer

P43-1: 24 VAC Gnd
P43-2: 24 VAC

P51: Hot Water Reheat

P51-1:	24 VAC Out	P51-3:	H.W. Mod (0 – 2.5 VDC)
P51-2:	-5 VDC Gnd	P51-4:	24 VAC Gnd (E1)

P52: Glycool Valve (Opt. Pressure Modulating)

P52-1:	24 VAC Out	P52-4:	24 VAC Gnd (E1)
P52-2:	-5 VDC Gnd	P52-5:	no connection
P52-3:	Mod Valve (0 – 2.5 VDC)		

P53:

P53-1: 24 VAC
P53-2: no connection
P53-3: no connection
P53-4: E3
P53-5: no connection

P54:

P54-1: 24 VAC
P54-2: no connection
P54-3: no connection
P54-4: E3
P54-5: no connection

P67: Temperature/ Humidity Sensors

P67-1:	P16-3:
P67-6:	P16-4:

P65: Site Monitoring Signals – No Intelleslot Supplied

P65-1:	+5 VDC to TS 78
P65-2:	-5 VDC to TS 77

P65: Optional Intelleslot Power Suplly

P65-1:	P65-3:
P65-2:	P65-4:

P64: Unit Large Display (Digital Signals)
P66: Unit Small Display (Digital Signals)

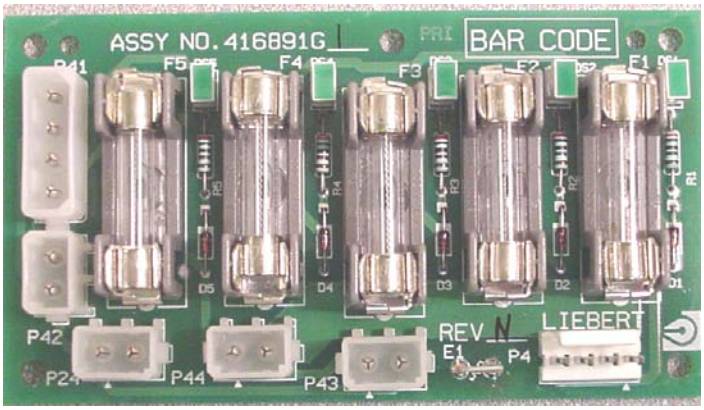
TB1: 24 VAC

TB1-1:	24 VAC (T2)	TB1-5:	E1 (G2)
TB1-2:	24 VAC (T3)	TB1-6:	E2 (G3)
TB1-3:	24 VAC (T4)	TB1-7:	E3 (G4)
TB1-4:	24 VAC (T5)	TB1-8:	E4 (G5)

E1/ E2/ E3/ E4: Transformer Grounds

Fuse Board Layout: All Units

This section deals with the seven (7) plug connectors on the fuse board. The fuse board is supplied on all systems with iCOM and is located in the low voltage section of the unit. The tables in this section show all of the connections and reference points for signal flow through these connectors.



Fuse Board

P4: 24 VAC Power

P4-1:	Fuse 1	P4-3:	Fuse 3
P4-2:	Fuse 2	P4-4:	Fuse 4

P24: T1 Transformer

P24-1: 24 VAC Gnd (T1)
P24-2: 24 VAC (T1)

P41: 24 VAC Power

P41-1:	24 VAC Gnd (T1)	P41-3:	24 VAC Gnd (not unit ground)
P41-2:	24 VAC (T1)	P41-4:	24 VAC

P42: Intelleslot

P42-1: 24 VAC Gnd (not unit ground)
P42-2: 24 VAC

P43: T6 Transformer

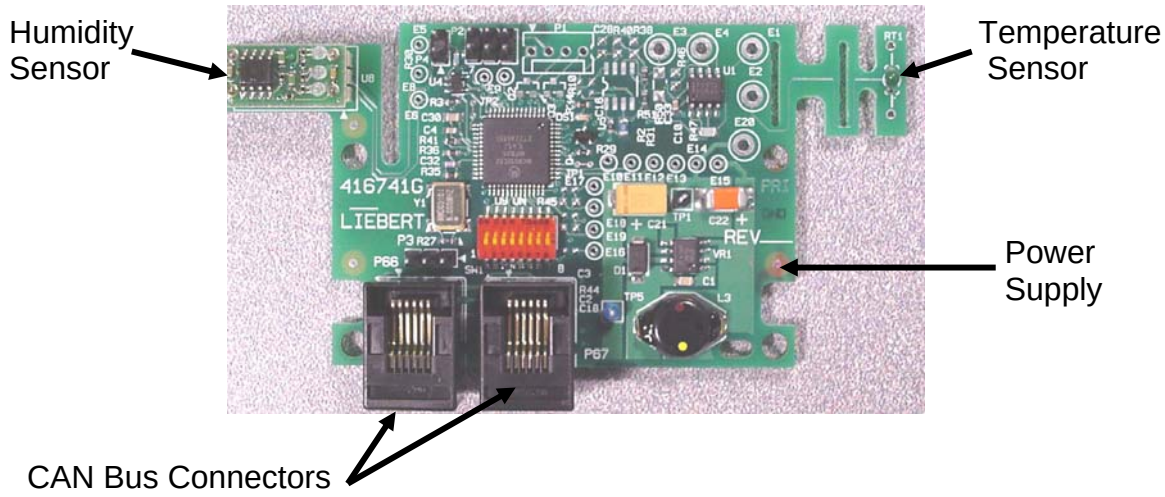
P43-1: 24 VAC Gnd (not unit ground)
P43-2: 24 VAC

P44: Jumper

E1: Transformer Secondary Ground (unit ground)

Temperature/ Humidity Board: All Units

This section deals with the single plug connection located on the system temperature and humidity board. The temperature/ humidity board is supplied on all systems with iCOM controls. The cable is plugged into Plug P67 on the unit microprocessor board and transmits information using "CAN" – Controlled Area Network communication. Troubleshooting is accomplished by observing an LED located on the board. If the LED is glowing the board is good. The temperature and humidity board is typically located in the unit return.



Temperature/ Humidity Board

P67: Return Air Temperature/ Humidity Board

P67-1: CAN communication
P67-6: CAN communication

Temperature/ Humidity Assembly Housing

NOTES

Chapter 4

General Troubleshooting Data

* Basic Operation of the Opto and Triac

* Troubleshooting the Opto-Isolator and Triac

* Control Input Check (Sensors)

* Frequency Conversion Chart (Temperature)

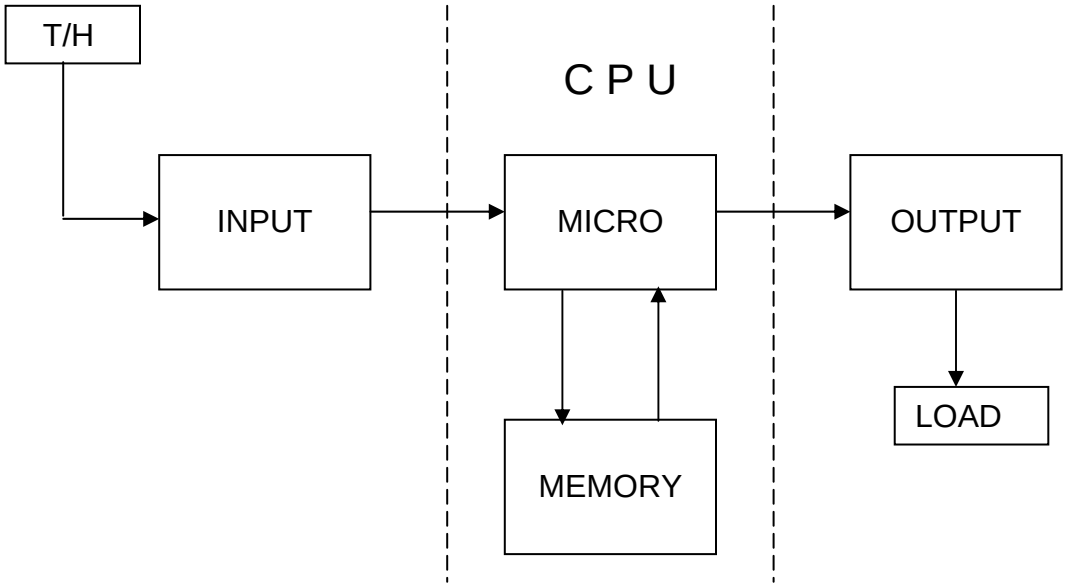
* Frequency Conversion Chart (Humidity)

* Troubleshooting Signals and Checklist

* Moisture Content Charts

This section covers only very basic electronics. The major components, such as triacs and opto-isolators are briefly described and related to the Liebert units you have come to study. It is our hope that this brief introduction to electronics stimulates your interest and encourages you to go further in the field.

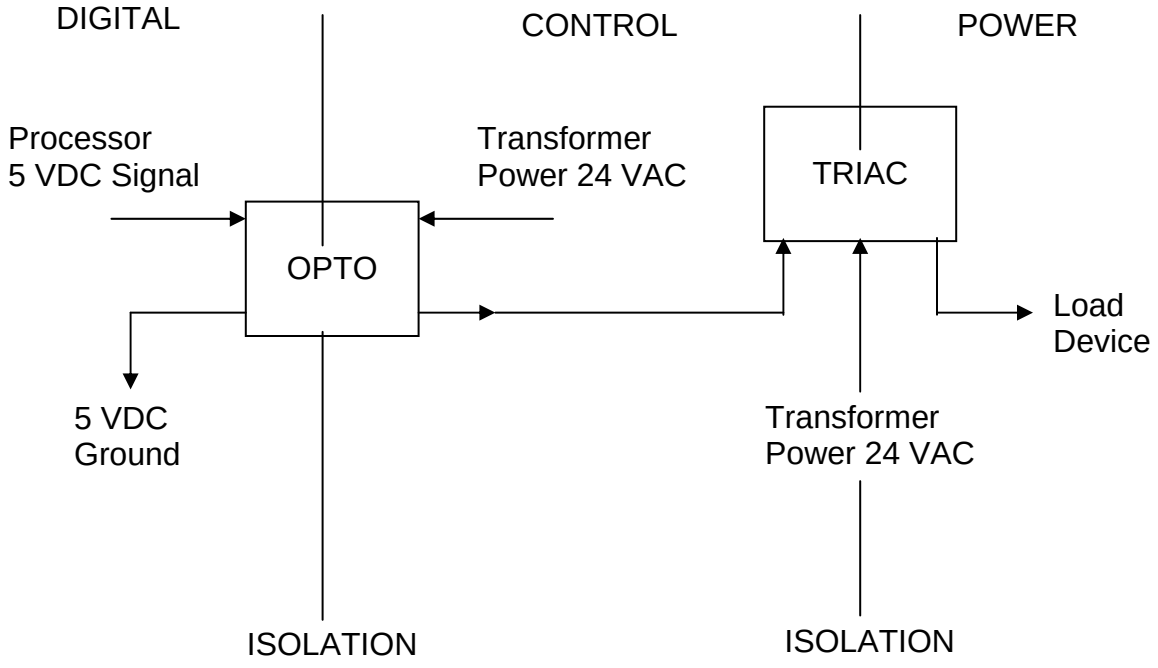
The path of a signal from beginning to the end - using the four block process.



The temperature sensor senses a rise in temperature. The rise is transmitted to the **C**entral **P**rocessing **U**nit (CPU). The CPU looks into its memory for information and instructions on what to do with the rise in temperature. The CPU then makes the decision to call for cooling.

Isolation

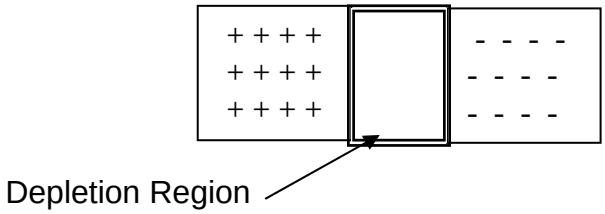
We use the opto-isolator and the triac to isolate areas of control and voltage. There are three areas of control and two voltage levels. Digital control comes from the microprocessor at 5 VDC and the other voltage level is 24 VAC. One voltage is used to turn on the triac and the other is used to operate the load device.



Areas of Control

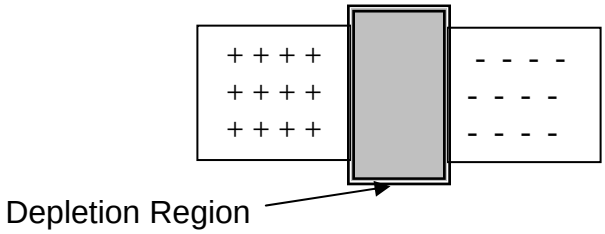
BASIC OPERATION OF THE TRIAC

To better understand the operation of the triac, we need to look at the movement of electrons in a special type of material used in electronics. Here we have a semiconductor material with what is called a depletion region. The depletion region restricts the flow of electrons to a point.



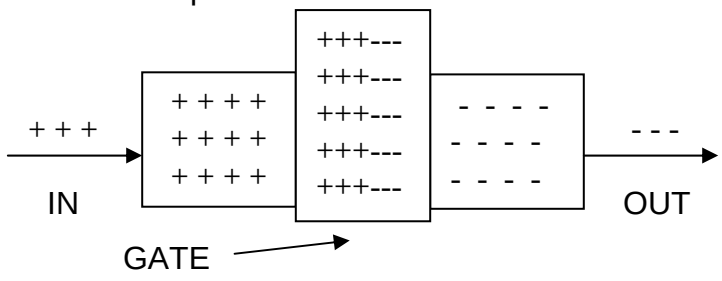
Semiconductor

By forcing more electrons in to the depletion region, we can cause an overflow of these electrons resulting in electron flow that in turn produces current. When we have current flow, the device is on.



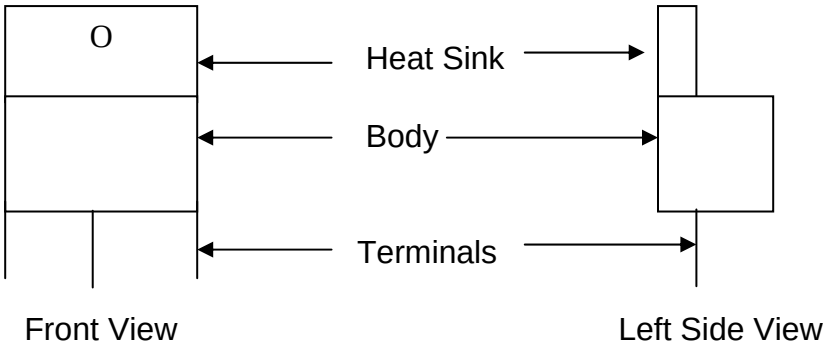
Semiconductor Showing No Movement of Electrons

If we add a third terminal to this simple device and call it the Gate, we have a basic triac. By sending electrons to the gate, which is connected to the depletion region, we create an overflow condition. You can see how this device can be turned on or off by this process. Now to put this in perspective with AC voltage circuits, this ON and OFF condition takes place every half cycle. When the AC voltage is removed from the gate, conduction stops.



Semiconductor Showing Movement of Electrons

The triacs that Liebert uses are standard in the industry and are rated at a 2-amp capacity. You can check these devices for proper operation while they are connected in the circuit. If the load is removed from the device, you can get a false reading from the meter. This is because the voltage potential is present and is detected by the meter. When the load is applied to the device, the potential is not detected by the meter. To test a triac for proper operation, energize the circuit and connect the load.

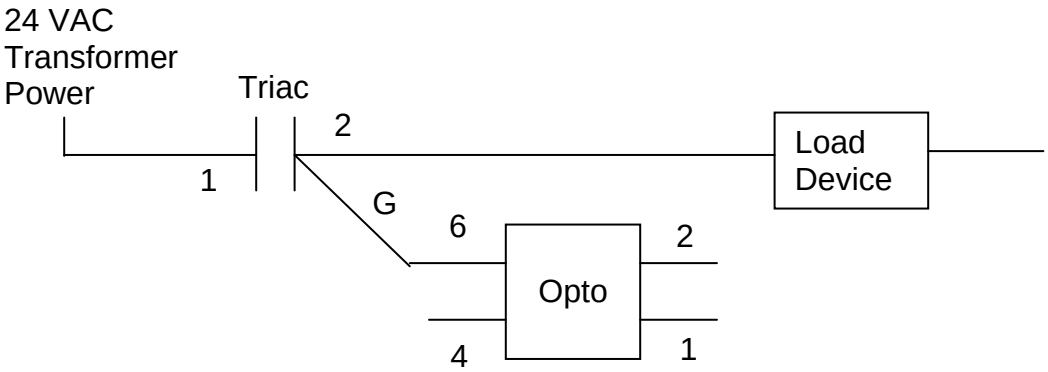


Front and Left Side Views of the Triac

As your view the triac from the front, the terminals are numbered as follows:

Terminal	Connection
Left	#2 Connects to the Load
Middle	#1 Connects to the Transformer power
Right	G(ate) Connects to the Opto-Isolator

Below is a simple schematic drawing for the triac using Liebert symbols.



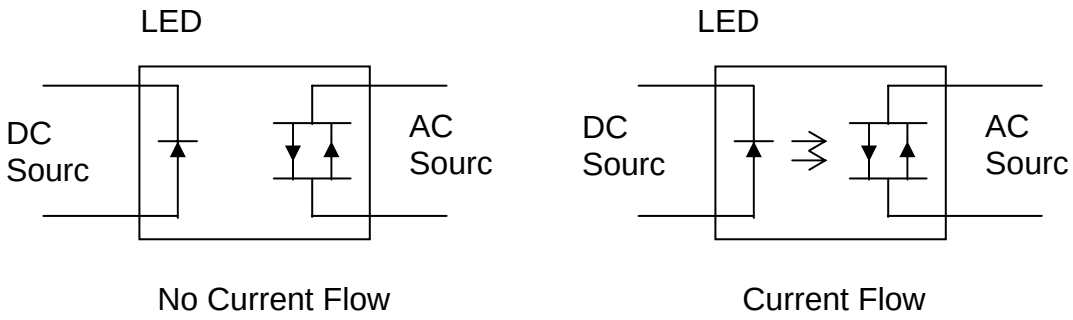
Schematic Drawing for the Triac

Basic Operation of the Opto-Isolator

The purpose of the opto-isolator is to provide isolation of two voltage sources. This allows a DC voltage source to activate an AC voltage load device or allows an AC voltage source to provide a DC signal.

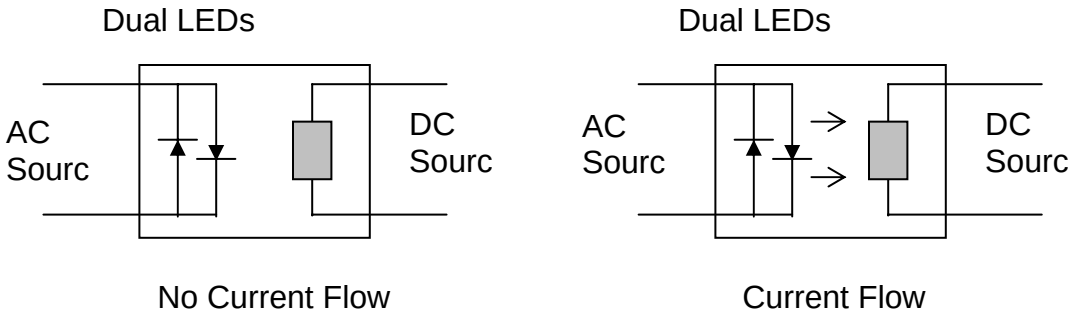
We are working with two types of circuits, an input and an output. Therefore, we require two types of opto-isolators (referred to as optos).

The output opto uses a DC voltage source to activate a **L**ight **E**mitting **D**iode (LED) internal to the IC chip. This causes a triac, also internal to the IC chip, to switch ON allowing current to flow to the AC load device.



Output Opto-Isolator

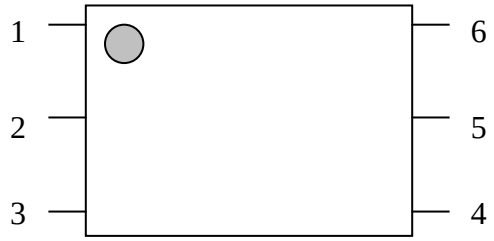
The input opto uses an AC voltage source to activate dual LEDs and turn on a transistor to pass the DC voltage and allow current to flow.



Input Opto-Isolator

Troubleshooting the Output Opto-Isolator

The opto-isolator IC chips used in these circuits are the H11J (output) devices. The drawing shows the pin location for component checks on the output opto. The indented circle in the upper left hand corner of this chip indicates the location of Pin 1. Note that the number sequence is in a "U" format: downward 1, 2 and 3 on the left and upward 4, 5 and 6 on the right.



Output Opto-Isolator Pin Location

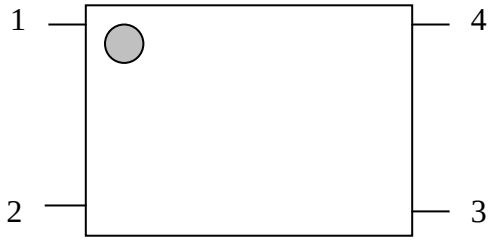
OUTPUT VOLTAGE CHECK

Pin 1	Receives the DC source voltage (3.3 VDC range)
Pin 2	Completes the DC source to the digital ground
Pin 3	No voltage signal at this point
Pin 4	Receives the AC source voltage signal from the input transformer
Pin 5	No voltage signal at this point
Pin 6	Completes the AC voltage path to the gate of the triac (24VAC)

Note that all AC source checks are referenced to the associated transformer neutral and/or the safety ground, and that the DC source reference is to V- or digital ground.

Troubleshooting the Input Opto-Isolator

The opto-isolator IC chips used in these circuits are the H11AA (input) devices. The pin location for component checks on the input opto. The indented circle in the upper left hand corner of this chip indicates the location of Pin 1. Note that the number sequence is in a "U" format: down 1 and 2 on the left and up 3 and 4 on the right.



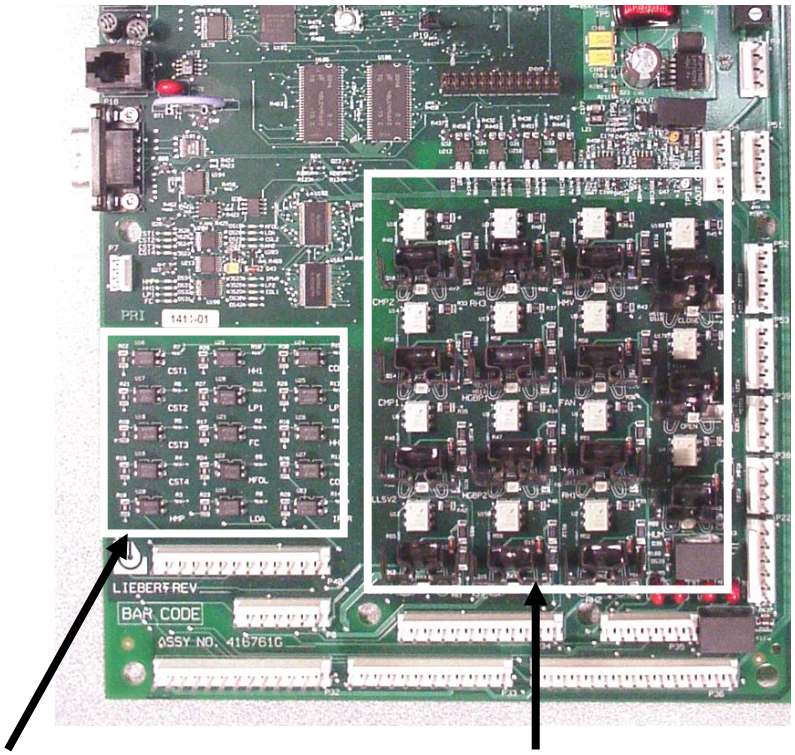
Input Opto-Isolator Pin Location

INPUT VOLTAGE CHECK

Pin 1	Receives the AC source voltage (This voltage is 24 VAC prior to the Opto and is about 1.2 VAC at the opto).
Pin 2	Completes the AC source to the neutral and or safety ground.
Pin 3	Completes the DC source to the digital ground.
Pin 4	Receives the DC voltage source from the microprocessor (This voltage level is 3.3 VDC when not activated and is 0 VDC when activated.)

Note that all AC source checks are referenced to the associated transformer neutral and/or the safety ground, and that the DC source reference is to -V or digital ground.

Microprocessor Control Board: Typical Location othe Opto-Isolators and Triacs



Input Opto-Islators

Output Opto-Isolators and Triacs

Microprocessor Control Board

Alarm Input Opto-Isolator Legend:

Opto	Purpose	Opto	Purpose
U15	Air Safety Switch	U23	Power On
U16	Custom Alarm 1	U24	Compressor 2 Overload
U17	Custom Alarm 2	U25	Low Pressure Switch 2
U18	High Water Alarm	U26	High Head Pressure 2
U19	Custom Alarm 3	U27	Compressor 1 Overload
U20	Humidifier Problem	U28	Low Pressure Switch 1
U21	Filter Clog switch	U29	High Head Pressure 1
U22	Main Fan Overload		

Note: Use Pin 5 on the input opto-isolator with reference to the V- terminal for voltage check. The voltage level is 5 VDC.

Control Output Opto-Isolator Legend:

Opto	Purpose	Opto	Purpose
U1	Reheat 1	U10	Compressor 2
U2	Reheat 2	U11	Econ-O-Cycle Relay (R5)
U3	Reheat 3	U12	Liquid Line Solenoid 1
U4	Humidifier	U13	Hot Gas Bypass 2
U5	Main Fan	U14	Compressor 1
U8	Liquid Line Solenoid 2	U17	CW Actuator
U9	Hot Gas Bypass 2	U18	CW Actuator Close

Note: Use Pin 4 on the output opto-isolator with reference to the correct transformer neutral/ ground. The voltage level is 24 VAC.

Control Output Triac Legend:

Opto	Purpose	Opto	Purpose
Q1	Reheat 1	Q10	Compressor 2
Q2	Reheat 2	Q11	Econ-O-Cycle Relay (R5)
Q3	Reheat 3	Q12	Liquid Line Solenoid 1
Q4	Humidifier	Q13	Hot Gas Bypass 2
Q5	Main Fan	Q14	Compressor 1
Q8	Liquid Line Solenoid 2	Q17	CW Actuator
Q9	Hot Gas Bypass 2	Q18	CW Actuator Close

iCOM Diagnostics / Service Mode Program

The iCOM controller has a valuable tool built into software under the **SERVICE MENU**. This program allows the user to evacuate and charge the refrigerant circuit at installation, turn on/off all loads (outputs) for testing, and allows user to check all inputs.

The procedure is as follows:

1- From the main screen select the **SERVICE MENU** parameters.
2- In the **SERVICE MENU** screen select the **SERVICE** icon.
3- Enter password and scroll to **MANUAL MODE,** select YES with the up key.
4- Now scroll to Fan On and select ON with the up key. The fan must be on to operate loads in this mode. You must turn off the fan and service mode when completed.

The Compressor 1 and 2 selections are for the **ON/OFF** and **RUN, EVACUATE, and CHARGE** modes.

When user scrolls to the Compressor 1 or 2 positions in the parameters list he must press enter to select the first item. Enter again will move the cursor to the ON/OFF selection first (far right item) then using the up arrow key the compressor may be turn on and down key will turn off. Now with the cursor on the ON/OFF position, now use the right arrow key to select the RUN, EVACUATE, CHARGE function and the up or down arrow key to make changes. The RUN selection is the normal operating position.

Parameters list is found on pages in Chapter 2

Basic Troubleshooting Steps:

Example: Unit load is not energizing.

Programming:

1. Read and record all program parameter values.
2. Read and record all DIP (control) switch positions on all boards. Check all jumpers on each board, check for the CAN healthy light on the boards and check programming per the read and record sheet in appropriate manuals to verify selected options.
3. Turn Unit off with ON/OFF button and reboot system power (disconnect switch off - on) to reconfigure system. If programming error is detected, recheck unit for proper operation.

If problem is not resolved in programming section, begin the signal flow check.

Signal Flow Check: Assumption is the unit is calling for a mechanical operation but the load is not activated. Using the appropriate control training and service manual, identify the output opto-isolator to be checked, locate the opto-isolator on the PCB and perform the following.

DC Voltage check:

1. Using a digital voltmeter check for the correct VDC signal at the output opto-isolator. Pin 1 referenced to - VDC will show low VDC (approximately 1.2 VDC) if the microprocessor control side of the device is functioning. A high VDC (approximately 3.3 VDC) indicates a microprocessor control problem. A meter reading of 0 VDC indicates a loss of microprocessor voltage, check VDC at the power supply referenced +VDC to -VDC should be approximately 3.3 VDC.
2. This check involves the microprocessor. To bypass the microprocessor completely, jumper from Pin 2 on the output opto-isolator to -VDC. As soon as the jumper is applied the load device should activate. If the load device activates the problem is in the microprocessor itself or the programming. If the load device does not activate continue the signal flow check.

AC Voltage check:

1. Place the digital VOM meter on AC voltage scale and verify that 24 VAC is being applied to the output opto-isolator by placing the VOM between Pin 4 and the proper transformer ground connection. To verify that the switch leg of the output opto-isolator is working properly place the VOM between Pin 6 and the proper transformer ground connection. A high VAC (approximately 24 VAC) display indicates a closed switch leg; a low VAC indicates an open switch leg.

2. If the programming is correct and the output opto-isolator is functioning properly but the load device is not activated the next step is to check the triac and hard wiring to the load device. Verify that 24 VAC is being applied to Pin 1 of the triac, place the VOM leads between Pin 1 and the proper transformer ground connection. If 24 VAC is not present at Pin 1 of the triac backtrack the circuit to the proper secondary hot of the control transformer.

If 24 VAC is present perform the following:

Select the appropriate diagnostics function from the control menu; use the training and service manual for reference. During the TEST OUTPUTS function the green LED on the microprocessor should light. If the LED lights check the hardware from the plug to the load device. If the LED does not light run the TEST CONTROL BOARD diagnostics function. If board failure is displayed contact your local sales office.

Note: Triacs are current limiting devices; therefore the load device must be connected to obtain valid voltage readings when doing VOM checks and circuit troubleshooting. Repair or replace any missing or defective components in the circuit.

Mechanical Problems: If the failure of the load device to activate is determined to be mechanical in nature consult the appropriate Liebert system operation and maintenance, reference the individual component manufacturers literature or contact your local Liebert representative.

Moisture Content Charts

The following charts show moisture content of various levels of relative humidity for given temperatures. Follow the procedures below to use the charts:

STEP 1: Locate the chart for the temperature with which you are working.

STEP 2: Locate the line with the relative humidity with which you are working.

STEP 3: Read the moisture content of the relative humidity in either grains per cubic foot or grains per pound of air.

For example, you have a room temperature of 70°F and 50% relative humidity.

STEP 1: Locate the chart for 70°F.

STEP 2: Locate the line with relative humidity 50%.

STEP 3: Read the moisture content value of 50% relative humidity (4.0275 grains per cubic foot of air **OR** 55.86143 grains per pound of air).

Moisture Content at Temperature = 80°F (26.7ºC)		
RH	**Grains Per Cu Ft**	**Grains Per Lb.**
35	3.864	53.59368
36	3.9744	55.12493
37	4.0848	56.65618
38	4.1952	58.18743
39	4.3056	59.71868
40	4.416	61.24992
41	4.5264	62.78116
42	4.6368	64.31241
43	4.7472	65.84367
44	4.8576	67.37492
45	4.968	68.90616
46	5.0784	70.43741
47	5.1888	71.96865
48	5.2992	73.4999
49	5.4096	75.03115
50	5.52	76.5624
51	5.6304	78.09365
52	5.7408	79.6249
53	5.8512	81.15615
54	5.9616	82.68739
55	6.072	84.21864
56	6.1824	85.74989
57	6.2928	87.28112
58	6.4032	88.81239
59	6.5136	90.34362
60	6.624	91.87488
61	6.7344	93.40612
62	6.8448	94.93738
63	6.9552	96.46862
64	7.0656	97.99987
65	7.176	99.53111

Moisture Content at Temperature = 79°F (26.1ºC)		
RH	**Grains Per Cu Ft**	**Grains Per Lb.**
35	3.7485	51.9917
36	3.8556	53.47717
37	3.9627	54.96265
38	4.0698	56.44813
39	4.1769	57.9336
40	4.284	59.41908
41	4.3911	60.90456
42	4.4982	62.39004
43	4.6053	63.87551
44	4.7124	65.36099
45	4.8195	66.84647
46	4.9266	68.33194
47	5.0337	69.81742
48	5.1408	71.3029
49	5.2479	72.78838
50	5.355	74.27385
51	5.4621	75.75933
52	5.5692	77.2448
53	5.6763	78.73028
54	5.7834	80.21575
55	5.8905	81.70123
56	5.9976	83.18671
57	6.1047	84.67218
58	6.2118	86.15767
59	6.3189	87.64314
60	6.426	89.12862
61	6.5331	90.6141
62	6.6402	92.09958
63	6.7473	93.58504
64	6.8544	95.07052
65	6.9615	96.55601

Moisture Content at Temperature = 78°F (25.6ºC)		
RH	**Grains Per Cu Ft**	**Grains Per Lb.**
35	3.633	50.38971
36	3.7368	51.82942
37	3.8406	53.26913
38	3.9444	54.70883
39	4.0482	56.14854
40	4.152	57.58824
41	4.2558	59.02795
42	4.3596	60.46765
43	4.4634	61.90736
44	4.5672	63.34707
45	4.671	64.78677
46	4.774801	66.22648
47	4.8786	67.66618
48	4.9824	69.10589
49	5.0862	70.5456
50	5.19	71.9853
51	5.2938	73.425
52	5.3976	74.86471
53	5.5014	76.30441
54	5.605201	77.74413
55	5.709	79.18383
56	5.812801	80.62335
57	5.9166	82.06325
58	6.0204	83.50295
59	6.1242	84.94265
60	6.228	86.38236
61	6.3318	87.82207
62	6.4356	89.26176
63	6.5394	90.70148
64	6.6432	92.14118
65	6.747	93.58089

Moisture Content at Temperature = 77°F (25.0ºC)		
RH	**Grains Per Cu Ft**	**Grains Per Lb.**
35	3.521	48.83628
36	3.6216	50.2316
37	3.7222	51.62691
38	3.8228	53.02224
39	3.9234	54.41756
40	4.024	55.81288
41	4.124601	57.20821
42	4.2252	58.60353
43	4.3258	59.99885
44	4.4264	61.39417
45	4.527	62.78949
46	4.6276	64.18481
47	4.7282	65.58013
48	4.8288	66.97546
49	4.9294	68.37078
50	5.03	69.7661
51	5.1306	71.16143
52	5.2312	72.55674
53	5.3318	73.95206
54	5.4324	75.34738
55	5.533001	76.74271
56	5.6336	78.13803
57	5.734201	79.53336
58	5.8348	80.92868
59	5.935401	82.32401
60	6.036001	83.71933
61	6.136601	85.11465
62	6.237201	86.50996
63	6.3378	87.90529
64	6.438401	89.30061
65	6.539	90.69593

Moisture Content at Temperature = 76°F (24.4ºC)		
RH	**Grains Per Cu Ft**	**Grains Per Lb.**
35	3.41215	47.32652
36	3.50964	48.67871
37	3.60713	50.03089
38	3.70462	51.38307
39	3.80211	52.73527
40	3.8996	54.08745
41	3.99709	55.43964
42	4.09458	56.79182
43	4.19207	58.14401
44	4.28956	59.4962
45	4.38705	60.84838
46	4.48454	62.20057
47	4.58203	63.55276
48	4.67952	64.90494
49	4.77701	66.25713
50	4.8745	67.60931
51	4.97199	68.9615
52	5.06948	70.31368
53	5.16697	71.66587
54	5.26446	73.01805
55	5.36195	74.37024
56	5.45944	75.72243
57	5.55693	77.07461
58	5.65442	78.4268
59	5.75191	79.77898
60	5.8494	81.13118
61	5.94689	82.48336
62	6.04438	83.83555
63	6.14187	85.18773
64	6.23936	86.53992
65	6.336849	87.8921

Moisture Content at Temperature = 75°F (23.9ºC)		
RH	**Grains Per Cu Ft**	**Grains Per Lb.**
35	3.3068	45.86532
36	3.40128	47.17575
37	3.49576	48.48619
38	3.59024	49.79663
39	3.68472	51.10707
40	3.7792	52.4175
41	3.87368	53.72794
42	3.96816	55.03838
43	4.06264	56.34882
44	4.15712	57.65926
45	4.251601	58.9697
46	4.34608	60.28013
47	4.44056	61.59057
48	4.53504	62.901
49	4.62952	64.21145
50	4.724	65.52188
51	4.81848	66.83231
52	4.91296	68.14276
53	5.00744	69.45319
54	5.10192	70.76363
55	5.1964	72.07407
56	5.29088	73.38451
57	5.38536	74.69495
58	5.479841	76.00539
59	5.57432	77.31581
60	5.6688	78.62625
61	5.76328	79.9367
62	5.85776	81.24713
63	5.95224	82.55757
64	6.04672	83.86801
65	6.1412	85.17844

Moisture Content at Temperature = 74°F (23.3ºC)		
RH	**Grains Per Cu Ft**	**Grains Per Lb.**
35	3.20355	44.43324
36	3.29508	45.70276
37	3.38661	46.97228
38	3.47814	48.2418
39	3.56967	49.51132
40	3.6612	50.78085
41	3.75273	52.05037
42	3.84426	53.31989
43	3.93579	54.58941
44	4.02732	55.85893
45	4.11885	57.12845
46	4.21038	58.39797
47	4.30191	59.66749
48	4.39344	60.93701
49	4.48497	62.20654
50	4.5765	63.47605
51	4.66803	64.74558
52	4.75956	66.0151
53	4.85109	67.28461
54	4.94262	68.55414
55	5.03415	69.82366
56	5.12568	71.09318
57	5.21721	72.3627
58	5.30874	73.63223
59	5.40027	74.90173
60	5.4918	76.17126
61	5.58333	77.44079
62	5.67486	78.7103
63	5.76639	79.97983
64	5.85792	81.24935
65	5.94945	82.51887

Moisture Content at Temperature = 73°F (22.8ºC)		
RH	**Grains Per Cu Ft**	**Grains Per Lb.**
35	3.10345	43.04485
36	3.19212	44.2747
37	3.28079	45.50456
38	3.36946	46.73441
39	3.45813	47.96426
40	3.5468	49.19412
41	3.63547	50.42397
42	3.72414	51.65382
43	3.81281	52.88367
44	3.90148	54.11352
45	3.99015	55.34338
46	4.07882	56.57323
47	4.16749	57.80309
48	4.25616	59.03294
49	4.34483	60.26279
50	4.4335	61.49264
51	4.52217	62.72249
52	4.61084	63.95235
53	4.69951	65.1822
54	4.78818	66.41206
55	4.87685	67.64191
56	4.96552	68.87176
57	5.05419	70.10161
58	5.14286	71.33146
59	5.23153	72.56132
60	5.3202	73.79117
61	5.40887	75.02102
62	5.49754	76.25087
63	5.58621	77.48073
64	5.67488	78.71058
65	5.76355	79.94044

Moisture Content at Temperature = 72°F (22.2ºC)		
RH	**Grains Per Cu Ft**	**Grains Per Lb.**
35	2.9988	41.59336
36	3.08448	42.78174
37	3.17016	43.97012
38	3.25584	45.1585
39	3.34152	46.34688
40	3.4272	47.53527
41	3.51288	48.72365
42	3.59856	49.91203
43	3.68424	51.10041
44	3.76992	52.28879
45	3.8556	53.47717
46	3.94128	54.66555
47	4.02696	55.85393
48	4.11264	57.04232
49	4.19832	58.2307
50	4.284	59.41908
51	4.36968	60.60746
52	4.45536	61.79584
53	4.54104	62.98422
54	4.62672	64.17261
55	4.7124	65.36099
56	4.79808	66.54937
57	4.88376	67.73775
58	4.96944	68.92613
59	5.05512	70.11452
60	5.1408	71.30289
61	5.22648	72.49128
62	5.31216	73.67966
63	5.39784	74.86805
64	5.48352	76.05642
65	5.5692	77.2448

Moisture Content at Temperature = 71°F (21.7ºC)		
RH	**Grains Per Cu Ft**	**Grains Per Lb.**
35	2.91165	40.38459
36	2.99484	41.53843
37	3.07803	42.69228
38	3.16122	43.84613
39	3.24441	44.99997
40	3.3276	46.15381
41	3.41079	47.30766
42	3.49398	48.46151
43	3.57717	49.61535
44	3.66036	50.7692
45	3.74355	51.92304
46	3.82674	53.07688
47	3.90993	54.23073
48	3.99312	55.38458
49	4.07631	56.53842
50	4.1595	57.69227
51	4.24269	58.84611
52	4.32588	59.99996
53	4.40907	61.1538
54	4.49226	62.30765
55	4.57545	63.46149
56	4.65864	64.61533
57	4.74183	65.76918
58	4.825021	66.92304
59	4.908211	68.07688
60	4.9914	69.23072
61	5.07459	70.38457
62	5.15778	71.53841
63	5.240971	72.69226
64	5.32416	73.8461
65	5.40735	74.99994

Moisture Content at Temperature = 70°F (21.1ºC)		
RH	**Grains Per Cu Ft**	**Grains Per Lb.**
35	2.81925	39.103
36	2.8998	40.22023
37	2.98035	41.33746
38	3.0609	42.45469
39	3.14145	43.57192
40	3.222	44.68914
41	3.30255	45.80637
42	3.3831	46.9236
43	3.46365	48.04083
44	3.5442	49.15806
45	3.62475	50.27529
46	3.7053	51.39252
47	3.78585	52.50975
48	3.8664	53.62697
49	3.94695	54.7442
50	4.0275	55.86143
51	4.10805	56.97866
52	4.1886	58.09588
53	4.269151	59.21311
54	4.349701	60.33035
55	4.43025	61.44757
56	4.510801	62.5648
57	4.59135	63.68203
58	4.6719	64.79925
59	4.75245	65.91648
60	4.833	67.03371
61	4.91355	68.15094
62	4.994101	69.26818
63	5.074651	70.3854
64	5.1552	71.50263
65	5.23575	72.61986

Moisture Content at Temperature = 69°F (20.6ºC)		
RH	**Grains Per Cu Ft**	**Grains Per Lb.**
35	2.7293	37.85539
36	2.80728	38.93697
37	2.88526	40.01856
38	2.96324	41.10014
39	3.04122	42.18173
40	3.1192	43.2633
41	3.19718	44.34489
42	3.27516	45.42647
43	3.35314	46.50805
44	3.43112	47.58964
45	3.5091	48.67122
46	3.58708	49.7528
47	3.66506	50.83438
48	3.74304	51.91596
49	3.82102	52.99755
50	3.899	54.07913
51	3.97698	55.16072
52	4.05496	56.2423
53	4.13294	57.32389
54	4.21092	58.40546
55	4.2889	59.48704
56	4.36688	60.56863
57	4.44486	61.65021
58	4.52284	62.73179
59	4.60082	63.81338
60	4.6788	64.89496
61	4.75678	65.97653
62	4.83476	67.05811
63	4.91274	68.1397
64	4.99072	69.22128
65	5.0687	70.30286

Moisture Content at Temperature = 68°F (20.0ºC)		
RH	**Grains Per Cu Ft**	**Grains Per Lb.**
35	2.64985	36.75342
36	2.72556	37.80352
37	2.80127	38.85362
38	2.87698	39.90371
39	2.95269	40.95381
40	3.0284	42.00391
41	3.10411	43.05401
42	3.17982	44.10411
43	3.25553	45.1542
44	3.33124	46.2043
45	3.40695	47.2544
46	3.48266	48.30449
47	3.55837	49.35459
48	3.63408	50.40469
49	3.70979	51.45479
50	3.7855	52.50489
51	3.86121	53.55499
52	3.93692	54.60509
53	4.01263	55.65518
54	4.08834	56.70528
55	4.16405	57.75538
56	4.23976	58.80547
57	4.31547	59.85557
58	4.39118	60.90567
59	4.46689	61.95576
60	4.5426	63.00587
61	4.61831	64.05596
62	4.694021	65.10606
63	4.76973	66.15616
64	4.84544	67.20625
65	4.92115	68.25635

Moisture Content at Temperature = 67°F (19.4ºC)		
RH	**Grains Per Cu Ft**	**Grains Per Lb.**
35	2.5578	35.47669
36	2.63088	36.49031
37	2.70396	37.50393
38	2.77704	38.51755
39	2.85012	39.53116
40	2.9232	40.54479
41	2.99628	41.5584
42	3.06936	42.57202
43	3.14244	43.58565
44	3.21552	44.59926
45	3.2886	45.61288
46	3.36168	46.62651
47	3.43476	47.64012
48	3.50784	48.65374
49	3.58092	49.66736
50	3.654	50.68098
51	3.72708	51.6946
52	3.80016	52.70822
53	3.87324	53.72184
54	3.94632	54.73546
55	4.0194	55.74908
56	4.09248	56.7627
57	4.16556	57.77632
58	4.238641	58.78994
59	4.31172	59.80356
60	4.3848	60.81718
61	4.45788	61.8308
62	4.53096	62.84442
63	4.60404	63.85804
64	4.67712	64.87166
65	4.750201	65.88528

Moisture Content at Temperature = 66°F (18.9ºC)		
RH	**Grains Per Cu Ft**	**Grains Per Lb.**
35	2.4759	34.34073
36	2.54664	35.3219
37	2.61738	36.30306
38	2.68812	37.28422
39	2.75886	38.26539
40	2.8296	39.24655
41	2.90034	40.22772
42	2.97108	41.20888
43	3.04182	42.19005
44	3.11256	43.17121
45	3.1833	44.15237
46	3.25404	45.13354
47	3.32478	46.1147
48	3.39552	47.09587
49	3.46626	48.07703
50	3.537	49.05819
51	3.60774	50.03935
52	3.67848	51.02052
53	3.74922	52.00168
54	3.81996	52.98285
55	3.8907	53.96401
56	3.96144	54.94517
57	4.03218	55.92634
58	4.10292	56.9075
59	4.17366	57.88866
60	4.2444	58.86983
61	4.31514	59.85099
62	4.38588	60.83216
63	4.45662	61.81332
64	4.52736	62.79449
65	4.5981	63.77564

Moisture Content at Temperature = 65°F (18.3ºC)		
RH	**Grains Per Cu Ft**	**Grains Per Lb.**
35	2.39575	33.22905
36	2.4642	34.17846
37	2.53265	35.12785
38	2.6011	36.07726
39	2.66955	37.02666
40	2.738	37.97606
41	2.80645	38.92546
42	2.8749	39.87486
43	2.94335	40.82426
44	3.0118	41.77366
45	3.08025	42.72307
46	3.1487	43.67247
47	3.21715	44.62187
48	3.2856	45.57127
49	3.35405	46.52067
50	3.4225	47.47008
51	3.49095	48.41947
52	3.5594	49.36888
53	3.62785	50.31828
54	3.6963	51.26768
55	3.76475	52.21708
56	3.8332	53.16648
57	3.90165	54.11589
58	3.9701	55.06528
59	4.03855	56.01469
60	4.107	56.96409
61	4.17545	57.91349
62	4.2439	58.86289
63	4.31235	59.81229
64	4.3808	60.76169
65	4.44925	61.7111

Suction Transducer Information (Codes A124-A128)

%	psig	psia	volts	barg	bara
0	-33.5	-18.8	0	-2.31	-1.29
1	-31.6	-16.9	0.05	-2.18	-1.16
2	-29.7	-15.0	0.1	-2.05	-1.03
3	-27.8	-13.1	0.15	-1.92	-0.90
4	-26.0	-11.3	0.2	-1.79	-0.78
5	-24.1	-9.4	0.25	-1.66	-0.65
6	-22.2	-7.5	0.3	-1.53	-0.52
7	-20.3	-5.6	0.35	-1.40	-0.39
8	-18.5	-3.8	0.4	-1.27	-0.26
9	-16.6	-1.9	0.45	-1.14	-0.13
10	-14.7	0.0	0.5	-1.01	0.00
11	-12.8	1.9	0.55	-0.88	0.13
12	-11.0	3.8	0.6	-0.75	0.26
13	-9.1	5.6	0.65	-0.63	0.39
14	-7.2	7.5	0.7	-0.50	0.52
15	-5.3	9.4	0.75	-0.37	0.65
16	-3.5	11.3	0.8	-0.24	0.78
17	-1.6	13.1	0.85	-0.11	0.90
18	0.3	15.0	0.9	0.02	1.03
19	2.2	16.9	0.95	0.15	1.16
20	4.1	18.8	1	0.28	1.29
21	5.9	20.6	1.05	0.41	1.42
22	7.8	22.5	1.1	0.54	1.55
23	9.7	24.4	1.15	0.67	1.68
24	11.6	26.3	1.2	0.80	1.81
25	13.4	28.1	1.25	0.93	1.94
26	15.3	30.0	1.3	1.05	2.07
27	17.2	31.9	1.35	1.18	2.20
28	19.1	33.8	1.4	1.31	2.33
29	20.9	35.6	1.45	1.44	2.46
30	22.8	37.5	1.5	1.57	2.59
31	24.7	39.4	1.55	1.70	2.71
32	26.6	41.3	1.6	1.83	2.84
33	28.4	43.1	1.65	1.96	2.97
34	30.3	45.0	1.7	2.09	3.10
35	32.2	46.9	1.75	2.22	3.23
36	34.1	48.8	1.8	2.35	3.36
37	35.9	50.6	1.85	2.48	3.49
38	37.8	52.5	1.9	2.61	3.62
39	39.7	54.4	1.95	2.74	3.75
40	41.6	56.3	2	2.86	3.88
41	43.4	58.1	2.05	2.99	4.01
42	45.3	60.0	2.1	3.12	4.14
43	47.2	61.9	2.15	3.25	4.27
44	49.1	63.8	2.2	3.38	4.40
45	50.9	65.6	2.25	3.51	4.52
46	52.8	67.5	2.3	3.64	4.65
47	54.7	69.4	2.35	3.77	4.78
48	56.6	71.3	2.4	3.90	4.91
49	58.4	73.1	2.45	4.03	5.04
50	60.3	75.0	2.5	4.16	5.17
51	62.2	76.9	2.55	4.29	5.30
52	64.1	78.8	2.6	4.42	5.43
53	65.9	80.6	2.65	4.55	5.56
54	67.8	82.5	2.7	4.67	5.69
55	69.7	84.4	2.75	4.80	5.82
56	71.6	86.3	2.8	4.93	5.95
57	73.4	88.1	2.85	5.06	6.08
58	75.3	90.0	2.9	5.19	6.21
59	77.2	91.9	2.95	5.32	6.33
60	79.1	93.8	3	5.45	6.46
61	80.9	95.6	3.05	5.58	6.59
62	82.8	97.5	3.1	5.71	6.72
63	84.7	99.4	3.15	5.84	6.85
64	86.6	101.3	3.2	5.97	6.98
65	88.4	103.1	3.25	6.10	7.11
66	90.3	105.0	3.3	6.23	7.24
67	92.2	106.9	3.35	6.36	7.37
68	94.1	108.8	3.4	6.48	7.50
69	95.9	110.6	3.45	6.61	7.63
70	97.8	112.5	3.5	6.74	7.76
71	99.7	114.4	3.55	6.87	7.89
72	101.6	116.3	3.6	7.00	8.02
73	103.4	118.1	3.65	7.13	8.14
74	105.3	120.0	3.7	7.26	8.27
75	107.2	121.9	3.75	7.39	8.40
76	109.1	123.8	3.8	7.52	8.53
77	110.9	125.6	3.85	7.65	8.66
78	112.8	127.5	3.9	7.78	8.79
79	114.7	129.4	3.95	7.91	8.92
80	116.6	131.3	4	8.04	9.05
81	118.4	133.1	4.05	8.16	9.18
82	120.3	135.0	4.1	8.29	9.31
83	122.2	136.9	4.15	8.42	9.44
84	124.1	138.8	4.2	8.55	9.57
85	125.9	140.6	4.25	8.68	9.70
86	127.8	142.5	4.3	8.81	9.82
87	129.7	144.4	4.35	8.94	9.95
88	131.6	146.3	4.4	9.07	10.08
89	133.4	148.1	4.45	9.20	10.21
90	135.3	150.0	4.5	9.33	10.34
91	137.2	151.9	4.55	9.46	10.47
92	139.1	153.8	4.6	9.59	10.60
93	140.9	155.6	4.65	9.72	10.73
94	142.8	157.5	4.7	9.85	10.86
95	144.7	159.4	4.75	9.97	10.99
96	146.6	161.3	4.8	10.10	11.12
97	148.4	163.1	4.85	10.23	11.25
98	150.3	165.0	4.9	10.36	11.38
99	152.2	166.9	4.95	10.49	11.51
100	154.1	168.8	5	10.62	11.63

Digital Scroll High Temperature Sensor Chart
NTC (Code S606 and S608)

Deg C	Deg F	Resistance (kOhms)
-40	-40	2889.60
-35	-31	2087.22
-30	-22	1522.20
-25	-13	1121.44
-20	-4	834.72
-15	5	627.28
-10	14	475.74
-5	23	363.99
0	32	280.82
5	41	218.41
10	50	171.17
15	59	135.14
20	68	107.44
25	77	86.00
30	86	69.28
35	95	56.16
40	104	45.81
45	113	37.58
50	122	30.99
55	131	25.68
60	140	21.40
65	149	17.91
70	158	15.07
75	167	12.73
80	176	10.79
85	185	9.20
90	194	7.87
95	203	6.77
100	212	5.85
105	221	5.09
110	230	4.45
115	239	3.87
120	248	3.35
125	257	2.92
130	266	2.58
135	275	2.28
140	284	2.02
145	293	1.80
150	302	1.59
155	311	1.39
160	320	1.25
165	329	1.12
170	338	1.01
175	347	0.92
180	356	0.83

Unit Code Description

The *iCOM* controller uses a system parameters auto configuration methodology. The unit will have a code on a serial tag displayed on the front of the electric panel. This code when entered during the factory QA process will define unit configuration and auto set various parameters for functionality. The sheets in the back of this manual will allow the service technician to understand and be able to enter this unit code manually if necessary through the control panel and the **FACTORY SETTINGS** parameter. The parameter codes are listed in Chapter as A001 to A011. The **UNIT CODE** ID numbers must be entered in groups of six at a time. When all ID numbers of the UNIT CODE are entered user must select A008 to “Send and Execute Unit Code” then verify parameter code A011 for a **“VALID”** status. If UNIT CODE is missing or lost the unit will not start until the correct code is entered and saved.

The **UNIT CODE** sheets will show a **VALUE** field on the left of the first page and followed by 18 columns of unit configuration definitions.

THIS UNIT CODE IS NOT TO BE CHANGED UNLESS INSTRUCTED BY A FACTORY SERVICE TECHNICIAN.

Troubleshooting Checklist

1. Check the obvious before beginning troubleshooting.

   A. Be sure that a remote control switch has not been shut off.
   B. Be sure that the communication cable is properly connected.
   C. Be sure that power is reaching all modules associated with the system.

2. Power down the entire unit during the process of removing or replacing any component or cable.

   A. Serious damage to components may result if this step is not taken.
   B. After removal or replacement actions, power may be restored to the unit.

3. Wear a personal ground strap when handling printed circuit boards or associated connecting cables**.** Static electricity, besides being annoying, can damage delicate electronic components.

4. Protect exposed components from accidental contact by personnel or dropped hardware or tools.

5. When checking voltage, use the correct reference (ground) points. The chassis is not always the correct ground point, especially within the electronic housing.

6. Reassemble modules correctly.
   A. Observe assembled appearance prior to disassembly.
   B. Replace all hardware (especially insulating or nylon hardware) in the same places and in the same relationship as the original.

7. When advised to check and replace cables, do the following:
   A. Inspect for damaged insulation, broken conductors, and/or loose connectors.
   B. Check continuity with an ohm meter (Flex cable while checking.).
   C. Make certain that connectors mate firmly with proper receptacles.

8. When changing set points to cause a call for heating or cooling, set the points at least 10°-15° above (for heating) or below (for cooling) the present room temperature.

9. Bring the room temperature level to within the working range of the equipment (35°-90°F) before attempting troubleshooting.

10. Bring the room humidity level to within the working range of the equipment (35%-65%) before attempting troubleshooting**.**

Glossary of Unit and System Parameters

User Menu

Code	Setpoints	Type
U102	Temperature setpoint	Unit
U103	Humidity setpoint	Unit
U104	Predictive Humidity control	Unit
U105	Supply Limit	Unit
U106	Supply Limit Value	Unit
	Graphics	**Type**
	System temperature time scale	System
	System temperature graph height	System
	System humidity time scale	System
	System humidity graph height	System
	Unit temperature time scale	Unit
	Unit temperature graph height	Unit
	Unit humidity time scale	Unit
	Unit humidity graph height	Unit
Code	**Set Alarms**	**Type**
U202	Std. Sensor Alarms	Unit
U203	High temperature	Unit
U204	Low temperature	Unit
U205	High humidity	Unit
U206	Low humidity	Unit
U207	Sensor A Alarms	Unit
U208	High temperature sensor A	Unit
U209	Low temperature sensor A	Unit
U210	High humidity sensor A	Unit
U211	Low humidity sensor A	Unit
Code	**Various Sensors**	**Type**
U301	Actual temperature setpoint	Unit
U302	Actual humidity setpoint	Unit
U303	Optional sensor A temperature	Unit
U304	Optional sensor A humidity	Unit
U305	Optional sensor B temperature	Unit
U306	Optional sensor B humidity	Unit
U307	Optional sensor C temperature	Unit
U308	Optional sensor C humidity	Unit
U309	Glycol temperature	Unit
U310	DigiScroll 1 temperature	Unit
U311	DigiScroll 2 temperature	Unit
U312	Freecooling status	Unit

Code	Display Setup	Type
U401	Language	Display
U402	Date	Unit
U403	Time	Unit
U404	Temperature Indication	Unit
U405	Display contrast	Display
U406	Buzzer Frequency	Display
U407	Backlight off after x hours	Display
U408	Screen:	Display
U409	Display shows:	Display
U410	Display View	Display
Code	**Total Run Hours**	**Type**
U502	Fan Motor	Unit
U502	Fan Motor Limit	Unit
U503	Compressor 1	Unit
U503	Compressor 1 Limit	Unit
U504	Compressor 2	Unit
U504	Compressor 2 Limit	Unit
U505	Freecooling	Unit
U505	Freecooling Limit	Unit
U506	Hotgas / Hotwater	Unit
U506	Hotgas / Hotwater Limit	Unit
U507	Electrical Heater 1	Unit
U507	Electrical Heater 1 Limit	Unit
U508	Electrical Heater 2	Unit
U508	Electrical Heater 2 Limit	Unit
U509	Electrical Heater 3	Unit
U509	Electrical Heater 3 Limit	Unit
U510	Humidifier	Unit
U510	Humidifier Limit	Unit
U511	Dehumidification	Unit
U511	Dehumidification Limit	Unit
Code	**Timer**	**Type**
U603	Monday	Unit
U603	Tuesday	Unit
U603	Wednesday	Unit
U603	Thursday	Unit
U603	Friday	Unit
U603	Saturday	Unit
U603	Sunday	Unit
U605	From / to	Unit
U607	From / to	Unit
U609	Timer mode	Unit
U610	Timer Mode Type	Unit
U611	Deadband	Unit

Code	Service contacts	Type
U703	Address line 1	System
U704	Address line 2	System
U705	Address line 3	System
U706	Address line 4	System

Service Menu

Code	Setpoints	Type
S102	Temperature setpoint	Unit
S103	Humidity setpoint	Unit
S104	Predictive Humidity control	Unit
S105	Supply Limit	Unit
S106	Supply Limit Value	Unit
S107	Autoset enable	Unit
S108	Temperature proportional band	Unit
S109	Temperature integration time	Unit
S110	Temperature deadband	Unit
S113	Humidity proportional band	Unit
S114	Humidity integration time	Unit
S115	Humidity deadband	Unit
S116	DT between Room / Glycol Type	Unit
S117	DT between Room / Glycol Value	Unit
S118	Min.Chilled Water Temp. Enable	Unit
S119	Min.Chilled Water Temp. Value	Unit
Code	**Standby settings / Lead-lag**	**Type**
S502	Number of standby units	System
S503	Rotation Frequency	System
S504	Rotate at (hour)	System
S505	Rotate at (minute)	System
S506	Rotate by	System
S507	Perform one rotation	System
S508	Cascade units	System
Code	**Wellness / General Settings**	**Type**
S002	Maintenance frequency	System
S003	Max bonus	System
S004	Max penalty	System
S005	Last maintenance	System
S006	Service engineer	System
S007	Reset	System
S008	Calculated next maintenance	System

	Fan Settings	**Type**
S013	Number of starts	Unit
S014	Working hours	Unit
S015	Average working time	Unit
S016	Starts per day optimum	Unit
S017	Starts per day worst	Unit
S018	Number of alarms	Unit
S019	Actual bonus	Unit
	Compr. 1 Settings	**Type**
S024	Number of starts	Unit
S025	Working hours	Unit
S026	Average working time	Unit
S027	Starts per day optimum	Unit
S028	Starts per day worst	Unit
S029	Number of HP alarms	Unit
S030	Number of LP alarms	Unit
S031	Number of TH alarms	Unit
S032	Number of HT alarms	Unit
S033	Actual bonus	Unit
	Compr. 2 Settings	**Type**
S035	Number of starts	Unit
S036	Working hours	Unit
S037	Average working time	Unit
S038	Starts per day optimum	Unit
S039	Starts per day worst	Unit
S040	Number of HP alarms	Unit
S041	Number of LP alarms	Unit
S042	Number of TH alarms	Unit
S043	Number of HT alarms	Unit
S044	Actual bonus	Unit
	El. Heater 1 Settings	**Type**
S046	Number of starts	Unit
S047	Working hours	Unit
S048	Average working time	Unit
S049	Starts per day optimum	Unit
S050	Starts per day worst	Unit
S051	Number of alarms	Unit
S052	Actual bonus	Unit
	El. Heater 2 Settings	**Type**
S057	Number of starts	Unit
S058	Working hours	Unit
S059	Average working time	Unit
S060	Starts per day optimum	Unit
S061	Starts per day worst	Unit
S062	Number of alarms	Unit

S063	Actual bonus	Unit
	El. Heater 3 Settings	**Type**
S068	Number of starts	Unit
S069	Working hours	Unit
S070	Average working time	Unit
S071	Starts per day optimum	Unit
S072	Starts per day worst	Unit
S073	Number of alarms	Unit
S074	Actual bonus	Unit
	Humidifier Settings	**Type**
S079	Number of starts	Unit
S080	Working hours	Unit
S081	Average working time	Unit
S082	Starts per day optimum	Unit
S083	Starts per day worst	Unit
S084	Number of alarms	Unit
S085	Actual bonus	Unit
Code	**Diagnostics / Service**	**Type**
S302	Manual Mode	Unit
S303	Unit Fan	Unit
S304	Compressor 1	Unit
S304	Compressor 1 (Mode)	Unit
S305	Compressor 1 capacity	Unit
S306	Compressor 1 cycle ramp	Unit
S307	Compressor 2	Unit
S307	Compressor 2 (Mode)	Unit
S308	Compressor 2 capacity	Unit
S309	Compressor 2 cycle ramp	Unit
S313	Heat 1	Unit
S314	Heat 2	Unit
S315	Heat 3	Unit
S324	Hum Fill	Unit
S325	Hum	Unit
S326	Alarm Relay	Unit
S327	R5	Unit
S328	3P actuator open	Unit
S329	3P actuator close	Unit
S330	Analog out 1	Unit
S331	Analog out 2	Unit
S332	Analog out 3	Unit
S333	Analog out 4	Unit
S335	Status Remote	Unit
S336	Status Air Sail	Unit
S337	Status Fan Overload	Unit

S338	Status Filter	Unit
S339	Status Customer Input 1	Unit
S340	Status Customer Input 2	Unit
S341	Status Customer Input 3	Unit
S342	Status Customer Input 4	Unit
S343	HP 1 alarm counter per 12 hours	Unit
S344	HP 2 alarm counter per 12 hours	Unit
S346	Status HP 1	Unit
S347	Status LP 1	Unit
S348	Status TH 1	Unit
S349	Status HP 2	Unit
S350	Status LP 2	Unit
S351	Status TH 2	Unit
S352	Status Humidifier Problem	Unit
S353	Status DT 2	Unit
S354	Status Min CW	Unit
Code	**Set Alarms**	**Type**
S202	Std. Sensor Alarms	Unit
S203	High temperature	Unit
S204	Low temperature	Unit
S205	High humidity	Unit
S206	Low humidity	Unit
S207	Sensor A Alarms	Unit
S208	High temperature sensor A	Unit
S209	Low temperature sensor A	Unit
S210	High humidity sensor A	Unit
S211	Low humidity sensor A	Unit
S213	Customer Input 1	Unit
S214	Customer Input 1 active when	Unit
S215	Customer Input 2	Unit
S216	Customer Input 2 active when	Unit
S217	Customer Input 3	Unit
S218	Customer Input 3 active when	Unit
S219	Customer Input 4	Unit
S220	Customer Input 4 active when	Unit
Code	**Sensor Calibration**	**Type**
S602	Return temperature	Unit
S603	Calibrated Return temperature	Unit
S604	Return humidity	Unit
S605	Calibrated return humidity	Unit
S606	DigiScroll 1 NTC	Unit
S607	Calibrated DigiScroll 1 NTC	Unit
S608	DigiScroll 2 NTC	Unit
S609	Calibrated DigiScroll 2 NTC	Unit
S613	Temperature Sensor A	Unit

S614	Calibrated Temp. Sensor A	Unit
S615	Humidity Sensor A	Unit
S616	Calibrated Humidity Sensor A	Unit
S617	Temperature Sensor B	Unit
S618	Calibrated Temp. Sensor B	Unit
S619	Humidity Sensor B	Unit
S620	Calibrated Humidity Sensor B	Unit
S624	Glycol Sensor PTC or NTC	Unit
S625	Glycol Sensor	Unit
S626	Calibrated Glycol Sensor	Unit
S627	Supply Sensor PTC or NTC	Unit
S628	Supply Sensor	Unit
S629	Calibrated Supply Sensor	Unit
S630	Temperature Sensor C	Unit
S631	Calibrated Temp. Sensor C	Unit
S632	Humidity Sensor C	Unit
S633	Calibrated Humidity Sensor C	Unit
Code	**System / Network Setup**	**Type**
S802	Number of connected units	System
S803	Teamwork Mode	System
S804	IP Address	System
S805	Netmask	System
S806	Gateway	System
S807	MAC	System
S808	U2U Address	System
S809	U2U Protocol	System
S810	U2U Group	System
S811	SW Version	System
S813	Monitoring Address	Unit
S814	Monitoring Protocol	Unit
S815	IP Address	Unit
S816	Netmask	Unit
S817	Gateway	Unit
S818	MAC	Unit
S819	U2U Address	Unit
S820	U2U Protocol	Unit
S821	U2U Group	Unit
S822	SW Version	Unit
Code	**Options Setup**	**Type**
S402	Compressor sequence	Unit
S403	Low pressure alarm delay	Unit
S404	Actual LP1 pressure	Unit
S405	Actual LP2 pressure	Unit
S406	Number of all heat stages	Unit

S407	Electrical	Unit
S408	Hot water On/Off	Unit
S409	Hot gas	Unit
S410	3P actuator runtime	Unit
S411	3P actuator direction	Unit
S413	Humidification enabled	Unit
S414	Infrared Flush Rate	
S415	Dehum enabled	Unit
S416	Electric reheat operation	Unit
Code	**Service contacts**	**Type**
S702	Country	System
S703	Address line 1	System
S704	Address line 2	System
S705	Address line 3	System
S706	Address line 4	System

Advanced Menu

Code	Factory Settings	Type
A002	Unit Code Field: (01-06)	Unit
A003	Set Code: (01-06)	Unit
A004	Unit Code Field: (7-12)	Unit
A005	Set Code: (7-12)	Unit
A006	Unit Code Field: (13-18)	Unit
A007	Set Code: (13-18)	Unit
A008	Send and Execute Unit Code	Unit
A009	Load and Execute XML Code	Unit
A010	Check XML Unit Code	Unit
A011	Status Unit Code	Unit
A102	Refrigerant Type	Unit
A103	Main Fan Overload	Unit
A104	Loss of Airflow	Unit
A105	Number of compressors	Unit
A106	Compressor delay time	Unit
A107	Compressor min on time	System
A108	Compressor min off time	System
A109	Pump down	Unit
A110	Capacity Ctrl.	Unit
A113	Digi Scroll Cycle	Unit
A114	High temperature Digi Scroll	Unit
A115	Digi Scroll switchback	Unit
A116	Low pressure device	Unit

A117	Low pressure threshold Phase 1	Unit
A118	Low pressure threshold Phase 2	Unit
A124	LP1 sensor 0% =	Unit
A124	LP1 sensor 0% =	Unit
A125	LP1 sensor 100% =	Unit
A125	LP1 sensor 100% =	Unit
A126	Actual LP1 signal	Unit
A127	LP2 sensor 0% =	Unit
A127	LP2 sensor 0% =	Unit
A128	LP2 sensor 100% =	Unit
A128	LP2 sensor 100% =	Unit
A129	Actual LP2 signal	Unit
A130	Pump down cutout	Unit
A131	Pump down recycle	Unit
A132	Condenser Control	Unit
A135	CW flush	Unit
A136	CW flush duration	Unit
A137	Freecooling	Unit
A138	Freecooling flush	Unit
A139	Freecooling flush duration	Unit
A140	Freecooling flush starts R5	Unit
A141	CO + FC simultaneously	Unit
A142	Hot water flush	Unit
A143	Hot water flush duration	Unit
A146	Humidifier Model	Unit
A147	Humidity in Last xx Hours	Unit
A148	Prefill Time	Unit
A149	Fill Time	Unit
A150	Humidifier On Time	Unit
A151	Dehum with compressor	Unit
A152	Analog output 1	Unit
A153	Analog output 2	Unit
A154	Analog output 3	Unit
A155	Analog output 4	Unit
Code	**Access**	**Type**
A201	Password Level 1 (User)	System
A202	Password Level 2 (Service)	System
A203	Password Level 3 (Advanced)	System

Glossary of Terms

Address: A pattern of characters that identifies a unique storage location

Algorithm: A set of procedures to obtain a given result

Ambient: Condition on immediately surrounding atmosphere or area: usually refers to temperature or pressure

Analog: Refers to circuitry; also called linear circuitry; circuitry that varies certain properties or electricity continuously and smoothly over a range

Anti-Static Material: A slightly conductive material that allows the net charge to be drained off through a path; an electrostatic protective material having a surface resistively greater than 10^4 but not greater than 10^9 Ohms per square inch (does not generate static electricity)

Binary Number System or Binary Code: A method of writing numbers by using two digits, 0 and 1

Bit: The smallest possible piece of information; a specification of one of two possible conditions. (Bits are written as 1 for yes and 0 for no.)

Bus: Large trace or foil extending around the edge of a PCB to provide conduction for several sources

Byte: A set of adjacent binary digits operated upon as a unit (usually 8 bits)

Charge: The product of capacitance times voltage

CMOS: Complimentary **M**etal **O**xide **S**ubstrate semiconductor

Computer: At least one CPU together with input, output, control switch buttons and memory units

Conductive Material: Material that conducts electrical charge (Because it conducts charge, there is no potential difference across or storage of a static charge.); electrostatic protective material having a maximum surface resistivity of 10 Ohms per square unit, or a maximum volume resistivity of 10 Ohms/cm.

Control Buttons: Push buttons on the display bezels to operate the increase/decrease, advance, or silence functions

Control Switches: Sometimes called dip switches and used for additional programming features on all levels

CPU: Central **P**rocessing **U**nit; the part of a computer system that contains the main storage, arithmetic unit and special register groups (It performs arithmetic operations, controls instruction processing and provides timing signals.)

Data: Another name for information

Data Bus: One method of input/output for a system where data is moved by way of a group of wires forming a common bus

Decrease Button: Control button used to decrease values

Digital: Information in discrete or quantified form, not continuous

DIP: Dual **I**nline **P**ackage; a type of Integrated Circuit (IC)

DIP Switch: Type of electronic switch having multiple, manually selectable settings

Earth ground: The portion of an electrical circuit that is at zero potential with respect to the earth

Electrostatic Field: The field around an electrostatically charged object

Electrostatic Voltage: Voltage generated by the sliding, rubbing or separating action between materials

EPROM: Erasable and **P**rogrammable **R**ead-**O**nly **M**emory; an integrated circuit memory chip whose stored data can be read at random (Data can be erased and new data can be stored.)

ESDS: Electro**S**tatic **D**ischarge **S**ensitive; sensitive to electrostatic voltage of 4000 volts or less as determined by the human test circuit

Fill Period: The period during which the humidifier pan is filled from a partially filled state to the level required for optimum humidification

Firmware: Software stored in EPROM or PROM

Hard Ground: A direct connection to earthground (also refer to soft ground)

Hardware: The PCB, cable, switches and associated devices

Hysteresis: Differential

IC: Integrated **C**ircuit; an assembly that consists of all the necessary parts of an electronic circuit

Impedance: Opposition that a circuit offers to the flow of current through it, measured in Ohms

Input: An incoming information signal

Isolation: Separation of one device or environment from the effects of an adjacent or connected device or environment

Lead Compressor: Compressor coming on first as a result of a call for Cooling 1

Lag Compressor: Compressor coming on second as a result of a call for Cooling 2

LED: **L**ight **E**mitting **D**iode; a semiconductor that emits light when electric current is passed through it by way of two terminals

Manual Override: A means of bypassing triac switches at all levels for manual operation of system components for test or emergency

Memory: In a digital system, the part of the system where information is stored

Microprocessor: An **I**ntegrated **C**ircuit (IC, or set of a few ICs) that can be programmed with stored instructions to perform a wide variety of functions (A microprocessor consists of at least a controller, some registers and some sort of **A**rithmetic **L**ogic **U**nit (ALU).

N-Type Semiconductor: Semiconductor crystal doped to have an excess of free electrons with a predominately negative current carrying capacity (also referred to as a P-Type Semiconductor).

Off Time: The time since humidification was last on

Output: An outgoing information signal

P-N-Junction: Interface boundary between two semiconductor regions with differing electrical properties (Current only flows across the junction in the forward direction if circuit voltage exceeds a certain threshold. Current cannot flow across the junction in the reverse direction.)

P-Type Semiconductor: Semiconductor crystal doped for an excess of holes to enable heavier positive current-carrying capacity (also referred to as an N-Type Semiconductor).

PCB: **P**rinted **C**ircuit **B**oard; made of insulating material with conducting paths secured to one or both sides

Prefill: The period of time between when the water begins to fill the pan and the humidifier lamps turn on

Program: A set of instructions to achieve a certain result

PROM: Programmable **R**ead-**O**nly **M**emory; an **I**ntegrated **C**ircuit (IC) memory chip whose stored data can be read at random (The IC can be used only one time.)

RAM: Random-**A**ccess **M**emory where work can be written (stored) or read (recovered) in any order

Remote: Component(s) or control(s) located at a distance away from the main components or controls

Reset: To return a control to its original position

ROM: Read-**O**nly **M**emory: the location reserved for data permanently stored by the manufacturer

Soft Ground: A connection to ground through an impedance sufficiently high to limit current flow to safe levels for personnel (Impedance needed for a soft ground is dependent upon the voltage levels that can be contacted by personnel near the ground.)

Software: A set of computer programs, procedures and possible associated documentation concerned with the operation of a data processing system

Static-Dissipative Material: Electrostatic protective material having surface restiveness greater than 10^4 but not greater than 10^9 Ohms per square inch

Static-Shielding Material: Material that does not allow spark energy or electrostatic fields to pass through or penetrate it

Surface Resistivity: An inverse measure of the conductivity of a material and equal to the ratio of the potential gradient to the current per unit width of the surface where the potential gradient is measured in the direction of current flow in the material (Surface resistivity is numerically equal to the surface resistance between two electrodes forming opposite sides of a square. The size of the square is immaterial. Its value is measured in Ohms per square inch.)

Transformer: Electromagnetic device for changing the voltage of an AC circuit by induction and/or isolating an AC circuit from its distribution

Triboelectric Effect: The generation of static electricity on an object by contact, separation or friction

Computer and Network Terms

Agent: A program that performs some information gathering or processing task in the background. Typically, an agent is given a very small and well-defined task. Although the theory behind agents has been around for some time, agents have become more prominent with the recent growth of the Internet. Many companies now sell software that enables you to configure an agent to search the Internet for certain types of information.

In computer science, there is a school of thought that believes that the human mind essentially consists of thousands or millions of agents all working in parallel. To produce real artificial intelligence, this school holds, we should build computer systems that also contain many agents and systems for arbitrating among the agents' competing results.

BOOTP: Short for Bootstrap Protocol, an Internet protocol that enables a diskless workstation to discover its own IP address, the IP address of a BOOTP server on the network, and a file to be loaded into memory to boot the machine. This enables the workstation to boot without requiring a hard or floppy disk drive. The protocol is defined by RFC 951.

Cookie: A message given to a Web browser by a Web server. The browser stores the message in a text file called cookie.txt. The message is then sent back to the server each time the browser requests a page from the server. The main purpose of cookies is to identify users and possibly prepare customized Web pages for them. When you enter a Web site using cookies, you may be asked to fill out a form providing such information as your name and interests. This information is packaged into a cookie and sent to your Web browser who stores it for later use. The next time you go to the same Web site, your browser will send the cookie to the Web server. The server can use this information to present you with custom Web pages. So, for example, instead of seeing just a generic welcome page you might see a welcome page with your name on it.

DHCP: Short for Dynamic Host Configuration Protocol, a protocol for assigning dynamic IP addresses to devices on a network. With dynamic addressing, a device can have a different IP address every time it connects to the network. In some systems, the device's IP address can even change while it is still connected. DHCP also supports a mix of static and dynamic IP addresses.

Dynamic addressing simplifies network administration because the software keeps track of IP addresses rather than requiring an administrator to manage the task. This means that a new computer can be added to a network without the hassle of manually assigning it a unique IP address. Many ISPs use dynamic IP addressing for dial-up users. DHCP client support is built into Windows 95 and NT workstation. NT 4 server includes both client and server support.

Ethernet: A local-area network (LAN) architecture developed by Xerox Corporation in cooperation with DEC and Intel in 1976. Ethernet uses a bus or star topology and supports data transfer rates of 10 Mbps. The Ethernet specification served as the basis for the IEEE 802.3 standard, which specifies the physical and lower software layers. Ethernet uses the CSMA/CD access method to handle simultaneous demands. It is one of the most widely implemented LAN standards.

A newer version of Ethernet, called 100Base-T (or Fast Ethernet), supports data transfer rates of 100 Mbps. And the newest version, Gigabit Ethernet supports data rates of 1 gigabit (1,000 megabits) per second.

Internet: A global network connecting millions of computers. More than 100 countries are linked into exchanges of data, news and opinions. Unlike online services, which are centrally controlled, the Internet is decentralized by design. Each Internet computer, called a host, is independent. Its operators can choose which Internet services to use and which local services to make available to the global Internet community. Remarkably, this anarchy by design works exceedingly well. There are a variety of ways to access the Internet. Most online services, such as America Online, offer access to some Internet services. It is also possible to gain access through a commercial Internet Service Provider (ISP).

IP address: An identifier for a computer or device on a TCP/IP network. Networks using the TCP/IP protocol route messages based on the IP address of the destination. The format of an IP address is a 32-bit numeric address written as four numbers separated by periods. Each number can be zero to 255. For example, 1.160.10.240 could be an IP address. Within an isolated network, you can assign IP addresses at random as long as each one is unique. However, connecting a private network to the Internet requires using registered IP addresses (called Internet addresses) to avoid duplicates.

The four numbers in an IP address are used in different ways to identify a particular network and a host on that network. The InterNIC Registration Service assigns Internet addresses from the following three classes.

- Class A - supports 16 million hosts on each of 127 networks
- Class B - supports 65,000 hosts on each of 16,000 networks
- Class C - supports 254 hosts on each of 2 million networks

The number of unassigned Internet addresses is running out, so a new classless scheme called CIDR is gradually replacing the system based on classes A, B, and C and is tied to adoption of IPv6.

Network: A group of two or more computer systems linked together. There are many types of computer networks, including:

- local-area networks (LANs): The computers are geographically close together (that is, in the same building).

- wide-area networks (WANs): The computers are farther apart and are connected by telephone lines or radio waves.
- campus-area networks (CANs): The computers are within a limited geographic area, such as a campus or military base.
- metropolitan-area networks MANs): A data network designed for a town or city.
- home-area networks (HANs): A network contained within a user's home that connects a person's digital devices.

In addition to these types, the following characteristics are also used to categorize different types of networks:

- topology: The geometric arrangement of a computer system. Common topologies include a bus, star, and ring. See the Network topology diagrams in the Quick Reference section.
- protocol: The protocol defines a common set of rules and signals that computers on the network use to communicate. One of the most popular protocols for LANs is called Ethernet. Another popular LAN protocol for PCs is the IBM token-ring network .
- architecture: Networks can be broadly classified as using either a peer-to-peer or client/server architecture.

Computers on a network are sometimes called nodes. Computers and devices that allocate resources for a network are called servers.

Network cross-over cable: A specially designed cable tin which the receive and transmit lines (input and output) are crossed. Used to connect two computers together or hubs. Also called a null modem cable using either RS-232 port connectors or RJ-45 connectors.

Network interface card: Often abbreviated as NIC, an expansion board you insert into a computer so the computer can be connected to a network. Most NICs are designed for a particular type of network, protocol, and media, although some can serve multiple networks.

Null-modem cable: A specially designed cable that allows you to connect two computers directly to each other via their communications ports (RS-232 ports). Null modems are particularly useful with portable computers because they enable the portable computer to exchange data with a larger system.

Protocol: An agreed-upon format for transmitting data between two devices. The protocol determines the following:

- the type of error checking to be used
- data compression method, if any
- how the sending device will indicate that it has finished sending a message
- how the receiving device will indicate that it has received a message

There are a variety of standard protocols from which programmers can choose. Each has particular advantages and disadvantages; for example, some are simpler than others, some are more reliable, and some are faster. From a user's point of view, the only interesting aspect about protocols is that your computer or device must support the right ones if you want to communicate with other computers. The protocol can be implemented either in hardware or in software.

RJ-45: Short for Registered Jack-45, an eight-wire **connector** used commonly to connect computers onto a **local-area networks (LAN)**, especially **Ethernets**. RJ-45 connectors look similar to the ubiquitous **RJ-11 connectors** used for connecting telephone equipment, but they are somewhat wider.

SNMP: Short for Simple Network Management Protocol, a set of protocols for managing complex networks. The first versions of SNMP were developed in the early 80s. SNMP works by sending messages, called protocol data units (PDUs), to different parts of a network. SNMP-compliant devices, called agents, store data about themselves in Management Information Bases (MIBs) and return this data to the SNMP requesters.
SNMP 1 reports only whether a device is functioning properly. The industry has attempted to define a new set of protocols called SNMP 2 that would provide additional information, but the standardization efforts have not been successful. Instead, network managers have turned to a related technology called RMON that provides more detailed information about network usage.

TCP/IP: Abbreviation for Transmission Control Protocol/Internet Protocol, the suite of communications protocols used to connect hosts on the Internet. TCP/IP uses several protocols, the two main ones being TCP and IP. TCP/IP is built into the UNIX operating system and is used by the Internet, making it the de facto standard for transmitting data over networks. Even network operating systems that have their own protocols, such as NetWare, also support TCP/IP.

10BaseT: One of several adaptations of the Ethernet (IEEE 802.3) standard for Local Area Networks (LANs). The 10Base-T standard (also called Twisted Pair Ethernet) uses a twisted-pair cable with maximum lengths of 100 meters. The cable is thinner and more flexible than the coaxial cable used for the 10Base-2 or 10Base-5 standards. Cables in the 10Base-T system connect with RJ-45 connectors. A star topology is common with 12 or more computers connected directly to a hub or concentrator. The 10Base-T system operates at 10 Mbps and uses baseband transmission methods.

Understanding IP Addressing: Every computer that communicates over the Internet is assigned an IP address that uniquely identifies the device and distinguishes it from other computers on the Internet. An IP address consists of 32 bits, often shown as 4 octets of numbers from 0-255 represented in decimal form instead of binary form. For example, the IP address 168.212.226.204 in binary form is: 10101000.11010100.11100010.11001100.

But it is easier for us to remember decimals than it is to remember binary numbers, so we use decimals to represent the IP addresses when describing them. However, the binary number is important because that will determine which class of network the IP address belongs to. An IP address consists of two parts, one identifying the network and one identifying the node, or host. The Class of the address determines which part belongs to the network address and which part belongs to the node address. All nodes on a given network share the same network prefix but must have a unique host number.

Class A Network: Binary address start with 0, therefore the decimal number can be anywhere from 1 to 126. The first 8 bits (the first octet) identify the network and the remaining 24 bits indicate the host within the network. An example of a Class A IP address is 102.168.212.226, where "102" identifies the network and "168.212.226" identifies the host on that network.

Class B Network: Binary addresses start with 10, therefore the decimal number can be anywhere from 128 to 191 (the number 127 is reserved for loopback and is used for internal testing on the local machine). The first 16 bits (the first two octets) identify the network and the remaining 16 bits indicate the host within the network. An example of a Class B IP address is 168.212.226.204 where "168.212" identifies the network and "226.204" identifies the host on that network.

Class C Network: Binary addresses start with 110, therefore the decimal number can be anywhere from 192 to 223. The first 24 bits (the first three octets) identify the network and the remaining 8 bits indicate the host within the network. An example of a Class C IP address is 200.168.212.226 where "200.168.212" identifies the network and "226" identifies the host on that network.

Class D Network: Binary addresses start with 1110, therefore the decimal number can be anywhere from 224 to 239. Class D networks are used to support multicasting.

Class E Network: Binary addresses start with 1111, therefore the decimal number can be anywhere from 240 to 255. Class E networks are used for experimentation. They have never been documented or utilized in a standard way.

Network Information

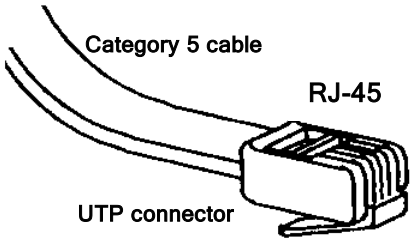
Commonly known as: Network wire, Ethernet cable, Cat5 cable, the information following will explain the connectivity for Liebert Environmental units. Fundamentally, this section will explain the terms of networking so that you can apply the information to building your own network. The parts and components are discussed in generic fashion since equipment manufacturers and price range of the equipment varies and changes on an almost daily basis. However, the terms themselves stay relatively consistent, so purchasing or discussing your needs with networking personnel remains the same.

What is networking?…

In it's simplest form, a network can be created when 2 units are connected through communication wires. This simple connection requires a special "crossover" cable which "crosses" the receive and transmit lines (hence, the name of the cable) and is readily available at your local computer store. However, for most applications, the simpler and more generic installation requires network cables and a hub or switch as explained below.

NETWORK CABLING

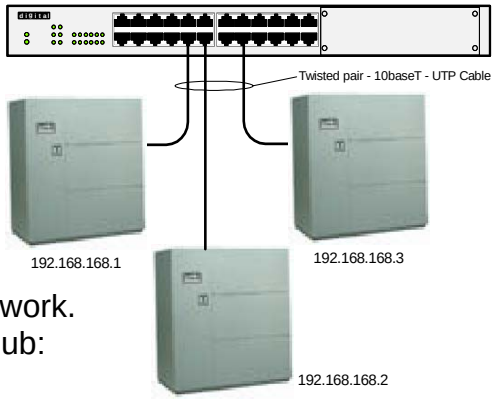
Twisted Pair Ethernet (10baseT), sometime also called "UTP" from "Unshielded Twisted Pair", is based on using a cable and connectors similar to phone-wiring. The cable is connected via an RJ-45 connectors to the network connection installed in the Air Unit. The wire itself is generally called Category 5 wire.



HUBS AND SWITCHES

The opposite end of the network cable connects each Air Unit to the "hub" or "switch": these devices amplify and distribute the signal to other connected units. Switches and hubs range in prices from $20 to thousands depending on the application. Most businesses have standardized on their networking equipment, so there is one probably already installed. Hubs are like mechanical devices where the connections themselves are automatically switched, allowing you to "bus" 2 or more devices easily. In a hub, only 1 device can communicate at a time.

Switches perform the same mechanical function, but they also include software inside that allows communication to operate at faster speeds and allow for multiple unit communication. Switches are the latest technology, but you are safe to use either device.



Hubs are available in different configuration, with 4, 8, 12, 15 or 24 RJ-45 connections. You can plug in the RJ45-connector into a hub while the network is running on the other connected systems, allowing you to move / add systems without having to shutdown the network. As network grow, you may need a second hub:

UNIT IDENTIFICATION OR ADDRESSING

The units are separated and identified through their TCP/IP address. TCP/IP refers to the protocol or language being used to communicate between the Environmental Units. The addresses are arranged in 32-bit numbers. To make it easier to memorize such IP-addresses, they are usually expressed as 4 8-bit numbers (example: 192.168.10.1), where each of the 4 numbers is within the range of '0' to '255' (there are restriction on using '0' and '255', avoid using them.)

When setting up a small private network, you are free to use ANY IP-address, however, when you are connected to a company network, you need to ask the Network-administrator to assign you an IP-address. And if you are connected to the Internet, your ISP (Internet Service Provider) will assign an IP-address to you.

Even if a network is NOT connected to the Internet, it has become custom to use on private networks a range of IP-addresses, which are reserved for private networks (that makes it later possible to connect your private network to the Internet without having to re-configure everything). The reserved IP-address is: **192.168.x.y**, where x=same number on all systems and y=different/unique number on all systems.

See the example above under HUBS AND SWITCHES for an example of this configuration.

How To Use The Schematics

As you look at the outside edge of the electrical schematic (drawing), you will see the numbers 8 through 1 (reading left to right) across the top and bottom and the letters D through A (reading from top to bottom) along both the left and right edges of the schematic. These numbers and letters are called locators, just like on a map. By intersecting the number and letter into the drawing, you can locate the section of the schematic you need to reference.

The next area of interest is the line numbers along both sides of the schematic. By using these line numbers and a straight edge, you can pinpoint a particular item in the located section. Also, useful is the Nomenclature section along the right side of the schematic. The nomenclature sections refers identifies the device by abbreviation and name and indicates on which line the device is found.

If you look deep into the schematic, you can see that the transformer section is laid out in a ladder progression making it easy to follow-out each circuit. You may wish to highlight each circuit with a marker making it easy to follow.

The number indicators in the area to the right of the ladder circuit section are also important. These are the contact locators for each relay or contactor shown on the drawing. The number represents the line location of the contact(s) for the adjacent shown relay or contactor. There are two types of line number indicators. One is highlighted with a bar across the top of the number, this indicates a normally closed contact. The other number shown without the bar indicates a normally open contact. Remember that the drawing is shown in the non-powered (de-energized) state.

These drawings are the latest revisions at publication of this manual and are what Liebert calls Universal drawings. Liebert has included numerous options on each one of these drawing to help in troubleshooting the system. These drawings may or may not be on your particular unit.

It is important to become familiar with legend, nomenclature and notes on each drawing.

Electrical Schematics

182769 Liebert DS iCOM Global Control 8 - 12 Ton
182770 Liebert DS iCOM Global Control 15 – 30 Ton, 380 – 575V
182771 Liebert DS iCOM Global Control 15 – 30 Ton, 200 – 230V
182772 Liebert DS iCOM Global Control 8 - 12 Ton, SCR Reheat
182952 Connection Drawing Liebert DS

Notes