PVCHECKs-PRO is a one-stop test solution to meet the **IEC 62446-1** standards for category 1 tests.

PVCHECKs-PRO performs on single-face (SF) as well as on bi-facial (BF) photovoltaic systems all tests required by the IEC 62446-1 to commission a photovoltaic installation **in automatic sequence**. Therefore, **by a single GO-key stroke** PVCHECKs-PRO measures and tests:

- continuity of protective earthing and/or equipotential bonding conductors, where fitted;
- polarity test;
- string open-circuit voltage test **up to 1500V**;
- string short-circuit current test **up to 40A**;
- insulation resistance of the DC circuits by generating **up to 1500V even on live circuits**.

As required by IEC 62446-1, **PVCHECKs-PRO** compares the just-measured values of string Voc and Isc to the previously measured strings composing the PV installation to prevent voltage and current mismatching.

By measuring the solar radiation (SOLAR03 required) and PV module temperature, PVCHECKs-PRO can extrapolate Voc and Isc to the STC (Standard Test Conditions: 1000W/m^2, 25°C, AM 1.5) to compare them to the nominal values as provided by the module manufacturer. The internal database already stores the most popular modules, more modules can be added. Finally, PVCHECKs-PRO provides a positive or negative outcome (OK/NO).

Insulation resistance of DC circuits is performed according to IEC 62446-1 test method 1. Two tests are then performed: a first test between array negative and earth followed by a second test between array positive and earth, avoiding the use of any short-circuit switch box (*).

Troubleshooting is a time consuming and costly activity. Any time an inverter shuts down because of lack of insulation, the quickest it is recovered it to normal operation, the quickest the installation returns to generating power and income. GFL is the new function **PVCHECKs-PRO** performs answering each technician's question: where is the fault? By this function **PVCHECKs-PRO** indicates the precise position of the lack of insulation, so the technician can go without fail to service the broken component.

(*) According to IEC 62446-1, insulation resistance test method 2 would require the use of a short-circuit switch box (incorporating a load break rated DC switch) to safely make and break the short circuit connection - after array cables have been safely connected into the device.

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1. GENERAL FEATURES

Feature		Note
Ratings		CAT III 1500VDC
PV module type - all most common types of photovoltaic module	• Single face	✔
	• Bi-facial	✔
Voltage range		15V – 1500V DC
Current range		0.1A – 40A DC
DMM (input voltages)		✔
Wireless environmental parameters measurement (free field; max 100m, bluetooth connection with SOLAR03 required)	• Irradiance	✔
	• Module temperature	✔
Commissioning tests @ OPC (OPerating Conditions)	• Open circuit voltage (Voc)	✔
	• Short circuit current (Isc)	✔
Commissioning tests @ STC (Standard Test Conditions) (free field; max 100m, bluetooth connection with SOLAR03 required)	• Open circuit voltage (Voc)	✔
	• Short circuit current (Isc)	✔
Performance/Acceptance tests @ OPC (OPerating Conditions) – Voc and Isc:		✔
Performance/Acceptance tests @ STC (Standard Test Conditions) (free field; max 100m, bluetooth connection with SOLAR03 required)	• Voc and Isc	✔
	• Outcome (OK/NO)	✔
Continuity of protective earthing and/or equipotential bonding conductors with 200mA test current		✔
Insulation measurement (DUAL mode and TIMER mode with test voltage 250V, 500V, 1000V, 1500V)	• Module	✔
	• Array/string	✔
	• Whole field	✔
GFL (Ground Fault Locator)		✔
PV module datasheet data base		60 internal 150000 on PC
Memory		999 Test
Data transfer / Communication port		USB and WiFi
Graphic LCD		240 x 240 pxl
Help on line		✔
Buzzer		✔
Batteries	• 6 x 1.5V alkaline AA	✔
	• 6 x1.2V rechargeable AA	✔
Temperature range		-10°C – +50°C 14°F – 122°F
Waterproof		IP40

2. ELECTRICAL SPECIFICATIONS

Accuracy is calculated as ± [% readings + (no. of digits) * resolution] at 23°C ± 5°C, relative humidity <80%HR

2.1. DMM

DC Voltage

Range (V)	Resolution (V)	Uncertainty
3 ÷ 1500	1	± (1.0%rdg + 2dgt)

AC TRMS Voltage

Range (V)	Resolution (V)	Uncertainty
3 ÷ 1000	1	± (1.0%rdg + 3dgt)

Frequency range: 42.5 ÷ 69Hz ; Voltages zeroed for measured value <3V

2.2. COMMISSIONING TESTS

IV CHECK - DC Voltage @ OPC

Range (V)	Resolution (V)	Uncertainty
3.0 ÷ 1500.0	0.1	±(1.0%rdg + 2dgt)

Minimum VPN voltage to start the test: 15V

IV CHECK - DC Current @ OPC

Range (A)	Resolution (A)	Uncertainty
0.10 ÷ 40.00	0.01	±(1.0%rdg + 2dgt)

PV module stray capacitance: max 30uF

IV CHECK - DC Voltage @ STC

Range (V)	Resolution (V)	Uncertainty
3.0 ÷ 1500.0	0.1	±(4.0%rdg + 2dgt)

IV CHECK - DC Current @ STC

Range (A)	Resolution (A)	Uncertainty
0.10 ÷ 40.00	0.01	±(4.0%rdg + 2dgt)

GFL (Ground Fault Locator)

Test voltage DC [V]	Range [MΩ]	Resolution [MΩ]	Accuracy (*)	Position accuracy
250, 500, 1000, 1500	0.1 ÷ 0.99	0.01	±(5%rdg + 5dgt)	± 1module
	1.0 ÷ 19.9	0.1		
	20 ÷ 100	1		

Open voltage <1.25 x nominal test voltage
Short circuit current <15mA (peak) for each test voltage
Nominal measured current >1mA on R = 1kΩ x Vnom (with VPE, VNE= 0)
(*) For Accuracy the following constraints shall be considered:
Accuracy is indicated for VPN ≥240V, Rfault≥10Ω
Accuracy for Rp and R(+) is not declared if R(+)≥ 0.2MΩ and R(-) <0.2MΩ
Accuracy for Rp and R(-) is not declared if R(+) < 0.2MΩ and R(-) ≥0.2MΩ
Set limit threshold on measure 0.05MΩ, 0.1MΩ, 0.23MΩ ; Number of set modules: 4 ÷ 35

The GFL function allows obtaining correct results under the following conditions:

- **Test carried out with Vtest ≥Vnom on a single ungrounded string disconnected from the inverter and from possible arresters**
- **Test performed upstream of any blocking diode**
- **Single fault of low insulation located at any position across the string**
- **Insulation resistance of the single fault <0.23MΩ**
- **Environmental conditions similar to those in which the fault was reported**

2.3. SAFETY TEST

Continuity Test (RPE)

Range [Ω]	Resolution [Ω]	Uncertainty
0.00 ÷ 9.99	0.01	±(2.0%rdg+2dgt)
10.0 ÷ 99.9	0.1	
100 ÷ 1999	1	

Test current >200mA DC up to 2Ω (test leads included), Resolution 1mA, Test current uncertainty ±(5.0%rdg + 5dgt)
Open loop voltage 4 < V_0 < 10V

Insulation Test (MΩ) – Mode TIMER

Test voltage [V]	Range [MΩ]	Resolution [MΩ]	Uncertainty
250, 500, 1000, 1500	0.01 ÷ 9.99	0.01	±(5.0%rdg+ 5dgt)
	10.0 ÷ 99.9	0.1	

Open voltage: < 1.25 * nominal test voltage
Short circuit current: <15mA (peak) for all test voltages
Generated voltage Resolution 1V, uncertainty ±(5.0%rdg + 5dgt) @ Rmis> 0.5% FS
Test current > 1mA with load = 1kΩ x Vnom

Insulation Test (MΩ) – Mode DUAL

Test voltage DC [V]	Range [MΩ]	Resolution [MΩ]	Accuracy (*)
250, 500, 1000, 1500	0.1 ÷ 0.99	0.01	±(5.0%reading + 5digits)
	1.0 ÷ 19.9	0.1	
	20 ÷ 100	1	

Open voltage <1.25 x nominal test voltage
Short circuit current <15mA (peak) for each test voltage
Nominal measured current >1mA on R = 1kΩ x Vnom (with VPE, VNE= 0)
(*) For Accuracy the following constraints shall be considered:
Accuracy is indicated for VPN ≥240V, Rfault≥10Ω
Accuracy for Rp and R(+) is not declared if R(+)≥ 0.2MΩ and R(-) <0.2MΩ
Accuracy for Rp and R(-) is not declared if R(+) < 0.2MΩ and R(-) ≥0.2MΩ

3. GENERAL SPECIFICATIONS

DISPLAY AND MEMORY:	
Features:	graphic COG LCD 240x240 with backlight
Memory:	max 999 test, 3 levels of marker
Internal Data Base of PV module:	60
POWER SUPPLY:	
Internal:	6x1.5V type AA alkaline or 6x1.2V type AA NiMH rechargeable battery
External battery charger for NiMH batteries is required	
Battery life:	RPE: > 500 Test (RPE ≥ 0.1Ohm) GFL, MΩ: > 500 Test (Riso ≥ 1kΩ x VTest, 5sec on, 25s off) IVCK: > 500 Test (no SOLAR03, see a.m. conditions for RPE, MΩ)
OUTPUT INTERFACE	
PC communication:	USB and WiFi
SOLAR-03 communication:	BT communication (max distance 100m – outdoor free field)
MECHANICAL FEATURES	
Dimensions (L x W x H):	225 x 165 x 75mm; (9 x 6 x 3in)
Weight (batteries included):	1.2kg; (42 ounces)
Mechanical protection:	IP40
ENVIRONMENTAL CONDITIONS:	
Reference temperature:	23°C ± 5°C ; (73°F ± 41°F)
Operating temperature:	-10°C ÷ 50°C ; (14°F ÷ 122°F)
Allowable relative humidity:	<80%RH
Storage temperature:	-10°C ÷ 60°C ; (14°F ÷ 140°F)
Storage humidity:	<80%RH
Max. operating altitude:	2000m (6562ft)
GENERAL REFERENCE STANDARDS:	
Safety:	IEC/EN61010-1, IEC/EN61010-2-034
EMC:	IEC/EN61326-1
Safety of measurement accessories:	IEC/EN61010-031
Measurements:	IEC 60891, IEC/EN62446-1 (IVCK) IEC/EN 61557-1, 2, -4 (RPE, MΩ)
Technical documentation:	IEC EN 61187
Insulation:	double insulation
Pollution degree:	2
Overvoltage category:	CAT III 1500V to ground, Max 1500VDC, 1000V~ between inputs
Max. operating altitude:	2000m (6562ft)

This instrument satisfies the requirements of Directives:
RED: Directive 2014/53/EU, LVD: Directive 2014/35/EU, EMCD: Directive 2014/30/EU
RoHS: Directive 2011/65/EU, WEEE: Directive 2012/19/EU