

TOP CLASS “SPARK”

Inverter für Netzeinspeisung

TCS1500

Betriebs- und Installationsanleitung



Made in Switzerland

About this Manual

Congratulations on your purchase of a TOP CLASS sinewave inverter. You've become the owner of the finest engineered, highest quality sinewave inverter. We have dedicated our product's, our services and ourselves to the satisfaction of every customer.



This manual for installation and operation contains important information's about this unit. Please familiarise yourself with all the information's contained in these instructions before installing and operating this unit. This will help you to acquaint yourself properly with this unit and make full use of its Advanced technical features under all operating conditions.

Should you encounter problems while installing or running this unit, please contact the dealer you purchased the unit From or a dealer authorised by ASP.

Improper assembly, installation and maintenance may impair the safety and function of this unit. For this reason make sure that you understand all the information's in this manual before beginning the assembly and installation procedure.

Thank you again for choosing to become a part of the ASP family!.

Limitation of liability

Since neither the observance of these instructions for installation and operation, nor the conditions and methods of installation, operation, utilisation and maintenance of the unit can be supervised by ASP, we don't assume any responsibility or liability for loss, damage or costs arising from using this unit or in any way connected with faulty installation, improper operation or incorrect utilisation and maintenance.

Furthermore we don't assume any responsibility for infringement of patent rights or violations of the rights of third parties arising from the utilisation of this unit.

We reserve the right to make product changes, change technical specifications or these instructions without prior notice.

Important: Please be informed that units without CE-declaration can only be used on your own liability in Europe countries. If you have an unit without CE please contact your local dealer.

WARNING! Unauthorised repairs and operation of this device for any use other than that for which it was intended will result in loss of warranty. If you have problems with the unit ASP will provide you with the authorisation necessary to return or repair a unit.

Environmental protection

Recycling raw materials instead of waste disposal. This unit is built from valuable materials and is easy to recycle. The unit, accessories and packaging should be sorted for environment-friendly recycling. Please keep packaging for retransport the



inverter later. To prevent damage during transport we have to use and bill you a new packaging if we receive the unit not with original packaging. Thank you.

Precautions

Warning! In this unit potential differences of up to 1000V occur during operation and can result in death or serious bodily injury. Use extreme caution while operating and always observe precautions as:

Only specially trained maintenance and service personnel are permitted to test and repair this unit. This personnel further must be familiar with this manual and all domestic regulations.

The unit is tested by the manufacturer and it is not allowed to change anything! Without a written permission of ASP AG you will lose warranty if you repair the unit. Please refer to the warranty information's.

Any work performed on this unit, its installation and electrical connection must be carried out in compliance with national electric codes and local regulations, which may deviate from those contained herein. Refer to responsible authorities for relevant information's.

Operate the device only when all factory-supplied covers are available and in place.

Temperatures at the heatsink of the device may be as high as 80 degrees C during operation. Obstruction of the ventilation of the unit may result in overheating and thus in failure of the unit. Always keep the unit and the ventilation slots clean. Do not cover up or place any item on ventilation holes or cooling components.

Please note the permissible ambient conditions for operating the unit.

Automatic restart of the unit may occur after fault clearance.

The unit is also ready for operation if the LC-display is dark!

Attention! The large input capacitors may still be charged even if DC-cables are disconnected.



Do not use any measuring equipment damaged or defective.

Contact with energised parts can result in serious or fatal injury. Please note that, even under excessively light load or in stand by operation, high voltage can be present at the AC-output.

Maintenance and Spare parts

This unit is maintenance-free.

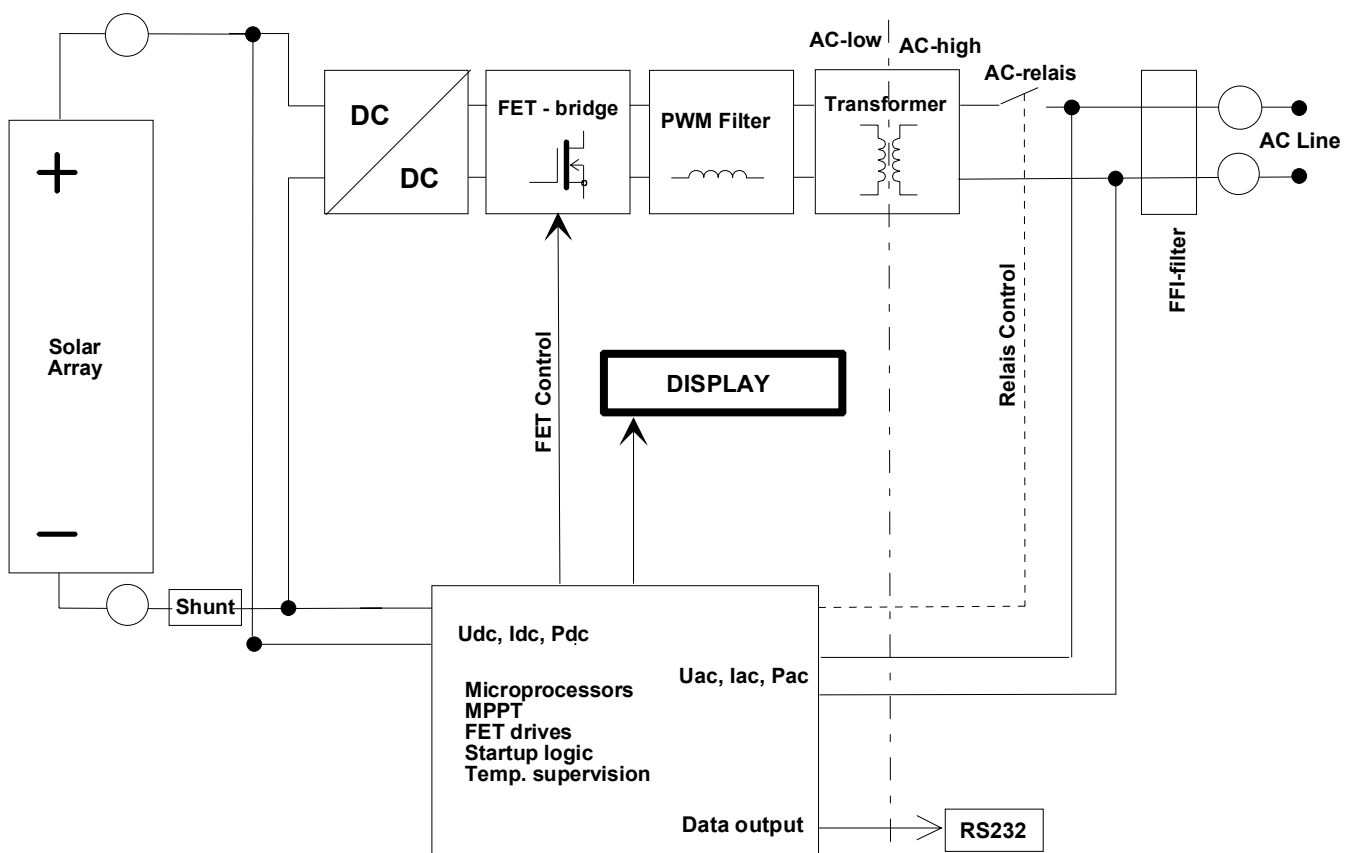
Should malfunctions of the unit occur despite these inspections, the unit must be returned to the manufacturer for repair. Original spare parts are only available from ASP. ASP will provide you with the authorisation necessary to return a unit for repair. Before you call please prepare you for the following questions: Type of unit, DC-voltage, date of purchase, kind of fault, type of solar generator.

1. Unpacking the unit

Please check if the unit has no visible damage. If the unit is damaged you must inform your dealer within 3 days after receiving the unit.

2. Function, technology

The inverter is ready to use. It is suitable for grid parallel connection of domestic solar generating systems. It converts the DC current delivered from solar arrays into AC current that can be fed into the electricity distribution grid. Through being self tracking, a harmonic current is fed into the grid, independent of the grids sine wave shape. This eliminates the problems of high grid impedance and grid ring signals.



Inverter Major Components

- Step-up-converter at DC-input
- Fully automatic self management
- Toroidal transformer for galvanic separation
- Smoothing capacitors and inductors
- Watchdog failure and maximum power point tracking (MPP)
- DC filter components and AC filter components

This inverter is microprocessor controlled. The micros are responsible for:

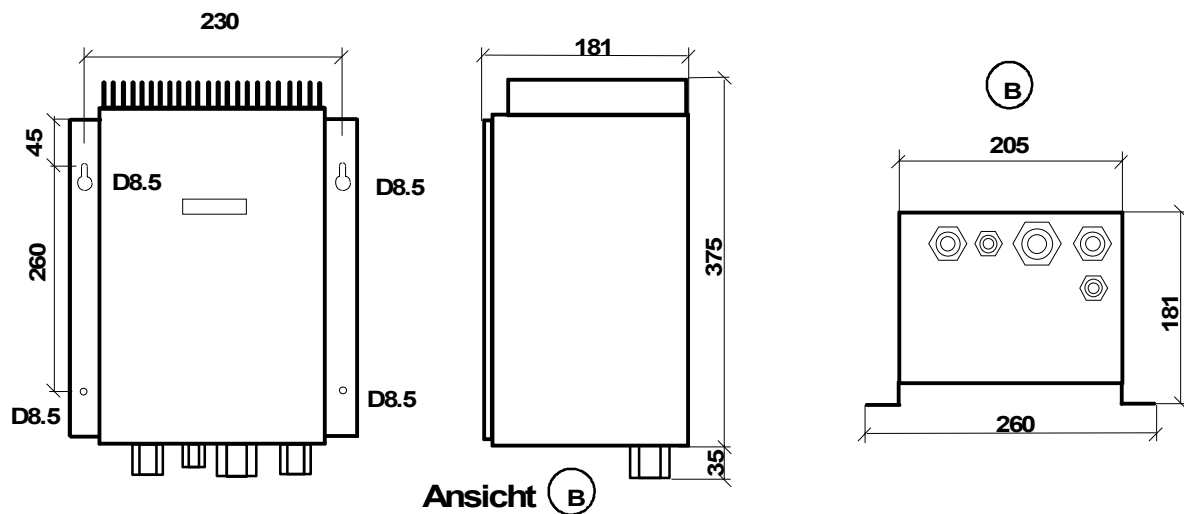
- Construction of sine wave
- Monitoring the grid (voltage, frequency), zero voltage crossover, ENS monitoring

- M.P.P. (maximum power point tracking)
- Power factor correction
- LCD display multifunction and RS232

The highest degree of efficiency and reliability is reached by utilising mos-fet transistors in a full bridge configuration and the use of fast MOS-FETtransistors in protection networks. M.P.P. is responsible for maximum power extraction from solar array and maximises power fed into the grid.

The superb toroidal transformer has very low magnetic losses, high efficiency and a very low RFI-radiation level. The transformer design provides a high efficiency over a wide operating range. No electrical connection between DC-input and AC-output due to the transformer. It complies with the following guidelines: IEC 742, EN60742, VDE 0551 TI, SEMLO 9742.

3. Installation



The selection of a safe location for installing the inverter depends on the following criteria:

- ◆ Check for compatibility of correct DC-Voltage and AC-Voltage on compliance plate.
- ◆ The inverter can be used in any position (wall mounting or tabletop use).
- ◆ Protection from unauthorised access in particular of children's.
- ◆ Keep in dry place (max. 95% humidity, not condensing), ambient temperature -25°C - +60°C.
- ◆ Do not install the unit in living rooms because of noise emission.
- ◆ Adequate ventilation. Keep min. 10cm distance to other objects (except mounting side)
- ◆ Use shielded DC-cables or put the cables through a metal tube



Protect your inverter from rain. The unit is not designed for outdoor use.

4. Electrical Connection

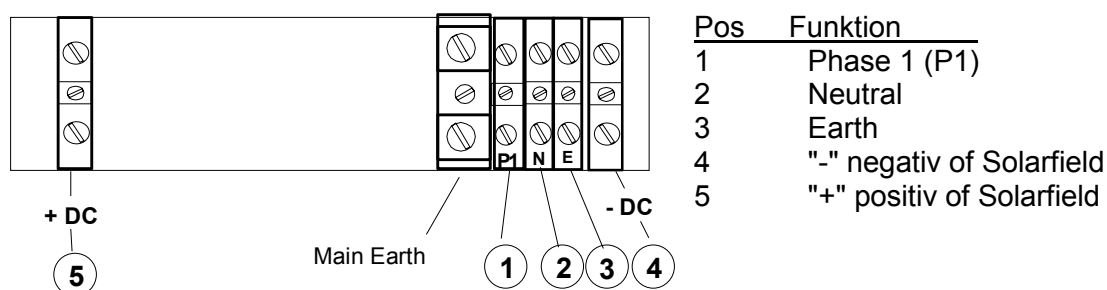
Remove screws from topside of cover, only loosen the six screws on the side, lift up the cover slightly and disconnect earth connection on the left hand side.
All necessary electrical connectors are mounted on din-rail mount standard connector blocks inside the inverter. Refer to drawings for pinout of connections.

4.1 Connection of Solar Array

Note: Inverter cannot be paralleled on DC-side because of MPP.

Because of the large input voltage range it is possible to choose from several possibilities:

- 1 String with 12 modules (each 120W/12V)
- 1 String with 6 modules (each 250W/24V)
- 3 Strings with 12 modules (each 55W/12V) per string
- 4 Strings with 8 modules (each 55W/12V) per string
- etc.



To use the inverter at it's maximum we recommend to match solar array power output to input power P.Max plus 10% of inverter.

All popular brands of solar panels may be used according to manufacturers recommendations.

Warning: Open circuit voltage of solar array is never to exceed nominal input voltage of the inverter.

Adequate fusing and overvoltage protection has to be used between solar array and the inverter. (>6mm²) shielded cable, or DC cables in an earthed metal conduit should be used for DC side connections.

Check polarity (DC)!

Before connecting to the inverter DC mains should be switched off.

Connect solar mains positive + to left hand side marked connector +DC

Connect solar mains negative - to right hand side marked connector -DC

Be aware of local lightning protection rules.

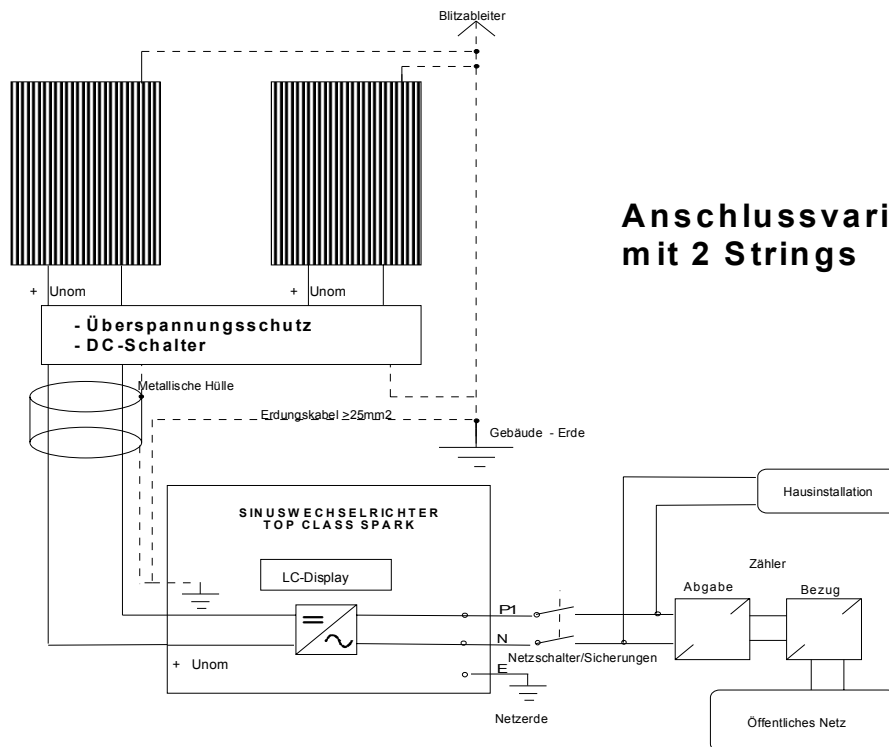
Recommended 25mm² equital bonding main earth, see relevant drawings.

4.2. Connecting AC side to 230V Grid

Note: No limit of parallel connected inverters into the same phase. Nominal connecting voltage is 230V/50Hz. Tolerance for operation is from 196V to 253V. A 10 amp circuit breaker must be installed between the inverter and the grid. It should be situated as close as possible to the inverter.

The connecting points for 230V AC are marked P1 and N (P1=phase and N=neutral). Connect as per wiring diagram. This inverter is equipped with ENS. Use a 2.5mm² cable to connect to mains power.

5. Wiring diagram



All works must be carried out by a licensed and qualified tradesperson.

6. First operation

Prior to grid connection make sure you have permission of your power company.

Double check all electric connections.

- Check DC voltage between solar clamp left (+) and solar clamp right (-).
- Check correct polarity of solar voltage.
- Check mains connection (P1, N, Earth).

Put On/Off switch on display panel to **OFF**.

Now the external switches for DC and AC may be closed. Caution! The inverter now is armed.

With the external switches closed the display should read "TOP CLASS SPARK".

You now may switch on the inverter. Operation is fully automatic. The switch is in the ON position continuously for normal operation (switch in top position).

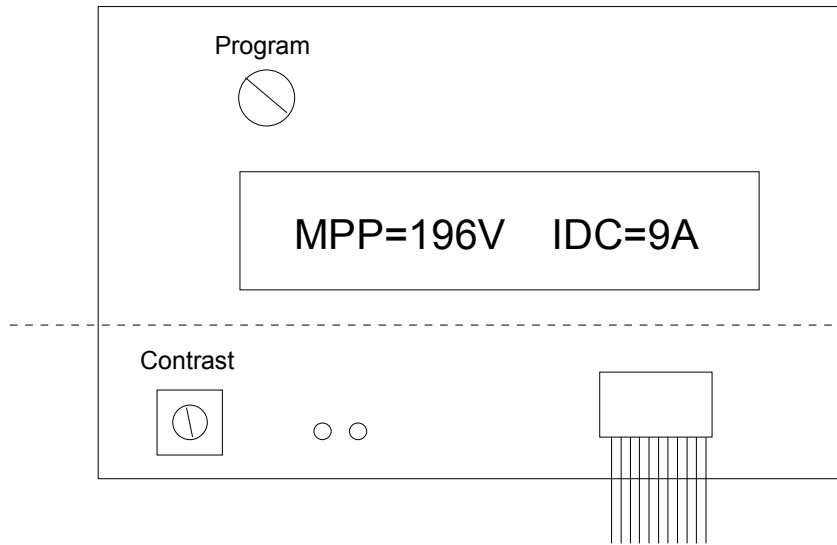
If there is no change on the display readout check:

1. Is mains within the limits?
2. Is there enough sun for 18W of solar power? (shading?).

The inverter is turning itself on automatically in the morning and off in the evening or in cases of insufficient radiation ($P < 15W$).

7. Display

The backbite of LCD switches on automatically if you turn the programme potentiometer.
After app.20sec. it switches off.



All parts below the dashed line are only visible with lid removed.
Contrast: preset by factory. do not adjust.

Important! No user adjustable potentiometers inside the unit! Inverter may be destroyed!

Adjust knob "Program" is for menu selection:

Knob fully counter clock wise, menu position 1:
MPP voltage of solar field UDC and solar current IDC
e.g.: MPP=196V IDC=6A

Clockwise adjust, menu position 2:
Mains voltage and ac power fed into the grid
e.g.: UAC=229V PAC=1200W

Clockwise adjust, menu position 3:
Working time since last connection to grid (normally dawn) and kwh since last connection to grid.
These readouts are reset during night or any disconnection of dc voltage.
e.g. 07.6h 000.58KWH

Clockwise adjust, menu position 4:
Total ac energy fed to the grid since first connection, reset only by factory.
e.g.: TOTAL 1234.69KWH

Clockwise adjust, menu position 5
Information about peak power today. This value will reset during night.
e.g.: Pmax TODAY 1380W

Knob fully clockwise, menu position 6:
99 day memory
Working hours per day and energy (KWH) per day are displayed for the last 99 days. Days are scrolled automatically. Start always with day-1 (yesterday) to day-99
e.g. -3 12h3 06.9KWH means: Three days ago the inverter was running for 12 hours 20 minutes and was feeding 6.9 KWH to the grid.
This readout is only possible while dc voltage is present (inverter working).

General hints regarding display:

Display position doesn't matter for operation. Display flicker any few minutes is normal, new initialising then occurs.

RS232 Interface

The unit is delivered with RS232 interface. This interface is electrically isolated from the unit. You may use a standard RS232 computer cable with 9pin connector for data read out.

Top Class Spark RS232 telegram (9-pin connector)

- RTS (Pin7) must be high all the time (+12V)
- DTR (Pin4) must be high all the time (+12V)
- TXD (Pin3) must be low all the time (-12V)

Baud Rate 19200, no parity, 8 Data Bits, 1 stop bit

A total of 53 characters +cr +lf will be sent every second.

```
# 200Vdc 1.6A 229Vac 0260Wac 000012Wh0011898Wh01t088
# 201Vdc 1.6A 229Vac 0270Wac 000012Wh0011898Wh01e022
# 200Vdc 1.6A 230Vac 0270Wac 000012Wh0011898Wh02t100
# 201Vdc 1.7A 230Vac 0280Wac 000012Wh0011898Wh02e025
# 201Vdc 1.7A 229Vac 0280Wac 000012Wh0011898Wh03t103
# 200Vdc 1.7A 230Vac 0280Wac 000012Wh0011898Wh03e036
# 201Vdc 1.7A 230Vac 0290Wac 000013Wh0011899Wh04t099
# 201Vdc 1.7A 230Vac 0290Wac 000013Wh0011899Wh04e033
```

Behind the second Wh is the read out of history e.g:

02t100 means day -2, 10.0 working hours

02e025 means day -2, 2.5 KWh of energy feeded into grid

8. Service

Only trained staff may perform service to the unit

Service procedure:

1. Open DC breaker
2. Wait for display to blank out
3. Open fuse/ circuit breaker on AC side
4. Wait for internal capacitors to discharge (15 min. approx.).
5. Remove lid and make sure no internal led's are lit.

9. Remarks

- 1) Make sure your solar field voltage does not exceed specs with low temperatures (negative coefficient of solar cells -2mV/Celsius/cell
- 2) Minimum DC power for operation is 15...20Wdc.
- 3) Lightning protection is important for locations with high thunderstorm activities. Ask your electrician for perfect lightning protection.
- 4) Solar plants for grid feeding are subject to various regulations depending on the country of service. Ask your power company for details.

Technical data's

TOP CLASS "SPARK"	TCS1500
Inverter	
Rated Input Power PDC _{IN}	1500W
Input Voltage Range	75 ... 276V DC
Switch on voltage	82V DC
MPP operating Window	75 ... 225V DC
Consumption (from PV-array)	9W operation / 0W night
Operation starts from PDC	13W
Efficiency Factor max..	94%
Rated Power PAC max.	1350W
Output Voltage range UAC _{OUT}	195 ... 256V AC
Rated Output Current IAC _{OUT}	6A AC (sinewave, elektr. limited)
Output Frequency	49 ... 51Hz
CosPhi	1 (Inverter self controlled)
Grid surveillance	single-phase by ENS
Working Frequency	max. 30 kHz (PWM technology)
General data	
Ambient Temperature range	-25°C ... +85°C (max. 95% rH, not condensing)
Status indication	LCD
Toroidal Transformer (galvanically isolated)	IEC742, VDE0551
Temperature and Load controlled fan	ON 55°C / OFF 40°C, P _D >80%
RS-232 Interface	yes, 9-Pin, female
Dimensions (L x W x H)	375 x 260 x 181 mm
IP Protection	IP20
Standards	CE
Weight	18 kg
Warranty	2 years

Technical changes reserved (02/2003)

Warranty (short form)

Dear Customer,

Thank you for buying this ASP product.

In the event that your ASP product needs guarantee service you should return it to the retailer from whom it was purchased. We guarantee TOP CLASS appliances in accordance with statutory/country-specific regulations (proof of purchase by invoice or delivery note).

Damage attributable to normal wear and tear, overload or improper handling will be excluded from the guarantee.

In case of complaint please send the unit with the original packaging, undismantled to your dealer or an ASP service centre for inverters. Please be aware of the information's we need to repair the unit as soon as possible (page 3, Maintenance and Spare parts).

ASP AG is not responsible for costs arising for transport of the unit or damage that occur if the unit is out of service. If you wish we will send you our complete documentation about our guarantee terms.

10. CE-Declaration of conformity

We declare under our sole responsibility that this product is in conformity with the following standards or standardisation documents: EN 50081-1 Generic 92, EN50082-1 Generic 92

