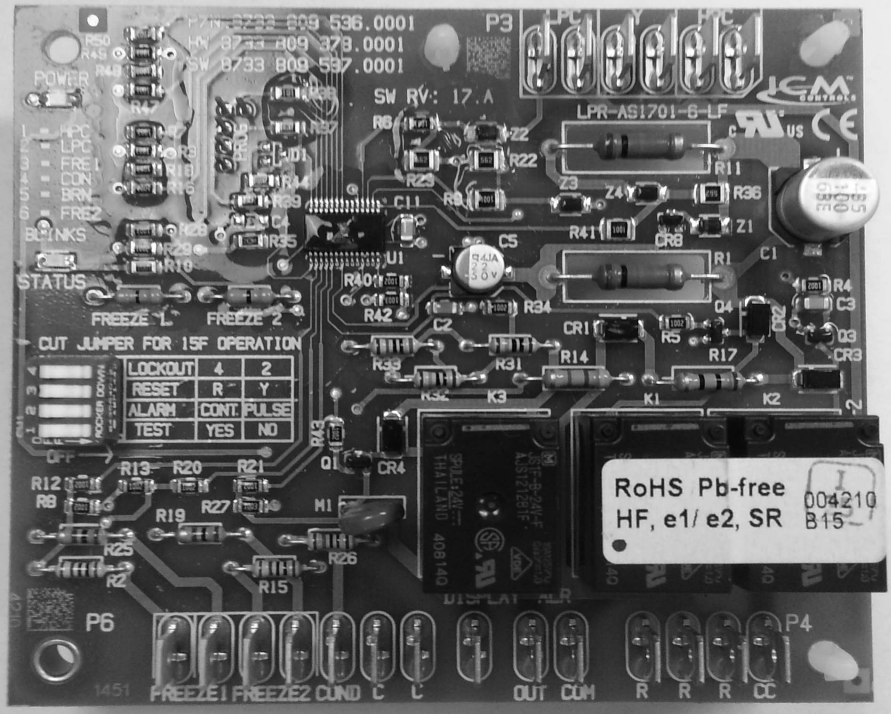

UPM I

Unit Protection Module

BOSCH

Installation and Operation Manual

6 720 220 321(2015/06)

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KEY TO SYMBOLS

Warnings

Warnings in this document are identified by a warning triangle printed against a grey background. Keywords at the start of the warning indicate the type and seriousness of the ensuing risk if measures to prevent the risk are not taken.

The following keywords are defined and can be used in this document:

- **NOTICE** Is used to address practices not related to personal injury.
- **CAUTION** Indicates a hazardous situation wich if not avoided, could result in minor to moderate injury.
- **WARNING** Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
- **DANGER** Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

Important Information

This symbol indicates important information where there is no risk to property or people.

Warnings

WARNING: Installation and servicing of this equipment can be hazardous due to system pressure and electrical components. Only trained and qualified personnel should install, repair, or service the equipment.

DANGER: Before performing service or maintenance operations on the system, turn off main power to the unit. Electrical shock could cause personal injury or death.

CAUTION: When working on equipment, always observe precautions described in the literature, tags, and labels attached to the unit. Follow all safety codes. Wear safety glasses and work gloves. Use a quenching cloth for brazing, and place a fire extinguisher close to the work area.

SPECIFICATIONS

Power: 24VAC ± 10%, 50-60Hz, 1.4 VA of standby power consumption (Single Class II 70VA or 100VA option available)

Physical: Printed Circuit Board with plastic stand-offs.

Environmental Operating Range: A range of -40°F to 176°F (-40 °C to 80°C); 10% to 90% relative humidity, non-condensing. All controls are conformal coated for protection from environmental contaminates.

Digital Outputs: Three (3) digital outputs - relay contacts rated at 10A resistive @ 125 VAC, reserved for:

- Compressor contactor: 24VAC when “ON”
- Alarm purposes dry contact (normally open dry contact)- Pulse or Constant.
- Unit Diagnostics Display (UDD) -Pulse only

Inputs: Six (6) inputs - dedicated inputs for:

- High Pressure Control (HPC)
- Low Pressure Control (LPC)
- Water coil Freeze Sensor (FREEZE 1) 10K @ 77ºF Thermistor
- Air Coil Freeze Sensor (FREEZE 2) 10K@ 77ºF Thermistor.
- Condensate Overflow Sensor (CON) 230 kΩ .+/- 15%
- Compressor Call (Y) Signal

Status Indication:

Visual (LED) status of power and alarm status indication.

Protection:

Surge and transient protection circuitry.

Weight:

0.14 lbs. (0.07 Kg).

Overall Dimensions:

4-1/4” (width) by 3-3/4” (height) (recommended panel depth).

108mm (width) by 95mm (height) by 44mm (recommended panel depth).

Mounting Hole Dimensions:

Four mounting holes in rectangular pattern with dimensions between them as follows:

3-3/4” (width) by 3-1/4” (height).

95mm (width) by 83mm (height).

Listed By: UL E118867 As a recognized component in USA and Canada.

This manual is for UPM board P/N# 8733 809 536.

UNIT PROTECTION MODULE (UPM)

The Unit Protection Module (UPM) is a Printed Circuit Board Assembly (PCBA) that interfaces with the thermostat or the Digital Direct Controller (DDC). (Figure #1)

The main purpose of this device is to protect the compressor by monitoring the different states of switches and sensors. This device provides time delays and protects against freezing of the unit water and refrigerant heat exchangers, as well as condensate overflow when the appropriate sensors are installed.

The ALARM output is a Normally Open (NO) dry contact. If 24 VAC output is needed, The R terminal must be wired to the ALR-COM terminal; 24 VAC will be available on the ALR-OUT terminal when the unit is in alarm condition. If pulse is selected the alarm output will be pulsed.

The display output is dedicated for the unit diagnostic display only.

Display output: The display output is a pulse output connected to the Unit Diagnostics Display (UDD) and it pulses 24VAC when the unit is in a lockout condition.

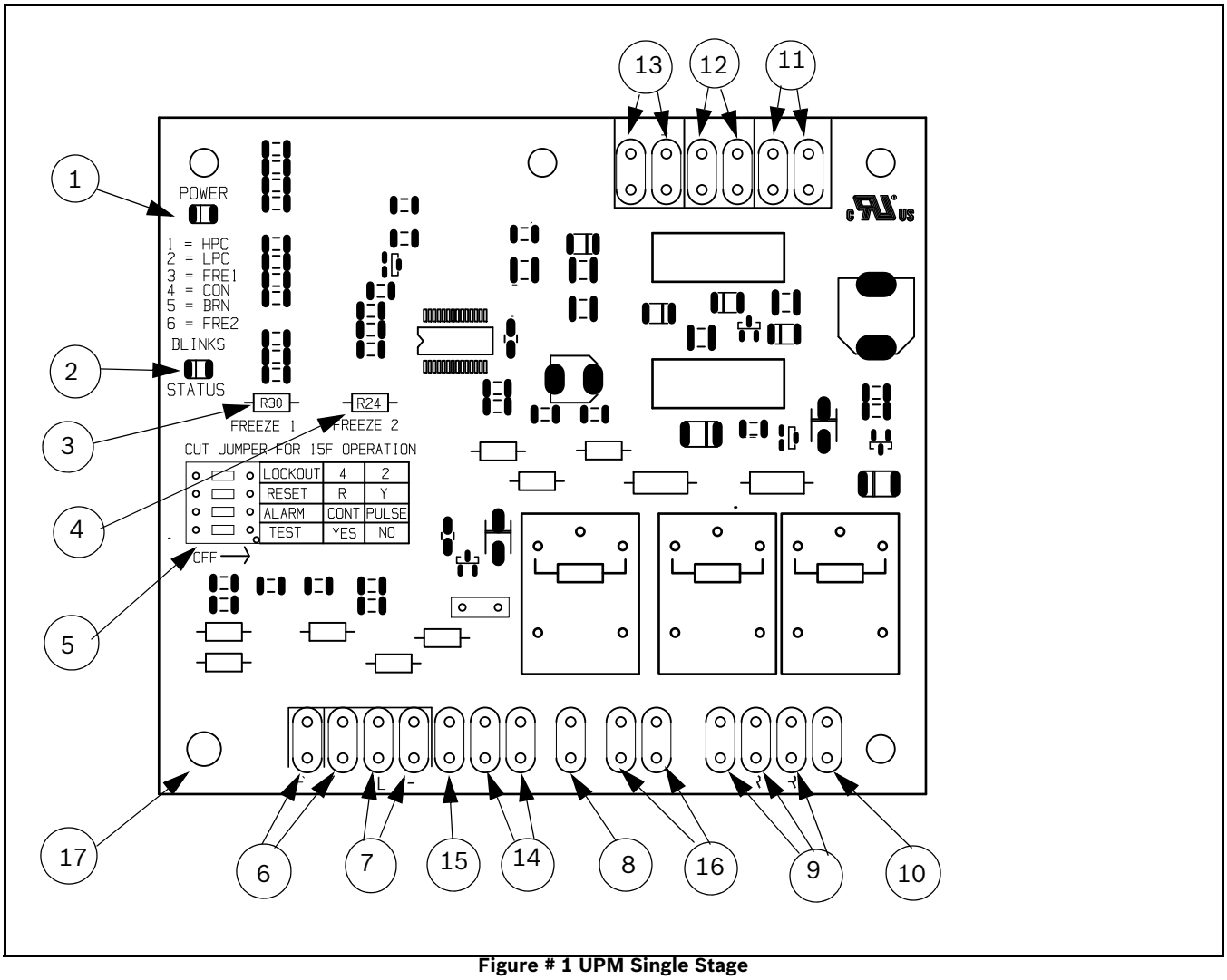


Figure # 1 UPM Single Stage

[1] Board Power LED Indicator

[2] UPM Status LED Indicator

[3] Water Coil Freeze Protection Temperature Selection [R30]

[4] Air Coil Freeze Protection Temperature Selection [R24]

[5] DIP switch bank-for UPM Board Settings

[6] Water Coil Freeze Connection [Freeze 1]

[7] Air Coil Freeze Connection [Freeze 2]

[8] LCD Unit Display Connection [Display]

[9] 24VAC Power Input [R]

[10] Compressor Contactor Output [CC]

[11] High Pressure Switch Connection [HPC]

[12] Call for Compressor [Y1]

[13] Low Pressure Switch Connection [LPC]

[14] 24VAC Power Common [C]

[15] Condensate Overflow Sensor [COND]

[16] Alarm Dry Contact [OUT & COM]

[17] UPM Ground Standoff

Power Random Start Up

This feature prevents multiple units sharing the same electrical circuit or network from starting at the same time.

It assures that Heat Pumps sharing the same electrical circuit do not demand high inrush currents simultaneously when restarting after a power failure.

If the controller has been completely powered down for more than **28 milliseconds**, a random delay is initiated; typically, if the controller is set to **normal** operation (test switch set to **NO**) the unit will start between the time range of 270 and 300 seconds.

In order for the random sequence to initiate, the unit power must be removed completely.

If the UPM board is set to "TEST" mode through the "TEST" DIP switch (SW1), the **Time Delay** will be 10 seconds.

Anti Short Cycle Delay

This feature protects the compressor from short-cycling if the Y call is set and removed in quick succession.

The anti short cycle (ASC) delay is a 300 second delay on break during normal operation.

If the UPM board is set to test mode through the "TEST" DIP switch, the **Anti Short Cycle Delay** will be 5 seconds.

Y Call

The UPM will energize the compressor's output (CC) in the event of a "Y" call from a thermostat or controller (after the random start up and/or the anti short cycle delays have elapsed). The Y input terminal must be energized with a 24VAC signal.

HIGH AND LOW PRESSURE PROTECTION

The UPM monitors the state of the High and Low Pressure switch inputs, HPC and LPC respectively on the board. These switches must be closed in order for the controller to energize the compressor output (CC). The CC output will only be energized when the switches are closed and the **anti short cycle** (and/or random start up when applicable) has expired.

High Pressure Protection

If the HPC switch is open upon a Y call the UPM will not energize the CC output and therefore the compressor will remain off. The fault LED will flash one (1) time intermittently, indicating a High Pressure fault, and the alarm contact will remain open.

If the compressor is running in normal mode on a Y call and the high pressure switch opens, the UPM will shut down the compressor output, and will keep it off until the switch closes and the **anti-short cycle** has expired. The controller will keep track of the number of times the switch opens. If within a one (1) hour period the switch opens the number of times set via the DIP switch, the controller will shut the compressor down and enter a hard lockout condition; **it is only under this condition that the alarm contact will be closed and energized**.

If the high pressure fault condition still exist, or occurs 2 to 4 times (depending on "LOCKOUT" DIP switch setting) within 60 minutes of the initial condition, the unit will enter a hard-lockout state and require a manual reset.

Low Pressure Protection

If the LPC switch is open upon a Y call the UPM will not energize the CC output and therefore the compressor will remain off. The fault LED will flash two (2) times intermittently, indicating a Low Pressure fault, and the alarm contact will remain open.

If the compressor is running in normal mode on a Y call and the low pressure switch opens, the UPM will keep the compressor running for two (2) minutes. If the condition remains after this period of time the compressor will shut down and the UPM will enter a soft lockout. The UPM will flash two (2) times for the LPC, and the alarm contact will remain open.

If the LPC switch closes, the UPM will start the compressor after the **anti short cycle** has expired and the UPM will energize the compressor output.

If the low pressure fault condition still exists, or occurs 2 to 4 times (depending on "LOCKOUT" DIP switch setting) within 60 minutes of the initial condition, the unit will enter a hard-lockout state and require a manual reset.

NOTICE: To exit a hard lockout condition, the controller must be reset from the Y or R terminal by removing the power from the selected terminal. The user can choose which will be the reset point via the RESET DIP switch.

GROUND

The UPM controller takes its ground reference from the unit chassis. This is connected via the controller's metal stand off located in the lower left corner.

(See Figure #1)

DIP SWITCH SETTINGS

The DIP switches are used to configure most of the available features of the UPM as follows:

- Lockout mode: two (2) or four (4) strikes
- Reset mode: Y signal or R signal
- Alarm mode: Constant or Pulse
- Test mode: Normal or Test operation

The settings shown in Figure #2 are factory default for most heat pump applications. However, the unit wiring diagram is the ultimate guide for factory DIP switch default settings.

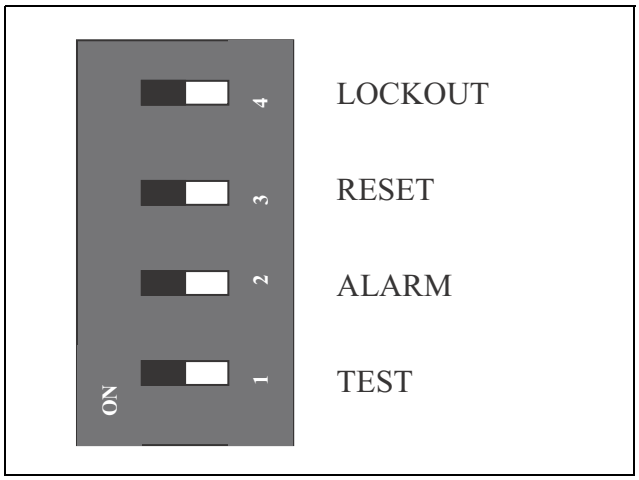


Figure # 2 -DIP Switch Settings

Table #1 shows the available options on the UPM board DIP switch banks and it depicts the switch position and its associated functionality.

Table 1: UPM DIP Switch Configuration			
4	LOCKOUT	4	2
3	RESET	R	Y
2	ALARM	CONT	PULSE
1	TEST	YES	NO

Intelligent Reset

If a fault condition is initiated, the 5 minute delay on break time period is initiated and the unit will restart after these delays expire. During this period the fault LED will indicate the cause of the fault. If the fault condition still exists or occurs 2 or 4 times (depending on 2 or 4 setting for Lockout dip switch) before 60 minutes, the unit will go into a hard lockout and requires a manual lockout reset. A single condensate overflow fault will cause the unit to go into a hard lockout immediately, and will require a manual lockout reset.

Lockout Reset

A hard lockout can be reset

by turning the unit thermostat off and then back on when the “RESET” dip switch is set to “Y” or by shutting off unit power at the circuit breaker when the “RESET” dip switch is set to “R”.

Selectable Alarm Mode

The UPM controller can be configured to have either a constant or pulse signal.

If constant (CONT) is selected the UPM will provide a closed contact at the alarm output until the alarm is cleared.

If pulsed (PULSE) is selected the UPM will sequence the alarm contact with the fault LED flashes.

Test Mode (TEST)

In test mode the ASC and Random Start time delays are reduced (5 seconds and 10 seconds respectively), and serves no function to the end-user equipment. The alarm and display relays also pulse for both soft and hard lockout conditions, and are both cleared through a manual reset.

FREEZE PROTECTION

The water side freeze protection sensor, mounted close to condensing water coils (see Figure#3) monitors refrigerant temperature between condensing water coil and thermal expansion valve (TXV). If temperature drops below or remains at freeze limit trip for 30 seconds, the controller will shut down the compressor and enter into a soft lockout condition. The default freeze limit is 26° F, however this can be changed to 15° F by cutting the R30 or freeze 1 resistor located on top of DIP switch bank as shown in Figure# 1.

Evaporator freeze protection sensor mounted after the thermal expansion device and the evaporator, (see figure #4) monitors refrigerant temperature between the evaporator coil and thermal expansion valve. If temperature drops below or remains at freeze limit trip for 30 seconds the controller will shut down the compressor and enter into a soft lockout condition. The default freeze limit trip is 26°F

If temperature drops below or remalns at the freeze limit trip for 30 seconds, the controller will shut the compressor down and enter into a soft lockout condition. Both the status LED and the Alarm contact will be active. The LED will flash three (3) times the code associated with this alarm condition.

If the freeze stat fault condition still exist, or occurs 2 to 4 times (depending on “LOCKOUT” DIP

switch setting) within 60 minutes of the initial condition, the unit will enter a hard-lockout state and require a manual reset.

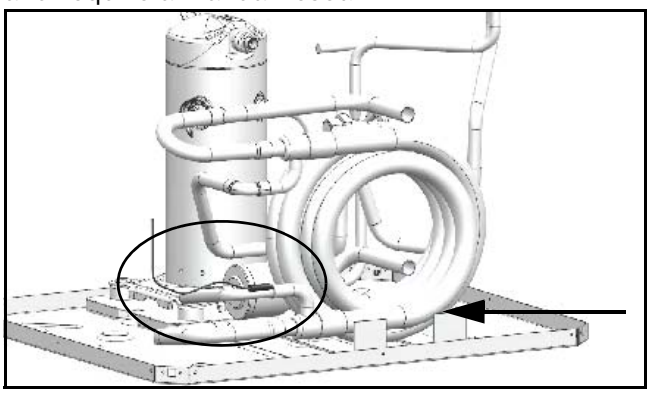


Figure # 3 - Freeze Sensor Location

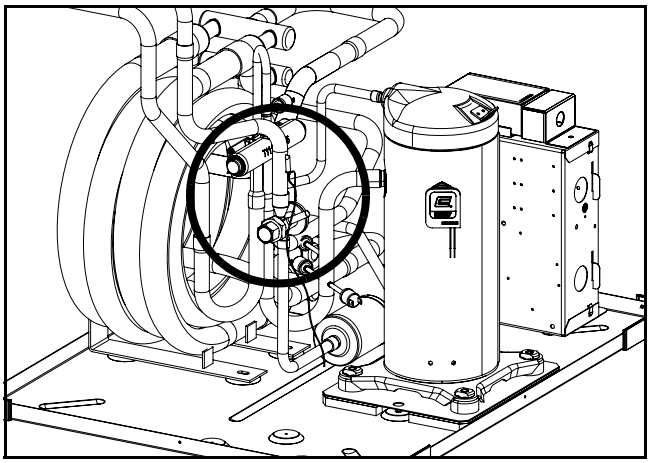


Figure # 4

BROWNOUT PROTECTION

The UPM controller will constantly monitor the power supply; if the nominal voltage drops below 25% of its value, (18 VAC approximately), the unit will enter brownout protection mode. The compressor CC output will be de-energized and the unit will enter the soft lockout mode.

The controller **will not** monitor the power supply during the first 500 milliseconds of compressor start up to avoid nuisance and false alarms.

Once the UPM detects a brownout condition, the fault LED will flash five (5) times intermittently, as error code indication.

If the brownout fault condition still exist, or occurs 2 to 4 times (depending on “LOCKOUT” DIP switch setting) within 60 minutes of the initial condition, the unit will enter a hard-lockout state and require a manual reset.

CONDENSATION OVERFLOW

The UPM controller continuously monitors the drain pan for high condensate water level. It utilizes a sensor (See Figure #5) to identify an alarm condition when the sensor’s impedance drops below 230KΩ +/- 15% (**Only** when condensate sensor option is present). Once the UPM senses this resistance value it enters into a hard lockout and reports the corresponding code via its status LED; four (4) flashes.

To exit the hard lockout condition water has to return to its normal level in the drain pan and the UPM has to be reset by removing power from the Y terminal (or if set accordingly on the DIP switch). The compressor will be turned on **after the anti short cycle** expires.

The condensate overflow is the only system safety (of the 6 safeties) that enters directly into a hard-lockout upon an initial fault condition. There is no soft-lockout state for the condensate overflow fault.

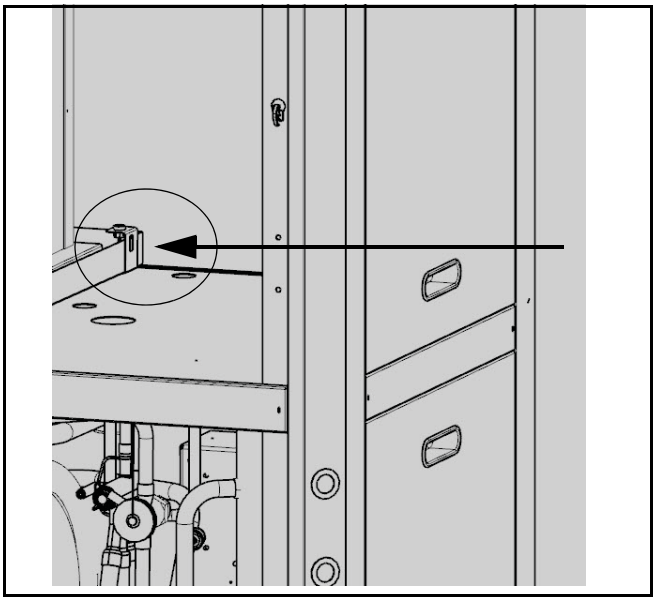
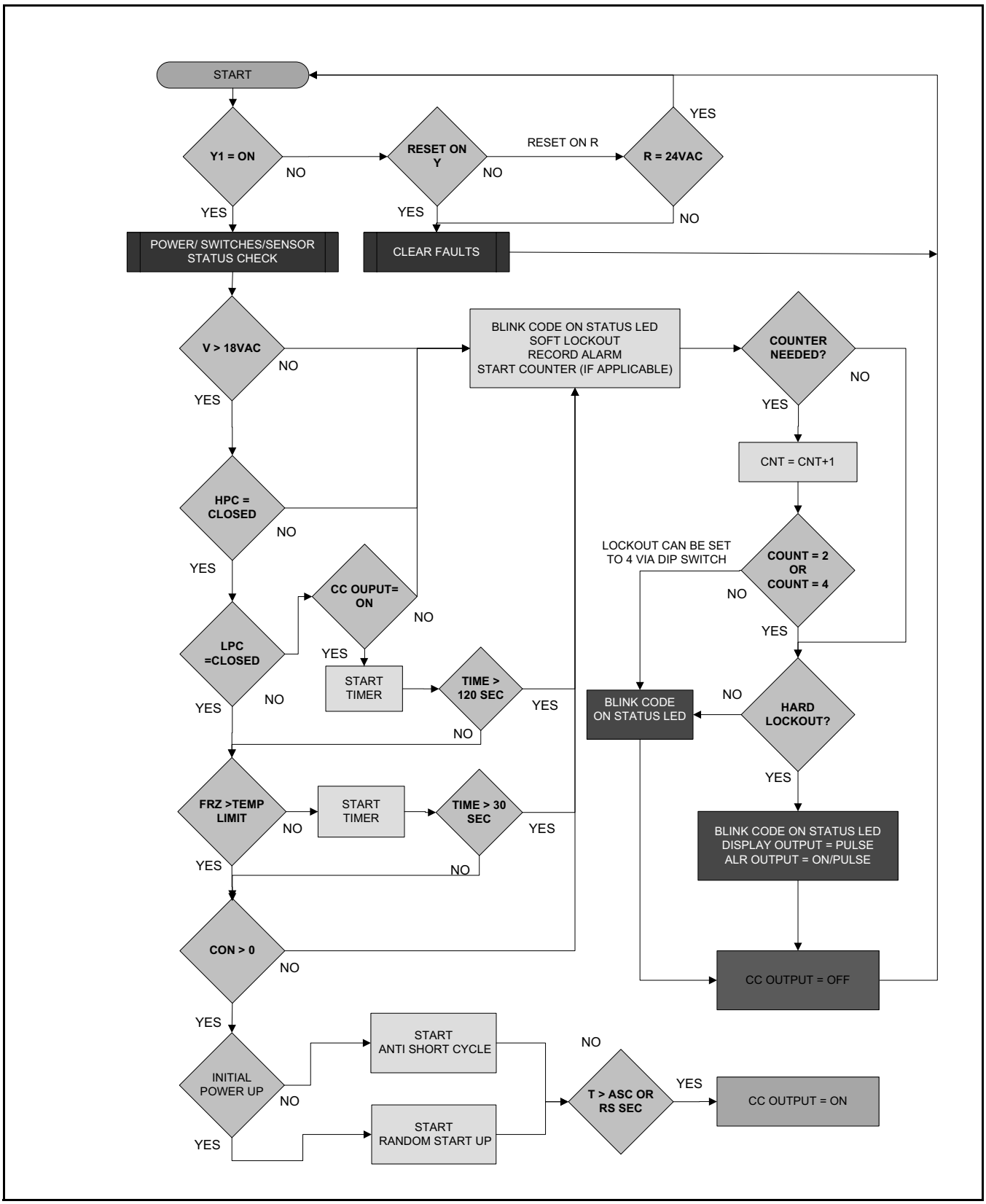


Figure # 5 - Condensate Overflow Sensor Location

UPM SEQUENCE OF OPERATION FLOW CHART



TERMINOLOGY

PSC - Permanent-split capacitor motor

EER - Energy Efficiency Ratio

COP - Coefficient of Performance. The COP provides a measure of performance for heat pumps that is analogous to thermal efficiency for power cycles.

ECM-Electronically Commutated Motor.

UPM-Unit Protection Module

WLHP - Water Loop Heat Pump

GLHP - Ground Loop Heat Pump

RLA - Running Load Amps

LRA - Locked Rotor Amps

FLA - Full Load Amps

NPA - Name Plate Amps **HP –** Heat Pump

Suction Pressure - Pressure entering compressor

Discharge Pressure - Pressure leaving compressor

(R/A) - Return Air

Recovery - Means the collection and storage of fluorinated greenhouse gases from products, including containers, and equipment during maintenance or servicing or prior to the disposal of the products or equipment;

Recycling- Means the reuse of a recovered fluorinated greenhouse gas following a basic cleaning process;

Reclamation-Means the reprocessing of a recovered fluorinated greenhouse gas in order to match the equivalent performance of a virgin substance, taking into account its intended use**;**

Decommissioning- Means the final shut-down and removal from operation or usage of a product or piece of equipment containing fluorinated greenhouse gases;

Repair- Means the restoration of damaged or leaking products or equipment that contain, or whose functioning relies upon, fluorinated greenhouse gases, involving a part containing or designed to contain such gases;

Conditioned space-Space within a building provided with heated or cooled air, or both (or surfaces); and, where required, with humidification or dehumidification means, to maintain conditions for an acceptable thermal environment.

NOTES

BOSCH

FHP Manufacturing Company
601 N.W. 65th Court
Ft. Lauderdale, FL 33309
U.S.A.
Phone: 866-642-3198 | Fax: 954-776-5529
www.boschheatingandcooling.com

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