



PVAF-R Series

Arc Fault Detection for Solar Applications

INTRODUCTION

In the course of normal operation, high voltage PV systems experience severe environments, thermal expansion, and potentially lingering issues from improper installation. These items contribute to the possibility of a fire due to arcing events. To mitigate this, article 690.11 of the 2011 and 2014 NEC mandates listed arc fault protection on all PV systems with a maximum voltage of 80VDC or more operating on buildings.

Sensata's PVAF-R arc fault detector is an integrated arc detection solution which is appropriate for NEC 2011 and 2014 compliant equipment. By building on Sensata's experience in aerospace arc fault technology, Sensata has developed one of the first UL 1699B recognized arc fault detectors for the solar PV industry. Sensata's PVAF-R arc fault detection solutions offer this capability at an economical price point.

Sensata's PVAF-R includes an on-board CT for each monitored string in a solar array. Up to four individual PV strings can be monitored concurrently on one PVAF-R rectangular board, and multiple boards can be nested for larger string quantities. If an arc is found, a signal is sent via an open collector transistor to the string control circuitry of the combiner box or inverter. The on board LED provides a quick visual indication of which strings the PVAF-R has detected an arc on.

SPECIFICATIONS

Required External Power Supply	12 VDC nominal, 11.4 VDC to 15.75 VDC range, 30 mA max; 24 VDC nominal, 21.6 VDC to 26.4 VDC range, 30 mA max
Number of CT's per PVAF board	Up to 4 CT's
CT Amperage Rating	Up to 20 A Isc STC max per CT
Max Line Voltage	1000 VDC
Insulation	> 3000 VDC
Compliance & Approvals	UL1699B (Type 1) & UL1998 recognized, RoHS compliant (lead-free)
Storage & Operating Temperature	-40°C to 85°C (-40°F to 185°F)
Mounting	PC board holes for customer-supplied standoff
Mass	70 grams (2.5 oz)

FEATURES

- Monitor up to four strings (20 A Isc STC max, 1000 VDC max) per PVAF-R arc fault detector
- Self test feature provides verification of unit functionality
- Wiring pitch of 17.8mm matches that of most commonly used electrical buses
- CT's mounted at right angle to PCB, enabling convenient wiring
- Compact size and nesting geometry simplifies system integration
- Conformal coated PCB protects from environmental contaminants
- Single interface connection eases harness management
- On Board LED provides quick visual indication of power ON/OFF and any detected arcing
- Open-collector output can remotely trip breaker or contactor
- Designed for use on systems without DC optimizers
- UL1699B (type 1) recognition

ADVANTAGES

- Proprietary algorithm minimizes nuisance trips on most system topographies, reducing downtime and costly manual intervention
- Applicable to products for new installations and retrofits
- Tested with a variety of string and central inverters
- PVAF's UL recognition does not require additional arc testing during UL listing




SELF TEST FEATURE

As required by UL, a self test feature is provided on every unit. The self test interface (PIN 4) provides the user the ability to send an electrical signal to the PVAF-R to simulate an arc fault condition in the system. The PVAF-R will perform a self test when the signal is low (short) for a minimum of 10ms. Note: a latching reset is required to restore the PVAF-R and the system to proper working function.

OPEN COLLECTOR OUTPUT

The PVAF-R provides a signal to the user indicating that there is an arc fault condition present. During normal operating conditions, this signal is low (short). When an arc fault is detected or an AFD fault is registered, this signal changes to high (open).





VISUAL INDICATOR (GREEN LED)

	A blinking green light means system is working properly to detect arc fault.
	A solid green light means an arc fault has been detected and the system needs attention.
	No light means there is an issue with the power reaching the PVAF-R from the external power supply

LATCHING RESET

When the PVAF-R detects an arc fault, the unit is latched in the arc fault state. Once the arc fault situation has been resolved, the PVAF-R needs to have the latching function reset. This is accomplished by cycling the external power supply OFF and ON again. Turning the power OFF and ON resets the PVAF-R to its normal arc fault monitoring functionality.

CONNECTOR TERMINATIONS (PINS)

	Pin 4 - Self test IN (reference to ground)
	Pin 3 - Arcing detect OUT (reference to ground)
	Pin 2 - Ground
	Pin 1 - Power (+12VDC; +24VDC)

UL 1699B TYPE 1 RECOGNITION

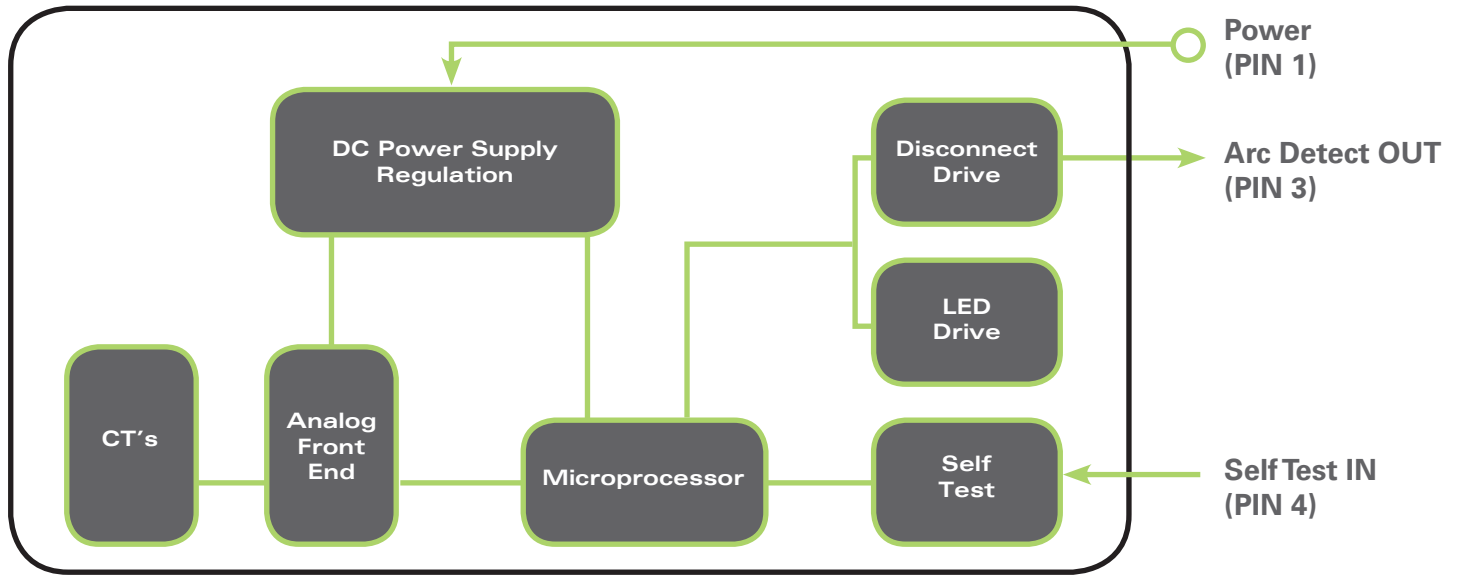
As described in UL 1699B Edition 2 (2013), there are two types of UL 1699B recognition: Type 1 and Type 2. UL 1699B Type 1 recognition requires that the arc fault detector (AFD) detect a class of series faults. It also allows that the AFD may detect a class of parallel faults. UL 1699B Type 2 recognition requires detection of both a class of series and a class of parallel faults. Neither Type 1 nor Type 2 recognized AFD's are required to distinguish between parallel or series faults. UL 1699B only requires that the AFD detect an arc of 300 W or more in conditions defined in the standard.

Sensata's PVAF AFD has UL 1699B Type 1 recognition only. As such, it detects a class of series faults. The PVAF-R also detects a class of parallel faults, but it does not distinguish whether a specific fault is a series or parallel fault. System designers using the PVAF-R should incorporate appropriate system responses for both series and parallel faults in their designs. System designers should also read the UL 1699B standard to fully understand the differences and capabilities of Type 1 and Type 2 AFD's before designing an arc fault interruption system including any UL 1699B recognized AFD.

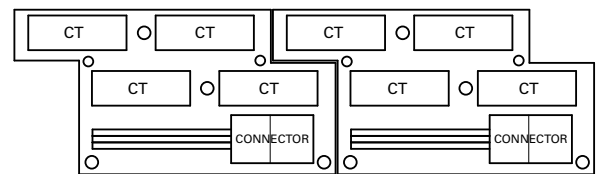
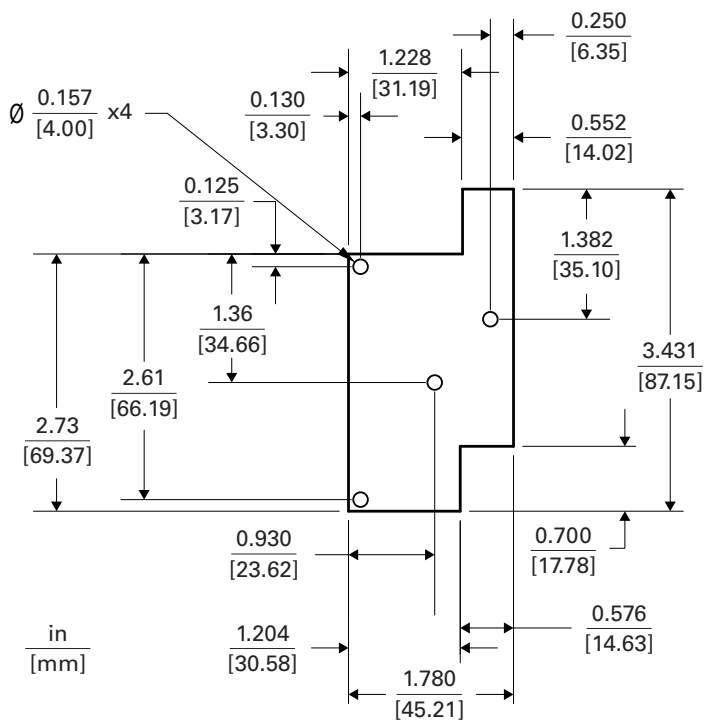
UL 1699B CURRENT RATINGS

PVAF is recognized for use on conductors up to 20 A I_{sc} STC. Though it allows ratings beyond 15 A, UL 1699B Edition 2 (2013) only describes test conditions that would exist in a single string system. At conditions outside of the limited conditions discussed in UL 1699B, the PVAF's detection performance does not have a standard to be measured against. System designers using PVAF should thoroughly understand and evaluate the benefits and risks of using PVAF to sense arcs on multiple string systems prior to using these system designs in their application.

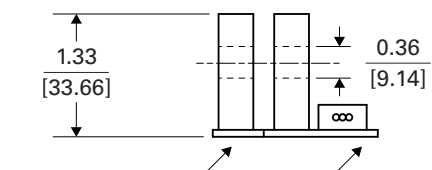
BLOCK DIAGRAM



DIMENSIONAL DRAWINGS (4 CT, 20 A max shown)

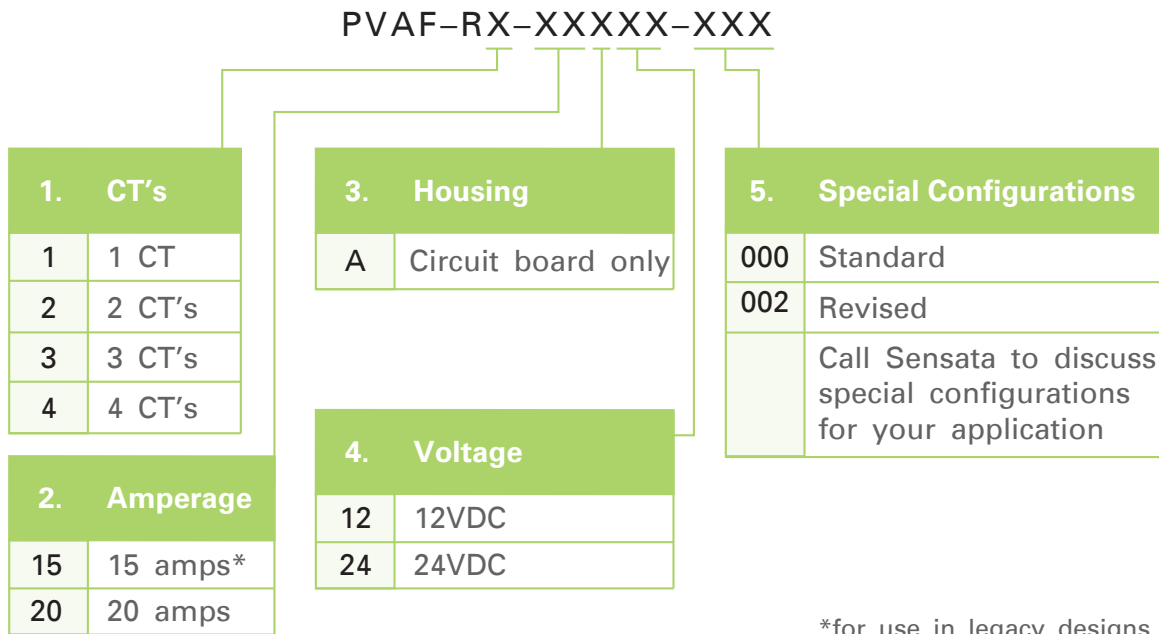


Example of two sets of 4CT configuration PVAF series mounted side-by-side



Recommend a minimum of 0.25" (6.35mm) tall standoffs be used when mounting to a surface

PART NUMBERING SCHEME



*for use in legacy designs only

www.sensata.com/uses/solar.htm

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