

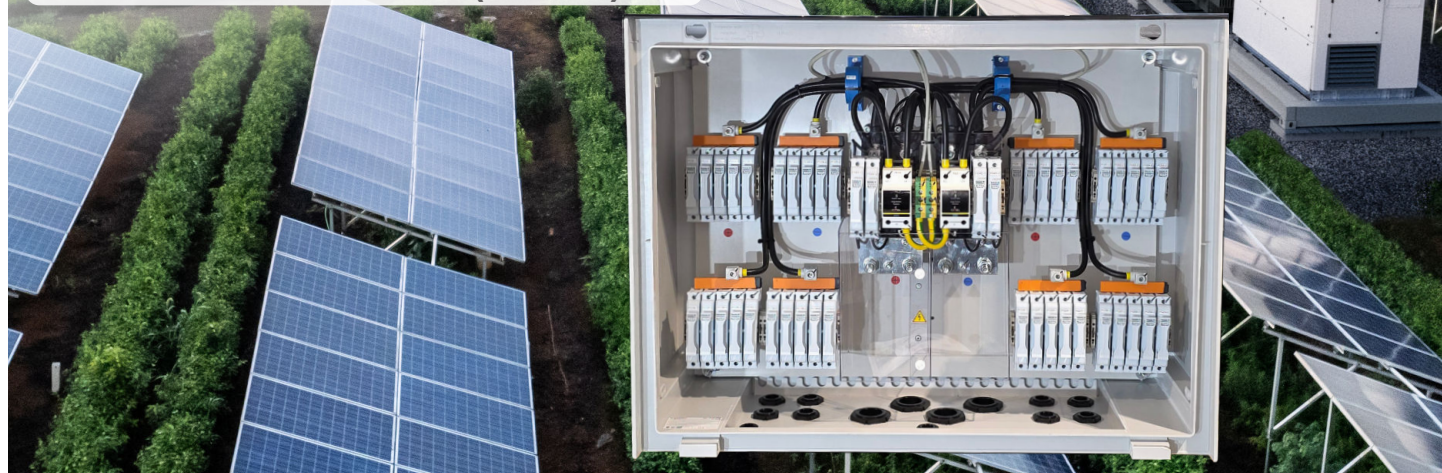
KLSA

KSU SmartShield S²

Smart & Secure DC Protection

THE NEW SAFETY CLASS

FOR UTILITY-SCALE (AGRI-) PV



ADVANCED DC SAFETY

Automatic fault
shutdown
reduces risks and
protects people.



MAXIMUM UPTIME

Only affected
strings disconnect.
The rest of the
plant keeps
producing.



REDUCED SYSTEM COSTS

Lower fencing
requirements, reduced
service effort and
reduced loss of revenue.



BUILT FOR AGRI-PV

Supports modern
hybrid land use
concepts while
improving
operational safety.



ACTIVE DC PROTECTION FUNCTIONS

fault current protection | insulation monitoring

automatic DC shutdown | Intelligent system communication



DISCOVER THE NEXT
GENERATION OF
SAFE (AGRI-) PV
INFRASTRUCTURE

SmartShield S²

Smart & Secure DC Protection



ACTIVE
PROTECTION



INTELLIGENT
MONITORING



UTILITY-SCALE
READY



BUILT FOR
THE FUTURE

KLEIN GmbH

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The safety architecture and central functional principles used in KSU SmartShield S² are the subject of an ongoing patent application
by SMA Solar Technology AG and are protected by intellectual property rights.
Preliminary data – as of 05/2026



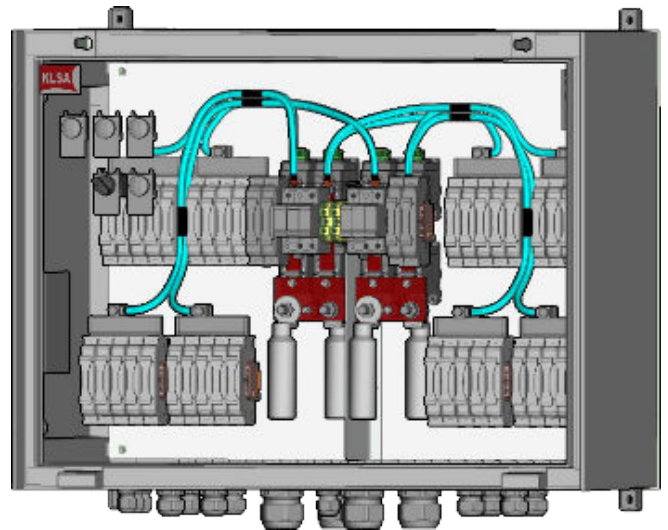
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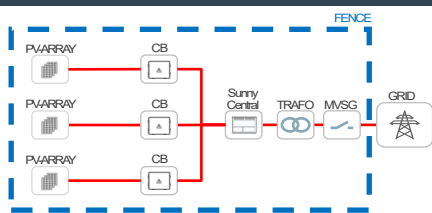
The Smart Combiner Box is a solution developed and provided by KLSA to extend PV systems in utility-scale and Agri-PV applications. It can be deployed in combination with SMA systems.

KSU SmartShield S² transforms the traditional combiner box into an intelligent DC safety system for modern PV power plants.

By combining active DC protection, automatic shutdown and direct communication with the central inverter, SmartShield S² enables safer, more efficient and more sustainable Agri-PV installations.

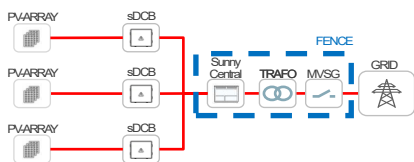


Behind the Fence - Standard Combiner Box



Smart Combiner Box

NEW



Advantages Standard Combiner Box

Safety: Protects against overcurrent, faults, and surges.

Costs: Reduces cabling and installation effort.

Fault isolation (manual): Limits failures to Combiner Box level (manual operation) preventing system-wide outages.

Scalability: Enables easy expansion by adding additional PV strings without major redesign.

Advantages Smart Combiner Box (same as Standard)

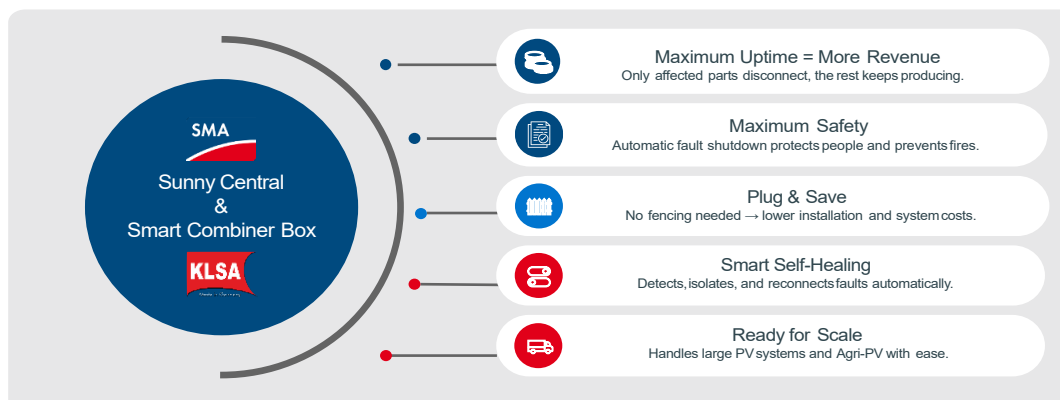
Enhanced Safety: Actively detecting and disconnecting insulation and differential current faults, preventing fire risks, and ensuring safe operation without the need for external protective measures (fence).

Reduced Cost (system level): Reduces overall system costs through continued operation of unaffected strings, eliminating fencing requirements.

Fault isolation (automated): Automatically detects and isolates faults at string level, enabling rapid identification, self-reconnection and continuous operation of unaffected parts without manual intervention.

Compliance: Enables regulatory compliance by allowing wildlife movement (e.g., reduced fencing requirements), ensuring environmental protection without compromising system safety.

Scalability: same



BUSINESS VALUE

TYPICAL 50 MW PROJECT EXAMPLE

- ✓ Reduced downtime losses
- ✓ Lower O&M costs
- ✓ Reduced fencing expenses
- ✓ Faster fault identification
- ✓ Higher plant availability

ESTIMATED RESULTS

ROI WITHIN
1.5 - 2.5 YEARS
UP TO
500.000 €
LIFECYCLE SAVINGS*

*Example calculation based on a 50 MW project. Individual results may vary.

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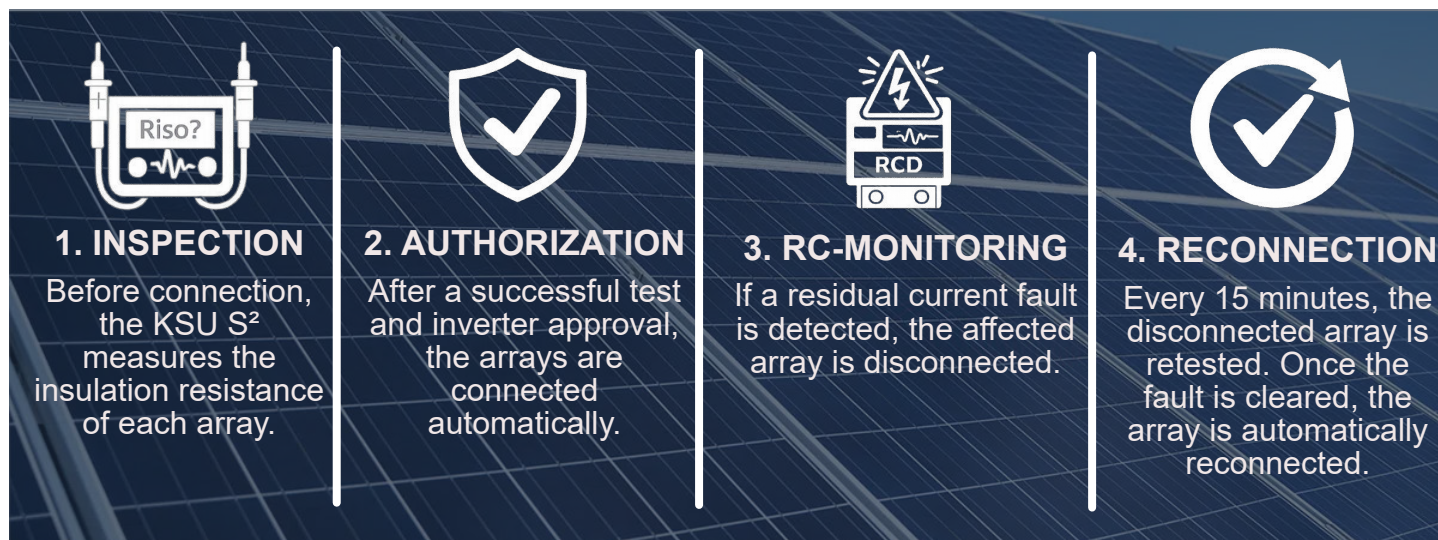
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KSU SmartShield S²

Main Functions



Feature	Standard Combiner Box	Smart Combiner Box
Fault Handling	Fault → Entire PV generator is shut down	Fault → Only the affected array is disconnected
System Recovery	Manual restart required	Automatic reconnection after fault cleared
Fault Localization	No fault localization	Selective fault isolation and localization

Status Indication

- Yellow – Insulation test active or at least one array disconnected.
- Red – Fault detected.
- Green – System operating normally.



ADDITIONAL FEATURES

SPD status monitoring | external disconnect switch
SD card: Event logging & configuration
Support for external light signal or alarm horn

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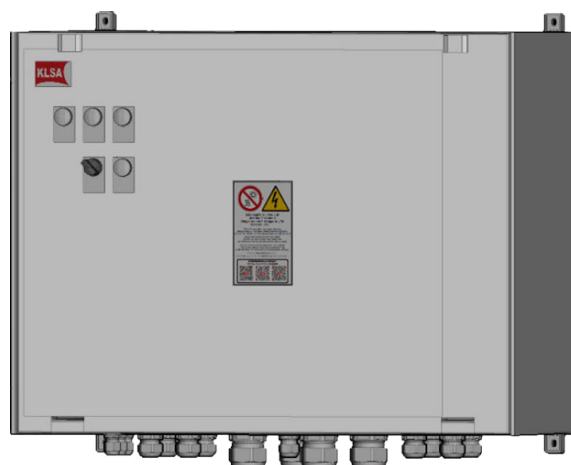
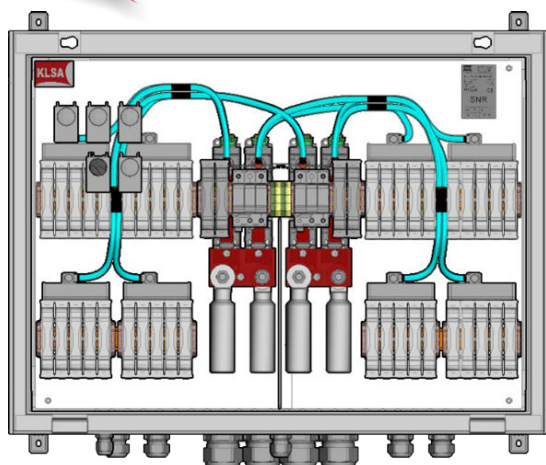
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KSU SmartShield S²

Technical specifications



Electrical values		
Rated voltage (U _n)	1500 V	
Rated insulation voltage (U _i)	1500 V	
Rated impulse withstand voltage (U _{imp})	6 kV	
Number of sub-arrays	2	
Inputs per sub-array	10	5
Rated input current (I _{sc})	20 A	40 A
Fuse type	10 x 85	22 x 58
Rated current per sub-array (I _n)	200 A	
Switching and switching capacity	250 A	
Switching elements per sub-array		
Rated current per DCB (I _{n dcb})	400 A	
Power consumption	< 40 W	
Connection data		
DC connection input	Direct connection max. 6 mm²	Direct connection max. 10 mm²
DC connection output	Cable lug - max. 2 x 400 mm² CU/AL	
Interfaces	Single-mode simplex unidirectional fibre optic cable 9/125µ (1350nm)	
	3 potential-free contacts for signal lights (green, yellow, red) or acoustic warnings	
Functions		
Fault current (fire protection)	100 mA bis 2,5 A (0,1 - 0,3 s)	
Fault current (personal protection)	30 mA (0,3s) / 60 mA (0,15s) / 90 mA (0,04s)	
Insulation measurement	10 kΩ bis 500 kΩ	
Ambient conditions / Enclosure data		
Ambient temperature	-20 °C - +40 °C	
Humidity	0 – 95 %	
Maximum installation height (above sea level)	2000 m	
Degree of protection	IP65	
Enclosure (H x W x D)	615 x 847 x 330 mm	
General information		
Standardisation	DIN EN IEC 61439-1:2021-10 and 61439-2:2021-10 IEC 60364-7-712:2017-04 IEC 63112:2023-05	

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