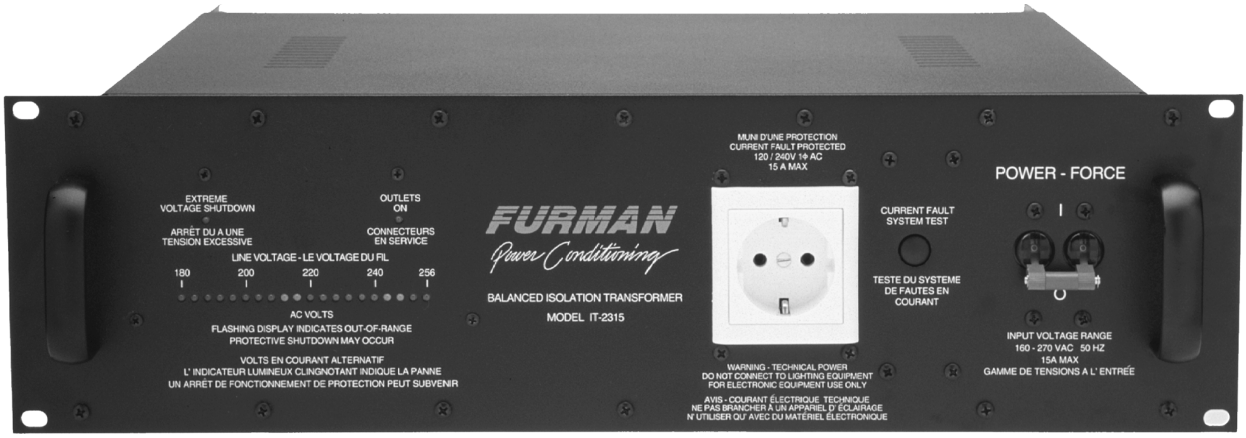
Furman Model IT-2315

Balanced Isolation Transformer



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FURMAN
PRODUCTS FOR AUDIO, VIDEO AND COMPUTER PROFESSIONALS

The following variations on the Model IT-2315 may be obtained to satisfy the current and voltage specifications required for international use:

Table 1 Current ratings for international versions of the IT-2315

Model	Current (A)	Voltage (V)
IT-2315B, IT-2315I, IT-2315F	15	230
IT-2315U	13	230
IT-2315S	10	230
IT-2315A*	15	240

*The IT-2315A draws 15 A from the mains but supplies 10 A to each outlet.

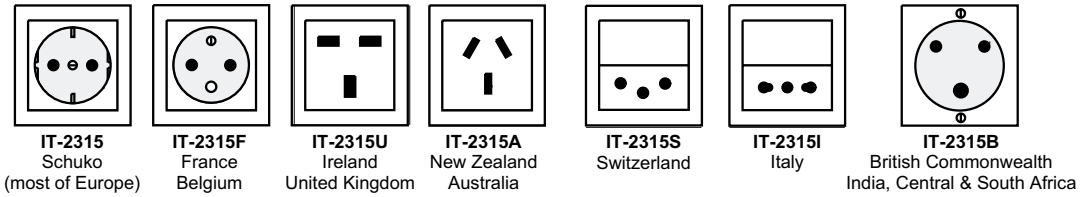

Figure 1 Optional outlet configurations

Features

- Tightly balanced, isolated, AC power for ultra-low-noise installations.
- Available with seven outlet configurations to meet the requirements of almost every nation.
- Available in 10 A, 13 A and 15 A models (15 A typical).
- Typically provides a 16 dB improvement in background noise floor.
- Toroidal transformer with center-tapped secondary is the most efficient and compact design, with minimal magnetic field leakage.
- Exclusive **Soft Start** circuit prevents turn-on transients and high inrush currents.
- Faraday shield reduces electrostatic coupling between primary and secondary.
- **Extreme Voltage Shutdown** circuit protects against dangerously high or low input voltages, such as accidental connection to 460 V.
- Microprocessor-controlled, smart AC voltmeter monitors line voltage and alerts the user to marginal and extreme voltage conditions, even when the unit is switched off (must be plugged in).
- Provides basic power conditioning functions like spike suppression and RFI filtering; dissipates spikes with a gas discharge tube.
- **Current Fault Protection System** prevents inadvertent shocks (equivalent to GFCI).
- CE and C-tic listed

Introduction

Thank you for purchasing the **Furman IT-2315 Balanced Isolation Transformer**, designed to supply low-noise AC power for critical installations. It can supply up to 15 A of balanced AC power to a recording studio, video or film production facility, broadcast station, live concert venue, or home theater. Its main function is to drastically reduce hum and buzz caused by ground currents from power supplies and radiation from supply cables into sensitive signal sources like guitar pickups, tape heads, and microphones. The IT-2315 dramatically reduces the noise floor and significantly improves dynamic range and sonic clarity. The unit is housed in a 3-U rack-mount chassis and can be installed in just a few minutes.

The heart of the IT-2315 consists of a specially wound and shielded, toroidal, isolation transformer with a center-tapped secondary. Its normal input voltage range is 180–256 V. The back panel provides four outlets and one inlet; the front panel contains one outlet (see Table 1 on page 2 for current ratings of different models). All outlets are spaced widely enough to provide clearance for "wall warts." The IT-2315 supplies completely clean and safe power without using ground lifts or compromising the integrity of safety ground wires to reduce hum.

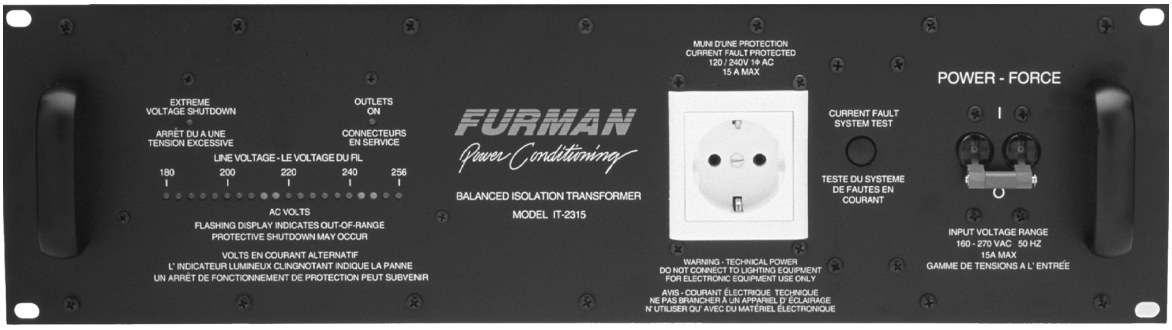

Figure 2 IT-2315 front panel

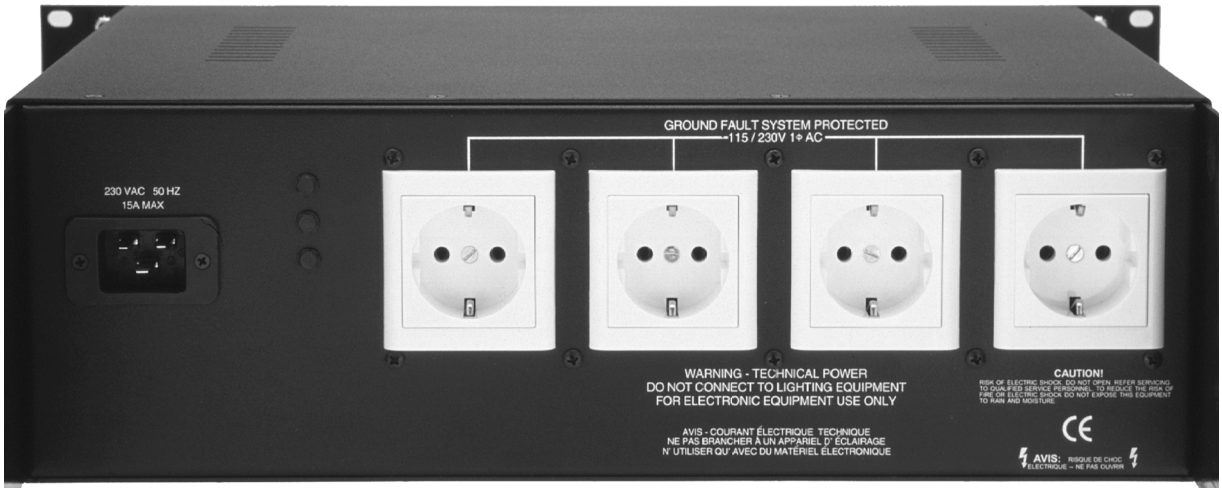

Figure 3 IT-2315 rear panel

Background

Unfortunately, international power distribution is not balanced. Current distribution standards were derived over a century ago, long before the existence of EMI-sensitive applications, when electric power was used primarily for lights and motors. The original emphasis was on convenience for the power utilities and safety for the consumer, not on noise cancellation. The resulting distribution scheme used one hot and one neutral wire for the 230 V branch circuit with the neutral tied to a third wire connected to an earth ground. The third wire carried current as a safety precaution only if there was a short circuit. This unbalanced method causes hum in audio circuits for two main reasons:

- The current flowing in the hot wire induces hum in other nearby wires; low-level audio signals are particularly vulnerable.
- Because the impedance of chassis and cable shielding to ground is not zero, ground current flows from power supply capacitors and from EMI. This resulting voltage drop adds a 50 Hz fundamental and its harmonics to the audio signal.

Similar to the method by which balanced audio lines reduce hum and other types of EMI, balanced AC power lines significantly reduce system noise in sensitive audio, video, or computer installations. The AC power feeding a facility can be balanced at its source with a center-tapped isolation transformer. The two current-carrying wires are no longer hot (230 V) and neutral (0 V), but equal voltages of opposite polarity, each referenced to the safety ground connected to the center tap.

Balanced power does not induce hum into nearby audio wiring because the two power conductors induce equal and opposite voltages that cancel each other. Ground currents are also virtually eliminated by the same common-mode cancellation effect. Cumbersome and expensive star-ground systems, massive bus bars, or heavy ground rods are no longer necessary. These methods yielded only mediocre results because it is impossible to reduce the ground impedance to zero. The common-mode rejection of a truly balanced, AC supply is far more effective, simpler, and cheaper.

Note: *Balanced, or "technical," power is recognized by the IEC for critical, low-noise applications.*

Installation

Because of its weight, the IT-2315 should be mounted at the bottom of a standard 3-U rack. Although the toroidal transformer minimizes magnetic leakage, its high capacity can radiate a small magnetic field. We recommend *not* placing the IT-2315 adjacent to a low-level audio signal processor, such as a mic preamp, mixer, or tape recorder; a power amp may be a more suitable rack neighbor.

Place the IT-2315 in a central location so its balanced power can reach all devices to achieve the maximum noise reduction. It must be connected to a power source that supplies at least 15 A. If the total power consumption for all equipment exceeds 15 A at 230 V, disconnect high-level or mechanical devices first, such as power amps, large tape machines, and power supplies. Physically isolate equipment that must use conventional power on a different circuit and route their AC cords away from all other cables.

To install the IT-2315 in a rack that has rear- as well as front-mounting rails, adjustable rear-rack ears are available from Furman (model RRM-2) to more securely attach the device on both sides.

Note: *The balanced power produced by the IT-2315 is restricted for use with electronic equipment only and may not be used for lighting equipment.*

Operation

Soft Start and Outlets On/Off Indicator

When power is first applied to the IT-2315, the **Soft Start** circuit prevents excessive inrush current from reaching the IT-2315's transformer. After about half a second, the green **Outlets On** LED turns on, indicating that all outlets are fully powered.

Note: *If power at any of the IT-2315's outlets turns off for any reason, the* **Outlets On** *LED will be off.*

Circuit Breaker–On/Off Switch

The only control on the IT-2315 is the large blue switch on the front panel that functions as both a precision, magnetic circuit breaker and an on/off switch (Figure 4). This breaker trips (snaps to the *O* position) if the total current drawn through the IT-2315 exceeds 15 A. If this occurs, reduce the load by unplugging some equipment (see Installation above), then flip the switch back to the *I* position. The breaker also trips in response to a short circuit at the input or output and excessive current leakage to ground.

Current Fault System Protection

Current Fault System Protection is a safety feature that uses a special circuit breaker to detect an imbalance in the current flowing in the two hot wires. The "missing" current is assumed to flow through the center pin on the AC outlet (ground conductor). Ground current is a hazardous condition that often indicates a partial or full short circuit. A current as small as 5 mA is sufficient to trip the main breaker and shutdown the unit.

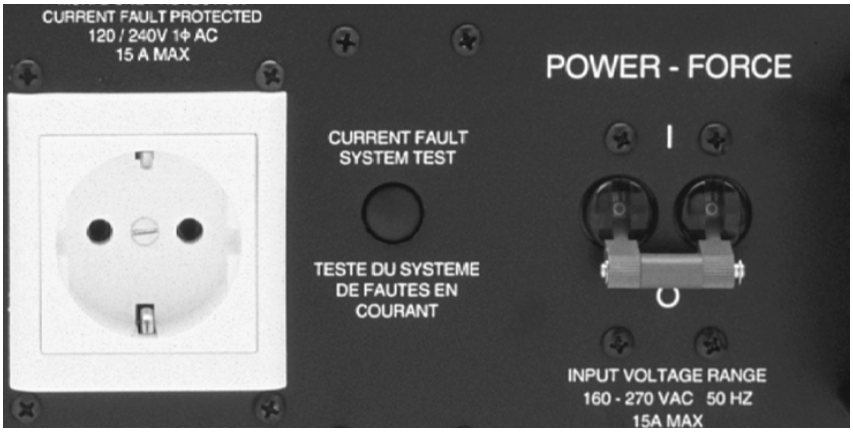

Figure 4 Current Fault System Test button and circuit breaker/power switch

Before resuming operation, it is essential to troubleshoot the source of the problem. Start by powering up the IT-2315 with nothing connected. Add one piece of gear at a time until the circuit trips again. If this device must be used, do not power it from the IT-2315; isolate it on a different AC circuit than that which supplies power to the IT-2315. Contact the manufacturer of the unit for possible solutions.

Test the fault protection once a month by pushing the button marked **Current Fault System Test** (Figure 4). This should cause the main breaker to trip and cut off power. *If this does not occur, contact a local Furman service representative.* Restore operation after the test by simply turning the unit on.

Extreme Voltage Shutdown

This LED Status Indicator monitors wiring faults, such as accidental connection to 460 V, a hazard particularly common in the entertainment industries. The IT-2315 detects voltages less than 170 V or greater than 270 V that make operation impossible. A voltage in this *Extreme* range removes power to the unit before damage can occur and lights the **Extreme Voltage Shutdown** LED (Figure 5).

If the mains voltage is in the Extreme range when power is first applied, the outlets will not receive power. If the unit has been operating within the normal voltage range and the voltage rises or falls into the Extreme range, the IT-2315 will shutdown and the LED will flash. Power will not be restored until the mains voltage rises above 180 V or falls below 260 V, which prevents on/off oscillation under marginal conditions.

LED Voltmeter

The AC voltmeter continuously measures input voltages in four-Volt steps and displays the result on a three-color, 20-LED bargraph (Figure 5). The voltmeter reads the input voltage *before* the circuit breaker-on/off switch so its LEDs stay on while the IT-2315 is plugged in, even when the power switch is off; this allows the voltage to be checked before powering up equipment. The LEDs are designed for continuous use and consume very little power.

The normal voltage range is indicated by green LEDs, moderately high and low voltages by yellow, and high and low voltages by red (see Table 2).

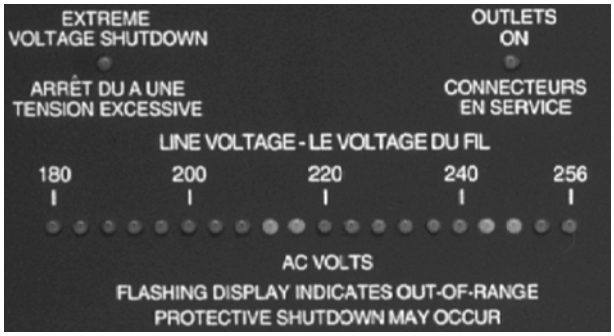

Figure 5 Extreme Voltage Shutdown and **Outlets On** LEDs and voltmeter

Three special flashing patterns indicate abnormal voltage status conditions:

1. **Marginal Low**: The single LED flashing beneath the number 180 indicates an input voltage below 180 V. The outlets remain powered unless the input voltage falls below 170 V.
2. **Marginal High**: All LEDs flashing indicates an input voltage in the range 257–265 V. The outlets remain powered unless the input voltage exceeds 265 V.
3. **Extreme Voltage Shutdown**: If none of the voltmeter LEDs are lit and the Extreme Voltage Shutdown LED indicator is flashing, the IT-2315 has removed power from the outlets due to an input voltage below 170 V or above 270 V.

The voltmeter is accurate to ±4 V under normal conditions and ±5 V in extreme cold or heat. Table 2 summarizes the IT-2315's outlet status and the voltmeter's display for all possible voltage ranges.

Table 2 AC Voltmeter behavior and outlet status

AC Mains Voltage Range (V)	Voltage Status	VoltmeterReading	Outlet Status
< 165	Extreme Shutdown	No meter display Extreme Voltage LED flashes	Off
166–179	Marginal Low	LED below the 180 V mark flashes	On
180–211	Low	Low red	On
212–219	Moderate Low	Low yellow	On
220–240	Normal	Green	On
241–248	Moderate High	High yellow	On
249–256	High	High red	On
257–265	Marginal High	All LEDs flash red	On
> 265	Extreme Shutdown	No meter display Extreme Voltage LED flashes	Off

Note: *The voltage reading is for advisory purposes only. The IT-2315 does not compensate for high or low line voltage. If you frequently relocate your rack, derive power from generators, use long extension cords, travel internationally, or are at risk of brownouts, you may benefit from one of Furman's AC Line Voltage Regulators. Contact Furman for more information.*

IT-2315 Specifications

Output Current (1Ø AC, 50 Hz)	
IT-2315S	10 A (2300 W at 230/115 VAC)
IT-2315, IT-2315B (I, F)	15 A (3450 W at 230/115 VAC)
IT-2315U	13 A (2990 W at 230/115 VAC)
IT-2315A	15 A (3600 W at 240/120 VAC)
Voltage Ranges	
Normal	220–240 V
High	241–256 V
Low	180–219 V
Marginal (flashes alert)	166–179 V or 257–270 V
Extreme (shuts down IT-2315)	below 170 V or above 270 V
Inlets	
IT-2315, IT-2315A (B, I, F)	Detachable heavy duty power cord with 15 A three-prong plug to IEC-320 C-19 connector
IT-2315U	Detachable heavy duty power cord with 13 A three-prong plug to IEC-320 C-19 connector
IT-2315S	Detachable heavy duty power cord with 10 A three-prong plug to IEC-320 C-13 connector
Outlets (Current Fault System Protected)	
IT-2315, (B, I, F)	4 rear, 1 front, each rated at 15 A
IT-2315U	4 rear, 1 front, each rated at 13 A
IT-2315S (A)	4 rear, 1 front, each rated at 10 A
Input-to-Output Isolation	
Breakdown Voltage	1500 V minimum
Capacitance	300 pF maximum
Noise Attenuation	
Transverse Mode	> 60 dB at 1–200 MHz
Common Mode	> 80 dB at DC–1 MHz

IT-2315 Specifications

Mechanical	
Dimensions	88 mm H x 475 mm W x 425 mm D
Weight	79 lb (35 kg)
Construction	Steel chassis, powder coated; glass epoxy printed circuit boards
General	
Turns Ratio	1:1; windings separated with Faraday shield
Transformer Regulation	3% at full load
Spike Protection Modes	Line to neutral, neutral to ground, line to ground
Spike Clamping Voltage	TVSS rating of 650 V peak L-N, 400 V peak L-G, N-G
Spike Response Time	1 nanosecond
Maximum Spike Energy	80 J per mode; 240 J total
Maximum Surge Current	6500 A (8 x 20 ms pulse)
Power Consumption	8.5 W for display and control circuits independent of load
Safety Information	CE and C-tic listed