ElectricalOM User Manual

for Solar Photovoltaic (PV) Systems

1. Terms, definitions, symbols and abbreviated terms

Ns

The total number of parallel-connected PV strings in the PV array.

I_MOD_MAX_OCPR

The PV module's maximum overcurrent protection rating determined by IEC 61730-2.

I_SC_MAX

The maximum short-circuit current of a PV string.

U_OC_MAX

The maximum open-circuit voltage of the PV string or module under certain environmental conditions.

In

The rated current of the protective device being used.

I_Z

The continuous current-carrying capacity of the PV string cable.

N_p

The number of parallel strings connected to the same overcurrent protective device.

N_a

The number of sub-arrays connected in parallel.

STC

Standard Test Conditions reference values of in-plane irradiance (G_I,ref = 1 000 W·m-2), PV cell junction temperature (25 °C), and air mass (AM = 1,5) to be used during the testing of any PV device.

I_SC_STC

The short-circuit current of the PV array under Standard Test Conditions (STC).

U_OC_STC

The open-circuit voltage of the PV module under Standard Test Conditions (STC).

Solar PV Inverter

A system that converts the electrical power delivered by the PV array into the appropriate frequency and/or voltage values to be delivered to the load, or stored in a battery or injected into the electricity grid.

Power Optimiser

A unit connected to individual PV modules or groups of PV modules to allow DC conditioning of the PV output.

MPPT

Maximum Power Point Tracking is a control strategy that ensures the operation of a PV array remains at or near the point on a photovoltaic device's current-voltage characteristic where the product of electric current and voltage produces the maximum electrical power under specified operating conditions.

Blocking diode

Diode connected in series with module(s), panel(s), sub-arrays and array(s) to block reverse current into such module(s), panel(s), sub-array(s) and array(s).

Bypass diode

Diode connected across one or more cells in the forward current direction to allow the module current to bypass shaded or broken cells to prevent hot spot or hot cell damage resulting from the reverse voltage biasing from the other cells in that module.

Charge controller

Unit used between a battery and a PV array to regulate charge delivered to the battery.

PV array

Assembly of electrically interconnected PV modules, PV strings or PV sub-arrays.

PV cell

The most elementary device that exhibits the photovoltaic effect, i.e. the direct non-thermal conversion of radiant energy into electrical energy.

PV module

A complete and environmentally protected assembly of interconnected photovoltaic cells.

PV string

A circuit of one or more series-connected modules

PV sub-array

An electrical subset of a PV array formed of parallel connected PV strings.

SLD

Single-Line Diagram

2. Solar Photovoltaic Systems (PVs) Modelling

To model Solar Photovoltaic Systems (PVs) in ElectricalOM, the user must connect a 3-Ph + N or 3Ph + N Solar PV Inverter component to a distribution node (e.g. distribution board, switchboard, junction box).

6	Insert •	\sim	Source	ŀ					
1	Edit F2		Switchboard	•					
\$	Save as Template		Distribution Board	•					
x	Cut Ctrl+X	PM	Board Extension	۲					
	Copy Ctrl+C	BTS	Busbar Trunking System	•					
	Paste Ctrl+V		Final circuit 3Ph						
	Paste special •		Final circuit 1Ph						
0	Delete Del	Ð	Floating Load	•					
\$	Shift circuit	-11-	Power Factor Correction						
	Circuit functions	SPD	Overvoltage protection						
Ŧ	Schematic functions		Connection	•	.IB	Junction Box	•		
23	Zoom to element					Transfer switch	•		
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						Converters	•	2	3Ph AC / DC Rectifier
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					?	Unknown network	•	2	3Ph Solar PV Inverter
									1Ph Solar PV Inverter
								\mathbb{Z}	DC / DC Converter
								=	DC / AC Inverter (Beta)

Figure 1: Inserting a Solar PV Inverter via the Actions Menu

b



Figure 2: Single-Line Diagram (SLD) of the AC Side of a Solar PV Inverter

The Circuit Edit tab of a Solar PV Inverter component features the Inverter Settings section, where users can define various parameters related to the Solar PV Inverter.

Supply from	MDB			Active
Plan prefix	Solar PV Inverter		✓ Us	e conductor
Description				
Cable ID	c-d-2			
Solar PV Inve	ter settings		Linether	10
	Voltage		AC kW	10
L-N 230		2 🌻 DC	DC/AC ratio	1
L-L 400			DC kW	10
	Settings		VD Limit (%)	3.00
V Dron	within circuit L 1% 0.5	8		Neutral A
1010			rop @400V	0
V.Drop	within circuit L2%	8 0.0	2.32V	esian kVA
V.Drop	within circuit L3% 0.5	8		11
Ib	(A) In (A)	min Iz (A)	It	(A)
15	.94 ≤ 20	20	≤ 42	2
Z1(Ω)	0.0554 Z2(Ω)	0.0328	Z1+Z2(Ω)	0.0878
Phase fault				
Max Isc end	ooint (kA) 3.6347	Max Isc star	rt point (kA)	9.513
Min Isc end p	oint (kA) 1.5347		Ze_ph (Ω)	0.0329
	Disconnection	Conduct	tors withstand	
	time of MCB (sec)	dura	ation (sec)	
	0.01 ≤		0.2	
Earth Fault		_		
Ief (kA)	1.8136 Ia(A) 200		Ze(Ω)	0.0444
Disconnecti	n Time (sec)			

Figure 3: Solar PV Inverter Settings in the Circuit Edit Menu

Solar PV Inverter Settings

The inverter's settings section enables the user to define key operational parameters for integrating solar PV inverters. These settings influence current calculations, protection coordination, and voltage drop compliance:

- **1.** AC kW Specifies the inverter's nominal output power on the AC side. This value is used to calculate the inverter's design current (Ib) and supports the sizing of AC cables and protection devices.
- 2. DC/AC Ratio This ratio defines the relationship between the installed PV array's DC capacity and the inverter's AC output. This parameter helps simulate realistic operating conditions and assess potential inverter clipping or overloading.
- **3.** DC kW Represents the total DC power of the connected PV array. It is automatically calculated based on the DC capacity.
- 4. VD Limit (%) Sets the maximum allowable voltage drop on the DC side of the inverter.
- **5. Ib (A)** Indicates the calculated design current on the AC side of the inverter. It serves as a reference for selecting protective devices and ensuring that cable current-carrying capacities (Iz) are suitable, in accordance with regulatory standards.

Information Icons in ElectricalOM

Throughout the Solar PV Inverter settings and calculation sections, info icon buttons (**i**) are provided next to critical parameters and computed values. These icons offer context-specific guidance to help users understand design inputs, regulatory checks, and industry best practices.

Clicking on an info icon reveals a pop-up explanation tailored to the specific field. This feature enhances usability, ensures informed decision-making, and facilitates alignment with established standards.

Info Icons (🚺)



Figure 4: Circuit Edit Menu Info Icons – (A) DC/AC Ratio and (B) Ib (Design Current)

In addition to the main input parameters, users can access and configure additional inverter-specific options by clicking the **"Settings..."** button located beneath the Solar PV Inverter symbol. This section allows for the adjustment of advanced parameters related to the inverter's functional operational limits.



Figure 5: Solar PV Inverter Settings Button in the Circuit Edit Menu

Solar PV Inverter Settings – Input Limit Checks

INPUT Max. lsc_STC / MPPT Max. voltage Min. voltage Peak PV power Max. AC current @ V 230	Inverter ≤ 55.7 A ≥ 1000 V ≥ 200 V ≤ 15000 Wp ≥ A ×	Connected System/MPPT 14.17 530.52 367.9 10000 15.94A	A V V
Use optimiser - Inverter Fixed	I DC Input Voltage	750	v
Show optimiser symbol on P	V Strings		
Power Optimiser Settings			
Max. Input Voltage of PV Modu	e per Optimiser	60	V
Max. Input Short Circuit Curren	t of PV Module per Optimise	r 15	A
Rated Input Power Per Optimise	2ľ	600	W
Number of PV Modules In Serie	s Per Optimiser	1	A
Number of PV Modules In Para	lel Per Optimiser	1	4. V
OUTPUT			
Max. Output Voltage Per Optimi	ser	60	V
Max. Output Short Circuit Curre	nt Per Optimiser	15	A
FUNTIONAL LIMITS			
	ng	6000	W
Max. Continuous Power Per Stri		25	
Max. Continuous Power Per Stri Max. Number of Modules Per St	ring		_

Figure 6: Solar PV Inverter Settings – Input Limit Checks

Inverter Input Limit Checks

The inverter parameters outlined below determine the acceptable DC input and AC output limits, as specified by the manufacturer. ElectricalOM verifies these parameters against the connected PV system and highlights any violations:

- 1. Max. Isc_STC / MPPT (A) Sets the inverter's maximum allowable short-circuit current per MPPT, compared to the calculated PV string Isc @ STC.
- 2. Max. Voltage (V) Defines the maximum DC voltage input the inverter can withstand, checked against the PV array's Voc at low temperatures.
- **3.** Min. Voltage (V) Specifies the minimum DC voltage required for inverter operation, validated against the PV system's lowest expected voltage.
- **4. Peak PV Power (Wp)** Limits the total DC power the inverter can accept, compared to the installed PV array's capacity.
- 5. Max. AC Current @ V (A) Indicates the inverter's maximum AC output current at a given voltage. If specified, the design current (Ib) will be overwritten; otherwise, it will be automatically calculated based on the inverter's AC kW rating specified in the circuit edit.

Info Icon (🚺)



Figure 7: Info Icon in Inverter Settings – Max. AC Current at Specified Voltage

Solar PV Inverter Settings - Power Optimiser Settings

2019	ar PV Inverter Settings				×
	INPLIT	Inverter		Connected	
		inverter 60			
	Max, Isc_STC / MPPT	00	A ≥		A
	Max. voltage	1000	V ≥	750	V
	Min. voltage	200	V ≤	7 <mark>5</mark> 0	V
	Peak PV power	15000	Wp ≥	15000	Wp
0	Max. AC current @ V 230 -		A	15.94A	
0	☑ Use optimiser - Inverter Fixed DC	Input Voltage		750	v
	Show optimiser symbol on PV Str	rings			
	Power Optimiser Settings	-			
	INPUT				
	Max. Input Voltage of PV Module pe	er Optimiser		60	v
	Max. Input Short Circuit Current of	PV Module per	Optimise	r 15	Α
	Rated Input Power Per Optimiser			600	w
	Number of PV Modules In Series Pe	r Optimiser		1	÷
	Number of PV Modules In Parallel P	er Optimiser		1	÷
	OUTPUT				
	Max. Output Voltage Per Optimiser			60	V
	Max. Output Short Circuit Current P	er Optimiser		15	A
	FUNTIONAL LIMITS				
				6000	1 100
	Max. Continuous Power Per String			0000	VV
	Max. Continuous Power Per String Max. Number of Modules Per String			25	

Figure 8: Solar PV Inverter Settings – Power Optimiser Configuration



Figure 9: SLD of a Solar PV System with Power Optimisers

Power Optimiser Settings

When optimisers are enabled, ElectricalOM performs checks against the following parameters to ensure that each PV string and module configuration remains within safe and manufacturer-specified operational limits:

1. Use optimiser – Inverter Fixed DC Input Voltage

Enables optimiser mode and sets the inverter's fixed DC input voltage when optimisers regulate the string voltage.

2. Show optimiser symbol on PV Strings

Displays the optimiser icon on each string in the schematic to visually indicate the use of optimisers.

- **3.** Max. Input Voltage of PV Module per Optimiser (V) Sets the highest voltage a PV module can deliver to an optimiser without exceeding its input tolerance.
- 4. Max. Input Short Circuit Current of PV Module per Optimiser (A) Defines the maximum current an optimiser can accept from a PV module under short-circuit conditions.
- 5. Rated Input Power per Optimiser (W)

Specifies the maximum continuous DC power each optimiser is designed to handle safely.

- 6. Number of PV Modules in Series per Optimiser Determines the maximum number of PV modules that can be connected in series to a single optimiser.
- 7. Number of PV Modules in Parallel per Optimiser Determines the maximum number of PV modules that can be connected in parallel to a single optimiser.
- 8. Max. Output Voltage per Optimiser (V) Sets the maximum DC voltage an optimiser can output to the string.
- Max. Output Short Circuit Current per Optimiser (A) Indicates the highest output current the optimiser can deliver during a short-circuit event.
- **10. Max. Continuous Power per String (W)** Limits the total DC power a single string (with optimisers) can output continuously.
- **11. Max. Number of Modules per String** Sets the maximum number of PV modules allowed in a string using optimisers.
- **12. Min. Number of Modules per String** Sets the minimum number of PV modules required in a string using optimisers to maintain correct voltage and operation.

Info Icon (🚺)

Use optimiser - Inverter Fixed DC Input Voltage (Point 1)



Figure 10: Info Icon – Optimiser Reverse Current Blocking and Overcurrent Protection Compliance

Available Components for the DC Side of a Solar PV Inverter

Only specific components can be inserted on the DC side of a Solar PV Inverter. As shown, options such as **(A)** Solar PV string, **(B)** Floating Solar PV string, **(C)** Overvoltage protection, and **(D)** Junction Box (1Ph) are available, while all other options are disabled (greyed out) for compliance and design consistency (Figure 11).



Figure 11: Actions Menu – Available Components for the DC Side of a Solar PV Inverter

Inverters with Independent MPPT DC Inputs and Internally-Connected DC Inputs

By default, ElectricalOM treats each inverter DC input as being connected to an independent MPPT (Figure 12). However, when modelling inverters with multiple DC inputs internally paralleled onto a common DC bus, or when multiple PV strings are connected via a combiner box, users can represent this configuration using the Junction Box component, as illustrated in Figures 13–14.



Figure 12: SLD of an Inverter with Independent MPPT DC Inputs



Figure 13: SLD of an Inverter with Internally-Connected DC Inputs



Figure 14: SLD of PV Arrays, PV String Combiner Boxes, and MPPT Inverter Inputs

Configuring PV Strings in the Circuit Edit Module

ElectricalOM allows users to configure PV strings efficiently (see Figure 15) through the Circuit Edit Module by providing an intuitive interface split across several functional areas, each serving a specific purpose in the design process:

1. Tree-Network View of a Solar PV System

This panel displays the complete PV system layout in a hierarchical tree format, allowing users to navigate through inverters, MPPTs, and strings for easy access and organisation.

2. PV String Configuration

Here, users input the key electrical parameters of each PV module and string, such as current, voltage, and power ratings, which are used to calculate total string performance.

3. PV String Calculation Checks

This section performs automatic calculations and checks at the string level, ensuring compliance with Section 712 of BS 7671 and flagging configuration issues.

4. String Power Optimisers Settings

Allows users to configure power optimisers when enabled from the Solar PV Inverter settings, which adjust system behaviour and protection logic when optimisers are integrated into the PV string design.

5. Circuit Edit Tabs

This area provides access to tabs for configuring DC conductor properties, installation methods, DC protective devices, and correction factors, ensuring the PV string circuit is safely and efficiently designed.

6. PV String Voltage

Displays the total design DC voltage of the PV string, calculated based on the number of modules and environmental factors, ensuring it stays within the inverter voltage limits.

7. Warnings Area

Summarises any configuration or compliance issues detected in real time, guiding the user to resolve design conflicts and ensure regulatory alignment.

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III MAIN SWITCH-4-POLE	Supply from MPPT 1 Active	Ph/N Conductor Earthing Protective Devices Correction Factors Voltage Drop Other Test Notes	
[1.L1,L2,L3] Solar PV Inverter	Plan prefix 👔 Solar PV string	BS - Solar Cu Solar Energy Cable BS EN 50618	
	Pesciption PV/String Configuration	Filter list Makeup of circuit conductors	Options
[1.dc] Solar PV string (x10)	Cable ID c42 PV Stilling Coningulation	Cu All insulations Solar/S/Cu	<u>EC10</u>
[2 dc] Solar PV string (x10)	Solar PV String	Al Al kinds ✓ 2x1Cx6mm ²	
(3.00) Solar PV aning (x10)		Installation	
— — — — — — — — — —	Wp 500 W BC50C 14.17 A U00_50C 44.21 V	Category All methods	-
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of a Solar PV System		Hende C.Ho. 20 - Capped direct has counting	
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	V.Drop within circuit L2% 0 V.Drop @750V 0.72V	Cables fixed on (clipped direct), or spaced less than 0.3 x cable diameter from wooden	
	V.Drop within circuit L3% 0	or masonry wall	
	Overcurrent protection at a string level	000000	
	ISC_MAX_opt Ns IMOU_MAX_OCH miniz II 18.75 3 25 37.5 ≤ 57	Ref. method: C	888 I I I I I I I I I I I I I I I I I I
	(Ns-1)xlsc_MAX/Corr.Fact	Cables are subject to heat from the PV panels	
	PV String Protection		
	Checks		
	Chicana	Length (m) 15	
		C.S.A. (mm²) / Rating 6 57A • Find	
	PV Optimisers are utilised within each string	Daraha candustara	
	String Power Ontimicare		
	A Sung Power Opunisers	Temp. (%) Full loaded: 90	Actual: 36.5 Max: 90
	Settings		
	Warnings Area		
	C Warnings: 0/0 Al • 477 Calculations = Load AV Votage drop	Selectivity 🚯 Other ன Tests Selected element only 🔐 Print 📳	
	Item Type	Warning	

Figure 15: Circuit Edit Environment for Configuring PV String Parameters

PV Modules and String Configuration

As shown in Figures 11 (A) and (B), users can add a Solar PV String either directly to a Solar PV Inverter or via a Junction Box component, which serves as a connection point for MPPT inputs or a DC Combiner Box. ElectricalOM features a dedicated input section in the Circuit Edit Module, allowing users to define the electrical characteristics of each string. This enables accurate sizing, performance evaluation, and compliance checks.



Figure 16: PV String Electrical Configuration in the Circuit Edit Module

PV String Parameter Descriptions:

- 1. **Number of Modules in the String –** Specifies the number of PV modules connected in series within the string.
- 2. **Module Rated Power (Wp) –** Indicates the nominal power output of each PV module under Standard Test Conditions (STC).
- 3. Isc_STC (A) Short-circuit current per module at STC, used for overcurrent protection checks.
- 4. **Imp_STC (A)** Operating current at maximum power under STC, used to determine the string's output.
- 5. **I_MOD_MAX_OCPR (A) –** Maximum allowable overcurrent protection rating for each module, based on standards or manufacturer data.
- 6. **Voc_STC (V) –** Open-circuit voltage per module at STC, used for total string voltage calculations.
- 7. **Vmp_STC (V) –** Voltage at the maximum power point under STC, relevant to string operating voltage.
- 8. **Voc_MAX (V) –** Maximum calculated open-circuit voltage under worst-case environmental conditions, used for inverter input checks.
- 9. **Total String Power (Tot. kW)** Displays the total power output of the string based on the number of modules and their Wp.
- 10. **Voltage Drop at Design Voltage –** Displays the voltage drop across the string at a specified voltage (e.g., 750 V), facilitating verification of compliance with design limits.

Info Icon (1)

I_MOD_MAX_OCPR (A) (Point 5)



Figure 17: Info Icon – PV Module Maximum Overcurrent Protection Rating as per IEC 61730-2

PV String Calculation Checks

This section performs automated calculations and validation checks at the string, sub-array and array level to ensure compliance with Section 712 of BS 7671. Depending on the system's configuration, it evaluates key protection criteria, including:

1. Protection of PV modules and strings (Reg. 712.431.101 and 712.431.102):

$$\begin{split} 1.35 \times I_{MOD_MAX_OCPR} < (N_s-1) \times I_{SC_MAX} \\ 1.1 \times I_{SC_MAX} \leq I_n \leq I_{MOD_MAX_OCPR} \\ Np \times 1.1 \times I_{SC_MAX} \leq I_n \leq I_{MOD_MAX_OCPR} - (N_p-1) \times I_{SC_MAX} \end{split}$$

2. Choice of protective devices in line with IEC 62548:

1. 5 × $I_{SC_{STC}}$ < I_n < 2. 4 × $I_{SC_{STC}}$

3. Protection of PV string cables (Reg. 712.433.101):

 $I_{SC_MAX} \leq I_Z$ $(N_s - 1) \times I_{SC_MAX}$ $(N_s - 1) \times I_{SC_MAX} \leq I_Z$ $I_n \leq I_Z$

4. Calculation of maximum open-circuit voltage and short-circuit current (Reg. 712.433.101.1):

$$\begin{split} U_{OC_{MAX}} &= 1.2 \times U_{OC_{STC}} \\ I_{SC\ MAX} &= 1.25 \times I_{SC\ STC} \end{split}$$

5. Protection of PV sub-array cables (Reg. 712.433.102):

 $I_{SC_MAX} \leq I_Z$ $(N_a - 1) \times I_{SC_MAX}$ $(N_a - 1) \times I_{SC_MAX} \leq I_Z$ $1.1 \times I_{SC_MAX} \leq I_n \leq I_Z$

ElectricalOM automatically highlights any violations or non-compliance, supporting accurate and regulation-compliant PV system design (see Figures 18 - 19).

Isc_MAX_opt Ns IMOD_MAX_OCPR	minIz It 37.5 ≤ 57 (Ns-1)xIsc_MAX/Corr.Fact
PV Optimisers are utilise	ed within each string

Figure 18: Overcurrent Protection Checks for a PV System with 3 Strings and Integrated Power Optimisers (No Additional String Protection Required)

_MAX	Ns IMOD_MAX_OCP	R minIz It
		(Ns-1)xlsc MAX/Corr.Fact
		(, <u>-</u>
	1.35 x I_MOD_MAX_OCPR	(Ns-1) x Isc_MAX
	33.75	< 35.426
	0	and the second DM resident

Figure 19A: Overcurrent Protection Checks for a PV System with 3 Strings without Power Optimisers

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Protective devices shall be provided to protect each PV string. Reg BS 7671:2024 712.431.101
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Figure 19B: Tooltip Warning Message – Overcurrent Protection Required for Each PV String (Reg. 712.431.101)

C	Warnings: 3/3 I Critical: 3 All	oad 🚺 Voltage dro	p 📉 Selectivity 🕕 Other 🖓 Tests 🛛 Selected element only 🛛 🖓 Print 📲
	Item	Туре	Warning
	MPPT 1 -> Solar PV string	Critical	There are errors in 'MPPT 1 -> Solar PV string'. Please edit the circuit Protective devices shall be provided to protect each Solar PV string. Reg BS 7671:2024 712.431.101
	MPPT 1 -> Solar PV string	Critical	There are errors in 'MPPT 1 -> Solar PV string'. Please edit the circuit Protective devices shall be provided to protect each Solar PV string. Reg BS 7671:2024 712.431.101
	MPPT 1 -> Solar PV string	Critical	There are errors in 'MPPT 1 -> Solar PV string'. Please edit the circuit Protective devices shall be provided to protect each Solar PV string. Reg BS 7671:2024 712.431.101

Figure 19C: Warning Area Message – Overcurrent Protection Required for Each PV String (Reg. 712.431.101)

Figures 18 and 19 illustrate different outcomes resulting from the use of power optimisers. In Figure 18, the system features optimisers that block reverse fault currents, enabling the PV strings to operate without requiring additional overcurrent protection. In contrast, Figure 19 depicts a system lacking optimisers, where the calculated reverse current exceeds the allowable limit, triggering a non-compliance warning under Regulation 712.431.101 and requiring separate protection for each PV string.

Configuring Power Optimisers within PV String Settings

When power optimisers are enabled in the Solar PV Inverter settings (see Figure 8), users can access the corresponding configuration parameters by clicking the PV Optimisers button within the PV String Circuit Edit section. This enables adjustment of optimiser characteristics at the string level, including verification of the rated string current (see Figures 20 - 21).

Overcurrent p Isc_MAX_opt 18.75	rotection at a string level Ns IMOD_MAX_OCF 3 25	PR minIz I 37.5 ≤ (Ns-1)xIsc_MAX/Co	t 57 prr.Fact
2	PV Optimisers are	utilised within each string	

Figure 20: Power Optimiser Button in the PV String Circuit Edit Section

Power Optimiser		×
Power Optimiser Settings INPUT		
Max. Input Voltage of PV Module per Optimiser	60	V
Max. Input Short Circuit Current of PV Module per Optimiser	15	Α
Rated Input Power Per Optimiser	600	w
Number of PV Modules In Series Per Optimiser	1	-
Number of PV Modules In Parallel Per Optimiser	1	-
OUTPUT	1	
Max. Output Voltage Per Optimiser	60	V
Max. Output Short Circuit Current Per Optimiser	15	Α
Rated String Current (No. of PV Mod. x Wp / Fixed String Volts)	6.67	Α
FUNTIONAL LIMITS		
Max. Continuous Power Per String	6000	w
Max. Number of Modules Per String	25	
Min. Number of Modules Per String	6	

Figure 21: Power Optimiser Settings in the PV String Circuit Edit Section

Configuring DC Cable Properties

Within the Ph/N Conductor tab of the Circuit Edit Module, users can configure the DC cable properties by selecting the conductor material, size, installation method, and correction factors. A key option is the checkbox "Cables are subject to heat from the PV panels", which applies Regulation 712.523.101 of BS 7671:2018+A3:2024. When selected, ElectricalOM considers an ambient temperature of at least 70 °C for derating calculations, accounting for thermal effects from PV modules mounted directly above the cables. This ensures the cable sizing is compliant with heat exposure requirements under solar panels.

	- Solar	Cu Solar Er	ergy Cable B	IS EN 506	518					
er list Cu Al	All insulations All kinds	•	Makeup o Solar/S/C 2x1Cx6m	o <mark>f circuit c</mark> Cu m²	conductors				Options	<u>EC(0)</u>
tallation										
Catego	ory All metho	ods								
Method	d Method	C No. 20	- Clipped	direct flat	t touching					
Cabl or m Ref.	les fixed on (dipped nasonry wall method: C	direct), or s	paced less th	han 0.3 x	Cables ar	er from wooden	0			•
Cabl or m Ref.	Nes fixed on (dipped nasonry wall method: C	direct), or s	paced less th	han 0.3 x	cable diamete	e subject to n the PV panels Info	0			•
Cabl or m Ref. Length C.S.A.	nles fixed on (clipped nasonry wall method: C n (m) . (mm²) / Rating	lirect), or s	paced less th	nan 0.3 x	Cable diamete	e subject to n the PV panels	\$7671:2018+ f cables subj V module the t least equal	A3:2024 - 712.52 etced to direct h ambient temper to 70 °C	3.101 For the designed at the shall be considered at the shall be considere	gn and sizing erside of the issidered to be
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Figure 22: DC Cable Configuration in the Ph/N Conductor Tab

Examples of Single-Line Diagrams for Solar PV Configurations

The following examples illustrate typical Single-Line Diagrams (SLDs) for a range of Solar PV system configurations, including: a simple PV string inverter (with and without power optimisers), systems with multiple MPPT inputs, DC combiner boxes with multiple strings, setups featuring array and sub-array separation, and a utility-scale PV system layout. These diagrams help visualise practical design approaches and integration methods within ElectricalOM. For a detailed walkthrough, users are encouraged to watch the ElectricalOM Webinar – Solar PV Design Based on BS 7671 Section 712, available on YouTube [Click Here].

Simple Solar PV System Configuration



Figure 23A: SLD of a Simple Solar PV System Configuration

c_MAX 7.713	Ns IMOD_MAX_OCPR	minIz It 35.43 ≤ 57
		(Ns-1)xlsc_MAX/Corr.Fact
	1.35 x I_MOD_MAX_OCPR	(Ns-1) x Isc_MAX
	33.75 <	35.426
	Overcurrent protection is requ	uired for each PV string

Figure 23B: Overcurrent Protection Checks for a Simple Solar PV System Configuration

Solar PV System with Power Optimisers



Figure 24A: SLD of a Solar PV System with Power Optimisers

Overcurrent protection Isc_MAX_opt Ns 18.75 3	on at a string level IMOD_MAX_OCPR	minIz 37.5 ≤ (Ns-1)xlsc_MAX	It 57 J/Corr.Fact	
	PV Optimisers are utilise	d within each stri	ng	

Figure 24B: Overcurrent Protection Checks for a Solar PV System with Power Optimisers



Solar PV System with Multi-MPPT Inputs and DC Combiner Boxes



Overcurrent p Isc_MAX_opt 18.75	Ns 4	at a string level MOD_MAX_OCPR	minIz 56.25 ≤ (Ns-1)xIsc_M/	It 57 AX/Corr.Fact	
	PV	Optimisers are util	sed within each s	tring	

Figure 25B: Overcurrent Protection Checks for a Multi-String Solar PV System with Power Optimisers



Figure 25C: Overcurrent Protection Checks for a Sub-array Solar PV System Cable



Single-MPPT Solar PV System with Sub-Arrays and DC Combiner Boxes

Figure 26A: SLD of a Single-MPPT Solar PV System with Sub-Arrays and DC Combiner Boxes



Figure 26B: Overcurrent Protection Checks for a Multi-String Solar PV System with Protection

sc_MAX_arr	Na	IMOD_MAX_OCPR	minlz		lt	
70	3	25	80	≤	107	
			minIz = Ir	n/Corr.F	Fact	

Figure 26C: Overcurrent Protection Checks for a Sub-array Solar PV System Cable

sc_MAX_arr	Na	IMOD_MAX_OCPR	minIz It	
210	1	25	123.53 ≤ 142	
			minIz = Isc_MAX/Corr.Fact	

Figure 26D: Overcurrent Protection Checks for the Main Array Solar PV System Cable

Utility-Scale Solar PV System



Figure 27A: SLD of MV/LV Switchgear in a Utility-Scale PV System



Figure 27B: SLD of Inverter Groups in a Medium Voltage Utility-Scale PV System



Figure 27C: SLD of Utility-Scale PV System Strings and Arrays



Figure 27D: SLD of a Medium Voltage Utility-Scale PV System Layout