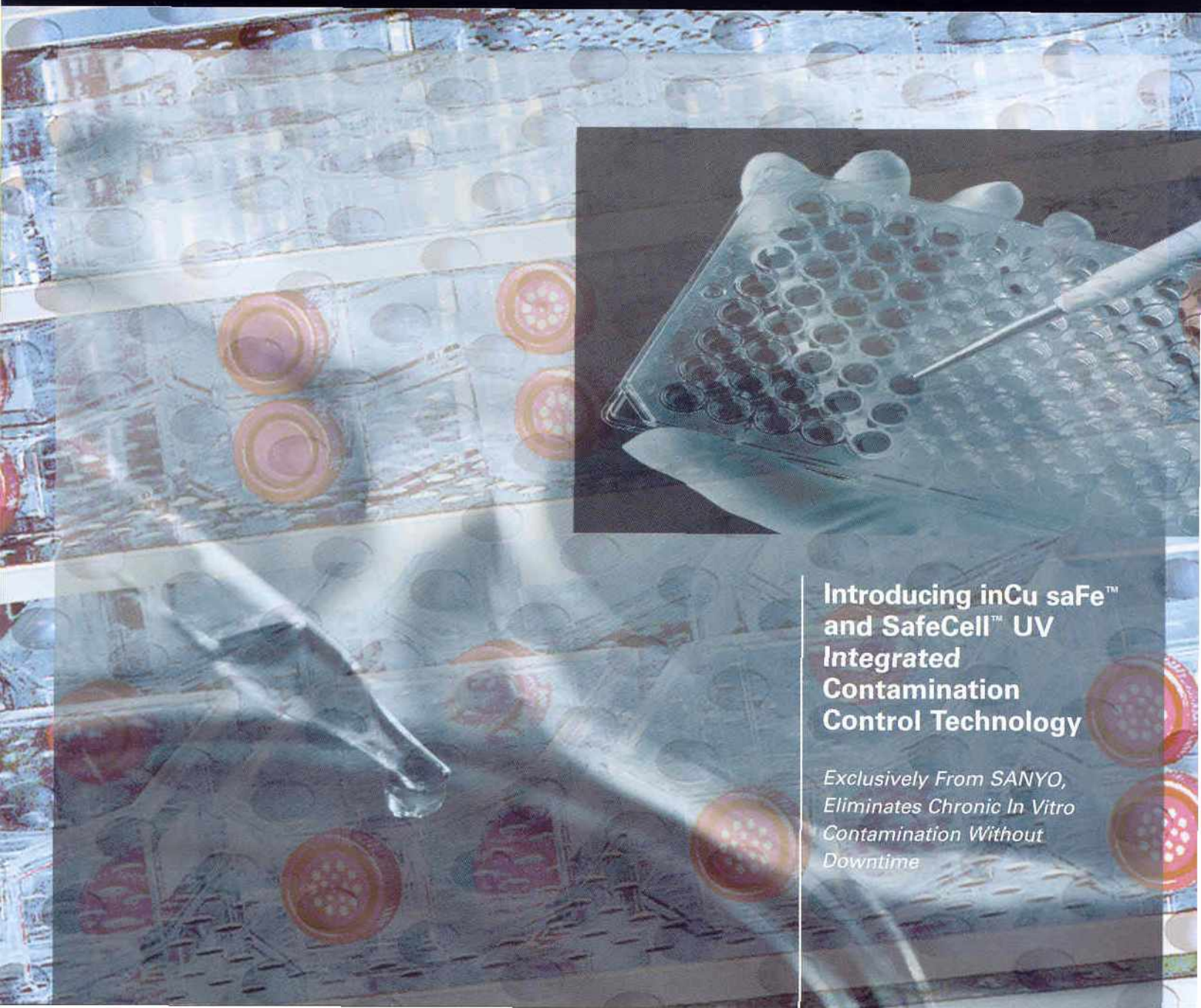


# SANYO

## MCO-20AIC Professional Cell Culture CO<sub>2</sub> Incubator



**Introducing inCu saFe™  
and SafeCell™ UV  
Integrated  
Contamination  
Control Technology**

*Exclusively From SANYO,  
Eliminates Chronic In Vitro  
Contamination Without  
Downtime*



**Contamination.**

**Downtime.**

**Controlled.**

**None.**

The new MCO-20AIC Automatic CO<sub>2</sub> Incubator provides a stable cell culture environment where contamination control is a continuous process, not an inconvenience.



InCu saFe™ Copper Enriched  
Stainless Steel Interior



Direct Heat Air, Jacket

**CULTURE**  
**24/7/365**

RS485  
1001110110100011001  
RS232C

$\Delta T$  5°C .. 50°C  
AMB

$\pm 0.25^\circ\text{C} \leftrightarrow 0.1^\circ\text{C}$

CO<sub>2</sub> 0-20%  $\leftrightarrow$  0.1%

RH95% @ 37°C

195 liters  
6.9 cu.ft.

NET INTERIOR VOLUME

After years of research, development and laboratory testing, SANYO introduces the Model MCO-20AIC. Here is an extraordinary cell culture CO<sub>2</sub> incubator, functional in performance, easy to use, and designed specifically for critical applications in pharmaceutical, biotechnology and clinical investigation.

Safe for the most demanding cell culture protocols, the SANYO MCO-20AIC offers significant economic benefits by avoiding costly interruptions for decontamination, improving cell culture growth and expression under stable, repeatable conditions, and minimizing the potential for loss due to contamination, drift, overshoot or operator error.



MCO-20AIC with world recognized  
SANYO Electronic temperature control.  
Shown with two removable shelves, included.





### Background Contamination Control

The SANYO MCO-20AIC is the world's first and only cell culture CO<sub>2</sub> incubator to employ continuous *active background* ultraviolet light sterilization in combination with the passive resistance of a copper-enriched stainless steel chamber to destroy contaminants *in vitro* without affecting cell cultures and without downtime.

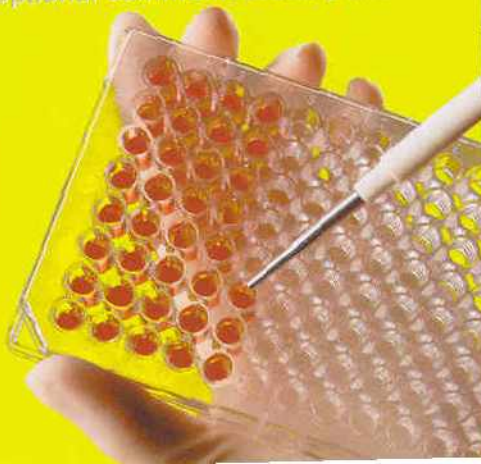
### Eliminates HEPA Filter Scrubber and Decontamination Heat Cycle

The MCO-20AIC inhibits the growth of mycoplasmas, bacteria, molds, spores, yeasts and fungi without costly HEPA filter air scrubbers which accumulate contaminants in the chamber, or disruptive, high temperature decontamination schemes which can actually encourage growth of heat resistant thermophilic and hyperthermophilic microorganisms *in vitro*.

As a result, the MCO-20AIC offers a sensitive yet robust platform for short term, high-throughput drug discovery projects as well as intermediate and long-term cell culture investigations.

### High Performance *In Vitro* Modeling

Stable temperature, humidity and CO<sub>2</sub> density are achieved through a combination of performance systems supervised by a centralized microprocessor controller complete with alarm, programming, calibration and diagnostic protocols exportable to remote databases through optional communications ports for compliance monitoring.



- Exclusive SafeCell™ UV System (Patent Pending) with programmable ultraviolet lamp, isolated from cell cultures, sterilizes conditioned air and humidity water reservoir to prevent contamination
- inCu saFe™ copper-enriched stainless steel interior chamber and inventory components provide natural germicidal protection without rust or corrosion
- Direct Heat, Air Jacket (DHA) heating system eliminates need for water jacket, and provides accurate temperature control, quick recovery and uniform stability without condensation
- Ceramic-based IR Infrared CO<sub>2</sub> sensor eliminates conventional filament bulbs and electro-mechanical devices to deliver accurate CO<sub>2</sub> control with fast recovery following door openings
- Mounted in the door, SANYO electronic PID microprocessor control assures safe, secure operation with alarm and monitoring for all functions, plus system programming for individual protocol or preference
- A spacious 6.9 cu.ft./195 liter interior chamber (net useable volume), field-reversible doors and stackable design assure efficient use of available laboratory space with easy installation and relocation when desired





Contamination control in the MCO-20AIC is managed by a combination of three basic performance techniques:

- A programmable ultra-violet lamp to sterilize air and humidity pan water without affecting cell cultures
- Copper-enriched polished stainless steel interior walls, shelves and plenum components
- A gentle, blower-assisted air circulation system which stops when the door is opened



The SafeCell™ UV system gently circulates incubator air through a plenum for decontamination and humidification.

## UV Lamp Program Options

| Mode               | Function                                                                                                                 |
|--------------------|--------------------------------------------------------------------------------------------------------------------------|
| After Door Opening | UV lamp automatically ON for five minutes after door is closed. Time factory set, user programmable from 0-30 minutes.   |
| OFF                | If UV protection is not desired                                                                                          |
| Continuous ON      | Useful for overnight decontamination prior to first use or following total chamber wipe-out after maintenance or service |

Although the contamination control system is factory set for normal use, operation of the UV lamp can be programmed as desired. Program parameters are input through the microprocessor control panel.

## Active Background Contamination Control

At the base of the plenum, an isolated beam of high intensity, ozone-free UV light destroys contaminants in the air and in the water reservoir, away from cell cultures, not simply collected in a HEPA filter. •

- Contaminants contained within the distilled water in the humidity pan are destroyed by UV.
- Sterile, humidified air is released from the lower plenum for vertical convection through and around the perforated shelves.
- Interior air motion stops when the door is opened, minimizing movement of room air into the chamber.
- Plenum components isolate UV light to protect cell cultures, while the UV process continues in the background as programmed without downtime.
- Following door openings, trace contaminants which attach to walls, shelves and plenum components are destroyed by the germicidal properties of the inCu saFe™ copper-enriched stainless steel surfaces, and air-borne contaminants are eliminated by an automatic 5 minute UV cycle (programmable 0 - 30 minutes).
- Other design factors which help mitigate contamination include condensation control, inner door gasket design and triple 0.3 micron filters for vent air and CO<sub>2</sub> sensor sampling.

Humidifying Water Comparison



Test results after three months confirm the efficacy of SANYO SafeCell™ UV protection on humidifying water after three months.

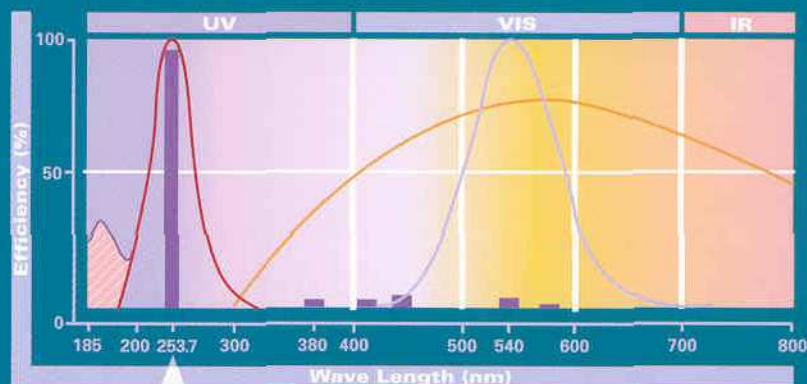


Fig. 1: Germicidal efficiency of the SafeCell™ UV lamp. The graph shows the germicidal efficiency of the SafeCell™ UV lamp across the UV, VIS, and IR spectrum.

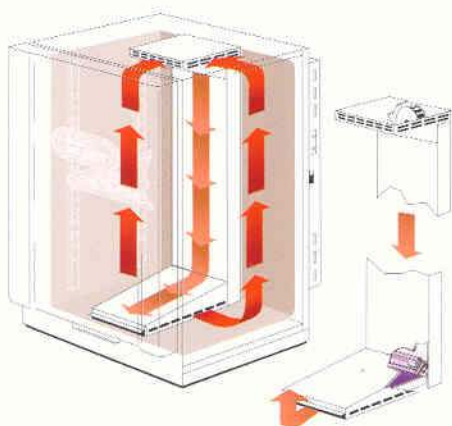
SafeCell™ UV lamp, Copper-enriched stainless steel, Germicidal efficiency, SafeCell™ UV lamp, Germicidal efficiency

Unlike typical germicidal lamps, the long-life SafeCell™ UV lamp is designed to deliver straight-line performance at approximately 253.7 nm for maximum germicidal efficiency and long life.



## Direct Heat, Air Jacket (DHA) Heating System

The Direct Heat, Air Jacket (DHA) heating system eliminates the need for a conventional water jacket, while achieving temperature stability, uniformity and fast recovery following door openings.



The SafeCell™ UV air flow plenum promotes temperature uniformity through the chamber, shaped by natural and mechanical convection through and around the perforated shelves with gentle circulation through the plenum for UV sterilization and warm water humidification. Air motion stops when door is opened.

## Elevated Humidity, Low Water Level Warning

To avoid cell culture desiccation, the MCO-20AIC maintains 95% RH at 37°C through a combined forced

air and natural evaporation method, which is enhanced by the DHA base heater and protected by an optical water level indicator to warn of low water in the removable humidity pan.

- A unique optical water level sensor automatically inserts into the humidity pan when filled and replaced.
- If the water level drops below one liter (nominal), an indicator on the main control panel will flash.
- Because the DHA base heater helps maintain higher RH levels than in conventional incubators without direct RH control, media desiccation is minimized and condensation is eliminated.
- The humidity pan removes easily with one hand; the optical sensor releases automatically and no tools are required.
- When filled with distilled water, the pan slides into place and the optical sensor returns to position automatically.
- Once returned to position, the SafeCell™ UV lamp destroys any contaminants introduced during the process.

## IR Infrared CO<sub>2</sub> Control

The SANYO MCO-20AIC uses a unique ceramic-based infrared sensor system to maintain precise CO<sub>2</sub> control regardless of temperature and relative humidity changes within the incubator chamber. Sensor stability is especially useful following door openings while temperature and humidity return to equilibrium.

The sensor is virtually maintenance free with no moving parts and eliminates filament bulbs or electro-mechanical "chopping" devices.



- The CO<sub>2</sub> sensor automatically calibrates every four hours.
- The system allows CO<sub>2</sub> control over a range from 0-20% in 0.1% setpoint increments.
- Actual CO<sub>2</sub> is displayed on the main control panel.
- A CO<sub>2</sub> sample port mounted on the incubator front permits convenient confirmation of chamber CO<sub>2</sub> density.
- An optional automatic CO<sub>2</sub> switchover system is available. See Accessories.
- A two-stage regulator from the supply cylinder to the incubator is required. See Accessories.

The microprocessor controller directs proportional distribution of electrical power to a series of independent heating sources in the incubator.

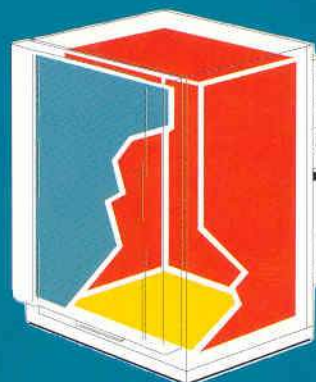
Arranged in three zones, these sources include the side, top and rear walls, the chamber base and the outer door. Together, the heating sources maintain accurate temperature control over a range from 5°C above ambient to +50°C, with setpoint accuracy to 0.1°C and uniformity better than 0.25°C throughout the chamber.

Each zone is controlled according to the demands of the microprocessor, which manages continuous feedback from the incubator via a PID (proportional, integral and derivative) algorithm.

| Zone  | Location                  | Energy   | Microprocessor Control                                              |
|-------|---------------------------|----------|---------------------------------------------------------------------|
| Main  | Side, top, and rear walls | Variable | Energizes any, all or a combination of heating elements as required |
| Base  | Floor                     | Variable |                                                                     |
| Front | Outer door                | Variable |                                                                     |

An air jacket with five independent heating elements arranged in three zones surrounds the interior chamber. The microprocessor control system apportions energy to heaters in response to chamber demand and ambient temperature.

- Side, top and rear walls form the dominant radiant heat source.
- The base heater elevates the humidity reservoir water temperature to achieve 95% RH at 37°C.
- The outer door heater warms the inner glass in response to ambient conditions to eliminate condensation on the glass and around the opening, and to assure interior uniformity.





## Microprocessor Control System

SANYO expertise in electronic innovations applies to the SANYO MCO-20AIC microprocessor control system. All incubator functions are managed by a fully integrated controller which acquires and processes information from data entry, set-points and alarm parameters.

- Proportional, integral and derivative controls supervise temperature, CO<sub>2</sub> and other features for accurate, repeatable performance.
- A range of setpoint, alarm and programmable inputs are established through the use of function keys.
- Standard parameters are factory-set for quick start-up, and all parameters may be changed as required.
- A remote alarm terminal mounted at the rear of the cabinet can be connected to an external alarm system.

## Data Communications (Optional)

The MCO-20AIC microprocessor control system automatically exports performance values to the optional RS232 or RS485 data port for transfer to computer or other data logging systems.

- Data points include temperature, CO<sub>2</sub> density, low water level and door ajar signal.
- When installed, ports are located at the rear of the cabinet.

## Cabinet Design

The MCO-20AIC represents a continuing evolution in incubator development pioneered by SANYO applications in inCu saFe™ copper alloy stainless steel, unitized interior radii and flexible door configurations for universal installation.

Integrated contamination control techniques are based on the MCO-20AIC cabinet design, with particular emphasis on relational sub-components such as gaskets, hardware and utility management.

## inCu saFe™ Interior Chamber



When exposed to humidity and CO<sub>2</sub>, the copper-enriched, polished stainless steel interior expresses a natural germicidal attribute to inhibit the growth of molds, fungi, mycoplasma and bacteria.

- All interior components, including the air management plenum, shelf supports, humidity pan and blower wheel are easily removable without tools if required.
- When components are removed, all interior surfaces are exposed for conventional wipe-down.
- Large curve corners and electropolished surfaces are easy to clean.
- A pass-thru port accommodates probes or instrumentation leads as required for specialized cell culture protocols. The port is positioned in the interior chamber, rear wall, upper left, with dual rubber stoppers inside and outside the cabinet for added protection.

The MCO-20AIC control panel is center mounted in the outer door for easy access, even when incubators are stacked. Microprocessor based controls manage all incubator functions including setpoints, alarm parameters, UV lamp periods, programming, calibration and diagnostics. Extra-large digital displays are easy to read. Tactile feedback touchpad data shift and entry keys simplify operation. When stacked, door mounted controls remain easily accessible in comparison to conventional dual incubators.





## Inner Door and Gasket

The inner door gasket is comprised of a dual durometer extrusion from closed-cell silicone to inhibit contamination. A feather-edge outside surface allows the inner glass door to close gently against the chamber opening for a tight peripheral seal.

- The inside gasket body forms an effective thermal transition between the ambient air and warm, humidified incubator atmosphere, minimizing condensation and eliminating moisture traps which can harbor contaminants.
- The entire inner door gasket is removable for cleaning and/or replacement if required.
- The inner door features an adjustable cam-action latch which pulls the glass against the gasket for a gas-tight seal.
- Radiant heat from the outer door, controlled by the DHA heat system, automatically warms the glass in proportion to total heat demand and condensation control.

## Exterior Cabinet

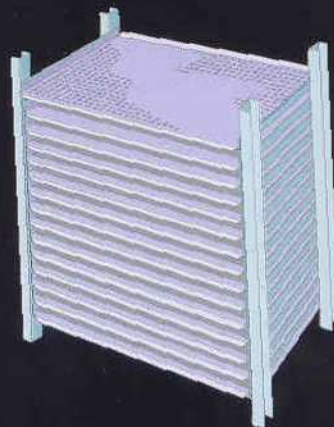
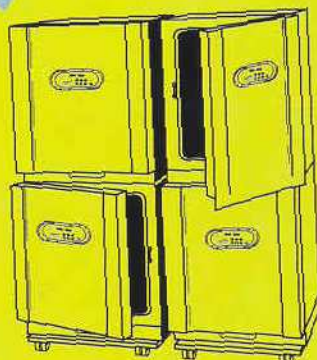
Universal design offers a distinct advantage in model selection. With reversible inner and outer doors and a cabinet reinforced for stacking, a single SANYO MCO-20AIC offers the industry's most flexible installation option without added cost.

- Stacking hardware is included.
- Low density cabinet insulation promotes energy efficiency and protects the air jacket from ambient temperature fluctuations, while allowing the cabinet to operate at setpoint temperatures as low as 5°C above ambient.
- The outer door latches and door heater cable are easily switched if a reverse opening is required. Cabinet knock-outs are pre-punched to eliminate drilling.
- The outer door closes against the cabinet opening with a soft, easy-to-clean magnetic gasket designed to eliminate ambient air motion across the inner glass door.
- A door ajar alarm provides an audible and visual warning if the outer door is left open.



The exterior cabinet is constructed of smooth, stainless steel for easy cleaning. Adjustable leveling feet provide proper installation on uneven surfaces. Removable pins on the interior top are attached to leveling feet to eliminate warping & lightweight design with stainless steel handle permits effortless opening from within.

With a reversible door and optional shelving designed for stacking, the MCO-20AIC permits an unlimited combination of possible non-sterile uses and in the future, an optional roller base adds mobility where required. See Accessories.



Shelves are easily arranged in 1.1"/29mm increments. Five shelves are supplied with the MCO-20AIC. Total incubator capacity is fifteen shelves.

## Shelves and Inventory Management



Inventory management components including shelves, brackets and shelf supports are formed from copper-enriched polished stainless steel to inhibit contamination. All components are removable without tools for cleaning or autoclaving if required.

- Incubator shelves are perforated to permit natural vertical air convection through and around lab ware.
- Shelves are easily accessible and can be removed with one hand for transfer to a bench or biological safety cabinet.
- Shelf brackets slip easily into vertical supports that attach to interior chamber walls with clearance sufficient to permit air circulation against all interior surfaces.
- Additional shelves include two brackets. See Accessories.



### Automatic CO<sub>2</sub> Cylinder Switchover System

Automatically changes from primary to secondary gas cylinder when first cylinder is depleted. Audible alarm and flashing indicator on main control panel notifies user when switch has occurred. Field installed by authorized service personnel only.

Catalog Number MCO-20GC



### CO<sub>2</sub> Cylinder Regulator

Two-stage gas regulator monitors cylinder supply and meters gas to incubator input. CGA Fitting 320.

Catalog Number MCO-100L



### Roller Base

For use in single or stacked installations. Solid steel base includes positioning plates for incubator levelers. High-impact casters permit easy location. Adjustable front mounting pins extend

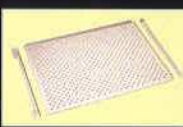
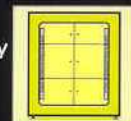
to floor to prevent movement when installation is complete. Pins retract if roller base must be moved.

Catalog Number MCO-20RB

### Independent Inner Door Kit

High impact, clear plastic doors attach to interior inventory system behind glass inner door. Customer installed; directions included.

Catalog Number MCO-20ID



### inCu saFe™ Shelf and Brackets

The MCO-20AIC Incubator holds up to fifteen shelves. Five shelves are included with each incubator. Additional shelves may be ordered. Each shelf includes two shelf brackets which insert without tools.

Catalog Number MCO-58ST

### Communications Port

Located at rear of chamber, RS232/RS485 data port acquires information from microprocessor controller including temperature, CO<sub>2</sub>, door ajar status and humidity pan water level. Connector, cable and software not supplied.

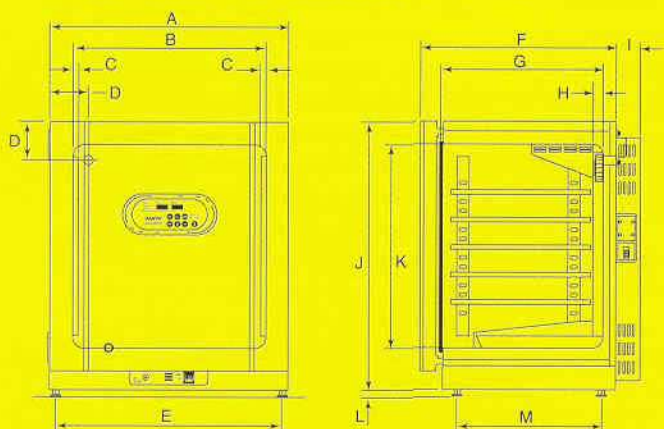
Catalog Number MTR-480

### Data Acquisition Software

Available for monitoring and/or controlling microprocessor system. Windows® based, for installation on PC. LAN compatible, configurable, SMTP server to internet for user PC or mobile phone delivery.

Catalog Number MTR-2000

## MCO-20AIC DIMENSIONS



| KEY | in. (nominal) | mm  | KEY | in. (nominal) | mm  | KEY | in. (nominal) | mm  |
|-----|---------------|-----|-----|---------------|-----|-----|---------------|-----|
| A   | 30.3          | 770 | F   | 24.7          | 628 | K   | 26.2          | 665 |
| B   | 24.4          | 620 | G   | 20.6          | 523 | L   | 0.8           | 20  |
| C   | 0.6           | 15  | H   | 1.3           | 34  | M   | 18.5          | 469 |
| D   | 4.9           | 125 | I   | 3.1           | 80  |     |               |     |
| E   | 28.7          | 730 | J   | 34.6          | 880 |     |               |     |

# SANYO

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Distributed By:

## SPECIFICATION SUMMARY

|                                      |                                                                                      |
|--------------------------------------|--------------------------------------------------------------------------------------|
| Heating System                       | Direct Heat, Air Jacket (DHA) with positive air flow                                 |
| Combined Heating Elements            | 395 W distributed proportionally                                                     |
| Temperature Controller               | Microprocessor PID                                                                   |
| Temperature Display                  | Digital, resolution to 0.1°C                                                         |
| Temperature Range                    | 5°C above ambient to +50°C, ±0.1°C                                                   |
| Temperature Uniformity               | ±0.25°C top to bottom                                                                |
| CO <sub>2</sub> System               | Ceramic based infrared CO <sub>2</sub> sensor with ON/OFF inject                     |
| CO <sub>2</sub> Range                | 0 to 20%, ±0.1%                                                                      |
| CO <sub>2</sub> Variation            | ±0.15%                                                                               |
| CO <sub>2</sub> Setpoint and Display | Digital, control panel, resolution to 0.1%                                           |
| CO <sub>2</sub> Inlet Connection     | Requires 4 to 6mm ID tubing                                                          |
| CO <sub>2</sub> Inlet Pressure       | 5 PSIG • 0.03MPaG • 0.3kgf/cm <sup>2</sup> G • 294millibarG                          |
| Humidification Method                | Gentle air flow through duct, natural evaporation from humidity pan over base heater |
| Relative Humidity                    | 95% @ 37°C, ±5%                                                                      |
| Water Level Sensor                   | Optical, with visual low water alarm                                                 |
| Net Interior Volume                  | 6.9 cu.ft./195 liters, nominal                                                       |
| Gross Interior Volume                | 7.6 cu.ft./215 liters, nominal                                                       |
| Interior Dimensions                  | 24.4"W x 20.6"F-B x 26.2"H (620 x 523 x 665mm)                                       |
| Exterior Dimensions                  | 30.3"W x 27.9"F-B x 35.5"H (770 x 708 x 900mm)                                       |
| Shelf Dimensions                     | 22.8"W x 17.7"F-B x 0.5" lip (580 x 450 x 12mm)                                      |
| Maximum Load Each Shelf              | 11 lbs (5 kg) nominal, 5 shelves standard, 15 shelves maximum                        |
| Access Port                          | 1.18" diameter (30mm) with inner and outer rubber stoppers                           |
| Exterior Finish                      | Polyester finished, baked-on zinc galvanized steel                                   |
| Inner Door                           | Tempered glass                                                                       |
| Outer Door                           | PMMA/PVC with integrated door heater                                                 |
| Cabinet Insulation                   | Rigid polyurethane, foamed-in-place, CFC-free                                        |
| Decontamination, Programmable        | Continuous UV sterilization of air and humidity source                               |
| UV Lamp                              | 4 W, 253.7 nanometer, ozone-free emission                                            |
| Microbiological Filters              | Three, 0.3 micron, 99.97% efficient                                                  |
| Interior Surface                     | Copper alloy polished stainless steel for germicidal protection                      |
| Alarm System                         | Overtemperature, CO <sub>2</sub> deviation, low water, door ajar                     |
| Remote Alarm Contacts                | 30V, DC, 2 amps allowable                                                            |
| Communications                       | RS232/RS485 data port (optional)                                                     |
| Electrical                           | Switchable, 110-120V, 60Hz, AC or 220-240V, 50Hz, AC                                 |
| Maximum Current                      | 110-120V, 3.8 amps; 220-240V, 1.9 amps                                               |
| Maximum Heat Emission                | 1299 BTU/Hr (1370 kJ/Hr)                                                             |
| Noise Emission                       | 30 dB (A scale)                                                                      |
| Net Weight                           | 234 lbs (106 kg)                                                                     |



SANYO Electric Biomedical Co., Ltd. is a member of the SANYO Group. Sanyo Group has received ISO 14001 Certification for its environmental management system.