

# Outdoor VRx

International

Precision voltage regulator

Isolation transformer

**Od-VRx model****4400-0455**

19 amps  
4.4kVA  
4.4 kW  
230 vac  
-20° to +52° C

**4400-0460**

19 amps  
4.4kVA  
4.4 kW  
230 vac  
with isolation  
transformer  
-20° to +52° C

## Outdoor Precision PWM Automatic Voltage Regulator with optional Low-impedance Isolation Transformer

TSi Power's Outdoor VRx precision PWM automatic voltage regulator with optional built-in low-impedance isolation transformer allows trouble-free operation of electronic equipment over a wide mains ac voltage range of 172 to 276V found in many developing countries.

There is no switching of taps or otherwise a break in the power path thanks to continuous PWM switching of a buck-boost transformer primary winding.

VRx is also designed with a fail-safe automatic bypass which enables the VRx to provide power to the load even in the event of internal failure that may otherwise result in a disruption of power to the load.

VRx with optional isolation transformer provides complete isolation from the ac line, with a neutral-to-ground bond to eliminate all surge voltages between neutral and ground.

### Typical applications

Designed for critical outdoor systems where reliability and predictability matter, such as remote transceiver base stations, fixed wireless applications, as well as for other outdoor equipment requiring additional protection. They are also for mission-critical applications such as telecom applications in remote environments where consistent voltage levels cannot be trusted, and where service calls are expensive.

VRx provides highly available regulated power and protection from mains voltages outside of the design limits for RBS power plants, typically 172 to 276vac. A low input voltage can result in inadequately charged batteries as the ac to dc power system is unable to draw the power required. An input voltage in excess of 276V, even for a short time, can cause the destruction of ac to dc power systems. In summary, VRx is designed to protect equipment even in the most challenging worldwide electrical, mechanical and environmental conditions.



### Key features of the VRx-4400

- Accepts continuous 172 to 276 vac at 50/60Hz input
- PWM automatic voltage regulation
- Built-in over-voltage (OVP) and under-voltage (UVP) protection
- Automatic fail-safe bypass
- Fail-safe design ensures OVP functions even if voltage regulation circuits fail and unit transfers to bypass
- Coordinated surge protection in accordance with IEC 61312
- EFT and noise protection with low dv/dt
- True isolation and neutral-ground bond with optional isolation transformer
- Low weight and high efficiency
- Quiet operation
- 2 year warranty

Power with a  
Precision Attitude™



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# Outdoor VRx



## Key VRx Series benefits

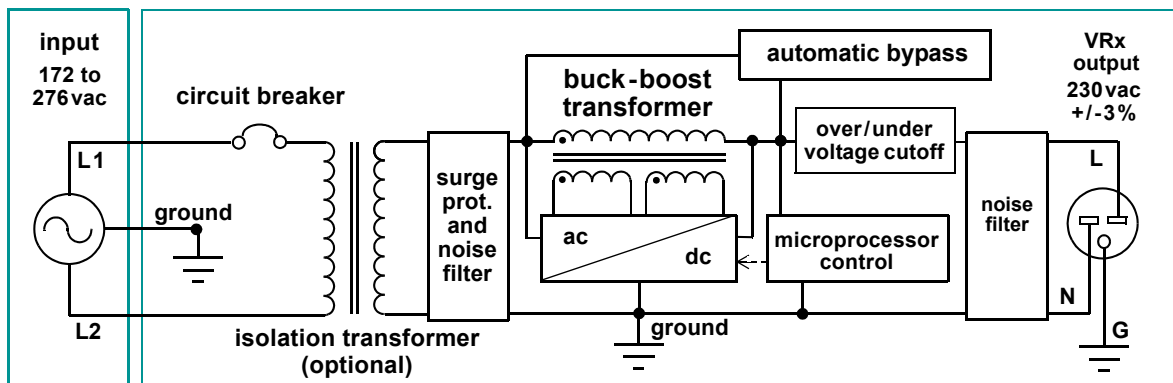
The lightweight, high efficiency Outdoor VRx is easy to install in severe weather exposed environments. The unit comes in a specially designed IP44 (NEMA-3R) outdoor rated enclosure and has removable lifting eyes to enable use of lifting equipment.

The automatic bypass assures that connected equipment will not shut down, even if VRx fails. VRx is compatible with all loads as it does not switch any components in the power path. VRx's ultra-low impedance assures stability even with the most demanding loads.

The automatic over-voltage / under-voltage cutoff with automatic restart ensures that operation is off-line during serious over-voltage or under-voltage situations that could damage the system and/or load, and then restarts without intervention when the ac mains voltage becomes within the operating range.

The optional isolation line conditioner provides maximum equipment protection against surges, spikes and transients, for higher equipment reliability and maximum equipment operating life. In addition, improved repeatability, fewer reboots or system lock-ups, a reduction in equipment down time and service costs can be expected.

## Outdoor VRx system architecture



## How the VRx Series works

The high frequency IGBT driven converter takes the incoming ac power, measures against the nominal voltage and adds or subtracts voltage, 20,000 times per second, to achieve precisely regulated 230 +/- 3% vac output.

The automatic bypass will be activated when there is a fault condition. Two green LED's indicate Normal (regulating protected mode operation), Yellow LED indicates Bypass (non-regulated output), and the Red LED indicates a Fault condition.

The over-voltage and under-voltage cutoff is activated whenever the ac mains voltage becomes dangerously high or low (outside 172 to 276 vac). It automatically restarts whenever ac mains voltage is restored within 172 to 276 vac.

An optional low-impedance isolation transformer provides complete isolation between the primary and secondary, and permits bonding its output neutral to ground, which completely eliminates all disturbances between neutral and ground. The leakage inductance of the isolation transformer, in combination with capacitive elements and MOVs, provide superb noise filtering, as well as coordinated multi-stage surge protection in accordance with the principles of IEC-61312.

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# Outdoor VRx

Outdoor rated wide voltage range precision automatic voltage regulator



VRx-4400 with isolation transformer option



VRx-4400 liquid-tight cable glands



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Specification	Od-VRx-4400-0455	Od-VRx-4400-0460																												
<b>Electrical</b>																														
Capacity in VA (watts)	4400VA (4400W)																													
Regulator engine	High frequency 20kHz IGBT driven voltage regulation converter																													
Transformer type	PWM buck-boost transformer	PWM buck-boost transformer plus isolation transformer																												
<b>Input</b>																														
Operating voltage	172 to 276 vac																													
Nominal frequency	47 to 63Hz																													
Circuit breaker rating	Upstream two-pole, 50A is recommended (to be supplied by customer).																													
VRx circuit breaker rating	Internal two-pole, 32A.																													
Input wire size (two wires plus ground)	10mm <sup>2</sup> (AWG 8) for both power and earth conductors. Stranded copper wire with min. 105°C insulation system recommended.																													
<b>Output</b>																														
Nominal voltage	230 vac, single phase.																													
Voltage regulation	Combined 3% maximum under 0 to 100% load and input of 172~276V.																													
Over-voltage protection	OVP removes power to protected load if output voltage exceeds 264V. Automatic reset returns power when voltage levels are back in tolerance.																													
Power efficiency	96% (typical)	90% (typical)																												
Automatic bypass	Automatic bypass will be activated when there is a fault condition.																													
System status indicators	System status LED's provided as follows: Green LED (blinking) indicates Normal (regulating mode operation); Yellow LED (blinking) indicates Bypass (non-regulated output); Red LED indicates Overload (system may shut down).																													
Surge protection	A coordinated surge protection system consisting of buck-boost transformer, filter and MOV. <i>(Plus isolation transformer on -0460).</i>																													
Surge test conditions	Class 2 and Class 3 simulated lightning surge (Combination wave) Per ANSI/IEEE C62.41-1991, Cat. C test waveform: 6kV, 3kA, 8x20µS																													
Surge let-through Voltage	<table border="1"> <thead> <tr> <th></th> <th>L-N</th> <th>L-G</th> <th></th> <th>L-N</th> <th>L-G</th> <th>N-G</th> </tr> </thead> <tbody> <tr> <td>Single pulse:</td> <td>50 V</td> <td>50 V</td> <td>Singlepulse:</td> <td>50V</td> <td>50V</td> <td>0.5V</td> </tr> <tr> <td>Ring wave:</td> <td>20 V</td> <td>20 V</td> <td>Ring wave:</td> <td>20V</td> <td>20V</td> <td>0.5V</td> </tr> <tr> <td>Comb. wave:</td> <td>250 V</td> <td>250 V</td> <td>Comb. wave:</td> <td>250V</td> <td>250V</td> <td>0.5V</td> </tr> </tbody> </table>		L-N	L-G		L-N	L-G	N-G	Single pulse:	50 V	50 V	Singlepulse:	50V	50V	0.5V	Ring wave:	20 V	20 V	Ring wave:	20V	20V	0.5V	Comb. wave:	250 V	250 V	Comb. wave:	250V	250V	0.5V	
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Comb. wave:	250 V	250 V	Comb. wave:	250V	250V	0.5V																								
Ac connection	Terminal block connectors via 19mm(3/4") liquid-tight cable glands.																													
<b>Physical</b>																														
Dimensions	406mm(16")wide x 711mm(28")high x 305mm(12")deep																													
Weight	36.3kg (80 lbs)	72.6kg (160 lbs)																												
Mounting options	Pole mountable with optional pole mounting kit, pedestal(ground), or wall-mountable, four wall-mounting 'feet' included.																													
Enclosure	System is built in a weather tight IP44 (NEMA 3R) metal enclosure.																													
<b>Safety</b>																														
Agency approvals	Designed to meet UL, cUL and IEC standards.																													
<b>Environmental</b>																														
Ambient temperature	-20° to +52°C. (-40° to +52°C with optional built-in heater), -4° to +125°F. (-40° to +125°F with optional built-in heater).																													
Altitude	From sea level to 10,000 feet (3000m) above sea level.																													
<b>Warranty</b>																														
Warranty	Two year limited warranty, parts and labor.																													

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# Outdoor VRx



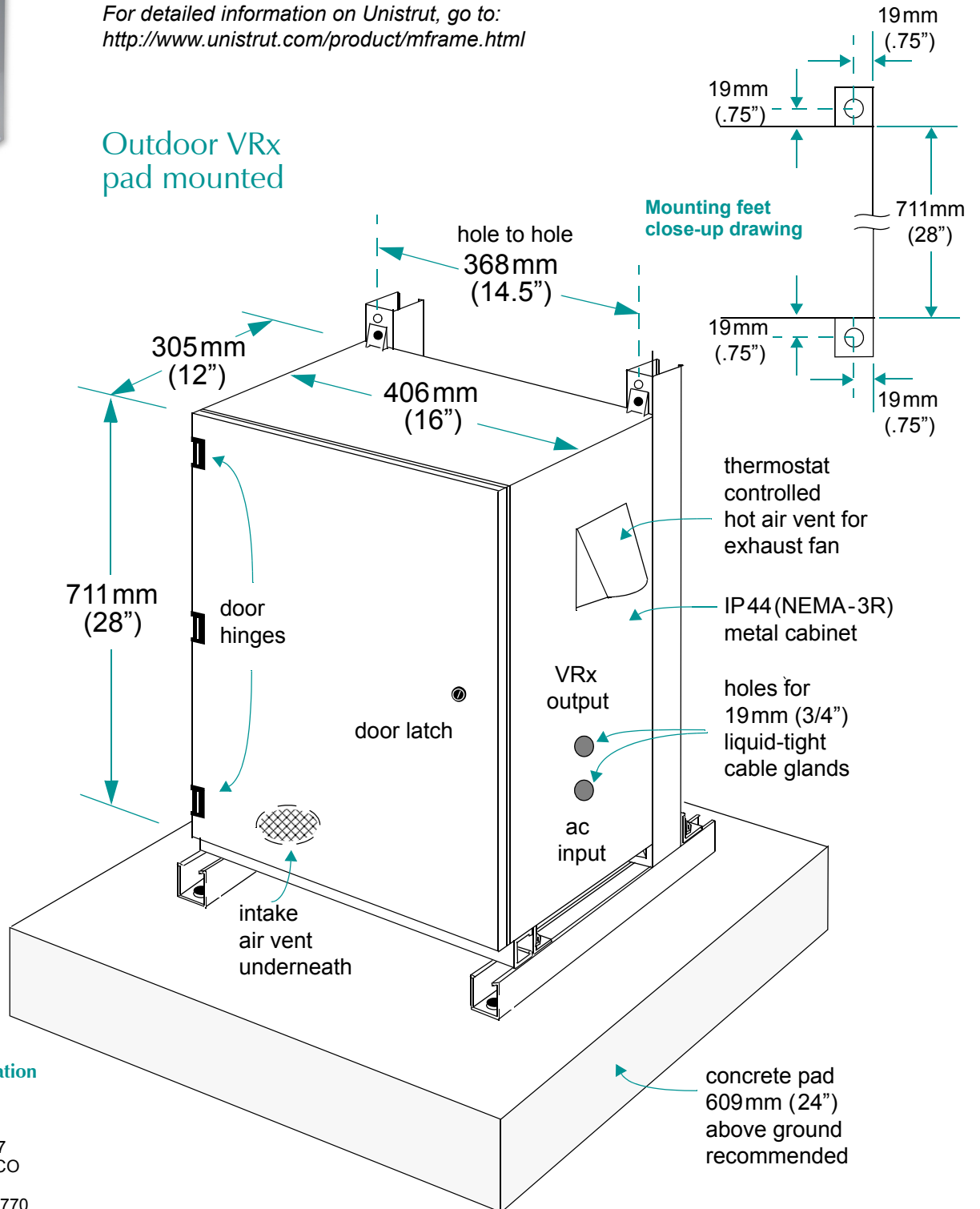
## Mounting on a concrete pad with Unistrut (or similar)

Following is a drawing of a recommended pedestal/concrete pad mounted installation of an Outdoor VRx Series unit bolted to vertical Unistrut members, which are bolted to horizontal Unistrut members that are bolted to a concrete pad.

The Outdoor VRx cabinet is provided with four (4) mounting feet at the four (4) corners.

For detailed information on Unistrut, go to:  
<http://www.unistrut.com/product/mframe.html>

### Outdoor VRx pad mounted



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