

# 890GTR Inverter Safety & Quickstart Manual

HA502996U100 Issue 01

Software Version: 5.3



Please read this Safety Information BEFORE installing the equipment.



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# SAFETY INFORMATION

**FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.**

This document and other information from Parker-Hannifin Corporation, its subsidiaries and authorized distributors provide product or system options for further investigation by users having technical expertise.

The user, through its own analysis and testing, is solely responsible for making the final selection of the system and components and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyze all aspects of the application, follow applicable industry standards, and follow the information concerning the product in the current product catalogue and in any other materials provided from Parker or its subsidiaries or authorized distributors.

To the extent that Parker or its subsidiaries or authorized distributors provide component or system options based upon data or specifications provided by the user, the user is responsible for determining that such data and specifications are suitable and sufficient for all applications and reasonably foreseeable uses of the components or systems.

## Requirements

**IMPORTANT** Please read this information **BEFORE** installing the equipment.

**WARNING** - Operation of this equipment requires detailed installation and operation instructions provided in the product manual intended for use with this product. This information is provided in the memory stick included in the container this device was packaged in. It should be retained with this device at all times.

## Intended Users

This manual is to be made available to all persons who are required to configure or service equipment described herein, or any other associated operation.

The information given is intended to highlight safety issues, and to enable the user to obtain maximum benefit from the equipment.

## Application Area

The equipment described is intended for use as power conversion in an energy storage system.

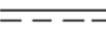
## Personnel

Installation, operation and maintenance of the equipment should be carried out by qualified personnel. A qualified person is someone who is technically competent and familiar with all safety information and established safety practices; with the installation process, operation and maintenance of this equipment; and with all the hazards involved.

## Training

Qualified personnel must be trained in Safety-Related Work Practices, Job Hazard Analysis, First Aid and CPR, Arc Flash Hazards, and PPE Requirements (both classroom and on-the-job training are required in accordance with NFPA 70E requirements). **Retraining is required in intervals not to exceed three years.**

## Product Warnings and Symbols

 <b>Caution</b> Risk of electric shock	 <b>Caution</b> Refer to documentation	 <b>Earth/Ground</b> Protective Conductor Terminal
 <b>Direct Current Supply</b>	 <b>Alternating Current Supply</b>	 <b>Phase Symbol</b>
 <b>ON Symbol</b>	 <b>OFF Symbol</b>	

**WARNING:** The 890GTR is not provided with a GFDI device. This inverter must be used with an external GFDI device as required by the Article 690 of the National Electrical Code for the Installation location.

## Hazards

### **DANGER! – Ignoring the following may result in injury**

1. This equipment can endanger life by exposure to high voltages.
2. The equipment must be permanently earthed due to the high earth leakage current, and the supplies and loads must be connected to an appropriate safety earth.
3. Ensure all incoming supplies are isolated before working on the equipment. Be aware that there may be more than one supply connection to the inverter.
4. There may still be dangerous voltages present at power terminals (battery inputs and DC bus) when the inverter is stopped.
5. For measurements use only a meter to IEC 61010 (CAT III or higher). Always begin using the highest range. CAT I and CAT II meters must not be used on this product.
6. Under normal circumstances the AC and DC Bus should discharge within 10 minutes. Use a meter capable of measuring up to 1000 VDC & 600 VAC RMS to confirm that less than 50V is present on the DC BUS and between all power terminals and earth before working on or near the DC Bus.
7. Unless otherwise stated, this product must NOT be dismantled. In the event of a fault the component must be returned.

### **WARNING! - Ignoring the following may result in injury or damage to equipment**

#### **SAFETY**

**Where there is conflict between EMC and Safety requirements, personnel safety shall always take precedence.**

- Never perform high voltage resistance checks on the wiring without first disconnecting the inverter from the circuit being tested.
- Whilst ensuring ventilation is sufficient, provide guarding and /or additional safety systems to prevent injury or damage to equipment.
- All control and signal terminals are SELV, i.e. protected by double insulation. Ensure all external wiring is rated for the highest system voltage.
- All exposed metalwork in the Inverter is protected by basic insulation and bonded to a safety earth.
- When replacing an inverter in an application and before returning to use, it is essential that all user defined parameters for the product's operation are correctly installed.
- RCDs are not recommended for use with this product but, where their use is mandatory, only Type B RCDs should be used.

## EMC

- In a domestic environment this product may cause radio interference in which case supplementary mitigation measures may be required.
- This equipment contains electrostatic discharge (ESD) sensitive parts. Observe static control precautions when handling, installing and servicing this product.
- This is a product of the restricted sales distribution class according to IEC 61800-3. It is designated as “professional equipment” as defined in EN61000-3-2. Permission of the supply authority shall be obtained before connection to the low voltage supply.

**WARNING!** – Control Unit Removal / Fitting  
Isolate supply before plugging or unplugging control unit to the inverter

**WARNING!** – Unit is connected to multiple energy sources.

### CAUTION!

#### APPLICATION RISK

- The specifications, processes and circuitry described herein are for guidance only and may need to be adapted to the user’s specific application. We cannot guarantee the suitability of the equipment described in this Manual for individual applications.

#### RISK ASSESSMENT

Under fault conditions, power loss or unintended operating conditions, the inverter may not operate as intended.

In particular:

- Stored energy might not discharge to safe levels as quickly as suggested, and can still be present even though the inverter appears to be switched off.

An inverter is a component within a system that may influence its operation or effects under a fault condition. Consideration must be given to:

- Stored energy
- Supply disconnects
- Sequencing logic

**WARNING!** – Ignoring the following may result in serious injury or damage to equipment

**OSHA Electric Power Generation, transmission, and distribution safety standards (29 CFR 1910.269) consideration:**

Workers may be exposed to arc flash hazards, electric shocks, and burns that can cause injury and death when making battery or grid connections. Do not work on connections to the battery container or the grid without proper safety considerations.

Safe work practices as proscribed in OSHA’s Electric Power Generation, Transmission and Distribution Standard must be implemented and observed. Workers must complete worker training requirements of OSHA’s Electric Power Generation, Transmission and Distribution Standard, 29 CFR 1910.269.

Dangerous electrical potentials which can result in electrocution and arc flash hazards are present while the battery container is connected. Workers must pay attention to both battery power conductors and overhead power lines. While fatal electrocution is the main hazard, other hazards include using tools and equipment that can contact power lines.

- Look for overhead power lines and buried power line indicators.
- Stay at least 10 feet away from overhead power lines and assume they are energized.
- De-energize and ground lines when working near them.
- Use non-conductive wood or fiberglass ladders when working near power lines.

# QUICKSTART

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## BEFORE YOU START

This document covers the steps necessary for a basic start-up of the 890GTR inverter. Inverter start-up should be performed by competent electrical technicians who are familiar with AC inverters and their applications. For detailed installation, safety and applications refer to the 890GTR Product Manual HA502996.

Ensure that all local electric codes are met while installing the inverter. Check that all live parts are covered to protect against electric shock.

This document expects that the inverter is already installed in its intended location and that all relevant installation procedures have been followed. Please ensure that the inverter has adequate ventilation so that ambient temperature does not exceed 45°C (112°F) under normal operating conditions.

We suggest you check to see if any new firmware is available at [www.parker.com/egt](http://www.parker.com/egt).

## ABOUT THIS QUICKSTART

This QuickStart will:

- Familiarise you with the terminals and operation of the unit.
- Provide **\*basic** installation details and a quick set-up procedure.
- Show you how to setup and start the inverter.

\* Because the 890GTR is a system product and we have no knowledge of your application, we detail the quickest way to power-up the inverter using a simple earthing scheme with minimal control wiring. Refer to the full 890GTR Product Manual HA502996 for items not covered in this QuickStart.

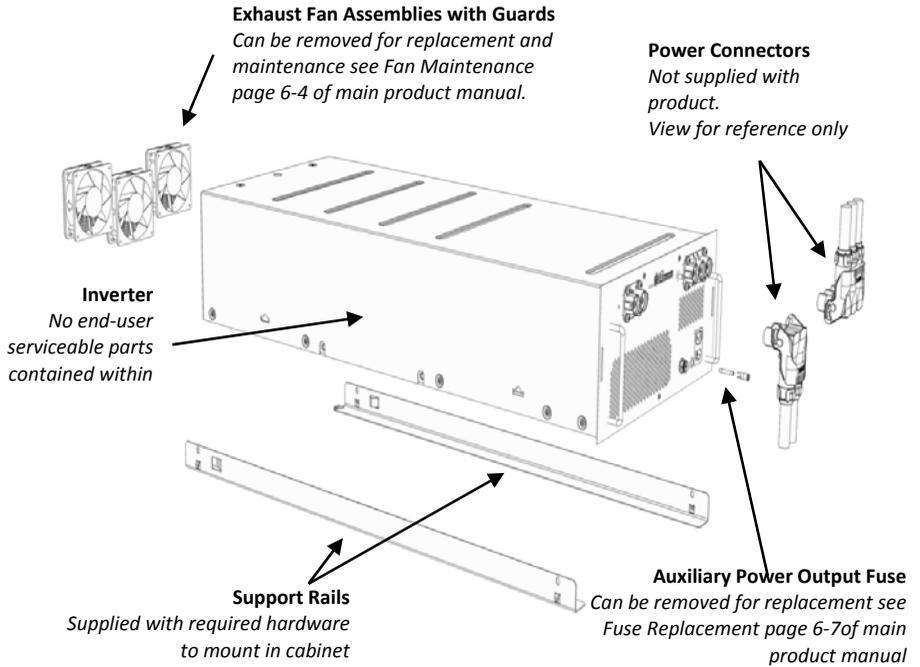
### Provided with every 890GTR unit is:

- Quickstart.
- Memory stick containing a cd with the Product Manuals.
- Customer ordered Options.

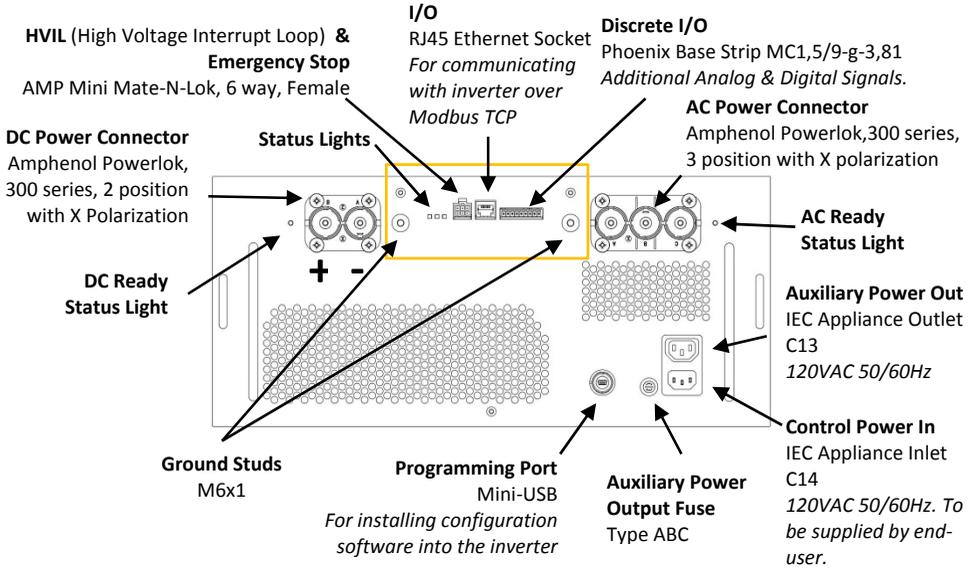
### This QuickStart assumes that:

- You are a competent technician with experience of installing this type of equipment.
- You are familiar with the relevant standards and Local Electric Codes (which take precedence).
- You have read and understood the Safety Information provided at the front of this QuickStart.
- You realise that this guide contains only basic information and that you may need to refer to the 890GTR Product Manual to complete your installation.

# OVERVIEW



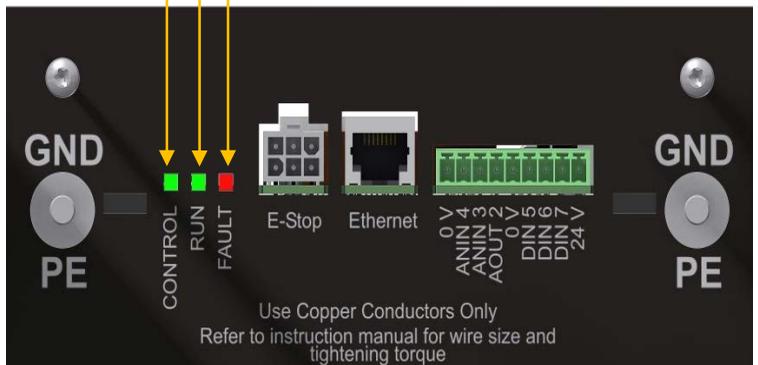
# Electrical Installation



## Status Lights

Inverter is Synchronized to Grid

Control Power Exists      Inverter has Tripped



## Wiring Requirements

**\*\*WARNING: Parker Inverters must be installed using wiring methods according to the requirements of ANSI/NFPA 70, Canadian Electrical Code Part I, or other appropriate local or national electrical codes. It is the responsibility of the installer to ensure installation is designed and performed in compliance with these standards.**

Function	Wire size**	Mating Connector	Notes
DC Ground	Minimum 21.2 mm <sup>2</sup> wire (4 AWG)	Wire Lug	Tightening torque 6-7 Nm (4.4-5.2 lb-ft)
AC Ground	Minimum 13.3 mm <sup>2</sup> wire (6 AWG)	Wire Lug	Tightening torque 6-7 Nm (4.4-5.2 lb-ft)
DC Bus Connection	Minimum 33.6 mm <sup>2</sup> (2 AWG)	Amphenol Powerlok, 300 Series, 2 Position with X Polarization	Maximum continuous current = 160A <sub>DC</sub>
AC Bus Connection	Minimum 33.6 mm <sup>2</sup> (2 AWG)	Amphenol Powerlok, 300 Series, 3 Position with X Polarization	Maximum continuous current = 128A <sub>RMS</sub>
HVIL & Emergency Stop	Minimum 0.3 mm <sup>2</sup> (22 AWG) Maximum 0.8 mm <sup>2</sup> (18 AWG)	AMP 172168-1 (Mini Mate-N-Lok Housing)	AMP 770988-1 (crimp socket, 18-22 AWG)
Discrete I/O	Minimum 0.14 mm <sup>2</sup> (28 AWG) Maximum 1.5 mm <sup>2</sup> (16 AWG)	Phoenix Contact 1803646 (MC 1,5/9-ST-3,81)	
Auxiliary Power Out	Minimum 2.1 mm <sup>2</sup> (14 AWG)	IEC type C14 (male)	Rated output = 120V, 750VA, 50/60Hz
Auxiliary Power In	Minimum 2.1 mm <sup>2</sup> (14 AWG)	IEC type C13 (female)	120V (+/-5%), 150VA, 50/60Hz
Communication Port	Cat5 w Shield Ethernet Cable	RJ-45	
Programming Port	Mini-USB	Mini-USB	

## ***DC connection notes:***

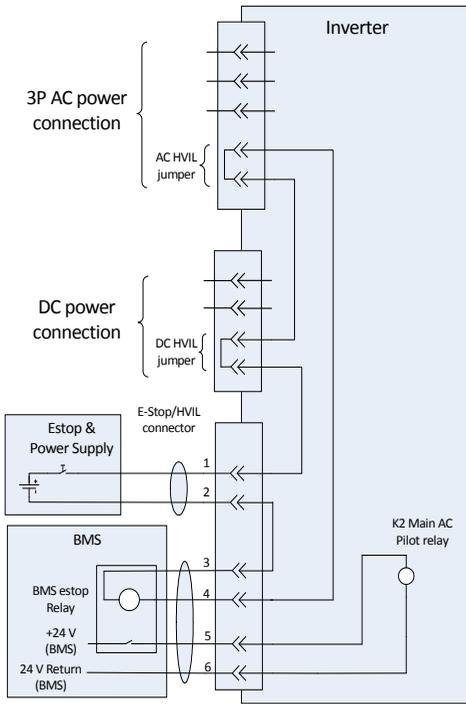
1. Verify correct polarity before connecting to the DC bus. Improper DC polarity could result in damage to the inverter and/or DC supply.
2. DC supply must provide a method to pre-charge the DC bus capacitors contained within the inverter. Failure to properly precharge the inverter will result in high inrush currents possibly damaging the inverter.
3. External fusing or breaker is required for the DC connection.
4. Lethal voltages and energies are present in this equipment. It is the responsibility of the installer to follow the requirements of ANSI/NFPA 70, Canadian Electrical Code Part I, and/or other appropriate local and national electrical codes.
5. It is the responsibility of the operator of this equipment to ensure adequate safety procedures and Arc Flash precautions are followed.

## ***AC connection notes:***

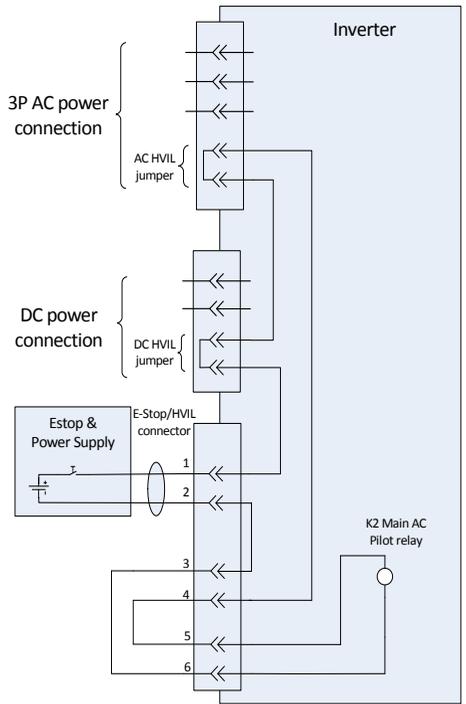
1. AC polarity (phase rotation) is automatically detected and accommodated by the inverter.
2. AC supply must have appropriate disconnection and fusing. Refer to NEC and all applicable codes
3. Lethal voltages and energies are present in this equipment. It is the responsibility of the installer to follow the requirements of ANSI/NFPA 70, Canadian Electrical Code Part I, and/or other appropriate local and national electrical codes.
4. It is the responsibility of the operator of this equipment to ensure adequate safety procedures and Arc Flash precautions are followed.

## ***Estop/HVIL connection notes:***

1. Although the Estop and HVIL circuits are galvanically isolated from the inverter control circuits, it is recommended that they are referenced to ground potential.
2. Estop circuit requires external 24 Vdc but is polarity insensitive.
3. HVIL circuit utilizes isolated contacts in both AC and DC power connectors. External 24 Vdc power supply is recommended. The following figure illustrates two possible connections schemes:



Proposed E-Stop & HVIL Circuit  
w BMS



Proposed E-Stop & HVIL Circuit  
w/o BMS

Example E-Stop & HVIL Circuit

## Start-up Sequence

Proper power up and starting sequence is required to successfully connect the DC supply with the Grid. Failure to follow an acceptable sequence could result in damage to the inverter or associated equipment.

1. **Apply control power**—connect 120 Volt 50/60 Hz ac power to “control power in”. This supply is typically an Uninterruptable Power Supply (UPS) for black start and VRT features. Maximum control power requirements: 120 Watts (150 VA).
2. **Ensure Estop/EPO circuit is satisfied**—an external 24 Volt DC supply is required to engage the main AC contactor. This input is usually used in conjunction with a normally closed Estop pushbutton. Additionally, the High Voltage Interrupt Loop contacts should be included in the Estop circuit.
3. **Close dc bus pre-charge contactor**—the DC bus capacitors need to be pre-charged through a current limited circuit (i.e. resistor) to prevent excessively high in-rush currents. Failure to properly pre-charge the bus could result in damage to the inverter or associated equipment.
4. **Ensure dc bus voltage is equal to DC supply voltage (+/-5%)**—verify the dc bus is properly charged by query of the DC LINK VOLTS parameter through the Modbus communication link.
5. **Close dc main contactor**—once the DC bus is fully charged, then the main DC contactor can be closed. This contactor is part of the DC supply.
6. **Disengage dc pre-charge contactor**—opening the pre-charge contactor after closing the DC main contactor is recommended to prevent damage to the pre-charge circuit in case the main contact opens unexpectedly.
7. **Ensure both start and stop bits are cleared**—the Modbus Start Request and Stop Request parameters are rising edge sensitive and it is good practice to initialize them before attempting a start.
8. **Clear faults**—send a Fault Reset command to clear any extraneous faults that may have occurred during the startup sequence.
9. **Verify faults are all cleared**—read the Tripped bit to ensure all faults are cleared. Correct any persistent faults before proceeding.
10. **Toggle start bit true then false**—the Start Request bit is rising edge sensitive. It is good practice to return the start bit to false once a request is sent.
11. **Wait 2 seconds**—there are two 1 second delays built into the start up configuration. Therefore it may take at least two seconds before the inverter actually starts and indicates a Running condition.
12. **Verify inverter running**—read the Running bit to make sure the inverter is enabled and connected to the grid.
13. **Select Control Mode**—select either Id/Iq or KW/KVAR control.
14. **Set Output Demand**—set either Id/Iq or KW/KVAR to desired level.

## COMPLIANCE

A comprehensive guide to product compliance is available in the 890GTR Product Manual.

### General Installation Considerations

#### Supply requirements

To maintain compliance with the EC Directive 2006/95/EC under EN 50178 (1998) the following conditions must be met:

- The system battery voltage must not exceed 825V DC
- Battery source to be transient limited <2.5kV impulse
- Primary Source 3 phase (Grid side) rated at 400V OV Category III
- Auxiliary Source 120/240 OV Category II and must not be derived from 400V 'Y' supply

#### Earthing Requirements

**IMPORTANT** Protective earthing always takes precedence over EMC screening.

##### *Protective Earth (PE) Connections*

**Note** *In accordance with installations to EN60204, only one protective earth conductor is permitted at each protective earth terminal contacting point.*

Local wiring regulations take precedence and may require the protective earth connection of the transformer to be connected locally, i.e. not as specified in these instructions. This will not cause shielding problems because of the relatively high RF impedance of the local earth connection.

##### *EMC Earth Connections*

For compliance with EMC requirements, we recommend that the "0V/signal ground" be separately earthed. When a number of units are used in a system, these terminals should be connected together at a single, local earthing point.

Control and signal cables for the all analogue inputs, and communications require screening with the screen connected only at the inverter end. However, if high frequency noise is still a problem, earth the screen at the non-inverter end via a 0.1µF capacitor.

**Note** *Connect the screen (at the inverter end) to the inverter protective earth point, and not to the control board terminals.*

#### Cabling Requirements - Planning Cable Runs

- Use the shortest possible grid cable lengths.
- Keep electrically noisy and sensitive cables apart.
- Keep electrically noisy and sensitive parallel cable runs to a minimum. Separate parallel cable runs by at least 0.25 metres. For runs longer than 10 metres, separation should be increased proportionally. For example if the parallel runs were 50m, then the separation would be  $(50/10) \times 0.25\text{m} = 1.25\text{m}$ .
- Sensitive cables should cross noisy cables at 90°.
- Never run sensitive cables close or parallel to the grid or dc link conductors for any distance.
- Never run supply, dc link or grid cables in the same bundle as the signal/control and feedback cables, even if they are screened.
- Ensure EMC filter input and output cables are separately routed and do not couple across the filter.



## Parker Worldwide

**AE – UAE, Dubai**  
Tel: +971 4 8127100  
parker.me@parker.com

**AR – Argentina, Buenos Aires**  
Tel: +54 3327 44 4129

**AT – Austria, Wiener Neustadt**  
Tel: +43 (0)2622 23501-0  
parker.austria@parker.com

**AT – Eastern Europe, Wiener Neustadt**  
Tel: +43 (0)2622 23501 900  
parker.easteurope@parker.com

**AU – Australia, Castle Hill**  
Tel: +61 (0)2-9634 7777

**AZ – Azerbaijan, Baku**  
Tel: +994 50 2233 458  
parker.azerbaijan@parker.com

**BE/LU – Belgium, Nivelles**  
Tel: +32 (0)67 280 900  
parker.belgium@parker.com

**BR – Brazil, Cachoeirinha RS**  
Tel: +55 51 3470 9144

**BY – Belarus, Minsk**  
Tel: +375 17 209 9399  
parker.belarus@parker.com

**CA – Canada, Milton, Ontario**  
Tel: +1 905 693 3000

**CH – Switzerland, Etoy**  
Tel: +41 (0)21 821 87 00  
parker.switzerland@parker.com

**CL – Chile, Santiago**  
Tel: +56 2 623 1216

**CN – China, Shanghai**  
Tel: +86 21 2899 5000

**CZ – Czech Republic, Klecany**  
Tel: +420 284 083 111  
parker.czechrepublic@parker.com

**DE – Germany, Kaarst**  
Tel: +49 (0)2131 4016 0  
parker.germany@parker.com

**DK – Denmark, Ballerup**  
Tel: +45 43 56 04 00  
parker.denmark@parker.com

**ES – Spain, Madrid**  
Tel: +34 902 330 001  
parker.spain@parker.com

**FI – Finland, Vantaa**  
Tel: +358 (0)20 753 2500 parker.fi  
nland@parker.com

**FR – France, Contamine s/Arve**  
Tel: +33 (0)4 50 25 80 25  
parker.france@parker.com

**GR – Greece, Athens**  
Tel: +30 210 933 6450  
parker.greece@parker.com

**HK – Hong Kong**  
Tel: +852 2428 8008

**HU – Hungary, Budapest**  
Tel: +36 1 220 4155  
parker.hungary@parker.com

**IE – Ireland, Dublin**  
Tel: +353 (0)1 466 6370  
parker.ireland@parker.com

**IN – India, Mumbai**  
Tel: +91 22 6513 7081-85

**IT – Italy, Corsico (MI)**  
Tel: +39 02 45 19 21  
parker.italy@parker.com

**JP – Japan, Tokyo**  
Tel: +81 (0)3 6408 3901

**KR – South Korea, Seoul**  
Tel: +82 2 559 0400

**KZ – Kazakhstan, Almaty**  
Tel: +7 7272 505 800  
parker.easteurope@parker.com

**MX – Mexico, Apodaca**  
Tel: +52 81 8156 6000

**MY – Malaysia, Shah Alam**  
Tel: +60 3 7849 0800

**NL – The Netherlands, Oldenzaal**  
Tel: +31 (0)541 585 000  
parker.nl@parker.com

**NO – Norway, Asker**  
Tel: +47 66 75 34 00  
parker.norway@parker.com

**NZ – New Zealand, Mt Wellington**  
Tel: +64 9 574 1744

**PL – Poland, Warsaw**  
Tel: +48 (0)22 573 24 00  
parker.poland@parker.com

**PT – Portugal, Leca da Palmeira**  
Tel: +351 22 999 7360  
parker.portugal@parker.com

**RO – Romania, Bucharest**  
Tel: +40 21 252 1382  
parker.romania@parker.com

**RU – Russia, Moscow**  
Tel: +7 495 645-2156  
parker.russia@parker.com

**SE – Sweden, Spånga**  
Tel: +46 (0)8 59 79 50 00  
parker.sweden@parker.com

**SG – Singapore**  
Tel: +65 6887 6300

**SK – Slovakia, Banská Bystrica**  
Tel: +421 484 162 252  
parker.slovakia@parker.com

**SL – Slovenia, Novo Mesto**  
Tel: +386 7 337 6650  
parker.slovenia@parker.com

**TH – Thailand, Bangkok**  
Tel: +662 717 8140

**TR – Turkey, Istanbul**  
Tel: +90 216 4997081  
parker.turkey@parker.com

**TW – Taiwan, Taipei**  
Tel: +886 2 2298 8987

**UA – Ukraine, Kiev**  
Tel: +380 44 494 2731  
parker.ukraine@parker.com

**UK – United Kingdom, Warwick**  
Tel: +44 (0)1926 317 878  
parker.uk@parker.com

**US – USA, Cleveland**  
Tel: +1 216 896 3000

**VE – Venezuela, Caracas**  
Tel: +58 212 238 5422

**ZA – South Africa, Kempton Park**  
Tel: +27 (0)11 961 0700  
parker.southafrica@parker.com

European Product Information Centre  
Free phone: 00 800 27 27 5374  
(from AT, BE, CH, CZ, DE, EE, ES, FI, FR, IE,  
IL, IS, IT, LU, MT, NL, NO, PT, SE, SK, UK)

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**Parker Hannifin Corporation**  
Automation Group, Energy Grid Tie Division  
9201 Forsyth Park Drive,  
Charlotte, NC28273,  
USA

Tel: +1 704 5874051  
www.parker.com/egt



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