

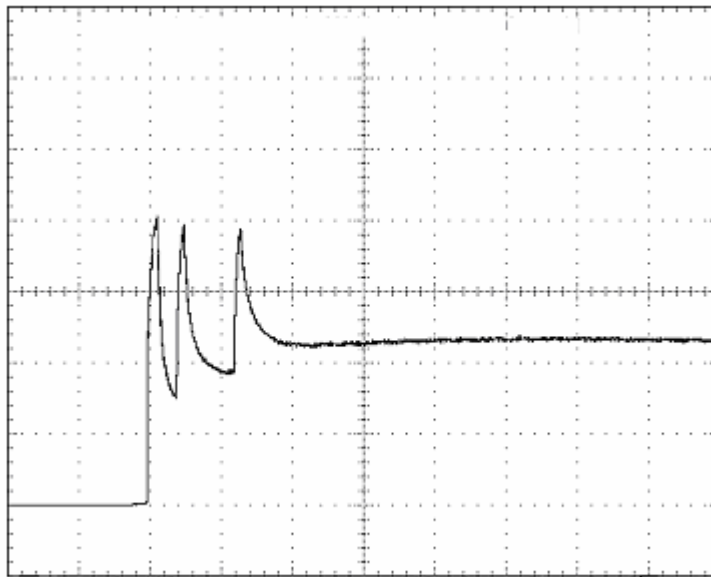
SLI Telecom Inverter – Installation manual

Revision	Date	Changes	Author	Approved
A	03/11/03	Initial draft	A. Piazzini	R.Salutari
B	09/04/03	Correction of typographical errors	CFO	R. Ballou
C	11/02/04	Model with screw terminal connections	A.Viviani	R.Salutari
D	14/04/04	1. Headlines: input fuse characterization and input current absorption	P.Casini	S.Macerini
E	30/04/2004	3-phase configuration	P.Casini	S.Macerini
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G	8/02/2006	New paralleling cable kit; warning on neutral grounding	A.Pasquini	P.Casini
F	27/09/2007	Manual bypass chapter	G.Fiesoli	G.Fiesoli

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1 Headlines

- The Inverter is designed to operate from a DC Source, its input current features a very low ripple. Its psophometric value is 31dBnrc (without battery). The above feature allows the inverter to be supplied by a charger or power supply even without a battery in the circuit, as long as the DC source has the necessary current capacity to sustain the inverter's inrush current and the current variations induced by load changes of which the following diagram shows the worst case.



Input current absorption with 1500W resistive load step. 25mSec/div; 20A/div (48V input model) or 40A/div (24V input model).

- **Input and Output Voltages are floating:** even though it is possible to refer to GND one Input or Output terminal this connection it is not required.



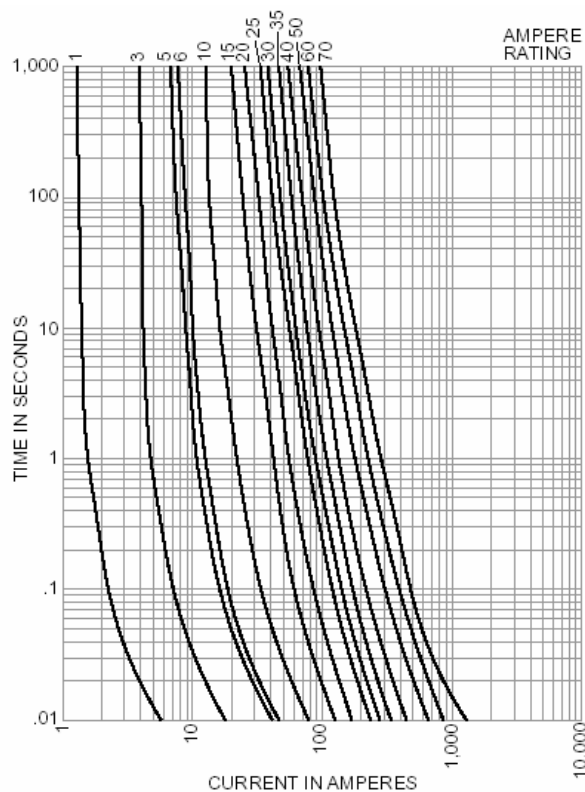
CAUTION: It is essential to read and understand all Warnings, Cautions and Notes before any connections are made to the Unit or System.



CAUTION: Before any connections are made to the Unit or the System, be sure to disconnect any AC load and any DC Input source. If the DC Input source is a battery, make all connections to the inverter BEFORE connecting DC leads to the battery.



WARNING: The unit is not protected from Polarity Inversion: correct polarity of DC input leads is critical to avoid damage to the unit or system. **Check DC Input source cables for correct polarity and voltage.** The inverter features an internal reverse polarity protection diode and an upstream, non replaceable, fuse. The application of a reverse polarity protection may blow the fuse and make the inverter non operating. To prevent damage a proper circuit breaker should be installed between the DC source and the inverter's input. Refer to the following diagram to determine the type of delay of the breaker.



The curve to be used is the one indicated by "70".



CAUTION: Observe all national and Local Electric Codes when connecting AC Power Connections.

2 Location Selection

The SLI Inverter is designed for indoor application, away from heat and moisture. The inverter will provide its full performance with internal forced ventilation at ambient temperatures ranging from -25°C to +55°C (+65°C with power derating, see also Technical Specifications).

Therefore, the following requirements must be considered when choosing a mounting location:

1. Inverter must be sheltered from the elements. Select a clean, dry location
2. Inverter requires proper ventilation for cooling. It can be installed vertically as well as horizontally provided a there is a 10-inch minimum clearance on the backside to provide adequate airflow. The fans suck in the air from the front vent holes and blow it through the backside holes.
3. Inverter should be mounted as close to the DC Input source as possible to minimize losses in the DC Input cables.

3 Receiving Instructions



Please Note: For your protection, the following information and the product manual should be read And thoroughly understood before unpacking, installing or using the equipment.

We present all equipment to the delivering carrier securely packed and in perfect condition. Upon acceptance of the package from us, the delivering carrier assumes responsibility for its safe arrival to you. Once you receive the equipment, it is your responsibility to document any damage the carrier may have inflicted, and to file your claim promptly and accurately.

3.1 Package Inspection

- Examine the shipping crate or carton for any visible damage: punctures, dents and any other signs of possible internal damage.
- Describe any damage or shortage on the receiving documents and have the carrier sign their full name.

3.2 Equipment Inspection

- Within fifteen days, open crate or carton and inspect the contents for damages. While unpacking, be careful not to discard any equipment, parts or manuals. If any damage is detected, call the delivering carrier to determine the appropriate action. They may require an inspection.

Save all shipping material for the inspector to see!

- After the inspection has been made, call us. We will determine if the equipment should be returned to our plant for repair or if some other method would be more expeditious. If it is determined that the equipment should be returned to us, ask the delivering carrier to send the packages back at the delivering carrier's expense.
- If repair is necessary, we will invoice you for the repair so that you may submit the bill to the delivering carrier with your claim forms.
- It is your responsibility to file a claim with the delivering carrier. Failure to properly file a claim for shipping damages may void warranty service for any physical damages later reported for repair.

3.3 Handling

Handle the inverter with care. Do not drop or lean on front panel or connector. Keep away from moisture.

3.4 Identification Label

Model number and serial number located on label on the cover identify the unit. Please refer to these numbers in all correspondence with Power-One.

3.5 Initial Settings

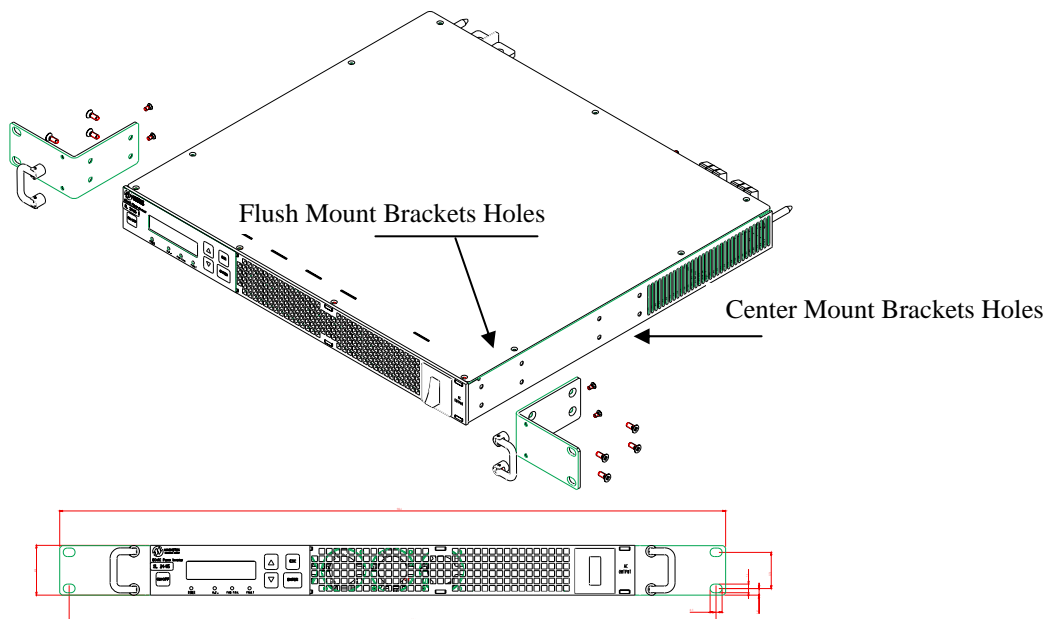
All equipment is shipped from our production facility **fully checked and adjusted**. Do not make any adjustments until you have referred to the technical reference or product manual.

4 Mounting Procedures

⚠ Please Note: Mounting brackets are included with the inverter when they are shipped from the factory. Failure to follow proper mounting procedures could result in the unit failing causing personal injury and equipment damage.

4.1 Rack mounting types

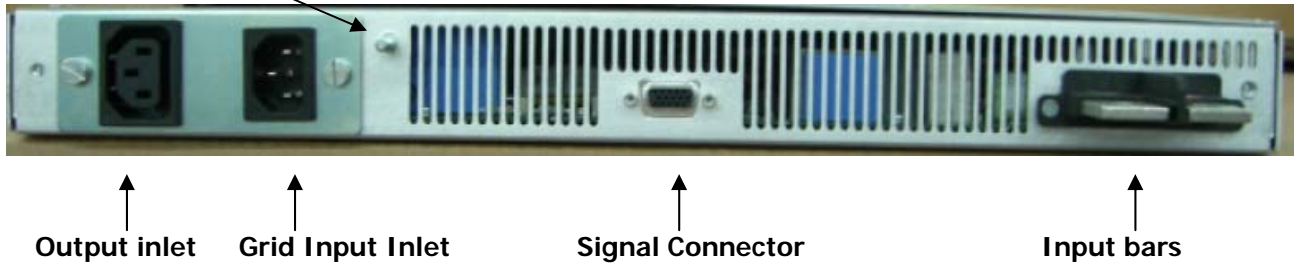
- The inverters will fit either a 19" or a 23" inch relay rack.
- The customer can install the mounting brackets either as a flush mount or a center mount on the inverters using the proper holes and tools as illustrated below.
- Leave adequate clearance between this shelf and any existing shelves: a 10-inch minimum clearance is required in the rear.
- Connect the protective earth (PE) standoff located on the back of the unit to the safety earth connection by the proper nut and washer provided in the package of the unit.
- The mounting kit provided consists of:
 - 2 x 19" mounting brackets OR 2 x 23" mounting brackets upon request
 - 8 x M4 screws to connect the brackets to the unit (4+ 4)
 - 2 x handles
 - 4 x screws to connect the handles to the brackets (2+2)



4.2 Connections

- Back Plane View -

Protective Earth (PE)



4.2.1 Input Connections (all models)

Positive (+) and Negative (-) input terminals consist of two bars located on the backside of the chassis (see Fig. 1). The bars can be mated with clips or bolted to bus bars or cables. To facilitate the connection the input bars have M6 holes. Polarity identifiers are marked on the chassis. A plastic protection screen is provided to avoid the accidental contact of the input terminations.



Fig.1. Input bars connections (all models)



Consult Appendix "A" to set the proper wire size, length and terminal types for the 24 or 48V inverters models vs. distance from the source.

4.2.2 Output and Grid Connections

4.2.2.1 Models with plug connections

These models are equipped with the following connector types:

- Output: AC Appliance Outlet - IEC 320 socket
- Input Grid (for inverters with static transfer switch option only): AC Appliance Inlet - IEC 320 socket



Fig.2. Plug connections: Output AC & Input Grid AC

4.2.2.2 Models with screw terminal connections

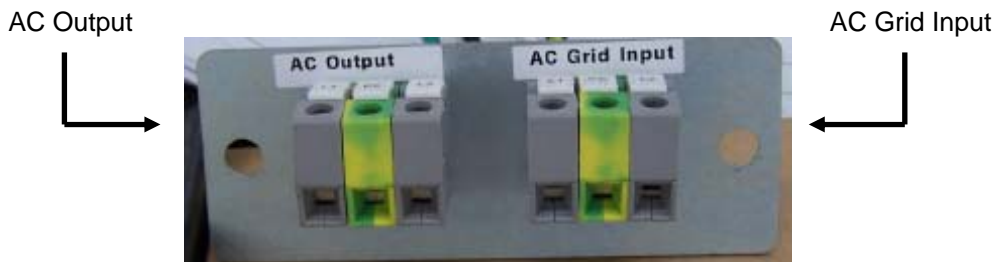


Fig.3. Screw Terminal connections

4.2.2.3 AC Output connections for parallel configuration (plug and screw terminal connection models)

When you connect multiple units in parallel, pay attention to the following:

1. Observe the correct **pin-to-pin correlation** between the terminals avoiding cross connections (**pin 1 to pin 1, pin 2 to pin 2, etc.**).
2. Be careful to use cables with **the same section and length** for each inverter, from the outlet terminals to the common points A, B, GND, as shown in the Fig. 4.
Longer cable improves the sharing current accuracy. **Sharing performance is guaranteed with 250mm minimum cable length.**

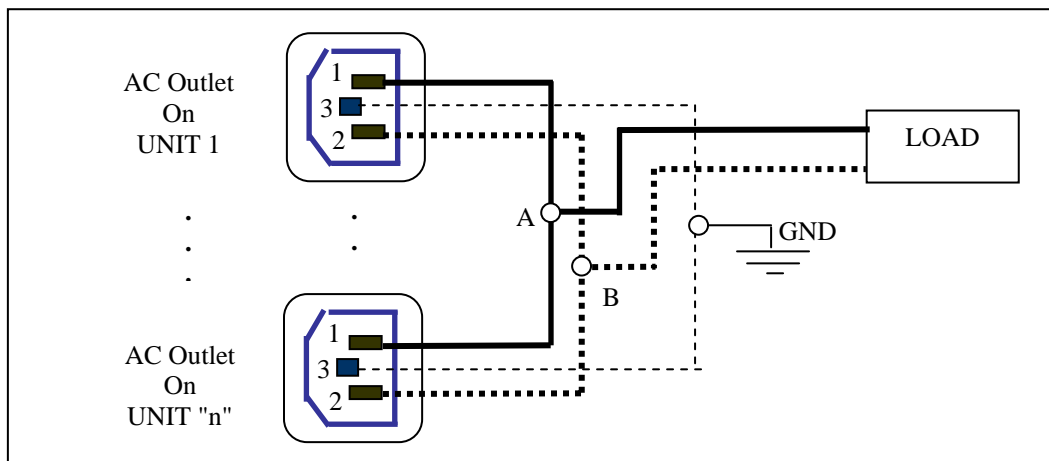


Fig.4 - AC output connections for n-inverters in parallel configuration – models with plug connectors -
Note: L1→ 1; L2→ 2 ; PE→ 3

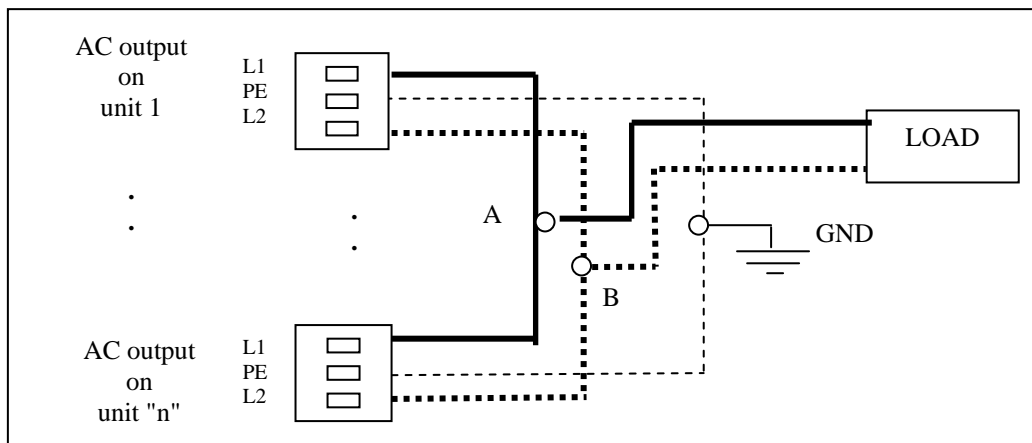


Fig.5 - AC output connections for n-inverters in parallel configuration – models with screw terminals

4.2.2.4 AC grid input connections for parallel configuration (models with Static Transfer Switch)

The cables for the AC Grid connection have the same size and length (Fig.6).

We recommend 4mm² gauge wire for 115Vac models and 2.5 mm² gauge wire for 230Vac models.

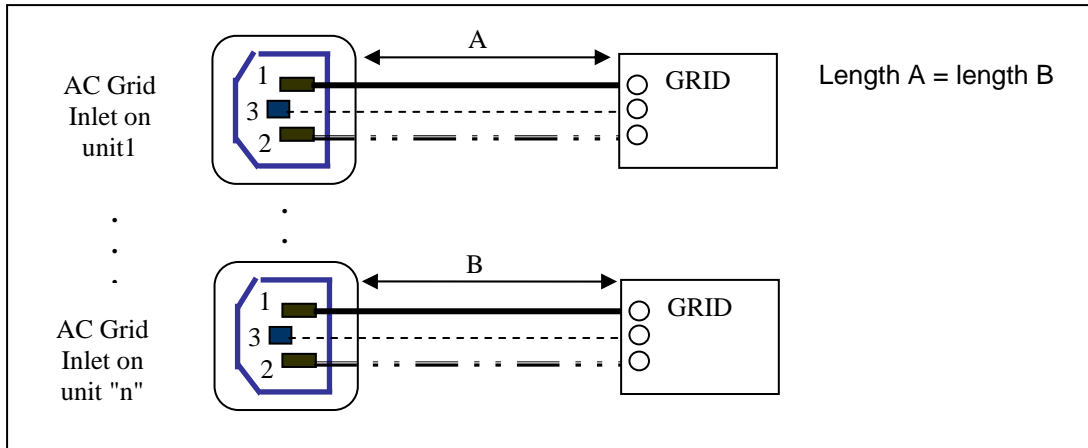


Fig.6. AC grid input connections for parallel configuration: use cable with the same length and section for models with pug connectors

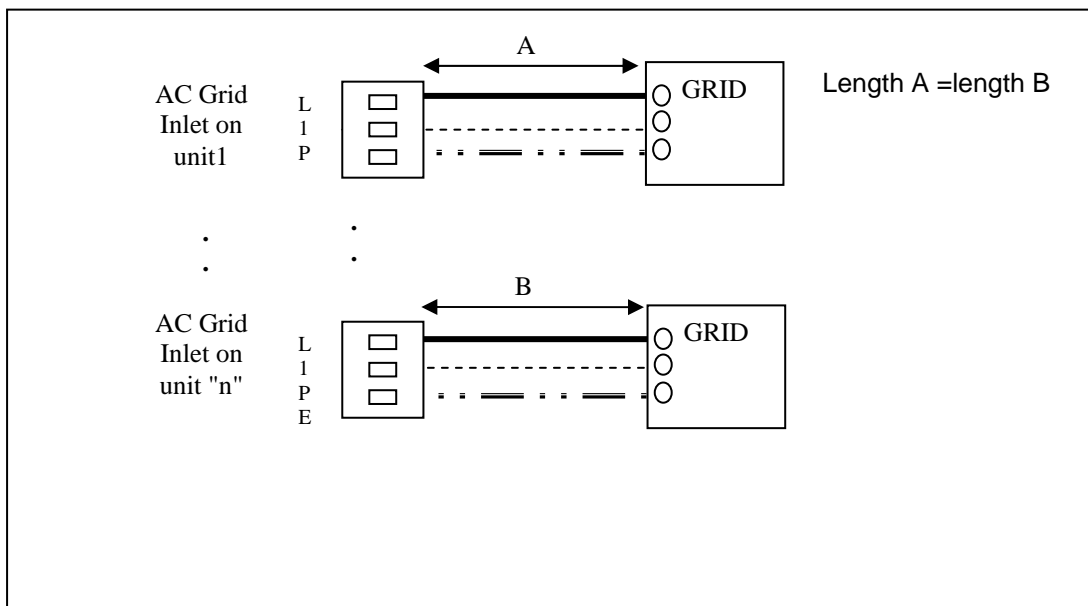


Fig.7. AC grid input connections for parallel configuration: use cable with the same length and section for models with screw terminals

4.2.3 Signal connections

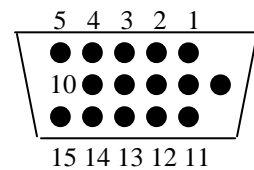
A15 poles connector or the optional signal connector adapter can be used to connect the signals.

4.2.3.1 Connecting units using a standard 15-poles connector

Signal Connector Type :
Molex 89263-6065 (CON SUB 15HD)



Signal description	Pin
General failure signal	1
+T/R	2
-T/R	3
Signal return pin for General failure signal and serial port signals (+/-T/R)	4
Master indicator	5
Chassis ground and common pin for synch signals and remote on/off	6
Remote ON/OFF	7
Synch-120	8
-	9
-TR/I (Reserved)	10
Transfer synch (T.S. option version only)	11
Output synch	12
Synch-240	13
Synch	14
+TR/I (Reserved)	15



Signal description

- Pin 1 Normally open; active low. It provides a general failure indication related to any fault condition (see "General failure" Table on "User's Guide"). It is referred to Pin 4 "Signal Return".
- Pin 2 & Pin 3 Dedicated to the serial link for RS485. They are referred to Pin 4, "Signal Return".
- Pin 4 Signal return for signals on Pins 1-3. This pin can be connected to an external ground.
- Pin 5 Master indicator: For parallel mode only.
- Pin 6 Common GND (chassis) for all the signals from Pin 7 to pin 15
- Pin 7 Remote ON/OFF. Active low. It must be connected to Pin 6 (through a switch or relay), to turn on or off the unit remotely. **The pin must be enabled from the front panel. Go to the settings menu and turn ON the remote ON/OFF option.**
Please note: If you do not use remote ON/OFF capability then you must leave the pin not connected. Otherwise the Remote OFF option set through front panel will not have effect.
- Pin 8 & Pin 13 Dedicated to the synchronization of units Y connected for 3-phase voltage generation.
- Pin 9 Not Used
- Pin 10 & Pin15 Reserved
- Pin 11 For parallel mode between units with Static Transfer Switch option only
- Pin 12 For parallel mode only
- Pin 14 For parallel mode only

4.2.3.2 Connecting units in Parallel using standard 15-pole connectors

To operate the units in parallel, Pins 5,6,12,14 of each unit must be connected together as described in the figure 8.

Pins 1, 4, 6, 7 should be connected among the units.

For parallel operation of units having Static Transfer Switches, Pin 11 of each unit must be connected together as in Fig. 8 (synchronization for the Static Transfer Switches of each unit).

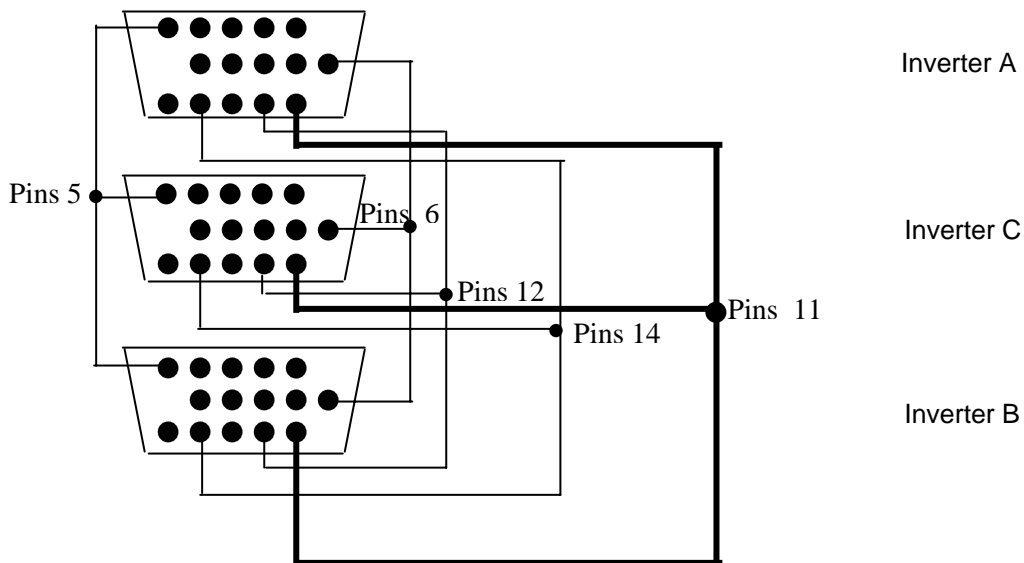


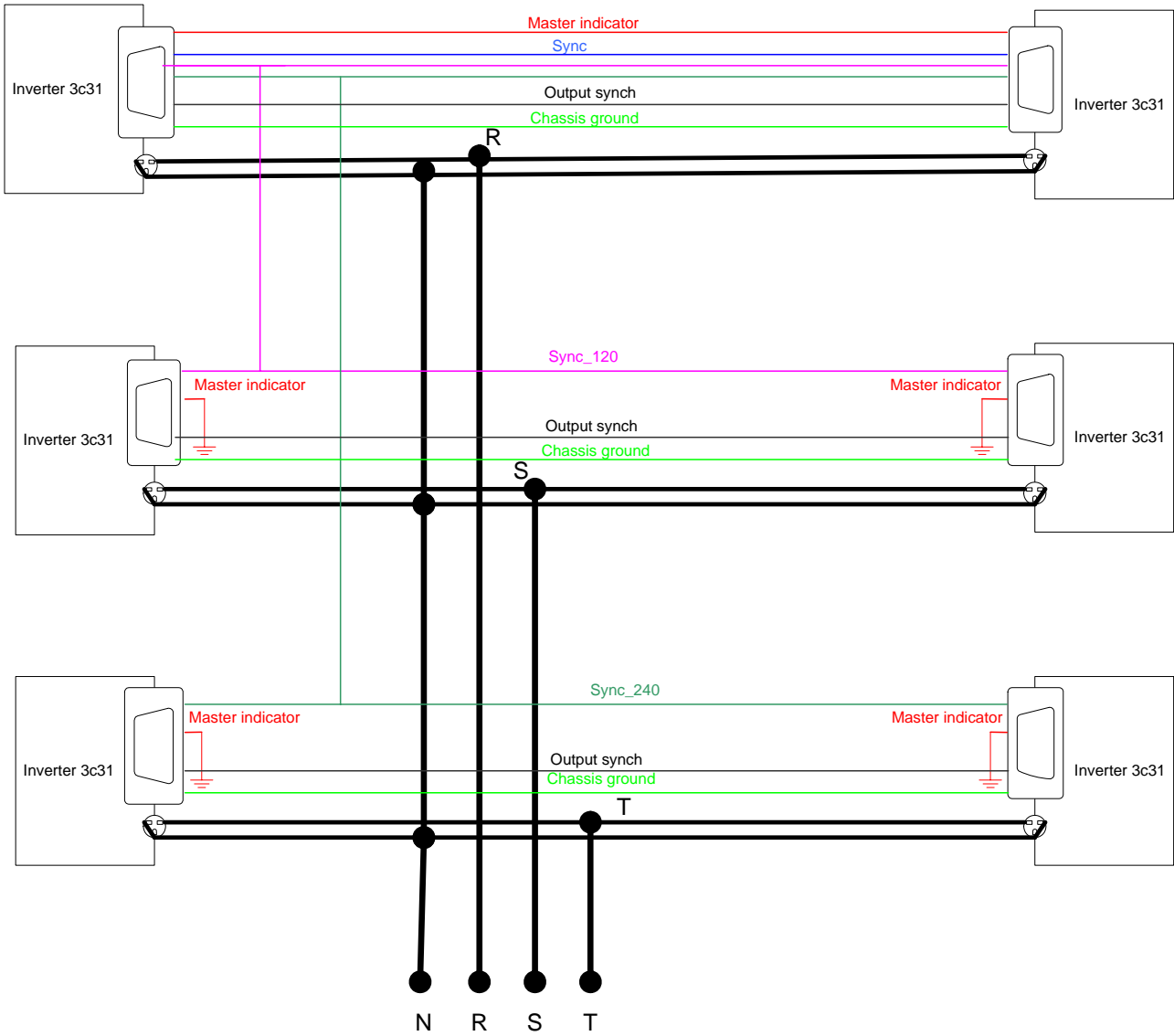
Fig.8. PARALLEL CONFIGURATION

- Pins 5,6,12,14 are dedicated to the parallel configuration -
- Pin 11 must be connected if the units employ the Static Transfer switch option -

4.2.3.3 Generation of a 3-phase Y voltage

There is the possibility to generate a 3-phase voltage by connecting into a Y an equal number of inverters per each one of the three phases. The following diagram shows an example of the necessary connections. Be aware that the 3-phase configuration needs to be enabled by acting on the service menu of the unit (see user manual).

Inverter 3C3X
 Additional wiring needed for three phase
 voltage generation



4.3 Step by Step procedures to turn on the unit

4.3.1 Models without the optional Static Transfer Switch, in stand-alone configuration

1. Be sure every AC user is disconnected and the AC Output Breaker on the front panel is turned OFF.
2. Connect the Signal connector. Refer to paragraph 4.2.3.
3. Make DC input connections to the inverter as described in paragraph 4.2.1. The display unit lights up and shows "STAND BY..." Refer to "User's Guide", page 3.
4. Press ENTER to visualize the status of the unit and verify on the display that the current Mode is "Stand Alone Mode" (you can change the settings for Frequency, Voltage, Current Limit and Remote ON/OFF only if the unit 's Mode is the "Stand Alone ". Refer to "User's Guide", Note on page 9).
5. *Optional:* to change factory settings for the following: Frequency, Voltage, Current Limit and Remote ON/OFF through the "SETTINGS MENU" (for procedures and factory settings see " User's Guide", page. 8).
6. Switch the AC Output Breaker ON (the "Power" LED lights up GREEN) and check on the display that the output voltage from the inverter is 230Vac (115Vac). Turn again the AC Breaker OFF.
7. Press the ON/OFF button to turn the inverter in stand-by.

Turning on the load

Check that the rated input power of the load is less or equal to the rated output power of the inverter.
Connect the load to the inverter as described in paragraph 4.2.2.
Press the ON/OFF key to turn the unit ON.
Switch the front panel AC Output Breaker ON. The unit should feed the load properly.

4.3.2 Models without the optional Static Transfer Switch, in parallel configuration (6 units max.)

4.3.2.1 Setting up the units

Be sure every AC user is disconnected and the AC Output Breaker on front panel of each inverter is turned OFF.



Repeat steps 2 to 6 for each unit

Make DC input connections to the inverter as described in paragraph 4.2.1. The display unit lights up and shows "STAND BY..."

Press ENTER to display the status of the unit and verify on the display that the current Mode is the "Stand Alone Mode 0"

Please Note: you can change the settings for Frequency, Voltage, Current Limit and Remote ON/OFF only if the unit Mode is the "Stand Alone Mode 0"(default mode). To set that one (if necessary), refer to "User's Guide", Note on page 9.

Optional: Change the unit's settings for Frequency, Voltage, Current Limit and Remote ON/OFF through the "SETTINGS MENU". See the "User's Guide" page 8 for the procedure.

Please Note: This step operates on critical unit parameters: we suggest changing the factory settings only if it is strictly needed.

Warning: for proper parallel operation all units need to have exactly the same Frequency, Voltage, Current limit and Remote ON/OFF settings.

Set the "Unit Status" as "Parallel Mode 2" (see also the "User's Guide", *Appendix A*)

- Select the "SETTINGS Menu" ("user's Guide, page 8) and press "Enter".
- Insert the password (default password is "0000", use "Enter" key to type the "0" character).
- Scroll the "SETTING Menu" using UP/DOWN keys up to "SERVICE" Menu. Press "Enter" to confirm.
- Type the password (default password: 1111).
- Select the "Operant. Mode" menu. Press "ENTER".

- Set " Mode = 2". Press "ENTER"

Re-cycle the DC input voltage. After this is done the Inverter is set to work in parallel configuration.

Connect the Signal connector to the unit. Refer to paragraph 4.2.3.

Connect the grid. Refer to paragraph 4.2.2.4.

4.3.2.2 Turning on the load

1. Press the ON/OFF key to put in Stand-By each inverter.
2. Check that the rated input power of the load is less or equal to the rated output power of parallel system of inverters.
3. Connect the load to the inverter as described in paragraph 4.2.2. Make sure that the length and the section of the cables between each unit and the common point of the load are the same (Fig.4, Fig.5)
4. Switch ON the front panel AC Output Breaker of each inverter
5. Press the ON/OFF button of the one inverter to turn on all inverter system

4.3.3 Models with the optional Static Transfer Switch in stand-alone configuration



Please Note: To operate the Static Transfer Switch it is necessary to make sure that the nominal voltage and frequency of the grid match the corresponding settings of the unit (step 6 of procedure below).


4.3.3.1 Setting up the unit


1. Be sure every AC load is disconnected and the AC Output Breaker on the front panel is turned OFF.
2. Connect the Signal connector. Refer to paragraph 4.2.3.
3. Make DC input connections to the inverter as described in paragraph 4.2.1. The display unit lights up and shows "STAND BY..."
4. Verifying that the nominal Frequency and Voltage values are equal to those of the grid (refer also to "User's Guide" page 3)
 - Press the ON/OFF key and wait few seconds. The display will indicate the Vout (and Iout) value,
 - Press "Enter" to indicate the frequency.
 - Return the unit to stand-by, pressing the "ON/OFF" key.If it is necessary change the Vout and/or Frequency values, please follow the procedure in the next step.
5. Changing the settings of the unit
 - 5.1 Press "Enter" from "STAND-BY" and check that the unit's mode is the "Stand-Alone Mode 0" (refer to "User's Guide", page 3).
 - 5.2 If the "Stand-Alone Mode in step 5.1 is not verified, set the Stand-Alone mode as described in the "User's Guide", Note on page 9.
 - 5.3 Enter in the "SETTINGS MENU" and set the new values for Vout and/or Frequency. Refer to "User Guide", page 8).
6. Setting the Transfer Switch Mode
From the "TRANSFER SWITCH MENU" set the desired "Transfer Switch Operate Mode" option among the following (see "User's Guide", page 13):
 - Mode 1 = "On-line Mode" (default Mode). The inverter is the primary source and the Static Transfer Switch is normally switched on the inverter.
 - Mode 2 = "Off-Line Mode". The grid is the primary source and the Static Transfer Switch is normally switched on the grid.
 - Mode 3 = "Manual Mode". Enables the Static Transfer Switch to be in a position determined by the "Manual Switch" setting. The positions can be: (a) switched on the inverter; (b) switched on the grid or (c) not connected. To change the position, use the "MANUAL SWITCH" menu (refer to "User's Guide", page 13)
7. Connect the signal connector to the unit. Refer to paragraph 4.2.3.
8. Connect the grid. Refer to paragraph 4.2.2.4

4.3.3.2 Turning on the load

1. Check that the rated input power of the load is less or equal to the rated output power of the inverter.
2. Connect the load to the inverter as described in paragraph 4.2.2.
3. Press the ON/OFF key to turn the unit ON
4. Switch the front panel AC Output Breaker ON. The unit should feed the load properly.


4.3.4 Models with the optional Static Transfer Switch in parallel configuration (6 max.)

 **Please Note:** To operate the Static Transfer Switch it is necessary to make sure that the nominal voltage and frequency of the grid match the corresponding settings of the unit (step 6 of procedure below).

 **Please Note:** It is not possible to connect to GND the neutral of units with Static Transfer Switch operating in parallel. In order to allow the grounding of the neutral an isolation transformer has to be used between the inverters' output and the load. Ask your Power-One technical or commercial interface about suggestions on how to do it.

4.3.4.1 Setting up the units

Be sure every AC user is disconnected and the AC Output Breaker on front panel of each inverter is turned OFF.

 Repeat steps 2 to 6 for each unit.

Make DC input connections to the inverter as described in paragraph 4.2.1. The display unit lights up and shows "STAND BY..."

Verify that the nominal Frequency and Voltage values are equal to those of the grid (refer also to "User's Guide" page 3).

- Press the ON/OFF key and wait few seconds. The display will indicate the V_{OUT} (and I_{OUT}) value,
- Press "Enter" to indicate the frequency.
- Turn again the unit in stand-by pressing the "ON/OFF" key.

If it is necessary change the V_{out} and/or Frequency values, please follow the procedure in the next step.

4. Changing the settings of the unit

4.1 Press "Enter" from the "STAND-BY..." and check that the unit's mode is the "Stand-Alone Mode 0" (refer "User's Guide", page 3).

4.2 If the Stand-Alone Mode 0 is not verified, set the Stand -Alone mode as described on the "User's Guide", Note on page 9.

4.3 Enter the "SETTINGS MENU" and set the new values for V_{OUT} and/or Frequency. Refer to "User's Guide", page 8.

4.3.1 *Optional:* If you desire, before exiting from the "SETTINGS MENU", you can also change the default settings for Current Limit and Remote ON/OFF. Refer to "SET Limit" and "SET Remote ON/OFF" options in "User's Guide", page 8.

Please Note: the default settings for Frequency, Voltage, Current Limit and Remote ON/OFF can be modified only if the unit Mode is the "Stand Alone Mode 0" (default mode). To set that one, refer to "User's Guide", Note on page 9.

Warning: for proper parallel operation, all units need to have exactly the same Frequency, Voltage, Current limit and Remote ON/OFF settings.

5. Set the "Unit Status" as "Parallel Mode 2" (see also the "User's Guide", *Appendix A*)
 - Select the "SETTINGS Menu" ("user's Guide, pag.8) and press "Enter".
 - Insert the password (default password is "0000", use "Enter" key to type the "0" character).
 - Scroll the "SETTING Menu" using UP/DOWN keys up to "SERVICE" Menu. Press "Enter" to confirm.
 - Type the password (default password: 1111).
 - Select the "Operate Mode" menu. Press "ENTER".
 - Set " Mode = 2". Press "ENTER"
6. Re-cycle the DC input voltage. After this is done the Inverter is set to work in parallel configuration.

7. Setting the Transfer Switch Mode

From the "TRANSFER SWITCH MENU" set the desired "Transfer Switch Operate Mode" option among the following (see "User's Guide", page 13).

- Mode 1 = "On-line Mode" (default Mode). The inverter is the primary source and the Static Transfer Switch is normally switched on the inverter.
- Mode 2 = "Off-Line Mode". The grid is the primary source and the Static Transfer Switch is normally switched on the grid.
- Mode 3 = "Manual Mode". Enables the Static Transfer Switch to be in a position determined by the "Manual Switch" setting. The positions can be: (a) switched on the inverter; (b) switched on the grid or (c) not connected. To change the position, use the "MANUAL SWITCH" menu (refer to "User's Guide", page 13)

Warning: for proper parallel operation all units need to have exactly the same "Transfer Switch Operate Mode" setting.

8. Connect the signal connector on the unit(s). Refer to paragraph 4.2.3.
9. Connect the grid. Refer to paragraph 4.2.2.4

4.3.4.2 Turning on the load

See paragraph 4.3.2.2

Appendix A: Input Power Requirements and DC Input wire sizing

Input Power Requirements

Model	Nominal VDC	Minimum VDC Cut-OFF/ Alarm	Maximum VDC	Rated Current At Nominal Voltage	Peak Current
SLI-48-XXX	48 VDC	36 - 40 VDC	72 VDC	34A	60A
SLI-24-XXX	24 VDC	18 - 20 VDC	36 VDC	70A	120A

DC Input wire sizing

Minimum input wire sizes vs. distance from input source and P/N of terminals (type: AMP TERMINYL[®]) we recommend.

Model	Less than 1m		Less than 2 m		Less than 3m		Less than 4m	
	SLI-48-XXX	AWG 8	P/N 324082	AWG 5	P/N 324047	AWG 3	P/N 324050 or P/N 330966	AWG 2
SLI-24-XXX	AWG 2	P/N 324053	2xAWG2	P/N 324053	2XAWG1	P/N 324053	2xAWG0	P/N 55822-1

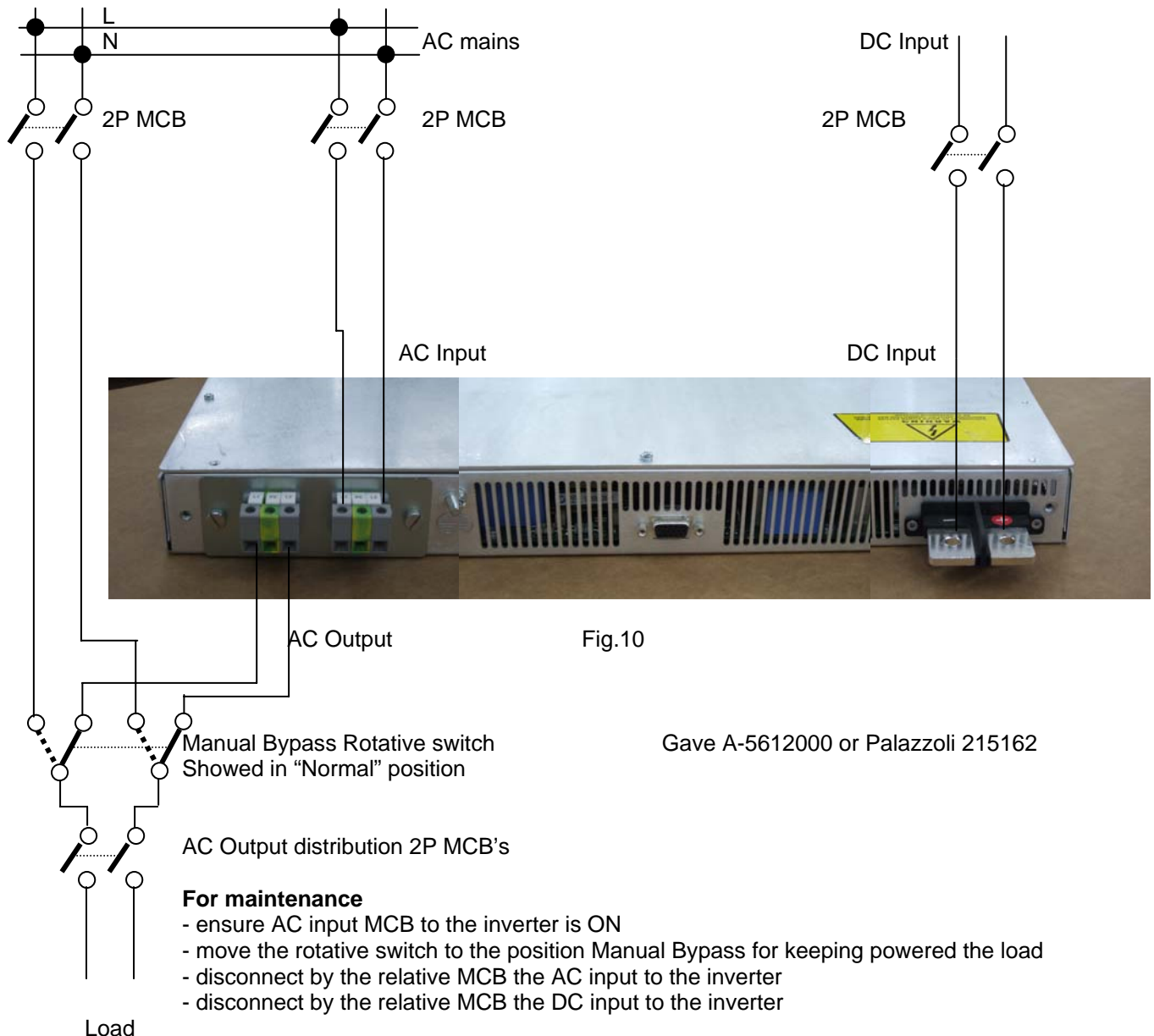
Note: The table specifies standard wire size that will provide 200mV max. Voltage drops at low-line input voltage and rated output power.

Appendix B: Manual Bypass

Manual by pass function may be useful for isolating the inverter to allow maintenance without dangerous high voltage presence.

It is recommended the use of a double pole rotative switch also if different implementations of same concept may exist without a rotative switch; in this case proper sequence shall be scrupulously followed.

A typical Manual Bypass application is described by the following scheme.



WARNING: a different sequencing from the above may result into a severe damage of the unit.

Appendix C: Grounding restrictions summary

STS option	Mode	Grounding Restriction	Remark
With STS	Stand Alone Mode	Neutral grounding is possible just internally, by factory, on the STS board. Caution: do not short Neutral to Ground outside of the inverter	See picture at pag.13 of the engineering specification
	Parallel Mode	Neutral grounding is possible just using an isolation transformer before the AC input. Neutral to Ground can be connected by factory with an internal connection or right at the inverter output.	See schematic here below, Fig.11
Without STS	Stand Alone Mode	NO grounding restrictions. Neutral to Ground can be connected by factory with an internal connection or right at the inverter output.	
	Parallel Mode	NO grounding restrictions. Neutral to Ground can be connected by factory with an internal connection or right at the inverter output.	

GROUNDING OF NEUTRAL FOR SLI INVERTERS WITH TRANSFER-SWITCH

