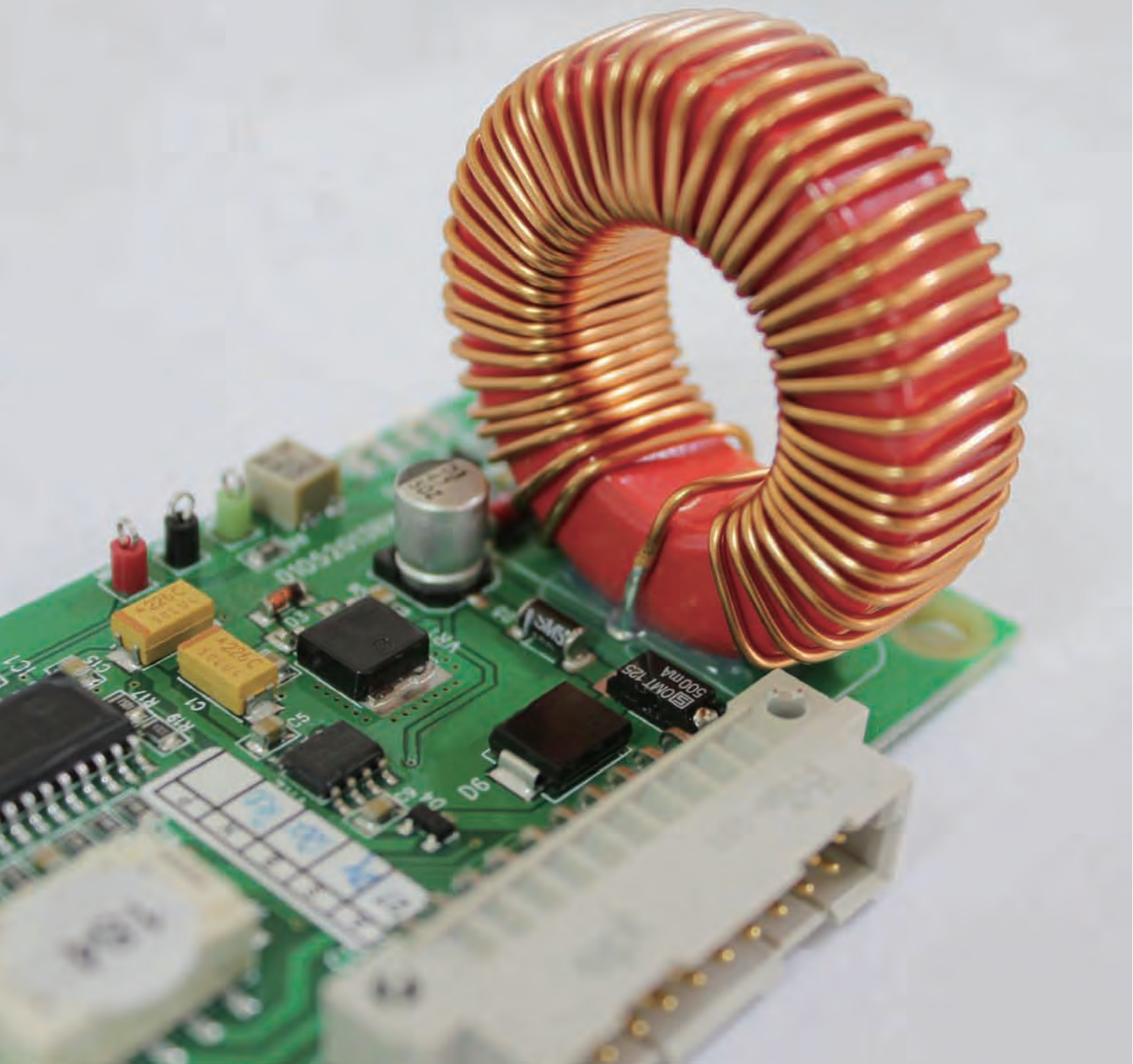
JDA 日煬科技有限公司
JD Auspice Co., Ltd.

PVAD Arc Detection

故障電弧偵測器

アーク検出器



Introduction

PVAD Arc Detection Manual

JDA is presenting a new prototype board for arc detection and alarm function (optical, by relay) in AC/DC systems (e.g. photovoltaic applications).
This board replaces all former boards and circuitries for arc detection developed by JDA.
Key points of the new development are robustness and stability in line with small size, components count and cost. All components are multi-sourced standard parts.
Multiple use of the boards in one box, use of the circuitry itself in customer applications with their own board layouts is all possible, for e.g. DIN rail systems, inverters, electro vehicles or wind power systems.
Depending on the position in a PV system, serial arcs (type 1/UL1699B) as well as parallel arcs (type 2/UL1699B) can be detected. To differentiate between these two arcs you need to monitor the string voltage (or string current, respectively) at the inverter input at the same time an arc is detected: if the string voltage during the arc decreases to near zero volts, it will evidently be a parallel arc.
You can ask JDA for an optional test circuitry for functional testing of this arc detection system (see requirements of UL1699B).

Technical data	
Rated operational voltage	max. DC 1,500 V
Rated operational current	max. 40 A
Ambient temperature	-25 °C...+70 °C , IP40 / 65
Standards	UL1699B, Type 1 ,Type 2
Signal output	9+ Change-over aux contact
Modular conecpt for monitoring	up to 5 strings,1500 VDC / 40A per string
Connectors	cable gland , potential-free feed-through of string c ables 10 mm2
Box size	200 X 150 X 75 mm
External power supply	24 VDC, 100 - 240 VAC 50 / 60 Hz

PVAD - XX X XX - XXX

1. Amperage	
40	40 amps

2. Housing	
B	Enclosure with DIN rail mount
D	DIN rail mount

3. Voltage	
24	24VDC
12	12VDC
05	5VDC

4. Special Configurations	
000	None
	Call JDA to discuss special configurations for your application

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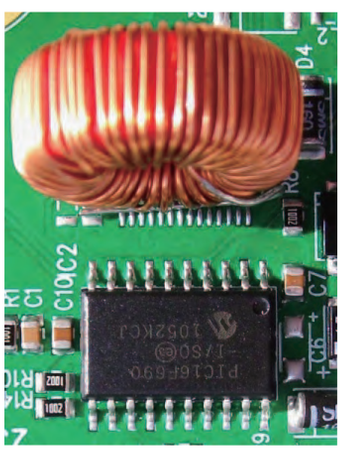
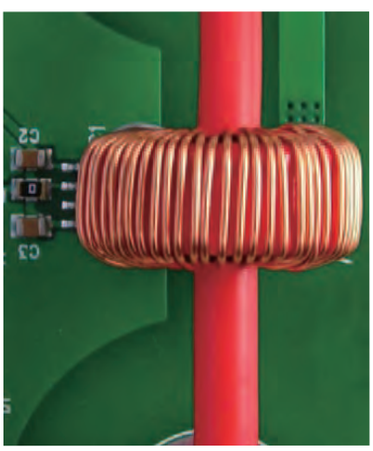
PVAD Arc Detection

Properties

Specs of the prototype PCB:

- Dimensions: 48x77x1,6 (mm), max height of the components given by the sensor choke: 22 mm
- Connections to the board by soldering wires (AWG18/AWG24) to the solder eyes of a 20pin connector field or using such a connector instead
- Two different versions regarding supply voltage available: 12VDC (-5/+10%) or 24VDC (+/-10%), AC supply upon request
- Current in alarm mode: max 36mA, Standby max 24mA
- Max. power consumption: < 1 watt
- Protected against polarity reversal, shorts, overloads, over voltages (SMD fuse 0,1A) for all supply and control lines, protection against current spikes from the sensor choke
- LED indicators : green (Ready for measurements), yellow(arc alarm)
- Alarm relay: potential-free contacts (2xCO,DPDT), max. 4A/30V DC, Fail-Safe Control of motor switches and power relays: alarm status remains even if supply voltage for the board drops
- Output of sensor: adjustable (by potentiometer) for simple compensation of HF-noise, different cable loop length and attenuation effects by filters. Use coloured test points MP0 (black),MP1(green) and MP2(red)
- Inner diameter of the choke allows for pass through of (solar) cables up to 9mm of outer diameter (equal approximately to a 10 square mm solar cable)
- Insulation and quality of the (solar) cable only will determine the electric strength (e.g. up to 1500VDC), there is full galvanic isolation between the cable carrying arcs and the detection circuitry
- All important parameters and control functions are available from the two rows of solder eyes (see Operation Manual)
- 4 corner-holes (D = 4,2mm) are available for simple mounting of the PCB





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PVAD Arc Detection

The cable with potential arcs (e.g. solar plus cable of a PV-string) is passed through the hole of the sensor choke straight away. Attention: Do not violate the wire windings of the choke or the insulation of the cable! There is no need to pay attention to the direction of the cable to be passed through.

At solder eyes A3/B3 (Minus) and A6/B6 (Plus), connect a supply voltage, either 12VDC or 24VDC, as selected.
At A7 and A3/B3 you should connect a pushbutton switch for reset.

After the voltage is supplied, the green LED will be on after about 1s indicating the readiness to measure.

Should the yellow LED be on at the same time (and the relay be activated), please measure the voltage at test point MP2(red) towards GND at test point MP0(black): if the voltage is above 0,2VDC, turn the potentiometer until you get a reading of about 0,11VDC, the yellow LED will be out after reset then. Now the circuitry is ready to detect arcs. It is recommended even with no yellow LED on, to measure the voltage at MP2(red) anyway. This voltage should be about 0,05 to 0,1VDC below the presently programmed threshold of 0,2VDC.
At MP1(green) you have the max sensor DC signal.

An arc should stand at least for 0,25s (presently programmed time threshold) to trigger the alarm. This prevents from false triggering of the circuitry by e.g. relay contact “fire” or other “normal” arcs.

The yellow LED and the relay stay activated until the reset pushbutton switch is pressed for at least 2s. During reset, the green LED is off for about 1s and back on again for further measurements.

By use of the potential-free alarm relay contacts A8/B8, A9/B9, A10/B10 you can control external motor-switches, power relays, sirens, signal lamps or other alarm systems.

Regarding the relay, the last status (e.g. alarm) will stay present even in case of loss of supply power or voltage dips. Pushing the reset pushbutton switch (or applying external reset) after supply voltage is back, will change the status again (Fail-safe operation in case of interruptions of supply voltage for the arc detection circuitry).

Furthermore, you have a TTL signal at B4 to check for readiness for measurement and at B7 you have a TTL signal indicating the alarm condition. These TTL signals (both Active High) can be used for further processing with another external controller.

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PVAD Arc Detection

Detects high frequency signal within „target Noise of arcs

- Detects serial and parallel arcs on same position
- No spectrum analysis by digital filtering
- Assailable to inverters (String-Inverter, Micro-Inverter)
- Low power consumption of sensor
- The sensor output signal can be individually processed: message, siren, motor-switchor relay contact
- Arc detection during Metallisation and Gas Phase
- Detects arcs in DC and AC systems
- Fast implementation into existing systems - fifteen components(smd) + toroid coil
- Excellent cost – performance ratio, standard components, multi-sourced
- All JDA tests according to UL1699B
- Patent pending

Important notes

The circuitry is protected by a SMD fuse soldered to the board. In case of a defect please return the PCB to JDA, do not change the fuse or manipulate the board in any kind.

This arc detection procedure is worldwide patent pending by JDA.

Please note that the PCB is a prototype, not a series unit. Appropriate authorization tests (e.g. EMI) need to be performed in the final application of the customer.

All standard safety rules for use of electronic prototypes in a lab environment need to be followed. Only qualified personnel is allowed to operate this circuitry.

There is no warranty or liability whatsoever for this prototype unit.

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PVAD Arc Detection

Operation Manual

Use the solder eyes marked with A1 to A10 and B1 to B10 to either solder wires or use an appropriate male connector 20pin.
The rows of solder eyes can be connected as follows:

A1	:	RS PIC	(PIC Programmer)
A2/B2	:	VDD PIC	(PIC Programmer)
A3/B3	:	VCC PIC/GND	(PIC Programmer)
A 4	:	ICSP -DATA	(PIC Programmer)
A5	:	ICSP -CLOCK	(PIC Programmer)

B1	:	not connected
B4	:	TTL signal for "Ready for measurement" (High = Ready, Low during Reset)
B5	:	not connected
A6/B6	:	Supply voltage (positive), ~~12VDC~~ or 24VDC, as selected
A 7	:	Reset (if connected to A3/B3 for at least 2s)
B7	:	TTL signal for "Alarm" (High = Alarm, Low = Standby)
A8/B8	:	potential-free relay contact , max 4A/30VDC
A9/B9	:	potential-free relay contact Center, max 4A/30VDC
A10/B10	:	potential-free relay contact, max 4A/30VDC

The cable with potential arcs (e.g. solar plus cable of a PV - string) is passed through the hole of the sensor choke straight away. Attention: Do not violate the wire windings of the choke or the insulation of the cable! There is no need to pay attention to the direction of the cable to be passed through.

PIN`s on the PVAD board

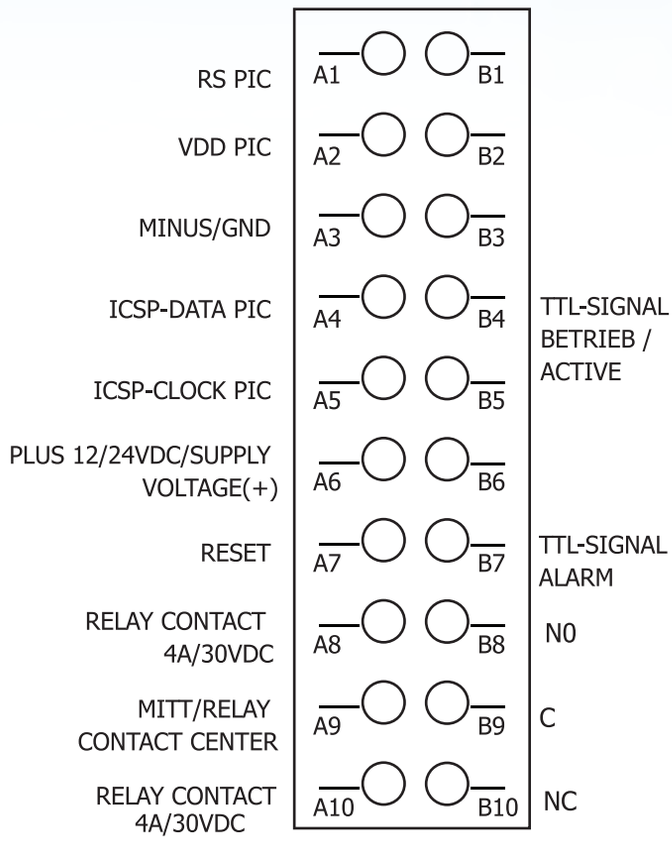
- PIN B6 plus and PIN B3 minus for contact 24voltage (24V = Panasonic relais)
- PIN A7 and PIN A3 = its open, after an arc (yellow led) if you close = is reset > green led
- PIN B7 TTL signal for "Alarm" 5V if led yellow
- PIN B4 TTL signal for "Ready for measurment " 5V if led green

Potential free contact for a external motorswitch or extern signal

- PIN A10 potential free relay contact open (max 4A/30VDC)
- PIN A9 potential free relay contact for center (ground) (max 4A/30VDC)
- PIN A8 potential free relay contact for close (max 4A/30VDC)

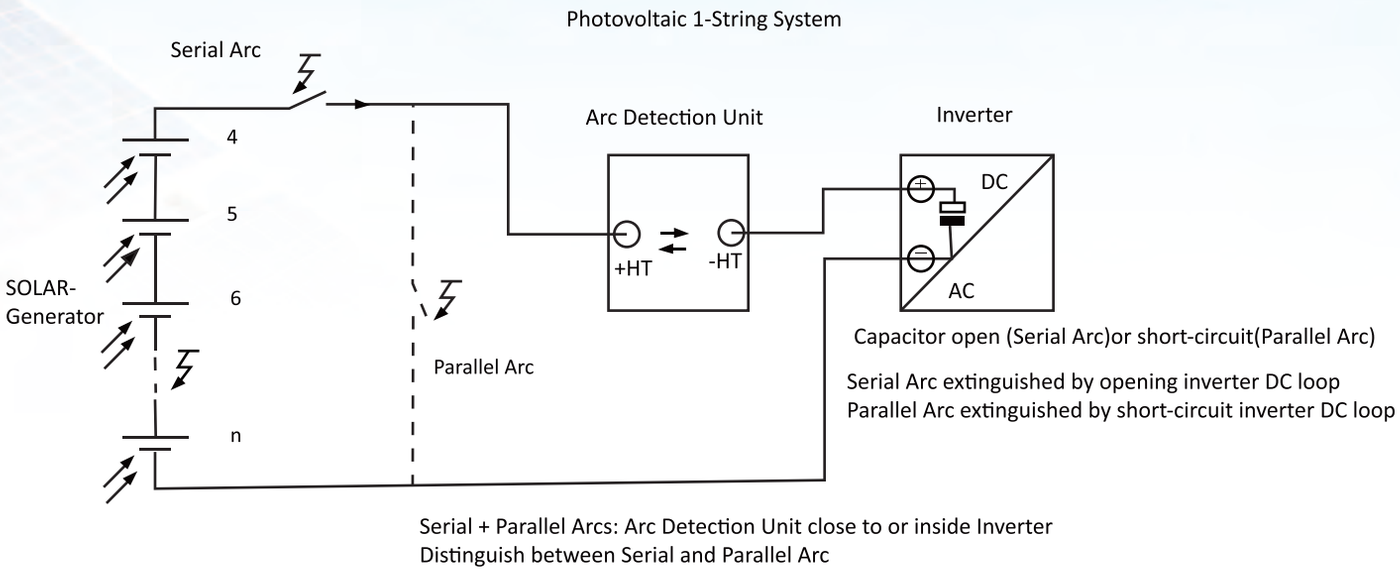
Testing the PVAD board in a PV System:

To do the adjustment and optimisation, please connect a voltmeter to the test points MP0 (black, equals GND) and MP2 (red) and adjust the voltage by turning the screw of potentiometer P1 until you get a reading of about 0,11VDC (adjust the system in the "best" time of insolation = optimal setting) in an arc-free system. This serves as a compensation of various noises in the string and should be performed for each string individually.

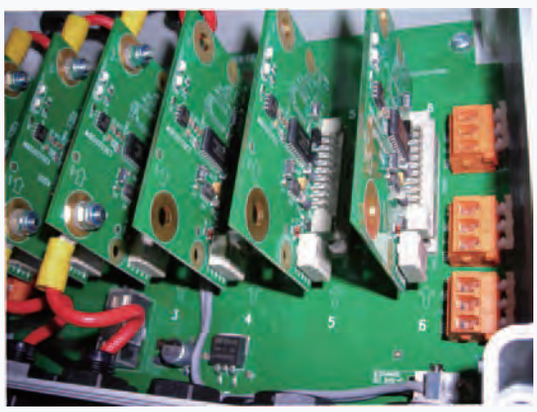


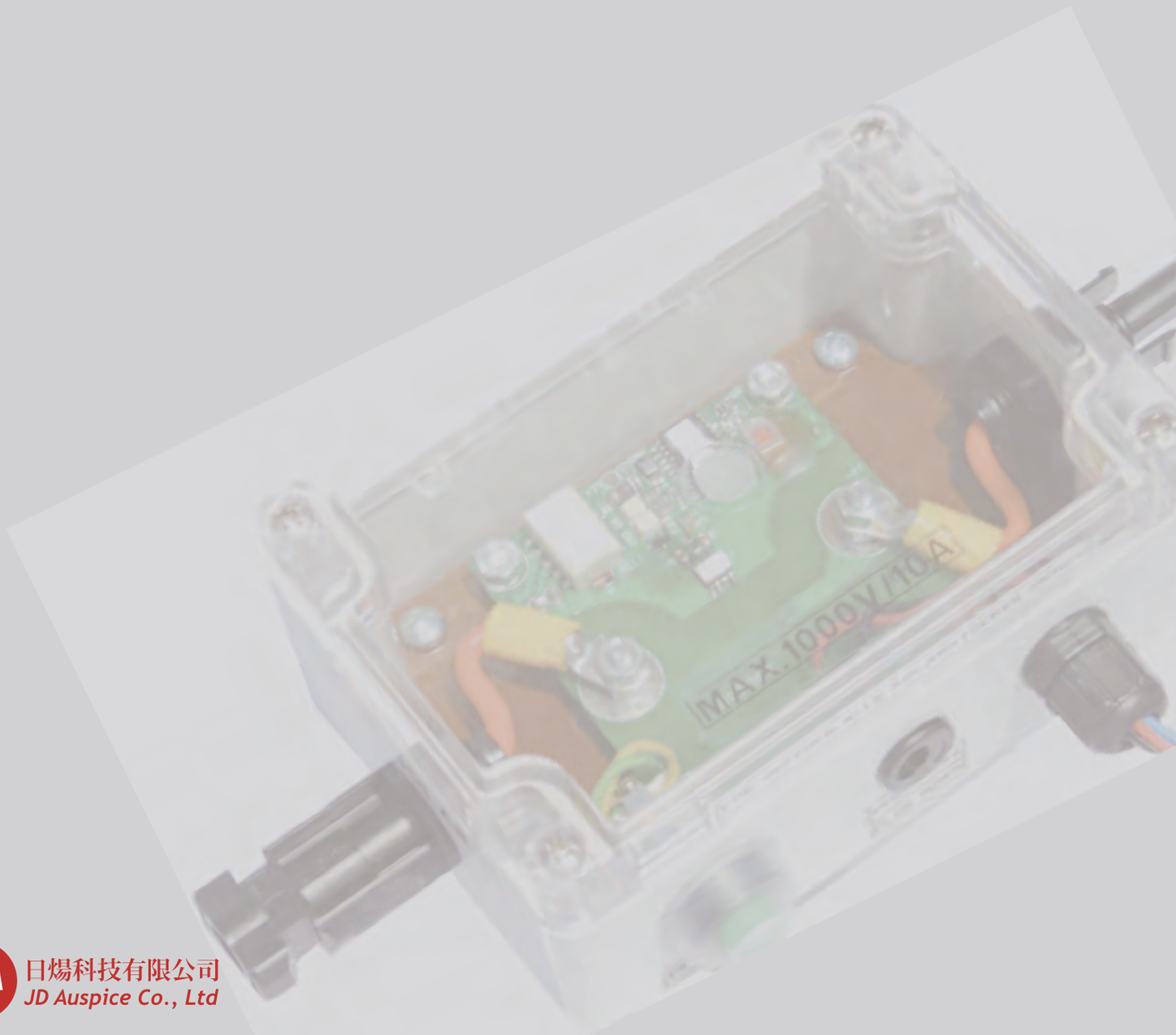
ARC DETECTION ON DC FOR INVERTER

- Electronic solution for arc detection on DC side
- Detects fast current changes within the solar power plant, as the are caused by arcs and generates an electrical signal
- The electrical signal can be individually processed, message, siren motor-switch or relay contact (active fire safety)
- no high frequency method. JDA detect serial and parallel arcs on one position
- Assemble in inverter (String inverter, Micro-Inverter)
- Combinable with other products (motor - switch, relay …)
- JDA Solar DETECT AT3 - 3 string detects electric arcs DC and theft
- JDA SOLAR DETECT A1/6 – 1-6 stings arc detection DC
- Electronic board – for arc detection 15 A, 1500 Vdc and current transformer
- Patent pending, positive international research report
- JDA is ready for US UL1699B



Serial + Parallel Arcs: Arc Detection Unit close to or inside Inverter
Distinguish between Serial and Parallel Arc





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