



## Midi 40 Series

### CO<sub>2</sub> Incubator

Operating and Maintenance Manual 7003403 Rev. 9

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<b>Models covered by this manual</b>				
<b>Catalog Number</b>	<b>Manufacturer Model Number</b>	<b>Sensor</b>	<b>Capacity (cu ft)</b>	<b>Voltage</b>
RMB300S-9-A	3403	T/C	1.4	115V/60Hz
RMB300S-9-V	3404	T/C	1.4	208/230V 50/60Hz

**MANUAL NUMBER 7003403**

9	41116/MN-4785	11/30/16	Replaced Sample Port and CO <sub>2</sub> Inlet labels on pg 3-4	ocs
8	40639	3/22/16	Updated to UL requirements, added risk assessments	ocs
7	30073/MN-4491	7/7/15	Added stacking hardware kit to Parts List	ocs
6	30073/MN-4491	7/28/14	Clarified specs in Location for stacking	ocs
5	26439/MN-4050	2/5/13	Updated uniformity in Specifications	ocs
4	28251/MN-4219	8/30/12	Removed RS-485	ocs
3	28728	6/18/12	Updated Calibration sections - pg 6-4 through 6-6	ocs
2	27796/MN-4127	10/3/11	Tubing size from 3/16 to 1/4" - pgs 4-1 and 4-3	ocs
--	--	6/10/10	Corrected typo in Table 6-1 on pg 6-2 - removed O2 port ID, Wernerspachl	ocs



**Important** Read this instruction manual. Failure to read, understand and follow the instructions in this manual may result in damage to the unit, injury to operating personnel, and poor equipment performance. ▲

**Warning** All internal adjustments and maintenance must be performed by qualified service personnel. ▲



- Use this product only in the way described in the product literature and in this manual. Before using it, verify that this product is suitable for the intended use.
- Do not modify system components, especially the controller. Use OEM exact replacement equipment or parts. Before use, confirm that the product has not been altered in any way.
- Disconnect the unit from all power sources before cleaning, troubleshooting, or performing other maintenance on the product or its controls. To disconnect power supply to the incubator, unplug the supply cord at the back of the incubator. Note that turning the key switch on the front control panel to the Off position is not sufficient to disconnect power.

**Warning** The user is responsible for carrying out appropriate decontamination procedures when hazardous materials are spilled on or inside the incubator. ▲

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Important operating and/or maintenance instructions. Read the accompanying text carefully.



Potential electrical hazards. Only qualified persons should perform procedures associated with this symbol.



Equipment being maintained or serviced must be turned off and locked off to prevent possible injury.



Asphyxiation Hazard Warning. High concentrations of CO<sub>2</sub> can displace oxygen and cause asphyxiation!



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- ✓ Always use the proper protective equipment (clothing, gloves, goggles, etc.)
- ✓ Always dissipate extreme cold or heat and wear protective clothing.
- ✓ Always follow good hygiene practices.
- ✓ Each individual is responsible for his or her own safety.

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When more extensive service is necessary, we will assist you with direct factory trained technicians or a qualified service organization for on-the-spot repair. If your service need is covered by the warranty, we will arrange for the unit to be repaired at our expense and to your satisfaction.

Regardless of your needs, our professional telephone technicians are available to assist you Monday through Friday from 8:00 a.m. to 6:00 p.m. Eastern Time. Please contact us by telephone or fax. If you wish to write, our mailing address is:

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# Table of Contents

<b>Section 1</b>	<b>Introduction</b> .....	<b>1-1</b>
	Requirements .....	1-1
	Specifications .....	1-2
<b>Section 2</b>	<b>Operating Standards</b> .....	<b>2-1</b>
<b>Section 3</b>	<b>Pre-Installation</b> .....	<b>3-1</b>
	Set-Up .....	3-2
	Location .....	3-2
	Gas Supplies .....	3-2
	Electrical Connection .....	3-2
	CO <sub>2</sub> Gas Connections .....	3-3
	Component Locations .....	3-4
<b>Section 4</b>	<b>Initial Start-Up Procedures</b> .....	<b>4-1</b>
	Power / Key Switch .....	4-1
	Setpoint Parameters .....	4-1
<b>Section 5</b>	<b>Key Switch and Control Operation</b> .....	<b>5-1</b>
	Setpoint and Alarm Programming .....	5-3
	Service Mode Parameters .....	5-3
	Restore Function .....	5-3
	Calibration (Optional) .....	5-4
	Access Program or Service Menu .....	5-4
	Temperature Calibration .....	5-5
	CO <sub>2</sub> Calibration .....	5-6
<b>Section 6</b>	<b>Control Systems Theory</b> .....	<b>6-1</b>
	Overtemperature Monitoring System .....	6-1
	Door Heat System .....	6-2
	CO <sub>2</sub> Control System .....	6-2
	CO <sub>2</sub> Recovery (after door opening) .....	6-2

<b>Section 7</b>	<b>Maintenance</b> .....	<b>7-1</b>
	Cleaning .....	7-2
	CO <sub>2</sub> Filter Replacement .....	7-2
	Fuses .....	7-3
	Door Seal Check .....	7-3
<b>Section 8</b>	<b>Parts List</b> .....	<b>8-1</b>
<b>Section 9</b>	<b>Warranty Information</b> .....	<b>9-1</b>

## Section 1 Introduction

These incubators are designed to create a stable, reliable environment for cell culture applications. They operate at temperatures ranging from 5°C above ambient temperature to +60°C, accurate to  $\pm 0.2^\circ\text{C}$ . The gas system controls within  $\pm 0.1\%$  of measurable setpoint.

- Thermal conductivity sensor provides stable, automatic injection of  $\text{CO}_2$ .
- Automatic Gas Shutoff control turns off the gas supply when the inner glass door is opened to prevent wasting the control gas.
- Alarms:
  - High and low level  $\text{CO}_2$  setpoint alarms, adjustable.
  - High and low temperature alarms; high alarm can be set by user.
  - Battery Low alarm; control system has tested the alarm battery and determined that it should be replaced.

**Caution** The function of the alarm battery is to operate the display and alarm system **ONLY** during a power loss, while the key switch is in the On or Alarm position. This battery system will not power the heaters, fan motor or gas control system. Only qualified service technicians should replace this battery. Replacement instructions and batteries are available from Thermo Scientific. ▲

### Requirements

- A high quality two-stage, low pressure 15 psig (1.056 kg/cm<sup>2</sup>) pressure regulator is required for proper operation of the  $\text{CO}_2$  gas supply.
- In-line gas supply filters must be used on the  $\text{CO}_2$  supply to prevent damage to the solenoid valve(s):
  - Type: Microbiological
  - Specification: 0.3 micron
  - Location: rear of unit
- $\text{CO}_2$  used in the incubator must be at least 99.9% pure.



## Specifications

Technical Specifications	Model 3403	Model 3404
Dimensions		
Exterior (w x h x d) inch/cm	23.5 x 18 x 18.5 (59.7 x 45.7 x 47)	
Interior (w x h x d) inch/cm	14 x 14 x 12 (35.5 x 35.5 x 30.5)	
Construction		
Cabinet configuration	Benchtop	
Interior	non-corrosive stainless steel, type 304, mirror finish	
Interior volume		
Chamber capacity	1.4 cu ft (39.6 l)	
Shelves	4	
Construction	stainless steel, perforated	
Shelf dimensions (w x d) inch/cm	13.5" x 11.5" (34.3 x 29.2)	
Surface area per shelf	1.08 sq ft (0.1 sq m)	
Temperature		
Range	5°C above ambient to 60°C	
Control	±0.1°C	
Uniformity	±0.5°C @ 37°C	
Alarm	user programmable high/low	
CO <sub>2</sub>		
Range	0-20%	
Control	±0.1%	
Sensor	long life thermal conductivity sensor	
Uniformity	0.10%	
Inlet pressure required	15 PSIG (1.0 bar), 99.5 medicinal grade CO <sub>2</sub>	
Inlet air filtration	0.3 micron anti-microbial filter	
Alarm	user programmable high/low	
Humidity		
rH	to 95% @ 37°C	
Source	humidity pan, removable	
Electrical		
Rated voltage	115V, 60Hz	206/230V, 50/60Hz
Amps/breaker	3A/15	2A/15
Weight		
Net	60 lbs. (27kg)	
Shipping	70 lbs. (32kg)	
Warranty	1 year	

All specifications are subject to change without notice.

## Section 2 Operating Standards

The incubators described in this manual are classified for use as stationary equipment in a Pollution Degree 2 and Overvoltage Category II environment, according to the UL 61010-1, 3rd Edition, 2012-05-11, CAN/CSA-C22.2 No 61010-1 3rd Edition 2012-11, IEC/EN 61010-1:2010, 3rd Edition, IEC/EN 61010-1-010: 2014, 3rd Edition.

These units are designed to operate under the following environmental conditions:

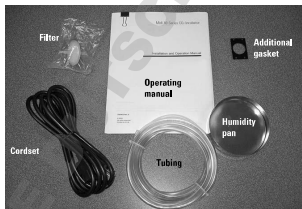
- Indoor use only
- Altitude up to 2000m
- Maximum relative humidity 80% for temperatures up to 31°C
- Main supply voltage fluctuations not to exceed 10% of the nominal voltage.

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## Section 3 Pre-Installation

The following items are packaged and shipped inside the incubator cabinet:

- This manual
- Shelves and shelf brackets
- 1/4 in. (6,35 mm) ID clear tubing for the gas connection
- Cordset
- 5" round humidity pan
- Additional CO<sub>2</sub> sensor gasket
- CO<sub>2</sub> disposable filter 99.97



**Figure 3-1.** Included Components (shelves and brackets not shown)

## Set-Up

Remove shelves from the inside of the incubator and clean the chamber. Shelves and brackets can be autoclaved.

## Location

This unit weighs 60 lbs. (27kg). Be safe when moving it. Request assistance when required, or use a lift truck.

Install the unit in a level area free from vibration with a minimum of three inches (7.6 cm) of space on the sides and rear, and twelve inches (30.5 cm) at the top. The floor must be able to support 40 PSI (single chamber incubator) or 75 PSI (stack of two incubators with the addition of stacking hardware kit).

*Be sure to position the incubator so that the power cord (mains disconnect) is easily accessible to disconnect power.*

*Do not position the equipment in direct sunlight or near any HVAC duct/diffusers. The ambient temperature range at the work location must be 59 to 90°F (15 to 32°C).*

## Gas Supplies

Verify that the incubator CO<sub>2</sub> gas supplies are available near the installation area. The required gas supply pressure is 15 PSI, controlled by a high-quality, two-stage regulator suitable for the connected input gas.

**Warning** Do not connect the gas at this time. ▲

## Electrical Connection

**Caution** Connect the equipment to the correct power source. Be sure to operate the incubator at the voltage specified on the dataplate. Incorrect voltage can result in severe damage to the equipment. ▲

**Warning** For personal safety and trouble-free operation, this unit must be properly grounded before it is used. Failure to ground the equipment may cause personal injury or damage to the equipment. Always conform to the National Electrical Code and local codes. Do not connect the unit to overloaded power lines. ▲

The incubators described in this manual are available with the following voltages: 115VAC, single-phase, 60Hz, 3A and 208/230VAC, single phase, 50/60Hz, 2A. Be sure to check your dataplate to verify the correct voltage for your unit.

Always connect the unit to a dedicated (separate) circuit. Do not exceed the electrical and temperature ratings printed on the dataplate located near the upper hinge of the unit. Electrical codes require fuse or circuit breaker protection for branch circuit conductors. Use time delay fuses for #12 AWG circuits.

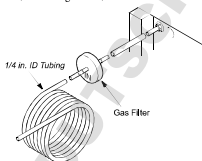
## CO<sub>2</sub> Gas Connections

CO<sub>2</sub> gas connection(s) are located at the rear of the unit.

**Note** The required gas supply pressure is 15 PSI. Make sure the supply is available in the installation area. ▲

To install the CO<sub>2</sub> connections, complete the following steps:

1. Locate the included 1/4 in. (6.3mm) interior diameter tubing.
2. Cut a small length (approximately 6 in. [15cm]) from the roll of 1/4 in. (6.3mm) ID tubing.
3. Pull the cap off the gas connection port at the rear of the incubator and attach one end of the tubing to the gas connection port.
4. Connect the opposite end of the tubing to a high-quality input gas filter (0.3 micron supplied). Note that the side of the filter marked "IN" faces the incoming gas connection, not the back of the incubator (refer to Figure 1-2).

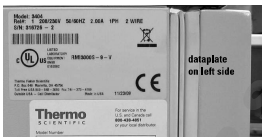


**Figure 3-2.** CO<sub>2</sub> Gas Connections

5. Use the remaining 1/4 in. ID tubing to connect the input gas to the gas filter. Keep the tubing length as short as possible to minimize the pressure drop.

**Caution** DO NOT turn on the gas supply at this time. ▲

## Component Locations



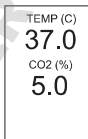
Upper back of unit



## Section 4 Initial Start-Up Procedures

On first start-up of the incubator, the control display will go through several prompts to guide you through the entire set-up process, from leveling the incubator to adjusting the operating parameters.

During normal operation, the control panel display looks like Figure 4-1. The next section explains all the control functions available during normal operation. On initial start-up, however, a series of prompts displays. This section explains the start-up prompts and the procedures to follow.



### Power / Key Switch

Turn the key switch (shown in Figure 4-1) to the "I" position. Press and hold the up arrow button to initiate the special start-up prompts. If a temperature displays instead of a start-up prompt, the up arrow button hasn't been held long enough. Turn the key switch back to "O" and try again.



key switch



### Setpoint Parameters

A prompt displays to accept or adjust the values of several operating parameters. In each case, press the up or down arrow buttons (increase or decrease) to change a displayed value. Press Mode when the displayed value is the one desired. The modifiable value is always the one flashing.

Figure 4-1. Control Panel

If a displayed parameter is not adjusted and 60 seconds elapse, the software registers the existing default value and moves to the next parameter.

If no changes are needed to the factory-set defaults, press Mode repeatedly until the end of the prompts.



## Setpoint Parameters (continued)

The adjustable parameters are:

- Temperature (default 37°C)
- Warm alarm (default 40°C; cannot deviate from the temperature setpoint by less than 0.3°C)
- Cold alarm (default 34°C; cannot deviate from the temperature setpoint by less than 0.3°C)
- CO<sub>2</sub> (default 5%)
- High CO<sub>2</sub> alarm (default 6%; cannot deviate from the CO<sub>2</sub> setpoint by less than 1%)
- Low CO<sub>2</sub> alarm (default 4%; cannot deviate from the CO<sub>2</sub> setpoint by less than 1%)

When parameter adjustments are complete, the screen returns to the normal display (Figure 4-1). An additional message indicates that the stabilization period has begun.

*During this initial stabilization period, leave the door closed.*

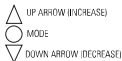
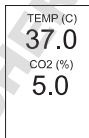
## Section 5 Key Switch and Control Operation

To operate the incubator with alarms activated, be sure to turn the key switch all the way to the rightmost position (as shown in Figure 5-1). To avoid nuisance alarms, work with the key switch in the "I" position during the set-up procedures described in Section 4.

The control panel is located on the front of your incubator.

Before loading and using your incubator, be sure to take some time to review the control panel functions.

The main display, during normal operation, shows: cabinet temperature in degrees Celsius, as measured by the sensor inside the cabinet; and percentage levels of carbon dioxide (CO<sub>2</sub>). When one or more of these fields flashes during normal operation, an alarm or error condition is indicated. Note that alarm conditions are displayed only when the key switch is turned to the alarm position.



**Figure 5-1.** Key Switch

In programming mode (described in detail in Table 5-1) the main display changes to show the setpoint being viewed and related alarm setpoints. For example (Figure 5-2):

Set Temp
SETPOINT:
37.0C
40.2C
33.8C

The first value displayed is the temperature setpoint; the next two values are the high temp alarm and low temp alarm setpoints. The flashing value is one that can be changed, using the up and down arrow buttons.

**Figure 5-2.**  
Programming Mode

The up and down arrow buttons are used to change setpoint values in programming mode and for various display functions.

The Mode pushbutton is used: to silence an audible alarm; to enter programming and service modes; and in combination with the other buttons for various display functions.

For full descriptions of display, programming, and service functions, refer to Tables 5-1, 5-2, and 5-3.

**Table 5-1.** Control Panel Display

Function	Meaning	Sequence	Display
Normal operation	Default display while incubator is running	—	Display shows cabinet temperature, CO <sub>2</sub> , Relative Humidity.
Cold excursion	Show coldest cabinet temperature since last startup or reset	Press ▾	Display shows cold excursion while button is pressed.
Warm excursion	Show warmest cabinet temperature since last startup or reset	Press ▲	Display shows warm excursion while button is pressed.
Mode	Silence audible alarm	Press Mode	Display shows current values, alarm or error field continues to flash.
Reset	Return to default display after excursion or alarm condition	Press ▲ and ▾ simultaneously	Excursion values are reset; display shows current values. Display flashes twice.

## Setpoint and Alarm Programming

To enter Program mode, press and hold the MODE button until the display indicates it is changing to Program mode. Press Mode repeatedly to scroll through the available functions. Exit Program mode by scrolling through all available functions and parameters using the Mode button, or the display will automatically return to normal operating mode 30 seconds after the last key entry.

**Table 5-2.** Setpoint and Alarm Programming Functions

Function	Programming Sequence
Adjust temperature setpoint	Enter programming mode by pressing Mode and holding for 5 seconds. On release, the current temperature setpoint value flashes in the display; use $\nabla$ and $\Delta$ to adjust it.
Adjust warm alarm setpoint	Press Mode again. The current warm alarm setpoint value then flashes in the display; use $\nabla$ and $\Delta$ to adjust it. There is a minimum deviation of 0.3° C between each alarm setpoint and the temperature setpoint.
Adjust cold alarm setpoint	Press Mode again. The current cold alarm setpoint value then flashes in the display; use $\nabla$ and $\Delta$ to adjust it. There is a minimum deviation of 0.3° C between each alarm setpoint and the temperature setpoint.
Adjust CO <sub>2</sub> setpoint	Press Mode again. The display changes to display CO <sub>2</sub> setpoint and high and low CO <sub>2</sub> alarm setpoints, with the operating CO <sub>2</sub> setpoint flashing. Use $\nabla$ and $\Delta$ to adjust it. There is a minimum deviation of 1% between each alarm setpoint and the operating CO <sub>2</sub> setpoint.
Adjust CO <sub>2</sub> high alarm setpoint	Press Mode again. The current high CO <sub>2</sub> alarm setpoint then flashes; Use $\nabla$ and $\Delta$ to adjust it. There is a minimum deviation of 1% between each alarm setpoint and the operating CO <sub>2</sub> setpoint.
Adjust CO <sub>2</sub> low alarm setpoint	Press Mode again. The current high CO <sub>2</sub> low setpoint then flashes; Use $\nabla$ and $\Delta$ to adjust it. There is a minimum deviation of 1% between each alarm setpoint and the operating CO <sub>2</sub> setpoint.
Set Temp offset	Press Mode again. The display changes to display temperature offset (for calibration purposes). Use $\nabla$ and $\Delta$ to adjust it.
Set CO <sub>2</sub> offset	Press Mode again. The display changes to display CO <sub>2</sub> offset (for calibration purposes). Use $\nabla$ and $\Delta$ to adjust it.

## Service Mode Parameters

Service mode can be entered from Program mode by pressing Mode and holding for 5 seconds. Pressing Mode repeatedly scrolls through the available functions. For any modifiable parameter, the up and down arrow buttons can be used to adjust the value. The display automatically returns to normal operating mode 30 seconds after the last key entry, or after scrolling through all available functions and parameters.

**Table 5-3.** Service Parameters

Parameter	Notes
SN	Serial number.
Check Sum	Checksum to identify firmware version
PWM Info	CO <sub>2</sub> sensor and excursion information

## Restore Function

When the incubator is first powered up, all factory-set program parameter defaults can be restored as follows:

**Table 5-4.** Restore Defaults

Function	Sequence	Notes
Restore program defaults	Press $\Delta$ and $\nabla$ simultaneously, hold for five seconds	Restores original (factory-set) values of all program parameters.

## Calibration (Optional)

The Midi-40 Incubator utilizes a Thermal Conductivity (T/C) CO<sub>2</sub> sensor. This style of CO<sub>2</sub> sensor is adversely affected by changes in temperature and relative humidity (RH). Therefore it is necessary to verify the temperature calibration first and then wait for the passive RH inside the chamber to stabilize, after any adjustment is made to temperature settings.

It is recommended that a full CO<sub>2</sub> calibration procedure be performed:

- After replacing the CO<sub>2</sub> sensor or main micro board.
- If, after re-setting a CO<sub>2</sub> calibration offset and the offset calibration does not improve the true measured accuracy.
- If the interior RH condition is changed by adding or removing the RH water pan to convert from a wet to dry condition.

**Caution** The full zero/span calibration procedure requires the user to access the Program and Service Mode menu. ▲

## Access Program or Service Menu

To access the Service Mode, you first must enter Program mode. Press and hold the Mode key for approximately five seconds until "Program Mode;" is displayed. Release the key.

Next press and hold the Mode key again for approximately six seconds until "Service Mode;" is displayed. Release the key.

**Note** If user does not push any keys after approximately thirty seconds, the display will revert back to the normal Run mode. If a value was changed, whatever value was last displayed will be stored as the new setting.

## Temperature Calibration

1. Ensure shelf support system and empty shelves are in place
2. Fill humidity pan approximately halfway full with sterile, distilled water and position the pan centered on the incubator chamber floor.
3. Install reference temperature sensor into the geometric center of the chamber, ensuring the sensor is not touching any shelves and is measuring air temp only.

**Note** There is no access port located on a Midi-40 incubator to permit passing cables through. Therefore a user must pass their independent calibration temperature sensor cable through the inner and outer door gasket seal. If access to a flat or thin style cable is not available, this may lead to humidity escaping the inner chamber thus causing condensation to form on the glass door or between the inner and outer doors surfaces. If a thin style cable is not available, attempt to seal around the cable using some Permagum-style putty (part # 13014) to help seal the passing of the cable through the door gasket seal.

4. After power is connected, turn key switch from (0) to (I) On position.
- 5.) To set or adjust the Temp setpoint, enter Program mode. The first menu is "Set Temp Setpoint". Using the increment up arrow or the decrement down arrow, adjust setting to desired temperature. Continue to press the Mode button to advance from menu to menu to exit, or wait 30 seconds and system will default to normal Run menu.
6. Set CO<sub>2</sub> control set point in Program mode to 0.0% to keep CO<sub>2</sub> injection solenoid off. It is highly recommended NOT to connect the CO<sub>2</sub> supply at this time.
7. Allow for temperature to stabilize;
  - a. Start-Up - Allow 12 hours for the temperature in the cabinet to stabilize before proceeding.
  - b. Operating Unit - Allow at least two hours after the display reaches setpoint for the temperature to stabilize before proceeding.
8. Enter Program Mode, go to "Set Temp OFFSET" option and press the up/down arrow to match the display to a calibrated instrument.
9. For any offset adjustments made, allow at least 1 hour between adjustments to permit the unit to stabilize again.
10. After the temperature is calibrated, it is recommended to remove the temp sensor from the inner chamber to ensure the humidity inside the chamber is not passing through the door seal. TC CO<sub>2</sub> sensors require stable temp and RH environment to ensure accurate calibration!

## CO2 Calibration

1. After performing the Temperature calibration first, ensuring the unit has stabilized and the outer and inner door has not been opened for at least two hours, proceed to zero the CO<sub>2</sub> sensor.
2. Enter the Program mode, press Mode key until "Set CO<sub>2</sub> OFFSET" is displayed. Using the increment or decrement keys, make offset read 0.0%. Exit Program mode back to normal Run mode.
- 3a. Enter the "Service Mode", press Mode key until "Zero CO<sub>2</sub>TC Sensor" is displayed. Press the decrement key to zero, then press the increment key to accept. The display should read zero micro-volts (0uV). **IMPORTANT NOTE** You must complete the next step to fully zero the CO<sub>2</sub> sensor! ▲
- 3b. Press the increment key to set the new zero micro-volt (uV) value and then press the decrement key to accept. Repeat this step until you get repeating micro-volt values that are within  $\pm 50\text{uV}$  of each other. If the uV values are greater than 50 digits, this indicates that the Temp/RH has not fully stabilized inside the chamber and you should wait longer for the Temp/RH to stabilize.
4. In "Service Mode", press the Mode key again to display "Span CO<sub>2</sub>TC Sensor". Adjust CO<sub>2</sub> span to read 975uV.
5. Press Mode key to exit Service mode, or wait 30 seconds for auto exit.
6. Connect CO<sub>2</sub> supply and ensure CO<sub>2</sub> gas pressure is set at 15psig, set CO<sub>2</sub> setpoint to desired setpoint, e.g. 5.0%.
7. Allow system to stabilize at least 1 hour after unit display shows set point. Ensure that no door openings occur during this stabilization period.
8. Just before taking a CO<sub>2</sub> gas sample with your CO<sub>2</sub> calibration hand-held meter or FYRITE, lower the CO<sub>2</sub> control set point in Program mode 1.0% below your current set point, e.g. from 5% to 4%. This step is necessary to prevent CO<sub>2</sub> gas injection during the calibration of the unit.

## CO<sub>2</sub> Calibration (continued)

**IMPORTANT NOTE** During the sampling of the chamber with your FYRITE or hand-held calibration meter, the CO<sub>2</sub> value shown on the unit display will most likely drop a few tenths of a percent from e.g. 5% CO<sub>2</sub> to maybe 4.5%, depending on how many FYRITE measurements/ aspirations you take, or depending on how long you leave your hand-held calibration meter aspiration pump running. It is recommended that you take 2-3 FYRITE measurements and or leave your CO<sub>2</sub> hand-held meter sampling the interior chamber for approx 1.5 to 2 minutes but no greater than 3 minutes. After obtaining your calibration readings, remove the tubing from CO<sub>2</sub> sample port and cap the port. Allow the unit CO<sub>2</sub> displayed value to stabilize, waiting approximately 3 minutes before proceeding with the CO<sub>2</sub> calibration offset in the next step!

9. Enter Service Mode, press Mode key until "Span CO<sub>2</sub>TC Sensor" is displayed. Using the increment or decrement keys, adjust the span until the correct CO<sub>2</sub> % level is indicated.
10. Press Mode key to exit Service Mode, or wait 30 seconds for auto exit.
11. To verify if the new CO<sub>2</sub> calibration works correctly, open both outer and inner doors for at least 30 seconds, close the doors and wait a minimum of two hours permitting the temperature and RH to stabilize.
12. After two hours, sample the CO<sub>2</sub> via the sample port with calibration instrument; remember to reduce CO<sub>2</sub> set point 1.0% below your actual set point to avoid injecting gas during your measurement check.
13. If a small offset adjustment between (0.1 to 0.5%) is necessary, enter Program mode, press Mode key until "Set CO<sub>2</sub> OFFSET" is displayed. Using the increment or decrement keys, enter a corresponding offset to match the displayed value with your calibration instrument. Press Mode key to exit Program mode, or wait 30 seconds for auto exit.

**CO<sub>2</sub> OFFSET NOTE** If a CO<sub>2</sub> offset value was entered, after exiting Program mode back to the normal Run mode; wait at least 2 to 3 minutes for the displayed value to auto-correct using the new offset value entered. The delay in the update is due to how the system microprocessor averages CO<sub>2</sub> measurements, the displayed value will not update immediately! ▲



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## Section 6 Control Systems Theory

Laboratory CO<sub>2</sub> Incubators have a "jacket" between the incubator chamber and the exterior wall of the unit. In water jacketed incubators, the jacket is filled with water; in dry wall incubators, the jacket contains air. The temperature control system operates in the same manner for both types of incubators.

Interior chamber temperature control is maintained by two sensors. One sensor is located in the jacket and the other sensor is located in the chamber air. Both sensors constantly signal the electronic circuitry. The chamber air provides a reference point while the jacket is being controlled. This circuitry recognizes that jacket temperature is very slow to react to any change in either ambient or chamber temperature but the chamber temperature can change very rapidly due to door opening.

**For example:** The chamber inner door is opened. The chamber air sensor immediately signals a large drop in temperature but the control recognizes that, unless there is a corresponding (smaller) drop in jacket temperature, there is no need to increase the heat. The system does nothing until sufficient time passes to measure how fast the chamber air temperature is rising to meet the jacket temperature after the door is closed. Heat is applied to the jacket in short bursts. The rate of heat application changes as the circuit monitors the two sensors. This control scheme is extremely accurate and stable, with the ability to control within  $\pm 0.1^{\circ}\text{C}$  of the setpoint.

### Overtemperature Monitoring System

This system is activated anytime the chamber air sensor detects a temperature above the overtemperature setpoint, which should be set no closer than  $0.3^{\circ}\text{C}$  above the chamber temperature. When the system is activated, the jacket heater is turned off and both audio and visual alarms are activated. Control is now effectively switched to the overtemperature monitoring system. The overtemperature sensor is the chamber air sensor which also provides the signal for the digital display on the control panel.

### **Door Heat System**

Heating the inner surface of the outer door with a low wattage, large area heater provides enough radiant heat to the glass door to control condensation. The micro-processor control operates the door heater.

### **CO<sub>2</sub> Control System**

This system uses a sensor assembly consisting of a pair of matched, thermistor sensors in a housing. One of the sensors is sealed in a nitrogen filled housing and provides the 0 to 1 VDC reference signal for the gas control board. The other sensor continually samples filtered chamber air. The main control board compares these signals with the input from the control panel CO<sub>2</sub> setpoint. If the difference exceeds 0.5% below setpoint, the CO<sub>2</sub> solenoid remains open 100% of the time. If the difference is less than 0.5%, the CO<sub>2</sub> solenoid cycles until setpoint is reached.

### **CO<sub>2</sub> Recovery (after door opening)**

When the chamber inner door is opened, the door switch shuts off all gas flow into the chamber. When the door is closed, gas again flows into the chamber under the control of the TC gas concentration sensor. At this time the gas solenoid is open 100% of the time and remains open until the CO<sub>2</sub> level has recovered to within 5% of the setpoint. The solenoid then reverts to cycling.

## Section 7 Maintenance

**Warning** Maintenance procedures involve working with high voltages which can cause injury or death. Maintenance should only be performed by trained personnel. ▲

The incubator can be easily cleaned and disinfected in about 30 minutes.

Be sure to use an appropriate disinfectant solution: Roccal II; its Lysol equivalent, 5 milliliters per liter; or O-Syl in a one percent solution. Disinfectants should always be diluted with sterile, distilled water.

**Caution** Before using any cleaning or decontamination method except for those recommended in the manufacturer, contact Technical Services to verify that you will not damage the equipment. ▲

**Caution** Do not use strong alkaline or caustic agents, which can cause corrosion, rust and pitting of stainless steel surfaces. Stainless steel is corrosion-resistant but not corrosion-proof. ▲

**Caution** Do not use sodium hypochlorite solutions such as Purex and Clorox. These can also cause corrosion and pitting of stainless steel. ▲

**Caution** Do not use steel wool pads such as Brillo; they deposit carbon particles in the chamber. ▲

When cleaning stainless steel, use the mildest cleaning procedure that will do the job effectively. To avoid marring the surface, always rub in the direction of the finish polish lines.

**Caution** Do not use aromatic solvents to clean the cabinet interior; residues could cause contamination of the cabinet environment. ▲

## Cleaning

To clean and disinfect your incubator:

1. Remove the shelves, support walls and pans.
2. Clean all interior surfaces with the disinfectant solution using a clean sponge.
3. Rinse the interior surfaces at least twice with sterile distilled water.
4. Clean the inner door gasket thoroughly.
5. Clean the inside of the glass door with the disinfectant solution, then rinse twice with sterile distilled water.
6. Clean the shelves, support walls and pans with disinfectant and rinse thoroughly with sterile distilled water.
7. Wipe down all disinfected surfaces with an alcohol solution.

**Caution** Alcohol is volatile and flammable. Use only in a well-ventilated area removed from open flames and other heat sources. Allow sufficient time for fumes to dissipate before using cleaned components. ▲

## CO<sub>2</sub> Filter Replacement

To replace the CO<sub>2</sub> Filter:

1. Turn the main power switch to OFF.
2. Turn the gas supply (or supplies) to OFF.
3. Remove the tubing from both ends of the gas filter.
4. Note the flow direction on the filter. The side marked IN points to the gas supply. Install the new filter onto the tubing connected to the incubator and the tubing connected to the gas supply (refer to Gas Supplies in Section 3 and Figure 2-1).
5. Turn the gas supply (or supplies) to ON.
6. Turn the main power switch to ON.

## Fuses

The fuses used in this incubator are located on the power supply board and should only be replaced by a qualified technician.

The F1 and F2 fuses are Type "T", rated at 120V/6A or 230VAC/3A.

The F3 and F4 fuses are Type "T", rated at 120V/500mA or 230VAC/300mA.

## Door Seal Check

To check the door seal, complete the following steps:

1. Open the inner glass door.
2. Insert a strip of paper (a couple of inches wide) between the door gasket and the cabinet flange and close the door.
3. Slowly pull the paper strip from the outside. You should feel some resistance.
4. Repeat this test at 4 inch (10 cm) intervals around the door. If the door does not seal properly, call Technical Services; the gasket needs to be adjusted or replaced.

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## Section 8 Parts List

Description	Part Number
Door Gasket, Inner Assy (6 ft)	103140
MIDI Door Heater 115V	132073
MIDI Chamber Heater 115V	132083
MIDI Door Heater 230V	132113
MIDI Chamber Heater 230V	132121
MIDI Control Panel Overlay	140393
SYMPHONY Control Panel Overlay	140394
MIDI Display Assembly SRO	192039
MIDI Micro Board SRO	192040
MIDI, Power Board 120V SRO	192041
MIDI, Power Board 230V SRO	192042
MIDI CO <sub>2</sub> Incubator Decal (VWR)	220981
MIDI Inc Decal (SYMPHONY)	220982
MIDI RTD Temp Sensor 1000HM	290194
MIDI CO <sub>2</sub> Sensor Assembly	290195
MIDI EPROM Programmed	320546
MIDI Inc Power To Micro Harness	350061
MIDI Inc Door Switch and Harness	350062
MIDI Incubator Key Switch and Harness	350064
MIDI, Lead-Acid Battery 12V	400194
Cordset 10A,125V,18/3,USA	430108
Cordset 10A,250V, European	430109
2 Black Rubber Suction Type Foot	505180
Disposable Filter 99.97	770001
MIDI Exterior Door Gasket	990044
MIDI Inner Glass Door SRO	1900435
MIDI Inner Door Latch SRO	1900436
Valve Assembly, CO <sub>2</sub> Solenoid SRO	1900437
Stacking Hardware Kit	290225



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## THERMO FISHER SCIENTIFIC STANDARD PRODUCT WARRANTY

The Warranty Period starts two weeks from the date your equipment is shipped from our facility. This allows for shipping time so the warranty will go into effect at approximately the same time your equipment is delivered. The warranty protection extends to any subsequent owner during the first year warranty period.

During the first year, component parts proven to be non-conforming in materials or workmanship will be repaired or replaced at Thermo's expense, labor included. The Warlow EZ-ZONE PM controller is covered for one additional year for repair or replacement (parts only), provided the unit has not been misapplied. Installation and calibration are not covered by this warranty agreement. The Technical Services Department must be contacted for warranty determination and direction prior to performance of any repairs. Expendable items, glass, filters and gaskets are excluded from this warranty.

Replacement or repair of components parts or equipment under this warranty shall not extend the warranty to either the equipment or to the component part beyond the original warranty period. The Technical Services Department must give prior approval for return of any components or equipment.

At Thermo's option, all non-conforming parts must be returned to Thermo Fisher Scientific postage paid and replacement parts are shipped FOB destination.

**THIS WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, WHETHER WRITTEN, ORAL OR IMPLIED, NO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE SHALL APPLY.** Thermo shall not be liable for any indirect or consequential damages including, without limitation, damages relating to lost profits or loss of products.

Your local Thermo Sales Office is ready to help with comprehensive site preparation information before your equipment arrives. Printed instruction manuals carefully detail equipment installation, operation and preventive maintenance.

If equipment service is required, please call your Technical Services Department at 1-800-438-4851 (USA and Canada) or 1-740-373-4763. We're ready to answer your questions on equipment warranty, operation, maintenance, service and special application. Outside the USA, contact your local distributor for warranty information.



REV. 5/8/13

### HERMO FISHER SCIENTIFIC INTERNATIONAL DEALER WARRANTY

The Warranty Period starts two months from the date your equipment is shipped from our facility. This allows for shipping time so the warranty will go into effect at approximately the same time your equipment is delivered. The warranty protection extends to any subsequent owner during the first year warranty period. Dealers who stock our equipment are allowed an additional six months for delivery and installation, provided the warranty card is completed and returned to the Technical Services Department.

During the first year, component parts proven to be non-conforming in materials or workmanship will be repaired or replaced at Thermo's expense, labor excluded. The Watlow EZ-ZONE PM controller is covered for one additional year for repair or replacement (parts only), provided the unit has not been misapplied. Installation and calibration are not covered by this warranty agreement. The Technical Services Department must be contacted for warranty determination and direction prior to performance of any repairs. Expendable items, glass, filters, reagents, tubing, and gaskets are excluded from this warranty.

Replacement or repair of components parts or equipment under this warranty shall not extend the warranty to either the equipment or to the component part beyond the original warranty period. The Technical Services Department must give prior approval for return of any components or equipment. At Thermo's option, all non-conforming parts must be returned to Thermo postage paid and replacement parts are shipped FOB destination.

**THIS WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, WHETHER WRITTEN, ORAL OR IMPLIED. NO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE SHALL APPLY.** Thermo shall not be liable for any indirect or consequential damages including, without limitation, damages relating to lost profits or loss of products.

Your local Thermo Sales Office is ready to help with comprehensive site preparation information before your equipment arrives. Printed instruction manuals carefully detail equipment installation, operation and preventive maintenance.

Contact your local distributor for warranty information. We're ready to answer your questions on equipment warranty, operation, maintenance, service and special application.



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401 Mill Creek Road  
Marietta, Ohio 45750  
United States

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