



DC VOLTAGE GRADIENT TECHNOLOGY & SUPPLY LTD

MARKET LEADERS IN ECDA SURVEY EQUIPMENT & SOFTWARE

SATELLITE SYNCHRONISED INTERRUPTERS SIMPLE TO USE, RUGGED, ACCURATE, RELIABLE



INTERRUPTER SWITCHING CAPACITY

When purchasing an Interrupter remember that the current capacity of the Interrupter must accommodate the anodic and cathodic spikes caused by switching any rectifier output ON/OFF. For a normal rectifier output of for example 50 amperes the Cathodic spike can be at least 100 amperes depending on the Rectifier design. The Interrupter switch must be able to accommodate the 100+ amperes. Hence the normal recommended operation of an interrupter should always be approximately one third of the Interrupters actual capability to allow for this fact plus a safety margin.

SIMPLICITY IN OPERATION

All DCVG Ltd Interrupters have been designed with a rugged construction and simplicity of operation for field use. There are no complex set up activities. You simply connect up the rectifier and satellite aerial, select the ON / OFF switching sequence from 5 most commonly used for DCVG or CIPS, switch ON, wait for the satellite aerial to log on then you are ready. Our company philosophy is to keep equipment simple to use in the field as operators have enough to do without worrying about complex set up conditions of equipment they are expected to use.

All of DCVG Ltd Satellite Synchronised Interrupters utilise a Metal Oxide Semiconductor Field Effect Transistor (MOSFET) rated at 180 Amps 200 volts DC to switch DC at one of five speeds determined by the position of the selection switch. The 125 Amp Interrupters have two Mosfets in parallel for the high capacity. We **DO NOT** use noisy car starter motor switches or mercury switches as the device for interrupting the DC. We use only state of the art MOSFETS.



SAFETY NOTE.

NONE of DCVG Ltd Interrupters are designed to switch AC. The switching of AC which requires some rewiring in the field of the Mains Cables to a Transformer Rectifier is considered by DCVG Ltd to be very dangerous and not an activity we would recommend to any of our Customers. Hence, DCVG Ltd do not encourage switching AC mains electricity.

Rewiring would also not meet most Client Company Health and Safety Regulations.

SATELLITE INTERRUPTERS.

The following Interrupters are available in either 50 ampere or 125 Ampere versions

Variation 1. Unsynchronised Interrupter for simple DCVG Surveys. DCVG Pulse Frequency of 0.45/0.8 seconds only. (not recommended for CIPS).

Variation 3. Satellite Synchronised Interrupter for DCVG or CIPS Surveys. Can be operated at 5 different On/OFF Pulse Frequencies.

Variation 5. A heavy duty DCVG Satellite Synchronised Interrupter for DCVG and CIPS Surveys. The same as Variation 3 but with twice the current capacity.

Variations 3 or 5 are available fitted with a timing device that allows the Interrupter to pulse the DC during selected morning to evening hours and then switch back to normal continuous CP during other times.

SATELLITE INTERRUPTER ON/OFF SWITCHING SEQUENCES

- | | |
|------------------------------|--|
| 1. STANDARD DCVG Setting | 0.45 secs ON followed by 0.8 secs OFF. |
| 2. SLOW Reverse DCVG Setting | 1.6 secs ON followed by 0.9 secs OFF. |
| 3. Reverse DCVG | 0.8 secs ON followed by 0.45 secs OFF. |
| 4. CIPS | 3 Secs ON, 2 Secs OFF. |
| 5. CIPS | 4 Secs ON, 1 Secs OFF |

All Satellite Interrupters check synchronization every 5 seconds so there is no possibility of synchronization drift.

1. The **STANDARD DCVG Setting** 0.45 ON/0.8 OFF of the switch is used for normal DC Voltage Gradient surveying to find coating faults. This speed of switching matches the typical response time of a survey operative. This switching speed can also be used to survey using DCVG's Quantum combined DCVG and CIPS (Close interval Potential Survey) equipment where simultaneous surveys are synchronised by the one second satellite pulse.
2. The **SLOW Reverse DCVG Setting** 1.6 ON/0.9 OFF of the switch is used in conjunction with a digital voltmeter for Pipe to Soil Potential measurements, or Current measurements via an in line calibrated shunt. This is also a good ON/OFF setting for CIPS Surveys.
3. The **Reverse DCVG Setting** 0.8 ON/0.45 OFF of the switch is used when longer ON than OFF sequences are required when carrying out DCVG surveys. Users are warned that the interpretation of the meter pulse can be difficult until some experience is gained.
4. The **CIPS Setting** 3 secON/2secOFF of the switch is used when slightly longer ON than OFF sequences are required; and will allow a digital voltmeter to be used under the best response sequence to gather ON and OFF potentials.
5. The second **CIPS Setting** of the switch 4 sec ON/1 sec OFF is used in typical CIPS operations, when ON sequences are longer than OFF sequences.



There is no need to use long ON/OFF sequences provided the CIPS Data Logger is synchronized with the Interrupters so that measurements avoid the anodic and cathodic spikes caused by switching the rectifier output. Any measurements that incorporate the spikes contain an avoidable error. In older equipment longer times were necessary due to the drift in synchronization when only crystal controlled Interrupters were used which are notorious for drift in synchronization.

The timing sequences can be changed to suit any requirements than those normally offered but these must be specified at time of Ordering, alternatively the Interrupter must be sent back to DCVG Ltd for the new sequence to be installed in the Chip embedded software.



CONNECTING A SATELLITE INTERRUPTER TO A RECTIFIER

The Interrupter is connected in **SERIES** into either the DC negative or positive output cables from the DC source being interrupted. The negative cable is preferred. After noting the rectifier output Volts and Amperes, the rectifier output is reduced and then unit switched OFF.

Never believe that the front panel switch is off until checked with an AC voltmeter. Then switch OFF the mains switch that totally isolates the rectifier from the mains electricity. If there is no totally isolating mains switch be very cautious as

inside the rectifier will be live mains electricity that cannot easily be disconnected.

The Negative cable from the pipeline is disconnected from the rectifier terminal and connected to the large **Red Terminal** on the Interrupter. Using a suitable insulated wire (between 5 and 10mm) the negative terminal on the rectifier is connected to the **Black Terminal** on the Interrupter. The polarity of the connection is important, **If Connected Around The Wrong Way The Interrupter Will Not Switch The DC Output. If This Happens Just Reverse The Terminal Connections On The Interrupter.** The Interrupter should be inserted with the Transformer / Rectifier set in its lowest output setting and the Transformer / Rectifier mains electricity switch in the **OFF** position. When inserted, the rectifier should be switched ON and output adjusted to the same amperes as normal operation without the Interrupter in the circuit. All Interrupters have a small internal resistance. For our equipment this resistance is 0.03 ohms so a slight increase in rectifier setting is necessary to ensure same amperes flowing to give potential values the same as under normal operating conditions where no Interrupter is used.

DANGER DANGER DANGER DANGER

UNDER NO CIRCUMSTANCES SHOULD THE TERMINALS OF THE INTERRUPTER BE DIRECTLY CONNECTED ACROSS THE TERMINALS OF THE DC POWER SOURCE/ TRANSFORMER RECTIFIER AS THIS WILL SHORT OUT THE RECTIFIER AND DO SERIOUS DAMAGE TO EQUIPMENT. ALSO DO NOT UNDER ANY CIRCUMSTANCE CONNECT THE DC INTERRUPTER TERMINALS TO AN AC MAINS ELECTRICITY SOURCE. FOR SAFETY WE NEVER RECOMMEND USING ANY INTERRUPTERS TO SWITCH MAINS ELECTRICITY.

Inside each Interrupter there is a fast acting fuse as protection of all equipment from misuse

The operation of the current switching by the Interrupter is indicated by a LED sited on the front panel. This LED indicates the status as follows.

Red.....	Switch ON (passing current)
No Colour.....	Switch OFF (not passing current)

The Interrupter will cease to operate when the battery charge becomes too low. This prevents damage to components that make up the Interrupter timing circuit. Under normal operation the Interrupter internal battery

has sufficient capacity to work for one week without charging if operated as a stand alone unit without the satellite aerial or two days with the active aerial. Under surveying conditions it is recommended that the Interrupter be kept as fully charged as possible by regular charging or connecting the Interrupter to its battery charger which is driven by the mains electricity of the CP Transformer Rectifier being switched. Using the charger will keep the Interrupter and satellite aerial continually operational. Alternatively a supplementary 12 Volt car battery pack is available that will keep the satellite configuration operational for a long time.



To one side of the Interrupter is fitted a large heat sink to dissipate heat from the MOSFETS. These normally do not get hot, but have been observed to get warm when switching a 100 volt, 5 ampere Transformer Rectifier, in high resistance soil where the ambient temperature was 30°C at midday.

The silver handle on the black Interrupter case is meant for passing a chain (not supplied) through so that the Interrupter can be padlocked to the Transformer Rectifier / DC power source to prevent theft.

LOGGING ON TO THE NAVSTAR SATELLITES

DCVG Ltd do not use a Master Slave combination. Each Satellite Interrupter is unique with its own satellite aerial and ability to recognize which second of the day it is and to initiate synchronization every 5 seconds so any number of units can be started up at different locations but independently they will all come rapidly into synchronization so they are all switching ON and OFF at the same instant. The Satellite Aerial is an active antenna and plugs into the back of the Interrupter case. Place the Satellite aerial at a convenient location where it can see the sky as clearly as possible. Trees, overhead high voltage power lines, building or bridges, etc. can interfere with satellite access. Ideally the aerial should be placed on top of the Transformer / Rectifier.

Alongside the socket where the aerial plugs in is an indicating LED. The status of the Interrupter in relation to the NAVSTAR satellites is indicated by the colour of this LED.

RED NOT LOGGED ON TO SATELLITES
GREEN LOGGED ON TO SATELLITES

There will be no colour on the LED light until the satellite aerial has been connected to the Interrupter.

The following acquisition times are automatically carried out after connecting the aerial to the interrupter and switching ON: -

Satellite Acquisition Times: 15 seconds warm up time (all data known when aerial used in similar part of the world).
45 seconds to 2 minutes initially cold (initial position, time and almanac known, ephemeris unknown).
5 minutes auto locate (almanac known, initial position and time unknown)
5 minutes search the sky (no data known)
Update Rate: 5 minutes continuous searching for the satellites
When first logging onto the satellites at your location it could take a maximum of 5 minutes for the aerial to recognise its location and to log on. Thereafter log on times are quite short.

ENVIRONMENTAL WORKING CONDITIONS

Operating temperature: -30°C to +85°C (internal temperature)
Storage temperature: -40°C to +90°C, Caution as battery is sealed lead acid.

The electronics inside the Interrupter are potted in epoxy to keep free from ambient humidity. The Interrupter is capable of being used in wet rainy weather which does not affect its operation.

BATTERY CHARGING

The Battery Charger for the Satellite Interrupters comes as a small black box with a lead out of either end. At the rear of the Battery Charger is a cable for connection to the mains electricity. At the other end, set in a front panel is a mains voltage range selector switch, so that either **120 or 240 Volts AC can be utilised. Please Check The Mains Voltage, Which Varies For Different Countries.** The front panel also holds a two ampere fuse to protect the battery charger and a LED that glows red when the charger is operational. Inside the battery charger each of the Transformer Primary circuits has a one ampere fuse. This is to prevent the Transformer being damaged if plugged into the wrong mains voltage. The Low Voltage cable also comes out of the front panel and has a two-pin figure 8 plug sized to fit into the Interrupter Charger socket. The output from the battery charger is 18 to 20 volts AC. It is not DC. Each Interrupter has its own built in rectifier for charging the internal battery. The same charger is used for our DC Voltage Gradient and Quantum CIPS equipment. If charging several items at once caution needs to be exercised. For example:-

THE BATTERY PACKS IN THE INTERRUPTER AND DCVG SURVEY METER OR QUANTUM CIPS EQUIPMENT ARE QUITE LARGE. IF THESE BATTERIES ARE BADLY DISCHARGED, THEN WHEN FIRST PLUGGED INTO THE BATTERY CHARGER THEY WILL EACH TAKE VERY LARGE INITIAL CURRENTS, WHICH WILL BLOW THE 2 AMP FUSE ON THE BATTERY CHARGER. IF IN ANY DOUBT IT IS BEST TO CHARGE THE INTERRUPTER ON ITS OWN FIRST AND THEN ANY OTHER EQUIPMENT.

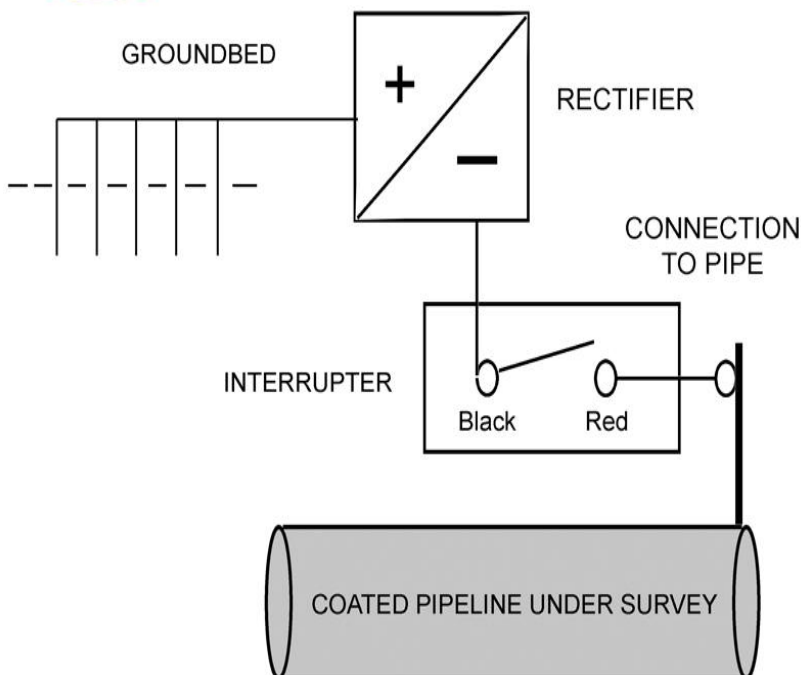
Under normal operation where the Interrupter is charged on a daily basis every night such a problem should not occur and it is quite normal to charge any combination of pieces of the equipment at the same time.

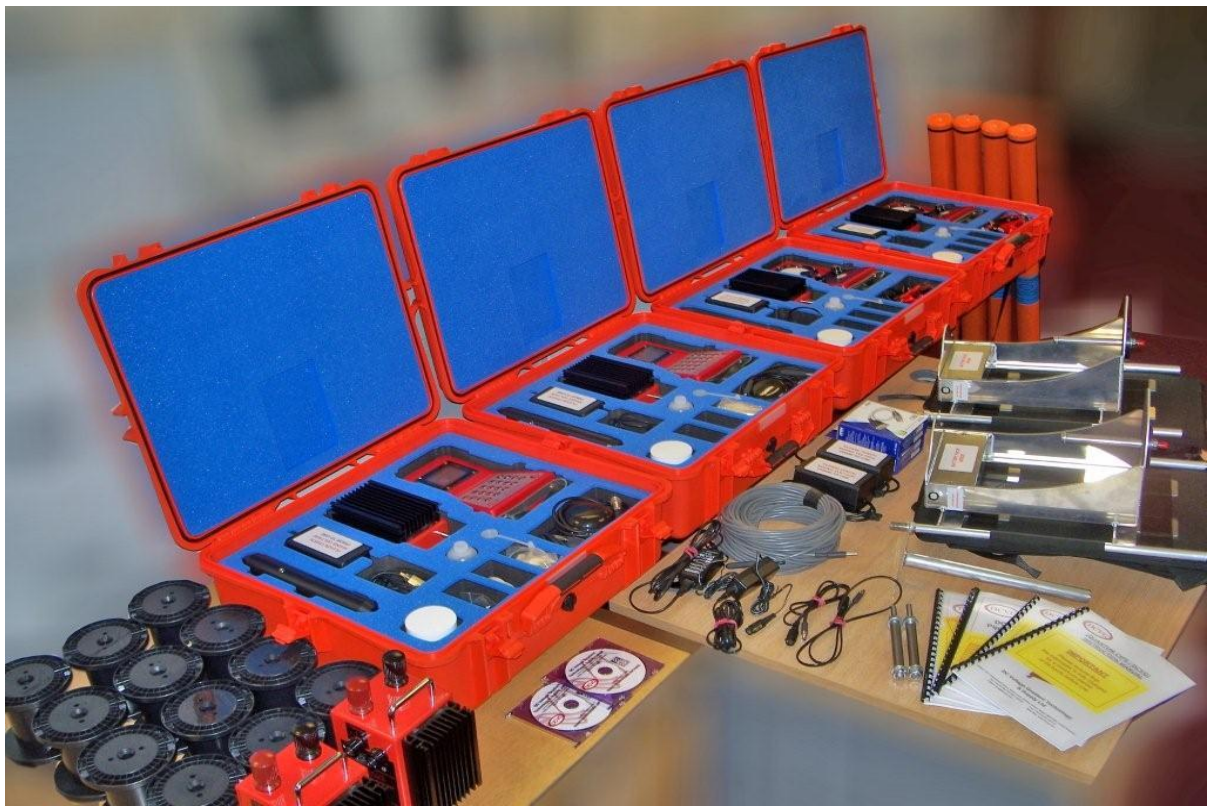
All DCVG Ltd Satellite Interrupters are fitted with the ability to use a larger capacity 12 volt car battery. A cable fitted at one end with a jack plug and at the other end with two crocodile clips are used to connect the external battery. Ensure the black crocodile clip is to the external battery negative terminal and the red clip to the positive. There is internal protection provided that cuts off the external battery if wrongly connected. Inserting the jack plug into the appropriate socket in the Interrupter disconnects the Interrupter internal battery so the unit is then totally powered by the external battery.

Never connect a low voltage AC source from the Transformer Rectifier to the battery charging figure 8 charging socket as this can damage the Interrupter by direct connection of the rectifier to the control circuit of the Interrupter.



RECTIFIER AND GROUNDBED CIRCUIT





4 Full sets of CIPS each having 3 x 50 amp Satellite Interrupters

125 Amp Satellite Interrupter with External Battery for Extended Operation.



50 Amp Stand Alone Interrupter