User Manual

Fronus®

TIATN PRO + 3.2KW
MPPT SOLAR INVERTER

Table Of Contents

ABOUT THIS MANUAL

Purpose

This manual describes the assembly, installation, operation and troubleshooting of this unit. Please read this manual carefully before installations and operations. Keep this manual for future reference.

Scope

This manual provides safety and installation guidelines as well as information on tools and wiring.

SAFETY INSTRUCTIONS

⚠️ **WARNING: This chapter contains important safety and operating instructions. Read and keep this manual for future reference.**

1. Before using the unit, read all instructions and cautionary markings on the unit, the batteries and all appropriate sections of this manual.
2. **CAUTION** --To reduce risk of injury, charge only deep-cycle lead acid type rechargeable batteries. Other types of batteries may burst, causing personal injury and damage.
3. Do not disassemble the unit. Take it to a qualified service center when service or repair is required. Incorrect re-assembly may result in a risk of electric shock or fire.
4. To reduce risk of electric shock, disconnect all wirings before attempting any maintenance or cleaning. Turning off the unit will not reduce this risk.
5. **CAUTION –** Only qualified personnel can install this device with battery.
6. **NEVER** charge a frozen battery.
7. For optimum operation of this inverter/charger, please follow required spec to select appropriate cable size. It's very important to correctly operate this inverter/charger.
8. Be very cautious when working with metal tools on or around batteries. A potential risk exists to drop a tool to spark or short circuit batteries or other electrical parts and could cause an explosion.
9. Please strictly follow installation procedure when you want to disconnect AC or DC terminals. Please refer to INSTALLATION section of this manual for the details.
10. One piece of 150A fuse is provided as over-current protection for the battery supply.
11. GROUNDING INSTRUCTIONS -This inverter/charger should be connected to a permanent grounded wiring system. Be sure to comply with local requirements and regulation to install this inverter.
12. NEVER cause AC output and DC input short circuited. Do NOT connect to the mains when DC input short circuits.
13. **Warning!!** Only qualified service persons are able to service this device. If errors still persist after following troubleshooting table, please send this inverter/charger back to local dealer or service center for maintenance.

INTRODUCTION

This is a multi-function inverter/charger, combining functions of inverter, solar charger and battery charger to offer uninterruptible power support with portable size. Its comprehensive LCD display offers user-configurable and easy-accessible button operation such as battery charging current, AC/solar charger priority, and acceptable input voltage based on different applications.

Features

- Pure sine wave inverter
- Configurable input voltage range for home appliances and personal computers via LCD setting
- Configurable battery charging current based on applications via LCD setting
- Configurable AC/Solar Charger priority via LCD setting
- Compatible to mains voltage or generator power
- Auto restart while AC is recovering
- Overload/ Over temperature/ short circuit protection
- Smart battery charger design for optimized battery performance
- Cold start function

Basic System Architecture

The following illustration shows basic application for this inverter/charger. It also includes following devices to have a complete running system:

- Generator or Utility.
- PV modules

Consult with your system integrator for other possible system architectures depending on your requirements.

This inverter can power all kinds of appliances in home or office environment, including motor-type appliances such as tube light, fan, refrigerator and air conditioner.
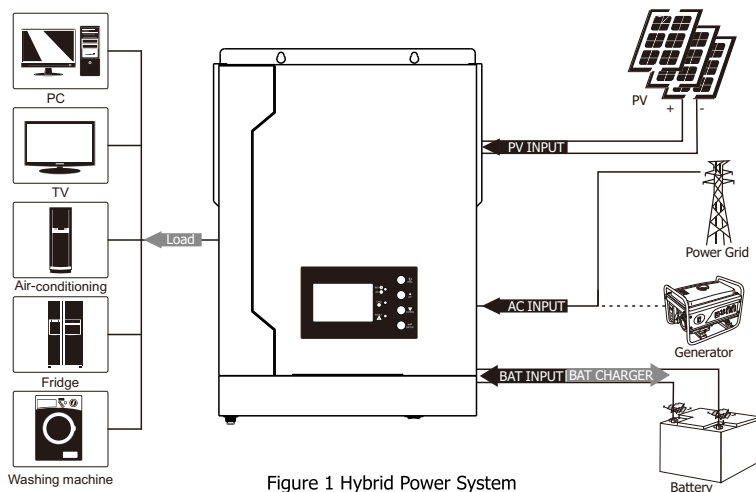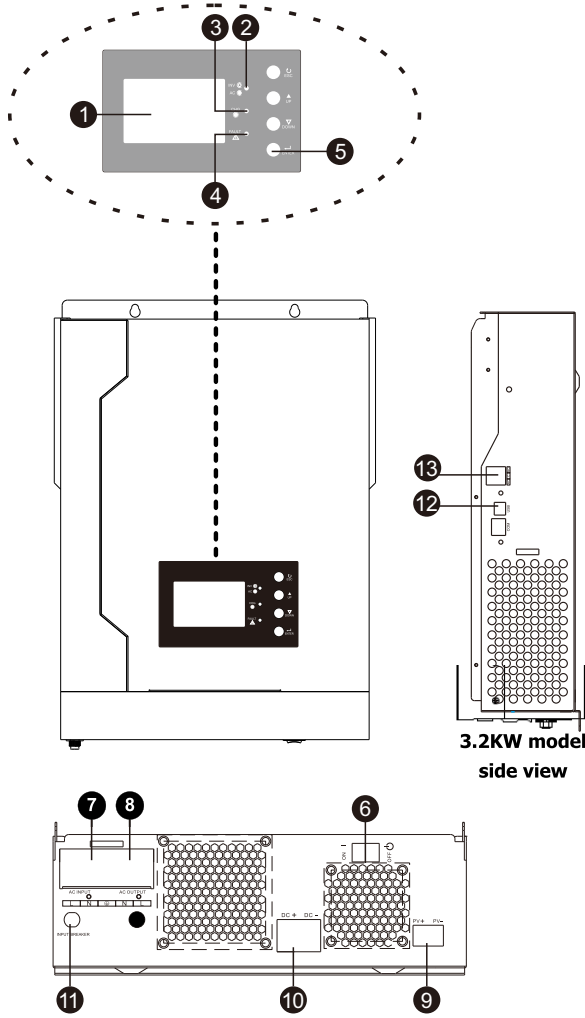

Figure 1 Hybrid Power System

Product Overview

3.2KW model side view

3.2KW Model

1. LCD display
2. Status indicator
3. Charging indicator
4. Fault indicator
5. Function buttons
6. Power on/off switch
7. AC input
8. AC output
9. PV input
10. Battery input
11. Fuse or Circuit breaker
12. USB communication port
13. RS-485 communication port

INSTALLATION

Unpacking and Inspection

Before installation, please inspect the unit. Be sure that nothing inside the package is damaged. You should have received the following items inside of package:

- The unit x 1
- User manual x 1
- Communication cable x 2
- Software CD x 1

Preparation

Before connecting all wirings, please take off bottom cover by removing the screws (3.2KW)
as shown below.
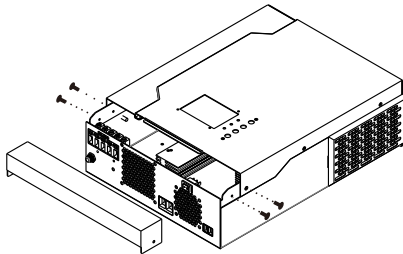
3.2KW model

Mounting the Unit

Consider the following points before selecting where to install:

- Do not mount the inverter on flammable construction materials.
- Mount on a solid surface
- Install this inverter at eye level in order to allow the LCD display to be read at all times.
- For proper air circulation to dissipate heat, allow a clearance of approx. 20 cm to the side and approx. 50 cm above and below the unit.
- The ambient temperature should be between 0°C and 55°C to ensure optimal operation.
- The recommended installation position is to be adhered to the wall vertically.
- Be sure to keep other objects and surfaces as shown in the diagram to guarantee sufficient heat dissipation and to have enough space for removing wires.
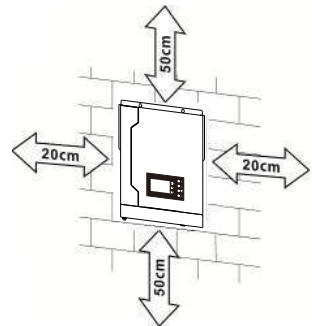
⚠ **SUITABLE FOR MOUNTING ON CONCRETE OR OTHER NON-COMBUSTIBLE SURFACE ONLY.**

Install the unit by screwing two screws. It's recommended to use M4 or M5 screws.
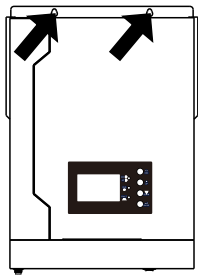
Battery Connection

CAUTION: For safety operation and regulation compliance, it's requested to install a separate DC over-current protector or disconnect device between battery and inverter. It may not be requested to have a disconnect device in some applications, however, it's still requested to have over-current protection installed. Please refer to typical amperage in below table as required fuse or breaker size.

WARNING! All wiring must be performed by a qualified personnel.
WARNING! It's very important for system safety and efficient operation to use appropriate cable for battery connection. To reduce risk of injury, please use the proper recommended cable as below.

Recommended battery cable size:

| Model	Typical Amperage	Wire Size	Terminal Cable mm^2	Torque Value
3.2KW	148A	1 x 2AWG	38	2Nm

Ring terminal for 3.2KW:

1、Remove insulation sleeve 18mm for positive and negative conductors.
2、Surrest to put bootlace ferrules on the end of positive and negative wires with a proper crimping tool.
3、Fix strain relief plate to the inverter by supplied screws as shown in below chart.
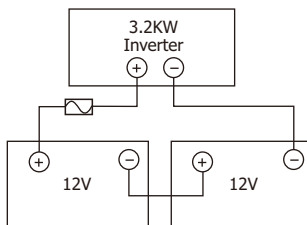
4. Insert the battery wires flatly into battery connectors of inverter and make sure the bolts are tightened with torque of 2 Nm in clockwise direction. Make sure polarity at both the battery and the inverter/charge is correctly connected and conductors are tightly screwed into the battery terminals.
Recommended tool: #2 Pozi Screwdriver
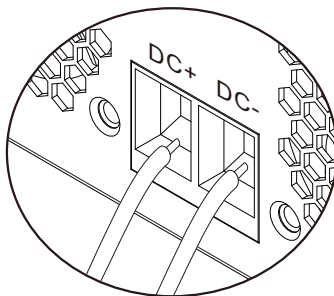
Battery connection for 3.2KW:

Please follow below steps to implement battery connection:
1. Assemble battery ring terminal based on recommended battery cable and terminal size.
2. Connect battery packs with 24VDC system. It's suggested to connect at least 100Ah capacity battery.
3. Insert the ring terminal of battery cable flatly into battery connector of inverter and make sure the bolts are tightened with torque of 2 Nm. Make sure the polarity at both the battery and the inverter/charge is correctly connected and ring terminals are tightly screwed to the battery terminals.
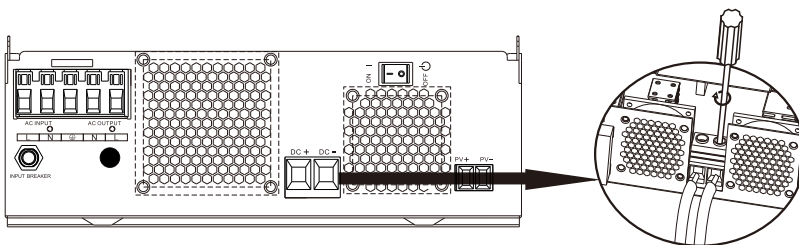
⚠	**WARNING: Shock Hazard** Installation must be performed with care due to high battery voltage in series.

⚠	**CAUTION!!** Before making the final DC connection or closing DC breaker/disconnector, be sure positive (+) must be connected to positive (+) and negative (-) must be connected to negative (-).

AC Input/Output Connection

CAUTION!! Before connecting to AC input power source, please install a **separate** AC breaker between inverter and AC input power source. This will ensure the inverter can be securely disconnected during maintenance and fully protected from over current of AC input. The recommended spec of AC breaker is 32A for 3.2KW.

CAUTION!! There are two terminal blocks with "AC IN" and "AC OUT" markings. Please do NOT mis-connect input and output connectors.

WARNING! All wiring must be performed by a qualified personnel.

WARNING! It's very important for system safety and efficient operation to use appropriate cable for AC input connection. To reduce risk of injury, please use the proper recommended cable size as below.

Suggested cable requirement for AC wires

| Model	Gauge	Cable (mm²)	Torque Value
3.2KW	12 AWG	4	1.2 Nm

Please follow below steps to implement AC input/output connection:

1. Before making AC input/output connection, be sure to open DC protector or disconnector first.
2. Remove insulation sleeve 10mm for 5 conductors for 3.2K
3. For 3.2KW models, insert AC input wires according to polarities indicated on terminal block and tighten the terminal screws. Be sure to connect PE protective conductor **(⏚)** first.

   ⏚**→Ground (yellow-green)**
   L→LINE (brown or black)
   N→Neutral (blue)

3.2KW model
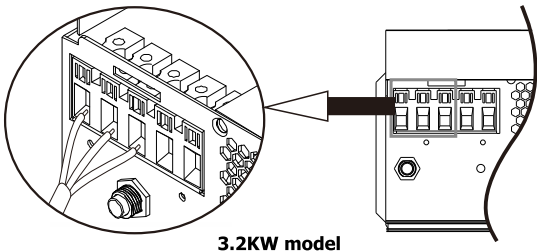
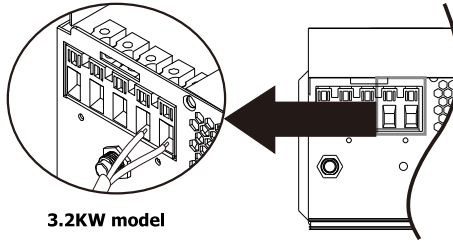| ⚠	**WARNING:**
	Be sure that AC power source is disconnected before attempting to hardwire it to the unit.

4. Then, insert AC output wires according to polarities indicated on terminal block and tighten terminal screws. Be sure to connect PE protective conductor **(⏚)** first.

   ⏚**→Ground (yellow-green)**
   L→LINE (brown or black)
   N→Neutral (blue)

3.2KW model

5. Make sure the wires are securely connected.

CAUTION: Appliances such as air conditioner are required at least 2~3 minutes to restart because it's required to have enough time to balance refrigerant gas inside of circuits. If a power shortage occurs and recovers in a short time, it will cause damage to your connected appliances. To prevent this kind of damage, please check manufacturer of air conditioner if it's equipped with time-delay function before installation. Otherwise, this inverter/charger will trig overload fault and cut off output to protect your appliance but sometimes it still causes internal damage to the air conditioner.

PV Connection

CAUTION: Before connecting to PV modules, please install **separately** a DC circuit breaker between inverter and PV modules.

WARNING! It's very important for system safety and efficient operation to use appropriate cable for PV module connection. To reduce risk of injury, please use the proper recommended cable size as below.

Wire Size	Cable (mm²)	Torque value (max)
1 x 8AWG	10	1.6 Nm

When selecting proper PV modules, please be sure to consider below parameters:
1. Open circuit Voltage (Voc) of PV modules not exceeds max. PV array open circuit voltage of inverter.
2. Open circuit Voltage (Voc) of PV modules should be higher than min. battery voltage.

INVERTER MODEL	3.2KW
Max. PV Array Open Circuit Voltage	102Vdc
PV Array MPPT Voltage Range	30~80Vdc

Take 300Wp PV module as an example. After considering above two parameters, the recommended module configurations listed as below table.

| Maximum Power (Pmax)	300W	
Max. Power Voltage Vmpp(V)	32V	For 3.2KW:
Max. Power Current Impp(A)	9.4A	2 pieces in serial and 3 sets in parallel
Open Circuit Voltage Voc(V)	40V	
Short Circuit Current Isc(A)	10A	

PV Module Wire Connection
Please follow below steps to implement PV module connection:
1. Remove insulation sleeve 10 mm for positive and negative conductors.
2. Suggest to put bootlace ferrules on the end of positive and negative wires with a proper crimping tool.
3. Check correct polarity of wire connection from PV modules and PV input connectors. Then, connect positive pole (+) of connection wire to positive pole (+) of PV input connector. Connect negative pole (-) of connection wire to negative pole (-) of PV input connector. Screw two wires tightly in clockwise direction.
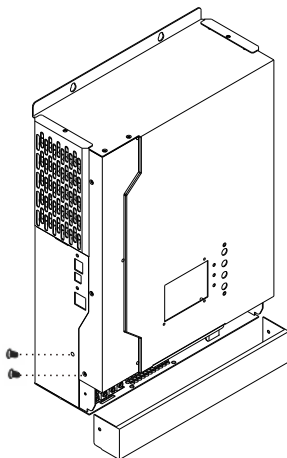

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Recommended tool: 4mm blade screwdriver
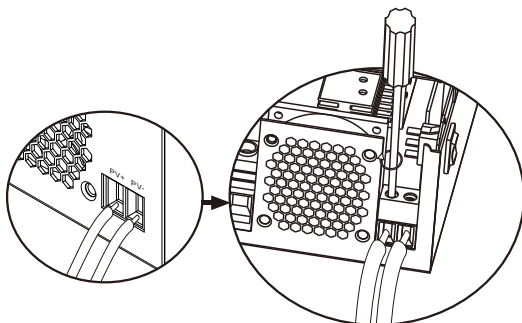
3.2KW model

Final Assembly

After connecting all wirings, please put bottom cover back by screwing the screws as shown below.

3.2KW model

Communication Connection

Please use supplied communication cable to connect to inverter and PC. Insert bundled CD into a computer and follow on-screen instruction to install the monitoring software. For the detailed software operation, please check user manual of software inside of CD.

WARNING: It's forbidden to use network cable as the communication cable to directly communicate with the PC port. Otherwise, the internal components of the controller will be damaged.
WARNING: RJ45 interface is only suitable for the use of the company's supporting products or professional operation.

Below chart shows RJ45 Pins definition

Pin	Definition
1	RS-485-B
2	RS-485-A
3	GND
4	
5	
6	
7	
8	
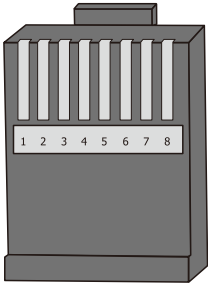
Dry Contact Signal

There is one dry contact (3A/250VAC) available on the rear panel. It can be used to deliver signal to external device when battery voltage reaches warning level.

Unit Status	Condition		Dry contact port	
			NC & C	NO & C
Power Off	Unit is off and no output is powered.		Close	Open
Power On	Output is powered from Utility		Close	Open
	Output is powered from Battery or Solar.	Program 01 set as Utility	Battery voltage < Low DC warning voltage	Open	Close
			Battery voltage > Setting value in Program 21 or battery charging reaches floating stage	Close	Open
		Program 01 is set as SBU or Solar first	Battery voltage < Setting value in Program 20	Open	Close
			Battery voltage>Setting value in Program 21 or battery charging reaches floating stage	Close	Open

OPERATION

Power ON/OFF
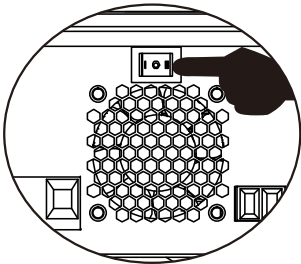
Once the unit has been properly installed and the batteries are connected well, simply press On/Off switch (located on the button of the case) to turn on the unit.

Operation and Display Panel

The operation and display panel, shown in below chart, is on the front panel of the inverter. It includes three indicators, four function keys and a LCD display, indicating the operating status and input/output power information.


LED indicators
Function keys

LCD display
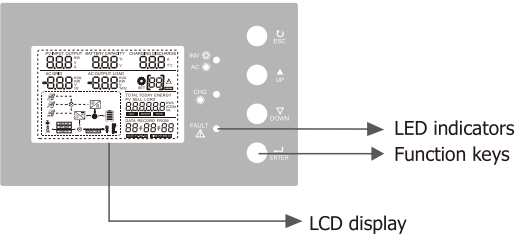
LED Indicator

LED Indicator			Messages
AC / INV	Green	Solid On	Output is powered by utility in Line mode.
		Flashing	Output is powered by battery or PV in battery mode.
CHG	Green	Solid On	Battery is fully charged.
		Flashing	Battery is charging.
FAULT	Red	Solid On	Fault occurs in the inverter.
		Flashing	Warning condition occurs in the inverter.

Function Keys

Function Key		Description
↻	ESC	To exit setting mode
↕	SCROLL	To go to next selection
↵	ENTER	To confirm the selection in setting mode or enter setting mode

LCD Display Icons
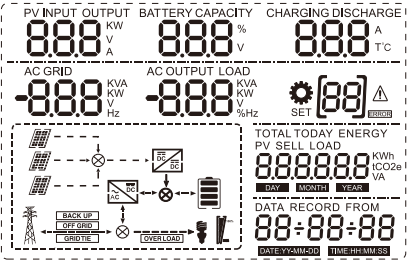
Icon	Function description
Input Source Information and Output Information	
PV INPUT OUTPUT KW V A	Indicate PV voltage, PV charger current, PV charger output voltage, PV charger output power.
BATTERY CAPACITY % V	Indicate Battery voltage.

11

CHARGING DISCHARGE 8.8.8 A TC	Indicate Battery current.
AC GRID -8.8.8 KVA KW V Hz	Indicate grid voltage, grid frequency, grid power.
AC OUTPUT LOAD -8.8.8 KVA KW V %Hz	Indicate output voltage, output frequency, load in VA, load in Watt and discharging current.

Configuration Program and Fault Information

⚙ [88] SET	Indicates the setting programs.
88 ⚠ ERROR	Indicates the warning and fault codes. Warning: flashing 88 ⚠ with warning code. Fault: lighting 88 ERROR with fault code.

Battery Information

🔋 SLA Li	Indicates battery level by 0-24%, 25-49%, 50-74% and 75-100% in battery mode and charging status in line mode.

In AC mode, it will present battery charging status.		
Status	Battery voltage	LCD Display
Constant Current mode / Constant Voltage mode	<2V/cell	4 bars will flash in turns.
	2 ~ 2.083V/cell	Bottom bar will be on and the other three bars will flash in turns.
	2.083 ~ 2.167V/cell	Bottom two bars will be on and the other two bars will flash in turns.
	> 2.167 V/cell	Bottom three bars will be on and the top bar will flash.
Batteries are fully charged.		4 bars will be on.

In battery mode, it will present battery capacity.		
Load Percentage	Battery Voltage	LCD Display
Load >50%	< 1.717V/cell	🔋
	1.717V/cell ~ 1.8V/cell	🔋
	1.8 ~ 1.883V/cell	🔋
	> 1.883 V/cell	🔋

50%> Load > 20%	< 1.817V/cell	
	1.817V/cell ~ 1.9V/cell	
	1.9 ~ 1.983V/cell	
	> 1.983V/cell	
Load < 20%	< 1.867V/cell	
	1.867V/cell ~ 1.95V/cell	
	1.95 ~ 2.033V/cell	
	> 2.033V/cell	

Load Information

OVER LOAD	Indicates overload.

	Indicates the load level by 0-24%, 25-49%, 50-74% and 75-100%.			
100% 25%	0%~24%	25%~49%	50%~74%	75%~100%

Mode Operation Information

	Indicates unit connected to the mains.
	Indicates unit connected to the PV panel.
BYPASS	Indicates load is supplied by utility power.
	Indicates the solar charger is working.
	Indicates the DC/AC inverter circuit is working.

Mute Operation

	Indicates unit alarm is disabled.

LCD Setting

After pressing and holding "ENTER" button for 2 seconds, the unit will enter setting mode. Press "UP"or "DOWN" button to select setting programs. And then, press "ENTER" or "ESC" button to confirm the selection and exit.

Setting Programs:

Program	Description	Selectable option	
00	Exit setting mode	Escape **[00] ESC**	
01	Output source priority selection	**[01] SbU**	Solar energy provides power to the loads as first priority. If battery voltage has been higher than the setting point in program 21 for 5 minutes, the inverter will turn to battery mode, solar and battery will provide power to the load at the same time. When the battery voltage drops to the setting point in program 20, the inverter will turn to bypass mode, utility provides power to the load only, and the solar will charge the battery at the same time.
		[01] SOL	Solar energy provides power to the loads as first priority. If battery voltage has been higher than the setting point in program 21 for 5 minutes, and the solar energy has been available for 5 minutes too, the inverter will turn to battery mode, solar and battery will provide power to the load at the same time. When the battery voltage drops to the setting point in program 20, the inverter will turn to bypass mode, utility provides power to the load only, and the solar will charge the battery at the same time.
		(default) **[01] Uti**	Utility will provide power to the loads as first priority. Solar and battery energy will provide power to the loads only when utility power is not available.

02	AC input voltage range	Appliances (default) [02] APL	If selected, acceptable AC input voltage range will be within 90-280VAC.
		UPS [02] UPS	If selected, acceptable AC input voltage range will be within 170-280VAC.
		VDE [02] VdE	If selected, acceptable AC input voltage range will conform to VDE4105(184VAC-253VAC)
		GEN [02] GEN	When the user uses the device to connect the generator, select the generator mode.
03	Output voltage	[03] 230 v	Set the output voltage amplitude, (220VAC-240VAC)
04	Output frequency	50HZ(default) [04] 50.0	60HZ [04] 60.0
05	Solar supply priority	[05] bLU	Solar energy provides power to charge battery as first priority
		(default) [05] LbU	Solar energy provides power to the loads as first priority
06	Overload bypass: When enabled, the unit will transfer to line mode if overload occurs in battery mode.	Bypass disable [06] bYd	Bypass enable (default) [06] bYE
07	Auto restart when overload occurs	Restart disable (default) [07] Ltd	Restart enable [07] LtE
08	Auto restart when over temperature occurs	Restart disable (default) [08] ttd	Restart enable [08] ttE
10	Charger source priority: To configure charger source priority	If this inverter/charger is working in Line, Standby or Fault mode, charger source can be programmed as below:	
		Solar first [10] CSO	Solar energy will charge battery as first priority. Utility will charge battery only when solar energy is not available.
		Solar and Utility (default) [10] SNU	Solar energy and utility will charge battery at the same time.

		Only Solar `[10 050`	Solar energy will be the only charger source no matter utility is available or not.
		If this inverter/charger is working in Battery mode or Power saving mode, only solar energy can charge battery. Solar energy will charge battery if it's available and sufficient.	
11	Maximum charging current: To configure total charging current for solar and utility chargers.(Max. charging current=utility charging current +solar charging current)	3.2KW	
		MPPT-60A	
		60A (default) `[11 60` A	Setting range is from 1 A to 80A. Increment of each click is 1A.
13	Maximum utility charging current	3.2KW	
		20A (default) `[13 20` A	30A (Maximum current) `[13 30` A
14	Battery type	AGM (default) `[14 AGn`	Flooded `[14 FLd`
		GEL `[14 GEL`	LEAD `[14 LEA`
		Lithium Ion `[14 Li`	User-Defined `[14 USE`
		If "User-Defined" LI is selected, battery charge voltage and low DC cut-off voltage can be set up in program 17, 18 and 19.	
17	Bulk charging voltage (C.V voltage)	24V model default setting: 28.2V `[17 28.2` v	
		If "User-Defined" LI is selected in program 14, this program can be set up. Setting range is from 24.0V to 29.2V for 24Vdc model. Increment of each click is 0.1V	

18	Floating charging voltage	24V model default setting: 27.0V [18] 27.0 v
		If "User-Defined" LI is selected in program 14, this program can be set up, Setting range is from 24.0V to 29.2V for 24Vdc model. Increment of each click is 0.1V.
19	Low DC cut off battery voltage setting	24V model default setting: 20.4V [19] 20.4 v
		If "User-Defined" LI is selected in program 14, this program can be set up. Setting range is from 20.0V to 24.0V for 24Vdc model. Increment of each click is 0.1V. Low DC cut-off voltage will be fixed to setting value no matter what percentage of load is connected.

20	Battery stop discharging voltage when grid is available	Available options for 24V models:	
		23V (default) [20] 23.0 v	Setting range is from 22.0V to 29.0V Increment of each click is 0.1V

21	Battery stop charging voltage when grid is available	Available options for 24V models:	
		27.0V (default) [21] 27.0 v	Setting range is from 22.0V to 29.0V. Increment of each click is 0.1V

22	Auto turn page	(default) [22] PtE	If selected, the display screen will auto turn the display page.
		[22] Ptd	If selected, the display screen will stay at latest screen user finally switches.

23	Backlight control	Backlight on `[23] LON`	Backlight off(default) `[23] LOF`
24	Alarm control	Alarm on (default) `[24] bON`	Alarm off `[24] bOF`
25	Beeps while primary source is interrupted	Alarm on `[25] AON`	Alarm off (default) `[25] AOF`
27	Record Fault code	Record enable (default) `[27] FON`	Record disable `[27] FOF`

28	Solar power balance: When enabled, solar input power will be automatically adjusted according to connected load power.	Solar power balance enable `[28] SbE`	If selected, the solar input power will be automatically adjusted according to the following formula: Max. Input solar power = Max. battery charging power + Connected load power when the machine in OffGrid workstate.
		Solar power balance disable (default) `[28] Sbd`	If selected, the solar input power will be the same to max. Battery charging power no matter how much loads are connected. The max.battery charging power will be based on the setting current in program 11 (Max. solar power = Max.battery charging power)

29	Power saving mode enable/ disable	Saving mode disable (default) `[29] SdS`	If disable, no matter connected load is low or high, the on/off status of inverter output will not be effected.
		Saving mode enable `[29] SEN`	If enable, the output of inverter will be off when connected load is pretty low or not detected.

30	Battery equalization	Battery equalization `[30] EEN`	Battery equalization disable(default) `[30] EdS`

31	Battery equalization voltage	Available options for 24V models:28.8V `[31] EV 28.8 v`	
		Setting range is from 12.0V to 14.6V for 12V model and 24.0V to 29.2V for 24V model. Increment of each click is 0.1V.	

33	Battery equalization time	60min(default) `33  60`	Setting range is from 5 min to 900min. Increment of each clink is 5min.
34	Battery equalization timeout	120min(default) `34 120`	Setting range is from 5 min to 900min. Increment of each clink is 5min.
35	Equalization interval	30days(default) `35 30d`	Setting range is from 0 to 90days. Increment of each clink is 1 day.
36	Equalization activated immediately	Enable `36 AEN` Disable(default) `36 AdS` If equalization function is enabled in program 30, this program can be set up. If "Enable"is selected in this program, it's to activate battery equalization immediately and LCD main page will shows " `E9` ". If "Disable"is selected, it will cancel equalization function until next activated equalization time arrives based on program 35 setting. At this time, " `E9` " will be shown in LCD main page too.	

After pressing and holding "ESC" button for 6 seconds, the unit will enter reset model. Press "Up"and "DOWN" button to select programs. And then ,press "ENTER" button to exit.

`EY`	(default) `dAtntt`	Don't clear the power.
	`dAtrSt`	Clear the power.
`US`	(default) `SEtntt`	Reset setting disable.
	`SEtrSt`	Reset setting enable.

Fault Reference Code

Fault Code	Fault Event	Icon on
01	Fan is locked when inverter is off	01 ⚠ ERROR
02	Inverter transformer over temperature	02 ⚠ ERROR
03	battery voltage is too high	03 ⚠ ERROR
04	battery voltage is too low	04 ⚠ ERROR
05	Output short circuited	05 ⚠ ERROR
06	Inverter output voltage is high	06 ⚠ ERROR
07	Overload time out	07 ⚠ ERROR
08	Inverter bus voltage is too high	08 ⚠ ERROR
09	Bus soft start failed	09 ⚠ ERROR
11	Main relay failed	11 ⚠ ERROR
21	Inverter output voltage sensor error	21 ⚠ ERROR
22	Inverter grid voltage sensor error	22 ⚠ ERROR
23	Inverter output current sensor error	23 ⚠ ERROR
24	Inverter grid current sensor error	24 ⚠ ERROR
25	Inverter load current sensor error	25 ⚠ ERROR
26	Inverter grid over current error	26 ⚠ ERROR
27	Inverter radiator over temperature	27 ⚠ ERROR
31	Solar charger battery voltage class error	31 ⚠ ERROR
32	Solar charger current sensor error	32 ⚠ ERROR
33	Solar charger current is uncontrollable	33 ⚠ ERROR
41	Inverter grid voltage is low	41 ⚠ ERROR
42	Inverter grid voltage is high	42 ⚠ ERROR
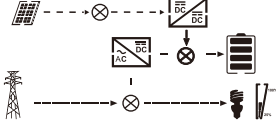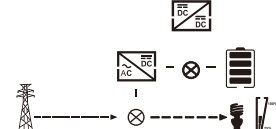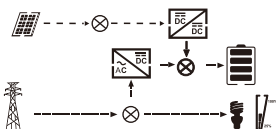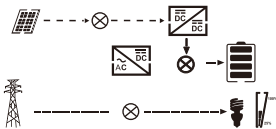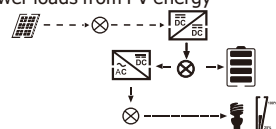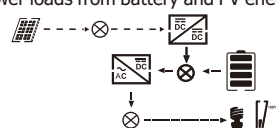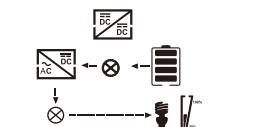
43	Inverter grid under frequency	[43] ⚠ ERROR
44	Inverter grid over frequency	[44] ⚠ ERROR
51	Inverter over current protection error	[51] ⚠ ERROR
52	Inverter bus voltage is too low	[52] ⚠ ERROR
53	Inverter soft start failed	[53] ⚠ ERROR
55	Over DC voltage in AC output	[55] ⚠ ERROR
56	Battery connection is open	[56] ⚠ ERROR
57	Inverter control current sensor error	[57] ⚠ ERROR
58	Inverter output voltage is too low	[58] ⚠ ERROR

Warning Indicator

Fault Code	Fault Event	Icon on
61	Fan is locked when inverter is on.	[61] ⚠ ERROR
62	Fan 2 is locked when inverter is on.	[62] ⚠ ERROR
63	Battery is over-charged.	[63] ⚠ ERROR
64	Low battery.	[64] ⚠ ERROR
67	Overload.	[67] ⚠ ERROR
70	Output power derating.	[70] ⚠ ERROR
72	Solar charger stops due to low battery.	[72] ⚠ ERROR
73	Solar charger stops due to high PV voltage.	[73] ⚠ ERROR
74	Solar charger stops due to over load.	[74] ⚠ ERROR
75	Solar charger over temperature.	[75] ⚠ ERROR
76	PV charger communication error.	[76] ⚠ ERROR
77	Parameter error.	[77] ⚠ ERROR

Operating State Description

Operation state	Description	LCD display
Utility-Tie state	PV energy is charger into the battery and utility provide power to the AC load.	PV is on PV is off
Charge state	PV energy and grid can charge batteries.	
Bypass state	Error are caused by inside circuit error or external reasons such as over temperature, output short circuited and so on.	
Off-Grid state	The inverter will provide output power from battery and PV power.	Inverter power loads from PV energy Inverter power loads from battery and PV energy Inverter power loads from battery only
Stop mode	The inverter stop working if you turn off the inverter by the soft key or error has occurred in the condition of no grid.	

Display Setting

The LCD display information will be switched in turns by pressing "UP" or "DOWN" key. The selectable information is switched as below order: battery voltage, battery current ,inverter voltage, inverter current, grid voltage, grid current, load in Watt, load in VA, grid frequency, inverter frequency, PV voltage, PV charging power, PV charging output voltage, PV charging current.

area	Selectable information	LCD display
PV	PV voltage	PV INPUT **55** V
	PV input current	PV INPUT **21.3** A
	PV output current	PV OUTPUT **46.9** A
	PV output power	PV OUTPUT KW **1.23**
	PV output voltage	PV OUTPUT **26.5** V
Battery	Battery voltage	BATERY CAPACITY **25.6** V
	Battery charging current	CHARGING **37** A
	Battery discharge current	DISCHARGE **76** A
Grid	Grid voltage	AC GRID **231** V
	Grid frequency	AC GRID **50.0** Hz
Load	Load current	LOAD **5.3** A
	Load active power	**1.47** KW
	Load apparent power	LOAD **1.54** KVA
	Load frequency	LOAD **50.0** Hz
	Load voltage	LOAD **230** V
Energy	Total PV energy	TOTAL PV ENERGY **12587** KWh
	Total load energy	TOTAL LOAD ENERGY **8961** KWh

Battery Equalization Description

Equalization function is added into charge controller. It reverses the buildup of negative chemical effects like stratification, a condition where acid concentration is greater at the bottom of the battery than at the top. Equalization also helps to remove sulfate crystals that might have built up on the plates. If left unchecked, this condition, called sulfation, will reduce the overall capacity of the battery. Therefore, it's recommended to equalize battery periodically.

● **How to Apply Equalization Function**

You must enable battery equalization function in monitoring LCD setting program 30 first. Then, you may apply this function in device by either one of following methods:

1. Setting equalization interval in program 35.
2. Active equalization immediately in program 36.

● **When to Equalize**

In float stage, when the setting equalization interval (battery equalization cycle) is arrived, or equalization is active immediately, the controller will start to enter Equalize stage.
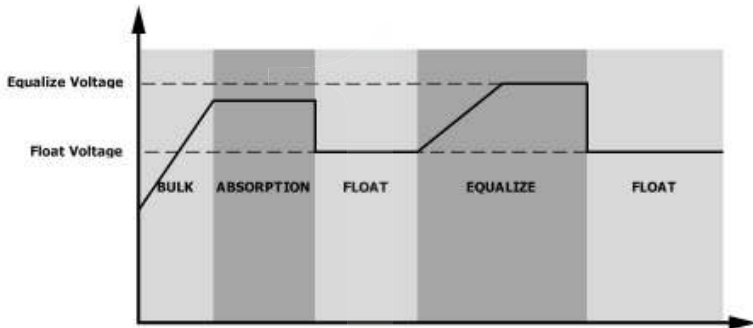
● **Equalize charging time and timeout**

In Equalize stage, the controller will supply power to charge battery as much as possible until battery voltage raises to battery equalization voltage. Then, constant-voltage regulation is applied to maintain battery voltage at the battery equalization voltage. The battery will remain in the Equalize stage until setting battery equalized time is arrived.
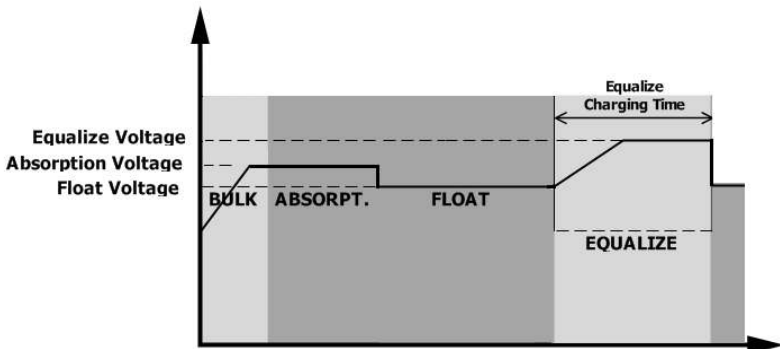
However, in Equalize stage, when battery equalized time is expired and battery voltage doesn't rise to battery equalization voltage point, the charge controller will extend the battery equalized time until battery voltage achieves battery equalization voltage. If battery voltage is still lower than battery equalization voltage when battery equalized timeout setting is over, the charge controller will stop equalization and return to float stage.
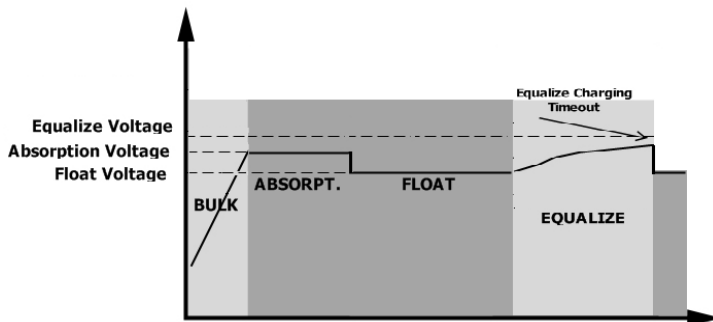
SPECIFICATIONS

Table 1 Line Mode Specifications
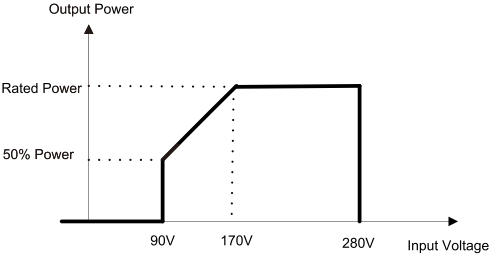
INVERTER MODEL	3.2KW
Input Voltage Waveform	Sinusoidal (utility or generator)
Nominal Input Voltage	230Vac
Low Loss Voltage	170Vac±7V (UPS); 90Vac±7V (Appliances)
Low Loss Return Voltage	180Vac±7V (UPS); 100Vac±7V (Appliances)
High Loss Voltage	280Vac±7V
High Loss Return Voltage	270Vac±7V
Max AC Input Voltage	300Vac
Nominal Input Frequency	50Hz / 60Hz (Auto detection)
Low Loss Frequency	40±1Hz
Low Loss Return Frequency	42±1Hz
High Loss Frequency	65±1Hz
High Loss Return Frequency	63±1Hz
Output Short Circuit Protection	Circuit Breaker
Efficiency (Line Mode)	>95% (Rated R load, battery full charged)
Transfer Time	10ms typical (UPS); 20ms typical (Appliances)
Output power derating: When AC input voltage drops to 170V, the output power will be derated.	Output Power Rated Power · · · · · · · · · · · · 50% Power · · · · · · 90V 170V 280V Input Voltage

Table 2 Inverter Mode Specifications

INVERTER MODEL	3.2KW	
Rated Output Power	3.2KVA/3.2KW	
Output Voltage Waveform	Pure Sine Wave	
Output Voltage Regulation	230Vac±5%	
Output Frequency	50Hz	
Peak Efficiency	93%	
Overload Protection	5s@≥130% load; 10s@105%~130% load	
Nominal DC Input Voltage	24Vdc	
Cold Start Voltage	23.0Vdc	
Low DC Warning Voltage		
@ load < 20%	11.0Vdc	22.0Vdc
@ 20% ≤ load < 50%	10.7Vdc	21.4Vdc
@ load ≥ 50%	10.1Vdc	20.2Vdc
Low DC Warning Return Voltage		
@ load < 20%	11.5Vdc	23.0Vdc
@ 20% ≤ load < 50%	11.2Vdc	22.4Vdc
@ load ≥ 50%	10.6Vdc	21.2Vdc
Low DC Cut-off Voltage		
@ load < 20%	10.5Vdc	21.0Vdc
@ 20% ≤ load < 50%	10.2Vdc	20.4Vdc
@ load ≥ 50%	9.6Vdc	19.2Vdc

Table 3 Charge Mode Specifications

Utility Charging Mode	
INVERTER MODEL	**3.2KW**
Charging Algorithm	3-Step
AC Charging Current (Max)	30Amp (@V$_{I/P}$=230Vac)
Bulk Charging Voltage — **Flooded Battery**	28.4
Bulk Charging Voltage — **AGM / Gel Battery**	28.8
Floating Charging Voltage	27.4Vdc
Charging Curve	

MPPT Solar Charging Mode	
INVERTER MODEL	**3.2KW**
Max. PV Array Power	1800W
Charging Current	60 Amp
PV Array MPPT Voltage Range	30~80Vdc
Max. PV Array Open Circuit Voltage	102Vdc
Max Charging Current **(AC charger and solar charger)**	80Amp

Table 4 General Specifications

INVERTER MODEL	**3.2KW**
Operating Temperature Range	-10°C to 50°C
Storage temperature	-15°C~ 60°C
Humidity	5% to 95% Relative Humidity (Non-condensing)
Dimension (D*W*H), mm	118.3 x 285 x 360.4
Net Weight, kg	7.6

TROUBLE SHOOTING

Problem	LCD/LED/Buzzer	Explanation / Possible cause	What to do
Warning code 02 is displayed in the LCD.	No beep but it shows warning code 02 in the LCD.	Temperature of inverter inside is high.	1. Remove the loads. 2. Reduce the operation environment temperature.
	Beep once every 0.5 second and it shows warning code 02 in the LCD.		
Unit shuts down automatically during startup process.	LCD/LEDs and buzzer will be active for 3 seconds and then complete off.	The battery voltage is too low (<1.91V/Cell)	1. Re-charge battery. 2. Replace battery.
No response after power on.	No indication.	1. The battery voltage is far too low. (<1.4V/Cell) 2. Internal fuse tripped.	1. Contact repair center for replacing the fuse. 2. Re-charge battery. 3. Replace battery.
Mains exist but the unit works in battery mode.	Input voltage is displayed as 0 on the LCD and green LED is flashing.	Input protector is tripped	Check if AC breaker is tripped and AC wiring is connected well.
	Green LED is flashing.	Insufficient quality of AC power. (Shore or Generator)	1. Check if AC wires are too thin and/or too long. 2. Check if generator (if applied) is working well or if input voltage range setting is correct. (UPS→Appliance)
	Green LED is flashing.	Set "Solar First" as the priority of output source.	Change output source priority to Utility first.
When the unit is turned on, internal relay is switched on and off repeatedly.	LCD display and LEDs are flashing	Battery is disconnected.	Check if battery wires are connected well.
Buzzer beeps continuously and red LED is on.	Fault code 07	Overload error. The inverter is overload 105% and time is up.	Reduce the connected load by switching off some equipment.
		If PV input voltage is higher than specification, the output power will be derated. At this time, if connected loads are higher than derated output power, it will cause overload.	Reduce the number of PV modules in series or the connected load.
	Fault code 05	Output short circuited.	Check if wiring is connected well and remove abnormal load.
		Temperature of internal converter component is over 120℃.	Check whether the air flow of the unit is blocked or whether the ambient temperature is too high.
	Fault code 02	Internal temperature of inverter component is over 100℃.	
	Fault code 03	Battery is over-charged.	Return to repair center.
		The battery voltage is too high.	Check if spec and quantity of batteries are meet requirements.
	Fault code 06	Output abnormal (Inverter voltage below than 190Vac or is higher than 260Vac)	1. Reduce the connected load. 2. Return to repair center
	Fault code 08/09	Internal components failed.	Return to repair center.

Appendix: Approximate Back-up Time Table

Model	Load (VA)	Backup Time @ 24Vdc 100Ah (min)	Backup Time @ 24Vdc 200Ah (min)
3.2KW	300	393	843
	600	155	393
	900	95	233
	1200	72	157
	1500	52	127
	1800	44	98
	2100	30	84
	2400	26	73
	2700	23	57
	3000	20	51
	3200	14	47

Note: Backup time depends on the quality of the battery, age of battery and type of battery.
Specifications of batteries may vary depending on different manufacturers.

![Fronus Solar Energy logo]

BTA CUSTOMER CARE

SINDH

01 HEAD OFFICE KARACHI
Office # 1103-1104 11th Floor, Al Najoebi Tower,
Main Abdullah Haroon Road, Saddar, Karachi
Tel: 021-32711156-57-58
Cell: 0330-2422663, 0333-0383809

04 KARACHI
Qazi Solar And Battery Centre
Memon Goth Malir Karachi
Cell: 0330-2422663, 0312-2735002

02 SUKKUR
Electronics Market Shaheed Gunj
Buksh SSD Street Sukkur
Tel : 0330-2422663

05 HYDERABAD
Baldia Foujdari Road Hyderabad
Tel: 0330-2422663, 0340-2017811

03 Nawabshah
New Liaqat Market Nawabshah
Tel: 0330-2422663, 0333-0383802

06 LARKANA
Pakistani chok barabar khokhar plaza
maharn center ground floor B.T.A
serves center larkana
Tel: 0330-2422663, 0341-8370441

PUNJAB

01 Faisalabad
Shop#22 Ground Floor Ibrahim Plaza Eid
Gah Road Faisalabad
Tel: 0330-2422663 , 0332-7509007

04 GUJRAT
Jinnah Mor Super Market Gujrat
Tel: 0330-2422663

07 Mianwali
City Street Near City Choki Mianwali
Tel: 045-9230033, 0330-2422663,
0321-6092940

10 Jhang
Sargodha Road Near Khan Battery
Jhang Saddar
Tel: 0330-2422663, 0343-8676291

02 Multan
Ishaq Market Hussain Agahi Road Multan
Tel: 0330-2422663,
0307-9807667

05 BHAWALPUR
Giri-Ganj Bazar Bhawalpur
Tel: 0330-2422663, 0333-0383802

08 LAHORE
Regal Center 1st Floor Hall Road The
Mall Lahore
Tel: 0330-2422663, 0344-6932005,
0320-2440550

11 Sargodha — Regional Head Office
Block 5 Near Allah Wala Hotel Sargodha
Tel: 048-3726700, 0330-2422663
0333-6097880

03 RAHIM YAR KHAN
Near Pholon Wali Street Railway Chowk,
Rahim Yar Khan
Tel: 0330-2422663, 0321-6008388,

06 Rawalpindi
Shop#26 Ground Floor, TM Plaza
D.A.V College Road Rawalpindi
Tel: 051-5552937, 0330-2422663
0316-7193271

09 GUJRANWALA
Kacha Fatomand Farooq e Azam Road
Near Fazal Town Gujranwala.
Tel:055-3401044,
0330-2422663

12 SIALKOT
Mujahid Road Sialkot Pakistan
Tel: 0330-2422663, 0333-0383802

KHYBER PAKHTOONKHUA

01 MARDAN
Al-Saud Electronics Bypass Road
Charsada Chowk, Mardan
Tel: 0330-2422663, 0302-5295872,
0341-2687002

04 PESHAWAR CITY
LG 439 Deans Mall, Peshawar Cantt.
Tel: 0330-2422663, 0311-7855590,
0307-4588310

02 PESHAWAR KARKHANO MARKET
Amin Plaza Karkhano Market Peshawar
Tel: 0330-2422663, 0301-3466240,
0311-7855590

05 NORANG
1st Floor Shop#4-5,Isam Gul Market
(Near the Bank Of Khayber)
G.T.Road Sarai-Norang Distt. Laki Marwat
Tel: 0330-2422663, 0346—5540016,
03002315200

03 BANNU
Near Peshawar Coaster Stand
New Adda Banna.
Tel: 0330-2422663, 0334-4554822,
0346-5540016, 0300-2315200

06 BANNU
Gury Mandi Inaam Market Bannu
Tel: 0330-2422663, 0333-0383802

BALOCHISTAN

07 QUETTA
Shop no.10 underground sphinzer plaza
Angle Road Quetta
Tel: 0330-2422663, 0306-7042117,
0313-2520409

IN-CASE OF EMERGENCY AND COMPLAIN PHONE : 0330-2422663

![BTA Customer Care — OFFICIAL SERVICE PARTNER logo]

31

USER'S MANUAL

SOLAR INVERTER/CHARGER