

# POWERSTAR 10

Three Phase Quickstart Guide



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# 1. Introduction

## 1.1 Warnings and Cautions

A safety instruction (message) includes a hazard alert symbol and a signal word, **WARNING** or **CAUTION**. Each signal word has the following meaning:



**HIGH VOLTAGE:** This symbol indicates the presence of a high voltage. It calls your attention to items or operations that could be dangerous to yourself or others operating this equipment. Read the message and follow the instructions carefully.



**WARNING:** Indicates a potentially hazardous situation which, if not avoided, can result in serious injury or death.



**CAUTION:** Indicates a potentially hazardous situation which, if not avoided, can result in minor to moderate injury, or serious damage to the product. The situation described in the **CAUTION** may, if not avoided, lead to serious results.

## GENERAL WARNINGS

**DANGER OF ELECTRIC SHOCK.** There are no user serviceable parts inside the inverter. **DO NOT** attempt to make repairs or alterations to the unit.

**WARNING:** This equipment should be installed, adjusted, and serviced by qualified electrical maintenance personnel familiar with the construction and operation of the equipment and the hazards involved. Failure to observe this precaution could result in personal injury.

## GENERAL CAUTIONS

**CAUTION:** Always wear personal protective equipment (protective clothing, gloves, and safety boots) while performing an installation or maintenance, to avoid the danger of injuries.

**CAUTION:** Proper grounds, disconnecting devices, e.g. bypass boxes and other safety devices and their location are the responsibility of the user and are not provided by MLT Inverters.

**CAUTION:** Do not cover the device or store it in a small space - always keep it well ventilated and well away from flammable gases or powders. Components in the device could potentially cause a small electric spark that could ignite flammable gas or powders. Flammable gases are created by batteries and can become a hazard in poorly ventilated spaces.

**CAUTION:** For indoor use only and **MUST** be installed in a dry area free from conductive liquids or conductive debris. If part of the inverter becomes submerged in water look for a safe way to isolate it at the distribution board and if possible at the batteries.

## 1.2 Contacting MLT Inverters

### 1.2.1 Product Support

When contacting Product Support via telephone, email or fax please provide the following information for the fastest possible service:

- Type of Inverter
- Serial number
- Battery type
- Battery bank capacity
- Battery bank voltage
- A description of the event

Note that the serial number is available on the serial plate that is attached to the bottom of the machine inside the cover.

### 1.2.2 Contact Details

Telephone: +27 (0) 21 201 1335

Email: [info@mltinverters.com](mailto:info@mltinverters.com)

Address: 103 Garfield Road  
Kenilworth 7708  
Cape Town  
South Africa

### 1.2.3 Telephone

You can reach technical support by telephone directly Monday to Friday between 08h00 and 17h00 (GMT +2 hours). Queries outside of these hours should be directed to [support@mltinverters.com](mailto:support@mltinverters.com) and will be answered at the earliest opportunity. When contacting technical support, please ensure that you have the information listed above available.

## 2. Scope

This quickstart guide is intended for the end user. It gives a brief guide on how to start and stop the inverter and how to reset any temporary faults.

## 3. Overview

The Powerstar 10H inverter/charger offers a cost-effective and reliable solution to the home or farm owner faced with unreliable or no grid electricity supply. Each Powerstar unit in a system can deliver 10 kW for half-an-hour and 8 kW continuously.

The inverter operates at low-voltage DC and is transformer-based, which translates to a robust and safe product that guarantees trusted power in the harshest environments. A typical installation will include the inverter/charger, a battery bank, a battery cable fuse box (9), and an AC Bypass Box (3). The installation often also includes either some dc-coupled solar chargers or ac-coupled solar grid-tied inverters. An example of such a system is shown in Figure 1.

The Powerstar inverter system can be configured in various ways, one of these is with 3 units running as a three phase off-grid generator.

This document describes how to start and stop a single-phase system, and subsequently a three-phase system.

## 4. Startup instructions

### 4.1 General Instructions

One will normally startup/stop the inverter using its touch screen display (referred to here as the Human Machine Interface or HMI for short). The HMI is on the front of the inverter as shown in Figure 1. Every screen on the HMI includes the navigation bar on the right side. From top to bottom, the navigation bar is used to navigate between the dashboard panel, the control panel, the charts and events panel, and the settings panel (Figure 2).

Assuming that the machine is ready to startup, i.e. it is in *Standby* mode, navigate to the control screen by clicking on the standby symbol (second icon from the top right). Once on the control panel, click on the "Turn On/Turn Off" icon which will be on the left of the screen (see Figure 3). The inverter will go into *Startup* mode, and then shortly afterwards *Stand-Alone* mode. (Note the inverter's operational mode is given in the status bar which is shown at the bottom of the dashboard and control screens).

Once the inverter is running in *Stand-Alone* mode it will be powering the loads on its load port but will not be connected to the mains supply on the source port. If the mains supply is available, the inverter will synchronise to it and after 60 seconds connect to it and go into *Grid Tied* mode.

## 4.1.1 Three Phase Specific Instructions

**NOTE:** For a three-phase system, one machine must be setup as the *Master* machine and it should be assigned to phase 1. The other machines should be assigned to phase 2 and 3 to match the phase rotation of the grid installation. The installer should setup this up before they start up the machines for the first time.

With all relevant settings set, starting up a three-phase system is similar to that of starting up a single machine. Firstly, the on/off switch on all the inverters must be in the *on* position. Then with all machines in *Standby* mode, the machines can be started up using the instructions from the previous section. The start instruction can be given on any one of the machines. The *Master* machine will then check the communication and synchronization between the machines after which the machines will start-up altogether in *Stand-Along* Mode. Similarly, the stop command can be given on any one of the machines.

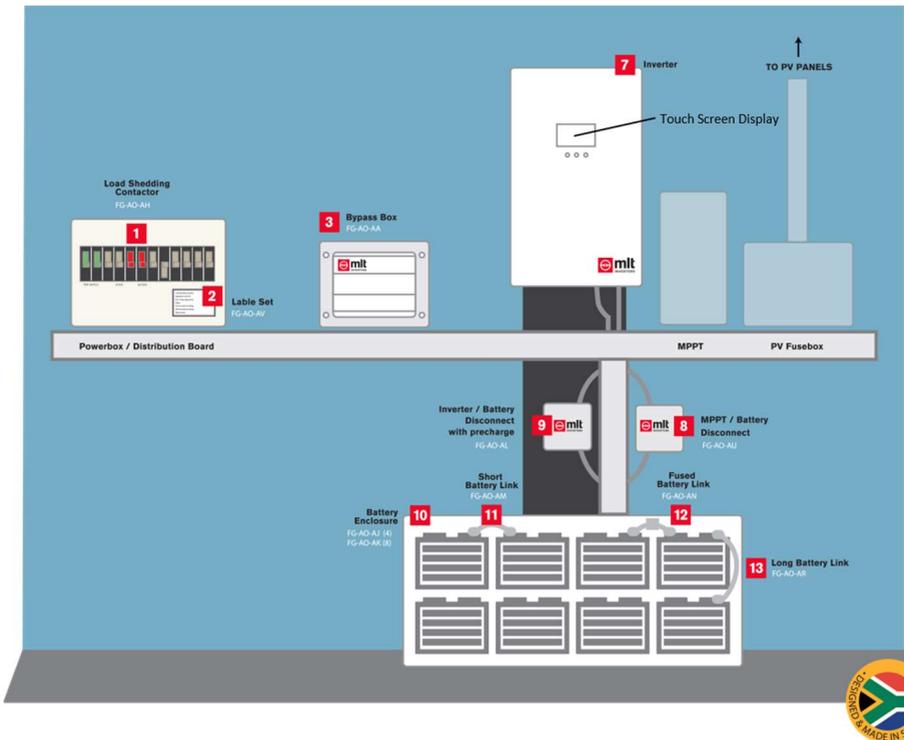


Figure 1. A typical layout of a single-phase Powerstar 10H installation showing the inverter (7), the battery bank (10), the battery cable fuse box (9), the AC Bypass Box (3), and an optional MPPT. For the most part, the user will interact with the inverter using the inverter's touch screen display.

The instructions just given assume that the inverter is in *Standby* mode and ready to start. If this is not the case, then:

- check that the “On/Off Switch” on the underside of the inverter is in the “On” position (see Figure 4),
- reset any faults by navigating to the control panel and clicking the reset icon.

If for some reason the inverter does not start, then contact your installer or continue reading this manual.



Figure 2. A screenshot of the inverter’s touch screen display or Human Machine Interface (HMI). From top to bottom the buttons on the right side navigate between the dashboard panel, the control panel, the charts and events panel, and the settings panel, respectively.



Figure 3. To start/stop the inverter using the touch-screen display, navigate to the control panel and then click the 'turn on'/'turn off' button. (Note: The inverter must be in *Standby* mode before it will start, as explained in the text.)

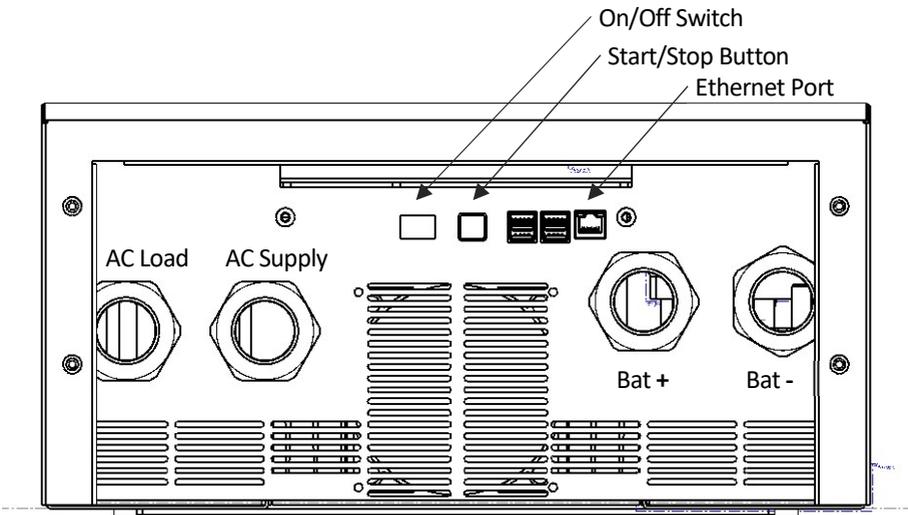


Figure 4. This figure shows the underside of the enclosure where the on/off switch, the start/stop button, the ethernet port, and the entry points for the AC and DC power cables are located.

## 5. An overview of the Inverter's Human Machine Interface System

The Powerstar 10H includes a touch screen display, three status LEDs, an on/off switch, a start/stop button, and an ethernet port for web-based monitoring/control. Together these make up the Human Machine Interface system.

### 5.1 The Touch Screen Display

As shown in Figure 5, the Powerstar 10H has a touch screen display on its front. The touch screen display is often referred to as the Human Machine Interface (HMI) in MLT documents as it is the primary way the user will interact with the machine.

The touch screen display's user interface consists of four main screens, namely the: dashboard screen, the control screen, the history (or charts and events) screen, and the settings screen.

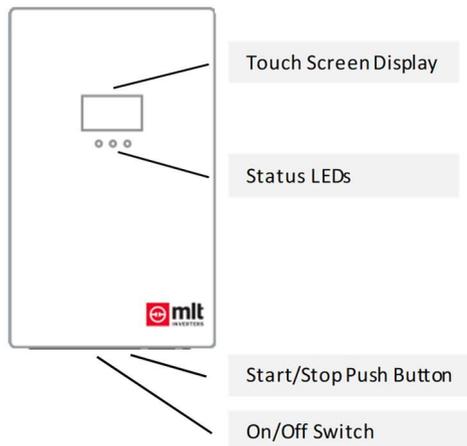


Figure 5. An image showing the position of the Powerstar 10H's touch screen display, the status LEDs, the start/stop button and the on/off switch.

#### 5.1.1 The Dashboard Screen

An example of how the dashboard screen might look is shown in Figure 2. The dashboard screen includes a status bar shown on the bottom of the screen. In the status bar, the inverter's operational mode is shown and underneath this any recent events or messages. The status bar also shows the time and date as set on the inverter.

The dashboard also shows a collection of icons which can show how power is flowing through the system or alternatively the voltage and currents measured at various points in the system. To cycle

between showing power flow (i.e. kW or kVA) and/or voltage (V) or current (Amps) click on the purple units icon.

The description of each of the icons is given in Table 1.

Table 1. A table describing the icons shown on the dashboard screen of the touch screen display.

Icon Position (Colour)	Description
Top Left (Red)	Power (kW), voltage (V), or current (Amps) as measured at the inverter's SOURCE PORT.
Top Middle (Blue)	The Inverter.
Top Right (Orange)	Power (kW), voltage (V), or current (Amps) as measured at the inverter's LOAD PORT.
Bottom Left (Blue)	Power (kW) or current (Amps) generated by the solar system.
Bottom Middle (Green)	Power (kW), voltage (V), or current (Amps) as measured at the inverter's BATTERY PORT.

## 5.1.2 The Control Screen

### 5.1.2.1 Starting or Stopping the Inverter

An example of how the control screen might look is shown in Figure 3. The control screen includes two icons, namely a "turn on/turn off" icon and a "reset" icon and a status bar which shows the inverter's operational mode and any recent events/messages. The "turn on/turn off" icon is used to start or stop the inverter. (Note, the inverter can only be started using this icon if the "On/Off" switch is in the "On" position, as already described.)

### 5.1.2.2 Resetting Faults and Warnings

If the inverter's controller has detected some fault which will prevent it from starting then the icon on the left will not show a tick, a relevant message will be shown in the status bar, and the Inverter Status LED (described later) will not be green. Many of the faults the controller detects can be remedied easily (for example the communication cable between the inverter and the battery bank was unplugged). If you believe the fault has been remedied, then click on the "Reset" icon. If the fault is still present the controller will detect it again, otherwise the inverter will go into *Standby* mode (assuming the "On/Off" switch is in the correct position).

If the fault persists then contact your installer.

### 5.1.3 The History Screen

Clicking on the third icon from the top in the navigation pane will take the user to the History (Charts and Events) screens. On this screen, the user can cycle between sub-screens. Namely:

- a plot of the power measured at the inverter’s source port over the last 24 hours,
- a plot of the power measured at the inverter’s load port over the last 24 hours,
- the battery State of Charge (SoC) or voltage measured over the last 24 hours, and
- the list of recent events/messages.

### 5.1.4 The Settings Screen

The Settings Screen is shown in Figure 6. There are a few icons which will take the user to settings wizards that show a collection of commonly used and related settings, for example the “battery setup” wizard. The advanced icon allows the user/installer to access all the user settings as well as real-time data points. Many of the settings are passcode protected to prevent the user from changing them unintentionally.

If you feel that you need to change a setting, then contact your installer for assistance.



Figure 6. The top-level settings screen.

## 5.2 Buttons and Switches

The Powerstar has an on/off switch and a start/stop push button on the underside of the enclosure as shown in Figure 4.

### 5.2.1 The On/Off Switch

When this switch is in the off position the inverter will stay in *System Off* mode and will not respond to start/stop instructions. When the switch is in the on position, the inverter will go into *Standby* mode and will respond to start/stop instructions.

### 5.2.2 The Start/Stop (and Fault Reset) Button

On the underside of the inverter, there is a start/stop push button located next to the on/off switch (Figure 4). This button also acts a fault reset button. This button has a few functions depending on the operating mode of the inverter and for how long the button is pushed:

- If the inverter is running and the button is pushed the inverter will stop running and return to *Standby* mode;
- If the inverter is *Tripped, Off, or in Standby* mode and the button is pushed any faults will be reset; and
- If the inverter is in *Standby* mode and the button is pressed in for 3 seconds or more the inverter will go into *Full Auto* mode, i.e. the inverter will start up into *Stand-Alone* mode. On a single machine setup, if the grid is available the machine will synchronise and then connect to the grid.

## 5.3 The Status LED Indicators

On the front of the inverter, underneath the touch screen display, there are three status LEDs that can flash green, orange, and/or red. There is a status LED for the AC source, the inverter, and the battery. The icons used to label the LEDs are shown in Figure 7.

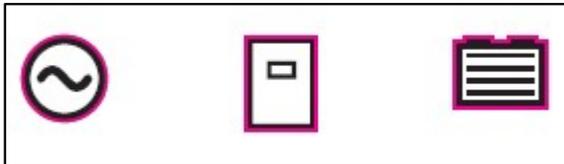


Figure 7. The icons used with the status LEDs. From left to right, the LEDs indicate the status of the AC Source (e.g. Mains), the inverter, and the battery.

The following tables describe what the status LEDs indicate based on their colour and whether they are blinking or not.

### 5.3.1 The AC Source LED

LED status	Notes
Off	No (or very low) voltage is detected on the inverter's source port.
Green - Blinking	The source is within acceptable bounds but the inverter's internal source relays are still open, i.e. the load port is still isolated from the source port.
Green - Solid	The source is within acceptable bounds and the source relays have been closed, i.e. the load port is not electrically connected to the source port.
Orange - Solid	The inverter and the load are connected to the source but the source's frequency is higher than the power curtailment threshold.
Red - Solid	The source voltage/frequency is out-of-bounds (as specified by the local grid code).

### 5.3.2 The Inverter LED

LED status	Notes
Off	The inverter's On/Off position is in the Off position but no other faults are detected.
Green - Blinking	The inverter is in <i>Standby</i> or <i>Startup</i> mode and is ready to start.
Green - Solid	The inverter is running.
Orange - Solid	The inverter is switched off and there are faults detected that will stop the inverter from starting.
Red - Solid	The inverter has tripped.

### 5.3.3 The Battery LED

LED status	Notes
Blinking / Flashing	The inverter is being charged (i.e. current is flowing into the battery).
Green	The battery State of Charge (SoC) is 64% or more. Or on a Lead Acid battery, the battery voltage is above 48 V.
Orange	The battery SoC is between 37% and 64%. Or on a Lead Acid battery, the battery voltage is less than 48 V.
Red	The battery SoC is below 37%. Or on a Lead Acid battery, the voltage is below 47.2 V.

