Protection logic of the Azzurro 3PH 250KTL/350-HV Z0 smart switch

Summary

Identificazione

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Revision

Rev.	*Date*	*Author*	*Description of changes*
00	28/03/2025	A. Rossi	First Release
01	02/04/2025	A. Rossi	Editorial Changes

1. functioning principle

The smart switch works in conjunction with the inverter's DSP (Digital Signal Processor). When the system detects an overcurrent, short circuit or reverse current condition, the DSP sends a trip signal to the switch. The switch's internal coil generates an electromagnetic force that activates the trip mechanism, disconnecting the switch. In the event of a system failure, the switch trip quickly interrupts the circuit, effectively preventing string current backflow and short-circuit hazards, thus avoiding equipment damage and safety issues.

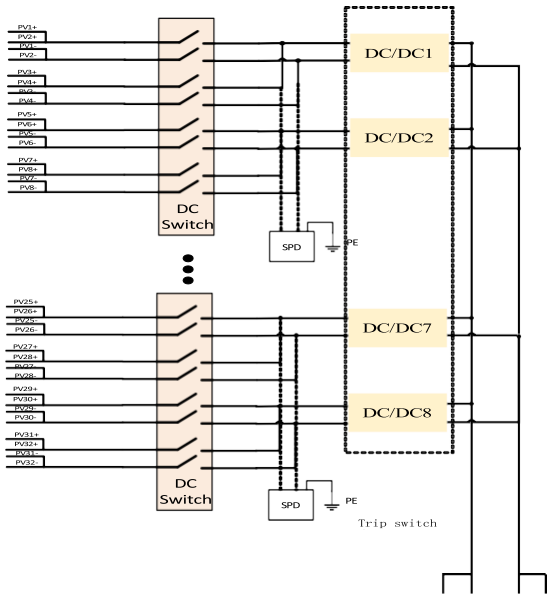
2. -supported models

All models in the 3PH 250KTL-HV Z0 / 3PH 350KTL-HV Z0 series are equipped with intelligent DC switches and a reset handle to be used after the switch trips. The models involved include:

- AZZURRO 3PH 250KTL-HV Z0
- AZZURRO 3PH 330KTL-HV Z0
- AZZURRO 3PH 350KTL-HV Z0

3. MPPT inverter Azzurro 3PH 250KTL-HV Z0 / 3PH 350KTL-HV ZO

The 3PH 330KTL-HV Z0 and 3PH 350KTL-HV Z0 series inverters are designed with **8 MPPTs** (whereas the 3PH 250KTL-HV Z0 model is designed with **6**). Each MPPT can connect **4 photovoltaic (PV) strings** for a total of 32 strings. The input side is equipped with 4 **DC switches,** each of which controls the input of 2 **MPPTs.**



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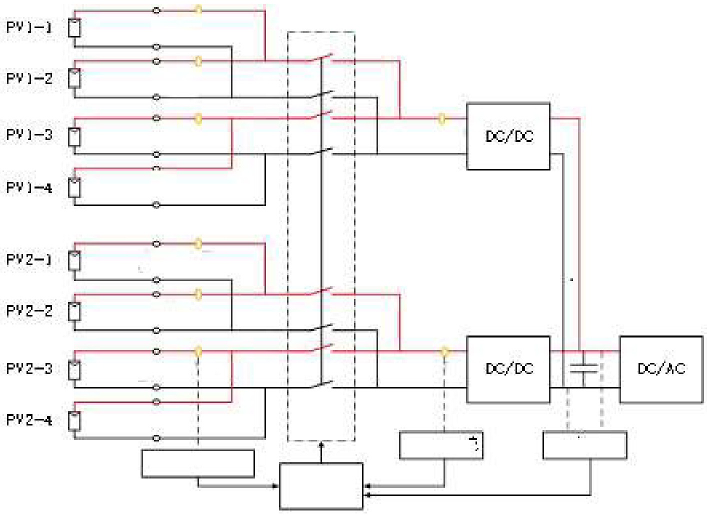
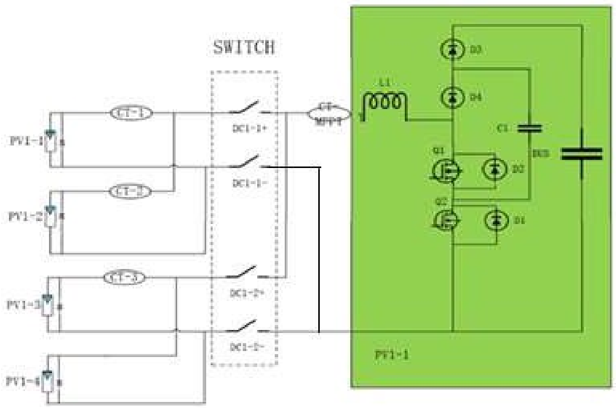
DC disconnection circuit

Since the circuits of the **four DC disconnect switches** are identical, one switch is taken as an example.

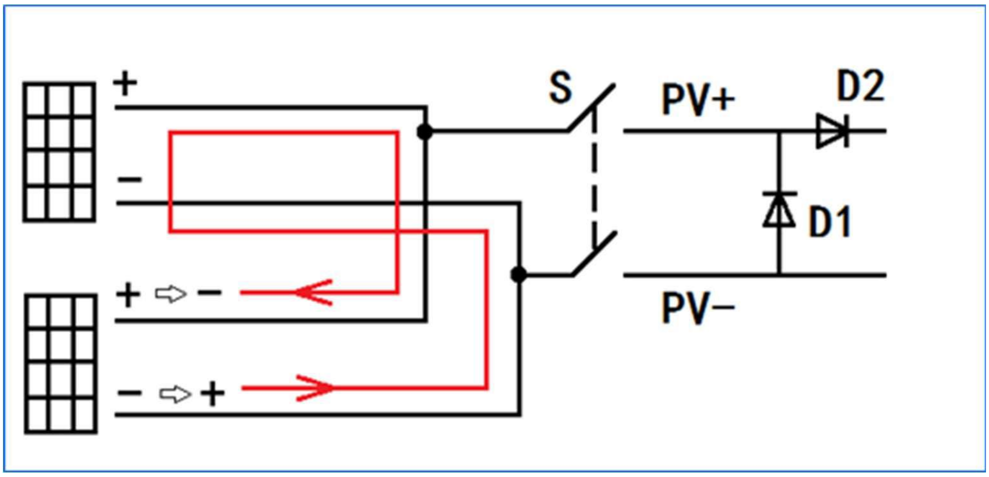


Single MPPT circuit diagram The diagram of an MPPT is shown below



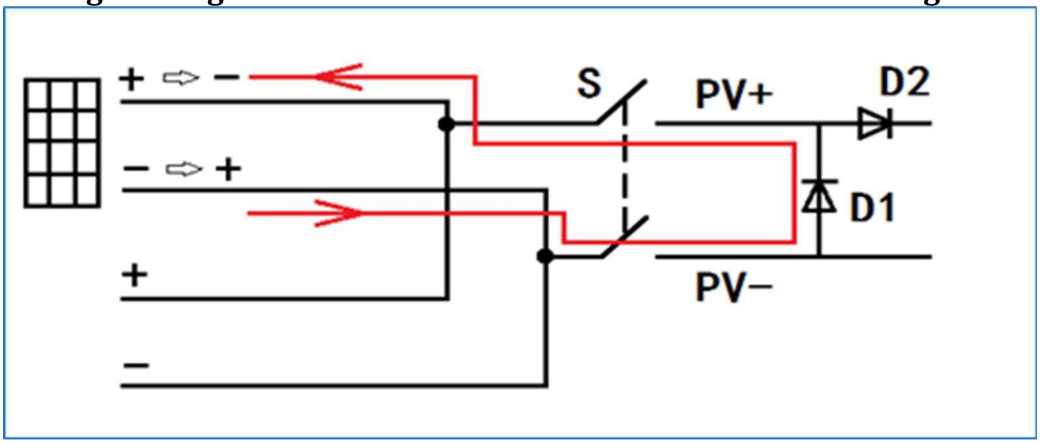
The inverter uses current sampling from each string to detect reverse connections or other anomalies, promptly signalling faults.

Case 1: One string connected correctly, the other reverse connected in the same MPPT as shown in the image below:



The two strings are directly short-circuited, bypassing the DC switch (red line in the diagram). The input voltage is **0V**, while the string current corresponds to the short-circuit current of the photovoltaic panel. This does not damage the inverter, but it can compromise the PV modules.

Case 2: A single string inverted in the same MPPT as shown in the image below:



When the DC switch is closed, the string forms a short circuit via the anti-parallel diode of the IGBT (red line in the diagram).

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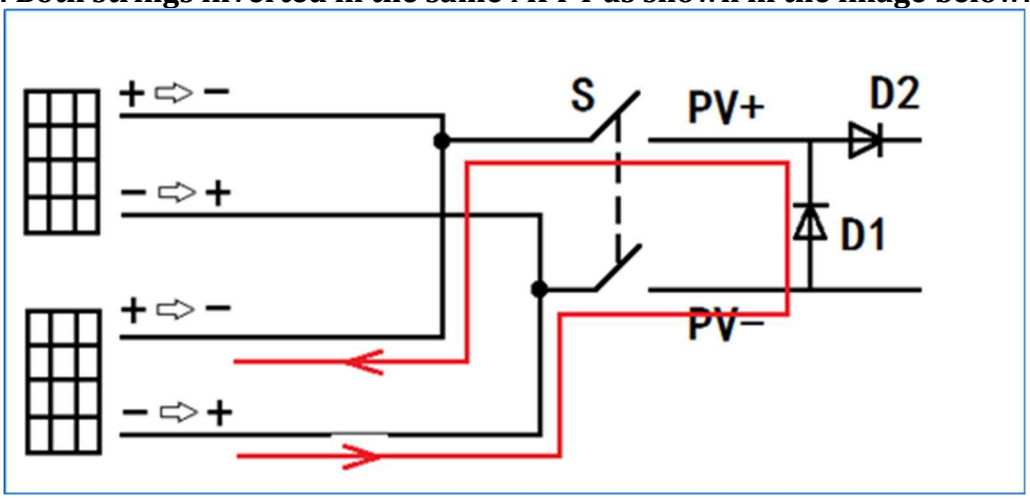
Case 3: Both strings inverted in the same MPPT as shown in the image below:



When the DC switch is closed, each string forms a short circuit via the anti-parallel diode of the IGBT (red line in the diagram).

4. 's intelligent DC switch protection logic

Reverse connection protection logic 1: When the PV voltage of a circuit is <100V and the MPPT current <-3A, the inverter signals a reverse connection fault and disconnects the corresponding smart DC switch.
Backflow protection logic 2: When the PV branch current (single connector) exceeds 30A, the inverter signals a branch overcurrent (backflow) fault and disconnects the corresponding smart DC switch.
Bus short-circuit protection logic 3: When the bus voltage is < 500V and the difference between the voltage of two measurement cycles is >100V, the inverter signals a bus short-circuit fault, disconnects from the grid and activates the tripping of all smart DC switches.

PS: the switch logic works if at least one string is correctly connected for 3 minutes, so tests must be carried out sequentially

5. Resetting the smart DC switch

Verification and reset procedure after the smart DC switch trips

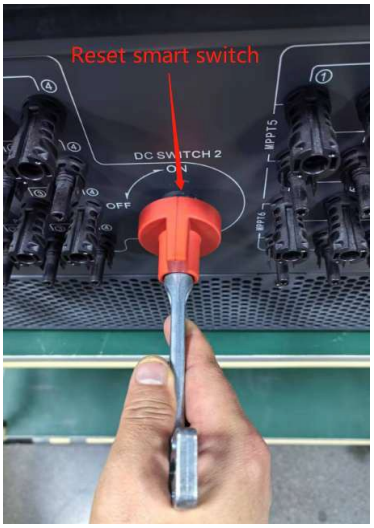
Step 1: Resolve the fault detected by the inverter.

Step 2: Use the **reset handle** on the smart DC switch to close it only when the inverter is not connected.

Step 3: Once the switch is closed, the inverter can return to the grid connection state.

After the smart DC switch trips, first resolve the fault and then use the reset handle to close the switch.

When closing the switch, the handle must be **moved to the closed position and held for about 10 seconds** until you hear the sound of the switch closing.



Caution before resetting

- **Ensure that the inverter is switched off before resetting the switch.**
- **Do not reset the DC switch while the inverter is connected to the grid, to avoid damage to the inverter.**

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