



**HIRED-HAND®**

---

# **Farm Hand Stage Master**

**Environmental Stage Controller**

**Hired Hand Manufacturing, Inc.  
1733 Co Rd 68  
PO Box 99  
Bremen, Alabama 35033**

# Table of Contents

Section	Title	Page
1.	Ratings and specifications .....	3
2.	Warnings .....	3
3.	Limited Warranty .....	3
4.	Introduction .....	4
5.	Day to Day Operating Instructions.....	5
5.1	Checking/Adjusting Temperatures, and Timer Percentages.....	5
5.2	Running Curtain Machines.....	7
5.3	Adjusting Stage On/OffPoints.....	7
6.	Program Mode.....	8
6.1	Sensors For Display (PSd).....	8
6.2	Stage Parameters.....	8
6.2.1	Stage Sensors (P1).....	9
6.2.2	Stage Mode (P2).....	9
6.2.3	Stage Timer Settings (P3).....	9
6.2.4	Minimum Runtime Percentage (P10) (Variable Stages Only).....	10
6.2.5	Motor Curve (P11) (Variable Stages Only).....	10
6.3	Curtain Parameters.....	10
6.4	Cool Timer Settings (ON/OFF Stages Only).....	11
6.5	PC Compatible Network Parameters .....	11
6.6	Sensor Calibration .....	12
7.	Rarely Changed Settings .....	12
7.1	Switch Settings .....	13
8.	Controller Installation and Setup.....	14
8.1	Installation .....	14
9.	Programming Examples.....	15
9.1	Setting Stage OnPoints and OffPoints.....	15
9.2	Setting up Stage Modes, and Timer Status.....	15
9.3	Setting Up Tunnel Control .....	15
9.4	Cool Timer Stage Operation.....	16
9.5	Variable Speed Stage Operation.....	17
9.5.1	Variable Speed Stage Operation (Variable Stage Model Only) .....	17
9.5.2	Progressive Cool Timer Option .....	18
10.	Maintenance.....	19
11.	Wiring Diagrams, Schematics, etc.....	19
11.1	FH Stage Master Layout.....	20
11.2	Connecting the Curtain Machines to the Controller .....	21
11.3	Connecting Sensors to the Controller.....	22
11.4	Connecting Stages in a Variable Controller or Controller with PCB 150 to a Relay Panel .....	23
11.5	Connecting Stages in a Non-variable Controller or Controller with PCB 164 to a Relay Panel.....	24
11.6	Connecting AC Power to the Controller.....	25
11.7	Variable Speed Wiring .....	26
11.8	Variable Speed Wiring with External Hookup.....	27
11.9	Connecting the Stage Master to a Data Shuttle .....	28
11.10	Connecting the Stage Master to a Series or Parallel Alarm.....	29
12.	Program Reference .....	30
13.	Error Codes.....	33
13.1	Descriptions .....	33
13.2	Possible Solutions.....	33
14.	Temperature vs. Sensor Resistance Table .....	35
15.	Program Parameter Listing .....	36
16.	Error Code Listing .....	37
17.	Curtain Movement Time (sec.) Vs. Distance (inches/cm.).....	38
18.	Program Data Sheet.....	39

## 1. Ratings and specifications

- 115/230 Volts (Depending on switch position.)
- 50/60 Hz.
- 12 Amps per stage.
- 12 Amps per variable speed stage.
- 8 Amps per curtain machine.
- Room must be kept above 32°F/0°C.

## 2. Warnings

### **Warning!**

Before connecting power to the machine, be sure to check the position of the voltage selector switch located next to the transformer on the relay board. Improper positioning of this switch will cause system failure.

### **Warning!**

When this controller is used in a life support heating and ventilation system where failure could result in loss or injury, the user should provide adequate back-up, or accept the risk of such loss or injury!

## 3. Limited Warranty

All products are warranted to be free from defects in material and workmanship for a period of one year from the date of purchase if installed and used in strict accordance with the installation instructions.

Liability is limited to the sale price of any products proved to be defective or, at manufacturers option, to the replacement of such products upon their return. No products are to be returned to the manufacturer, until there is an inspection and/or a return-goods authorization (RGA) number is issued.

All complaints should be directed first to the authorized distributor who sold the product. If satisfaction is not obtained or the name of the distributor is not known, write the manufacturer that appears below, directed to the attention of Customer Service Manager.

This limited warranty is expressly in lieu of any and all representations and warranties expressed or implied, including any implied warranty of merchantability or fitness for a particular purpose. The remedy set forth in this limited warranty shall be the exclusive remedy available to any person. No person has authority to bind the manufacturer to any representation or warranty other than this limited warranty. The manufacturer shall not be liable for any consequential damages resulting from the use of our products or caused by any defect, failure or malfunction of our products. (Some areas do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.)

This warranty gives you specific legal rights and you may also have other rights that vary from area to area.

### **Warrantor:**

Hired-Hand Manufacturing, Inc.  
1733 Co. Rd. 68  
PO Box 99  
Bremen, Alabama 35033

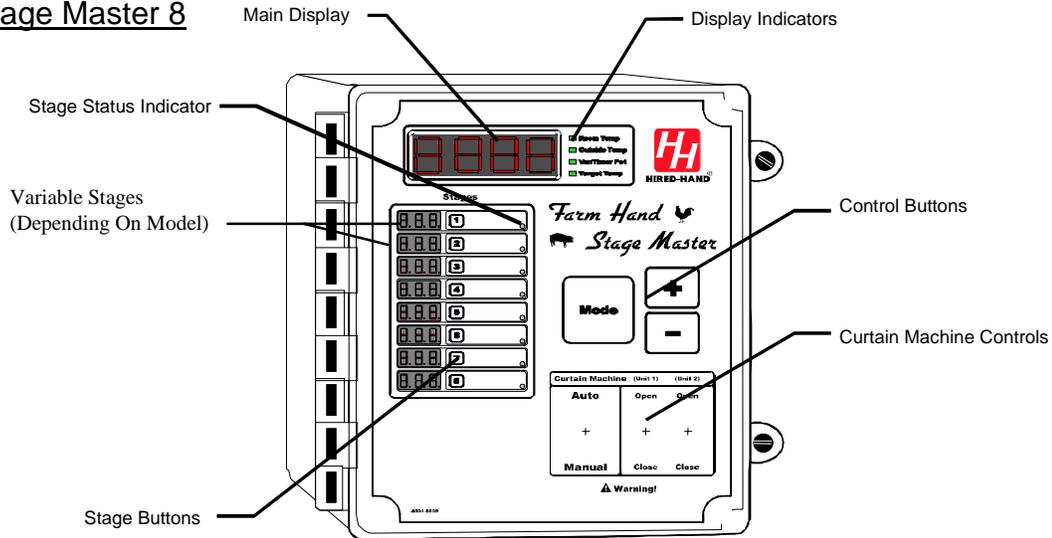
## 4. Introduction

There are four models of the Stage Master controllers that are listed below:

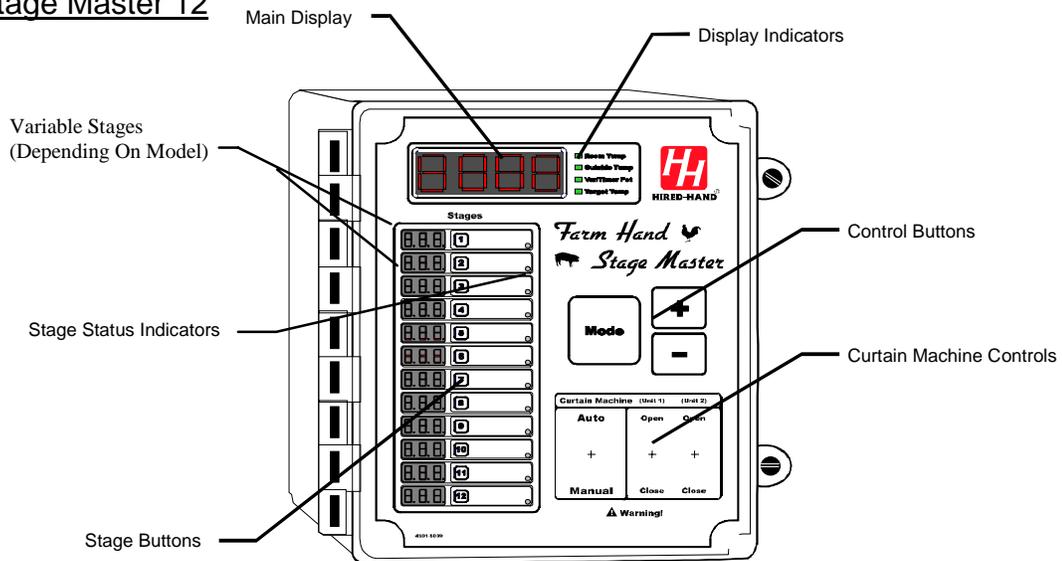
- Farm Hand Stage Master 8 without Variable Speed
- Farm Hand Stage Master 8 with Variable Speed
- Farm Hand Stage Master 12 without Variable Speed
- Farm Hand Stage Master 12 with Variable Speed

The only distinctions between the 8 Stage models and the 12 Stage models are the number of stages and the face pad. The following figures show the differences in the face pads.

### Stage Master 8



### Stage Master 12



**Notice: If the Farm Hand Stage Master is a Variable Speed Model, then stages 1 & 2 are the Variable Speed stages.**

The Farm Hand Stage Master Stage Controller is designed to be one of the simplest controllers on the market to operate, but to also be one of the most powerful.

The Stage Master has four main regions on the facepad that you need to be concerned with. First is the main display. This section includes the main display, and four green LED's which tell what the display is

indicating. If the green light beside “Room Temperature” is lit, then the display is showing the display option chosen in the Program Mode under the parameter **PSd**. Refer to Section 6.1 for an explanation of the **PSd** parameter. Later in this manual you will learn how to see the other three parameters.

On the left hand side of the controller face you will see the stage displays. When the controller is operating you will see the OnPoint of each stage (the temperature the stage will turn on). Next to the stage indicators, is a button with the number of the stage printed on it. You will press this button to set your on and OffPoints for that stage. (Stage OnPoints and OffPoints are discussed later in the manual.) The blank white region is for you to label your equipment such as (front heat, back heat, sidewall fans, etc.). Finally, there is a small red LED on the bottom right of this white region. This is the stage status indicator. This light will be lit if the stage is on, and will flash on and off if it is running because it is on a timer.

Just below the main display on the right hand side of the controller is the control button region. This region has three buttons, Mode, +, and -. You will learn the use of these three buttons later in the manual.

Finally, on the bottom right hand side of the controller is the curtain machine control region. This region includes an Automatic/Manual switch, and an Open/Off/Close switch for each machine.

## 5. Day to Day Operating Instructions

This section of the manual will give you all you need to know about the day to day operation of your controller.

### 5.1 Checking/Adjusting Temperatures, and Timer Percentages

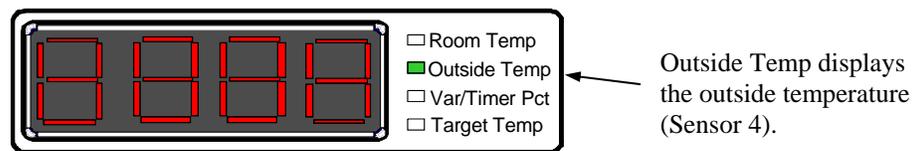
When no one has pressed a button for over one minute, the display will automatically show “Room Temperature”. To see the outside temperature, press the button labeled “Mode”. This button is located in the center of the controller facepad. When you press the button, watch the green LED’s beside the main display. Whichever LED is lit is the parameter you are viewing. You can easily see “Outside Temperature”, “Var/Timer Percentage”, and “Target Temperature”.

#### Room Temperature

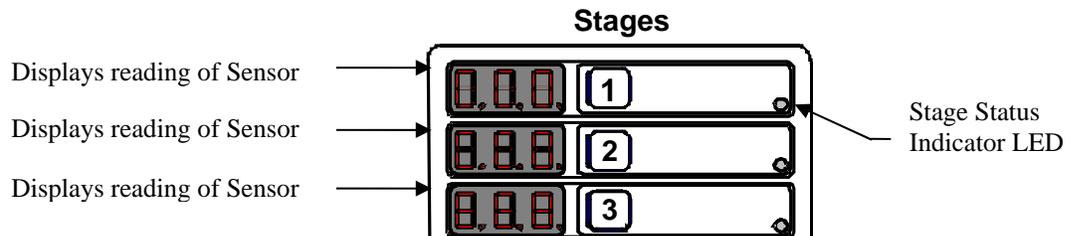
The temperature read by the sensor(s) chosen in the Program Mode under the parameter **PSd**. Refer to Section 6.1 for an explanation of the **PSd** parameter.

#### Outside Temperature

The temperature read by the sensor located outside the house. (Sensor 4)



While displaying the **Outside Temp**, the controller will also display the temperatures read by sensors 1, 2, & 3 in the corresponding stage displays. The remaining Stage Displays will be blank at this time.



## Var/Timer Percentage

The Var/Timer percentage parameter can be used to set *variable speed* and/or *runtime percentage* depending on the model of the Farm Hand Stage Master.

Variable Speed refers to the increase or decrease of fan speed as regulated by the controller based on temperature. For example, a Var/Timer Pct. set to 50 means that a fan will run at 50% of its maximum speed at a particular temperature.

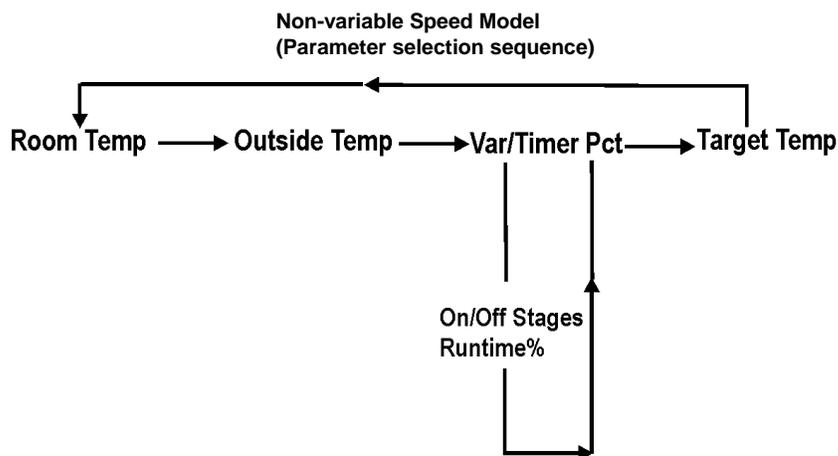
Runtime percentage refers to the percentage of the timer cycle that a stage on a timer will run. For example, if the Var/Timer Pct. is set for 30, and your timer cycle is set for 10 minutes, the timed stages will run for 3 minutes out of every 10 minutes (i.e. 30% of the timer cycle).

There are two models of the Farm Hand Stage Master Controller. On the **Non-variable speed model**, this setting refers to the Runtime percentage for any of the stages that are on the system timer. On the **Variable speed model**, this setting is used to set the minimum speed for stages 1 & 2 and also the Runtime percentage for any of the remaining ON/OFF stages that are on the system timer. Please note your model. You can determine the model by comparing the main display sequence to that described in the following diagrams.

### Non-variable Speed Model - (Runtime Percentage)

The Var/Timer Pct. parameter sets the Runtime percentage of all stages that are placed on a timer (See Section 9.2). The value of the Var/Timer Pct. in the main display refers to a Runtime % which can be set to values between 0 and 100 using the "+" and "-" buttons.

When you step through the main display parameters, notice the stage status indicators. As the Mode button is pressed, a Var/Timer Pct. value will appear in the main display, and stages affected by this setting will have stage status indicators lit.

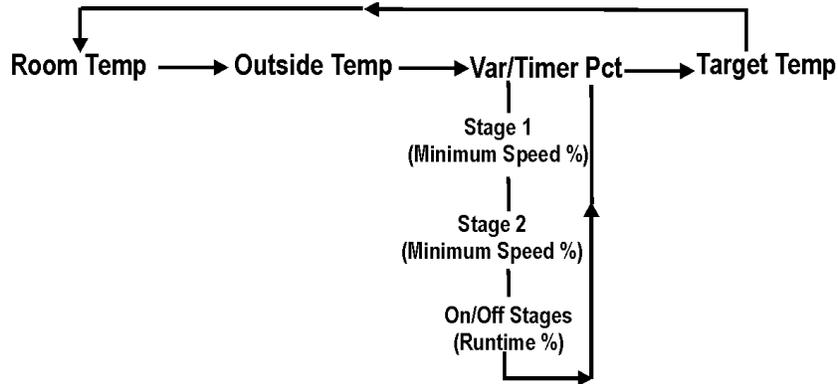


### Variable Speed Model - (Minimum Speed %)

On the variable speed model, this setting allows you to program three parameters: the Minimum speed % for stage 1, the Minimum speed % for stage 2, and the Runtime % for the remaining ON/OFF stages. If using the variable stages as progressive cool timer stages, this setting becomes the Minimum runtime % instead of the Minimum speed %. (Refer to Section 9.5.2 for more discussion on this option).

As you step through the main display and you get to the Var/Timer Pct. setting, notice the stage status indicators. These indicators show which setting you are programming. The Var/Timer Pct setting is displayed as shown in the following diagram.

**Variable Speed Model  
(Parameter selection sequence)**



**Target Temperature**

The temperature the system tries to maintain.

To adjust these settings, press the mode button until you see the setting you want to adjust, then use the + button to raise the value, and the - button to lower the value. When you are finished setting a new value, either press the mode button again, or do nothing, and the system will return to normal operation within a few seconds.

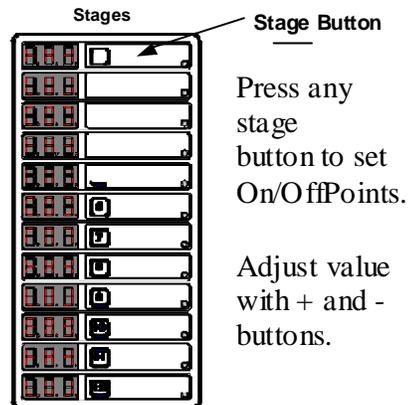
**5.2 Running Curtain Machines**

Under normal circumstances the machines should be left in automatic. This way, if the controller needs to open the curtains, it will open them. If, however, you want to open or close them for any reason do the following.

1. Find the switches for the machine you want to run, and check that the Open/Off/Close switch is in the off position. This makes sure that the machine does not turn until you want it to.
2. Place the Automatic/Manual switch for that machine in the "Manual" position.
3. To open the machine place the Open/Off/Close switch to the position marked "Open".
4. To close the machine place the Open/Off/Close switch to the position marked "Close".
5. Finally when you are finished positioning the machine, place the switch back into the "Off" position. Note: "Off" position is between "Open" and "Close".
6. When you are ready for the controller to take over control of the curtain, place the Automatic/Manual switch in the automatic position.

**5.3 Adjusting Stage On/OffPoints**

If you decide that a fan stage comes on too soon, or waits until temperature is too high to come on, you can easily adjust that setting. To adjust the stage OnPoint, press the numbered stage button one time. The individual stage display will flash, and the main display will flash between "On" and the Target Temperature. Use the + button to raise the value in the individual stage display until you see the correct temperature, or the - button to lower the value until the stage OnPoint is where you want it. When you are finished setting a new value, press the individual stage button again and the main display will read "Off" and flash the target



temperature. Use the + and/or - buttons until the correct setting shows in the individual stage display.

Notice that as you press the stage button the first time, all of the individual stage displays show their stage's OnPoints. Only one stage will flash this reading. When you press the + and/or - button, you will only adjust that particular stage's value. To adjust another stage, press that stage's button.

When you have finished setting your stage on/OffPoints press the individual stage button once more, and the system will not flash any stage displays, and the main display will read a steady value. Your controller is now operating normally again.

**Note:** In this manual, a stage's OnPoint parameter is referenced as **(ON)**. A stage's OffPoint parameter is referenced as **(OFF)**. **For Variable stages**, the Minimum OnPoint is the value of the **(OFF)** parameter. The Maximum OnPoint is the value of the **(ON)** parameter

## 6. Program Mode

Settings that are usually set up once per growout, or maybe even just for summer or winter are referred to as program parameters and are accessed by taking the controller to program mode. Some examples of these settings are Curtain Runtime, Stages on Timers, and Sensor Calibration.

To get to program mode, press and hold the "Mode" button for five seconds. When the controller has entered program mode, the main display will flash between "PSd" and the value of this parameter.

The "PSd" is known as a parameter number. All the program items for the controller have a parameter number assigned to them. The numbers are listed in the section called "Program Reference" in the back of this manual with a short description of each parameter. When in program mode, you change the current parameter by using the + and - buttons as needed. When you have finished with the current setting, press the "Mode" button to move to the next parameter.

### 6.1 Sensors For Display (PSd)

The user is given the choice as to what he/she wants to display for **Room Temp**. The choice is made in Program Mode under the parameter **PSd**. The following is a list of choices:

**PSd = Room Temperature Display**

100 = Sensor 1

020 = Sensor 2

120 = Average of Sensors 1 & 2

003 = Sensor 3

103 = Average of Sensors 1 & 3

023 = Average of Sensors 2 & 3

123 = Average of Sensors 1, 2, & 3

### 6.2 Stage Parameters

The following parameters are used to program each stage on the Farm Hand Stage Master. Through these parameters, the user has complete control over the operation of each stage. The following sections explain each parameter in detail.

**P1 = Stage Sensors**

**P2 = Stage Mode**

**P3 = Stage Timer Settings**

**P10 = Minimum Runtime Percentage (Variable Speed Stages Only)**

**P11 = Motor Curve (Variable Speed Stages Only)**

### 6.2.1 Stage Sensors (P1)

A stage can be programmed to run off of any sensor or combination of sensors. The following is the list of **P1** options:

#### **P1 = Stage Sensors**

- 100 = Sensor 1
- 020 = Sensor 2
- 120 = Average of Sensors 1 & 2
- 003 = Sensor 3
- 103 = Average of Sensors 1 & 3
- 023 = Average of Sensors 2 & 3
- 123 = Average of Sensors 1, 2, & 3

### 6.2.2 Stage Mode (P2)

The Farm Hand Stage Master is a very intelligent controller, therefore, it needs to not only know whether this is a heating or cooling stage but also what type of cooling stage. The Farm Hand Stage Master reacts not only to temperature but also curtain position. This feature allows the grower to program the cooling stages to work exactly like he wants them to without the expense of hard wiring through relays and limit switches. This feature allows the Farm Hand Stage Master to better react to the environment. Any Stage can be programmed to be one of the following:

**Important:** In the following descriptions, many references are made to the Main Curtain (Unit 1). If you do not have a Main Curtain or do not wish to use the auxiliary connection as shown in **Section 11.2**, you must place a jumper across the signal terminals for Unit 1. This manipulates the controller into thinking the main curtain is closed. In turn, this allows the heat and negative stages to operate.

#### **1 = Heat**

This mode allows the equipment to operate when room temperature is below the OnPoint for the stage, and the curtains are closed.

#### **2 = Cool Stir**

This mode setting allows the cool stage to run whether the main curtain is open or closed. The only time that this mode will not run is during tunnel mode.

#### **3 = Cool Negative**

This mode setting only allows the cooling stage to run if the main curtain is closed, hence the name Negative. This stage will not run if the controller is in tunnel mode.

#### **4 = Cool Negative Tunnel**

This mode setting works exactly like the Cool Negative setting except it will run if the controller goes into tunnel mode. This stage is sometimes referred to as a transitional stage. In other words, it operates before it goes into tunnel and also during tunnel.

#### **5 = Cool Tunnel**

This mode setting only works when the controller is in tunnel mode.

### 6.2.3 Stage Timer Settings (P3)

The Farm Hand Stage Master is equipped to satisfy any of your minimum ventilation needs for regular runtime timers, to cool timers, to progressive timers.

#### **00 = No Timer**

Select 0 for the timer setting if you do not want the stage to be on a timer.

### 01 = Runtime Timers

Any one of the On/Off stages can be placed on the system timer by placing a "1" in parameter 3 (**P3**) of the stage. By doing this the stage will operate off of the system timer while the temperature is below the stage's OnPoint. Once the temperature reaches the stage OnPoint, the stage will come on full time.

### 02 = Cool Timers

#### ON/Off Stages

Any one of the On/Off Stages can be placed on a cool timer. By doing this the stage will operate off the system timer only while the temperature is above the stage OffPoint (**OFF**). Refer to Section 9.4 "Cool Timer Stage Operation" for proper setup.

#### Variable Stages

Any of the variable stages can be placed on a cool timer. By doing this the stage will be placed on the system timer all the time. It will run full speed for a certain percentage of time which is set in Var Timer/PCT. This percentage will progressively increase as the temperature rises above the minimum OnPoint setting (**OFF**). Refer to Section 9.5 "Variable Speed Stage Operation" for proper setup.

## 6.2.4 Minimum Runtime Percentage (P10) (Variable Stages Only)

This setting is the percentage of the system timer that the variable stage will run at minimum speed if the stage sensor's temperature is below the Minimum OnPoint (**OFF**) for the stage.

## 6.2.5 Motor Curve (P11) (Variable Stages Only)

The controller is programmed to operate single phase or three phase fan motors at their optimum performance levels. Select the correct motor curve parameter (**P11**) for your particular application from the following table.

Curve	Conditions
0	This curve is optimized for use with Hired Hand's line of Funnel Flow Fans that are 24" or less. Also, line voltage must be Single Phase.
1	This curve lends itself better to operation of 36" fans. The power distributed at each percentage is somewhat greater than that of <b>curve 0</b> . Therefore, the speed will be a little greater than that of <b>curve 0</b>
2	This curve is for 3-Phase systems. Its purpose is to shift the voltage curve to give a much higher power from the varied phase. Conditions that would warrant the use of this curve is a variable speed fan that varies a great deal from 100% speed to 95% speed.
3	This curve is for 3-Phase systems. Its purpose is to shift the voltage curve to give much less power from the varied phase. Conditions that would warrant the use of this curve is a variable speed fan that varies very little from 100% speed to 5% speed.
4	This curve is for use with Hired-Hand's newest Emerson fan motor. These motors are typically used on fans that are 24" or smaller.

## 6.3 Curtain Parameters

This controller runs 1 or 2 curtain machines independently. No additional resources – including external timers – are necessary. The curtain machines run off a common cycle timer and run timer, however they can use separate sensors. The sensor selection is made via a switch located on the inside of the front cover of the machine. This switch causes the machines to either operate together or independently. If they are operating independently, unit 1 always uses sensor 1 and unit 2 uses sensor 2. A brief overview of the programmable parameters for the curtain machines follows:

**Note:** Parameters P20-P24 are only used when using the main curtain to naturally ventilate the building.

**P20 -- Cycle Time**

The controller looks at all parameters and decides whether or not to move the curtains occasionally. This parameter determines how often this occurs. Valid settings are 1 to 10 minutes.

**P21 -- Run Time**

When the controller determines that curtains need to run open or close, this setting determines how long they run. Valid settings are 1 to 240 seconds.

**P22 -- Initial Run Time**

When the controller determines that the curtains should run open and senses that they are closed, it uses this parameter for the 'first' run. This setting is used to allow the curtains to open enough on the first run to guarantee adequate ventilation. Valid settings are 1 to 240 seconds.

**P23 -- Degrees above target for Unit 1**

Generally a grower would like to give his variable speed and/or first stage fans an opportunity to ventilate the building before starting curtains open. Thus, when the curtains do come down, they will most likely stay down for a fair period of time. This setting allows the user to do that. Valid settings are: 0 - 25.

**P24 -- Degrees above target for Unit 2**

Occasionally, a grower may want one curtain sidewall to drop before the other to try to avoid large temperature swings. This setting allows for this to happen.  
**Note: If you would like both curtain units to always react together, you must set P23 = P24.**

**P25 -- Tunnel OnPoint**

This is the sensor 4 temperature at which the controller will enter tunnel mode. Only applicable when tunneling on outside temperature.

**P26 -- Tunnel OffPoint**

This is the sensor 4 temperature at which the controller will exit tunnel mode. Only applicable when tunneling on outside temperature.

**P27 -- Close Override (Degrees Below Target)**

This setting provides the grower a temperature at which to override the curtains closed. The setting represents degrees below target at which time the curtains will begin closing regardless of the cycle. The setting allows the user to anticipate quick temperature drops to help maintain a stable inside temperature. Valid settings are 1-25.

## 6.4 Cool Timer Settings (ON/OFF Stages Only)

The following two settings allow the user to set the Runtime range for their cool timer stages. These settings apply to the cool timers on the On/Off stages only.

**P70 = Cool Timer Maximum Percentage**

This sets the maximum Runtime percentage that a cool timer stage can operate.

**P71 = Cool Timer Minimum Percentage**

This sets the minimum Runtime percentage that a cool timer stage can operate.

## 6.5 PC Compatible Network Parameters

This option requires Hired-Hand's Farm Manager Software. The controller has 3 functions which are used to set it up on the Hired-Hand PC compatible inter-controller network (HH.Net). These are:

**P40 – HH.Net Address**

HH.Net allows you to connect up to 32 controllers on a single communications port of your personal computer (PC). In order for the computer to recognize the communications from the controllers, each controller must have a unique address. For example: If you have two *Stage Master*, and two *Power Vents* you would

need to set the first *Stage Master* to be address 1, the second *Stage Master* to address 2, the first *Power Vent* to address 3, and the second *Power Vent* to address 4. Valid settings are: 1 - 32. (You do not have to address the controllers in any particular order.)

**P41 -- Version Number**

This is not settable. It is the version of controller software.

**P42 -- Controller Type**

This is not settable. It is a unique number that allows the network software (Farm Manager) to know the type of controller.

**6.6 Sensor Calibration**

The Stage Master has 4 sensors that may be calibrated. The parameter(s) for calibration are PSx with x being the sensor number. The sensor temperature reading is alternately displayed along with the parameter number. You should never attempt to calibrate a sensor more than 8 degrees. If you have a setting that far out of range, it indicates that there is a problem that should be corrected.

**PS1 - Calibrate Sensor 1**

This reading can be changed by pressing the + or - button until the desired reading is displayed.

**PS2 - Calibrate Sensor 2**

This reading can be changed by pressing the + or - button until the desired reading is displayed.

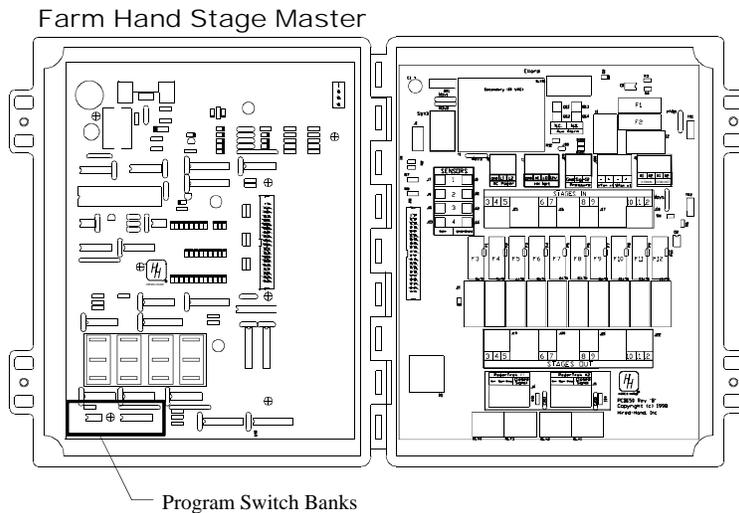
**PS3 - Calibrate Sensor 3**

This reading can be changed by pressing the + or - button until the desired reading is displayed.

**PS4 - Calibrate Sensor 4**

This reading can be changed by pressing the + or - button until the desired reading is displayed.

**7. Rarely Changed Settings**



Settings which are rarely, or never, changed are found on two banks of switches located inside the front panel of the controller. The left hand bank of switches is for Tunnel Control, and the right hand bank of switches controls the status of the controller. When a switch is up it is ON, when a switch is down it is OFF. The functions of the switches are as follows:

## 7.1 **Switch Settings**

### **Tunnel Switches**

#### **SWX 1 - Tunnel On/Off**

This switch is used to enable or disable the tunnel mode of the controller. When this switch is in the OFF position, the controller will not go into tunnel for any reason.

#### **SWX 2 - Tunnel On Stage**

This switch tells the controller whether it is tunneling off of the lowest programmed tunnel stage or if it is tunneling off of outside temperature. If this switch is OFF, the controller will use the “Tunnel OnPoint” setting for entry into tunnel.

#### **SWX 3 - Power Ventilate**

This switch indicates whether this is a power ventilated house or a natural ventilated house. If it is a power ventilated house the controller will leave the inlet curtain closed until tunnel mode is entered. This switch must be set to ON if you have a Power Ventilated house.

#### **SWX 4 - Not used at this time**

This switch may be used in the future by Hired-Hand to add greater functionality/flexibility to the controller. The switch position has no effect on the operation of the controller.

### **Status Switches**

#### **SWX 1 - Lock**

This switch is used to lock the controller. When it is on, the user may change settings such as target temperature and minimum speed/timer percentages but they can not change the settings in program mode. If the switch is set to ON the program settings are locked.

#### **SWX 2 - Fahrenheit/Celsius**

This switch toggles between Fahrenheit and Celsius operation. If the switch is set to ON the controller will read the sensors as Fahrenheit. (Note: If you change this switch, you will have to reset your tunnel OnPoints and OffPoints and your Target Temperature.)

#### **SWX 3 - 5/10 minute timer**

This switch selects between a 5 and 10 minute system timer. If the switch is ON, the timer is 10 minutes.

#### **SWX 4 - Sensor 3 Active**

This switch turns off sensor 3. If the switch is off, sensor 3 is turned off. Note: This is used to disable the sensor in the back half of a half house brooding situation. This way the low temperature reading does not affect the temperature readings for the rest of the house. Just be sure that sensor 3 is placed in the non-brood end of the house. If the switch is ON, sensor 3 is used.

#### **SWX 5 - Curtains On Separate Sensor**

This switch is used to choose whether the curtain machines operate off the same sensor or if they operate independently. If the switch is ON, the curtains are independent with curtain 1 running on sensor 1, and curtain 2 running on sensor 2. If the switch is OFF, both units operate on the average of all the inside sensors.

#### **SWX 6 - Not used at this time**

This switch may be used in the future by Hired-Hand to add greater functionality/flexibility to the controller. The switch position has no effect on the operation of the controller.

### **SWX 7 - Not used at this time**

This switch may be used in the future by Hired-Hand to add greater functionality/flexibility to the controller. The switch position has no effect on the operation of the controller.

### **SWX 8 - Program 'A' or 'B'**

This switch is used to toggle between 2 preset programs. This could be used to store separate summer/winter programs for instance. The ON position is for Program A, and the OFF position is for Program B.

## **8. Controller Installation and Setup**

### **8.1 Installation**

#### Tools Required

Mini Screwdriver                      Standard Screwdriver  
Wire Strippers

#### Installation Instructions

1. Unpack system, and check that all components are present.
  - 1      Farm Hand Stage Master
  - 1      Installation Kit
  - 1      Fuse Kit
  - 4      Sensors
  - 1      Manual
2. Hang Farm Hand Stage Master with four screws.
3. Make sure all power supplies are disconnected before breaking any wires, or reaching into the enclosure.
4. Open Stage Master and find all connections. Refer to wiring diagrams in back of this manual.
5. Run sensors out to locations inside the house. (Outside sensor should be installed outside the house.) Be sure that the sensors are in a safe location, free from any temperature influences (direct sunlight, water, etc.) Use care when securing sensor wires so that you do not cut the wire, Any short, or break in the wire will cause improper sensor operation.
6. Connect each sensor to its appropriate terminals inside the enclosure. (See wiring diagrams in the back of this manual.)
7. Connect wires from stage terminals to the contactor panel, or relay box. See wiring diagrams for locations of terminals.
8. Hookup three wire connections from Stage Master board to curtain machines. See wiring diagrams for locations of terminals.
9. **CHECK THE POSITION OF THE VOLTAGE SELECTOR SWITCH.** Connect the wires for 120/240V power to the terminals specified in the wiring diagram.

## 9. Programming Examples

When following these examples, you will need to refer to the Program Reference section to see which options are available for each of the parameters (P1, P24, etc.).

### 9.1 Setting Stage OnPoints and OffPoints

OnPoint, and OffPoint are easily set by pressing the numbered button on the left hand side of the front panel. When you press one of the stage buttons, the main display will show “ON”. Then use the + and - buttons until you see your setting in the individual stage display. (The stage display you are adjusting will flash until you press the stage button again.) If you want to program all the stages OnPoints, you may do so by clicking on another stage’s button, then using the + and - buttons.

Press the stage button again, and the main display will show “OFF” adjust the OffPoint just like you did the OnPoint. When you are finished, press the stage button again, and you will return to normal operation. Repeat this process for each of the twelve stages.

### 9.2 Setting up Stage Modes, and Timer Status

There are three parameters used in programming any stage. They are P1-P3. The following is an overview of how to program a stage:

1. Enter *Program Mode* by pressing and holding the *Mode* button for 5 seconds until **P1** is displayed, and the stage 1 display begins to flash. This parameter selects the sensor(s) that this stage watches for on/off operation.
2. Select the stage you want to program by pressing the stage button (next to the stage display.)
3. Press the + *or* - button until the desired sensor is displayed. 100= sensor 1; 020 = sensor 2; 120 = Average of Sensors 1&2; 003 = Sensor 3; 103 = Average of Sensors 1 & 3; 023 = Average of Sensors 2 & 3; 123 = Average of Sensors 1,2, & 3.
4. If you want to program more stages sensors, press the next stage’s button, and repeat step 3.
5. Press the *Mode* button again and **P2** is shown. This parameter selects what mode the stage operates as.
6. Press the + *or* - button until the desired mode is displayed.
7. If you want to program more stages modes, press the next stage’s button, and repeat step 6.
8. Press the *Mode* button until **P3** is displayed. This parameter allows you to put a stage on the system timer (5 or 10 minutes).
9. Press the + *or* - button until the desired setting is displayed.
10. If you want to program more stages stage timer settings, press the next stage’s button, and repeat step 9.
11. Exit Program Mode by pressing the *Mode* button until after **PS4** has been displayed or wait 1 minute.

### 9.3 Setting Up Tunnel Control

**Note:** If you do not want the controller to ever enter tunnel mode just make sure that the Tunnel On/Off switch is in the off position and you can ignore this section.

The Stage Master is a very versatile tunnel controller. It provides the grower with many different ways to tunnel based on the layout of the house. It also provides two different ways of initiating tunnel mode. The following are some tips and examples of setting up this controller to tunnel your house appropriately.

1. The first step in setting up your tunnel house is to configure the stages that you want as your **cool tunnel stages**. If some stages need to operate in tunnel mode and in normal mode, then program these stages to be **cool negative tunnel stages**. See the Program Reference section in the back of this manual for more information on the operation of various stage modes.
2. The next step in setting up your tunnel house is determining how your controller should operate while out of tunnel mode. In other words, does your house always power ventilate or does it naturally ventilate using curtain sidewalls. If it is a power ventilated house you must set the **Power Ventilate** switch (Tunnel bank SWX-3) in the on position.
3. The last step in setting up your tunnel house is determining how you would like to initiate tunnel mode. You can initiate tunnel mode by outside temperature or by your lowest programmed **cool tunnel** stage. The lowest programmed cool tunnel stage is determined by the lowest OnPoint. If you would like to tunnel based on outside temperature you must set the **Tunnel On Stage** (SWX-2) switch to off. You can then set the temperature at which you would like to enter tunnel mode at **P24** and the temperature at which you would like to exit tunnel mode at **P25**. Otherwise, set the **Tunnel On Stage** (SWX-2) to on.

The following is a brief description of how the tunnel would work in each of the situations.

#### **Tunneling on outside temperature in a naturally ventilated building**

When the outside temperature rises above the Tunnel OnPoint (**P25**), the controller will shut down all stages and begin to close the main curtain and open the inlet curtain. After 1 minute has passed, the controller makes sure that the inlet is open. If there is no error condition, the controller will begin waiting for the main curtain to close. If the controller does not see the main curtain closed after 12 more minutes, it will abort tunneling, and sound the alarm. Once the controller recognizes that the main curtain is closed, it will then allow the other cool tunnel and cool negative tunnel stages to come on. Once the temperature drops below the Tunnel OffPoint (**P26**), the controller will open both the inlet and the main curtain fully and return the stages to normal operation immediately.

#### **Tunneling on a stage in a power ventilated building**

As soon as the lowest programmed Cool Tunnel stage comes on, the controller opens the inlet curtain and leaves all Cool Negative Tunnel and Cool Tunnel stages on. When the temperature begins to fall and the lowest programmed Cool Tunnel stage turns off, the controller will close the inlet fully and return the stages to normal operation immediately.

#### **Tunneling on outside temperature in a power ventilated building**

The controller reacts in the same way as in the previous example, except it uses **P25** and **P26** to enter and exit tunnel. For proper operation in a house without a curtain sidewall, you must jumper the curtain closed switches on the main curtain together.

**Note:** If you are using a main sidewall curtain, it must run at a speed where it can go from fully open to fully closed in less than 13 minutes. If not, the controller will not operate properly as tunnel.

### **9.4 Cool Timer Stage Operation**

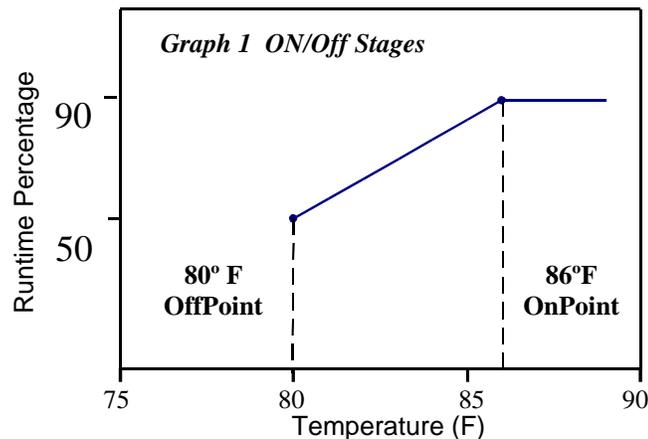
On the Farm Hand Stage Master any of the ON/OFF can be placed on a cool timer. A cool timer stage will come on and run at the timer percentage whenever temperature is above it's OffPoint (**Off**), and its timer percentage will increase as temperature rises. The following graph shows how you can vary this percentage.

Refer to **Graph 1 and Table 1**. The stage is placed on a cool timer by setting **P3=2**. A Cool Timer stage always varies its runtime based on the stage's temperature and it's **ON** and **OFF** settings. In this example, the OffPoint is set to 80°F (**OFF=80**), and the OnPoint is set to 86°F

(ON=86). The stage will not run if the temperature is below the OffPoint, as shown in **Graph 1**. When the temperature reaches the OffPoint, the stage is placed on the system timer.

To enhance temperature control, the Runtime percentage of a cool timer stage can be varied. The percentage of the Runtime that the cool timer stage is ON can be varied when the temperature is between the OffPoint and the OnPoint by setting parameters P70 and P71. In this example, the Minimum Runtime percentage is 50%, as set by **P71 = 50**. The Maximum Runtime percentage is 90%, as set by **P70 = 90**.

When the temperature reaches 80°F the stage runs for 50% of the Runtime period (2-1/2 minutes if the system timer is set for 5 minutes, or 5 minutes if the system timer is set for 10 minutes). As the temperature increases, the Runtime percentage of the stage progressively increases up to the Maximum Runtime percentage of 90% when the temperature reaches 86°F. Above 86°F, the Runtime percentage remains constant at 90%.



**Table 1 Example Of Cool Timer Stage Operation**

Setting	Stage Sensor	Stage Mode	Stage Timer	OffPoint	OnPoint	Cool Timer Max %	Cool Timer Min %
Parameter	P1	P2	P3	OFF	ON	P70	P71
Value	10	02	02	80	86	90	50
Option	Sensor 1	Cool Stir	Timer ON	Minimum OnPoint	Maximum OnPoint	Maximum Runtime %	Minimum Runtime %

**Brief Description Of Cool Timer Stage Operation**

As you can see, a stage will be placed on the system timer once the temperature rises above 80°F (OFF) and will start running 50% (P71) of the time. If the temperature continues to increase then the run time percentage will also increase toward 90% (P70).

**9.5 Variable Speed Stage Operation**

Depending on the Farm Hand Stage Master model, you have 0 or 2 variable stages. The Variable stages can be used in one of two ways: Variable Speed or Progressive Cool Timer. The two options are selected by the parameters P3. The following sections explain the operation of both options.

**9.5.1 Variable Speed Stage Operation (Variable Stage Model Only)**

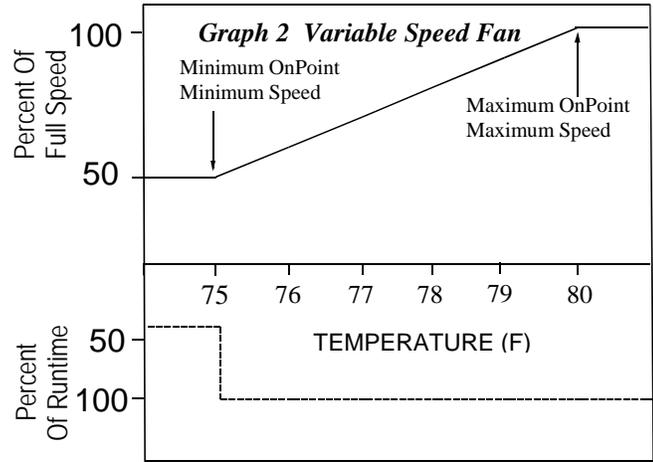
**Note: This option applies to stages 1 and 2 of the Variable Stage Farm Hand Stage Master.**

The variable speed option (P3=0) allows the user to configure the variable stage to vary the speed of the fan for their minimum ventilation needs. The following explains the setup and operation.

In this case, the stage timer setting is P3=0 to indicate variable speed operation. The Minimum OnPoint (OFF) is set for 75°F, and the Maximum OnPoint (ON) is set for 80°F. This establishes the temperature range (75°-80°) over which the speed is varied. The variable speed percentage is set by the "Var/Timer

Pct." parameter as described in Section 5.1. In this example, Var/Timer Pct. is set to 50%. The Minimum Runtime percentage is set to 40% (**P10=40**).

Below 75°F, a fan connected to the variable speed stage will run at 50% speed for 40% of the system timer (either 2 minutes for a 5 minute timer, or 4 minutes for a 10 minute timer). When the temperature reaches 75°F, the fan will run at minimum speed (50%) continuously. As the temperature increases, the fan speed progressively increases from 50% up to 100% at 80°F. Above 80°F, the fan runs continuously at its maximum speed.



**Table 2 Example Of Variable Speed Fan Control**

Setting	Stage Sensor	Stage Mode	Stage Timer	Minimum OnPoint	Maximum OnPoint	Minimum Runtime %	Motor Curve	Var/Timer Percentage
Parameter	P1	P2	P3	OFF	ON	P10	P11	N/A
Value	10	02	00	75	80	40	0	50
Option	Sensor 1	Cool Stir	No Timer	Fan begins Varying Speed	Fan begins Maximum Speed	Runtime 40%	Standard single phase	Refer to Section 5.1

**Brief Description Of Variable Speed Fan Control**

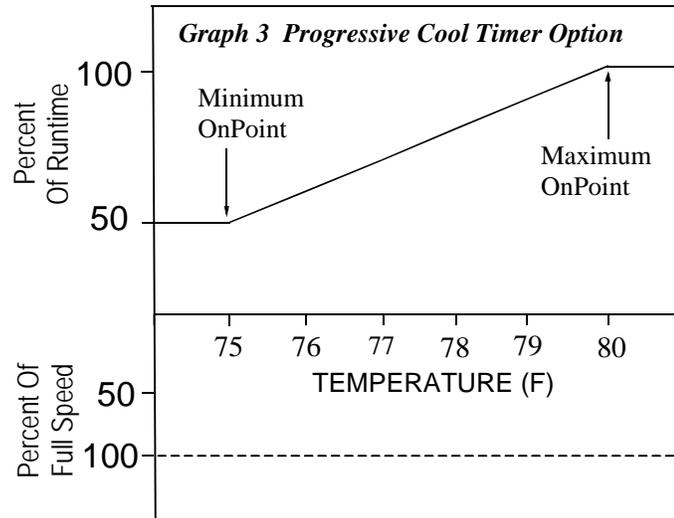
From the graph, you can see that at 78°F, the variable speed fan will run at 70% of maximum speed. Below 75°F the variable speed fan will run at its minimum speed, for the minimum timer percentage (**P10**). Above 80°F the variable speed fan will run at 100% continuously.

**9.5.2 Progressive Cool Timer Option**

The progressive Cool Timer operation varies the Runtime percentage while keeping the fan speed constant. Refer to Graph 3 and Table 3. The stage timer is set to ON (**P3=2**). In this case, the stage timer setting is **P3=2** to indicate progressive cool timer operation.

As in the previous example, the Maximum OnPoint is set to 80°F (**ON=80**), and the Minimum OnPoint is set to 75°F (**OFF=75**). The Runtime percentage is progressively varied over this temperature range from 75° to 80°. The "Var/Timer Pct." parameter, which in this case refers to the stage's minimum runtime percentage, is set to 50 (See Section 5.1)

At 75°F and below, the stage will operate at full speed on a system timer running at its minimum runtime percentage (Var/Timer Pct. = 50). As the temperature increases above 75°F so does the stage's runtime percentage. Once the temperature rises above 80°F, the stage will run continuously.



**Table 3 Progressive Cool Timer Option**

Setting	Stage Sensor	Stage Mode	Stage Timer	Minimum OnPoint	Maximum OnPoint	Minimum Runtime %	Motor Curve	Var/Timer %
Parameter	P1	P2	P3	OFF	ON	P10	P11	N/A
Value	10	02	02	75	80	N/A	N/A	50
Option	Sensor 1	Cool Stir	Timer ON	Stage begins varying Runtime	Stage runs continuously	N/A	N/A	Refer to Section 5.1

**Brief Description of Progressive Cool Timer Option**

As you can see from graph 3, as the temperature increases above the Minimum OnPoint, (OFF=75°F) the Runtime % progressively increases until it reaches 100% at its Maximum OnPoint (ON = 80°F). When using this option, it is not necessary to set P10 or P11 for the stage. These parameters only apply to variable speed operation.

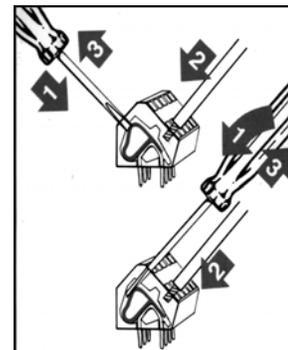
**10. Maintenance**

Check the calibration of your sensors at least once per quarter. To do this, you will need to have two persons: one at the sensor with a trusted thermometer, and one at the controller to set the sensor to the proper setting.

**11. Wiring Diagrams, Schematics, etc.**

All wiring connections for stages, curtain machines, variable speed fans, and curtain sensors inside the controller are made without terminals on the end of the wire. To make the connection, strip about ¼” of the insulation off the wire, and follow the diagram below.

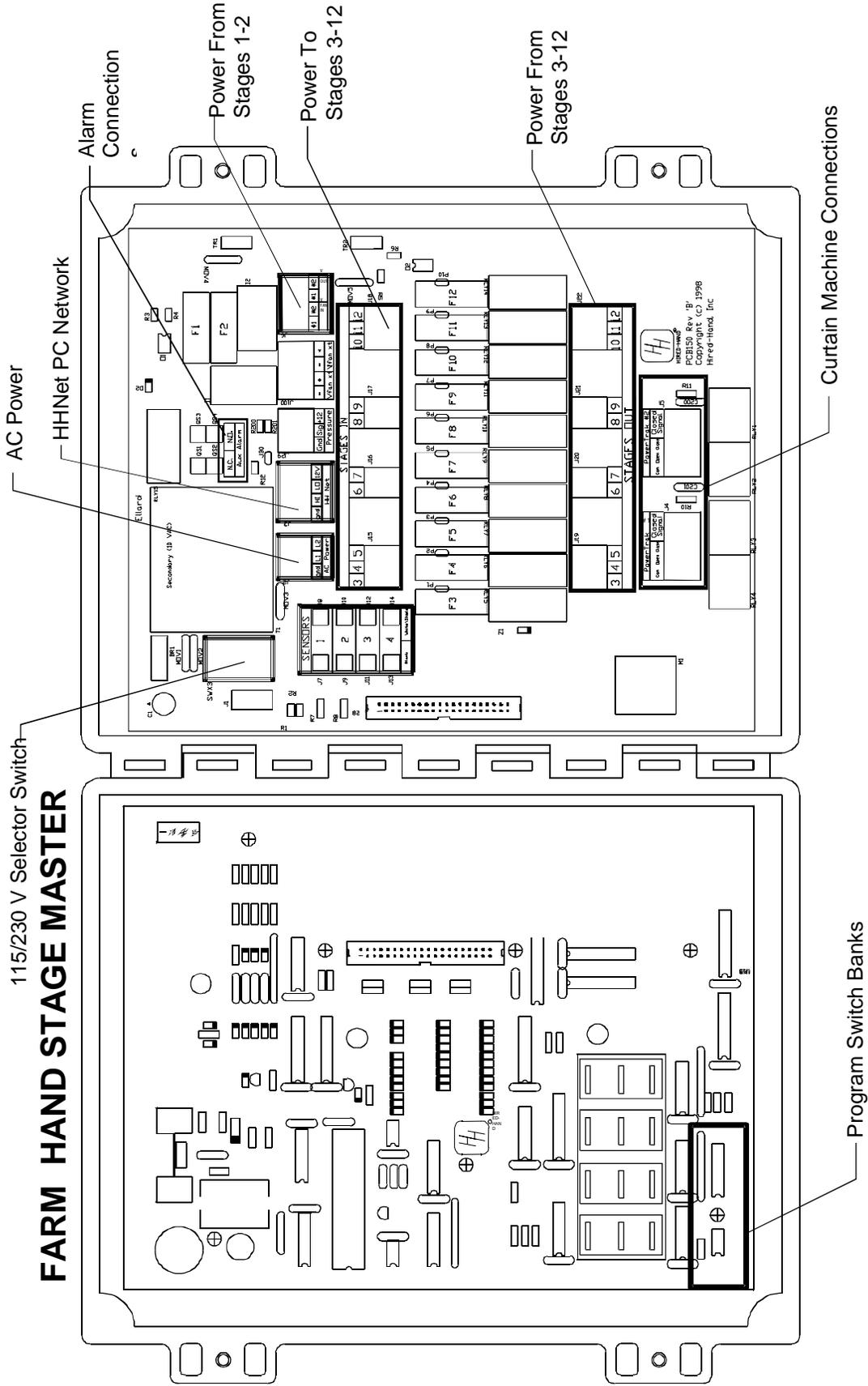
1. Insert a small screwdriver into either the hole shown in the diagram.
2. Insert the stripped end of the wire into the hole shown in the diagram.
3. Remove the screwdriver, and tug slightly on the wire to check that it is snug.



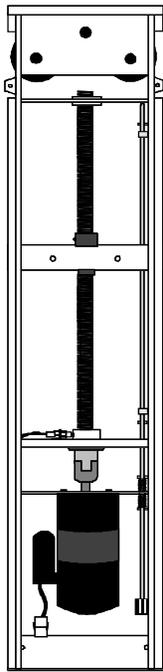
**Warning!**

Do not connect more than 12 amps of load to any one stage. The Variable Speed Circuit will carry up to 12 amps.

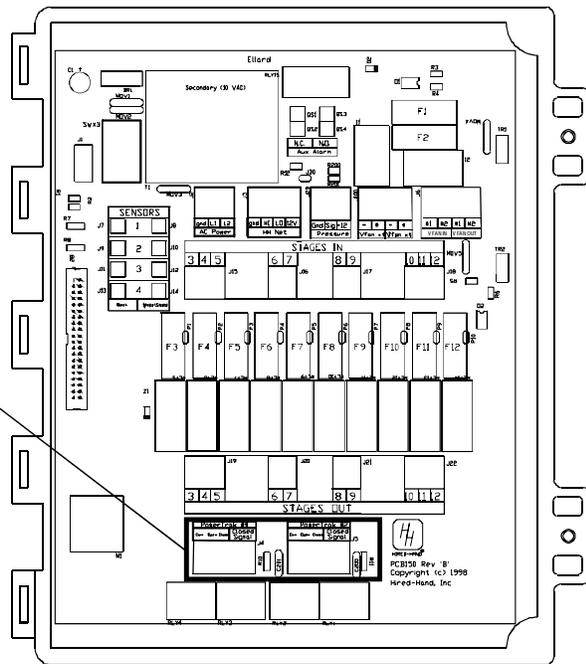
# 11.1 FH Stage Master Layout



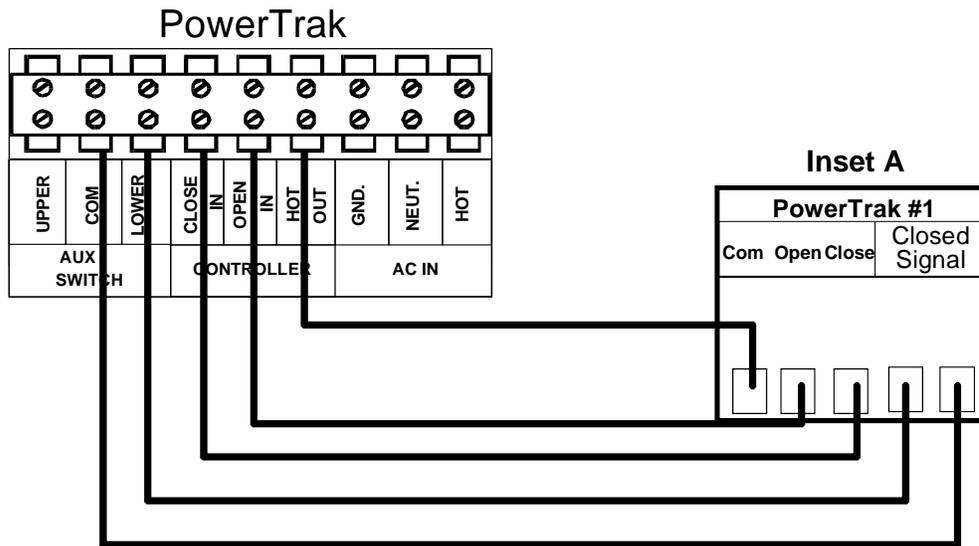
## 11.2 Connecting the Curtain Machines to the Controller



PowerTrak

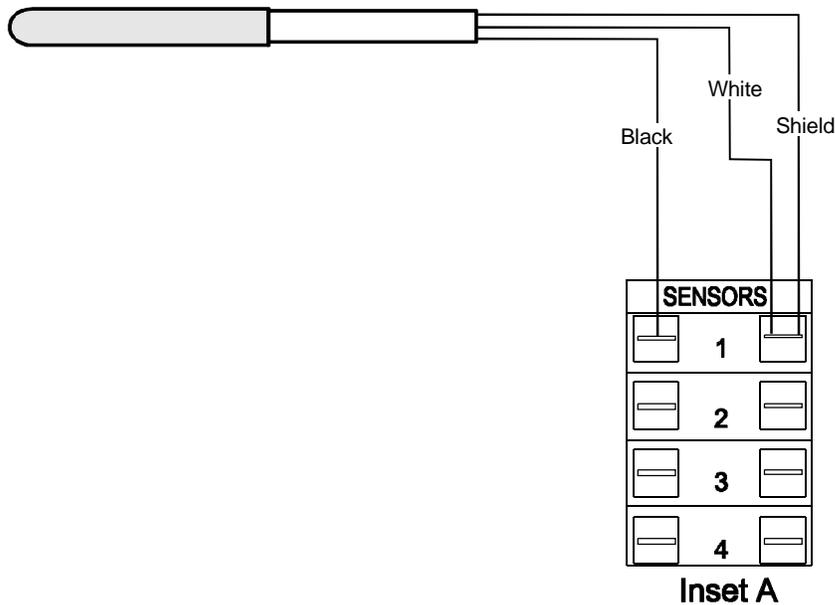
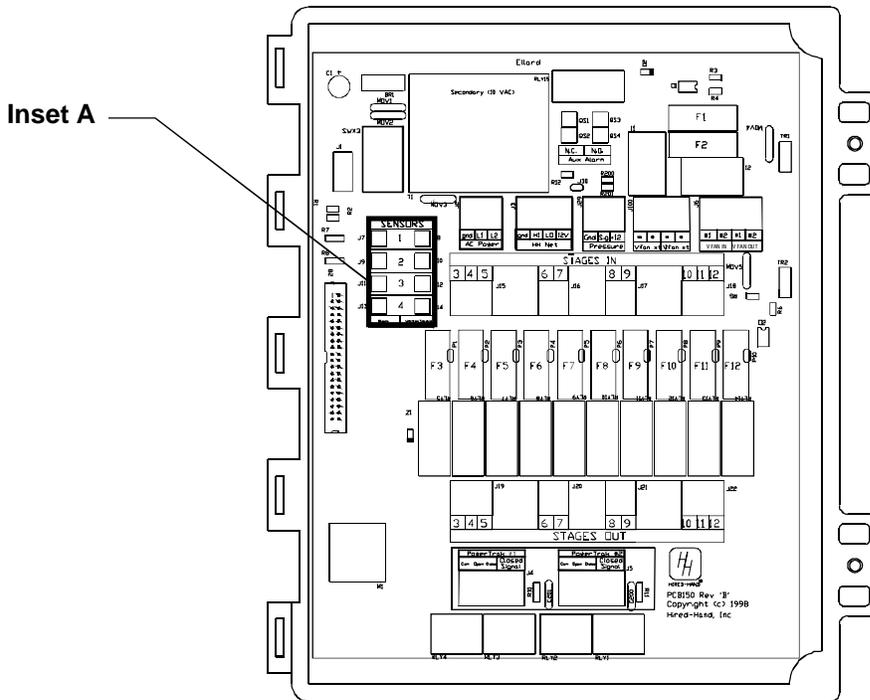


Inset A



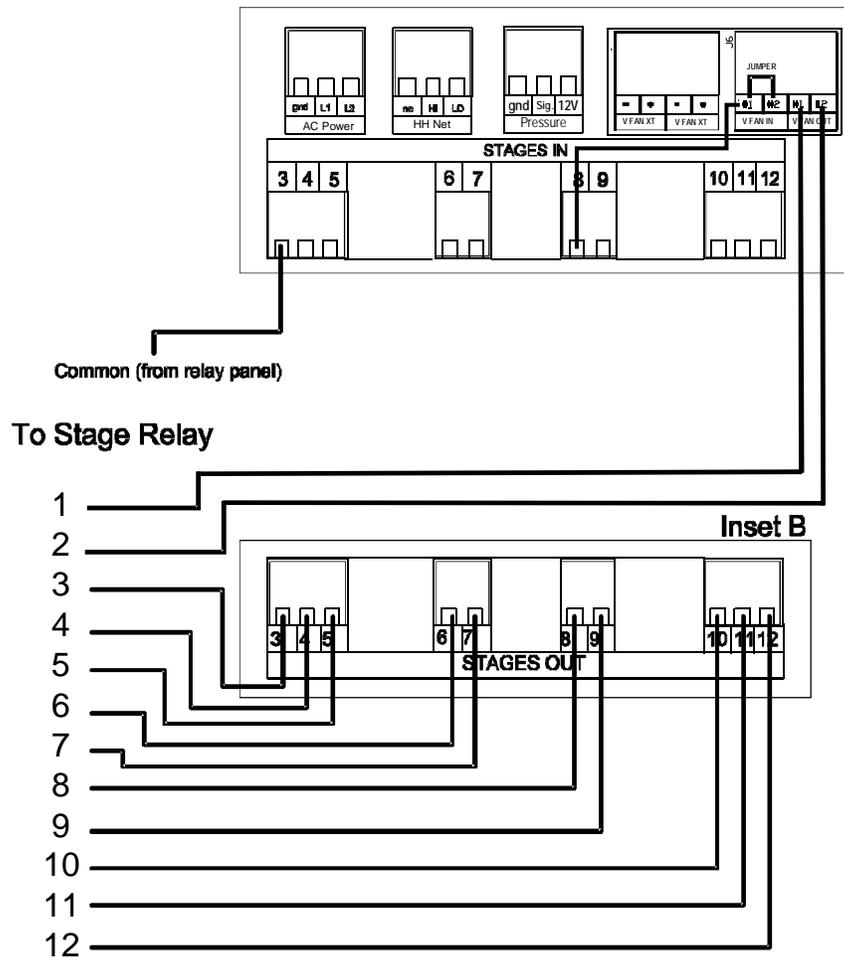
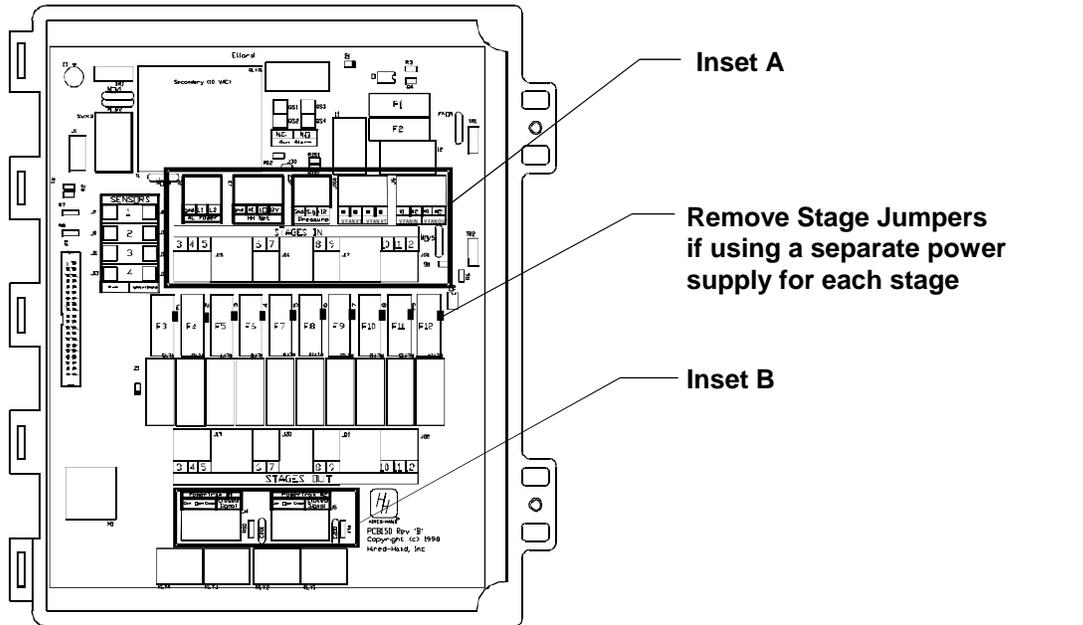
**Note: If you are tunnelling with this controller, the inlet machine must be connected to "Curtain 2". Your main curtain should be connected to "Curtain 1"**

### 11.3 Connecting Sensors to the Controller

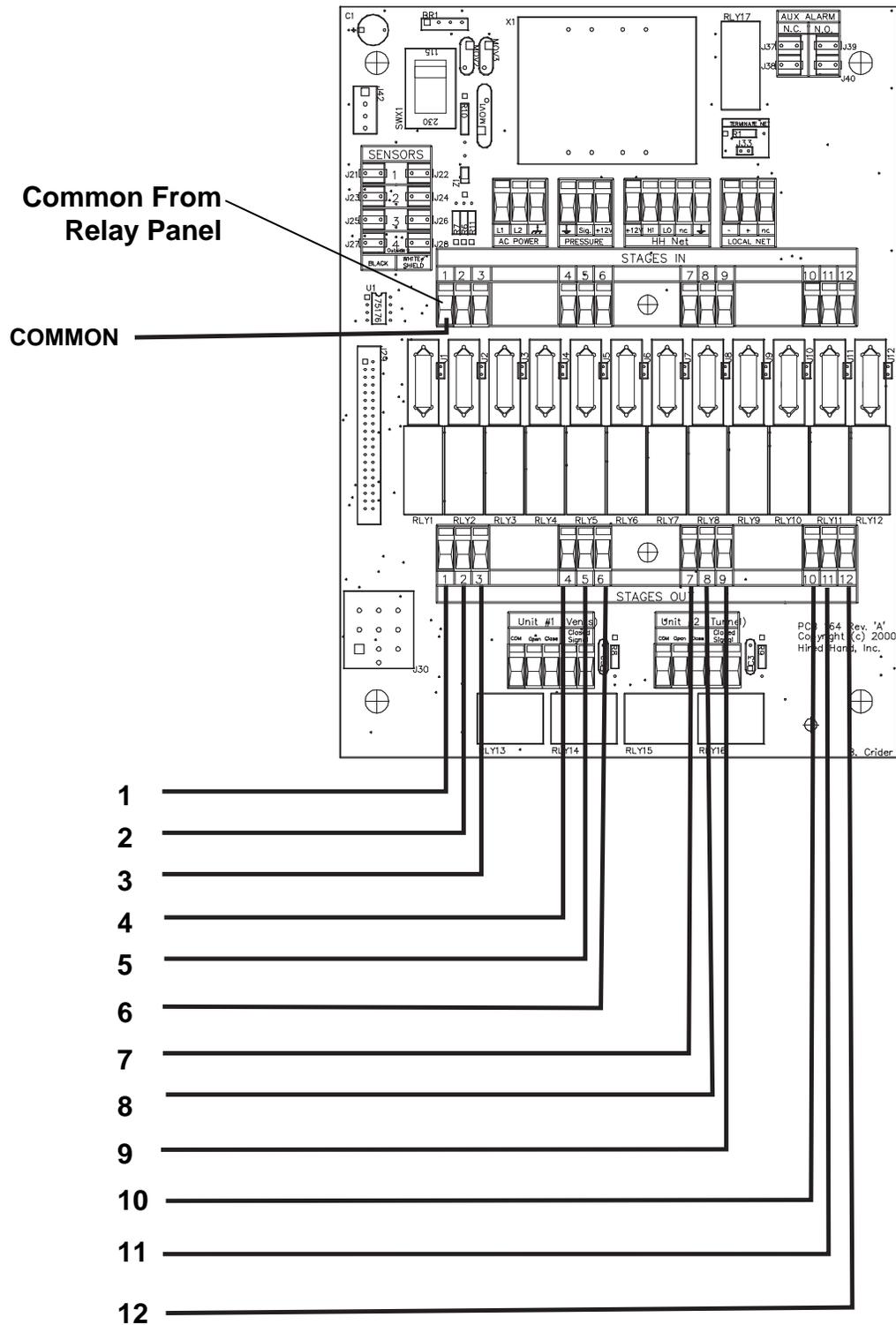


The controller has a switch for disabling Sensor 3. If you use a half house brood layout, you need to place Sensor 3 in the non brood section of the house, and disable Sensor 3 by turning switch 4 of the Status Switch Bank to off. (See “Rarely Changed Settings” for more information.)

## 11.4 Connecting Stages in a Variable Controller or Controller with PCB 150 to a Relay Panel



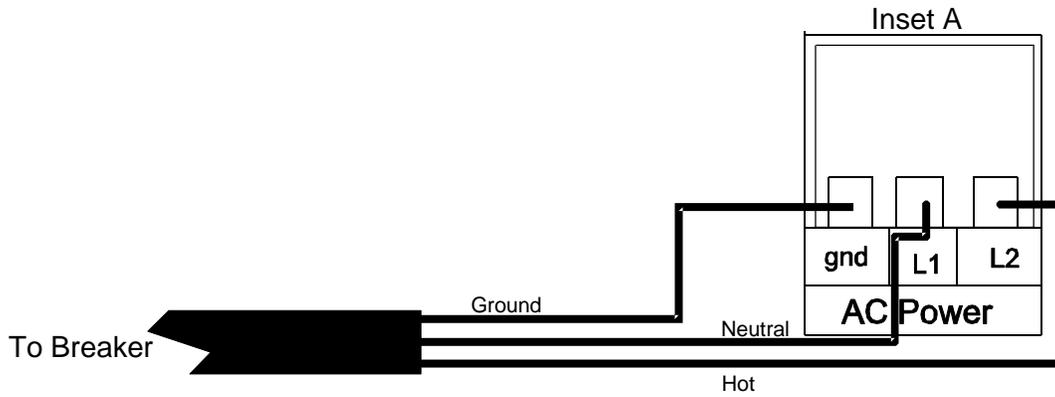
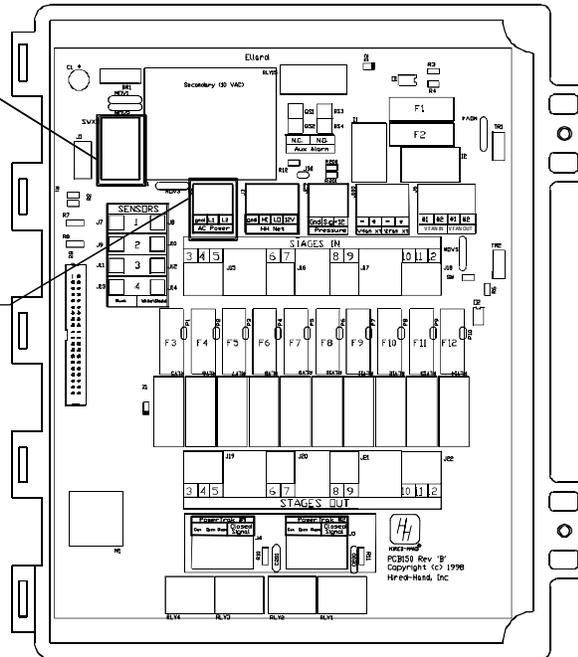
# 11.5 Connecting Stages in a Non-variable Controller or Controller with PCB 164 to a Relay Panel



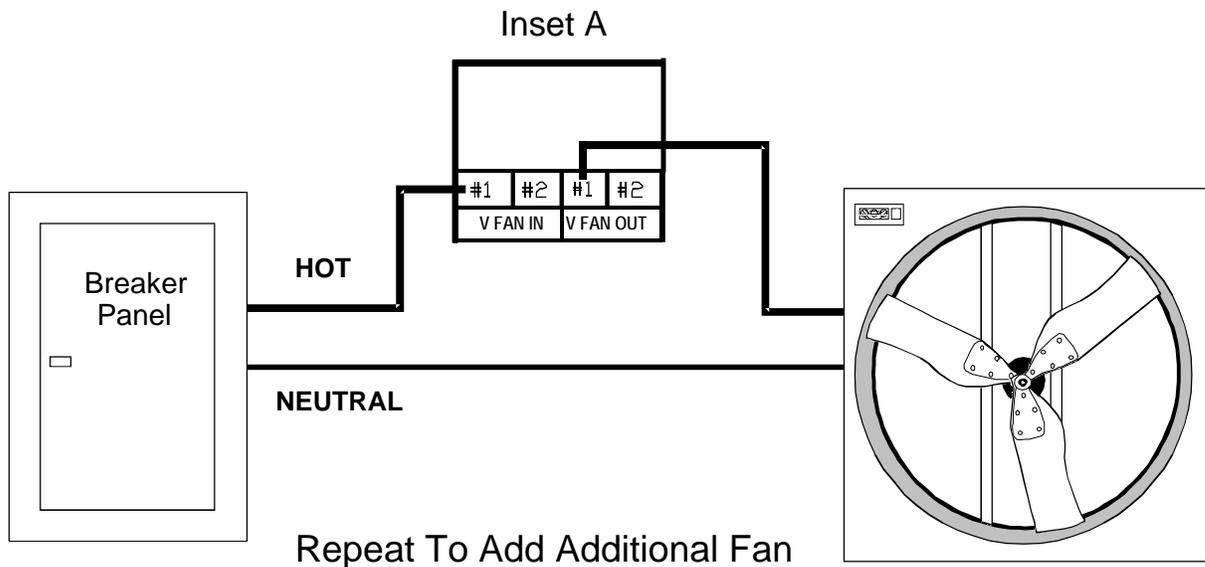
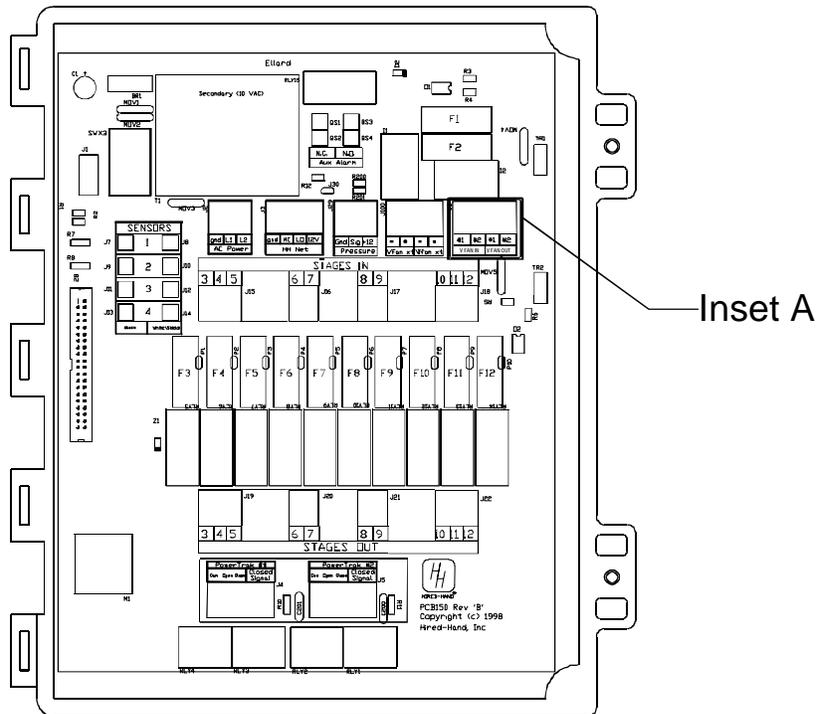
## 11.6 Connecting AC Power to the Controller

Check Position of the  
115/230 Volt Selector  
Switch

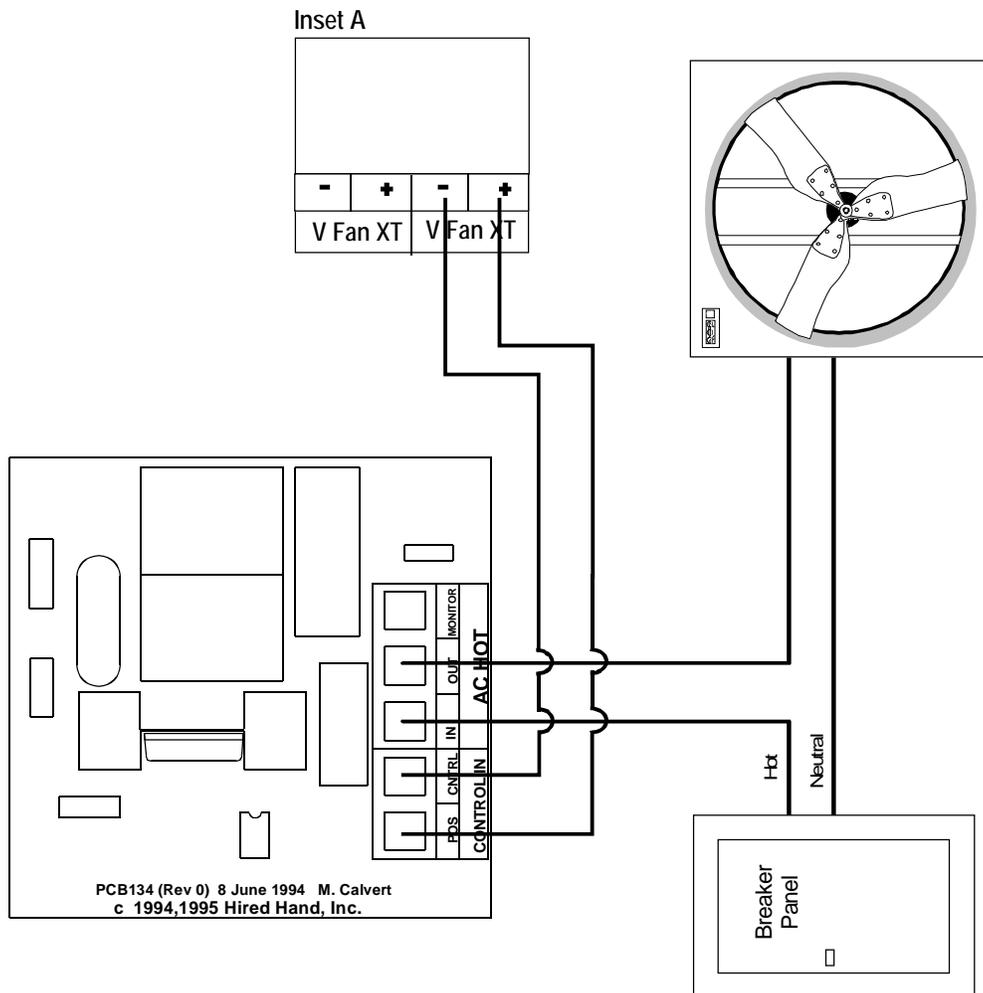
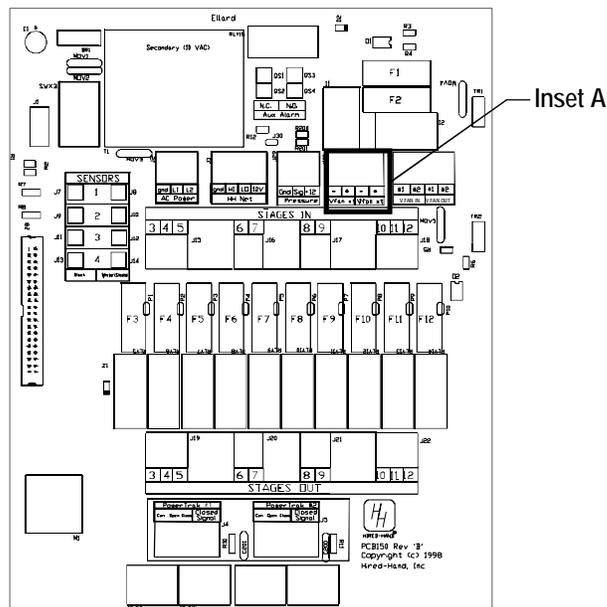
Inset A



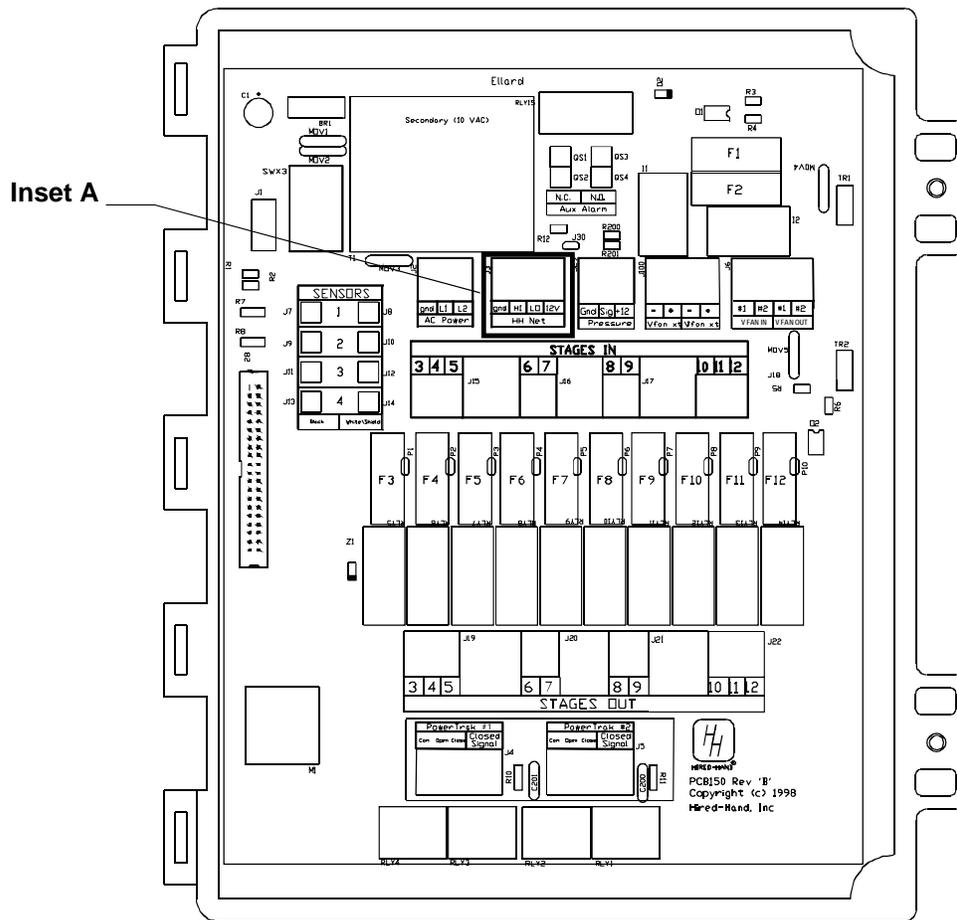
## 11.7 Variable Speed Wiring



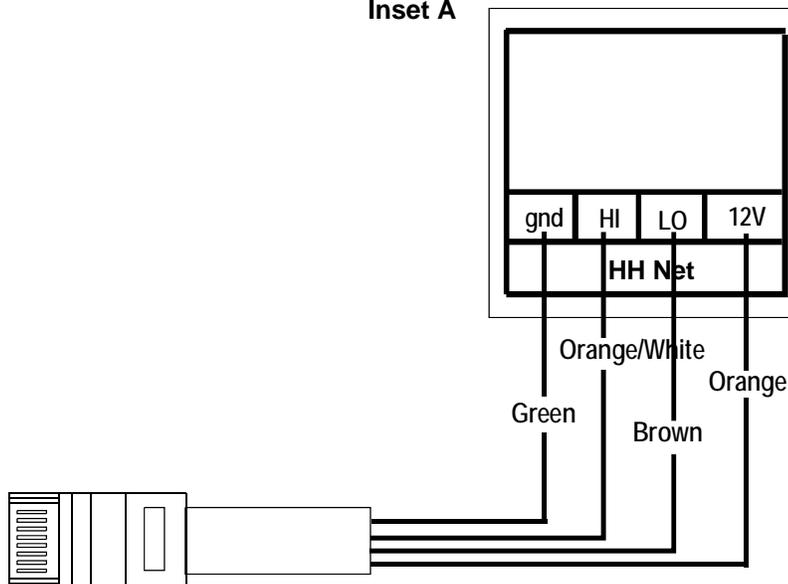
## 11.8 Variable Speed Wiring with External Hookup



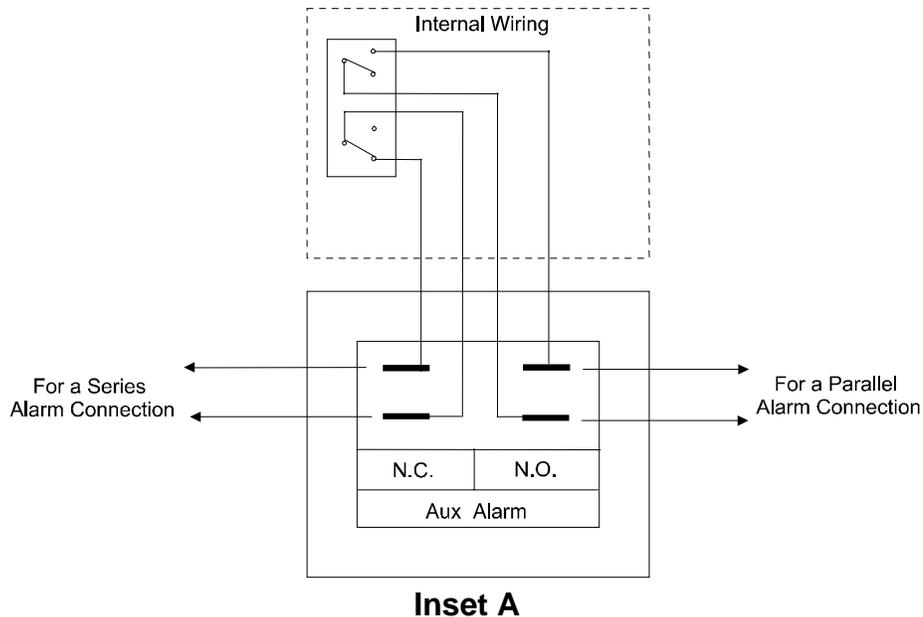
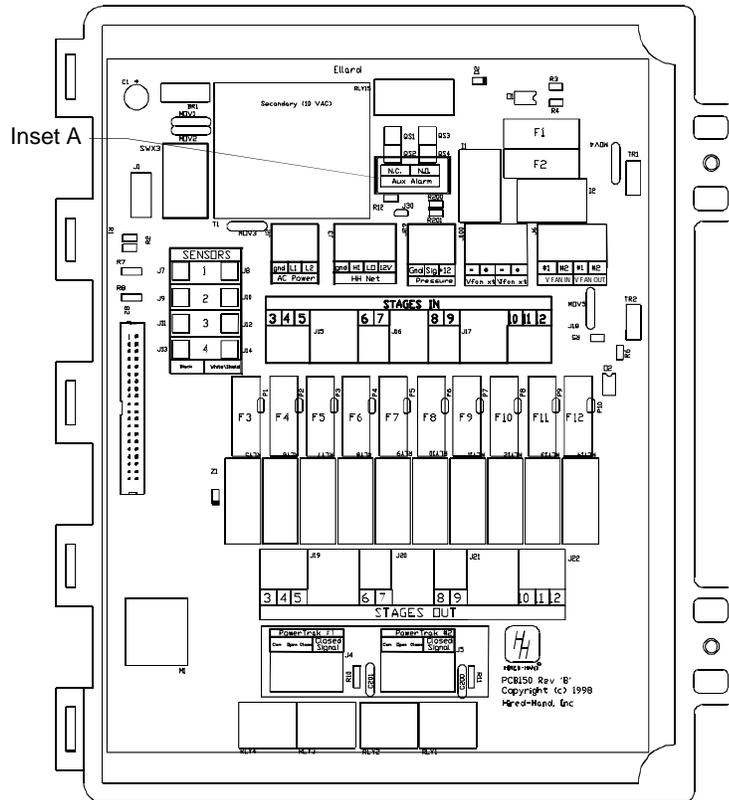
## 11.9 Connecting the Stage Master to a Data Shuttle



**Inset A**



## 11.10 Connecting the Stage Master to a Series or Parallel Alarm



**Note: The internal wiring shows the condition of the alarm relay during normal conditions (no alarm present). During an alarm condition, the contact positions will be reversed.**

## 12. Program Reference

### Program Parameters

#### PSd --Room Temp Display

Default reading displayed in the Main Display.

- 100 = Sensor 1
- 020 = Sensor 2
- 120 = Average of Sensors 1 & 2
- 003 = Sensor 3
- 103 = Average of Sensors 1 & 3
- 023 = Average of Sensors 2 & 3
- 123 = Average of Sensors 1,2,& 3

#### P1 -- Stage Sensor

The combination of sensors used to determine whether that stage should be on or off.

- 100 = Stage uses sensor 1
- 020 = Stage uses sensor 2
- 120 = Average of sensors 1 & 2
- 003 = Stage uses sensor 3
- 103 = Average of sensors 2 & 3
- 023 = Average of sensors 2 & 3
- 123 = Average of sensors 1,2,& 3

#### P2 -- Stage Mode

Heat, Cool Negative, etc. This setting determines when the stage is allowed to run, and how the stage will run.

- 1 = Heat Mode
- 2 = Cool Stir Mode
- 3 = Cool Negative Mode
- 4 = Cool Negative Tunnel Mode
- 5 = Cool Tunnel Mode

#### P3 -- Stage on Timer

Any cool stage can be placed on the system timer. This timer is settable to 5 or 10 minutes. Any stage on a timer will run for the system runtime percentage. (Example: 30% runtime of 10 minutes = 3 minutes out of each ten.)

- 0 = No Timer
- 1 = Standard Timer
- 2 = Cool Timer

#### ON -- OnPoint

The temperature at which a stage will turn on.

#### OFF -- OffPoint

The temperature at which a stage will turn off.

#### P10 -- Minimum Runtime Percentage

If temperature is below the offpoint, the percent of the system timer that the fan will run at it's minimum speed.

#### P11 -- Motor Curve

Different manufacturers motors speeds vary at different rates. For this reason, it is necessary to make calculations based on the fan manufacturer. 0 = Hired-Hand

#### P20 -- Cycle Time

The length of time in minutes between the start of one curtain position adjustment, and the start of the next curtain position adjustment. (Cycle time of 3 means that the curtain will move up or down (or remain stationary) depending upon temperature for its runtime once every 3 minutes.)

<b>P21 -- Run Time</b>	The number of seconds that the curtain machine will run opening or closing at the beginning of each curtain cycle (See Cycle Time).
<b>P22 -- Initial Run Time</b>	Number of seconds to run on the first drop from closed. This is to be sure that you have cleared the top of the opening. This setting only applies when the controller senses that the curtain is closed when it begins its run.
<b>P23 -- Degrees above target (Unit 1)</b>	Many times it is more cost effective to bring a slightly high temperature back into range with a fan. This setting allows you to specify a number of degrees above the target temperature that the curtain will allow before trying to open.
<b>P24 -- Degrees above target (Unit 2)</b>	Occasionally, a grower may want one curtain sidewall to drop before the other to try to avoid large temperature swings. This setting allows for this to happen. <b>Note: If you would like both curtain units to always react together, you must set P23=P24.</b>
<b>P25 -- Tunnel Onpoint</b>	The temperature at which the controller will go into tunnel mode.
<b>P26 -- Tunnel Offpoint</b>	The temperature at which the controller will go out of tunnel mode.
<b>P27 -- Close Override</b>	The degrees below target at which time the curtains will override to close.
<b>P40 - HHNet Address</b>	Unique setting for controllers along a single network wire pair. Only used with the PC compatibility feature using Hired-Hand's Farm Manager software.
<b>P41 -- Version Number</b>	This is the version of the code for the controller. This value is not settable.
<b>P42 -- Controller Type</b>	This is a number that identifies the type of controller (Stage Master) to the Farm Manager Software (PC compatible)
<b>PS1 - Calibrate Sensor 1</b>	The temperature the controller reads from the sensor. This setting is used only when calibrating sensors. Press the + and/or - buttons until the correct reading is seen in the main display. (See Sensor Calibration)
<b>PS2 -- Calibrate Sensor 2</b>	Same instructions as sensor PS1
<b>PS3 -- Calibrate Sensor 3</b>	Same instructions as sensor PS1
<b>PS4 -- Calibrate Sensor 4</b>	Same instructions as sensor PS1

## Tunnel Switches (Located inside the Controller Door)

<b>SWX 1 - Tunnel On/Off</b>	Enables/Disables tunnel mode When this switch is in the OFF position, the controller will not go into tunnel for any reason.
<b>SWX 2 - Tunnel On Stage</b>	Option to have the controller go into tunnel whenever the first tunnel stage turns on. If this switch is OFF, the controller will use the “Tunnel OnPoint” setting for entry into tunnel.
<b>SWX 3 - Power Ventilate</b>	If you have a power ventilated house the controller will leave the inlet curtain closed until tunnel mode is entered. This switch must be set to ON if you have a Power Ventilated house.

## Status Switches (Located inside the Controller Door)

<b>SWX 1 - Lock</b>	Locks the front panel to protect your settings from accidental change. If the switch is set to ON the program settings are locked.
<b>SWX 2 - Fahrenheit or Celsius</b>	Switches the temperature readings from Fahrenheit to Celsius. If the switch is set to ON the controller will read the sensors as Fahrenheit. (Note: If you change this switch, you will have to reset your tunnel OnPoints and OffPoints and your Target Temperature.)
<b>SWX 3 - 5/10 minute timer</b>	This switch selects between a 5 and 10 minute system timer. If the switch is on, the timer is 10 minutes.
<b>SWX 4 - Sensor 3 Active</b>	When this switch is in the off position, Sensor 3 is turned off. Note: For half house brooding, place Sensor 3 in the non-brooding end of the house, and disable it with this switch when brooding. If the switch is ON, sensor 3 is used.
<b>SWX 5 - Curtains On Separate Sensor</b>	This switch is used to choose whether the curtain machines operate off the same sensor or if they operate independently. If the switch is on, the curtains are independent with curtain 1 running on sensor 1, and curtain 2 running on sensor 2.
<b>SWX 8 - Program ‘A’ or ‘B’</b>	This switch is used to toggle between 2 preset programs. This could be used to store separate summer/winter programs for instance.

## 13. Error Codes

### 13.1 Descriptions

If your controller is displaying an “E1”, or “E2”, etc. the controller has recorded an error. The controller records errors from sensor readings, and tunnel related problems. To diagnose your controller problem, look up the error on the table (under “Error Codes”) and look across the table to find the components that have failed. ( Items with an “x” have failed according to the controller.)

Error Code	Description	Sensor 1 Error	Sensor 2 Error	Sensor 3 Error	Sensor 4 Error	Tunnel Error
E1	Sensor 1 Error	X				
E2	Sensor 2 Error		X			
E3	Sensor 1 & 2 Error	X	X			
E4	Sensor 3 Error			X		
E5	Sensor 1 & 3 Error	X		X		
E6	Sensor 2 & 3 Error		X	X		
E7	Sensor 1,2 & 3 Error	X	X	X		
E8	Sensor 4 Error				X	
E9	Sensor 1 & 4 Error	X			X	
E10	Sensor 2 & 4 Error		X		X	
E11	Sensor 1, 2 & 4 Error	X	X		X	
E12	Sensor 3 & 4 Error			X	X	
E13	Sensor 1, 3, and 4 Error	X		X	X	
E14	Sensor 2, 3, & 4 Error		X	X	X	
E15	All Sensors Error	X	X	X	X	
E16	Tunnel Error					X
E17	Tunnel and Sensor 1 Error	X				X
E18	Tunnel and Sensor 2 Error		X			X
E19	Tunnel and Sensor 1 & 2 Error	X	X			X
E20	Tunnel and Sensor 3 Error			X		X
E21	Tunnel and Sensor 1 & 3 Error	X		X		X
E22	Tunnel and Sensor 2 & 3 Error		X	X		X
E23	Tunnel and Sensor 1,2 & 3 Error	X	X	X		X
E24	Tunnel and Sensor 4 Error				X	X
E25	Tunnel and Sensor 1 & 4 Error	X			X	X
E26	Tunnel and Sensor 2 & 4 Error		X		X	X
E27	Tunnel and Sensor 1, 2 & 4 Error	X	X		X	X
E28	Tunnel and Sensor 3 & 4 Error			X	X	X
E29	Tunnel and Sensor 1, 3, and 4 Error	X		X	X	X
E30	Tunnel and Sensor 2, 3, & 4 Error		X	X	X	X
E31	Tunnel and All Sensors Error	X	X	X	X	X

### 13.2 Possible Solutions

#### Sensor Error

If any of the sensors are bad try the following:

- Reset the controller by taking power away at the breaker, or unplugging it.
- Determine which sensor is bad, then check the connection inside the controller door. If the error is for sensor 3, read the section below to determine alternate course of action.
- Determine which sensor is bad, then check the sensor that is hanging in the house to make sure that it has not been damaged.
- Replace the bad sensor.

#### Sensor 3 Error

- Check to see if you are using sensor 3. If not, deactivate it using switch number 4 (SWX-4) on the status switch bank located on the back of the controller’s door.

### **Tunnel Error**

The controller will error if it can not open the inlet curtain, or if you are using a main curtain it will error if it can not close the main curtain.

**Note:** If not using a main curtain, you must put a jumper wire across the main curtain closed signal inside the control box.

If you see a tunnel error, check the following:

- Make sure that the inlet is operating correctly.
- If applicable, make sure the main curtain is operating correctly.
- Make sure that the curtain closed signals inside the control box are wired to the auxiliary switches inside the PowerTrak.

### **Variable Speed Fans not Operating**

If the variable speed fans are not operating properly, do the following:

- Try a different motor curve (P11).
- If the system is using 110 VAC, make sure that the neutral wire is connected to L1, and the Hot wire is Connected to L2
- Make sure a proper earth ground is connected to the controller.

## 14. Temperature vs. Sensor Resistance Table

The following chart gives the resistance when measured between the white and black sensor wires at a given temperature. To check a sensor, first know the temperature in the area, then, use a multi-meter to check the resistance.

Resistance Kohms	Temp (F)	Temp (C)	Resistance Kohms	Temp (F)	Temp (C)	Resistance Kohms	Temp (F)	Temp (C)
32.654	32	0	15.714	59	15	8.59	83.3	28.5
32.158	32.5	0.3	15.568	59.4	15.2	8.517	83.7	28.7
31.671	33.1	0.6	15.353	59.9	15.5	8.408	84	28.9
31.191	33.6	0.9	15.211	60.3	15.7	8.336	84.6	29.2
30.72	34.2	1.2	15.001	60.8	16	8.23	85.1	29.5
30.257	34.7	1.5	14.863	61.2	16.2	8.125	85.6	29.8
29.802	35.2	1.8	14.658	61.7	16.5	8.056	86	30
29.355	35.8	2.1	14.457	62.2	16.8	7.954	86.5	30.3
28.915	36.3	2.4	14.325	62.6	17	7.853	87.1	30.6
28.482	36.9	2.7	14.128	63.1	17.3	7.787	87.4	30.8
28.057	37.4	3	13.999	63.5	17.5	7.689	88	31.1
27.777	37.8	3.2	13.808	64	17.8	7.592	88.5	31.4
27.363	38.3	3.5	13.682	64.4	18	7.496	89.1	31.7
26.957	38.8	3.8	13.496	64.9	18.3	7.433	89.4	31.9
26.557	39.4	4.1	13.373	65.3	18.5	7.34	90	32.2
26.164	39.9	4.4	13.192	65.8	18.8	7.248	90.5	32.5
25.777	40.5	4.7	13.073	66.2	19	7.157	91	32.8
25.523	40.8	4.9	12.896	66.7	19.3	7.098	91.4	33
25.147	41.4	5.2	12.779	67.1	19.5	7.009	91.9	33.3
24.777	41.9	5.5	12.607	67.6	19.8	6.922	92.5	33.6
24.413	42.4	5.8	12.493	68	20	6.836	93	33.9
24.055	43	6.1	12.325	68.5	20.3	6.779	93.4	34.1
23.82	43.3	6.3	12.215	68.9	20.5	6.695	93.9	34.4
23.472	43.9	6.6	12.051	69.4	20.8	6.612	94.5	34.7
23.13	44.4	6.9	11.943	69.8	21	6.531	95	35
22.793	45	7.2	11.783	70.3	21.3	6.45	95.5	35.3
22.572	45.3	7.4	11.678	70.7	21.5	6.371	96.1	35.6
22.244	45.9	7.7	11.522	71.2	21.8	6.319	96.4	35.8
21.922	46.4	8	11.42	71.6	22	6.241	97	36.1
21.71	46.8	8.2	11.268	72.1	22.3	6.165	97.5	36.4
21.397	47.3	8.5	11.168	72.5	22.5	6.089	98.1	36.7
21.088	47.8	8.8	11.02	73	22.8	6.015	98.6	37
20.886	48.2	9	10.874	73.6	23.1	5.941	99.1	37.3
20.586	48.7	9.3	10.778	73.9	23.3	5.869	99.7	37.6
20.29	49.3	9.6	10.636	74.5	23.6	5.798	100.2	37.9
20.096	49.6	9.8	10.542	74.8	23.8	5.728	100.8	38.2
19.809	50.2	10.1	10.404	75.4	24.1	5.658	101.3	38.5
19.526	50.7	10.4	10.312	75.7	24.3	5.59	101.8	38.8
19.34	51.1	10.6	10.177	76.3	24.6	5.522	102.4	39.1
19.065	51.6	10.9	10.088	76.6	24.8	5.456	102.9	39.4
18.884	52	11.1	9.956	77.2	25.1	5.39	103.4	39.7
18.616	52.5	11.4	9.869	77.5	25.3	5.326	104	40
18.352	53.1	11.7	9.741	78.1	25.6	5.262	104.5	40.3
18.179	53.4	11.9	9.614	78.6	25.9	5.199	105.1	40.6
17.503	54.9	12.7	9.53	79	26.1	5.137	105.6	40.9
17.339	55.2	12.9	9.407	79.5	26.4	5.076	106.2	41.2
17.095	55.8	13.2	9.325	79.9	26.6	4.995	106.9	41.6
16.856	56.3	13.5	9.205	80.4	26.9	4.936	107.4	41.9
16.698	56.7	13.7	9.086	81	27.2	4.877	108	42.2
16.465	57.2	14	9.007	81.3	27.4	4.82	108.5	42.5
16.312	57.6	14.2	8.891	81.9	27.7	4.763	109	42.8
16.085	58.1	14.5	8.815	82.2	27.9	4.688	109.8	43.2
15.935	58.5	14.7	8.702	82.8	28.2			

## 15. Program Parameter Listing

# *Programming* (Stage Master)

### PSD Room Temperature Display

100= Sensor 1  
020= Sensor 2  
120= Average of Sensors 1 & 2  
003= Sensor 3  
103= Average of Sensors 1 & 3  
023= Average of Sensors 2 & 3  
123= Average of Sensors 1, 2 & 3

### P 1-9 Stage Programming

**P1 = Stage Sensor**  
100= Sensor 1  
020= Sensor 2  
120= Average of Sensors 1 & 2  
003= Sensor 3  
103= Average of Sensors 1 & 3  
023= Average of Sensors 2 & 3  
123= Average of Sensors 1, 2 & 3

**P2 = Stage Mode**  
1= Heat Mode  
2= Cool Stir Mode  
3= Cool Neg. Mode  
4= Cool Neg. Tunnel Mode  
5= Cool Tunnel Mode

**P3 = Timer Status**  
0= Stage Not On Timer  
1= Stage On Timer  
2= Stage is On Cool Timer

### P 10-19 Variable/Cool Timer

P10 = Min. Runtime Percentage  
P11 = Motor Curve Selection

### P 20-29 Curtain Machine

P20 = Curtain Cycle time (min.)  
P21 = Curtain Runtime (sec.)  
P22 = Curtain Initial Runtime (sec.)  
P23 = Unit 1 Degrees Above Target  
P24 = Unit 2 Degrees Above Target  
P25 = Tunnel "On" Temperature  
P26 = Tunnel "On" Temperature  
P27 = Close Override (Degrees Below Target)

### P 40-49 Hired Hand Network

P40 = Network Address  
P41 = Software Version  
P42 = Controller Setup

### P70-79 Timer Settings

P70 = Cool Timer Max. Percentage  
P71 = Cool Timer Min. Percentage

### PS Sensor Calibration

PS1 = Sensor 1  
PS2 = Sensor 2  
PS3 = Sensor 3  
PS4 = Sensor 4

4501-5032 rev 8-04

## 16. Error Code Listing

Error Code	Description	Sensor 1 Error	Sensor 2 Error	Sensor 3 Error	Sensor 4 Error	Tunnel Error
E1	Sensor 1 Error	X				
E2	Sensor 2 Error		X			
E3	Sensor 1 & 2 Error	X	X			
E4	Sensor 3 Error			X		
E5	Sensor 1 & 3 Error	X		X		
E6	Sensor 2 & 3 Error		X	X		
E7	Sensor 1,2 & 3 Error	X	X	X		
E8	Sensor 4 Error				X	
E9	Sensor 1 & 4 Error	X			X	
E10	Sensor 2 & 4 Error		X		X	
E11	Sensor 1, 2 & 4 Error	X	X		X	
E12	Sensor 3 & 4 Error			X	X	
E13	Sensor 1, 3, and 4 Error	X		X	X	
E14	Sensor 2, 3, & 4 Error		X	X	X	
E15	All Sensors Error	X	X	X	X	
E16	Tunnel Error					X
E17	Tunnel and Sensor 1 Error	X				X
E18	Tunnel and Sensor 2 Error		X			X
E19	Tunnel and Sensor 1 & 2 Error	X	X			X
E20	Tunnel and Sensor 3 Error			X		X
E21	Tunnel and Sensor 1 & 3 Error	X		X		X
E22	Tunnel and Sensor 2 & 3 Error		X	X		X
E23	Tunnel and Sensor 1,2 & 3 Error	X	X	X		X
E24	Tunnel and Sensor 4 Error				X	X
E25	Tunnel and Sensor 1 & 4 Error	X			X	X
E26	Tunnel and Sensor 2 & 4 Error		X		X	X
E27	Tunnel and Sensor 1, 2 & 4 Error	X	X		X	X
E28	Tunnel and Sensor 3 & 4 Error			X	X	X
E29	Tunnel and Sensor 1, 3, and 4 Error	X		X	X	X
E30	Tunnel and Sensor 2, 3, & 4 Error		X	X	X	X
E31	Tunnel and All Sensors Error	X	X	X	X	X

## 17. Curtain Movement Time (sec.) Vs. Distance (inches/cm.)

To find the distance moved, select the chart corresponding to a specific Motor Speed and Cabling Ratio.

NOTE: Cabling Ratio = First number is PT and second number is load.

Motor RPM	Cabling Ratio	Seconds	Inches	Centimeters
15	1 to 1	5	0.25	0.635
		10	0.50	1.27
		15	0.75	1.905
		30	1.5	3.81
		45	2.25	5.715
		60	3	7.652
	1 to 2	5	0.5	1.27
		10	1.0	2.54
		15	1.5	3.81
		30	3.0	7.62
		45	4.5	11.43
		60	6.0	15.24
	2 to 1	5	0.125	0.3175
		10	0.25	0.635
		15	0.375	0.9525
		30	0.75	1.905
		45	1.125	2.875
		60	1.5	3.81
30	1 to 1	5	0.5	1.27
		10	1.0	2.54
		15	1.5	3.81
		30	3.0	7.62
		45	45.5	11.43
		60	6.0	15.24
	1 to 2	5	1	2.54
		10	2	5.08
		15	3	7.62
		30	6	15.24
		45	9	22.86
		60	12	30.48
	2 to 1	5	0.25	0.635
		10	0.50	1.27
		15	0.75	1.905
		30	1.5	3.81
		45	2.25	5.715
		60	3	7.652
60	1 to 1	5	1	2.54
		10	2	5.08
		15	3	7.62
		30	6	15.24
		45	9	22.86
		60	12	30.48
	1 to 2	5	2	5.08
		10	4	10.16
		15	6	15.24
		30	12	30.48
		45	18	45.72
		60	24	60.96
	2 to 1	5	0.5	1.27
		10	1.0	2.54
		15	1.5	3.81
		30	3.0	7.62
		45	45.5	11.43
		60	6.0	15.24

## 18. Program Data Sheet

Use this Data Sheet to record your personal settings for the Stage Master. Copy this form as needed.

### Farm Hand Stage Master

Target	
V1 Min. Speed	
V2 Min. Speed	
Timer %	
PSD	

Status Switches	
Swx 1 Lock	On/Off
Swx 2 Unit	On-Far./Off Cel.
Swx 3 Timer	On-10/Off-5
Swx 4 Sensor 3	On/Off
Swx 5 Curtains	On-SS/Off-Avg.
Swx 6 Unused	
Swx 7 Unused	
Swx 8 Program	On-B/Off-A

Tunnel Switches	
Swx 1 Tunnel On	On/Off
Swx 2 Initiate	On-Stage/Off-Outside
Swx 3 House Style	On-Power/Off-Natural
Swx 4 Unused	

Stages	Equipment	OnPoint	OffPoint	P1 Sensors	P2 Mode	P3 Timer	P10 Runtime %	P11 Motor Curve
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								

P20 Curtain Cycle Time	Min.
P21 Curtain Runtime	Sec.
P22 Curtain Initial Runtime	Sec.
P23 Unit 1 DAT	
P24 Unit 2 DAT	
P25 Tunnel "On" Temp	
P26 Tunnel "Off" Temp	
P27 Close Override	

Network Address	P40	
Software Version	P41	
Controller Setup	P42	
Cool Timer Max. %	P70	
Cool Time Min. %	P71	

#### P1 Sensors

100=Sensor 1  
 020=Sensor 2  
 120=Avg. Sen 1&2  
 003=Sensor 3  
 103=Avg. Sen 1&3  
 023=Avg. Sen 2&3  
 123=Avg. Sen 1,2&3

#### P2 Mode

1=Heat  
 2=Cool Stir  
 3=Cool Neg  
 4=Cool Neg Tunnel  
 5=Cool Tunnel

#### P3 Timer

0=Off Timer  
 1=On Normal Timer  
 2=On Cool Timer

(Version 15 or above)