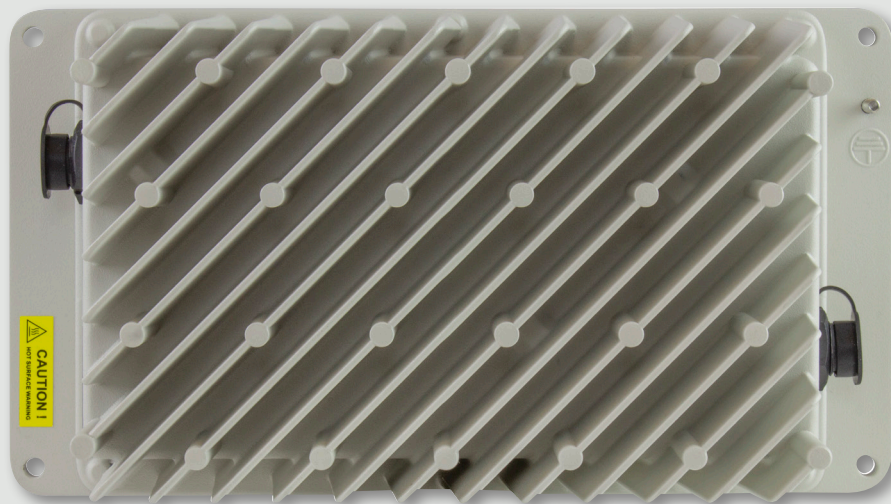


INV90AC-400

Technical Guide: 0120074-J0

Effective: 01/2019



INV90AC-400



NOTE:

Photographs contained in this manual are for illustrative purposes only. These photographs may not match your installation.



NOTE:

Operator is cautioned to review the drawings and illustrations contained in this manual before proceeding. If there are questions regarding the safe operation of this powering system, contact Alpha Technologies or your nearest Alpha representative.



NOTE:

Alpha shall not be held liable for any damage or injury involving its enclosures, power supplies, generators, batteries, or other hardware if used or operated in any manner or subject to any condition inconsistent with its intended purpose, or if installed or operated in an unapproved manner, or improperly maintained.

For technical support, contact Alpha Technologies:

Canada and USA: **1-888-462-7487**

International: **+1-604-436-5547**

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1. Safety

SAVE THESE INSTRUCTIONS: This manual contains important safety instructions that must be followed during the installation, servicing, and maintenance of the product. Keep it in a safe place. Review the drawings and illustrations contained in this manual before proceeding. If there are any questions regarding the safe installation or operation of this product, contact Alpha Technologies or the nearest Alpha representative.

1.1 Safety Symbols

To reduce the risk of injury or death, and to ensure the continued safe operation of this product, the following symbols have been placed throughout this manual. Where these symbols appear, use extra care and attention.

The use of **ATTENTION** indicates specific regulatory/code requirements that may affect the placement of equipment and/or installation procedures.



NOTE:

A **NOTE** provides additional information to help complete a specific task or procedure. Notes are designated with a checkmark, the word **NOTE**, and a rule beneath which the information appears



CAUTION!

CAUTION indicates safety information intended to **PREVENT DAMAGE** to material or equipment. Cautions are designated with a yellow warning triangle, the word **CAUTION**, and a rule beneath which the information appears.



WARNING!

WARNING presents safety information to **PREVENT INJURY OR DEATH** to personnel. Warnings are indicated by a shock hazard icon, the word **WARNING**, and a rule beneath which the information appears.



HOT!

The use of **HOT** presents safety information to **PREVENT BURNS** to the technician or user.

1.2 General Warnings and Cautions



WARNING!

You must read and understand the following warnings before installing the enclosure and its component. Failure to do so could result in personal injury or death.

- Read and follow all instructions included in this manual.
- Only trained personnel are qualified to install or replace this equipment and its components.
- Use proper lifting techniques whenever handling equipment, parts, or batteries.

1.3 Electrical Safety



WARNING!

Lethal voltages are present within the power system. Always assume that an electrical connection or conductor is energized. Check the circuit with a voltmeter with respect to the grounded portion of the enclosure (both AC and DC) before performing any installation or removal procedure.

- Do not work alone under hazardous conditions.
- A licensed electrician is required to install permanently wired equipment. Input voltages can range up to 126Vac. Ensure that the utility power is disconnected and locked out before performing any installation or removal procedure.
- No user serviceable components inside.
- Do not open chassis.

2. Introduction

2.1 Scope of the Manual

This instruction manual explains the installation and interconnection of Alpha Technologies' INV90AC-400 Sealed Outdoor Inverter system. To aid with installation, frequent reference is made to the drawings located at the rear of the manual.

2.2 Product Overview

The INV90AC-400 is a compact, sealed, standalone inverter unit to be used with either remote line powering equipment or with the existing HFC infrastructure.

The INV90AC-400 can either be powered from 48Vdc input (i.e LPR48-300) or HFC input (50Vac to 126Vac) and outputs up to 400W at 90Vac (350W at 120Vac) to power remote telecommunication equipment. Applications include powering Small Cells, MicroCells, WAPs and any other AC powered device where the installation location of the device doesn't always coincide with the availability of AC power source. The INV90AC-400 is sealed to an IP67 rating and may be discreetly deployed virtually anywhere: telecom vaults, pedestals, aerial strands, walls, lamp posts, poles, sides of buildings, bus stops, etc.

Line powering enables use of the existing centralized power node backup by eliminating the need at the remote site for AC utility or battery backup. This reduces operating expenses, and provides flexibility related to site selection for the installation of the remote communication equipment.

HFC (Hybrid Fiber Coax) infrastructure leverages the cable operator's existing coax network to provide power to Small Cells. The INV90AC-400 will adapt to the HFC grid to transform the trapezoidal input power source and provide pure sinusoidal waveform for powering Small Cells.

2.3 Part Number

This product is available to order under the following part numbers:

INV90AC-400 without cables **0120074-001**

INV90AC-400 with standard 2m (6ft) cables **0370514-001**

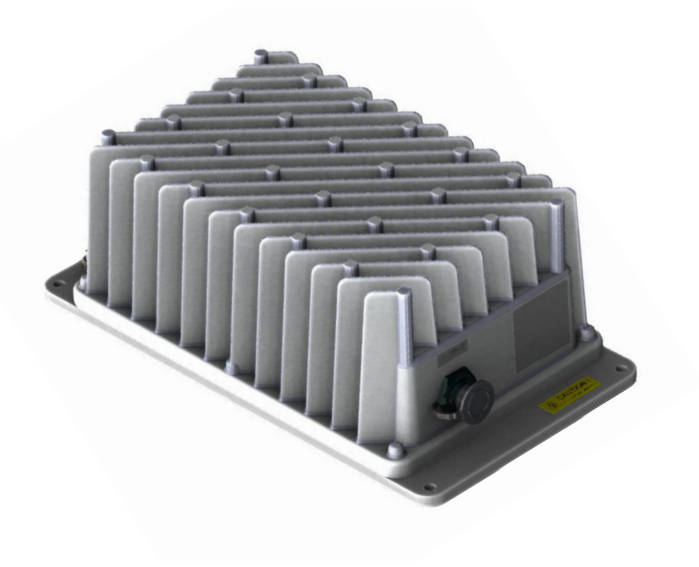


Figure 1 — View of the INV90AC-400

3. Product Specifications

Electrical	
Input Voltage:	48Vdc to 140Vdc or 50Vac to 126Vac
Input:	1 input (AC or DC)
Output Power:	at 89/90Vac output: 400W continuous at 52Vdc to 140Vdc input 400W continuous at 60Vac to 126Vac input at 120Vac output: 350W continuous at 52Vdc to 140Vdc input 350W continuous at 60Vac to 126Vac input
Output Voltage:	89Vac, 90Vac, 120Vac
Efficiency:	>92% Typ.
Output Voltage Regulation:	±0.5V across 0 to 100% load
Start-up Delay:	<12 seconds
Mechanical	
Dimensions (HxWxD):	millimeters: 91H x 255W x 140D inches: 3.6H x 10.0W x 5.5D
Weight:	3.1kg (6.82lb)
Connections:	Requires INV90AC-400 cable kit with pre-connectorized input and output cable.
Environmental	
Temperature Operating:	-40 to 65°C (-40 to 149°F)
Temperature Storage:	-40 to 85°C (-40 to 185°F)
Environmental Protection:	IP67
Humidity	5 to 100% RH non-condensing
Altitude:	-400 to 2000m (-1312 to 6562ft).
Agency Compliance	
Safety:	IEC/CSA/UL 60950-1 IEC/CSA/UL 60950-22 Low Voltage Directive 2014/35/EU
EMC:	FCC CFR47 Part 15 Class A EN 300 386 v1.6.1 EMC Directive 2014/30/EC

4. Features

DC Input

The INV90AC-400 is to be connected with an unearthed DC input voltage source (48Vdc to 140Vdc), where the polarity of DC input does not matter.

AC Input

The INV90AC-400 operates within the nominal voltage range of 50Vac to 126Vac (trapezoidal or sine wave input) and is configured for single phase input only (Line-to-Neutral) where the nominal voltage is 90Vac.

Output Power

The unit can deliver up to 400W, 90Vac continuous output power within the input voltage range of 52Vdc to 140Vdc input (nominal operation).

The unit can deliver up to 400W, 90Vac continuous output power within the input voltage range of 60Vac to 126Vac input (nominal operation). The power output is a function of the input voltage.

For example, in a remote line power application where one LPR48-300 is connected to a INV90AC-400, the maximum available output power is 275W. With two LPR48-300 connected in parallel powering the INV90AC-400 will result in increased output power of up to 400W. Proper network engineering and copper pair sizing is a requirement for meeting the power demand of the load.

AC Output Voltage Regulation

AC output voltage is user configurable through the adjustment of the rotary switch located on the back of the INV90AC-400 with a voltage regulation of $\pm 0.5V$ across 0 to 100% load.

5. Inspection








5.1 Packing Materials

Alpha is committed to providing products and services that meet our customers' needs and expectations in a sustainable manner, while complying with all relevant regulatory requirements. As such Alpha strives to follow our quality and environmental objectives from product supply and development through to the packaging for our products.

Rectifiers and batteries are shipped on individual pallets and are packaged according to the manufacturer's guidelines.

Almost all of Alpha's packaging material is from sustainable resources and/or is recyclable. See the following table for the material and its environmental codes.

5.1.1 Returns for Service

 PAP/PCB	 PET	 PE-LD	 PS	 FE	 ALU	 NW
Cardboard	Polyethylene Terephthalate	Low Density Polyethylene	Polystyrene	Steel	Aluminum	Wood
Packing boxes Caps	Flexible film Packaging	Bubble wrap Shrink wrap Plastic bags	Foam	Strapping on pallets	Strapping on pallets	Pallets Lumber

Save the original shipping container. If the product needs to be returned for service, it should be packaged in its original shipping container. If the original container is unavailable, make sure that the product is packed with at least three inches of shock-absorbing material to prevent shipping damage.

Alpha Technologies is not responsible for damage caused by improper packaging of returned products.

5.2 Check for Damage

Before unpacking the product, note any damage to the shipping container. Unpack the product and inspect the exterior for damage. If any damage is observed, contact the carrier immediately.

Continue the inspection for any internal damage. In the unlikely event of internal damage, inform the carrier and contact Alpha Technologies for advice on the impact of any damage.

5.3 General Receipt of Shipment

The inventory included with your shipment depends on the options you have ordered. The options are clearly marked on the shipping container labels and bill of materials.

Call Alpha Technologies if you have any questions before you proceed: 1 888 462-7487.

6. Pre-installation Requirements

6.1 Installation Locations

Allowable installation locations for the INV90AC-400 include the following: outdoors, direct sunlight, and inside or outside a cabinet.

6.2 AC Output Voltage Regulation

To configure the AC output:

1. Remove the cap to access output voltage selector switch.
2. Adjust the dial to desired output voltage. The available setpoints are found in Table A.
3. Reinstall cap.

Table A — AC Output Voltage Selection	
Switch Position	Output
0	89Vac/275W
1	89Vac/400W
2	90Vac/275W
3	90Vac/400W
4	120Vac/275W
5	120Vac/350W
6	Off
7	Off
8	Off
9	Off

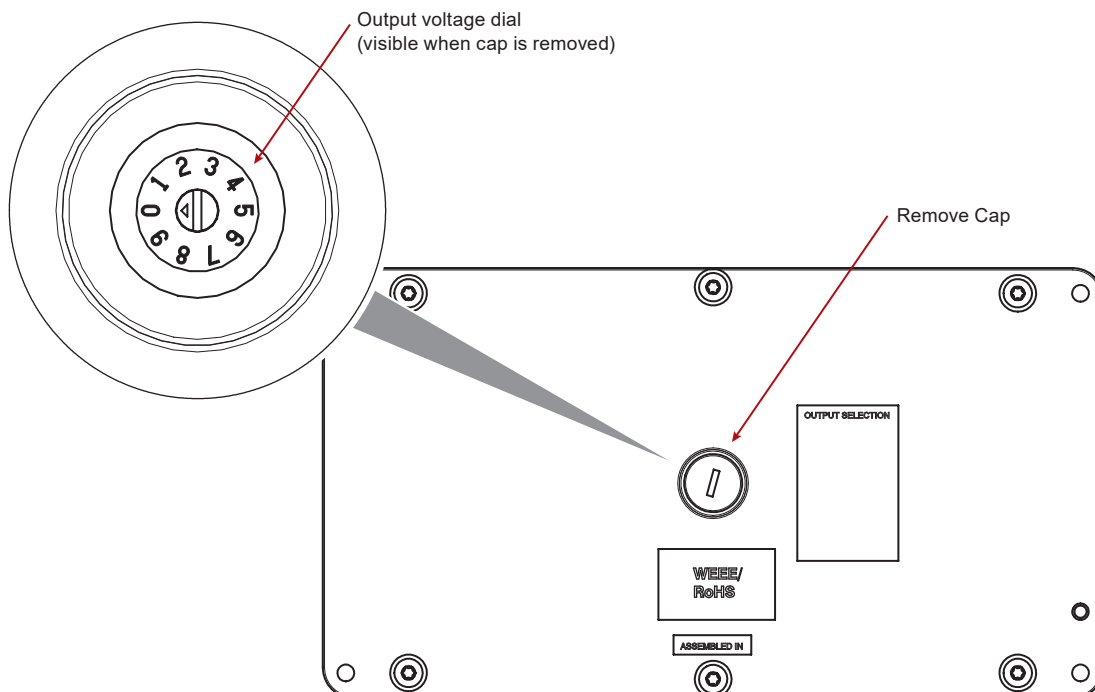


Figure 2 — Bottom View of the INV90AC-400

7. Installation

This chapter is provided for qualified personnel to install the product, which shall be mounted in the most non extreme environment. The installer should follow all applicable local rules and regulations for electrical and battery installations; e.g., CSA, UL, CEC, NEC, OSHA, and local fire codes.

7.1 Safety Precautions



WARNING!

This system is designed to be installed in a restricted access location that is inaccessible to the general public.

AC input wiring shall be protected by an upstream 15A branch circuit breaker.

Refer to the Safety section near the front of this manual.

7.2 Tools Required

Various insulated tools are essential for the installation.

Use this list as a guide:

- Electric drill with hammer action, 1/2" capacity.
- Various crimping tools and dies to match lugs used in installation.
- Digital voltmeter equipped with test leads.
- Cable cutters.
- Cutters and wire strippers (#14 to #22 AWG) [2.5 to 0.34 mm²].
- Torque wrench: 1/4" drive, 0 - 150 in-lb.
- Torque wrench: 3/8" drive, 0 - 100 ft-lb.
- Insulating canvases as required (2' x 2', 1' x 1', 3' x 3', etc.).
- Various insulated hand tools including:
 - Combination wrenches.
 - Ratchet and socket set.
 - Various screwdrivers.
 - Electricians knife.

7.3 Module Preparation/Mounting

For detailed information refer to 0120074-08 drawing at the rear of this manual.

Recommended hardware:

- 4x #10 screws or bolts
- 4x #10 flat narrow washers with 0.75" OD max.

The INV90AC-400 can be mounted to surfaces with #10 (M5) fastening hardware in four locations. Alpha recommends using flat washers for improved fastening.

8. Wiring



WARNING!

For safety reasons, ensure the shelf is properly bonded to the enclosure's ground grid. Chassis must be permanently grounded.



CAUTION!

This equipment is intended to be used in outdoor environments. Load connections should be made in close proximity to the power output.

8.1 Input and Output Connectors



CAUTION!

Connectors may fail if excessive side loading is applied to the cables. Ensure the cables have sufficient strain relief by attaching them to the mounting bracket or strand. If the unit connector is cracked please replace the unit.

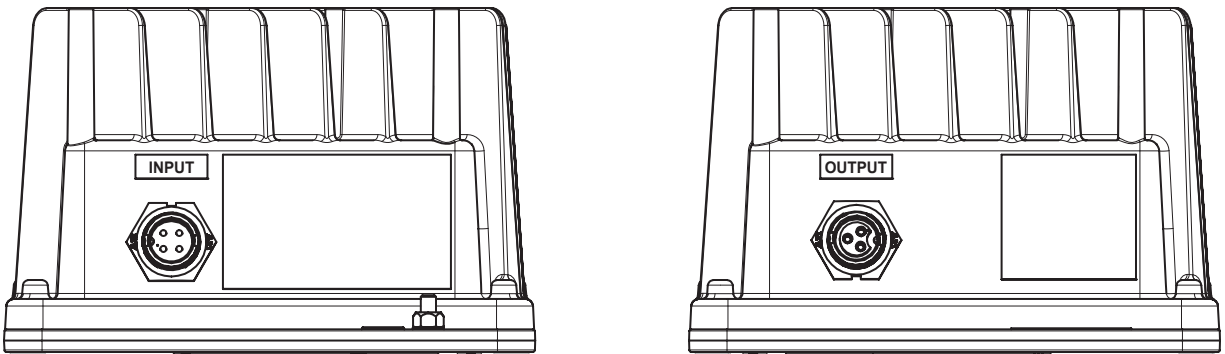


Figure 3 — Input and Output Connector View

8.2 INV90AC-400 Cable Kit

The INV90AC-400 when ordered as a 0370514-001 comes with a 2m input and output cable connectorized on one end with flying leads on the other end.

8.2.1 DC Input

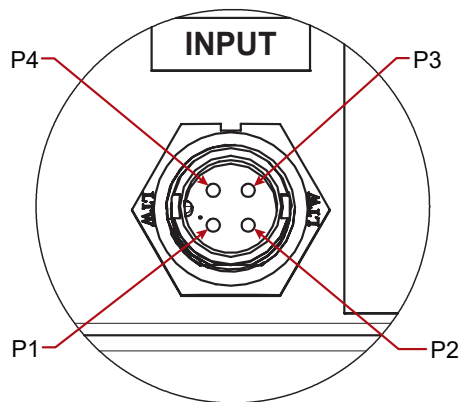



Figure 4 — Details of DC Input

 **NOTE:**
DC Input connection is polarity independent.

PIN #	CIRCUIT DESIGNATION	CABLE WIRE COLOR
1	DC1	RED
2		WHITE
3	DC2	GREEN
4		BLACK

8.2.2 AC Input

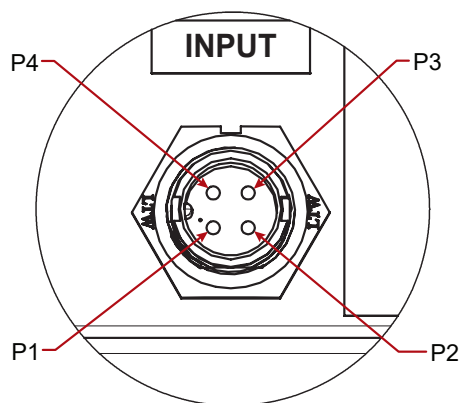



Figure 5 — Details of AC Input

 **WARNING!**
The polarity of the AC input wiring shall be as follows: Line In to Pin1, 2; Neutral In to Pin3, 4. Failure to do so will result in electric shock.

PIN #	CIRCUIT DESIGNATION	CABLE WIRE COLOR
1	LINE IN	RED
2	LINE IN	WHITE
3	NEUTRAL	GREEN
4	NEUTRAL	BLACK

8.2.3 AC Output

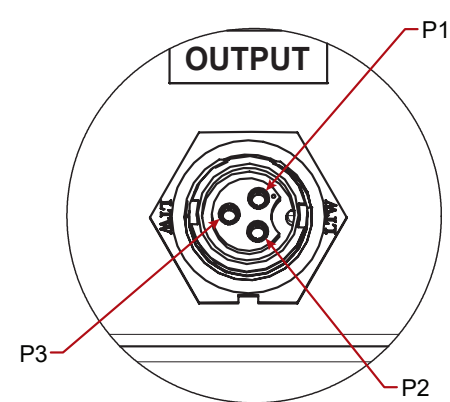



Figure 6 — Details of AC Output

 **WARNING!**
AC output neutral is internally bonded to chassis ground that must be permanently grounded in the end installation. Failure to do so will result in electric shock.

PIN #	CIRCUIT DESIGNATION	CABLE WIRE COLOR
1	LINE OUT	BLACK
2	NEUTRAL	WHITE
3	GROUND	GREEN/ YELLOW

9. Initial Startup

1. Remove customer-supplied 4-pin protectors (if available) from power-pairs termination block and disconnect the output 48V cable.
2. Verify by both measurement and observation that the chassis of the system is bonded to ground.
3. Connect module input cable to the host system
4. Complete the input circuits by plugging in the 4-pin protectors.

9.1 Normal Mode of Operation

Normal operation of the inverter system will be indicated by the presence of voltage on the inverter output cables.

9.2 Reverse Polarity Protection

The converter will not be damaged and will operate if an input connection is made only in unearthed DC input operation.

10. Warranty Statement and Service Information

10.1 Technical Support

In Canada and the USA, call toll free 1-888-462-7487.

Customers outside Canada and the USA, call +1-604-436-5547.

10.2 Warranty Statement

For full information details review Alpha's online Warranty Statement at www.alpha.ca/support.

10.3 Product Warranty

Alpha warrants that for a period of two (2) years from the date of shipment its products shall be free from defects under normal authorized use consistent with the product specifications and Alpha's instructions, the terms of the manual will take precedence.

The warranty provides for repairing, replacing or issuing credit (at Alpha's discretion) for any equipment manufactured by it and returned by the customer to the factory or other authorized location during the warranty period.

There are limitations to this warranty coverage. The warranty does not provide to the customer or other parties any remedies other than the above. It does not provide coverage for any loss of profits, loss of use, costs for removal or installation of defective equipment, damages or consequential damages based upon equipment failure during or after the warranty period. No other obligations are expressed or implied. Warranty also does not cover damage or equipment failure due to cause(s) external to the unit including, but not limited to, environmental conditions, water damage, power surges or any other external influence.

The customer is responsible for all shipping and handling charges. Where products are covered under warranty Alpha will pay the cost of shipping the repaired or replacement unit back to the customer.

10.4 Battery Warranty

Note that battery warranty terms and conditions vary by battery and by intended use. Contact your Alpha sales representative or the Technical Support team at the above number to understand your entitlements under Battery Warranty.

10.5 Warranty Claims

Any claim under this Limited Warranty must be made in writing to Alpha BEFORE sending material back. Alpha will provide Product return instructions upon approval of return request. A Service Repair Order (SRO) and / or Return Authorization (RA) number will be issued ensuring that your service needs are handled promptly and efficiently.

Claims must be made online at: www.alpha.ca.

10.6 Service Information

For a list of international service centers, refer to the Alpha website: www.alpha.ca

11. Acronyms and Definitions

AC	Alternating current
AWG	American wire gauge
CEC	Canadian Electrical Code
CMA	Circular mil area
CSA	Canadian Standards Association
DC	Direct current
HFC	Hybrid Fiber Coax
LED	Light emitting diode
LPR	Line Powering Remote
NC	Normally closed
NEC	National Electrical Code (for the USA)
NO	Normally open
OSHA	Occupational Safety & Health Administration
OVP	Over voltage protection
RU	Rack unit (1.75")
UL	Underwriters Laboratories

12. Certification

About CSA and NRTL

CSA (Canadian Standards Association also known as CSA International) was established in 1919 as an independent testing laboratory in Canada. CSA received its recognition as an NRTL (Nationally Recognized Testing Laboratory) in 1992 from OSHA (Occupational Safety and Health Administration) in the United States of America (Docket No. NRTL-2-92). This was expanded and renewed in 1997, 1999, and 2001. The specific notifications were posted on OSHA's official website as follows:

- Federal Register #: 59:40602 - 40609 [08/09/1994]
- Federal Register #: 64:60240 - 60241 [11/04/1999]
- Federal Register #: 66:35271 - 35278 [07/03/2001]

When these marks appear with the indicator “C and US” or “NRTL/C” it means that the product is certified for both the US and Canadian markets, to the applicable US and Canadian standards. (1)

Alpha rectifier and power system products, bearing the aforementioned CSA marks, are certified to CSA C22.2 No. 60950-01 and UL 60950-01. Alpha UPS products, bearing the aforementioned CSA marks, are certified to CSA C22.2 No. 107.3 and UL 1778.

As part of the reciprocal, US/Canada agreement regarding testing laboratories, the Standards Council of Canada (Canada's national accreditation body) granted Underwriters Laboratories (UL) authority to certify products for sale in Canada. (2)

Only Underwriters Laboratories may grant a licence for the use of this mark, which indicates compliance with both Canadian and US requirements. (3)

NRTLs capabilities

NRTLs are third party organizations recognized by OSHA, US Department of Labor, under the NRTL program.

The testing and certifications are based on product safety standards developed by US based standards developing organizations and are often issued by the American National Standards Institute (ANSI). (4)

The NRTL determines that a product meets the requirements of an appropriate consensus-based product safety standard either by successfully testing the product itself, or by verifying that a contract laboratory has done so, and the NRTL certifies that the product meets the requirements of the product safety standard. (4)

Governance of NRTL

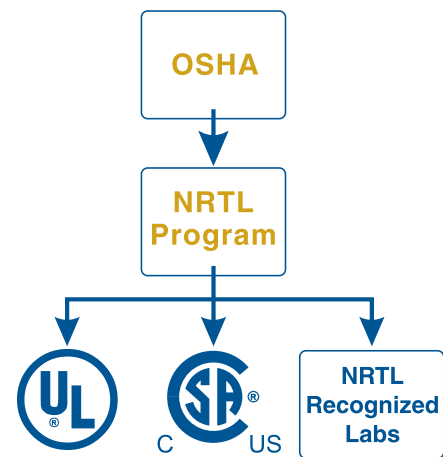
The NRTL Program is both national and international in scope with foreign labs permitted.

(1) www.csagroup.org

(2) www.scc.ca

(3) www.ulc.ca

(4) www.osha.gov



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