1 GENERAL DESCRIPTION

PVCHECKs-ONE: The All-in-One Frontline Testing Solution

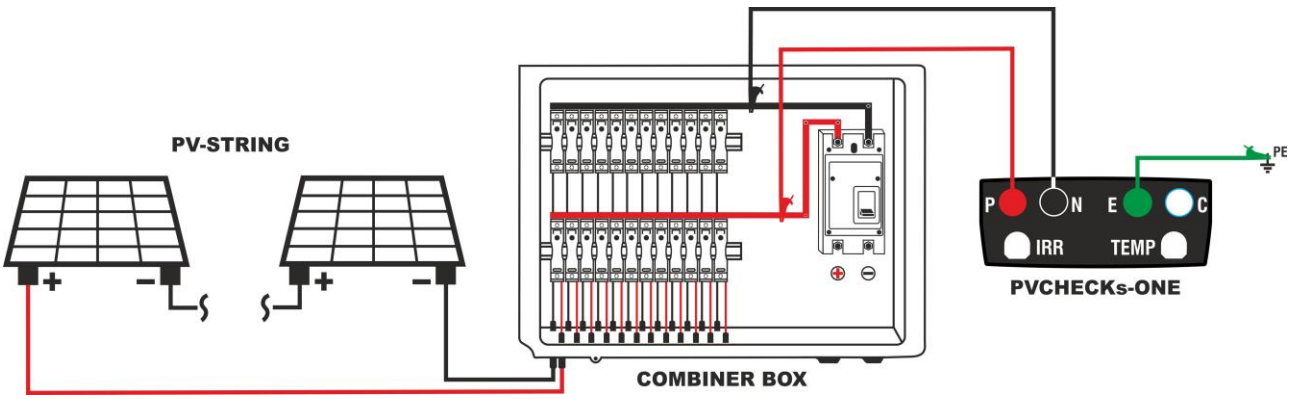
The PVCHECKs-ONE is a comprehensive, all-in-one meter designed to support the **commissioning**, **verification**, and **troubleshooting** of photovoltaic (PV) installations. Combining high-performance measurement capabilities with advanced diagnostic functions, it enables technicians to quickly assess system integrity, identify issues, and ensure reliable operation.

Thanks to its cutting-edge technology, technicians can easily perform commissioning tests in full compliance with **IEC/EN62446-1** Category 1 requirements, while efficiently identifying ground faults during troubleshooting. With its fully automated test sequences, PVCHECKs-ONE ensures comprehensive certification of the performance and safety of both Monofacial and Bifacial PV modules. The instrument also introduces two innovative features that further enhance testing experience and operational efficiency:

- **AUTOSTART/AUTOSAVE** function
- Insulation testing on PV strings **with DC optimizers**

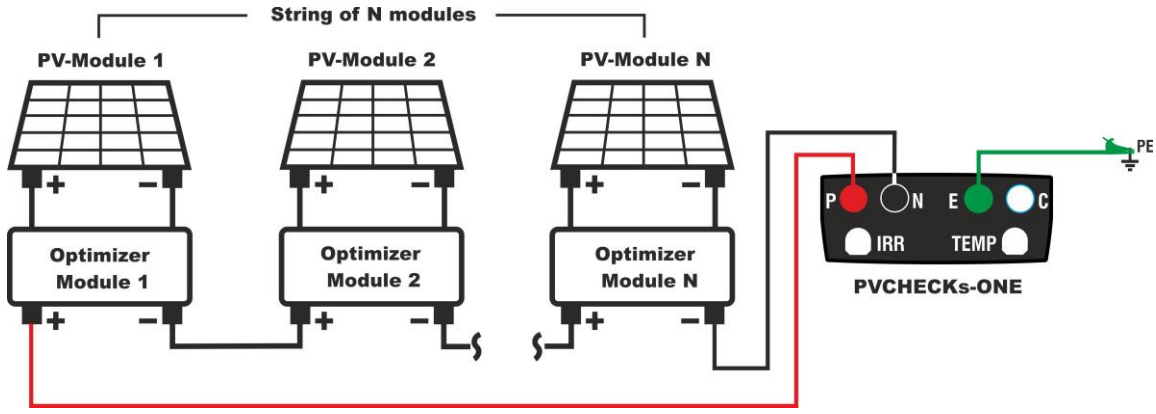
AUTOSTART & AUTOSAVE FUNCTION

The automatic sequential testing is engineered to maximize the throughput by reducing the time needed to test each PV string. PVCHECKs-ONE connects directly to the bus bars inside the combiner box, allowing seamless operation. Starting with all string fuses or switches open, the technician simply enables one string at a time. As soon as PVCHECKs-ONE detects voltage at its inputs, it **automatically** initiates the test sequence—performing the five measurements required by IEC/EN62446-1 and storing all results in its internal memory. When the fuses or switches of the tested string are reopened and those of the next string are closed, PVCHECKs-ONE immediately begins the next test cycle. **No manual action is required**; the instrument handles the entire process autonomously for fast, reliable, and efficient testing.



INSULATION TESTING ON PV STRINGS WITH DC OPTIMIZERS

PVCHECKs-ONE offers an innovative capability that allows insulation resistance testing on PV strings equipped with **DC optimizers**, **without the need for disconnection**. Fully compliant with NEC § 690.12 Rapid Shutdown optimizer guidelines, this feature enhances the instrument's versatility while ensuring safety and performance in modern PV installations that incorporate advanced power electronics.



PVCHECKs-ONE: commissioning tests – functionality

During system commissioning, verifying the integrity of PV modules and strings is essential for correct installation, safe operation, and long-term performance. The **PVCHECKs-ONE**, compliant with **IEC/EN 62446**, performs detailed checks by measuring open-circuit voltage (**Voc**) and short-circuit current (**Isc**) up to **1000 V / 30 A**. It supports several operating modes to match different testing needs:

1. **Quick comparative testing** (without environmental measurements)
   - Compares the tested string with the average of previously measured results, providing a simple **OK/NOT OK** evaluation.
   - Ideal for quick **troubleshooting** and verifying string uniformity under similar conditions.
2. **Functional Verification with environmental compensation** (without SOLAR03)
   - For monofacial modules, PVCHECKs-ONE directly measures **irradiance** and **temperature**, extrapolating results to Standard Test Conditions (**STC**).
   - Compares measured performance against nominal module values stored in the internal database to determine an **OK/NOT OK** status.
   - Enables accurate commissioning checks without extra equipment.
3. **Advanced functionality testing with SOLAR03** (monofacial & bifacial modules)
   - The SOLAR03 remote unit records irradiance and module temperature data, transmitting them wirelessly to the PVCHECKs-ONE in real time or storing them for later transfer.
   - Data are then used for STC extrapolation and comparison with nominal values.
   - Provides the most accurate performance verification, especially for bifacial module installations or when environmental conditions vary.

Through these comprehensive test modes, **PVCHECKs-ONE** ensures that all PV modules and strings operate as intended, supporting **reliable commissioning**, **accurate diagnostics**, and **effective troubleshooting** from day one.

PVCHECKs-ONE: commissioning and re-commissioning tests – safety

The **PVCHECKs-ONE**, fully compliant with **IEC/EN 62446 Category I** testing standards, offers a comprehensive suite of features designed to ensure the **safe, efficient, and reliable commissioning and re-commissioning** of photovoltaic (PV) installations.

1. Insulation Testing (DUAL Mode)

Perform insulation tests on an entire PV field, a single PV string, or an individual PV module in just **~40 seconds**.

- Provides **global insulation resistance** measurements as well as **separate values** for the positive and negative poles.
- The innovative **DUAL mode** eliminates the need for external switches to short-circuit the terminals, ensuring **fast, safe, and streamlined operation**.
- Ideal for **commissioning and troubleshooting**, helping identify insulation issues early in the system lifecycle.

2. Insulation Testing (TMR Mode)

The **TMR mode** enables continuous insulation resistance testing on **non-live cables**, with a selectable duration up to **999 seconds**.

- Measures insulation resistance over time and automatically calculates **Dielectric Absorption Ratio (DAR)** and **Polarization Index (PI)** when test duration permits.
- This mode provides valuable insight into the **quality and stability of insulation**, supporting **predictive maintenance** and in-depth **diagnostic troubleshooting**.

3. Electrical Bonding Continuity Test

Verifies the **continuity of protective and equipotential bonding conductors** throughout the PV system.

- Ensures compliance with **safety and grounding standards**, confirming proper installation and electrical safety integrity.
- A crucial step in both **commissioning** and **re-commissioning** to guarantee system safety and long-term reliability.

PVCHECKs-ONE: Quickly Pinpoint Ground Faults with the GFL Function

The **Ground Fault Locator (GFL)** function, developed through continuous innovation by HT Instruments, enables **precise identification and troubleshooting of insulation faults** within PV strings. These faults are often caused by issues such as moisture ingress, water leakage, or aging of insulation materials. As the PV industry evolves introducing higher-power, larger-area modules, the risk of minor insulation issues has increased. The GFL function is designed to meet these new challenges, providing **fast, accurate, and reliable fault localization** in the field. Key advantages include:

- **Targeted troubleshooting:** Rapidly identifies and locates insulation faults along the PV string, streamlining maintenance operations.
- **High sensitivity:** Detects insulation resistances as low as 1 MΩ, ensuring early fault detection before major performance losses occur.
- **Reduced downtime:** Enables technicians to perform efficient on-site diagnostics and corrective actions.
- **Enhanced system reliability:** Minimizes safety risks and performance degradation caused by hidden ground faults.

With its advanced diagnostic and troubleshooting capabilities, **PVCHECKs-ONE** is an essential tool for maintaining **optimal performance, safety, and reliability** across all types of PV installations.

2 GENERAL FEATURES

FEATURES	NOTE
Measurement category	CAT III 1000V Max 1000VDC/AC between inputs
PV module Type: all most common types of Monofacial and Bifacial	✔
Voltage range	15V ÷1000VDC/AC
Current range	0.1A ÷ 30ADC
DMM (Input voltages)	✔
Direct Environmental parameters measurement ➢ Irradiance measurement ➢ PV Module Temperature measurement	HT305 reference cell and PT305 temperature probe required
Wireless environmental parameters (within Bluetooth range) ➢ Irradiance measurement (PV Monofacial or Bifacial modules) ➢ PV Module temperature measurement	(HT305, PT305 and Bluetooth connection with SOLAR03 required)
Commissioning test: ➢ Open loop voltage (Voc) OPC (Operating conditions) e STC (standard condition) ➢ Short circuit current (Isc) @ OPC (Operating conditions) e STC (standard condition) ➢ PV module, String, Field Insulation measurement (DUAL mode and TMR mode with Test voltage 250V, 500V, 1000VDC) ➢ Electrical bonding Continuity Test (200mA Test current) ➢ Final outcome (OK/NOT OK)	For STC measurements the HT305 irradiance sensor and PT305 temperature probe must be either: ➢ Directly connected to the PVCHECKs-ONE inputs, or ➢ Connected via Bluetooth through the SOLAR03 interface)
Ground Fault Locator (GFL) function (Insulation ≤1MΩ)	✔
Optimizer insulation test (with or without rapid shutdown)	✔
PV module Datasheet Data Base (DB) used as reference for STC measurements	max 64 module internal Database
Memory for test results	999 Test
Data Transfer / Communication Port	Optical to USB cable and WiFi
Graphic LCD	240x240
Help on line	✔
Backlight	✔
Buzzer	✔
Batteries	6 x 1.5V alkaline 6x1.2V external rechargeable batteries
Environmental conditions of works	-10°C ÷ 50°C
Mechanical protection	IP40

3 ELECTRICAL SPECIFICATIONS

Accuracy is calculated as ± [% readings + (digits * resolution)] at 23 °C ± 5 °C, relative humidity <80%RH

3.1 COMMISSIONING TESTS

Continuity test of bonding earths (RPE)

Range [Ω]	Resolution [Ω]	Accuracy
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 Accuracy ±(5.0%rdg + 5dgt
Open loop voltage: 4 < V_0 < 10V

PV Module Type

All most common types of photovoltaic module Monofacial and Bifacial

IV CHECK - DC Voltage @ OPC

Range (V)	Resolution (V)	Accuracy
3.0 ÷ 1000.0	0.1	±(1.0%rdg+2dgt)

Minimum VPN voltage to start the test: 15V

IVCK test - DC Current @ OPC

Range (A)	Resolution (A)	Accuracy
0.10 ÷ 30.00	0.01	±(1.0%rdg+2dgt)

IVCK test - DC Voltage @ STC

Range (V)	Resolution (V)	Accuracy
3.0 ÷ 1000.0	0.1	±(4.0%rdg+2dgt)

IVCK test - DC Current @ STC

Range (A)	Resolution (A)	Accuracy
0.10 ÷ 30.00	0.01	±(4.0%rdg+2dgt)

Insulation Test (MΩ) – TMR mode

Test voltage [V]	Range [MΩ]	Resolution [MΩ]	Accuracy
250, 500, 1000	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, Accuracy ±(5.0%rdg + 5dgt) @ Rmis> 0.5% FS
Test current: > 1mA with load = 1kΩ x Vnom

Insulation Test (MΩ) – DUAL mode

Test voltage DC [V]	Range [MΩ]	Resolution [MΩ]	Accuracy (*)
250, 500, 1000	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)
Set limit threshold on measure: 0.05MΩ, 0.1MΩ, 0.23MΩ, 0.25MΩ, 0.50MΩ, 1.00MΩ
(*) 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

OPT (Optimzer Insulation Test)

Test voltage DC [V]	Range [MΩ]	Resol. [MΩ]	Accuracy
250, 500, 1000	0.1 ÷ 0.99	0.01	±(5%rdg + 10dgt)
	1.0 ÷ 19.9	0.1	
	20 ÷ 200	1	

Open circuit voltage	<1.25 x rated test voltage
Insulation Test Short-circuit current	<15mA (peak) for each test voltage
Insulation Rated test current	> 1mA on R = 1kΩ x Vnom (with VPN, VPE, VNE= 0)
Insulation Measuring limit:	0.10, 0.25, 0.60, 1.00, 100, 200 MΩ
Number of optimizers:	1 ÷ 60
Optimzer:	Max circuit current allowed in RSD (Rapid ShutDown) mode: 1A

3.2 TROUBLESHOOTING TOOLS

GFL (Ground Fault Locator)

Test voltage DC [V]	Range [MΩ]	Resol. [MΩ]	Accuracy (*)	Position accuracy (*)
250, 500, 1000	0.1 ÷ 0.99	0.01	±(5%rdg + 5dgt)	±1 module (NMOD≤35) ±3 modules (NMOD>35)
	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)
Set limit threshold on measure	0.05MΩ, 0.1MΩ, 0.23MΩ, 0.25MΩ, 0.50MΩ, 1.00MΩ
Number of set modules:	4 ÷ 60

(*) 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

The GFL function allows obtaining correct results with the following conditions:
- **Test carried out with Vtest ≥Vnom on a single string disconnected from the inverter, from possible arresters and from earth connections**
- **Test performed upstream of any blocking diodes**
- **Single fault of low insulation located at any position in the string**
- **Insulation resistance of the single fault <= 1.00MΩ**
- **Environmental conditions similar to those in which the fault was reported**

3.3 DMM FEATURE

DC Voltage

Range (V)	Resolution (V)	Accuracy
3 ÷ 1000	1	± (1.0%rdg + 2dgt)

AC TRMS Voltage

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

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

4 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:	max 64
POWER SUPPLY:	
Power supply:	6x1.5V type AA alkaline or 6x1.2V type AA NiMH rechargeable battery (external battery charger for NiMH batteries is required)
Battery life (Environ. Temp = 20°C):	RPE: >500 Test (RPE >= 0.1Ohm) GFL, MΩ: >500 Test (Riso >=1kΩxVTest, 5sec on, 25s off) IVCK: > 500 Test (no SOLAR03, see conditions above for RPE, MΩ)
OUTPUT INTERFACE	
PC communication:	optical-USB and WiFi
SOLAR03 communication:	Bluetooth (range up to 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 ; (32°F ÷ 104°F)
Allowable relative humidity:	<80%RH (non condensing)
Storage temperature:	-10°C ÷ 60°C ; (14°F ÷ 140°F)
Storage humidity:	<80%RH (non condensing)
Max. operating altitude:	2000m (6562ft)
GENERAL REFERENCE STANDARDS:	
Safety:	IEC/EN61010-1, -2-030, -2-033, -2-034
EMC:	IEC/EN61326-1, IEC/EN61326-2-2
Safety of measurement accessories:	IEC/EN61010-031
Measurements:	IEC 60891, IEC/EN62446-1 (IVCK), IEC 60904-1-5, IEC/EN 61557-1,-2,-4 (RPE, MΩ)
Technical documentation:	IEC EN 61187
Insulation:	double insulation
Pollution degree:	2
Overvoltage category:	CAT III 1000V to ground, Max 1000VDC, 1000VAC between inputs
Max. operating altitude:	2000m (6562ft)
Radio	
RED directive:	ETSI EN300328, ETSI EN301489-1, ETSI EN301489-17

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