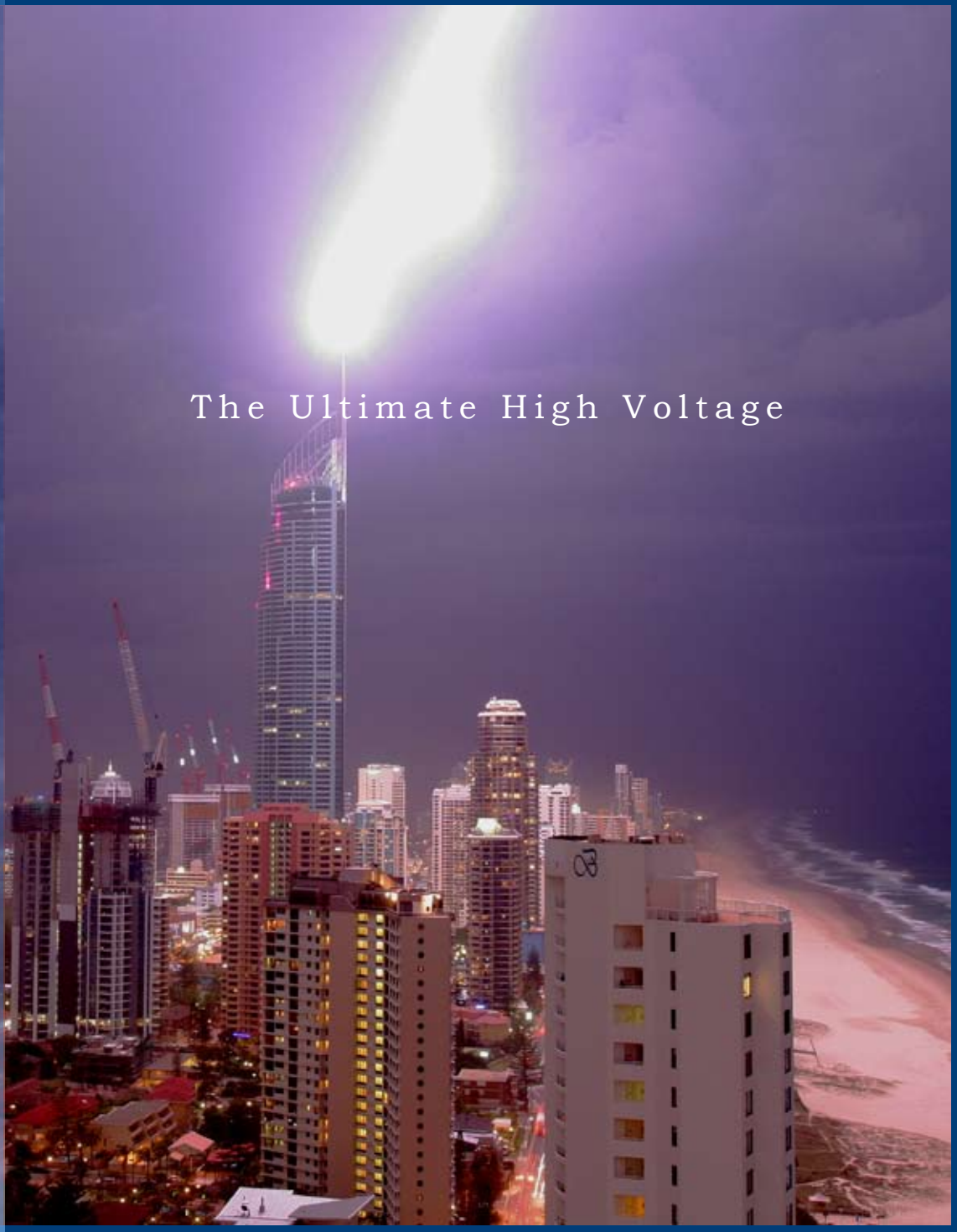
Novaris

Global Solutions in Lightning and Surge Protection

PRODUCT HANDBOOK



Photographer: Renee Doyle

Q1 Building - Gold Coast, Queensland AUSTRALIA

Lightning Protection Consultants: Powercom Consultants Pty Ltd

Surge Protection Design and Manufacture: Novaris Pty Ltd

This was the ultimate high voltage test of

The Novaris Systematic Approach

to lightning and surge protection.

The Novaris Systematic Approach

Lightning strikes are an unpredictable natural phenomenon. However the way equipment can be protected from lightning strikes is predictable. The 'Novaris Systematic Approach' is a step-by-step solution to lightning and surge protection that can be applied to any application.

1 **Define Boundaries**
Boundaries divide areas of different potential.

2 **Protect Structure**
Novaris supports conventional lightning protection methods.

3 **Install Bonded Earthing System**
A single bonded earthing system within each boundary is essential.

4 **Protect Power Lines**
Protect all power lines crossing protection boundaries.

5 **Protect Signal/Data Lines**
Protect all signal/data lines crossing protection boundaries.

Novaris offers:

Investigation and Analysis

- Novaris offers a complete package from analysis of your existing lightning and surge protection system to providing complete recommendations based on site surveys and technical analysis.

Structural Lightning Protection and Earthing Systems

- design and advice on lightning protection systems for all structures in accordance with recognised world standards.
- supply of structural lightning protection and earthing components.

A Comprehensive range of Surge Protection Products to suit any application

- ranging from main switchboard and distribution board surge protection, PLC and control system protection, to RF coaxial protection.

Custom Product Design

- our innovative R&D team can engineer a surge protection solution for even the most demanding of applications.

Project Management & Installation

- Novaris actively seeks consultancy, project management and installation work. Our experience extends from Australia to the Pacific, Asia, Africa and the Middle East.

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Key Product Features

IEC Compliant

Compliant with the relevant IEC lightning and surge protection standards, in particular IEC 62305 and IEC 61643.

All Mode Protection

Novaris models featuring all mode protection provide protection for all combinations of lines (L-N, L-E, N-E) ensuring the maximum level of protection is achieved at all times. They have been designed for installation in any wiring system worldwide.

Multistage Transient Protection

Models featuring multistage transient protection deliver greater levels of protection through a staged approach. The primary stage absorbs the majority of the surge energy. The remaining stages provide accurate clamping and a degree of redundancy.

Redundant Segments

Models featuring redundant segments have a parallel redundant arrangement of high energy metal oxide varistors (MOVs), thus promoting long life and exceptional surge handling capacity.

Thermal Sensing

Sustained overvoltages can cause components to overheat and degrade. Thermal sensing warns of this condition without disconnecting the protection.

Percentage Active Display

A digital display confirms the device rating upon switch on, then displays percentage active. The display indicates segment status and thermal overload.

LED Status Display

LED indicators are provided to indicate operating status.

SIP and External Alarms

The Novaris Surge Indicator Panel (SIP) allows remote monitoring of any Novaris product featuring external alarms. Models featuring external alarms have voltage free changeover contacts (SPDT) for remote status indication.

DIN 43880 Compliant

Protection devices housed in DIN 43880 compliant enclosures allow for convenient installation on DIN rail fittings commonly used in switchboards worldwide.

Safe Metal Enclosure

Novaris surge protection products are housed in safe, all metal enclosures. In the event of a prolonged overvoltage they will not catch fire or explode.

Novaris

Table Of Contents

NOTE:

Throughout this handbook, **catalogue numbers and specifications shown in black** are non-indent products.
Novaris is committed to providing short delivery lead time for these products.

Catalogue numbers and specifications shown in red are indent products.
These products may attract a surcharge and have longer lead times.

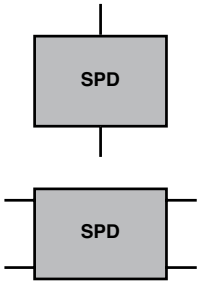
Consult your local Novaris agent for more details.

Due to the Novaris policy of continuing product development, specifications are subject to change without notice.

Power line surge protection must:

1. Provide adequate protection for all equipment.
2. Achieve a long working life.
3. Optimise the cost and size of the surge protection devices **(SPDs).**

Options for Surge Protection Devices



There are two common configurations of SPDs:

One port SPDs are parallel or shunt connected across the line. These include the Novaris SD, SG and HSG products.

Two port SPDs are connected in series with the line. These include the Novaris SSP, SF and PP products.

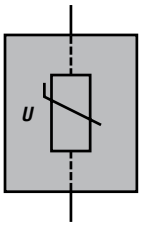
There are two classes of SPD components:

Voltage limiting SPDs include metal oxide varistors and suppressor diodes. These have a high impedance when no surge is present but can reduce impedance continuously with increased surge current and voltage. These are also called “clamping devices”. Novaris SD, SSP, SF and PP products are voltage clamping SPDs.

Voltage switching SPDs include spark gaps, gas discharge tubes, thyristors and triacs. These have a high impedance when no surge is present but can have a sudden change to a low impedance in response to a voltage surge. These are also called “crowbar devices”. The Novaris SG products are voltage switching SPDs.

Sometimes a combination of these components may be used. The Novaris HSG is an example of a combination SPD.

Selection of Surge Protection Devices



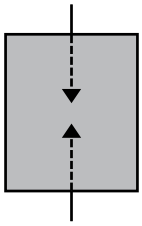
1. Surge Diverters, SD

All Novaris surge diverters with initial product code SD employ metal oxide varistor **(MOV)** voltage limiting components. These can be used for main switchboard primary protection, distribution board and final circuit protection. As voltage limiting components there is no follow on current, and with suitable fusing these are easy to install and operate.

SD products are suitable for all applications except where extreme voltage fluctuations may be experienced. Excessive overvoltage can damage MOV based SPDs although all Novaris surge diverters are housed in metal enclosures and meet the fail-safe requirements of UL1449 - specifically package rupture and the effects of excessive heating.

Novaris manufactures surge diverters to suit all applications from high exposure environments to final circuit protection with ratings of I_{max} up to 250kA (8/20µs) or I_{imp} of 25kA (10/350µs)*.

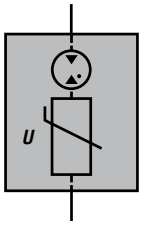
Like all one port shunt connected SPDs, performance can be compromised by the presence of long connecting leads, particularly in physically large main switchboards. For this reason primary SPDs on main switchboards would be followed by secondary protection on distribution boards and final circuits.



2. Spark Gaps, SG

Spark gaps have high surge ratings and are suitable for point of entry protection in installations with highly exposed overhead LV power lines with no local transformer in high lightning areas. As voltage switching SPDs, spark gaps have a crowbar effect and effectively place a short circuit across the line once fired. Thus high levels of AC follow on current will flow. Unless properly configured to be compatible with the AC fault rating of the supply and suitably fused, spark gaps can cause nuisance tripping of supply circuit breakers and extreme voltage disturbances whilst the follow on current flows.

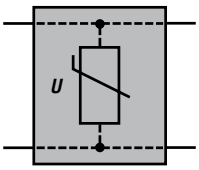
Novaris spark gap SPDs have surge ratings (I_{imp}) of up to 110kA (10/350µs). Triggered spark gaps must be followed by secondary protection further downstream in the distribution network because they have a high impulse firing voltage.



3. Hybrid Spark Gaps, HSG

Hybrid spark gaps combine the best qualities of voltage switching and voltage limiting components. Novaris HSG hybrid spark gaps are suitable for all high exposure installations and meet the recommendations of IEC61643-12 in relation to surge ratings with I_{max} of 250kA (8/20µs) or I_{imp} of 25kA (10/350µs)*. The spark gap in the HSG is a high energy gas discharge tube with a clearly defined impulse firing voltage, its let through voltage closely approaches that of an MOV based surge diverter.

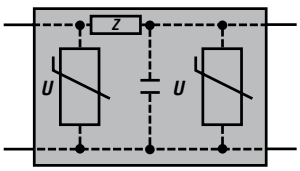
The hybrid combination ensures that there is no follow on current and the HSG may be as easily deployed as our SD range. The HSG is able to tolerate excessive temporary overvoltages (TOV) and is ideal for applications where mains voltages fluctuations are significant.



4. Series Surge Protector, SSP

All shunt connected SPDs are compromised in performance by the presence of their interconnecting leads. Typically voltage drops of 500V per meter of connecting lead can be expected. Such lead lengths are often unavoidable in physically large main switchboards. Nevertheless one port SPDs provide effective protection for the main switchboard.

For circuits that are more sensitive the SSP provides a means of eliminating the shunt connected leads and places the SPD directly across the line. Such applications might include UPS inputs, rectifiers, VSDs and motors.



5. Surge Filters, SF

The surge filter is a true two port SPD offering an extremely low let through voltage capable of protecting the most sensitive of electronic circuits. The Novaris range of surge filters is extensive: from 2A DIN rail mount units designed to protect sensitive PLCs and process equipment; plug in units for final circuit outlets; to 2000A per phase filters designed to protect major data centres.

Surge ratings up to 250kA (8/20µs) are available making surge filters suitable for providing primary and secondary protection in one package as may be required at a cellular basestations, process plant control rooms or data centres. As surge filters are series connected they must have a current rating I_L equal to or greater than the protected circuit.

***Surge Ratings:** tests conducted by some manufacturers and informally reported to the IEEE have indicated that the stress imposed on an MOV based SPD by a 10/350µs impulse might be equivalent to the stress imposed by a standard 8/20µs impulse, with a scaling factor of 10. Thus an SPD with I_{imp}=25kA could be equivalent to I_{max}= 250kA. From IEEE Std C62.41.2-2002.

SD Surge Diverters

Novaris MULTIMOV MSB surge diverters offer unsurpassed safety, quality and reliability in protection for your electrical system. MULTIMOV surge diverters are an ideal point-of-entry protector for all industrial, commercial and communications applications.

SD 1 - 100 - 275 - N

Product Series
Phase
I_{max}
Options
U_c

SD1-100-275	SD1-150-275	SD1-200-275	SD1-250-275	SD3-100-275	SD3-150-275	SD3-200-275	SD3-250-275

Electrical Specifications								
Connection Type		Shunt						
Modes of protection		L-N						
Phases		1				3		
Nominal voltage	U_0	230V / 50Hz (110V / 60Hz by request only)						
Maximum continuous voltage	U_c	275V / 50Hz (130V / 60Hz by request only)						
Maximum discharge current (8/20µs)	I_{max}	100kA	150kA	200kA	250kA	100kA	150kA	200kA	250kA
Voltage protection level @ 3kA (8/20µs)	U_p	<800V						
Response time	t_A	<5ns						
Earth leakage current		<5µA						
Display		7-segment LED, percentage active						
Alarms		Segment / thermal failure, clean SPDT contact						
Alarm isolation to active circuitry		4kV						
Recommended backup fuse (HRC) / circuit breaker		63A (not supplied)						

Mechanical Specifications		
Operating temperature / humidity	-40 to +40ºC / 0 to 90% non-condensing	
Terminal capacity - power	16mm²	
Terminal capacity - alarm	2.5mm²	
Terminal screw torque - power	1.0Nm	
Terminal screw torque - alarm	0.5Nm	
Environmental	IP 20	
Mounting	Panel mount / TS35 DIN	Panel mount
Enclosure / Colour	Metal / Blue	
Weight	1.2kg	5.0kg

Dimensions		
Width	60mm	260mm
Height	200mm	310mm
Depth	70mm	78mm

Standards Compliance
IEC 61643-1 class I
AS/NZS 1768 category C
IEEE C62.41 category C
BS 6651 category C
CP 33 category C
IEC 1000-4-5
UL1449 third edition
A-tick

Options	
Neutral-earth protection	N
Metal enclosure	M
Polycarbonate enclosure	P
Extended operating voltage (95-415V / 50Hz)	X
Over / under voltage relay	O
Non-MEN version (L-PE)	U

SDN All Mode Surge Diverters

Novaris SDN Surge Diverters are the ideal choice for all mode protection in major distribution switchboards. Being all mode the SDN is particularly suitable for switchboards in non MEN installations.

SDN 1 - 50 - 275 - P

- **Product Series**
- **Phase**
- **I_{max}**
- **Options**
- **U_c**

	SDN1-50-275	SDN1-100-275	SDN3-50-275	SDN3-100-275
Electrical Specifications				
Connection type	Shunt			
Modes of protection	All mode (L-N, L-PE, N-PE)			
Phases	1		3	
Nominal voltage (U_0)	230V / 50Hz (110V / 60Hz by request only)			
Maximum continuous voltage (U_c)	275V / 50Hz (130V / 60Hz by request only)			
Maximum discharge current (8/20µs) (I_{max})	50kA	100kA	50kA	100kA
Voltage protection level @ 3kA (8/20µs) (U_p)	<800V			
Response time (t_A)	<5ns			
Earth leakage current	<500µA			
Display	LED, status			
Alarms	Segment / thermal failure, clean SPDT contact			
Alarm isolation	4kV			
Backup fuse (HRC)	32A	63A	32A	63A
Mechanical Specifications				
Operating temperature / humidity	-40 to +40°C / 0 to 90% non-condensing			
Terminal capacity - power	16mm²			
Terminal capacity - alarm	2.5mm²			
Terminal screw torque - power	1.0Nm			
Terminal screw torque - alarm	0.5Nm			
Environmental	IP 20			
Mounting	Panel mount / TS35 DIN			
Enclosure / colour	Metal / Blue			
Weight	1.0kg	1.2kg		1.6kg
Dimensions				
Width	60mm	80mm		120mm
Height	200mm			
Depth	70mm			
Options				
Metal enclosure	M			
Polycarbonate enclosure	P			
Extended operating voltage (95-415V / 50Hz)	-		X	
Over / under voltage relay	O			

Standards Compliance
IEC 61643-1 class I
AS/NZS 1768 categories B, C
IEEE C62.41 categories B, C
BS 6651 categories B, C
CP 33 categories B, C
IEC 1000-4-5
UL1449 third edition

SDD1 DINsafe Surge Diverters

Novaris SDD DINsafe Surge Diverters offer powerful performance at domestic MSB and industrial DBs. The SDD diverters are housed in a DIN compliant, fail-safe metal enclosure.

SDD 1 - 50 - 275 - A

- **Product Series**
- **Phase**
- **I_{max}**
- **Options**
- **U_c**

SDD1-25-275	SDD1-50-275	SDD1-100-275	SDD1-100-275-A	SDD3-25-275	SDD3-50-275	SDD3-100-275	SDD3-150-275

Electrical Specifications								
Connection type		Shunt						
Modes of protection		All mode (L-N, L-PE, N-PE)						
Phases		1			3			
Nominal voltage	U_0	230V / 50Hz						
Maximum continuous voltage	U_c	275V / 50Hz						
Maximum discharge current (8/20µs)	I_{max}	25kA	50kA	100kA	25kA	50kA	100kA	150kA
Voltage protection level @ 3kA (8/20µs)	U_p	<800V						
Response time	t_A	<5ns						
Earth leakage current		<10µA						
Display		LED status						
Alarms (optional)		Segment / thermal failure, clean SPDT contact						
Alarm isolation		4kV						
Backup fuse (HRC)		32A						

Mechanical Specifications				
Operating temperature / humidity	-40 to +40ºC / 0 to 90% non-condensing			
Terminal capacity - power	16mm²			
Terminal capacity - alarms	2.5mm²			
Terminal screw torque - power	1.0Nm			
Terminal screw torque - alarm	0.5Nm			
Environmental	IP 20			
Mounting	TS35 DIN rail			
Enclosure / Colour	Metal / black			
Weight	270g	300g	440g	

Dimensions		
Width	36mm	72mm
Height	95mm	
Depth	80mm	

Options				
External alarm	A	Standard	A	
Polycarbonate enclosure	P			
Voltage variations	U_c	50V / 130V	130V	

Standards Compliance
IEC 61643-1 class II, III
AS/NZS 1768 categories A, B
IEEE C62.41 categories A, B
BS 6651 categories A, B
CP 33 categories A, B
IEC 1000-4-5-1995
UL1449 third edition

SDD2 DINsafe Surge Diverters

Novaris SDD2 Surge Diverters offer an ideal solution for DC and two phase systems. The SDD2 diverters are housed in a DIN compliant, fail-safe metal enclosure.

SDD2 - 10 - 18 - DC

Product Series — **AC / DC**

I_{max} — **U_c**

SDD2-10-22-DC	SDD2-10-45-DC	SDD2-10-30-AC	SDD2-32-60-AC	SDD2-50-100-DC	SDD2-50-150-DC	SDD2-50-180-DC

Electrical Specifications								
Connection Type		Shunt						
Modes of protection		All mode (L1-L2, L1-PE and L2-PE)						
Phases / poles		2						
AC / DC		DC		AC		DC		
Nominal voltage	U_N	12V	24V		48V		72V	96V
Maximum continuous voltage	U_c	22V	45V	30V	60V	100V	150V	180V
Maximum discharge current (8/20µs)	I_{max}	10kA			32kA	50kA		
Voltage protection level @ 3kA (8/20µs)	U_p	<100V	<180V	<150V	<190V	<240V	<400V	<500V
Response time	t_A	<5ns						
Earth leakage current		<10µA						
Display		LED status						

Mechanical Specifications	
Operating temperature / humidity	-40°C to +40°C / 0 to 90% non-condensing
Terminal capacity	16mm²
Terminal screw torque	1.0Nm
Environmental	IP 20
Mounting	TS35 DIN rail
Enclosure / colour	Metal / Black
Weight	500g

Dimensions	
Width	72mm
Height	95mm
Depth	80mm

Standards Compliance
IEC 61643-1 class II, III
AS/NZS 1768 categories A, B, C
IEEE C62.41 categories A, B, C
BS 6651 categories A, B, C
CP 33 categories A, B, C
IEC 1000-4-5
UL1449 third edition

SDD2 DINsafe Surge Diverters

Novaris SDD2 Surge Diverters offer an ideal solution for DC and two phase systems. The SDD2 diverters are housed in a DIN compliant, fail-safe metal enclosure.

SDD2 - 50 - 150 - AC

Product Series

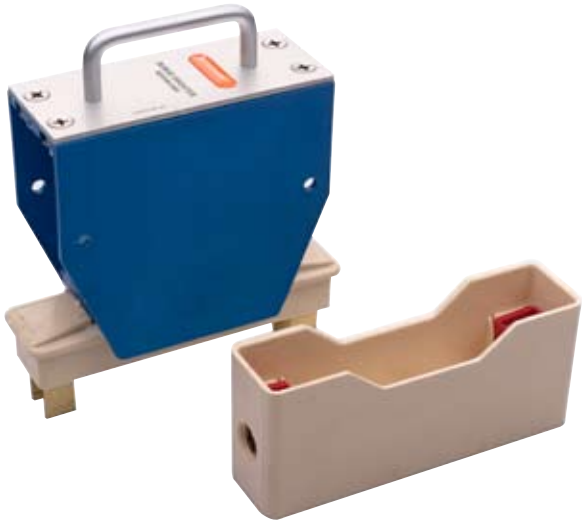
I_{max}

AC / DC

U_c

	SDD2-50-225-DC	SDD2-50-130-AC	SDD2-100-130-AC	SDD2-50-350-DC	SDD2-100-350-DC	SDD2-50-275-AC	SDD2-100-275-AC
Electrical Specifications							
Connection Type	Shunt						
Modes of protection	All Mode (L1-L2, L1-PE and L2-PE)						
Phases / poles	2						
AC / DC	DC	AC		DC		AC	
Nominal voltage U_N	120V			240V		230V	
Maximum continuous voltage U_C	225V	130V		350V		275V	
Discharge current 8/20µs I_{MAX}	50kA		100kA	50kA	100kA	50kA	100kA
Voltage protection @ 3kA (8/20µs) U_p	<550V	<500V		<800V			
Response time t_A	<5ns						
Earth leakage current	<10µA						
Display	LED status						
Mechanical Specifications							
Operating temperature / humidity	-40°C to +40°C / 0 to 90% non-condensing						
Terminal capacity	16mm²						
Terminal screw torque	1.0Nm						
Environmental	IP 20						
Mounting	TS35 DIN rail						
Enclosure / colour	Metal / Black						
Weight	500g						
Dimensions							
Width	72mm						
Height	95mm						
Depth	80mm						

Standards Compliance
IEC 61643-1 class II, III
AS/NZS 1768 categories A, B, C
IEEE C62.41 categories A, B, C
BS 6651 categories A, B, C
CP 33 categories A, B, C
IEC 1000-4-5
UL1449 third edition



SDH High Voltage Surge Diverters

Novaris SDH High Voltage Surge Diverters have been engineered for system voltages above 600VRMS. Typical applications include aviation runway lighting, mining and railway industries.

SDH - 70 - 2000 - H

Product Series — **Options**

I_{max} — U_c

	SDH-140-1000	SDH-200-1000	SDH-70-2000	SDH-100-2000
Electrical Specifications				
Connection type	Shunt			
Modes of protection	L-PE			
Phases	1			
Maximum continuous voltage (U_0)	1000		2000	
Maximum discharge current (8/20µs) (I_{max})	140kA	200kA	70kA	100kA
Voltage protection level @ 3kA (8/20µs) (U_p)	2.6kV		4.8kV	
Response time (t_A)	<5ns			
Mechanical Specifications				
Operating temperature / humidity	-40 to +80ºC / 0 to 90% non-condensing			
Terminal capacity	25mm²			
Terminal screw torque	2.5Nm			
Environmental	IP 20			
Mounting	See mounting options below			
Enclosure / colour	ABS, ceramic / Blue			
Weight	2.0kg			
Dimensions				
Width	164mm	193mm	164mm	193mm
Height	56mm			
Depth	215mm			
Options				
GEC RSL63H mounting	H			
GEC RSL63P mounting	P			
GEC RSL63PH mounting	PH			

Standards Compliance
IEC 61643-1 class I
AS/NZS 1768 category C
IEEE C62.41 category C
BS 6651 category C
CP 33 category C

SG Spark Gap Arresters

Novaris SG Spark Gap Arresters have high surge ratings suitable for point of entry protection in installations with highly exposed overhead LV power lines with no local transformer. These are triggered spark gaps resulting in relatively low let through voltages sufficient to protect switchgear in main switchboards.

SG 1 - 50 - 275 - N

- **Product Series**
- **Phase**
- **I_{imp}**
- **Options**
- **U_c**

Electrical Specifications		SG1-50-255	SG1-110-275	SG3-50-255	SG3-110-275	SGN-100-275
Connection type		Shunt				
Modes of protection		L-N		L-N		N-PE
Phases		1		3		-
Nominal voltage	U_0	230V / 50Hz				
Maximum continuous voltage	U_c	255V / 50Hz	275V / 50Hz	255V / 50Hz	275V / 50Hz	-
Interrupting follow current @ U_c	I_{fi}	50kA$_{RMS}$	110kA$_{RMS}$	50kA$_{RMS}$	110kA$_{RMS}$	100A$_{RMS}$
Lightning impulse voltage sparkover (1.2/50µs)	U_p	<1.3kV	<2.5kV	<1.3kV	<2.5kV	<1.5kV
Maximum impulse current (10/350µs)	I_{imp}	50kA	110kA	50kA	110kA	100kA
Charge	Q	25As	55As	25As	55As	50As
Specific energy	W/R	600kJ/Ω	3000kJ/Ω	600kJ/Ω	3000kJ/Ω	2500kJ/Ω
Response time	t_A	<100ns				
Backup fuse (HRC)		315A	500A	315A	500A	-
Mechanical Specifications						
Operating temperature / humidity		-40 to +80ºC / 0 to 90% non-condensing				
Terminal capacity		35mm²	Lug Ø10	35mm²	Lug Ø10	35mm²
Terminal screw torque		2.5Nm		2.5Nm		2.5Nm
Environmental		IP 20	IP 00	IP 20	IP 00	IP 20
Mounting		TS35 DIN	Panel	TS35 DIN	Panel	TS35 DIN
Enclosure / colour		Flame retardant Polyamide 6 / Black				
Weight		230g	1.0kg	690g	3.0kg	210g
Dimensions						
Width		36mm	67mm	106mm	201mm	36mm
Height		90mm	150mm	90mm	150mm	90mm
Depth		67mm	94mm	67mm	94mm	67mm
Options						
Neutral-earth protection		N				-
Metal enclosure		M				
Over / under voltage relay		O				-

Standards Compliance
IEC 61643-1 class I
AS/NZS 1768 category C
IEEE C62.41 category C
BS 6651 category C
CP 33 category C
IEC 1000-4-5

HSG Hybrid Spark Gap Arresters

Novaris HSG Hybrid Spark Gap Arresters combine the best qualities of voltage switching and voltage limiting components. Novaris HSG hybrid spark gaps suit all high exposure installations. There is no follow on current. The HSG is ideal for applications where mains voltages fluctuations are significant.

HSG 1 - 25 - 275 - N

- **Product Series**
- **Phase**
- **I_{imp}**
- **Options**
- **U_c**

	HSG1-25-275	HSG3-25-275

Electrical Specifications			
Connection type		Shunt	
Modes of protection		L-N	
Phases		1	3
Nominal voltage	U_0	230V / 50Hz	
Maximum continuous voltage	U_c	275V / 50Hz	
Interrupting follow current @ U_c	I_{fi}	-	
Lightning impulse voltage sparkover (1.2/50µs)	U_p	<1.3kV	
Maximum impulse current (10/350µs)	I_{imp}	25kA	
Charge	Q	12.5As	
Specific energy	W/R	625kJ/Ω	
Response time	t_A	<100ns	
Display		LED status	
Alarms		Clean SPDT contact	
Alarm isolation to active circuitry		4kV	
Backup fuse (HRC)		63A	

Mechanical Specifications		
Operating temperature / humidity	-40 to +80ºC / 0 to 90%	
Terminal capacity - power	16mm²	
Terminal capacity - alarms	2.5mm²	
Terminal screw torque - power	1.0Nm	
Terminal screw torque - alarms	0.5Nm	
Environmental	IP 20	
Mounting	Panel mount / TS35 DIN	
Enclosure / colour	Metal / Blue	
Weight	1.2kg	5.0kg

Dimensions		
Width	60mm	240mm
Height	200mm	260mm
Depth	70mm	78mm

Options	
Neutral-earth protection	N
Metal enclosure	M
Over / under voltage relay	O

Standards Compliance
IEC 61643-1 class I
AS/NZS 1768 category C
IEEE C62.41 category C
BS 6651 category C
CP 33 category C
IEC 1000-4-5
UL1449 third edition

SSP Surge Protectors 6 - 32A

Novaris SSP protectors are suitable for installation in circuits up to 32A. The SSP range has been engineered to provide excellent performance and economical protection. Their compact design makes them an ideal choice for space restricted applications.

SSP 1 - 6 - 6.5 - 275 - P

- **Product Series**
- **Phase**
- **I_L**
- **Options**
- **U_c**
- **I_{max}**

SSP1-6-6.5-275	SSP1-10-6.5-275	SSP1-20-6.5-275	SSP1-20-50-275	SSP1-32-6.5-275-A	SSP1-32-50-275-A

Electrical Specifications							
Connection type		Series					
Modes of protection		All mode (L-N, L-PE, N-PE)					
Phases		1					
Nominal voltage	U_0	230V / 50Hz					
Maximum continuous voltage	U_c	275V / 50Hz					
Maximum load curent	I_L	6A	10A	20A		32A	
Maximum discharge current (8/20µs)	I_{max}	6.5kA			50kA	6.5kA	50kA
Voltage protection level @ 3kA (8/20µs)	U_p	<800V					
Response time	t_A	<5ns					
Earth leakage current		<500µA					
Display		-		LED power and status			
Alarms (optional)		-		Segment / thermal failure, clean SPDT contact			
Alarm isolation to active circuitry		-		4kV			
Backup fuse		32A					

Mechanical Specifications						
Operating temperature / humidity	-40 to +80ºC / 0 to 90% non-condensing					
Connection type	Screw terminal					
Terminal capacity - power	16mm²					
Terminal capacity - alarm	2.5mm²					
Terminal screw torque - power	1.0Nm					
Terminal screw torque - alarm	0.5Nm					
Environmental	IP 20					
Mounting	TS35 DIN rail					
Enclosure / colour	Metal / Black					
Weight	220g	350g	450g	500g	700g	750g

Dimensions					
Width	18mm	27mm	54mm		90mm
Height	95mm				
Depth	80mm				

Options					
External alarm contacts	-		A		Standard
Polycarbonate enclosure	P				
Voltage variation U_c	50V / 130V			130V	50V / 130V	130V

Standards Compliance
IEC 61643-1 class II, III
AS/NZS 1768 categories A, B, C
IEEE C62.41 categories A, B, C
BS 6651 categories A, B, C
CP 33 categories A, B, C
IEC 1000-4-5
UL1449 third edition

SSP Surge Protectors 63A

Novaris SSP protectors are suitable for installation in circuits up to 63A. The SSP range has been engineered to provide excellent performance and economical protection. Their compact design makes them an ideal choice for space restricted applications.

SSP 1 - 63 - 50 - 275 - A

- **Product Series**
- **Phase**
- **I_L**
- **Options**
- **U_c**
- **I_{max}**

	SSP1-63-50-275-A	SSP1-63-100-275-A	SSP3-63-50-275-A	SSP3-63-100-275-A
Electrical Specifications				
Connection type	Series			
Modes of protection	All mode (L-N, L-PE, N-PE)			
Phases	1		3	
Nominal voltage (U_0)	230V / 50Hz			
Maximum continuous voltage (U_c)	275V / 50Hz			
Maximum load curent (I_L)	63A			
Maximum discharge current (8/20µs) (I_{max})	50kA	100kA	50kA	100kA
Voltage protection level @ 3kA (8/20µs) (U_p)	<800V			
Response time (t_A)	<5ns			
Earth leakage current	<500µA			
Display	LED power and status			
Alarms (optional)	Segment / thermal failure, clean SPDT contact			
Alarm isolation to active circuitry	4kV			
Backup fuse	63A			
Mechanical Specifications				
Operating temperature / humidity	-40 to +80ºC / 0 to 90% non-condensing			
Connection type	16mm² flying leads (1m)			
Terminal capacity - power	-			
Terminal capacity - alarm	2.5mm²			
Terminal screw torque - power	-			
Terminal screw torque - alarm	0.5Nm			
Environmental	IP 20			
Mounting	TS35 DIN rail			
Enclosure / colour	Metal / Black			
Weight	1.2kg			
Dimensions				
Width	187mm			
Height	100mm			
Depth	63mm			
Options				
External alarm contacts	Standard			
Polycarbonate enclosure	P			
Voltage variation (U_c)	130V			

Standards Compliance
IEC 61643-1 class II, III
AS/NZS 1768 categories A, B, C
IEEE C62.41 categories A, B, C
BS 6651 categories A, B, C
CP 33 categories A, B, C
IEC 1000-4-5
UL1449 third edition

SFH Surge Filters 250 – 800A

Novaris SFH surge filters provide the highest level of protection with the lowest let through voltage. When installed at a main switchboard Novaris surge filters will protect all connected equipment.

SFH 3 - 250 - 100 - 275 - M

- Product Series
- Phase
- I_L
- Options
- U_c
- I_{max}

SFH3-250-100-275	SFH3-250-200-275	SFH3-400-100-275	SFH3-400-200-275	SFH3-630-100-275	SFH3-630-200-275	SFH3-800-100-275	SFH3-800-200-275

Electrical Specifications									
Connection type		Series							
Modes of protection		All mode (L-N, L-PE, N-PE)							
Nominal voltage	U_0	230V / 50Hz							
Maximum continuous voltage	U_c	275V / 50Hz							
Phases		3							
Discharge current 8/20µs	I_{max}	100kA	200kA	100kA	200kA	100kA	200kA	100kA	200kA
Maximum load curent	I_L	250A		400A		630A		800A	
Protection stages		Metal oxide varistor / LC filter / metal oxide varistor							
Voltage protection @ 3kA (8/20µs)	U_p	<360V							
Response time	t_A	Instantaneous							
Earth leakage current		<1µA							
Maximum voltage drop (% of U_0)	ΔU	<1%							
3dB Frequency @ 50Ω		200Hz		150Hz				80Hz	
Displays		7-segment LED, percentage active							
Alarms		Segment / thermal failure, clean SPDT contact							
Alarm isolation to active circuitry		4kV							

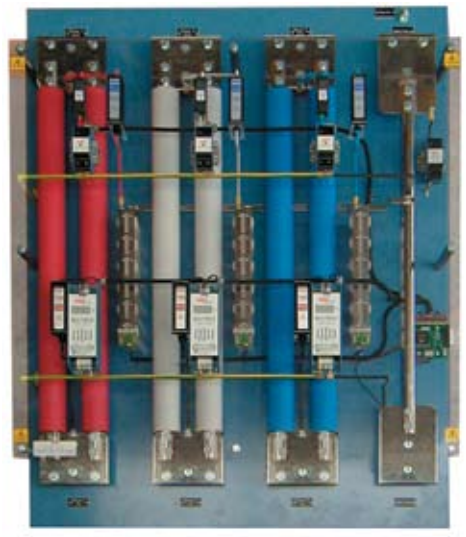
Standards Compliance
IEC 61643-1 class I
AS/NZS 1768 category C
IEEE C62.41 category C
BS 6651 category C
CP 33 category C
IEC 1000-4-5
UL1449 third edition

Options	
HRC fusing	H
Metal enclosure IP 55	M
Over / under voltage relay	O
Extended voltage (95-415V)	X

Mechanical Specifications		
Operating temperature / humidity	-40 to +40ºC / 0 to 90% non-condensing	
Connection type	Bus bar / cable lug	
Alarm terminal capacity	2.5mm²	
Terminal screw torque	0.5Nm	
Environmental	IP 55 in enclosure	
Mounting	Wall mount	
Weight	90kg	160kg

Dimensions (in enclosure)		
Width	710mm	800mm
Height	710mm	1200mm
Depth	285mm	400mm

Maximum Discharge Current Variations		
Discharge Current variations	I_{max}	150kA / 250kA



SFH Surge Filters 1200 – 2000A

Novaris SFH surge filters provide the highest level of protection with the lowest let through voltage. When installed at a main switchboard Novaris surge filters will protect all connected equipment.

SFH 3 - 1200 - 100 - 275 - M

- **Product Series**
- **Phase**
- **I_L**
- **Options**
- **U_c**
- **I_{max}**

SFH3-1200-100-275	SFH3-1200-200-275	SFH3-1600-100-275	SFH3-1600-200-275	SFH3-2000-100-275	SFH3-2000-200-275

Electrical Specifications											
Connection type		Series									
Modes of protection		All mode (L-N, L-PE, N-PE)									
Nominal voltage	U_0	230V / 50Hz									
Maximum continuous voltage	U_c	275V / 50Hz									
Phases		3									
Discharge current 8/20µs	I_{max}	100kA	200kA	100kA	200kA	100kA	200kA				
Maximum load curent	I_L	1200A		1600A		2000A					
Protection stages		Metal oxide varistor / LC filter / metal oxide varistor									
Voltage protection @ 3kA (8/20µs)	U_p	<360V									
Response time	t_A	Instantaneous									
Earth leakage current		<1µA									
Maximum voltage drop (% of U_0)	ΔU	<1%									
3dB Frequency @ 50Ω		80Hz									
Displays		7-segment LED, percentage active									
Alarms		Segment / thermal failure, clean SPDT contact									
Alarm isolation to active circuitry		4kV									

Mechanical Specifications	
Operating temperature / humidity	-40 to +40ºC / 0 to 90% non-condensing
Connection type	Bus bar / cable lug
Alarm terminal capacity	2.5mm²
Terminal screw torque	0.5Nm
Environmental	IP 55 in enclosure
Mounting	Wall mount
Weight	120kg

Dimensions (in enclosure)	
Width	1325mm
Height	914mm
Depth	303mm

Maximum Discharge Current Variations		
Discharge Current variations	I_{max}	150kA / 250kA

Standards Compliance
IEC 61643-1 class I
AS/NZS 1768 category C
IEEE C62.41 category C
BS 6651 category C
CP 33 category C
IEC 1000-4-5
UL1449 third edition

Options	
Metal enclosure IP 55	M
Over / under voltage relay	O
Extended voltage (95-415V)	X

SFM Surge Filters 40 – 63A

Novaris SFM surge filters provide excellent and effective MSB and DB protection for critical equipment up to 63A per phase.

SFM 1 - 40 - 50 - 275 - M

- **Product Series**
- **Phase**
- **I_L**
- **Options**
- **U_c**
- **I_{max}**

SFM1-40-50-275	SFM1-40-100-275	SFM3-40-50-275	SFM3-40-100-275	SFM1-63-50-275	SFM1-63-100-275	SFM3-63-50-275	SFM3-63-100-275

Electrical Specifications									
Connection type		Series							
Modes of protection		All mode (L-N, L-PE, N-PE)							
Nominal Voltage	U_0	230V / 50Hz (110V / 60Hz by request only)							
Maximum continuous voltage	U_c	275V / 50Hz (130V / 60Hz by request only)							
Phases		1		3		1		3	
Discharge current 8/20µs	I_{max}	50kA	100kA	50kA	100kA	50kA	100kA	50kA	100kA
Maximum load curent	I_L	40A				63A			
Protection stages		Metal oxide varistor / LC filter / metal oxide varistor							
Voltage protection @ 3kA (8/20µs)	U_p	<360V							
Response time	t_A	Instantaneous							
Earth leakage current		<1µA							
Maximum voltage drop (% of U_0)	ΔU	<1%							
3dB Frequency @ 50Ω		750Hz				420Hz			
Displays		LED status	% active	LED status	% active	LED status	% active	LED status	% active
Alarms		Segment failure and overcurrent / thermal overload, SPDT contact							
Alarm isolation to active circuitry		4kV							

Mechanical Specifications									
Operating temperature / humidity		-40 to +40ºC / 0 to 90% non-condensing							
Connection type		UIK35 Terminals							
Terminal capacity - power		35mm²							
Terminal capacity - alarm		2.5mm²							
Terminal screw torque - power		1.0Nm							
Terminal screw torque - alarm		0.5Nm							
Environmental		IP 55 in enclosure							
Mounting		Wall mount							
Weight (in enclosure)		9kg	10kg	18kg	22kg	10kg	11kg	20kg	24kg

Standards Compliance
IEC 61643-1 class I, II
AS/NZS 1768 categories B, C
IEEE C62.41 categories B, C
BS 6651 categories B, C
CP 33 categories B, C
IEC 1000-4-5
UL1449 third edition

Options	
Circuit breaker	C
HRC fusing	H
Metal enclosure IP 55	M
Over / under voltage relay	O
Extended voltage (95-415V)	X

Dimensions (in enclosure)					
Width	310mm	426mm	310mm	426mm	
Height	390mm	506mm	390mm	506mm	
Depth	130mm	200mm	130mm	200mm	

Maximum Discharge Current Variations		
Discharge Current variations	I_{max}	150kA / 200kA / 250kA

SFM Surge Filters 125A

Novaris SFM surge filters provide excellent and effective MSB and DB protection for critical equipment up to 125A per phase.

SFM 1 - 125 - 50 - 275 - M

- **Product Series**
- **Phase**
- **I_L**
- **Options**
- **U_c**
- **I_{max}**

SFM1-125-50-275	SFM1-125-100-275	SFM3-125-50-275	SFM3-125-100-275

Electrical Specifications						
Connection type		Series				
Modes of protection		All mode (L-N, L-PE, N-PE)				
Nominal Voltage	U_0	230V / 50Hz (110V / 60Hz by request only)				
Maximum continuous voltage	U_c	275V / 50Hz (130V / 60Hz by request only)				
Phases		1		3		
Discharge current 8/20µs	I_{max}	50kA	100kA	50kA	100kA	
Maximum load curent	I_L	125A				
Protection stages		Metal oxide varistor / LC filter / metal oxide varistor				
Voltage protection @ 3kA (8/20µs)	U_p	<360V				
Response time	t_A	Instantaneous				
Earth leakage current		<1µA				
Maximum voltage drop (% of U_0)	ΔU	<1%				
3dB Frequency @ 50Ω		350Hz				
Displays		LED status	% active	LED status	% active	
Alarms		Seg failure and o'current / thermal o'load, SPDT contact				
Alarm isolation to active circuitry		4kV				

Mechanical Specifications					
Operating temperature / humidity	-40 to +40°C / 0 to 90% non-condensing				
Connection type	UIK35 Terminals				
Terminal capacity - power	35mm²				
Terminal capacity - alarm	2.5mm²				
Terminal screw torque - power	1.0Nm				
Terminal screw torque - alarm	0.5Nm				
Environmental	IP 55 in enclosure				
Mounting	Wall mount				
Weight (in enclosure)	11kg	12kg	25kg	28kg	

Dimensions (in enclosure)			
Width	310mm	426mm	
Height	390mm	506mm	
Depth	130mm		200mm

Maximum Discharge Current Variations		
Discharge Current variations	I_{max}	150kA / 200kA / 250kA

Standards Compliance
IEC 61643- class I, II
AS/NZS 1768 categories B, C
IEEE C62.41 categories B, C
BS 6651 categories B, C
CP 33 categories B, C
IEC 1000-4-5
UL1449 third edition

Options	
HRC fusing	H
Metal enclosure	M
Over / under voltage relay	O
Extended voltage (95-415V)	X

SFD Surge Filters 2 - 10A

Novaris SFD surge filters provide the highest level of protection for critical and essential equipment up to 10A per phase.

SFD 1 - 2 - 6.5 - 275 - P

- **Product Series**
- **Phase**
- **I_L**
- **Options**
- **U_c**
- **I_{max}**

SFD1-2-6.5-275	SFD1-6-6.5-275	SFD3-6-13-275-A	SFD3-6-50-275-A	SFD1-10-13-275	SFD1-10-50-275-A	SFD3-10-13-275-A	SFD3-10-50-275-A

Electrical Specifications								
Connection type		Series						
Modes of protection		All mode (L-N, L-PE, N-PE)						
Nominal voltage	U_0	230V / 50Hz						
Maximum continuous voltage	U_c	275V / 50Hz						
Phases		1		3		1		3
Maximum discharge current (8/20µs)	I_{max}	6.5kA		13kA	50kA	13kA	50kA	13kA	50kA
Maximum load curent	I_L	2A	6A			10A		
Protection stages		Metal oxide varistor / LC filter / metal oxide varistor						
Voltage protection level @ 3kA (8/20µs)	U_p	<700V						
Response time	t_A	Instantaneous						
Earth leakage current		<500µA						
Maximum voltage drop (% of U_0)	ΔU	<1%						
Displays (optional)		LED*		LED power and status				
Alarms (optional)		-				Overcurrent / thermal, SPDT contact		
Alarm isolation to active circuitry		-				4kV		

Mechanical Specifications						
Operating temperature / humidity	-40 to +40ºC / 0 to 90% non-condensing					
Terminal capacity - power	2.5mm²	16mm²				
Terminal capacity - alarm	2.5mm²					
Terminal screw torque - power	0.5Nm	1.0Nm				
Terminal screw torque - alarm	0.5Nm					
Environmental	IP 20					
Mounting	TS35 DIN rail					
Weight	350g	1.2kg		450g	1.05kg	1.55kg

Dimensions						
Width* (can vary with options)	27mm (54mm with LED)*	180mm		54mm	118mm	180mm
Height* (can vary with options)	116mm (95mm with LED)*	95mm				
Depth	78mm					

Options								
LED indication and external alarm	-	Standard		-	Standard			
LED indication only	L*	L						
Polycarbonate enclosure	P							
Voltage variation	U_c	30V / 50V / 130V	50V / 130V	130V	50V / 130V	130V	50V / 130V	130V

Standards Compliance
IEC 61643-1 class II, III
AS/NZS 1768 categories A, B
IEEE C62.41 categories A, B
BS 6651 categories A, B
CP 33 categories A, B
IEC 1000-4-5
UL1449 third edition

SFD Surge Filters 20A

Novaris SFD surge filters provide the highest level of protection for critical and essential equipment up to 20A per phase.

SFD 3 - 20 - 13 - 275 - P

- Product Series
- Phase
- I_L
- Options
- U_c
- I_{max}

SFD1-20-13-275-A	SFD1-20-50-275-A	SFD3-20-13-275-A	SFD3-20-50-275-A

Electrical Specifications						
Connection type		Series				
Modes of protection		All mode (L-N, L-PE, N-PE)				
Nominal voltage	U_0	230V / 50Hz				
Maximum continuous voltage	U_c	275V / 50Hz				
Phases		1		3		
Maximum discharge current (8/20µs)	I_{max}	13kA	50kA	13kA	50kA	
Maximum load curent	I_L	20A				
Protection stages		Metal oxide varistor / LC filter / metal oxide varistor				
Voltage protection level @ 3kA (8/20µs)	U_p	<700V				
Response time	t_A	Instantaneous				
Earth leakage current		<500µA				
Maximum voltage drop (% of U_0)	ΔU	<1%				
Displays (optional)		LED power and status				
Alarms (optional)		Overcurrent / thermal, SPDT contact				
Alarm isolation to active circuitry		4kV				

Mechanical Specifications		
Operating temperature / humidity	-40 to +40ºC / 0 to 90% non-condensing	
Terminal capacity - power	16mm²	
Terminal capacity - alarm	2.5mm²	
Terminal screw torque - power	1.0Nm	
Terminal screw torque - alarm	0.5Nm	
Environmental	IP 20	
Mounting	TS35 DIN rail	
Weight	1.05kg	1.55kg

Dimensions		
Width	118mm	180mm
Height	95mm	
Depth	78mm	

Options						
LED indication and external alarm		Standard				
LED indication only		L				
Polycarbonate enclosure		P				
Voltage variation	U_c	50V / 130V	130V	50V / 130V	130V	

Standards Compliance
IEC 61643-1 class II, III
AS/NZS 1768 categories A, B
IEEE C62.41 categories A, B
BS 6651 categories A, B
CP 33 categories A, B
IEC 1000-4-5
UL1449 third edition

PP Plug-in Surge Filters 10A

Novaris plug-in surge filters plug into a standard mains outlet socket to provide premium protection for sensitive or critical electronic equipment.

PP 10 A 2 - 19 - C

- **Product Series**
- **I_L**
- **Plug type**
- **Options**
- **I_{max}**
- **Outlets**

PP10A2-19	PP10A2-50	PP10A4-19	PP10A6-19	PP10A8-19

Electrical Specifications						
Connection type		Series				
Modes of protection		All mode (L-N, L-PE, N-PE)				
Nominal voltage	U_0	230V / 50Hz				
Maximum continuous voltage	U_c	275V / 50Hz				
Maximum discharge current (8/20µs)	I_{max}	19kA	50kA	19kA		
Maximum load curent	I_L	10A				
Protection stages		Metal oxide varistor / LC filter / metal oxide varistor				
Voltage protection level @ 3kA (8/20µs)	U_P	<360V				
Response time	t_A	Instantaneous				
Earth leakage current		<200µA				
Maximum voltage drop (% of U_0)	ΔU	<1%				
Display		LED power and status				LED status

Mechanical Specifications				
Operating temperature / humidity	-40 to +40ºC / 0 to 90% non-condensing			
Connection type - line side cord	Australian plug			
Connection type - load side outlet	Australian socket			
Number of outlets	2	4	6	8
Environmental	IP 20			
Mounting	Free standing, optional wall mount			Rack 1RU
Weight	1.3kg	1.4kg	1.7kg	2.8kg

Dimensions				
Width	170mm	220mm	345mm	484mm
Height	100mm			44mm
Depth	60mm			220mm

Standards Compliance
IEC 61643-1 class III
AS/NZS 1768 category A
IEEE C62.41 category A
BS 6651 category A
CP 33 category A
IEC 1000-4-5
UL1449 third edition

Options				
Integrated two pair RJ12 protection	C	-		
Integrated F-type comms. protection	F	-		
Integrated RJ45 CAT6 comms. protection	J			-
Integrated RJ45 CAT6 PoE protection	P			-
Wall mounting option*	M			-
RFI line filtering*	R	-		
IEC 3 pin outlet, Australian plug	I			

* Only R and M options may be combined with other options.

PP Plug-in Surge Filters 15A and UK 13A

Novaris plug-in surge filters plug into Australian 15A or UK 13A outlet sockets and provide premium protection for sensitive electronic equipment.

PP 15 A 1 - 19 - M

- **Product Series**
- **I_L**
- **Plug type**
- **Options**
- **I_{max}**
- **Outlets**

	PP15A1-19	PP15A1-50	PP13B2-19	PP13B2-50
Electrical Specifications				
Connection type	Series			
Modes of protection	All mode (L-N, L-PE, N-PE)			
Nominal voltage (U_0)	230V / 50Hz			
Maximum continuous voltage (U_c)	275V / 50Hz			
Maximum discharge current (8/20µs) (I_{max})	19kA	50kA	19kA	50kA
Maximum load curent (I_L)	15A		13A	
Protection stages	Metal oxide varistor / LC filter / metal oxide varistor			
Voltage protection level @ 3kA (8/20µs) (U_P)	<360V			
Response time (t_A)	Instantaneous			
Earth leakage current	<200µA			
Maximum voltage drop (% of U_0) (ΔU)	<1%			
Display	LED power and status			
Mechanical Specifications				
Operating temperature / humidity	-40 to +40ºC / 0 to 90% non-condensing			
Connection type - line side cord	Australian plug		UK plug	
Connection type - load side outlet	Australian socket		UK socket	
Number of outlets	1		2	
Environmental	IP 20			
Mounting	Free standing, optional wall mount			
Weight	1.3kg			
Dimensions				
Width	170mm			
Height	100mm			
Depth	60mm			

Standards Compliance
IEC 61643-1 class III
AS/NZS 1768 category A
IEEE C62.41 category A
BS 6651 category A
CP 33 category A
IEC 1000-4-5
UL1449 third edition

Options		
Integrated two pair RJ12 protection	-	C
Integrated F-type comms. protection	-	F
Integrated RJ45 CAT6 comms. protection	-	J
Integrated RJ45 CAT6 PoE protection	-	P
Wall mounting option*	M	
RFI line filtering*	-	R
IEC 3 pin outlet, Australian plug	I	-

* Only R and M options may be combined with other options.

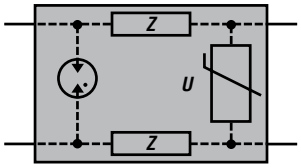

NEWSMAN 40

Selecting Process Control Protection

Process control protection must:

1. Provide adequate protection for all equipment.
2. Achieve a long working life.
3. Allow the signal to pass under normal operation.
4. Optimise the cost and size of the surge protection devices (SPDs).

Options for Surge Protection Devices



Two port SPDs are connected in series with the line. Almost all Novaris process control SPDs incorporate this configuration where a low let through voltage, (U_p) is always required to adequately protect low level signals.

Novaris process control SPDs contain a combination of voltage switching components comprising gas discharge tubes, series impedances and voltage limiting components comprising MOVs and suppressor diodes.

Selection of Surge Protection Devices

The selection of SPDs for process control requires more attention than the selection of power line SPDs to ensure the signal is not attenuated or lost through the SPD. Novaris manufactures process control SPDs for almost all applications and can design custom solutions for unique applications.

1. Determine the signalling protocol and peak line voltage

Table 1 on page 60 provides common signalling protocols and the appropriate Novaris SPD for each application. Even if the actual protocol is unknown the peak signal voltage must be determined.

2. Select the clamping voltage

The clamping voltage of the SPD must be greater than the peak signalling voltage.
The following is a guide.

Nominal Peak Signal Voltage (V)	Power System (V)	Clamping Voltage (V)
0-6	6	7v5
6-15	12	18
15-30	24	36
30-60	48	68

3. Determine the signal current

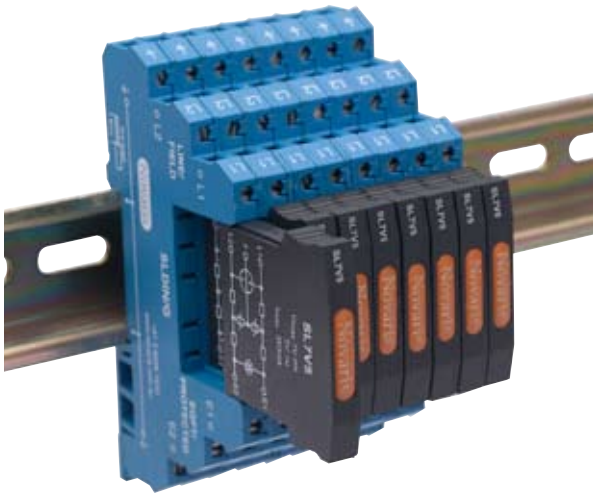
Standard SL models are rated at I_L = 350mA. For current up to I_L = 6A use the SSP6A series.
For higher current applications, consider using SFD surge filters.

4. Select signal frequency / data rate

Standard SL series will pass signals up to 250kHz. For higher frequency / faster data rates consider the SL485 or SL-DH.

5. Consider earth isolation

The normal SL DIN rail base, designated -G, connects the protective earth to the DIN rail to provide a low impedance earth path. If the earth must be isolated, for example with instrument loops, use the -EC90 base.



SL Slimline Signal Line Protectors

Novaris SL range of plug-in signal line protectors provide surge protection for most twisted pair signalling schemes. Ideal for the protection of PLCs, fire and security systems, telecommunications and telemetry systems, railway signalling, SCADA and other industrial monitoring and control equipment.

SL 7v5 - G

Product Series — **SL 7v5**
Top
Base option — **G**

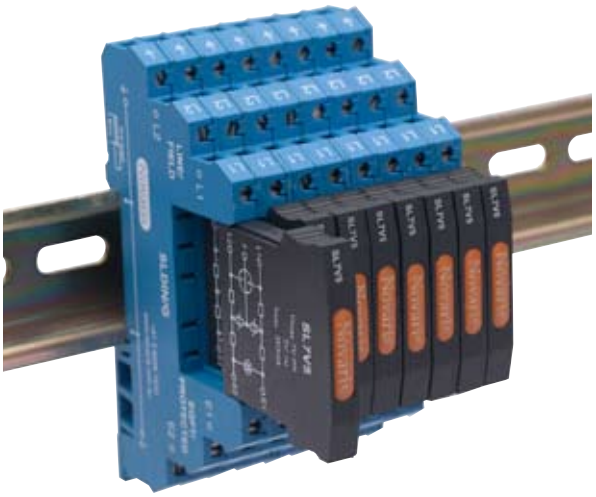
	SL7v5	SL18	SL36	SL68	SL-PTSN	SL-iSwitch
Electrical Specifications						
Connection type	Series					
Modes of protection	Transverse and common mode					
Maximum continuous voltage (DC) U_0	7V	16V	34V	65V	200V	200V
Maximum continuous voltage (AC) U_c	5V	11V	24V	46V	140V	140V
Discharge current 8/20µs I_{max}	5kA					
Maximum load current I_L	350mA					180mA
Impulse voltage 1.2/50µs U_p	8V	19V	40V	76V	235V	30V
Line resistance	8.2Ω					17Ω
3dB Frequency @ 50Ω	250kHz				10MHz	20MHz

Mechanical Specifications	
Operating temperature / humidity	-20 to +40ºC / 0 to 90% non-condensing
Terminal capacity	2.5mm²
Terminal screw torque	0.5Nm
Environmental	IP 20
Mounting	TS35 DIN rail
Weight	35g

Dimensions	
Width	7mm
Height	102mm
Depth	68mm

Base Options	
Earth connected to DIN rail	G
Earth connected to DIN rail via GDT	EC90

Standards Compliance
ITU-T K.44
AS/NZS 1768
IEEE C62.41
BS 6651
CP 33
IEC 61643-21
UL497B
A-tick (PSTN & iSwitch)



SL Slimline Signal Line Protectors

Novaris SL range of plug-in signal line protectors provide surge protection for most twisted pair signalling schemes. Ideal for the protection of PLCs, fire and security systems, telecommunications and telemetry systems, railway signalling, SCADA and other industrial monitoring and control equipment.

SL 485 - EC90

Product Series — **Base option**

Top

Electrical Specifications		SL485-EC90	SL-DH	SL-RTD
Connection type		Series		
Modes of protection		Transverse and common mode		
Maximum continuous voltage (DC)	U_0	8V	34V*	8V
Maximum continuous voltage (AC)	U_c	6V	24V*	6V
Discharge current 8/20µs	I_{max}	5kA		
Maximum load current	I_L	500mA		
Impulse voltage 1.2/50µs	U_p	15V	50V	15V
Line resistance		3.9Ω		
3dB Frequency @ 50Ω		20MHz		

Mechanical Specifications	
Operating temperature / humidity	-20 to +40ºC / 0 to 90% non-condensing
Terminal capacity	2.5mm²
Terminal screw torque	0.5Nm
Environmental	IP 20
Mounting	TS35 DIN rail
Weight	35g

Dimensions	
Width	7mm
Height	102mm
Depth	68mm

Base Options		
Earth connected to DIN rail	-	G
Earth connected to DIN rail via GDT	Standard	EC90

Standards Compliance
ITU-T K.44
AS/NZS 1768
IEEE C62.41
BS 6651
CP 33
IEC 61643-21
UL497B

* Voltage variations available by request

SSP Slimline Series Surge Protectors

Novaris SL range of plug-in signal line protectors provide surge protection for power supplies with loads up to 6A. Ideal for the protection of PLCs, fire and security systems, telecommunications and telemetry systems, railway signalling, SCADA and other industrial monitoring and control equipment.

SSP 6A - 14 - G

Product Series — **I_L** — **U_c** — **Base options**

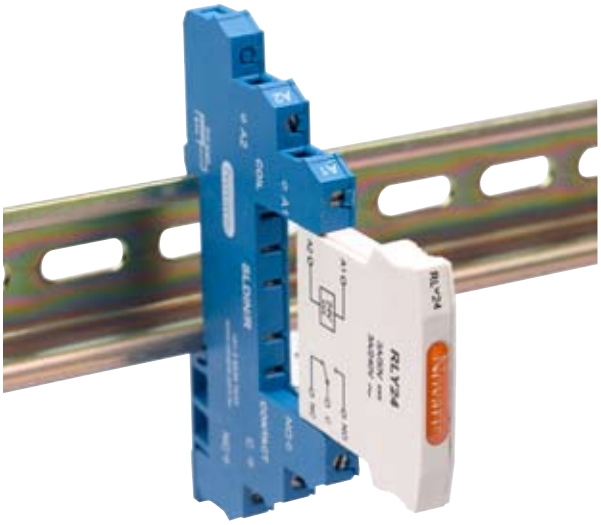
Electrical Specifications		SSP6A-14	SSP6A-26	SSP6A-38	SSP6A-65
Connection type		Series			
Modes of protection		Transverse and common mode			
Maximum continuous voltage (DC)	U_0	14V	26V	38V	65V
Maximum continuous voltage (AC)	U_c	11V	20V	30V	50V
Maximum discharge current (8/20µs)	I_{max}	9.6kA			
Maximum load current	I_L	6A			
Voltage protection level @ 5kV (10/700µs)	U_p	26V	52V	70V	120V
Line resistance		0Ω			
3dB Frequency @ 50Ω		100kHz			

Mechanical Specifications	
Operating temperature / humidity	-20 to +40°C / 0 to 90% non-condensing
Terminal capacity	2.5mm²
Terminal screw torque	0.5 Nm
Environmental	IP 20
Mounting	TS35 DIN rail
Weight	35g

Dimensions	
Width	7mm
Height	102mm
Depth	68mm

Base Options	
Earth connected to DIN rail	G
Earth connected to DIN rail via GDT	EC90

Standards Compliance
ITU-T K.44
AS/NZS 1768
IEEE C62.41
BS 6651
CP 33
IEC 61643-21
UL497B



SL Slimline Relays

Novaris RLY range of plug-in interposing relays provide ideal switching for 12V or 24V input; with loads up to 6 Amps at 240 Volts AC, with 1 X N/O and 1 X N/C contact.

RLY 12 - R

Product Series

U_c

Relay base

	RLY12-R	RLY24-R	RLY48-R
Electrical Specifications			
Coil nominal voltage	U_c	12VDC	24VDC	48VDC
Number of contacts		1 CO (SPDT)	
Contact rating		6A @ 30VDC 6A @ 240VAC	
Contact-coil isolation (1.2/50µs)		6kV	
Operate time		5ms	
Release time		3ms	
Coil sensitivity		170mW	
Mechanical Specifications			
Operating temperature / humidity		-40 to +85ºC / 0 to 90% non-condensing	
Terminal capacity		2.5mm²	
Terminal screw torque		0.5Nm	
Environmental		IP 20	
Mounting		TS35 DIN rail	
Weight		35g	
Dimensions			
Width		7mm	
Height		102mm	
Depth		68mm	

Accessories

SL Test Plug

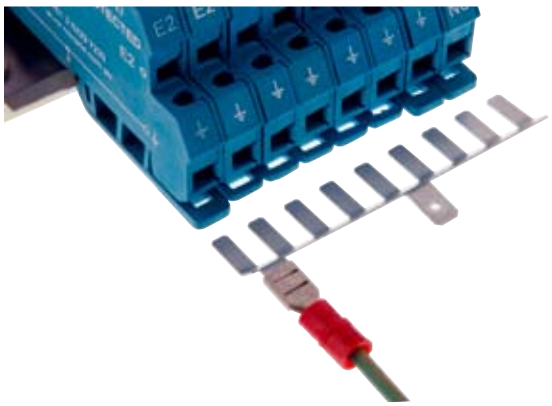
SL-TEST

Novaris SL Test Plug provides access to field and equipment terminals plus earth via mini banana sockets mounted in the top face of the test plug. It provides a convenient way to connect to these lines for testing.

SL Earth Comb

SL-COMB

The Novaris SL Earth Comb provides a convenient means of connecting the common points of SL series surge protectors. The earth comb contains nine contacts, allowing banks of 8 SL protectors to be commoned together with one overlapping contact. The earth comb can be cut to provide a lesser number of points. The earth comb contains two 6.3mm spade terminals.



Novaris Screwdriver

SL-SCREW

SLM Multiline Protectors

Novaris SLM offers protection for up to 12 signal lines. Typical applications include process control, telemetry, PLC, and irrigation systems.

SLM - 7v5 - 2

Product Series

Options

U_c

	SLM-7v5	SLM-18	SLM-36	SLM-68	SLM-200
Electrical Specifications					
Connection type	Series				
Modes of protection	Transverse and common mode				
Number of lines	12				
Maximum continuous voltage (DC) U_0	7V	16V	34V	65V	200V
Maximum continuous voltage (AC) U_c	5V	11V	24V	46V	140V
Discharge current 8/20µs I_{max}	20kA				
Protection stages	Multistage				
Maximum load current I_L	350mA (2A for option 2; 500mA for option H)				
Impulse voltage 10/700µs U_p	8V	19V	40V	76V	235V
Line resistance - base	8.2Ω				
Line resistance - 2A	0.1Ω				
Line resistance - high frequency	3.9Ω				
Maximum frequency f_c	250kHz (25MHz high frequency option)				

Mechanical Specifications	
Operating temperature / humidity	-40 to +85ºC / 0 to 90% non-condensing
Terminal capacity	2.5mm²
Terminal screw torque	0.5Nm
Environmental	IP 20
Mounting	Panel mount
Weight	250g

Dimensions	
Width	128mm
Height	80mm
Depth	42mm

Options		
Maximum load current 2A	I_L	2
High frequency 25MHz	f_c	H

Standards Compliance
IEC61643-21
ITU-T K.44
AS/NZS 1768
IEEE C62.41
BS 6651
CP 33
UL497B

RS Serial Port Protectors

Novaris RS Protectors provide protection for serial protocol systems in RS232 and RS485 applications. These units are housed in a headshell enclosure.

DB 9 - RS232

Product Series
Connector
Signalling Protocol

	DB9-RS232	DB25-RS232	DB9-RS485
Electrical Specifications			
Connection type	Series		
Modes of protection	Transverse and common		
Maximum continuous voltage (U_c)	36V		8.2V
Discharge current 8/20µs (I_{max})	250A		
Protection stages	SAD and GDT		
Number of lines	8		
Impulse voltage 10/700µs (U_p)	40V		14V
Signalling protocol	RS232		RS485
Mechanical Specifications			
Operating temperature / humidity	-40 to +85ºC / 0 to 90% non-condensing		
Connection type	DB9	DB25	DB9
Connector orientation	M / F		
Environmental	IP 20		
Weight	70g		
Dimensions			
Width	34mm	56mm	34mm
Height	17mm		
Depth	63mm		

Standards Compliance
IEC61643-21
ITU-T K.44
AS/NZS 1768
IEEE C62.41
BS 6651
CP 33
UL497B

LCP Load Cell Protector

The Novaris LCP provides protection for both 4-wire and 6-wire loadcells as well as the measuring instrument. The LCP is contained within an IP65 enclosure, or alternatively as a PCB only. Installation of the LCP is certified and does not affect weighbridge calibration.

LCP - 36 - PCB

Product Series

PCB Mount

U_c

		LCP-18	LCP-36	LCP-18-PCB	LCP-36-PCB
Electrical Specifications					
Connection type		Series			
Modes of protection		Transverse and common mode			
Maximum continuous voltage (DC)	U_c	18V	36V	18V	36V
Maximum discharge current (8/20µs)	I_{max}	250A			
Protection stages		SAD and GDT			
Maximum load current	I_L	6.5A		5A	
Lines protected		4 or 6			
Mechanical Specifications					
Operating temperature / humidity		-40 to +85ºC / 0 to 90% non-condensing			
Terminal capacity		2.5mm²			
Terminal screw torque		0.5Nm			
Ground connection		M5 s/s stud		100mm lead	
Environmental		IP 65		IP 00	
Mounting		Panel mount			
Enclosure / colour		Aluminium / blue		PCB only	
Weight		600g		80g	
Dimensions					
Width		116mm		76mm	
Height		65mm		63mm	
Depth		56mm		20mm	

Standards Compliance
IEC61643-21
ITU-T K.44
AS/NZS 1768
IEEE C62.41
BS 6651
CP 33
UL497B
NSC No: S366

CL Coaxial CCTV Protectors

Novaris Coaxial CCTV protectors are suited to the protection of security and CCTV applications.

CL B - M F - 10

- **Product Series**
- **Connector**
- **Gender Line**
- **U_c**
- **Gender EQPT**

	CLB-MF-10	CLB-FF-10	CLB-FM-10	CLF-FF-10	CLB-MF-18	CLB-FF-18	CLB-FM-18	CLF-FF-18
Electrical Specifications								
Connection type	Series							
Modes of protection	Transverse and common modes							
Maximum continuous voltage (U_c)	8.2V				18V			
Maximum discharge current (8/20µs) (I_{max})	20kA							
Maximum load current (I_L)	500mA							
Protection stages	Multistage							
Voltage protection level @ 5kV (10/700µs) (U_p)	14V				20V			
3dB frequency	20MHz							
Insertion loss	<1dB @ 20MHz							
Mechanical Specifications								
Operating temperature / humidity	-40 to +85ºC / 0 to 90% non-condensing							
Connector type	BNC			F-type	BNC			F-type
Connector orientation (Line / EQPT)	M / F	F / F	F / M	F / F	M / F	F / F	F / M	F / F
Environmental	IP 20							
Enclosure / colour	Aluminium / Black							
Weight	100g							
Dimensions								
Width	26mm							
Height	26mm							
Depth	89mm	86mm	86mm	88mm	89mm	86mm	86mm	88mm

Standards Compliance
ITU-T K.44
AS/NZS 1768
BS 6651
IEEE C62.41
CP 33
IEC 61643-21
UL497B

CL Coaxial CCTV Protectors

Novaris Coaxial CCTV protectors are suited to the protection of security and CCTV applications.

CL B - M F - 36

- **Product Series**
- **Connector**
- **Gender Line**
- **Gender EQPT**
- **U_c**

Electrical Specifications		CLB-MF-36	CLB-FF-36	CLB-FM-36	CLF-FF-36
Connection type		Series			
Modes of protection		Transverse and common modes			
Maximum continuous voltage	U_c	36V			
Maximum discharge current (8/20µs)	I_{max}	20kA			
Maximum load current	I_L	500mA			
Protection stages		Multistage			
Voltage protection level @ 5kV (10/700µs)	U_p	40V			
3dB frequency		20MHz			
Insertion loss		<1dB @ 20MHz			

Mechanical Specifications	CLB-MF-36	CLB-FF-36	CLB-FM-36	CLF-FF-36
Operating temperature / humidity	-40 to +85ºC / 0 to 90% non-condensing			
Connector type	BNC			F-type
Connector orientation (Line / EQPT)	M / F	F / F	F / M	F / F
Environmental	IP 20			
Enclosure / colour	Aluminium / Black			
Weight	100g			

Dimensions	CLB-MF-36	CLB-FF-36	CLB-FM-36	CLF-FF-36
Width	26mm			
Height	26mm			
Depth	89mm	86mm	86mm	88mm

Standards Compliance
ITU-T K.44
AS/NZS 1768
BS 6651
IEEE C62.41
CP 33
IEC 61643-21
UL497B

SFD Combined Power and Signal Protectors

Novaris protection for both power and signal is provided in one compact and economical DIN compliant package. Ideal for security and CCTV camera protection.

SFD 1 - 2 - 6.5 - 30 - C

- **Product Series**
- **Phase**
- **I_L**
- **CCTV**
- **U_c**
- **I_{max}**

SFD1-2-2-30-C	SFD1-6-2-30-C	SFD1-2-6.5-50-C	SFD1-6-6.5-50-C	SFD1-2-6.5-130-C	SFD1-6-6.5-130-C	SFD1-2-6.5-275-C	SFD1-6-6.5-275-C

Power Line Protection									
Connection type		Series							
Modes of protection		All mode (L-N, L-PE, N-PE)							
Nominal voltage	U_0	24V / 50Hz		40V / 50Hz		110V / 50Hz		230V / 50Hz	
Maximum continuous voltage	U_c	30V / 50Hz		50V / 50Hz		130V / 50Hz		275V / 50Hz	
Phases		1							
Maximum discharge current (8/20µs)	I_{max}	2kA		6.5kA					
Maximum load current	I_L	2A	6A	2A	6A	2A	6A	2A	6A
Protection stages		Metal oxide varistor / LC filter / metal oxide varistor							
Voltage protection level @ 3kA (8/20µs)	U_p	<50V		<150V		<450V		<750V	
Response time	t_A	Instantaneous							
Earth leakage current		<500uA							
Maximum voltage drop (% of U_0)	ΔU	<1%							

Signal Line Protection		
Connection type		Series
Modes of protection		Transverse and common modes
Maximum continuous voltage	U_c	8.2V
Maximum discharge current (8/20µs)	I_{max}	20kA
Maximum load current	I_L	500mA
Protection stages		Gas discharge tube / series impedance / SAD
Impulse voltage 1.2/50µs	U_p	14V
3dB frequency		20MHz
Insertion loss		<1dB @ 20MHz

Mechanical Specifications	
Operating temperature / humidity	-40 to +85ºC / 0 to 90% non-condensing
Connector type - power	2.5mm² polarised plugs
Connector type - signal	Female / female BNC
Terminal screw torque	0.5 Nm
Environmental	IP 20
Mounting	TS35 DIN rail
Weight	300g

Dimensions	
Width	28mm
Height	116mm
Depth	78mm

Standards Compliance
IEC 61643-1 class II, III
AS/NZS 1768 categories A, B
IEEE C62.41 categories A, B
BS 6651 categories A, B
CP 33 categories A, B
IEC 1000-4-5
UL1449 third edition
ITU-T K.44
IEC 61643-21
UL497B

RJ45 UTP Network Protectors - Terminal

Novaris RJ45 terminal protectors are compliant with 1000BaseT (gigabit Ethernet), CAT6 and power over ethernet applications.

UTP - RJ45 - 1CAT6 - D

Product Series
Connector
Options
Circuits

UTP-RJ45-1CAT6	UTP-RJ45-8CAT6	UTP-RJ45-16CAT6	UTP-RJ45-24CAT6	UTP-RJ45-1PoE	UTP-RJ45-8PoE	UTP-RJ45-16PoE	UTP-RJ45-24PoE

Standards Compliance
100BaseT
1000BaseT (excluding PoE models)
CAT5 (excluding PoE models)
CAT5e (excluding PoE models)
CAT6 (excluding PoE models)
TIA/EIA 568A
TIA/EIA 568B
AS/NZS 1768
IEEE C62.41
BS 6651
CP 33

Electrical Specifications									
Connection type		Series							
Modes of protection		Transverse and common modes							
Lines protected		All							
Maximum continuous voltage	U_c	6VDC				6VDC, 230VDC lines 4&5, 7&8			
Maximum discharge current (8/20µs)	I_{max}	10kA							
Protection stages		Multistage				Multistage except lines 4&5, 7&8			
Voltage protection level @ 5kV (10/700µs)	U_p	<20V							
Maximum frequency	f_c	250MHz							

Mechanical Specifications								
Operating temperature / humidity	-40 to +85ºC / 0 to 90% non-condensing							
Connection type	RJ45 socket							
Number of outlets	1	8	16	24	1	8	16	24
Environmental	IP 20							
Mounting	Inline	2RU rack mount			Inline	2RU rack mount		
Enclosure / colour	Aluminium / black							
Weight	200g	1.85kg	1.95kg	2.0kg	200g	1.85kg	1.95kg	2.0kg

Dimensions				
Width	26mm	483mm	26mm	483mm
Height	26mm	89mm	26mm	89mm
Depth	85mm	80mm	85mm	80mm

Options				
DIN rail mounting clip	D	-	D	-

Selecting Coaxial Protection

Coaxial line surge protection must:

1. Provide adequate protection for all equipment.
2. Achieve a long working life.
3. Allow the signal to pass under normal operation and not have an adverse affect on insertion loss and return loss.
4. Optimise the cost and size of the surge protection devices (SPDs).

Options for Surge Protection Devices

Novaris manufacturers two types of RF coaxial SPDs. Those containing a gas discharge tube (GDT) are suitable for a wide frequency range but must be chosen carefully taking into account the power on the line if used for a transmitting application. Quarter wave stub protectors offer exceptionally low let through voltages but are frequency sensitive. Their power handling capability is only limited by the rating of the coaxial connectors employed.

Selection of Surge Protection Devices

1. Identify the connector type

Novaris manufactures a range of coaxial SPDs to suit most common connectors and gender variations.

2. Select the clamping voltage

The clamping voltage of the SPD must be greater than the peak voltage on the line. This is particularly i s a guide.

Power in 50Ω (W)	GDT Voltage (V)
0-40	90
40-125	230
125-300	350
300-800	600
800-2000	1000

3. Identify the maximum operating frequency

For standard models using N-type connectors the maximum frequency is 2GHz. 3G models feature replaceable GDTs and will operate to 3GHz. For other variations the upper frequency is dependent upon the connector type.

4. Tuned stub protectors

For narrow bandwidth applications where no DC voltage is injected, tuned stub protectors provide exceptionally low let through voltages and very low intermodulation products. The centre operating frequency must be specified when ordering.

RF Equipment Protection up to 2GHz

Novaris gas discharge surge protectors are capable of passing RF signals to 2GHz (limited by connector type). N-type female / female protectors are suitable for bulkhead mounting.

C N - FF - 90 - 2 - M

- **Product Series** — C
- **Connector** — N
- **Gender** — FF
- **Options** — M
- f_c — 2
- U_c — 90

	CN-MF-90-2	CN-FF-90-2	CN-MF-230-2	CN-FF-230-2	CN-MF-350-2	CN-FF-350-2
Electrical Specifications						
Connection type	Series					
Modes of protection	Signal-Earth					
Sparkover voltage (U_c)	90VDC		230VDC		350VDC	
Maximum discharge current (8/20µs) (I_{max})	20kA					
Power rating	0 - 40W		40 - 125W		125 - 300W	
Maximum working frequency (f_c)	2GHz					
Voltage protection level @ 3kA (8/20µs) (U_p)	<650V		<820V		<1.1kV	
Characteristic impedence	50Ω (75Ω F-type only)					
VSWR	<1.1:1					
Return loss	>26dB					
Insertion loss	<0.2dB					
Mechanical Specifications						
Operating temperature / humidity	-40 to +85ºC / 0 to 90% non-condensing					
Connection type	N-type					
Connection orientation	M / F	F / F	M / F	F / F	M / F	F / F
Mounting	Inline / bulkhead (N-type only)					
Environmental	IP 55					
Enclosure / colour	Aluminium / black					
Weight	150g					
Connector type variation						
BNC	B					
7/16 DIN	D (Mounting bracket not available)					
F-type	-	F	-	F	-	F
N-type (bulkhead mount female)	N	Standard	N	Standard	N	Standard
UHF	U					
TNC	T					
Options						
Mounting bracket	M					

Standards Compliance
ITU-T K.44
AS/NZS 1768
IEEE C62.41
BS 6651
CP 33
IEC 61643-21
UL497B

Dimensions											
Configuration	**CB-MF**	**CB-FF**	**CD-MF**	**CD-FF**	**CF-FF**	**CN-MF**	**CN-FF**	**CU-MF**	**CU-FF**	**CT-MF**	**CT-FF**
Width	26mm		Ø40mm	Ø40mm	26mm						
Height	26mm				26mm						
Maximum length	64mm	61mm	70mm	73mm	57mm	64mm	72mm	57mm		80mm	

RF Equipment Protection up to 2GHz

Novaris gas discharge surge protectors are capable of passing RF signals to 2GHz (limited by connector type). N-type female / female protectors are suitable for bulkhead mounting.

C N - FF - 600 - 2 - M

- **Product Series** — C
- **Connector** — N
- **Gender** — FF
- **U_c** — 600
- **f_c** — 2
- **Options** — M

Electrical Specifications		CN-MF-600-2	CN-FF-600-2	CN-MF-1000-2	CN-FF-1000-2
Connection type		Series			
Modes of protection		Signal-Earth			
Sparkover voltage	U_c	600VDC		1000VDC	
Maximum discharge current (8/20µs)	I_{max}	20kA			
Power rating		300 - 800W		800 - 1000W	
Maximum working frequency	f_c	2GHz			
Voltage protection level @ 3kA (8/20µs)	U_p	<1.3kV		<1.5kV	
Characteristic impedence		50Ω (75Ω F-type only)			
VSWR		<1.1:1			
Return loss		>26dB			
Insertion loss		<0.2dB			

Mechanical Specifications	CN-MF-600-2	CN-FF-600-2	CN-MF-1000-2	CN-FF-1000-2
Operating temperature / humidity	-40 to +85ºC / 0 to 90% non-condensing			
Connection type	N-type			
Connection orientation	M / F	F / F	M / F	F / F
Mounting	Inline / bulkhead (N-type only)			
Environmental	IP 55			
Enclosure / colour	Aluminium / black			
Weight	150g			

Connector type variation	CN-MF-600-2	CN-FF-600-2	CN-MF-1000-2	CN-FF-1000-2
BNC	B			
7/16 DIN	D (Mounting bracket not available)			
F-type	-	F	-	F
N-type (bulkhead mount female)	N	Standard	N	Standard
UHF	U			
TNC	T			

Options	CN-MF-600-2	CN-FF-600-2	CN-MF-1000-2	CN-FF-1000-2
Mounting bracket	M			

Standards Compliance
ITU-T K.44
AS/NZS 1768
IEEE C62.41
BS 6651
CP 33
IEC 61643-21
UL497B

Dimensions											
Configuration	**CB-MF**	**CB-FF**	**CD-MF**	**CD-FF**	**CF-FF**	**CN-MF**	**CN-FF**	**CU-MF**	**CU-FF**	**CT-MF**	**CT-FF**
Width	26mm		Ø40mm	Ø40mm	26mm						
Height	26mm				26mm						
Maximum length	64mm	61mm	70mm	73mm	57mm	64mm	72mm	57mm		80mm	

RF Equipment Protection up to 3GHz

Novaris gas discharge surge protectors are capable of passing RF signals to 3GHz (limited by connector type). N-type female / female protectors are suitable for bulkhead mounting.

C N - FF - 90 - 3

- **Product Series**
- **Connector**
- **Gender**
- **f_c**
- **U_c**

Electrical Specifications		CN-MF-90-3	CN-FF-90-3	CN-MF-230-3	CN-FF-230-3	CN-MF-350-3	CN-FF-350-3
Connection type		Series					
Modes of protection		Signal-Earth					
Sparkover voltage	U_c	90VDC		230VDC		350VDC	
Maximum discharge current (8/20µs)	I_{max}	20kA					
Power rating		0 - 40W		40 - 125W		125 - 300W	
Maximum working frequency	f_c	3GHz					
Voltage protection level @ 3kA (8/20µs)	U_p	<650V		<820V		<1.1kV	
Characteristic impedence		50Ω					
VSWR		<1.1:1					
Return loss		>26dB					
Insertion loss		<0.2dB					

Mechanical Specifications	CN-MF-90-3	CN-FF-90-3	CN-MF-230-3	CN-FF-230-3	CN-MF-350-3	CN-FF-350-3
Operating temperature / humidity	-40 to +85ºC / 0 to 90% non-condensing					
Connection type	N-type					
Connection orientation	M / F	F / F	M / F	F / F	M / F	F / F
Mounting	Inline / bulkhead					
Maximum bulkhead thickness	9mm					
Environmental	IP 55					
Enclosure / colour	Brass / silver					
Weight	160g					

Dimensions	CN-MF-90-3	CN-FF-90-3	CN-MF-230-3	CN-FF-230-3	CN-MF-350-3	CN-FF-350-3
Width	26mm					
Height	26mm					
Maximum length	65mm	72mm	65mm	72mm	65mm	72mm

Standards Compliance
ITU-T K.44
AS/NZS 1768
IEEE C62.41
BS 6651
CP 33
IEC 61643-21
UL497B

RF Equipment Protection up to 3GHz

Novaris gas discharge surge protectors are capable of passing RF signals to 3GHz (limited by connector type). N-type female / female protectors are suitable for bulkhead mounting.

C N - FF - 600 - 3

- **Product Series** — C
- **Connector** — N
- **Gender** — FF
- **U_c** — 600
- **f_c** — 3

Electrical Specifications		CN-MF-600-3	CN-FF-600-3	CN-MF-1000-3	CN-FF-1000-3
Connection type		Series			
Modes of protection		Signal-Earth			
Sparkover voltage	U_c	600VDC		1000VDC	
Maximum discharge current (8/20µs)	I_{max}	20kA			
Power rating		300 - 800W		800 - 1000W	
Maximum working frequency	f_c	3GHz			
Voltage protection level @ 3kA (8/20µs)	U_p	<1.3kV		<1.5kV	
Characteristic impedence		50Ω			
VSWR		<1.1:1			
Return loss		>26dB			
Insertion loss		<0.2dB			

Mechanical Specifications	CN-MF-600-3	CN-FF-600-3	CN-MF-1000-3	CN-FF-1000-3
Operating temperature / humidity	-40 to +85ºC / 0 to 90% non-condensing			
Connection type	N-type			
Connection orientation	M / F	F / F	M / F	F / F
Mounting	Inline / bulkhead			
Maximum bulkhead thickness	9mm			
Environmental	IP 55			
Enclosure / colour	Brass / silver			
Weight	160g			

Dimensions	CN-MF-600-3	CN-FF-600-3	CN-MF-1000-3	CN-FF-1000-3
Width	26mm			
Height	26mm			
Maximum length	65mm	72mm	65mm	72mm

Standards Compliance
ITU-T K.44
AS/NZS 1768
IEEE C62.41
BS 6651
CP 33
IEC 61643-21
UL497B

RF Equipment Protection Tuned Stub

Novaris tuned stub surge protectors employ quarter-wavelength short circuit stub technology. Suitable for narrow bandwidth applications where no DC voltage is injected. RF power and surge rating are limited by the cables and connectors only.

CSTUB - N - MF - 2400

Product Series
Connector
Gender
t_f

CSTUB-D-MF-900	CSTUB-D-FF-900	CSTUB-N-MF-900	CSTUB-N-FF-900	CSTUB-D-MF-2400	CSTUB-D-FF-2400	CSTUB-N-MF-2400	CSTUB-N-FF-2400

Electrical Specifications		
Connection type		Series
Modes of protection		Signal-Earth
Maximum discharge current (8/20µs)	I_{max}	50kA
Power rating		Limited only by connectors and cables used.
Tuned frequency range	t_f	400MHz to 3GHz (specify)
Voltage protection level @ 3kA (8/20µs)	U_p	<20V
Characteristic impedence		50Ω
Bandwidth		±10% of tuned frequency
VSWR		<1.1:1 within bandwidth
Return loss		>26dB within bandwidth
Insertion loss		<0.1dB at tuned bandwidth

Mechanical Specifications								
Operating temperature / humidity	-40 to +85ºC / 0 to 90% non-condensing							
Connection type	7/16 DIN		N-type		7/16 DIN		N-type	
Connection orientation	M / F	F / F	M / F	F / F	M / F	F / F	M / F	F / F
Mounting	Inline							
Maximum bulkhead thickness	9mm							
Environmental	IP 55							
Enclosure / colour	Brass / silver							

Dimensions								
Body diameter	32mm							
Height	Depends upon operating frequency							
Maximum length	63mm	60mm	56mm	54mm	63mm	60mm	56mm	54mm

Standards Compliance
ITU-T K.44
AS/NZS 1768
IEEE C62.41
BS 6651
CP 33
IEC 61643-21

RF Equipment Protection High Power

Novaris high power surge protectors suit applications including MF, HF and VHF transmitters to 50kW. The spark gap arrester has an optical arc sensor which may be used to momentarily interrupt the transmitter.

CEIA - 078 - 1

Product Series
Connector Size
Options

Electrical Specifications		CEIA-078	CEIA-158	CEIA-318
Connection type		Series		
Modes of protection		Signal-Earth		
Maximum discharge current (8/20µs)	I_{max}	100kA		
Power rating		>50kW limited only by coaxial cable		
Surge element		Spark gap, gap setting: 2mm / 10kW		
Spark over voltage		2.6kV for 2mm gap		
Characteristic impedence		50Ω		
Insertion loss		<0.1dB to 500MHz <0.2db to 1GHz (gap setting: 1mm)		
Return loss		>26dB to 500MHz >20dB to 1GHz (gap setting: 1mm)		
Arc sensor		Optical detector utilising photodiode, feeding transmitter interface to provide momentary shutdown		
Power requirements		Arc sensor: 12VDC @ 35mA		
Transmission medium		Arc detector fed to transmitter via optic fibre. Alternate metallic cable available.		

Mechanical Specifications			
Operating temperature / humidity	-40 to +85ºC / 0 to 90% non-condensing		
Connection type	7/8" EIA	1 5/8" EIA	3 1/8" EIA
Mounting	Bulkhead / flange		
Environmental	IP 55		
Enclosure	Brass and copper		

Options	
Spark gap only, no TX controller	Standard
1RU 19" rack, one TX controller only	1
3RU 19" rack, up to 14 TX controllers	n*

* Denotes number of TX controllers

Standards Compliance
ITU-T K.44
AS/NZS 1768
IEEE C62.41
BS 6651
CP 33
IEC 61643-21
UL497B

KP KRONE-LSA® MDF - 1 Pair / 10 Pair

The Novaris KP provides protection for KRONE-LSA® termination systems and is suitable for all twisted pair telecommunication services. The unique iSwitch technology offers the ultimate in protection against induced transients and AC induction by totally isolating the load from the incoming line during the disturbance.

KP 10 - i

Product Series
Pairs
iSwitch

KP1	KP10	KP1-i	KP10-i

Electrical Specifications					
Connection type		Series			
Modes of protection		Transverse and common modes			
Maximum continuous voltage	U_c	200VDC			
Maximum discharge current (8/20µs)	I_{max}	10kA			
Maximum load current	I_L	350mA		180mA	
Protection stages		Multistage			
Voltage protection level @ 5kV (10/700µs)	U_p	<150V		<30V	
Maximum frequency	f_c	20MHz			
Series resistance		8.2Ω		17Ω	

Mechanical Specifications				
Operating temperature / humidity	-40 to +85ºC / 0 to 90% non-condensing			
Connection type	KRONE LSA-PLUS®			
Environmental	IP 20			
Mounting	KRONE LSA-PLUS®			
Enclosure / colour	ABS / black			
Weight	6.5g	150g	6.5g	150g

Dimensions				
Width	9.4mm	125mm	9.4mm	125mm
Height	21mm	18mm	21mm	18mm
Depth	36mm	42mm	36mm	42mm

Standards Compliance
ITU-T K.44
AS/NZS 1768
IEEE C62.41
BS 6651
CP 33
IEC 61643-21
UL497B
A-tick

Note: KRONE-LSA® is a trademark of KRONE, GmbH, Germany

RJ Modular Plug Protection

Novaris Modular Plug provides protection for twisted pair telecommunication services suitable for telephones, FAX, dial-up, ISDN and DSL modems.

MPP - RJ12

Product Series **Connector Type**

Electrical Specifications		MPP-RJ12	MPP-RJ45
Connection type		Series	
Modes of protection		Transverse and common	
Number of pairs		2	
Maximum continuous voltage	U_c	200VDC	
Maximum discharge current (8/20µs)	I_{max}	5kA	
Maximum load current	I_L	350mA	
Protection stages		Multistage	
Voltage protection level @ 5kV (10/700µs)	U_p	<150V	
Maximum frequency		20MHz	
Series resistance		8.2Ω	

Mechanical Specifications		
Operating temperature / humidity	-40 to +85ºC / 0 to 90%	
Connection type	RJ12	RJ45
Environmental	IP 20	
Enclosure / colour	Aluminium / black	
Weight (packed)	100g	

Dimensions (enclosure only)	
Width	26mm
Height	26mm
Depth	90mm

Standards Compliance
AS/NZS 4117
AS/ACIF S002
AS/NZS 60950
AS/NZS 1768
IEEE C62.41
BS 6651
CP 33
IEC 61643-21
UL497B
A-tick

SLD - Hardwired

Novaris hardwired high energy multistage transient protection for highly exposed circuits.

SLD 1 - PSTN - 2

Product Series
Pairs
Options
PSTN

Electrical Specifications		SLD1-PSTN	SLD2-PSTN	SLD4-PSTN
Connection type		Series		
Modes of protection		Transverse and common modes		
Number of pairs		1	2	4
Maximum continuous voltage	U_c	200VDC (variations by request)		
Maximum discharge current (8/20µs)	I_{max}	20kA		
Maximum load current	I_L	350mA		
Protection stages		Multistage		
Voltage protection level @ 5kV (10/700µs)	U_p	<130V		
Maximum frequency	f_c	20MHz		
Series resistance		8.2Ω		

Mechanical Specifications			
Operating temperature / humidity	-40 to +85ºC / 0 to 90% non-condensing		
Connection type	2.5mm² pluggable		
Environmental	IP 20		
Mounting	TS35 DIN rail		
Enclosure / colour	Metal / black		
Weight	250g	300g	400g

Dimensions			
Width	19.5mm	29mm	49mm
Height	95mm		
Depth	78mm		

Options		
Maximum load current 2A	I_L	2

Standards Compliance
ITU-T K.44
AS/NZS 1768
AS4117
BS 6651
CP 33
IEC 61643-21
UL497B
A-tick

SIP Surge Indicator Panel

Novaris Surge Indicator Panel allows remote monitoring of any Novaris product featuring external alarms. Visual and audible indicators provide at-a-glance surge protection status. Designed to fit in standard 72mm panel meter cutouts, integration into switchboards is simple.

SIP - 230

Product Series — **Nominal voltage**

		SIP-110	SIP-230
Electrical Specifications			
Nominal voltage	U_0	110V / 60Hz	230V / 50Hz
Display		LED power and status	
Alarm		SPDT contacts	
Alarm isolation to active circuitry		4kV	
Mechanical Specifications			
Operating temperature / humidity		-40 to +40ºC / 0 to 90%	
Connector type		2.5mm² polarised plug	
Terminal screw torque		0.5Nm	
Environmental		IP 20	
Mounting		Flush panel mount	
Panel cut-out		68mm x 68mm	
Weight		200g	
Dimensions			
Width		72mm	
Height		72mm	
Depth		55mm	

EC Earth Clamp 20kA

Novaris EC provides a means to electrically clamp different earthing systems during transient disturbances. Applications include computer rooms and in the bonding of cable sheaths to ground where direct bonding would introduce interference and “earth loops”.

EC 20 - 90

Product Series

I_{max}

U_c

	EC20-90	EC20-230	EC20-350	EC20-600	EC20-1000
Electrical Specifications					
Active element	Gas Discharge Tube (GDT)				
DC spark over voltage (U_c)	90V	230V	350V	600V	1000V
Voltage tolerance	± 20%				
Discharge current 8/20µs (I_{max})	20kA				
Isolation resistance	$>10^{10}\Omega$				
Capacitance	<2pF				
Mechanical Specifications					
Operating temperature / humidity	-40 to +65ºC / 0 to 90% non-condensing				
Connection type	$10mm^2$ flying leads				
Environmental	IP 65				
Weight	160g				
Dimensions					
Body diameter	20mm				
Body length	60mm				
Lead length	500mm each				

Standards Compliance
AS/NZS 1768
IEEE C62.41
BS 6651
CP 33
IEC61643

EC Earth Clamp 100kA

Novaris EC provides a means to electrically clamp different earthing systems during transient disturbances. Applications include computer rooms, defence installations and gas pipeline insulated joints.

EC 100 - 230

Product Series

I_{max}

U_c

	EC100-230	EC100-350	EC100-500

IEC

Electrical Specifications				
Active element		Gas Discharge Tube (GDT)		
DC spark over voltage	U_c	230V	350V	500V
Voltage tolerance		± 20%		
Discharge current 8/20µs	I_{max}	100kA		
Isolation resistance		$>10^{10}\Omega$		
Capacitance		<4pF		

Mechanical Specifications	
Operating temperature / humidity	-40 to +65ºC / 0 to 90% non-condensing
Connection type	16mm² flying leads
Environmental	IP 65
Weight	200g

Dimensions	
Body diameter	30mm
Body length	100mm
Lead length	500mm each

Standards Compliance
AS/NZS 1768
IEEE C62.41
BS 6651
CP 33
IEC61643 Class 1

EKIT Cable Bonding Kit

Novaris Cable Bonding Kits are used to bond the shields of coaxial feeders and wave guides on communication towers and at cable entry points to communications buildings.

EKIT - 012

Product Series — **Cable size**

Standards Compliance
AS/NZS 1768
IEEE C62.41
BS 6651
CP 33

Electrical Specifications	EKIT-012	EKIT-078	EKIT-158	EKIT-318
Connection type	Cable clamp			
Sheath connection	25mm braid			
Earth connection	900mm 6mm^2 flying lead			
Cable sealing	Self amalgamating upper and lower seals			
Coaxial cable size	1/2"	7/8"	1 5/8"	3 1/8"

TSC Transient Surge Counter

Novaris Transient Surge Counters count direct lightning strikes and transient events. They may be clamped to the downconductor of a building or tower or in the earth return conductor of a surge diverter or filter. The EC version also acts as a transient earth clamp.

TSC1 - DIN - EC

Product Series
Type
Earth Clamp

		TSC1-IP65	TSC1-DIN	TSC1-DIN-EC
Electrical Specifications				
Sensitivity			150A	
DC spark over voltage	U_c		-	230V
Discharge current 8/20µs	I_{max}		-	150kA
Battery life of counter			7 years	
Display			Resettable, LCD	
Active element			-	GDT
Voltage tolerance			-	± 20%
Isolation resistance			-	$>10^{10}\Omega$
Capacitance			-	<4pF

	TSC1-IP65	TSC1-DIN
Mechanical Specifications		
Operating temperature / humidity	0 to +50ºC / 0 to 90% non-condensing	
Terminal capacity	-	$16mm^2$
Terminal screw torque	-	2.5Nm
Environmental	IP 65	IP 20
Mounting	Clamp	TS35 DIN rail
Counter connection	-	2-way plug
Weight	400g	600g

Dimensions		
Width	80mm	54mm
Height	110mm	95mm
Depth	65mm	80mm

Standards

Many countries have comprehensive lightning protection standards. As a global provider of lightning and surge protection solutions Novaris strives to provide its solutions in accordance with recognised world standards.

As an Australian company Novaris conforms strictly to the guidelines contained in the Australian and New Zealand standard on lightning protection AS/NZS1768:2007.

Additionally Novaris' solutions and products conform to the relevant IEC standards, notably IEC62305 (Protection against Lightning) and IEC61643 (Low-voltage Surge Protection Devices).

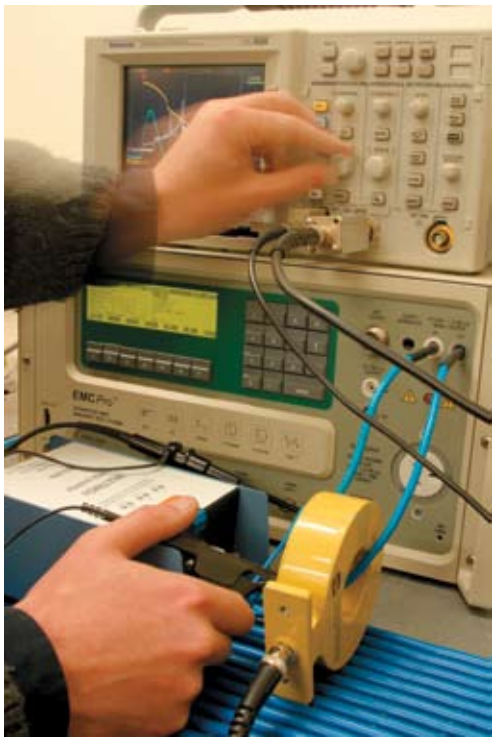
In line with AS/NZS1768:2007, Novaris does not recommend or endorse the use of so called non-conventional lightning 'attraction' or protection systems.

Safety

Because Novaris cares about personnel and equipment safety all our products are subjected to rigorous testing in our laboratory. We are able to generate most of the test waveforms specified in the IEC, Australian and US standards. We can test for temporary overvoltage and high current test series connected or two port SPDs up to 2000A per phase.

Because of the unpredictable nature of lightning transients and the follow on effects of power systems overvoltages, surge protection components can be overloaded and fail catastrophically. For this reason our laboratory is equipped to carry out the most severe of destructive tests.

From years of experience we know that surge protection components can rupture and be subject to excessive heating under fault conditions. It is for this reason that all Novaris power line surge protection products are housed in robust metal enclosures and we recommend that all SPDs be protected with appropriate fuses or circuit breakers in accordance with the relevant standards.



Risk Assessment

Historically, lightning protection consulting only concentrated on the protection of buildings and structures. Little thought was ever given to protecting against the indirect effects of lightning strikes which causes damage to equipment, regardless of whether structural protection is present or not. It was simply assumed that structural lightning protection would protect everything.

This is far from being the case, and protection against the indirect effects of a lightning strike is often more important that structural protection.

When it is considered that many modern buildings with steel frames and metal sheet roofing are inherently self protecting, it is regrettable to see structural lightning protection added for absolutely no reason, particularly when the indirect protection has been completely ignored.

Fortunately this situation is now recognised and both the IEC and the Australian and New Zealand lightning protection standards present risk assessment procedures capable of clearly defining the need for both structural and surge (or indirect) protection. The IEC standard (IEC62305-2) recognizes the need for both structural and surge protection but mandates that structural protection is necessary whenever surge protection is needed **(Figure 1)**. The Australian and New Zealand standard (AS/NZS1768:2007) allows surge protection in the absence of structural protection **(Figure 2)**. This is entirely rational.

Any lightning protection design should first start with a risk assessment. If structural protection is required, first determine if the structure is self protecting before following the procedures in the standards.

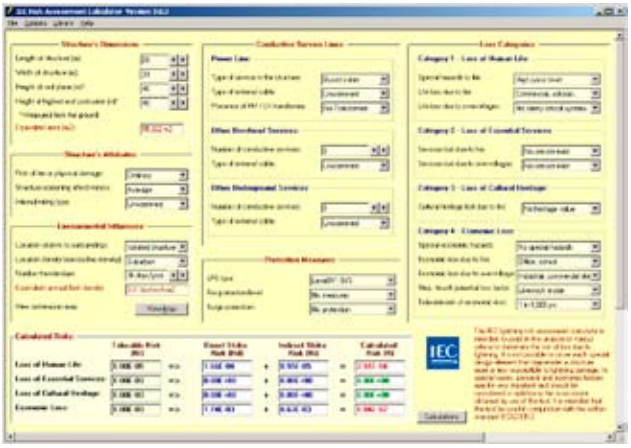


Figure 1. IEC Risk Assessment Procedure (from IEC62305-2)

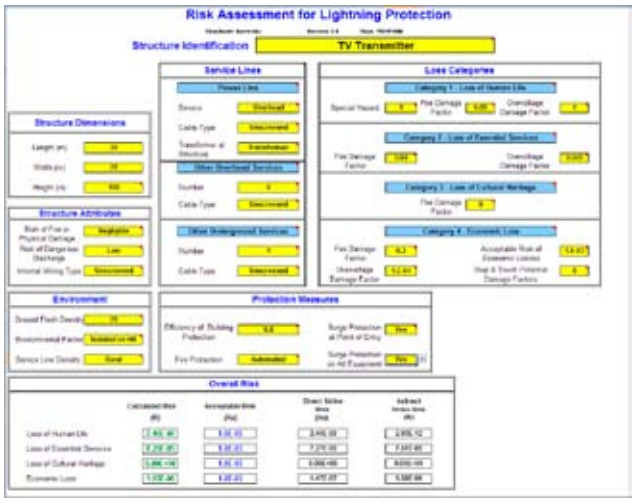


Figure 2. Australian and New Zealand Standard Risk Assessment Procedure (from AS/NZS1768:2007)

The ratings of primary and secondary surge protection can be obtained from the Australian Standard. AS/NZS1768:2007 makes specific recommendations for the surge ratings of surge protection devices. **Figure 3** is taken from this standard.

RECOMMENDED SURGE RATINGS FOR A.C. POWER SYSTEM SPDs PER PHASE		
Category	**SPD location**	**I_{max} ratings**
A	Long final subcircuits and electricity supply outlets	3-10kA
B	Major submains, short final subcircuits and load centres	10-40kA
C1	Service entrance, other than below	40kA
C2	Service entrance, building fed by long overhead service lines, or is a large industrial or commercial premises	40-100kA
C3	Service entrance, building in a high lightning area, or fitted with a LPS	100kA

Figure 3. Table 5.1 from AS/NZS1768:2007

The above table recommends that for main switchboards at sites fitted with a lightning protection system, or fed with long overhead power lines, the surge rating of primary LV arresters (per phase) should be at least 100kA for an 8/20µs impulse.

All SPDs should be installed in accordance with AS4070, or the equivalent wiring standard for that country, and be connected between each phase and neutral. At switchboards where there is no MEN, neutral-earth protection is also required. The neutral-earth protection is generally provided by means of a high energy gas discharge tube (GDT), with I_{max} = 100kA.

Secondary protection generally requires a lower surge rating. Sub-boards within buildings can be regarded as occupying location category B and surge ratings around 40kA are suitable. The most appropriate surge protector for these applications is a series connected device, either a series surge protector or surge filter. These will require all mode protection since there is unlikely to be an MEN link in the equipment cabinet.

The normal configuration of primary and secondary protection would be shunt surge diverters as the primary protection and suitably rated series protection devices as secondary protection in the sub or distribution boards.

At sites where primary and secondary protection is required, yet the cable length from MSB to equipment is short (typically less than 10m), a surge filter protecting the whole site should be considered. This would have the appropriate category C surge rating plus an LC filter and a final stage of category B surge protection. The series inductance “builds out” (artificially lengthens) the line. The above is appropriate for small sites such as cellular basestations, TV translators, remote telemetry field sites etc.

At installations with an MSB and a number of distribution boards, such as a multi-storey building, primary and secondary protection should be provided. The primary protection would comprise shunt connected surge diverters fitted to the main switchboard. These provide a path to earth, via the neutral, for the surge energy.

Note: These SPDs are wired from phase to neutral in accordance with the IEC and other standards. In countries employing the MEN system the MEN link provides the neutral to earth path. In other countries the neutral to earth connection may be via a high energy gas discharge tube (GDT).

The effectiveness of this primary protection depends upon how it is installed. In large switchboards long shunt leads are unavoidable and the voltage let through by such primary protection is unlikely to be low enough to provide effective protection for sensitive loads. It is generally sufficient to protect the switchboard.For this reason secondary protection is recommended.

Surge filters provide the best protection and are recommended to protect electronic and computing equipment. Being series connected these eliminate the degradation caused by long shunt connected leads; and with an inbuilt low pass LC filter their let through voltage (U_p), is low enough to protect the most sensitive electronic equipment.

Effective surge protection is highly dependant upon installation practices. All Novaris products are supplied with detailed installation instructions to ensure they are installed correctly. The following diagrams show examples of power line surge diverter and surge filter installations.

Surge Diverter – Main Switchboard (Figure 4)

Install protection:

- Downstream of the main switch.
- Upstream of all equipment including earth leakage devices where possible.
- Protect with 63A HRC fuses or circuit breaker.
- Keep lead lengths as short as possible.

MEN systems - install single mode (L-N) protection as close to the MEN link as possible.
Non-MEN systems - install all mode (L-N, L-PE, N-PE) protection.

Surge Filter – Distribution Board (Figure 5)

Install all mode protection:

- Downstream of main switch.
- Upstream of all equipment, including earth leakage devices where possible.
- Protect with HRC fuses or circuit breaker, with current rating less than or equal to the load current rating of the filter.
- Keep output cables away from input cables.

Surge Diverter – Distribution Board (Figure 6)

Install all mode protection:

- Downstream of main switch.
- Upstream of all equipment, including earth leakage devices where possible.
- Protect with 32A HRC fuses or circuit breakers.
- Keep lead lengths as short as possible.

Surge Filter – Final Circuit / Equipment (Figure 7)

Install all mode protection:

- Downstream of fuses or circuit breaker with current rating less than or equal to the load current rating of the filter.
- As close to the equipment as possible.
- Keep output cables away from input cables.

For further details see individual product installation instructions.

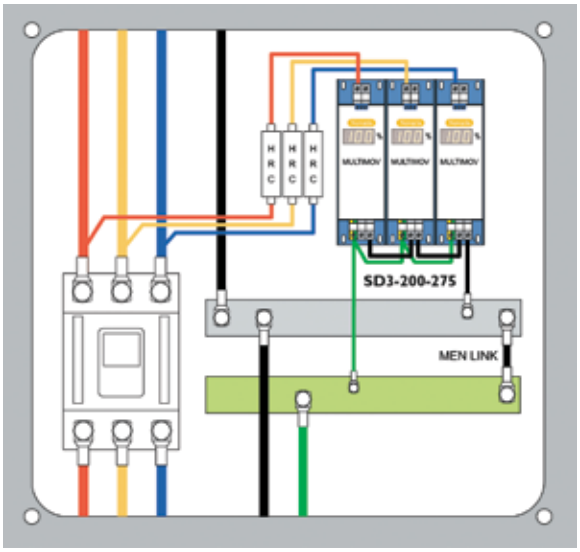


Figure 4. Surge Diverter - Main Switchboard.

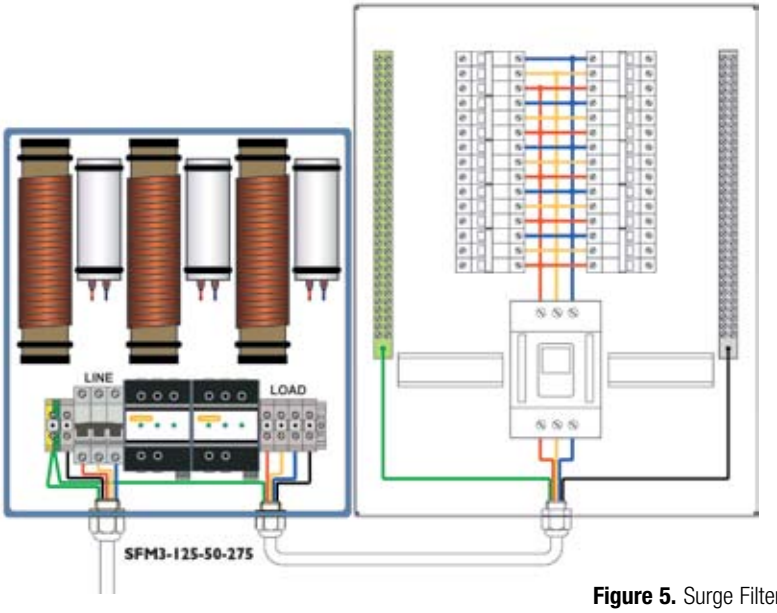


Figure 5. Surge Filter – Distribution Board.

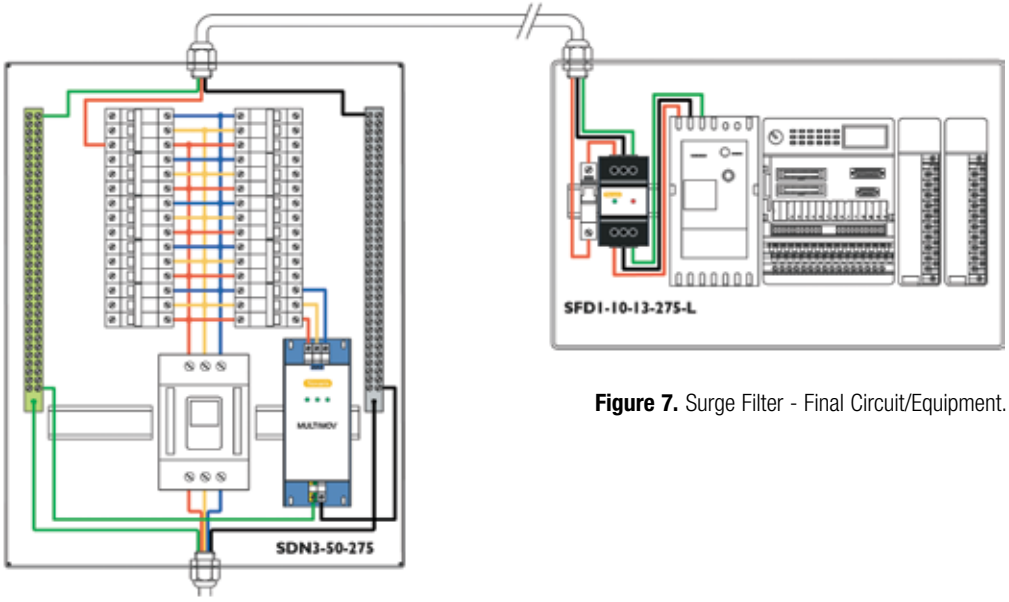


Figure 6. Surge Diverter – Distribution Board.

Figure 7. Surge Filter - Final Circuit/Equipment.

Signalling Protocols

Table 1 outlines some of the most common signalling protocols along with the Novaris surge protection product best suited to your application. For other signalling protocols please contact Novaris to discuss your protection requirements.

Signal Type	Novaris Product
5V	SL7v5-G
6V	SL7v5-G
12V	SL18-G
24V	SL36-G
0-5V	SL7v5-G
0-10V	SL18-G
0-20V	SL36-G
±10V	SL18-G
0-20mA	SL36-G
4-20mA	SL36-G
10Base2	CLB-MF-10
10BaseT	UTP-RJ45-xCAT6
100BaseT	UTP-RJ45-xCAT6
1000BaseT	UTP-RJ45-xCAT6
BitBus	DB9-RS485
CAN - high speed	SL485-EC90
CAN - low speed	SL485-EC90
CCTV	CLB-MF-10
ControlNet	CLB-MF-10
Data Highway	SL-DH-EC90
Data Highway Plus	SL-DH-EC90
DeviceNet (signal pair)	SL7v5-G
Dupline (signal pair)	SL7v5-G
FIP Bus	SL485-EC90
Foundation Fieldbus	SSP6A-38-G
HART	SL36-G
Interbus	SL485-EC90
ISDN	SL-PTSN-G, KP1, KP10, MPP-RJ12, MPP-RJ45
Load cells	LCP-36
P-Net	SL485-EC90
Power over Ethernet	UTP-RJ45-xPoE
Process Bus (P-Bus)	SL485-EC90
Profibus DP	SL485-EC90
Profibus FMS	SL485-EC90
Profibus PA	SSP6A-38-G
PTSN	SL-PTSN-G, KP1, KP10, MPP-RJ12, MPP-RJ45
RS232	DB9-RS232, DB25-RS232
RS422	2x SL485-EC90, DB9-RS485
RS432	2x SL485-EC90, DB9-RS485
RS485	2x SL485-EC90, DB9-RS485
V.10	2x SL485-EC90, DB9-RS485
V.11	2x SL485-EC90, DB9-RS485
V.24	SL36-EC90, DB9-RS232, DB25-RS232
V.35	SL485-EC90
WorldFIP	SSP6A-38-G
X.21	SL36-EC90, DB9-RS232, DB25-RS232
DSL	SL-PTSN-G, KP1, KP10, MPP-RJ12, MPP-RJ45

Table 1. Signalling Protocols.

Ph	Phase
I_{imp}	Defined by three parameters, a current peak value, a charge and a specific energy. Generally relates the IEC definition of a direct lightning strike modelled by a 10/350µs waveshape. This is used for the classification of SPDs for test class I in accordance with IEC61643-1.
Q	Charge contained in a test waveform. Expressed in coulombs (As).
W/R	Specific Energy relating to a test waveform. Expressed in kJ/µs.
I_{max}	Defined as the peak value of a current through the SPD having an 8/20µs waveshape. This is used for the classification of SPDs for test class II in accordance with IEC61643-1. This is generally recognized for MOV based SPDs as the single shot impulse rating.
I_n	Defined as the peak value of a current through the SPD having an 8/20µs waveshape. This is used for the classification of SPDs for test class II in accordance with IEC61643-1. This is known as the nominal discharge current and is generally recognized for MOV based SPDs as the rating of the SPD for 15 such impulses.
I_L	The maximum continuous RMS or DC current that can be supplied to a load connected to a two port or series connected SPD.
I_f	The current supplied by the electrical power system which flows through an SPD after a discharge current impulse. This is called the follow-on current and is particularly applicable to voltage switching type SPDs such as spark gaps and gas discharge tubes.
I_{fi}	Follow-on current interrupting rating. This is the maximum AC RMS current that a voltage switching SPD such as a spark gap can interrupt.
U_0	The RMS line to neutral voltage of the power system.
U_c	The maximum RMS or DC voltage, which may be continuously applied to an SPD.
U_p	The let through voltage of an SPD defined for a specified test waveform.
t_A	Response time of an SPD to a defined test waveform.
ΔU	Voltage drop of a two port SPD at rated current expressed as a percentage of U_0.
f_c	The maximum usable frequency.

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