



Water-Jacketed Automatic CO₂ Incubator

Models

NU-8600, NU-8600E

NU-8631, NU-8631E

Operation and Maintenance Manual

March 2022

Revision 8

Series 3



For 115 Vac, 50/60 Hz Only

Manufactured By:

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Water-Jacketed Water Jacket Invitrocell CO₂ Incubator

Operation & Maintenance Manual

NU-8600, NU-8600E

NU-8631, NU-8631E

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**Water Jacket
Invitrocell CO₂ Incubator
Model: NU-8600, NU-8600E, NU-8631, NU-8631E**

Operation and Maintenance Manual

1.0 General Description

The NuAire Water Jacketed Incubator has been designed to provide a reliable controlled In-vitro environment for optimum tissue cell culture growth. The chamber also provides an environment for the storage and preservation of gametes and animal tissue cell cultures intended for research at or near body temperature.

There are five parameters that contribute to optimum growth conditions, they are:

- Humidity
- Precise temperature control
- Precise CO₂ control
- Sterility
- Reliability

Like all NuAire equipment, this Incubator has been designed to provide the highest quality standards of performance with matching computer technology, precise temperature control, and CO₂ gas control system combining state-of-the-art technology with years of design, quality, and manufacturing experience.

1.1 Extra Large (18 to 20 gallon) Water-Jacket - Each Chamber

The outer stainless-steel wall is lined with a space-age insulation providing a R5.0 rating, minimizing heat loss. The large 20-gallon (75.7 liters) Water-Jacket utilizes water, one of nature's best "sinks" of heat. Its high capacity to hold heat makes it the ideal medium to surround a chamber in order to obtain temperature uniformity. In fact, the ability of materials to hold heat, called the specific heat, uses water as the comparative standard. The large water-jacket surrounding the chamber permits the water to circulate within the jacket, producing a temperature uniformity of $\pm 0.2^{\circ}\text{C}$. The larger the mass, the less susceptible the environment within the chamber is to environment fluctuations outside. It also adds cabinet stability for the growth of vibration sensitive cells.

1.2 Incubator Closed loop chamber sample circulation system & HEPA Filter

A continuous operating air pump draws environmental sample from the chamber and circulates it through a HEPA filter capsule then through sensors that measure CO₂ volume (as a percentage) in the chamber for monitoring and control.

1.3 Incubator Control Electronics

The NuAire Incubator Control Electronics is a state-of-the-art microcomputer-based control system specifically designed to service the precise control requirements of the chambers environment, providing optimum programmable conditions for culture growth. The microcomputer is "user-friendly" and provides a 5x7 LCD screen which provides operating control parameters, status indicators, additional key operational parameters, and an imbedded touch panel to permit efficient operator entry of data.

The microcomputer is supported with Read Only Memory (ROM) containing executable software, Random Access Memory (RAM) for temporary storage, and Electronically Erasable Programmable Read Only Memory (EEPROM) for control set points and parameters. The EEPROM provides for indefinite storage of these values during periods of power off or power interruption (power fault tolerant).

1.4 Incubator CO₂ Control

The NuAire direct heat Incubator incorporates a microprocessor-based, non-dispersive infrared CO₂ induction sensor. The amount of energy received at the detector is an approximate logarithmic function of the CO₂ concentration in the gas between source and detector. The wavelengths used are absorbed only by CO₂ making the measurement insensitive to other components, such as water vapor. Detector linearization is performed with 32-bit digital accuracy. Advanced design provides a very stable output minimizing drift and requiring less frequent calibration. The output is digital, alleviating errors brought about by analog signals. Calibration of this control is accomplished by a zero & span calibration done on the sensor and a display off- set calibration. These calibrations are accessible through the *NuTouch LCD* located on the front of the unit.

1.5 All Stainless-Steel Construction

The exterior is constructed of 16-gauge, type 304L stainless steel with the interior being 16-gauge, type 304L polished stainless steel using coved corner construction, which provides an easily cleanable (for decontamination) inert surface that does not promote biological growth. All exposed edges are deburred to insure no sharp edges. The exterior is finished in a textured polyurethane finish, which is resistant to chemicals and easily cleaned using mild household detergents. In addition, all shelves, shelf supports, and guide rails are easily removable and can be autoclaved to remove contamination.

Remember: The chamber environment is not selective. The growth environment is applied equally to all microorganisms (specimens and contaminants) within the chamber.

1.6 Incubator Humidity

All Model(s)

A relative humidity level of up to 90% is achieved in the Incubator by the use of a stainless-steel pan filled with distilled water no purer than 1 mega ohm, and placed on the bottom of the chamber. It is necessary to set the duty cycle of the door heater in proper proportions to reduce the possibility of condensation forming on the glass inner door and the chamber walls. It is also important to thoroughly wipe the walls and the glass door clean before adding the humidity water pan. Condensation will occur more readily at contamination points. There is no electronic sensing and thus no automatic control of the humidity level in the Water Jacketed Incubator. An air pump injects fresh air into the chamber at a preset duty cycle to reduce condensation forming on the chamber walls and front glass door. The air injections are settable by the user to help control condensation. (See section 8.8 for this option.)

1.7 O₂ Display and Control (NU-8631)

The Incubator has an available optional Oxygen display and control system. The system controls from 21% (ambient level) down to 0.5%. The recovery time from ambient to 5% ± 2% is typically less than 15 minutes. The accuracy is ±0.25% from any given set point.

Oxygen sensor is a type, which generates logarithmic signal based on O₂ content in the chamber. The sensor is unaffected by CO, H₂ and various acidic gases such as CO₂, etc.












1.8 Safety Instructions

These safety instructions describe the safety features of the INVITROCELL Incubator.

The incubator has been manufactured using the latest technological developments and has been thoroughly tested before delivery. It may, however, present potential hazards if it is not used according to the intended purpose or outside of operating parameters. Therefore, the following procedures must always be observed:

- The incubator must be operated only by trained and authorized personnel.
- For any operation of this unit, the operator must prepare clear and concise written instructions for operating and cleaning, utilizing applicable safety data sheets, plant hygiene guidelines, and technical regulations, in particular.
 - Which decontamination measures are to be applied for the incubator and accessories?
 - Which protective measures apply while specific agents are used?
 - Which measures are to be taken in the case of an accident?
- Repairs to the device must be carried out only by trained and authorized expert personnel.
- Keep these operating instructions close to the unit so that safety instructions and important information are always accessible.
- Should you encounter problems that are not detailed adequately in the operating instructions, please contact your NuAire Representative or NuAire technical Services.

1.9 Explanation of symbols

Symbol (in text box)	Description (in text box)
	Safety alert symbol indicates a potentially hazardous situation which, if not avoided, could result in death of serious injury.
	Safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.
CAUTION	CAUTION used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.
	Potential electrical hazard, only qualified person to access.
	Note:
	Biohazard
	Ground, Earth
	Hazardous Gases! Personal Protection Equipment Required.
	Chemical Hazard
	Flammable Hazard
	Lead Free
	Hot Surface Burn Potential

2.0 Performance Parameters and Features

- Each chamber's water-jacket holds 18 to 20 gallons (up to 75.7 liters) of water that, in conjunction with the microcomputer control system, provides an interior chamber temperature uniformity of $\pm 0.2^{\circ}\text{C}$ at 37.0°C .
- The microcomputer temperature control system has two temperature sensors located inside the chamber at the back wall. The temperature sensors compare the values to a set point and execute a differential control algorithm that energizes a solid-state switch, supplying power to the heaters.
- Easily removable inner shelves and rails for sterilization.
- Up to 16 shelves can be placed inside the chamber (4 shelves are shipped).
- Space-age high-temperature material is used to insulate the Water Jacket walls.
- Most electronics, motors, pumps, and valves are fully accessible from the back of the unit.
- A CO_2 sample port is provided in the center of the inner glass door to check the concentration of CO_2 in the chamber.
- The CO_2 percentage is controlled by a solid-state gas infrared sensor using a single light source with dual-wavelength detection, providing accurate monitoring of CO_2 .
- After a door opening the CO_2 level automatically recovers to $5.0 + 0.2/- 0.5\%$ within a 5-minute period on average.
- The outer door includes an internal radiant heater in order to minimize condensation on the inner glass door. A magnetic outer door gasket helps to insure a tight seal against the cabinet.
- The inner glass door is $3/16''$ tempered with smooth-ground edges and seals are tight against a silicone rubber gasket. The door latch is cam action. A momentary switch monitors the door position, the position being opened or closed.
- All control electronics are protected with a circuit breaker that may trip at 110% of loading rating but will trip at 145% of load rating in less than 2 seconds.

NOTE: **Should the circuit breaker open (pop-out button will appear), merely depress to reset.**

- The Incubator has adjustable leveling legs to compensate for uneven laboratory surfaces.

3.0 Models & Features

3.1 Dimensions (see also Specification Drawing BCD-18002)

Overall Dimensions - inches (mm): All Models

Height:	Exterior:	37.750 inches (958 mm)
Width:		25.625 inches (680 mm)
Depth:		27 inches (685 mm)
Footprint:		22 inches (557 mm) wide x 17.5 inches (445 mm) deep
Height:	Interior:	24 inches (611mm)
Width:		20.375 inches (518mm)
Depth:		20.625 inches (524mm)

Shelf Capacity:

Size:	18 inches (457mm) wide x 18.75 inches (476mm) deep
Supplied:	4 Shelves
Maximum Capacity:	16 Shelves
Maximum Weight Capacity	25 lbs. per Water Jacket shelf 125 lbs. per Water Jacket Incubator

(Make sure shelf is empty before changing position or removing.)

Water Pan:

Dimensions:	Mean Length	12.0" (305mm)
	Mean Width	10.0" (254mm)
	Depth	1.5" (38mm)
Capacity:	Maximum	2.0 Liters
	Recommended Fill	1.5 Liters

3.2 Performance Parameters:

Temperature Control: Performance Determined with O₂ Set Point @ 21.0%

- Temperature Range: 5°C to 55°C (37°C default) (5°C above ambient to 30°C maximum ambient)
- Temperature Uniformity: $\pm 0.2^{\circ}\text{C}$ @ 37°C.
- Temperature Accuracy: $\pm 0.1^{\circ}\text{C}$.
- Temperature Recovery: 0.12°C/minute Average
- Temperature Display Resolution: 0.1°C
- Temperature Sensor Type: Precision Integrated Circuit
- Door: Proportional base duty cycle based on Temperature set point and -20 to +20% manually adjustable to adapt to ambient conditions.

CO₂ Control: Available on All Models Performance Determined with O₂ Set Point @ 21.0%

- CO₂ Range: 0.1 to 20% (default 5%). (0.0 set point idles system)
- CO₂ Accuracy: $\pm 0.1\%$
- CO₂ Recovery: Up to 5% +0.2/-0.5 in 5 minutes average.
- CO₂ Display Resolution: 0.1%
- CO₂ Control Logic: Fixed Algorithm/Manual Environmental Adaptable.
- CO₂ Sensor Type: Infrared single source dual wavelength
- Sensor Bay Temp: Chamber Set Point +3.5 Degree C.

O₂ control and monitoring system w/ the Fujikura Zirconia sensor Available on the NU-8631 models

- O₂ measuring range: 0 to 25 %
- Default Set-Point: 21% (system is idle at this point)
- O₂ set- point Range: .5 to 21%
- O₂ Accuracy: $\pm .25\%$
- O₂ Recovery: 5% $\pm 2\%$: 15 minutes on average
- Connectors on rear panel are provided for Dry contact remote alarm, RS-485 2way communication,

and 4-20 mA analog output signals for system performance.

Notes: Performance ratings apply **ONLY** when the Incubator is installed and set up properly per the instructions in the manual, has stabilized at all set points and is in a stable environment. See sections 8 and 9 for proper set up.

Idle system will not inject gas or RH and will not alarm.

3.3 Standard Items Packed with Unit

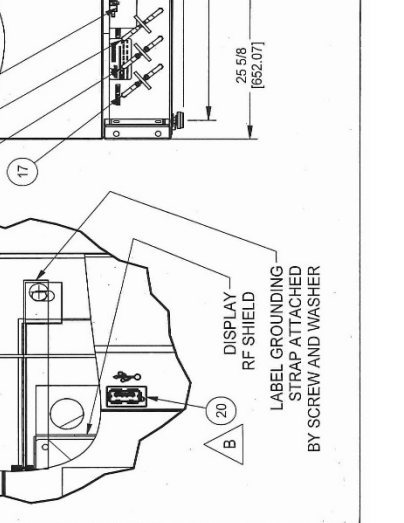
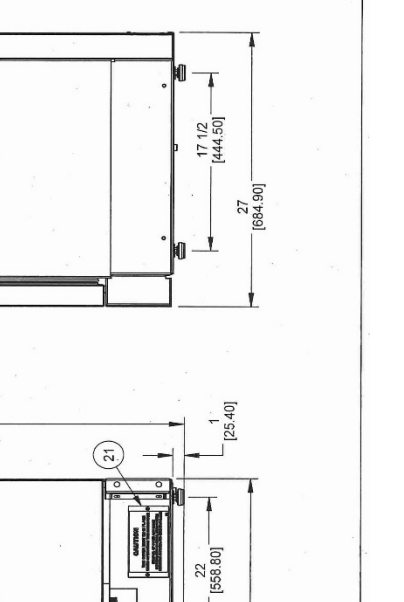
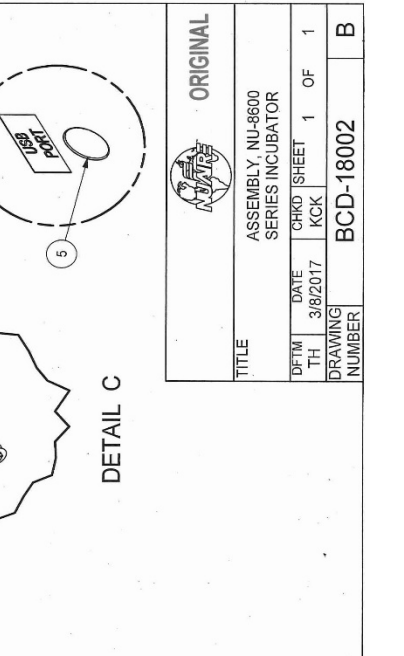
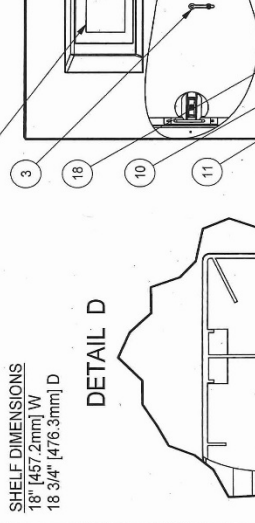
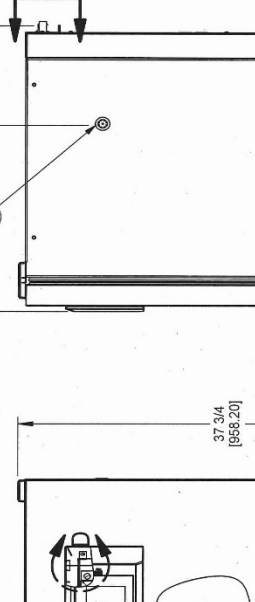
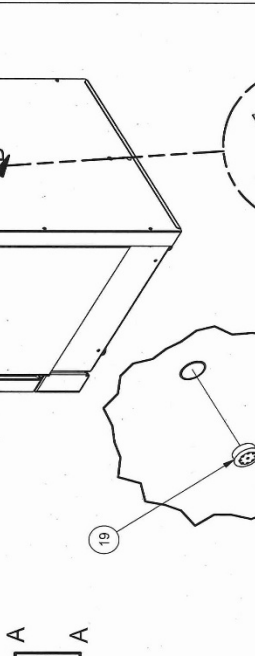
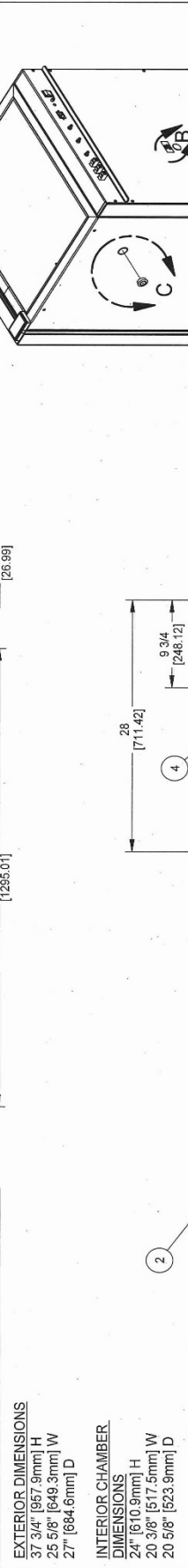
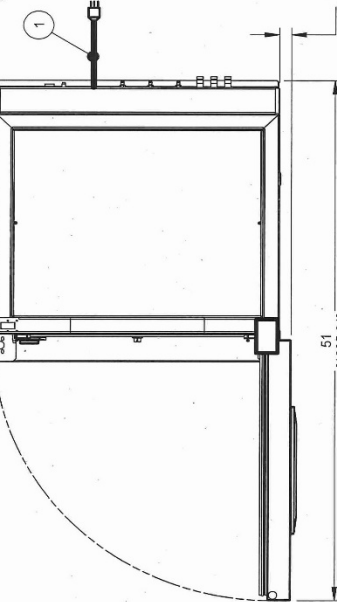
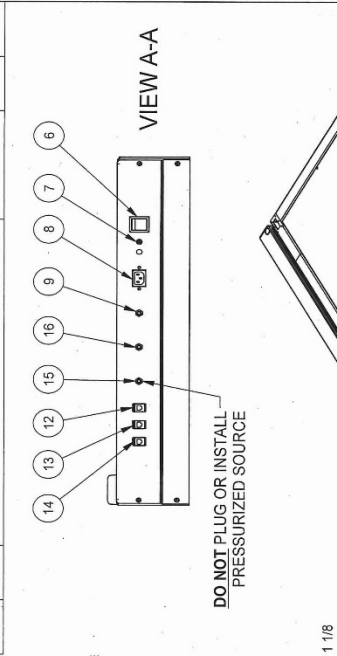
- Four (4) stainless steel shelves
- Eight (8) stainless steel shelf brackets
- One (1) water pan
- Gas supply tube(s)
- Access port plug with breather hole
- One (1), 2 meters (6.5 ft.) electrical cord 10 Amp 18awg *
- Operation and Maintenance Manual
- Operating Instructions

***Do not replace electrical cord with an inadequately rated cord.
A factory supplied replacement is recommended.**

3.4 Consult factory for additional Accessories (Ordered Separately)

REV	ECO	DESCRIPTION	DATE	DFTM	CHKD
B	13712	ADDED FRONT USB PORT, ADDED CAUTION LABEL TO FRONT VIEW	4/2/2018	TH	KCK

ITEM	DESCRIPTION
1	POWER CORD
2	DISPLAY SCREEN
3	CO2 SAMPLE PORT
4	ACCESS PORT 1-1/8" [28.6mm]
5	USB CONNECTION PORT COVER
6	ON/OFF SWITCH
7	CIRCUIT BREAKER
8	AC POWER CORD CONNECTION
9	CO2 SUPPLY INLET
10	AIR SUPPLY FILTER
11	CO2 FILTER
12	4-20 MA CONNECTION
13	RS-485 CONNECTION
14	REMOTE ALARM CONNECTION
15	AIR SUPPLY INLET
16	N2 INLET
17	N2 SUPPLY FILTER
18	DRAIN VALVE
19	NON-DECON PORT CAP
20	USB PORT - FRONT
21	SENSOR BAY ACCESS PANEL



ORIGINAL	
TITLE ASSEMBLY, NU-8600	
SERIES INCUBATOR	
DFTM	DATE
TH	3/8/2017
CHRD	KCK
SHEET	1 OF 1
DRAWING	BCD-18002
NUMBER	B

4.0 Test Performance & Procedures

All equipment is thoroughly inspected at the NuAire Factory at the time of shipment. Quality control is maintained by constant surveillance over the product, beginning at the receipt of purchased material and concluding with a final inspection, which certifies the Incubator performance to the specifications. In all instances where product quality cannot be easily assessed on the end item, the product is inspected during sub-assembly fabrication. The following test procedures are conducted on every Water Jacket Incubator and a copy of the test report is included with each Incubator.

4.1 Visual Inspection

- Each Incubator is visually inspected to ensure that the interior is clean and free from scratches, nicks, and burrs and that all welds, both interior and exterior are finished.
- Painted surfaces are inspected to be free of scratches, nicks, insufficient covering, and noticeable paint runs.
- The doors open and close freely without binding of the hinges.
- The gasket seals the inner glass door to the Incubator tightly across its entire opening.
- The glass door is free of scratches.

4.2 Electrical Tests

- **Electrical Leakage Test**
All Incubators are required to have a primary-circuit filtering to meet EMC (electromagnetic compatibility) regulations. Electrical leakage does not exceed 1.0 milliamperes.
- **Dielectric Voltage – Withstand Test**
1200 VDC (115-volt units) or 1970 VDC (230-volt units) is applied between dead metal parts and the hot/neutral power source lead with no electrical breakdown using an Associated Research Model 7564SA Quadchek II, 8106 Omnia 6, or 8006 Omnia 6, or other models.
- **Grounding Continuity**
The resistance between the green bonding conductor of the supply cord and any dead metal part of the cabinet shall not exceed 0.10 ohms.

4.3 Functional Tests

These functional tests are performed on every Incubator over a minimum of a 48-hour /burn-in period. The results are recorded on the final Inspection report and a copy is included with each incubator that is shipped. All failures are noted, corrected, and any failed test is successfully repeated. Changes from any default value of the optional configuration parameters meant to improve performance are recorded on this report for your reference.

- **Control Systems**
All performance and diagnostic functions are exercised to insure proper operation of control systems, components, and alarms.
- **Temperature**
Each Incubator is monitored for stable temperature control over the 48-hour burn-in period at (37°C).
- **CO₂ Control**
Each Incubator is calibrated to function at a 5% CO₂ level.
The concentration is checked with an independent calibrated instrument.
Each unit is monitored during the 48-hour burn-in period and only accepted with zero failures.
- **CO₂ Recovery**
Each Incubator is exercised for CO₂ recovery time at the end of the 48-hour burn-in period.
The door is opened for 1 minute to deplete the CO₂.
After the door is closed, the unit shall recover to 5% +0.2/- 0.5% within a 5-minute period.
- **Humidity**
Each unit has a default RH level intended to avoid condensation.
The door duty cycles is determined by a Base duty cycle calculation based on the chamber Temperature set point. Automatically adjusted in response to environmental conditions but can be manually adjusted if needed to control condensation and tune in the chamber temperature uniformity for the environment that the incubator is installed in. If unit is master reset these settings will be changed to a default value of 0.0.
The factory default door and setting is: **Door: 0.0.**

5 Warranty

Details regarding product warranties can be found in the published warranty data separate from this manual and included within the data packet sent with the unit.

6 Shipments

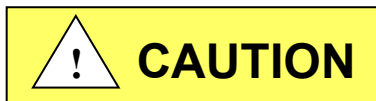
NuAire, Inc. takes every reasonable precaution to assure that your Incubator arrives without damage. Motor carriers are carefully selected, and shipping cartons have been specifically designed to insure your purchase arrives safely and undamaged. However, damage can occur in any shipment and the following paragraph outlines those steps you should take on receipt of a NuAire Incubator to be sure that if damage has occurred, the proper claims and actions are taken immediately.

6.1 Damaged Shipments

- 6.1.1** Terms are F.O.B. factory, unless stated otherwise.
Therefore, it is important to check each shipment before acceptance.
- 6.1.2** If there is visible damage, the material can be accepted after the driver makes a notation on the consignee's copy of the freight bill. Then an inspection must be made to verify the claim against the carrier. This inspection is the basis of your filing the claim against the carrier.
- 6.1.3** If concealed damage is found, it is absolutely necessary to NOTIFY THE FREIGHT AGENT AT ONCE and request an inspection. Without this inspection, the transportation company may not accept a claim for loss or damage. If the carrier will not perform the inspection, an affidavit must be prepared to state that he was contacted on a certain date and that he failed to comply with the request. This, along with other papers in the customer's possession will support the claim.

7 Installation

The Incubator is fastened to the base skid, and it is usually the best procedure to leave the skid attached until the Incubator is located in its approximate position to facilitate ease in handling. The base skid can then be removed by removing the two bolts holding the cabinet to the skid. See BCD-18002 for dimensions and features of the incubator.



It is recommended that no less than two people are present when the incubator needs to be moved.

Examine the Incubator carefully.

INSPECT both the exterior and the interior for any transit damage before discarding the shipping crate.

7.1 Location

In locating the Incubator, consider all possible conditions that might affect its performance as well as laboratory procedures for its intended purpose. Do not locate near heating or cooling ducts, or next to equipment that generates heat (steam radiators, stoves, ovens, autoclaves, etc.). Avoid direct sunrays and rapidly moving air currents. These conditions adversely affect the even heat dissipation required from the exterior surfaces of the Incubator and may cause the temperature variation in the chamber to exceed specifications as stated in section 3.2. Since the Incubator needs even heat dissipation on all surfaces in order to maintain an internal temperature variation of less than $\pm 0.2^{\circ}\text{C}$, a minimum of 2 inches (50mm) must be allowed between the rear and sides of the Incubator and any walls, partitions or obstructions to facilitate adequate convection of air around the Incubator. Confirm clearance with a tape measure if needed. Adjust the Incubator location accordingly. In addition, the Incubator location should address access to its power cord for connection/disconnection if necessary. For maintenance and service purposes, the control center electronics should remain accessible. Leave at least 3 ft of clearance in front for the swinging door.

7.2 Leveling

Prior to use, the incubator should be leveled using a bubble level on a middle shelf in the chamber. The Incubator should have all 4 leveling feet firmly on the bench or floor. Level from side to side and front to back. By turning the adjustable leveling feet counterclockwise, raises the Incubator. The leveling feet height should allow for a 2 inches (50mm) space between Incubator base and the floor. There is a 1-inch-long Stainless-Steel spacer supplied with each foot. Be sure that it is in place when you are leveling the incubator.

7.3 Interior Chamber, Shelf & Water Pan Preparation

Shelves

Incubator is shipped with the shelves installed. The shelf-mounted water pan is also in place that option is ordered NuAire recommends decontamination of all surfaces within the interior chamber, glass door, and outer door with gasket. They can be wiped down with a disinfectant of 70 percent alcohol or a similar non-corrosive antimicrobial agent. Use only disinfectants that are compatible with the vinyl gasket, the powder coat paint on the outer door and the 304L stainless steel in the chamber. See BCD-19905

Note: Absolutely no chlorinated or halogen materials are to be used in the chamber.

NOTE: NuAire does not offer any product warranty with respect to cleaning material compatibility. USE AT YOUR OWN RISK! The information provided above is from raw material suppliers and known general source documents for use to develop application cleaning SOP's.

Four (4) shelves are installed in each Incubator. The shelf positions are easily changed by removing the shelf and moving the horizontal guides to the desired position. If the shelf does not bind or disengage from the horizontal bracket it is installed correctly. Additional shelves and shelf guides are available.

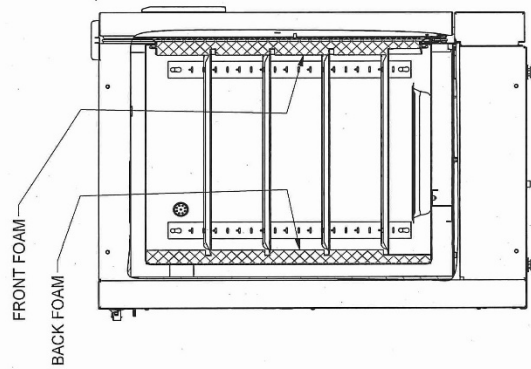
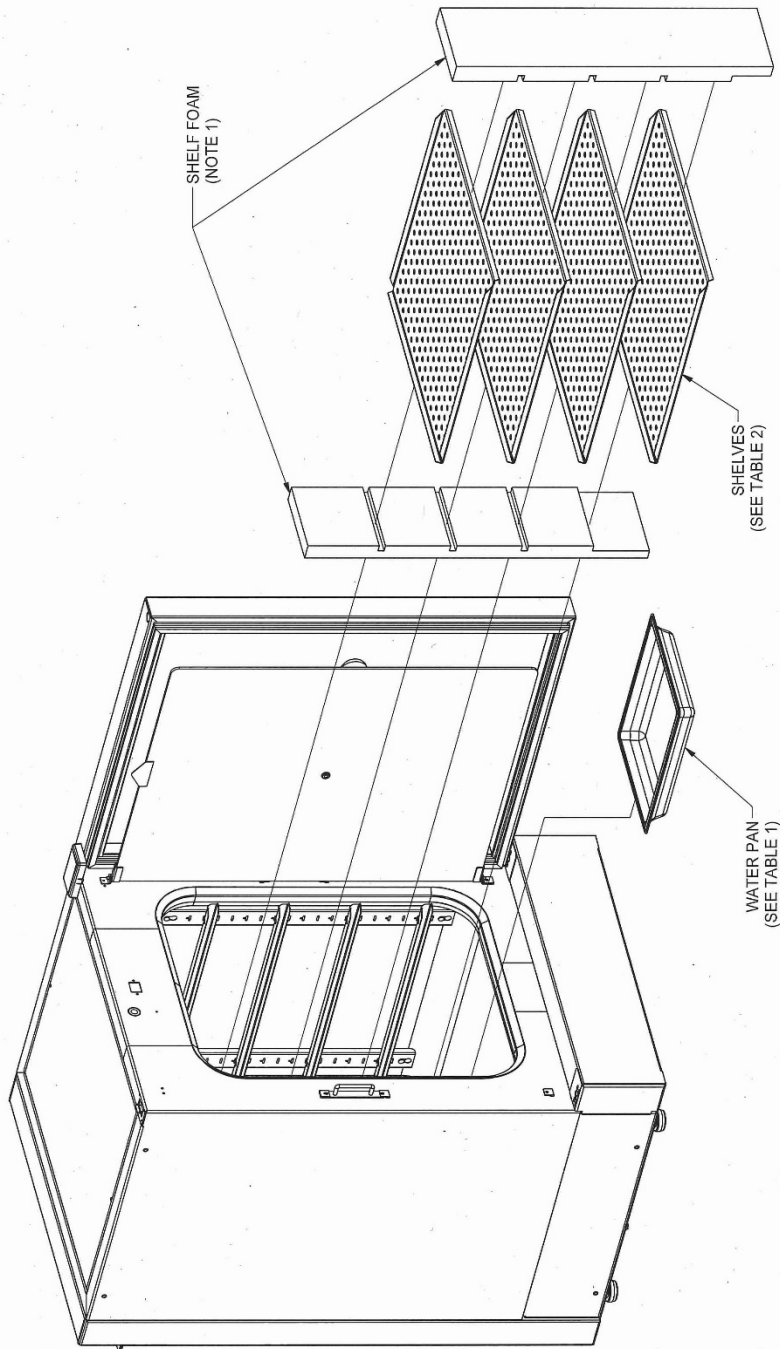
Water Pan

Place water pan in the center on the bottom of the chamber and fill with **SINGLE DISTILLED WATER no purer than 1 Mega Ohm.**

It is recommended to fill the pan to a maximum of about 1/2 inch below the top rim. See Sections 3.1 and 8.2 for more specifications and operational details regarding proper maintenance instruction regarding the water.

REV	ECO	DESCRIPTION	DATE	DFTM	CHKD
A	13712	RELEASED TO PRODUCTION	4/18/2018	TH	KCK

JCP



ORIGINAL



TITLE		WJ INTERIOR PREP	
DFTM	DATE	CHKD	SHEET
TH	4/18/2018	KCK	1 OF 1
DRAWING NUMBER		BCD-19905	
		A	

MATERIAL	SHELVES
SST	NU-5783
COPPER	NU-5784

MATERIAL	FLOOR WATER PAN (SHOWN)	SHELF MOUNT	WATER PAN
SST	NU-5842		NU-5765
COPPER	NU-5860		NU-5766

NOTES:
1. REMOVE FOAM WHEN SHELVES ARE REMOVED FOR CLEANING.

7.4 Electrical

The electrical supply circuit to the Incubator must conform to all national and local electrical codes. Consult the serial-data plate, located at the front of the right side of the Incubator, for voltage, cycle, phase, and ampere requirements before making a connection. Plug the power cord securely into a grounded power source. **VOLTAGE SHOULD NOT VARY MORE THAN 10% FROM SERIAL PLATE RATINGS.** Have a qualified technician check with the power source with a properly rated voltmeter if needed. A separate branch circuit is recommended to prevent possible loss of product due to overloading or failure of other equipment on the same circuit. **A SURGE PROTECTOR IS STRONGLY RECOMMENDED** to avoid power-related faults.

7.5 Precaution for Incubator Filling

To prepare the Incubator for filling, turn on main power switch located on the back panel. The "Maintenance Required" notification will show on the main screen indicating that the Jacket requires water.

CAUTION: Only turn the Incubator on when you are ready to fill the water jacket.

7.6 Filling & Draining the Water-Jacket

The fill port plug is located on the front top left side behind the door. Install the fill port fitting. Place the tubing over the adapter and connect the other end to either a funnel or serrated tap. Use single distilled water, **NO PURER THAN 1 MEGA OHM.** Fill the Water Jacket until the "Maintenance Required" indicator in the display screen turns off. Add an additional 3 to 4 liters of water, remove the tube adapter, and replace with the fill port plug.



CAUTION

Be sure to position and level the Incubator as desired before filling with water.

DO NOT OVERFILL!

The Water Jacket requires no anti-bacterial agents. The Incubator already incorporates a copper tube producing copper sulfate which eliminates bacterial growth within the water jacket. **ABSOLUTELY NO CHLORINATED OR HALOGEN MATERIALS ARE TO BE USED IN THE WATER JACKET.**

A safety overfill port is located next to the fill port plug so if overfill does occur, the water will be relieved through the port.

This can be drained from the drain plug located on the bottom front under the valance. The drain uses a ball valve to control the drain water. If the valve stem is perpendicular to the port in the valve it is closed. Turn it clockwise to open. A white safety plug must be removed prior to draining located on the bottom of the ball valve. It also insures no leakage will occur.

7.7 Air Inlet Connection

The air inlet and filter are installed at the Factory. The filter has flexible hose that attaches to bulkhead fittings in the bottom of the front panel and can be found under the valance that is beneath the door. One 50mm polypropylene .3-micron HEPA filter is connected to the hoses. The filter is labeled “Air filter”. To remove the valance the outer door must be open. Reach in under the valance and lift it to remove. See BCD-18476. The air inlet on the back of the incubator is connected to the filter by a hose at the factory and does not require installation.

CAUTION: This is a free air supply. DO NOT connect to a pressurized air source.

7.8 CO₂ / N₂ Gas Supply Setup

7.8.1 Gas and Air supply HEPA filtering is installed at the Factory on the front of the incubator as illustrated in the picture.

Each incubator is equipped with the filters required for the control systems available on that model.



- CO₂/N₂ Pressure to the Invitrocell is rated at 20 PSIG or 1.4 BAR. Do not exceed 25 PSIG or 1.8 BAR to avoid damaging the incubator.
- CO₂/N₂ of medical grade is recommended.
- A two-stage pressure regulator, Linde #19590 (NU-1564) or equal is recommended.
- **DO NOT USE a single stage regulator.**

7.8.2 CO₂/ N₂ Gas Supply Tubing Connections

Included with this unit and for all models of the 5800 series is (1) six-foot (2 m) of vinyl tube. It connects between the low-pressure side of the 2-stage regulator at the CO₂ supply and incubator fitting labeled **CO₂ INLET** (as shown in the following Figure). Next, secure each connection with the clamps supplied.

On Model NU-8631 there is a second six foot (2 m) of vinyl tube. It connects between the low-pressure side of the 2 stage regulator at the N₂ supply gas and incubator fitting labeled **N₂ INLET**. Next, secure each connection with the clamps supplied.

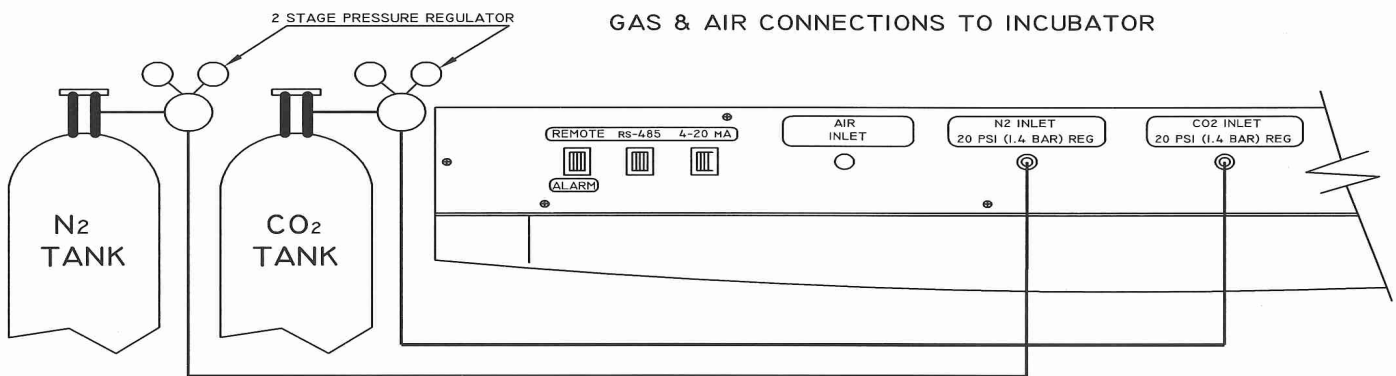


Figure illustrating CO₂ and N₂ gas supply connections

7.8.3 CO₂/ N₂ Supply

- CO₂/ N₂ of medical grade is recommended.
- A two-stage pressure regulator, Linde # 19590, or equal, is recommended.
- DO NOT USE a single stage regulator.

It will not give a stable output at 20 psi and exposes the Incubator to the gas cylinder pressure.



- **High concentrations of CO₂ gas can cause asphyxiation!**
- **Install Incubator in a well-ventilated area.**
- **Gas Supply pressure to the Invitrocell is rated at 20psi (1.4 bar).**
- **Do not exceed 25psi (1.8 bar) or damage to the incubator may occur.**

This Incubator is designed to be operated with CO₂ gas only.

Connecting a flammable or toxic gas can result in a hazardous condition.

Gases other than CO₂/ N₂ should not be connected to this equipment.

CO₂ gas cylinders have a UN1013 label on the cylinder and are equipped with a CGA 320 outlet valve.

Check the gas cylinder for the proper identification labels.

Do not use CO₂ gas cylinders equipped with siphon tubes.

A siphon tube is used to extract liquid CO₂ from the cylinder which can damage the pressure regulator.

Consult with your gas supplier to ensure that the CO₂ cylinder does not contain a siphon tube.

7.8.4 CO₂/ N₂ Pressure Regulators

- The regulator's high-pressure stage direct from the supply cylinder must have a range of from 0 to 2000 PSI or 0 to 140 BAR. This gauge indicates actual tank pressure.
- The low-pressure stage should have a range of 0 to 30 PSI or 0 to 2 BAR (100 PSI or 6 BARS maximum). This gauge will indicate the actual CO₂/N₂ pressure to the Incubator.
- Some single stage CO₂/N₂ pressure regulators have two gauges. USE A TWO-STAGE REGULATOR.

All NuAire Incubators use CO₂/N₂ in such quantities that precise metering of CO₂/N₂ input pressure is important for maximum performance.

To connect the regulator:

1. Open the CO₂ cylinder slightly, for an instant (this is termed "cracking the valve.") This will blow out dust or dirt that may have collected in the valve outlet.
BE SURE to keep your face away from the valve outlet to protect your eyes from dust or dirt.
2. Make sure the regulator pressure-adjusting screw is released by turning it counterclockwise until it turns freely.
3. Attach the regulator to the cylinder valve and tighten the connection nut with a wrench.
BE SURE DISC SEAL IS IN PLACE BEFORE MAKING A CONNECTION.

7.8.5 CO₂/ N₂ Supply Adjustment

With the regulator OFF (i.e. fully counterclockwise), open the cylinder valve slowly usually 1 to 2 turns is sufficient.



NEVER STAND IN FRONT OR BEHIND THE REGULATOR WHEN OPENING THE VALVE. ALWAYS STAND TO ONE SIDE.

The cylinder tank pressure should read: 700 to 800 PSI (48 to 55 BAR) for CO₂ or 2550 to 2650 PSI (176 to 183 BAR) for N₂ more or less depending on the temperature of the cylinder.

Next turn each regulator's pressure adjusting knob clockwise until the low-pressure gauge reads 20 PSI or 1.4 BAR.

Both gas connections are now complete.

Note: OSHA requires the CO₂ tanks to be physically restrained (i.e. via chained to wall) to prevent accidental damage to cylinder.

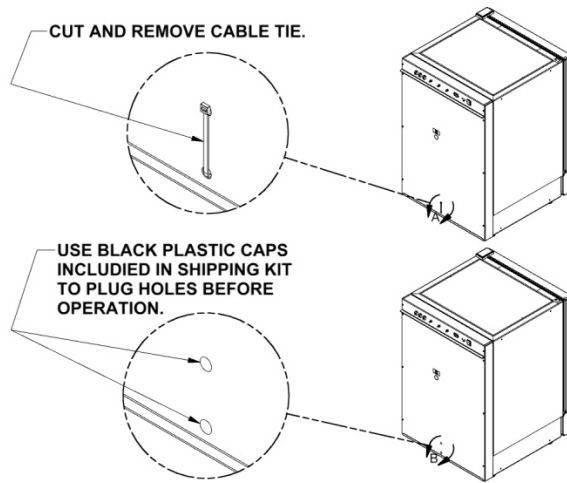
7.8.6 Checking the Connections

The connections can be checked for leakage by brushing a small amount of soapy water on each one.

Observe to see if any bubbles are blown. If not, the connection is secured properly.

If it is, the cause of the leaking needs to be determined, (i.e. loose clamp or damaged hose) and corrected.

7.9 Removing the cable ties used to secure the Air pump for shipping:



7.10 Setting up the access port:

When utilizing the access port do not block or restrict the relief holes in the center of the port plug. Blocking this venting can cause performance issues for the incubator. Cut slits or new holes in the vented plug to make passage for cables or other items requiring access to the chamber if needed.

7.11 Correct Installation

When the Incubator is installed correctly connected to the power source it is rated for gas connections made properly, the water pan filled, the shelves in place, and the unit is leveled. Read section 8 and follow all instructions for setting set points at the desired value. Then calibrate the Incubator control systems as explained in section 9. If the Incubator is installed and calibrated correctly it will meet the performance specs listed in section 3.2.

7.12 Reversing Incubator Hinges

Reversing the incubator hinges from the right to the left side SEE PTB0236 for instructions. This requires disassembly of the incubator and should be done by a qualified service technician.

8.0 Water Jacket Operation



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ATTENTION ACCOMPANY'S INFORMATION OR IMPORTANT SYMBOL



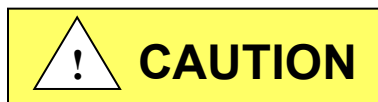
188

POTENTIAL ELECTRICAL HAZARD ONLY QUALIFIED PERSON TO ACCESS



564

HOT SURFACE BURN POTENTIAL



Safety alert symbol indicates potentially hazardous Situation which, if not avoided, may result in minor Or Moderate injury.

CAUTION: A qualified technician who is familiar with the proper maintenance procedures required for this equipment, as well as repair, must perform all maintenance actions on this equipment.

The Incubator is designed to provide a sterile, constant temperature, constant CO₂ level and naturally humidified atmosphere for optimum growth of tissue cell cultures and other organisms requiring this precise environment. To operate the Incubator properly, the following parameters must be reviewed, carefully set, and/or prepared.

8.1 Sterility

The chamber environment is not selective. The growth environment is applied equally to all microorganisms (specimens and contaminants) within the chamber. Therefore, before placing any cultures in the incubator, the shelves and sidewall top plenums should be sterilized. The interior sidewalls, top, bottom, door, as well as the gasket should be wiped clean

with a 70% solution of isopropyl alcohol or other disinfectant compatible with the chamber construction, to remove any contamination. Use mild detergent to clean the exterior of the Incubator.

NOTE: NuAire does not offer any product warranty with respect to cleaning material compatibility. USE AT YOUR OWN RISK! The information provided above is from raw material suppliers and known general source documents for use to develop application cleaning SOP's.

8.2 Humidity

Water Pan available on all Models

Humidification of the Incubator chamber is achieved through the process of water evaporation (vapor water pressure) from a stainless-steel water pan placed on the bottom of the chamber. Materials of different thermal resistance (e.g., glass, plastic) do not offer sufficient thermal recovery and are not recommended for water pan usage. Although some metals offer better thermal coefficients than stainless steel, dissimilar metals cause electrolysis in the acid atmosphere (carbonic acid) and should never be used, or placed within the chamber.

Use only distilled or mineral-free water, **no purer than 1 megaohm**, in the stainless-steel pan. The water should be changed at least once a week. **FLOODING THE BOTTOM OF THE INCUBATOR IS NOT RECOMMENDED** since it is difficult to change the water weekly and almost always necessitates the use of chemicals, which are not recommended and may damage the stainless steel. Also, it promotes condensation on the inner walls because it steals the natural convection, heat flow through the inner chamber and condensation points occur.

NOTE: ABSOLUTELY NO CHLORINATED OR HALOGEN MATERIALS ARE TO BE USED IN THE CHAMBER.

Humidity Recovery: Using the water pan supplied with the incubator and with a 5.0% CO₂ set point.

NU-8631: Recovery after a door opening is directly dependent on the O₂ set point and ambient RH. The lower each of these factors is the longer the recovery time.

Contamination in the water pan may be avoided by adding a small amount of copper sulfate to the water pan after each Incubator decontamination.

NOTE: Please contact the copper sulfate manufacturer to determine the proper amount of copper sulfate that should be added to the water pan.

Condensation on the glass door / front chamber or in the back of the chamber indicates that the door heater cycle requires calibration (see section 9.2). The fresh airflow that the air pump delivers to the chamber has been preset at the factory. If condensation starts forming on the sides or back wall in the chamber, the number and length of air injections into the chamber can be increased. (See section 8.8.1.2 for instructions.) To alleviate the condensation, increase the airflow. To increase RH in the chamber reduce the airflow. If airflow is decreased, some condensation may be unavoidable. The port plug with a breather hole must be used on the side port.

**NOTE: DO NOT SEAL OR RESTRICT THE OPENING IN THE PORT PLUG.
THIS IS A PRESSURE RELIEF FOR THE CHAMBER.**

8.3 Control System Introduction

The NuAire Incubator Control Electronics system is designed to serve the control requirements of the Incubator chamber. Temperature, CO₂ levels in all models and O₂ in available models are controlled by preset values to provide the optimum conditions for culture growth within a chamber. Operator input is coordinated through the NuTouch LCD keypad and status displays.

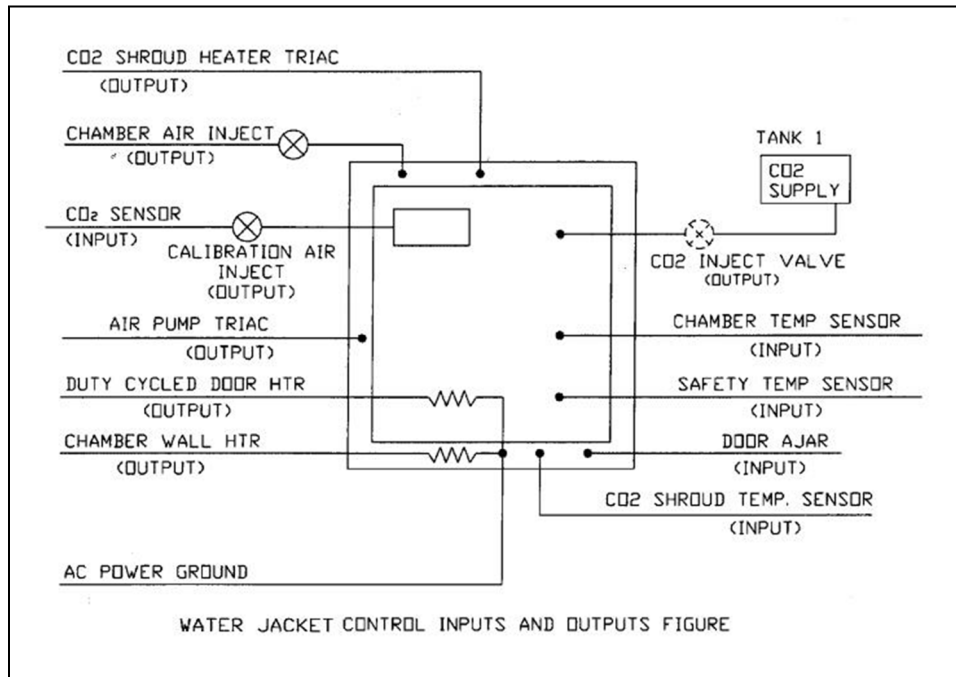


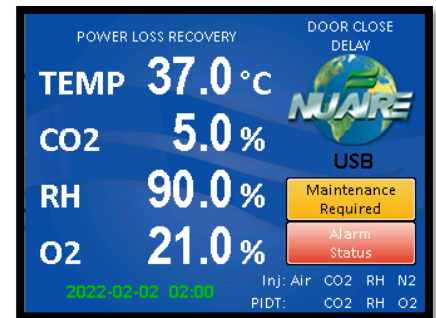
Figure 1 shows the various inputs and outputs of the system.

8.3.1 Chamber control in a single electronic package.

8.3.2 Enhanced information presentation on a NuTouch LCD

Main Screen Continuously displays:

- Measured Chamber Temperature
- Measured CO₂ %
- Measured O₂ % in available models
- Current Screen ID "MAIN SCREEN"
- A mode status indicator (RUN, STANDBY or Power loss Recovery)
- Door ajar status displays when door is ajar
- Door Closed status displays when door is closed and flashes during the post door close delay time.
- NuAire Logo button Leads to the System settings menu when pressed
- Date and Time
- Air, CO₂ & O₂ inject indicators show when gas or RH is injecting.
- PIDT: CO₂ & O₂ indicate that the system showing is in Post Inject Delay Time.
- An Alarm Status Menu
- Maintenance Required displayed



8.3.3 Active buttons on the MAIN SCREEN:

Button Description	Action when touched
Control system description (i.e. TEMP or CO ₂)	Brings a pop-up screen that describes the control system that was touched
Measured value of each control system	Goes to the Environmental Set Point Screen (Keypad to enter the password will pop up if the password function is enabled)
NuAire Logo	Goes to "System Settings" Screen for access to more menus
Date & time display	Goes to screen for adjusting time and date

8.3.4 Accessing the Incubator Control Screens

Accessing the many Control screens, performing functions and diagnostic tests, and maneuvering through the NuTouch LCD menu system is accomplished through the following methods:

- Touching a "graphic" Icon like the NuAire Logo in the Main Screen which access the System Settings menu, or lead you to an Enter Password screen when a password has been established.
- Touching a "Button function" button command that is visible on the screen. The button will have text in it indication the function you are about to perform.

The following buttons are used on all models:



An explanation of these buttons is as follows:

- Save** – This command saves the changes you have made and returns you to the calling screen or, in some cases, back to the main menu.
- Exit** – This command exits you from the current screen and returns you to the calling screen.
- Close** – The command causes the current screen to be removed and returns back to the calling screen.
- Cancel** – This command will cancel the changes you have made, and in some circumstances, cancels the "set of requests" that you have entered and returns you back to the calling screen. (e.g., cancel in the middle of the Decon screen setup returns you to the calling screen)
- Start** – This command causes a main event to begin (e.g. Decon Cycle).
- Next** – This command causes another step (screen), in a list of steps (screens) to be displayed (e.g., Decon cycles and some CO₂ calibration screens).
- Back** – This command returns you to the previous screen.
- Decon** – This command begins the Decon sequence.

- Touching a "Text" button command. The text or numerical value will be in blue indicating that is a link similar to the computer or on the internet. The system settings menu screen shown below is a good example of both the Text commands and Button commands:

NOTE: The Main Screen is the one exception for the above-described buttons.
The green clock text is and is a link to adjusting the time.
The large white Control system measured values are also a "second" link to the "Environmental Set-Points" menu and the control system descriptions are a link to system description pop up screens when touched.

8.3.5 Functioning accessed from the System Settings screen:

The "System Settings" menu screen can be accessed from the "Main Screen" by touching the NUAIRE logo:

Environmental Set-Points: Allows adjustment of Temperature, CO₂, and Door heater power level settings.

NOTE: You can also access the Environmental set points by touching any control system numerical value in the MAIN SCREEN.

Performance Monitor: Views a function's Set-Point and Measured values over the last seven days.

- Service Settings:** Protected by the password 9876, it facilitates Calibrations, Option settings, and access to Diagnostics.
- System Information:** Views the units Model Number, Serial Number, Control board assembly (CCBA) Software Revision and the Display board assembly (LCBA) Software Revision.
- Display Settings:**
 - Brightness:** Allows adjustment of the screen brightness. Slide right to increase / left to decrease
 - Calibrate:** Press button to access screen calibration - follow screen prompts / target symbols.
 - Save:** Remember to press the “Save” button after making changes or calibrating the screen. They will be lost if “Cancel” is pressed to exit the screen.
- Set Password:** A 4-digit password can be set and will protect access to Environmental Set points, running Decon cycles and changing the password. See section 8.3.7 for instructions to set the User Password.

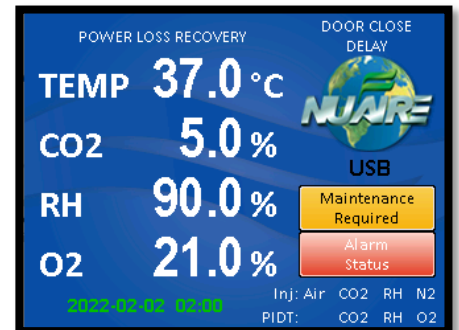
System Settings Screen



8.3.6 Automatic notification of abnormal situations (See Section 11 for details)

The red “Alarm Status” text message (button) will appear on the Main Screen to indicate a fault within the Incubator system. An audible alarm is also heard. The audible alarm is on for 10 seconds at the beginning of an alarm condition and thereafter, it will be on 1 second every 30 seconds.

By depressing (touching) the Alarm Status text on the Main Screen, you now reach the Incubator Alarm Status screen which will identify which Incubator sub-systems are in an alarm state (Temperature, CO₂, or General). You may exit the screen or touch any of the sub-system buttons which will give you more specific information on alarm conditions. See Section 11.0 for more specifics on alarm conditions.



8.3.7 Password Protection

There are 2 levels of password protection.

1. The permanent numerical password required for accessing the “Service Settings” menu screen. This screen is accessed by pressing the “Service Settings” text Icon in the “System Settings” menu screen.

The password is 9 8 7 6 and it cannot be changed or deleted.

The functions in the “Service Settings” screen are intended to be used by qualified technicians to calibrate the control system sensors like Temperature and CO₂, adjust optional parameter settings to customize incubator performance, perform system diagnostics and to Factory or Master reset for returning the incubator to Default settings.

2. A selectable 4-digit numerical password that is entered by the Incubator user to prevent others that are not authorized to change the Incubator set points (CO₂%, Temp), running conditions of the Incubator, initiate a

Decon Cycle or changing passwords. The password protection may be initiated by accessing the “Set Password” menu in the System Settings menu screen. Once initiated, a four-digit number must be entered, then re-entered for verification.

8.3.8 Standard remote communication capability

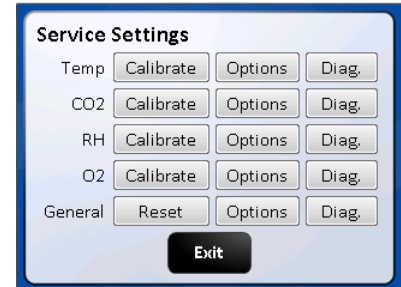
The NU-8600 & NU-8631 Incubator model series comes equipped with the following remote communication tools:

- USB Output of daily, weekly & monthly performance logs and an event log that indicates when alarms, door openings and power interruptions occur.
- 4-20 milliamp analog Output
- RS-485 2-way communications
- A USB method of updating the software

8.3.9 Diagnostic and calibration assists.

To access the Service Settings Menu, perform the following steps: NuAire Logo → Service Settings → 9876 Enter. You are now in the Service Settings Menu (screen). This screen provides you the capability to review and analyze numerous Incubator functions including the following:

- Individual analog inputs may be displayed to assist calibration.
- Individual outputs may be forced to an on or off condition.
- Individual digital inputs may be displayed.
- Calibrated and Uncalibrated values are displayed.
- All options may be individually tested.



8.4 NuTouch Display Screen

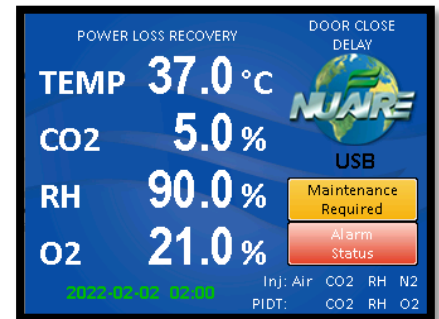
The system LCD touch screen has the following functions.

8.4.1 Front LCD touch screen Descriptions

The NuTouch LCD allows the user to access a wide variety of unit configurations and diagnostic menus by touching the NuAire logo icon.

The Main Screen displays:

- Power Interrupted message displayed when power is lost and then re-connected
- current Calibrated values of control systems that have been enabled
- Current operating mode (run or standby)
- Door Ajar, Alarms, and Maintenance notices



8.4.2 Inject CO₂ / O₂

On the bottom right of ‘Main’ screen, “CO₂ / O₂” text indicates when the inject valve is open and the gas is flowing into the chamber maintain set point for each of the control systems.

Each text icon appears independently when that System is actively injecting.

8.4.3 Post Inject Delay Time (PIDT)

On the bottom right of the ‘Main” screen just below the inject status icons from 8.4.2, “CO₂ / O₂” text indicates when these systems are in post inject time after the injection is done.

Each text icon appears independently when that system is in the delay time.

8.4.4 Inject Air Status

On the bottom right of the Main screen “Air” text indicates that fresh air is currently being injected into the chamber.

8.4.5 Door Ajar Status

The door ajar white text message indicates when the inner glass door is not closed and latched; the inner glass door is open. The door ajar status is a result of the pressure switch (open/closed) located along the top middle of the front panel. After the door is closed, the text will display “Door Closed Delay” indicating the delay time (60 sec adjustable).

8.4.6 USB status

The USB status icon appears in the lower right side of the Main screen when a memory stick is placed in the USB port to the right of the NuTouch display while downloading performance and event history. This icon disappears when the memory stick is removed from the port.

CAUTION: When a memory stick is placed in the USB port it can interfere with the RS-485 communication output. The RS-485 communication may have to be restarted after the memory stick is removed from the port.

8.4.7 Power Interruption Notification

Indicates when a power interruption has occurred. This can be from a power outage or just turning off the incubator. Responding by touching the text will return the Logo button.

8.4.8 Maintenance Required Notice

The Maintenance required notice appears in the middle of the right side of the screen indicating that either the water jacket needs to be filled or that it is time to check the capsule filter in the Sensor Bay. Press the notification button to bring up the screen that indicates the maintenance that is required.

8.4.9 Alarm Status Notice

The "Alarm Status" button indicates an abnormal status condition.

This text appears just above the AIR CO₂ status messages (paragraph 8.4.2 and 8.4.3). The "Alarm Status" button and audible alarm indicates the abnormality. A catastrophic temperature control condition will de-energize the safety relay and cause the chamber to cool below the set point. The unit will resume heating when it has recovered from the abnormality. See section 8.3.5 and 11.0 for more details on Alarms.

8.5 Rear Component Panel Detail

The rear control panel contains the following functions (see also BDC-15170)

8.5.1 Power Cord

The power cord is 6.5-foot (2 m) in length, type "SVT" molded plug, allowing for long life and easy cleaning.

8.5.2 Circuit Breaker

All control electronics are protected with a circuit breaker that may trip at 110% of load rating but will trip at 145% of load rating in less than 2 seconds.

Should the circuit breaker open (pop-out button will appear), merely depress to reset.

8.5.3 N₂ Inlet on NU-8631

The N₂ inlet provides a fitting for vinyl tubing for oxygen control.

Be sure to follow the recommended inlet pressure to insure proper flow rates and consistent O₂ percentage readings.

8.5.4 CO₂ Inlet All models

The CO₂ inlet provides a fitting for vinyl tubing.

Be sure to follow the recommended inlet pressure to insure proper flow rates and consistent CO₂ percentage readings.

8.5.5 Power Switch

The power switch, located at the top of the rear panel, controls all power to the Incubator.

8.5.6 Standard Communication Interface's / Alarm

Three receptacle connectors are provided for direct field connection of a computer for 2-way communications and incubator monitoring/or output to a printer or other device only capable of receiving RS-485 digital information, dry contact remote alarm indicator, also 4 to 20 mA output to an analog monitoring device or system. All come standard and ready to use. See section 10 for more detail.

8.5.7 Air Inlet (All Models)

This is a free air supply.

DO NOT CONNECT TO A PRESSURIZED SOURCE.

Air filter is installed at the factory on the front of the unit.

8.6 Front Component Panel

The front component panel contains the following functions. See BCD-18476

8.6.1 N₂ Supply filter (Available on NU-8631)

The N₂ supply filter is installed at the factory and should be changed following the instructions found in Maintenance Section 10.

8.6.2 CO₂ Supply Filter

The CO₂ supply filter is installed at the factory and should be changed following the instructions found in Maintenance Section 10.

8.6.3 Air Inlet Filter - All models

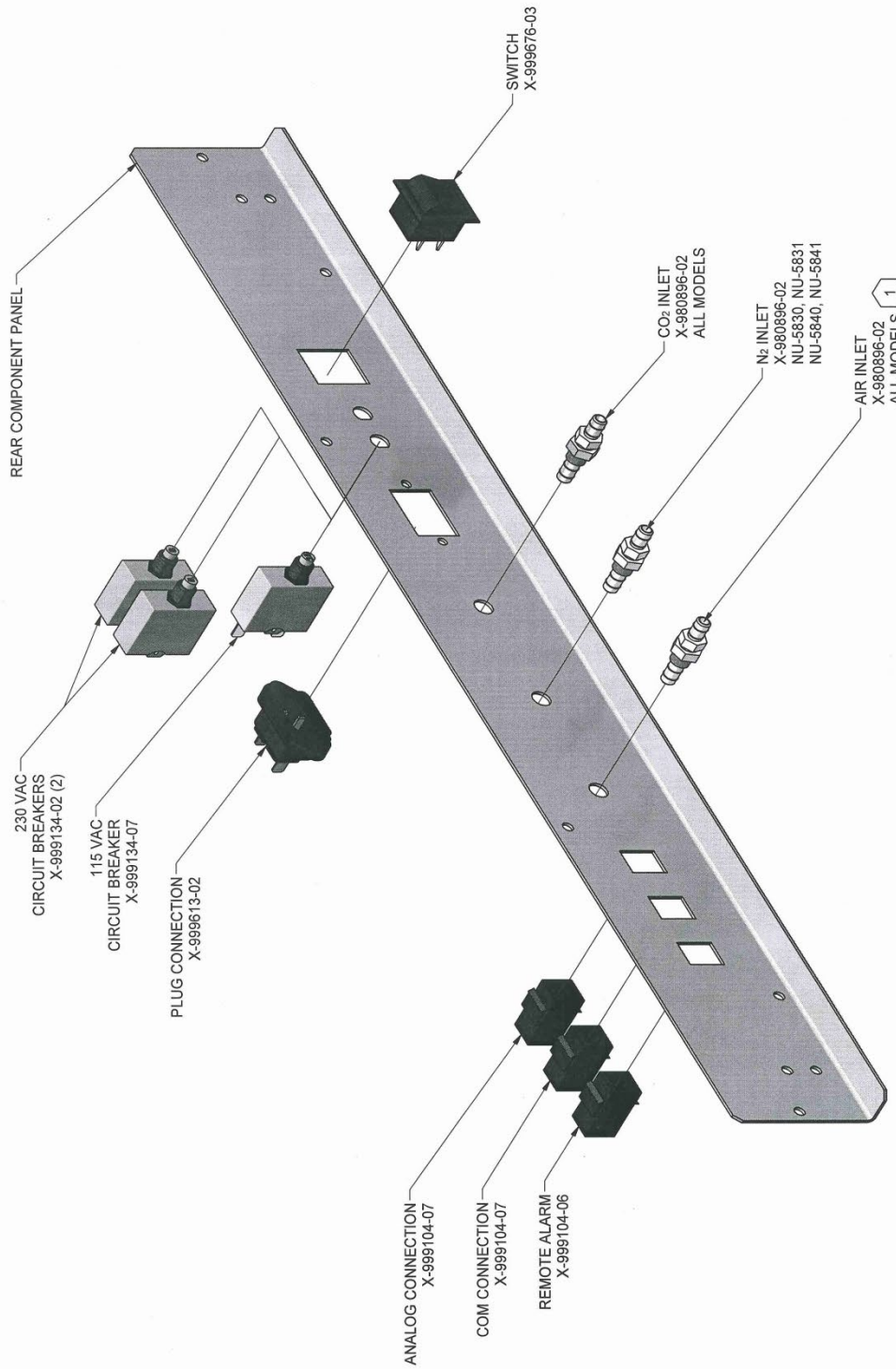
The air inlet filter is installed at the factory and should be changed following the instructions found in Maintenance Section 10. This is a free air supply.

NOTE: DO NOT CONNECT TO A PRESSURIZED SOURCE.

8.6.4 Chamber sample port

The Sample port is provided for checking the CO₂ level in the chamber to monitor the calibration the Sensor and determine if it need adjustment. Located in the inner glass door.

REV	ECO	DESCRIPTION	DATE	DFTM	CHKD
C	12439	UPDATED FITTINGS	7/11/2014	LS	KCK



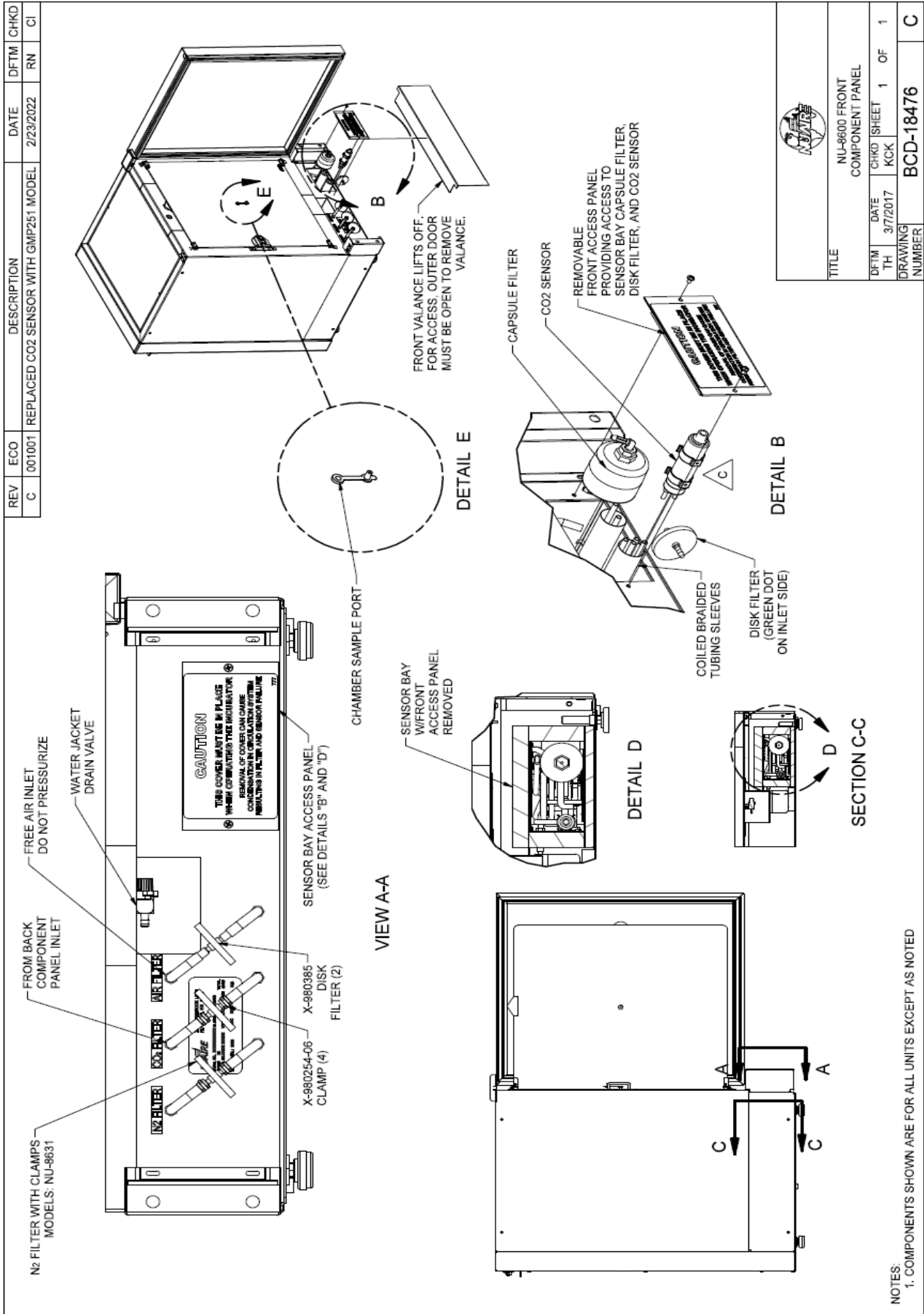
		ORIGINAL	
REAR PANEL ASSEMBLY			
DFTM	DATE	CHKD	SHEET
LS	3/1/2012	KCK	1 OF 1
DRAWING NUMBER		BCD-15170	
		C	

NOTES:
 1 AIR FILTER INSTALLED AT FACTORY ON FRONT OF INCUBATOR.

REV	ECO	DESCRIPTION	DATE	DFTM	CHKD
C	001001	REPLACED CO2 SENSOR WITH GMP251 MODEL	2/23/2022	RN	CI

REV	ECO	DESCRIPTION	DATE	DFTM	CHKD
C	001001	REPLACED CO2 SENSOR WITH GMP251 MODEL	2/23/2022	RN	CI

TITLE		NU-8600 FRONT COMPONENT PANEL
DFTM	DATE	CHKD
TH	3/7/2017	KCK
DRAWING NUMBER	BCD-18476	C



NOTES:
1. COMPONENTS SHOWN ARE FOR ALL UNITS EXCEPT AS NOTED

8.7 Run Mode Operator Interactions

8.7.1 THE FIRST TIME THE INCUBATOR IS TURNED ON

- The NuTouch boot up screen appears then shows a screen instructing you to “Read the manual and follow all instructions to properly install the incubator” Both screens will automatically advance after 5 minutes.

To manually advance:

- Press the exit button then a thank you screen will appear.
- Press the “Continue” button then the unit will go to the “MAIN SCREEN”.

These screens will not show again unless you “MASTER RESET” the incubator control board.

- Setting the Clock

Clock display organization:

YYYY-MM-DD Hr: Min and is displayed in green text in the lower left of the display screen.

- Press the green text and the Time and date adjustment screen appears.
After a power interruption the date and time will flash as follows:
 - Green text indicates there was a power interruption, but the real-time clock remained powered. Press the flashing text to bring up the “set the clock” screen. If no change is needed press cancel to go back to the main screen. Otherwise, make the required changes then, press the save button to save the changes and return to the main screen.
 - Yellow text indicates the real-time clock lost the backup power and the date and time need to be reset. Press the flashing text to bring up the date/time setting screen Use the up/down arrows to increase or decrease the highlighted value.
- Use the left/right arrows to move between date and time values that require changing.
- Press “Save” to save the changes you just made or Press “Cancel” to abort the changes and return to the main screen.

The mode display, on the ‘Main’ screen, is used to identify the mode of chamber operation: either standby or run. In general, there is no need for operator interaction in “run” mode. However, operator interaction is required when the incubator is first turned on then to perform calibration functions and address abnormal conditions status. If an abnormal condition has, or does, exist for a particular parameter, an alarm becomes active and the ‘Alarm Status’ button will appear. This could be a catastrophic alarm condition, which could harm the tissue culture cells. It does indicate an operational abnormality and should be checked. To acknowledge the abnormality, simply press the “Alarm Status’ button to view the alarm, to dismiss it press the corresponding alarm’s button. The audio and visual alarms will then extinguish. If the abnormality still exists, the return after waiting the specified alarm time. Let the Incubator run normally, and if the alarm doesn't come back on, then everything is normal. If the alarm does come back on, use the troubleshooting guide to correct the abnormality (see Section 11.0).

8.8 Standby Mode Operator Interactions

The NuAire incubator automatically enters the standby mode when necessary.

There is no action required by the user to enter this mode.

All functions that put the incubator in standby mode automatically start a 1minute timer.

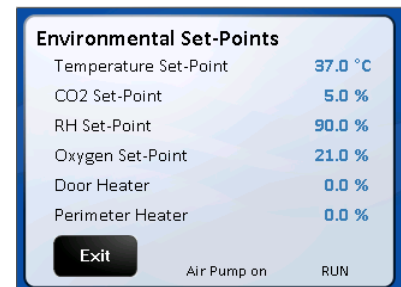
If the function is not interfaced through the screen on the NuTouch display, the incubator then returns to the MAIN SCREEN and switches to RUN mode.

8.8.1 Chamber Temperature, CO₂% & O₂% Set- points

8.8.1.1 Accessing the Environmental Set point screen used to manage set points is done one of two ways:

- Press any control system value displayed in the main screen.
- Press the NuAire logo then press the Environmental Set Point text in the systems Settings screen

8.8.1.2 Pressing the blue numerical value next to the control system that you intend to change will bring up a number keypad. Punch in the new value and hit the “Enter” key to leave the keypad and return to the Set-



point screen. You will be asked if you want to save the new set point(s) when you press Exit to leave the set point screen and return to the Main screen.
Press "Save" to retain the changes.

8.8.1.3 Default Set points

Temperature	37.0 C		All Models
CO ₂	5.0%	Note 1: A set point of 0 (zero) will put the system into an Idle state where it does not control and all alarms are inhibited. The sensor remains active and reports the level of gas in the chamber.	All Models
O ₂	21.0%	Note 2: A set point of 21.0% will put the system into an idle state where it does not control and all alarms are inhibited. Note 3: O ₂ set points below 10% will automatically reduce the Air Injection Time value to "0". This stops air injections that will interfere with achieving these lower O ₂ set points.	NU-8631

8.8.1.4 Automatic Adjustment of Post Inject Delay Times when O₂ control system is active

Post inject delays are automatically adjusted according to the O₂ set point to facilitate gas recovery after a door opening. The value displayed in the option menu will not change but is the basis for a formula in the software that calculates the new delay time depending on the O₂ set point. As the set point is reduced the delay times are shortened.

The value of the post inject delay time used is the value that shows in the Options display for that control system whether it is the default or user selected.

8.8.1.5 When the CO₂ system is active the level of CO₂ inversely affects the O₂ present in the chamber. The maximum achievable O₂ set point is indicated by the following table.

CO ₂ Set Point	Automatic maximum O ₂ Adjustment
0.1% to 1.0%	20.7%
1.1% to 3.0%	20.0%
3.1% to 6.0%	19.0%
6.1% to 10.0%	18.0%
10.1% to 15.0%	17.0%
15.1% to 20.0%	16.0%

8.9 Diagnostic and Checkout Procedures

The Incubator controller provides general diagnostic facilities:

- Diagnostic mode is intended for factory and field technicians.
- It allows them to turn the controller's output signals (heaters, valves, safety devices etc.) on and off.
- Diagnostics are located in the "Service Settings" menu categorized by the control systems (i.e. Temperature, CO₂, RH and O₂) plus a general category for diagnostics not directly related to the control systems. Press the "Diag" button to access them.
- Each screen and the function buttons in them initiate a 5-minute timer. When the timer runs out, the display will exit that screen and go back to the Main screen. Manually exiting the diagnostic screen will automatically stop that timer and return to the Service Settings screen. The function button that was activated will return the function to the default diagnostic condition at the end of the 5-minute timer. Manually putting the button back to the default condition will reset and stop the timer.

8.9.1 Diagnostic Mode

To initiate the diagnostic mode, perform the following from the 'Main' screen:

- Select the NuAire Logo to enter "System Settings"
- Select "Service Settings" and enter 9876, and then hit enter (ENT)
- In the Service Settings menu, select the "Diagnostics" button for the desired function

Output/Input Diagnostic Parameter Functions

Temperature

1. Safety Relay (on/off)
2. Chamber Temp. Sensor (shows current temp.)
3. Safety Temp. Sensor (shows current temp.)
4. Chamber heater Triac control (**0** - **50%** - 100 % phase firing)
5. Door Heater Triac control (**0** - 50% - 100 % phase firing)

CO₂

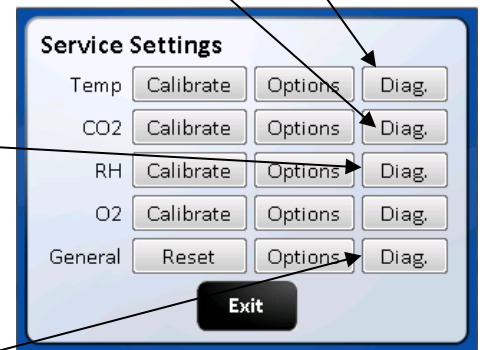
1. INACTIVE
2. CO₂ Sensor (Display current CO₂ percentage)
3. CO₂ Inject Valve /on/off
4. CO₂ Sensor Bay Heater Triac (**0** - 50% - 100 % phase firing)
5. CO₂ Sensor Bay Temp. Sensor (Displays current temp.)

O₂

1. O₂ Sensor (shows current oxygen level)
2. N₂ Inject Valve /on/off
3. O₂ Bypass valve on/off
4. Blocking Solenoid / on/off

General diagnostics

1. Power Supply Regulated +12 VDC (current voltage)
2. Power Supply Regulated -12 VDC (current voltage)
3. Air Inject Solenoid (on/off)
4. Alarm dry contact Relay (NO/C/NC) switch states
5. Air Pump Triac (on/off)
6. Spare AC Triac



(Note: Default values are in bold)

The paragraphs on the following page provide a more complete description of the diagnostics listed above. The Diagnostic screen is shown to the right of each of the control systems Temperature, CO₂ & O₂ and the General category for your reference. Once entered, the Diagnostics screen will display the calibrated and uncalibrated values of the given function and all related components.

Temperature Control Diagnostics

1. Safety Relay

This function shows the current state of the safety relay. LCD display will show "On" or "Off" corresponding to the relay condition. On for closed or set or yes.

2. Chamber Temperature Sensor

This function shows on LCD the current values, calibrated (displayed) and not calibrated of the temperature sensor controlling the chamber temperature.

3. Safety Temperature Sensor

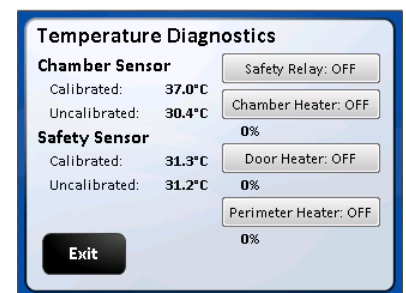
This function shows on LCD the current values, calibrated and not calibrated of the Safety temperature sensor located in the chamber.

4. Chamber Heater Triac Control (0%, 50%, and 100%)

This function allows the jacket heater to be turned on at different percentages 0, 50,100)

5. Door Heater

This function shows on LCD the current state of the door heater. This function also allows the door heater to be turned on at different percentages (0, 50, and 100 percent). The LCD display will show phase firing percentage chosen default is 0%.



CO₂ Control Diagnostics

1. CO₂ Sensor

This function shows the current CO₂ sensor reading both the “Un-Calibrated sensor signal and the Calibrated value shown in the display screen.

2. CO₂ Inject Valve / on/off

This function shows on LCD the current state of the CO₂ inject valve. LCD will show “ON” or “OFF” corresponding to the valve condition. On for open or set or yes.

3. Sensor Bay Heater Triac Condition / on/off

This function shows on LCD the current state of the sensor bay Heater triac. LCD will show 0, 50, and 100 percent corresponding to the relay position. The triac can be toggled to each percent of phase firing manually.

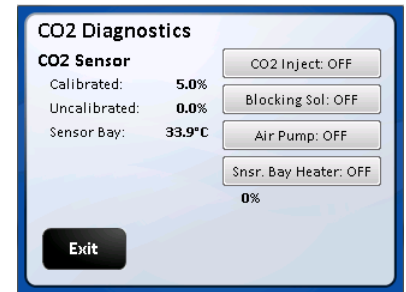
4. CO₂ Sensor Bay Temperature Sensor

This function shows on LCD the sensor bay temperature in degrees C. The Sensor Bay is heated to temperature set point +3.5 degrees

5. Air inject Solenoid / on/off

This function shows on LCD the current state of the Air Inject Solenoid. LCD will show “ON” or “OFF” corresponding to the solenoid position. Default is off-solenoid activates when the button is touched

6. Air Pump / on/off



O₂ Control Diagnostics Functioning

1. O₂ Sensor

This value displays the current value of the chambers oxygen sensor both the Calibrated value shown in the display screen and Un-Calibrated sensor signal.

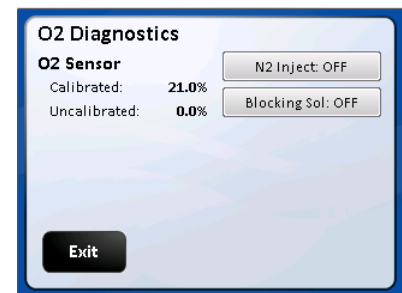
2. N₂ Inject Valve /on/off:

This function indicates the on/off (default off) state of the N₂ Inject solenoid valve and allows the activation of it.

3. O₂ Bypass valve on/off: THIS FEATURE IS NOT ACTIVE.

4. Blocking Solenoid /on/off

This function indicates the on/off (default off) state of the Blocking solenoid valve and allows the activation of it.



General Control Diagnostics

1. Power Supply Regulated +12 VDC

This function will display on the LCD screen the current value (+12.xx) of the regulated +12 VDC power supply.

2. Power Supply Regulated – 12VDC

This function will display on the LED screen the current value (-12xx) of the regulated -12VDC power supply.

3. Power Supply Regulated +5 VDC

This function will display on LCD screen the current value (+5.00) of the regulated +5 VDC power supply.

4. Chamber Air Inject Solenoid

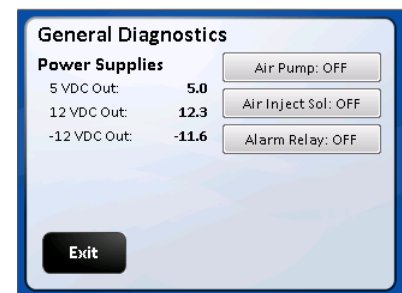
This function shows on LCD the current state of the Air Inject Solenoid. LCD will show “ON” or “OFF” corresponding to the solenoid position. Default is off-solenoid activates when the button is touched

5. Remote Alarm Relay

This function shows on LCD the current state of the remote alarm relay. The LCD display will show “ON” or “OFF” corresponding to the relay condition and its Normally Open (NO0 pair of contacts

6. Air Pump Triac

This function shows on LCD the current state of the Air Pump Triac. LCD will show “ON” or “OFF” corresponding to the relay position. The triac can be manually turned On and Off.



Option Configuration Parameters

Format: Option (**Default**, Minimum/Maximum)

All the options for the NU-8600 & NU-8631 Incubator use this same format. The default is set at the factory and can be restored in the field with a Master, or a Factory reset command. On the following pages, there is a short description of each Option with its Default/Minimum/Maximum setting, followed by a more detailed description.

Temperature

1. Maximum Above Set Point (**1.0°**, .1/10.0)
2. Temp Low Time Out Timer (**360 minutes**, 0/420)
3. Minimum Below Set Point (**0.5°**, .1/10.0)
4. Temp Sensor Differential (**6.0°**, 0/10.0)
5. Recovery Delay Time (**60 seconds**, 0/120)

CO₂

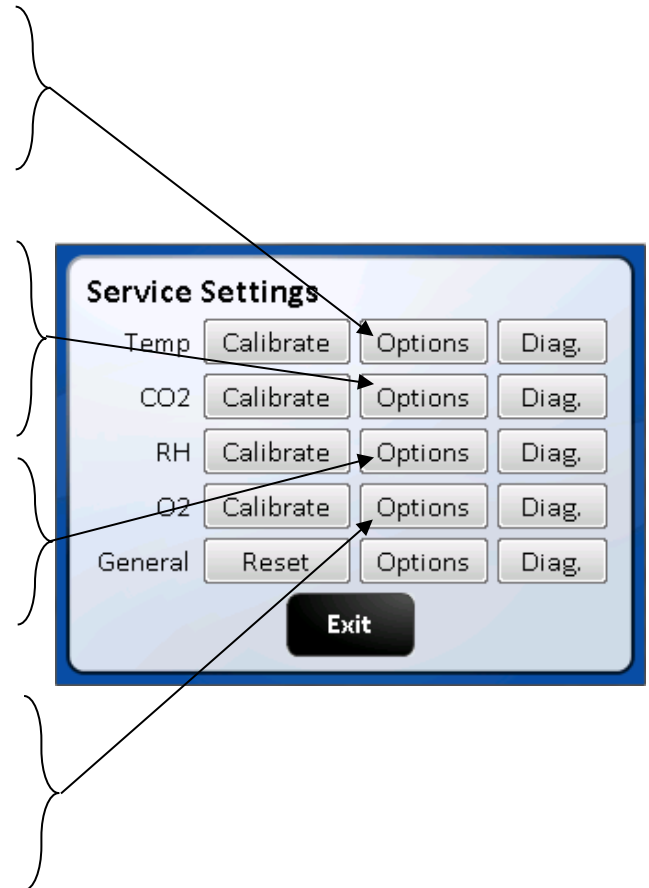
1. System Enable (**On**, On/Off) (in Settings Screen)
2. Maximum Above Set Point (**1.0%**, .1/10.0)
3. CO₂ Low Time Out Timer (**10 minutes**, 0/240)
4. Minimum Below Set Point (**0.5%**, .1/10.0)
5. Post Inject Delay Time (PIDT) (**60 seconds**, 0/250)

O₂

1. System Enable (**On**, On/Off) (in Settings Screen)
2. Maximum above Set Point (**1.0 %**, 0.0/10.0)
3. O₂ Time out timer (**30 minutes**, 0/300)
4. Minimum below Set Point (**1.0 %**, .1/10)
5. N₂ Post Inject Delay time (PIDT) (**30 seconds**, 0/300)

General

1. Door Close Delay Time (**60 seconds**, 0/300)
2. Air Inject Time (**5 seconds**, 0/100)
3. Air Inject Cycle Time (**1 minute**, 0/120)
4. Digital Output Interval (**0 minutes**, 0/120)
5. Door Ajar Alarm Delay (**5 minutes**, 1/60)
6. Settings (Text in top left side of screen)



NOTE: Selecting any of the Option title texts will open a brief description of that option's functions. Default values are in bold

The following paragraphs provide a more complete description of the Optional configuration parameters listed above.

Temperature

1. Maximum Above Set point

This value determines the maximum deviation, measured in (°C) that the chamber is permitted to rise above set point, once it is reached before an alarm condition is declared. An alarm condition will cause the chamber to enter a safe condition where no power is enabled to any of the system output controls until the situation is rectified.

2. Temp Time Out

This value determines the time, in minutes, for the temperature to achieve set point. If the temperature doesn't get to within 0.2° of set point within this time period, an alarm condition is declared.

3. Minimum Below Set point

This value determines the maximum deviation, measured in (°C) that the chamber is permitted to fall below set point, once it is reached before an alarm condition is declared. CO₂ injections are stopped, and air is injected for 15 minutes incase CO₂ was not being detected by the sensor. This alarm can be cleared through the alarm screens or by opening the inner door.

4. Temp Sensor Differential

This value specifies a maximum differential, measured in temperature (°C) that the two temperature sensors may deviate from one another, or from the last read value. If this differential is exceeded, an alarm condition will cause the chamber to enter a safe condition where no power is enabled to the chamber heaters until the situation is rectified.

5. Recovery Delay Time

This value determines the time, in seconds, to turn off the chamber heaters in half-degree increments during a temperature recovery cycle. The delay time is required to prevent temperature overshoot of the control set point.

CO₂

1. CO₂ System Enable (Enabled/disabled) is located in the bottom right of the screen

This function will enable or disable the CO₂ system. If the system is Enabled it will be displayed in the MAIN screen. If it is disabled it will not be displayed in the Main or Option/Settings screen for the CO₂ system:

System Enabled (with check mark) means the System is enabled

System Enabled (without check mark) indicates that the system is disabled

2. Maximum Above Set point

This value determines the maximum deviation, measured in (%) that the chamber is permitted to rise above set-point, once it is reached before an alarm condition is declared.

3. CO₂ Time Out Timer

This value determines the time, in minutes, for the CO₂ percentage to achieve set point. If the CO₂ percentage doesn't get to within its lower limit of set point within this time period an alarm condition is declared

4. Minimum Below Set Point

This Function gives the ability to set the value in percent CO₂ below set point that starts the CO₂ time out timer described in item 2.

5. Post Inject Delay Time

This value specifies the time, in seconds, for an injection of CO₂ to be measurable at the sensor. When CO₂ is injected into the chamber, the system delays until this time period has elapsed before making a new control decision. In this manner, diffusion induced delays will not cause the CO₂ system to overshoot the control set point.

O₂

1. System Enable (Enabled/disabled) on model NU-8631

Is located in the bottom right of the screen

This function will enable or disable the O₂ system. If the system is Enabled it will be displayed in the MAIN screen. If it is disabled it will not be displayed in the Main or Option/Settings screen for the O₂ system:

System Enabled (with check mark) means the System is enabled

System Enabled (without check mark) indicates that the system is disabled

NOTE: System is disabled on all other models

2. Maximum Above Set-Point

This value determines the maximum deviation, measured in (%) that the chamber is permitted to rise above set-point, once it is reached before an alarm condition is declared.

3. O₂ Time Out Timer

This value determines the time, in minutes, for the O₂ percentage to achieve set-point. If the O₂ percentage doesn't get to within its upper limit of set-point within this time period an alarm condition is declared.

4. Minimum below set-point to Start Alarm Timer

This value determines the limit in percent that starts the Alarm Timer for declaring the alarm.

5. N₂ Post Inject Delay Time

This value specifies the time, in seconds, for an injection of N₂ to be measurable at the sensor. When N₂ is injected into the chamber, the system delays until this time period has elapsed before making a new control decision. In this manner, diffusion induced delays do not cause the O₂ system to overshoot the control set-point.

General Options

1. Door Close Delay Time
This value determines the time, in seconds, to increase the door and parameter heater to duty cycle by 10% after the inner door is closed. Also inhibits gas for the same period.
2. Air Inject Time
This value specifies the time, in seconds, for an injection of air into the chamber
3. Air Inject Cycle Time
This value specifies the amount of time in minutes between each injection of air into the chamber
4. Digital Output Interval
This parameter specifies the frequency, in minutes that performance and set point data is output to a device such as a printer that is only capable of receiving data. If the frequency is specified as zero, no data will be output.
5. Door Ajar Alarm Delay
Determines how long in minutes the glass door can be open before an alarm is declared.
7. Settings (text located at the top of screen)
Pressing the next button will go to the second page containing the following:
 - The Filter Maintenance button to access:
 - Resetting the change filter notice
 - Setting time to reminder (**48 months**) and 0 disables the feature.
 - View time remaining until current notice is triggered.
 - The Clear Password button that clears the 4-digit password that was input through the Set Password screen.
 - Change language Button: Pressing this button brings up a screen with the language choices of English (default), Spanish, French & German. Pressing the button in that screen of the language desired will change the user screens to that language.
 - Screen Lock button (default Main Screen Unlocked). Pressing this button will change it to “Main screen Locked” (Lockout = 1). This puts a “Press to unlock” button on the NuAire Logo in the Main screen. This feature stops accidental screen changes by brushing the touch screen. You must press and hold (2 seconds) until the message disappears which unlocks the main screen so that you can navigate into; the System settings, Alarms, Environmental Set Point and Clock Adjustment screens. Pressing the button again will change the text to “Main Screen Unlocked (Lockout = 0). This removes the “Press to Unlock” button from the NuAire Logo and the Main screen goes back to the default condition.
 - Power Loss Mode cancel button. Cancels Power loss mode. Only use this if it is certain that there is no condensation in the circulation system. See Section 10.2 for further details about the Power Loss Mode.

8.10 Resetting the Electronics Software

8.10.1 Factory Reset

The Factory Reset is similar to the Mast Reset. However, it only changes the Options (returned to default settings) and the environmental set-points (returned to their defaults).

To perform a Factory Reset, you will need to do the following:

NuAire Logo → Service Settings → 9876 Enter → Reset → Factory Reset → Confirm

The Incubator will perform the Factory Reset and return to the Main screen.

8.10.2 Master Reset

The master reset diagnostic function is the last effort to correct operational faults which otherwise cannot be solved. By reloading the default configuration, the entire memory will be reset and ALL CALIBRATION OFFSETS, USER PASSWORD, CONFIGURATION OPTIONS WILL BE LOST. All calibrations will need to be performed following a master reset.

To perform a Master Reset, you will need to do the following:

- NuAire Logo →
- Service Settings →
- 9876 Enter →
- Reset →
- Master Reset →
- Confirm

The Incubator will perform the Master Reset then the “Factory Setup” Screen will appear

The Factory Setup screen shows the Model Number, Serial Number and Language that was chosen for the user screens. As long as this information is correct you can press Save which will resave the information displayed in the screen then, take you to the date and time set screen. If the date and time are correct you can press exit and go to the MAIN screen. If you press Exit you will go to the main screen however if there is a power cycle the incubator will reboot to the Factory set up screen again. All setup information will show correctly but, you must press save to boot up into the MAIN screen after a power cycle. The model number and the serial number can be verified by comparing them to the serial number label found down behind the valence under the door. The language defaults to English. It can be changed any time through the Service Settings/General/Option/settings menu. See section 8.10 for further instructions.

The screenshot shows a 'Factory Set-Up' screen with the following information:

Factory Set-Up	
Model Number	NU-5710
Serial Number	0123456789012
Set Language	English

At the bottom right of the screen, there are two buttons: a black 'Exit' button and a green 'Save' button.

Note: After performing either Factory or Master Reset remember to turn the incubator off then on again to ensure that all intended parameters were reset.

8.10.3 Inputting the Factory settings:

The “Factory Set-up” screen will appear after the master reset. If the Model Number or the Serial Number need to be re-input for any reason the following steps should be taken:

Setting the model number sets the following function:

- All Nuair customers will press Nuair in the “Choose Company” Screen. This will bring up the Nuair logo in the main screen.
- Model number NU-8600 and NU-8631 and E or D models
Enables Temperature and CO₂ the only control systems available on this model
Chooses the algorithm suited for low watt heating of the chamber
Suppresses the decon button in the “Systems Settings” screen
Loads the model number in the System information screen
- Model numbers NU-5720 through NU-5741 and E or D models
Enables Temperature and CO₂ plus RH and O₂ control systems as available on the various models
Chooses the algorithm suited for high watt heating of the chamber suited for heated Decon cycles.
Activates the heated decon cycle choices in the “Systems Settings” screen
- Touch the “Model Number” text then follow the screen prompts as shown below.
Pressing continue to choose Region screen will bring you back to the Factory Set-Up screen showing the Model Number you just entered. Default is NU-5800 if no model number is entered



- Touch the Serial Number text then enter the 12 digits serial number which can be found on the serial number label located behind the valance under the sample port. Press the ENT button on the keypad screen and you will return to the Factory Set-Up screen showing the serial number you just entered. Default is blank if no number is entered.



- Touch the Set Language text then touch the save button. This sets the language on all of the user screens. The language in the Service Settings menu /screen will remain in English. English is default language if none is chosen. Touch the green save button to exit the factory screen.



- The final change that is requested is the clock. It should not have been reset. As long as the date and time are correct you can press cancel or save in that screen to exit to the Main screen. See section 8.8.1 if for instructions to reset date and/or time.

9.0 Calibration

Proper calibration of the incubator involves following parameters. On all models of the Invitrocell incubator the chamber temperature, door temperature, and CO₂ sensor require calibration at installation and the calibration should be checked on a regular schedule. The first two, chamber, and door temperature should be completed and stabilized before any CO₂ sensor calibration is performed. On Invitrocell Below, each calibration procedure is described in detail. For the best results, follow the procedure carefully, and if the desired result is not achieved, try procedure again from the start.

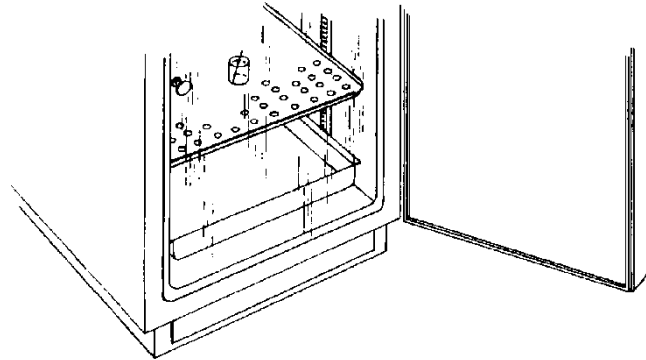
9.1 Chamber Temperature Calibration

The DH's TEMPERATURE CALIBRATION MUST BE PERFORMED WITHIN 1°C OF THE PLANNED OPERATING TEMPERATURE. Normally, 37.0°C is the most common set point. To initiate the procedure, turn on the incubator via the power switch on the back panel. The default set point is 37.0°C; enter "Environmental Set Points" and adjust if desired. Let the unit stabilize for 8 to 12 hours. Use an independent calibrated instrument to check and calibrate the temperature.

Below is a description of calibration with a glass thermometer as one example for temperature calibration.

At the beginning of this procedure, set a calibrated glass thermometer in a glass beaker filled with water resting on a shelf in the middle of the chamber. Do not place the glass beaker on the bottom of the chamber because it will result in a slightly higher temperature reading due to the heater located on the chamber bottom. Placing the thermometer in glass beaker on the middle shelf will give the most accurate results for calibration. The chamber should be humidified to avoid false low readings due to evaporation of water from the flask. An accurate digital thermometer with a type K thermal couple could

also be used. No matter what instrument is used the measurement for this calibration should be taken in the middle of the incubator chamber and in a stabilized condition.



When the unit has stabilized at the operating temperature, perform the following calibration procedure.

- Allow Incubator to stabilize at its given temperature set point in run mode.
- Enter “Service Settings” by means of your provided password.
- Press the Temperature Calibration button.
- Determine actual temperature within chamber by reading temperature measurement instrument.
- Select the number digits below the “Current Calibrated Sensor Reading” blue text button
- Input the current value displayed on your temperature measurement instrument and exit calibration.

Note: THE DISPLAY DOES NOT UPDATE IMMEDIATELY; IT TAKES 2-3 SECONDS

The chamber temperature calibration is complete. Let unit stabilize for 8 to 12 hours. If the chamber temperature (actual thermometer) still does not match the display, perform the above procedure again. In some cases, it might be necessary to calibrate several times to achieve a stable condition due to ambient conditions of temperature and humidity within the laboratory.

9.2 Door Duty Cycle Adjustments for Temperature Calibration

The Door heater is run on “Base Duty Cycle” calculations that are automatically increased or decreased to run in accordance with the chamber temperature at a chosen set point. These duty cycles work in the controlled lab environment but due to the many variables involved in temperature control, there is also a manual adjustment. The heater duty cycles can be adjusted to control condensation or to improve the temperature uniformity in the chamber.

The inner glass door temperature calibration is best accomplished by running the Incubator for a minimum of 24 hours with the water pan in place and perform the following calibration sequence, if required. Open the outer Incubator door and look for general condensation. Some condensation on the glass door can be desirable as an indication of adequate humidity in the chamber. Typically, one to two inches of condensation in the corners of the glass door and/or gasket indicates a properly calibrated door heater. If calibration is required, simply perform the procedure as stated below. As stated earlier, the door heater operates on a base duty cycle calculated for the chamber temperature set point being used. In the door heater (adjustment) screen “0.0” = the calculated base duty cycle. Adjusting the value up or down will increase or decrease the percent of power to each heater in 0.1% increments. Small adjustments are recommended to a maximum of 5.0% at a time.

The following steps should be taken for setting these duty cycle percentages:

- Allow Incubator to stabilize at its given temperature and humidity level in run mode.
- Enter the “Environmental Set Points” screen either from the MAIN SCREEN or the SYSTEM SETTINGS screen.
- Select the numerical digits following the “Door” text. Go to the adjustment screen.
- Press UP or DOWN keys to increase or decrease the numerical value to the desired level. The limits the settings can be changed to are +50 and -20.
- Press “Done” to set current value and exit calibration.
- The reset button for the door heater resets the number displayed to 0.0 removing any adjustment previously made.



9.3 Setting Air Injections

If there is still some undesired condensation in the chamber when the door heater is set for the desired result, the air injections can be adjusted. There is a control for the length of the air injection labeled, Air Inject Time, and the frequency that air is injected called, Air Inject Cycle. These controls are described in more detail in the "General Options" section of the Service Settings menu. The default is 5-second injections every 1 minute. Start by increasing the length of the injection by a few seconds at a time then increase the frequency if needed. If the humidity in the chamber is less than desired, reduce the Air Inject Time.

Air and O₂ Levels

When the O₂ set point is set below 10% the “air inj time” is automatically reduced to 0(zero) to stop air injects which will interfere with achieving the lower O₂ set points.

9.4 CO₂ Calibration

The Water Jacket infrared CO₂ sensor may be calibrated using the following technique: Open Door Zero-Span Calibration CO₂ calibrations can be performed in approximately ten minutes, by accessing the CO₂ calibrations menu in “Service Settings” and following the on-screen instructions. To perform Open Door CO₂ sensor calibration routine

- Attach independent CO₂ monitoring device to the sample port in the center of the inner glass door of the unit
- Enter CO₂ calibrations by means of Service Settings
- Select the “Open Door Zero Span Calibration” text
- Follow on-screen instructions

NOTE: The CO₂ sensor has an internal SPAN limit of +/- 8% of the displayed value (i.e. display value is 5%, change up to 5.4% would be accepted by the system). It is always recommended NOT to enter the full measured value into the SPAN when calibrating. This will avoid overshoot and stay on the lower side of the internal CO₂ sensor value tolerance (rounding and significant values). If the CO₂ sensor rejects the SPAN value, either try again or lower the value.

The CO₂ inject rate is automatically calculated from the CO₂ injection made during the span calibration. The injection is dependent on the proper gas pressure and factory set flow rate. Any changes in either will result in a change to the value reached during this injection.

9.5 O₂ Calibration – System available on Model NU-8631

When unit chamber has stabilized at the operational temperature, CO₂%, and O₂ system has been powered for at least 10 minutes ensuring the sensor is up to temperature - take an O₂ measurement with an independent instrument through the chamber sample port used for taking CO₂ readings. It is located in the center of the inner glass door and, if necessary, perform the following:

**NOTE: If a Fyrite instrument is used,
BE SURE TO READ THE O₂ FYRITE OPERATING AND SAFETY INSTRUCTIONS
FOR PROPER O₂ MEASUREMENTS AND SAFETY CONSIDERATIONS.**

Display Offset Calibration:

Press the Calibrate button on the Service settings screen produces the Calibrate the O₂ offset screen. Press the Calibrated sensor reading value to access the keypad to input the independently measured value then press the ENT button on the keypad. When you return the Calibrate O₂ offset screen press the save button to return to the System settings screen. Press the exit button in this screen to go back to the main screen.

10.0 Maintaining Your Water Jacket

Water Jacket Chamber

The chamber maintenance is up to the discretion of the owner and the extent of cleanliness and sterility desired. The shelves and bracket supports are all removable and autoclavable. The interior should be wiped down with an appropriate disinfectant such as 70% ISOPROPYL ALCOHOL or equivalent.

**NOTE: DO NOT USE ANY CHLORINATED OR HALOGEN MATERIALS IN THE CHAMBER.
SUCH MATERIAL IS HARMFUL TO THE POLISHED STAINLESS STEEL.**

NOTE: NuAire does not offer any product warranty with respect to cleaning material compatibility. **USE AT YOUR OWN RISK!** The information provided above is from raw material suppliers and known general source documents for use to develop application cleaning SOP's.

The humidity pan should also be sterilized, and the water changed regularly to assure sterility. A small amount of copper sulfate may be added to the humidity pan to inhibit bacterial growth.

CO₂ / N₂ Supply Filter

P/N X-980385 (50 mm Disk, Uni-directional In-Line, Dry)*

The CO₂ / N₂ Supply Filter should be replaced every fifth empty CO₂ tank or when the filter is visibly discolored (yellow-brown).

Note: Direction of flow (IN is labeled on one side of filter) when replacing filter.

Sensor Bay Capsule Filter

P/N RF566 (Capsule, Uni-Directional In-Line, Wet)

This filter should be replaced EVERY FOUR YEARS to assure optimum performance.

A visual check should be performed when maintenance reminder appears in the main screen to assure filter integrity.

Remove sensor bay cover to perform visual check.

Air Supply Filter

P/N X-980385 (50 mm Disk, Uni-directional In-Line, Dry)*

The Air Supply Filter should be replaced every fifth empty CO₂ tank or when the filter is visibly discolored (yellow-brown).

Note: direction of flow (IN is labeled on one side of filter) when replacing filter.

CO₂ Sensor Filter

P/N X-980366 (50mm Disk, Uni-Directional In-Line, Wet)*

The filter should be changed when discolored (yellow brown).

The filter is plumbed in the chamber sample hose and can be inspected when the cover is removed to check the air pump filter.

This filter has a green dot to distinguish it from the "dry" filter.

*** NOTE: The word "In" on the outer rink of the body indicates the inlet side of the filter
and should be installed toward the gas supply.**

10.1 Chemical Decontamination of the Incubator Chamber

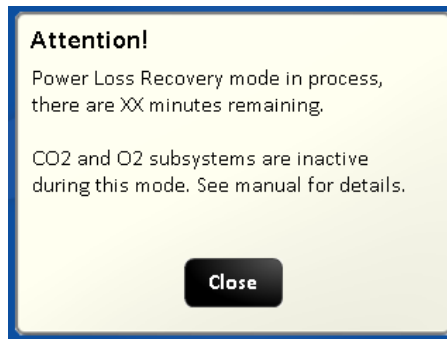
To chemically decontaminate NuAire Incubator inner chambers, users may use the traditional formaldehyde or Chlorine Dioxide in gas form, or Vapor Phased Hydrogen Peroxide. All three of the chemicals are compatible to all parts within NuAire Incubator chambers. The incubator should be turned off during these procedures

NOTE: As stated previously, the chamber and components can also be wiped down with a 70% solution of Isopropyl Alcohol for cleaning and decontamination.

10.2 Power Loss Recovery Mode

When an incubator experiences a sudden loss of power there is an increased chance of condensation building up in the circulation system tubing. This mode helps to dissipate that buildup before it causes the sensors to fail

- Conditions for entering mode: - Incubator must be without power for 45 minutes or longer. This includes first time setup. Mode is automatically triggered after power is restored (after 45+ min outage). If less than 45 minutes have passed incubator will enter normal Run mode.
- When in Power Loss Recovery Mode
 - o Blocking solenoid will be turned "ON" which will bypass the CO2 and O2 sensors in the circulation system.
 - o Both systems will be put in standby mode meaning they will not control or alarm while in this mode.
 - o "Power Loss Recovery" shows in place of "RUN" in the main screen. Heaters and Air Pump run as normal.
- Once entered, this mode will run for 1 hour. A count down timer screen (seen below) can be found when pressing the CO2 or O2 Diagnostics button in the Service Settings screen. It is also recorded in the event log.

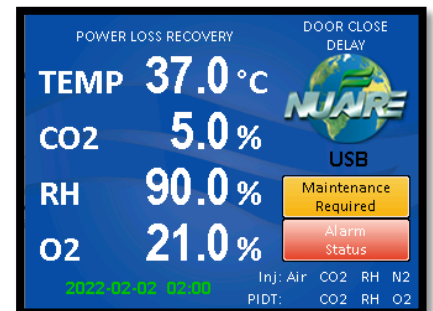


10.3 Shutting down the Incubator

Prior to shutting down the Incubator open the inner and outer doors and remove the water pan. Leave doors open for at least 5 minutes prior to shutting it off. This will purge the chamber, circulating system and the sensors of humidity that could condense and cause faulty readings when the Incubator is turned back on. Be sure to empty the water pan prior to putting it back into the chamber if the Incubator is going to be shut off for any length of time.

10.4 Automatic Filter Change Notification

The Capsule filter located in the Sensor Bay (see BCD-18477 for location) should be checked average every 2 years to see if it should be changed. The Filter material is normally a white material. Discoloration of the filter material is an indicator that it should be changed. Retro Fit Kit RF566 should be ordered for the replacement filter. A timed notice triggers a Maintenance Notification button in the Main Screen. Pressing the Maintenance Required button produces a screen indicating that the date for filter life has expired.



Responding to the notification:

From the main screen press the NuAire Logo / Service settings / General Option / Next/ / Filter Maintenance to access the Filter Maintenance screen.

In these screens you can:



- Extend the alarm by 1 month by pushing Last Replacement Date, date displays, extend the date by one month. Press Enter, Save and Exit button to retain the extension and go to the General Settings screen. Pressing Save will not retain the time extension.
- Reset the notification by pressing Last replacement date and extend date by one month
- Press the Save button to save the timer setting and go the General Setting screen.
- Setting the timer to 0 months deactivates the notification.

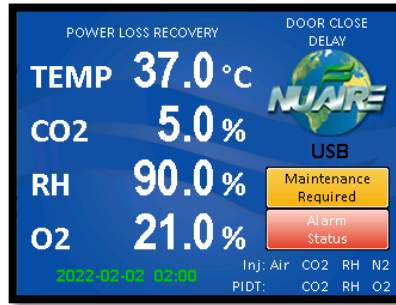
After extending or resetting the timer you can return to the main screen by following the screen prompts to save your choice and exit the menu.

11.0 Error Indicators & Troubleshooting

Step 1 NOTE ALL ERROR INDICATORS

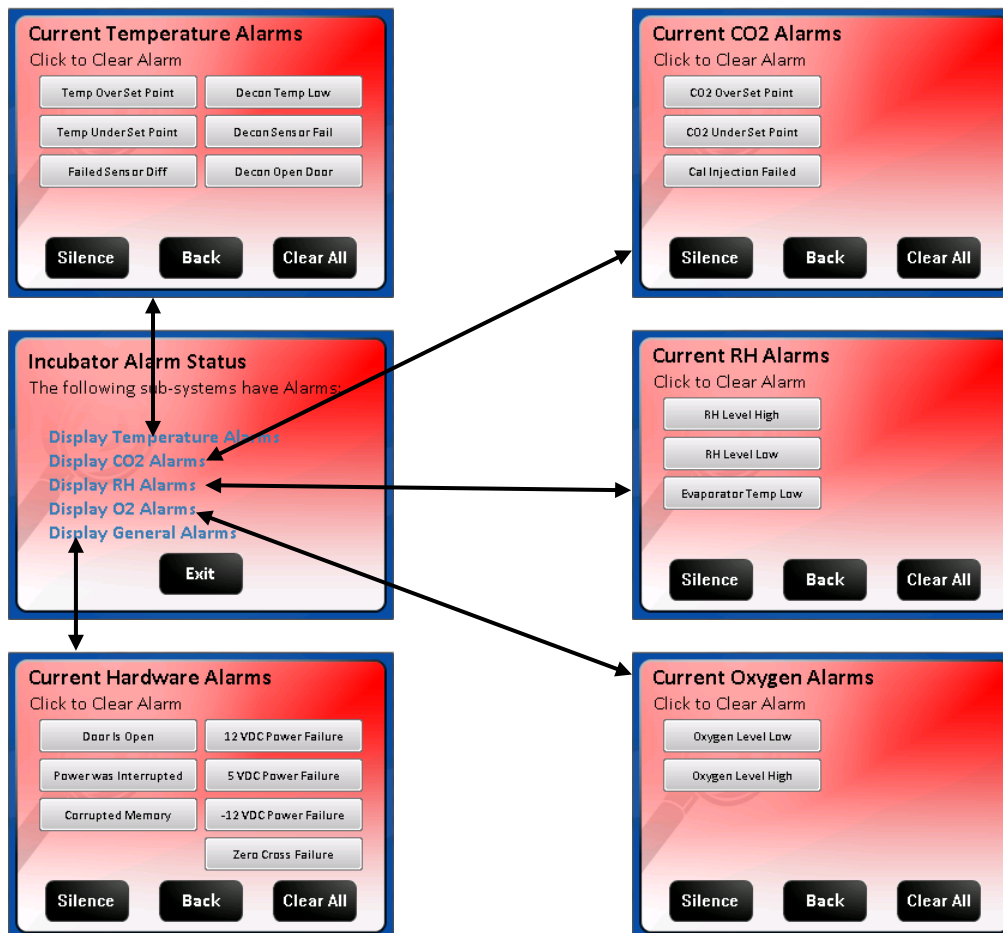
When the Incubator is running, the Alarm Status button indicates an error.

Pressing the Alarm Status button, entering the correlating Alarms Menu and pressing the Silence button in the Alarms Menu will silence the audible alarm until Diagnostics is entered or another alarm becomes active.



Step 2 CLEAR ERROR INDICATORS.

Error indicators can be cleared by entering the Alarms Menu and pressing the Clear All button; if the error is still present the indicator will return when the alarm time reaches 0.



Step 3 MONITOR REOCCURRENCE OF ERROR INDICATORS.

If reoccurrence of the error indicator is immediate or daily, use guide below to correct the situation.

Error Indicator Troubleshooting Guide

Temperature System		
Displayed Error Code	Code Description	Checks and Corrections
Temp Over Set Point	-Temperature over set point Normal mode	<ul style="list-style-type: none"> – Check temperature sensor calibration. – Faulty TRIAC, replace control board.
Temp Under Set Point	-Temperature time out error during normal running and in	<ul style="list-style-type: none"> – Check temperature sensor calibration. – Replace fuse. – Faulty TRIAC, replace control board. – Faulty chamber heater contact NuAire Technical Service. – Door heater needs to be increased with a high temperature set-point in a low ambient temperature.
Failed Sensor Differential	-Sensor temperature (differential) error normal running. -Occurs when difference between sensors exceed 4°C.	<ul style="list-style-type: none"> – Check temperature sensor calibration. – Check connection on control board. – One or both temp sensors faulty, replace.
Maintenance Required	Breakdown in communication	<ul style="list-style-type: none"> – One or both temp. sensors disconnect, check connection of temp. sensors between main and display boards

CO ₂ Sensor Shroud Heater		
Displayed Error Code	Code Description	Checks and Corrections
Temp Sensor Failure	-Defective shroud temperature sensor	<ul style="list-style-type: none"> – Confirm it is plugged in at board connector P6. – Replace CO₂ shroud temperature sensor.
Sensor Bay Temp Low	Sensor bay is below temp set point +2° - See CO ₂ diagnostics screen	<ul style="list-style-type: none"> – Check control board output to relay, replace board if faulty. – Check that all connections are secure. – Check sensor bay heater for function, replace if faulty.
Sensor Bay Temp High	Sensor bay temp is above 65 deg C	<ul style="list-style-type: none"> Check control board output to relay, replace board if faulty. Check that all connections are secure Check sensor bay heater for function, replace if faulty. Check for uncontrolled sources of heat influencing the bay.

CO ₂ System		
Displayed Error Code	Code Description	Checks and Corrections
CO₂ Over Set Point	- CO ₂ over set point	<ul style="list-style-type: none"> – Perform CO₂ sensor calibration. – Check injection solenoid for leaking valve. – Check sensor and disk filter for condensation.
CO₂ Under Set Point	- CO ₂ time out error. The measured CO ₂ level has not reached with in the allowed percentage in the allowed time. CO ₂ stops injecting and air is injected for 15 minutes in case the sensor is not detecting the CO ₂ .	<ul style="list-style-type: none"> – Check CO₂ gas supply - inline gas filters, CO₂ gas tank pressure, CO₂ sensor function. – Run Cal Inj. Calibration (see Section 9.3.3). – Check/replace CO₂ gas supply tanks. – Check for leaks in chamber - inner door gasket, recirculation tubes. – Check for leaks in air pump and hosing.
Cal Inject Failed	- Cal inject calibration failed. Not enough increase in the CO ₂ reading after gas was injected.	<ul style="list-style-type: none"> – Check gas supply then run calibration again. – Call NuAire Technical Services if error persists.

O ₂ System		
Displayed Error Code	Code Description	Checks and Corrections
O₂ Under Set Point	- O ₂ under set point	<ul style="list-style-type: none"> – Perform O₂ sensor calibration. – Check injection solenoid for leaking valve. – Check sensor and disk filter for condensation.
O₂ Over Set Point	- O ₂ time out error	<ul style="list-style-type: none"> – Check O₂ gas supply - inline gas filters, CO₂ gas tank pressure, O₂ sensor function. – Check/replace O₂ gas supply tanks. – Check for leaks in chamber, inner door gasket, chamber blower fan shaft seal. – Check for leaks in air pump and hosing.

General Indicators		
Displayed Error Code	Code Description	Checks and Corrections
Door Ajar	- Inner glass door is not closed or switch not making connection with the control board.	<ul style="list-style-type: none"> - Close and latch inner glass door. - Confirm connection on the Control Board. - Check door switch, if faulty, replace.
"Power Interruption" Text instead of the NuAire Logo	- Interruption of power	<ul style="list-style-type: none"> - Press the power interruption text to dismiss the notice.
date/time flashing	- Interruption of power	<p>Flashing Green: Indicates that the real time clock did not lose power. See section 8.7.1.1 to address this. Canceling or saving in the clock set screen will return to the main screen and stop the flashing.</p> <p>Flashing Yellow Indicates the real time clock lost backup power and needs to be set again. See section 8.7.1.1 to address this. Save must be pressed in the clock set screen to stop the flashing and return the date and time to green text.</p>
Power Loss Recovery Mode	Displayed in main screen in place of RUN or STANDBY.	Shows when incubator has lost power for more than 45 minutes long enough to get condensation in the circulation system and cause the CO2 and O2 sensors to malfunction. This mode blocks circulation through the sensors and does not control the gas for 1 hour to allow the condensation to dissipate. Gas control is then resumed.
Corrupted Memory	Corrupted memory was detected during boot up of the incubator	<ul style="list-style-type: none"> - Replace Control Board.
Data Write Failure	A change in parameters failed to write to memory	<ul style="list-style-type: none"> - Replace Control board.
+ 12 VDC Power Failure	Low voltage detected on the 12 VDC power circuit	<ul style="list-style-type: none"> - Check output @ Power Supply. If good, could be Control Board. - Check power supply connection to Control Board DC power supply failed. Replace.
- 12 VDC Power Failure	Low voltage detected on the 12 VDC power circuit	<ul style="list-style-type: none"> - Check output @ Power Supply. If good, could be Control Board. - Check power supply connection to Control board DC power supply failed. Replace.
5 VDC Power Failure	Low voltage detected on the 5 VDC power circuit	<ul style="list-style-type: none"> - Check output @ Power Supply. If good, could be Control Board. - Check power supply connection to Control board DC power supply failed. Replace.
Zero Cross Failure	The Power Triacs control circuit not working	<ul style="list-style-type: none"> - Check that AC line voltage to the board is at the correct level. If not, trouble shoot cause and correct. - Check for loose line voltage connection to control bd. - Replace fuse with slow blow fuse of the correct amp rating as specified on the wiring diagram. - Replace Control Board.
Universal Serial Bus Error	Stops trying to write to USB memory stick after several tries	Memory stick no compatible try another one. May take several tries USB port not functioning contact Nuair technical service
Condensation Excessive (Humidity pan in place)	- Glass door, gasket or front wall of chamber is wet.	<ul style="list-style-type: none"> - Increase door heater duty cycles. - See section 9 for detailed instructions.
	- Back wall bottom and top walls	<ul style="list-style-type: none"> - Decrease door heater duty cycle. - See section 9 for detailed instructions.
Note: Depending on the ambient conditions where the Incubator is operating, the operator may have to readjust the door-heater duty cycle. If the door heater cycle is too low, the glass door and front wall of the chamber will show excessive condensation. If the door heater duty cycle is too high, the back wall or sides will have excessive condensation.		
Condensation Persists After Door Duty Cycles are Adjusted		<ul style="list-style-type: none"> - Increase air injections, increasing duration first, recommended initial change to 6 sec (Air Inj) & 1 minute (Air Cyc).
Condensation on the face of the incubator outside of the chamber	Pressure in chamber high enough to cause blow by around the inner door gasket	<ul style="list-style-type: none"> - Check side access port stopper pressure relief hole(s) for blockage. - Check circulation system for blockage causing flow out of the chamber to be less than flow into the chamber.
Excess Vibration		<ul style="list-style-type: none"> - Check for and remove the block of shipping foam from under the air pump.

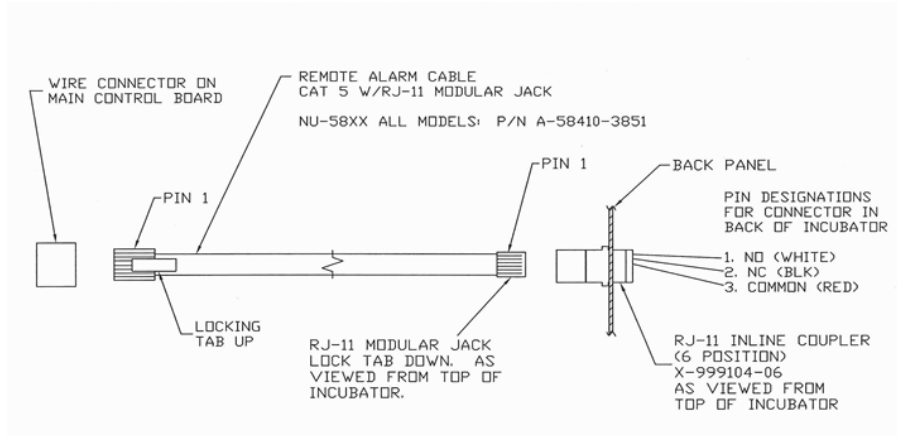
General Indicators		
Displayed Error Code	Code Description	Checks and Corrections
		<ul style="list-style-type: none"> – Turn the incubator off. If the vibration persists, it is from the room where the incubator is installed.
Maintenance Required Button in Main Screen	Press button Message says it is time to change Filter	<ul style="list-style-type: none"> – Check and Change filters in sensor bay and reset timer. – Check Filter and extend timer if filter doesn't need Changing. – Extend Timer – See section 10.4 for more detail on all Responses.
	Message says Water Supply Low	<ul style="list-style-type: none"> – Fill Water Jacket with single distilled water no purer – Than 1 Mega Ohm per instructions in manual. – Float switch bad. Replace.

For further assistance, call NuAire Customer Service at 1-800-328-3352 or (763) 553-1270 USA.

12.0 Communication Outputs

12.1 Remote Alarm Contacts

The NuAire Water Jacket Incubator contains a set of contact points to connect to a remote alarm system. The contacts are located on the rear panel (see page 14). The contacts are housed in a modular (RJ-11) telephone jack and rated for (30V at 1 Amp). The contacts provided are normally open (NO), normally closed (NC) and common (COM) as shown below. The alarm contacts do not distinguish between a CO₂ temperature and any other alarm. Each will open or close the contacts upon an alarm condition. Power interruption will also change the state of the contacts.



12.2 4 to 20mA Analog System Performance Output:

Refer to PTB0235 rev 3 or higher

12.3 RS-485 2-way Communications:

Refer to PTB0234

12.4 On-Board USB Port:

Uploading Service Performance/Event Data:

Refer to STB0348

Uploading Incubator Programming:

Refer to PTB0347



When connecting external accessories or components to the system, attach only components that have been tested and certified for compliance to UL/IEC 60601-1 or UL/IEC 60950

13.0 Electrical/Environmental Requirements

13.1 Electrical

Model: NU-8600 and NU-8631

Domestic Units:	115V,	50/60Hz,	1 Phase,	5 Amps
"E" Units:	230V,	50/60Hz,	1 Phase,	3 Amps

Start Up Power 575 Watts

Running Power 250 Watts

13.2 Operational Performance (for indoor use only)

Environment Temperature Range: 60°F-85°F (15°C – 30°C)

Environment Humidity: Maximum relative humidity 80% for temperatures up to 31°C decreasing linearly to 50% relative humidity at 40°C

Environment Altitude: 6562 ft (2000 m) over sea level maximum

13.3 Light Exposure

Standard Fluorescent Lighting @ 150 ft. candles (1614 LUX) maximum intensity.

13.4 Installation Category: 2.0

Installation category (overvoltage category) defines the level of transient overvoltage, which the instrument is designed to withstand safely. It depends on the nature of the electricity supply and its overvoltage protection means. For example, in CAT II, which is the category used for instruments in installations supplied from a supply comparable to public

mains such as hospital and research laboratories and most industrial laboratories, the expected transient overvoltage is 2500V for a 230V supply and 1500V for a 120V supply.

13.5 Pollution Degree: 2.0

Pollution degree describes the amount of conductive pollution present in the operating environment. Pollution degree 2.0 assumes that normally only non-conductive pollution such as dust occurs with the exception of occasional conductivity caused by condensation.

13.6 Chemical Exposure

Chemical exposure should be limited to antibacterial materials used for cleaning and disinfecting. Chlorinated and Halogen materials are not recommended for use on stainless steel surfaces. Chamber decontamination can be accomplished by paraformaldehyde, vapor phased Hydrogen Peroxide or Ethylene Oxide without degradation of cabinet materials.

13.7 EMC Performance (classified for light industrial)

Emissions: EN61326

Immunity: EN61326



Class A equipment is intended for use in an industrial environment. In the documentation for the user, a statement shall be included drawing attention to the fact that there may be potential difficulties in ensuring electromagnetic compatibility in other environments, due to conducted as well as radiated disturbances.

13.8 Heat Rejection: 14 BTU/Minute.

14.0 Disposal and Recycle

Incubators that are no longer in use and are ready for disposal contain reusable materials. ALL components with the exception of the HEPA filters may be disposed and/or recycled after they are known to be properly disinfected.

Note: Follow all local, state and federal guidelines for disposal of HEPA filter solid waste.



BIOHAZARD



Prior to any disassembly for disposal the incubator must be decontaminated

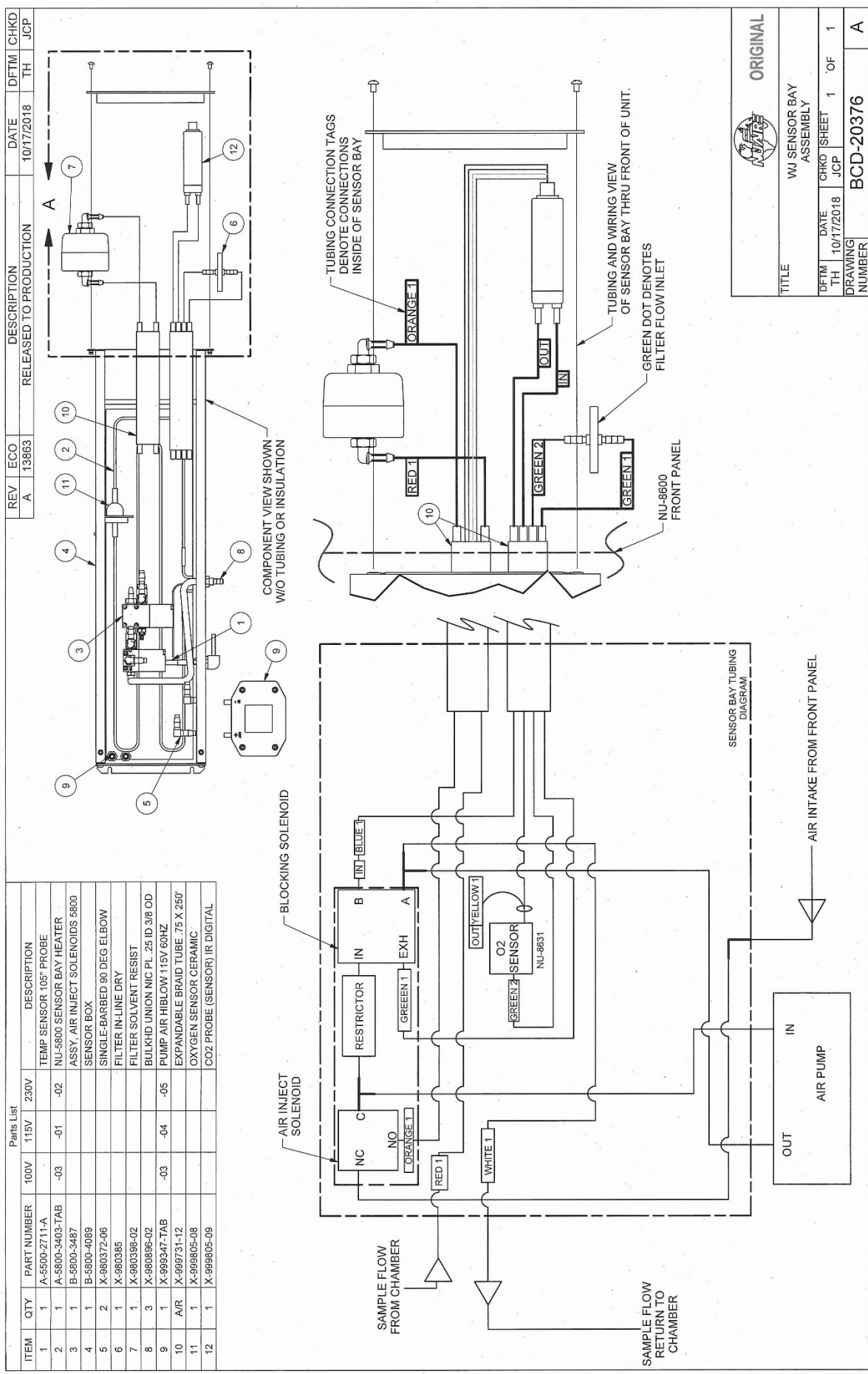


RECYCLE

LEAD FREE

Component	Material
Incubator Cabinet	Painted Steel
Outer Door	Painted Steel
Chamber	Stainless Steel
Outer Door Gasket	Vinyl Clad Magnet
Inner Door Gasket	Silicon Rubber
Front Service Panel	Painted Steel
Electronics Panel	Painted Steel
Sensor Bay	Aluminum
Exhaust Filter	Aluminum
Hosing	Silicon Rubber
Tubing	Stainless Steel
Air Pump	Various Steel/Copper/Nylon
Motor	Various Steel/Copper/PVC
Printed Wiring Assembly	Lead Free Electronic
Wire	PVC Coated Copper
Solenoid Valves	Various Steel/Copper
Connectors	PVC
Hardware	Stainless Steel and Steel

NOTE: Material type can be verified with use of a magnet with stainless and aluminum being non-magnetic.

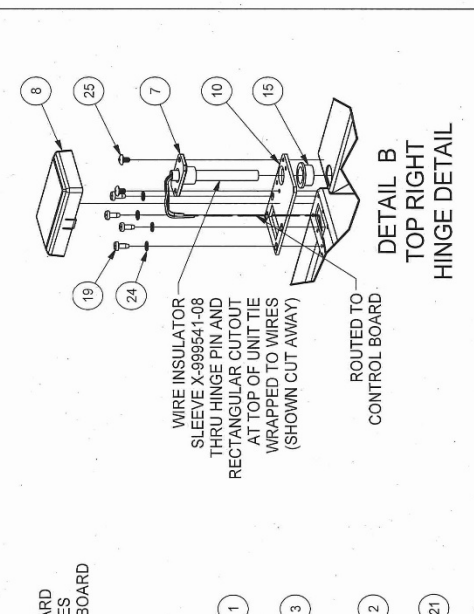


REV	ECO	DESCRIPTION	DATE	DFTM	CHKD
B	13712	UPDATED VIEWS	4/3/2018	TH	KGK

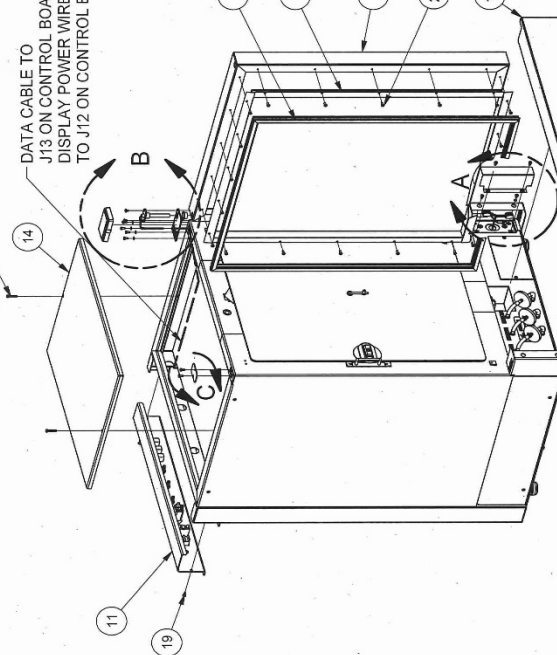
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	B-5700-3941	VINYL MAGNETIC OUTER DOOR GASKET
2	1	B-5700-3962	WELDMENT, OUTER DOOR
3	1	B-5700-3964	INNER DOOR PANEL
4	1	B-5900-3333	BEZEL FRONT PANEL
5	1	B-5800-3379	DISPLAY MOUNTING PANEL
6	1	B-5900-3384	COVER PLATE
7	2	B-5900-3386	HINGE PIN MOUNT
8	1	B-5800-3389	COVER, HINGE PLATE
9	1	B-5900-3549	DISPLAY, RF SHIELD
10	1	B-5900-3751	PLATE, TOP HINGE
11	1	B-8600-4074	WELDMENT, COMPONENT PANEL
12	2	B-8600-4079	LOWER DOOR HARNESS, SCREEN 8600
13	1	B-8600-4081	PANEL, LOWER VALANCE
14	1	B-8600-4085	TOP LID
15	2	X-990395-03	BUSHING FLANGED 5/8 SHAF
16	4	X-990600	8-32 X 3/8 PPH SCREW
17	2	X-990509-05	8-32 X .750 PPH
18	4	X-990633-04	4-40 CUP POINT SET SCR
19	14	X-990642-04	8-32 X .375 TAP TITE SCREW
20	2	X-990644-03	SCREW 8-32 X 1, SST
21	20	X-990716-04	SCREW PPH #8-32X1/2 WAXED SST
22	1	X-990783-03	#8 SST FLAT WASHER
23	1	X-990795-01	LOCK WASHER #8
24	5	X-990815-03	#8 INT. TOOTH LOCK WASHER
25	2	X-990871-05	SCR PTH 8-32 X 1/4 LG SST
26	4	X-999934-01	WIRE NUT

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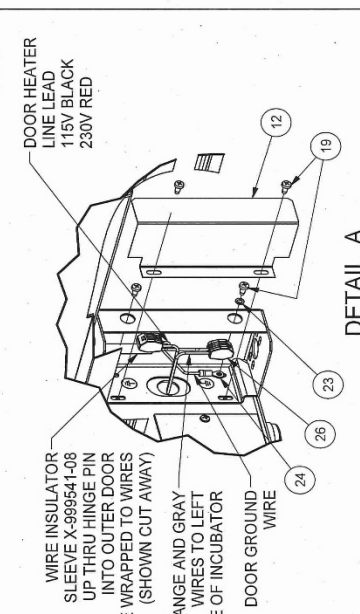
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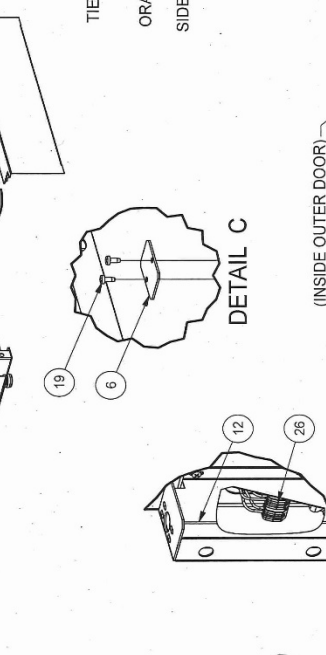
**DETAIL B
TOP RIGHT
HINGE DETAIL**



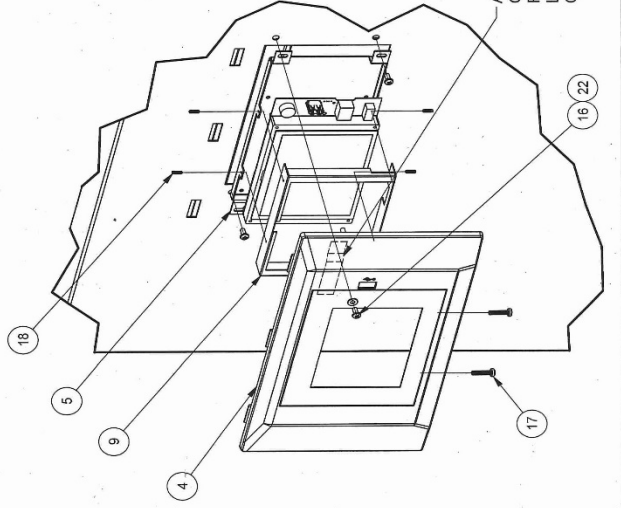
**DETAIL A
LOWER RIGHT
HINGE DETAIL**



**LEFT SIDE LOWER
CONNECTION**



DETAIL C

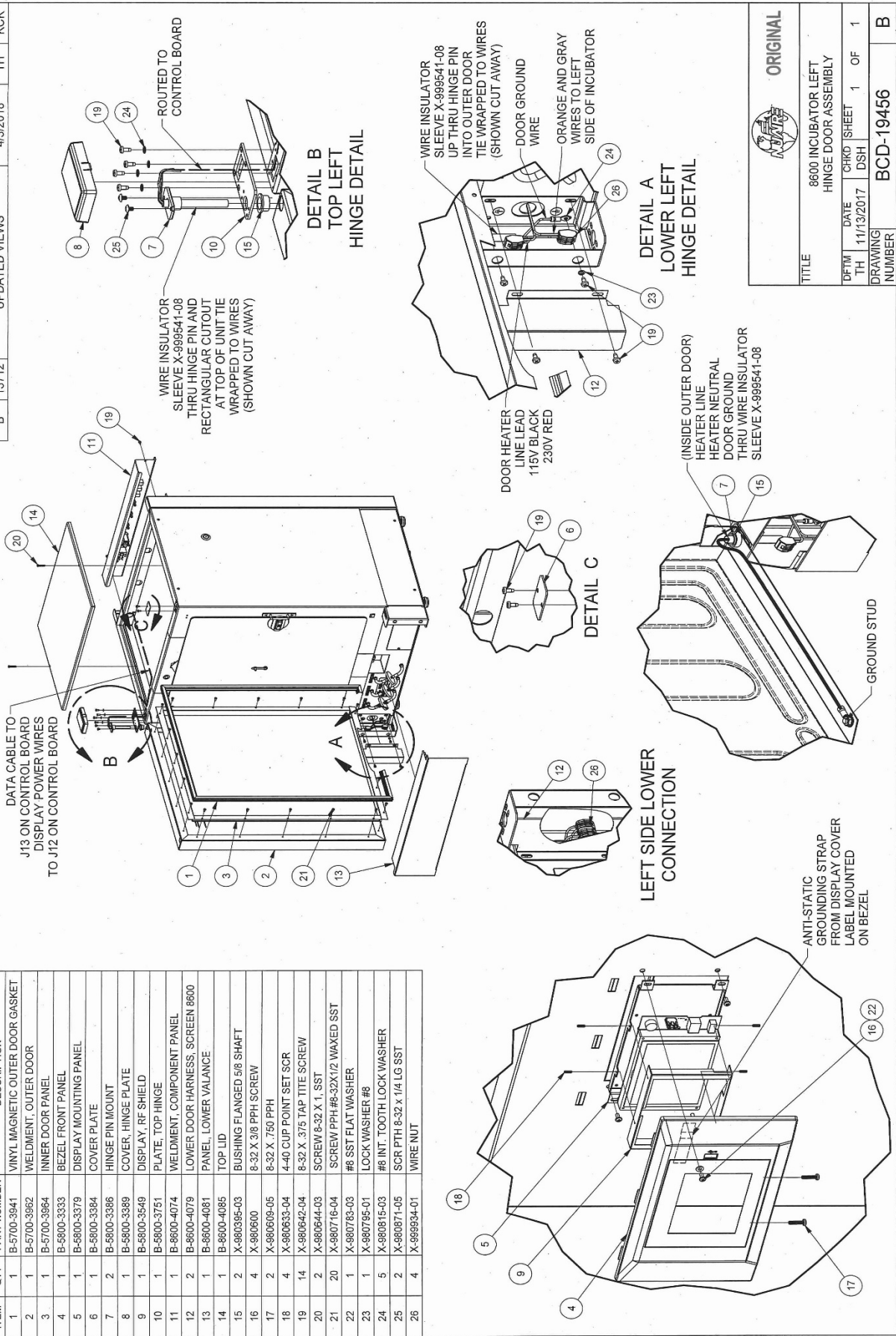


**ANTI-STATIC
GROUNDING STRAP
FROM DISPLAY COVER
LABEL MOUNTED
ON BEZEL**

ORIGINAL	
8600 INCUBATOR RIGHT HINGE DOOR ASSEMBLY	
DFTM	DATE
TH	11/9/2017
CHKO	DSH
SHEET	1 OF 1
DRAWING	NUMBER
	BCD-19455

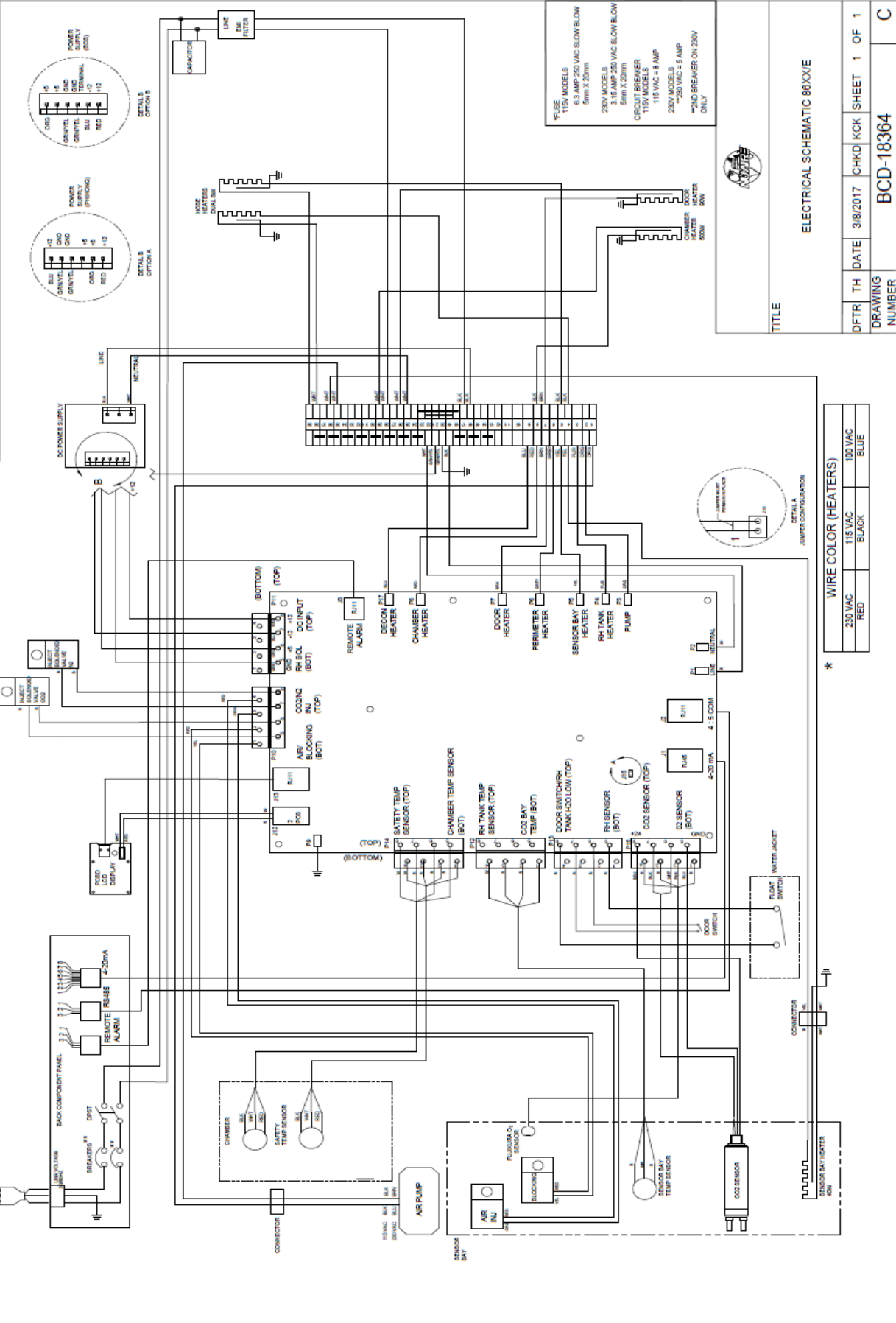
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1	B-5700-3941	VINYL MAGNETIC OUTER DOOR GASKET
2	B-5700-3962	WELDMENT, OUTER DOOR
3	B-5700-3964	INNER DOOR PANEL
4	B-5800-3333	BEZEL FRONT PANEL
5	B-5800-3379	DISPLAY MOUNTING PANEL
6	B-5800-3384	COVER PLATE
7	B-5800-3386	HINGE PIN MOUNT
8	B-5800-3389	COVER, HINGE PLATE
9	B-5800-3549	DISPLAY, RF SHIELD
10	B-5800-3751	PLATE, TOP HINGE
11	B-8600-4074	WELDMENT, COMPONENT PANEL
12	B-8600-4079	LOWER DOOR HARNESS, SCREEN 8600
13	B-8600-4081	PANEL, LOWER VALANCE
14	B-8600-4085	TOP LID
15	X-980395-03	BUSHING FLANGED 5/8 SHAFT
16	X-980600	8-32 X 3/8 PPH SCREW
17	X-980609-05	8-32 X .750 PPH
18	X-980633-04	4-40 CUP POINT SET SCR
19	X-980642-04	8-32 X .375 TAP TITE SCREW
20	X-980644-03	SCREW PPH #6-32X1/2 WAXED SST
21	X-980716-04	#6 SST FLAT WASHER
22	X-980783-03	LOCK WASHER #8
23	X-980795-01	#8 INT. TOOTH LOCK WASHER
24	X-980815-03	SCR PTH 8-32 X 1/4 LG SST
25	X-980871-05	WIRE NUT
26	X-989934-01	

REV	ECO	DESCRIPTION	DATE	DFTM	CHKD
B	13712	UPDATED VIEWS	4/3/2018	TH	KCK

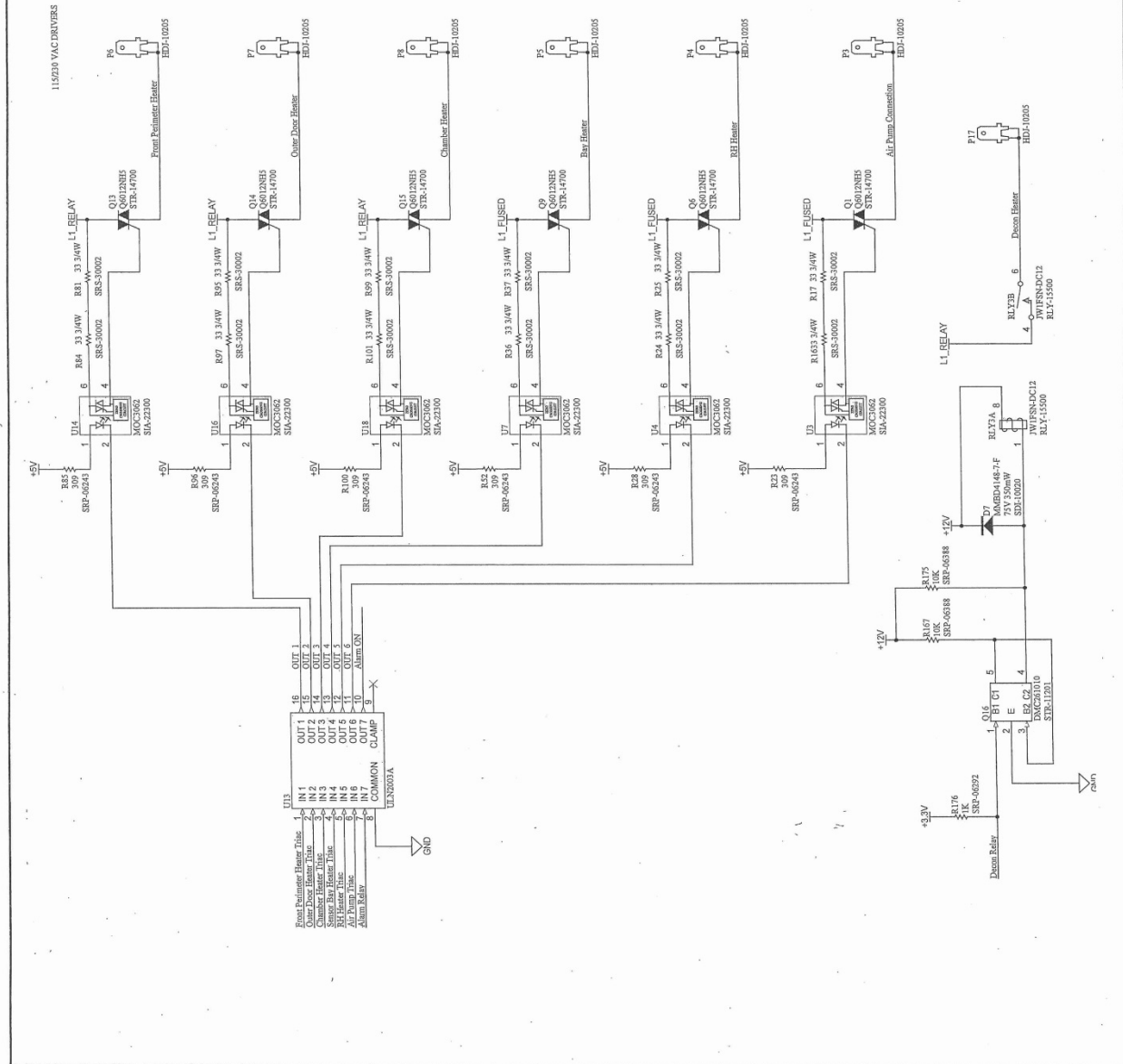


REV	CO	DESCRIPTION	DATE	DFTR	CHKD
C	000542	UPDATED CO2 SENSOR	10/7/2020	TH	JCP

REV	CO	DESCRIPTION	DATE	DFTR	CHKD
C	000542	UPDATED CO2 SENSOR	10/7/2020	TH	JCP



REV	ECO	DESCRIPTION	DATE	DRFT	CHKD
A	12870	RELEASED TO PRODUCTION	12/04/15	LS	KCK



ORIGINAL

NU-5800 CONTROL BOARD
OUTPUTS SCHEMATIC

DFTM	LS	12/04/15	CHKD	KCK	SHEET	1 OF 1
DRAWING NUMBER				BCD-18007		
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