

**SM-SERIES**

**SP-SERIES**

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# SMART-IN

DC/AC POWER CONVERTER



MANUALE UTENTE / USER GUIDE



**NDS ENERGY S.R.L.**

VIA PASCOLI, 169

65010 CAPPELLE SUL TAVO (PE) ITALY

TEL.: +39 085 4470396 | CELL/WHATSAPP: +39 373 8886 875


FAX: +39 085 9507049

WEB: [WWW.NDSENERGY.IT](http://WWW.NDSENERGY.IT)

EMAIL: [COMMER@NDSENERGY.IT](mailto:COMMER@NDSENERGY.IT)



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# INTRODUCTION

**SMART-IN** IS AN INVERTER TRADEMARK DESIGNED AND DEVELOPED BY **NDS**, MADE TO PROVIDE HIGH PERFORMANCE, MAXIMUM SAFETY, RELIABILITY AND, ABOVE ALL, SILENT OPERATION, IMPORTANT FOR THOSE WHO INSTALL THE INVERTER INSIDE THE PASSENGERS COMPARTMENT. THANKS TO THE ADOPTION OF SOME SPECIALLY ENGINEERED ADVANCED SOLUTIONS, SMART-IN INVERTERS ARE ALSO SUITABLE FOR PROFESSIONAL USE.

THE **SMART-IN** FAMILY CONSIST OF TWO LINES:

- **SM:** WITH SINUSOIDAL WAVE OUTPUT MODIFIED IN BLACK AND GRAY COLOR.
- **SP:** WITH PURE SINUSOIDAL WAVE OUTPUT FROM RED AND GRAY

THE TWO DIFFERENT LINES COVER DIFFERENT POWERS FROM 400W TO 3000W, WITH THE POSSIBILITY TO HAVE (FOR SOME MODELS) THE 24V INPUT VOLTAGE.

MAIN FEATURES:

- HIGH EFFICIENCY: UP TO 90% AND LOW SELF-CONSUMPTION
- PROFESSIONAL INPUT CONNECTORS
- READY FOR REMOTE CONTROL (ON/OFF)
- GALVANICALLY ISOLATED INPUT AND OUTPUT FOR INCREASED SAFETY
- GREAT WORKING STABILITY ACROSS ALL INPUT VOLTAGE RANGE (10V – 15.5V FOR 12V AND 20V – 31V FOR 24V).
- ULTRA QUIET WITH FAN SPEED CONTROLLED ACCORDING TO THE TEMPERATURE OF THE DEVICE.
- PRIORITY SWITCH BETWEEN EXTERNAL AC NETWORK AND BATTERY OPERATION AND VICE VERSA.

HIGH EFFICIENCY IS ACHIEVED THANKS TO AN INNOVATIVE CIRCUIT SOLUTION AND THE USE OF PROFESSIONAL INPUT CONNECTORS WHICH REDUCE THE POWER LOST IN THE NODE WITH HIGHER POWER. INLET AND OUTLET ARE GALVANICALLY ISOLATED FROM INTERNAL TRANSFORMERS, GIVING A HIGH SAFETY LEVEL. THE CHOSEN CIRCUIT SOLUTION FOR THE SMART-IN SERIES ALLOWS OPERATING EFFICIENCY AND STABILITY THROUGHOUT THE INPUT VOLTAGE RANGE WITH LOW SELF-CONSUMPTION. THE COOLING FAN SPEED IS CONTROLLED BY THE AMOUNT OF CONNECTED LOAD AND THE TEMPERATURE REACHED BY THE DEVICE, ALLOWING THE INVERTER TO WORK IN ULTRA SILENT MODE WITH SMALL UTILITIES AND

INSTEAD, WITH LARGE USERS ALWAYS WORKING WITH A LEVEL NOISE AS LOW AS POSSIBLE.

THE PRIORITY SWITCH BETWEEN NETWORK AND BATTERY OPERATED OPERATION SAVES BATTERY POWER WHEN THE EXTERNAL POWER SUPPLY IS CONNECTED, AS THE AC POWER SUPPLIES WILL BE POWERED DIRECTLY FROM THE PUBLIC POWER LINE IF CONNECTED, OTHERWISE THE INVERTER WILL RUN NORMALLY TAKING ENERGY FROM THE 12VDC BATTERY.

# MODELS

## SMART-IN SM

<b>12V</b>		
<b>CODE</b>	INPUT VOLTAGE	OUTPUT POWER
<b>SM 400</b>	12V	400W
<b>SM 600</b>	12V	600W
<b>SM 1000</b>	12V	1000W
<b>SM 1500</b>	12V	1500W
<b>24V</b>		
<b>SM 600-24</b>	24V	600W

## SMART-IN SP







<b>12V</b>		
<b>CODE</b>	INPUT VOLTAGE	OUTPUT POWER
<b>SP 400</b>	12V	400W
<b>SP 600</b>	12V	600W
<b>SP 1000</b>	12V	1000W
<b>SP 1500</b>	12V	1500W
<b>SP 3000</b>	12V	3000W
<b>24V</b>		
<b>SP 600-24</b>	24V	600W
<b>SP 1500-24</b>	24V	1500W
<b>SP 3000-24</b>	24V	3000W

## SMART-IN SP - CON FUNZIONE IVT

<b>12V</b>		
<b>CODE</b>	<b>INPUT VOLTAGE</b>	<b>OUTPUT POWER</b>
<b>SP 1000-I</b>	12V	1000W
<b>SP 1500-I</b>	12V	1500W
<b>SP 2000-I</b>	12V	2000W

## IMPORTANT SAFETY INSTRUCTIONS

THIS SECTION CONTAINS IMPORTANT SAFETY INSTRUCTIONS TO KNOW BEFORE INSTALLING AND USING SM-SM AND SP INVERTERS:

	<b>WARNING!</b> PAY ATTENTION TO HANDLE THIS DEVICE.
	READ THIS MANUAL BEFORE INSTALLATION AND USE
	DEVICE FOR USE IN ENCLOSED SPACES PROTECTED FROM RAIN AND SPLASHES OF WATER AND LIQUIDS IN GENERAL. THE INTRODUCTION OF LIQUID INTO THE INVERTER MAY RESULT IN ELECTRIC SHOCK.
	THE INVERTER CONTAINS DANGEROUS SUBSTANCES AND THEREFORE IT IS NOT FORBIDDEN IS DISPOSED OF IN HOUSEHOLD GARBAGE, BUT YOU HAVE TO USE THE FREE COLLECTION POINTS PROVIDED BY THE MUNICIPALITIES INVOLVED OR DIRECTLY BY THE DEVICE MANUFACTURER. RESPECTING THIS RULE IS RESPECTED THE ENVIRONMENT.
	DO NOT USE THE DEVICE IN FLAMMABLE ENVIRONMENTS WHERE A SPARK COULD CAUSE A FIRE OR THE SPREADING OF FLAMES, BECAUSE THE INVERTER CONTAINS COMPONENTS WHICH TEND TO PRODUCE ARCS OR SPARKS.
	DO NOT OPEN THE DEVICE, ELECTRIC SHOCK HAZARD

## **FIRE AND BURN HAZARD**

- DO NOT COVER OR OBSTRUCT THE AIR INTAKE VENT OPENINGS AND/OR INSTALL IN A ZERO-CLEARANCE
- DO NOT WORK IN THE VICINITY OF LEAD-ACID BATTERIES. BATTERIES GENERATE CORROSIVE GASES DURING NORMAL OPERATION THAT CAN DAMAGE THE INVERTER. THIS GAS IS ALSO EXPLOSIVE, SO IT IS CAN BE VERY DANGEROUS.

## **PROTECTION FEATURES**

OUR POWER INVERTERS ARE EQUIPPED WITH NUMEROUS PROTECTION FEATURES TO GUARANTEE SAFE AND TROUBLE-FREE OPERATION:

- SOFT START
- PROTECTION AGAINST OVERLOAD AND SHORTCIRCUIT
- LOW BATTERY ALARM
- PROTECTION AGAINST POLARITY INVERSION AND OVERTEMPERATURE

<b>LOW BATTERY ALARM</b>	ALERTS YOU IF THE BATTERY HAS BECOME DISCHARGED TO 10.5V OR LOWER. ALERT IS DONE BY AN INTERNAL BUZZER "BEEP".
<b>LOW BATTERY VOLTAGE SHUTDOWN</b>	SHUTS THE INVERTER DOWN AUTOMATICALLY IF THE BATTERY VOLTAGE DROPS BELOW 9.5V. THIS FEATURE PROTECTS THE BATTERY FROM BEING COMPLETELY DISCHARGED.
<b>HIGH BATTERY VOLTAGE SHUTDOWN</b>	SHUTS THE INVERTER DOWN AUTOMATICALLY IF THE INPUT VOLTAGE RISES TO 15.5V OR MORE.
<b>OVER LOAD SHUTDOWN</b>	SHUTS THE INVERTER DOWN AUTOMATICALLY IF THE LOADS CONNECTED TO THE INVERTER EXCEED THE INVERTER'S OPERATING LIMITS.

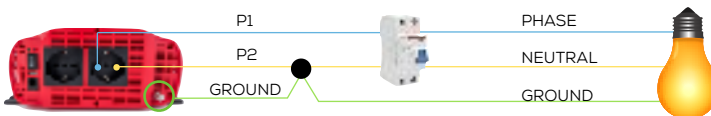
**NOTE:** TUTTE LE PROTEZIONI SI RIPRISTINANO AUTOMATICAMENTE.



<b>OVER THERMAL SHUTDOWN</b>	SHUTS THE INVERTER DOWN AUTOMATICALLY IF ITS INTERNAL TEMPERATURE RISES ABOVE AN UNACCEPTABLE LEVEL.
<b>OUTPUT SHORT CIRCUIT SHUTDOWN</b>	SHUTS THE INVERTER DOWN AUTOMATICALLY IF A SHORT CIRCUIT IS DETECTED IN THE CIRCUITRY CONNECTED TO THE INVERTER'S OUTPUT.
<b>REVERSE POLARITY PROTECTION</b>	IF WRONG POLARITY CONNECTION, THE INTERNAL FUSE SHALL BLOW OUT.

## GROUND LEAK PROTECTION

THE INVERTER EARTH SOCKET IS DESIGNED FOR A SAFETY SYSTEM SUCH AS THE DIFFERENTIAL SWITCH. TO USE THE DIFFERENTIAL SWITCH, FOLLOW THE CONNECTION BELOW, RECOMMENDED BY NDS



1. PREPARE THE DIFFERENTIAL SWITCH WITH SENSITIVITY  $\Delta = 30\text{MA}$  OR LESS.
2. CONNECT THE NEUTRAL AND PHASE OF THE INVERTER'S OUTPUT P1 AND P2 TO THE DIFFERENTIAL SWITCH INPUT; SINCE IT IS NOT POSSIBLE TO DISTINGUISH THE NEUTRAL AND THE OUTPUT PHASE FROM THE INVERTER, THE CONNECTIONS DO NOT HAVE TO FOLLOW A PARTICULAR ORDER.
3. CONNECT THE INVERTER'S GROUND TO ONE OF THE TWO WIRES CONNECTED TO THE DIFFERENTIAL SWITCH INPUT (P1 OR P2 INDIFFERENTLY).
4. THE TWO OUTPUT POLES OF THE DIFFERENTIAL SWITCH ARE NEUTRAL AND THE PHASE TO BE CONNECTED TO THE UTILITIES. THE GROUND OF THE INVERTER MUST BE CONNECTED TO THE USER GROUND.

IN THE CASE OF INVERTERS WITH INT (INTEGRATED PRIORITY SWITCH) FUNCTIONS, THE CIRCUIT ABOVE REFERS TO THE CONNECTION OF THE INVERTER OUTPUT, AND WITH REGARD TO THE IEC CONNECTOR OF THE

NETWORK INPUT, IT IS NECESSARY TO CONNECT TO THE OUTPUT OF THE SAFETY SYSTEM (DIFFERENTIAL SWITCH AND MAGNETOTHERMIC) ALREADY PRESENT ON THE SOURCE PLANT.

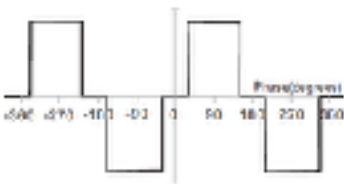
WITH THIS CONNECTION ONLY IS POSSIBLE TO PROTECT AGAINST EARTH LEAKAGE CURRENTS.

CONSIDERED THAT IN APPLICATIONS WHERE THE INVERTER IS ISOLATED FROM THE GROUND (CARS, MOTORHOMES, MOTORHOMES, ETC ...), THE POSSIBILITY OF EARTH LEAKAGE CURRENTS IS VERY REMOTE, SO PLEASE REFER TO THE INSTALLER'S DECISION EVALUATION OF NOT ADOPTING THE CIRCUIT ABOVE.

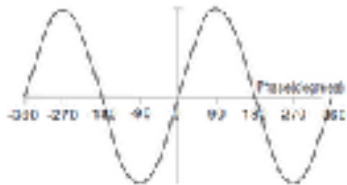
## HOW IT WORKS

INSIDE THE SMART-IN INVERTER THERE ARE 2 MAIN CIRCUIT STAGES, TO CONVERT THE DC INPUT VOLTAGE TO THE OUTPUT AC VOLTAGE:

1. FIRST STAGE CONSISTS OF AN ISOLATED HIGH FREQUENCY DC/DC CONVERTER TO CONVERT THE INPUT 12VDC TO AN HIGHER VOLTAGE UP TO 330VDC.
2. THE FINAL STAGE CONSISTS OF AN H BRIDGE THAT CONVERT THE DC HIGH VOLTAGE BUS TO THE 220VAC VOLTAGE WITH TWO POSSIBILITY OF WAVEFORM:

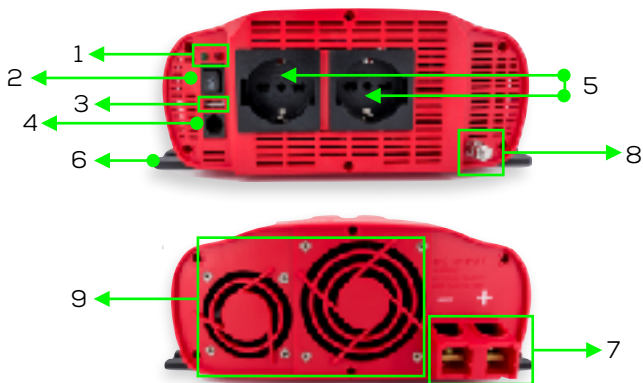


MODIFIED SINE WAVE



PURE SINE WAVE

# FRONT AND BACK LAYOUT



1	<p><b>LED INDICATORS GREEN AND RED:</b>          THE GREEN LED IS ON WHEN INVERTER IS SWITCHED ON AND IT IS OPERATIONAL          THE RED LED IS ON ONLY TO SHOW AN ALARM CONDITION (OVER LOAD, OVER HEAT ETC...)</p>
2	<p><b>MAIN SWITCH WITH 3 POSITIONS:</b>          0 - SWITCH ON THE DEVICE          1 - SWITCH OFF THE DEVICE          2 - SWITCH ON/OFF THE DEVICE FROM REMOTE CONTROLLER</p>
3	<p><b>USB PORT WITH 5V 1.2A OUTPUT POWER, ONLY TO CHARGE OR SUPPLY YOUR TABLET, SMARTPHONE ETC...</b></p>
4	<p><b>AUX/REMOTE CONTROL PORT TO SWITCH ON/OFF THE DEVICE FROM REMOTE.</b></p>
5	<p><b>OUTPUT OUTLETS TO CONNET AND SUPPLY YOUR AC LOADS.</b></p>
6	<p><b>PLASTIC FLANGES TO FIX THE INVERTER TO FLOOR OR WALL.</b></p>
7	<p><b>INPUT POWER CONNECTORS + AND - TO CONNECT TO THE 12V OR 24V DC BATTERY BANK.</b></p>
8	<p><b>CHASSIS GROUND SCREW CONNECTOR FOR PROTECTION ISSUE.</b></p>
9	<p><b>FAN HOLES FOR COOLING ISSUE</b></p>

# **INTERFERENCE PROBLEMS**

SOME INEXPENSIVE STEREO SYSTEMS MAY EMIT A BUZZING NOISE FROM THEIR LOUDSPEAKERS WHEN OPERATED FROM THE INVERTER. THIS OCCURS BECAUSE THE POWER SUPPLY IN THE AUDIO SYSTEM DOES NOT ADEQUATELY FILTER THE MODIFIED SINE WAVE PRODUCED BY THE INVERTER.

THE ONLY SOLUTION IS TO USE A SOUND SYSTEM THAT HAS A HIGH QUALITY POWER SUPPLY, OR USE A PURE SINE WAVE INVERTER.

WHEN THE INVERTER IS OPERATING, IT CAN INTERFERE WITH TELEVISION RECEPTION ON SOME CHANNELS. IF INTERFERENCE OCCURS, TRY THE FOLLOWING:

- MAKE SURE THAT THE CHASSIS GROUND SCREW OF THE INVERTER IS CONNECTED TO THE GROUND SYSTEM OF YOUR VEHICLE.
- MAKE SURE THAT THE TELEVISION ANTENNA PROVIDES AN ADEQUATE SIGNAL AND THE ANTENNA CABLE IS IN GOOD CONDITIONS.
- KEEP THE CABLES BETWEEN THE BATTERY AND THE INVERTER AS SHORT AS POSSIBLE, AND TWIST THEM TOGETHER TO REDUCE THE RADIATED EMISSIONS.
- MOVE THE TELEVISION AS FAR AWAY FROM THE INVERTER AS POSSIBLE.
- DO NOT OPERATE HIGH POWER LOADS WITH THE INVERTER WHICH THE TELEVISION IS ON.

# **BATTERY REQUIREMENTS**

BATTERY TYPE, AND BATTERY SIZE, STRONGLY AFFECTS PERFORMANCES OF THE POWER INVERTERS. THEREFORE, YOU NEED TO IDENTIFY THE TYPE OF LOADS YOUR INVERTER WILL BE POWERING AND HOW MUCH YOU WILL BE USING THEM BETWEEN CHARGES. TO DETERMINE THE MINIMUM BATTERY SIZE THAT YOU NEED TO OPERATE APPLIANCES, FOLLOWING THESE STEPS:

- DETERMINE THE WATTAGE OF EACH APPLIANCE AND/OR TOOL YOU WILL NEED TO SIMULTANEOUSLY OPERATE FROM THE INVERTER. TO DO THIS, READ THE LABELS ON THE REQUIREMENT TO BE OPERATED. USUALLY, POWER CONSUMPTIONS SHOWN IN WATTS. IF IT IS SHOWN IN AMPS, MULTIPLY BY 110V/220V TO DETERMINE THE WATTAGE.

- ESTIMATE THE NUMBER OF HOURS THE EQUIPMENT WILL BE IN USE BEFORE RECHARGE THE BATTERY.
- CALCULATE THE TOTAL ENERGY REQUIRED IN WH (WATT HOURS) BY MULTIPLYING THE TIME DETERMINED ABOVE FOR THE SUM OF THE POWERS OF EACH USER. IN DOING SO, YOU CAN DIVIDE THE RESULT BY 10 IF THE INVERTER INPUT IS 12V, FOR 20 IF IT IS 24V. THIS WAY, YOU GET THE VALUE OF AH NEEDED TO FEED THE UTILITIES YOU CONSIDER.

## **NOTES**

SOME APPLIANCES REQUIRED HIGH SURGE POWER TO START, THEN THE CONSUMES GOES DOWN. AND SOME APPLIANCES ARE NOT OPERATING FOR LONG PERIODS OF TIME. FOR EXAMPLE, A TYPICAL HOME-USE COFFEE MAKER DRAWS 500WATTS DURING ITS BREW TIME OF 5MINUTES, BUT IT MAINTAINS THE TEMPERATURE OF THE POT AT ABOUT 100WATTS. TYPICAL USE OF A MICROWAVE IS ONLY A FEW MINUTES, SOMETIMES AT LOWER POWER; SOME EXCEPTIONS TO BRIEF OPERATING TIMES ARE LAMPS, TVS AND COMPUTERS.

WHEN POSSIBLE, RECHARGE YOUR BATTERIES WHEN THEY ABOUT 50% DISCHARGED OR EARLIER. THIS GIVES THE BATTERIES A MUCH LONGER LIFE CYCLE THAN RECHARGING WHEN THEY ARE MORE DEEPLY DISCHARGED.

## **INSTALLATION**

THE INVERTER HAS FOUR SLOTS IN ITS MOUNTING BRACKET THAT ALLOW THE UNIT TO BE FASTENED AGAINST A BULKHEAD, FLOOR, WALL OR OTHER FLAT SURFACE.

IDEALLY, THE MOUNTING SURFACE SHOULD BE COOL TO THE TOUCH.

IT IS MORE ELECTRICALLY EFFICIENT TO USE LONGER AC WIRING THAN DC WIRING, SO INSTALL THE INVERTER AS CLOSE AS POSSIBLE TO THE 12V/24V DC POWER SOURCE.

THE INVERTER CAN BE OPERATED IN ANY POSITION, BUT IF IT SI INSTALLED ON A VERTICAL WALL WE RECOMMEND TO MOUNT IT WITH THE LONGEST SIDE PARALLEL TO THE FLOOR.

FOR SAFETY CONCERN, YOU CAN CONNECT A DC-RATED FUSE OR A DC-RATED CIRCUIT BREAKERS ON THE POSITIVE CABLE LINE IN YOUR POWER

SYSTEM, FOLLOWING THESE RECOMMENDATIONS WHEN YOU PURCHASING FUSES OR CIRCUIT BREAKERS.

SELECT A FUSE OR CIRCUIT BREAKER WITH A PROPER RATING (E.G.:1000W ADVICE 150ADC, 1500W ADVICE 200ADC)

### **INSTALLATION STEPS**

- CHECK THE INVERTER'S, BE SURE THE POWER SWITCH IS TURNED OFF AND THAT NO FLAMMABLE FUMES ARE PRESENT.
- IDENTIFY THE POSITIVE (+) AND NEGATIVE (-) BATTERY'S TERMINALS.
- INSTALL A FUSE HOLDER OR BREAKER CLOSE TO THE POSITIVE (+) BATTERY'S TERMINAL.
- CONNECT A LENGTH OF WIRE ON ONE SIDE OF THE FUSE HOLDER OR CIRCUIT BREAKER. CONNECT THE OTHER END OF THE WIRE TO THE POSITIVE (+) TERMINAL OF THE INVERTER.
- CONNECT A LENGTH OF WIRE BETWEEN THE INVERTER'S NEGATIVE (-) TERMINAL AND THE BATTERY'S NEGATIVE (-) TERMINAL.
- CONNECT A SHORT LENGTH OF WIRE TO THE OTHER TERMINAL OF THE FUSE HOLDER OR CIRCUIT BREAKER. MARK IT "POSITIVE" OR "+".
  
- CONNECT THE FREE END OF THE FUSE OR BREAKER WIRE TO THE POSITIVE TERMINAL OF THE BATTERY.
- INSERT A SUITABLE FUSE IN THE FUSE HOLDER.
- CHECK TO BE SURE THAT ALL CONNECTIONS BETWEEN BATTERY CLIPS, TERMINALS AND FUSES ARE SECURE AND TIGHT.

### **AC LOADS CONNECTION STEPS**

- WHEN YOU HAVE CONFIRMED THAT THE AC APPLIANCES TO BE OPERATED IS TURNED OFF, PLUG AN APPLIANCE INTO THE AC OUTLET ON THE FRONT PANEL OF THE INVERTER.
- TURN ON THE INVERTER.
- TURN THE APPLIANCE ON.
- PLUG IN ADDITIONAL APPLIANCES AND TURN THEM ON.

### **NOTES**

PLUG THE CORD FROM THE AC APPLIANCES YOU WISH TO OPERATE INTO THE AC RECEPTACLE. WHEN TURN ON THE INVERTER. THE RED AND GREEN LED BOTH TURN ON FOR 3~5 SECONDS THEN RED LED TURNS OFF AND THE

GREEN REMAIN ON. THE GREEN LED INDICATOR MEANS THAT THE INVERTER IS FUNCTIONING PROPERLY. MAKE SURE THE COMBINED LOAD REQUIREMENT OF YOUR EQUIPMENT DOES NOT EXCEED INVERTER'S OUTPUT RATING.

- TURN OFF THE INVERTER. THE OVER LOAD LED MAY BRIEFLY "BLINK" AND THE AUDIBLE ALARM MAY ALSO SOUND A SHORT "CHIRP." THIS IS NORMAL. THIS SAME ALARM MAY ALSO SOUND WHEN THE INVERTER BEING CONNECTED TO OR DISCONNECT FROM THE BATTERY.
- WHEN USING AN EXTENSION CORD FROM THE INVERTER TO AN APPLIANCE THE EXTENSION CORD SHOULD NOT BE LONGER THAN 1,5M AND WITH APPROPRIATE SECTION.
- WHEN YOU PLAN TO OPERATE MORE APPLIANCES, PLEASE MAKE SURE PLUG AND SWITCH ON THE BIGGEST ONE FIRST AND THEN SMALLER ONE.

**CAUTION: THE INVERTER IS ENGINEERED TO BE CONNECTED DIRECTLY TO STANDARD ELECTRICAL AND ELECTRONIC EQUIPMENTS. DO NOT CONNECT THE POWER INVERTER TO HOUSEHOLD AC DISTRIBUTION WIRING. DO NOT CONNECT THE POWER INVERTER TO ANY AC LOAD CIRCUIT IN WHICH THE NEUTRAL CONDUCTOR IS CONNECTED TO GROUND (EARTH).**

**AC INPUT MAIN CONNECTION STEPS:**

YOU CAN CONNECT THE IEC CABLE IN THE MAIN INPUT SOCKET WHEN YOU WANT SO WHEN IS PRESENT THE MAIN POWER AC FROM THE PUBLIC POWER NETWORK ALL AC LOADS CONNECTED TO THE LOADS SOCKET WILL BE SUPPLIED DIRECTLY FROM THE PUBLIC POWER SAVING THE BATTERY ENERGY.



## **RATED VS. ACTUAL CURRENT OF LOADS**

MOST ELECTRICAL DEVICES AND AUDIO/VIDEO EQUIPMENT HAVE LABELS THAT INDICATE POWER CONSUMPTION IN AMPS OR WATTS.

BE SURE THAT THE POWER CONSUMPTION OF THE ITEM YOU WISH TO OPERATE IS LESS THAN INVERTER'S RATING POWER ( IF THE POWER CONSUMPTION IS RATED IN AMPS, SIMPLY MULTIPLY BY THE AC VOLT (220V) TO DETERMINE THE WATTAGE). THE INVERTER WILL SHUTDOWN IF IT IS OVERLOADED. THE OVERLOAD MUST BE REMOVED BEFORE THE INVERTER WILL RESTART.

RESISTIVE LOADS ARE THE EASIEST FOR THE INVERTER TO RUN. HOWEVER, LARGER RESISTIVE LOADS, SUCH AS ELECTRIC STOVES OR HEATERS, USUALLY REQUIRE MORE WATTAGE THAN THE INVERTER CAN DELIVER. INDUCTIVE LOADS, SUCH AS TV'S AND STEREOS, REQUIRE MORE CURRENT TO OPERATE THAN DO RESISTIVE LOADS OF THE SAME WATTAGE RATING. INDUCTION MOTORS, AS WELL AS SOME TELEVISIONS, MAY REQUIRE 2 TO 6 TIMES THEIR WATTAGE RATING TO START UP. THE MOST DEMANDING IN THIS CATEGORY ARE THOSE THAT START UNDER LOAD, SUCH AS COMPRESSORS AND PUMPS. TO RESTART THE UNIT AFTER A SHUTDOWN DUE TO OVERLOADING, REMOVE THE OVERLOAD IF NECESSARY RESTART THE INVERTER TURN OFF AND THEN ON AGAIN.

## **FUSES REPLACEMENT**

OUR INVERTERS ARE PROTECTED BY INTEGRAL ELECTRONIC CIRCUIT AND WILL AUTOMATICALLY RESET.

MORE THAN THAT, THIS INVERTER IS EQUIPMENT WITH A FUSE THAT IS LOCATED INSIDE THE INVERTER. IF POLARITY CONNECTION IS REVERSED, THE FUSE BURNS. YOU NEED TO OPEN THE BOTTOM TO REPLACE THE FUSE. THERE ARE SOME SPARE FUSES INSIDE OF INVERTER'S PACKING.

PLEASE REPLACE THE FUSE BY SAME SIZE AS THE ORIGINAL ONE. NORMALLY AFTER YOU REPLACE THE NEW FUSE, THE INVERTER RECOVERS AUTOMATICALLY. BUT SOMETIMES THERE IS A KIND OF SPECIAL CONDITION, EVEN AFTER YOU REPLACE THE NEW FUSE, THE INVERTER STILL NOT WORKING PROPERLY, THEN PLEASE YOU NEED CONTACT TECHNICIAN TO FIND AND FIX THE PROBLEMS.

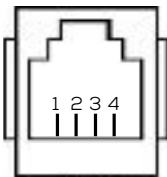


FOR MODELS WITH IVT FUNCTION THERE IS A GLASS FUSE INSIDE THE IEC SOCKET FOR THE EXTERNAL POWER LINE.

## OPTIONALS

- ONLY FOR LOW POWER: 400W AND 600W MODELS, A POWER SUPPLY CABLE SET WITH BATTERY POLE CLAMPS IS AVAILABLE.
- ALL THE NDS INVERTERS CAN BE REMOTELY CONTROLLED WITH AN OPTIONAL REMOTE CONTROLLER (RC02 OR RC03) OR ANY GENERIC SWITCH INTERFACED TO THE RJ11 CONNECTOR (LOCATED BELOW THE 1-O-2 SWITCH) ON ALL MODELS AND IDENTIFIED WITH THE WORD "REMOTE". TO CONNECT TO THE RJ11 CONNECTOR, YOU NEED THE OPTIONAL FC01 CABLE, OTHERWISE REFER TO THE CONNECTION DIAGRAM AS FOLLOWS:

TO CONNECT TO THE RJ11 CONNECTOR, YOU NEED THE OPTIONAL FC01 CABLE, OTHERWISE REFER TO THE PINION OF THE CONNECTOR AS FOLLOWS:



PIN NUMBER	FUNCTION
1-2	12V AND 24V FROM EXTERNAL BATTERY
3	CONNECT AT PIN N°2 WITH EXTERNAL SWITCH TO REMOTELY CONTROL THE DEVICE
4	MASS

TO BE ABLE TO TURN THE INVERTER ON AND OFF VIA REMOTE CONTROL, CONNECT AN EXTERNAL SWITCH FROM AT LEAST 24V 3A BETWEEN PIN 2 AND 3 OF THE RJ11 PHONE CONNECTOR. TO ENABLE THE INVERTER REMOTE CONTROL, SWITCH THE SELECTOR IN POSITION 2.

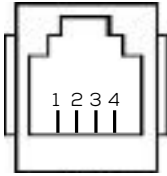
FOR ALL DEVICES WITH S/N STARTING FROM THE FOLLOWING:

SP1500 12V S/N: 171260.

SP2000I 12V S/N: 170451.

SP3000 S/N: ALL.

ONLY THE RC03 AND FC02 ACCESSORIES AND THE RJ11 CONNECTOR CAN BE USED.



PIN NUMBER	FUNCTION
2	RED LED CONNECTION (FAULT)
1-3	CONNECT THE EXTERNAL SWITCH TO REMOTELY CONTROL THE DEVICE
4	MASS

## MAINTENANCE

MINIMAL MAINTENANCE IS REQUIRED TO KEEP YOUR INVERTER OPERATING PROPERLY, PERIODICALLY YOU SHOULD:

- CLEAN THE EXTERIOR OF THE UNIT WITH A DAMP CLOTH TO PREVENT THE ACCUMULATION OF DUST AND DIRT. ENSURE THAT DC CABLES ARE SECURE AND FASTENERS ARE TIGHT.
- MAKE SURE THE VENTILATION OPENINGS ON THE DC PANEL AND BOTTOM OF THE INVERTER ARE NOT CLOGGED.

## TECHNICAL CHARACTERISTICS

<b>SMART-IN MODIFIED</b>	SM 400
<b>CONTINUOUS OUTPUT POWER</b>	400W
<b>PEAK OUTPUT POWER</b>	800W (FEW SECONDS)
<b>OUTPUT VOLTAGE (RMS)/FREQ.</b>	230VAC/50HZ ± 3 HZ
<b>USB OUTPUT</b>	5V @ 2.1A
<b>INPUT VOLTAGE</b>	12V / 200 mA
<b>DIMENSIONS [MM]</b>	184 X 140 X 71

<b>SMART-IN MODIFIED</b>	SM 600	SM 600-24
<b>CONTINUOUS OUTPUT POWER</b>	600W	600W
<b>PEAK OUTPUT POWER</b>	1200W (FEW SECONDS)	1200W (FEW SECONDS)
<b>OUTPUT VOLTAGE (RMS)/FREQ.</b>	230VAC/50HZ ± 3 HZ	230VAC/50HZ ± 3 HZ
<b>USB OUTPUT</b>	5V @ 2.1A	5V @ 2.1A
<b>INPUT VOLTAGE</b>	12V / 510 mA	24V / 170 mA
<b>DIMENSIONS [MM]</b>	214 X 140 X 71	214 X 140 X 72

<b>SMART-IN MODIFIED</b>	SM 1000
<b>CONTINUOUS OUTPUT POWER</b>	1000W
<b>PEAK OUTPUT POWER</b>	2000W (FEW SECONDS)
<b>OUTPUT VOLTAGE (RMS)/FREQ.</b>	230VAC/50HZ ± 3 HZ
<b>USB OUTPUT</b>	5V @ 2.1A
<b>INPUT VOLTAGE</b>	12V / 330 mA
<b>DIMENSIONS [MM]</b> <b>ONI [MM]</b>	262 X 270 X 121

<b>SMART-IN MODIFIED</b>	SM 1500
<b>CONTINUOUS OUTPUT POWER</b>	1500W
<b>PEAK OUTPUT POWER</b>	3000W (FEW SECONDS)
<b>OUTPUT VOLTAGE (RMS)/FREQ.</b>	230VAC/50HZ ± 3 HZ
<b>USB OUTPUT</b>	5V @ 2.1A
<b>INPUT VOLTAGE</b>	12V / 560 mA
<b>DIMENSIONS [MM]</b>	262 X 270 X 107,5

<b>SMART-IN PURE</b>	SP 400
<b>CONTINUOUS OUTPUT POWER</b>	400W
<b>PEAK OUTPUT POWER</b>	1000W (FEW SECONDS)
<b>OUTPUT VOLTAGE (RMS)/FREQ.</b>	230VAC/50HZ ± 3 HZ
<b>USB OUTPUT</b>	5V @ 2.1A
<b>INPUT VOLTAGE</b>	12V / 325 mA
<b>DIMENSIONS [MM]</b>	214,5 X 140 X 71

<b>SMART-IN PURE</b>	SP 600	SP 600-24
<b>CONTINUOUS OUTPUT POWER</b>	600W	600W
<b>PEAK OUTPUT POWER</b>	1500W (FEW SECONDS)	1500W (FEW SECONDS)
<b>OUTPUT VOLTAGE (RMS)/FREQ.</b>	230VAC/50HZ ± 3 HZ	230VAC/50HZ ± 3 HZ
<b>USB OUTPUT</b>	5V @ 2.1A	5V @ 2.1A
<b>INPUT VOLTAGE</b>	12V / 375 mA	24V / 210 mA
<b>DIMENSIONS [MM]</b>	244,5 X 140 X 71	244,5 X 140 X 71

<b>SMART-IN PURE</b>	SP 1000	SP 1000-I
<b>CONTINUOUS OUTPUT POWER</b>	1000W	1000W
<b>PEAK OUTPUT POWER</b>	2500W (POCHI SECONDI)	2500W (POCHI SECONDI)
<b>OUTPUT VOLTAGE(RMS)/FREQ.</b>	230VAC/50HZ ± 3 HZ	230VAC/50HZ ± 3 HZ
<b>USB OUTPUT</b>	5V @ 2.1A	5V @ 2.1A
<b>INPUT VOLTAGE</b>	12V / 490 mA	12V / 490 mA
<b>SWITH TIME FROM BATTERY TO MAIN AC LINE.</b>	/	20MS
<b>SWITCH TIME FROM MAIN LINE TO BATTERY</b>	/	100MS
<b>INPUT VOLTAGE</b>	12V	12V
<b>DIMENSIONS [MM]</b>	262,4 X 270 X 107,5	262,4 X 270 X 121

<b>SMART-IN PURE</b>	SP 1500	SP 1500-I	SP 1500-24
<b>CONTINUOUS OUTPUT POWER</b>	1500W	1500W	1500W
<b>PEAK OUTPUT POWER</b>	4000W (POCHI SECONDI)	4000W (POCHI SECONDI)	4000W (POCHI SECONDI)
<b>OUTPUT VOLTAGE(RMS)/FREQ.</b>	230VAC/50HZ ± 3 HZ	230VAC/50HZ ± 3 HZ	230VAC/50HZ ± 3 HZ
<b>USB OUTPUT</b>	5V @ 2.1A	5V @ 2.1A	5V @ 2.1A
<b>INPUT VOLTAGE</b>	12V / 590 mA	12V / 590 mA	24V / 300 mA
<b>SWITCH TIME FROM BATTERY TO MAIN AC LINE</b>	/	20MS	/
<b>SWITCH TIME FROM MAIN LINE TO BATTERY</b>	/	100MS	/
<b>INPUT VOLTAGE</b>	12V	12V	24V
<b>DIMENSIONS [MM]</b>	322,4 X 270 X 107,5	322,4 X 270 X 121	322,4 X 270 X 107,5

<b>SMART-IN PURE</b>	SP 2000-I
<b>CONTINUOUS OUTPUT POWER</b>	2000W
<b>PEAK OUTPUT POWER</b>	6000W (FEW SECONDS)
<b>OUTPUT VOLTAGE(RMS)/FREQ.</b>	230VAC/50HZ ± 3 HZ
<b>USB OUTPUT</b>	5V @ 2.1A
<b>INPUT VOLTAGE</b>	12V / 690 mA
<b>SWITCH TIME FROM BATTERY TO MAIN AC LINE</b>	20MS
<b>SWITCH TIME FROM MAIN LINE TO BATTERY</b>	100MS
<b>DIMENSIONI [MM]</b>	385 X 270 X 107,5

<b>SMART-IN PURE</b>	SP 3000	SP 3000-24
<b>CONTINUOUS OUTPUT POWER</b>	3000W	3000W
<b>PEAK OUTPUT POWER</b>	8000W (FEW SECONDS)	8000W (FEW SECONDS)
<b>OUTPUT VOLTAGE (RMS)/FREQ.</b>	230VAC/50HZ ± 3 HZ	230VAC/50HZ ± 3 HZ
<b>USB OUTPUT</b>	5V @ 2.1A	5V @ 2.1A
<b>INPUT VOLTAGE</b>	12V / 1270 mA	24V / 725 mA
<b>INPUT VOLTAGE</b>	12V	24V
<b>DIMENSIONS [MM]</b>	412 X 270 X 107,5	412 X 270 X 107,6

## FAQ

- **WHICH DEVICES CAN I USE THE MODIFIED WAVE?**

ALL ELECTRICAL AND ELECTRONIC EQUIPMENT ARE DESIGNED TO WORK WITH ORDINARY MAINS VOLTAGE THAT IS SINUSOIDAL, SO USING THE MODIFIED WAVE COULD WORK UNDER DIFFERENT CONDITIONS FOR THOSE WITH THE RISK OF NOT WORKING PROPERLY OR HAVING A REDUCED LIFE. THE MODIFIED WAVE IS THEREFORE ONLY INDICATED FOR ILLUMINATION APPLICATIONS AND EQUIPMENT THAT ARE NOT SOPHISTICATED, THAT WE DO NOT HAVE ANY ELECTRICAL MOTORS OR SENSITIVE ELECTRONICS. IT IS ALWAYS ADVISABLE TO USE INVERTERS WITH PURE SINUSOIDAL WAVE.

- **CAN I EXTEND THE 12V OR 24V CONNECTION CABLE?**

CONNECTION CABLES FOR THE 12V OR 24V PART ARE SUPPLIED FOR BEST DEVICES PERFORMANCES. IT IS ALWAYS POSSIBLE TO EXTEND THE CONNECTION CABLES, BUT CLEARLY IT IS NECESSARY TO INCREASE THE SECTION OF THE NEW CABLES YOU USE, NEVER MAKE JUNCTIONS, BUT USE INTEGRAL CABLES. CONTACT A QUALIFIED SERVICE TECHNICIAN FOR ADVICE ON THE SECTION AND TYPE OF CABLE TO BE TAKEN.

- **IS IT ALWAYS NECESSARY TO HAVE AN EXTERNAL FUSE?**

ALL NDS INVERTERS HAVE INTERNAL FUSES TO PROTECT THE DEVICE AND BATTERY CONNECTED TO THEM, IT IS GOOD TO ADD A FUSE CLOSE TO THE 12V OR 24V BATTERY CONNECTION TO PROTECT THE CABLES AND THE SYSTEM. THE POWER OF THE FUSE MUST BE PROPORTIONAL TO THAT OF THE INVERTER WITH THIS CALCULATION:  $(P\_INVERTER \cdot 1.3) / (12V \text{ OR } 24V) = \text{FUSE-OUTSIDE}$ .

# WARRANTY

THE MANUFACTURER SHALL GUARANTEE THE PROPER FUNCTIONING OF THE SMART-IN POWER INVERTER AND UNDERTAKE TO MAKE FREE REPLACEMENT OF PART WHICH SHOULD BE DETERIORATED DUE TO DEFECTS IN CONSTRUCTION WITHIN 24 MONTHS FROM THE PURCHASING DATE, AS EVIDENCED BY THE VALIDATION SLIP (TO BE FILLED IN EACH PART AND RETURNED TO THE MANUFACTURER).

THE DEFECTS RESULTING FROM IMPROPER INSTALLATION, USE, TAMPERING OR NEGLIGENCE SHALL NOT BE COVERED BY WARRANTY. FURTHERMORE, WE ASSUME NO LIABILITY FOR ANY DIRECT OR INDIRECT DAMAGES. THE SMART-IN POWER INVERTER RETURNED, EVEN IF UNDER WARRANTY, WILL HAVE TO BE SHIPPED "FREIGHT PAID" AND SHALL BE RETURNED AND ON A "FREIGHT COLLECT" BASIS.

THE WARRANTY CERTIFICATE SHALL BE VALID ONLY IF ACCOMPANIED BY A OFFICIAL RECEIPT OR DELIVERY DOCUMENT.

ANY DISPUTE WILL BE UNDER THE COMPETENT JURISDICTION OF THE COURT OF PESCARA (ITALY)



## WARRANTY

MODEL\_\_\_\_\_

CODE\_\_\_\_\_

PURCHASE DATE\_\_\_\_\_

SELLER SIGNATURE AND STAMP

**NDS ENERGY S.R.L.**

VIA G. PASCOLI, 169  
65010 CAPPELLE SUL TAVO (PE)  
ITALY

EMAIL: [COMMER@NDSENERGY.IT](mailto:COMMER@NDSENERGY.IT)

TEL: +39 085 4470396

FAX: +39 085 9112263



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TUTTA L'ENERGIA CHE TI SERVE



**NDS ENERGY S.R.L.**

VIA PASCOLI, 169

65010 CAPPELLE SUL TAVO (PE) ITALY

TEL.: +39 085 4470396 | CELL./WHATSAPP: +39 373 8886 875

FAX: +39 085 9507049

WEB: [WWW.NDSENERGY.IT](http://WWW.NDSENERGY.IT)

EMAIL: [COMMER@NDSENERGY.IT](mailto:COMMER@NDSENERGY.IT)

