



FHP MANUFACTURING  
Florida Heat Pump Environmental Equipment

# GENESYS VI™

## ENGINEERING APPLICATION MANUAL

### INTEGRATED HEAT PUMP CONTROLLER

#### TABLE OF CONTENTS

Introduction . . . . .	1	Fault Indication . . . . .	4
Thermostat Inputs . . . . .	1	Lockout . . . . .	4
Low Voltage Outputs . . . . .	2	Detail Component Layout . . . . .	5
High Voltage Outputs . . . . .	2	Connection Diagram SX Single Speed . . . . .	6
Output L.E.D.'s . . . . .	2	Connection Diagram SX Two Speed . . . . .	7
Safety Device Inputs . . . . .	2	Connection Diagram Dual Compressor . . . . .	8
Sequence of Operation . . . . .	3		

#### INTRODUCTION:

The Genesys VI™ micro processor based integrated heat pump controller was developed to accomplish all the necessary control functions associated with FHP Manufacturing heat pump units that conventional electro-mechanical controls provided in the past. In addition to the normal control functions, many special features have been added to insure a safe, quiet, and reliable operating control system.

Trouble shooting of the Genesys VI™ controller has been made very simple by incorporating a RS-485 communications port on the control board to which a hand held diagnostic tool can be connected. All board inputs, outputs, malfunctions, etc... can be determined by the use of the hand held device. (See installation and operating manual for hand held diagnostic tool) On SX Series units, an additional RS485 port is located in the units electrical corner post for easy access.

On-board diagnostic L.E.D.'s also enable the service technician to trouble shoot the heat pump with relative

ease. The Genesys VI™ controller also allows the specifying engineer to determine his unique control requirements that correspond to the Genesys VI™ unique control features.

The Genesys VI™ controller may be applied to all FHP Manufacturing Heat Pumps currently being manufactured. The Genesys VI™ controller is standard in all SX-Series Heat Pumps, both single and two speed models. The controller is option in all other heat pumps. FHP recommends the use of the Genesys VI™ controller in dual compressor heat pumps when micro processor based controls are specified. On single compressor heat pumps containing PSC fan motors FHP recommends the use of the Genesys IV™ controller. (See installation and operating manual for Genesys IV™)

#### THERMOSTAT INPUTS:

The inputs from the thermostat are connected to the controller at the top center of the mother board. Thermostats are always connected to this point. The

connector is removable to make field wiring easier. The SX-interface board is attached to the mother board when the controller is being used in an SX-Series. When this board is installed, the micro processor is set to the SX-control algorithm. When this board is not installed, the micro processor is set to the dual compressor control algorithm. The SX-interface module provides motor control functions for the variable speed programmable motors utilized in the SX Series. It also contains the two speed compressor thermal sensor logic that monitors compressor thermal and current draw characteristics. There are nine (9) thermostat input connections and one thermostat output connection along with a common thermostat connection at the thermostat field connector. The nomenclature on the connector is as follows: (from left to right)

- R Hot Side of Transformer
- ML Malfunction Light (see note)
- E Emergency Heat
- H Humidistat
- W3 Auxiliary Heat
- EM Energy Management/Night Set-Back Relay
- G Fan
- O Reversing Valve (energized in cooling mode)
- Y2 High speed compressor in two speed units or compressor number two in dual compressor units
- Y1 Low speed compressor in two speed units or compressor number one on dual compressor units
- C Transformer Common

**NOTE:** The thermostat malfunction light may either be powered from the hot "R", terminal or common, "C" terminal. The jumper pin located on the lower left portion of the board marked "R" or "C" dictates the malfunction light output voltage supply. On most mercury bulb thermostats the pin placement will be "C" and for most programmable or digital thermostats the pin placement will be "R". Review of the thermostat sub-base wiring is necessary to insure proper pin placement. **Factory pin placement is "R". Improper pin placement may cause damage to the controller and/or the thermostat.**

Following is a list of FHP offered thermostats with the corresponding MALFUNCTION LITE pin placements.

FHP T'STAT P/N	PIN PLACEMENT
641-060	R
641-061	R
641-068	C
641-072	R

Input L.E.D.'s are present when the SX-interface board is utilized on SX models only. L.E.D.'s present on the SX-

board are illuminated based on what input signals are present from the thermostat.

**LOW VOLTAGE OUTPUTS:**

All of the low voltage control outputs are located on the lower right portion of the controller. These output relays are double pole normally open relays. They are rated at 3 Amps @ 24 VAC. All low voltage output relays with the exception of the "Y2" output relay have monitoring point (dry contact) capabilities associated with them. The monitoring points are located on the lower center portion of the board. There are seven low voltage output relays located in the lower left portion of the board situated as follows: (left to right)

- FAULT RELAY Dry Contacts
- EHR Emergency Heat/Auxiliary Heat Output
- REV. VALVE Reversing Valve output
- FAN Fan output (used to control motor contactor on large tonnage machines)
- HGR Hot Gas Reheat Solenoid output
- COMP 1 Compressor One or Low Speed Compressor
- COMP 2 Compressor Two or High Speed Compressor

**HIGH VOLTAGE OUTPUTS:**

There are three high voltage output relays provided on the Genesys VI™ controller. These relays are located on the left edge of the board. The relays are single pole-single throw relays rated at 30 amps @ 277 Volts or 2 HP @ 277 Volts. The relays are designated for the following functions:

- FAN High voltage fan relay to directly power a PSC single phase fan motor
- HEAT RECOVERY High voltage heat recovery relay to power the heat recovery pump
- LOOP/REM. PUMP High voltage relay to power the loop pump or a high voltage water solenoid

**NOTE:** Do not use the high voltage output relays to power a compressor motor. The inrush (LRA) ratings of the relay will not withstand compressor motor starts.

**OUTPUT L.E.D.'S:**

There are seven (7) green output L.E.D.'s located above the output relays on the board. These L.E.D.'s are illuminated when the associated output relays have been energized.

**SAFETY DEVICE INPUTS:**

The safety device inputs are connected to the board at the upper right edge of the controller. The safety device inputs are as follow: from bottom to top)

HI TEMP	Hi Temperature Limit
LO TEMP	Lo Temperature Limit
HI PRESS	Hi Pressure Switch
LO PRESS	Low Pressure Switch
COND	Condensate Overflow Switch

These devices are all normally closed inputs that will signal a fault upon opening. The condensate switch input can be programmed as either normally open or normally closed. The condensate input, hi temp input, and lo temp inputs can be enabled or disabled through the hand held device. Factory default settings are as follows:

HI TEMP	Disabled
LO TEMP	Disabled
Cond. Overflow	Enabled-normally closed
Brown-Out Setting	18 VAC
Random Start	30 Seconds
Remote Reset	On (For reset at thermostat. For power reset only capability remote reset is off)

A board mounted reset button is located on top left center of the main board. This reset button is provided for use during trouble shooting to avoid numerous trips to the thermostat when in default (remote reset-on) mode, or to the unit disconnect when in the remote reset-off mode, indicating power reset feature is enabled. The reset button initiates the beginning of the microprocessor's algorithm and all timing sequences revert back to the initiation sequence. The board mounted diagnostic fault L.E.D. (red) is located directly above the reset button. This fault L.E.D. provides on board diagnostics by blinking a prescribed number of times indicating the associated safety input device causing the fault. (see blink codes in sequence of operation) A board mounted automotive type fuse rated at 5 Amps is located in the lower left center of the board. This fuse protects the logic circuit within the controller itself. If this fuse blows it is an indication of a severe short in the control circuit components or the controller itself. A high voltage transient may also cause the fuse to blow. Replace the fuse only once when troubleshooting the control. If the second fuse blows, consult the factory before proceeding in troubleshooting.

The compressor sensor input circuit is located on the SX-interface board. The sensor leads from the compressor thermistors located in the compressor motor windings are attached directly to the sensor input on the interface board. This circuit is enabled through the hand held at the factory with two speed SX models. When the sensor input is disabled through the hand held, however, the fault L.E.D. on the upper level of the hand held device will remain illuminated. This is normal and does not indicate an actual

motor sensor failure since no motor sensor input exists. (Also see sequence of operation flow chart and hand held device operating instructions).

Power is applied to the controller by the unit's Class 2 transformer. The 24 Volt secondary power is connected to the "R" and "C" terminal strip located on the lower left bottom edge of the board. The output relay buss is also powered by the unit's transformer. A board mounted "green" power L.E.D. is illuminated when power is present. This L.E.D. is located directly above the MALF LITE select pin.

**SEQUENCE OF OPERATION:**

Upon power-up the brown-out condition is continuously monitored. If the secondary voltage drops below 17.1 VAC (5% below the default setting of 18 VAC) or 5% below the brown-out setting programmed through the hand held device, all control functions are inhibited and one blink of the malfunction L.E.D. indicates a brown-out fault. When the secondary voltage returns to 18.9 VAC or 5% above the brown-out setpoint, the fault clears and the controller is enabled.

In the cooling mode the reversing valve output is energized through the "O" input from the thermostat. When it is on it is on, and when it is off it is off. There are no delays or shifts of the reversing valve in the cooling mode. Shifting the reversing valve can cause extensive wear and excessive noise to occur within the reversing valve. When the "O" line is energized the "W3" and "E" outputs are inhibited. This disables the resistance heat in the cooling mode.

The fan comes on when the "G" line input is made from the thermostat. In the constant on position the fan will run constantly. In SX-Series units, the fan operates based on the internal programs contained in the ICM motor. In all other applications, when the "G" line is operated in the auto mode from the thermostat, it operates in conjunction with the "Y1" or "H" inputs from the thermostat. In this mode the fan is delayed for 10 seconds after "Y1" or "H" inputs are initiated. When "Y1" or "H" is de-energized, the fan continues to run for a period of 30 seconds afterwards. This delay on make and break of the fan motor provides two functions: On start up the air coil of the heat pump can cool down or heat up thus eliminating unwanted cold or warm drafts depending on the mode of operation. Also, on shutdown the residual heating or cooling thermal energy stored in the coil can be transferred to the space. On a call for electric auxiliary heat or emergency heat the fan delay on make is eliminated so that whenever resistance heaters are energized the fan comes on instantaneously. The fan continues to run for 30 seconds after strip heater de-energization.

When the "Y1" input line is energized from the thermostat calling for 1st stage heating or cooling, the Remote Solenoid or Loop Pump Output Relay is energized after the random

start time has been satisfied (30-600 seconds selectable). Also, the anti-short cycle period of 60 seconds must have elapsed since the previous start. After the above timing periods, the 1st stage compressor output relay is energized in conjunction with the heat recovery output relay. On shutdown the fan and loop pump/remote solenoid outputs remain energized for 30 seconds.

When the "Y2" input line is energized from the thermostat calling for 2nd stage heating or cooling, and the SX-interface board is present, the heat pump operates in the two speed mode. On a call for "Y2" the "Y1" output is de-energized. This eliminates the possibility of energizing both compressor windings simultaneously. After a 60 second delay, the "Y2" output relay is engaged and high speed cooling or heating is initiated. When the SX-interface board is not present the heat pump operates in the dual compressor mode. In this mode the "Y2" output is energized 60 seconds after the "Y1" output. If 60 seconds has already elapsed between "Y1" and "Y2" inputs the second stage compressor will start instantaneously. On dual compressor or two speed heat pumps the "Y2" output remains active until the "Y1" input is satisfied. This unique high stage lock-in logic reduces compressor run time and eliminates cycling back and forth from low to high speed, or from single to dual compressors. On single speed SX units, use the "Y2" input on the board connected to the "Y1" output of the thermostat.

In the heating mode the sequence of operation is exactly that as cooling mode operation with the absence of the "O" input/output, reversing valve energized.

On a call for "W3" from the thermostat, the auxiliary heat output is energized and the electric heat is enabled. This is third stage heat which supplements the compressor in the heating mode.

On a call for "E" from the thermostat, the emergency heat output is energized. The electric heat is enabled and all other outputs are disabled. In both auxiliary heat and emergency heat modes the fan motor is energized instantaneously.

In the reheat mode (dual compressor units only, reheat not available on SX models) the H input from the humidistat drives "Y1" and "Y2" outputs off for a 60 second period. The reversing valve output is energized and the hot gas reheat solenoid output is energized. After the 60 second off delay the compressor output is enabled. Shutdown sequence is identical to cooling mode operation.

When the EM input is made from an energy management/night setback relay/time clock, all outputs are inhibited. The random start feature is initiated upon termination of power supply, night setback period, or EMS mode.

#### FAULT INDICATION:

All safety device inputs are normally closed switches with the exception of the condensate overflow switch which can be set to either N.O. or N.C. through the hand held device. The safety device fault codes generated through the on board red fault L.E.D. are as follow:

Brown-Out	1
Hi Pressure	2
Lo Pressure	3
Hi Temperature	4
Lo Temperature	5
Condensate Overflow	6
Compressor Overload (SX-2 spd.)	7

#### LOCKOUT:

The low pressure input is bypassed for a period of 180 seconds upon the initiation of the "Y1" output to allow for cold start applications. After 180 seconds it is enabled.

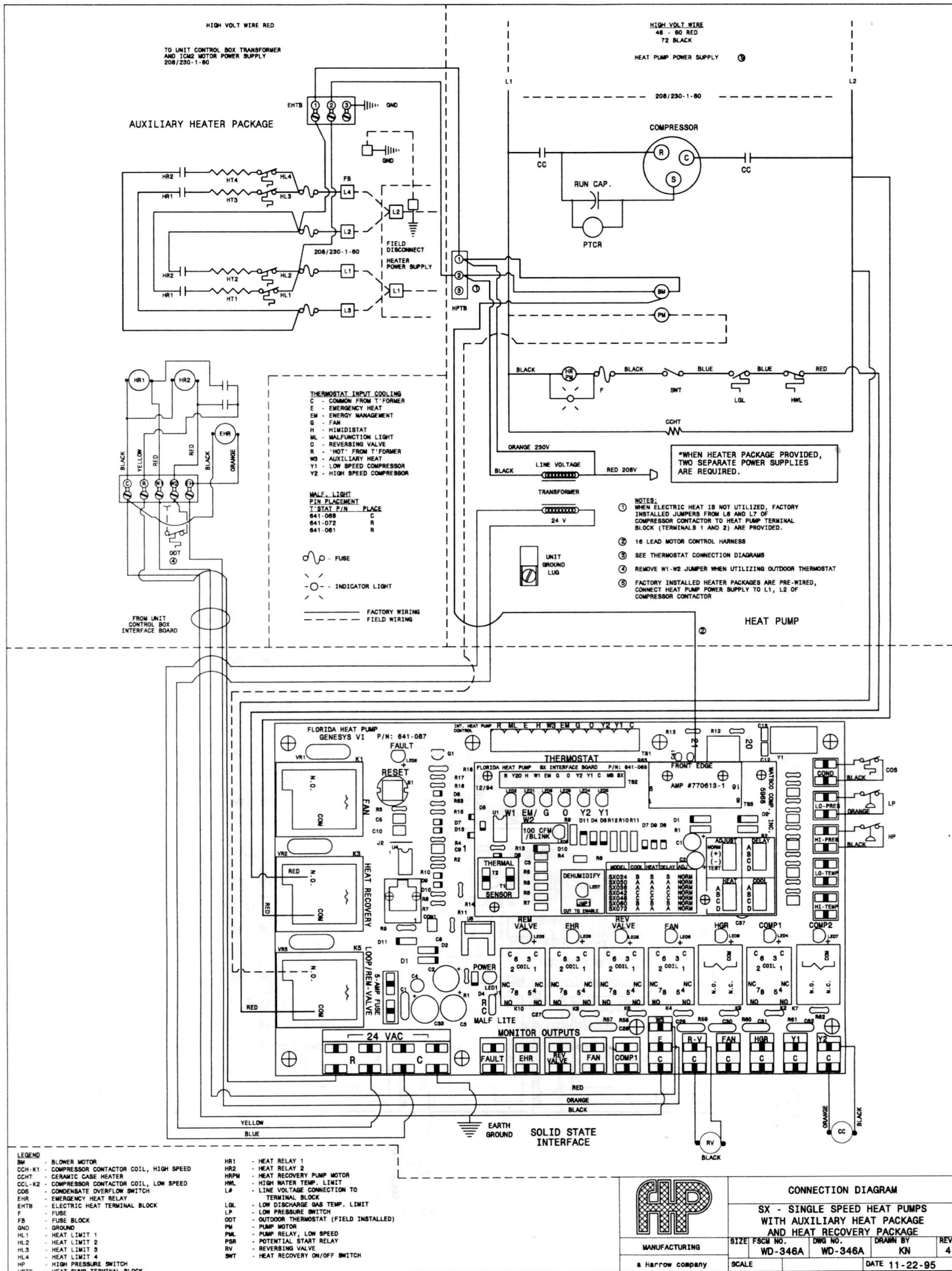
The condensate overflow input is monitored for 270 seconds before a lockout is initiated.

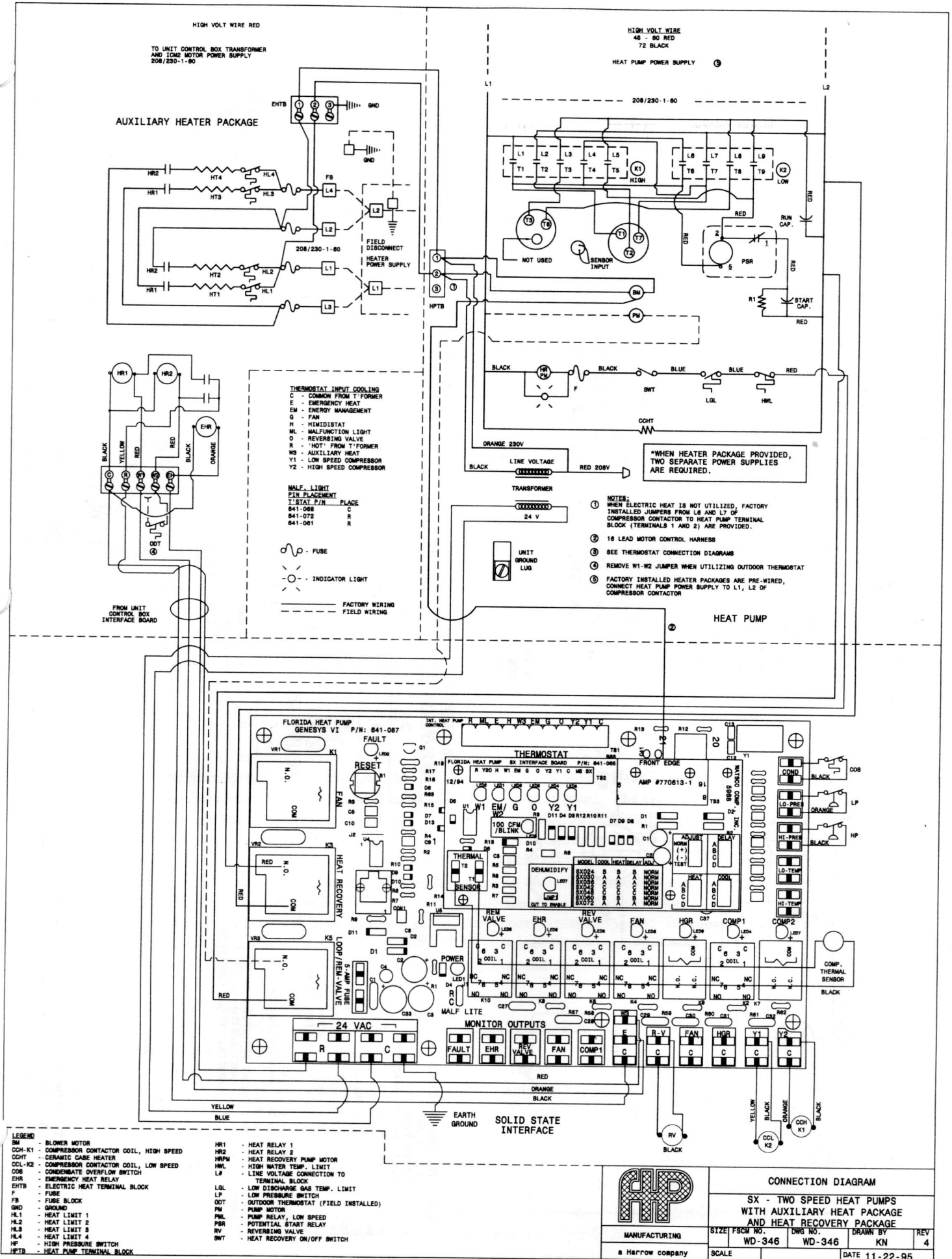
All other safety input openings dictate an immediate lockout situation. A 10 minute intelligent reset feature is incorporated into the logic such that the microprocessor monitors the safety inputs for 10 minutes after initial lockout. If the safety device resets itself within this time period normal sequencing is re-initiated. If any malfunction occurs or re-occurs within a 30 minute time frame a hard lockout is initiated. A lockout mode can be reset by either pushing the board mounted reset button or turning the unit's thermostat off for a 60 second period and then back on.

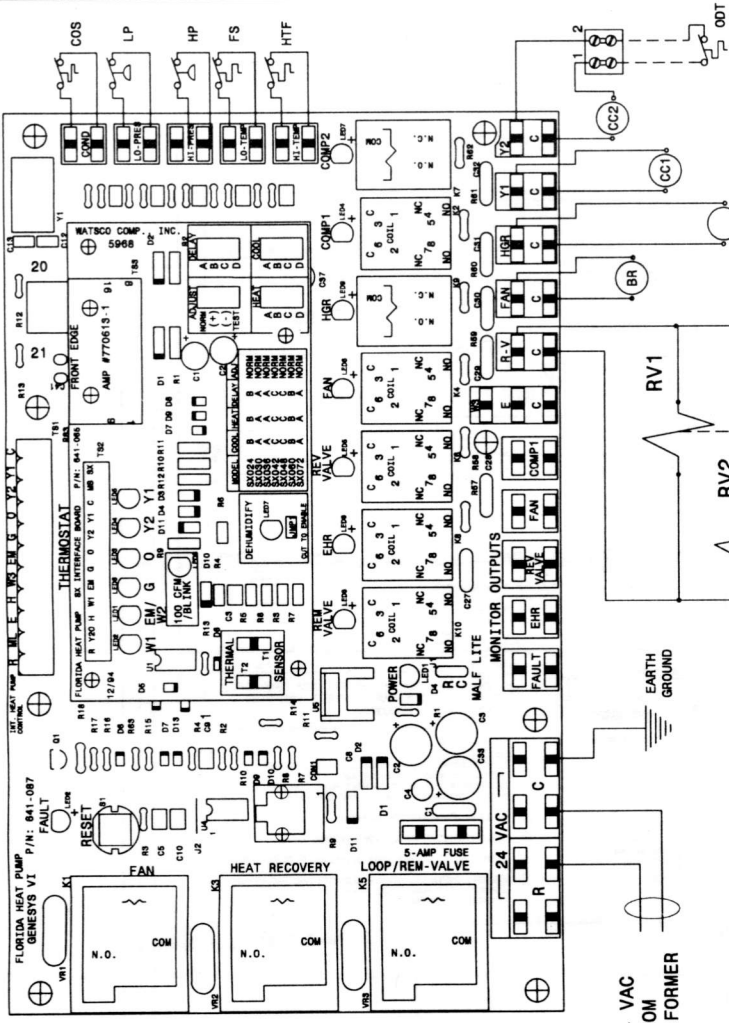
The controller can be run in a test mode by the use of the hand held device. In the test mode all sequence timings are reduced to 10 seconds to allow for quick diagnostics and troubleshooting. See the operating manual on the hand held device for troubleshooting with the hand held. Thermostat connections do not have to be removed from the controller when troubleshooting with the hand held device. The fan switch must be in the constant on position when troubleshooting with the hand held device on all SX Series units



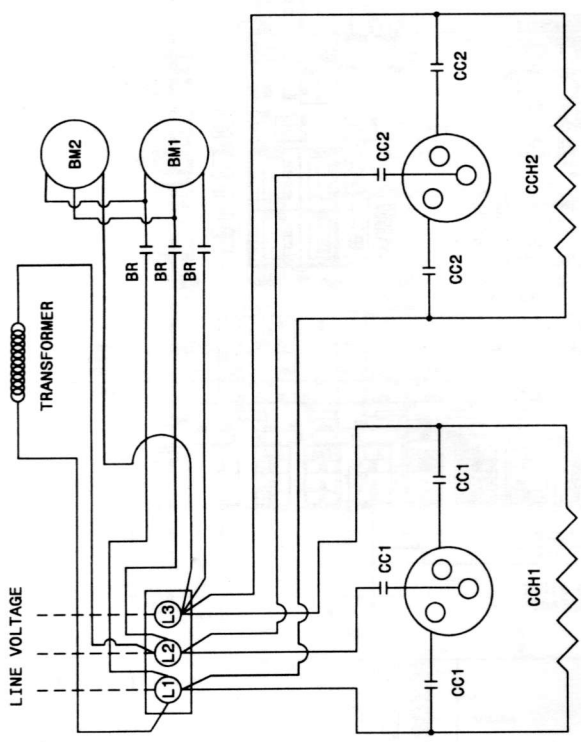








VOLTAGE DESIGNATOR	LINE VOLTAGE
- 3	208/230
- 4	460
- 5	575
<b>VOLTAGE DESIGNATOR</b>	
- 7	200-220
- 9	220-240
- A	380-420



STANDARD COMPONENTS LEGEND:

- #1 - FIRST STAGE
- #2 - SECOND STAGE
- BC - BLOWER MOTOR CAPACITOR
- BM - BLOWER MOTOR
- BR - BLOWER RELAY
- CC - COMPRESSOR CONTACTOR
- CCH - CRANKCASE HEATER (WHEN SUPPLIED)
- HP - HIGH PRESSURE SAFETY CONTROL
- LP - LOW PRESSURE SAFETY CONTROL
- RV - REVERSING VALVE (HEAT PUMPS ONLY)

OPTIONAL COMPONENTS LEGEND:

- [ ] COS - CONDENSATE OVERFLOW SWITCH
- [ ] FS - FREEZE STAT
- [ ] HGRS - HOT GAS REHEAT SOLENOID
- [ ] HTF - HIGH TEMP. FAULT SWITCH
- [ ] ODT - OUTDOOR THERMOSTAT (FIELD INSTALLED)

NOTES:

- 1) SEE UNIT RATING PLATE FOR ELECTRICAL RATING.
- 2) ALL FIELD WIRING MUST BE IN ACCORDANCE WITH N.E.C.-N.F.P.A. #70.



WIRING DIAGRAM  
THREE PHASE - ALL VOLTAGES

DUAL COMPRESSORS  
DUAL BELT DRIVE BLOWERS  
WITH GENESYS VI CONTROLLER

SIZE FSCM NO.	DWG NO.	DRAWN BY	REV
D173L1BA	WD173L01CA	K.N.	5
MANUFACTURING	SCALE	DATE	
a Harrow company		12-11-95	