



by Commander Industries Inc.



1. Introduction to Environmental Control System Operations Manual

1.1. Overview

The Sturdy Key Pad Computer is designed to automatically monitor the components of the Control System and adjust their output to control indoor air quality including: temperature, relative humidity, carbon dioxide and oxygen in the interior of the straight truck under various exterior and interior conditions. The primary purpose of the System is for the control of indoor air quality while shipping live poultry.

This manual outlines the Control System and general procedures to follow during operation, including maintenance and troubleshooting.



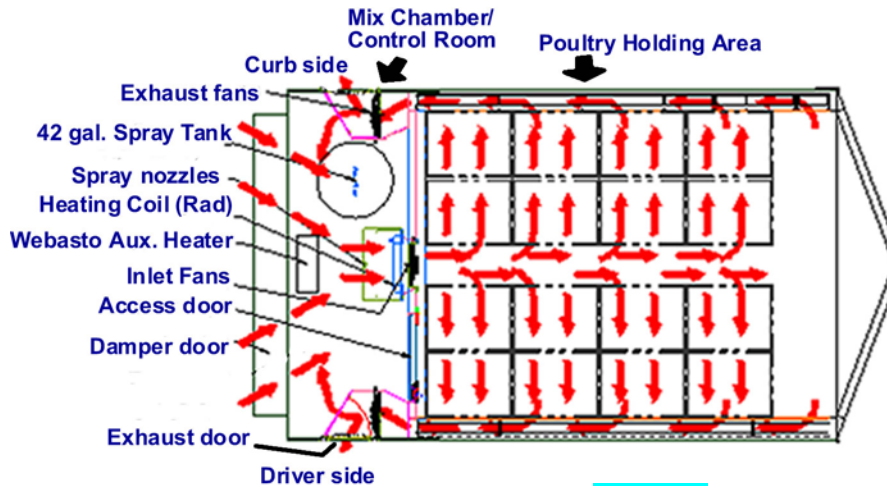
Figure 1

1.2. How it works – the basics

1.2.1. Air Flow

The Sturdy Chick delivery body design system has been developed over the last 25 years with the guidance and help of our many long-term customers. It is unique in the chick delivery industry, with its exclusive patented CROSS AIR FLOW SYSTEM in which safe and happy birds travel on journeys up to 30 hours and longer.

The air enters the vehicle through the front Damper Door. It is directed through the Poultry Holding Area by Inlet Fans, and moves through the chicks into the sidewalls. The sidewall air is regulated by engineered gaps in the walls to ensure even air flow throughout the vehicle. The air is then either exhausted completely or in part through the exhaust Doors located on the sides of the vehicle. See air flow diagram [Figure 2](#):



Air Flow - Figure 2

Please note that the air only flows through two boxes before it is returned to the Mix Chamber/Control Room for rejuvenation. This whole Mix Chamber is controlled and monitored by the driver or the cab mounted Computer. The system will control temperature and humidity to match targets set by the Hatchery Manager. Both the Mix Chamber (with large walk-in door) and the Poultry Holding Area are the easiest to clean and disinfect in the industry. This is made faster and easier because of the solid floor and roof, along with our cleanout doors located approximately every four feet in the sidewall ducts.

1.2.2. Heating

The Three-way Mix Valve controls the flow of heated fluid from the truck chassis engine either back to the engine when no heat is called for or in a metered amount through the rest of the heating components, i.e. the Heating Coil (Rad), the Webasto Auxiliary Heater, and the Heat Pump.

1.2.3. Humidity & Evaporative Cooling

Relative humidity and evaporative cooling of the Poultry Holding Area are adjusted by introducing water in a mist form through Nozzles into the Mix Chamber. The mist is then dispersed into the Poultry Holding Area by the Inlet Fans.

The Spray Tank provides a reservoir of water to feed the Nozzles. There is a cap on the tank to add ice to the water for more efficient cooling. When the heated mist is needed for humidity adjustment the Three-way Mix Valve will divert heated fluid through a sealed hose, looped inside the Spray Tank, so heat is radiated throughout the spray water. The spray pump will be activated to either increase humidity or decrease temperature when the sensor feedback indicates it's needed.

2. Environmental Control System Components

2.1. Key Pad Computer

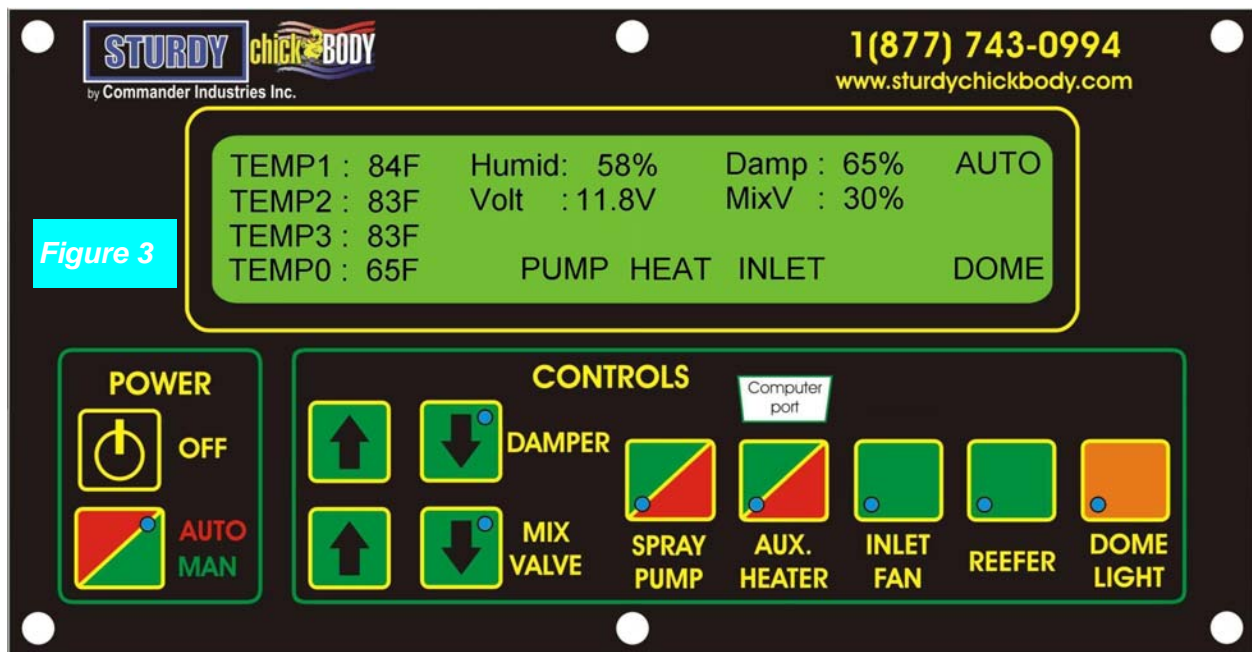
2.1.1. Control Logic

The Key Pad Computer gathers feedback from positioning of the Mix Valve and Damper Door, and from sensor readings, thermostat setting, and target set points. It will adjust Control System Components as required to satisfy the set points.

2.1.2. LED Display





The Key Pad is equipped with a constant display for the status of the outside temperature sensor, three inside temperature sensors, one humidity sensor, a volt meter, and a position of the Damper and Mix Valve (from 0 to 100% open.) It will also display the names of various active components when in use (i.e. Automatic Mode or Manual Mode, Dome, Spray Pump, Auxiliary Heater and Inlet Fans). Adjustments to the back light brightness of the LED display can be programmed by the Hatchery Manager.


The Key Pad requires a minimum of 10.5 volts to start the system, and 11.7 plus volts to get maximum performance from the fans. The LED Display for voltage must be carefully monitored.



The Key Pad, [Figure 3](#), allows for the user to control different modules that are connected such as the Damper, Inlet Fan, Auxiliary Heater and more.

2.1.3. Individual Key Description:

 <p><i>Figure 4</i></p>	<p>Complete system shut down or exit from menus or programming. Press key to turn system OFF.</p> <p>To turn system on, use AUTO MAN key. See <i>Figure 5</i> for instructions.</p>
 <p><i>Figure 5</i></p>	<p>The AUTO MAN key is used to turn the system ON. The AUTO MAN key is also used to control the operating mode of the system. You may select between AUTO and MANUAL.</p> <p>How To Use</p> <ul style="list-style-type: none"> • If system is off, press AUTO MAN key once to turn system on. System is ON when the LED display is lit. • Continuing to press AUTO MAN key when system is on will alternate between Manual Mode and Automatic Mode. • Manual Mode is ON when indicator light is OFF*. See <i>Figure 13</i> for indicator lights. • Automatic Mode is ON when indicator light is ON*. See <i>Figure 13</i> for indicator lights. • Manual Mode is controlled by the user. • Automatic Mode is controlled by the pre-set parameters programmed by the Hatchery Manager. <p>*The operational mode will show in the upper right hand corner of the Key Pad LED Display.</p>
 <p><i>Figure 6</i></p>	<p>Opens and closes Damper. The arrow pointing up opens the Damper and the arrow pointing down closes the Damper. Each keystroke enables a 5% incremental opening or closing of the Damper.</p>
 <p><i>Figure 7</i></p>	<p>Opens and closes the Mix Valve. The arrow pointing up opens the Mix Valve and the arrow pointing down closes the Mix Valve. Each keystroke enables a 5% incremental opening (increase in heat) or closing (decrease in heat) of the Mix Valve.</p>

 <p>SPRAY PUMP</p> <p><i>Figure 8</i></p>	<p>Activate or de-activate the Spray Pump by pressing key. On when indicator light is lit. When operating the word "PUMP" will display in the LED Display.</p>
 <p>AUX. HEATER</p> <p><i>Figure 9</i></p>	<p>Activate or de-activate the Auxiliary Heater by pressing key. On when indicator light is lit. When operating the word "HEAT" will display in the LED Display.</p>
 <p>INLET FAN</p> <p><i>Figure 10</i></p>	<p>Activate or de-activate the Inlet Fans by pressing key. On when indicator light is lit. When operating the word "INLET" will display in the LED Display.</p> <p>This function cannot be modified by the user while in automatic mode.</p>
 <p>REEFER</p> <p><i>Figure 11</i></p>	<p>Activate or de-activate the Reefer unit by pressing the key. On when indicator light is lit.</p> <p>The REEFER key is used only when transporting eggs, when the outside temp is above 60 degrees Fahrenheit:</p> <ol style="list-style-type: none"> 1 turn system to Manual Mode 2 turn Inlet Fans on 3 set Damper at 0% (Damper Door completely closed.) 4 set Mix Valve at 0% (completely shut off – no heat to system.)
 <p>DOME LIGHT</p> <p><i>Figure 12</i></p>	<p>Activate or de-activate the Dome Lights by pressing the key. On when indicator light is lit. When operating the word "DOME" will display in the LED Display.</p>

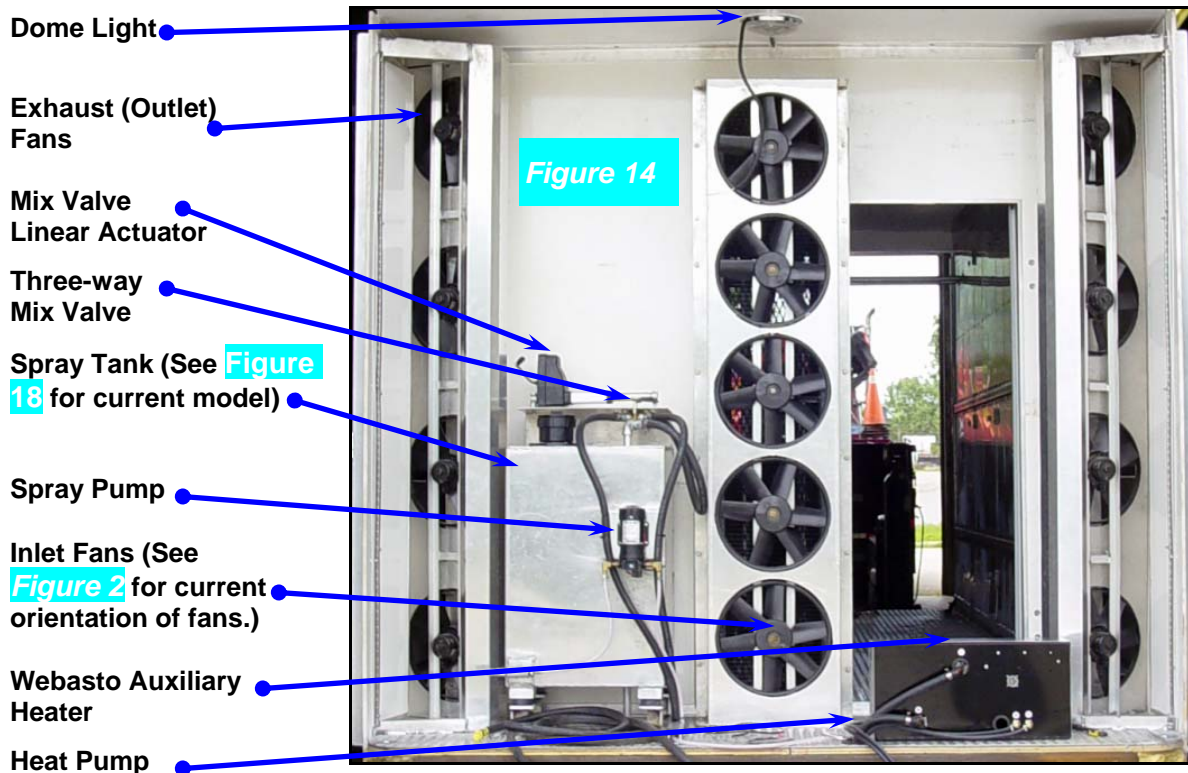
Indicator Lights

The indicator lights show functions are on when lit, with the exception of the **AUTO MAN** key (see [Figure 5](#))

The control panel features a digital display at the top showing: TEMP1: 84F, Humid: 58%, Damp: 65%, AUTO; TEMP2: 83F, Volt: 11.8V, MixV: 30%; TEMP3: 83F; and TEMP0: 65F. Below the display are sections for POWER (OFF, AUTO MAN), CONTROLS (DAMPER, MIX VALVE, SPRAY PUMP, AUX. HEATER, INLET FAN, REEFER, DOME LIGHT), and Indicator Lights. A computer port is also visible.

Figure 13

Other Environmental Control System Components



Mix Chamber/Control Room cross section. (Note: Layout of the Control compartment has been changed since this photo was taken. See notes under labels for Spray Tank and Inlet Fans.)

2.2. Dome Lights

Three Dome Lights are located in the Poultry Holding Area and one Dome Light is centred in the Mix Chamber/Control Room of the truck for lighting. The lights can be turned on during loading/unloading, maintenance, etc. The lights are turned off by a pre-set timer. Operational time must be programmed by the Hatchery Manager.

2.3. Heat Pump

The Heat Pump assists in providing consistent heat to the Poultry Holding Area by insuring that the volume of heated fluid entering the Heating Coil (Rad) is evenly distributed from top to bottom.

2.4. Webasto Auxiliary Heater

The diesel fired Webasto Auxiliary Heater, located on the floor in the Control Room, is used to boost the temperature of the heating fluid coming from the chassis engine. It works in conjunction with the external Heat Pump to increase fluid flow. See [Section 2.3](#).

Note: the Auxiliary Heater has an internal pump that continues to circulate the fluid for one or two minutes after the Auxiliary Heater shuts down, to allow the heater to cool.

2.5. Heating Coil (Control Room Rad)

A custom made Heating Coil is positioned vertically in the control room in advance of the Inlet Fans. It is the full height of the fan shroud, ensuring that air entering the Poultry Holding Area must pass through the Heating Coil supplying even heat when required by the system. The Heating Coil shroud on the control room side is fully open and the fan shroud on the Poultry Holding Area side is hinged to allow easy access for inspection and cleaning of the Heating Coil and Inlet Fans.

2.6. Three-way Mix Valve

The Three-way Mix Valve, which is operated by a Linear Actuator, controls the flow of heated fluid from the truck chassis engine either back to the engine, when no heat is called for, or in a metered amount through the rest of the heating components, i.e. the Heating Coil (Rad), the Webasto Auxiliary Heater, and the Heat Pump. *Should you need to manually run the system, use the parameters in [Table 1](#) below to set the Mix Valve and Damper.*

Table 1 Mix Valve and Damper Control Table			
#	Outside Environmental Conditions	Damper Setting	Mix Valve Setting
1	Outside Temperature is at target temperature or higher	100%	0%
2	Outside Temperature is 20°F below target temperature	50%	50%
3	Outside Temperature is more than 20°F below target temperature	10%	100%

2.7. Damper

The Damper is the top/front inlet baffle door, which regulates the amount of fresh air allowed into the Poultry Holding Area.

Exhaust Doors act as baffles to direct air from the Poultry Holding Area either outside the body (exhausted) or back into the Mix Chamber for re-circulation to Poultry Holding Area along with fresh air.

The Damper Door, operated by a linear actuator, is connected to the Exhaust Doors by two linkage rods, allowing all three doors to be opened and closed in tandem in 5% incremental adjustments.

As the Damper opens, more fresh air is brought into the Poultry Holding Area and more air is exhausted to the outside. As the Damper closes, less fresh air is brought in and more air is re-circulated.

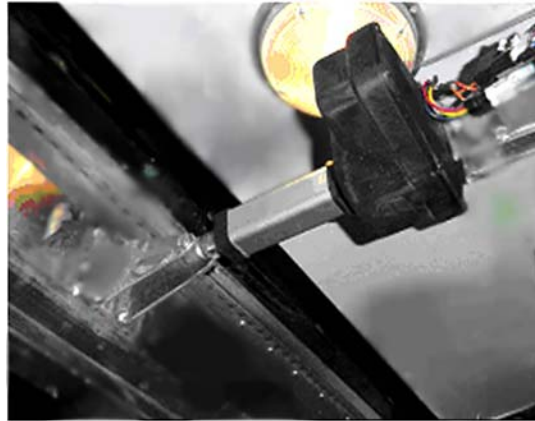
When the Key Pad Computer is set to Automatic Mode the Damper will not close less than a minimum specified setting (to be programmed by the Hatchery Manager) to ensure oxygen requirements are maintained.

When operating in Manual Mode, DO NOT under any circumstances operate the vehicle with the Damper closed below 10% when the box contains chicks. See [Figures 15 & 16](#). Should you need to manually run the system, use the parameters in [Table 1](#) above to set the Mix Valve and Damper.



Damper Door and Exhaust Door

Figure 15



Damper Door with Linear Actuator – interior view

Figure 16

2.8. Inlet and Exhaust Fans

The Inlet Fans provide the required airflow for ventilation. There are Inlet Fans located at the centre front of the Poultry Holding Area and Exhaust Fans located at the front along the sides in the control room. The Inlet Fans blow air down the centre along the length of the Poultry Holding Area and the Exhaust Fans draw air from the side wall ducts of the Poultry Holding Area. The INLET FAN key controls the operation of the Inlet Fans only in Manual Mode.

At start up the Control System is in Manual Mode. In this mode the Exhaust Fans turn on automatically and continue to run, however, the Inlet Fans must be turned on using the INLET FAN key.

In Automatic Mode, both Inlet and Exhaust Fans turn on automatically and continue to run under the control of the Key Pad Computer.

2.9. Spray Pump and Nozzles

Relative humidity and evaporative cooling of the Poultry Holding Area are adjusted by introducing water in a mist form through Nozzles into the Mix Chamber. The mist is then dispersed into the Poultry Holding Area by the Inlet Fans.

The Spray Pump provides pressure to operate the sprayers. Spray Nozzles are located on the front wall across from the Inlet Fans in the Mix Chamber/Control Room. There are four Spray Nozzles each rated at 1.0 U.S. gal/hr for a total of 4 U.S. gal/hr. The fresh water holding tank for spray water is 42 U.S. gallons. The holding tank capacity will provide continuous spraying for approximately 10 hours.

2.10. Spray Pump Pressure Tank

Water is supplied to the evaporative cooling spray system by the Spray Pump. A Pressure Tank, set to 20 psi is installed between the pump and the Spray Nozzles to create a reservoir of pressurized water for continuous fluid to the Spray Nozzles. This extends the life of the pump by reducing the number of times that it cycles on and off in providing water to the spray system.

2.11. Spray Tank

The Spray Tank requires filling when empty. Actual time of spray operation will determine the time required to empty the Spray Tank. The tank should be refilled prior to loading an empty truck. A spigot is located outside of the front of the unit on the passenger side to fill the Spray Tank. Attach a water hose and fill the tank. Water will flow out of an overflow port (and onto the ground) when the tank is full. Additionally, there is a cap on the tank to permit the addition of ice to the water if required.



Spray Tank Refill Spigot

Figure 17



Spray Tank located inside Control Room

Figure 18

2.12. Sensors

Four environmental sensors are installed to feed back information to the Key Pad Computer for monitoring and control. Their readings show on the Key Pad LED Display under the following headings:

- TEMP.1 - is an inside temperature sensor located near the front of the Poultry Holding Area (passenger side).
- TEMP.2 - is an inside temperature sensor located near the middle of the Poultry Holding Area (passenger side). See **Figure 20**.
- TEMP.3 - is an inside temperature sensor located near the back of the Poultry Holding Area (passenger side).
- TEMP.O - is an outside temperature sensor mounted inside the Control Room on the driver side front wall just below the Damper Door. A temperature probe is

connected through the front wall and located outside in an aluminum protective housing. See **Figure 19**.

- HUMIDITY - is a relative humidity sensor located with 'TEMP.2'. See **Figure 20**.



Outside temperature probe in aluminum protective housing - probe is connected to sensor box mounted inside the control room on the front wall directly behind the outside probe position.

Figure 19

Inside mounted sensors consist of two temperature sensors and one combination humidity / temperature sensor. They are located inside the access doors on the curb side of the vehicle.

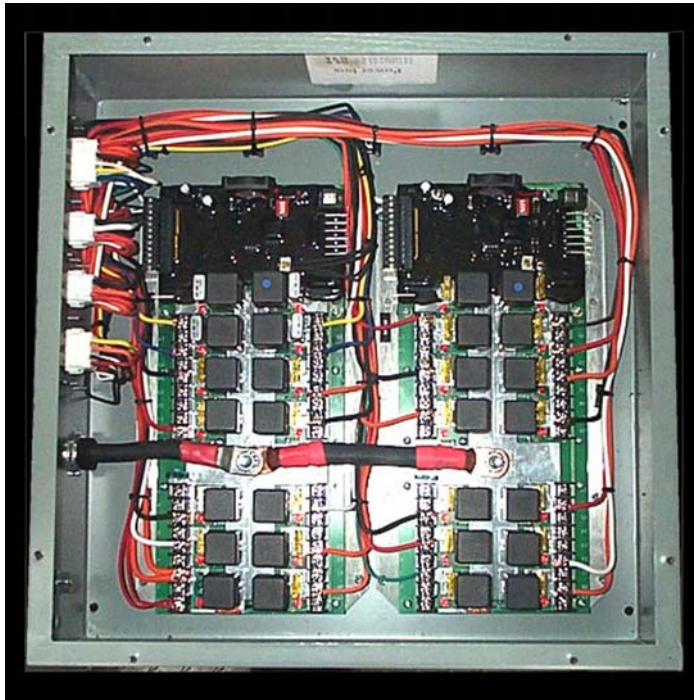
Figure 20



2.13. Electrical Panel

2.13.1. Overview

The Electrical Panel is located in the cab of the truck. Fuses, circuit breakers and control relays are located inside the Electrical Panel.



Electrical Panel

Figure 21

See Troubleshooting Tab for
Connections Diagram
(Electrical Panel Schematic),
Wiring Harness, Fuses &
Ratings and Fan Connection
Version Identification Chart

2.13.2. Fuses, Relays and Circuit Breakers

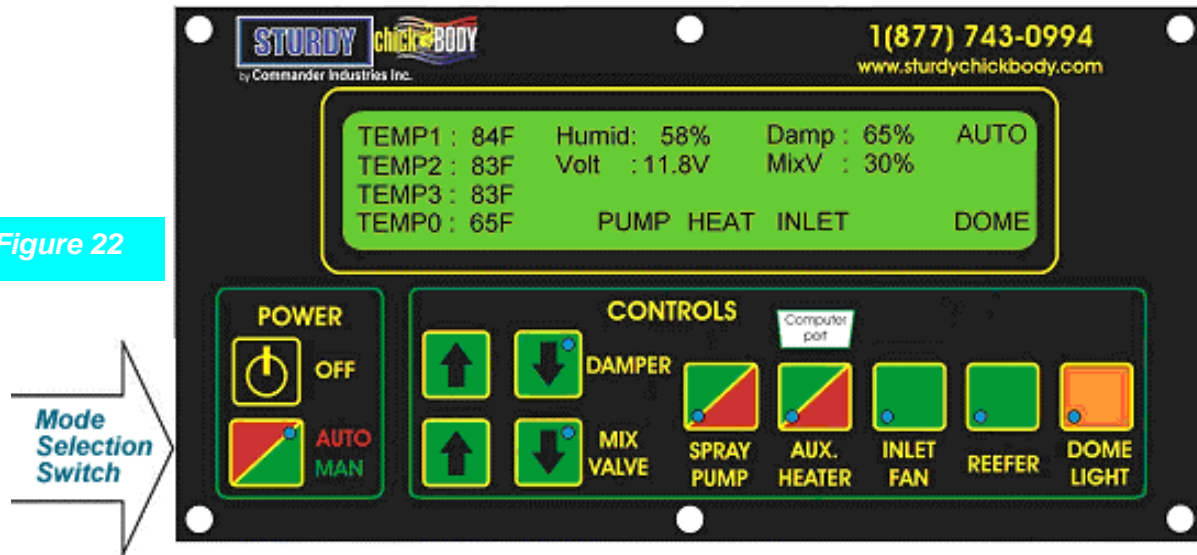
This system uses standard automotive relays and ATO style fuses and circuit breakers for safety. All fuses are located in the Electrical Panel (located in the truck cab, between the seats) except a) 275 amp fast acting limiter fuse mounted on the fire wall in the Cab engine compartment to protect the alternator and batteries and b) 30 amp in-line-fuse in the power line from batteries to Auxiliary Heater. Under no circumstances change the value of any fuses in the panel. If a fuse repeatedly is blowing, contact Commander Industries Technical Support. Changing values of fuses will result in the damaging of the Key Pad, or other electrically sensitive components, and may void warranty on these items.

3. General Operations

3.1. Operational Modes and Overrides

The Key Pad Computer has two modes of operation: AUTO (Automatic Mode) and MAN (Manual Mode). Selection between modes is done on the Key Pad. (See figure 22)

Figure 22



3.1.1. Automatic Mode

The Key Pad Computer should be operated in Automatic Mode during normal operation between the times when the truck is loaded until unloading. While in Automatic Mode, the only direct control the user has over any of the components of the Environmental System is humidity and cooling with the Spray Pump and heating with the Auxiliary Heater. The user should only have to monitor the sensor feedback on the visual display. Several conditions require the user to operate the system manually by switching the Key Pad to MAN. Refer to the [3.1.2.2. Section Manual Mode](#) below.

The Key Pad controls are inactive except: SPRAY PUMP, AUX HEATER and DOME LIGHT keys.

The DAMPER is preset at the factory to be open at 10% at startup. This startup default can be reset by the Hatchery Manager in 1% increments from 5% to 25%. Opening and closing of the Damper Door is adjusted automatically by the system afterwards.

There are four temperature sensors (one for the outside temperature and three for the interior temperature.)

To determine the interior temperature, the Computer calculates the average of the three interior temperature sensors. If one of the temperature sensor readings differs by 5°F with the others, it will be excluded from the average calculation. The exterior sensor is used simply for information to the driver.

If the temperature is below or above the programmed value, the Key Pad Computer will automatically adjust the Damper opening value and the Mix Valve to regulate the

temperature back to the pre-set value. In certain cases, the Auxiliary Heater will be activated if the temperature is more than 5°F lower than the pre-programmed value. If the temperature rises more than 10°F higher than the target temperature, the Spray Pump will be activated to refresh the chicks.

The humidity control is regulated by feedback from a humidity sensor compared to the set value programmed by the Hatchery Manager.

If the humidity is below the programmed value, the system automatically activates the Spray Pump to increase humidity back to the pre-set value programmed by the Hatchery Manager. Should the humidity be above the pre-set value, the sprayers will be idle.

3.1.2. Manual Mode

3.1.2.1. General Instructions for operations in Manual Mode

Once the Key Pad Computer is changed to Manual Mode, the operation of each of the ventilation components are operated at the choice of the user.

1. turn on the Inlet Fans
2. adjust the Damper and Mix Valve to suit conditions (see **Table 1** – *Mix Valve and Damper control table, found between Sections 2.4 and 2.5*)
3. if heat is required, turn on the Auxiliary Heater.
4. turn off the Auxiliary Heater when the target temperature is reached.
5. turn Spray Pump on if the interior relative humidity is less than 50% and/or the temperature is more than 90°F.

3.1.2.2. Compulsory Manual Mode

Extreme changes in exterior temperature

Extreme changes in exterior temperature is considered to be more than 10 degrees in less than 15 minutes, which could happen during spring and fall, as well as when being parked on hot asphalt.

Preheat

The Poultry Holding Area should be preheated to target temperature prior to loading. The Auxiliary Heater will automatically turn on until the thermostat temperature is reached. The length of time required for preheat will depend on exterior conditions, temperatures and storage of shipping truck.

If the cargo temperature is below target, the time for preheating the Poultry Holding Area can be decreased by steps one through four in the following order:

1. switch the control to MAN (Manual Mode)
2. turn on the Inlet Fan
3. fully close the Damper
4. fully open the Mix Valve

When the Poultry Holding Area temperature reaches pre-set temperature switch the control to AUTO.

Control or other electrical malfunction

See Troubleshooting Guide.

Washing

The Key Pad Computer MUST be turned to OFF during washing. If required, to decrease drying time and to prevent freezing, the following components can be manually operated:

- turn on the Inlet Fans
- open the Mix Valve 100%

3.1.3. System Overrides

In the Automatic Mode the Spray Pump will only be activated if the humidity is below the pre-set value programmed by the Hatchery Manager. The driver can override this function by pressing the Spray Pump key even in Automatic Mode.

The driver can also override the system in Automatic Mode by turning on the Auxiliary Heater.



System Overrides

Figure 23

3.2. Maintenance

Regular maintenance of your Environmental Control System Components is very important to ensure optimum performance. See the Maintenance Section for schedules and checklists.

3.3. Troubleshooting

A variety of situations have been listed in the Troubleshooting Guide that may occur during normal operation of the shipping truck Environmental Control System. It is generally recommended to first check if the issue is Key Pad Computer related by switching to Manual Mode to determine if a component will operate outside of the Automatic Mode. If there is insufficient voltage, some components may operate in Manual Mode but not in Automatic Mode. Follow the appropriate steps in the Troubleshooting Guide and if you have ANY questions or concerns contact Commander Industries Technical Support toll free (877)743-0994 for further details (General office phone number (519)245-1386).