



H-IM-80D

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Part No. 25000601

Replaces H-IM-80C (12/03)

# Beacon II Smart Controller Installation & Operation Manual

## Table of Contents

Features .....	2-3
Installation .....	4
Wiring .....	5
Power Supply .....	6
Initialization of Beacon II Smart Controller .....	7
Button Functions .....	7
Programming Beacon II Smart Controller .....	8
Monitoring Beacon II Smart Controller .....	9
Locking Beacon II Smart Controller .....	10
Error Codes .....	10
Wiring Errors .....	11
Alarm Codes .....	11
Alarm Buzzer .....	12
Data Logging .....	12
Smart Defrost .....	13
PC & Modem Access .....	14
System Defaults .....	15
Parts List .....	16
Operational Limits .....	16
Diagnostics .....	17-20
Wiring Diagrams .....	21-23

# Beacon II Smart Controller Features



The Beacon II Smart Controller performs all the standard Beacon functions with the additional benefit of:

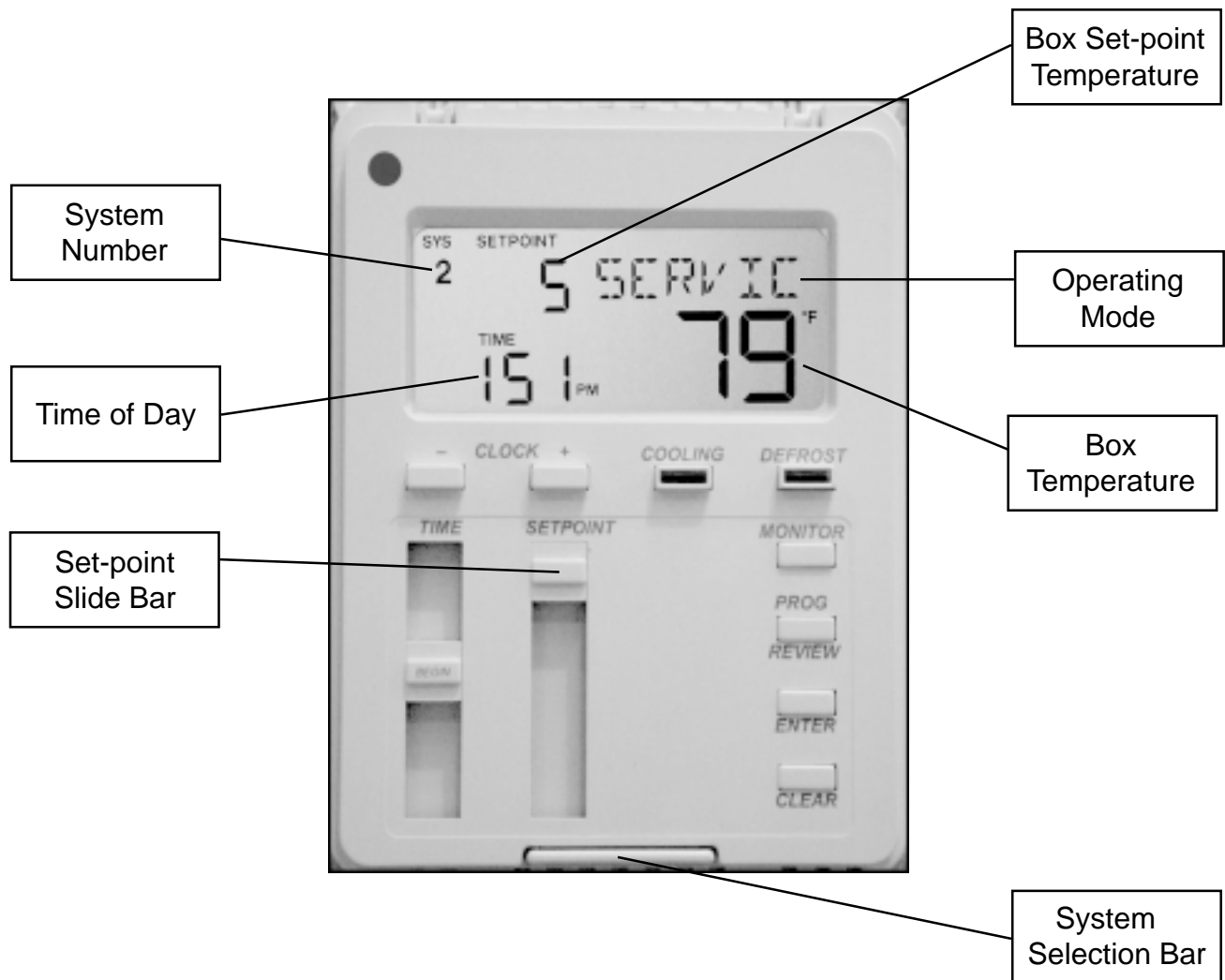
- a) Remote mounting for easy access
- b) Remote monitoring and programming
- c) Controlling four completely separate systems
- d) Logging data
- e) Smart Defrost
- f) Access via PC or modem
- g) Has buzzer to signal alarms
- h) Locking keypad

Beacon II Smart Controller allows complete monitoring and programming of the system. The Controller display has the following buttons: COOLING, DEFROST, PROG REVIEW, MONITOR, ENTER, CLEAR, SETPOINT AND TIME.

The normal LCD display will show the Programmed Box Set-point temperature. Actual Box Temperature, the Current Time of day and the Mode (i.e. COOL, DEFROST or OFF). When multiple systems are being controlled, the system number (i.e. SYS 1, SYS 2, SYS 3, SYS 4) will also be displayed on the LCD.

# Beacon II Smart Controller Features

- Monitoring of the complete refrigeration system.
- Programming of a variety of parameters for the optimum control of the refrigeration system.
- The Beacon II Smart Controller has a Liquid Crystal Display (LCD) which shows: current time, actual box temperature, box temperature set-point and if there is an alarm or fault condition.
- Data Logging.
- Smart Defrost to save energy on defrost.
- Sounds a buzzer to indicate an Alarm condition.
- Can be mounted up to 1000 ft. away from the system being controlled.
- Each Beacon II Smart Controller can control **four independent systems** with up to 4 evaporators on each system.
- An RS232 port is provided which allows connection to system via PC or Modem.
- A Backup battery will maintain the clock settings for 10 years.
- Double E PROM Chip will maintain program settings indefinitely.
- Password protection system.
- Locking feature to prevent unauthorized access to program settings.



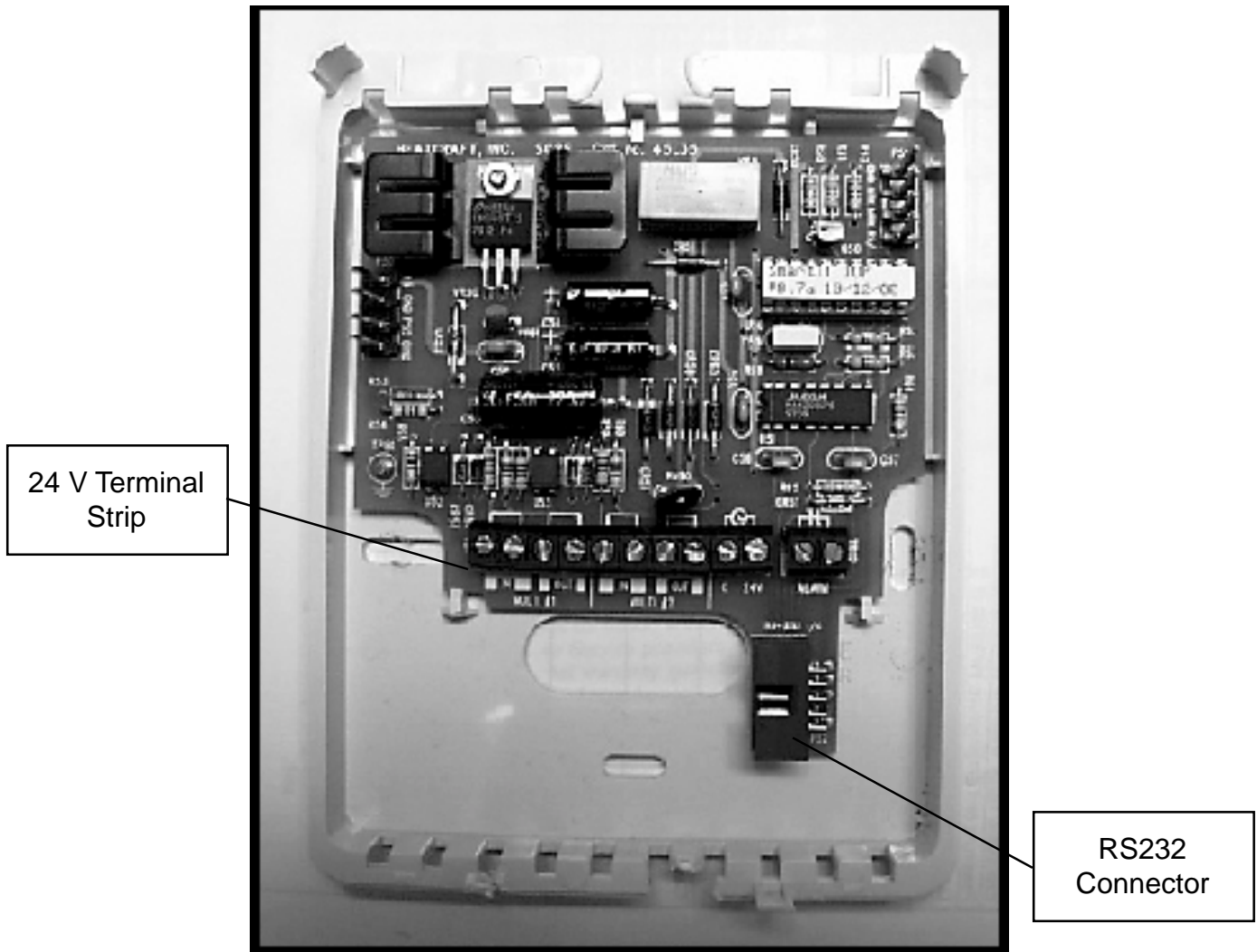
# Installation

## INSTALLATION

The Beacon II Smart Controller should be installed in a location where the large Liquid Crystal Display (LCD) can be viewed easily, yet is secure and vibration free. Because of the LCD screen, the Beacon II Smart Controller should not be mounted where it will experience temperatures below 40°F or above 100°F.

A terminal strip for wiring connections is located on the base of the Beacon II Smart Controller. To access this terminal strip, pull both halves of the Beacon II Smart Controller housing apart. Mounting holes are located in the plastic base.

## Beacon II Smart Controller Base



# Wiring

## WIRING

**All 24 volt wiring must be run separate from the line voltage wiring.**

All Low voltage wiring must be 18 gauge minimum and must be run separate from high voltage wiring. The maximum distance from the Beacon II Smart Controller to the Master Evaporator is 1000 ft.

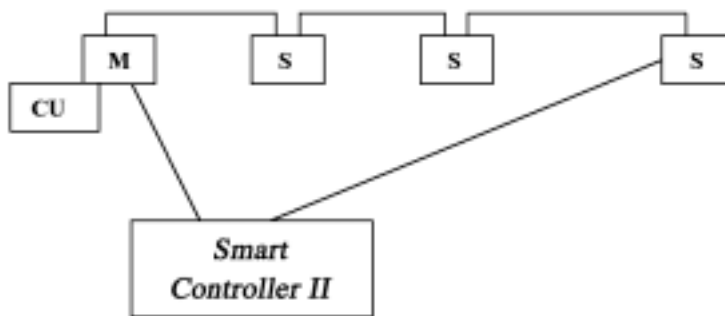
The terminal strip in the Beacon II Smart Controller is labeled similarly to that of the Beacon II boards. Connect the corresponding terminals to those on the Beacon board.

For single Refrigeration system:

Connect **MULTI OUT 1** from the Beacon II Smart Controller to the **MULTI IN** on the Beacon board on the Evaporator. Then connect **MULTI IN 1** from the Beacon II Smart Controller to the **MULTI OUT** on the Beacon board on the Evaporator. See typical wiring diagram at the back of these instructions.

On systems with multiple evaporators the Beacon II Smart Controller must be wired to the Master Evaporator first. **DO NOT** disconnect the Room sensor from any of the Evaporators.

## SINGLE SYSTEM CONNECTION



M = Master Evaporator    S = Slave Evaporator    CU = Condensing unit

## For MULTIPLE independent Refrigeration systems:

For the **first** system, connect **MULTI OUT 1** from the Beacon II Smart Controller to the **MULTI IN** on the Beacon II board on the Evaporator in this **first** system. Then connect **MULTI IN 1** from the Beacon II Smart Controller to the **MULTI OUT** on the Beacon II board on the Evaporator on this **first** system. **DO NOT** disconnect the Room sensor from any of the Evaporators. See typical wiring diagram at the back of these instructions.

# Power Supply

For the **second** system, connect **MULTI OUT 2** from the Beacon II Smart Controller to the **MULTI IN** on the Beacon II board on the Evaporator in this **second** system. Then connect **MULTI IN 2** from the Beacon II Smart Controller to the **MULTI OUT** on the Beacon II board on the Evaporator on this second system. See typical wiring diagram at the back of these instructions.

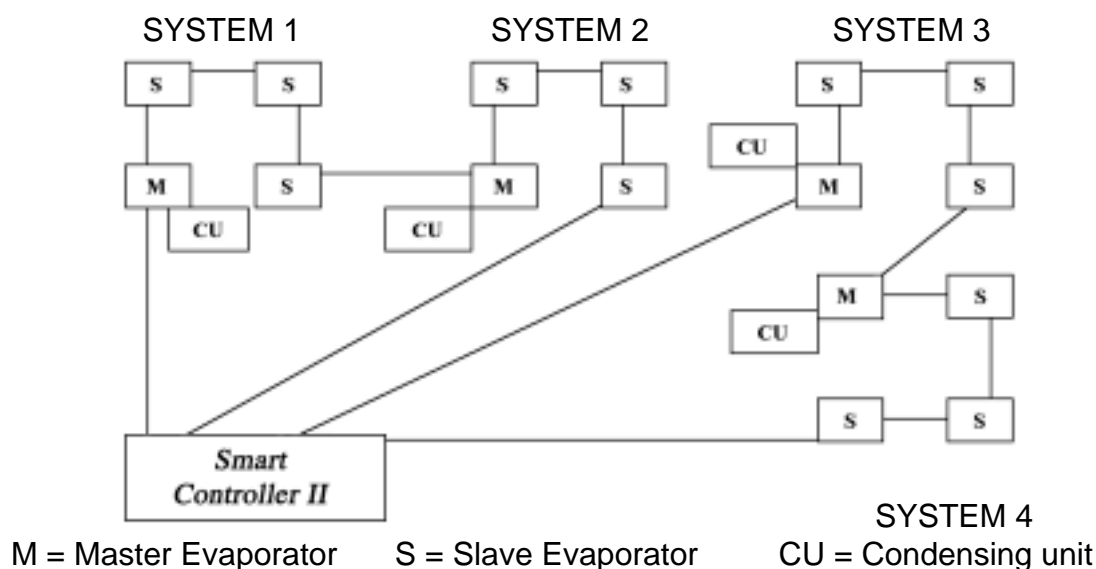
On systems with multiple evaporators the Beacon II Smart Controller must be wired to the Master Evaporator first. **DO NOT** disconnect the Room sensor from any of the Evaporators.

**DO NOT CONNECT 24V & C BETWEEN EVAPORATORS.**

The Beacon II Smart Controller and the evaporators are then connected in a daisy-chain fashion. (See the wiring diagrams in the back of this manual)

A minimum 18 gauge wire should be used. All low voltage wiring must be run separate from high voltage wiring.

## MULTIPLE SYSTEM CONNECTION



## POWER SUPPLY

The Beacon II Smart Controller gets its 24 VAC power supply from the evaporator. When controlling multiple systems, the Beacon II Smart Controller is powered from the evaporator of only one of the systems. If a power interruption occurs to the system supplying the Beacon II Smart Controller, the Beacon II Smart Controller LCD screen will go blank. The other systems will, however, continue to operate and maintain their box temperature.

The Beacon II Smart Controller can be supplied with its own power supply by using a 24 VAC Universal Plug-in Power Source with a minimum of 300 mA. When powered by an independent power supply, if power is lost to the Beacon II Smart Controller the systems

# Initialization of Beacon II Smart Controller

will continue to operate and maintain the box temperature. **This occurs only if an external power supply is used on the Beacon II Smart Controller.**

If the Beacon II Smart Controller LCD displays all **88888** this indicates that the power supply is below 18 VAC. When this occurs the system will power down and shut off. When the power supply is corrected to 24 VAC, the system will restart after the four-minute hold off period and resume normal operation. The Beacon II Smart Controller LCD display will then be normal.

## INITIALIZATION of BEACON II SMART CONTROLLER

When power is first applied to the Beacon II Smart Controller it checks the configuration of the system to which it is connected and stores this in its memory. Beacon II Smart Controller checks how many condensing units there are and how many evaporators are connected to each condensing unit. The order in which the units are wired from the multi-out of the Beacon II Smart Controller determines the unit ID (UNI-4) assigned by the Beacon II Smart Controller. This is called initialization. ***Whenever a system is added, removed or modified (changing the number of evaporators on a condensing unit), while connected to the Beacon II Smart Controller, it must be re-initialized.***

Place all systems in the service mode before initializing the Beacon II Smart Controller. Make sure all wiring changes to the system and the Beacon II Smart Controller are complete and accurate before initializing the Beacon II Smart Controller. Each SLAVE Evaporator must also be programmed as a SLAVE BEFORE the system is initialized. The "SLA" setpoint must be set from the board programming. It cannot be done from the Beacon II Smart Controller.

To initialize the Beacon II Smart Controller (for version 1.2),

- Press and Hold both the **ENTER** and **CLEAR** buttons until the LCD displays **EEROM?**
- Release the **ENTER** and **CLEAR** buttons quickly, then press the **ENTER** button
- The LCD will display **WAIT**

It may take up to 2 minutes to complete the initialization of the system after which the normal LCD screen will appear.

## BUTTON FUNCTIONS

- **SYSTEM SELECTION BAR:** If two or more systems are being controlled from the Beacon II Smart Controller, this bar allows switching between systems. The display will show the SYS number and all parameters related to that system. The cover plate of Beacon II Smart Controller, when pushed will also change the display between systems.
- **CLOCK (+ -)** This is used to set the time of day on the display.
  - Depress the + button to move the clock forward
  - Depress the - button to move the clock backward
  - When in **PROG Mode**, these are used to step through values for setting superheat etc. for each evaporator of the system(s) attached to the Beacon II Smart Controller and for different defrost start time periods.

# Programming Beacon II Smart Controller

- **COOLING:** Depressing this button will start the system in the cooling cycle immediately (The 4 minutes “Hold Off” is bypassed). This button will illuminate to indicate that the Cooling function is “ON”. System operation will be as described under REFRIGERATION MODE in the Beacon II installation manual.

Pressing the COOLING button while the system is cooling, and the button illuminated, will pumpdown the system and turn it off.

- **DEFROST:** Depressing this button will force the system into defrost immediately (The “Hold Off/Hold On” times are bypassed). This button will illuminate to indicate that the Defrost function is “ON”. When in Defrost, pressing this button a second time will end defrost.
- **MONITOR:** Depressing the MONITOR button will display the setpoints shown on page 10.

*If one Beacon II Smart Controller is controlling two or more independent systems, you must press the **SELECTION BAR** to display information on the system you want to monitor. If multiple evaporators are connected to the system displayed, you must press the “+” or “-” buttons to display information on the evaporator you want to monitor.*

- **PROG REVIEW:** This button allows stepping through each of the setpoints for initial setup and to make changes.

*If one Beacon II Smart Controller is controlling two or more independent systems, you must press the **SELECTION BAR** to display information on the system you want to make program changes. If multiple evaporators are connected to the system displayed, you must press the “+” or “-” buttons to display information on the evaporator you want to monitor.*

- **CLEAR:** Used to clear incorrect entries while programming or to return to the System display when monitoring.
- **TIME:** Slide-bar is used to set the thermostat clock for Defrost times.
- **SETPOINT:** Slide-bar is used to change settings while programming.
- **ENTER:** To enter new settings into the program. NOTE: Settings are recorded in memory even if power fails.

## PROGRAMMING BEACON II SMART CONTROLLER

To make a change, press the **PROG REVIEW** button until the setpoint item that needs to be changed is displayed. The **SETPOINT** Slide-bar is then used to change to the desired new setting. When the new desired setting is displayed, press the “ENTER” button. The new setting is now programmed into the Beacon II Smart Controller memory.

Press the **PROG REVIEW** button and follow the steps below (to back up one step during programming, while pressing the “MONITOR” button, press the “PROG REVIEW” button):

- **DEFTYP – ELE or AIR:** Select for Electric Defrost or Air Defrost then press “ENTER”. This selection will automatically set the defaults for Air and Electric Defrost. **Important:** This will set the refrigerant type to R22 for Air and R404A for Electric. **You must change to the refrigerant you are using in your application if these are incorrect.**
- **REFTYP – 22, 404, 507.** Use “SETPOINT” slide-bar to display desired value, then press “ENTER.”
- **BOXTMP – Box Temp:** -30° F to 70° F. Use “SETPOINT” slide-bar to get desired temp., then press “ENTER.”



# Monitoring With Beacon II Smart Controller

- **SUPRHT – Superheat:** 4 to 20 ° F. Use “SETPOINT” slide-bar to select desired superheat temp., then press “ENTER.” If multiple evaporators are connected, use the “+” button to set other evaporators on this system.
- **SMT DFT: Smart Defrost:** On/Off. Use “SETPOINT” slide-bar to turn it ON or OFF, then press “ENTER” - (for version 1.2. When Smart Defrost is turned on, 8 defrost periods per day will automatically be programmed. These will be at 12:00 am, 3:00 am, 6:00 am, 9:00 am, 12:00 pm, 3:00 pm, 6:00 pm, and 9:00 pm. Also, the defrost fail safe time will be set to 60 minutes, and the defrost termination temperature will be set to 55°F. The user can change these as needed for the application).
- **DEF ST- Defrost Start time:** Up to 12 settings per day (For **dF 1**, use the “TIME” slide-bar to select first defrost time, then press “ENTER”. Use + button to scroll to next defrost period, **dF 2**, use “TIME” slide-bar to select second defrost time and press “ENTER”. Repeat steps for each required defrost period). **If defrost times are not programmed the system will use the defaults:** Electric Defrost - four per day at 4:00 AM, 10:00 PM, 4:00 PM, 10:00 AM. Air Defrost - two per day at 9:00 AM, 9:00 PM.
- **DEFSAF – Defrost Fail Safe Time:** 10 to 200 minutes. When this time has elapsed, the defrost cycle will end, even if the programmed Defrost Termination temperature was not achieved. Use “SETPOINT” slide-bar to select desired time, then press “ENTER”.
- **DEFTMP – Defrost Termination Temperature:** 40 to 100° F. Use “SETPOINT” slide-bar to select desired temp., then press “ENTER”. If multiple evaporators are connected, use the “+” button to set other evaporators on this system.
- **ALR HI – Alarm High Temperature.** -40 to 90° F. Use “SETPOINT” slide-bar to select desired temp., then press “ENTER”.
- **ALR LO – Alarm Low Temperature** -40 to 90° F. Use “SETPOINT” slide-bar to select desired temp., then press “ENTER”.
- **ALRMIN – Alarm Time**, in minutes. Condition must exceed before alarm is indicated: 2 to 120 min. Use “SETPOINT” slide-bar to select desired time, then press “ENTER”.
- **° F / ° C – ° F or ° C.** Use “SETPOINT” slide-bar to select then press “ENTER”.
- **12/24H – Clock:** 12H is for standard time. 24H is for international time. Use “SETPOINT” slide-bar to select, then press “ENTER”.
- **TEST: OFF or ON:** Puts all evaporators in TEST mode. **Use with Caution.** This will cycle each output at 10 second intervals. Use “SETPOINT” slide-bar to select, then press “ENTER”. Return to “OFF” and then press “ENTER” to end the test.
- **SERVIC – ON or OFF:** When placed in the ON mode this will pump the system down and shut it off. The system will not restart until *SERVIC* is placed back in the OFF mode.

When multiple evaporators are connected as master/slave, depressing the + or - button will display information specific to each evaporator. Units in a master/slave connection are numbered 1 through 4. **The first evaporator connected to the BEACON II SMART CONTROLLER MULTI-OUT Terminals is Evaporator # 1.**

## MONITORING with BEACON II SMART CONTROLLER

The Monitoring function can be used to monitor live system data. The information displayed, such as superheat, is the actual superheat of the system as it is changing.

Press the MONITOR button and follow the steps below (to back up one step during monitoring, while pressing the “PROG REVIEW” button, press the “MONITOR” button):

- **SUPRHT – Superheat** (use + button to check superheat of other evaporators, if Master/slave)

# Locking Beacon II Smart Controller & Error Codes

- *EXVSET*- **Expansion valve step setting** (Stepper Motor setting 0 to 255 steps: use + button to check other evaporators if Master/slave)
- *SUCTMP*- **Evaporator Suction temperature** (Measured by the Suction Sensor)
- *SSVTMP*- **Saturated Suction temperature at the Evaporator** (Determined by Suction Transducer)
- *SUCPRE*- **Evaporator Suction Pressure** (Measured by Suction Transducer)
- *OD TMP*- **Actual outdoor ambient temperature** (Measured at the Condensing Unit)
- *DEFTMP*- **Evaporator coil temperature** (Used to terminate defrost)
- *DEFTIM*- **Defrost Time**: Length of last defrost
- *CMPCYC*- **Comp Cycles**: No of Compressor Cycles since 12:00 midnight
- *CMPRUN*- **Comp run time** (Measured since 12:00 midnight)
- *SPRTMP*- **Spare sensor temperature input**
- *VERSON*- **Software Version**: For each controller (use “+” button to check other evaporators, if Master/slave)
- *VERSON*- **Software Version**: for Beacon II Smart Controller

When multiple evaporators are connected as master/slave depressing the + or - button will display information specific to each evaporator. Units in a master/slave connection are numbered 1 through 4.

**The first evaporator connected to the BEACON II SMART CONTROLLER MULTI-OUT Terminals is Evaporator # 1.**

## LOCKING BEACON II SMART CONTROLLER

BEACON II SMART CONTROLLER is lockable to prevent programmed settings changes by unauthorized personnel. When the Controller is Locked, all the Buttons, except for the Monitor and Prog Review Buttons, are disabled.

**To LOCK** the settings, do the following:

- Press “PROG REVIEW” button.
- Press and **hold** “MONITOR” button
- **While holding** “MONITOR” button, Press “ENTER” button.
- The LCD will display **LOCK**

This will prevent unauthorized persons from changing any settings for system displayed. **To UNLOCK** the Controller, repeat these steps. LCD will display “UNLOCK.” Note: Each system must be locked or unlocked separately.

## ERROR CODES

- *\*BXSEN* - Room temperature sensor shorted, open or not installed
- *\*DFSEN* - Defrost temperature sensor shorted, open or not installed
- *\*STSEN* - Suction Temperature sensor shorted, open or not installed

# Wiring Error & Alarm Codes

- *\*SPSEN* - Suction pressure transducer shorted, open or not installed
- *\*ODSEN* - Outdoor temperature sensor shorted
- *\*SUPLO* - Superheat too low
- *\*SHTDN* - Compressor shutdown (High or low refrigerant pressure or low oil pressure)

The error code will flash alternately with the normal display information. When the error condition is corrected, the error code will no longer be displayed and only the normal information will be displayed.

\*All errors for all units connected to the Beacon II Smart Controller will be displayed with an appropriate indicator for the unit experiencing the error. The individual boards will also display the errors.

## WIRING ERROR

If the Beacon II Smart Controller LCD displays **+COMM+**, this indicates that there is an error in the communication wiring or that the wiring is broken or disconnected. Occurrence of this error on the connected unit will indicate which wires are faulty.

The communication wiring is the MULTI IN and MULTI OUT connections. Check to make sure the OUT is connected to IN. Never connect OUT to OUT or IN to IN.

## ALARM CODES

- *\*BOXHI*: Box temperature too high
- *\*BOXLO*: Box temperature too low
- *\*STRUP*: System Start-up failure (Compressor pumps down and tries to restart after 4 minutes.)
- *\*INFLT*: Input fault (Box Temp., Suction Temp., Pressure Transducer open or not installed)
- *Power failure*

When an ALARM condition occurs, the Beacon II Smart Controller will display "CALL FOR SERVICE", the ALARM code, the SYSTEM Number and will sound an internal buzzer along with the closure of alarm contacts on controller.

The alarm code will flash alternately with the normal display information. When the alarm condition is corrected, the alarm code will no longer be displayed and only the normal information will be displayed.

The system will pumpdown and cycle off and will **not restart** until the fault is cleared for the following conditions:

- Suction sensor shorted, open or not installed
- Room temperature sensor shorted, open or not installed
- Pressure Transducer open or not installed

# Alarm Buzzer & Data Logging

The system will pumpdown, cycle off and **try to restart for three consecutive times**. Each try will be after the 4 minutes "Hold Off" period, for the following fault conditions.

Oil pressure

High pressure or low pressure cutout (or any other compressor safeties)

After the fourth try, the Alarm contacts will be closed and an alarm message displayed on the LCD screen. To clear this condition, the system should be cycled through the "Service" mode after correction is complete.

On Multiple systems the Alarm contacts on each of the Master Evaporator will also announce Alarms for that system.

## ALARM BUZZER

The ALARM buzzer will sound when an Alarm condition occurs. This buzzer will turn off when the Alarm condition is cleared. The buzzer can also be silenced at any time by pressing the "CLEAR" button.

## DATA LOGGING

Beacon II Smart Controller logs system data in its memory every 15 minutes. The length of time it records data is dependent on how many systems are being controlled by the Beacon II Smart Controller. It keeps writing data to its memory until the memory is full. When the memory is full it will overwrite its oldest stored data in memory with newly recorded data.

Data recorded: **System Mode, Box Temperature, AUX Temperature, Superheat, Suction Pressure and the Number of Compressor cycles since midnight.**

Errors and Alarms recorded: **Date, Time, System #, Unit #, Error type, Alarm type, Error duration and Alarm duration**

Length of data recorded: One System = 30 days  
Two Independent Systems = 15 days  
Three Independent Systems = 10 days  
Four Independent Systems = 7 days

Recording intervals: Every 15 minutes  
All recorded data will have a date/time stamp.

On multiple evaporator systems, the data recorded is from the master evaporator only. This data is available via connection to a PC through the Beacon II Smart Controller's RS232 serial port. The data can be viewed on a PC using our Windows based SMART II software and can be imported into an Excel spreadsheet.

# Smart Defrost

Real-time data can also be recorded and stored on a Desktop PC while the PC is connected to the Beacon II Smart Controller. The PC will continuously request information from the Beacon II Smart Controller regarding system operation and setup and record this data every minute, in an Excel spreadsheet. This information is stored to the PC hard drive, which depending on the size of the hard drive, would allow for many days of recording. This data may also be periodically saved on a disk by the user.

The SMART II software is sold separately from the Beacon II Smart Controller.

## SMART DEFROST

The Beacon II Smart Controller continuously monitors the system performance to determine the need for defrost. It uses a variety of data such as the outdoor ambient and box temperature in its decision making process.

### Activating Smart Defrost:

After your system has been running for a week or two with normal defrost operation and the system has operated normally with no problems, you may consider activating Smart Defrost.

You must program multiple defrost times into the Beacon II Smart Controller to provide flexibility for the system to defrost the coil properly. Smart Defrost will only allow the system to defrost at a programmed defrost time. The system will not defrost in between programmed defrost times. Hence, we recommend that a minimum of **8 defrost periods** be programmed when Smart Defrost is turned on. The system will not defrost eight times per day but with this many defrost periods it will have better options to keep the coil clear and to allow the system to operate at optimum condition.

After programming the minimum 8 defrost periods, all that's needed to activate Smart Defrost is to press the "*PROG REVIEW*" button until "*SMT DFT*" is displayed. Also, it is recommended that the defrost fail-safe time be increased to 60 minutes.

Move the "*SETPOINT*" slide-bar to "ON" then press "*ENTER*". Press "*CLEAR*" to return to the main screen.

When Smart Defrost is turned on, 8 defrost periods per day will automatically be programmed. These will be at 12:00 am, 3:00 am, 6:00 am, 9:00 am, 12:00 pm, 3:00 pm, 6:00 pm, and 9:00 pm. Also, the defrost fail safe time will be set to 60 minutes, and the defrost termination temperature will be set to 55°F. The user can change these as needed for the application (for version 1.2).

### Deactivating Smart Defrost:

To turn Smart Defrost off move the "*SETPOINT*" slide-bar to "*OFF*" then press "*ENTER*". Press "*CLEAR*" to return to the main screen.

# PC And Modem Access

## PC & MODEM ACCESS

For access to the system from a PC directly or via a modem, the SMART II Software must be purchased and installed on your PC. With PC access, ALL system settings can be monitored, changed or logged from a remote location. The stored data can be viewed in an Excel spreadsheet.

### Recommended Requirements

PC with a 233 Mhz clock speed or higher

128 MB or higher RAM.

A CD drive.

Hard Drive with 100 MB of Free space. Requires 20 MB for installation.

(Data logging to a Hard Drive will require additional storage space).

A VGA monitor.

Windows 95 or later.

When purchased, Heatcraft will supply the software on a CD, a 6 ft. null modem cable, a 12" ribbon cable and a detailed instruction booklet. The null modem cable can be used to connect directly to a PC's serial port. A modem cable must be supplied with the modem for connection to the Beacon II Smart Controller.



For the connection of multiple Beacon II Smart Controllers to a single communication device (PC or modem).



Maximum configuration:

- 4 Beacon II Smart Controllers™ connected to one Communications Hub (4 systems per Beacon II Smart Controller™ equals 16 systems with maximum of 64 evaporators)
- 16 Beacon II Smart Controllers™ connected to five Communications Hubs (4 systems per Beacon II Smart Controller™ equals 64 systems with maximum of 256 evaporators; Communications Hubs can only be cascaded once)

# System Defaults

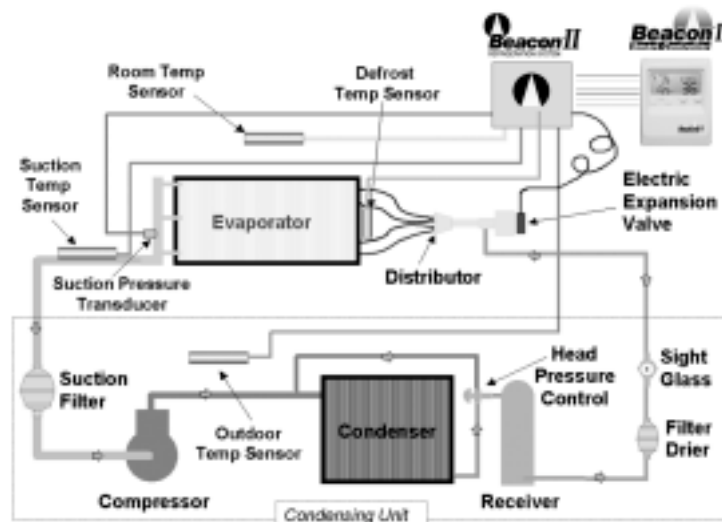
## SYSTEM DEFAULTS

Following are factory defaults for the parameters which can be programmed in the Beacon II Smart Controller. If the user does not select a setting for any of the following parameters, the default will be used.

It is important the user set ALL parameters based of their needs.

<u>PARAMETERS</u>	<u>CODE</u>	<u>AIR</u>	<u>ELECTRIC</u>
Refrigerant	<i>REFTYP</i>	R22	R404A
Box Temperature	<i>BOXTMP</i>	35°F	-10°F
Superheat	<i>SUPRHT</i>	8°F	8°F
Smart Defrost	<i>SMTDEF</i>	N/A	Off**
Defrost start times	<i>DEF ST</i>	9 AM/9 PM	4 AM, 10 AM, 4 PM, 10 PM
Defrost Fail-safe time	<i>DEFSAF</i>	40 min	30 min (60 min. when Smart Defrost is On)
Defrost End Temperature	<i>DEFTMP</i>	45°F	60°F (55°F when Smart Defrost is On)
Alarm High Temperature	<i>ALR HI</i>	50°F	5°F
Alarm Low Temperature	<i>ALR LO</i>	30°F	-15°F
Alarm Time	<i>ALRMIN</i>	60 min	60 min
Temperature Units	<i>°F/°C</i>	°F	°F
Clock setting	<i>12/24H</i>	12 H	12 H
Test mode	<i>TEST</i>	Off	Off
Service mode	<i>SERVIC</i>	Off	Off

\*\*When Smart Defrost is turned on, 8 defrost periods per day will automatically be programmed. These will be at 12:00 am, 3:00 am, 6:00 am, 9:00 am, 12:00 pm, 3:00 pm, 6:00 pm, and 9:00 pm. Also, the defrost fail safe time will be set to 60 minutes, and the defrost termination temperature will be set to 55°F. The user can change these as needed for the application (for version 1.2).



# Parts

## Parts List

<b>PART DESCRIPTION</b>	<b>HRP PART NUMBER</b>
Beacon II Control Board	28910101
Temperature Sensor kit – White Leads*	89904902
Transformer 120/24 volt – 40 VA	22529601
Transformer 240/24 volt - 40 VA	22529602
Transformer 460/24 volt – 40 VA	22529603
Transformer 575/24 volt – 40 VA	22529701
Pilot Relay	22511401
Contactora for Compressor 40 amp with 24 volt Coil	2252440
Terminal Block – Condensing Unit	2251266
Low Pressure Switch Time Delay Relay	22536801
Electric Expansion Valve	
ESB 1 – 3/8" x 3/8"      Conn	29320003
ESB 4 – 3/8" x 3/8"      Conn	29320004
ESB 10 – 3/8" x 3/8"     Conn	29320007
ESB 10 – 1/2" x 1/2"     Conn	29320008
ESB 15 – 7/8" x 1 3/8"   Conn	29320013
ESB 20 – 7/8" x 1 3/8"   Conn	29320014
Expansion Valve Molded Connector (Bipolar valve)	22515201
Pressure Transducer	28911201
Pressure Transducer Harness	22515101
Beacon II Smart Controller	89704301
Smart Controller Software Package**	89704101
Beacon II Communications Hub	89708001

\*Only sensors with White Leads are shipped as a Service Replacement Part.

\*\* Smart Controller Software Package is sold separately.

### OPERATIONAL LIMITS

<b>Voltage Range</b>	<b>18 VAC to 30 VAC</b>
<b>Surrounding Ambient Temp. Range</b>	<b>40°F to 100°F</b>
<b>Relative Humidity</b>	<b>60 % Maximum</b>
<b>Controlling Box Temp. Range</b>	<b>-30°F to 70°F</b>
<b>Box Temperature Differential</b>	<b>2 °F</b>

**Do not mount the Smart Controller where it will experience heavy vibration, such as near a Walk-in Box door.**



# Diagnostics

## Beacon II Troubleshooting Guide

PROBLEM	Step	ACTION ITEM	IF OK	IF NOT OK
LED is not lit.	1.	Check Primary Power Supply Disconnect	Go to next step	1. Check fuses and circuit breakers 2. Check field wiring for breaks 3. Replace if necessary 4. Check factory wiring and connections
	2.	Check Voltage to Evaporator Transformer		
	3.	Check Transformer Secondary Output Volts		
	4.	Check Voltage at Control Board (24V and C)		
	5.	Replace Control Board		
LED shows <b>Coo</b> , but compressor will not run.	1.	Check Compressor internal overloads	Go to next step	1. Wait for reset 2. Check transformer voltage (secondary and primary) and wiring of 208V power taps. 3. Check internal condensing unit wiring 4. Replace as needed
	2.	Check Control Power to Condensing Unit (24 Volts across "COMP" and "C" at board)		
	3.	Check Compressor Contactor Coil Voltage		
	4.	Check Compressor Contactor "pulled in"		
<b>ERROR CODES:</b>				
<i>E1</i> Room Sensor		Check Sensor and Board Connection		Replace as needed
<i>E2</i> Defrost Sensor		Check Sensor and Board Connection		Replace as needed
<i>E3</i> Suction Sensor		Check Sensor and Board Connection		Replace as needed
<i>E4</i> Suction Transducer		Check Transducer and Board Connection		Replace as needed
<i>E5</i> Outdoor Sensor		Check Sensor, wiring and Board Connection		Replace or remove
<b>E6 Low Superheat During Cooling</b> (0°F for 2 minutes)	1.	Check Refrigerant Type	Go to next step	1. Compare board setpoint and refrigerant 2. Defrost coil and check defrost cycle settings/setpoints, defrost sensor and heater amps. 3. Replace board if EEV steps not at 2. 4. Pumpdown system see if LPS opens or if it times out (EEV is bad or LPS is set incorrectly, if times out) – See Pumpdown. 5. Check overloads and contactor. 6. Compare board sensor reading against actual suction line temperature. 7. Compare pressure reading against gauges.
	2.	Check coil for ice		
	3.	Check Control Board step position from board LED		
	4.	Check Electric Expansion Valve Closure		
	5.	Compressor Not Operating		
	6.	Check Suction Temperature Sensor		
	7.	Check Suction Pressure Transducer		

# Diagnostics

## Beacon II Troubleshooting Guide (continued)

PROBLEM	Step	ACTION ITEM	IF OK	IF NOT OK
<b>E7 Compressor Shutdown</b>	1.	Check wiring connection to the board		<ul style="list-style-type: none"> <li>• Correct field wiring to the board</li> </ul>
	2.	Low Pressure Safety (LPS) Tripped: <ul style="list-style-type: none"> <li>• Check for correct refrigerant type</li> <li>• Check refrigerant charge</li> <li>• Check LPS setting</li> <li>• Check LPS wiring</li> <li>• Check EEV operation (stuck?)</li> <li>• Check coil for icing</li> <li>• Check for correct superheat reading</li> <li>• Check for correct nozzle selection</li> <li>• Check for clogged EEV inlet screen</li> <li>• Check line sizing</li> <li>• Check LPS time delay relay setting</li> <li>• Check operation of LPS</li> </ul>		<ul style="list-style-type: none"> <li>• Change setpoint to match refrigerant</li> <li>• Add more refrigerant to proper charge</li> <li>• Correct LPS setting</li> <li>• Correct LSP wiring</li> <li>• Clean or replace EEV</li> <li>• Defrost coil (see E6, step 2)</li> <li>• Check/replace sensor or transducer</li> <li>• Replace distributor nozzle</li> <li>• Replace EEV</li> <li>• Correct line sizing</li> <li>• Reset to 1 minute</li> <li>• Replace Low Pressure Safety Switch</li> </ul>
	3.	High Pressure Safety (HPS) Tripped: <ul style="list-style-type: none"> <li>• Check for system overcharge</li> <li>• Check for non-condensables</li> <li>• Check condenser fan motor and blade</li> <li>• Check for dirty condenser coil</li> <li>• Check head pressure controls</li> <li>• Check fan cycling controls</li> <li>• Check liquid line sizing</li> <li>• Check for liquid line restrictions</li> <li>• Check operation of HPS</li> </ul>		<ul style="list-style-type: none"> <li>• Reclaim/recover excess charge</li> <li>• Remove all non-condensables</li> <li>• Repair or replace motor and/or blade</li> <li>• Clean condenser coil</li> <li>• Adjust or replace faulty controls</li> <li>• Adjust or replace faulty controls</li> <li>• Correct line sizing</li> <li>• Repair line or remove restrictions</li> <li>• Replace HPS if necessary</li> </ul>
	4.	Oil Pressure Safety (OPS) Tripped: <ul style="list-style-type: none"> <li>• Check oil level in compressor</li> <li>• Check oil sump screen pickup</li> <li>• Check oil pump pressure</li> <li>• Check for proper piping practices</li> <li>• Check for low superheat (see E6)</li> <li>• Check operation of auxiliary relay (R6)</li> <li>• Check OPS sensor</li> <li>• Check operation of OPS</li> </ul>	Go to next step	<ul style="list-style-type: none"> <li>• Add oil to crankcase to minimum level</li> <li>• Clean or replace pickup screen</li> <li>• Replace compressor oil pump</li> <li>• Correct piping to minimize oil logging</li> <li>• Correct per steps in E6</li> <li>• Replace auxiliary relay</li> <li>• Replace faulty OPS sensor</li> <li>• Replace faulty OPS</li> </ul>
	5.	Compressor Module Tripped (when supplied): <ul style="list-style-type: none"> <li>• Check module</li> <li>• Check superheat at compressor inlet</li> <li>• Check compressor for overheating</li> <li>• Check suction pressure (too low?)</li> </ul>		<ul style="list-style-type: none"> <li>• Replace faulty module</li> <li>• Reduce superheat (TXV adjust, etc.)</li> <li>• Correct overheating problem</li> <li>• Consider crankcase pressure regulator or other measures</li> </ul>
	6.	Phase Loss Monitor (PLM) Tripped: <ul style="list-style-type: none"> <li>• Check presence of all phase legs</li> <li>• Check power supply</li> <li>• Check operation of PLM</li> </ul>		<ul style="list-style-type: none"> <li>• Correct power phase problem</li> <li>• Correct power supply problems</li> <li>• Replace faulty PLM</li> </ul>
	7.	Demand Cooling (when supplied): <ul style="list-style-type: none"> <li>• Check auxiliary relay</li> <li>• Check demand cooling device</li> </ul>		<ul style="list-style-type: none"> <li>• Replace auxiliary relay</li> <li>• Replace faulty demand cooling device</li> </ul>
	8.	Check compressor relay on board		<ul style="list-style-type: none"> <li>• Replace board if relay is faulty</li> </ul>

# Diagnostics

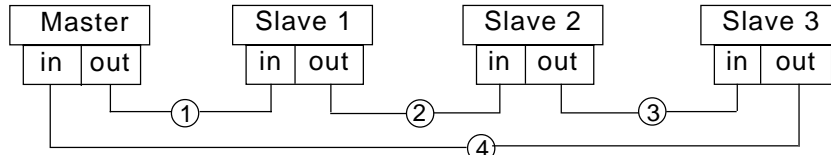
## Beacon II Troubleshooting Guide (continued)

PROBLEM	Step	ACTION ITEM	IF OK	IF NOT OK
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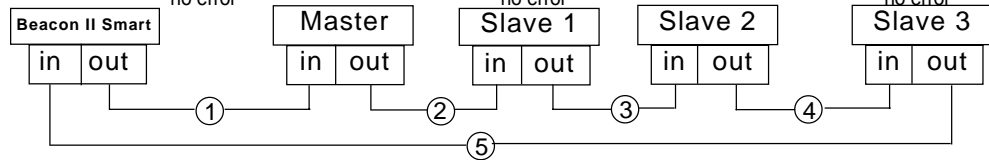
<b>E9 Multi-out to Multi-in Communication Wiring (only shows after initial successful connection)</b>	1. 2. 3.	Check for 24 volts power to the board Check for crossed communication wiring (multi-out not wired to multi-in terminals) Check for broken communication wiring	Go to next step	1. If no voltage, see "LED is not lit" above for low voltage, see "88888 LED display" 2. Correct wiring from "Master" unit Multi-out to Multi-in of "Slave" unit, etc. to all Slaves and return to Master. (See wiring diagrams) 3. Correct wiring between first Slave with error to previous board in the sequence.
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(E9 continued)  
Communication Error Occurrence:

Break in the designated lines will cause errors as follows:



Line #	Master	Slave1	Slave 2	Slave 3
①	E9	E9	E9	E9
②	E9	no error	E9	E9
③	E9	no error	no error	E9
④	E9	no error	no error	no error



[With Beacon II Smart Controller]

Line #	SMART	Master	Slave1	Slave 2	Slave 3
①	+COMM+	E9	no error	no error	no error
②	+COMM+	no error	E9	E9	E9
③	+COMM+	no error	no error	E9	E9
④	+COMM+	no error	no error	no error	E9
⑤	+COMM+	no error	no error	no error	no error

PROBLEM	Step	ACTION ITEM	IF OK	IF NOT OK
---------	------	-------------	-------	-----------

88888 LED display (power is below 18V and appears at initial power)	1. 2. 3. 4.	Check Voltage to Evaporator Transformer Check Transformer Secondary Output Volts Check Voltage at Control Board (24 and C) Check Voltage at Beacon II Smart Controller	Go to next step	1. Check field wiring for breaks or shorts 2. Replace if necessary 3. Check factory wiring and connections 4. Check field wiring from board
LED displays <b>dLy</b> then <b>oFF</b> with no displayed errors	1. 2. 3.	Check for low voltage Check for short in field wiring from "comp" on board to condensing unit terminal connection Replace defective contactor (holding coil)	Go to next step.	1. Check all steps for "88888 LED display" Voltage could drop off too fast to show. 2. Check internal factory wiring to compressor contactor.

# Diagnostics

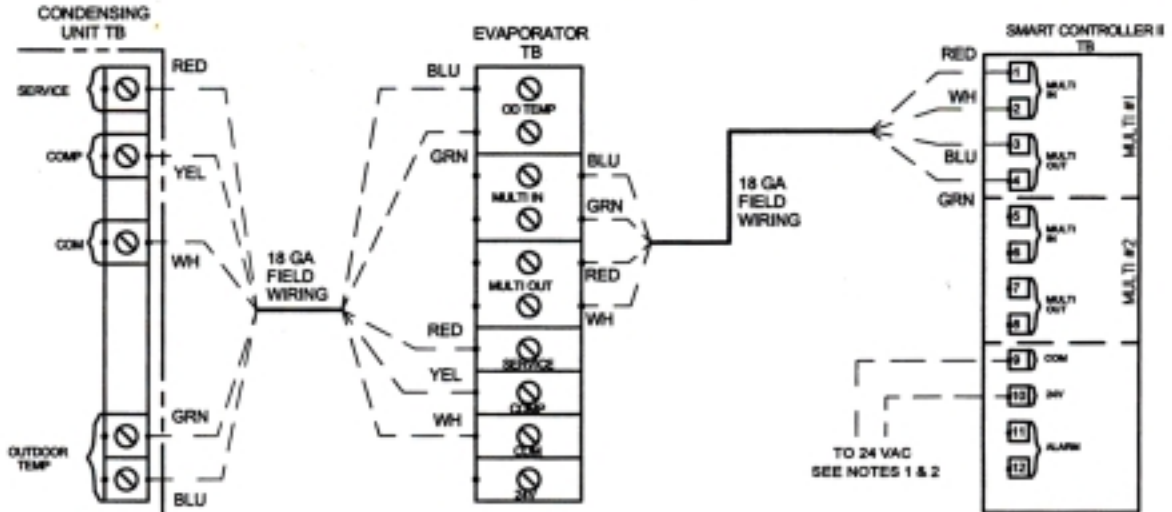
## Beacon II Troubleshooting Guide (continued)

PROBLEM	Step	ACTION ITEM	IF OK	IF NOT OK
<b>Cannot get to box temperature</b>	1.	Check system operation: Is it running?		1. Check power to condensing unit Check position of Service Mode switches Check compressor overloads and contactor
	2.	Check system charge		2. Add or remove refrigerant to proper charge
	3.	Check for proper operating superheat		3. Check EEV operation Check control board EEV signal Check suction sensor and transducer
	4.	Check for high superheat and EEV wide open		4. Check EEV inlet screen and restrictions Check liquid line sizing Check head pressure controls
	5.	Check Low Pressure Safety Switch		5. Check everything for E7 LPS above
	6.	Compare equipment capacity with requirements	Go to next step	6. Add or replace with more/larger equipment
	7.	Check box temperature setpoint		7. Correct setpoint to proper value
	8.	Check compressor performance		8. Check compressor application limitations Check integrity of compressor operation (impaired, worn or damaged components)
	9.	Check condenser coil for dirt/debris		9. Clean condenser coil
	10.	Check condenser for non-condensables		10. Remove all non-condensables
	11.	Check condenser fan operation		11. Replace/repair fan blade, motor, cycling switch or make corrective adjustments.
	12.	Check for correct refrigerant type		12. Compare board setpoint and refrigerant
	13.	Check for iced evaporator coil		13. Defrost coil and check defrost cycle (see E2) settings/setpoints and defrost sensor
	14.	Check defrost parameters		14. Correct defrost setpoints in program (frequency and termination of defrosts)
	15.	Check superheat setpoint (too high?)		15. Correct setpoint for more cooling surface
	16.	Check display values (°F or °C)		16. Correct setpoint for proper display values
<b>Service Mode (SEr is displayed)</b>	<b><u>Placing system into SERVICE MODE</u></b> (BOARDS ONLY)		<b><u>Terminating SERVICE MODE</u></b> (BOARDS ONLY)	
	1.	Use Remote Service Switch in condensing unit	1.	Must terminate using same switch
Controller,	2.	Pressing "Force Service" button board* twice	2.	Press "Clear" button on board
	3.	Connection between "Ser" and "C" on board* (all are wired in parallel; all will activate mode) *ONLY Master board on multiple evaporator systems	3.	Open connection between "Ser" and "C" (Note: If multiple switches were placed in Service Mode, <u>all</u> must be "open" to terminate the mode.)
	<b><u>(with Beacon II Smart Controller)</u></b>		<b><u>(with Beacon II Smart Controller)</u></b>	
	1.	Use Remote Service Switch in condensing unit	1.	Must terminate using same switch
	2.	Connection between "Ser" and "C" on board*	2.	Open connection between "Ser" and "C"
	3.	From program menu of Beacon II Smart Controller,	3.	From program menu of Beacon II Smart
		Change SERVICE setpoint to "On". [all are wired in parallel; any/all will activate mode.] *ONLY Master board on multiple evaporator systems		Change SERVICE setpoint to "Off" [Note: If multiple switches were placed in Service Mode, <u>all</u> must be "open" to terminate the mode.]

# Wiring Diagrams

## 24 VOLT CONNECTION WIRING W/ SINGLE SYSTEM

CONNECTION DIAGRAM FOR SMART CONTROLLER II  
(WITH ONE EVAPORATOR)

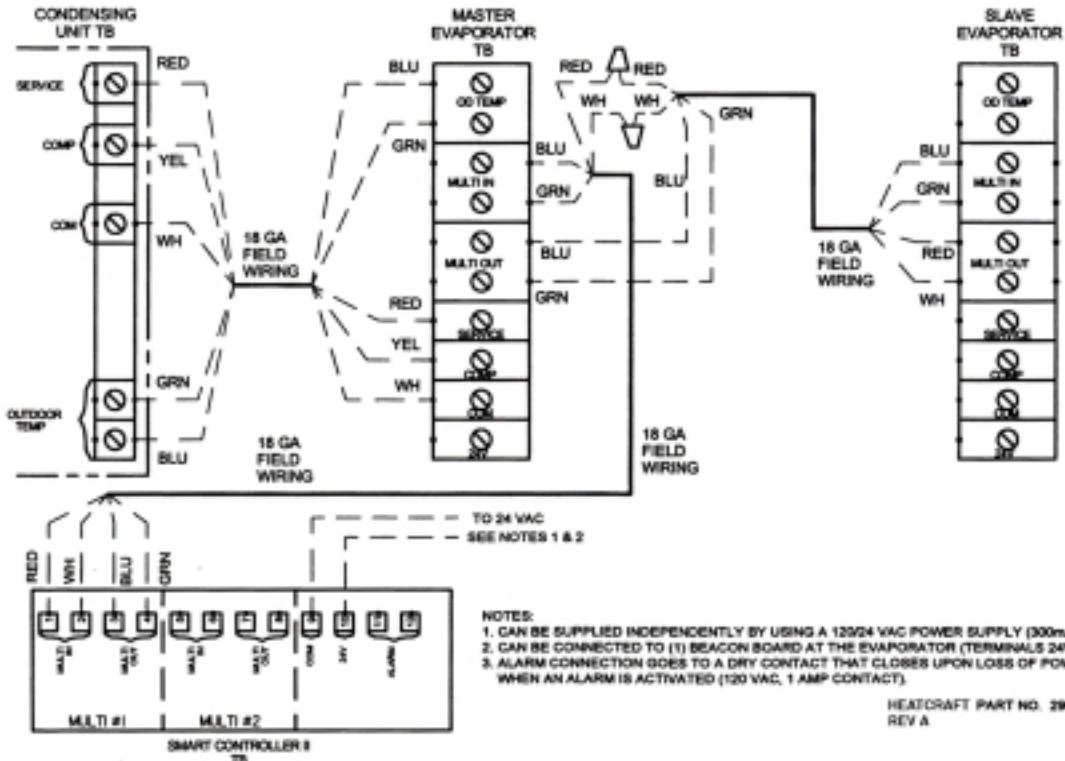


- NOTES:
1. CAN BE SUPPLIED INDEPENDENTLY BY USING A 120/24 VAC POWER SUPPLY (300mA).
  2. CAN BE CONNECTED TO (1) BEACON BOARD AT THE EVAPORATOR (TERMINALS 24V & CL).
  3. ALARM CONNECTION GOES TO A DRY CONTACT THAT CLOSSES UPON LOSS OF POWER OR WHEN AN ALARM IS ACTIVATED (120 VAC, 1 AMP CONTACT).

HEATCRAFT PART NO. 29661601  
REV A

## 24 VOLT CONNECTION WIRING W/ SINGLE SYSTEM

CONNECTION DIAGRAM FOR SMART CONTROLLER II  
(WITH TWO EVAPORATORS)



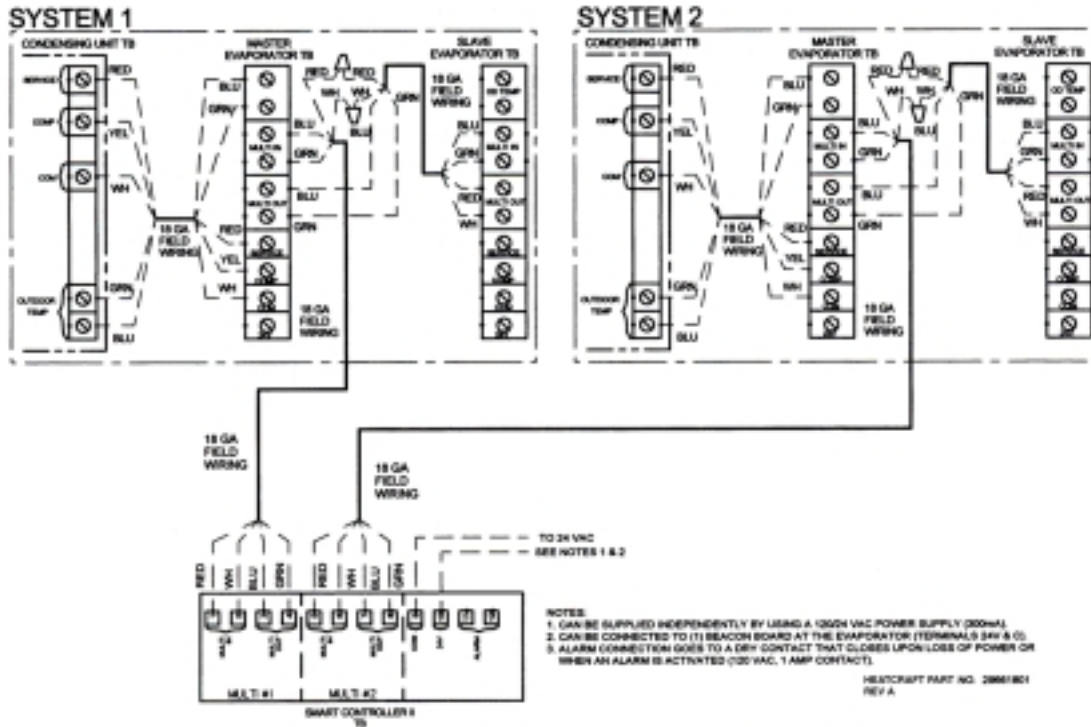
- NOTES:
1. CAN BE SUPPLIED INDEPENDENTLY BY USING A 120/24 VAC POWER SUPPLY (300mA).
  2. CAN BE CONNECTED TO (1) BEACON BOARD AT THE EVAPORATOR (TERMINALS 24V & CL).
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REV A

# Wiring Diagrams

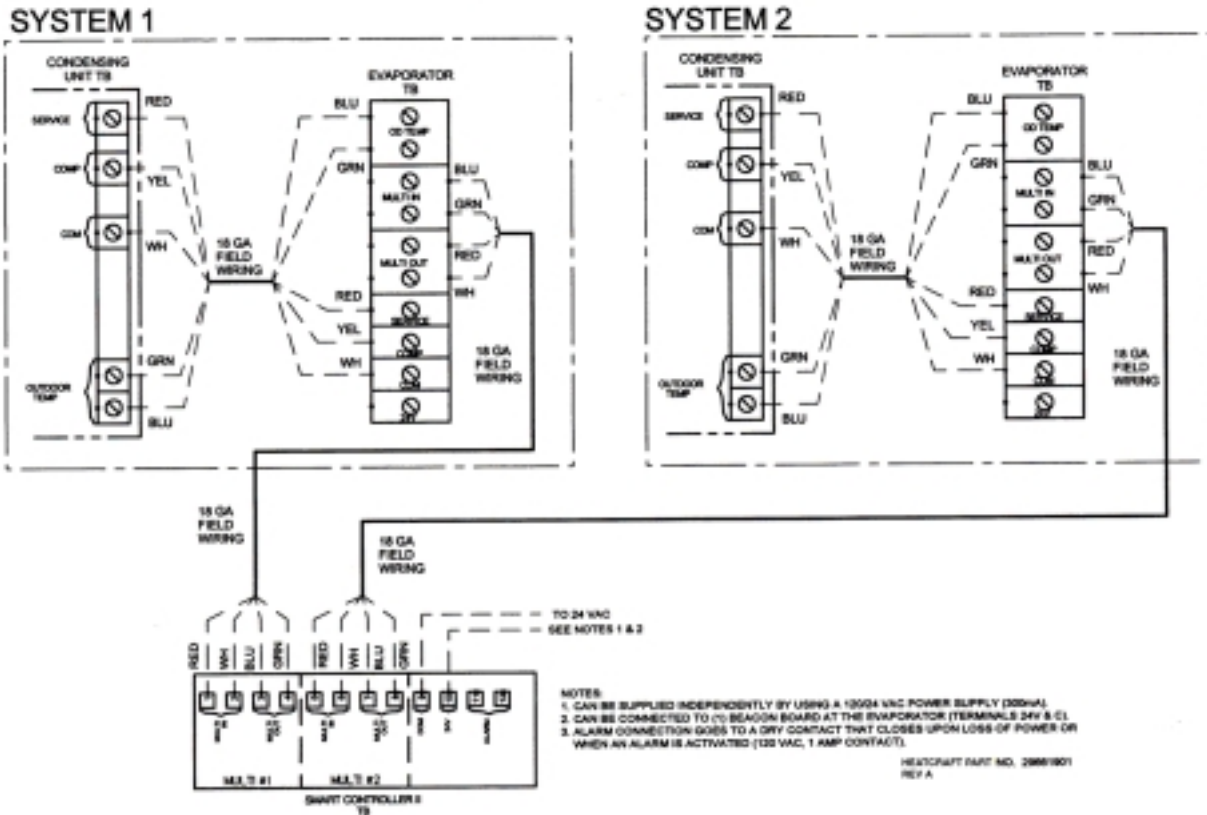
## 24 VOLT CONNECTION WIRING W/ 2 SYSTEMS

CONNECTION DIAGRAM FOR SMART CONTROLLER II  
(TWO SEPARATE SYSTEMS / (2) EVAPORATOR ON EACH SYSTEM)



## 24 VOLT CONNECTION WIRING W/ 2 SYSTEMS

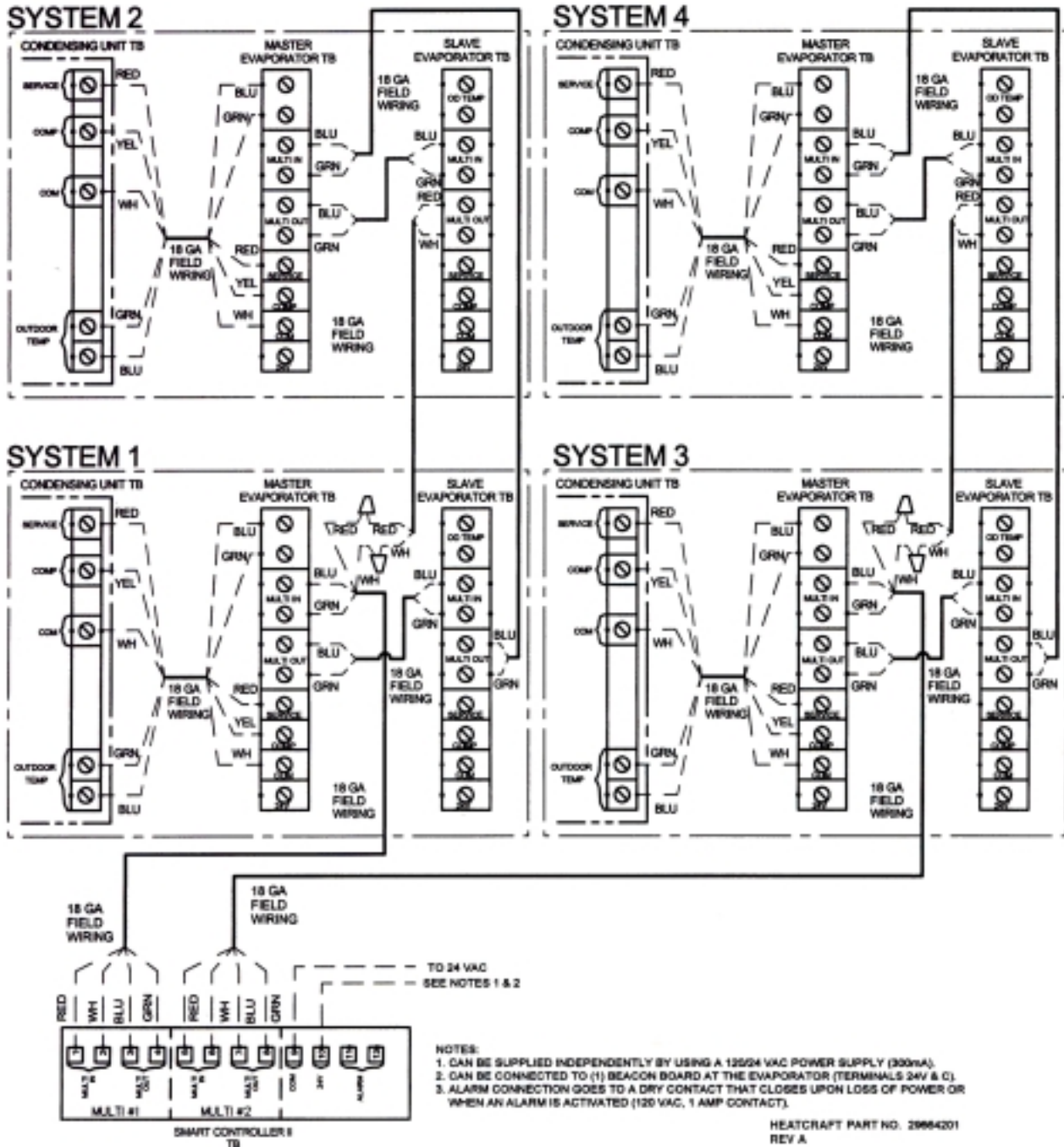
CONNECTION DIAGRAM FOR SMART CONTROLLER II  
(TWO SEPARATE SYSTEMS / (1) EVAPORATOR ON EACH SYSTEM)



# Wiring Diagrams

## 24 VOLT CONNECTION WIRING W/ 4 SYSTEMS

CONNECTION DIAGRAM FOR SMART CONTROLLER II  
(FOUR SEPARATE SYSTEMS / (2) EVAPORATOR ON EACH SYSTEM)

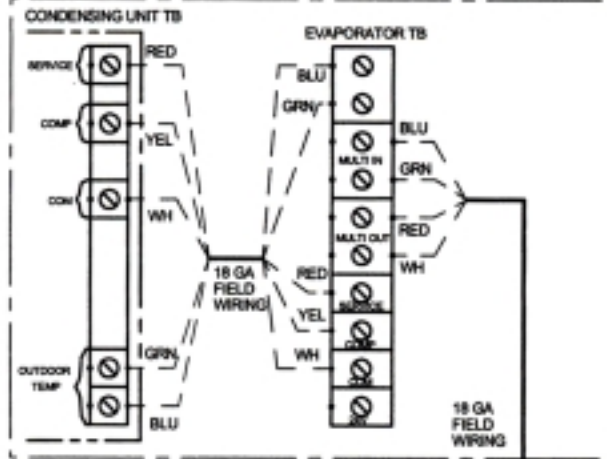


# Wiring Diagrams

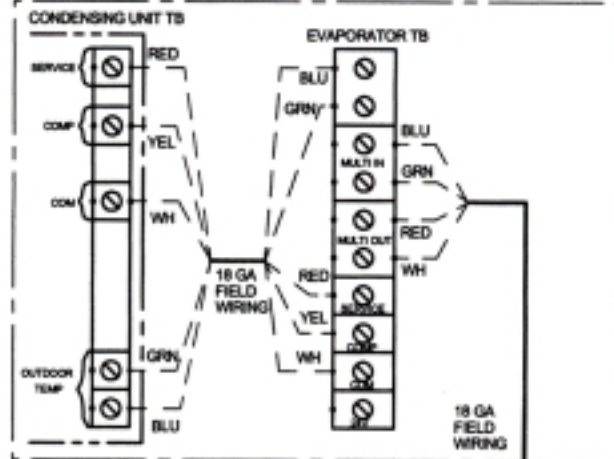
## 24 VOLT CONNECTION WIRING W/ 4 SYSTEMS

CONNECTION DIAGRAM FOR SMART CONTROLLER II  
(FOUR SEPARATE SYSTEMS / (1) EVAPORATOR ON EACH SYSTEM)

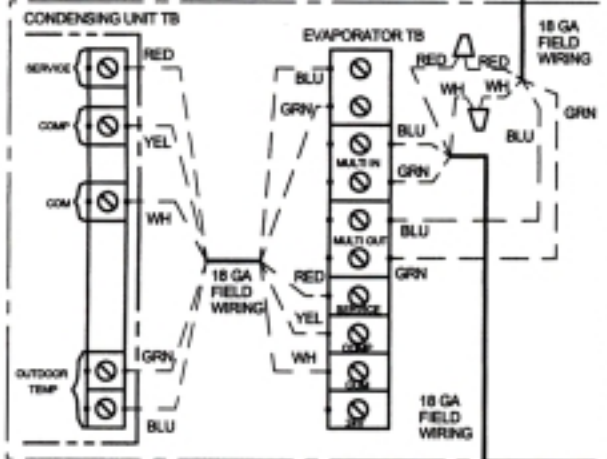
### SYSTEM 2



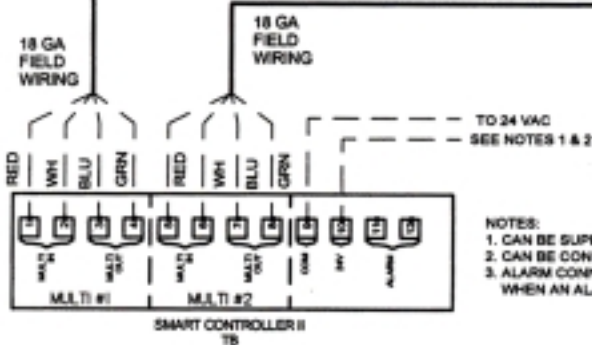
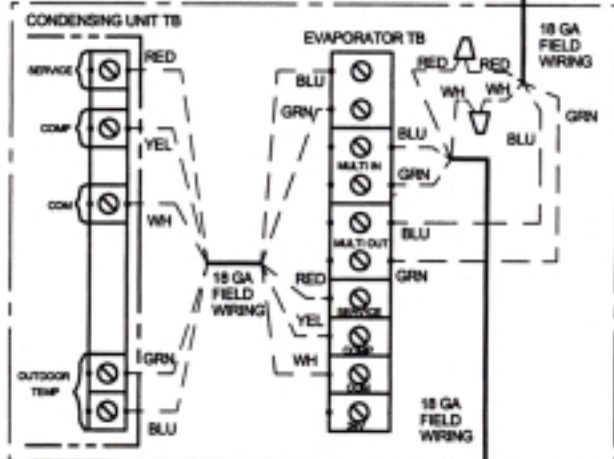
### SYSTEM 4



### SYSTEM 1



### SYSTEM 3



#### NOTES:

1. CAN BE SUPPLIED INDEPENDENTLY BY USING A 12504 VAC POWER SUPPLY (300mA).
2. CAN BE CONNECTED TO (1) BEACON BOARD AT THE EVAPORATOR (TERMINALS 24V & C).
3. ALARM CONNECTION GOES TO A DRY CONTACT THAT CLOSES UPON LOSS OF POWER OR WHEN AN ALARM IS ACTIVATED (120 VAC, 1 AMP CONTACT).

HEATCRAFT PART NO. 29682101



# Notes

# Notes

# Notes



# **Beacon<sup>TM</sup> II**

## **Smart Controller**

*Since product improvement is a continuing effort, we reserve the right to make changes in specifications without notice.*

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