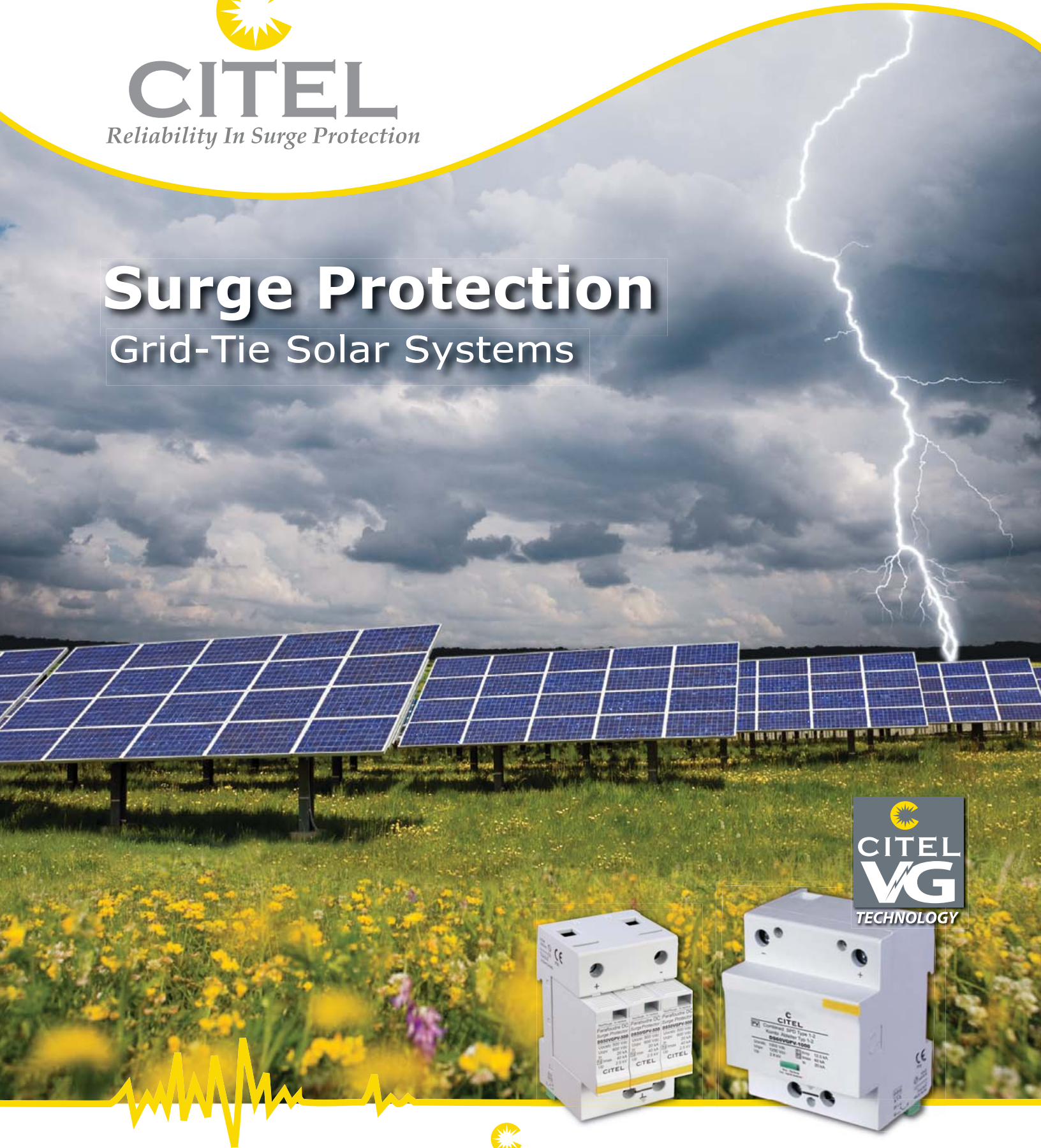
CITEL

Reliability In Surge Protection

Surge Protection

Grid-Tie Solar Systems



CITEL

11381 Interchange Circle South, Miramar, FL USA

Toll Free 1 800.248.3548 | Phone 954.430.6310 | Fax 954.430.7785 | www.citel.us | sales@citel.us

Surge Protection for Utility-Interactive Solar Photovoltaic (PV) Power Systems

Background and Protection Considerations

Utility-Interactive or Grid-Tie Solar Photovoltaic (PV) Systems are very demanding and cost intensive projects. They often require the Solar PV System to be operational for several years before it can yield the desired return on investment.

Many manufacturers will guarantee a system life of greater than 20 years while the inverter is generally guaranteed for only 5-10 years. All costs and return on investments are calculated based on these time periods. However, many PV systems are not reaching maturity due to the exposed nature of these applications and its interconnection back to the AC utility grid. The solar PV arrays, with its metallic frame and mounted in the open or on roof tops, act as a very good lightning rod. For this reason, it is prudent to invest in surge protection to eliminate these potential threats and thus maximize the systems life expectancy. Typically, the cost for a comprehensive surge protection system is less than 1% of the total system expenditure.

To analyze the full threat level of the installation, we must make a risk assessment.

Geographic Risk –	Areas with severe lightning and unstable utility power are more vulnerable.
Application Surface Area Risk –	The greater the surface area of the solar PV array, the more exposure to direct and/or induced lightning surges.
Power Interconnection Risk –	The AC utility grid is a likely source of switching transients and/or induced lightning surges.
Operational Downtime Risk –	Consequences of system downtime are not only limited to equipment replacement. Additional losses can result from lost orders, idle workers, overtime, customer/management dissatisfaction and expedited freight charges.

Recommended Practices

1) Earthing System

Surge Protectors shunt transients to the earth grounding system. A low impedance ground path, at the same potential, is critical for the surge protectors to function properly. All power systems, communication lines, grounded and ungrounded metallic objects need to be equipotentially bonded for the protection scheme to work efficiently.

2) Underground Connection from External PV Array to Electrical Control Equipment

If possible, the connection between the external Solar PV Array and the internal power control equipment should be underground or electrically shielded to limit the risk of direct lightning strikes and/or coupling.

3) Coordinated Protection Scheme

All available power and communication networks should be addressed with surge protection to eliminate PV system vulnerabilities. This would include the primary AC utility power supply, Inverter AC output, Inverter DC input, PV string combiner, power tracking and other related data/signal lines such as RS-485, 4-20mA current loop, PT-100, RTD, and telephone modems.

CITEL

11381 Interchange Circle South, Miramar, FL USA

Toll Free 1 800.248.3548 | Phone 954.430.6310 | Fax 954.430.7785 | www.citel.us | sales@citel.us

Application of Surge Protection for a Large Commercial Utility-Interactive Solar PV System

A comprehensive approach to the application of lightning and surge protection will help to ensure the maximum life expectancy and efficiency for your solar PV power system. The following illustration details the application points for the surge protectors and the primary protection goal of each device.

1 AC Distribution Panel

Protects all loads connected to the facility's main distribution panel against transients originating from the AC utility grid or internal switching equipment, i.e. CNC machines, elevators, inductive motors.

2 Inverter AC Output

Local protection in front of the inverter to protect against threats from the AC utility and generated internally within the facility.

3 Data/Signal Lines

Protects inverter, communication equipment and PC workstations against lightning induced transients entering the system via exposed sensor and communication lines.

4 Inverter DC Input

Local protection in front of the inverter to protect against lightning induced transients originating from the solar PV array.

5 PV Array Combiner

Protects solar modules, power tracking and blocking diodes from physical damage resulting from lightning induced transients.

NEW

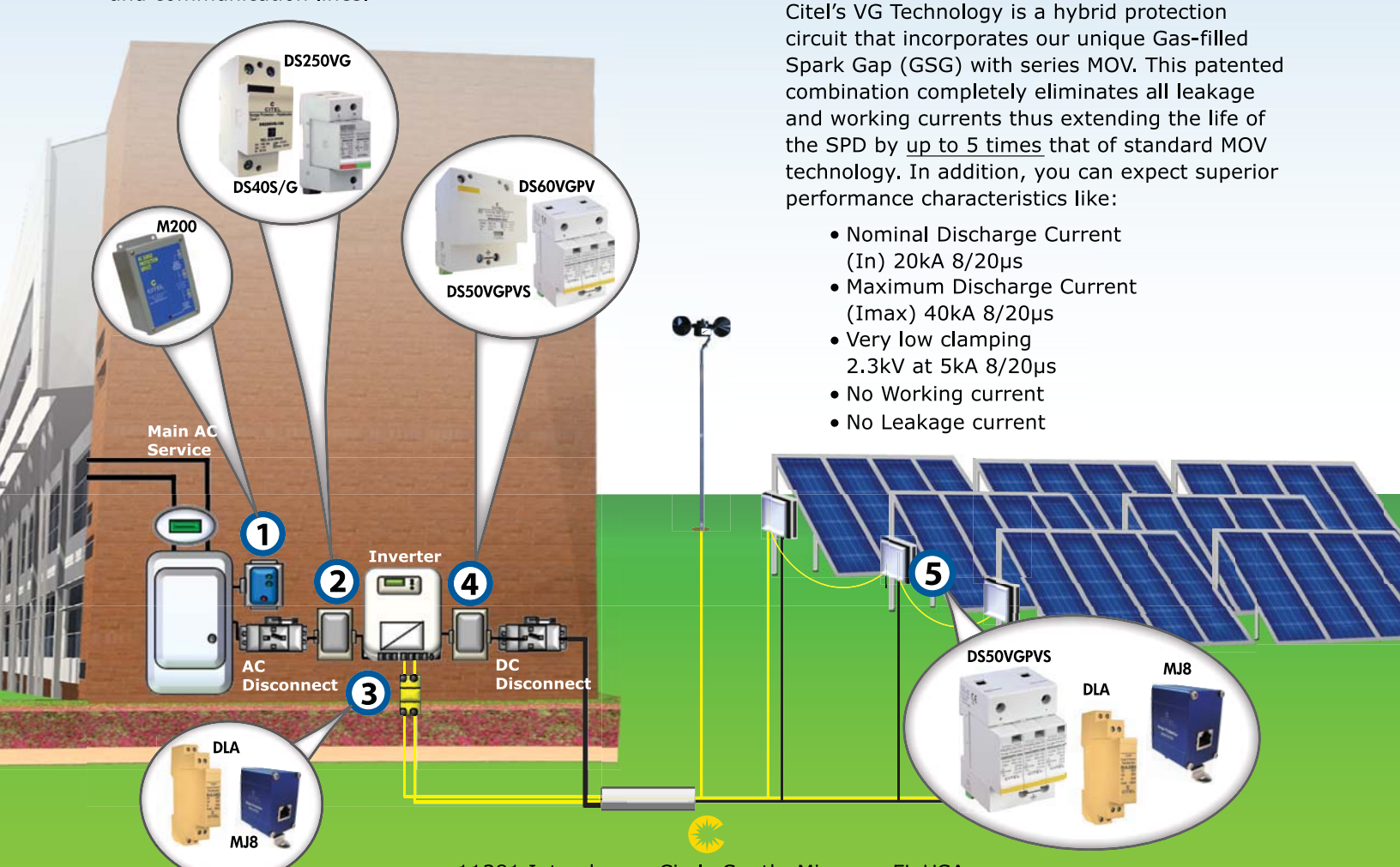
CITEL VG TECHNOLOGY

Why VG Technology?

DC Power Systems continuously stress Metal Oxide Varistors (MOVs) without impunity, when compared to AC Power lines. The result is a significantly shorter life (about 3-5 years) for devices that rely exclusively on standard MOV technology.

Citel's VG Technology is a hybrid protection circuit that incorporates our unique Gas-filled Spark Gap (GSG) with series MOV. This patented combination completely eliminates all leakage and working currents thus extending the life of the SPD by up to 5 times that of standard MOV technology. In addition, you can expect superior performance characteristics like:

- Nominal Discharge Current (In) 20kA 8/20µs
- Maximum Discharge Current (Imax) 40kA 8/20µs
- Very low clamping 2.3kV at 5kA 8/20µs
- No Working current
- No Leakage current



11381 Interchange Circle South, Miramar, FL USA

Toll Free 1 800.248.3548 | Phone 954.430.6310 | Fax 954.430.7785 | www.citel.us | sales@citel.us

Surge Protection Selection Guide

DS60VGPV

Heavy Duty - DC Surge Protector
- Inverter DC Input
- PV Combiner Box

*No Leakage Current
*No Working Current

Technical Data		DS60VGPV-500	DS60VGPV-1000
Nominal line voltage (DC)		600Vdc	1000Vdc
Repetitive surges x 15 (8/20 µs)	In	20kA	20kA
Surge current (10/350 µs)	Iimp	12.5kA	12.5kA

DS50VGPVS

General Duty - DC Surge Protector
- Inverter DC Input
- PV Combiner Box

*No Leakage Current
*No Working Current

Technical Data		DS50VGPVS-500	DS50VGPVS-1000
Nominal line voltage (DC)		600Vdc	1000Vdc
Repetitive surges x 15 (8/20 µs)	In	20kA	20kA
Surge current (8/20 µs)	Imax	40kA	40kA

DS250VG

Heavy Duty - AC Surge Protector
- Inverter AC Output

*No Leakage Current
*No Working Current

Technical Data		DS250VG-300	DS250VG-120
Nominal line voltage (AC)		277Vac	120Vac
Repetitive surges x 15 (8/20 µs)	In	30/20kA*	30/20kA*
Surge current (10/350 µs)	Iimp	25kA	25kA

* IEC = 30kA, UL = 20kA : UL maximum value is 20kA

DS40S/G

General Duty - AC Surge Protector
- Inverter AC Output

*No Leakage Current

Technical Data		DS4xS-480/G	DS4xS-400/G	DS4xS-120/G
Nominal line voltage (AC)		480Vac	277Vac	120Vac
Repetitive surges x 15 (8/20 µs)	In	20kA	20kA	20kA
Surge current (8/20 µs)	Imax	40kA	40kA	40kA

* x = Number of poles protected: 1,2,3,4

MJ8 - RJ45
DLA - Screw Terminal

Data/Signal Line Surge Protector
- RS-485
- 4-20mA
- PT100
- Telco

Technical Data		MJ8-170V DLA-170	MJ8-2RN DLA-48D3	MJ8-CAT5E DLA-6D3
Nominal line voltage (DC)		170Vdc	48Vdc	6Vdc
Repetitive surges x 10 (8/20 µs)	In	5kA	5kA	5kA
Surge current (8/20 µs)	Imax	20kA	20kA	20kA

M200

AC Surge Protector
- Main Distribution Panel
- Branch Distribution Panel

Technical Data		M200-480D	M200-277Y	M200-120Y M200-120T
Nominal line voltage (AC)		480Vac	277Vac	120Vac
Repetitive surges x 15 (8/20 µs)	In	5kA	5kA	5kA
Surge current (8/20 µs)	Imax	200kA	200kA	200kA

DS210..DC

DC Surge Protector
- Charge Controller

Technical Data		DS210-130DC	DS210-110DC	DS210-95DC	DS210-75DC	DS210-48DC	DS210-24DC	DS210-12DC
Nominal line voltage (DC)		130Vdc	110Vdc	95Vdc	75Vdc	48Vdc	24Vdc	12Vdc
Max. line voltage (DC)	Uc	150Vdc	125Vdc	100Vdc	85Vdc	56Vdc	30Vdc	15Vdc
Repetitive surges x 15 (8/20 µs)	In	2kA	2kA	2kA	2kA	1kA	1kA	1kA
Surge current (8/20 µs)	Imax	6kA	6kA	6kA	6kA	2kA	2kA	2kA

- Main Distribution Panel

CITEL

11381 Interchange Circle South, Miramar, FL USA

Toll Free 1 800.248.3548 | Phone 954.430.6310 | Fax 954.430.7785 | www.citel.us | sales@citel.us