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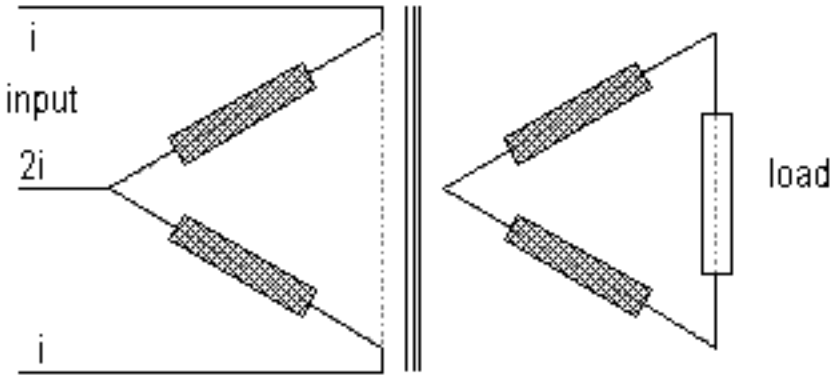
hb070 : 3phase open delta ratings

The `open delta' transformer is still the best way to transform the three phase output of a UPS into a single phase. In general it is better to try and avoid the transformer all together. However there are some considerations about the load characteristics on the UPS. The phase currents supplied by the UPS will be unbalanced. This unbalance is calculated thus:

assume the load is resistive
assume the transformer ratio is 1:1
assume the supply is 400Vac and the load required is 1kVAthe load in the input centre limb must equate to the sum of the other two inputs
the voltage across the load must be 400 square root 3 = 692.8V
for 1kVA then 1000/692.8 = 1.44A
therefore current in common leg is 2.88A for each kVA of 1PF load



In specific applications care must be taken to assume that

the transformer is only 94% efficient
the voltage may not be 400 ph-ph
the UPS may have difficulty with the unbalanced load
the PF of the load may affect the calculation

A sample calculation is shown:

for a 20kW single phase load a 20kW transformer is required
the transformer will require 20*2.88A * 230Vac=13248 watts on the common transformer leg
the UPS will need to provide 3 times this if it has three separate inverters and 2 times this if unbalanced loads are tolerated
the power is 13248*3=39744 watts - assuming the UPS has a capacity to provide only a 0.8PF the UPS size is 49600VA!
the transformer is about 94% efficient meaning a final figure of 52.851kVA is appropriate

A much better solution is to use two units rated at 12kW and run them in parallel

If the application cannot supply a single phase at the required load a cost effective solution is to use a single phase input UPS with a phase/phase input transformer rated 400/230Vac on the input to the UPS.

If you need any more help please ask!

hb027 : power protection in the third world

Background

Those of us who are used to the high standard of electricity utility supplies in the industrialised world sometimes forget the problems faced by users of high tech equipment in the third world. This page describes a strategy for planning electrical power protection in a small business or professional office application. These notes may also be helpful to householders facing regular damage to electrical equipment - even just ordinary light bulbs.

The problems

These fall into different categories the critical load must be protected from one or more of the following:

out of tolerance voltages

(sags surges and brownouts)

spikes on the line

and/or keep working when

out of tolerance voltages occur

mains supply fails.

Most electrical equipment is able to function normally if the voltage varies by less than ±10%.

Modern equipment is also usually able to operate satisfactorily in an environment where small noise spikes (less than 100V) arrive down the line.

However the data handled in modern digital equipment is sometimes corrupted by severe spikes.

Some of the equipment may be so critical that it needs protection from both noise spikes and power failure.

Other equipment may need protection from brownouts and/or very high voltages.

Planning a solution

A thorough survey of the various equipment loads around the business or office location should be prepared.

Each equipment needs to be classified. For example - critical essential non-essential.

The actual load of each item needs to be expressed in watts.

It is often misleading to take electrical ratings from external labels on the equipment to be protected.

Fuse ratings can also be much higher than actual consumption and should only be used as a guide where no measuring equipment is available.

Separate lists need to be made for the various loads showing which ones are critical and others which just need protection.

Consideration should be given to the possible need for a few lights to be supported when the mains fails so that critical equipment (keyboards!) can actually be seen.

Attention needs to be paid to the problems of separating the various electrical wiring circuits.

It also makes sense to adopt some procedure for ensuring that the load is not used on the wrong supply.

Typical approaches include labelling or the use of different style plugs and sockets.

For some systems permanent wiring is sometimes an alternate solution.

For more information or assistance in preparing a strategy please ask our sales office.

Typical strategy

Load	Watts	Protection equipment
light bulbs TV video freezer hi-fi	2600 300 75 450 200 3625	Advance power monitor disconnects the load when voltage goes outside predetermined limits
air conditioner	3000	tapping voltage stabiliser to maintain or APM as above
digital GSM phone	100	Advance low impedance power conditioner prevents spikes getting to the phone memory
fax machine for incoming orders	150	Galatrek ByteBak uninterruptible power supply brownout protection and batteries when mains fails - specify backup time
personal computer with data which is essential	450	Galatrek MicroBak UPS noise spike protection brown out protection + must be protected and batteries when mains fails - specify backup time
laser printer modem scanner	1200 40 120	Advance GT power conditioner noise spike protection brown out protection from mains supply these un-essential items go off when power fails

hb061 : A-G AIT series type test results

Introduction The Advance series of AIT power conditioners was introduced some years ago to provide a highly effective noise filter for modern ICT equipment. The technical differences between the AIT and our traditional ferroresonant power conditioners are covered in hb026. However we are routinely asked for type test results relating to their performance. Perhaps the best test is the high integrity of all the thousands of installations world-wide in telecomm and EPoS applications.

Features The technical results show that the electrical performance of this type of conditioner is second to none for noise spike attenuation. Common mode noise is virtually eliminated and transverse mode noise is reduced well below any CBEAMA threshold. In addition the unit provides galvanic isolation between the input and output. These conditioners have conservatively rated magnetics to accommodate the large surges and high crest factor loads found in modern SMPS. The AIT is ideally suited to office applications where small size and low audible noise are of paramount importance.

Benefits Protected ICT systems will not be damaged by the high energy spikes associated with lightning striking overhead distribution wires. Other electrical mains-borne noise will either be reduced to an acceptable level or completely eliminated. The AIT reduces warranty and power supply maintenance costs of ICT equipment to a minimum.

Results The results shown are typical for a range of type tests designed to stress the unit as far as possible without destroying it.

Electrical safety AITs comply with Class 1 to EN 60950 BS 1362:1973 BS 1363:1984 sect 12 + 13 BS 2754:1977 Units were tested with BS standard finger and pin and found compliant.

Breaking capacity Fuses comply with BS 1362.

Flammability Materials found to be compliant with UL 94VO.

Insulation resistance Between any two terminals the insulation resistance was >2MOhms measured at 500Vac. (Mains neon and protection elements removed).

Voltage regulation A step change from 10 to 90% in applied load was made in less than 1mS. The output voltage decreased by less than 5%.

Critical phase angle The AIT is insensitive to the effects of phase angle.

Load side surge protection An impulse generator capable of producing a combination waveshape of 2.4kV open circuit and 200A short circuit was used for this test. No electrical or mechanical damage occurred.

Electrical fast transient The surge generator used is capable of producing a 5nS/50nS waveshape of 2kV open circuit voltage and a 2.5kHz repetition frequency. The test waveform is applied for 15mS every 300mS for 10 minutes. The waveform is described in IEC 801-4 1988. For both polarities the peak voltage appearing on the output terminals was <400V.

0.5çS 100kHz ring wave test Positive and negative polarity tests were made LN/LE/NE. Output voltages were <10V symmetric and <0.5V asymmetric.

Impulse discharge limiting voltage A generator capable of a current of 5kA peak 8 x 20uS waveshape into a short circuit was used to apply 30 tests incorporating both polarities and all terminals. Output voltage peaks were all < 800V.

Failure modes The 5kA 8 x 20uS waveshape blew the input fuse as required on all tested samples.

Overcurrent performance The units were tested with slowly increased loads until the overload protection

operated. Units must run for >2 hours at a load just below the point at which protection operates. Case temperatures remained below 46¤C

Mode transfer The 5kA 8 x 20uS waveshape was applied between LE and measured between LN + NE. The 5kA 8 x 20uS waveshape was applied between NE and measured between LN + LE. At no time did the peak impulse output voltage exceed 200V.

Insertion loss The symmetric and asymmetric insertion losses were measured using both methods described in BS 6299 section 4.1 Appendix A. Insertion loss was <65db over the range 10kHZ to 30MHz. Negligible noise is transferred between modes. Waveforms relating to these tests can be viewed at the factory.

hb026 : power conditioner comparison AIT vs GT differences

CHARACTERISTICS	GT series	AIT series	Notes
Smallest in catalogue	8VA	125VA	
Largest single phase in catalogue	15kVA	7kVA	larger specials available
Largest single phase available	20kVA	100kVA	
Largest three phase in catalogue	50kVA	250kVA	
Largest three phase available	50kVA	400kVA	
Noise rejection	broadband for common & transient modes	excellent common mode	
Lightning protection	good if installed correctly pulls input fuse to protect system against very high energy pulse	excellent common mode noise rejection	
Voltages available	2 to 20 kVac	55-0-55 to 680 Vac	
Voltage stabilisation	5:1 or 15:1 or better	none	
Output regulation	3-5%	<2%	
Waveform re-shaping	THD < 5% for any input shape	none	
Galvanic isolation	yes	yes	
Creepage & clearance	usually > 15 mm	> 6 mm	
Typical efficiency	about 90%	about 97%	
Size & weight	~15kg/kVA	much lighter than GT series	
Audible noise	50 dbA for 5 kVA	virtually none	
MTBF	> 200 000 hrs	> 200 000 hrs	
Hold up with swiched mode PS	retained even @ low line voltage	same as mains supply	
Frequency	50 or 60 Hz or both	50/60Hz all units	
APPLICATIONS	GT series	AIT series	
Networked computers	where voltage stabilisation is required	ideal	
File servers	where voltage stabilisation is required	ideal	

EPoS systems	for robust protection	ideal	
3 phase STAR loads	ideal	ideal	
3 phase DELTA loads	can be done with complex filter ONLY	ideal	
UPS up front	care with charger waveform	ideal	
UPS bypass	care with phasing	ideal	
UPS output voltage step up/down	GT can be difficult to drive	ideal	
Generators	care with frequency stability	ideal	
Phase controlled loads	care with current waveform	ideal	

hb057 : CE Certificate - Declaration of Conformity

Manufacturers name :	Advance Electronics Ltd t/a ADVANCE-GALATREK
Manufacturers address :	Wrexham
Importers name/address :	None
Type of equipment :	Specialised transformer based products as shown in the table
Model prefix :	See table
Serial no :	Units manufactured after Jan 1st 1995 with the CE mark on the serial no label
Standard to which conformity is declared:	see table

I the undersigned hereby declare that the equipment described conforms to all the relevant Directives.

Signature 

Full name Michael John Briggs

Status: Director

Place: Wrexham UK

Date 4th January 1996

Directive	Low Voltage		EMC	
	73/23/EEC		89/336/EEC 91/263/EEC 92/31/EEC	
Product prefix	Standard	Status	Standard	Status
AIT	EN60742	OK	EN6100-3-2 EN55022 class C	OK
CIT				
CP CPE CQ SP SPE TP TPE				
ECV ECVN				
GT				up to 5kVA OK
GTI			EN50081 pt1 EN55022	in progress
HDC			EN55014 EN60555-2 + -3 EN50082-1	OK

STX (some)		ask factory/ check labels	EN6100-3-2 EN55022 class C	ask factory/ check labels
TCVN		OK		OK
TT		OK	n/a	n/a

hb053 : CE marking of power conditioners

Introduction We are actively pursuing a policy of CE marking all products where we are required and permitted to so do. It should be noted that AEL sells professional products intended for use by professionally qualified users.

For relevant information on CE marking of UPS products please see eb053

Validity Care should be taken to check that this is the most recent issue of this document which during 1995 was expected to change frequently!

Policy Due to the wide range of Advance products we are having third party test houses provide us with test history and certification on a few core products. It is our intention that Advance will `self certify' and the CE mark will be applied to similar products using common sub-assemblies but minor differences in construction. Catalogue and core OEM products will be assembled from new standard sub-assemblies which once approved will be used wherever possible. As of now most of the common and preferred sub assemblies are documented and global drawing revision is in progress. CE marking on OEM product will be addressed on a case by case basis. Product files will be maintained for all derivatives.

Relevant Directives Advance products fall under the scope of two Directives:
Low Voltage 73/23/EEC
EMC 89/336/EEC as amended by 91/263/EEC + 92/31/EEC.

Other Directives
Machinery 89/392/EEC amended 91/368/EEC
Telecom terminal 91/263/EEC
No Advance products come under the scope of these Directives.
As far as we have been able to ascertain no other Directive is applicable.

Timing of testing/approvals We are in the process of seeking 3rd party testing and approval on specific products and will declare the success of these tests as the results become available. Target completion dates for the main line catalogue products are about the end of the second quarter 1995.

CE marking Products shipped after January 1st 1996 will have the CE mark if it is appropriate. The CE mark will usually be added to the product serial label. Where appropriate packing cartons will have the CE mark shown on the outside probably on new labelling.

Certificates Certificates of conformity will only be issued by arrangement with customers. UK customers requiring certificates by unit or batch will be asked to pay for them at current prices. Customers will be required to enter the need for the C of C as an order item on EACH order placed. Certificates of conformity will be available FOC to our European importing agents where required by the EC.A generic certificate of conformity is to be found as hb057

Relevant Specifications The table on hb057 shows which specifications have been selected by Advance for various products. Please note that our plain transformers and CVTs are EMC benign and require only safety certification. We have had them tested anyway and the table indicates relevant standards. CVTs can be used to make existing equipment meet line conducted noise requirements.

Feedback We would be pleased to review this document with any interested party.

hb003 : CVT background data

Introduction

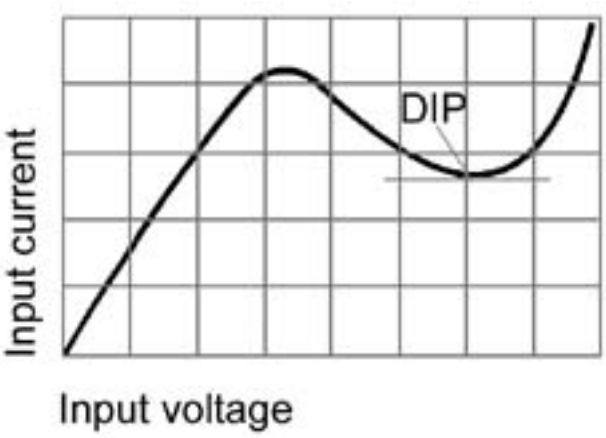
The effect was discovered during the 1930's in the USA by Joseph Sola a German born engineer.

The industrial use of ferroresonant transformers goes back to early 1940's. Through the last 5 decades a series of applications has been found for products based on the technique. In each case the CVT has some feature which made it the most reliable and cost effective solution to the problem. These characteristics continue to make the CVT one of the most cost effective ac power conditioners available.

Although different manufacturers use varying techniques the Advance CVT is normally based on a single transformer rather than an arrangement of transformer and separate filters. This lends itself to one of the most important aspects of the CVT its inherent reliability. Ignoring nuts bolts and other small components the unit consists of 3 or 4 windings and a special capacitor. With good manufacturing technique only the capacitor fails and a considerable time and effort goes into making this as unlikely as is practical.

The second major characteristics that the CVT is almost indestructible. It can be completely and continuously short circuited in use either at switch—on or from full load and the unit will be unaffected.

As can be seen from the output curve the CVT output characteristic is such that the published specification may be set at an arbitrary distance from the knee. This is important when comparing product from different sources.In situations where it is correctly installed the CVT is unaffected by low input voltage but will present a low impedance to very high voltage surges ensuring that in-line fusing or circuit breakers are opened before any damage occurs.



The graph of input current with voltage at fixed load shows this. It also indicates the normal operating 'dip' point. This means that the unit is self protecting to its supply and the critical load connected to it. The CVT provides the most effective buffer available to near—direct lightning strikes on power lines. The CVT also has the ability to provide usable output from low lines when operated below nominal power rating.

The third characteristic which makes the CVT suitable for more recent applications with computers is that there is limited energy storage in the resonating circuit. This means that the CVT is able to 'fill-in' small gaps in the power waveform (up to about 10 mS—half a cycle in a normal situation).

The output voltage waveform will not be a perfect sinewave but certainly one that will satisfactorily drive modern computer based equipment. This waveform remains the same even if the input voltage is very severely non-sinusoidal.

There is a limit to the dynamic range afforded by most designs but all CVT's exhibit the ability to provide a stable output voltage curve from a varying source. Although usually specified over a + / - 15% range the CVT does not just 'stop' outside this voltage range.

This is practically limited to a ± 25% input swing for a usable output unless very special design precautions are taken. This voltage stabilisation is a continuous operation on a cycle to cycle basis. Power supplies in modern computers will accommodate variations slightly larger than the planned ± 6% of most electricity supplies so it is usually straightforward to get the power supply input inside the necessary band using a CVT.

Another major feature of the CVT is that it inherently absorbs high energy voltage spikes on the input. In addition it is practical with careful constructional techniques to provide an effective barrier against lower energy ‘fast’ spikes which cause data corruption in computers and computer-based equipment.

On the negative side the CVT is a large and heavy transformer with operating efficiencies around 90% at full load. It has a substantial magnetic field and also produces a 50 or 60 Hz ‘hum’ dependent on unit size. The CVT is also frequency sensitive and will normally work at either 50 or 60 Hz.

We feel these features are more than offset by the knowledge that a properly selected and installed unit will usually cure mains problems on sensitive equipment. There is still a limited number of applications for specially wound CVT’s with output waveforms which are essentially ‘square’ rather than sinusoidal for use in simple power supplies or heating/lighting arrangements.

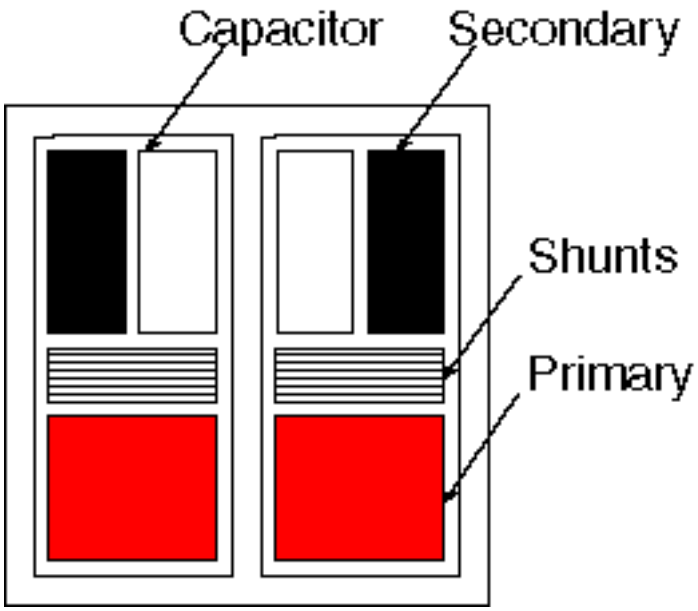
hb006 : CVT how does it work?

Introduction

AC stabilisation can be achieved using a simple magnetic device which has no moving parts.

This is a process of producing a constant ac voltage from a varying ac voltage supply and involves the use of saturable reactors. The latter may be incorporated in a special transformer magnetic saturation being produced in a part of the magnetic circuit.

The winding arrangement and construction of one such constant voltage transformer is shown in the diagram:



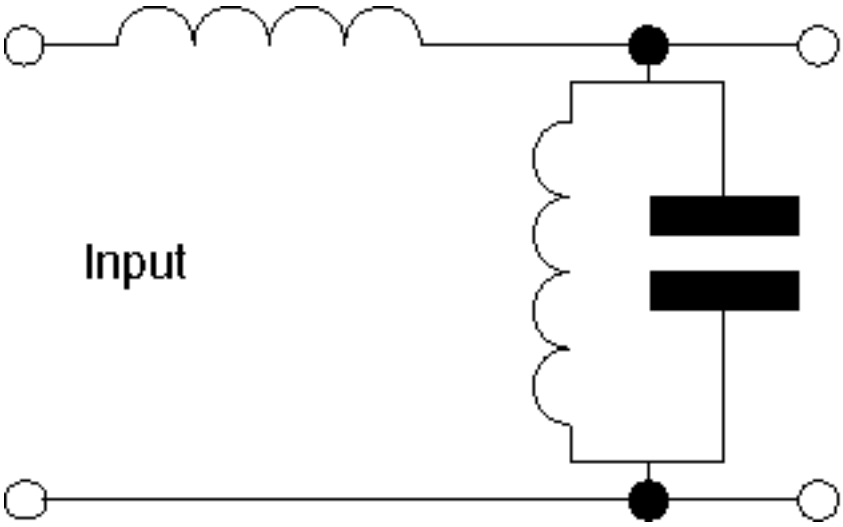
The core is a three-limbed shell with a magnetic leakage path dividing the winding space. On the upper winding space is the primary and a compensating winding while the lower winding space carries the secondary which has a capacitor connected across it.
An increasing voltage applied to the primary produces an increasing flux in the main magnetic circuit and the secondary voltage increases proportionally to this voltage. The increasing flux produces an increase in the leakage reactance of the secondary and this approaches a value which resonates with the capacitor connected across it. As the condition of resonance is reached the secondary current rises rapidly saturating the lower portions of the magnetic circuit. The flux due to the primary is diverted through the magnetic shunt and further increases in primary voltage produces little change in the secondary emf. It increases very slowly and this is offset by the emf induced in the compensating winding on the upper portion of the core which is connected in series opposition to the secondary winding.

Thus once the secondary is brought to resonance the output voltage from the secondary and compensating windings is constant and it is under these conditions that the transformer is used.

The advantage of this form of stabilisation is that it can be applied to the heater supplies in addition to any HT supplies derived from it. Owing to the non-sinusoidal waveform however readings taken with the usual rectifier-type meters are subject to error.

The compensating winding produces a small voltage which is used to 'buck' the output voltage.

To produce a sinusoidal waveform a further winding is added which is coupled via a magnetic gap. This extra 'neutralising' winding can be arranged to provide a suitable amount of 3rd and 5th harmonics which when summed with the output 'square' wave above results in a sinewave.



A first term equivalent circuit is also shown:

hb039 : Start up surges on (CVT's)

The switch on current surge for a CVT consists of two components. One of these is fixed at about 8 times running current for 5 - 10 mSec. Superimposed on this will be a ‘spike’ which will be dependent on where in the mains cycle the transformer was last turned off and where in the cycle it is turned back on. The spike will be less than 1 mSec and varies from zero to 25 times running current if the supply is very `stiff’. The input surge current at switch on is not significantly affected by the output load condition. The surge current will be substantially proportional to applied line voltage. Our normal circuit breaker recommendation is to fit a ‘Type 4 ‘ or ‘Curve 66’ unit which should function without nuisance tripping. Fuse earth loop impedance and cable size suggestions are shown.

Fuse ratings

Fuses known as 'motor circuit fuse links' in BS 88 / IEC629 are ideal for CVT's. The GEC type 'T' H.R.C. are used in the table and European types should be the type called `aM' or if available type `gTr'. We suggest that installers use a wall-mounting switch fuse arrangement or 'red-spot' fittings. The table shows the MINIMUM fuse that can be used in normal installations. Attention must be given to special cases where input voltage limits may go below the -20% figures used in the table. Cable sizes are also the minimum recommended by GEC for use with each fuse rating. The fuses will protect a PVC cable according to rule 433-2 for 'open conditions'. Earth loop impedance is for SAFETY considerations and does not reflect the needs of a clean earth. Protection against electric shock is provided by these fuses when correctly installed. Part numbers are based on GEC published data and some so-called direct equivalents may not be suitable. Discrimination must be proven under the requirements of the current edition of the local permanent wiring regulations BS 7671 : 1992 - it remains the responsibility of the installer to ensure that the supply is protected.

Output fuses

All Advance CVT’s have automatic overload characteristics. In normal situations the output current will limit at about 2 times rated current. The output voltage will collapse to near zero dependent on the fault impedance. It is impractical to provide a fuse that will remain intact for normal full load use and definitely open under fault conditions since the CVT does not and cannot supply enough energy. We therefore recommend no output fusing be used except where other high power conductors could become connected under fault conditions to the output circuit of the CVT or the fuse required is much smaller than the output capacity of the unit. If it is essential to protect the output we have had good success with thermal circuit breakers.

115Vac systems

VA rating	Amps @88Vac	BS88 Fuse A	IEC269 Fuse	UK Holder	Cable sq mm	Earth loop Ohms			VA rating	Amps @88Vac	BS88 Fuse	IEC269 Fuse	UK Holder	Cable sq mm	Earth loop Ohms
100	1.5	5	5aM		1	13			5000	65	100M125	100aM	A4	16	0.45
200	2.7	10	10aM		1	7.7			6000	78	100M160	100aM	A4	16	0.45
300	3.9	13	13aM		1	4.4			7000	88	100M200	100aM	A4	25	0.45
400	5.0	13	13aM		1	4.4			8000	107	200M250	200aM	B2	35	0.19
450	5.7	13	13aM		1	4.4			10000	134	200M250	200aM	B2	35	0.19
650	8.7	13	13aM		1	4.4			12500	158	315M355		B3	50	0.11
1000	13	20M25	20aM	A1	1.5	3			15000	189	315M355		B3	50	0.11
1500	19	32M50	32aM	A2	4	1.8			20000	267	315M355		B3	50	0.11
2100	27	32M63	32aM	A2	6	1.8			25000	334	400M450		B4	70	0.096
3000	39	63M80	63aM	A3	6	0.86			33000	441	400M450		B4	70	0.096
4000	52	63M100	63aM	A3	10	0.86			50000	693	630M670		C2	95	0.054

230Vac systems

VA rating	Amps @192Vac	BS88 Fuse A	IEC269 Fuse	UK Holder	Cable sq mm	Earth loop Ohms	VA rating	Amps @192Vac	BS88 Fuse	IEC269 Fuse	UK Holder	Cable sq mm	Earth loop Ohms
100	0.7	3	3aM		1	13	5000	30	32M63	32aM	A2	6	1.8
200	1.3	5	5aM		1	13	6000	36	63M80	63aM	A3	6	0.86
300	1.8	5	5aM		1	13	7000	41	63M80	63aM	A3	6	0.86
400	2.3	10	10aM		1	7.7	8000	49	63M100	63aM	A3	10	0.86
450	2.6	10	10aM		1	7.7	10000	61	100M125	100aM	A4	16	0.45
650	4	10	10aM		1	7.7	12500	72	100M160	100aM	A4	16	0.45
1000	6	13	13aM		1	4.4	15000	87	100M200	100aM	A4	25	0.45
1500	9	13	13aM		1	4.4	20000	123	200M250	200aM	B2	35	0.19
2100	12	20M25	20aM	A1	1.5	3	25000	153	200M250	200aM	B2	35	0.19
3000	18	20M32	20aM	A1	2.5	3	33000	202	200M315	200aM	B2	35	0.19
4000	24	32M50	32aM	A2	4	1.8	50000	318	315M355		B3	50	0.11

400Vac systems

VA rating	Amps @332Vac	BS88 Fuse	IEC269 Fuse	UK Holder	Cable sq mm	Earth loop Ohms	VA rating	Amps @332Vac	BS88 Fuse	IEC269 Fuse	UK Holder	Cable sq mm	Earth loop Ohms
100	0.4	3A	3aM	-	1	13	5000	17	20M32	20aM	A1	2.5	3
200	0.7	3A	3aM	-	1	13	6000	21	32M50	32aM	A2	4	1.8
300	1.0	3A	3aM	-	1	13	7000	23	32M50	32aM	A2	4	1.8
400	1.3	5A	5aM	-	1	13	8000	28	32M63	32aM	A2	6	1.8
450	1.5	5A	5aM	-	1	13	10000	35	63M80	63aM	A3	6	0.86
650	2.3	10A	10aM	-	1	7.7	12500	42	63M100	63aM	A3	10	0.86
1000	3.4	10A	10aM	-	1	7.7	15000	50	63M100	63aM	A3	10	0.86
1500	6.4	13A	13aM	-	1	4.4	20000	71	100M125	100aM	A4	16	0.45
2100	6.8	13A	13aM	-	1	4.4	25000	89	100M160	100aM	A4	25	0.45
3000	10	20M25	20aM	A1	1.5	3	33000	117	200M250	200aM	B2	35	0.19
4000	14	20M25	20aM	A1	1.5	3	50000	187	200M315	200aM	B2	35	0.19

Output protection using thermal breakers

Since the CVT is capable of developing a steady current when marginally overloaded and exhibiting an output voltage which is slightly lower than normal it is practical to protect the load wiring with a thermal breaker. The breaker should be chosen so that under all normal operating conditions it will not see it's rating. If a fault occurs causing excess current to flow then the breaker will eventually open - even if the overload is only 105-110% of the breaker rating. The breaker will open quite quickly in the event of a short circuit in the secondary load wiring.

hb009 : CVT gives lightning protection

Introduction

When lightning strikes enormous amounts of energy are dissipated. If the strike is in any way direct or near direct then most substances hit will be locally vapourised. Electrical distribution systems have special isolating devices to restrict the effects of lightning strikes on overhead wires. However overhead lines can pick up serious transients which will destroy sensitive electronics if the `spike' gets all the way into the equipment.

Lightning

A typical lightning strike produces a waveshape which has a front edge of about 1.2µS and after 50µS the voltage will have dropped to half its peak value. Special test equipment is available which generates a 8/20 µS waveform which represents the lightning effect if the voltage is 6kV and the source impedance less than 2 ohms. A further popular test is based on a 10/350 shape which is used in telecoms applications.

It is not generally appreciated that office and domestic electrical distribution wiring will normally `flash over' at about 6kV which limits the voltage expectation from local lightning strikes.

A typical `strike' may carry about 200 000 Amps which when applied to an earthed conductor will cause a huge rise in the local earth potential. This effect can cause quite large amounts of energy to be carried along local earth wiring. Particular attention needs to be given to this problem. See ICT wiring and considerations.

Bullet proof protection

Advance CVTs especially designed for computer protection provide one of the most effective barriers against lightning damage. The CVT has a magnetic circuit which becomes a very low impedance when fed with high voltage.

If the unit is correctly installed with a protecting fuse or circuit breaker then the CVT will open the protection before damaging energy gets to the electronic equipment being protected.

This means that the computer or other equipment may be turned off inadvertently but it will be protected from the resulting distributed energy from the lightning strike. Such energy spikes are relatively common.

The only user action required is to replace the fuse or reset the circuit breaker and continue using the equipment.

If the strike is of sufficient energy to damage the incoming distribution wiring because of a direct strike then anything may happen.

This is extremely unusual.

hb054 : CVTs approval to international standards

Background

There is currently no international specification which relates directly to constant voltage transformers.

A draft specification exists for UPS products (BS EN50091-93) but this is unlikely to be more applicable to CVTs than current specifications.

Existing approvals

The CIT range up to 1500VA has been approved to NEMKO NEK-EN 60742 and SEMKO 115X.

The Smartstab conditioners rated 100-1000VA have been designed to meet SEMKO 115X.

Potential approvals

UL

Some of the GT series were approved by UL but we have allowed this to lapse through lack of sales to interested parties.

We also used to have an insulation system approval but this has been allowed to lapse for the same reason.

We have no technical problems with meeting relevant UL specifications but the commercial cost of upkeep is uneconomic.

Customers who must have approval for their equipment may request that we design for the standard required.

When the equipment comes up for overall approval we provide constructional data to facilitate the approval process of our component.

Our customer remains responsible for the commercial upkeep of the approval as required.

CSA

Generally as per UL.

CE

We expect to comply with all the European Directives as and when applicable.

By getting certification to EN 60950 or EN 60742 we hope to have product safety acceptable for the USA and Canada as well as EEC member countries.

Current status on CE marking is covered on handbook sheet HB 53.

A generic Certificate of Conformance for CE requirements is available as HB 57.

EMC

We are in the process of having sample catalogue units third-party tested and plan to use the self certification method for most OEM items.

Our product is particularly suitable for filtering out mains conducted noise on old equipment.

Safety

We are in the process of having sample catalogue units third-party tested and plan to use the self certification method for most OEM items.

There are a number of transformer related specifications. There are also relevant specifications in the office equipment and information technology areas.

Where necessary we can review any one of our units to a particular specification.

We have supplied a number of different designs to meet various specifications as components and are happy to do this where customers need it.

Component Approvals

We maintain a computer file of international specifications held by various components which we use.

This is integrated with our Bill of Materials software and can be used to print a list of approved items in any of our products.

A file of master copies of component approval certificates is maintained.

Feedback

We would be pleased to review this document with any interested party.

hb025 : using CVT's outside published specification

All Advance catalogue CVTs are supplied and guaranteed to a published specification. In general the CVT is specified to industry recognised norms and can be operated well outside its described performance specification. This note describes where liberties may be taken and should be read in conjunction with our GT generic specification which gives curves for many situations. This very robust product is particularly suitable for the unpredictable electrical mains supply in third world countries. Our CVTs are still the most reliable and effective mains protection for such applications.

High input voltage

if the CVT is operated with the correct input fuse or circuit breaker it should work OK until the protection opens at about 150% of the nominal input voltage rating. The output voltage will rise with increasing input at about 20% of the change - i.e. if the input goes up 5% the output will go up about 1%.

Low input voltage

the output voltage will sag as the input voltage falls. To operate under expected very low input voltage select a larger unit than normally required. Under loading the unit will provide significantly improved results. Most units will provide usable power down to 30% of the rated input voltage.

Non-sinusoidal input voltage

If it is the correct frequency and alternating the CVT will operate. A THD up to 25% or even a square wave is NO problem for short term durations.

Overloading

The CVT may deliver up to 50% more power than specified this is very dependant on actual input voltage. After this the unit will self protect by reducing the output voltage progressively until it reaches nearly zero. The unit can be operated into a short circuit indefinitely. Electric motors take large currents at switch on. If the CVT will start the motor it is big enough.

Power factor loads

Inductive loads depress output voltages and can usually be corrected by adding capacitors. Capacitive loads have the opposite effect. If you can tell us about the load we can usually advise how to drive it.

Switching loads

Ordinary switched mode power supplies are particularly suitable for use with our CVTs. Care must be taken with units with self adjusting input voltage arrangements. Some dimmer circuits or phase controlled circuits can cause problems.

Wrong frequency

1 or 2 Hz off the correct frequency will produce low output volts for low frequency and vice versa. 50 Hz units will function at 52 Hz but will eventually fail if operated at 60 Hz.

Low temperature

Down to -25 ºC is usually no problem after that the capacitor bank becomes the limiting factor.

High temperature

For short term excursions of ambient temperature up to 70 ºC the only damage is to the life of the capacitor bank. For every 5 ºC above 40 ºC expect the life to be halved from the calculated 200 000 hours MTBF.

High humidity

If the unit is stored at 100% RH it will probably require drying before starting up. The unit will operate at 99% RH without problems.

Failed capacitor

If the unit has several capacitors and one fails the unit may still provide reduced power. Shorted capacitors will stop operation but open circuit failures can be tolerated. Problems will occur at switch on if the unit is operated at high input voltage and light loads when a capacitor has failed. If the unit makes a ‘humping’ or ‘motor-boating’ noise it should be turned off and on again. Failed capacitors should be replaced as soon as possible.

Damaged casework

We recommend that a thorough visual examination be made by a competent person prior to switch on. Don’t connect a critical load without prior testing. Light bulbs and fan heaters make excellent test gear in remote locations. So long as all the wiring and insulation seems intact and the situation demands it we suggest you try it.

Other problems

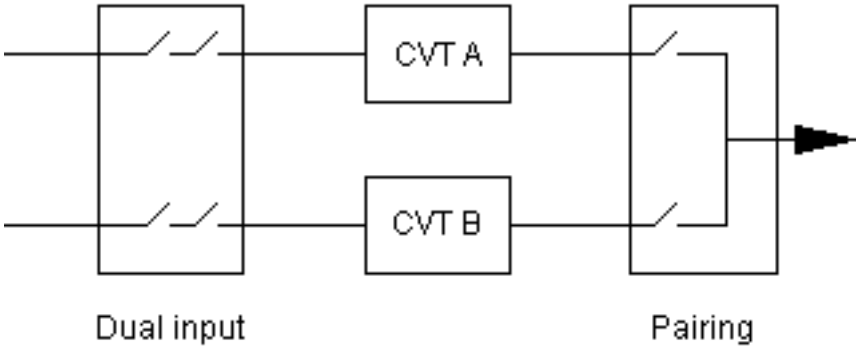
Please ask for technical assistance via our sales office.

hb069 : Pairing + monitoring system

BASIC PRINCIPLES AND OPERATION

OUTLINE

Two Constant Voltage Transformers are fed from two separate supplies the outputs of the CVT's are both connected to the same load. Under normal conditions each unit supplies approximately 50% of the load power. If one of the supplies fails the back-feeding transformer is made safe and the remaining transformer provides all the load power without any disruption.
Either CVT may be isolated and safely removed while the system is operating and the CVT maintained or repaired. Replacement is best done at service shutdowns but can be done on-line if essential.



DUAL INPUT CONTROLLER

Two separate supplies are connected to the input terminals. Each supply passes through the main poles of a n/o contactor - the coil of which is controlled and monitored by current sensing relay and associated circuitry.

The supplies then exit the controller via output terminals to be connected to the inputs of two Constant Voltage Transformers.

The supplies in the controller are indicated by neons. The supply to each transformer is operated by locking the key switch in its "closed position 1" and pressing the green "on" button. When the supply has failed the both neons are off. If the red "off" button is pressed then only the "CVT - input on " neon is off.

PAIRING AND MONITORING SYSTEM

The two separate outputs from CVT 'A' and CVT 'B' are connected to the input terminals. (Terminals S1 S2 S3 and S4 in both systems must also be interwired to provide a supply to the main contactor coils).

The main wiring then passes through the main poles of the N/O contactor (the coil of which is operated by the current sensing circuitry in the dual input controller) and then paired together at the high - low output terminals (to which the critical load is connected).

The load sharing of each transformer is monitored on the two ammeters with the output voltage of the system is shown on the voltmeter.

Provision is made for remote alarm circuitry by using N/C contacts on the alarm terminals

hb017 : generators with CVTs

Sophisticated computer systems sometimes use diesel engine driven generators for backup in case of mains failure.

Where our CVT's are used for power conditioning in the normal mains mode it is desirable to take advantage of the CVT performance when using the generator.

These notes provide some guidance on the potential problems which can be met together with solutions.

Neutral

Some generators do not refer the low side of the output to earth. This MUST be tied down to avoid damage to any of our larger catalogue units which have double primary shields.

Care must also be taken that the generator neutral is not connected to the CVT output low.

Frequency

All ferroresonant devices are frequency sensitive.

The generator must run close to 50 Hz for the unit to operate correctly.

Unfortunately the speed/output voltage curve for the generator goes the same way as the CVT so speed should be adjusted at actual running load.

We publish a curve for the effect of frequency variation in our CVT Handbook.

Short term off-frequency operation will not damage the CVT.

Phase

The output from the CVT will be out of phase with the input in cases where the generator supplies other equipment directly some care is needed if a phase sensitive triac firing circuit is installed.

Safety

Unless phasing circuits are fitted all circuits should use 'break before make' contactors and enforced supply separation.

Some thought needs to be given to the Regulations regarding out of phase supplies in the same area.

hb036 : using CVTs with a UPS

Introduction

Modern on-line Uninterruptible Power Supplies (UPS) give excellent performance when applied as expected by the designer.

Sometimes superior noise immunity or voltage variation handling is required. This is usually accommodated by adding a power conditioning product to the UPS. Such installations are attempting to provide a much higher protection than provided by the simple RF filters in the UPS which are designed to stop internal noise leaving the UPS.

Potential pitfalls

The UPS was probably not designed with the expectation that it would be driven from something other than an ordinary mains supply. Some UPS have output circuitry which does not manage difficult loads very well. Once the user decides to add the two products together it becomes apparent that there are several different ways to connect up the critical load. These different approaches give rise to various problems which can cause problems to the unwary.

Alternate scenarios

The UPS will normally have an automatic bypass if it is of the on-line type. We recommend that all such units should also be fitted with a maintenance bypass (either manual or automatic) for properly planned installations. The main problem is to assess whether or not the power conditioner should be put in front or behind the UPS. There also needs to be some consideration about how the bypass operates and whether or not power conditioning is available in either bypass mode.

Considerations

It is not often realised that a UPS supplied in today's modern market place may have characteristics which are not properly described in the sales literature.

For example the UPS output power rating is usually quoted with a `power factor'. The implication of this is that the unit may be rated at 1000 VA but is quite incapable of supplying 1000 watts.

An on-line UPS has to support the full rated load whilst the system is recharging it's batteries. This usually means that the unit requires considerably more input power than expected from the output rating.

The UPS may not have facilities to allow the bypass line to be connected to a different supply from the normal incoming mains.

The two major transformer based power conditioning technologies are `ferro-resonant' or `low impedance' types. Both also have internal inefficiencies and will require more power at the input when fully loaded than is available at the output.

The ferro-resonant types often based on constant voltage transformer (CVT) technology also have power factor considerations at both input and output.

The CVT is also less efficient than conventional transformers. However the CVT represents one of the most effective ways to solve noise and voltage problems when applying UPS products in tough working environments.

Working solutions

UPS + low impedance conditioner (AIT)

In this case the conditioner may be used in front of the UPS to protect it against mains borne spikes and

common mode noise. Clearly if it protects the UPS then it will protect the load against the same mains borne problems. The AIT must be rated to provide enough power for the worst case input requirements of the UPS. These must be considered for an exhausted battery full load and worst case temperature conditions. In the absence of proper data use a rule that the AIT should have a rating which is at least 50% bigger than the UPS.

It is also possible to use the AIT after the UPS to provide galvanic isolation and/or protect the critical load against common mode noise generated by the UPS. The AIT will NOT provide any protection to the UPS input circuitry. With this connection attention must be given to the capacity of the UPS to drive the AIT. Typically the AIT wattage rating should be no larger than about 50% of the rated VA of the UPS.

UPS + CVT power conditioner

There are huge benefits to feeding a UPS from a CVT based power conditioner. These include lightning protection better battery recharge times and a benign mains feed for the UPS. The mains becomes essentially clean and complements the battery back up features of the UPS. In this case however more problems are apparent.

The CVT is a resonant device which has unusual input characteristics. (See ds047) Consideration must given to the fact that the input power factor of the CVT is affected by line voltage and load value. Some UPS units will not drive inductive loads at all. Others may struggle to cope with the varying power factor. Either way the UPS load rated at 1000VA with a 0.6 PF rating on the output can only drive a CVT which is considerably smaller than one designed to deliver 1000 watts. A useful rule is that the CVT should be considered to be 80% efficient and therefore the rating is:

UPS load rating VA * PF * 0.8

So a normal 1000VA UPS may only be adequate to drive a 480 watt CVT! For CVTs driving the input of the UPS the issue is entirely one of the worst case UPS needs. The rule above for the AIT can be used. Further attention should be given to the fact that the CVT may provide a clean sinewave into a resistive load but it may not provide the low distortion waveform required by some UPS chargers. This can cause the UPS to run it's batteries flat.

Summary

The combination of a UPS and a power conditioner requires serious planning BEFORE buying equipment. If the two units have similar ratings they will probably not operate satisfactorily in any combination.

If one item is already installed it probably means that the only combination which will work is either a larger unit in front or a smaller unit after the existing one. This usually means the second unit is too small to drive the critical load!

Our engineers would be delighted to assist with any problems relating to a specific installation.

hb071 : digital camera problems

Introduction

The advent of very high quality scanning backs for studio cameras has caused a new interest in mains related image noise problems. Most photographers are not engineers and this page attempts to provide enough information for a studio camera user to try and evaluate whether or not a particular problem may be solved with mains power protection devices.

Diagnosis before cure

In most technical applications where problems occur it is usually easier to effect a cure if the problem is actually understood.
By examining images which have been produced by a suspect digital camera under differerent conditions it may be possible to eliminate possible causes of a problem.

It is also necessary to have to hand the expected performance for the camera. If the camera was never intended to produce an acceptable image under the conditions of test - then no amount of mains protection is going to improve it! (Some camera manufacturers have been reluctant to give measurable figures for performance and we feel this is unacceptable.)

Popular image problems

We usually ask photographers to examine poor images for the following problems:

variation in lighting conditions during the scan

An example of this is in a studio where ambient daylight is illuminating the subject and the sun goes in or out during the scan. In the simplest example where the sun starts behind a cloud and comes out during the scan there will be an overall brightness increase across the image in the direction of the scan. The change will be directly related to the rate of change of sunlight variation compared to the rate of scan. Clearly elimination is straightforward.

variation in artificial lighting due to mains problems

SPIKES - these short duration occurrences can produce bright spots in one line of pixels caused by the light actually brightening up momentarily - unusual even in direct off mains tungsten lighting because the spike energy has to be quite large. This effect is normally completely random.

BROWNOUTS - this is where the mains voltage sags and the light given out by unstabilised tungsten lights literally dims down for the same period as the voltage droops. The result is similar to the sun going behind a cloud during the scan. (This process can work the other way with voltage surges) and may vary considerably during a scan.

variation in artificial lighting due to mains frequency beats

The UK mains supply is modulated at 50 Hz (cycles per second) and direct-off-mains tungsten lights (ordinary bulbs) flicker at this frequency ALL THE TIME! The human eye `integrates' the effect and does not notice it.

This causes a problem which is always difficult for non-physicists to understand but musical people are familiar with tones which `beat' and the same effect can happen when the effective scan rate is close to 50Hz or a multiple. The result is that some lines of pixels see bright light and some dark.

The picture will have a series of `fringes' *parallel* to the scanning sensor - width and spacing of the fringes will be set-up and *scan-rate dependent*. Cameras have anti-fringing software to combat this problem. Usually the result looks like a venetian blind shadow over the image. It can also produce multicoloured effects not just light and dark beacuse only one colour channel may be beating.

light path obstruction

If a piece of dirt is stuck to the scanning sensor it will produce a (usually coloured) line in the *direction of the scan*. Usually the line is across the entire frame and the problem can only be corrected by using cleaner techniques. If the sensor is clean and the line is always the same colour it suggests that the sensor is faulty.

camera technology

this is a huge subject and only briefly touched here

the image faulty areas should be pushed to the limits of installed software using mainly contrast and brightness adjustments to view the image pixel by pixel to try and assess what is actually happening as the sensor moves along.

If there is quite a lot of colour variation along the line of pixels when scanning an evenly illuminated area it is probably directly related to any interpolation in the process or sensor/amplifier inconsistencies. (Users should appreciate that the analogue scanning data is converted to digital information right after the scanner head. The A to D process is where the electronics value really costs!)

Colour variation in the image under these conditions must be reviewed with the supplier specification to assess if it is typical or worse than usual for the camera back. Tests should be done at different scan rates and exposure combinations (f-stop & light change) to try and discern the relavance of the fault to external influences.

`Fringes' which occur along a distinct line of pixels *across* the scanning sensor are consistent with a change in camera system amplifier gain between successive pixel rows and really should not happen.

If a step function in the overall `gain' characteristic occurs on a random basis check the fringe to see if it gives the impression that the back slowly drifts in it's gain value and then suddenly regains control going back to a figure from several pixel lines previously in the scan. If so it can be either mechanical sticking of the traverse lack of amplifier gain control or a voltage fluctuation caused by changing loads elsewhere.

Summary

Sometimes it helps to build a test setup to eliminate external influences and still demonstrate that the back produces problems. A simple battery driven lamp which has no 50Hz and no spikes! It can be arranged to have no droop through the actual scan process by using a relatively large battery. The best approach would be a car battery and a couple of headlamp bulbs. To be utterly pedantic the bulb voltage could be monitored during the scan.

The subject should be a nice plain background with a small object used temporarily to set up the correct focus to simulate an actual shooting scenario. This test would eliminate a large proportion of the external influences which could otherwise be erroneously blamed.

Finally if after evaluation it is felt that the camera is really suffering from a direct or indirect mains related problem please ask us for help.

We can provide a UPS to provide power when the mains is down a power conditioner to remove spikes or a more sophisticated one which stabilises the voltage suppliying either the camera lights or both. Normally we would loan a unit to allow the photographer a chance to prove what may be an expensive cure actually solves the problem. We have at least one obsessive photographer on site!

If you need any more info please ask!

hb022 : earthing power conditioners - 4 options

The earthing connections for conditioners installed to isolate noise are very important.

The unit is designed to isolate the load from the building earth as well as to provide voltage stabilisation and noise attenuation.

The earth on the protected load may be connected to the safety earth but it must be realised that noise spikes on the safety earth may cause problems.

This applies to so-called `clean' or `dedicated' earths run from the main building power distribution box.

Ideal installations have the input of the conditioner protected by the safety earth and a separate clean earth provided for the critical load.

This can be achieved by an earth rod, water pipe (when suitably tested), or structure in tall buildings.

A `clean' earth may be made by employing any of the following:

Earth rod

Most installations can be earthed by driving a 10 mm x 2.5 m long earth rod within 30 m of the critical load.

This rod is then connected using at least the same size wire as the feeder circuit.

Water pipe

A water pipe can be used if the resistance to earth is less than 6 Ohms. Make certain by testing that the water pipe is not isolated by plastic connections, especially where it leaves the building.

Building structures

When the installation is in a multistorey building it will be necessary to connect to the structural steel for the clean earth. Choose a point that is close to the conditioner and bolt a wire to the structure. Connections to the structure are usually better than running a wire to the basement.

Earth usage

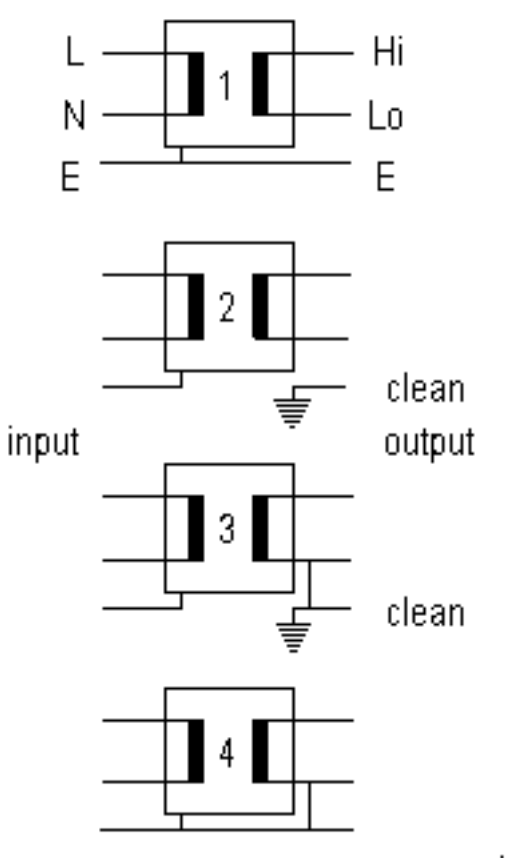
In those cases where the load is partially protected (some peripherals unprotected by the conditioner) we recommend that the low or pseudo neutral side of the conditioner output is connected to the clean earth to avoid voltages appearing between the floating output of the double wound CVT and the unprotected peripheral.

Further attention should be given to ensure that earth connections are `star-wired' to the clean earth.

Local permanent wiring regulations should always be observed.

The four major options are as follows:

	1 the output of the conditioner is floating with the safety earth wired through. Advance plug/socket units are like this. Unit fails normal earth loop impedance testing but is safe to BS 3535. If one output is fault connected to earth the other becomes hazardous. The conditioner will work OK. If both outputs are earthed the unit will close down to a safe condition. Note that some poorly designed SMPS are sensitive to floating neutrals.



2 hardwired using separate clean earth. This gives good overall noise performance. Clean earth must test out properly and be isolated form safety earth. Clean earth should be labelled in UK to 514-7.
3 as 2 but establishment of quasi neutral. Output high is now potentially hazardous and should be connected via an RCCD if feeding sockets. Common mode noise may be better than 2 above in some situations. For first time installations this option gives the most straightforward solution. The conditioner operates like a new distribution transformer.
4 safety earth wired through quasi neutral. Common mode attenuation poorer. Installation should use RCCD with sockets. The output is high-and-low not live-and-neutral so earthing the low output terminal is entirely compatible with the Regulations.

hb060 : e-mail + internet

Introduction

Advance has maintained an e-mail address since 1988.

With the huge increase in Internet activity and the desire to keep our product information databases current we make a big effort to maintain the Advance-Galatrek Web pages.

E-mail

Advance-Galatrek uses various e-mail addresses.

Business mail should be addressed to:

sales@aelgroup.co.uk

World Wide Web

The current Web site for Advance-Galatrek is at URL:

http://www.advance-galatrek.co.uk

Published information on our company and product summaries are included on our home pages.

We also advertise open opportunities for employment at this site.

hb052 : Standard + Extended Warranty on CVTs

Standard Warranty

If problems are experienced with the unit please contact our sales office for advice. All Advance power conditioners are covered by a 24 months warranty. This period is normally calculated from the date of supply. Normally we expect the user to return the unit to our factory for repair. We will repair or rebuild the unit at our discretion and return ship it as quickly as possible. With certain failures site work can be more practical in terms of both cost and time. In general terms our product is very reliable and once running satisfactorily in an application should cause no further concern.

These notes do not affect any commercial arrangements made with our customers or our legal obligations.

Warranty Extension

All Advance power conditioners are covered by a 24 month warranty. However with the increasing field population in computer applications we are sometimes asked to provide maintenance or long term repair contracts. We offer to provide warranty extension to any customer who owns and is using a product of our own manufacture. Warranty extension provides for free labour and materials as required to bring the operational efficiency of any unit back to our published data sheet specification. This extension is available on an annual basis only. Application for warranty extension is made by submitting an official purchase order detailing the model number serial number and installation location of the unit. The cost of extension is available on request Units with power ratings up to and including 2100 VA must be returned at customer cost to our factory for repair. The unit will be repaired and reshipped within two working days return shipping cost to be borne by Advance Electronics.

Units rated above 2100 VA will be repaired at any UK mainland site at the customers option within two working days of formal advice of any operational failure. Reasonable access must be provided.

Offshore sites must be discussed with Advance Electronics prior to submission of application for warranty extension.

Customers are required to ensure adequate fan cleaning is carried out on units where circulating or cooling fans are fitted.

We reserve the right to levy an estimate for repairing units which have seen unreasonable or abusive service. Any such units will only be repaired if the customer undertakes to cover the cost of repair. We reserve the right to replace units with a new similar item where the total cost of repair exceeds the replacement value. We reserve the right to inspect any unit prior to acceptance of warranty extension responsibility.

World wide service

In addition to manufacturing repair facilities an Wales UK Advance Electronics is represented around the world by independent companies.

These sales maintenance and repair facilities are not controlled by Advance however we provide extensive technical support to our representatives abroad. Most of these companies are involved in selling a range of power products and provide at least some form of limited repair service. We would be delighted to provide information about the nearest available repair facility for any location in any country around the world.

Advance maintains active representation in all of Europe Asia and some parts of Africa.

hb029 : Safety data on CVT based power conditioners

Scope

These notes apply to all ferroresonant transformers made by Advance Electronics Ltd. at Wrexham.

Construction

The transformer consists of insulated copper wires wound onto an insulated former subsequently assembled onto steel laminations. Advance power conditioners are double-wound transformers with tested secondary isolation from the mains. In addition high voltage capacitors are added into a resonant circuit configuration.

Installation

Advance provides detail installation instructions for all models and care should be taken to use them. It is practical to meet the fundamental safety needs and yet retain a high level of earth integrity with a little care at the planning and wiring stages.

Hazards

High voltage

The transformer must be correctly installed according to the requirements both of the latest edition of local wiring regulations and manufacturers recommendations. Specifically proper in-line fusing or other suitable protection must be installed. Output voltages can be as high as 650 volts and suitable RCCD protection and proper insulated fittings must be used in accordance with the needs of the application. The internal capacitors may run at 660 volts ac and are lethal when operating. The capacitors are safe when the unit is switched off SO LONG AS THE ‘CAPACITOR TO WINDING’ CONNECTIONS are SOUND. Only authorised and trained personnel should attempt repair.

Power

The unit is incapable of delivering more than 2 or 3 times its rated current in a failed mode and a maximum of less than 75% of its rated output voltage.

Temperature

The steel stack of the unit may reach 60 ºC in normal air and precautions must be taken when repairing or testing exposed units. The exposed stack on small units does not reach an unsafe temperature but may feel quite warm to touch. All units should be well ventilated as power ratings assume natural air cooling.

Chemicals

Once completed and all solvents have been burned off the transformer is chemically benign. The capacitors contain paper insulation soaked in transformer oil which is relatively odourless and harmless to human skin. Although messy this oil is only found if a capacitor leaks through some internal electrical fault in the capacitor. If the capacitor is leaking the transformer is faulty and should be switched off. Historically PCB’s have been used in the capacitors but Advance has not used any since about 1972.

Mass

All the transformers have a high density and suitable precautions should be taken in respect of the size under consideration.

Noise

Audible noise at 50 Hz is emitted at different intensities depending on unit size. Levels range 45 - 65 dBA. If other higher frequencies are present - checks should be made for potential faults.

Multi phase systems

Advance power systems can be wired in several different configurations. In cases where more than one 240 volt phase is to be connected into one enclosure attention must be given to external safety labelling. The wiring regulations demand that 415 volt warning labels be affixed in visually prominent positions after installation. Suitable labels are enclosed if appropriate and replacements are available on request from Advance at no charge to systems customers.

Self setting power supplies

During recent months an application problem has arisen with some types of UPS. The problem specifically relates to customer loads which have self-adjusting voltage power supplies. This type of power supply looks at the incoming mains and typically sets itself to either 115 or 230 Vac. If driven with any current limiting source such as a CVT or CVT based UPS the power supply sets itself to 115 V and then is promptly supplied with 230 V which usually means destruction of the customers' power supply.

Customers who have selected products with a load using this kind of SMPS should select a CVT which corresponds to the lower voltage input rating of the power supply or ensure that the CVT/UPS is switched on before the load. Most of the equipment we have seen with this type of 'world wide' power supply is small and rated below 1 kVA for razors and portable TV sets.

hb011 : PCB Health and Safety data

POLYCHLORINATED BIPHENYLS (PCBs) were used as a liquid impregnant in power and lighting capacitors during the period 1950 - 1980 under such trade names as AROCLOR ASKAREL BICLOR CLOPHEN DUCONOL PYROCLOR.

It is now known that PCBs are NON-BIODEGRADABLE are stored by body tissue and build up in the FOOD CHAIN give off TOXIC FUMES when operated at HIGH TEMPERATURES and increase the risk of cancer in animals and humans under these circumstances. There is strong evidence to show that PCBs attack welded metal seams and so produce a leak without any external influence thus necessitating early removal action as no practical drainage techniques are available.

This major health hazard is now under review by an EEC committee and all knowledgeable Authorities are recommending early attention to the problems of identification and approved disposal of this substance.

HAZARDS

PCBs give off FUMES and VAPOURS above 55º C and most capacitors operate at this level. Strict precautions must be taken to prevent the INHALATION of these under conditions of container LEAKAGE and FIRE and any such exposure must be reported to Health and Safety Officials concerned. Skin and eye CONTACT must be avoided at all costs and under such circumstances copious IRRIGATION with EYEWASH or WATER becomes an immediate necessity followed by urgent MEDICAL ATTENTION. The irrigation fluid now becomes a hazard and must be CONTAINED. All TOOLS and CONTAINERS and MATERIALS which have been exposed to the FUME or LIQUID versions of PCBs must be SEGREGATED to avoid any CROSS CONTAMINATION. INHALATION INGESTION OPEN WOUND and SKIN ABRASION contact with PCBs is a medical EMERGENCY.

PRECAUTIONS

Avoid all DIRECT CONTACT with the body and ensure that an IMPERVIOUS barrier is protecting the skin being particularly wary of the presence of CUTS and ABRASIONS. Never use clothing made of an absorbent material at the contact layer. All rubbers and most plastics are unsuitable for PCBs contact. POLYTHENE or similar material affords the best protection when used as GLOVES OVERSHOES HATS OVERALLS ETC. GOGGLES should be of a CHEMICAL grade. The possibility of EXPOSURE to FUMES and VAPOURS necessitate the use of SELF CONTAINED BREATHING APPARATUS. DO NOT SMOKE in the presence of PCBs. Do not dispose of neat or suspended PCBs in Drains Sewers Streams Effluent courses or any normal Waste Channels. Affix a prominent LABEL to all equipment which contains PCBs and initiate a formal COLLECTION and DISPOSAL PROGRAMME.

EMERGENCIES

CASUALTIES must be moved to FRESH AIR kept WARM at rest with OXYGEN if necessary and have contaminated clothing removed if possible. Urgent evacuation to hospital under medical supervision is necessary. CONTAMINATED CLOTHING must be removed as soon as possible to a suitable CONTAINER marked `PCB'. CONTAMINATED SKIN must be thoroughly cleaned with soap and water in a PCBs CONTAINER. INGESTION OF PCBs and any SKIN or CHEST or THROAT IRRITATION must be treated as a MEDICAL EMERGENCY. SPILLAGE must be absorbed with SAND ASH SAWDUST etc. and collected in a PCBs CONTAINER. All WETTED areas must be mopped using absorbent material soaked in PERCHLORETHYLENE or proprietary solvent such as GENKLENE and then collected in the PCBs CONTAINER.

PROTECTIVE CLOTHING

Pocketless Terylene Boiler Suit with elasticated waist ankle and wrist grips. Chemical grade goggles. Heavy duty Polythene Gauntlet gloves with thin Polythene disposable gloves inside the gauntlet and boiler suit sleeves. Protective Overshoes fitted inside the boiler suit leg bottoms. Self-contained Breathing Apparatus. Impervious overall.

ACTIONS

Identify all Capacitors which are suspect of containing PCBs and obtain a COMPETENT VERIFICATION of the impregnant used therein. LABEL as PCBs all Capacitors which are verified as such and institute a removal and replacement programme of work following a competent understanding of the activity involved. All REMOVAL ACTIVITY must give priority to the prevention of leakage from an undamaged Capacitor and the minimising of contamination from a leaking CAPACITOR by way of fixing clamps and terminals. All PCB CAPACITOR UNITS should be placed in a SEALED STEEL CONTAINER for subsequent transportation purposes. MOP UP all SPILLAGE and WETTED AREAS placing all agents and protective garments in the PCBs CONTAINER including washing solutions. Consider the need to replace cabinets and switchgear which may have been significantly contaminated with PCBs.

DO NOT SOLICIT INCOMPETENT JUDGEMENT on the suspect Capacitors.

DO NOT WAIT for the LEAKAGE to occur and make your Staff aware of the problems NOW.

hb010 : Polychlorinated biphenyl (PCB) in CVT capacitors

We are still servicing old CVTs made as early as 1943. Some of our suppliers have historically used PCB in the electrolyte of high voltage capacitors. These capacitors were incorporated in the manufacture of constant voltage transformers for a period during the 1960's and 70's. Non-PCB capacitors were introduced in the period 1972-75. Advance/Gould transformer model numbers changed when the units ceased using PCBs in capacitors. Specifically:

CV prefix became ECV

CVN became ECVN

some CVN models later became TCVN and all of these are safe. The `E' signifies `ecological' and means that no further checks are required.

1 CVT's labelled Advance in our current red/antelope colours definitely use non-PCB capacitors.

2 CVT's labelled Gould probably do not contain PCB in the capacitors.

3 CVT's labelled Advance and coloured black grey or silver may contain PCB in the capacitors.

If a unit in use is reported by model and serial number to Advance Electronics we can advise on the likely capacitor type.

We offer to service any suspect CVT capacitors at cost and properly dispose of the offending component.

Please note that most newer capacitors are actually marked `No-PCBs' or `Non-PCB'.

We have never used PCB in the actual transformer only in capacitor electrolyte.

Recent medical work suggests that PCB may be a carcinogen.

PCBs in capacitors used in CVT's prior to 1972

A single capacitor may be disposed of as part of 1 cubic metre of bland rubbish having carefully wrapped the capacitor to avoid contamination during handling.

Significant quantities should be disposed of via :

Capacitor Services Limited 24 Bridge Road Cove Farnborough Hants GU14 0HP

Telephone 01252-521911

The handbook sheet hb011 health and safety data is copied from the EEC directive on PCBs.

hb072 : ICT installation considerations

Introduction
Installers of permanent electrical wiring are required to ensure that new work meets current regulations. These regulations are designed to save life in the case of faulty wiring or equipment. Further the practice is regulated to make our offices factories and homes safe places to live from a fire risk point of view.

ICT systems
Unfortunately modern equipment suffers from a wide range of other influences. Some of these may actually cause sensitive electronic chips to fail. Just wiring up and performing routine regulation oriented checks is inadequate when mission critical or crucial systems are involved.

Considerations
By the time the wiring is being installed it is already too late. The retro-fitting of a star earthing system after a computer room has just been quite safely wired up involves a full strip out and re-install.

Safety
The regulations require that all permanent wiring is compliant with safe practice. Normally this means calculating fuse sizes and selecting wire sizes to create protection discrimination and quick disconnect.

The electrician is required to bond all exposed conducting elements in an equipotential zone together. As a practical matter this is normally done in a daisy chain fashion which is entirely safe. From a noise diversion point of view it can be a disaster. Just checking earth loop impedances does not mean that no earth loops exist in the protective wiring. A proper star plan must be evolved and the installer should prove the installation before connecting sensitive equipment. The regulations are covered by BS 7671 (until recently `the 16th edition').

Noise
Transients can occur naturally in our environment (lightning) and in heavy equipment switching. Specific attention must be given to the likelihood for such occurrences and a planned approach used to divert them as quickly as possible to earth.

Earth cabling should not be connected to more than one star point and all cables should radiate like spokes in a wheel.

Data cables between equipment must be checked for earth isolation at one end of the screen.

Data cables going outside the equipotential zone may require specific fitting of surge diversion boxes. This also applies to phone lines. Recommendations are given in BS 6651.

Static electricity
The static charge commonly experienced as a definite spark between humans and earthed objects in dry weather will destroy the silicon chips in a computer or telephone switch.

Aliens
ICT equipment mains circuitry should never be available (preferably by the use of hardwiring or special plug tops) to alien loads such as the office kettle or vacuum cleaner.

Networking
As our systems become more complex and critical to our daily business operations all installations should be planned for best practice. Networked systems are particularly prone to problems appearing in unexpected places. Modem lines monitoring communications and transducer signals with long wires connected to the network are perfect aerials to collect harmful spikes.

hb030 : ICT wiring to avoid earth loops

Introduction
With the ever increasing use of Information + Computer Technology (ICT) equipment there is a greater chance of installation with unsatisfactory wiring.

History
The traditional UK electrician is taught to earth all metallic chassis. His training is directed towards making all installations safe. If single phase work is properly carried out he will check that the three conductors are definitely connected where they should be and definitely not where they should not be! Clearly he will also check for correct use of live and neutral and prove discrimination on fusing. He may also install added safety protection in the form of an RCCD.

Today
These checks are no longer adequate. We have found that some wiring which is perfectly safe is quite unsuitable for ICT equipment. In some cases the use of mains noise protection equipment could be avoided by better wiring practice. However it is usually less expensive to retrofit protection rather than re-wire a whole building or even just the computer network. A better solution is to approach the problem at the planning stage. In addition to ensuring that the wiring is safe some specific attention must be made as early as the planning stage for wiring practice which ensures the best results for data processing equipment. After the installation is complete some extra checks should be carried out while the system is not connected to the supply and conductors may be temporarily disconnected.

Practice
The objective is to provide a totally safe installation without any earth `loops'. An earth loop can give rise to surprisingly large currents in low impedance circuits.

These currents can cause mysterious data processing faults hum problems and failed communication ports on PCBs in EPoS equipment.

Good results
The diagrams show the incidence of an earth loop and approaches to wiring to avoid them. In simple terms all equipment must be earthed **in only one place.** The following checks should be done on the wiring of a system prior to considering if it is satisfactory for ICT use.

1 ALL existing statutory checks should be made.

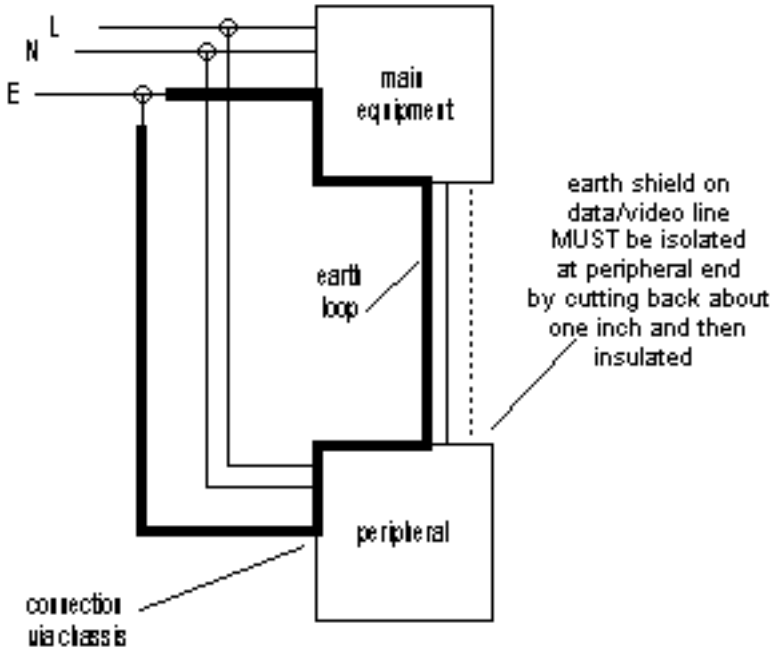
2 The `star point' earth connections should be opened and all related equipment checked for isolation from earth.

3 On installations where there is galvanic isolation provided by a mains noise protecting device the galvanic isolation must be proved.

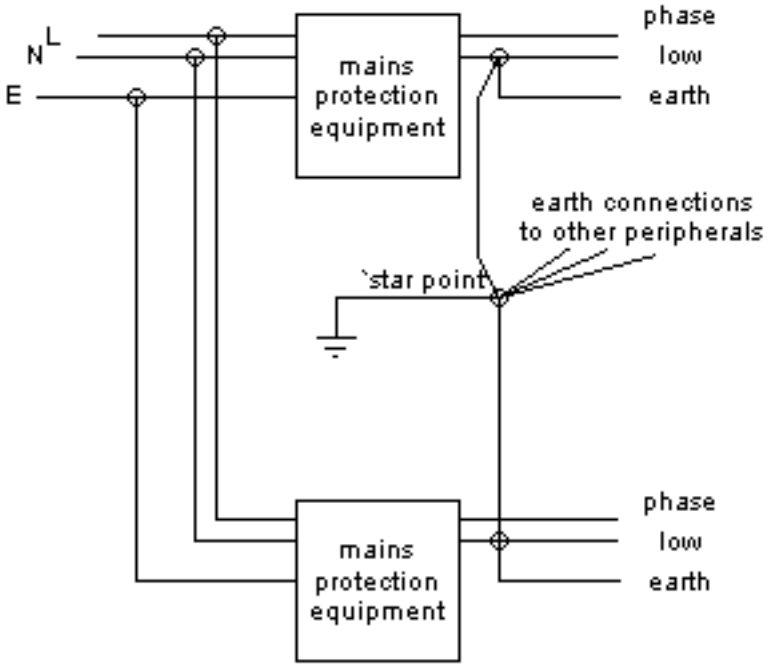
Checks should be made for both earth and neutral conductors.

4 Once inter peripheral data or video lines are connected the earths of EACH peripheral need to be checked for single connection only.

(This is best done on a networked system by removing all mains plugs from their sockets and seeing if any plug earth pin is connected to any other)



Incidence of earth loop via data cable screen and peripheral earthed chassis



Preferred practice for wiring two conditioning products to the same `star earth'

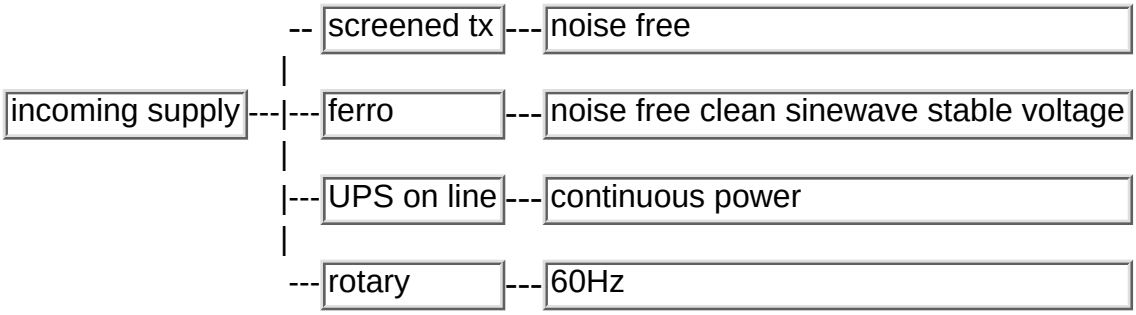
hb068 : Laboratory power facilities

Introduction

There are inevitable compromises with ALL methods of Electrical Power Conditioning. It is up to the USER to establish which technology provides the most attractive solution.

Flexible power solutions for Laboratory Installations

In the Test House or Specialised Test Facility where a variety of solutions can be required it may seem that the most flexible solution is to provide a number of small stabilisers and battery back-up units which can be moved around to the point of application. Experience shows that there is one extra major advantage to planning the needs when the facility is under construction and wiring out several power supply options to every general purpose test station. The advantage is that ALL power conditioning products have ratings which are determined by cost and if the distributed conditioning is combined into a central facility it is less likely that a test piece will be too large for a mobile conditioning solution.



There are several other considerations including efficiency impedance/shared usage load effects and MTBF. These are summarised in the table:

Topology	prime characteristic	features	benefits	considerations
surge diversion	lightning protection	low cost	zero series impedance very high MTBF	fit to guidelines in BS6601
notch filter	narrow band noise attenuation	low cost	unwanted frequency rejection	only works over design frequency band
isolation transformer	galvanic isolation	low impedance	safety of personnel	use RCCDs for protection
low impedance conditioner	galvanic isolation noise attenuation	exceptional common-mode noise protection	ease of application efficiency	leakage inductance adds to mains impedance
ferro resonant conditioner	transverse-mode noise attenuation voltage stabilisation	exceptionally robust noise filter waveform notch replacement sine waveform re-building 2-way filtering voltage stabilisation	clean mains supply MTBF=200kHr overload proof	weight efficiency 3-phase delta loads input protection down stream protection
UPS off line	normally on standby	lower cost	provides emergency power	switch over time usually lower power ratings battery maintenance
UPS on line	load runs on inverter full time	provides 2nd source supply	provides emergency power	non unity PF loads 3-phase delta loads battery run times efficiency battery maintenance MTBF=20kHr
rotary converter	50 to 60Hz etc	low technology solution	virtually perfect noise rejection	usually fixed frequency MTBF=5kHr maintenance cost
generator	chemical energy source	huge range of options	permits manual frequency variation	noise maintenance environmental problems

ADVANCE-GALATREK supplies a UPS combined with a low impedance transformer. If you need any more help - please ask!

hb048 : maintenance of CVTs

Routine maintenance

Routine checks should be made to ensure that the ventilation for the power conditioner is properly maintained. The unit should be positioned in a well ventilated location as power ratings assume natural air cooling. Annual checks of capacitor integrity may be worthwhile once the unit is more than five years old.

Preventative maintenance

Visual examination of capacitors on large units can often indicate a local fault through leakage of oil - in this case replace the faulty part. To prolong usable life it can be beneficial to replace the capacitor bank every five years. Some larger power conditioners are fitted with fans to assist with cooling. Under normal circumstances the only preventative maintenance required is the cleaning of fans if fitted.

Replacement of capacitors

We are occasionally asked to supply replacement capacitors for old CVT's. Capacitors are subject to two characteristics which affect the use of these spare components in CVT's.

a value tolerance

b physical dimensions

a - changes in capacitance value will result in differences in the CVT output voltage.

In general terms we expect normal production tolerances in the value of a spare capacitor to make less than a 1% change to the original output voltage nominal setting. This situation can be improved when a coloured dot is noted on the failed capacitor and it's colour dot is defined at the time of ordering a spare. The output voltage variation expected with CVT's using a spare capacitor of the same colour dot will be less than 0.3%.

b - the physical dimensions of commercial capacitors change over extended periods of time. In general terms our capacitors will be of similar size or smaller. In case of any anticipated problem we recommend a factory repair for units up to 3 kVA. Care must be taken when handling high voltage capacitor installations. Replaced capacitors must have an adequate Vac rating for duty with high harmonic currents.

hb101 : retrofit wiring for EPoS systems

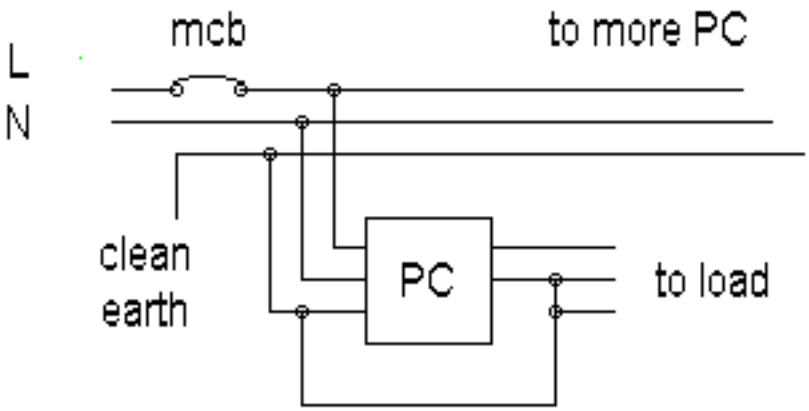
Background

A number of customers have asked us to document an approach to the replacement of poor EPoS wiring in recreational establishments

The need to re-wire is usually to ensure that the EPoS system is correctly connected and that no unrelated loads are on the same circuit

Where a site is prone to noise related problems caused by unknown or unpreventable causes the re-wiring will not necessarily make all the historical problems disappear. However it does mean that the wiring arrangement is clearly defined and will not have any earth loops

In addition the provision of both a dedicated line clean earth and the absence of all earth loops often solves transient noise related problems. In all cases the current regulations must be observed. The diagram shows the principles of the new wiring arrangement



The Spur

The EPoS equipment is generally fed from a single spur protected by an MCB

This spur should be routed around the building avoiding runs close to other wires - especially high power cables. The wire (conventional twin and earth) must be sized according to current regulations

The MCB

Type 4 is desirable to allow for the high switch on surges of CVT types of Power Conditioner

The Earth

The earth is derived from a dedicated earth rod of suitable impedance. NO other equipment should be attached to this earth. Care must be taken to ensure no earth loops exist. This can be tested by disconnecting the earth rod from the spur and checking all gear is isolated from earth

The Power Conditioner (PC)

This will usually be one of two types.

1) CVT based unit with voltage stabilisation and `bullet proof' noise protection. The CVT also provides soft start to the load and waveform re-build and well an enhanced ride-through for mains micro breaks

2) AIT series low impedance conditioner designed to remove ALL common mode noise

In either case the clean earth is fed to the unit as a safety earth. If a CVT is fitted the output `low' MUST also be connected to the earth. For the AIT series this connection is internal

General

It is good practice to ensure that no free sockets are available for non EPosS loads - kettles vacuums etc.

If for any reason RCCDs are to be fitted they will only protect the load if installed AFTER the PC

The installer should check the wiring is NOT connected to any other circuit

The system data cabling MUST be checked to ensure that the earth screens are only connected at ONE end

A diagram of the completed installation MUST be kept to assist further investigation if problems persist

hb067 : Safe UPS Installation + BS 7671 - pt 2

Introduction

A typical uninterruptible power supply (UPS) requires EXTRA calculations to be performed before installation and sign-off.

In the illustrated case the UPS has no galvanic isolation and the earth + neutral go through the unit. The recommended bypass switch means that it is possible for the distribution wiring to see the low impedance mains supply.

For the first part of the calculations the UPS should be ignored and the wiring calculated out in the normal way. It is unlikely that when the UPS is introduced into the system that the rating of any wiring will have to be increased EXCEPT the input supply.

Input supply

Most UPS equipment is not 100% efficient. In addition to supplying the full rated load current modified by the UPS efficiency there is a need to support the battery charger as well. The UPS manufacturer should provide worst case input power needs. For longer supply runs this often means that a larger wire is required than expected for an installation where there is no UPS.

Testing

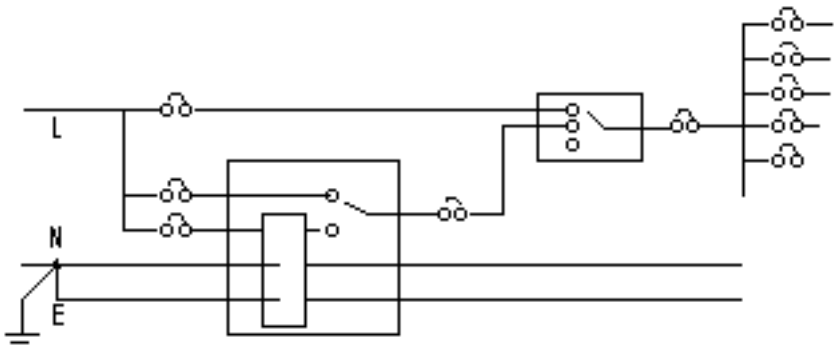
For the first part of the testing the UPS should be isolated and the distribution connected to the main supply via the bypass switch. Normal checks should be applied using calibrated equipment.

NOTE: some modern pulse-based testing equipment can damage electronic equipment which should normally be disconnected during testing.

The second consideration is where the distributed power is supplied by the static inverter in the UPS. This has real and apparent impedance. The apparent impedance is electronically controlled and should be specified by the UPS supplier as a worst case current available from the UPS.

For user safety the installer must ensure that the earth loop impedance is sufficiently low so that it provides a voltage inside regulations for the worst case fault current available from the UPS. It should be appreciated that under these conditions over current fault protection may not clear.

For fire safety the installer needs to evaluate that all the distribution wiring will not overheat or it must clear protection under fault conditions. If the current is below the continuous current rating of the wiring the apparent source impedance may mean that the protection does not clear.



hb066 : Safe Installation + BS 7671

Introduction Installers of permanent electrical wiring are required to ensure that new work meets current regulations. The UK wiring regulations have been converted to a BS specification (BS7671) which at the time of writing is being CENELEC harmonised. Current regulations are designed to ensure that new installations are safe under fault conditions. `Safe' means that the installation cannot harm a user OR cause a fire. For normal industrial and domestic site work the required testing usually covers BOTH needs.

In some special cases where the wiring is modified by local conditions EXTRA tests and results must be considered before a site can be signed off by the installer. There may also be situations where commonly used test equipment may damage part of the installation and defeat one or more reasons for the test. As manufacturers of electrical power conditioning equipment we offer the following guidelines to the extra special conditions which must considered.

Power Conditioning Equipment This may be an in-line filter or a generator. The filter may be of a galvanically isolated type. The generator may be a small rotary type or the static inverter found in uninterruptible power supplies (UPS).

The wiring regulations and good practice are founded on the expectation that electrical power is derived from a low impedance source. Fault conditions usually result in the clearance of a protective element such as a fuse or magnetically operated breaker. Most power conditioning equipment is by it's very intention NOT low impedance.

In addition there may be electronic or magnetic control of either voltage or current which cause the equipment to have a real impedance which is modified in operation to an apparent impedance. The installer must be aware of the critical schematic for the equipment being installed and consider all operational modes of current path selection devices. In addition distribution discrimination must be shown in the usual way.

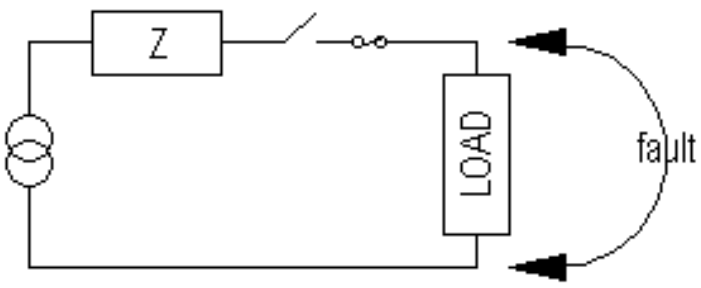
Special considerations
Two different views must be taken in cases where the supply is provided by an apparent or actual higher impedance source:

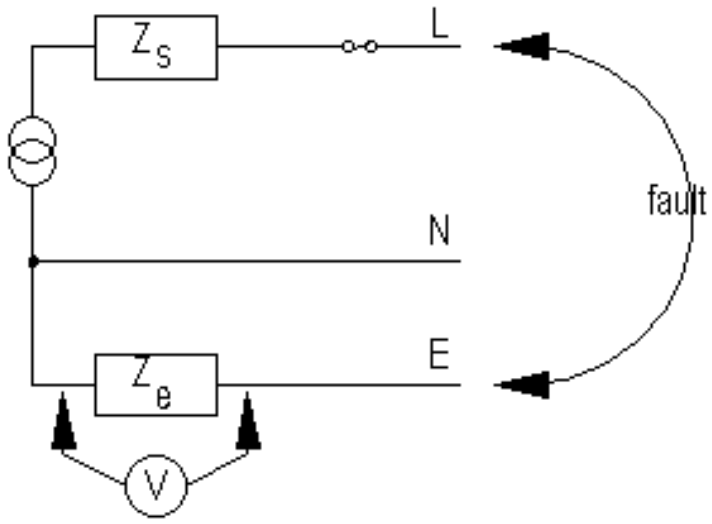
The first consideration is user safety:

the installer must ensure that when any live conductor is connected by a fault to an exposed earth that the resultant VOLTAGE is not unsafe. (In practice it is assumed that the fault is zero impedance) The voltage generated across the earth impedance (Ze) by the fault current must be `safe'. Although this is usually below 50 volts good practice and margins mean that a target of 5 volts is more realistic. If there is significant source impedance (Zs) whether real or apparent this must be considered in the calculation of the worst case fault current.

The second consideration is fire:

the installer must consider the worst case CURRENT under any one fault condition. If the apparent source impedance of the supply (shown as Z) is large enough to prevent the wiring from overheating then the protection is NOT required to open.





Since there is an almost infinite variety of potential installation variations even using our own products some further suggestions for ensuring safe installation are outlined in hb067.

hb058 : selecting power conditioners

Mains Monitoring

It is not essential to take on-site measurements but this process can be useful when the status of a site is unknown. Sometimes it is more economic to just experiment with a known good filter such as a CVT.

We offer a loan scheme to potential and existing customers.

Advance can also provide ac mains monitors for checking of local mains supplies. Our monitors check the incoming supply against various voltage and noise thresholds which are adjustable by the user. Some other environment data can also be recorded such as the temperature. Results are normally printed out but can be RS232 linked via a modem to a remote site.

Interpretation of readings

Over the years we have had some problems with various monitors providing misleading results. Care must be taken to evaluate the results obtained against reasonable expectation for the site. Common pitfalls include using the same monitor to measure the input and output of a filtering device. This results in the noise spikes bypassing the filter through the monitor! Sometimes there is a very poorly defined line between cause and effect.

On particularly bad sites we have eventually connected a conditioner to a simple resistive load on the secondary of our conditioner and monitored the voltage across the load. This removes the chance of extraneous noise data coming from an unknown load situation Such practice can also alleviate the problems of mains difficulties being mixed with unrelated data corruptions and failures due to other causes.

Specifying the conditioner

The application must be reviewed for some basic parameters before we can quote for the supply of a suitable unit. In addition background information can be very helpful in choosing the right technological solution.

The technical information suggested on hb055 is a good starting point.

hb028 : Sizing conditioners for refrigerator compressors

Background

Those of us who are used to the high standard of electricity utility supplies in the industrialised world sometimes forget the problems faced by users of high tech equipment in the third world.

This page describes how the World Health Organisation addresses the problems associated with protecting the compressor motors on refrigerators.

The data is extracted from the WHO document entitled `Guideline for establishing or improving national regional and district vaccine stores.'

Factors requiring consideration

The WHO presents data to assist in the selection of power protection equipment in section six of their recommendations:

"

World Health Organization
Geneva

6. Power Factors

6.1 Reliability

The reliability of the electricity supply is a key issue when choosing refrigeration equipment. Where power cuts exceed 8 hours in 24 hours the use of ice-lined refrigerators and freezers is essential.

6.2 Standby generators

No refrigeration equipment currently available has a holdover time greater than 2.5 days. Vaccine will be destroyed if there is an extended mains power failure unless there is an alternative source of power. It is essential to assess the risk of such failure. Failures may arise for many reasons. Examples include overloading of the power supply network; mechanical breakdown; lack of fuel or seasonal storms.

Replacing large quantities of damaged vaccine is expensive and extremely disruptive. It may not be possible to replace vaccines quickly because world stocks are limited. Emergency replacement from a finite world stock also disrupts the supply of vaccine to other countries.

All sites stoning large quantities of vaccine should have a standby power supply. Often this is achieved most economically by locating the vaccine store in a hospital compound or on some other site which already has a standby generator. When this is not possible it may be necessary to install a generator to serve the vaccine store alone.

6.2.1 Generator sizing and selection

The Product Information Sheets give advice on choosing and buying a generator and the EPI Equipment Performance Specifications provide detailed specifications. Wherever possible the final sizing of generators should be made the responsibility of the cold chain equipment supplier.

6.2.2 Generator control and operation

Generators serving vaccine stores only should be fitted with automatic starting devices linked into the cold room or refrigerator/freezer alarm system. If the vaccine store is served by a compound generator this will generally be started by an automatic mains failure device. In such cases alarm-triggered start-up is not required.

All generators should be run at least once per week and should be regularly serviced to ensure that they remain operational. The fuel tank should be kept full at all times.

6.2.3 Generator siting security and fire protection

A generator should be sited so that it does not create a fire hazard. Typically it should be located in a separate building or weatherproof enclosure. The fuel tank should be isolated and should be surrounded by a low wall or an earth bank to prevent fuel spills from spreading. Both the generator and the fuel tank should be located in a secure compound to prevent theft. The fuel filler cap tank should be locked and the fuel line should be protected so that it cannot be tampered with. Fire extinguishers capable of extinguishing fuel oil engine and electrical fires should be fitted dose to the generator and fuel tank.

6.2.4 Assuring fuel supplies

Fuel supply for the generator must be a priority allocation. A running log should be kept in order to monitor fuel consumption.

6.3 Voltage stability

In many countries severe voltage fluctuations occur in the mains power supply. Voltage fluctuations greater than 15% will damage compressor motors. The problem can be overcome by fitting each piece of refrigeration equipment with a voltage stabiliser. Some of the refrigerators and freezers in the Product Information Sheets are supplied with integral voltage stabilisers.

Voltage stabilisers for cold rooms should be specified by the cold room supplier. When a voltage stabiliser is ordered for a refrigerator or freezer the following information should be given to the supplier:

- *Actual voltage fluctuations (recorded by an engineer or electrician)*
- *Nominal voltage*
- *Single or three phase supply*
- *Frequency (50 Hz or 60 Hz)*
- *Nominal power of compressor in watts*

The nominal power of the stabiliser should be about five times greater than the nominal power of the compressor to allow for the starting load."

We are grateful to the WHO for the opportunity to reproduce their recommendations.

hb056 : Special casework for 3-15kVA CVT's

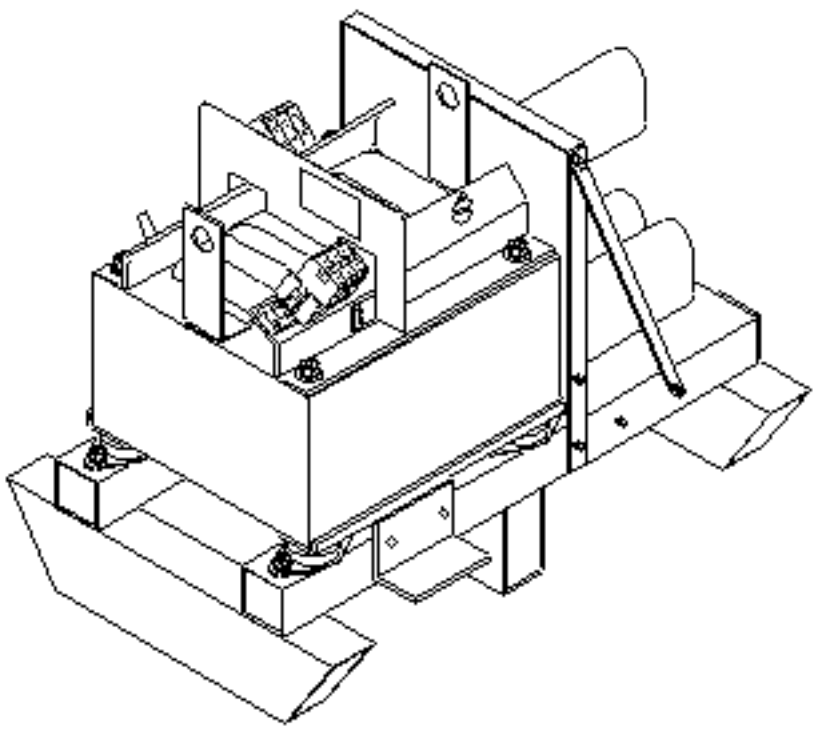
Introduction

Advance uses a range of special casework for CVT’s from 3 to 15kVA. Details of the various options are given to assist designers to specify particular requirements. The basic CVT based power conditioner is similar in each unit but variations are available for

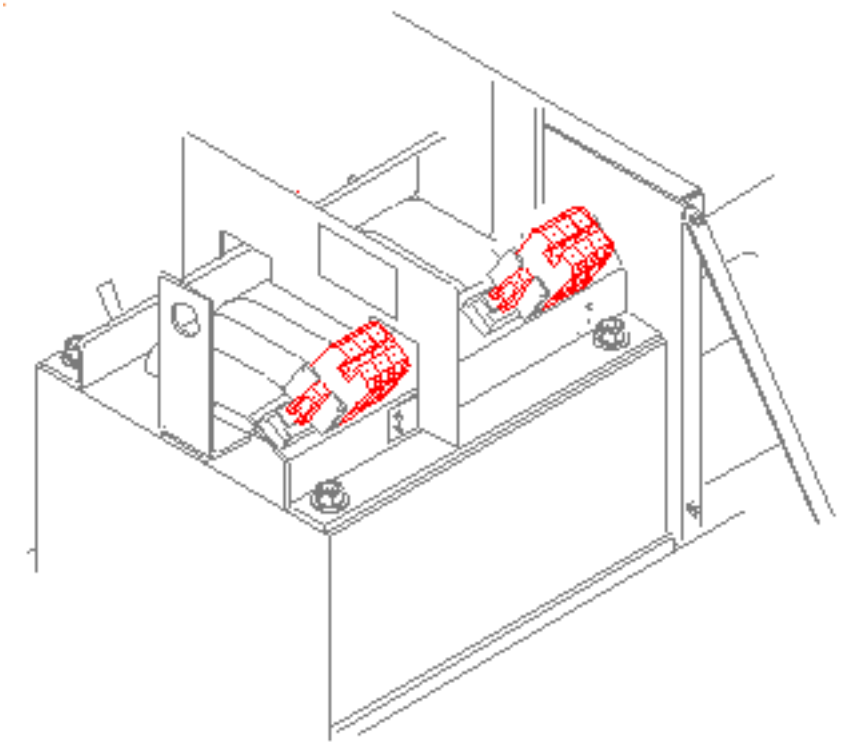
- optional output fusing
- cable access
- terminal arrangements
- optional fan cooling

The table indicates overall sizes of special enclosure with all sides removable.

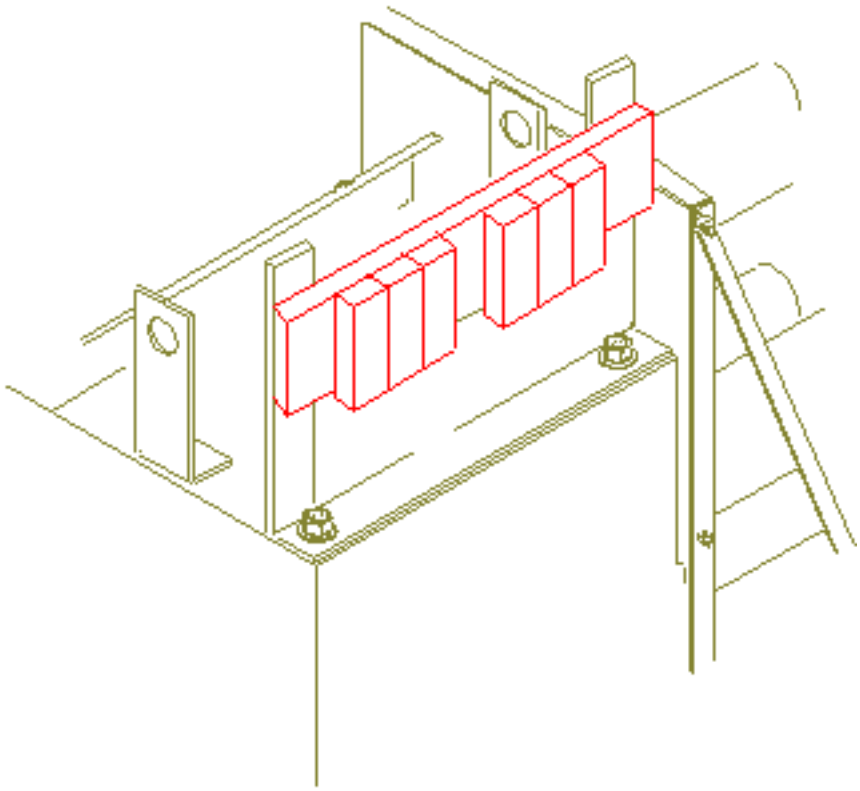
Baseplate fixing holes are the same as the catalogue unit described in ds051. The special cover is fitted so that it’s centre is over the centre of the baseplate fixings.



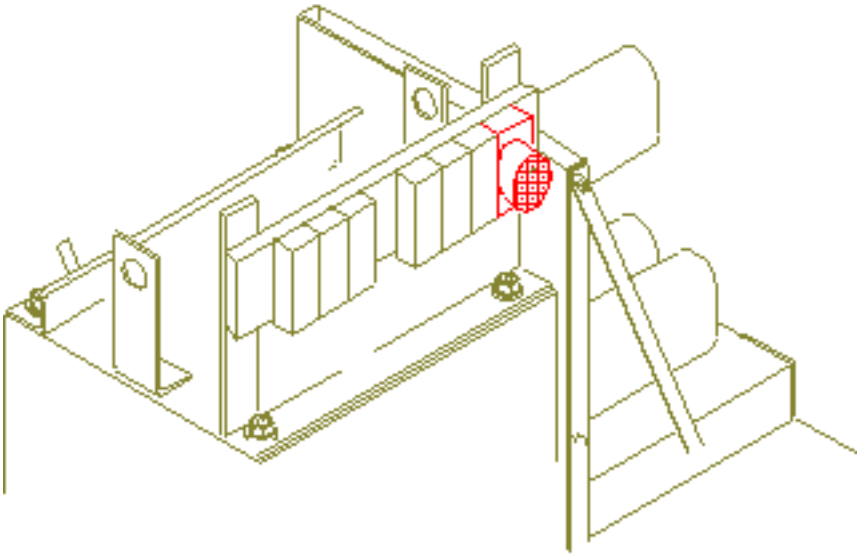
standard arrangement



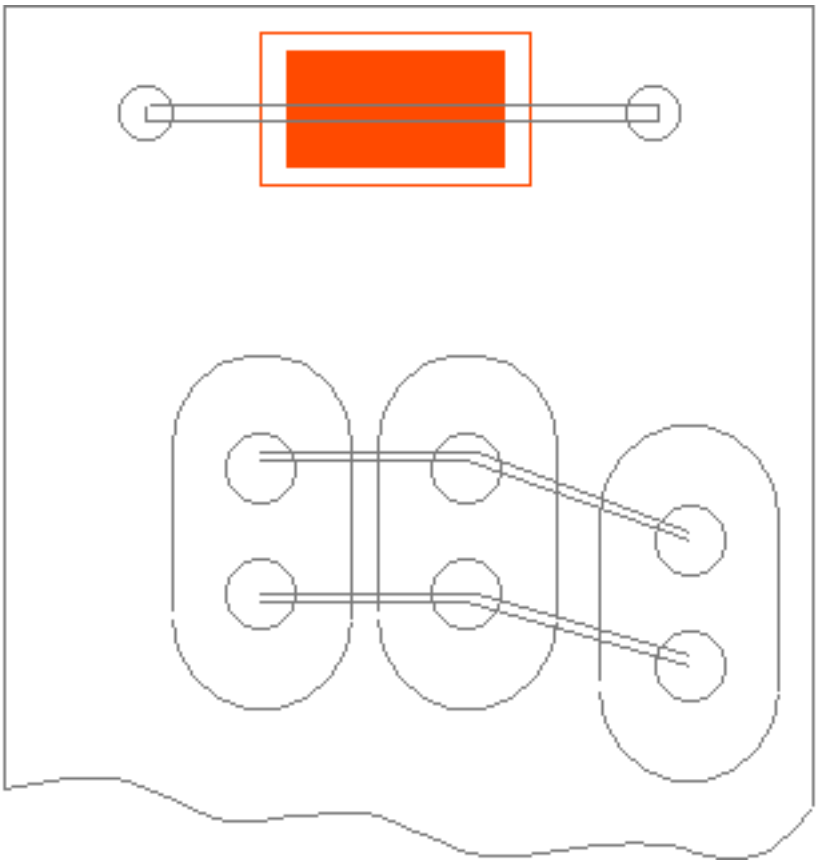
same side terminal style



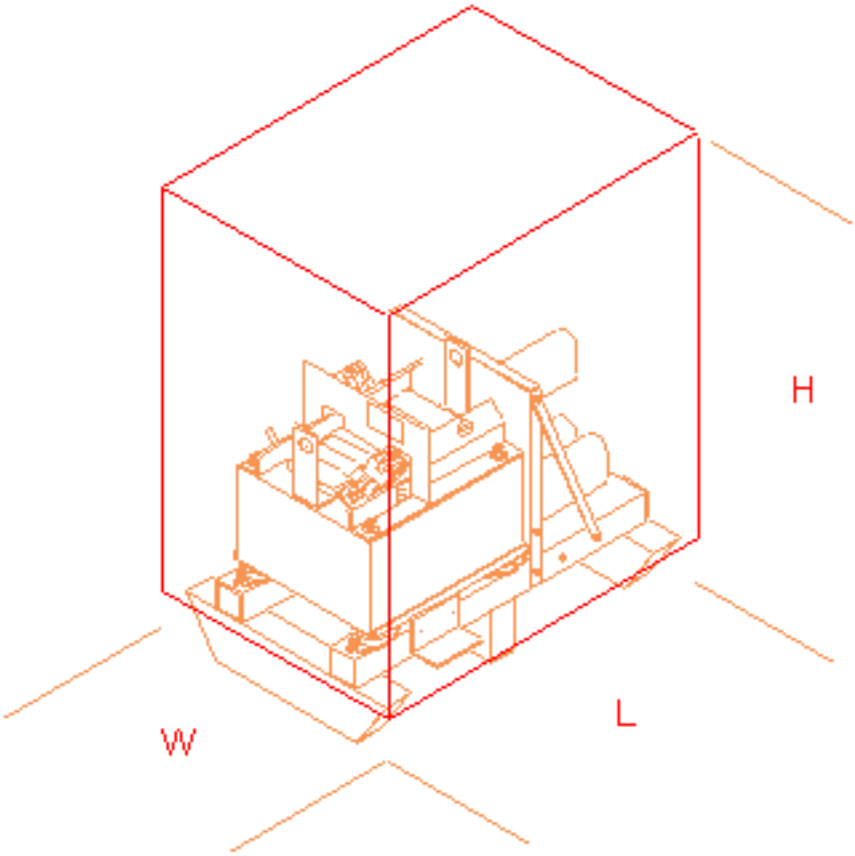
top entry terminal style



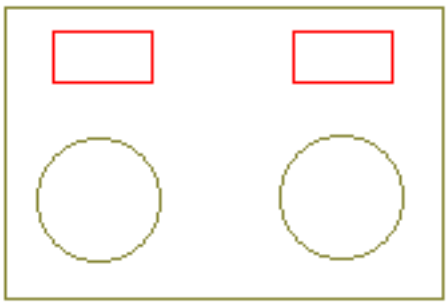
optional fuse holder location

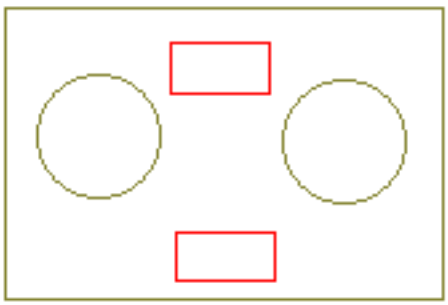


alternate fuse holder position



dims in mm			Height with	
VA	Length	Width	bottom entry internal gland plates	top entry external gland plates
3000 4000 5000 6000 7000 8000 10000 12500 15000	725	505	575 575 680 680 680 950 950 1150 1150	680 680 950 950 950 1150 1150 1320 1320





shows alternate gland plate styles for same side and opposite side cable entry

hb032 : how surge protection devices work

Introduction
Surge Protection Devices (SPD) provide a basic level of extremely cost-effective power protection to whole facilities or zones rather then individual pieces of equipment. They bridge the gap between the performance of ordinary surge and lightning arresters and filters or power conditioners.

Background
The traditional approach to protection of electronic equipment has been to apply measures solely to data processing installations e.g. the traditional "computer room". With modern networked computing and the spread of electronics into almost every aspect of the modern office and industrial building the need for protection has become wider. This includes heating and lighting fire detection and control building management systems access control telecommunications etc. Correctly located and installed Advance surge protection devices provide primary protection from damage to all these simultaneously and at realistic cost.

Operating description
Surge suppressors work by diverting the surge current back to its source so preventing the surge voltage reaching a dangerous level. For this reason they are sometimes called Surge Diverters.

Filters power conditioners and UPS work by "blocking" the surge voltage and preventing current flow. With large surges such as those caused by lightning (which can reach almost any value of voltage) "blocking" type products are likely to break down while surge diverters act as an electrical "pressure relief valve".

Surge Suppressors therefore complement other protection systems.

Description
Advance surge protection devices consist of non-linear resistors connected in parallel with the supply. At normal supply voltage the resistance is very high and the current drain is minuscule (a few milliamps). When the supply voltage rises above the normal extremity of the mains voltage the devices change to a low impedance state capable of diverting many tens of thousands of amperes. The effect of this is to prevent the voltage rising far above the threshold level.

When the voltage rises above the normal supply voltage the surge diverter switches to low-impedance state and prevents the voltage rising further to a dangerous level.

The devices are connected between each Phase and Earth and between Phase and Neutral additionally each Phase and Phase to ensure totally comprehensive protection.

Unlike some types of suppressor incorporating gas-discharge tubes Advance surge protection devices have is no measurable time-delay in operation and upon termination of the surge the devices return to their non-conducting state instantaneously.

Selection
Because surge suppressors are connected in parallel with the supply they are not dependent on the current rating of the installation or the load. Selection of the correct rating is based on the surge exposure level at the particular location.

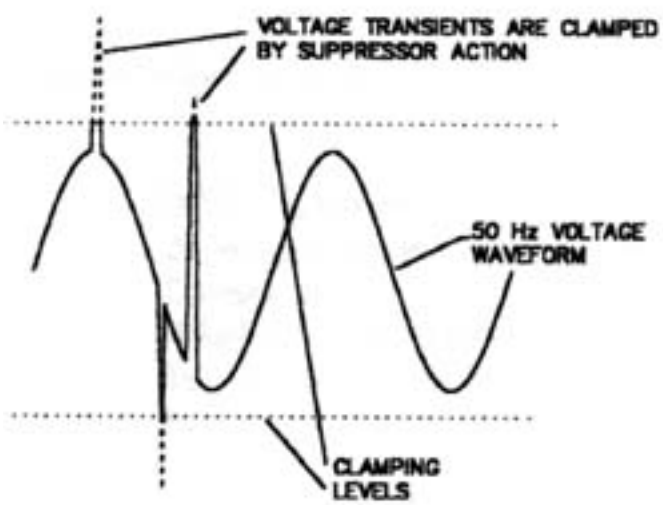
The surge exposure level at most locations in the U.K. is classified as Medium Exposure being an area shown on global lightning activity maps as of average lightning exposure (median of around 0.5 lightning ground strikes per square kilometre per year).

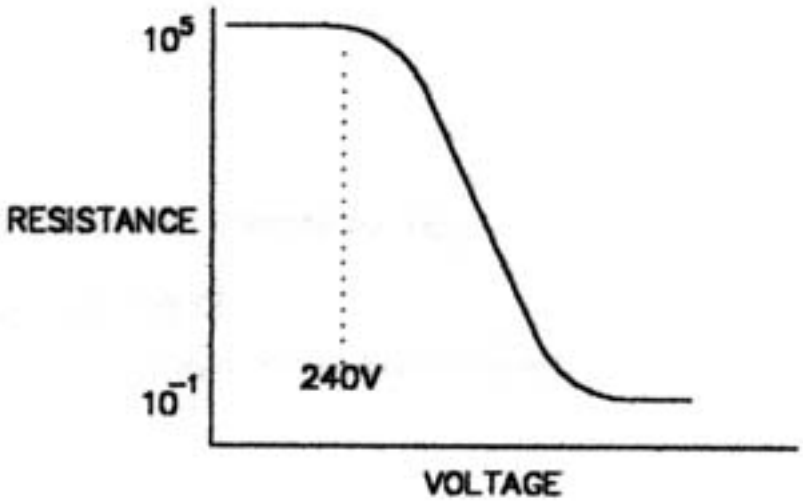
The optimum location for Advance surge protection devices to protect from externally generated transients such as lightning is at the main switchgear panel.

In BS6651 (lightning protection standard) this location is known as Category C. Whilst BS6651 describes the electrical transient environment it is not a product standard and does not address performance or safety requirements for suppressors. There are presently no British or European standards adequately covering all aspects of these devices. Advance transient suppressors are UL1449 listed which gives independent

verification of the important issues of performance safety construction and mechanical strength temperature rise flammability dielectric breakdown over-voltage tolerance surge follow-through current life expectancy reliability manufacturing and production-line testing.

Advance surge protection devices meet and exceed any lightning surge specification in the world are manufactured under a quality system approved to ISO9001 are tested and manufactured in accordance with UL1449 and carry the UL and CSA approval marks.





There is an excellent set application notes on this subject at microsemi

hb059 : Special applications - UK weighing memorandum

Background

The National Weights and Measures Laboratory (NWML) is a section within the Department of Trade + Industry.

NWML has instructed officers in the field to ensure that remote weighing sites are properly protected from an electrical supply point of view.

In cases where remote weighbridges and similar equipment is operated from small generator supplies there is a mandatory requirement to fit power protection devices in series with the electrical supply.

It should be noted that the main magnetic in the Galatrek UPS family called MicroBak uses the same technology to condition electrical power in ALL operating modes of the UPS.

Memorandum WM 429

The NWML has issued a Memorandum describing both the equipment which must be protected and how. The main part of of the Memorandum is transcribed here: An original is available on request from your local Weights + Measures.

DTI logo NATIONAL WEIGHTS AND MEASURES LABORATORY **WM 429**

Department of Trade and Industry (November 1988)

Stanton Avenue Teddington Middlesex TW11 0JZ

Memorandum for the guidance of Inspectors of Weights and Measures

WEIGHTS AND MEASURES ACT 1985

Section 12

The Secretary of State has issued the following amendments to the respective Notices of Examination/Certificates of Approval.

Generator powered equipment amendment No. 1 dated 14 October 1988

Type of Machine	Code Index
Counter machines	V (2) d V (2) e
Platform machines	V (6) d
Weighbridges	V(6) d
Person weighing machines	V (6) f
Overhead weighing machines	V (7)
Milk weighing machines	V (8)
Suspended weighing machines	V (9) a

Crane weighing machines V (9) b

Issued by NWML

Digital electronic machines and associated approved peripheral equipment.

As described in the Notice or minor modification to the Notice of Certificate or authorised variant thereof but having where appropriate the supply from a local generator in place of the mains supply.

In which case there shall be between the generator and the weighing equipment a constant voltage transformer Advance GT series of between 100 VA and 1000 VA rating. The rating chosen must be such that the minimum load on the CVT is not less than 5% of the rated output of the CVT and the maximum load including transient loads such as printing does not exceed the rating of the CVT.

The output of the CVT must be dedicated to the weighing systems and either:-

(i) hard wired directly to the system or

(ii) via a non standard connector in which case the output shall be marked "for weighing system only".

end of memorandum