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INTELLIGENT CO_2 CELL CULTURE INCUBATOR

Intelligent CO_2 Cell Culture Incubator – ToronCubator™ CI

ToronCubator™ CI is an intelligent CO_2 incubator engineered for high-demand cell culture and biological research laboratories that require precision atmospheric control, comprehensive data traceability, and remote monitoring capability. Spanning three chamber volumes (100 L, 180 L, and 260 L) this laboratory incubator combines a direct hot gas jacket heating system with three-zone uniform heating, BRIGHT I intelligent control, a 500,000-record data management system, and Boxun Smart Connect IoT integration. For B2B life science, pharmaceutical, and clinical research environments where documentation integrity and environmental stability are non-negotiable, the ToronCubator™ CI sets a new operational standard among CO_2 laboratory incubators. The ToronCubator™ CI is a full-featured intelligent CO_2 incubator designed for research-grade cell culture, biological assay incubation, and any laboratory workflow requiring simultaneous precision control of temperature, CO_2 concentration, and relative humidity. Three chamber volumes 100 L, 180 L, and 260 L serve a range of throughput requirements, from focused research setups to high-capacity institutional cell culture operations.

The operating platform is the BRIGHT I intelligent system, accessed through a 7-inch HD color touch screen. Unlike conventional laboratory incubator controllers, BRIGHT I automatically compensates control parameter values in response to real-time environmental changes maintaining set-point accuracy without manual recalibration when ambient conditions fluctuate. The system records every operational event with an exact timestamp and generates a unique traceable imprint for each operator action, providing a complete audit trail for GLP- and GMP-aligned laboratory environments.

The data management system can store more than 500,000 records without SD card dependency, with real-time visualization of instrument records and performance curves directly on the display. All data can be exported via USB in a non-modifiable file format, making records suitable for regulatory submissions, institutional review, and long-term study documentation. An optional embedded printer adds real-time hard-copy output of calendar time, temperature, and CO_2 concentration values for labs that require paper-based records alongside digital logging.

Structurally, the inner chamber uses integrated mirror inner liner construction with a large-arc, dead-angle-free design and no exposed fasteners minimizing contamination sites and making post-sterilization cleaning straightforward. Electrical components are positioned at the top of the unit, providing generous design space for maintenance access, routine service, and overhaul procedures without disturbing the internal working environment. A magnetic switch on the glass door monitors

door status continuously, allowing the system to compensate for parameter fluctuations that occur each time the chamber is accessed.

APPLICATIONS

Intelligent CO_2 Cell Culture Incubator – ToronCubator™ CI Applications

The ToronCubator™ CI addresses the most demanding CO_2 incubation requirements across B2B life science, clinical, and pharmaceutical research environments. Its intelligent data management, IoT connectivity, and precise atmospheric control make it suitable for regulated and high-throughput workflows alike.

- Cell & Tissue Culture: long-duration mammalian cell line maintenance, primary cell and stem cell culture requiring stable CO_2, temperature, and humidity with full operational traceability.
- Pharmaceutical Biologics: cell-based assay platforms, biologics upstream process development, and GMP-adjacent workflows requiring 500,000-record data management and USB audit export.
- Clinical & IVF Labs: embryo culture, IVF incubation, and reproductive medicine applications requiring precision CO_2 control and rapid set-point recovery after door access events.
- Biomedical Research: in vitro toxicology, drug screening, immunology, and long-term culture studies where continuous IoT monitoring and SMS alarm integration reduce risk of undetected events.
- Microbiology & Mycology: controlled-atmosphere microbial culture, fungal growth studies, and pathogen research requiring moist heat sterilization capability and HEPA-grade contamination control.
- Regulated Research Environments: GLP, GMP, and ISO 17025-aligned laboratory workflows requiring operator-level traceability, non-modifiable data export, and comprehensive multi-alarm protection.


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ToronCubator™ CI
Intelligent CO_2 Cell Culture Incubator

FEATURES

Intelligent CO_2 Cell Culture Incubator – ToronCubator™ CI Key Features

Smart Operating System

- BRIGHT I intelligent operating system with 7-inch HD color touch screen and automatic environmental compensation of control parameters
- 500,000+ record data management system no SD card required; real-time curve viewing on-screen with USB export in non-modifiable format
- Event management system records every control event with an exact timestamp for complete audit trail documentation
- Rights management system: administrators customize access rights per operator; each action generates a unique traceable imprint in the event record
- Temperature Control System
- Direct hot gas jacket design with three temperature zones and 6 heating units for fast, uniform heating and anti-condensation on inner walls and glass door
- Independently adjustable temperature limit switch for a second layer of overtemperature protection beyond the primary controller
- One-button automatic 90 °C moist heat and high-humidity sterilization UV sterilization also supported
- Temperature uniformity ±0.5 °C; fluctuation ±0.3 °C across the RT+5 to 55 °C operating range

Process Design

- Integrated mirror inner liner with large-arc, dead-angle-free geometry and no exposed screws for thorough post-sterilization cleaning
- Perforated mirror-reinforced stainless steel shelving for uniform sterilization and airflow across all shelf positions
- Universal adjustable casters for easy repositioning of the unit within the laboratory
- Electrical components positioned at the top of the unit for convenient maintenance access and routine servicing without chamber disruption
- Magnetic glass door switch for continuous monitoring of door status to compensate for parameter fluctuations on each door-opening event
- Relative humidity maintained above 90% RH throughout the incubation range

Configuration Interface

- Imported single-beam dual-wavelength IR CO_2 sensor with high accuracy (±0.1%) and zero drift across the full service life
- Dedicated sampling and testing ports on the glass door and inner chamber back wall for independent gas verification without chamber access
- Water level sensor at the base with water shortage alarm for humidification system monitoring
- Quick-insert drain port for regular water replacement in the chassis easy to operate without tools
- Independent temperature protection device separate from the primary control circuit

- USB interface, CO_2 inlet, and 485 communication interface for connectivity and external data integration
- Optional accessories include: Boxun Smart Connect App and SMS alarm integration for remote monitoring; optional embedded printer for real-time output of calendar time, temperature, and CO_2 concentration data.

Safety Protection

- Door-open alarm: audible and visual alert is triggered when the chamber door is left open beyond the defined threshold period.
- Double temperature protection: primary control system overtemperature protection combined with an independent temperature limit sensor a dual-layer safeguard against thermal excursions that could compromise cell culture viability.
- Low water level protection: a water level sensor at the base of the humidification system triggers a water shortage alarm when the reservoir level falls below the minimum operating threshold.
- Filter alarm: the system monitors filter condition and alerts the user when the filter requires replacement, maintaining HEPA-grade air quality inside the laboratory incubator throughout its service life.
- Abnormal CO_2 concentration alarm: if CO_2 concentration rises or falls outside the defined operating range, the device automatically triggers audible and visual alarms to alert laboratory personnel immediately.

THEORY & METHOD

Theory and Method

Direct Hot Gas Jacket Heating Three-Zone Design

The ToronCubator™ CI uses a direct hot gas jacket heating approach that distributes heated gas through a jacket surrounding the interior chamber. Three independent temperature zones each with dedicated heating units (6 units total across 3 zones) provide uniform thermal coverage across the full chamber volume, with no cold spots at corners or wall interfaces. This multi-zone architecture achieves temperature uniformity of ±0.5 °C and fluctuation of ±0.3 °C across the

RT+5 to 55 °C operating range. An independently adjustable temperature limit switch adds a second layer of overtemperature protection, and one-button 90 °C automatic moist heat and high-humidity sterilization eliminates the manual disassembly steps required by other sterilization methods.

BRIGHT I Intelligent Environmental Compensation

The BRIGHT I control platform continuously monitors environmental conditions and automatically adjusts control parameters to compensate for real-world fluctuations in ambient temperature, humidity, and CO_2 supply pressure. This adaptive approach maintains set-point accuracy without operator intervention when laboratory conditions change an important capability for research environments where HVAC cycling, seasonal temperature variation, or gas pressure changes would otherwise introduce systematic error into long-duration incubation runs. All compensation events are timestamped and logged within the 500,000-record data system.

Single-Beam Dual-Wavelength Imported IR CO_2 Sensing

CO_2 concentration is measured using an imported infrared sensor operating on a single-beam, dual-wavelength principle. The measurement wavelength targets CO_2 absorption; the reference wavelength compensates for sensor aging, particulate contamination, and thermal drift delivering high-accuracy, zero-drift CO_2 readings across the 0–20% control range with ±0.1% accuracy. CO_2 recovery time after a door-opening event is 6 minutes at 5% vol for ToronCubator™ CI 100, and 5 minutes for ToronCubator™ CI 180 and ToronCubator™ CI 260. The glass door and inner chamber back wall are fitted with dedicated sampling and testing ports for independent CO_2 verification without opening the main chamber.

90 °C Moist Heat Sterilization and UV Sterilization

The ToronCubator™ CI supports both 90 °C automatic moist heat sterilization and UV sterilization a dual sterilization approach that gives laboratories flexibility in selecting the decontamination method appropriate for their protocols. The one-button moist heat sterilization cycle operates at 90 °C with high humidity, effectively eliminating bacteria, fungi, and common contaminating organisms from interior surfaces, perforated shelves, and the mirror-finished stainless steel chamber walls. The perforated mirror-reinforced stainless steel shelving design ensures sterilizing conditions reach all surfaces uniformly without requiring shelf removal.

IoT Monitoring and Data Management

The Boxun Smart Connect platform provides remote monitoring of incubation status via app and SMS alarm integration, allowing laboratory managers to receive real-time alerts for alarm conditions regardless of physical proximity to the instrument. The on-board data management system stores over 500,000 records without SD card dependency, with real-time curve visualization on the touch screen. USB export delivers non-modifiable data files for audit trail documentation. An optional embedded printer outputs real-time records of calendar time, temperature, and CO_2 concentration for facilities that maintain paper-based logs alongside digital records.

TECHNICAL SPECIFICATIONS

Intelligent CO_2 Cell Culture Incubator – ToronCubator™ CI Technical Specifications

Parameter	ToronCubator™ CI 100	ToronCubator™ CI 180	ToronCubator™ CI 260
Chamber Volume	100 L	180 L	260 L
Sterilization Method	Moist Heat Sterilization / UV Sterilization		
Temperature Range	RT+5 to 55 °C		
Temperature Fluctuation	±0.3 °C		
Temperature Uniformity	±0.5 °C		
Temperature Control Accuracy	±0.1 °C		
Relative Humidity	> 90% RH		
CO_2 Inlet Pressure	0.05–0.1 MPa		

Parameter	ToronCubator™ CI 100	ToronCubator™ CI 180	ToronCubator™ CI 260
CO_2 Control Range (%vol)	0–20%		
CO_2 Control Accuracy (%vol)	±0.1%		
CO_2 Recovery Time	6 min @ 5% vol (BX-100C/CB); 5 min @ 5% vol (BX-180C/CB, BX-260C/CB)		
CO_2 Intake Time	5 min @ 5% vol		
CO_2 Fluctuation (%vol)	±0.1%		
CO_2 Sensor Type	Imported IR Single Beam Dual Wavelength, Zero Drift		
Water Required	1.5 L	3.0 L	3.0 L
Ambient Temperature Range	18–30 °C		
Housing Dimensions W×D×H	650×650×960 mm	750×740×1060 mm	800×780×1210 mm
Internal Dimensions W×D×H	400×430×600 mm	500×520×700 mm	550×560×850 mm
Shelf Dimensions	350×375 mm	450×465 mm	500×505 mm
Standard Quantity of Shelves	3		
Maximum Quantity of Shelves	14	18	22
Load per Shelf	10 kg		
Voltage	AC 220V (±10%), 50/60Hz (110V is also available)		
Maximum Power	900 W	950 W	1000 W
Data Storage	500,000+ records (no SD card required)		
Export Format	USB, non-modifiable file format		
Connectivity	USB, CO_2 inlet, RS-485 interface		
Remote Monitoring	Boxun Smart Connect App + SMS alarm (optional)		

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