SERVO-MATİK
ELEKTRONİK SİSTEMLER SAN. TİC. LTD. ŞTİ.

# SERVO-INV

## USER'S MANUAL

SERVO-MATİK ELECTRONICS SYSTEMS

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## Contents

# PREFACE

- Follow all the instructions in the correct order.
- Read the warnings in the manual.
- Make sure you read the manual carefully when you want to perform an action on the inverter. Otherwise the device can be damaged.
- Starting-up the device and all maintenance/service works for the dangerous parts of the system must be done by the authorized personnel who educated for giving technical service.
- Before starting-up the device all safety precautions must be done by authorized personnel.
- If you come across any problem while applying this manual, contact with the service center via phone number/e-mail on the back cover of this manual.

# CAUTION

- Danger of electric shock! Do not open cover of the device. The device has spares that users can not interfere. Contact with the authorized technical service center in case of fault.
- All maintenance/service works for the dangerous parts of the system must be done by the authorized personnel who has sufficient technical knowledge.
- It is dangerous stand close to inverter for ones who use devices like cardiac pacemaker etc.
- Change the fuses with the same type and value to minimize the fire risk.
- Provide the environment for the installation.
- Select the appropriate cable sizes which is specified in the manual for the inverter.
- Do not put the device in use without grounding.
- Do not place things that may prevent airflow of the device.
- Do not run the device in places where explosive and flammable materials exist.
- Avoid direct sunlight and heaters.
- Do not wear metal items like rings, watches during the installation. Use isolated tools.
- Keep the items like bank card, hard drives precise electronic devices which can be affected by magnetic field, at least 50 cm away from the regulator.
- Bear in mind that the damages caused by user faults or bad usage will put the device out of warranty.

# USER ERRORS

- Connection of abnormal loads that excedeeds device nominal power rate,
- Wrong connection of input, output and battery cables(phase connection to battery etc.),
- Changing phase sequence,
- Changing fuse rates of input, output and battery,
- Changing batteries, reverse connection of batteries and changing number of batteries,
- Working without batteries,
- Changing place of device without information of SERVO-MATİK Electronic Systems
- Being exposed to physical damage to Device or gotten harm
- Being kept out of normal environmental conditions or worked of device.(Temperature, Humidity, Cleaning, Ventilation, Enviromental conditions, Liquid Contact)

# INSTALLATION

## PLACING

1. Keep the device in an air conditioned place for the cooling system of the device to operate well.
2. Do not place things/close holes that may prevent airflow for the device. Keep at least 50 cm place free for each side of device.
3. Make sure the installation place to comply with environmental conditions described in TECHNICAL FEATURES.
4. Do not operate the device in dusty, humid, hot and corrosive places.
5. Do not keep flammable/explosive materials next to the device.
6. Keep the device in a dry place, avoid contact with liquids.

## TRANSPORTATION

- Carry the device without remove its transportation pallet with a forklift where will it be installed like in Figure 1.
- Package protect the device against problems while transportation since carry the device to its location with its cargo package.
- Pay attention that the device is kept vertical position at all transportation process.
- Device must be carried at least two person.

**Figure 1**

## UNPACKING

1. Contact with the technical service before using the product and the product with damaged packing material.
2. Carefully unpack the device, avoid damaging.
3. To move the device on its wheels, change the position of the stabiliser to clockwise that placed bottom corner of the wheels.
4. After unpacking the device, check if the device is damaged during transportation or not. To do this, W-Automat, Pacco Breaker and Compact Breaker on the device are checked and make sure the panel is not damaged.
5. Check the device physically to make sure the electrical connections are not broken.
6. Do not run the device if any noise comes from inside when it is removed. In this case, please contact with the manufacturer company.
7. Before installation, contact with the technical service or installation must be performed by authorized personnel.

# ELECTRICAL CONNECTIONS

## OUTSIDE APPEARANCE

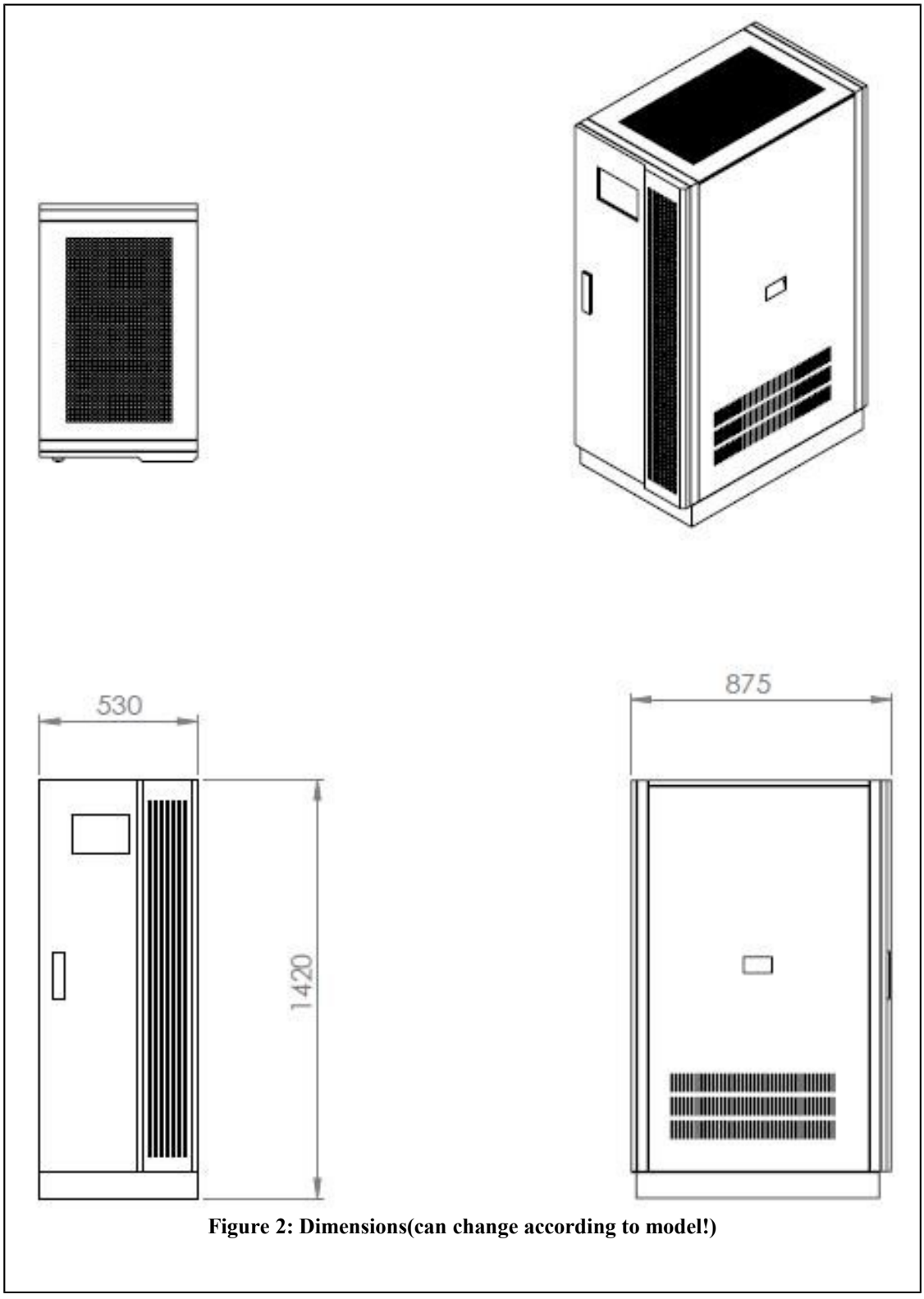
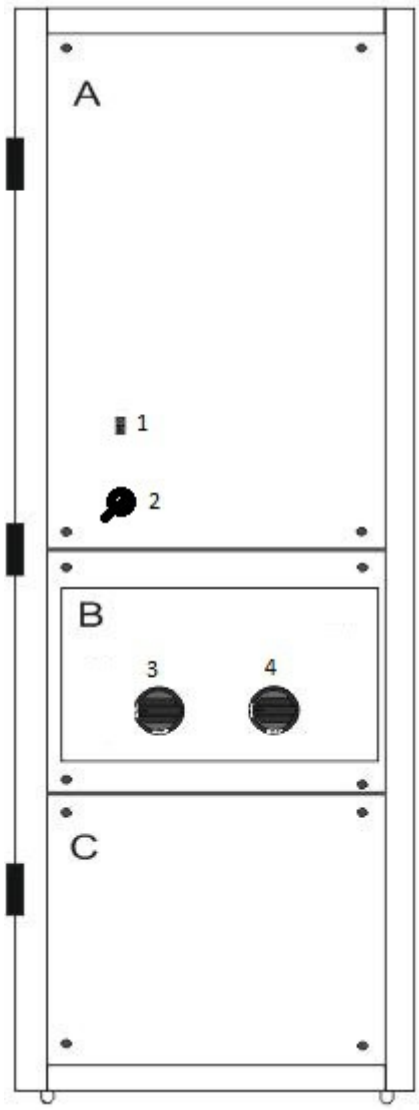



**Figure 2: Dimensions(can change according to model!)**

## FRONT SIDE OF THE DEVICE

When you open the front door of the device you can see panels that include BREAKERS, boards and connectors.




A: Place of Electronic boards

B: Place of Power Breakers

C: Place of Cable Terminals

1: Power On Switch

2: Charge/Soft Start Switch

3: Battery Breaker

4: Output Breaker

- Drawings and specifications can be changed without information.

## IGBT Module Appearance

Below you can see all IGBT's and their wiring diagram which is used in SERVO-INVdevice

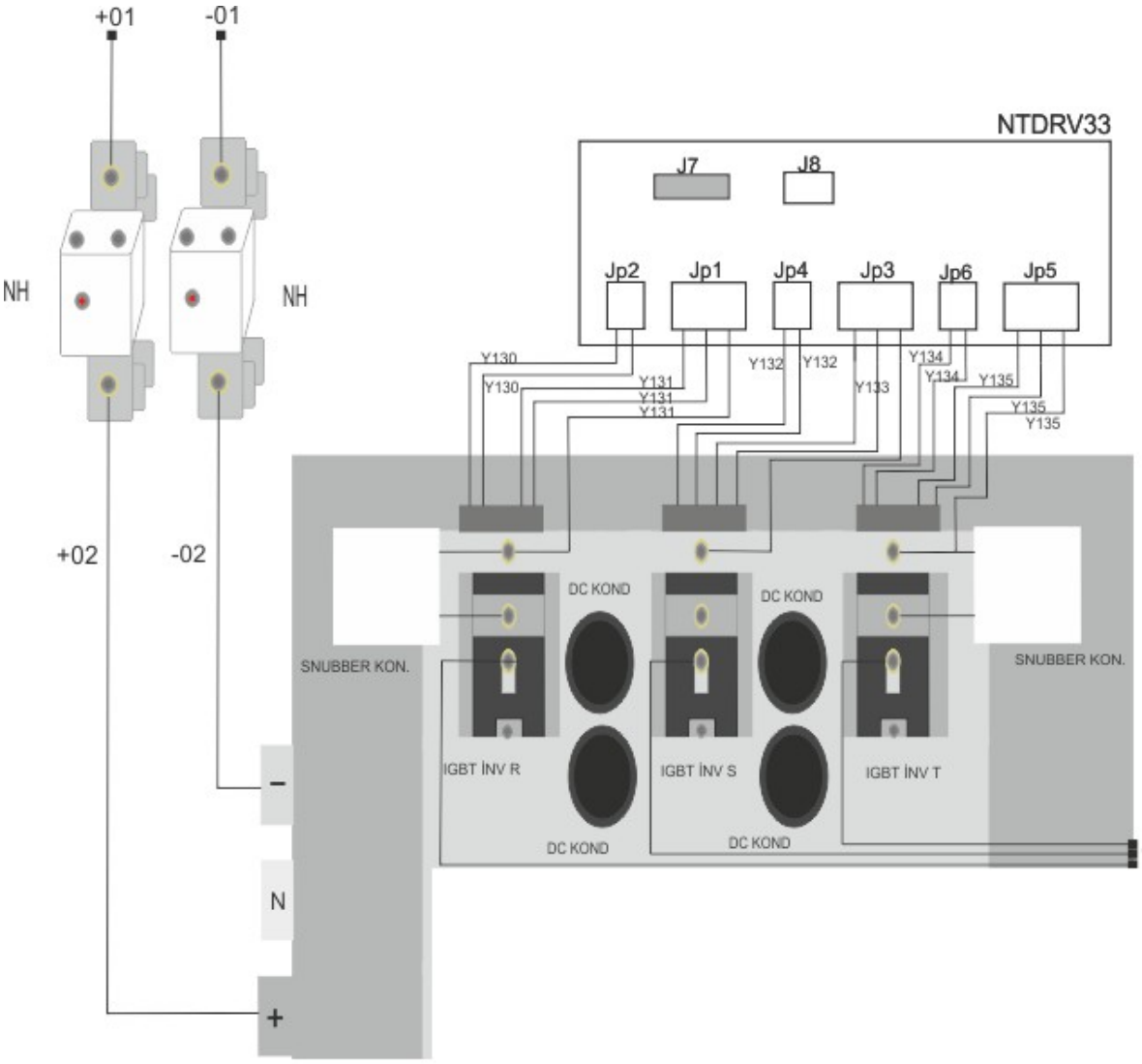



**Figure 1 : Parts and Connections**

(Connections of the boards and parts are representative only)

Making Connections

! Cable sizes, breakers and fuses that will be used in the distribution panel must be selected according to device's power.

! Cable sizes and breakers current shown in the below table. For safety operation, use the given values.

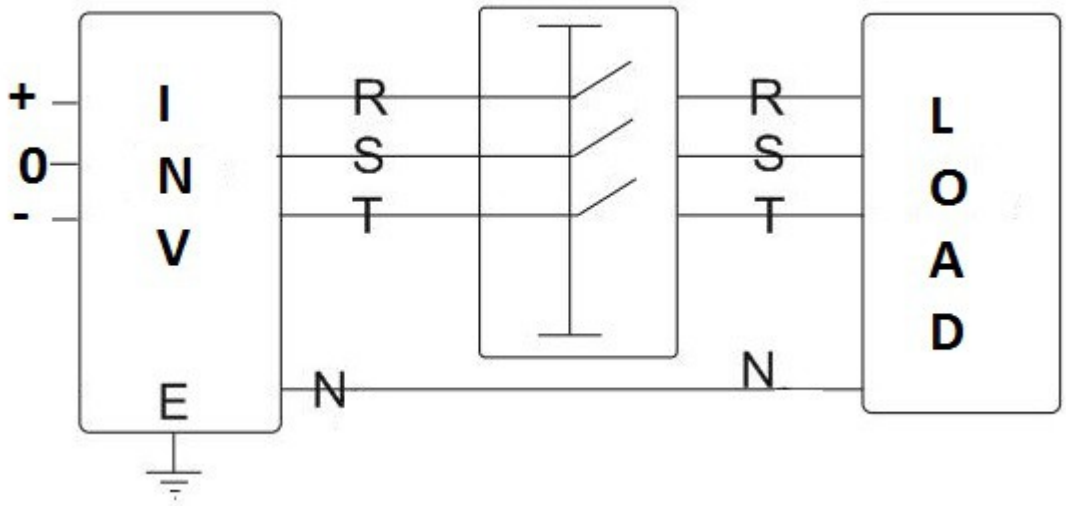



**Figure 2 : Inverter, Distribution Panel and Load Connections**

| INVERTER POWER(kVA) | Battery Connection Cable Dimension(mm2) | Output Cable Dimension($mm^2$) | Earth Cable Dimension($mm^2$) |
|---|---|---|---|
| 10 | 3X4 | 4X4 | 1X4 |
| 15 | 3X4 | 4X4 | 1X4 |
| 20 | 3X6 | 4X6 | 1X6 |
| 30 | 3X10 | 4X10 | 1X10 |
| 45 | 3X25 | 4X25 | 1X25 |
| 60 | 3x35 | 4X35 | 1X35 |
| 80 | 3x50 | 4X50 | 1X50 |
| 100 | 3x70 | 4X70 | 1X70 |
| 120 | 3x95 | 4X95 | 1X95 |
| 160 | 2x(3x50) | 2x(4x50) | 2x50 |
| 200 | 2X(3X70) | 2X(4X70) | 2X70 |
| 250 | 2X(3x95) | 2X(4x95) | 2X95 |
| 300 | 2X(3x120) | 2X(4x120) | 2X120 |
| 400 | 3X(3X120) | 3X(4X120) | 3X120 |

**Figure 3 : Cable Dimensions**

*Cable dimensions calculated according to current capacity in the tubes!*

! Use taller cables than given values to move device in case of service operation easily.

! Before connect the cables make sure that all breakers in OFF position.

## Earth Connection

! For a Safe and Trouble Free Operation, Grounding must be done properly. Make The Earth Connection before doing any other connections.

- Connect the grounding cable to the terminal ( T ).

## Output Connections

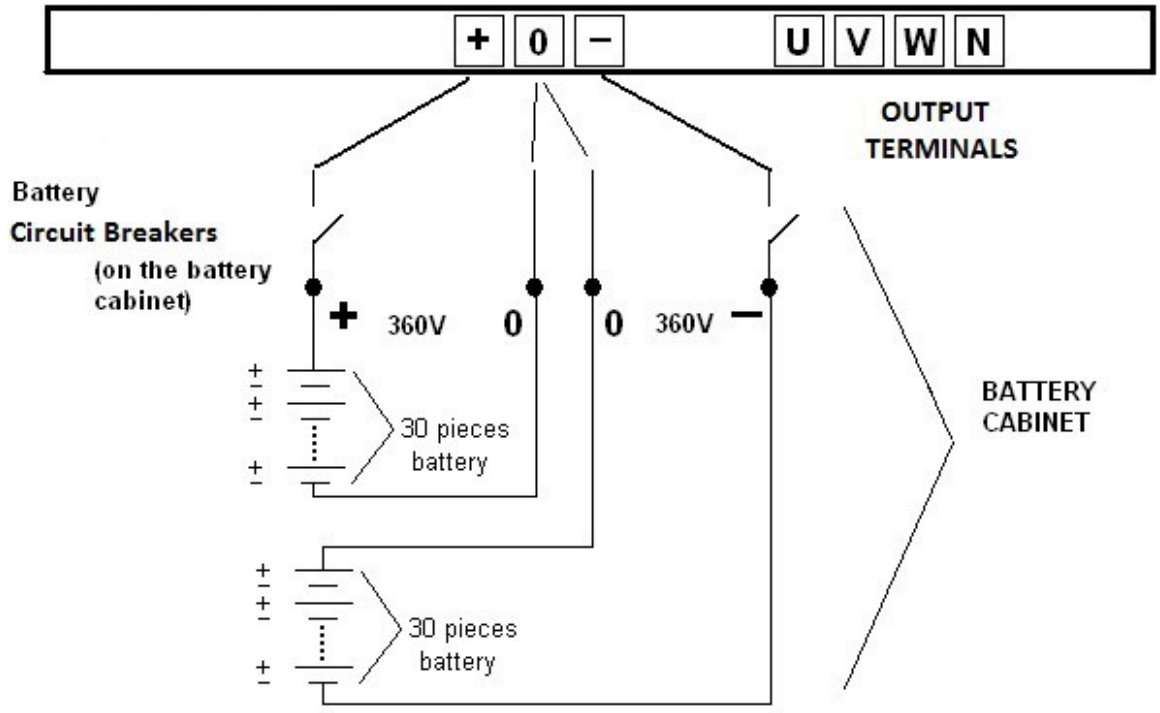
Connect Input and Output Cables to the terminals (R), (S), (T) in the correct order.
Connect the Output  Neutral Cable to the Terminal (N).

## External Battery Connections

! There might be dangerous voltage between terminals of the batteries in which devices that have internal batteries. Connect internal batteries' (+),(0),(-) connectors to terminals in appropriate with the polarization.

! When connecting the battery cables to terminals, pay attention to polarizations and battery zero voltage point otherwise device will be damaged.

- 60 pieces battery connects serial, while placing batteries into battery cabinet or device. After that 1st battery's (+) point connects to "BATTERY(+)" terminal, 60th battery's (-) point connects to "BATTERY(-)" terminal and 30th battery's (+) point connects to "0" terminal.
- When using 60 pieces battery and if there is an external battery cabinet for 60 pieces battery, connect (+), 0, (-) points of external battery cabinet with the same name on the input terminals of the device.



# START-UP PROCEDURE

! Before open the device all breakers and switches must be in OFF position.

## STARTING THE INVERTER

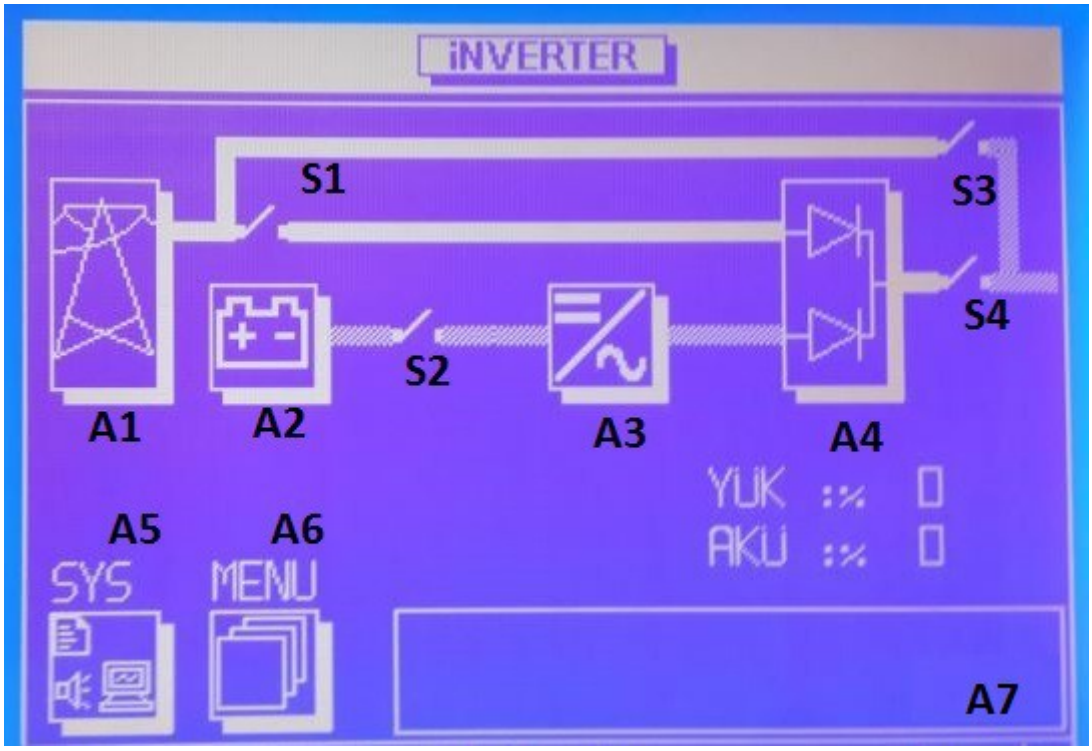
1) Turn on POWER ON switch.
2) If there is a CHARGE SWITCH or COLD START SWITCH turn it on. After 25s later turn it OFF. If there is a CHARGE BUTTON press it for 25s. At the same time see DC BUS voltage is rising on the LCD Panel.
3) When DC BUS voltage rose, turn on BATTERY breaker.
4) Press ON/OFF button on the LCD Panel for 3 seconds. Check the Lcd Panel and see the INVERTER is working.
5) Turn on OUTPUT breaker.

## CLOSING THE INVERTER

1) Press ON/OFF button on the Lcd Panel for 3 seconds. See the inverter is closed.
2) Turn off OUTPUT breaker. Turn off all loads which is connected to the inverter.
3) Turn off BATTERY breaker.
4) For your safety wait for 5 minutes to discharge capacitors and check the Lcd Panel, see the decrease of the DC BUS voltage.
5) Turn off POWER ON switch.

# MENU

You can see the main screen below. Slightly press to icons on the LCD Screen to navigate in the menus.




INVERTER MAIN MENU

## Breaker's Definitions

- S1: Static Bypass Breaker (Optional)
- S2: Battery Breaker
- S3: Maintenance ( Manual ) Bypass Breaker (Optional)
- S4: Output Breaker

## Icons and UPS Blocks

- A1: Menu Button.
- A2: Battery Block / Battery Status and Indicator Menu Button
- A3: Inverter Status and Indicator Block / Inverter Menu Button
- A4: Static Bypass Indicator and Block / Static Bypass Menu Button(Optional)
- A5: System Menu Button
- A6: Menu Button
- A7: Warnings / Events Menu Button

**BATTERIES :** Batteries connects to NETPRO-33-INV device to generate bipolar DC Voltage.

**INVERTER :** Be produced with hi-tech IGBT's and using PWM(Pulse Width Modulation) technics. Inverter, converts DC BUS voltage coming from Batteries or Rectifier Unit to 3 phase, regulated AC voltage and frequency

**STATIC BYPASS (STATIC BYPASS BREAKER-OPTIONAL) :** Automatic controlled this switch provide to feed load either inverter or bypass line. In normal operation load feeds from inverter. If an overload situation occurs load direct to BYPASS line without any cut.

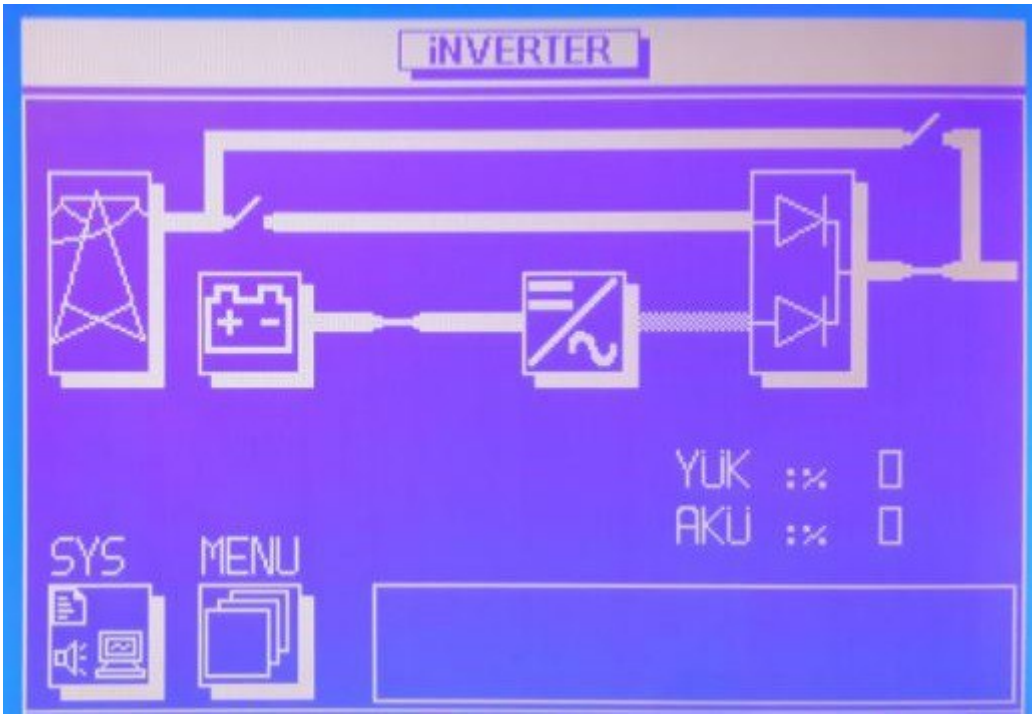
**MANUAL BYPASS BREAKER(OPTIONAL) :** It is a manual controlled breaker during maintenance or repair of the INVERTER, to feed the load from mains voltage. Load unprotected during a power cut or irregular mains voltage when the device in the static or manual bypass mode.

**BATTERY BREAKER :** UPS It is connected to the battery terminal of the UPS. This Breaker connected after the battery fuses and controls the battery block.

# INVERTER WORKING MODES

## Feeding from Battery

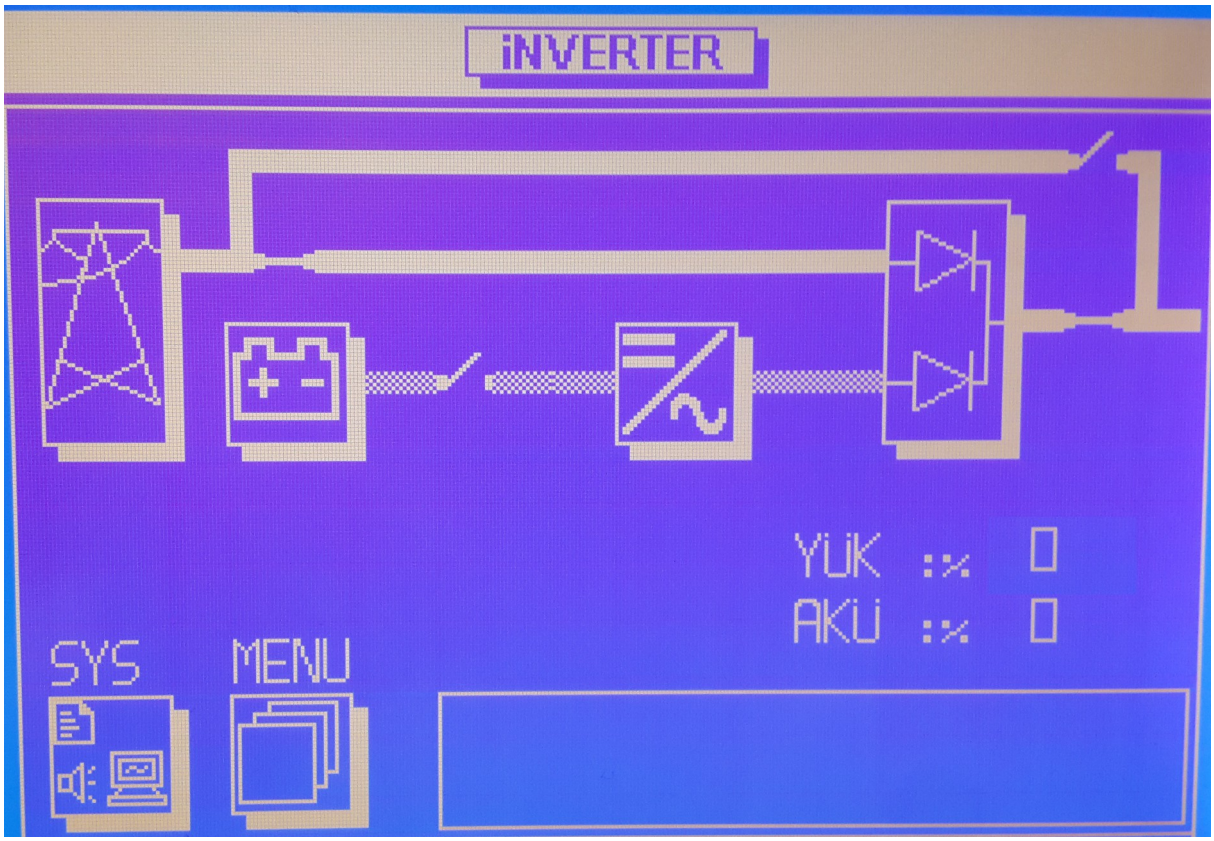
Required voltage for feeding the inverter provide from batteries. Thus until batteries are fully discharge, the AC voltage which feeds the load, continue to supply without any voltage cutting.



## Static Bypass Mode (Optional)

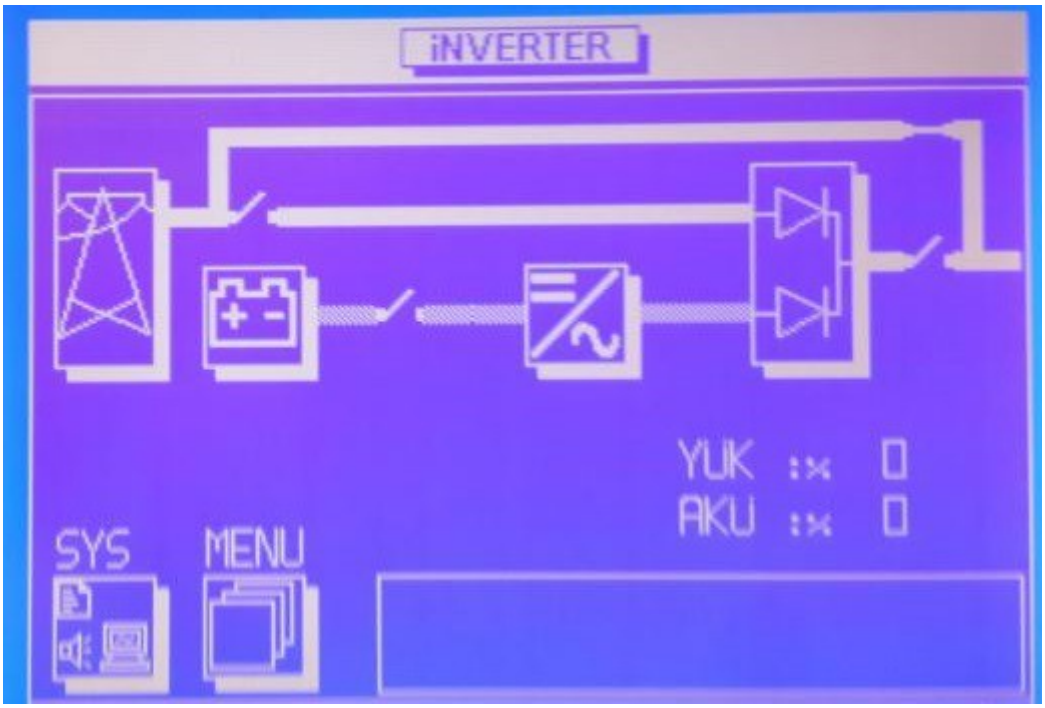
If load draw very high current from output of the inverter or is there a problem on the inverter, static bypass switch directs load to BYPASS line ( If there is mains voltage ).

When overload situation finish or problem is solved, device directs load to inverter. It is remembered that when load feeds from bypass line, it is unprotected against irregularity of the mains voltage or any power cut.



## Manal By-Pass Mode (Optional)

It is used to feed the load from mains voltage in case of maintenance.




*Drawings and specifications can be changed without information.

# SEVICE AND MAINTENANCE

Manufacturer of the device supposes that users guarantee to have technical knowledge, have the goods, gets training about device and not to do behaviors which are life-critical. All operations about life-critical part of the device should be done by the people who have technical knowledge about device.
Manufacturer refuses responsibility for damage because of user error or miss-use.
The user guide was prepared for the people who get all kind of the technical trainings without turning on and off the device.
All kind of response and operation should be done by only competent people or the people who have the goods about the device.
The device covers should be opened only for maintenance, repairing and special purpose entity.
Fault diagnosis and response to the failure should be done by the competent people. Problem analysis is not to be considered necessary for the competent people. The predicted rules and warnings are only to save the user against to potential dangers.
The system was designed to work safety if system safety and rules are considered and maintenance of the device is carried out by the competent people. All kind of precautions were taken for the life-critical parts of the device. The device will work for a long time if the technical rules are followed and all conditions are suitable.
When the device covers are open, it is possible to touch to the dangers parts of the device although all precautions taken. Thereby, users should be knowledgeable about the device and not touch dangers parts. Therefore, when the device works, all device covers should be close.

Device lifetime is identified and announced on 13/6/2014 dated and 29029 numbered Official Gazzete After Sales Services Regulation Appendix is 5 years.

Authorized service stations and spare part shops address', phone numbers and other informations can be get from +90 533 663 33 04 numbered customer support line.

## PERIODIC MAINTENANCE

The device will not need to periodic maintenance if it is worked in suitable environment and condition. However, it is recommended to carry out maintenance every other year.

FAULT

Nobody can carry out maintenance the device without technical service personal. In such case, the information about the fault must give to manufacturer technical service.

## BEFORE CALL THE SERVICE

- Read user guide carefully.
- Check the input and output connections whether it is done correct.
- If there is any fault, restart the device by using On/Off button on the LCD panel.
- Explain the problem by giving all detail.

# TROUBLESHOOTING

If a problem occurs when INVERTER is working or any abnormal operation observed please do the instructions before calling technical service.
Make sure that output, grounding and battery connections of INVERTER are correctly done,
Make sure all fuses are intact and turned on on the INVERTER or distrubution panel.
Make sure that POWER ON switch is turned on.
Check the LCD Screen if it is working.
If the INVERTER give an warning before it is faulted, send us that warning, serial number of the INVERTER and informations that is written on a sticker where the power of the device is typed
After above instructions are done, call the technical service and tell the problem clearly.
Do not allow anyone to interfere with the device without authorized personnel.
Only authorized and educated people can troubleshoot the problem of the device.

## Possible Faults and Solutions

Possible faults which could be happen about the device is listed below.

| **If front panel give 'Overtemperature Close'** | |
|---|---|
| **Possible Cause** | **Diagnosis/Solution** |
| Air holes may have closed. | Check all air holes.Clean the dusts from holes if required. |
| Working enviroment may not be suitable. | Environment temperature does not suiable shown in technical data.Choose more suitable place or install a new cooling system that provide appropriate cooling. |
| Fan fuses could be broken. | Check the fuses. |
| Thermostate may have broken. It doesn't conduct power to fans. | Check the thermostate by short circuit its ends. |
| Sockets that conduct power to the fans,may be loosen or there could be damaged. | Check the cables between fans and sockets and measure voltages. |
| Fans could be faulty. | Check the fans. |

| **If Device give 'DC High' Error** | |
|---|---|
| **Possible Cause** | **Diagnosis/Solution** |
| The calibration of DC Bus Voltage may have changed. | Check the DC Bus voltage calibration accuracy. Calibrate if it is needed. |
| In settings menu, DC Bus Voltage may have changed. | Check battery settings according to 'Settings' table. |
| DC Bus Voltage may have rise over upper limit(810V). | Turn off Battery breaker.Measure DC voltage across terminals. |

| **If device give *'Inverter error'*** | |
|---|---|
| **Possible Cause** | **Diagnosis/Solution** |
| One of the inverter igbt's may have broken. | Check IGBTs. |
| PWM signals do not reach to the Inverter IGBT Driver.Flat cables may have faulted or loosen. | Check the mainboard,inverter NTDRV33 board and cable that connected to the each other. |
| Voltage could not reach to the Inverter IGBT driver. | Check the voltage on the Inverter NTDRV33 driver. It should be 24V. |
| NT33HVSAMP AC sampling board may have faulted. | Check the components on the NT33HVSAMP board and voltage divider circuits. |
| Inverter voltage calibration may have changed. | Check the Inverter voltage calibration.Calibrate it if required. |
| Inverter thyristors may have broken. | Check the thyristors. |

| Front Panel does not energized | |
|---|---|
| **Possible Cause** | **Diagnosis/Solution** |
| On/off switch may have broken or open. | Check the switch. |
| LCD could be broken. | Turn off the On/Off switch and then turn on again. |
| Power Supply board may be broken thus could not feed the front panel. | Check the voltages NTPS33 board with a multimeter(±16V,±18V,±20V,±20V). |
| There could be disconnection on the cables that carry power to the monitör (NT33MON02) or looseness on them. | Check the power cables and connections between NTPS33-NT33MON02 boards. |
| Panel board may be broken. | Check the D2 LED if it is illuminated on the NT33MON02 board. |

| If Device Gives 'DC Low' Warning | |
|---|---|
| **Possible Cause** | **Diagnosis/Solution** |
| There could be decalibration on DC Bus voltages. | Check the DC Bus voltage calibration accuracy.Calibrate it if required. |
| DC Bus settings may be changed on the settings menü of the device. | Check the Battery Set Voltages according to the table. |
| DC Bus Voltage may be decreased under specified limit (600V). | Turn off Battery Breaker. Measure DC source voltage from terminals. |
| There could be sampling error of DC voltage or there is a miscapture on the microcontroller. | Check the AC voltage divider borad, Mainboard, Sampling Board and Cables between them. |

# WARRANTY CONDITIONS

Warranty conditions are declared on the proforma invoice of the product. Warranty period begins at the date of invoice and valid for ……. year for international markets. Extended warranties are based on contracts between the manufacturer and buyer.
Failures caused by: misuse, neglect, accident, modification, operation outside the Specified Operating Environment (including, but not limited to, lack of a good electrical ground) improper maintenance by the Customer, failure caused by service of the machine by non-authorized servicers, damage caused by the use of the SERVOMATIK product for purposes other than those for which it was designed, or failure caused by a product, which SERVOMATIK doesn't recommend and supply ARE NOT COVERED.
Warranty is not a guarantee of uninterrupted or error-free functioning of a machine. Restoration of lost data and reinstallation of software are not covered. This policy does not cover damage from a cause other than AC power line transients, except for damage due to telephone line, network or CATV transients, which is covered only if the SERVOMATIK product offers such protection.
SERVOMATIK reserves the right to replace relevant part with the same or equivalent part, rather than repair it. Where a replacement is provided the part replaced becomes the property of SERVOMATIK. SERVOMATIK may replace parts with refurbished parts. Replacement of the part does not extend or restart the warranty period.
SERVOMATIK On Site Warranty Service is provided in predefined and agreed terms at the site location during the contracted Principal Period of Maintenance (PPM) if any SERVOMATIK Authorized Distributor Exists in the location.. If an Authorized Service Technician is needed immediately in the countries which SASC (SERVOMATIK Authorized Service Center) is not available, the customer has to pay the travel and accommodation costs for the technician from SERVOMATIK TURKEY.
SERVOMATIK on Site Warranty Service is not available for all machines or machines that have been defaced, altered, or damaged beyond repair at any locations. Please contact SERVOMATIK to determine if this option is available for your location and machine model.