



# PRECISION CO<sub>2</sub> HORIZONTAL SHAKER INCUBATOR

# Precision CO<sub>2</sub> Horizontal Shaker Incubator – ToronShake™ HS-P Series

## CO<sub>2</sub>-Controlled Horizontal Shaking Incubation for Cell Culture and Biological Research

ToronShake™ HS-P Series is a precision CO<sub>2</sub> horizontal shaker incubator engineered for laboratories that require simultaneous control of temperature, orbital agitation, and CO<sub>2</sub> concentration in a single, floor-standing instrument. Available in three chamber volumes 200 L, 280 L, and 350 L this laboratory shaker incubator builds on the full-featured foundation of the ToronShake™ HS-B platform and adds a high-precision infrared CO<sub>2</sub> sensor and dedicated pressure reducing valve making it the correct incubator shaker choice for mammalian cell culture, tissue engineering, and any biological research protocol where maintaining physiological CO<sub>2</sub> levels alongside temperature and agitation is a core experimental requirement.

The ToronShake™ HS-P Series is offered in two sub-series. The ToronShake™ HS-2P operates across a temperature range of 4–60 °C with compressor refrigeration and CO<sub>2</sub> control from 0 to 20% ( $\pm 0.1\%$  accuracy), without humidity control suited to CO<sub>2</sub>-regulated shaking incubation protocols where moisture management is not a separate requirement. The HS-1P adds humidity control from ambient levels up to 95% RH on top of the same refrigerated temperature range and CO<sub>2</sub> control capability providing the most complete atmospheric control available in the ToronShake™ horizontal lab shaker incubator lineup for protocols requiring defined CO<sub>2</sub>, humidity, and temperature conditions simultaneously.

Both sub-series share the BRIGHT I intelligent operating system, a 7-inch color touch screen, 30-segment programmable profiles across 999 repeatable cycles, high-quality compressor refrigeration, and 1,000,000-record USB data management delivering the same control platform and data integrity capabilities as the broader ToronShake™ shaker incubator range, with high-precision CO<sub>2</sub> sensing as the defining additional capability.

## APPLICATIONS

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# Precision CO<sub>2</sub> Horizontal Shaker Incubator – ToronShake™ HS-P Series Applications

The ToronShake™ HS-P Series lab shaker incubator is suited to research, quality control, and production-support applications where defined CO<sub>2</sub> concentration is required alongside temperature management and continuous orbital agitation.

- **Mammalian Cell Culture:** The primary application for this CO<sub>2</sub>-controlled incubator shaker suspension cell culture, hybridoma culture, CHO cell propagation, and other mammalian cell lines requiring physiological CO<sub>2</sub> levels (typically 5%) alongside temperature control and continuous orbital aeration. The combination of precise CO<sub>2</sub> management and orbital agitation makes the ToronShake™ HS-P the technically correct laboratory shaker incubator for large-volume suspension culture workflows where both gas atmosphere and agitation-driven oxygenation affect cell viability and productivity.
- **Tissue Engineering & Stem Cell Research:** Three-dimensional tissue construct development, organoid culture, scaffold seeding protocols, and stem cell expansion under physiological atmospheric conditions requiring precise CO<sub>2</sub> control, stable temperature, and defined agitation intensity throughout extended culture periods.
- **Upstream Bioprocess Development:** Small- to mid-scale cell culture-based upstream bioprocess development, seed train propagation, and inoculum preparation for bioreactor workflows where the ToronShake™ HS-P shaker incubator provides a controlled, scalable platform for developing and validating culture conditions before transfer to larger bioreactor systems.
- **Hybridoma & Antibody Production:** Hybridoma cell line maintenance, clonal expansion, and early-phase antibody production in suspension culture requiring stable CO<sub>2</sub> atmosphere, temperature control, and continuous agitation for consistent cell density and productivity across long-duration incubation runs.
- **Pharmaceutical Biologics Research:** Cell-based assay development, in vitro toxicology screening, cytotoxicity testing, and biologics upstream process support requiring physiological CO<sub>2</sub> and temperature conditions with multi-level permission management and USB data export for audit trail documentation in regulated pharmaceutical laboratory environments.
- **Microbiology & Biochemical Research:** CO<sub>2</sub>-dependent microorganism culture, capnophilic bacterial growth studies, enzyme kinetics assays under defined gas atmospheres, and biochemical reaction incubation protocols requiring

programmable temperature profiles combined with controlled CO<sub>2</sub> concentration from a single shaker incubator platform.

- Virology & Immunology: Viral propagation in host cell cultures, immune cell activation studies, cytokine production assays, and pathogen research requiring maintained physiological CO<sub>2</sub> levels, stable temperature, and defined agitation throughout the incubation period.
- Food Science & Fermentation: CO<sub>2</sub>-influenced fermentation trials, carbonated beverage microbiological studies, and food safety incubation protocols requiring defined gas atmosphere conditions alongside reproducible temperature and agitation control over extended timelines.



## FEATURES

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# **Precision CO<sub>2</sub> Horizontal Shaker Incubator - ToronShake™ HS-P Series**

## **Key Features**



## **Intelligent Control System**

- BRIGHT I intelligent operating system with automatic environmental compensation of control parameters maintains temperature and CO<sub>2</sub> setpoint accuracy under varying ambient laboratory conditions without manual recalibration
- 7-inch color touch screen with real-time display of temperature, CO<sub>2</sub> concentration, agitation rate, program status, and elapsed run time
- Multi-segment programmable design supporting up to 30 segments and 999 repeatable cycles for complex, multi-phase CO<sub>2</sub>-controlled shaking incubation protocols
- Reservation function for delayed-start scheduling of culture and incubation cycles
- Multi-level permission management for access control in shared or regulated laboratory shaker incubator environments
- Event recording function with real-time curve and data viewing directly on the touch screen display

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

- High-precision infrared (NDIR) CO<sub>2</sub> sensor delivering CO<sub>2</sub> control across 0–20% with  $\pm 0.1\%$  accuracy the defining feature that distinguishes this incubator shaker from standard non-CO<sub>2</sub> horizontal shaker incubator platforms
- Dedicated pressure reducing valve for regulated, consistent CO<sub>2</sub> gas delivery from external cylinder supply regardless of supply pressure variation
- Stable CO<sub>2</sub> atmosphere management throughout long-duration culture runs without operator intervention for gas pressure adjustment

## **Shaking Performance**

- Horizontal orbital shaking mechanism with a fixed Ø26 mm vibration amplitude for consistent, reproducible fluid agitation and CO<sub>2</sub> equilibration across all vessel positions
- Rotation rate range of 30–300 rpm with  $\pm 1$  rpm accuracy covering gentle rocking through vigorous aeration on a single lab shaker incubator platform
- DC motor drive for low-noise, stable long-duration shaking performance throughout extended CO<sub>2</sub>-controlled incubation runs

## **Temperature & Refrigeration**

- High-quality compressor refrigeration enabling temperature control from 4 °C suited to CO<sub>2</sub>-controlled protocols requiring sub-ambient temperature alongside atmospheric gas management
- Temperature resolution of 0.1 °C across the full 4–60 °C operating range
- Temperature fluctuation of  $\pm 0.3$  °C at 37 °C and uniformity of  $\pm 1$  °C at 37 °C

### **Humidity Control (ToronShake™ HS-1P)**

- Internal water tank-based humidification system delivering humidity control from ambient levels up to 95% RH
- Humidity fluctuation maintained within  $\pm 3\%$  RH preventing evaporative concentration of culture media during long-duration CO<sub>2</sub>-controlled incubation

### **Data Management & Connectivity**

- Onboard data storage supporting up to 1,000,000 records without SD card dependency
- USB interface for data export; timestamped records of temperature, CO<sub>2</sub>, and agitation data suitable for audit trail and regulatory compliance documentation
- Event recording with real-time curve viewing directly on the touch screen

### **Chamber & Physical Design**

- Tempered glass door with mechanical lock for chamber security and sample observation between access events
- Single-tray configuration accommodating flask sizes from 50 mL to 5,000 mL across a wide range of loading configurations
- Three chamber volumes (200 L, 280 L, 350 L) providing scalable capacity from focused cell culture research setups to high-throughput institutional lab shaker incubator workflows
- Mobile caster base for easy repositioning within the laboratory

## **THEORY & METHOD**

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## Theory and Method

**Horizontal Orbital Shaking Mechanism** The ToronShake™ HS-P operates on a horizontal orbital shaking principle in which the tray platform moves in a circular, fixed-radius orbit of Ø26 mm. This orbital motion generates consistent fluid movement within culture vessels promoting dissolved oxygen transfer, nutrient distribution, CO<sub>2</sub> equilibration across the culture volume, and waste product removal simultaneously. The DC motor driving the orbital mechanism delivers rotation rates from 30 to 300 rpm with an accuracy of  $\pm 1$  rpm, maintaining the programmed agitation setpoint with precision across the full speed range and throughout extended incubation runs.

**High-Precision Infrared CO<sub>2</sub> Sensing and Control** CO<sub>2</sub> concentration is measured and controlled using a high-precision infrared (IR) CO<sub>2</sub> sensor operating on a non-dispersive infrared (NDIR) principle. The infrared sensing approach measures CO<sub>2</sub> absorption directly in the gas phase delivering accurate, stable CO<sub>2</sub> readings across the 0–20% control range with  $\pm 0.1\%$  accuracy. Unlike thermal conductivity-based CO<sub>2</sub> sensing methods, the IR sensor is not subject to cross-sensitivity from humidity or other gas-phase components, making it well suited to the variable humidity conditions that arise in a shaker incubator during culture evaporation and humidification cycles.

A dedicated pressure reducing valve regulates CO<sub>2</sub> inlet pressure from the external gas supply to the chamber, ensuring consistent, controlled gas delivery regardless of supply cylinder pressure variation. This combination of high-precision IR sensing and regulated gas delivery maintains stable CO<sub>2</sub> setpoints throughout long-duration culture runs without requiring operator intervention for gas pressure adjustment.

**BRIGHT I Intelligent Temperature Control** Temperature is governed by the BRIGHT I intelligent operating system, which continuously monitors the internal chamber sensor and modulates output from the heating and refrigeration systems to maintain the programmed setpoint. BRIGHT I automatically compensates control parameter values in response to real-time ambient environmental changes maintaining setpoint accuracy without manual recalibration when laboratory conditions shift. Temperature resolution is 0.1 °C across the full 4–60 °C operating range, with fluctuation held to  $\pm 0.3$  °C and spatial uniformity within  $\pm 1$  °C, both measured at 37 °C.

**Compressor Refrigeration** Both the ToronShake™ HS-2P and ToronShake™ HS-1P sub-series incorporate a high-quality compressor refrigeration system that extends temperature control below room temperature down to 4 °C enabling CO<sub>2</sub>-controlled shaking incubation protocols that require controlled cooling alongside active orbital agitation and atmospheric CO<sub>2</sub> management. This is particularly relevant for cold-adapted cell culture, low-temperature biological assays, and protocols where the heat generated by the compressor and shaking mechanism must be actively managed to maintain setpoint stability.

**Humidity Control (ToronShake™ HS-1P)** The ToronShake™ HS-1P configuration adds an internal water tank-based humidification system that controls relative humidity from ambient levels up to 95% RH, with fluctuation maintained within  $\pm 3\%$  RH. In CO<sub>2</sub>-controlled cell culture applications, humidity management is important for preventing evaporative loss from culture vessels which can concentrate media, alter osmolality, and affect cell viability over extended culture periods. The HS-1P addresses this by maintaining defined humidity alongside CO<sub>2</sub> and temperature control within the same lab shaker incubator chamber.

**Programmable Multi-Segment Profiles** The BRIGHT I platform supports up to 30 programmable segments arranged across 999 repeatable cycles. Operators can define ramp rates, target temperatures, CO<sub>2</sub> setpoints, agitation speeds, soak durations, and step transitions to create complex atmospheric and thermal profiles that run automatically without operator intervention between phases. The reservation function allows delayed-start scheduling, enabling culture cycles to begin at a predetermined time without manual initiation.

**Data Management and Access Control** All operational events including temperature, CO<sub>2</sub> concentration, agitation rate, and alarm history are recorded continuously in onboard memory capable of storing up to 1,000,000 data records. Real-time data curves are viewable directly on the 7-inch touch screen. USB export transfers timestamped data files to external drives for documentation, audit trail, and regulatory compliance purposes. Multi-level permission management restricts parameter access to authorized users in shared or regulated laboratory shaker incubator environments.

## **TECHNICAL SPECIFICATIONS**

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# Precision CO<sub>2</sub> Horizontal Shaker Incubator - ToronShake™ HS-P Series

## Technical Specifications

Housing Dimensions W×D×H (in)

| Parameter                            | ToronShake™ HS-2350P/ ToronShake™ HS-2280P/<br>ToronShake™ HS-2200P | ToronShake™ HS-1350P/ ToronShake™ HS-1280P |
|--------------------------------------|---------------------------------------------------------------------|--------------------------------------------|
| Temperature Range (°F / °C)          | 39–140 °F (4–60 °C)                                                 |                                            |
| Temperature Resolution (°F / °C)     | 0.18 °F (0.1 °C)                                                    |                                            |
| Temp. Fluctuation at 98.6 °F / 37 °C | ±0.54 °F (±0.3 °C)                                                  |                                            |
| Temp. Uniformity at 98.6 °F / 37 °C  | ±1.8 °F (±1 °C)                                                     |                                            |
| Humidity Range (%)                   | Ambient to 95% RH                                                   |                                            |
| Humidity Fluctuation (%)             | ±3                                                                  |                                            |
| CO <sub>2</sub> Control Range (%)    | 0–20                                                                |                                            |
| CO <sub>2</sub> Control Accuracy (%) | ±0.1                                                                |                                            |
| CO <sub>2</sub> Sensor Type          | High-Precision Infrared (NDIR)                                      |                                            |
| Rotation Rate (rpm)                  | 30–300                                                              |                                            |
| Rotation Accuracy (rpm)              | ±1                                                                  |                                            |
| Vibration Amplitude (in / mm)        | 1.02 in (Ø26 mm)                                                    |                                            |
| Timer Range (h)                      | 0–999                                                               |                                            |

| Parameter                           | ToronShake™ HS-2350P/ ToronShake™ HS-2280P/<br>ToronShake™ HS-2200P       | ToronShake™ HS-1350P/ ToronShake™ HS-1280P                                |
|-------------------------------------|---------------------------------------------------------------------------|---------------------------------------------------------------------------|
| Voltage                             | 220V, 50/60 Hz (110V is also available)                                   |                                                                           |
| Rated Power (W)                     | 1,800 / 1,600 / 1,500                                                     | 2,800 / 2,400                                                             |
| Internal Dimensions W×D×H (in)      | 40.7×26.6×18.5 / 39.8×23.2×18.5 / 39.8×23.2×12.2                          | 40.7×26.6×18.5 / 39.8×23.2×18.5                                           |
| Housing Dimensions W×D×H (in)       | 54.3×31.5×39.8 / 53.1×27.6×39.4 / 49.6×28.7×33.5                          | 54.3×31.5×39.8 / 53.1×27.6×39.4                                           |
| Tray Size W×D (in)                  | 38.2×23.8 / 37.4×20.9 / 37.4×20.9                                         | 38.2×23.8 / 37.4×20.9                                                     |
| Standard Configuration              | 2000 mL×8 / 2000 mL×6 / 500 mL×20                                         | 2000 mL×8 / 2000 mL×6                                                     |
| Full Load Config. 350 L (mL×flasks) | 50×103 / 100×103 / 250×63 / 500×41 / 1000×22 / 2000×15 / 3000×11 / 5000×7 | 50×103 / 100×103 / 250×63 / 500×41 / 1000×22 / 2000×15 / 3000×11 / 5000×7 |
| Full Load Config. 280 L (mL×flasks) | 50×71 / 100×71 / 250×45 / 500×37 / 1000×18 / 2000×15 / 3000×8 / 5000×7    | 50×71 / 100×71 / 250×45 / 500×37 / 1000×18 / 2000×15 / 3000×8 / 5000×7    |
| Full Load Config. 200 L (mL×flasks) | 50×71 / 100×71 / 250×45 / 500×37 / 1000×18                                |                                                                           |
| Net Weight (lb)                     | 613 / 578 / 503                                                           | 622 / 587                                                                 |
| Gross Weight (lb)                   | 790 / 710 / 565                                                           | 799 / 723                                                                 |
| Package Size (in)                   | 60.6×39.4×48.8 / 59.4×35.8×46.9 / 55.1×35.4×40.6                          | 60.6×39.4×48.8 / 59.4×35.8×46.9                                           |

Full load configuration format: flask volume (mL) × number of flasks per tray. Internal and housing dimensions converted from mm to inches. Net and gross weights converted from kg to lb. Package dimensions converted from mm to inches.

Note: The HS-1P humidity control variant includes an internal water tank. The HS-2P is the standard non-humidity CO<sub>2</sub> configuration. LED illumination is not available on the HS-P Series see the ToronShake™ HS-A Series for illuminated horizontal shaker incubator configurations.



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