I Additional functions

1.) Reference voltage (REF)

Some converters give an internal high-stable reference auxiliary voltage with 5V ±60mV.
The reference output is short-tern short circuit proof and is immediately available for the user after connecting the input voltage. It is usable for an external set-point value with a maximum load of 1mA (or <0,5mA at Uin>60V). The temperature coefficient is typ. 0,01% / °C.

2.) ON/OFF control (Inhibit)

With the inhibit-signal single or all output voltages are switchable. A further application is to bring the converter into a sleep-mode with very low no-load current. The inhibit-signal can be based on the primary or secondary potential or potential free with polarity independence. It can be offered with 1 ... 2mA and constant current over an extreme input voltage range (4 - 80)V / (12 - 300)V. Function, level values and limit values are given in the data sheets or application notes.

3.) Adjustable output voltage (BER)

If this function is given, the nominal output voltage can be adjusted about a defined range after connecting to the referenced potential. This BER function can also be build up that the output voltage is adjustable with potentiometer or an external auxiliary voltage in a customer defined range.

At some converter families the output voltage can be adjusted with a 0...5V signal at the BER-pin in the full voltage range. With this function the possibility is given to generate a direct driver stage for proportional valves or similar applications.

4.) Parallel operation MA/SL

SYKO-power supplies are not generally working in parallel operation without a decoupling diode. Depending on the converter family the parallel operation can be handled different. That‘s why we kindly ask for your consultation in those situations.

The main problematic is the different thermal load in the case of a static output sided short circuit or over load. Without master-slave regulation or compensation lines, one of the parallel operating converters runs into the short circuit current before the other converter can deliver energy. The result is an insufficient regulation characteristic and a highly reduced live time. DC/DC-converters can be equipped with a master-slave-connection (MA/SL). The master output must be bridged to all slave inputs. This results an equal load sharing of all connected converters.

In some cases none of the converters should work as a master-converter. The situation is needed that all converters are working equally on the network and generating a load sharing. For this situation SYKO designed the concept of a compensation connection. The load current is distributed in any case.

In customised projects the absolute security redundant operation of parallel working converters is needed. In those applications it is possible to take away converters while the system is running. The other converters take over the load part (of the un-build/not working converter) without delay (up to the power limitation).

II Additional output voltages

To generate further output voltages with other polarity, isolated or multiple outputs DC/DC converters can be switched output sided with limited input voltage range (product line D).

When the main output is higher than the needed additional outputs a further secondary switching regulator (product line A) can generate a second output voltage.

In general it is possible for SYKO to modify power supplies with functional independent outputs in any quantity and amplitude over all possible input voltage ranges.

III Capacitors

Switching regulators must be blocked with an input sided capacity because of the occurring chopping currents. These capacitors should have a preferably low series resistance (ESR-value) and a preferably low inductance.

The maximum input voltage Uinmax defines the capacitor's size and the input current's rms-value at the maximum occurring temperature. You can find these data in the corresponding application diagrams.

The current's rms-value effects a power loss in the capacitor of (approximated) Ploss = $Irms^2 \cdot ESR$. The input capacitor (connected directly to the chopping circuit) has to perform the chopping conditions without forming even after long storage time and by use with maximum ambient temperature. This is considered in all SYKO products based on the long experience. In the last years switching topologies have been adapted in that way that chopping circuits work without electrolytic capacitors and so the live time is increased. For storage situations free of voltage it must be considered that the wet-electrolytic capacitor's aging in increased. A re-forming is recommended starting after four year every 2 years.

IV Temperature compensated mechanics

SYKO designed a special plastic housing which gives the possibility to screw the carrying housing of potted modules to the PCB for shock and vibration requirements. This version is in advantage in compare to ordinary screw-on mounting of the basic plate. When the converter's internal build-up is designed that the potting compound can move with temperature, less mechanical forces work on the converter's internal soldering points or on the customer's PCB.

With this is also was achieved that the customer has the possibility to perform a quality control of soldering points. The soldering points can shape conforming to standards because of the sufficient distance between converter and carrying PCB. The welding flux can be washed out without problems. Generally SYKO designs new modifications in open build-up style without potting compound.

V Input current

A DC/DC converter's input current can be classified in the parts of ***inrush current, run-up current*** and ***nominal current***. The ***inrush current*** is generated by direct connecting of the supplying voltage (e.g. battery) to the converter's input capacity. The capacitor and the network's internal resistance define this inrush current pulse. Current values of many 100 amperes can be reached and the amplitude is not depending on the capacity. The capacity defines the current-time area. Special circuits, which are integrated in the most converters, can prevent this:

- The ***inrush current*** is limited by R-D-T-combinations.
  Here the inrush current is limited to a system suitable value with a pre-resistance.
  Time-delayed the high resistive distance is bridged with semiconductors or relays in the moment of the activating.
  At the same time the reverse polarity protection is guaranteed.

- ***Inrush currents*** and ***differential currents*** are limited with an active filter (Inrush Current Limiter, ICL-Technology).
  This SYKO patent is used successfully in many converters with following high capacities. The input current is limited to a defined value in the connecting moment or by occurring transients. The following electronic is protected against disturbances (transients) by absorption. When the filter is switched in active, following loads can be disconnected from the network high resistively. In this case the needed stand-by current is approx. 2mA.

The ***run-up current*** in SYKO converters is extensively an integral function of the voltage-set point value and is not exceeding the maximum ***nominal input current*** at minimum input voltage in normal situations.

The ***nominal input current*** is the result of the output power divided by the efficiency and input voltage. The input current varies inversely proportional to the input voltage. Please consider that an integral running-up front supplying converter is loaded with a super proportional current when a supplementary converter switches on at its minimum input voltage. It is recommended to switch on the supplementary converters after the supplying (5,1 / 3,3 / 1,2) V front converters achieved the nominal output voltage.

VI CE-conformity

Among other things it is necessary within the new EMC and security regulation for electronic equipment since 01.01.1996, to prove the power supply's CE conformity. To satisfy this requirement for the future, SYKO began already years ago to adapt the product range to the new situation with special developed, modern switching topologies.

Common one stage fly-back and forward concepts have been replaced in the most product lines with control system upgraded multi step concepts. These new concepts are featured with basically improved radio interference suppression and fundamentally improved characteristics at the same time e.g. wider input voltage range.

With the change of the product's concepts also the necessary measurement equipment have been purchased to be able to generate documented tests. To SYKO's development department disposal is a radio interference measuring cabin with measurement instrumentation for conducted disturbances (of EN, MIL, VG standards) as well as burst and surge test equipment. Special trained stuff is responsible for manufacturing guided support. With the own development of a generator long-term transients can be simulated.

Basically the compliance of security regulations is observed for all new power supply designs – as far as it is required. Among other things the main test criteria is the PCB-layout with the secured air and creepage distances in sufficient values, temperature cycle and aging tests (burn-In) as well as accurate compliance of component parameters. For sure at AC/DC power supplies the contact protection and faulty operation analysis is realised.

VII Corner parameters

SYKO does not put converter families in defined power classes. Instead of the power class for each power supply and its components, corner parameters like voltage, current and temperature for input and output are given.
The internal power loss defines the output power. This power loss is depending on the used switching topology but also depending on the input voltage range.

In principle with an input voltage range of 1:4 it not possible to work with Scotty-diodes in the rectifier circuit any more e.g. for 5V-outputs. The result is that the output power has to be reduced about factor 1,6 in compare with converters with an input voltage range of 1:2,5. Today in many multiple stage applications the diodes are replaced by synchronous switches, which stay cold.

At field-effect transistors the internal series resistance RDSON is the value, which defines the power loss. This resistance performs disproportional to the FET's nominal voltage. But the power loss can increase with the square $P_{loss} = Iin^2 \cdot RDSON$. Converters with limited input voltage range can perform higher output power as converters with wide input voltage range because of the lower input current. Even though the efficiency decreases with a wider input voltage range, which the multiple-stage topology can work against.

The operational temperature range also has a strong influence to the output power. Based on the operational area SYKO' power supplies in general can work with a temperature range of -25°C up to +70°C (Option -40°C/+85°C). When the user can limit this working temperature range, it is possible to increase the converter's output power considerably.

VIII Modifications / Temperature test

SYKO is able to adapt the following interface parameters of standard power supplies very flexible to the customer requirements:

- Input voltage / Input voltage range
- Output voltages
- Output currents
- Galvanic isolation
- Temperature range
- Switch-on/switch-off points and hysteresis
- Functionality

As long as the existing layout is not changed, the costs of modification are standard values for the catalogue converters. Single condition is the minimum order quantity of 10 pieces for modified converters. In general the series prices for modified power supplies are deduced from the standard prices of the corresponding series product. Following orders of modified converters are also based on the same prices as standard products.

All products, which leave the house SYKO, performed a 100% temperature test. All internal and peripheral interface parameters are 100% measured in accordance to Uin, load and temperature based on a test data sheet.

On request a documented temperature cycle test for SYKO converters can be performed. For this test 5 processor controlled inspection stations are available with automatic climatic-camber regulation over computer interfaces.

Additionally it is possible to perform a pre-aging with a documented long-term test (Burn-In. In this test the (rack) converters run under full load and regulated ambient temperature of 70°C in a closed cabinet for four, eight or more hours. Input and output parameters are regularly monitored and documented. Processor controlled instrumentation is available for this test.

IX Special modifications

For system applications in can be an advantage to order a new layout instead of using existing standard components. SYKO proved its competence and competitiveness in this area with many projects.

For Power supplies with multiple outputs different switching topologies have been developed, which are different in compare with present concepts because of the following:

- No crosswise load and functional interference of outputs in between each other
- All outputs short circuit proof, no-load and over load protected
- Easy to realise radio interference suppression
- Extreme wide input voltage range up to > 1:20 possible
- Compliance of all common disturbance requirements (burst, surge acc. To EN, VG, MIL, DO etc.)
- Any value of isolation, also in the transformer secured air and creepage distances
- Mechanical adaptation to the user requirements
- Very flexible heat connection
- Intergration of additional functions
- Each output separated switchable and adjustable from zero to maximum on request
- Combination of low voltage/current and high voltage/current outputs

Furthermore SYKO developed a special concept that allows to generating an active, extreme long hold-up time of more than 100 ms starting from minimum input voltage. The needed storage energy is not ordinary connected to the input (in this case the capacitor had to be resistant to the maximum input voltage), but connected to an active processed intermediate circuit.

With the upper explained switching concept UPS-solutions with battery charging are realised smartly. Many times it is necessary in mobile application (e.g. railway applications) to heat up or cool down the supplies electronic to the corresponding temperature requirements. In this case the possibility is given to realise an external logic with a complete power management system with multiple outputs for processors and periphery (e.g. LC-displays), UPS operation, supplying heat/cooling components (e.g. Peltier elements) and static functional monitoring. As standard series here can be named the SYKO product series DPV 01 (Power-Management) and LSR.P (current supply converter for Peltier elements).

An inquiry form for customised modifications is available in each product line overview underneath the download column as “Inquiry form button”.

X Manufacturing / Test laboratory / Documentation

The manufacturing is processed in accordance to DIN ISO 9001. SYKO performs an established, documented quality system. The production works according to documented data, which are given by the production planning system (PPS) and supplemented by CAD information. Special converters and modifications can be handled as standard components in this way.

The manufacturing is modern and transparent. At the moment two High-speed-SMD-assembling machines are available. The test laboratory is equipped with 10 installed measuring stations and high-precision measuring instrumentation. All converters, which leave our house, are 100% statically, dynamical and thermally adjusted, tested and loaded. The product specific test data sheet is binding in all parameters and is available for the customer after request.

A radio interference-measuring cabin is at disposal for conducted disturbances, near field measuring and comparable aerial measuring (emission). On request it is possible to certify complete systems including a SYKO power supply in accordance to CE-requirements.

Please inquire the actual version of the general sales delivery conditions at SYKO.

SYKO's power electronic components are high quality electronic products, which are performing a continuous testing in routine operating customer applications. Hence the given data in this catalogue are subject of changes in the meaning of the technical progress.

Based on the inquired flexibility in the area of research/development, production and organisation, the SYKO association was aligned and adapted to work with global market-specific requirements. This customized global orientation requires for the high functionality, complex and in medium and small batches produced items to use SYKO's manufacturing base in Mainhausen. We know about the fact, that standard knowhow for periodic series production can be much cheaper in global production locations.

Our customers appreciate the acquired competence of more than 40 years, in the areas of stationary and mobile markets on land, in water and in the air. And these customers can successfully penetrate new markets with their system ideas, which are realized with SYKO power supply solutions and the according specific requirements in mechanics and functionality.

For SYKO "Customised" means to be able to supply small and medium sized production batches to global customers and to be able to realise solutions for their national and international competence areas as well as to realise the specific specification requirements in the meaning of quality, functionality, mechanics and standards with SYKO's wide ranging knowhow. Hence the components with their described parameters, which are shown in each single data sheet and catalogue, are not standard items in the meaning of the availability. The given data are the information about the possibility to realise component solutions and modifications.

In the most cases of inquiries, SYKO can use existing layouts and standard knowhow for modifications to realize the customer required interface parameters. For totally new modified designs SYKO can offer a fair cost/performance ratio and deliver solutions in a short period of time.

All listed data and performance characteristics in this catalogue and the contained data sheets are not a guarantee of quality in accordance to §§ 444/639 BGB.

Mistakes, changes and errors excepted.

SYKO Gesellschaft für Leistungselektronik
Jahnstraße 2
D-63533 Mainhausen
Germany
Phone: +49(0)6182/9352-0
Fax: +49(0)6182/9352-15
info@syko.de
www.syko.de