Water-Jacketed,
IR Autoflow Automatic CO_2 Incubator

Models
NU-8500/D/E
NU-8700/D/E

Operation & Maintenance Manual

July, 2012
Revision 9

Series 9 or Higher 8500
Series 5 or Higher 8500D
Series 9 or Higher 8500E

Series 9 or Higher 8700
Series 4 or Higher 8700D
Series 9 or Higher 8700E

115 Vac, 60 Hz Unit Only

Manufactured By:
NuAire, Inc.
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IR Autoflow Automatic CO_2 Water-Jacketed Incubator

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1.0 General Description

The NuAire IR Autoflow Automatic CO_2 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 embryos, gametes and animal tissue cell cultures at on near body temperature. Six parameters contribute to optimum growth conditions. These are:

1. Humidity
2. Precise temperature control
3. Precise CO_2 control
4. Sterility
5. Reliability

Like all NuAire equipment, the IR Autoflow has been designed to provide the highest quality standards of performance with matching computer technology, precise temperature control and CO_2 gas control system combining state-of-the-art technology with years of design, quality and manufacturing experience.

In order to accomplish the foregoing objectives, the IR Autoflow features the following:

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

The outer stainless steel wall is lined with a space-age insulation providing an R5.0 rating, minimizing heat loss. The large 20 gallon (75.7 liters) water-jacket utilizes water, one of natures best heat "sinks". 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°C. The larger the mass, the less susceptible the chamber is to outside environment fluctuations. It also adds cabinet stability for the growth of vibration-sensitive cells.

1.2 NuAire Incubator Control Electronics

The NuAire Incubator Control Electronics (NICE) 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" with status indicators, LED display of control parameters, Hidden key, and three touch control key pads 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 setpoints and parameters. The EEPROM provides for indefinite storage of these values during periods of power off or power interruption (power fault tolerant).

The microcomputer includes a complete internal diagnostic software package that permits fault isolation detection down to the failed component.

1.3 CO_2 Display and Control

The NuAire IR Autoflow employs a solid-state single gas analyzer for carbon dioxide. This innovative analyzer utilizes a filter correlation technique for non-dispersive infrared analysis of CO_2. The analyzer consists of an optical bench incorporating an infrared source, sample cell, and infrared detector. The amount of power radiating on the detector is an approximate logarithmic function of the CO_2 concentration in the gas between source and detector. Detector linearization is performed with 32-bit digital accuracy. The measurement of CO_2 is independent of humidity and temperature variations within the chamber.

1.4 All Stainless Steel Construction

The IR Autoflow's 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 inert surface (for decontamination) that does not promote biological growth. All exposed edges are deburred to insure no sharp edges. The exterior is finished in a textured polyurethane powder-coat 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.

1.5 Humidity Display and Control (NU-8500, NU-8700)

Humidification of the chamber is achieved through the process of water evaporation from a water reservoir placed within the autoflow chamber. In addition, water condensation, which actually lowers the relative humidity within the chamber, is prevented by having all interior surfaces exposed to the constant temperature water-jacket, or heated separately via an integrated control that regulates door heat to maintain minimal condensation on the glass door.

The IR Autoflow has an optionally available relative humidity display. The system displays from 10% to 95% relative humidity. The recovery time to 95% $\pm$3% is typically less than 20 minutes. The accuracy is $\pm$3% from any given setpoint.

The display system uses a solid state capacitance humidity sensor to monitor the relative humidity within the chamber.

2.0 Performance Parameters

2.1 Both the interior and exterior of the IR Autoflow are constructed of 16-gauge, Type 304L stainless steel. The interior is highly polished using crevice-free construction. All exposed edges are de-burred 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.

2.2 Each chamber's water-jacket holds 20 gallons (75.7 liters) of water that in conjunction with the microcomputer control system provides an interior chamber temperature uniformity of $\pm$0.2°C at 37.0°C.

2.3 The IR Autoflow's microcomputer temperature control system has two temperature sensors: one in the water-jacket and one in the chamber. The chamber temperature sensor compares the values to a setpoint and executes a time proportional control algorithm that energizes a solid-state switch supplying power to the heater.

2.4 The CO_2 percentage is controlled by a solid-state infrared gas analyzer which provides accurate monitoring of CO_2, regardless of changes in temperature or humidity within the chamber.

2.5 Calibration of the infrared CO_2 gas analyzer is accomplished simply through a front panel diagnostic procedure to assure accuracy and minimize downtime.

2.6 Automatic recovery of CO_2 to 5.0 $\pm$0.2% CO_2 within 3-1/2 minutes after a door opening at default control, inject and delay settings.

2.7 The outer door includes a 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.

2.8 The inner glass door is 3/16 inch (5mm) tempered with smooth-ground edges and seals are tight against a removable U-grooved silicone rubber gasket. The door latch is cam action. A solid-state magnetic switch monitors door motion.

2.9 All electronic controls are modular and easily removed through the top service control center.

2.10 All control electronics are protected with a circuit breaker that 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.

2.11 A water fill access port is provided on the front of the IR Autoflow.
Removal of a ¼ inch NPT plated brass fill plug allows filling using a ¼ inch NPT hose adapter (provided).

2.12 The IR Autoflow has factory installed adjustable leveling legs to compensate for uneven laboratory surfaces.

2.13 The entire interior shelving assembly is easily removable for decontamination.
Shelves and brackets are constructed from 18 gauge, type 304 polished stainless steel.

2.14 A thru-wall access port is provided for operating electrical appliances such as roller apparatus, rockers, etc.

2.15 A CO_2 sample port is provided on the front panel to check the concentration of CO_2 in the chamber.

2.16 A water level sensor is provided to monitor the level of water within the jacket.

2.17 A water-jacket valve is provided on the bottom of the unit for ease of draining.

3.0 Models & Features

NuAire offers various Water-Jacketed IR Autoflow Automatic models:

Model	Standard	D	E
NU-8500 Single Chamber	115VAC / 60 Hz	100VAC / 50-60Hz	230VAC / 50-60Hz
NU-8700 Double Chamber	115VAC / 60 Hz	100VAC / 50-60Hz	230VAC / 50-60Hz

3.1 Weight

Weight (lbs./kg - per unit):	NU-8500	NU-8700
Dry:	218 / 99	492 / 224
Operational (jacket filled):	385 / 175	826 / 375
Shipping:	287 / 130	561 / 255

3.2 Dimensions (see also Specification Drawing BCD-10401 and BCD-10402)

Overall Dimensions - inches (mm):	NU-8500	NU-8700
Width:	25.5 (647.7)	25.5 (647.7)
Height:	40.5 (1028.7)	73.5 (1866.9)
Depth:	27 (685.8)	27 (685.8)

Shelf Capacity: (Do not slide shelf out with more than 20 lbs. on it.

Size:	19.25 Inches (489mm) x	19.25 Inches (489mm)
Supplied:	4 Shelves	
Max. Capacity:	20 Shelves	
Max. Weight Capacity:	30 lbs.	

Water Pan:

Dimensions:	Mean Length	18.00" (457mm)
	Mean Width	18.00" (457mm)
	Depth	1.250" (38mm)
Capacity:	Maximum Capacity	7.75 Liters
	Recommended Fill	6.5 Liters

3.3 NU-8500/8700 Standard Features

- 100% stainless steel chamber construction
- Large capacity water-jacket (20 gallon) (75.7liters)
- Temperature Control System (Default Set Point 37.0°C)
  - Chamber Temperature Range: 5°C above ambient to +55°C
  - Chamber temperature uniformity: ±0.2°C at 37°C
  - Temperature sensitivity: ±0.0125°C
- CO_2 Control System (Default Set Point 5.0%)
  - CO_2 Range: 0-20%
  - CO_2 Accuracy: ±0.1%
  - CO_2 Recovery to 5.0 ±0.2%: Less than 3-1/2 minutes
- Remote Alarm Output Contacts

3.4 Standard Items Packed with Unit:

4	Stainless Steel Shelves	1	Gas Tube w Filter
8	Stainless Steel Shelf Brackets	1	O & M Manual
4	Stainless Steel Shelf Bracket Supports	1	Operating Instructions
1	Full Size Water Pan with Supports	8' (2.5m)	Electrical Cord
1	Fill Port Hose Adapter	6' (2ml)	Fill Tube
1	Fill Port Plug		

3.5 Optional Features

- Model Number I01 Automatic CO_2 Tank Switch (Internal)
- Model Number I11 Internal Coil for Chilled Water
- Model Number I16 4 Inner Lexan Doors
- Model Number I18 RS-232 Communications Interface
- Model Number I44 Chart Recorder Multi-Signal Outputs

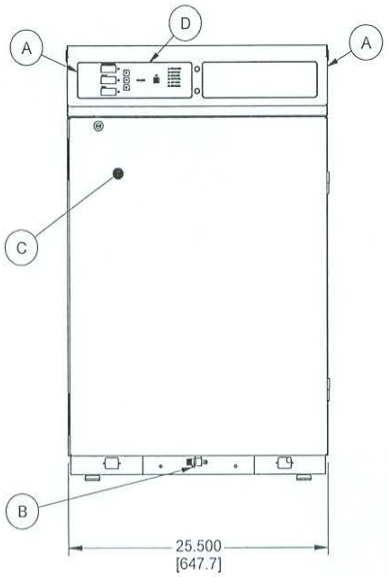
Note: All recovery ratings are at default control & option settings.

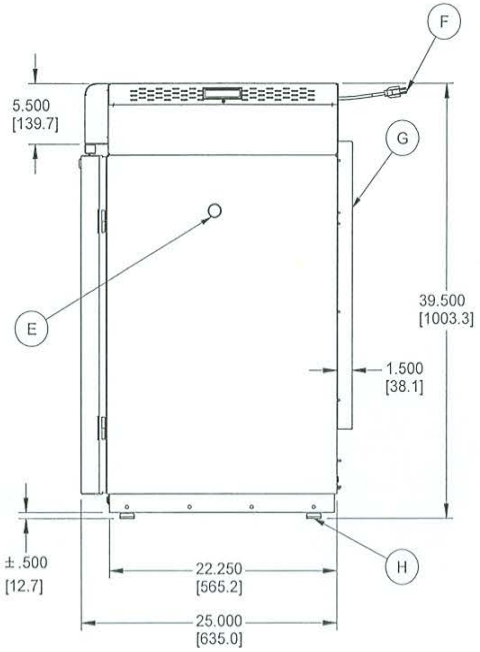
3.6 Accessories

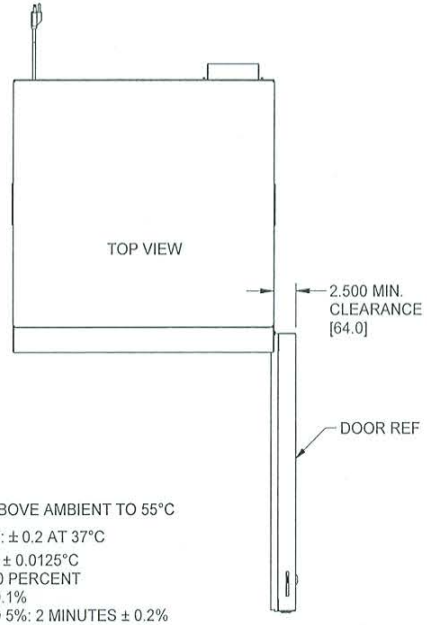
- Model NU-1550 Automatic Tank Switch (External) (115 VAC)
- Model NU-1550E Automatic Tank Switch (External) (230 VAC)
- Model NU-1552 CO_2/O_2 Tank Alarm (115 VAC)
- Model NU-1551E CO_2/O_2 Tank Alarm (230 VAC)
- Model NU-1553 Stacking Rack (Single Unit)
- Model NU-1555 Additional Stainless Steel Water Pan
- Model NU-1556 Additional Tubing Kit
- Model NU-1557 Additional Shelves
- Model NU-1559 CO_2 Analyzer Fyrite Kit (Dry) 0-20% (Replacement fluid required)
- Model NU-1561 Replacement Fluid for CO_2 Analyzer (two bottles/carton)*
- Model NU-1564 CO_2 Regulator, Two-Stage
- Model NU-1566 Platform
- Model NU-1574 Platform w/Combination Castors
- Model NU-1575 Moisture Proof Duplex Outlet (115 VAC)
- Model NU-2568 Surge Protector (115 VAC)

*Fyrite Replacement Fluid may only be ordered when shipment is possible by UPS Ground Service.

REV	ECO	DESCRIPTION	DATE	DRFT	CHKD
B	10770	UPDATE PRINT	3/16/2010	DHH	KCK







TEMP. RANGE: 5° ABOVE AMBIENT TO 55°C
TEMP. UNIFORMITY: ± 0.2 AT 37°C
TEMP. SENSITIVITY ± 0.0125°C
CO2 RANGE 0 TO 20 PERCENT
CO2 ACCURACY ± 0.1%
CO2 RECOVERY TO 5%: 2 MINUTES ± 0.2%
ELECTRICAL: 115 VAC, 1100 W, 50/60 HZ.
220 VAC, 1100 W, 50/60 HZ.
100 VAC, 1100 W, 50/60 HZ.
230 VAC, 1100 W, 50/60 HZ.
DIMENSIONS INTERIOR: (EACH CHAMBER)
25.500"H X 21.500"W X 21.000"D
[647.7mm H X 546.1mm W X 533.4mm D]
DIMENSIONS EXTERIOR:
40.500"H X 25.500"W X 27.000"D
[1028.7mm H X 647.7mm W X 685.8mm D]
SHELF: 19.250 X 19.250 [488.9mm X 488.9mm]

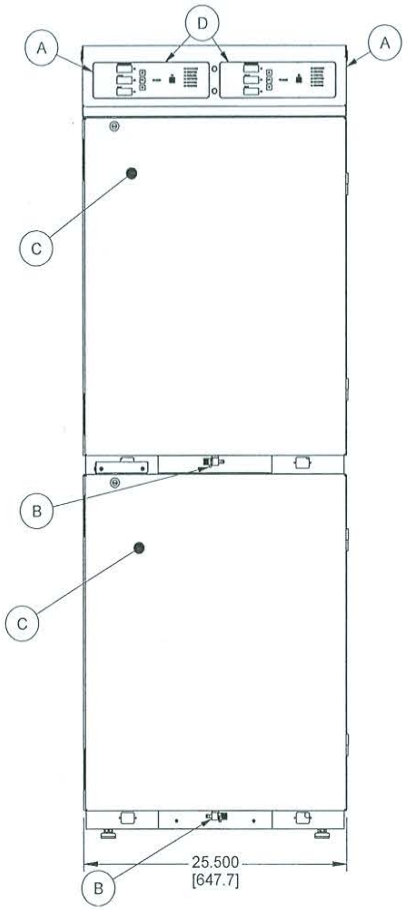
ORIGINAL

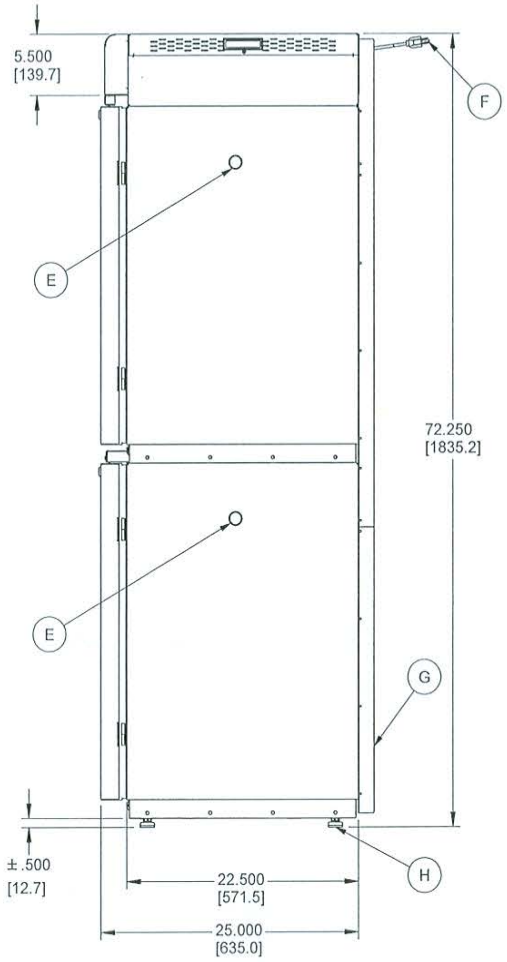
FRONT VIEW
A - FRONT PANEL CONTROLS & INDICATORS
B - WATER JACKET DRAIN
C - WATER FILL ACCESS PORT (BEHIND DOOR)
D - MODULAR CONTROL PANELS
E - ACCESS PORT 1.125 DIA [28.5mm]
F - POWER CORD 8' [2.5mm]
G - WIRE & TUBING COVER CHANNEL
H - LEG LEVELERS ±.500 [12.7mm] ADJUSTMENT

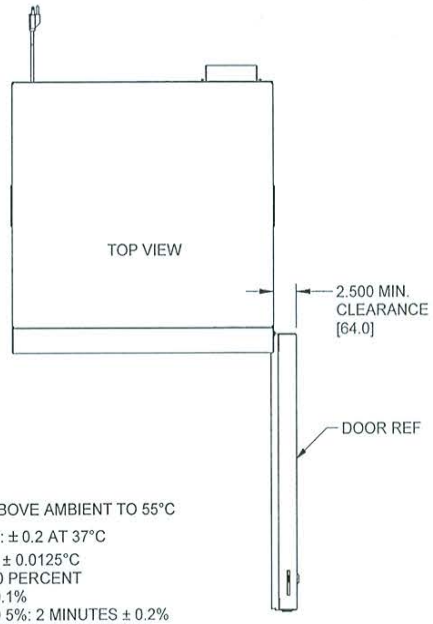
DATE	10/5/2004
DFTM	KF
CHKD	KCK
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES -TOLERANCES- DECIMALS ± .032 ANGLES ± 2°	

TITLE	SPEC. DWG NU-8500/D/E/G IR CO2 INCUBATOR	
MATERIAL	AS NOTED	
PART NUMBER	BCD-10401	B
PROJECT NUMBER		SHEET 1 OF 1

REV	ECO	DESCRIPTION	DATE	DRFT	CHKD
B	10770	UPDATE PRINTS	3/16/2010	DHH	KCK







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TEMP. RANGE: 5° ABOVE AMBIENT TO 55°C
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DIMENSIONS INTERIOR: (EACH CHAMBER)
25.500"H X 21.500"W X 21.000"D
[647.7mm H X 546.1mm W X 533.4mm D]
DIMENSIONS EXTERIOR:
73.500"H X 25.500"W X 27.000"D
[1866.9mm H X 647.7mm W X 685.8mm D]
SHELF: 19.250 X 19.250 [488.9mm X 488.9mm]

ORIGINAL

DATE	10/5/2004
DFTM	KF
CHKD	KCK

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
-TOLERANCES-
DECIMALS ± .032
ANGLES ± 2°

TITLE	SPEC. DWG NU-8700/D/E/G IR CO2 INCUBATOR
MATERIAL	AS NOTED
PART NUMBER	BCD-10402 B
PROJECT NUMBER	
SHEET	1 OF 1

4.0 Test Performance & Procedures

All equipment is thoroughly inspected by NuAire at the time of shipment. Quality control is maintained by constant surveillance over each product, beginning at the receipt of purchased material and concluding with a final inspection before packing. In all instances where product quality cannot be easily assessed on the end item (i.e. water-jacket leak tightness), the product is inspected during sub-assembly fabrication. The following test procedures are conducted on each cabinet and a copy of the test report is included with each unit.

4.1 Visual Inspection

4.1.1 Each IR Autoflow is visually inspected to insure that the interior is clean and free from scratches, nicks, and burrs, and that all welds, both interior and exterior, are ground and polished smooth.

4.1.2 Painted surfaces are inspected to be free of scratches, nicks, insufficient covering, and runs.

4.1.3 The doors open and close freely without binding of the hinges. The gasket seals the inner glass door tightly. The glass door is free of scratches.

4.2 Electrical Tests

4.2.1 Electrical Leakage Test

All Autoflow Incubators may not exceed 0.5 milliampere in the normal running mode and may not exceed 3.5 milliampere in a single fault condition (ex. open ground).

4.2.2 Dielectric Voltage

All Autoflow Incubators are required to withstand 1770 VDC (2150 VDC for 230 VAC units) between dead metal parts and the hot/neutral power source leads with no electrical breakdown. This is factory tested using an Associated Research Model 520L and 7564SA.

4.2.3 Grounding Continuity

The resistance between the green bonding conductor of supply cord and any dead metal part of the cabinet shall not exceed 0.10 ohms.

4.3 Functional Tests

The following functional tests are performed on every unit at the end of a continuous 48-hour burn in period.

4.3.1 Control Systems

All diagnostic functions are exercised to insure proper operation of control systems, components and alarms.

4.3.2 CO_2 Control

Each unit is calibrated to function at 5%. CO_2 is introduced into the chamber and allowed to stabilize for ten minutes at 5% concentration. The concentration is checked with a Fyrite measurement instrument. Each unit is monitored during the 48-hour burn in period and only accepted with zero failures.

4.3.3 CO_2 Recovery

Each unit is exercised for CO_2 recovery time at the end of the 48-hour burn in period. The door is opened for 1 minute to deplete the CO_2. After the door is closed, the unit shall recover to 5.0 $\pm$0.2% within
3-1/2 minutes

5.0 Warranty

NuAire, Inc. warrants that it will repair F.O.B. its factory or furnish without charge F.O.B. its factory a similar part to replace any material in its equipment within 24 months parts and labor after the date of sale if proven to the satisfaction of the company to have been defective at the time it was sold provided that all parts claimed defective shall be returned, properly identified to the company at its factory, charges prepaid. Factory installed equipment or accessories are warranted only to the extent guaranteed by the original manufacturer and this warranty shall not apply to any portion of the equipment modified by the user. Claims under this warranty should be directed to NuAire, Inc. setting forth in detail the nature of the defect, the date of the initial installation and the serial and model number of the equipment.

NuAire, Inc. warrants the water-jacket and will repair or replace F.O.B. its factory or furnish without charge F.O.B. its factory the water-jacket within five years after the date of sale if proved to the satisfaction of the company to have been defective at the time it was sold.

This warranty shall not apply to any NuAire product or part thereof which has been subject to misuse, abuse, filling the water-jacket improperly, using additives in water-jacket, accident, shipping damage, improper installation or service, or damage by fire, flood or acts of God. If the serial number of this product is altered, removed or defaced as to be illegible, the warranty shall be null and void in its entirety.

The warranty is for the sole benefit of the original purchaser and is not assignable or transferable. Prior to returning any item, for any reason, contact NuAire for a Return Authorization Number. This number must accompany all returns. Any product shipped to NuAire without this number will be returned, refused shipment, or collect freight.

6.0 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. However, damage can occur in any shipment and the following outlines the 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

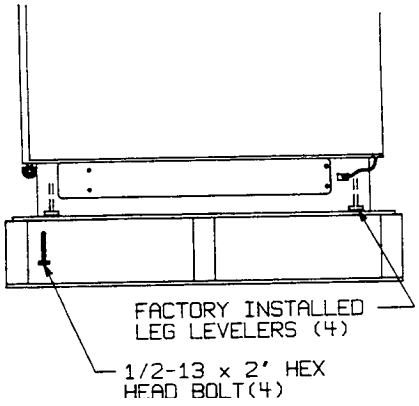
6.1.1 Terms are F.O.B. factory, unless stated otherwise. Therefore, it is important to check each shipment before acceptance.

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 stating 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.

7.0 Installation

The IR Autoflow is fastened to the base skid and it is usually the best procedure to leave the skid attached until the IR Autoflow is located in its approximate position, to facilitate ease in handling. The base skid can then be removed by removing the four bolts holding the cabinet to the skid. Examine the IR Autoflow carefully. INSPECT both the exterior and the interior of the IR Autoflow for any transit damage before discarding the shipping crate (see Section 6.1.3).



7.1 Location

In locating the IR Autoflow, 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 sun rays and rapidly moving air currents. The IR Autoflow needs even heat loss on all surfaces in order to maintain an internal temperature variation of less than 0.2 degrees C. As a result, a minimum of 2 inches (50 mm) must be allowed between the rear and sides of the IR Autoflow and any walls, partitions or obstructions to facilitate adequate convection of air around the IR Autoflow's water-jacket. For maintenance/service purposes, the control center top containing the electronics should remain accessible.

7.2 Leveling

The IR Autoflow should be leveled prior to filling the water, and should rest firmly on the bench or floor. Uneven water levels may cause false "Low Water" indications on the front panel, as well as affect the water circulation paths within the water-jacket, which could cause condensation on the walls of the chamber. Leveling feet are provided for this purpose factory installed into the base of the IR Autoflow. Turning the adjustable; leveling feet counter-clockwise raises the IR Autoflow. The leveling feet height should be approximately ¼ inch (6 mm) below the IR Autoflow Base.

7.3 Spring Pump Assembly Shipping Foam

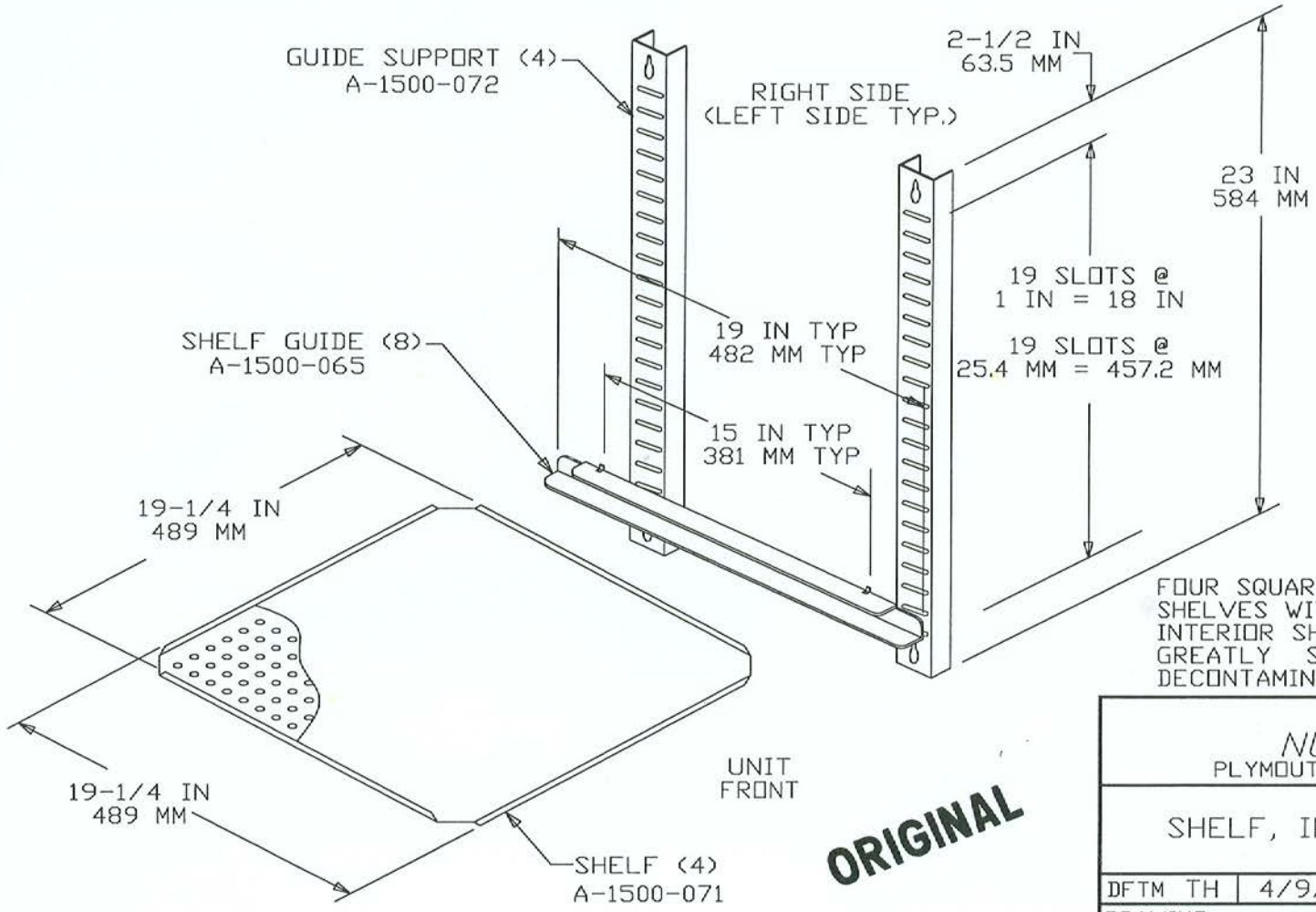
The spring pump assembly contains a piece of foam packing used to immobilize the pump during shipping: **IMPORTANT: FOAM MUST BE REMOVED BEFORE OPERATION!** To access, first remove top access cover then grasp foam from end and carefully remove. It may be saved for any future shipping. Replace access cover and screws.

7.4 Shelf & Water Pan Installation

Before installation of the shelves, 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 similar non-corrosive anti-microbial agent.

Provided with each IR Autoflow are four shelves. The shelves are easily installed per Drawing ACD-04119, by attaching the guide supports to the stainless steel pins in the interior of the chamber. Additional shelves and shelf guides are available. The water pan is installed on two shelf guides at the bottom of the shelf rack.

REV	ECO	DESCRIPTION	DATE	INL	INL
C	9730	UPDATE SHELF PART #	4/23/07	CV	KCK



FOUR SQUARE STAINLESS STEEL SHELVES WITH REMOVABLE INTERIOR SHELF ASSEMBLY GREATLY SIMPLIFIES DECONTAMINATION PROCEDURES.

NUAIRE
PLYMOUTH, MINNESOTA

SHELF, INSTALLATION

DFTM TH	4/9/92	SHEET 1	OF 1
DRAWING NUMBER	ACD-04119		C

7.5 Electrical

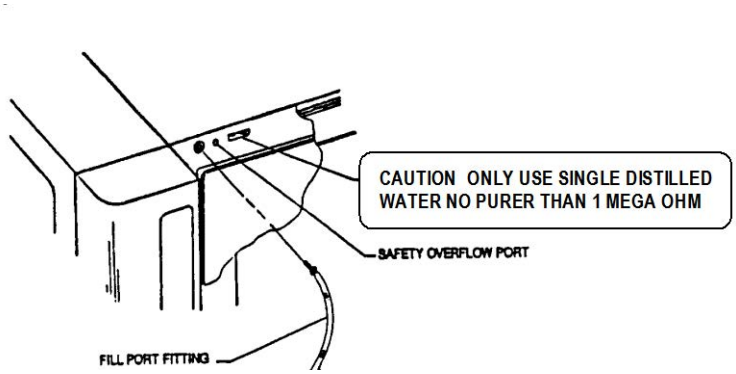
The electrical supply circuit to the IR Autoflow must conform to all national and local electrical codes. Consult the IR Autoflow's serial-data plate, located inside the door, for voltage, cycle, phase and ampere requirements before making connection. Plug the power cord securely into a grounded power source. VOLTAGE SHOULD NOT VARY MORE THAN 5% FROM SERIAL PLATE RATINGS. 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.

7.6 Precaution for IR Autoflow Filling

To prepare the IR Autoflow for filling, turn on main power switch located on back panel and set mode switch to setup. The digital indicator should light up as well as the low water light.

7.7 Filling & Draining the Water-Jacket

The fill port plug is located on the front top left side behind the exterior door. Remove fill port plug and install the fill port adapter. 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 MEGAOHM.** Fill the water-jacket until the "LOW WATER" light turns off. Add an additional 3 to 4 liters of water and remove the tube/adapter and replace fill port plug.



CAUTION

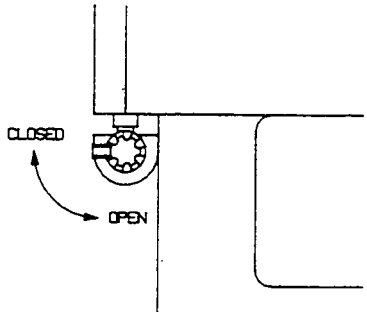
Be sure to position and level the IR Autoflow as desired before filling with water.

DO NOT OVERFILL!

The water-jacket requires no anti-bacterial agents. The IR Autoflow 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.

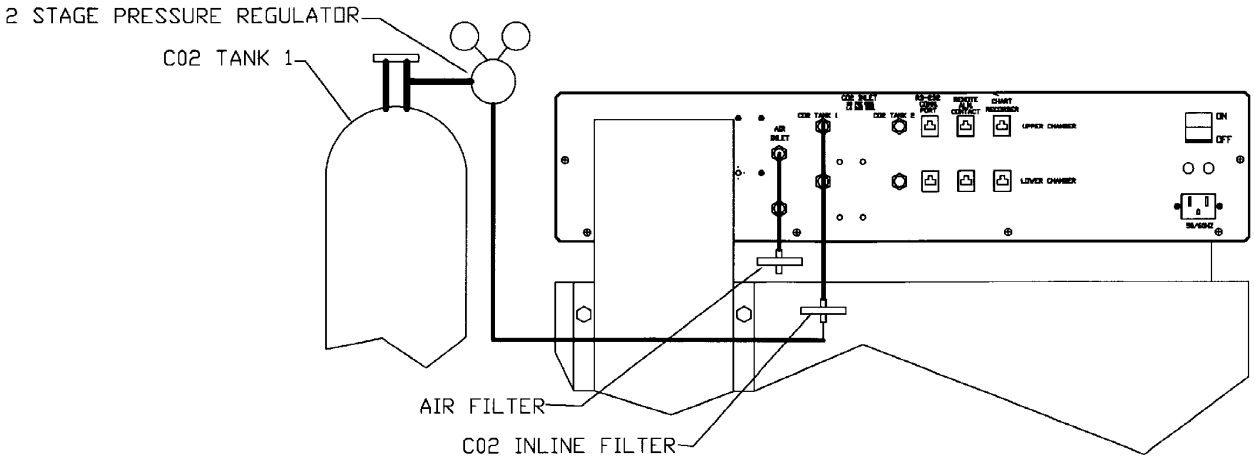
The water jacket can be drained from the drain plug located on the bottom left side. The drain uses a ball valve to control the drain water. If the valve stem is horizontal, the drain is closed and if it is vertical, the drain is open.
A white safety plug must be removed prior to draining located on the bottom of the ball valve. It also insures no leakage will occur.



7.8 Air Inlet Connection

An air inlet tubing kit consists of a one-foot clear vinyl tube and (1) 50mm polypropylene .3 micron HEPA filter. Locate the air inlet port on the back panel of the unit. Remove the cover cap; connect one end of tubing to the air inlet port, and the other end of tubing to the air filter.

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



7.9 CO_2 Tube Connection

High concentration of CO_2/N_2 gas can cause asphyxiation! Install Incubator in well ventilated area.

This Incubator is designed to be operated with CO_2 gas only. Connecting a flammable or toxic gas can result in a hazardous condition. Gases other than CO_2 should not be connected to this equipment. CO_2 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 CO_2 gas cylinders equipped with siphon tubes. A siphon tube is used to extract liquid CO_2 from the cylinder which can damage the pressure regulator. Consult with your gas supplier to ensure that the CO_2 cylinder does not contain a siphon tube.

Included with every IR Autoflow is a tubing kit consisting of (1) six foot (2 m) vinyl tube, and (1) 50 mm polypropylene 0.3 micron HEPA filter.

7.9.1 CO_2 Supply

1. Before the CO_2 supply is turned on to the IR Autoflow, fill the water-jacket and set the temperature (See Section 8.7.1.).

CAUTION:
CO_2 Pressure to the IR Autoflow is rated at 20 PSIG or 1.4 BAR.
Do not exceed 25 PSIG or 1.8 BAR

2. CO_2 of medical grade is recommended.
3. A two-stage pressure regulator, Linde #19590, or equal, is recommended.
4. DO NOT USE a single stage regulator.

7.9.2 CO_2 Pressure Regulators

The regulator's high-pressure stage, direct from supply cylinder must have a range of 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 CO_2 pressure into the IR Autoflow system. Some single stage CO_2 pressure regulators have two gauges. USE A TWO STAGE REGULATOR. All NuAire Autoflows use CO_2 in such small quantities that precise metering of CO_2 input pressure is important for maximum performance of the IR Autoflow.

To connect the regulator: First, open the CO_2 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. Second, MAKE SURE the regulator pressure-adjusting screw is released by turning it counterclockwise until it turns freely. Third, attach the regulator to the cylinder valve and tighten the connection nut with a wrench. BE SURE DISC GASKET IS IN PLACE BEFORE MAKING CONNECTION.

7.9.3 CO_2 Connection

Connect the CO_2 supply from the low-stage of the two-stage regulator to the inlet fitting located on the incubator back panel. The filter should be inserted downstream of the low-stage regulator before the inlet nozzle to the IR Autoflow. Observe proper flow orientation of the filter (look for "in" on filter). The tubing is easily cut with a sharp knife.

7.9.4 CO_2 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 or 48 to 55 BAR, more or less, depending on the temperature of the cylinder. Next turn the regulator's pressure adjusting screw clockwise until the low-pressure gauge reads 20 PSI or 1.4 BAR. The CO_2 connection is now complete.

NOTE: OSHA requires the CO_2 tanks to be physically restrained (i.e. via chained to wall) to prevent accidental damage to cylinder.

If optional feature Model Number I01, CO_2 Automatic Tank Switch (Internal) is purchased; separate installation instructions are provided.

8.0 IR Autoflow Operation

CAUTION: **All maintenance actions on this equipment must be performed by a qualified technician who is familiar with the proper maintenance procedures required for this equipment, as well as repair.**

ATTENTION ACCOMPANY'S INFORMATION OR IMPORTANT SYMBOL

POTENTIAL ELECTRICAL HAZARD ONLY QUALIFIED PERSON TO ACCESS

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

8.1 Sterility

The environment provided by the IR Autoflow is not selective. As a result, any contamination within the chamber is subjected to the same environment as the specimens. Therefore, before placing any cultures in the IR Autoflow, the shelves and shelf brackets should be sterilized. The interior side-walls, top, bottom, door, as well as the gasket should be wiped clean with a 70% solution of isopropyl alcohol or other disinfectant, to remove any contamination. Use a mild detergent to clean the exterior of the IR Autoflow.

8.2 Humidity

Humidification of the IR Autoflow is achieved through the process of water evaporation (vapor water pressure) from a stainless steel water pan (NuAire Model NU-1555) placed near the bottom of the Autoflow shelf rack. Materials of different thermal resistance (i.e. glass, plastic) do not offer sufficient thermal recovery and are not recommended for use. 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 IR Autoflow's chamber.

Use only single distilled water**, NO PURER THAN 1 MEGAOHM** in the stainless steel water pan. The water should be changed at least once a week, preferably more often. FLOODING THE BOTTOM OF THE IR AUTOFLOW IS NOT RECOMMENDED since it is difficult to change the water weekly and almost necessitates the use of chemicals which are not recommended and may damage the stainless steel. Also, it promotes condensation on the IR Autoflow's inner walls because it steals the natural convection, heat flow through the inner chamber and condensation points occur. **ABSOLUTELY NO CHLORINATED OR HALOGEN MATERIALS ARE TO BE USED IN THE CHAMBER.**

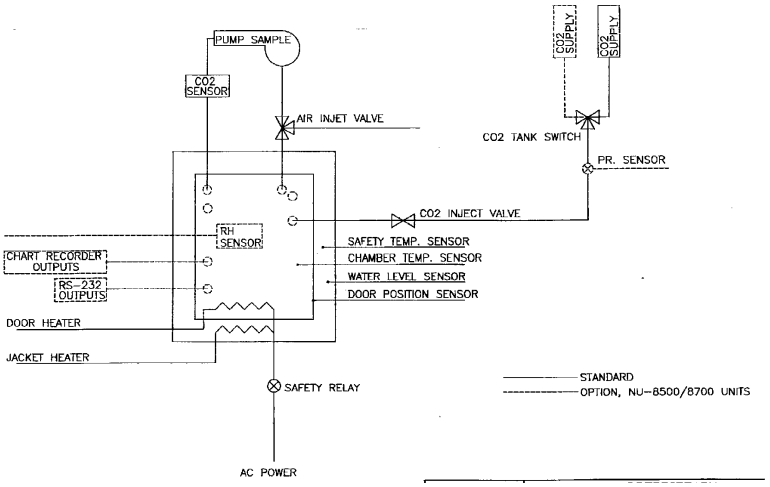
Humidity recovery will be back to 95% within 15-20 minutes after a 30 second door opening with a water reservoir area of 361 square inches (i.e. a NU-1555 full-sized pan). Contamination in the water pan may be avoided by adding a small amount of copper sulfate to the water pan after every decontamination of the chamber.

Condensation on the chamber walls, top or bottom usually indicates one of 3 issues:

a. The door heater duty cycle may be set too high. Follow the instructions in Section 9.2 to reduce it. Remember to adjust the door heat in small increments up or down. A change of 5% at a time would be a maximum change recommended.
b. Is the incubator installed near an air supply duct or in moving air? Diffuse the air supply duct so that it doesn't blow on the incubator or block the moving air. The incubator needs an environment that will allow it to dissipate heat evenly.
c. Change the air inject cycle as described in Section 8.8.4 (option configuration parameters). This will aid in reducing the condensation. It is recommended to increase the frequency of the injections in small increments to begin with.

8.3 System Introduction

The NuAire Incubator Control Electronics (NICE) system is designed to service the control requirements of the IR Autoflow incubator chamber. Temperature and CO_2 level are controlled by preset values to provide optimum conditions for culture growth within a chamber. Operator input is coordinated through the control panel keypad and status displays. The figure below shows the various inputs and outputs of the system.



The NuAire Incubator Control Electronics is a state-of-the-art microcomputer based system that provides:

8.3.1 Single chamber control in a single electronic package.

8.3.2 Enhanced information presentation of the following:

- Chamber temperature (setpoint and actual)
- CO_2 level (setpoint and actual)
- Humidity level (setpoint and actual) (Optional)
- Output and alarm status:
  - ❑ Water Jacket Heater Status
  - ❑ CO_2 Control Status
  - ❑ Water-Jacket Low Water Status
  - ❑ Door Ajar Status
  - ❑ System Alarm Condition Status
  - ❑ Optional, CO_2 Tank Selection
  - ❑ RH Display Status

8.3.3 Simplified operator controls. The control panel is operated using five keypads, mode key, Up/Down arrow keys, Select key, and Hidden key (NuAire logo). The mode key controls the incubator's two modes, Run or Setup. To change modes, press and hold the mode key for three seconds. If in Run mode, the green LED above the mode key should be on solid. If in Setup mode, the green LED above the mode key should be blinking, as well as the temperature and CO_2 displays indicating "SETUP". In the Run mode, the unit is fully functional with all control/alarms activated. In the Setup mode, the unit is inactive, no control/alarms exists. The Select key controls the current active parameter. As the Select key is repeatedly depressed, the corresponding green LED next to the parameter will indicate the parameter which is active. Each depression advances to the next parameter. The Up or Down arrow keys are used for setpoint parameter changes by depressing the Up or Down arrow key when the selected parameter is activated. As the Hidden key is pressed, it allows access to diagnosis, option, and reset modes.

Password Protection - The IR Autoflow has the ability to offer password protection of the setup parameters. By activating the password function in the option configuration parameters (Section 8.8.4), the use of the Up, Down, and Select keys are required in the correct order to access the set up mode.

8.3.4 Automatic notification of abnormal situations. The red alarm LED on the control panel indicators will light to indicate a fault within the system. Such faults include:

- System intermittent
- Temperature Control Fault (temperature exceeds setpoint by more than 1.0°C, or does not reach to setpoint within 4 hours)
- CO_2 Control Fault (CO_2 exceeds setpoint by more than 1.0% or doesn't reach setpoint within 30 minutes).

8.3.5 Provision for add-on expansion capability. Options include:

- Remote communication capability (RS-232)
- Chart recorder output (0-10VDC) of individual monitored parameters
- Automatic tank switch

8.3.6 Diagnostic and calibration assists. By pressing hidden key, diagnostic mode is entered. In this mode:

- 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
- Front panel lamps may be tested
- Memory and internal processor diagnostics may be selected
- All options may be individually tested

8.4 Front Control Panel

The system front control panel contains the following functions described in detail.
(See Drawing BCD-08317 & 08226)

8.4.1 Heat Jacket Status LED

The jacket heat green LED indicates when the chamber heater is turned on.
A blinking LED indicates chamber heater is being cycled to maintain chamber setpoint temperature.

8.4.2 Door Ajar Status LED

The door ajar yellow LED indicates when the inner glass door is not closed.
The LED acts upon a magnetic switch located along the lower right corner of the inner glass door.

8.4.3 Low Water Status LED

The low water yellow LED indicates when the water-jacket requires additional water. If the low water light is lit, the water-jacket should be filled as soon as possible to avoid uneven heating of the chamber.

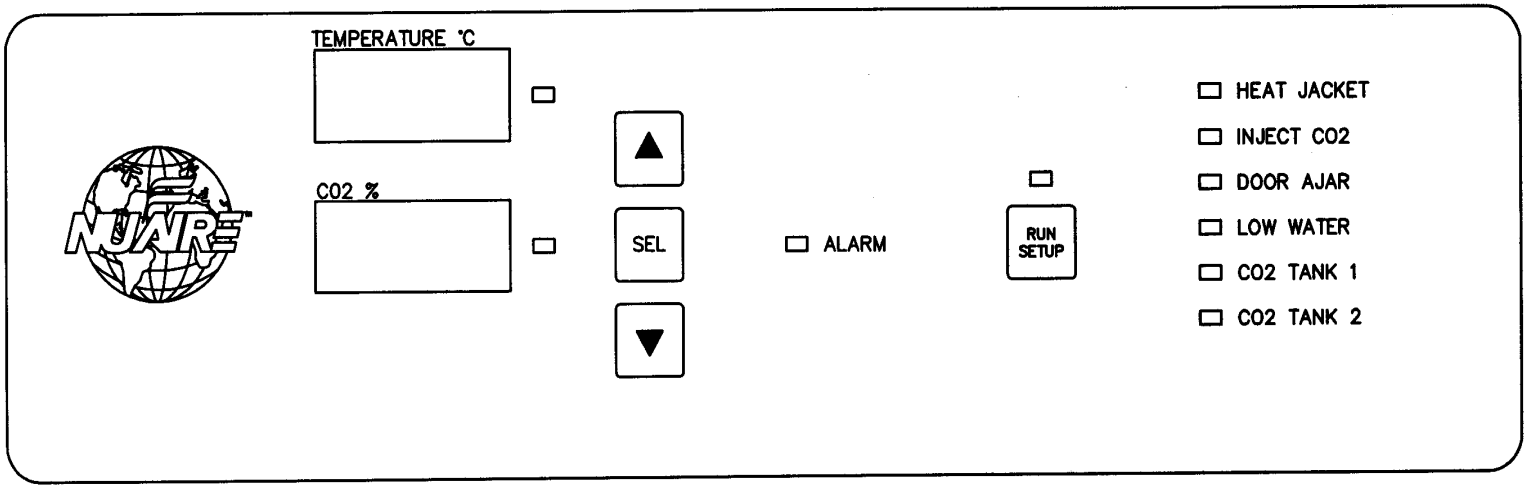
8.4.4 Inject CO_2 Status LED

The control CO_2 green LED indicates when the CO_2 control valve is open and CO_2 is flowing into the chamber.

8.4.5 CO_2 Tank 1 Status LED

The CO_2 tank 1 green LED indicates when the IR Autoflow is consuming CO_2 from tank 1.

REV	ECO	DESCRIPTION	DATE	DRFT	CHKD
A	7858	RELEASE TO PRODUCTION	8/9/00	LS	KCK

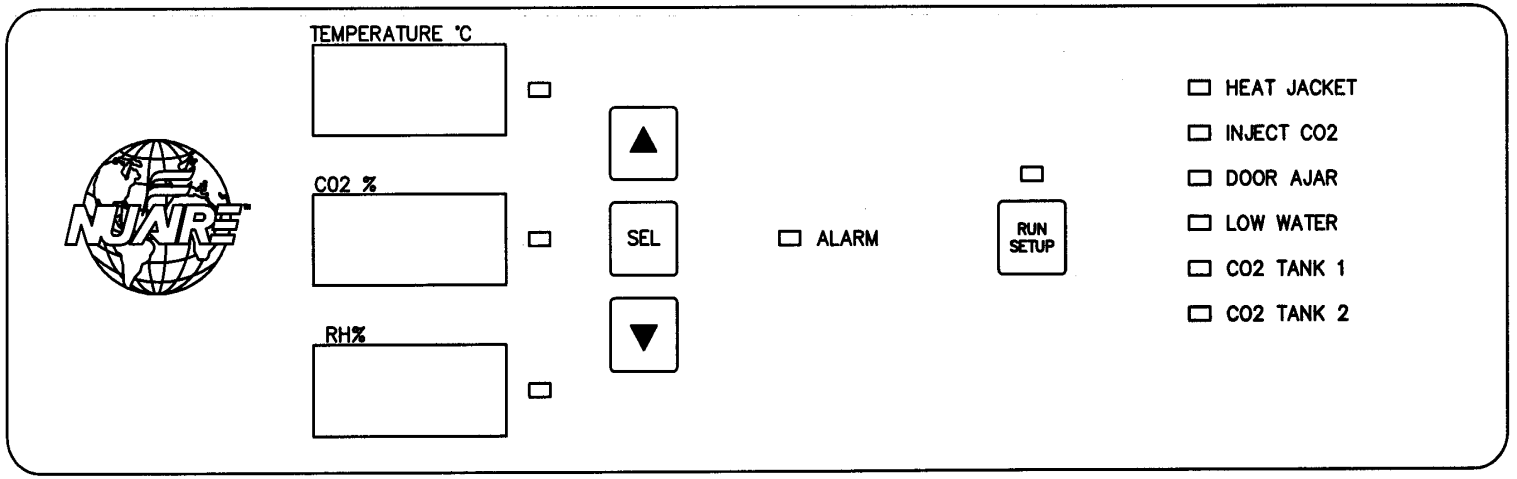


IR INCUBATOR
CONTROL DISPLAY
WITHOUT RH READOUT

DFTM	LS	8/9/00	CHKD	KCK	SHEET 1 OF 1

DRAWING NUMBER BCD-08317 A

REV	ECO	DESCRIPTION	DATE	DRFT	CHKD
A	7858	RELEASE TO PRODUCTION	7/24/00	LS	KCK



IR INCUBATOR
CONTROL DISPLAY

DFTM	LS	7/24/00	CHKD	KCK	SHEET 1 OF 1
DRAWING NUMBER	BCD-08226				A

8.4.6 CO_2 Tank 2 Status LED (Option)

The CO_2 tank 2 yellow LED indicates when the IR Autoflow is consuming CO_2 from tank 2.

8.4.7 Alarm Status LED

The alarm red LED indicates an abnormal status condition. The alarm LED is always accompanied by an additional LED or display that specifies the abnormality. If the Alarm Status LED is on continuously, a catastrophic condition exists. A catastrophic temperature control condition will de-energize the safety relay and cause the chamber to cool below the setpoint. The audible alarm ringback function may be silenced for twenty minutes by pressing any key.

8.4.8 Chamber Sample

The chamber sample port is provided to measure CO_2 percentage manually with a CO_2 Fyrite instrument, or other suitable instrument (see BCD-10401, BCD-10402 for port locations).

8.4.9 Parameter Indicators

The parameter indicators, green LED's, located next to the display indicate the activated parameter being shown in the two or three-digit display. If the parameter indicator is selected, the parameter (i.e. CO_2) value can be increased or decreased by pressing the appropriate arrow key.

8.4.10 **Mode Key** (labeled Run/Setup)

The mode key is used to select the operating mode of the IR Autoflow chamber, Setup or Run.
To initiate Run or Setup, press and hold the mode key for three seconds until the unit changes state.
A green LED above the mode key indicates if the unit is in Run mode (solid LED) or is in Setup mode (blinking LED).

8.4.11 Selection [SEL] & Arrow Keypad ▼▲

The selection and arrow keypad is used for all operator interaction with the system (KEYPAD INPUT SHOULD BE DONE WITH FINGER ONLY, DO NOT USE PENCIL OR SHARP INSTRUMENTS). The "SEL" key is always active, repeated depression of this key causes display of the next value in sequence as listed for the parameter indicators. The arrow keypads are used to input setpoints and access the calibration functions.

8.5 IR Autoflow Rear Panel

The IR Autoflow rear control panel contains the following functions described in detail (see Drawing BCD-08227).

8.5.1 Power Cord

The power cord is 8-feet (2m) in length, type "SVT" molded plug, allowing for long life and easily cleanable.

8.5.2 Circuit Breaker

All control electronics are protected with a circuit breaker that 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 CO_2 Inlet

The CO_2 inlets provide a fitting for clear vinyl tubing. Be sure to follow the recommended inlet pressure to insure proper flow rates and consistent CO_2 percentage readings.

8.5.4 Air Inlet

The incubator is provided with clear vinyl tubing and 0.3 micron HEPA filter.
This is a free air supply, **DO NOT CONNECT** with pressurized source.

8.5.5 RS-232 Communication Interface (Option)

The incubator is provided with RJ-45 telephone type connection for one to one communication interface with a serial printer.

8.5.6 Chart Recorder Outputs (Option)

The Chart Recorder Output board is provided as an option, which allows output signals of temperature, CO_2%, RH%, O_2%. The output signals are conditioned and linearized. There are 3 analog signals to choose from: 0 to 5 VDC, 0-10 VDC, and 4-20 MA. Connection to chart recorder or other monitoring device is via RJ-45 telephone type jack.

8.5.7 Remote Alarm Contacts

The incubator is provided with an RJ-11 telephone type connection to remote alarm device.
See Section 12.0 for details on configuration and connection.

8.5.8 Power Switch

The power switch, located at the top right-hand side of the rear panel, controls all power to the incubator.

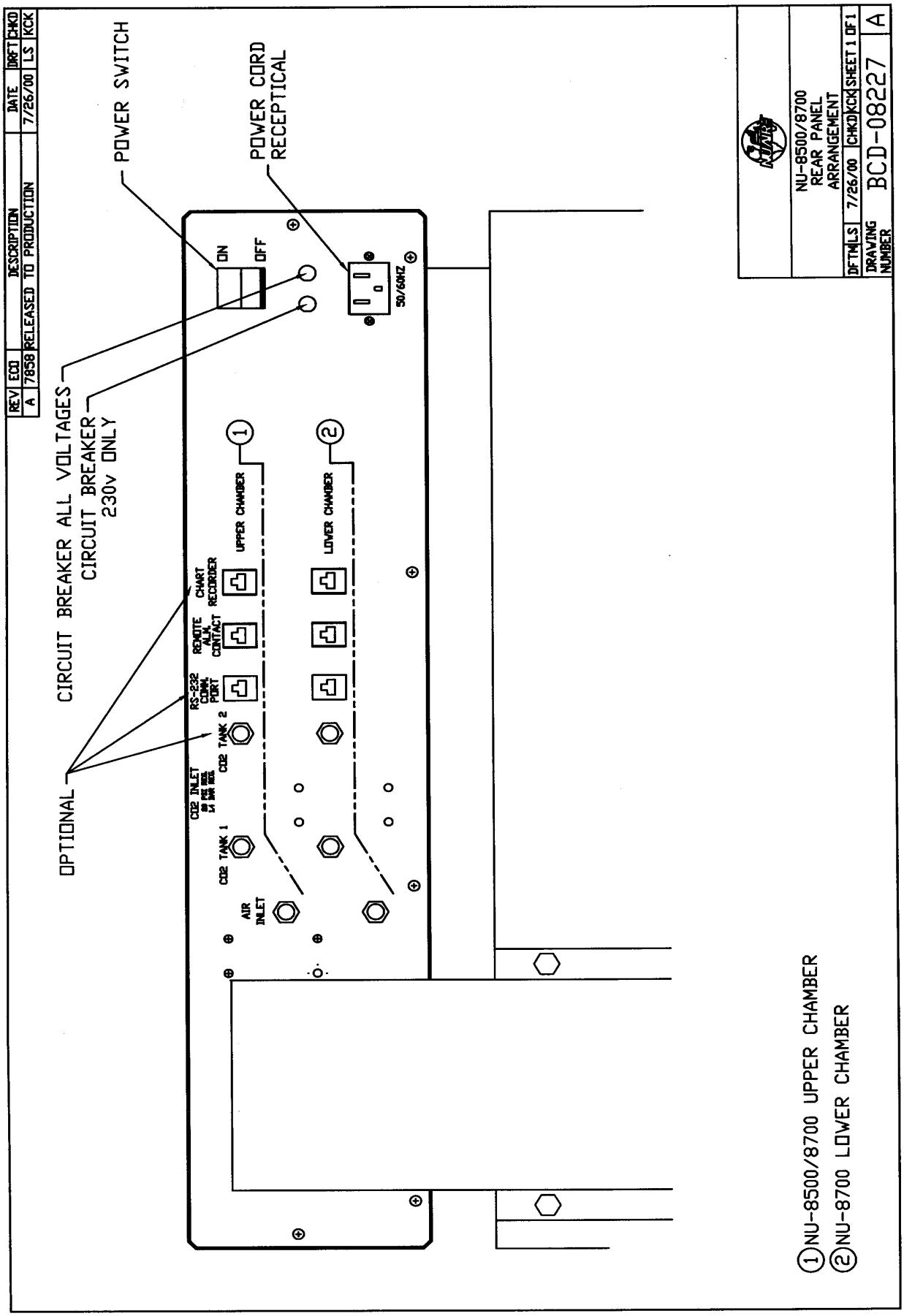
8.5.9 CO_2 Internal Tank Switch (Option)

The internal tank switch is an option which is factory installed at the time of manufacture.
The tank switch performs the critical back-up function of switching tank 1 and tank 2 and back again when each depleted tank is replaced.

8.6 Run Mode Operator Interactions

In general, there is no need for operator interaction in "RUN" mode.
Operator interaction is required to perform calibration functions (see Section 9) or respond to abnormal condition alarms (see Section 11).
If there is an abnormal condition alarm: the green LED next to the parameter display will be blinking, the condition will be displayed in the display window*, and an audible alarm will be beeping. To acknowledge the abnormal condition, press the mode key (labeled RUN - SETUP) for 3 seconds to put the unit into SETUP mode. Press it again for 3 seconds to return to RUN mode. The alarm condition will clear. If the unit alarms again (it will take anywhere from a few seconds to a couple of minutes depending on the alarm condition) this could indicate a catastrophic condition which could harm the tissue or culture cells.

*Please refer to Section 11 to identify and troubleshoot the abnormal condition.


REV ECO DESCRIPTION DATE DRFT CHKD
A 7858 RELEASED TO PRODUCTION 7/26/00 LS KCK
POWER SWITCH
POWER CORD RECEPTICAL
CIRCUIT BREAKER ALL VOLTAGES
CIRCUIT BREAKER 230v ONLY
OPTIONAL
ON
OFF
50/60HZ
UPPER CHAMBER
LOWER CHAMBER
CHART RECORDER
REMOTE ALM. CONTACT
RS-232 COMM. PORT
CO2 TANK 2
CO2 INLET
CO2 TANK 1
AIR INLET
NU-8500/8700 REAR PANEL ARRANGEMENT
DFTM|LS 7/26/00 CHKD|KCK SHEET 1 OF 1
DRAWING NUMBER BCD-08227 A
①NU-8500/8700 UPPER CHAMBER
②NU-8700 LOWER CHAMBER

8.7 Setup Mode Operator Interactions

8.7.1 Chamber Temperature, CO_2%, Humidity Percent

Setpoint values are entered by pressing the "SEL" key until the LED is lit next to the desired parameter indicator. The value of the selected parameter will be shown in the display in the form of "XX.X". To enter a setpoint, perform the following:

Chamber Temperature

- Press and hold mode key for three seconds to Setup.
- Press [SEL] to indicate green LED next to chamber temperature display.
- Press ↑ or ↓ to indicate desired temperature.
- Press mode key back to Run.

CO_2 Percent*

- Press and hold mode key for three seconds to Setup.
- Press [SEL] to indicate green LED next to CO_2 percent display.
- Press ↑ or ↓ to indicate desired CO_2 percent.
- Press mode key back to Run.

Humidity Percent (Optional)

- Press and hold mode key for three seconds to Setup.
- Press [SEL] to indicate green LED next to humidity percent display.
- Press ↑ or ↓ to indicate desired humidity percent.
- Press mode key back to Run.

*Please note: when the CO_2 setpoint is set for 0.0%,
the CO_2 control system is turned off and all alarms are inhibited.

8.8 Diagnostic Interactions

The IR Autoflow has two types of general diagnostic methods, Power-up self-test and Diagnostic Mode tests.

8.8.1 Power-Up Self Test

The power-up self-test is comprised of the following sequential tests:

1) Turns on all LED and all segments of the display for a few seconds.
2) Tests all main control board memory.
3) Verifies its non-volatile memory (EEPROM) and displays the current version of program.
4) All the displays will blink until either the mode key is pressed to Setup and back to Run, or the [SEL] key is pressed.

8.8.2 Diagnostic Mode Tests

The Diagnostic Mode allows the operator to configure and/or check the incubator for input/output signals manually and individually. The diagnostic mode has three menus to select from that are the following:

- Tst - test output parameters
- Opt - option configuration parameters
- Rst - reset, master

To initiate the diagnostic mode, perform the following:

a) Press and hold Hidden key (flag on NuAire logo) for four seconds (in either Run or Setup mode), the temperature display will indicate the first menu "tst"
b) To advance to second menu, press ↑ key, temp. display will indicate "opt"
c) To advance to the third menu, press ↑ key, temp. display will indicate "rst".
d) To repeat the menus, continue to press the ↑ which will advance the menus in a round robin fashion.
e) To enter to desired menu, press the SEL key while desired menu is indicated on temp. display.

The "tst" and "opt" menus each have several function parameters as described below. The "rst" menu performs a master reset function which clears the microprocessor's memory and resets all parameters to their default conditions.

To enter the function parameters, press the SEL key while the temp. display indicates the desired menu. Then, while in the menu, press SEL key to advance through the function parameters, again, in a round robin fashion. Once in the desired function parameter, press the ↑ or ↓ key to alter or toggle on/off. To exit the diagnostic mode at any time, press the Hidden key several times.

8.8.3 Test Output Parameters

1. All Lights — Display/LED Test
2. SAF — -Safety Relay (**yes**/no)
3. CHt — -Chamber Temp. Sensor (**0**,25,50,75,100)
4. SFt — -Safety Temp. Sensor (**0**,25,50,75,100)
5. CO2 — -CO_2 Inject Valve (on/**off**)
6. P 12 — -Power Supply Regulated +12 VDC
7. - 12 — -Power Supply Regulated -12 VDC
8. rH — -RH Display Status (optional)
9. Ct2 — -CO_2 Tank 2 Valve (on/**off**)
10. dor — -Door Heater (**0**, 25, 50, 75, 100)
11. Air — -Air Inject Valve (on/**off**)
12. ALr — -Alarm Relay (on/**off**)

(Note: Default values are in bold)

Once you have made your menu selection, you will remain within that menu selection until you exit the diagnostic mode. If another menu selection is desired, you must re-enter the diagnostic mode via the hidden key.

To exit the function parameters, press the hidden key (flag on NuAire logo). The following is a description of each function parameter.

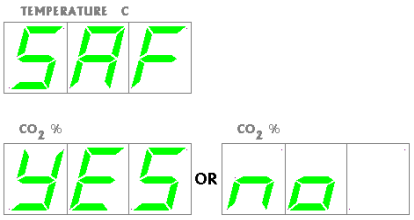
FUNCTION DESCRIPTION | **READOUT DISPLAYED**

Note: / - Indicates alternating displays
or *- Indicates displays you can choose*

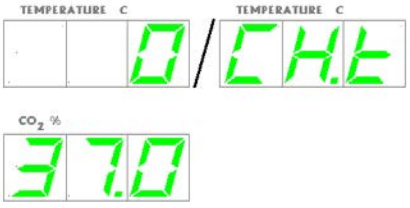
1. *Display/LED Test*
   This function will turn all individual LED's and value segments on, sequentially turn them all off and repeat the sequence until another function is selected.

   All Lights

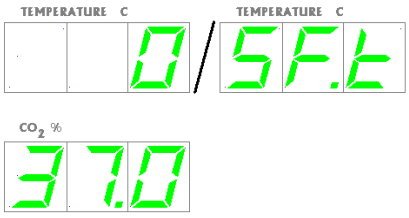
2. *Safety Relay*
   This function shows the current state of the safety relay. The CO_2 percent display will show "yes" or "no" corresponding to the relay condition.



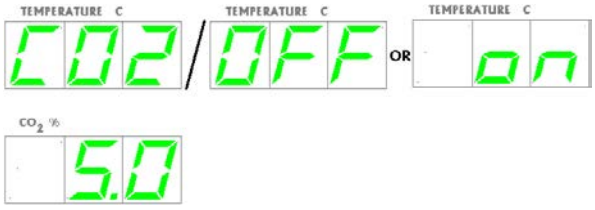
3. *Chamber Temperature Sensor*
   This function shows the current value of the chamber temperature sensor on the CO_2 display. This function also allows the jacket heater to be turned on at different percentages (0, 25, 50, 75,100) shown in the temperature display alternating with the function symbol characters (function 2 – Safety Relay should be "NO" to force heater output).



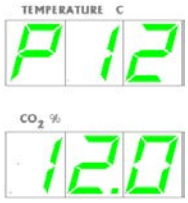
4. *Safety Temperature Sensor*
   This function shows the current value of the water jacket temperature sensor on the temperature display. This function also allows the jacket heater to be turned on at different percentages (0, 25, 50, 75,100) alternating with the function symbol characters temperature (function 2 – Safety Relay should be "NO" to force heater output).



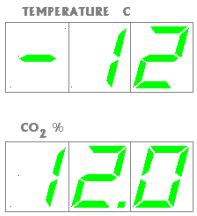
5. *CO_2 Inject Valve (Also shows CO_2%)*
   This function shows the current state of the CO_2 inject valve alternating with the function symbol characters in the temperature display. The CO_2 percent display will show the current level of CO_2 in the chamber.



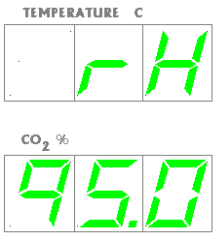
6. *Power Supply Regulated +12 VDC*
   This function shows the current state of the regulated +12 VDC power supply.



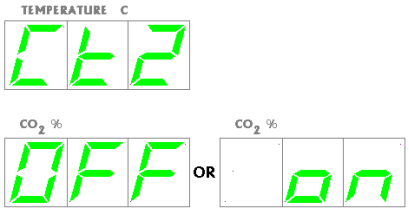
7. *Power Supply Regulated -12 VDC*
   This function shows the current state of the regulated -12 VDC power supply.



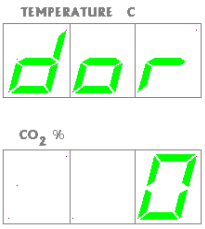
8. *RH Display Status*
   Shows chamber RH percent in CO_2% display.
   Not applicable for models without RH display option.



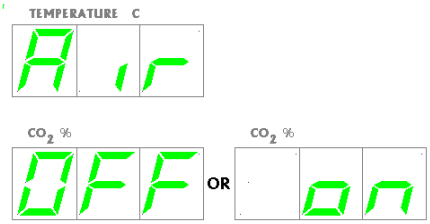
9. *CO_2 Tank 2 Valve*
   This function shows the current state of the CO_2 tank 2 valve. The CO_2 percent display will show “on” or “off” corresponding to the valve condition.



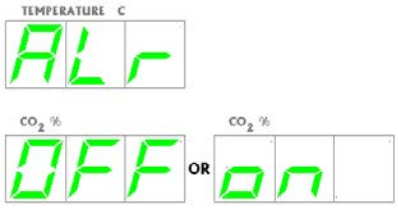
10. *Door Heater*
    This function shows the current state of the door heater. This function also allows the door heater to be turned on at Different percentages (0, 25, 50, 75,100).
    (Function 2 - Safety Relay should be “NO” to force heater output)



11. *Air Inject Valve*
    This function shows the current state of the air inject valve. The CO_2 percent display will show “on” or “off” corresponding to the valve condition.



Alarm Relay
This function shows the current state of the alarm relay.
The CO_2 percent display will show “on” or “off” corresponding to the relay condition.



8.8.4 Option Configuration Parameters (Note: Default values are in bold)

			Min	Max	Current
1.	CO2	-CO_2 System Enable (**on**/off)	N/A	N/A	
2.	C.2t	-CO_2 Tank 2 Enable (on/**off**)	N/A	N/A	
3.	C.AS	-CO_2 Auto Switch Back (on/**off**)	N/A	N/A	
4.	C.SC	-Closed Door CO_2 Zero/Span Calibration (on/**off**)	N/A	N/A	
5.	H2O	-RH System Enable (on/**off**)	N/A	N/A	
6.	PAS	-Password (on/**off**)	N/A	N/A	
7.	C.dd	-CO_2 Display Delay (**on**/off)	N/A	N/A	
8.	AAE	-Alarm Audible Enable (**on**/off)	N/A	N/A	
9.	At.O	-Auto Zero (**on**/off)	N/A	N/A	
10.	dor/dLY	-Door Heater Delay Time (seconds/**45**)	2	240	
11.	C2.i/dL.Y	-CO_2 Inject Delay Time (seconds/**45**)	2	240	
12.	Air/inJ	-Air Inject Time (seconds/**30**)	0	999	
13.	Air/CYL	-Air Inject Cycle (minutes/**10**)	1	999	
14.	Prt/int	-Print Frequency Time (minutes/**0**)	0	999	
15.	CHt/to	-Temperature Time Out (min/**360**)	1	999	
16.	CO2/to	-CO_2 Time Out (min/**30**)	1	999	
17.	H2O/to	-RH Time Out (optional) (min/**240**)	1	999	
18.	SAF/dif	-Temp. Sensor Differential (°C/**6.0**)	0.5	20.0	
19.	CHt/ALr	-Temp. Max. Above Setpoint (°C/**1.0**)	0.5	10.0	
20.	CO2/ALr	-CO_2 Max. Above Setpoint (%/**1.0**)	0.5	10.0	

Once you have made your menu selection, you will remain within that menu selection until you exit the diagnostic mode. If another menu selection is desired, you must re-enter the diagnostic mode via the hidden key.

To exit the function parameters, press the hidden key (flag on NuAire logo). Following is a description of each control parameter.

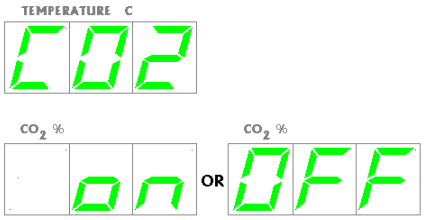
FUNCTION DESCRIPTION

READOUT DISPLAYED

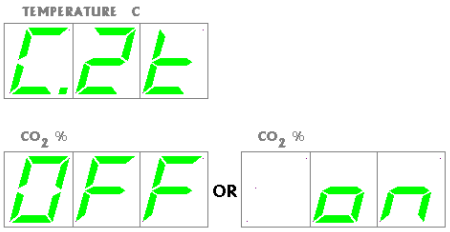
Note: **/** *- Indicates alternating displays*

or *- Indicates displays you can choose*

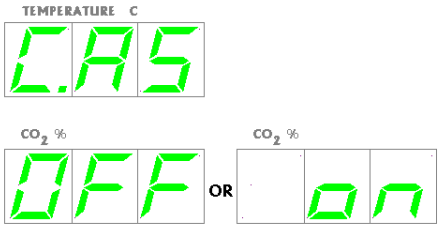
1. *CO_2 System Enable*
   This function will enable or disable the CO_2 system. The value display will show “on” or “off” corresponding to the current condition. In Run mode, the CO_2 percent display will indicate either the CO_2 percent when the system is on, or blank when the system is off.



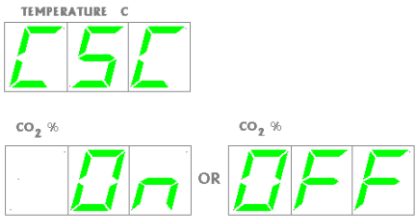
2. *CO_2 Tank 2 Enable (option)*
   This function will enable or disable the optional CO_2 tank 2 system. The value displayed will show “on” or “off” corresponding to the current condition.



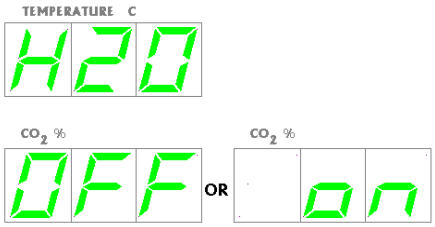
3. *CO_2 Tank Auto Switch Back (Option)*
   Note function can only be enabled with CO_2 tank 2 option in use. Unit will automatically check tank 1 for gas pressure every 12 hours, and switch back if present.



4. *Closed Door CO_2 Zero/Span Calibration*
   This option enables user to run zero & span calibration on the CO_2 sensor with out opening the incubator door. (See section 9.4.2).



5. *RH System Enable*
   This function will enable or disable the optional RH display system. The value display will show “on” or “off” corresponding to the current condition. In Run mode, the RH percent display will indicate either the RH percent when the system is on or blank when the system is off.



6. *Password*

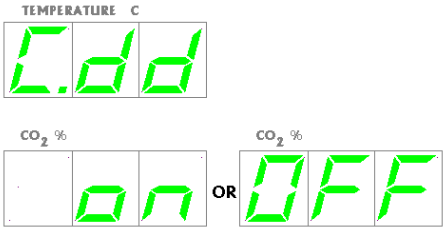
This function allows users to disable/enable password to prevent unauthorized change of setpoint using Up, Down and Select keys combination. Password requires three digits. If the password option is enabled, whenever 'SETUP' key is pressed, the password will be required. Every time the password option is disabled and re-enabled, the old password is cleared and new password will be required.

To set password:

- Press Hidden key to enter option menu.
- Press ↑ to advance to "opt".
- Press [SEL] several times to advance to "Pass"
- Press ↑ to enable option, "ON".
- Press Hidden key twice to exit option menu
- Enter your password,
  when Front panel message displays 'Ent – Pas".
- Re- Enter your password, when Front panel message displays 'Pas – rEO'
- Press Mode key to Setup, then back to Run to set.

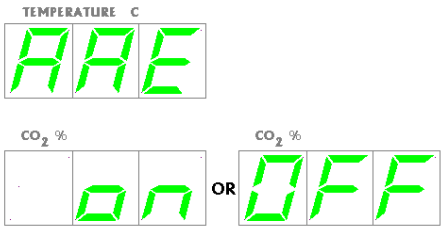
7. *CO_2 Display Delay*

This function delays the CO_2 display after a door opening for a period of twenty minutes. This function will not inhibit the CO_2 alarm system.



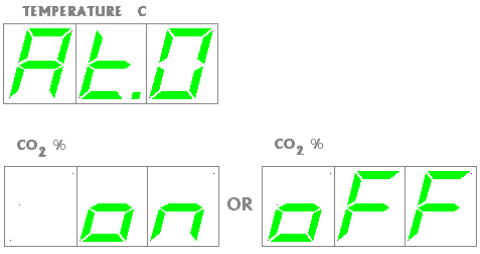
8. *Audible Alarm Enable*

This function will enable or disable the audible alarm ringback function. The value display will show "ON" or "OFF" corresponding to the current condition. If the function is "ON", the audible alarm will provide a ringback of the alarm condition. If the user pushes any key to silence the audible alarm, after 15 minutes of silence the audible alarm will return. If the function is "OFF", the ringback of the alarm condition will never come back after the user pushes a key to silence the audible alarm.



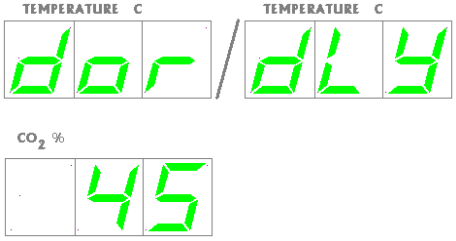
9. *Auto Zero Enable*

This function turns the CO_2 automatic zeroing routine on and off. Default on.



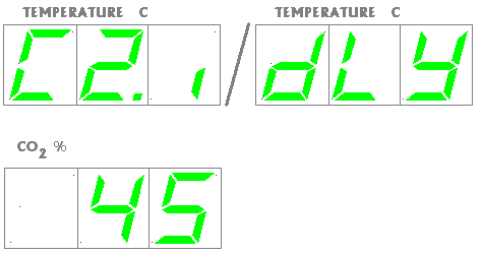
10. *Door Delay Time*

This value determines the time, in seconds, to turn on the door heater to a 100 percent duty cycle after an inner glass door opening and delay before gas injection.



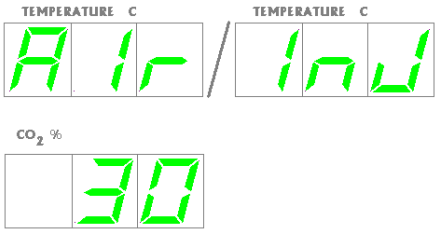
11. *CO_2 Inject Delay Time*

This value specifies the time, in seconds, for an injection of CO_2 to be measurable at the sensor. When CO_2 is injected into the chamber, the system delays until this period has elapsed before making a new control decision. In this manner tubing induced delays do not cause the CO_2 system to overshoot the control setpoint. The CO_2 inject delay time prevents CO_2 overshoot during the CO_2 inject process.



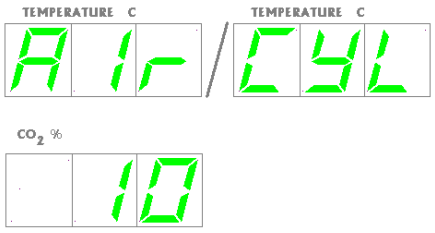
12 *Air Inject Time*

This value specifies the time, in seconds, for an injection of air into the chamber.



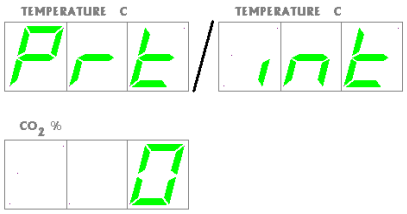
13. *Air Inject Cycle Time*

This value specifies the time, in minutes, the frequency of the air inject cycle.



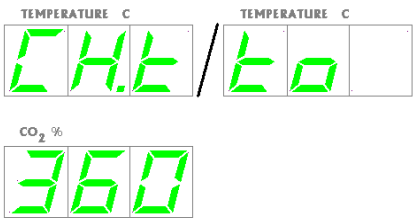
14. *Print Frequency Time (Option)*

This parameter specifies the frequency, in minutes, that lines are to be printed on a status report. If the frequency is specified as zero, no report will be printed.



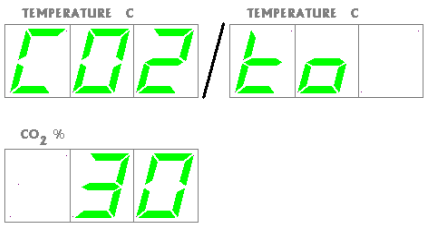
15. *Temperature Time Out*

This value determines the time, in minutes, for the temperature to achieve setpoint. If the temperature doesn't increase to within 0.2% of setpoint within this time period, an alarm condition is declared.

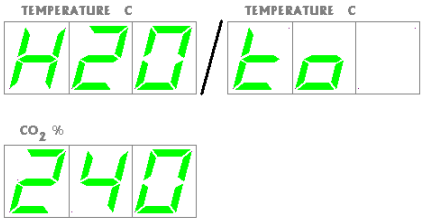


16. *CO_2 Time Out*

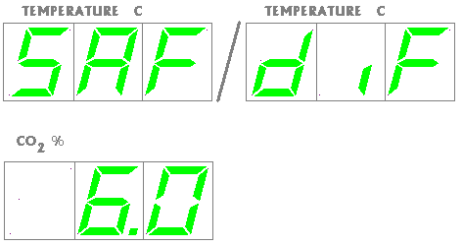
This value determines the time, in minutes, for the CO_2 percentage to achieve setpoint. If the CO_2 percentage doesn't increase to within 0.2% of setpoint within this time period, an alarm condition is declared.



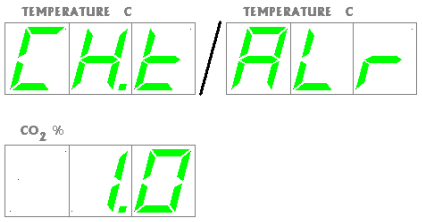
17. *RH Time Out (Optional)*
This value determines the time, in minutes, for the RH percentage to achieve setpoint. If the RH percentage doesn't increase to within 3% of setpoint within this time period, an alarm condition is declared.



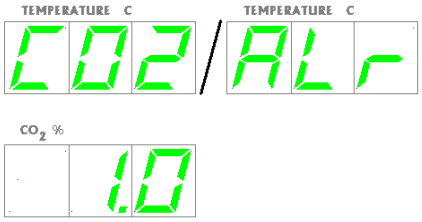
18. *Temperature Sensor Differential*
This value specifies a maximum differential, measured in temperature (°C) that the two temperature sensors may deviate from one another or from the last read value. If this differential is exceeded, a warning LED is shown, and an alarm condition is declared. An alarm 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.



19. *Temperature Maximum above Setpoint*
This value determines the maximum deviation, measured in temperature (°C) that the chamber is permitted above once the incubator reaches the specified setpoint 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.



20. *CO_2 Maximum above Setpoint*
This value determines the maximum deviation, measured in CO_2 percent (%) that the chamber is permitted above once the incubator reaches the specified setpoint before an alarm condition is declared.



8.8.5 Reset, Master

The master reset diagnosis 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 AND CONFIGURATION OPTIONS WILL BE LOST. ALL CURRENT RUN PARAMETERS WILL BE RESET TO DEFAULT VALUES.**

To perform a master reset, follow the steps below:

- Press and hold Hidden key for four seconds (in either Run or Setup mode), the temperature display will indicate the first menu "tst".
- Press ↑ key, temp. display will indicate "opt".
- Press ↑ key, temp. display will indicate "rst".
- Press [SEL] key two times to initiate the reset process. Once the master reset process is complete, the unit will reset into the Setup mode.

All calibration will need to be performed following a master reset. Default control parameters after master reset are 37 ^{o}C (temperature), and 5% (CO_2).

RH System Enable:

- Press Hidden key to enter option menu.
- Press ↑ to advance to “opt”.
- Press [SEL] several times to advance to “H2O”
- Press ↓ to enable system, “ON”.
- Press Hidden key twice to exit option menu.
- Change default setpoint (95%) if necessary.

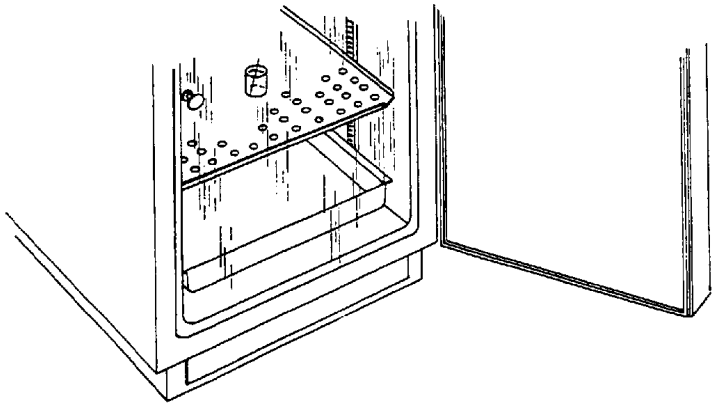
9.0 Calibration

Proper calibration of the IR Autoflow involves four parameters: chamber temperature, door temperature, CO_2 sensor & humidity. The first two, chamber and door temperature, should be completed and stabilized before any CO_2/humidity sensor calibration is performed. 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 procedures again from the start.

9.1 Chamber Temperature Calibration

The IR Autoflow's TEMPERATURE CALIBRATION MUST BE PERFORMED WITHIN 1°C OF THE PLANNED OPERATING TEMPERATURE. Normally, 37.0°C is the most common setpoint. To initiate the procedure, turn on the IR Autoflow via the power switch on the back panel. Press the mode key until the unit goes into setup mode to check the temperature value parameter for your planned operating temperature and change if necessary. Press the mode key again until the unit switches back to Run and let stabilize for 8 to 12 hours.

At the beginning of this procedure, set a mercury glass thermometer in a glass beaker filled with water resting on a shelf in the middle of the IR Autoflow chamber. Do not place the glass beaker on the bottom of the chamber because it will result in a slightly higher temperature due to the heater pan being located just below the chamber bottom. Placing the thermometer in a glass beaker on the middle shelf will give the most accurate results for calibration. 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 thermo couple could also be used.



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

- Make sure unit is in Run mode, green LED above the mode key should be on solid.
- Press [SEL] to indicate green LED next to temperature display.
- Press and hold ↑ key for four seconds,
  temperature display alternates between "Adj" and the current temperature.
- Press ↑ or ↓ key to indicate same temperature as thermometer.
- Press [SEL] key to complete calibration.

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 Temperature Calibration

This calibration is provided to control condensation on the inner glass door and help maintain chamber temperature uniformity over the range of ambient temperatures and chamber temperature set-points that the Incubator is designed to handle. The door heater operates on a duty cycle that is a percentage of the time that the heater is turned on. The duty cycle ranges from 0% which is “off” to 100% which is “on” continuously. The default setting for the door heater duty cycle is 45%. This setting should prevent excessive condensation from forming on the glass door in most cases when the Incubator is at default temperature (37.0°C) in a lab ambient of approximately 22.0°C. Typically, 40 to 60 percent is the most effective duty cycle range for this set of conditions if adjustment is required. The duty cycle can be adjusted up or down in as little as 1% increments to obtain the chamber temperature uniformity desired with in the specification published in section 3.3.

Adjustments for Lab Ambient Temperatures

The door temperature calibration has an inverse relationship with changes in the ambient temperature. At a constant chamber temperature the duty cycle percentage would be increased as the lab ambient temperature decreases and would be decreased as the ambient increases. This applies as long as the ambient temperature is below the chamber temperature set-point in accordance with the specifications published in sections 3.3 (Temperature set-point) and 13 (Ambient Temperature Range).

Adjustments for Chamber Temperature Set-Points

The door temperature calibration has a direct relationship with the temperature set-point of the Incubator. In a constant ambient temperature the duty cycle percentage would be increased as the Incubator temperature set-point is increased and is decreased when it is decreased. Here, like the changes for ambient temperature, the more the chamber temperature is above the ambient the higher the door duty cycle needs to be set.

Indications that Calibration is Needed

No matter why the calibration is needed, excessive fogging or condensation forming on the inner glass door is an indication that the door heater duty cycle should be increased. Excessive fogging or condensation forming on the sides and/or back wall of the chamber indicates the door duty cycle should be reduced. Be sure to wipe the fog/condensation off each time it is found. Due to the high humidity level in the chamber the condensation will not dissipate quickly enough to determine if the duty cycle change is correct. If there is enough condensation it will contribute to the problem.

Performing the Calibration

The calibration is best accomplished by running the incubator for at least 24 hours between adjustments to settings with the chamber humidified. Perform the following calibration sequence, if required. Open the 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 indicates a properly calibrated door heater. Typically, no condensation should form on the inner chamber next to the glass door. However, if calibration is required, simply perform the procedure as stated below. If condensation persists see section 9.3 on increasing air injections to help control the condensation.

CAUTION: Adjust the door heater duty cycle in small increments.
A maximum adjustment of 5% at a time either up or down is recommended.
If duty cycle is adjusted too much, it will cause condensation to form elsewhere in the chamber.

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, press "SEL" to indicate LED next to temperature display.
- Press and hold ▲ and ▼ keys simultaneously for three seconds.
  Temperature display shows "dor" and the duty cycle percentage.
- Press ▲ or ▼ key to desired "dor" duty cycle percentage.
  A maximum adjustment of 5% should be made at a time.
- Press "SEL" to set current value and return to run mode.

9.2.1 Door heater duty cycle automatic control

The door duty cycle is automatically reduced when the room temperature in the lab increases enough to allow the contribution from this heater to overheat the chamber. For example, if the door duty cycle is set up when the room temperature is 22ºC and the room temperature is allowed to increase to 27ºC. Less heat is required to keep the chamber at set point. If the chamber starts to overheat, the door duty cycle will be reduced at a rate of 1% per minute starting when the chamber temperature is 0.2ºC above set point. The duty cycle will continue to be reduced until the chamber temperature returns to set point. The duty cycle is continuously monitored and will be increased slowly again, as long as the chamber temperature does not go over the set point. If the room ambient reduces back to 22ºC, the door duty cycle will actually be returned to the original setting.

Note: If it is known that the lab room temperature where the incubator is installed will vary significantly. (For example, the heating or air conditioning is shut off after work hours or there is no air conditioning and the room has large temperature swings.) The door duty cycle should be set up in the lower temperature expected in the lab. Then the door heater will automatically be adjusted to avoid over temperature conditions in the chamber when the room temperature rises. In this case the chamber should be monitored for condensation regularly. If the chamber walls and ceiling start to get excessive condensation, the door heater duty cycle setting will need to be reduced. Do not adjust the duty cycle setting by more than 5% at a time.

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 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 "Opt" menu. The default is 30-second injections every 10 minutes. Start by increasing the length of the injection by a few seconds at a time then increase the frequency if needed.

9.4 CO_2 Calibration

The Autoflow infrared CO_2 sensor may be calibrated using one of three techniques: CO_2 control, CO_2 sensor and CO_2 injection calibration. The CO_2 control and CO_2 injection calibration procedure are easily performed on the front panel similar to the temperature offset requiring no tools. The CO_2 sensor internal procedure is more in depth requiring approximately 15 minutes to perform.

9.4.1 CO_2 Control Calibration

CO_2 Control Calibration can be performed anytime an independent measurement doesn't correlate to the front panel display. However, this calibration SHOULD NOT BE PERFORMED MORE THAN ONCE PER WEEK. Sensor calibration should be performed if an independent measurement doesn't match the display within $\pm$0.3 percent within one week after a sensor calibration. Before doing the following calibration, check and change, if necessary, the incubator in-line filter found within the control center and the CO_2 gas line filter found outside the back of the incubator.

When unit has stabilized at the operational temperature and CO_2 percentage, take an independent measurement and, if necessary, perform the following:

- In run mode press "SEL" to indicate LED next to CO_2 percent display.
- Press and hold ▲ key, CO_2 display alternates between “ADJ” and the CO_2 percentage.
- Press both ▲ and ▼ keys simultaneously, (clears all previous offsets).
- Use an independent instrument to determine actual CO_2 percentage (compare the display CO_2 value to the independent measurement). If these two readings have a difference of less than 1.0 percent, proceed to the next step in this routine. (See * **Note** below) If the difference is greater than 1.0 percent, proceed to CO_2 sensor zero/span calibration.
- Press ▲ or ▼ key to indicate same CO_2 percentage as the independent measurement.
- Press "SEL" to set current value and exit calibration.

*__Note__: When the display value is more that 0.3% different from the measured value, offset display 1/2 the difference measured. Allow the incubator to stabilize back to set point, then measure the CO_2 in the chamber again. Offset the display again if necessary.

9.4.2 CO_2 Sensor Calibration (Zero/Span)

There are 2 sensor (zero/span) calibration routines available to the lab professional. The first option is the "open door" routine involving opening the outer and inner door to zero the sensor. This routine also automatically calibrates to the CO_2 injection rate during the injection for the span portion of the sensor calibration. It is recommended that this routine be used during the initial setup of the incubator, if the set point of the system is changed or if other changes are made on the incubator affecting the CO_2 system. The second option is a "closed door" routine. This routine allows calibration of the sensor with out opening the door avoiding undue exposure to the cultures that may be in process. This routine injects "fresh air" into the detector head of the sensor to calibrate zero. The chamber air is then allowed back into the detector head to calibrate the gas span that is detected. The closed-door routine option is activated through the Options menu and must be turned off to use the open door routine.

<u>OPEN DOOR CO_2 SENSOR CALIBRATION ROUTINE</u> (Default CO_2 calibration routine):
Zero calibration

- Make sure unit is in Run mode, the green LED above the mode key should be on and not blinking.
- Press the "SEL" key to indicate the LED next to the CO_2 display.
- Open the inner and outer doors then push the ▼ until "dor" appears in the temperature display: When "dor" starts flashing after 90 seconds close the doors.
- Display shows old value if other than zero then zeros out.

Note: If the value in the display is greater than 0.2 prior to the display zeroing, run the calibration routine again to ensure a proper zero was achieved.

The CO_2 display will show the following in order:

Span Calibration

"INJ" alternating w/value: Shows right after the door is closed from the zero calibration. The unit injects CO_2 targeting the selected set point.

"DLY" alternating w/value: Shows for 90 seconds to indicate the delay to give CO_2 time to mix in chamber.

"SPn" alternating w/value: Indicates the span value shown in the display is ready for verification. Measure chamber CO_2 at sample port on the front panel with an independent instrument. Change display value to match this measurement using "▲▼".

Press mode key to switch to Set up then back to Run to lock in value and go back to normal running mode.

Note: The CaL inject rate is automatically calculated from the CO_2 injection made during the span calibration making it unnecessary to run the separate "CAL InJection" 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.

<u>CLOSED DOOR SENSOR CALIBRATION ROUTINE</u> (Default "OFF" see section 8.8.4 item 4):
Activating the routine

- Press logo key until tSt flashes in display then press ▲ to select the OPt menu.
- Press "SEL" until C.SC appears in the display.
- Press the ▲to turn this option on and shut off the open door routine.
- Press the logo key to return to run.

Note: Turning off this routine will reactivate the "open door" calibration routine.

Zero Calibration

- Make sure unit is in Run mode, the green LED above the mode key should be on and not blinking.
- Press the "SEL" key to indicate the LED next to the CO_2 display.
- Press the ▼ until "ZEr/value" alternate in the display:
  Air is being pumped through the sensor to confirm the sensor zero value.
  After 45 seconds the display is automatically zeroed and the span portion of the routine is started.

Note: If the value in the display is greater than 0.2 prior to the display zeroing, run the calibration routine again to ensure a proper zero was achieved.

The CO_2 display will show the following in order:

Span Calibration

"DLY" alternating w/value: Shows for 90 seconds to indicate the delay to give CO_2 from the chamber time to reenter the detector head and get an accurate reading.

"SPn" alternating w/value: Indicates the span value shown in the display is ready for verification. Measure chamber CO_2 at sample port on the front panel with an independent instrument. Change display value to match this measurement using either "▲▼".

Press mode key to switch SETUP then back to RUN to lock in value and go back to normal running mode.

Note: When the span measurement is greater than the setpoint, open the door briefly to remove the excess CO_2.

Allow unit to run and stabilize for a minimum of 2 hours then, check calibration with an independent instrument. Compare the display CO_2 percent to your independent measurement. If these two readings have a difference greater than 0.3%, repeat above procedure. If these two readings have a difference of less than 0.3%, perform the CO_2 control calibration procedure in Section 9.4.1.

9.4.3 CO_2 Injection Calibration

The CO_2 injection calibration can be performed separately from zero/span calibration to optimize the gas injection time required to recover the CO_2 level to set point after a door opening. The recovery time should be as minimal as possible with virtually no overshoot. CO_2 injection calibration should be performed only after a CO_2 sensor closed door calibration. CO_2 injection calibration should also be performed anytime the CO_2 supply pressure to the incubator is changed, or if the CO_2 flow control valve on the back panel is disturbed.

The following steps should be taken for the CO_2 injection calibration:

- Press "SEL" to indicate LED next to CO_2 percent display.
- Press and hold ▲and ▼ keys simultaneously for three seconds. "CAL" and current indicated CO_2% will blink.
- Open door for at least 1 minute to evacuate the CO_2 from the chamber. The value on the display should be below 1% before closing the door to continue the routine
- Press and hold ▲ and ▼ keys simultaneously again to start auto calibration procedure.
- Observe display, which will indicate the following sequence:
  a) dLY -Wait for door delay, prior inject delay, temp. in range.
  b) INJ - Inject CO_2 for fixed time period according to the set point
  c) dLY - Wait for post inject diffusion.
  d) End - Done with Calibration
- Press "SEL" to set current value and exit calibration.
- If necessary, open glass door to vent excess gas.

9.4.4 CO_2 System Auto Zero Calibration Function

This Incubator is programmed to automatically check and adjust the zero calibration of the CO_2 sensor. HEPA filtered room air is pumped through the sensor detector cell for 2 minutes. The CO_2 reading is checked at this time. If it 0.5% or less different than the current zero the sensor will use the new value as zero. When the value is greater than $\pm$ 0.5%, the auto zero routine is aborted and an ACF alarm is sounded. See Section 11.0 on Trouble Shooting for responses to this alarm.

The auto zero routine is scheduled to be initiated 12 hours after the Incubator is turned on and then every 24 hours thereafter. This timing is structured to run the auto zero routine daily at a time that would be considered "off hours". The timer for this routine can be reset at any time by simply turning the Incubator off then back on. Power failures will reset the timer.

This routine is essentially transparent to the operation of the Incubator and the factory supplied options like the chart recorder or the printer outputs while it is running. After the routine is done the CO_2 level will be reduced by about 0.2% to 1.0% depending on the amount of air that has be injected to perform the routine. The routine can run as long as 7 minutes because it will try to perform the zero function up to 5 times before declaring an “ACF” alarm. If any calibrations are attempted during this routine "SLF" shows in the display and the calibration is inhibited until the routine is complete. An independent monitoring system will record a minor shift in CO_2, the RH option and temperature during the routine. This happens because the air injected into the sensor, during the purge and while the sensor is performing the zero function, is passed into the chamber.
This routine compensates for minor shifts in zero due to electronic drift. Regularly scheduled checks of the calibration by an independent instrument must still be performed.

9.5 To abort the Auto Zero routine open the inner glass door and close it again.

9.6 Relative Humidity Calibration (Optional)

Relative humidity calibration can be performed anytime if the relative humidity display option has been installed. The relative humidity sensor can be calibrated from a known source of humidity within the incubator chamber. Typically, the water pan is used because it has a known level of about 96 percent within 12 hours after installing and filling the water pan.

When the unit is stabilized at the operational temperature, CO_2 percentage, and the water pan is in place, perform the following calibration procedure:

- Press mode switch to Run.
- Press [SEL] to indicate green LED next to RH display
- Press and hold ↑ key for four seconds, RH display alternates between “ADJ” and the RH percentage.
- Press ↑ or ↓ key to indicate same RH% as independent hygrometer
- Press [SEL] key to indicate calibration

Note: If there is excessive condensation forming on the chamber wall, (top or bottom) check the following conditions to correct this issue:

a. The door heater duty cycle may be set too high. Follow the instructions in Section 9.2 to reduce it. Remember to adjust the door heat in small increments up or down. A change of 5% at a time would be a maximum change recommended. Wipe down the walls between each adjustment and monitor for 24 hours before making further adjustments.
b. Is the incubator installed too close to an air supply duct or in moving air? Diffuse the air supply duct so that is doesn’t blow on the incubator or block the moving air. The incubator needs an environment that will allow it to dissipate heat evenly.
c. Not enough air is being injected into the chamber. Change the air inject cycle as described in Section 8.8.4 (option configuration parameters). This will aid in reducing the condensation. It is recommended to increase the frequency of the injections in small increments to begin with.

10.0 Maintaining Your IR Autoflow

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

IR Autoflow Water-Jacket

The water-jacket requires no anti-bacterial agents. The IR Autoflow already incorporates a copper tube producing copper sulfate which eliminates bacterial growth within the water-jacket. **DO NOT USE ANY CHLORINATED OR HALOGEN MATERIALS IN THE WATER-JACKET.**

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

- **CO_2 Supply***
  The CO_2 supply filter should be replaced every fifth empty CO_2 tank or when the filter is visibly discolored (yellow brown).
- **Air Inlet***
  The air inlet filter is located on the back panel. The purpose of the filter is to cleanse the room air, which is drawn into the chamber via the pump during the air inject cycles, assuring the proper amount of oxygen is available to the cultures. The air inlet filter should be replaced every three to six months or when visibly discolored.

P/N X-980398-02 (Capsule, Uni-Directional In-Line, Wet)

- **Air Pump Filter**
  The CO_2 sensor filter should be replaced EVERY TWO YEARS to assure optimum performance. A visual check should be performed during CO_2 sensor calibration to assure filter integrity. Remove sensor housing cover to perform visual check. Outlet port is on flat top side.

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

- **CO_2 Sensor***
  Should be changed when discolored (yellow brown). Is plumbed to the CO_2 sensor 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 ring of the body indicates the inlet side of the filter and should be installed toward the gas supply.

RH Sensor (Optional) Care and Cleaning

CAUTION: Do not spray cleaner / disinfectant directly on the filter cap or the sensor (inside the filter housing under the filter cap). Some cleaners may damage this sensor.

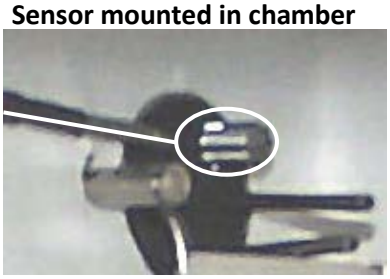
NOTE: If the sensor (inside of the housing) is exposed to any type of liquid it will not function properly until it is dry again. Any method other than air drying might also damage the sensor.

Remove sensor from chamber during a gas process decontamination.
Plug the mounting hole for the sensor during the procedure.

RECOMMENDED:
Wipe the outside of sensor housing with cloth or swab dampened in liquid disinfectant and immediately dry thoroughly. Reminder – do not use chlorinated or halogenated cleaners.

Sensor Filter Cap

Sensor mounted in chamber



10.1 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.

10.2 Chemical Decontamination of the Incubator Chamber

To chemically decontaminate NuAire Incubators, users may use the traditional formaldehyde, Vapor based Hydrogen Peroxide, or Chlorine Dioxide. All three of the chemicals are compatible to all parts within NuAire Incubators.

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

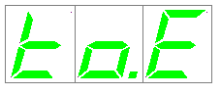
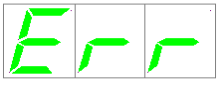
11.0 Error Indicators & Troubleshooting

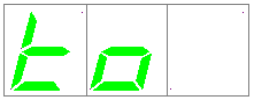
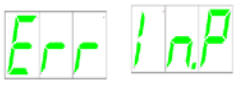
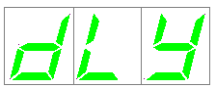
Step 1 NOTE ALL ERROR INDICATORS.
When the Incubator is running, any and all red or yellow LEDs indicate an error.
Pressing any key will silence the audible alarm for 15 minutes.

Step 2 CLEAR ERROR INDICATORS.
Error indicators can be cleared by pressing the mode key to Setup and back to Run.

Step 3 MONITOR REOCCURRENCE OF ERROR INDICATORS.
If reoccurrence of the error indicator is immediate or daily, use guide on next page to correct the situation.

Error Indicator Troubleshooting Guide

DISPLAYED ERROR CODE	CODE DESCRIPTION	CHECKS & CORRECTIONS
Temperature System		
	-Temperature over setpoint normal mode	1. Check temperature sensor calibration 2. Faulty TRIAC, replace control board 3. Door heater duty cycle too high, reduce 4. Door switch is faulty or out of position
	-Temperature time out error during normal running	1. Check temperature sensor calibration 2. Replace fuse 3. Faulty TRIAC, replace control board 4. Faulty chamber heater contact NuAire Technical Service 5. Door heater duty cycle needs to be increased with a high temperature set-point in a low ambient temperature
	-Sensor temperature (differential) error normal running. Occurs when difference between sensors exceeds 4°C.	1. Check temperature sensor calibration 2. Check connection on control board 3. One or both temp sensors faulty, replace
CO_2 System		
	- CO_2 over setpoint	1. Perform CO_2 sensor calibration open door 2. Check injection solenoid for leaking valve 3. Check sensor and disk filter for condensation
	- CO_2 time out error	1. Check CO_2 gas supply - inline gas filters, CO_2 gas tank pressure, CO_2 sensor function 2. Run Cal Inj. Calibration (see Section 9.3.3) 3. Check/replace CO_2 gas supply tanks 4. Check for leaks in chamber - inner door gasket 5. Check for leaks in air pump and hosing
	- CO_2 tank switch occurrence	1. Press mode key to “SETUP” and back to RUN to reset alarm
	- Cal inject calibration failed. Not enough increase in the CO_2 reading after gas was injected	1. Check gas supply then run calibration again 2. Call NuAire Technical Services if error persists
	- Auto zero failure. The value for zero generated by the routine is greater than 0.5%. This is an alert only and does not affect the operation of the CO_2 system	1. Zero span calibrate the CO_2 sensor 2. Check ambient CO_2 level. Ventilate area if level exceeds normal limits 3. Check air inject system function 4. Check for plugged filter 5. Contact NuAire Tech. Service if problem persists

RH System/Check Water Pan for Water Level		
	- RH time out error	1. Check water pan for water level. 2. Perform sensor calibration.
Memory Chip Fault		
	- Corrupted memory data read at start-up	1. Turn Incubator off and back on. 2. If CrC message persists, push "NUAIRE" button to reset. All systems will require recalibration 3. Continuation of 2, refer to Section 9. If CrC still persists, call NuAire Technical Service.
	- Set up information read failure	1. Turn Incubator off then on again. If error indicator continues, replace main control board. If error indicator is cleared, recalibrate Incubator temperature and CO_2 control.
	- Data write to EEProm chip failure	1. Occurs when the checksum read of manually or automatically input data fails at the time of the input. Input data will be active in volatile memory but will be lost if power to the Incubator is interrupted. Contact NuAire Technical Service to replace control board.
Power Supply Errors		
	+ 12 VDC power supply failure	Replace power supply
	- 12 VDC power supply failure	
General Indicators		
DOOR AJAR LED	- Inner glass door is not closed or magnetic switch needs a position adjustment	1. Close and latch inner glass door. 2. Adjust switch position to align it with the disk magnet on the glass door hinge by loosening acorn nut on the cable clip. 3. Check door switch, if faulty, replace.
	- Self diagnostic move	1. Indicates Incubator is performing self diagnostic task - Calibration can be performed when task is completed.
	- When performing on off set calibration DLY shows in display and the value will not change	1. Indicates the Incubator is busy with an automatic function like an air injection. Then display can be changed when the function is complete. This usually takes a few seconds CO_2 control is in delay for one of the following reasons: A. Power interruption just occurred. Will resume CO_2 within 1-minute. B. Chamber temperature is not within 2.0°C of Setpoint. Cannot bypass. 2. Shows for 1 minute in CO_2 display after a menu exit.

LOW WATER	- Low water level in water jacket - Faulty level indicator switch	1. Fill jacket until light goes out 2. Replace level indicator switch
BLINKING DISPLAY	- Interruption of power	1. Press any key to stop blinking displays.
CONDENSATION EXCESSIVE (Humidity pan in place)	- Glass door, gasket or front wall of chamber wet.	1. Increase door heater duty cycles. See section 9.2 for detailed instructions.
	- Back wall bottom and top walls	1. Decrease door heater duty cycle. See section 9.2 for detailed instructions.
CONDENSATION PERSISTS AFTER DOOR DUTY CYCLE IS ADJUSTED		1. Increase air injections, increasing duration first, recommended in 20 second intervals
EXCESS VIBRATION	1. Check for and remove the block of shipping foam from under the air pump. 2. Turn Incubator off. If vibration persists it is not caused by the Incubator.	
Alternating in Temperature Display with rapid beeping audio alarm dor / Temperature Value	Door ajar alarm activated 30 min after inner glass door is left opened	1. If door is open – close door 2. If Door is not open: a. Reposition door switch. b. Check for a faulty connection in the door switch assembly. c. Faulty door switch contact NuAire Customer Service.

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

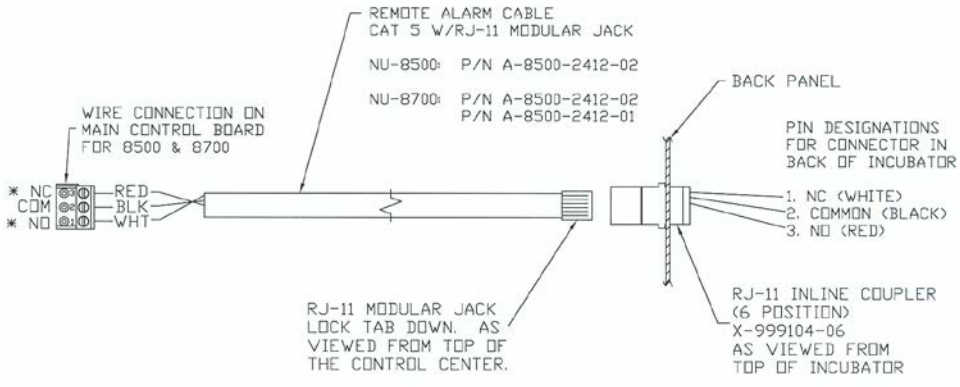
12.0 Remote Alarm Contacts

The NuAire IR Autoflow provides a set of relay contacts to monitor alarm via RJ-11 phone type connection on the back of the unit. The remote alarm contacts provide N.C, N.O outputs and ground or common.

The alarm contacts will change state during the occurrence of any alarm, a tank switch, or if power is cut by either a power failure, circuit breaker tripping or turning the unit off. This means that the normally open contacts will close or normally closed contacts will open

The alarm contact points do not distinguish between a CO_2 or temperature (or RH) alarm. Each alarm will produce a contact to the alarm system whenever an abnormal condition or power interruption occurs.

To reset alarm contacts, press mode key to setup, then back to Run.



* THE STATE OF THE CONTACTS EITHER NORMALY OPEN (NO) or NORMALY CLOSED (NC) INDICATED IN THIS DRAWING OCCURS WHEN INCUBATOR IS TURNED ON. THE STATE INDICATED ON THE PCBD OCCURES WITH THE INCUBATOR TURNED OFF.

13.0 Electrical/Environmental Requirements

13.1 Electrical (±10%)

Single Chamber					Start Up Power	Running Power	
NU-8500	115V	50/60Hz	1 Phase	5 Amps	550 Watts	250 Watts	UL Listed
NU-8500D	100V	50/60Hz	1 Phase	6 Amps	550 Watts	250 Watts	
NU-8500E	230V	50/60Hz	1 Phase	3 Amps	550 Watts	250 Watts	CE Certified

Dual Chamber					Start Up Power	Running Power	
NU-8700	115V	50/60Hz	1 Phase	10 Amps	1100 Watts	500 Watts	UL Listed
NU-8700D	100V	50/60Hz	1 Phase	12 Amps	1100 Watts	500 Watts	
NU-8700E	230V	50/60Hz	1 Phase	6 Amps	1100 Watts	500 Watts	CE Certified

13.2 Operational Performance - Indoor Use Only

Environment Temperature Range: 60°F-85°F (15°C - 30°C)
Environment Humidity: 20% - 60% Relative Humidity
Environment Altitude: 6562 Feet (2000 Meters) Maximum

13.3 Light Exposure

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

13.4 Installation Category: II

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 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.

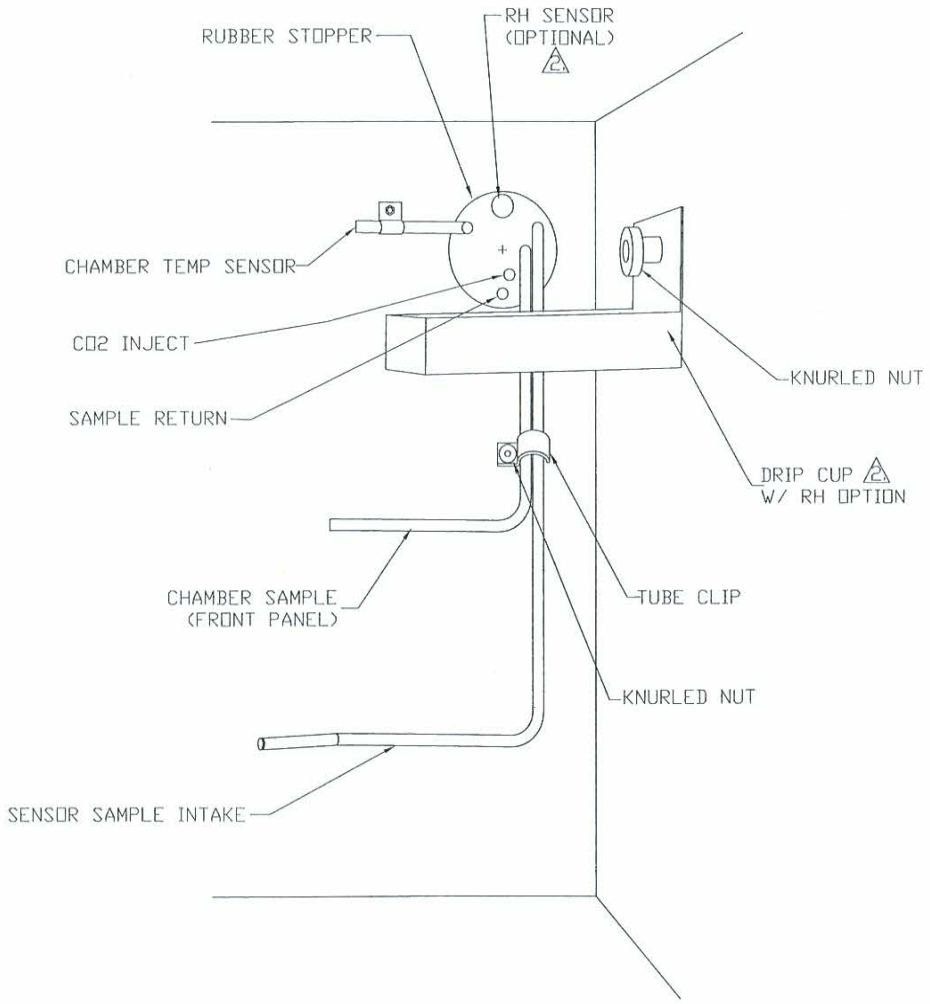
13.7 EMC Performance (classified for light industrial)

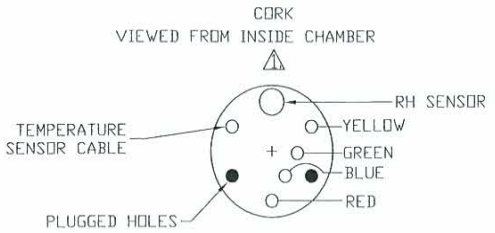
Conducted Emissions: CISPR 11, Class B & EN55011
Radiated Emission: CISPR 11, Class B & EN55011
Radiated Immunity: EN50082-1, IEC 801-3, Level 2
ESD Immunity: EN50082-1, IEC 801-2, Level 2
EFT/BURST Immunity: EN50082-1, IEC 801-4, Level 2

(Note: The EMC performance requirements are generated within the product enclosure. The enclosure will be all metal grounded to earth. In addition, the membrane front panel will also include a ground plane for maximum protection and an electrostatic shield.

13.8 Heat Rejection: 14 BTU/Min

REV	ECO	DESCRIPTION	DATE	DFTM	CHKD
A	8972	RELEASE TO PRODUCTION	10/05/04	KF	KCK





1 YELLOW: SENSOR SAMPLE INTAKE
GREEN: CHAMBER SAMPLE-FRONT PANEL
BLUE: CO2 INJECT
RED: SENSOR SAMPLE RETURN / RH INJECT

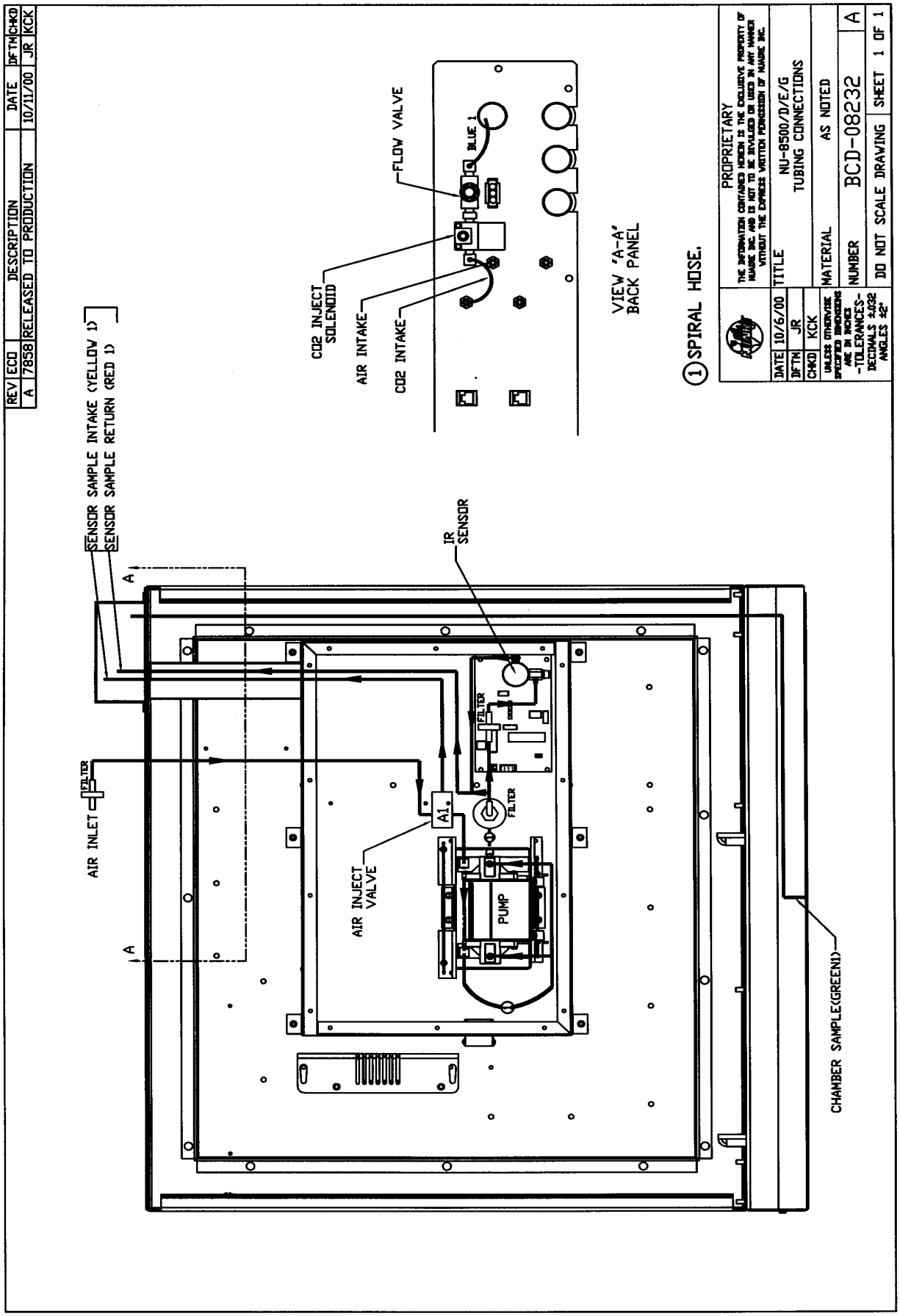
NOTE: 1 NOTED COLOR CODE CORRESPONDS WITH COLORED BANDS ON HOSES CONNECTED TO CHAMBER TUBING.

2 NU-4850 & NU-4950 ONLY

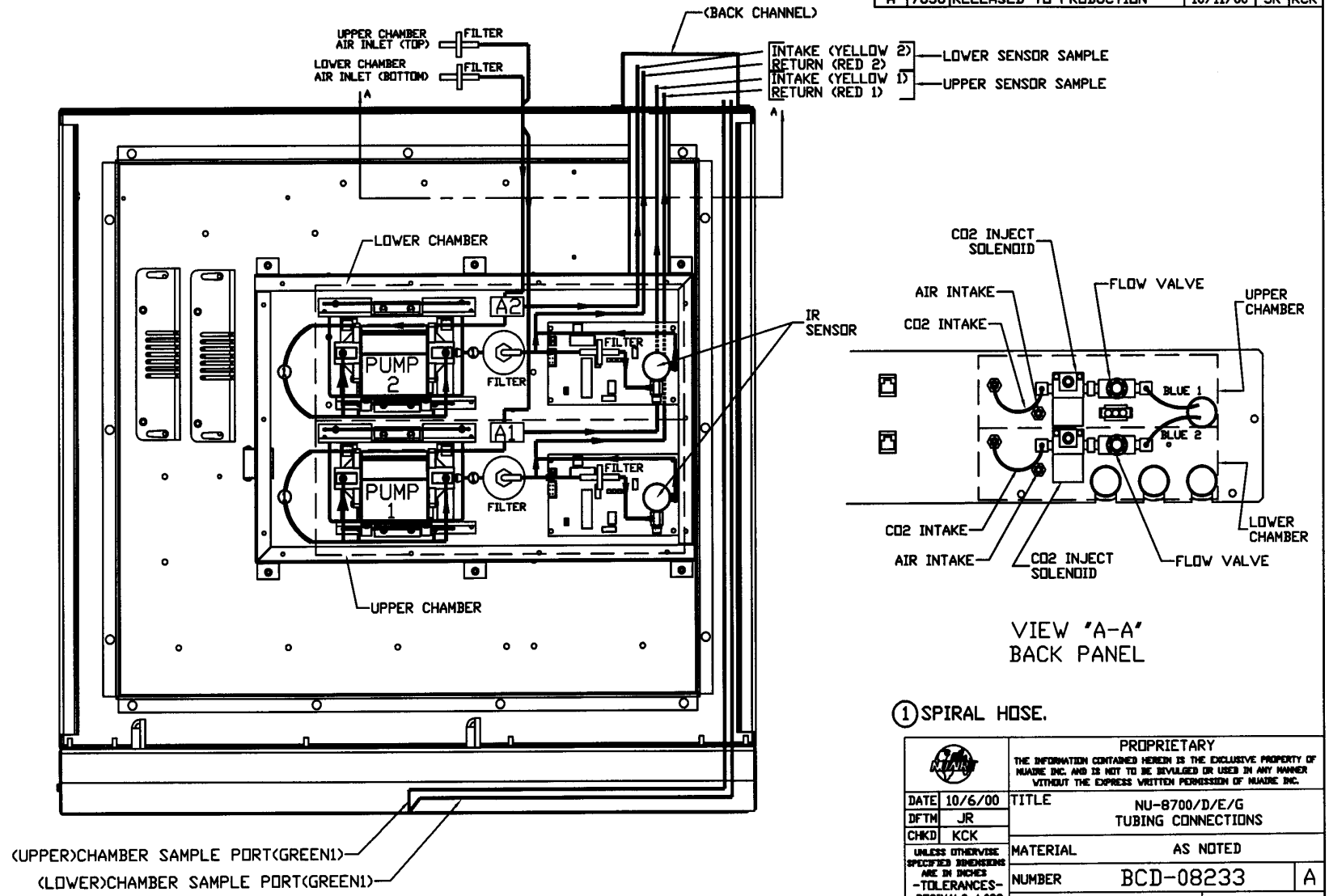
ORIGINAL

DATE	10/5/04
DFTM	KF
CHKD	KCK
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES -TOLERANCES- DECIMALS ±.032 ANGLES ±2°	

TITLE	CHAMBER TUBING ASSEMBLY 8500	
MATERIAL	AS NOTED	
NUMBER	BCD-10405	A
DO NOT SCALE DRAWING	SHEET 1 OF 1	


REV ECO DESCRIPTION DATE DFTM CHKD
A 7858 RELEASED TO PRODUCTION 10/11/00 JR KCK
SENSOR SAMPLE INTAKE (YELLOW 1)
SENSOR SAMPLE RETURN (RED 1)
FLOW VALVE
BLUE 1
CO2 INJECT SOLENOID
AIR INTAKE
CO2 INTAKE
VIEW 'A-A' BACK PANEL
1 SPIRAL HOSE.
IR SENSOR
FILTER
AIR INLET
A1
AIR INJECT VALVE
PUMP
CHAMBER SAMPLE(GREEN1)
PROPRIETARY
THE INFORMATION CONTAINED HEREIN IS THE EXCLUSIVE PROPERTY OF NUAIRE INC. AND IS NOT TO BE DIVULGED OR USED IN ANY MANNER WITHOUT THE EXPRESS WRITTEN PERMISSION OF NUAIRE INC.
DATE 10/6/00
DFTM JR
CHKD KCK
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES -TOLERANCES- DECIMALS ±.032 ANGLES ±2°
TITLE NU-8500/D/E/G TUBING CONNECTIONS
MATERIAL AS NOTED
NUMBER BCD-08232 A
DO NOT SCALE DRAWING SHEET 1 OF 1

REV	ECO	DESCRIPTION	DATE	DFTM	CHKD
A	7858	RELEASED TO PRODUCTION	10/11/00	JR	KCK



DATE	10/6/00
DFTM	JR
CHKD	KCK

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES -TOLERANCES- DECIMALS ±.032 ANGLES ±2°

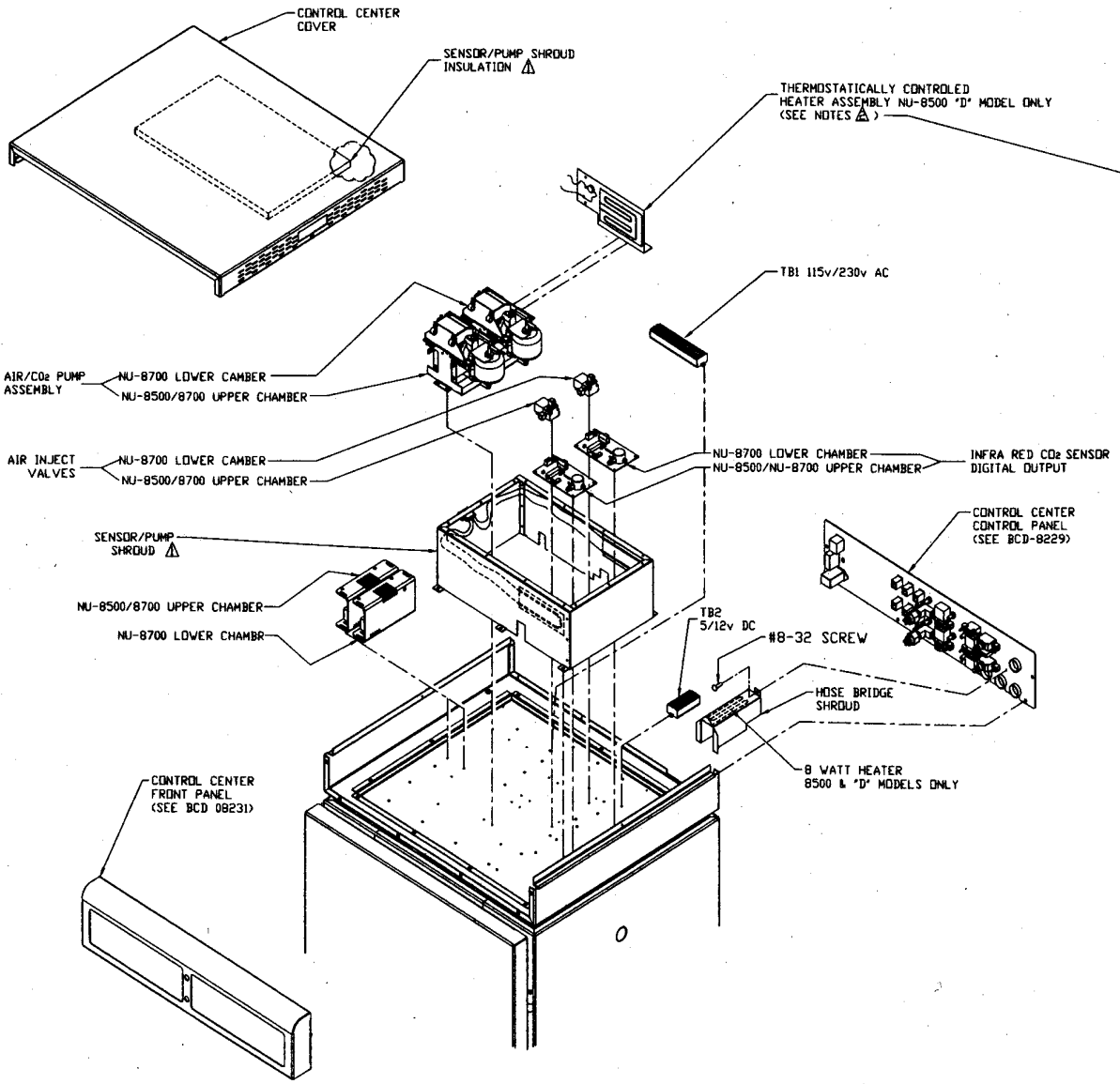
TITLE: NU-8700/D/E/G TUBING CONNECTIONS

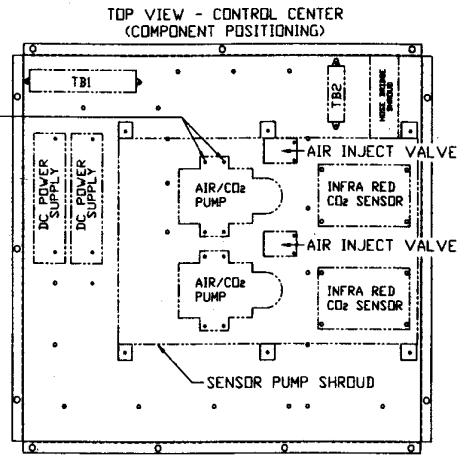
MATERIAL: AS NOTED

NUMBER: BCD-08233 A

DO NOT SCALE DRAWING | SHEET 1 OF 1

REV	ECO	DESCRIPTION	DATE	DRFT	CHKD
A	7858	RELEASED TO PRODUCTION	10/17/00	LS	KCK
B	7985	CORRECTED CALLOUT TO TB2	4/6/01	JR	KCK





NOTES: ⚠1 INSULATION TO BE ALIGNED WITH SENSOR/PUMP SHROUD WHEN CONTROL CENTER COVER IS INSTALLED.
⚠2 USE TWO MOUNTING HOLES FOR THERMOSTATICALLY CONTROLED HEATER IN THE NU-8500 'D' MODELS.

GENERAL COMPONENT REPLACEMENT PROCEDURE

1. DISCONNECT INCUBATOR FROM ALL ELECTRICAL POWER.
2. IDENTIFY COMPONENT FOR REPLACEMENT.
3. DISCONNECT ELECTRICAL CONNECTION, MAKING NOTE OF WIRE COLOR CODES & NUMBERED ID TAGS.
4. DISCONNECT HOSES (IF REQUIRED) AGAIN MAKING NOTE OF CONNECTION & ID NUMBERS.
5. REPLACE COMPONENT BY REVERSING THE ABOVE STEPS.

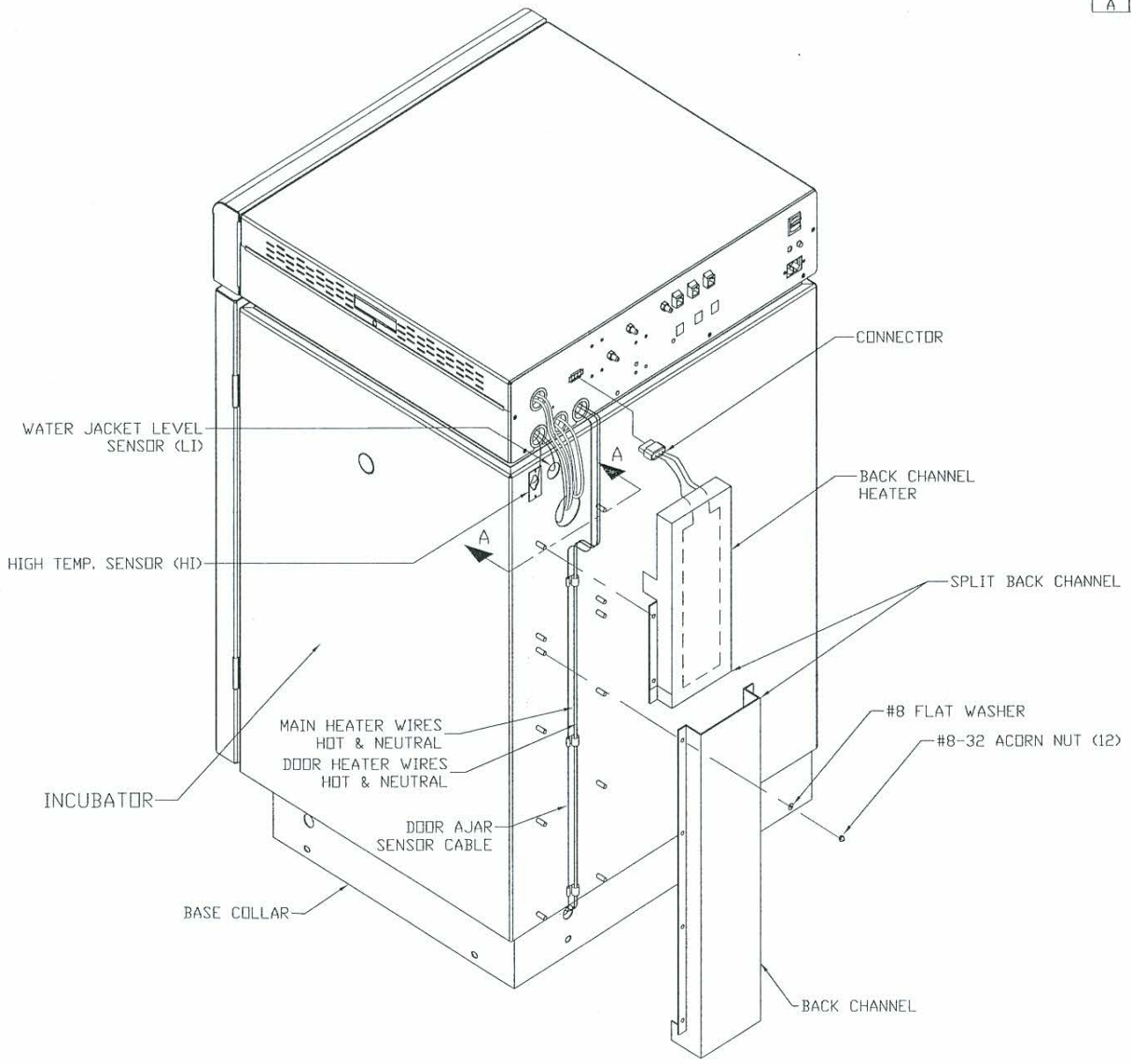
NUAIRE

CONTROL CENTER ASSEMBLY

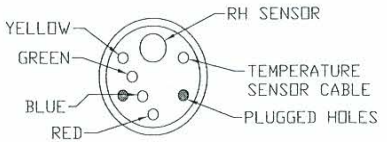
DFTM	LS	12/13/00	CHKD	JR	SHEET 1 OF 1

DRAWING NUMBER BCD-08228 B

REV	ECO	DESCRIPTION	DATE	DRFT	CHKD
A	8972	RELEASE TO PRODUCTION	10/05/04	KF	KCK



STOPPER
BACK OF UNIT
⚠



⚠ YELLOW: SENSOR SAMPLE INTAKE
GREEN: CHAMBER SAMPLE-FRONT PANEL
BLUE: CO2 INJECT
RED: SENSOR SAMPLE RETURN / RH INJECT

NOTE: ⚠ NOTED COLOR CODE CORRESPONDS WITH COLORED BANDS ON HOSES CONNECTED TO CHAMBER TUBING.

ORIGINAL

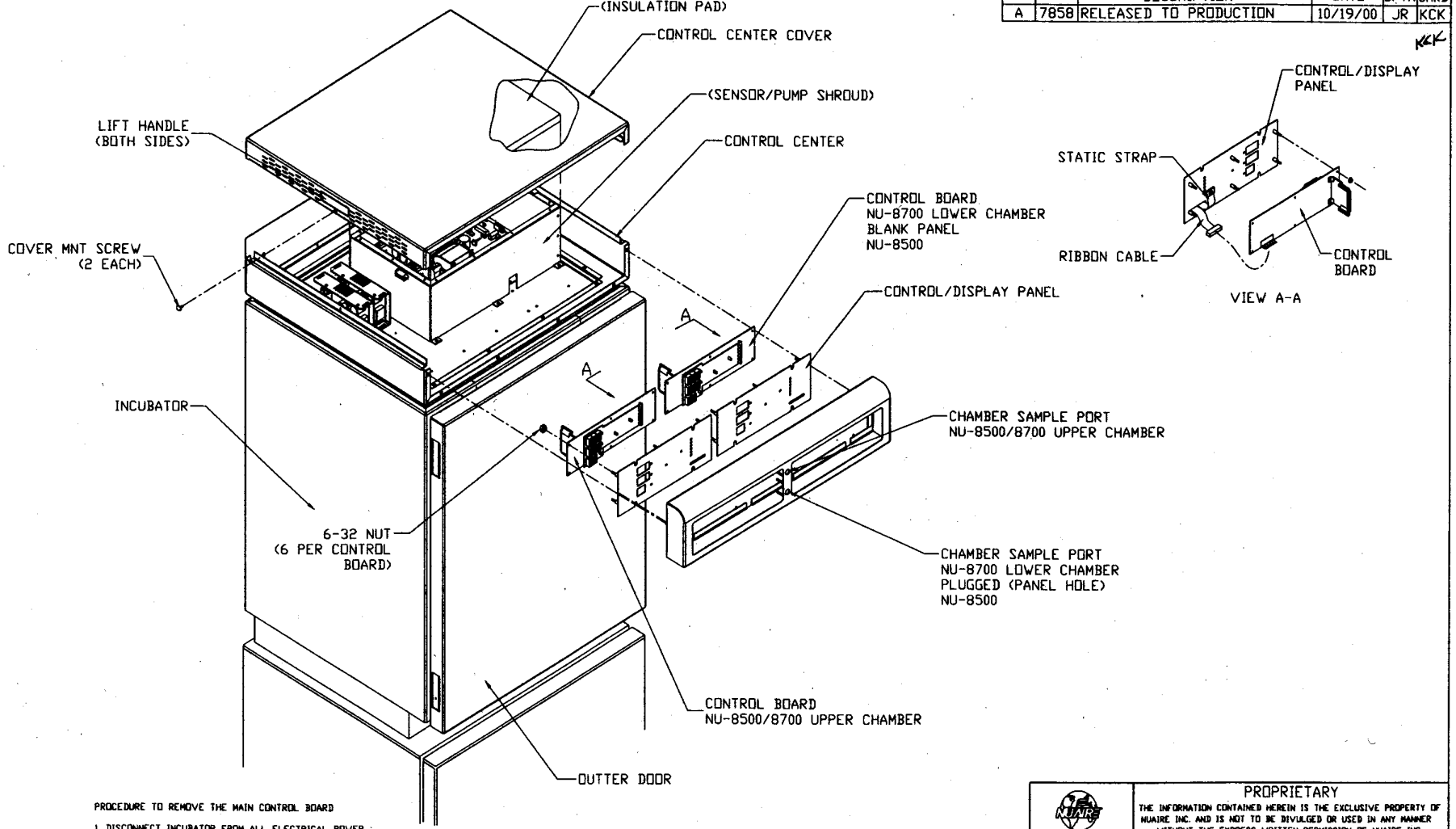
BACK CHANNEL ASSEMBLY

DFTM	KF	10/05/04	CHKD	KCK	SHEET 1 OF 1

DRAWING NUMBER BCD-10403 A

REV	ECO	DESCRIPTION	DATE	DFTM	CHKD
A	7858	RELEASED TO PRODUCTION	10/19/00	JR	KCK

KCK



VIEW A-A

PROCEDURE TO REMOVE THE MAIN CONTROL BOARD

1. DISCONNECT INCUBATOR FROM ALL ELECTRICAL POWER.
2. REMOVE COVER MOUNT SCREWS(BOTH VENTED SIDES) AND REMOVE CONTROL CENTER COVER USING THE HANDLES ON THE SIDES TO LIFT IT OFF AND SET IT ASIDE. NOTE THE POSITION OF THE WHITE INSULATION PAD ON THE INSIDE SURFACE OF THE COVER. THE COVER MUST BE REPLACED WITH THIS INSULATION PAD TO THE RIGHT OF THE UNIT TO ALIGN WITH THE SENSOR PUMP SHROUD.
3. REMOVE ALL CONNECTIONS FROM THE CONTROL BOARD. REFER TO WIRING DIAGRAMS FOR CONNECTION LOCATIONS ON THE CIRCUIT BOARD(S). SEE BCD-08234 FOR THE SINGLE CHAMBER UNITS NU-8500/D/E/G AND BCD-08237 FOR THE DUAL CHAMBER UNITS NU-8700/D/E/G
4. UNSCREW 6 EACH NO. 6-32 LOCK NUTS HOLDING THE CONTROL BOARD TO THE CONTROL/DISPLAY PANEL OF THE UNIT AND LIFT THE CONTROL BOARD(S) OUT.
5. UNPLUG THE CONTROL DISPLAY RIBBON CABLE FROM THE CONTROL BOARD.
6. TO REINSTALL A CONTROL BOARD REVERSE THE ABOVE STEPS.

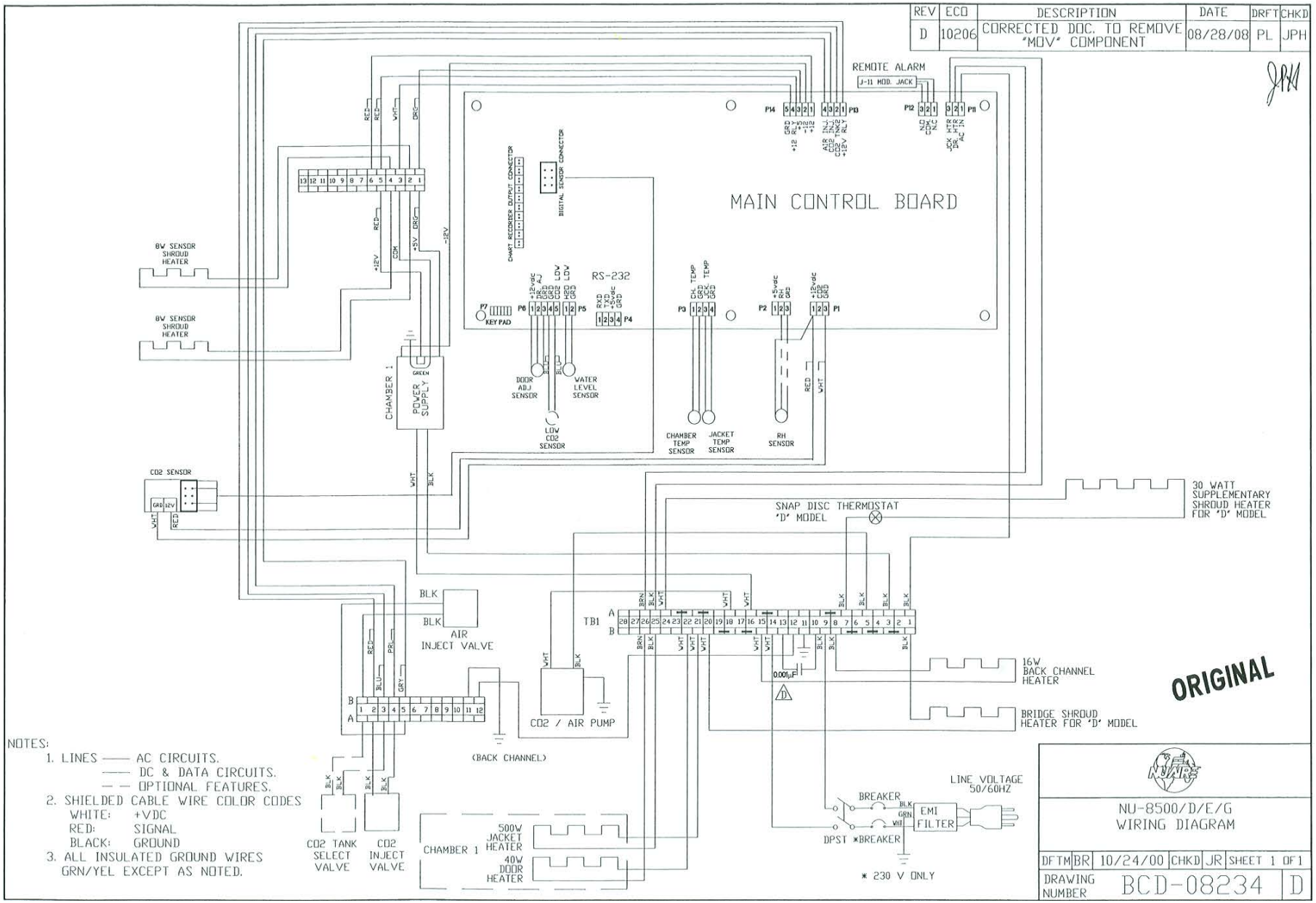
DATE	10/5/00
DFTM	JR
CHKD	KCK
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES -TOLERANCES- DECIMALS ±.032 ANGLES ±2°	

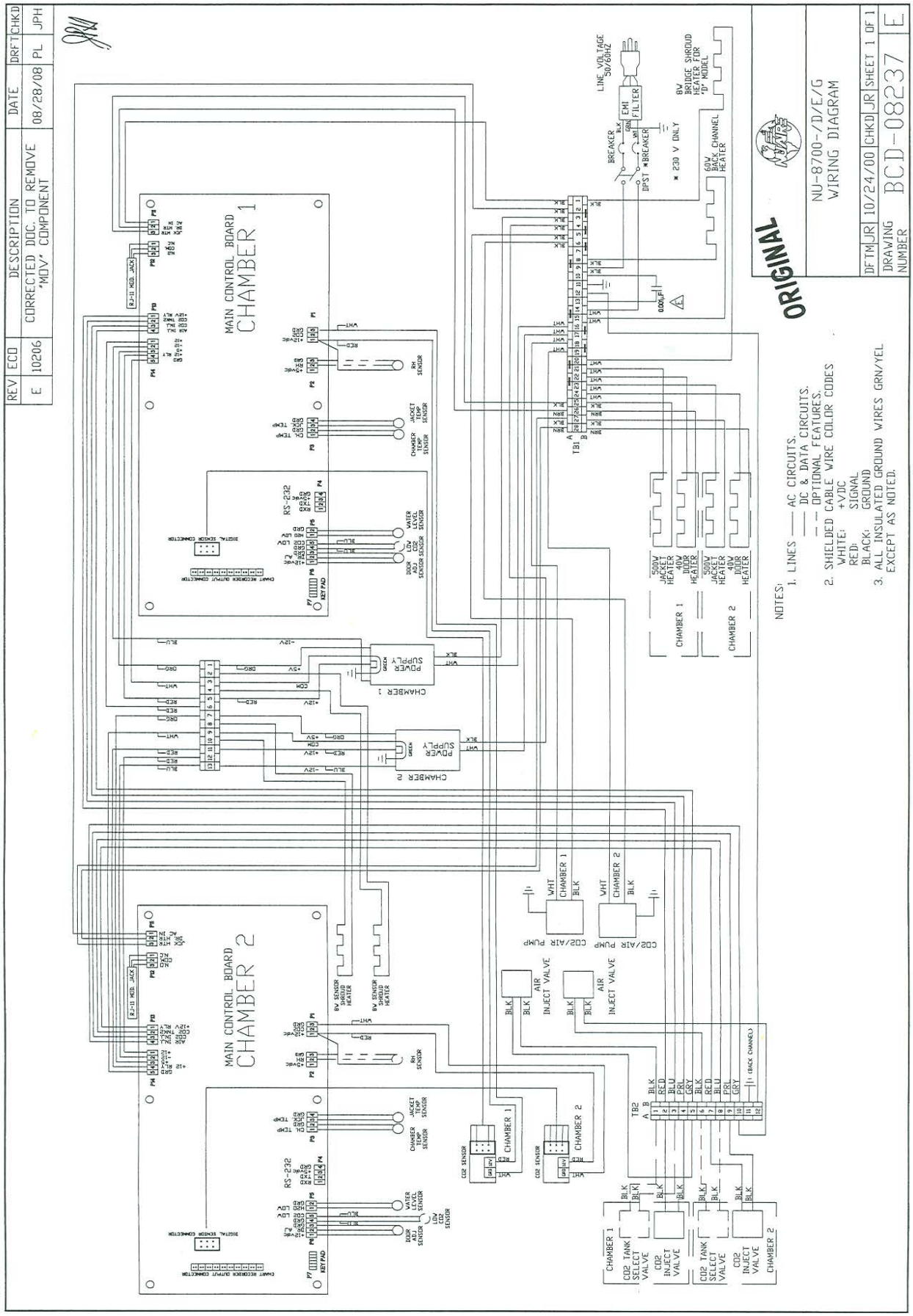
TITLE: FRONT CONTROL PANEL

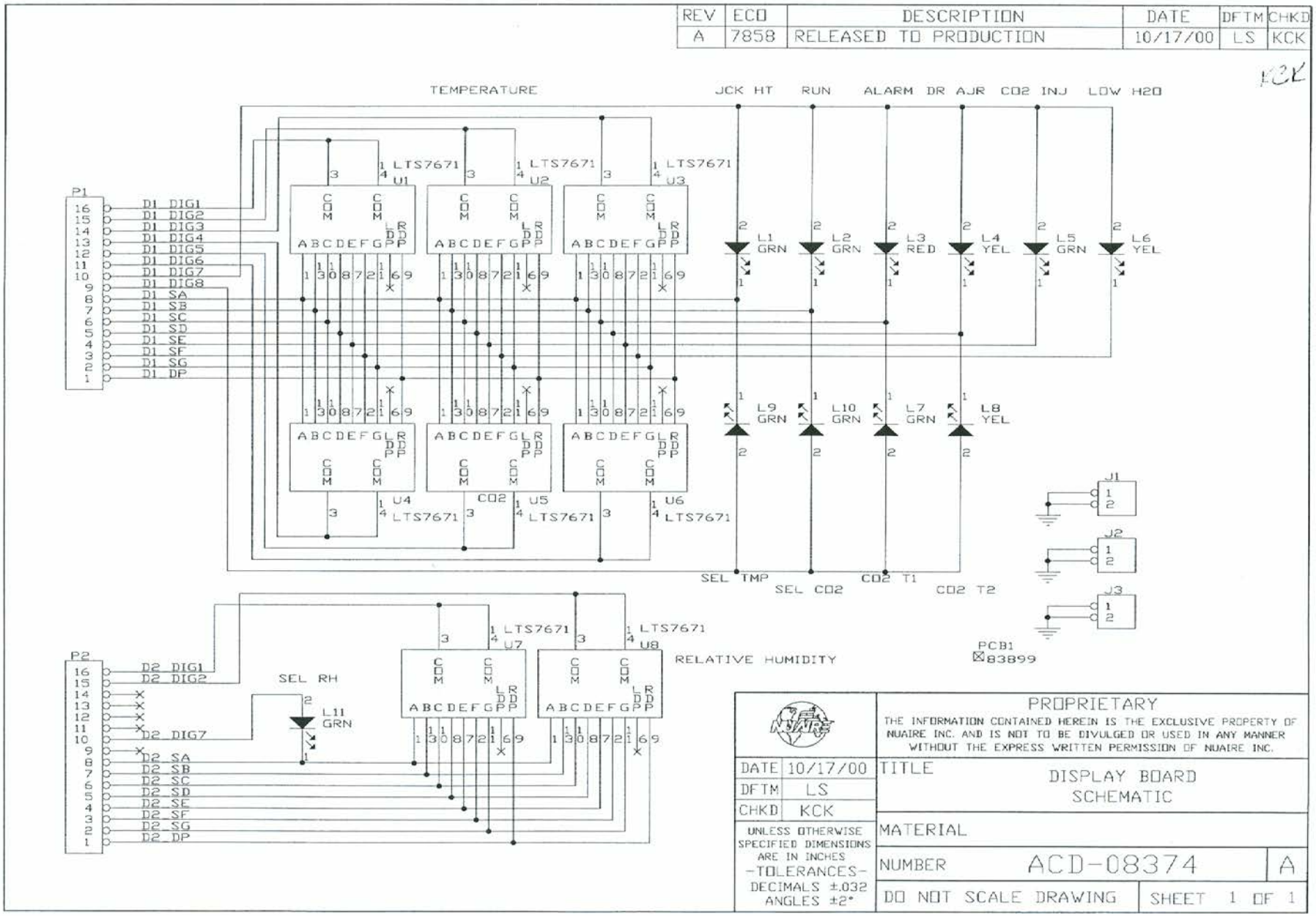
MATERIAL

NUMBER: BCD-08231 A

DO NOT SCALE DRAWING | SHEET 1 OF 1


REV | ECO | DESCRIPTION | DATE | DRFT | CHKD
D | 10206 | CORRECTED DOC. TO REMOVE "MOV" COMPONENT | 08/28/08 | PL | JPH
MAIN CONTROL BOARD
REMOTE ALARM
J-11 MOD. JACK
8W SENSOR SHROUD HEATER
8W SENSOR SHROUD HEATER
CHAMBER 1 POWER SUPPLY
KEY PAD
RS-232
DOOR ADJ SENSOR
WATER LEVEL SENSOR
LOW CO2 SENSOR
CHAMBER TEMP SENSOR
JACKET TEMP SENSOR
RH SENSOR
CO2 SENSOR
SNAP DISC THERMOSTAT 'D' MODEL
30 WATT SUPPLEMENTARY SHROUD HEATER FOR 'D' MODEL
TB1
AIR INJECT VALVE
CO2 / AIR PUMP
(BACK CHANNEL)
16W BACK CHANNEL HEATER
BRIDGE SHROUD HEATER FOR 'D' MODEL
ORIGINAL
LINE VOLTAGE 50/60HZ
BREAKER
EMI FILTER
DPST *BREAKER
* 230 V ONLY
CO2 TANK SELECT VALVE
CO2 INJECT VALVE
CHAMBER 1
500W JACKET HEATER
40W DOOR HEATER
NOTES:
1. LINES —— AC CIRCUITS.
—— DC & DATA CIRCUITS.
– – OPTIONAL FEATURES.
2. SHIELDED CABLE WIRE COLOR CODES
WHITE: +VDC
RED: SIGNAL
BLACK: GROUND
3. ALL INSULATED GROUND WIRES GRN/YEL EXCEPT AS NOTED.
NU-8500/D/E/G
WIRING DIAGRAM
DFTM BR 10/24/00 CHKD JR SHEET 1 OF1
DRAWING NUMBER BCD-08234 D


REV | ECO | DESCRIPTION | DATE | DRFT | CHKD
E | 10206 | CORRECTED DOC. TO REMOVE 'MOV' COMPONENT | 08/28/08 | PL | JPH
ORIGINAL
NU-8700-/D/E/G
WIRING DIAGRAM
DFTM JR | 10/24/00 | CHKD JR | SHEET 1 OF 1
DRAWING NUMBER BCD-08237 E
MAIN CONTROL BOARD CHAMBER 1
MAIN CONTROL BOARD CHAMBER 2
POWER SUPPLY CHAMBER 1
POWER SUPPLY CHAMBER 2
LINE VOLTAGE 50/60HZ
BREAKER
EMI FILTER
DPST *BREAKER
* 230 V ONLY
8W BRIDGE SHROUD HEATER FOR 'D' MODEL
60W BACK CHANNEL HEATER
500W JACKET HEATER
40W DOOR HEATER
CHAMBER 1
CHAMBER 2
CO2/AIR PUMP
AIR INJECT VALVE
CO2 SENSOR
CHAMBER TEMP SENSOR
JACKET TEMP SENSOR
WATER LEVEL SENSOR
DOOR ADJ SENSOR
RS-232
CO2 TANK SELECT VALVE
CO2 INJECT VALVE
TB1
TB2
NOTES:
1. LINES —— AC CIRCUITS.
—— DC & DATA CIRCUITS.
– – OPTIONAL FEATURES.
2. SHIELDED CABLE WIRE COLOR CODES
WHITE: +VDC
RED:
BLACK: GROUND
3. ALL INSULATED GROUND WIRES GRN/YEL
EXCEPT AS NOTED.


REV | ECO | DESCRIPTION | DATE | DFTM | CHKD
A | 7858 | RELEASED TO PRODUCTION | 10/17/00 | LS | KCK
KCK
TEMPERATURE
JCK HT
RUN
ALARM
DR AJR
CO2 INJ
LOW H2O
P1
D1 DIG1
D1 DIG2
D1 DIG3
D1 DIG4
D1 DIG5
D1 DIG6
D1 DIG7
D1 DIG8
D1 SA
D1 SB
D1 SC
D1 SD
D1 SE
D1 SF
D1 SG
D1 DP
U1 LTS7671
U2 LTS7671
U3 LTS7671
U4 LTS7671
U5 LTS7671
U6 LTS7671
L1 GRN
L2 GRN
L3 RED
L4 YEL
L5 GRN
L6 YEL
L9 GRN
L10 GRN
L7 GRN
L8 YEL
CO2
SEL TMP
SEL CO2
CO2 T1
CO2 T2
J1
J2
J3
PCB1
83899
P2
D2 DIG1
D2 DIG2
D2 DIG7
D2 SA
D2 SB
D2 SC
D2 SD
D2 SE
D2 SF
D2 SG
D2 DP
SEL RH
L11 GRN
U7 LTS7671
U8 LTS7671
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PROPRIETARY
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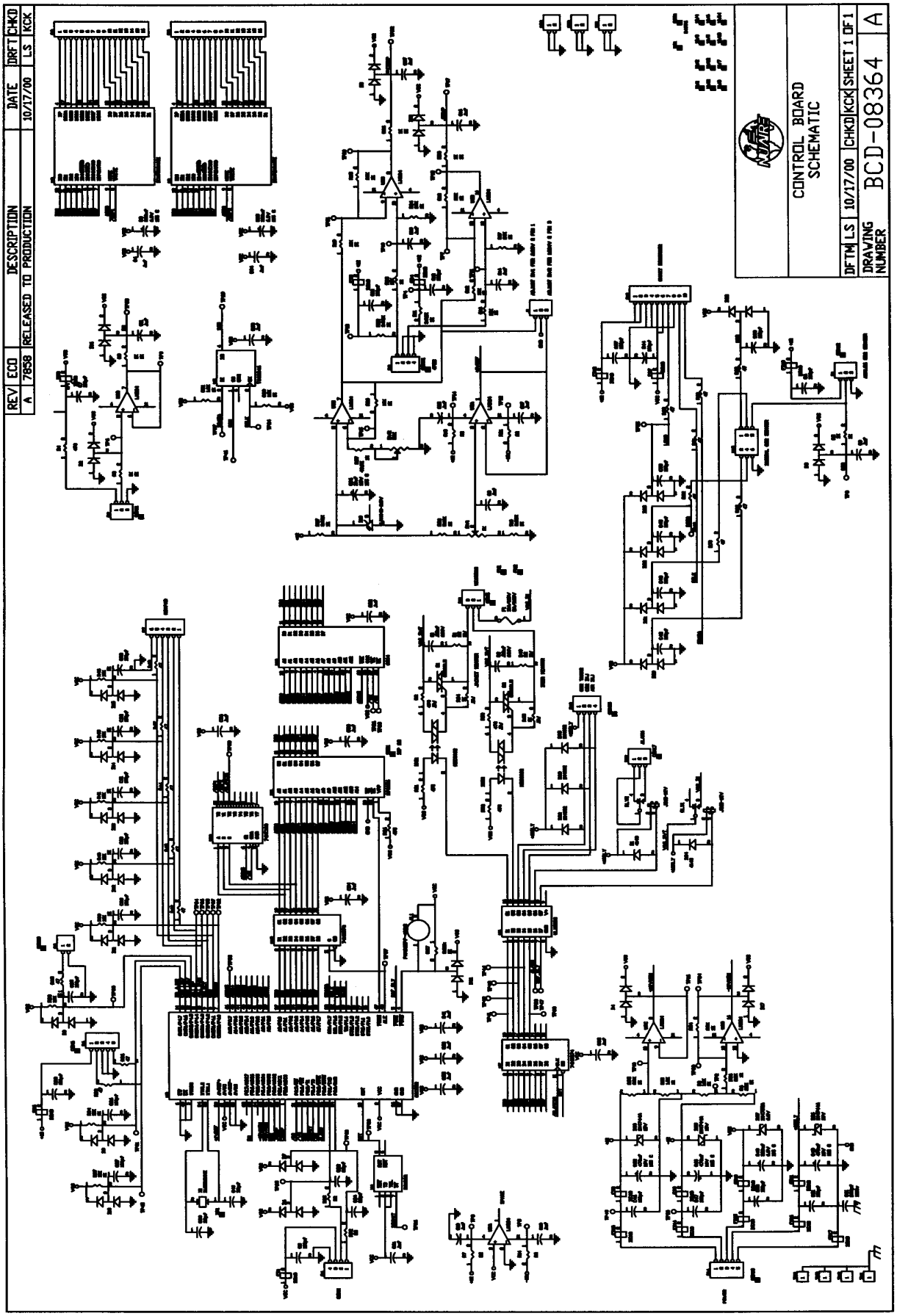
DATE 10/17/00
DFTM LS
CHKD KCK
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
-TOLERANCES-
DECIMALS ±.032
ANGLES ±2°
TITLE
DISPLAY BOARD SCHEMATIC
MATERIAL
NUMBER ACD-08374 A
DO NOT SCALE DRAWING
SHEET 1 OF 1


REV
ECO
DESCRIPTION
DATE
DRFT
CHKD
A
7858
RELEASED TO PRODUCTION
10/17/00
LS
KCK
CONTROL BOARD
SCHEMATIC
DFTM LS
10/17/00
CHKD KCK
SHEET 1 OF 1
DRAWING NUMBER
BCD-08364
A