

## Glossary

**AC Range** The input voltage that a power supply accepts during normal operation. Most Traco power supplies feature a universal input voltage range and are also applicable with DC input (but usually not certified for DC operation). Some older Traco power supplies might still provide user-switches to select the appropriate input voltage. Most accept any frequency between 47-63 Hz. See also Universal Input.

**Access Location** This defines the possibility of access. It could be type of building-in, with a restricted access location or free accessible.

**Altitude during Operation** Generally performed to determine the proper and safe functionality of equipment used above 2000m a.s.l..

**Table 8 – Multiplication factors for AIR CLEARANCES for altitudes up to 5 000 m**

RATED operating altitude (a) m	Normal barometric pressure kPa	Multiplication factor for MOOP	Multiplication factor for MOPP
$a \leq 2\,000$	80,0	1,00	1,00
$2\,000 < a \leq 3\,000$	70,0	1,14	1,00
$3\,000 < a \leq 4\,000$	62,0	1,29	1,14
$4\,000 < a \leq 5\,000$	54,0	1,48	1,29

According to 60601-1 © IEC:2005+A1:2012 (Page 122) for medical products or according to 62368-1 for IT equipment.

When operating at high altitudes, a slight output power derating shall be considered. This is necessary because thin air doesn't have the same cooling capabilities as dense air at sea level. It's not possible to define clear derating values, because of the big variety of influencing factors. Sufficient output power derating must be determined in the final application.

**Approved Ambient Temperature** The temperature of still air immediately surrounding a power supply or converter. Approved means that this value is conducted via a safety report. The temperature measurement should be made about 100 mm (4 inch) from the body of the converter or underneath of the power supply. See also Operating Temperature.

**ATEX** ATEX 94/9/EC is a European Directive which provides the technical requirements to be applied to equipment intended to use in potentially explosive atmospheres. It is named after the French «ATmosphere EXplosible».

**Bandwidth** A range of frequencies over which a certain phenomenon is to be considered.

**Base Material** A substrate to which circuit components are mounted or, a metal plate to which the power system is attached. Normally used to draw heat away from critical circuit components.

<b>Basic Insulation</b>	Basic or Supplementary Insulation satisfies the requirements of functional insulation but contains additional a single layer of required insulation applied to live parts to provide basic protection against electric shock. For this class of insulation, the input and output windings of transformer are not wound directly over one another, but are separated with a physical barrier, such as an insulating film. See also Insulation Class.
<b>Body floating</b>	“Body floating” is a term used to classify medical power supplies and it refers to the “patient leakage current” as per the medical safety standard IEC/EN 60601-1. Body floating applications are those which are used in direct conductive contact with the patient or in long term contact with the patient. To be classified as “BF” a power supply must provide a leakage current lower than 75uA.
<b>Boost Power</b>	The boost power facilitates the activation of stepper motors, solenoids, or actuators. It is a reserve power which is available constantly, to remove the need of more expensive higher rated power supply units. After the output has reached its steady state set value, the power supply can support surge loads with a higher short-term power demand up to 150% of maximum rated load, for a maximum duration of a few seconds. The Power Boost is available repetitively, provided that the average output power shall not exceed the continuous maximum operating condition.
<b>Breakdown Voltage</b>	The maximum AC or DC voltage that can be applied from input to output and/or chassis of a power supply without causing damage. It describes a voltage level at which dielectric insulation fails by excessive leakage current or arcing. See also Insulation Breakdown or Isolation Voltage (rated).
<b>Brownout</b>	A condition where the voltage supplied to the system drops below the specified nominal levels.
<b>Buffer Module</b>	A module with this feature will maintain a fixed output voltage of power supply during typical mains faults, short time blackouts or voltage dips. During this buffer period, no deterioration of the output voltage will occur. See also System Solution.
<b>Burn-in</b>	Burn-in is a process where marginal or accelerated thermal and electrical stresses under defined load conditions are applied to newly manufactured power supplies or DC/DC converters for extended periods. This process is used to ensure reliability and functionality of all TRACO POWER products.
<b>Burst</b>	Bursts of interference pulses simulate inductively loaded switches. The EFT waveform, as defined by the IEC 61000-4-4 standard, is intended to be used by manufacturers to test the performance of equipment when subjected to fast transients. See also EMC immunity.
<b>Capacitive Load</b>	The maximum output capacitive load is a value which limits the converter to start-up. Depending on the output current limitation characteristic of a converter, a corresponding (capacitive) load can be added. If the output current (inrush current of the load) exceeds the ability of the converter, it can go into current limitation. For converters with a constant power limit, a large capacitive load will lead to a slow ramp-up output voltage. For converters with a hiccup protected output, the device could continuously oscillate while trying to start.
<b>Case Ingress Protection</b>	A two-digit number according to EN 60529, is used to provide an Ingress Protection rating to an enclosure for electronic equipment, for example <i>IP67</i> . The first digit represents protection against ingress of solid objects. The second digit represents protection against ingress of liquids. The larger

the value of each digit, the greater the protection.

<b>Case Temperature</b>	The maximum temperature for safe operation of the power supply or converter case during operation. The temperature at a specified point should not exceed the datasheet value in the application. Often used as a specification for DC/DC converters with extended temperature ranges. See also Derating.
<b>CB-Report</b>	Document with the necessary tests and measurements for the mutual recognition of approvals required among different national safety test standards. <a href="http://www.cbscheme.org">www.cbscheme.org</a>
<b>CE Marking</b>	The mark consists of the letters CE (Conformité Européene) and indicates compliance with all relevant EC-directives which concern the marked product. It means that the natural or juristic person which executed or ordered marking has made sure that the good complies with all harmonised directives and has passed all conformity testing procedures required.
<b>Chassis Ground</b>	This is a connection to the main chassis of electrical equipment. It is also called common ground and ideally should lead to earth ground. It provides a reference that can be considered to have zero voltage. All other circuit voltages are defined with respect to it.
<b>CISPR</b>	International Special Committee on Radio Interference. See also Conducted Noise.
<b>Cleaning</b>	Only for hermetically sealed board mounted converters. Due to short-circuit hazard, TRACO POWER does not recommend washing insert moulded products, where it is difficult to get them dry inside. Please check also, if there is an additional comment about washing in the datasheet or application note of the concerned converter. Cleaning may reduce the reliability of the involved components in the application. Take "Cleaning Guideline" as reference. See also Encapsulated.
<b>Clearance Distance</b>	The shortest unimpeded distance through air separating two conductors or circuit components. The minimal required clearance distance may vary depending on the standards a product must comply with. See also Altitude during Operation, Safety Isolation or Working Voltage.
<b>Common</b>	A conductive path used as a return for two or more circuits. If the conductor is not connected to earth, do not confound with ground.
<b>Common-Mode Choke</b>	Common mode choke coils are made up of two conducting wires wrapped around a single ferrite core. If differential mode currents flowing through the coil generate flux in opposing directions, which cancel each other. Common mode choke coils are filters that only act as inductors for common modes, and not against differential modes. Because it presents a high impedance to common-mode signals and a low impedance to differential-mode signals.
<b>Common-Mode Noise</b>	When referenced to the local common or ground, a common-mode signal appears on both lines of a 2-wire cable, in-phase and with equal amplitude. Such signals can arise from one or more of the following sources: <ul style="list-style-type: none"><li>- Radiated signals coupled equally to both lines,</li><li>- An offset from signal common created in the driver circuit, or</li><li>- A ground differential between the transmitting and receiving locations.</li></ul> Common mode chokes will attenuate common-mode noise over a wide range of frequencies due to the high permeability of the core material. This is important to filter out the main switching frequency and its harmonics.

See also Noise or Differential-Mode Noise.

<b>Conducted Noise</b>	<p>Conducted noise will generally be in Common-Mode (CM) and appear across all external wires or connecting cables to a device. The source of this unwanted noise can include RF transmitters, switched-mode power supplies and other interconnected devices that have electronic activity in RF range. See also EMI conducted. There are different standards with limits and methods of measurement, e.g.:</p> <ul style="list-style-type: none"><li>- EN 55011 (CISPR 11): Industrial, scientific, and medical (ISM) radio-frequency equipment – Electromagnetic disturbance characteristics</li><li>- EN 55032 (CISPR 32): Electromagnetic compatibility of multimedia equipment - Emission Requirements</li></ul>
<b>Connection Type</b>	<p>There are several product series with different connection types, for example: SMD (surface-mount device), THD (through-hole device), wired or connectors like screw terminal, plug-in, or clip. The wire dimensions for power supplies with clip- or screw connectors can be found in the datasheet, application note or installation instructions (AWG and mm<sup>2</sup>). If several connector pins are specified the same for example double output pins for -V<sub>out</sub> and +V<sub>out</sub> because of the connectors max current rating, all output pins must be connected to the load.</p>
<b>Constant Current</b>	<p>A power supply or converter that regulates its output current to within a specified range regardless of changes in output load, input line or ambient temperature. This functionality is used in battery charging application. See also Overload Protection or Short Circuit Protection.</p>
<b>Cooling</b>	<p>The process of removing heat by convection (with forced air or natural) or by conduction. The internal heat must be dissipated out of the module. For that, the ambient temperature must always be lower than the maximum allowable internal temperature. The larger this difference, the more effectively waste heat can flow out of the DC/DC converter or power supply. Operating temperature range would be increased with forced air cooling by an internal fan. See also Forced Air Cooling.</p>
<b>Creepage Distance</b>	<p>The shortest path between two conductors along the surface of the insulation (typically one conductor primary and one conductor secondary). There are tables of creepage distances in safety standards for basic insulation given for various pollution conditions, materials and working voltages. These distances are doubled for reinforced insulation. See also Safety Isolation or Working Voltage.</p>
<b>Critical Components</b>	<p>Safety critical components perform functions that protect against electric shock, explosion, mechanical hazards, fire, etc. A safety critical component is essential to the compliance of the equipment. Such components are listed in a safety report. If one of those components shall be changed, the safety certification as to be done again with the modified components to keep compliance.</p>
<b>Cross Regulation</b>	<p>In a multiple output power supply or converter, the percent voltage change at one output caused by the load change on another output. Multiple output power supplies often require balanced or minimum loads to achieve stated regulation specifications.</p>
<b>CSA</b>	<p>Canadian Standards Association. An independent Canadian organisation testing for public safety, like the function of Underwriters Laboratories (UL) in the United States. <a href="http://www.csa-international.org">www.csa-international.org</a></p>
<b>Current Limitation</b>	<p>A circuit feature that protects the attached circuit (load) of a power supply or</p>

DC/DC converter (from damage during an overload condition. If the power supply or DC/DC converter is specified for auto restart, normal operation is automatically restored when the overload condition is removed. This feature is not intended to act as a self-protection. A current limitation is always an out of specification operation and shall be prevented. See also Overload Protection for Output Current Limitation figures or Foldback Current Limiting.

- Current Share** Multiple power supplies or DC/DC converters are often connected redundantly (to increase system reliability) or in parallel (to increase system power). If connected in parallel to increase total power, the outputs are connected together, and each power supply or DC/DC converter supplies approximately an equal «share» of the load current. If it is intended to increase maximum power, a parallel connection is not recommended due to undefined load sharing (except if the series, like TEQ 300WIR, TIS RED or TXL 750/1000, has such a load sharing feature specified in the datasheet).
- Derating** It is a physical condition that power conversion comes along with some power loss. This power loss depends on operating conditions. Depending on these conditions, only a reduced power can be obtained from the power supply or DC/DC converter. This must be observed in customer's design. For example: increased ambient temperature or low input voltage does not allow applying the full load. The specification therefore has the unit %/K or %/Vin. See also Temperature Margin ( $T_V$ ), Operating Temperature ( $T_H$ ) or Case Temperature ( $T_0$ ).
- Designed to meet** "Designed to meet" means that a parameter, safety standard or EMI standard is specified for a value that is better or higher than the value it was tested and approved by a safety and certification company.
- Design Lifetime** The design life of a product is the time during which the item is expected by its designers to work within its specified parameters. It is the duration of time between placement into service of a single item and its end of functioning. The lifetime is a certain value that depends on the particular use of a unit while the MTBF is a statistical value for reliability. See also MTBF.
- Device Style (Housing)** There are different housings of each converter series. They often come in encapsulated single- or double-in-line packages (SIP or DIP). Other package-types are cubiform, off-board module, encased, square (e.g., 2"x1") or for Din-Rail applications.
- Dielectric Strength** The maximum electric field that a pure material can withstand under ideal conditions without breaking down (e.g., without experiencing failure of its insulating properties). The insulation must withstand a DC or AC test voltage for 60 seconds. See also Working Voltage.
- Differential-Mode Noise** This kind of noise occurs when only one conductor of a current loop encounters a noise source. The noise therefore circulates within the loop. Disturbance on one line and return on the other. For example, this occurs when conductors are not closely coupled; such as in equipment internal wiring or when the noise is generated from circuit elements within the load or source itself. A practical solution for low differential mode noise is to add a low pass filter at the output of DC/DC converter with an external inductor in series and a capacitor in parallel of +Vout and -Vout. See also Noise.
- DIN Rail Mount** A DIN rail is a metal rail of a standard type to which industrial control devices inside equipment racks can be easily attached or removed. It is a mounting bracket or system that mates to the DIN rail. Few encased or

encapsulated power supplies or DC/DC converters have DIN-Rail-Clip as accessory. TRACO POWER uses Suffix “-MK” as order code.

**Distance Through Insulation (DTI)**

If a design is based on Distances Through Insulation (DTI), these distances shall be dimensioned according to the application of the insulation. See also Isolation Test Voltage. If peak Working Voltage does not exceed 71 V or if the device has functional or basic insulation, there is no requirement for DTI. But if the peak working voltage exceeds 71 V and there is condition for supplementary or reinforced insulation, then DTI shall be 0,4 mm or greater, provided by a single layer.

**Table 2A – Distance through insulation of internal wiring**

WORKING VOLTAGE (in case of failure of BASIC INSULATION)		Minimum distance through insulation mm
V peak or d.c.	V r.m.s. (sinusoidal)	
Over 71 up to and including 350	Over 50 up to and including 250	0,17
Over 350	Over 250	0,31

According to 60950-1 © IEC:2005+A1:2009+A2:2013 (Page 61) Table 2A

**Table 25 – Distance through insulation of internal wiring**

Working voltage in case of failure of basic insulation		Minimum distance through insulation mm
V peak or d.c.	V r.m.s. (sinusoidal)	
> 71 ≤ 350	> 50 ≤ 250	0,17
> 350	> 250	0,31

According to 62368-1 © IEC:2014 (Page 113) Table 25

**Double Insulation**

Insulation comprising both Basic Insulation and Supplementary Insulation. See also Reinforced Insulation or Insulation Class.

**Drift**

The change in output voltage of a power supply or DC/DC converter over a specified period, following a warm-up period, with all other operating parameters such as line, load and ambient temperature held constant.

**Dynamic Load**

A rapid change in load condition. During this load change, the output voltage may temporarily fall out of regulation. See also Transient Response or Transient Recovery Time.

**Earthing**

If the power supply has a field ground pin (FG), then it must be earthed to a safety ground point. To reduce EMC interference, use thicker and shorter cables to ensure good connection. "-Vout" can be also connected to FG to reference the output to Ground.

**Efficiency**

The ratio of total output power to input power expressed in percent. It is normally specified at full load and nominal input voltage. Since the value depends also on the input voltage, TRACO POWER indicates the value as typical. See also Power Dissipation.

**Electric Strength Test**

The electric strength of the solid insulation used in the equipment shall be adequate. Unless otherwise specified elsewhere in this standard the insulation is subjected either to a voltage of substantially sine-wave form having a frequency of 50 Hz or 60 Hz, or to a d.c. test voltage equal to the peak voltage of the prescribed a.c. test voltage. The voltage applied to the insulation under test is gradually raised from zero to the prescribed voltage and held at that value for 60 s. There shall be no insulation breakdown during the test. See also Isolation Test Voltage.

**Table 5B – Test voltages for electric strength tests based on peak working voltages Part 1**

Grade of Insulation	Points of application (as appropriate)						
	PRIMARY CIRCUIT to BODY PRIMARY CIRCUIT to SECONDARY CIRCUIT between parts in PRIMARY CIRCUITS					SECONDARY CIRCUIT to BODY between independent SECONDARY CIRCUITS	
	WORKING VOLTAGE $U$ , peak or d.c.					WORKING VOLTAGE $U$	
	Up to and including 210 V <sup>a</sup>	Over 210 V up to and including 420 V <sup>b</sup>	Over 420 V up to and including 1,41 kV	Over 1,41 kV up to and including 10 kV <sup>c</sup>	Over 10 kV up to and including 50 kV	Up to and including 42,4 V peak or 60 V d.c. <sup>d</sup>	Over 42,4 V peak or 60 V d.c. up to and including 10 kV peak or d.c. <sup>d</sup>
	Test voltage, volts a.c. r.m.s.						
FUNCTIONAL	1 000	1 500	see $V_a$ in Table 5B, part 2	see $V_a$ in Table 5B, part 2	$1,06 U$	500	see $V_a$ in Table 5B, part 2
BASIC, SUPPLEMENTARY	1 000	1 500	see $V_a$ in Table 5B, part 2	see $V_a$ in Table 5B, part 2	$1,06 U$	No test	see $V_a$ in Table 5B, part 2
REINFORCED	2 000	3 000	3 000	see $V_b$ in Table 5B, part 2	$1,06 U$	No test	see $V_b$ in Table 5B, part 2

According to 60950-1 © IEC:2005+A1:2009+A2:2013 (Page 183) Table 5B

**Table 27 – Test voltages for electric strength tests based on peak working voltages**

Peak working voltage up to and including	Test voltage for basic insulation or supplementary insulation	Test voltage for reinforced insulation
kV peak	kV peak or d.c.	
0,33	0,43	0,53
0,5	0,65	0,8
0,8	1,04	1,28
1,5	1,95	2,4
2,5	3,25	4
4	5,2	6,4
6	7,8	9,6
8	10,4	12,8
12	15,6	19,2
$U_p$ <sup>a</sup>	$1,3 \times U_p$ <sup>a</sup>	$1,6 \times U_p$ <sup>a</sup>
Linear interpolation may be used between the nearest two points.		
<sup>a</sup> $U_p$ is any peak working voltage higher than 12 kV.		

According to 62368-1 © IEC:2014 (Page 115) Table 27

## EMC

Electromagnetic Compatibility, relating to compliance with electromagnetic emissions and susceptibility or immunity standards. EMC pursues three main classes of issue: Emission, Immunity and Coupling. There are different generic emissions and immunity standards e.g.: EN61000-6-1, EN61000-6-2, EN61000-6-3, EN61000-6-4

## EMC Emission (EMI)

Electromagnetic interferences, also called radio-frequency interference (RFI) or Emission is the generation of electromagnetic energy by some power supply or DC/DC converter and its release into the environment. EMI can be conducted through the input or output lines or radiated through the air. The generic standards for emission includes several basic standards like CISPR 22 or CISPR 11 (each class A or B) with test-limits (dB QP or AV) for all different ports (enclosure, DC input power port, AC mains power ports).

<b>EMC Immunity (EMS)</b>	Electromagnetic susceptibility or immunity are electronic disturbances that may interrupt, disturb, or otherwise impair the performance of electronic equipment. The generic standards for immunity include a set of basic standards EN 61000-4-x, which are used to test system transient immunity with different test values referred to application-objective. The test values of each basic standard depend on the testing port (enclosure, AC power, DC power or I/O signal) and must reach defined performance criteria. Many system designs specify one or more of the tests listed within the EN 61000-4-x specification to comply with reliability standards for end customers. The most common tests are immunity against ESD, EFT and surge. See also Performance Criteria.
<b>EMI Conducted</b>	Conducted EMI is unwanted high-frequency energy caused e.g., by the switching transistors, output rectifiers, and transformers in switching power supplies and DC/DC converters and reflected into the power line. That portion that is present on the input and output lines are known as Conducted EMI. Most Conducted EMI measurements are done between 150 kHz and 30 MHz. See also Conducted Noise.
<b>EMI Filter</b>	Switch mode power supplies and most DC/DC converters are filtered by using an EMI filter on the primary side to be compliant with applicable EMC standards. When power supplies or converters are used in «real» situations, driving active electronic circuits, especially those featuring high speed and/or high-power switching, the characteristic of the interferences generated can change dramatically, thereby reducing the effectiveness of the EMI-filter. It is the final equipment as an entity, which is required to conform to the regulations, not only the individual internal sub-assemblies, like power supplies or converters. So, specifying a power supply or converter which meets the EMI classes does not remove the need for testing of the completed equipment for conformity. The employment of EMI compliant power supplies or converters is not a guarantee of system compliance.
<b>EMI Radiated</b>	Radiated EMI is unwanted high-frequency energy caused e.g., by the switching transistor, output rectifiers, and Zener diodes in switching power supplies and DC/DC converters and emitted into the area surrounding a power supply or DC/DC converter. That portion that is radiated through the air is known as Radiated EMI. Most radiated EMI measurements are done between 30 MHz and 300 MHz or 30 MHz and 1 GHz.
<b>EMS Filter</b>	EMS Filter suppresses surge and EFT. It also protects the circuit behind from damage. Often an external input filter capacitor is required if the module must meet EN61000-4-4, EN61000-4-5. See also External Input Capacitor.
<b>Encapsulated</b>	Hermetically sealed and may be contained in a thermally conductive epoxy resin or similar plastic as potting compound.
<b>Enclosed</b>	Covered in a metal or perforated metal cover assembly.
<b>Environmental Tests</b>	Environmental Engineering Considerations and Laboratory Tests such as MIL-STD 810F, IEC 60068-2-27 or EN 61373 to provide a standard that emphasizes tailoring equipment's environmental design. They also set the limits for the conditions that will occur throughout their design lifetime and mimic the effects of the environments. The standard guidance and test methods for mechanical shock, vibration and thermal shock are intended to define environmental stress sequences, durations, and levels when exposed to a life cycle of environmental stresses. See also Mechanical Shock Test, Vibration Test or Thermal Shock.



<b>ErP</b>	A European Directive defining no load power consumption limits and minimum efficiency levels of external power supplies. Traco power supplies are considered as components, therefore TRACO POWER refer them as ErP ready, if the requirements are fulfilled.
<b>ESD</b>	Electrostatic Discharge (ESD) is the current produced by two objects having a static charge when they are brought close enough to produce an arc or discharge. See also EMC Immunity.
<b>ESR</b>	Equivalent Series Resistance (ESR). The amount of resistance in series with an ideal (loss less) capacitor, which exactly duplicates the performance of a real capacitor. In general, the lower the ESR, the higher the quality of the capacitor and the more effective it is as a filtering device. ESR is a prime determinant of ripple in switching power supplies.
<b>External Input Capacitor</b>	For correct measurement of fast transient and surge, an external input capacitor is needed. E.g., Nippon Chemi-Con KY 220 $\mu$ F, 100 V, ESR 48 m $\Omega$ in parallel to a TVS diode might help to reduce input surge voltage. The corresponding datasheet contains further information. See also EMS Filter.
<b>Faraday Shield</b>	An electromagnetic shield, which is placed between input and output windings of a transformer and is used to reduce coupling capacitance, which in turn reduces output common mode noise. The induced charges create an opposing electric field that cancels the external electric field throughout the case.
<b>FCC</b>	The Federal Communications Commission is a US government agency that sets standards for the testing of conducted and radiated emissions. These are system level standards, but they are also used in power supplies and DC/DC converter specifications.
<b>Filter</b>	A frequency-sensitive network that attenuates unwanted noise and ripple components of a output. Could be internal or adapted as external circuit to a DC/DC converter. See also Input Filter, Output Filter, or Settling Time.
<b>FIT</b>	Failure In Time (FIT) specify the failure rate usually based on 1 billion ( $10^9$ h) operating hours. It can be calculated out of the MTBF: $FIT = 10^9 \text{hours} / \text{MTBF}$ . See also MTBF.
<b>Flammability</b>	Compliance can be achieved by using UL94 V-2 or better rated insulating and printed board materials. The flammability standard requires that the equipment design: <ul style="list-style-type: none"><li>- Avoids high temperatures, or shields and separates flammable materials from high temperature parts.</li><li>- Uses materials of low flammability both internally and for enclosures.</li><li>- Uses fire enclosures to limit the spread of fire.</li></ul>
<b>Flicker and Voltage Fluctuations</b>	"Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems", for equipment with rated current $\leq 16$ A per phase and not subject to conditional connection concerning EN61000-3-3 (for AC mains power ports). See also EMC Emission.
<b>Floating Output</b>	A power supply or DC/DC converter output that is ungrounded and not referenced to another output. Typically, floating outputs are fully isolated and may be referenced as either positive or negative by the user.
<b>Flyback Diode</b>	A diode connected across an inductor used to eliminate flyback, which is the sudden voltage spike seen across an inductive load when its supply

current is suddenly reduced or interrupted.

**Foldback Current Limiting**

A method of protecting a power supply or DC/DC converter from damage in a high overload or short-cut condition. The output current decreases with increasing overload, reaching a minimum at short circuit. This minimizes the internal power dissipation under overload conditions and protects the load attached. For a figure see Overload Protection. See also Short Circuit Protection or Current Limitation.

**Forced Air Cooling**

The use of a fan (or other air moving equipment) within a system to move air across heat producing components to increase the heat dissipation and therefore decrease the case temperature. See also Cooling.

**Full Load**

The maximum value of output load specified for a power supply or DC/DC converter under continuous operating conditions. The load could be resistive, capacitive, inductive or a combination. See also Load, Settling Time or Derating.

**Functional Insulation**

For Functional or Operational Insulation, the isolation is sufficient for the converter to function, meets the appropriate requirements for safety separations and will not provide a fire hazard during a fault. But functional isolation has no protection against electrical shock (just proper functioning). A lot of DC/DC converters are in this class as they are powered from non-hazardous voltages. This insulation class has the advantage of a very compact sized transformer which, despite the small size, can withstand up to 3 kV electric strength test voltage (DC). See also Electric Strength Test or Insulation Class.

**Galvanic Isolation**

The galvanic or electrical insulation of the primary circuit (input) and secondary circuit (output) is called isolation, meaning that there is no direct current path between the two circuits. Galvanic isolation (separation) is achieved by using transformer, opto-coupler, etc. The isolation is required to separate high-voltage circuits from safety extra-low voltage (SELV) or user-touchable circuits. The isolation carries specific characteristics like isolation voltage, isolation capacitance and isolation resistance. If these specifications cannot be found in datasheet, it can be assumed that the converter is not isolated. If the converter has just one common ground (for input and output) it is of course not isolated. See also Insulation Class.

**Ground**

Ground is the reference point from which voltages are measured. It is usually electrical connected to earth. A power supply or DC/DC converter "common" is not actually ground unless it is connected to earth.

**Ground Loop**

An unintended feedback condition caused by two or more circuits sharing a common electrical line, usually a common ground line. Voltage gradients in this line caused by one circuit may be capacitive, inductive, or resistive coupled into the other circuits via the common line.

**Harmonic Current Emissions**

"Limits for mains harmonic current emissions" is an international EMC standard concerning the harmonics emitted by electric equipment for AC mains power ports (EN61000-3-2). Just for equipment with input current  $\leq 16$  A per phase. See also EMC Emission.

**Harmonic Distortion**

This distortion is caused by the switching components and leads to multiple harmonics of the fundamental frequencies at input side. It is a gauge for the deviation of the actual input current from a sinusoidal current.

**Hazardous Voltage**

The definition of hazardous voltage is any voltage exceeding 42.2 Vac peak or 60 Vdc without a limited current circuit. Extra-Low Voltage (ELV) is called

a voltage in a secondary circuit not exceeding 42.4 Vac peak or 60 Vdc, the circuit being separated from hazardous voltage by at least basic insulation.

**Heat-Sink**

A metal plate, extrusion, case, etc. that is used to transfer heat away from sensitive components or circuits. Adding a heat-sink can be very effective, particularly in addition to a forced-air cooling system. For better thermal contact to the case, thermally conductive paste or pads and mounting clamps shall be used. See also Cooling.

**Hiccup Mode**

An operating mode triggered by an output fault condition (short circuit) in which the power supply or DC/DC converter cycles on and off till the short condition has been removed. The disadvantages of hiccup protection are that high capacitive loads can trigger the hiccup mechanism and the converter does not start up correctly. See also Short Circuit Protection.

**Hold-Up Time**

The time during a power supply or DC/DC converter output voltage remains within specification after the loss of input power.

**Housing Material**

It describes the material of the enclosure material. The housing material could be e.g. aluminium, nickel coated copper, plastic, stainless steel or fibreglas.

**Humidity**

The maximum moisture content permissible in the surrounding air of a power supply or DC/DC converter (within a specified temperature range).

**IEC**

International Electrotechnical Commission. The IEC is an organisation located in Switzerland (Geneva) that submits standards for electronic products and components. IEC standards must be adopted by national safety organisation to become legal (mandatory) standards. [www.iec.ch](http://www.iec.ch)

**IEC-Ex**

The objective of the IECEx system is to facilitate international trade in equipment and services for use in explosive atmospheres, while maintaining the required level of safety. Ex areas can be known by different names such as "Hazardous Locations", "Explosive Atmospheres", and the like and relate to areas where flammable liquids, vapours, gases, or combustible dusts are likely to occur in quantities sufficient to cause a fire or explosion. See also ATEX.

**Impedance**

Impedance, represented by the symbol Z, is a measure of the opposition to electrical flow. For DC systems, impedance and resistance are the same, defined as the voltage across an element divided by the current ( $R = U/I$ ). In AC systems, the "reactance" enters the equation due to the frequency-dependent contributions of capacitance and inductance. Impedance in an AC system is still measured in ohms and represented by the equation  $Z = U/I$ , but U and I are frequency-dependent (phase-shifted).

**Input Current**

The current drawn by a power supply or DC/DC converter, which can be measured under a range of input voltage and output load conditions. Typically listed as the maximum continuous input current under lowest input voltage and maximum output load so that proper fusing may be determined.

**Input Filter**

**Input Line Filter:** A low-pass or band-reject filter on the input of the power supply that attenuates differential noise from the system power bus (internal or external).

**Common Mode Filter:** Differential wound transformer with high impedance to common mode signals and low impedance to differential mode signals.

**PI-Filter:** A commonly used filter at the input of a switching power supply or DC/DC converter to reduce reflected ripple current.

<b>Input Protection</b>	A component or circuit that protects the input of the power supply or DC/DC converter from damage if a fault condition occurs on the input side (surge, transients, short circuit). Protection circuits can range from a simple fuse or capacitor to a full EMC-protection module. (See notes about external components in the datasheet.)
<b>Input Range</b>	Nominal input value of either AC or DC input voltage for which the power supply is designed for.
<b>Input Transient</b>	A spike or step change in the input line to a power supply or DC/DC converter. Input transient protection circuits are used to shield sensitive components (such as semiconductors) from possible damage due to transient voltages. See also Transient Response.
<b>Input Voltage Range</b>	Describes the input voltage range to which the device can maintain functional performance over the operating temperature range at full load. A common specification for DC/DC converters is to specify the ratio of high line to low line. "2:1" is the standard range, where the ranges usually are 4.5 - 9 Vdc, 9 - 18 Vdc, 18 - 36 Vdc or 36 - 75 Vdc. "4:1" is the enhanced range, where the ranges usually are 9 - 36 Vdc, 18 - 75 Vdc or 43 - 160 Vdc.
<b>Input Voltage Variation</b>	Input voltage variation, also known as slew rate, is defined as the change of voltage per unit of time. The input voltage must vary within those limits to guarantee a correct operation of the device attached.
<b>Inrush Current</b>	A high surge of input current that occurs in power supplies or DC/DC converters during initial turn on. It is caused by charging the input capacitors. The start-up sequence takes several milliseconds. During the first microseconds, the converter draws a very high current peak known as the inrush current. The inrush current is a multiple of the expected maximum input current during operation.
<b>Inrush Current Limiting</b>	A circuit which limits the inrush current during turn-on of a power supply or DC/DC converter. To limit the inrush current, there are many approaches possible. First, a simple NTC can be used. The NTC has initially a high resistance which limits the inrush current. The disadvantages are: power loss during operation and the NTC works as current limiter in cold start situations only. Another possibility is a common low resistor at the input side with a switch in parallel (e.g., FET or relay) shorting the resistor after a certain time (by a RC-circuit).
<b>Insulation Breakdown</b>	Insulation breakdown is considered to have occurred when the current (that flows as a result of the application of the test voltage) rapidly increases in an uncontrolled manner, that is the insulation does not restrict the flow of the current. Corona discharge or a single momentary flashover is not regarded as insulation breakdown. See also Breakdown Voltage.
<b>Insulation Class</b>	Isolation, specifically channel-to-earth ground isolation, is important for three reasons: signal integrity, safety, and instrument protection. An electrically safe system relies on the use of safety earthing, the insulation of hazardous voltages and the control of leakage currents. The different types of insulation grades describe protection against electrical shock are listed below. See also Galvanic Isolation, Leakage Current or specific description for each term. <ul style="list-style-type: none"><li>- Operational or Functional Insulation</li><li>- Basic Insulation</li><li>- Supplementary Insulation</li><li>- Double or Reinforced Insulation</li></ul>

<b>Inverter</b>	A device that delivers AC power when energised from a DC power source.
<b>Isolation Capacitance</b>	The isolation capacitance of a power supply or DC/DC converter measured from the input pins to the output pins. This is an undesired but inevitable capacitance formed by capacitive coupling between the transformer primary and secondary windings and intentionally placed capacitors for EM-compliance.
<b>Isolation Resistance</b>	The electrical resistance of an insulating material. It's measured between input and output circuits.
<b>Isolation Test Voltage</b>	<p>A voltage test to determine if the breakdown voltage of a transformer, power supply or DC/DC converter fulfils the minimum requirements. It is performed by applying a high voltage between the two isolated test points (typically input-to-output, input-to-ground, or output-to-ground). In production the isolation of a power supply or DC/DC converter will be tested for a time of 1 to 6 seconds max. (according to EN 50116) in order not to cause stress to the insulation material.</p> <p>The repeated high voltage isolation testing of the converter can degrade isolation capability depending on materials, construction, environment etc. Therefore, the number of tests should be strictly limited. We strongly advise against repeated high voltage isolation testing, but if it is necessary, the voltage should be reduced by 20% from specified test voltage. See also Isolation Voltage.</p>
<b>Isolation Voltage (rated)</b>	Rated Isolation voltage is defined as the maximum voltage across the isolation barrier (i.e., input to output for converters or primary to secondary for power supplies and transformers) a device can withstand for a fixed time. Usually, this time is specified as 60 seconds (according to UL/EN/IEC 60950 and UL/EN/IEC 62368-1). See also Dielectric or Electric Strength Test or Working Voltage.
<b>Leakage Current</b>	<p>It is the current that flows from either AC or DC circuit in an equipment to the chassis, or to the ground, and can be either from the input or the output at a specified voltage level. If the equipment is not properly grounded, the current flows through other paths such as the human body. If there is a known isolation capacitance and a known frequency for either the noise or test signal, then the expected leakage current between input and output circuits can be calculated from the impedance. To reach a low leakage current, high noise immunity designs, high isolation DC-DC converters should be selected with an appropriate low isolation capacitance. EN 60601 defines leakage current of three different sources. <b>Earth Leakage</b>; current flowing down the protective earth conductor of the mains inlet lead. <b>Touch Current or Enclosure Leakage Current</b>; current flowing to earth through a person by touching the enclosure of medical equipment or system. <b>Patient Leakage or Applied Part</b>; current flowing through a person connected to earth from the applied part. It can either flow from the applied parts via the patient to earth or from an external source of high potential via the patient and the applied parts to earth.</p> <p>For class II products there is no PE connection (due to double- or reinforced isolation). Without PE connection there is no earth leakage current - only touch current will be measured.</p>

<b>Life Cycle</b>	The complete life cycle of TRACO POWER products cannot be stated in general. It depends on so many factors (such as customer demand, component availability, new designs) that there is a quite big difference possible from one product series to another. But: TRACO POWER is known to have its products available over a very long duration of time in the market. See also Status Code.
<b>Line Regulation</b>	The variation of an output voltage due to a change of the input voltage, with all other variables held constant. Line regulation is expressed as the maximum percentage change in output voltage as the input voltage varied over its specified range.
<b>Load</b>	The electronic components or circuitry connected to the output of a power supply or DC/DC converter defines the load. The characteristic (resistance, reactance, etc.) of the load determines the power drawn from the power supply or DC/DC converter. The load is proportional to the output current (not to the impedance attached to the output).
<b>Load Regulation</b>	Variation of the output voltage due to a change of the output load within a specified range with all other factors held constant. The load change may be specified for no load to full load, 20 % load to full load or 10 % load to 90 % load and is specified as a percentage of the nominal DC output voltage.
<b>Load Share</b>	Ability of power supplies or DC/DC converters to split the total current into different similar parts supplied by different sources. Therewith, it an overload condition of one device can be prevented, while another device has hardly any current to supply. For example, TEQ 300 series come with an internal load share feature (also called as power share). A load share accuracy specified by $\pm 10\%$ means, that the difference of supplied power between different paralleled units is below 10%. A parallelization of two TEQ 300 for example fits to a max. 540W application (rated output power x numbers of units x 0.9). Do not forget power derating vs ambient temperature and do not place the units too close together (air flow).
<b>Low Input Voltage</b>	Some of our products require a derating when the operational input voltage is below a certain threshold stated in the datasheet. See also Derating and product specific Application Notes
<b>LVD (Low Voltage Directive)</b>	The Low Voltage Directive covers electrical equipment designed for use with a voltage rating between 50 and 1000 volts for alternating current (AC) or between 75 and 1500 volts for direct current (DC). Products falling under the general principles of the Low Voltage Directive and the relevant particular safety standards are marked with the CE marking to indicate compliance and acceptance throughout the EU. <a href="http://ec.europa.eu/growth/sectors/electrical-engineering/lvd-directive/">http://ec.europa.eu/growth/sectors/electrical-engineering/lvd-directive/</a>
<b>Maximum Rating</b>	Limit of specifications, if exceeded, could cause shutdown or damage of a power supply or DC/DC converter.
<b>Means of Protection</b>	A medical equipment shall have two Means of Protection to prevent applied parts and other accessible parts from exceeding the voltage-, current- or energy-limits. This ensures that if one MOP fails, there is always another MOP to protect the patient or operator. See also MOOP / MOPP.
<b>Mechanical Shock Test</b>	Shock tests are performed to provide a degree of confidence that a material can physically and functionally withstand the relatively infrequent, non-repetitive shocks encountered in handling, transportation, and service environments. See also Environmental Tests.

<b>Minimum Load</b>	If a minimum load >0% or a minimum output current is specified, the converter requires an equivalent minimum load for correct operation. In case the value is below the specified minimum load, the operation within specifications is not guaranteed (e.g., increased output voltage). Almost all TRACO POWER converters do not have minimum load requirement. See also Load.
<b>MOOP / MOPP</b>	MOOP is defined as a Means Of Operator Protection. MOPP is the short form for Means Of Operator Protection. The isolation requirements for patient protection are higher than for patient protection (e.g., regarding clearance and creepage distance).
<b>MTBF</b>	The Mean Time Between Failure is a unit of measure, expressed in hours, that gives an indication of the relative reliability of a power supply or DC/DC converter. MTBF is based upon actual operating data (demonstrated) or derived per the conditions of a referenced standard (calculated). TRACO POWER calculates MTBF values for their products in general for ground benign and at +25°C ambient. Therefore, the MTBF is a value to assess the failure probability after a specific operation time. The MTBF is not a specification for the lifetime of a product. See also MTTF.
<b>MTTF</b>	Mean Time To Failure is a statistic parameter to describe the operational mean time to a failure of the product. Early failures are also considered. For TRACO POWER products, where repair is not foreseen and early failures are greatly reduced by an adequate burn-in during production, MTTF and MTBF can be defined as approximately the same. See also MTBF.
<b>N+1</b>	A power system technology used to achieve higher reliability levels through system redundancy. The system consists of a number (N) of power supplies or DC/DC converters connected in parallel, sharing the power drawn by the system load. One more (+1) power supply or DC/DC converter than required (to provide full load) is used (i.e., for a 600 W load, three 300 W power supplies are used). Thus, if any single power supply or DC/DC converter fails, the remaining units will continue to supply the load. An isolation device such as an ORing diode ensures that a short within one power supply or DC/DC converter will not cause the entire system to fail.
<b>Natural Convection</b>	The dissipation of heat by convection caused by the natural movement of air (without fans). This air flow is usually defined as 20 LFM resp. 0.1 m/s.
<b>Noise</b>	Noise is the aperiodic, random component of undesired deviations in output voltage. When an electrical load is connected to a source, a current loop is formed. Noise can enter any current loop in a number of ways but can be largely categorised into common-mode or differential-mode noise. Short leads and proper grounding techniques shall be used. Noise could also easily be reduced by using small capacitors or filter inductors. See also Common-Mode Noise, Differential-Mode Noise or Ripple and Noise.
<b>Nominal Value</b>	Standardized value that is used as a reference point. Stated or objective value for a quantity, such as output voltage, which may not be the actual value measured.
<b>Off Idle Input Current</b>	In "remote off" state the max. drawn current by the power supply or DC/DC converter when its outputs are disabled. See also Remote Control.
<b>Open Frame</b>	A type of power supply which is not encased in a metal or plastic case or frame and subsequently is not surrounded by a potting compound. Their components are visible.
<b>Operating Temperature</b>	Operating temperature range of the converter is limited due to specifications

of the components used for the internal circuit of the power supply or DC/DC converter. TRACO POWER gives an operating temperature range, with minimum and maximum values. The maximum operating temperature is mostly the point, where a power derating of about 50% must be considered. The output power has therefore to be less than the nominal power to ensure function and guarantee specifications over the whole lifetime of the converter. See also Derating.

**ORing Diodes**

Used in parallel operation and called decoupling diodes. These diodes ensure that current can flow in only one direction - out of a power supply or DC/DC converter. Without the diodes in such a redundancy operation, a short on one device output could cause all power supplies to go into protection mode and generate a failure within a system. See also Parallel Operation.

**Output Filter**

A circuit that attenuates noise and ripple current present on an output. Normally, a power supply or DC/DC converter will include internal output filtering. For critical applications, external filter components may be added.

**Output Voltage Adjustment**

Some of the power supplies and DC/DC converters offer the feature of trimming the output voltage in a certain range around the nominal value with an internal trim potentiometer or by using external trim resistors.

**Over Temperature Protection**

Over temperature protection (OTP) is a protection against overheat of the converter. If the converter exceeds a certain temperature, it turns off. There are multiple ways to get the converter back to the "normal" state: The converter restarts automatically ("Auto recovery"). If nothing is specified, the converter must be restarted manually after it has cooled down. Most converters do not have an OTP implemented. OTP is not an overload protection. An activation of an OTP is always a result of an out of specification usage and must be prevented in the application.

**Over Voltage Category**

IEC defines the Installation Categories to address transient voltages. Installation Category is also (and better) known as Over Voltage Category. Equipment of Over Voltage Category II is energy-consuming equipment to be supplied from the fixed installation (e.g., at mains outlet). Most Traco power supplies are safety tested according to Installation Category II. For example, a 264 Vrms Cat. II device can handle transients of up to 2500V.

**Table G.1 – AC mains transient voltages**

AC MAINS SUPPLY voltage <sup>a</sup>  V r.m.s.	MAINS TRANSIENT VOLTAGE <sup>b</sup>			
	V peak			
	Overvoltage Category			
	I	II	III	IV
up to and including 50	330	500	800	1 500
over 50 up to and including 100	500	800	1 500	2 500
over 100 up to and including 150 <sup>c</sup>	800	1 500	2 500	4 000
over 150 up to and including 300 <sup>d</sup>	1 500	2 500	4 000	6 000
over 300 up to and including 600 <sup>e</sup>	2 500	4 000	6 000	8 000

According to 60950-1 © IEC:2005+A1:2009+A2:2013 (Page 222) Table G.1



**Table 13 – Mains transient voltages**

AC mains voltage <sup>a</sup> up to and including  V r.m.s.	Mains transient voltage <sup>b</sup> V peak			
	Overvoltage category			
	I	II	III	IV
50	330	500	800	1 500
100 <sup>c</sup>	500	800	1 500	2 500
150 <sup>d</sup>	800	1 500	2 500	4 000
300 <sup>e</sup>	1 500	2 500	4 000	6 000
600 <sup>f</sup>	2 500	4 000	6 000	8 000

According to 62368-1 © IEC:2014 (Page 93) Table 13

**Over Voltage Clamp**

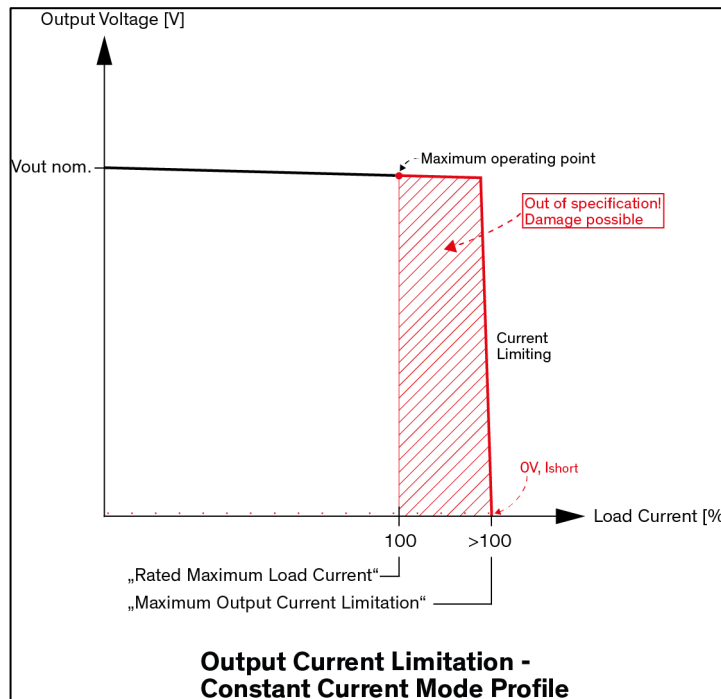
The clamp Zener diode limits the voltage level to a reference point and is used as part of a protection circuit.

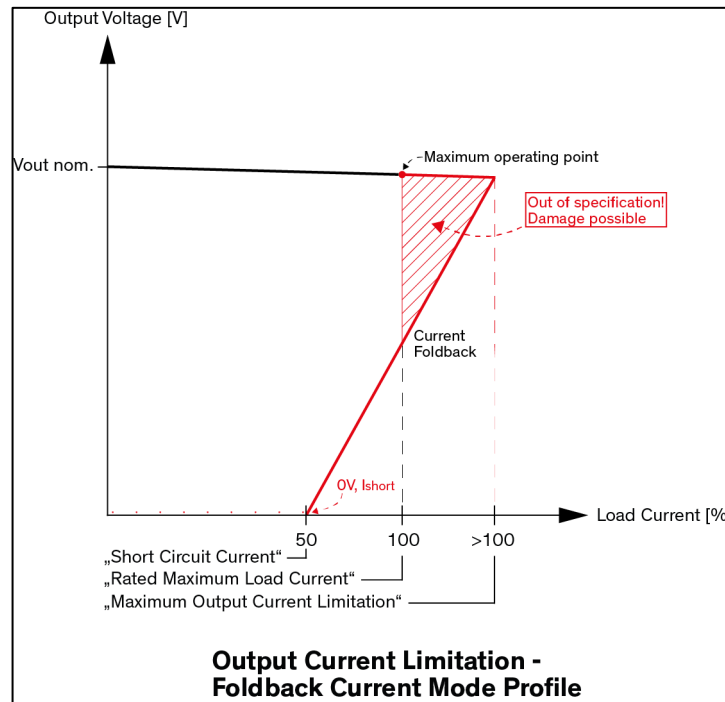
**Over Voltage Protection**

A protection mechanism for the load circuit which shuts down the supply or crowbars or clamps the output when its voltage exceeds a certain level. If the voltage level at the output exceeds the specified threshold value, a second protection circuit (e.g., a Zener diode) protects the output and therewith the load from an over voltage. See Over Voltage Clamp.

**Overload Protection**

One of the problems resulting from over current is that excessive heat may be generated in a power supply or DC/DC converter; especially MOSFET and Schottky diodes and the temperature of those devices may exceed their specified limits. Overload Protection is a protective feature that limits output power or current demands to prevent damage at the load attached to the power supply or DC/DC converter. By a defined current limit knee, at which current begins to foldback or limit on a plot of output voltage vs current. Since the overload condition (to enter the overload protection) is an out of specification usage, it is not a functional self-protection of the power supply or DC/DC converter but a protection of the load. See also Current Limitation, Foldback Current Limiting or Hiccup Mode.





## Overshoot Voltage

Transient change in output voltage that exceeds specified accuracy limits. Typically occurs on power supply or DC/DC converter while turning on/off or during a step change in output load or input line. See also Transient Response.

## Packaging

Information about how the power supplies or DC/DC converters are packed and shipped. It could be single packaging, tube, tray, tape&reel or carton with specified number of boxes.

## Parallel Operation

The connection of the outputs of two or more power supplies or DC/DC converters of the same output voltage to obtain a higher output current than from either power supply or DC/DC converter alone (including decoupling diodes). This requires power supplies or DC/DC converters specifically designed to share the load. If load sharing is not supported, a parallel connection does just lead to a redundancy operation without increasing the total power.

## Partial Discharge

Partial Discharge describes the momentary partial breakdown due to the high applied voltage between coupling paths within an insulation medium due to internal voids or inconsistencies. A partial discharge is not an insulation breakdown, but if it occurs frequently, it can lead to a breakdown. See also Hi-Pot Test or Isolation Voltage.

## Peak Output Current

The maximum peak current that can be delivered to a load during transient load conditions, such as electric motor starts. See also Boost Power.

## Performance Criteria

Results of immunity tests are classified in its standard into four categories:  
 perf. criteria A: performance within specification limits  
 perf. criteria B: temporary degradation which is self-recoverable  
 perf. criteria C: temporary degradation which requires operator intervention  
 perf. criteria D: loss of function which is not recoverable

## Pi-Filter

A commonly used filter at the input of a switching power supply or DC/DC converter to reduce reflected ripple current. The filter usually consists of two parallel capacitors and a series inductance. See also Input Filter.

<b>Pin Material</b>	For components with pins (THD or SMD), the pins consist of a base material and become a special foundation and surface plating with materials like tin or gold in different thickness.
<b>Pinout</b>	This is a cross-reference between the contacts, or pins of a component and its functionality. For THD devices there are different outline dimensions with similar positions of pins such as SIP- or DIP-standard pinning.
<b>Pollution Degree</b>	The Pollution Degree (PD) is an environmental rating that specifies the amount of dry pollution and condensation that a power supply or DC/DC converter can handle while functioning properly. Almost all TRACO POWER products are classified as PD 2 components. The minimum creepage distances are defined by the operating voltage, surface conductivity of the materials used and the pollution degree. See also Safety Isolation table or Creepage Distance.
<b>Potting Material</b>	For DC/DC converter, potting is a process of filling the complete electronic device with a solid or gelatinous compound for resistance to shock and vibration, and for exclusion of moisture and corrosive agents. It can also be used as an isolation barrier. TRACO POWER uses UL94 V-0 rated silicone or epoxy which is a plastics flammability standard released by Underwriters Laboratories. Thermally conductive potting compounds are in addition an effective way to control the heat build-up in an electronic assembly.
<b>Power Back Immunity</b>	When external voltage is supplied above set output voltage and below OVP threshold, the power supply will function normally up to the specified Power Back Immunity value without switching off, even if external voltage is applied continuously.
<b>Power Consumption</b>	Consumption is determined with no output load and is a limiting factor for the total efficiency of the device. See also Power Dissipation.
<b>Power Density</b>	The ratio of the output power from power supply or DC/DC converter to its volume in W/m <sup>3</sup> .
<b>Power Dissipation</b>	The power dissipated (as heat) within the power supply or DC/DC converter during normal operation. Primarily a function of the power handling capability and efficiency of the power supply or DC/DC converter. Internal power dissipation is given as a maximum specification that cannot be exceeded without risking damage of the power supply or DC/DC converter.
<b>Power Factor</b>	In a power supply, the ratio of true input power to apparent input power. The power factor is a measure of how synchronous or with how much lead or lag the input current follows the line voltage. A PF value closer to 1 means that the load is rather resistive while a PF value closer to 0 means that the load is rather reactive (asynchronous current). Inductive and capacitive loads are reactive. Lower PF values are undesired for multiple reasons and create losses in cables even if the average power consumption of the device is very low.
<b>Power Factor Correction</b>	Power supplies without PFC can draw line currents in form of short, strong pulses around line voltage crests. This introduces odd non-sinusoidal currents that are undesired since they degrade the quality of the power line and can interfere with other devices... PFC circuits ensure that the line current is drawn sinusoidal and in phase with the sinusoidal line voltage to improve the power factor... PFC circuits can be passive for lower power devices or active for higher power devices.

<b>Power Fail Detect</b>	A circuit that senses the DC voltage across the input capacitors of a switching power supply. Should the AC input line fail, it senses an abnormally low DC level across the capacitors and provides a logic output signal warning of imminent loss of output power.
<b>Power Good Signal</b>	The power good signal indicates the status-signal that is generated by a switching power supply when the device has stabilized its DC output voltages of the primary channel and passed all its internal self-tests. Also called DC-OK.
<b>Protection</b>	There are several internal safety circuits implemented to protect the power supplies and DC/DC converters or the attached load against destruction and failure. There are protections against over temperature, overvoltage, overload, and short circuits. See also Recommended Input Fuse or Reverse Voltage Protection.
<b>Protection Class</b>	Appliance Classes or IEC Protection Classes define the class of equipment with regards to isolation and protection against electric shock. See also Protective Earth, Safety Class II or SELV Output. <ul style="list-style-type: none"><li>- Class I: Protection with basic insulation and protective earth (PE)</li><li>- Class II: Protection with double or reinforced insulation (no PE)</li><li>- Class III: Supplied by a SELV circuit (inherently safe) and equipment in which hazardous voltages are not generated. In the TRACO POWER datasheets, the protection class is specified as "Class I prepared" resp. "Class I &amp; II prepared" because power supplies are considered components and therefore not Class I resp. II on their own. However, they are prepared for building into a Class I resp. Class II application.</li></ul>
<b>Protective Earth</b>	Class I equipment must have a protective earth conductor (green/yellow) wire with resistance to earth lower than 0.1 Ohm and no switch or fuse between. Resistance between earthed parts and the earth termination is tested by a current 1.5 times the current capacity of any hazardous voltage circuit at the point where failure of basic insulation would make the earthed part live. Test voltage maximum is 12 V. Test current may be ac or dc but must not exceed 25 A.
<b>Pulse Frequency Modulation (PFM)</b>	PFM fixes the width of square pulses using only levels 1 and 0 while varying the frequency. In other words, the frequency of the pulse train is varied in accordance with the instantaneous amplitude of the modulating signal at sampling intervals. The amplitude and width of the pulses is kept constant. The switching frequency must be much higher than what would affect the output voltage of a DC/DC converter.
<b>Pulse Width Modulation (PWM)</b>	A circuit used in switching power supplies or DC/DC converters where the switching frequency is held constant and the width of the power pulses is varied, controlling both line and load changes with minimal dissipation. The average value of voltage (or current) fed to the load is controlled by using levels 1 and 0 from on to off at a fast rate. The longer the switch is on compared to the off periods (Duty Cycle), the higher the total power supplied to the load. See also Ripple and Noise.
<b>Rated Power</b>	Each series of TRACO POWER is categorised and has a specific nominal power value. Devices that feature a lower output voltage within a series could have a lower output power compared to the power rating from the series. (Consult product specific datasheet)
<b>Reach</b>	The new chemicals regulation, called REACH (Registration, Evaluation, Authorization and Restriction of Chemicals), came into effect on June 1, 2007. TRACO POWER declares that all products do not contain

Substances of Very High Concern (SVHC) in concentrations greater than 0.1% by weight per article in view of Regulation 1907/2006 (REACH). The corresponding declaration can be found on our homepage.

**Recommended Input Fuse**

An input fuse is recommended for safety. However, it's not a protection for the converter. The fuse triggers in case of too high current e.g., because of a defective converter. Therefore, the fuse is designed to protect the part of the application before the converter. A time-delay or slow-blow fuse should be fitted. Fuses should be installed in front of each module when multiple DC/DC converters connect to the same power source. If the AC connector is not polarised, then fuses can be fitted on both inputs. See also Input Protection.

**Recommended Solder Pad Layout**

For each Pinout of THD or SMD devices a solder pad layout to your specific PCB Design Rules (regarding clearance, pads, and routing width) should be defined.

**Redundant Operation**

The ability to connect power supplies or DC/DC converters in parallel that if one fails the other will provide continuous power to the load. This mode is used in systems when a device failure cannot be tolerated. For redundant operation parallel connection might be a viable approach.

For designing such a redundant system, it is highly recommended to pay close attention to worst case situations so that specified parameters are never exceeded on any of the devices (also for non-redundant operation). See also Parallel Operation or N+1.

**Reflected Ripple Current**

The AC component generated at the input of a power supply or DC/DC converter by the switching operation of the converter, stated as peak-to-peak or RMS over a bandwidth 0 to 20 MHz. The largest part of this "kicked-back switching noise" current is at the fundamental switching frequency of the device.

**Regulation**

The ability of a power supply or DC/DC converter to maintain an output voltage within a specified tolerance as referenced to changing conditions of input voltage and load. In the case of unregulated converters, the output voltage is very much depending on the input voltage and the load.

Uncontrolled converters usually require more than 10% minimum load to meet the specifications. Unregulated converters can thus be recognized by the wide tolerance of the regulation accuracy in the datasheet. See also Line Regulation or Load Regulation.

**Reinforced Insulation**

Double or Reinforced Insulation is a second layer of insulation beyond Basic Insulation for increased safety and the ability to withstand higher voltages. A single insulation system which provides a degree of protection against electric shock equivalent to Double Insulation under the conditions specified in the applicable standards. Note: The term «insulation system» does not imply that the insulation must be in one homogeneous piece. It may comprise several layers which cannot be tested as supplementary or Basic Insulation. The construction and performance of Double or Reinforced Insulation ensure that the equipment is still safe even when the basic insulation fails. The insulation provides a physical separation between the solder tracks or joints, cores, windings, etc. This provides protection against electric shocks in addition to an adequate clearance either by one or two insulation levels or by a physical spacing from the live parts. Typical components that are constructed with a reinforced insulation include optocoupler and power transformers. See also Insulation Class.

**Remote Control**

A logic high or low signal to turn ON/OFF a power supply or DC/DC converter. Generally, there are two different types: voltage controlled or

current driven. For both types the required circuit is different. Mostly the **on state** for remote on/off pin is open circuit or high impedance and **off state** is constant input current over pull-up resistor or a fixed low input voltage under a defined margin. Also possible in negative logic on demand. If the remote ON/OFF is not used, leave the connection open (floating). See also Off Idle Input Current.

**Remote Sensing**

A method of moving the measuring point for the regulation from the output terminals directly to the load. Compensates voltage drops in the power distribution lines, which can vary under temperature, connection, and length. But negative impact on dynamic load behaviour must be tolerated. Typically, a twisted pair of wires is attached to "sense" the voltage at the load.

**Reverse Voltage Protection**

A built-in circuit or external element feature, which protects the internal components of a power supply or DC/DC converter against damage due to a reverse polarity voltage, applied at the input or output terminals.

**Ripple**

The periodic AC noise component of the power supply or DC/DC converter output voltage. The magnitude of AC voltage appearing superimposed on the DC output specified in peak-to-peak volts or expressed as a percent of the nominal output voltage.

**Ripple and Noise**

The magnitude of AC voltage on the output of a power supply or DC/DC converter, expressed in millivolts peak-to-peak or RMS, at a specified band width (typically 20MHz). This is the result of the feed through of the rectified line frequency, internal switching transients and other random noise. Reducing ripple & noise will usually be achieved by adding external capacitors to the output. Depending on your application requirements TRACO POWER recommends using a 0.1µF MLCC and a 4.7-10µF electrolyte capacitor in parallel to the output to further attenuate ripple and noise. . In case that load variations are expected, it is recommended to use decoupling capacitors directly in front of the load as well. See also Settling Time.

**RMS**

Root Mean Square is a function that makes the power of complex shaped signals comparable to other complex shaped or DC signals. 1V RMS and 1V DC create the same power in an electric load even if the waveforms look different. If you are working with pure sinusoidal AC waveforms that are not mixed with DC signals, the following functions are valid.:

	Equation/waveform:	RMS:
DC, constant	$y = V_{dc}$	$V_{dc}$
Sine wave	$y = V_{PK} \sin(2\pi ft)$	$V_{PK} / \sqrt{2}$

**RoHS Directive**

This European Directive (2011/65/EU) specifies the maximum concentration of lead, mercury, and other hazardous substances for 10 categories of electronic products listed in this Directive.

[www.ec.europa.eu/environment/waste/rohs\\_eee/index\\_en.htm](http://www.ec.europa.eu/environment/waste/rohs_eee/index_en.htm)

**RoHS Exemptions**

The RoHS Directive restricts the use of hazardous substances in electrical and electronic equipment. However, certain applications may be exempt from RoHS restriction if it is technically or scientifically impracticable to prohibit the use of certain hazardous substances at present. Which substances in which applications are exempted by these restrictions are defined in the RoHS exemptions. The RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (known as "Once an article, always an article" (O5A) rule). Because

of the O5A rule, a lot of our products have RoHS exemptions listed on the datasheet.

### Safety Approvals

The primary goal of safety standards for DC/DC converter and power supplies is to protect against fire, electric shock and injury. Products meeting these requirements may be identified by a safety approval from the associated standards organization and/or by a mark indicating compliance with the applicable standard.

### Safety Capacitor

X- and Y- capacitors are safety-certified capacitors generally designed and used in AC line filtering in many electronic device applications. They are also known as "EMI/RFI suppression capacitors". These capacitors help to minimize the generation of EMI and the negative effects associated with received EMI. For this reason, these capacitors are directly connected to the AC power input ("AC line" and "AC neutral"). Because of this direct connection to the AC voltage, the capacitors may be subjected to overvoltage or voltage transients. These Class-X-capacitors or Class-Y-capacitors are classified according to the peak impulse voltage which they can safely withstand. See also X Capacitor or Y Capacitor.

Table 1C – Capacitor ratings according to IEC 60384-14

Capacitor subclass according to IEC 60384-14	RATED VOLTAGE of the capacitor V r.m.s.	TYPE TEST impulse voltage of the capacitor kV peak	TYPE TEST r.m.s. voltage of the capacitor kV r.m.s.
Y1	Up to and including 500	8	4
Y2	Over 150 up to and including 300	5	1,5
Y4	Up to and including 150	2,5	0,9
X1	Up to and including 760	4 <sup>a</sup>	-
X2	Up to and including 760	2,5 <sup>a</sup>	-

According to 60950-1 © IEC:2005+A1:2009+A2:2013 (Page 39) Table 1C

Table G.8 – Capacitor ratings according to IEC 60384-14

Capacitor subclass according to IEC 60384-14	Rated voltage of the capacitor V r.m.s.	Type test impulse test voltage of the capacitor kV peak	Type test r.m.s. test voltage of the capacitor kV r.m.s.
Y1	Up to and including 500	8	4
Y2	Over 150 up to and including 300	5	1,5
Y4	Up to and including 150	2,5	0,9
X1	Up to and including 760	4 <sup>a</sup>	-
X2	Up to and including 760	2,5 <sup>a</sup>	-

According to 62368-1 © IEC:2014 (Page 236) Table G.8

### Safety Class II

The safety class II symbol specifies a power supply product which is double insulated and due to that no protective earth connection is available nor needed. That means that the product is designed with two layers of insulations between hazardous voltage and accessible parts. **Attention:** A Power Supply for building-in as stand alone is not a class II device until it's build in a final application. Because it has no touch protection itself. In TRACO POWER datasheet it's registered as "class II prepared". A class II PSU can be a part of a class I final application. See also Protection Class.

### Safety Isolation

The purpose of safety isolation is to physically separate hazardous circuits and transient sources from users and to protect products and their surroundings. It describes the electrical separation between the primary and secondary circuits and the safety standards to which the power supply or DC/DC converter conforms to. The safety standards consider three primary specifications for the protection from electric shock:

- Dielectric Strength
- Clearance Separation
- Creepage Separation

TABLE: To insulation diagram									Pass	
Pollution degree .....									2	—
Overvoltage category.....									II	—
Altitude.....									0 – 5000 m	—
Additional details on parts considered as applied parts .....									<input checked="" type="checkbox"/> None <input type="checkbox"/> Areas _____ (See Clause 4.6 for details)	—
Area	Number and type of Means of Protection: MOOP, MOPP	CTI (IIIb, unless is known)	Working voltage		Required creepage (mm)	Required clearance (mm)	Measured creepage (mm)	Measured clearance (mm)	Remarks	
			Vrms	Vpk						
For PCB P1										
B	2MOPP	IIIb	250	354	8.0	6.5 (5.0x1.29)	10.0	7.0	CP1 body to U2 pin 1	

According to Test Report EN 60601-1:2006/A1:2013/A12:2014

## SCIP

SCIP is the database for information on **S**ubstances of **C**oncern **I**n articles as such or in complex objects (**P**roducts). It is established under the Waste Framework Directive (WFD). Companies supplying articles containing substances of very high concern (SVHC) on the Candidate List in a concentration above 0.1% weight by weight (w/w) on the EU market must submit information on these articles to ECHA, as from January 2021. For this purpose, the SCIP database is used.

This obligation is also applicable if the concentration limit is only exceeded for single components and not for the overall concentration in the product.

This rule is known as “Once an article, always an article” (O5A).

The SCIP numbers of our products are available on request.

## SELV Output

Safety Extra Low Voltage. A term used by safety regulatory body (IEC, UL, CSA, CENELEC, etc.) to describe the highest voltage level than can be contacted by a person without causing injury. Under both normal operating conditions and in the event of a single fault condition (insulation or component failure) the voltage in accessible parts of SELV circuits shall not exceed 42.4 Vac peak or 60 Vdc for longer than 200 ms. See also Hazardous Voltage.

## Sense Lines

An output line used in «Remote Sensing» connection to route the output voltage (at the load or direct on the power supplies or DC/DC converters output) back to control feedback loop. See also Remote Sensing.

## Serial Connection

Although it is possible to connect power supplies or DC/DC converters in series on output side (including freewheeling diodes), TRACO POWER does not recommend it. It cannot be assumed, that any interconnection of several converters operates in each application condition as they would in a single operation (e.g., start-up behaviour, regulation, ripple & noise, max. load conditions, ...). The freewheeling diodes are recommended independent of the load to protect both regulation circuits during start-up or at fast load changes. This is needed because the two power supplies are not linked and the regulation circuits therefore are not able to communicate with each other, so they must be protected externally.

## Settling Time

The use of external filters and additional input or output capacitance will slow down the reaction time for a fast input voltage ramp. It is the designer's decision to balance between settling time or noise performance.

## Short Circuit Protection

A feature, which limits the output current of a power supply or DC/DC converter under short circuit conditions, so that the power supply or DC/DC converter will not be damaged. Common is that the output power will be



extensively reduced, or the voltage drops to a minimum. In most cases, a sporadic voltage peak (called Hiccup) is present at the output. The converter or power supply unit tries to restart and checks whether the short circuit is still present. But there are different modes of performance such as foldback, hiccup, continuous or constant current mostly with "Automatic Recovery" to normal operation when the short is removed. The protection could be limited to a defined time. A short circuit protection does not also provide an overload protection.

**Six-Sided Shielding**

A construction technique in which the circuit is placed into a metal case. This metal shielding minimises noise radiation from the converter components. A continuous shielded case has the base (or header) welded together, further reducing potential noise leakage.

**Soft Start**

A feature which limits the start-up switching current (inrush current) of a switching power supply or DC/DC converter and causes the output voltage to rise gradually to its final value.

**Soldering  
Soldering Profile  
Soldering Temperature**

SMD converters:  
Unless otherwise stated, TRACO POWER follows the standard IPC/JEDEC J-STD-020E for leadfree reflow soldering.  
In special cases, a specific peak package body temperature and/or peak temperature time must be considered.  
For further information check the reflow soldering application note at: [www.tracopower.com/info/reflow-soldering.pdf](http://www.tracopower.com/info/reflow-soldering.pdf)

THD converters:  
For leadfree wave soldering follow the soldering specifications (max. soldering temperature and max. soldering time) TRACO POWER provides in the respective product datasheet.

**Solid Insulation**

A material that provides electrical insulation between two opposite surfaces, not along an outer surface. The required property of solid insulation is specified as the actual minimum Distance through Insulation. See also Distance Through Isolation.

**Standby Current**

The current drawn by a power supply or DC/DC converter when there is no load and/or the converter has been shut down by a control signal.

**Start-up Time**

The time required, after initial turn-on, for a power supply or DC/DC converter to operate within its specifications. The rise time otherwise is the time required for the output voltage to rise from 10% to 90% of its nominal final value. See also Settling Time or Soft Start.

**Start-up Voltage**

The minimum amount of input voltage at which the power supply or DC/DC converter will start up.

**Status Code**

Describes the state of "Product Life Cycle" of all power supply and DC/DC converters. Status ACTIVE stands for introduction and growth, which means that the product is recommended for new designs and maturity, which means newer TRACO POWER alternatives may exist. Status NRND (not recommended for new designs) stands for decline, what means product is mature but remains in production for sustaining programs. Status EOL for "end of life" is during Phase-Out (due to component availability or ceased demand), product availability may become subject to phase out, product availability, back-order production, last time buy and stock drain. See also Life Cycle.

**Status Indicator**

On the TRACO POWER website colours are used to differentiate between

Status Codes (Search --> products direct access). ACTIVE: green, NRND: yellow and EOL: red. See also Status Code.

<b>Storage (Shelf Lifetime)</b>	For TRACO POWER Products the standards for storage and handling of industrial grade electronic (board mount) components apply. In low UV exposure environment and room temperature, non-aggressive dry atmosphere, TRACO POWER Products should reliably endure several years on shelf.
<b>Storage Temperature</b>	Temperature range within a power supply or DC/DC converter can be safely stored, non-operating, with no damage to its components.
<b>Supplementary Insulation</b>	Insulation applied in addition to and independent of basic insulation. Supplementary insulation provides protection against electric shock in case the basic insulation fails. See also Basic Insulation or Insulation Class.
<b>Surface Mount Technology (SMT)</b>	A space saving technique whereby special leadless components are soldered onto a surface of a PCB. Often used in design of low power DC/DC converter modules. TRACO POWER products with the suffix –SM in order code stands for surface mount technology devices.
<b>Surge</b>	A power surge is an abnormally high transient voltage, current or power in an electrical circuit lasting for a short period of time. This often happens when power supplies are initially turned on as circuit capacitors charge. Some fault conditions could also cause a surge. A significant surge could cause damage to a power supply or DC/DC converter if proper protection is not placed on the input. See also EMC Immunity.
<b>Surge Voltage</b>	The maximal input voltage over a time of 1 second.
<b>Switching Frequency</b>	The nominal frequency of operation at which the switching circuit is switched inside a DC/DC converter or switching power supply. There are many types of switched-mode devices but most of them use a proportional feedback method. The most common method is pulse-width modulation (PWM) and pulse-frequency modulation (PFM) or a mix of both.
<b>Switching Regulator</b>	A high-efficiency non-isolated DC/DC converter consisting of inductors and capacitors to store energy and switching elements (typically transistors), which open and close as necessary to regulate voltage across the load. The switching duty cycle is generally controlled by a feedback loop to stabilise the output voltage, generally by means of a pulse-width modulation.
<b>Synchronous Rectifiers</b>	A circuit arrangement where the output rectifier diodes of a power supply or DC/DC converter are replaced with active switches such as MOSFET. The switches are turned on and off under control and act as rectifier. This results in considerably lower losses in the output stage and subsequently much higher efficiency. They are particularly useful with low voltage outputs.
<b>System Solution</b>	If a power supply is accompanied by a wide range of function modules for reliable system solutions: <ul style="list-style-type: none"><li>- Redundancy modules for true current sharing in parallel operation and for redundant systems.</li><li>- Battery controller modules to configure high reliable UPS systems. Selection of battery packs available.</li><li>- Buffer modules for protection against short time AC power loss.</li></ul>
<b>Temperature Coefficient</b>	The average percent change in output voltage per degrees centigrade change in ambient temperature over a specified temperature range, with load and input voltage held constant.

<b>Temperature Margin</b>	The maximum temperature at which a power supply or DC/DC converter operates in defined ranges at full load without thermal derating. See also Derating.
<b>Thermal Impedance</b>	The Thermal Impedance is a measure of how effectively heat can flow from inside the converter to its surroundings. It is measured in K/W. It is possible to further lower the thermal resistance to ambient by fitting an external heat sink or by blowing air across the converter. See also Heat-Sink.
<b>Thermal Shock</b>	Temperature shock tests are used to determine if material can withstand sudden changes in the temperature of the surrounding atmosphere without experiencing physical damage or deterioration in performance. See also Environmental Tests.
<b>Thermal Shutdown</b>	Thermal shutdown feature shuts the power supply or DC/DC converter down if the internal temperature exceeds the present limits. Also called thermal protection. It shall not be used as a feature; it is just a protection mode and therefore an operation condition to prevent. See also Over Temperature Protection.
<b>Topology</b>	<p>The design type of a DC/DC converter or power supply, indicative of the configuration of switching transistors, utilization of the transformer, and type of filtering. Examples of topologies are fly-back, forward, half-bridge, full-bridge and resonant.</p> <p>Remark: The ringing choke converter (RCC) topology is a self-oscillating fly-back converter. It is a robust and low component circuit. Converters based on RCC topology are sensitive to high constant current load during start up and serial or parallel interconnection of outputs of multiple converters.</p>
<b>Touch Current</b>	Also called enclosure leakage current, which is defined as the current that flows from an exposed conductive part of the enclosure to earth through a conductor other than the protective earth conductor, such as a human body touching the enclosure of a power supply. See also Leakage Current.
<b>Transient Recovery Time</b>	The time required for the output voltage of a power supply or DC/DC converter to settle within specified output accuracy limits following a step change in output load current or a step change in input voltage. Specification in milliseconds. See also Transient Response.
<b>Transient Response</b>	<p>The output overshoot that occurs when the output load of a power supply or DC/DC converter is turned on/off or abruptly changed. This overshoot defines the high frequency output impedance of the converter.</p> <p>Measurement of both Response Deviation in percent of overshoot and Peak Variation in mV after a defined transient load step is possible, but often only one value is given in datasheet. See also Dynamic Load.</p>
<b>UL Listing Mark</b>	The UL listing mark shows that the whole equipment is approved by UL according to the relevant US safety standard requirements. If a product or equipment is carrying the UL listing mark no additional testing by UL is required. UL will only investigate if the product or equipment is used according to the manufacturers published specifications which must comply with the UL test report. The «c» in the UL listing mark means that the product complies with relative Canadian safety standards as well.

<b>UL Recognition Mark</b>	The UL recognition mark shows that the product is recognised as a component and has been approved by UL according to the relevant US safety standard requirements. The «c» in the UL recognition mark means that the product complies with relative Canadian safety standards as well.
<b>Under Voltage Lockout</b>	A protection system for power supplies or DC/DC converters where the power supply or DC/DC converter are designed to shut down if the input voltage drops below a pre-defined level. As the input voltage rises, they will restart. Some hysteresis is usually present to prevent the power supply or DC/DC converter oscillating on and off. If the input voltage is below the minimum input voltage of the converter, the input current can increase so strongly that the input circuit get damaged. For applications (e.g., battery operation), it is important to note that a converter with a lockout function is used to ensure safe shutdown before the current increases too much.
<b>Universal Input</b>	An AC input of a power supply that accept all the voltage levels available from the mains in most countries without any changes in settings to the power supply itself. Typically specified as 85 to 264 Vac RMS (100, 110, 230 and 240 Vac RMS). It has always to be checked in the Datasheet or Operations Manual of the used power supply to confirm that it is designed to operate from either an AC or DC input and if a derating has to be applied e.g., at low input voltage. Due to the rectification at the input of the supply it does not matter where to connect the + or - at the input (L+N) of the supply, except if it is mentioned in supporting documentation.
<b>UPS</b>	Uninterruptible Power Supply. A system designed to supply power in the event of temporary or permanent loss of AC line power. This is accomplished by means of a back-up battery and a DC/AC inverter or DC/DC converter. See also System Solution.
<b>Vibration Test</b>	Vibration tests are performed to verify that materiel will function in and withstand the vibration exposures of a life cycle. See also Environmental Tests.
<b>Voltage Balance</b>	Output voltage difference of dual output models with balanced load (symmetric load condition). See also Cross Regulation.
<b>Voltage Set Accuracy</b>	The maximum allowed deviation of the DC output of a power supply or DC/DC converter from its ideal or nominal value. Expressed as a percentage of output voltage. Often called output voltage tolerance.
<b>Wall Mount</b>	Several power supplies have the possibility for wall mounting. Wall mounting brackets therefor could optionally be added. The power supplies are typically enclosed in a UL 94V-0 rated, fireproof case.

- Working Voltage (rated)** Working voltage is the maximum continuous voltage that can be sustained continuously across the isolation barrier of a power supply or converter without causing stress to the isolation barrier. The rated working voltage is typically much lower than the rated isolation voltage. It is difficult to define the maximum working voltage from a specified isolation voltage because it depends much on the material and construction of the insulation. A relative conversion table can be found in the IEC/EN/UL 60950-1 and IEC/EN/UL 62368-1 safety standards. Peak value of a working voltage including any d.c. component and any repetitive peak impulses generated in the equipment. Minimum Clearances and Electric Strength Test depend on Peak Working Voltage.  
Note: A high I/O isolation voltage does not automatically mean that a device also contains an electrically protective separation (insulation system) and therefore has a high working voltage.
- X Capacitor** This capacitor is connected between line and neutral, to protect against differential mode interference. A failure of the placed capacitor does not create conditions for dangerous electric shock, although it can create a fire risk. Therefore, an overcurrent protective component is required. See also Safety Capacitor.
- Y Capacitor** Power supplies or DC/DC converters generally require bypass capacitors from line to chassis (earth ground) to shunt common-mode noise currents and keep them local to the converter. In cases where the converters are operating from rectified AC line voltage, the failure of a bypass capacitor could result in excessive leakage current to the equipment chassis thus creating a ground fault and shock hazard. For this reason, a special classification of capacitor, referred to as a Y-capacitor, is required. These capacitors contain a dielectric with unique “self-healing” properties to help prevent against excessive leakage and they are designed to fail open. See also Safety Capacitor.