XENIT by ATEX

MADE IN ITALY

APID

The APID range is a family of XENIT products designed to **repower photovoltaic installations** with P or N-Type cells affected by PID, and **prevent** PID in new installations.

XENIT.IT

Xenit is a division of ATEX INDUSTRIES for Photovoltaic and Safety.

P.I.D

One of the causes of power loss in PV installations

The series of APID devices:

- Repowers photovoltaic installations affected by PID.
- Prevents **power loss** in new installations.
- Solves the problem of **revamping** on installations with N-Type modules.
- Indicative timescale for return on investment **(ROI) of 80 days on a 1Mw installation.**
- **Easy to install**, approximately 30 minutes.
- APP for **remote management**.

For more information on P.I.D. visit xenit.it/en/repowering

Main causes of P.I.D. and types of installation at risk

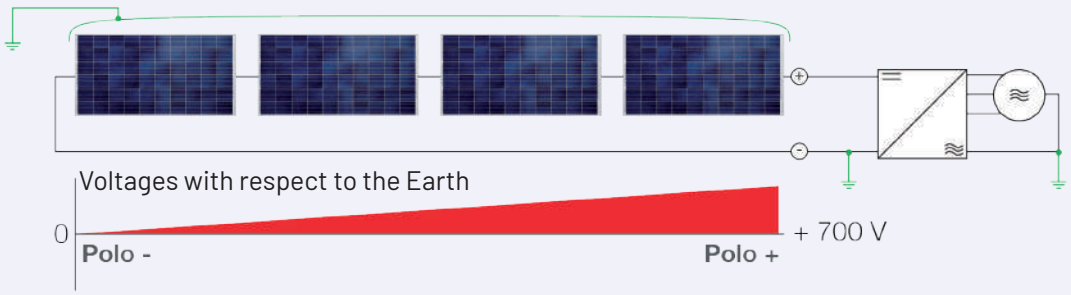
1. Use of new generation of Transformerless inverters on P-TYPE modules.

In **photovoltaic systems installed before 2008**, the negative pole (or positive, depending on the type of cell) of the strings is **connected to the ground**.

This connection, however, is **no longer compatible with the structure of the new generation of Transformerless inverters** (without an isolation transformer) because it would create a short circuit to the ground. This causes the string voltage to "centre" itself on the zero potential of the ground during operation of the inverter.

If, between the positive and the negative of a string, we have 700V, the positive pole of the string will be at about +350V with respect to the ground, whilst the negative pole will be at about -350V. The voltages may be different due to asymmetries resulting from the design of the inverter but the principle remains the same. These high voltages on the poles trigger **eddy currents that cross the entire module, to the point of causing the photovoltaic PID effect**. It is important to specify that the solar modules are certified for positive operating voltages of 1000V DC and not for negative voltages.

Optimal situation with isolation transformer



Installation at risk of P.I.D. without isolation transformer

2. Replacing the inverter on installations with N-TYPE modules.

In N-Type modules, which need to ground the positive pole, **the problem is the replacement of the inverters**. This is because in the models currently installed, it is **not possible to place the positive on the ground**. Hence the reason behind PID, which leads to a decrease in the power of the solar panel.

Other causes of P.I.D. include

- High **temperatures** and **humidity**.
- PV systems with **high string voltages**.
- **Quality** of the PV module.
- **Frame and metal structure** of the PV modules **connected to the ground**.

PID-Free
and High PID Resistance modules

are not immune to PID and can degrade by up to 5%

The regulation states that a module is PID-Free or High PID Resistance if it passes the IEC 62804 standard test.

IEC 62804
STANDARD

<5%
Power loss

Test conditions

Applied voltage	100V
Relative humidity	85 ±5%
Temperature	85°C
Test duration	3 cycles of 96 hours

P.I.D. Free

Modules are considered as "P.I.D. Free" or as having "High P.I.D. Resistance" when, following testing, there is a **loss of less than 5% and no serious defects are detected**.

Find out how APID protects your investment even on new installations.

Example of consequences on a new system with PID-FREE modules, with an estimated loss of 4.9%, and the effect obtained using APID.

Power	Radiation	Rate in kWk	PID degradation	Duration
2.000 kWp	**1100kWh/kWp**	**0,1€**	**4,9%**	**20 years**

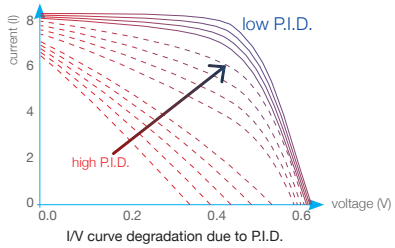
How to find out that a PV system is affected by P.I.D.

An abnormal loss of power not due to normal ageing of the modules is indicative of PID. To obtain this information, the PV system must be properly monitored.

Unlike other causes of deterioration, P.I.D. is the only one that, if stopped in time, allows the photovoltaic system's performance to be restored and recovered.

Checking with a digital multimeter

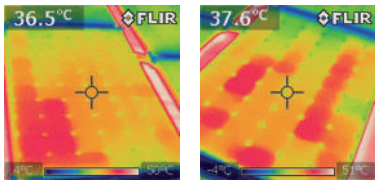
During production, the percentage difference between the working voltages of the last PV modules on the negative and positive side. This system is to be used when it is not possible to use one of the other 3 indicated.



I/V curve degradation due to P.I.D.

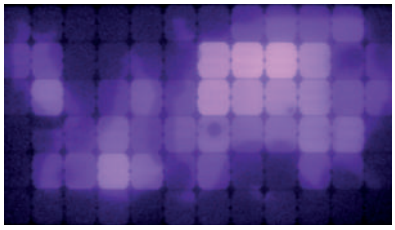
Checking with IV Curve Calculator

Disconnect the suspect modules from the negative side of the system, take the measurement and compare the IV curve with the nominal curve in the module data sheet. An example of the correct interpretation of the measurement made and the possible degradation is shown here.



Checking with Thermal camera

If it is P.I.D., we will see photos similar to these.
Yellow cells, cooler = healthy
Red cells, warmer = affected by P.I.D.



Test with Electroluminescence

This type of test must be carried out at night. In the photo the cells affected by P.I.D. are off, the black colour highlights the short-circuit state. Dark areas show the development of the phenomenon, whereas healthy ones have a bright uniform colour.

Effects of P.I.D.

Technical effects

1. **P.I.D. polarisation** causes the mono-pole – or crystalline – photovoltaic cells with **P-Type/N-Type** technology to switch off. It can be inverted by promptly installing an anti-P.I.D. device from the APID series.

2. **Electro-corrosion of the TCO** – a phenomenon resulting from an electrochemical reaction between the humidity and the sodium inside the cover glass of the modules – is caused by the leakage of currents between cells and the ground. **The damage is irreversible** and necessitates the replacement of the modules.

Economic damage

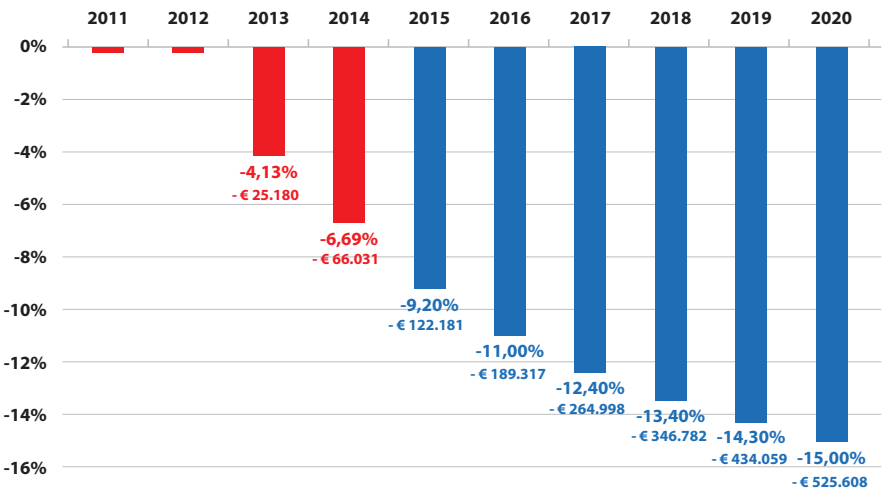
The degradation and loss of power of the photovoltaic system can upset the business plan conceived in the design phase of a photovoltaic system, with very serious and exponential economic consequences.

An Italian example

Below is an example of economic damage caused by P.I.D.
Here, we see a 1MW photovoltaic system installed at one of our Italian customers, where the degradation from PID reached 6.69% in two years, with economic damage of €66,000. If the APID had not been installed, by 2020 the percentage of power loss would have reached -15%, with a total economic loss of €525,000.
In this case the timescale for return on investment (ROI) for purchasing the APID was approximately 80 days.

Analysis of a photovoltaic system with APID

System power loss and economic damage*



RED LINE
loss before revamping

BLUE LINE
presumed loss without revamping

*Example of economic damage caused by Potential Induced Degradation. 1MW photovoltaic system installed at one of our Italian customers, where the degradation from PID – which began in 2012 – reached 6.69% in two years, with economic damage of €66,000. If the APID had not been installed in 2014, by 2020 the percentage of power loss would have reached -15%, with a total economic loss of €525,000.

APID

The solution to photovoltaic P.I.D.

Using **APID** devices (for modules with P-TYPE cells) or **APID-NG** (for modules with N-TYPE cells), guarantees the protection of PV systems from power losses.

APID is a universal voltage generator (max. 1000V) developed **for the restoration of modules affected by photovoltaic P.I.D.** and for the **prevention** of the onset of the phenomenon in those at risk. In systems that have been installed for some time, it recovers up to 100% of lost power and protects new systems from the photovoltaic P.I.D. effect, from their first day of operation.

APID
for P-TYPE cells

APID 3
for P-TYPE cells

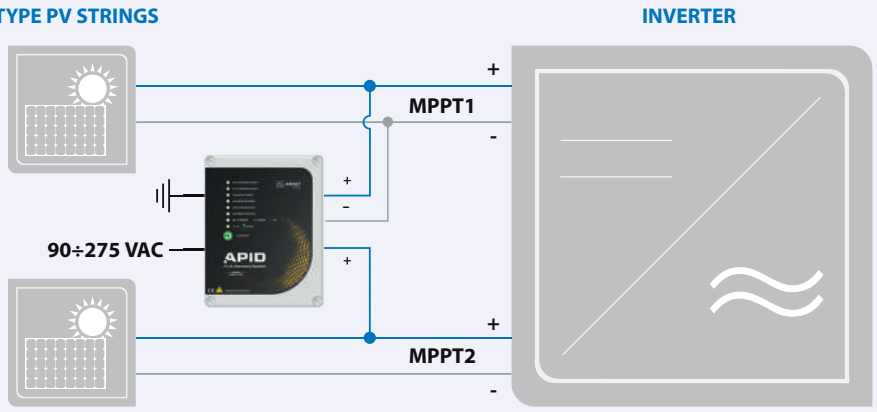
APID NG
for N-TYPE cells

APID series

Connection diagrams

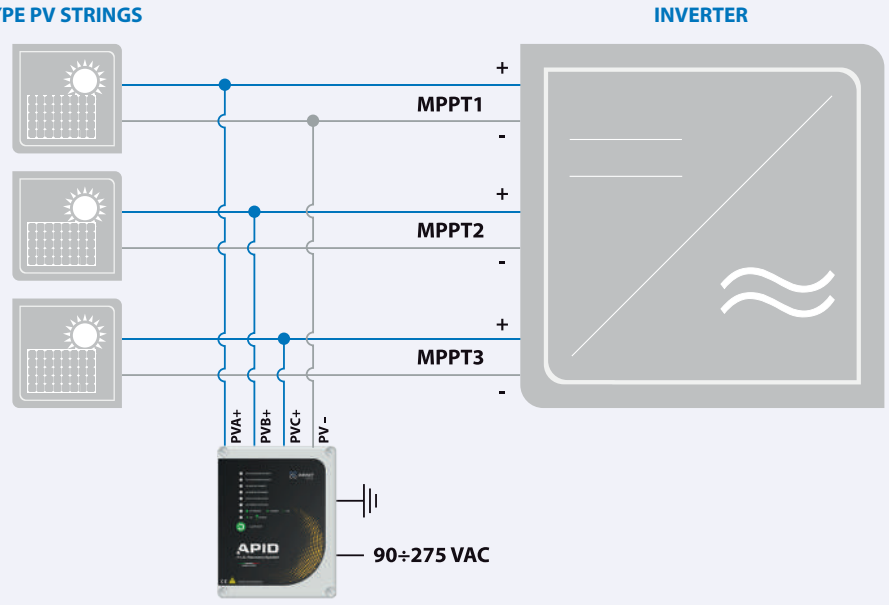
APID

system with
2 MPPT outputs

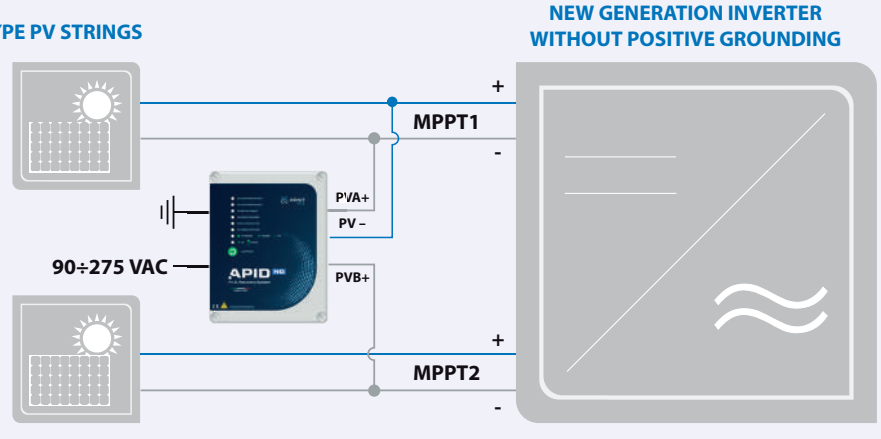


APID-3

system with
3 MPPT outputs



APID-NG

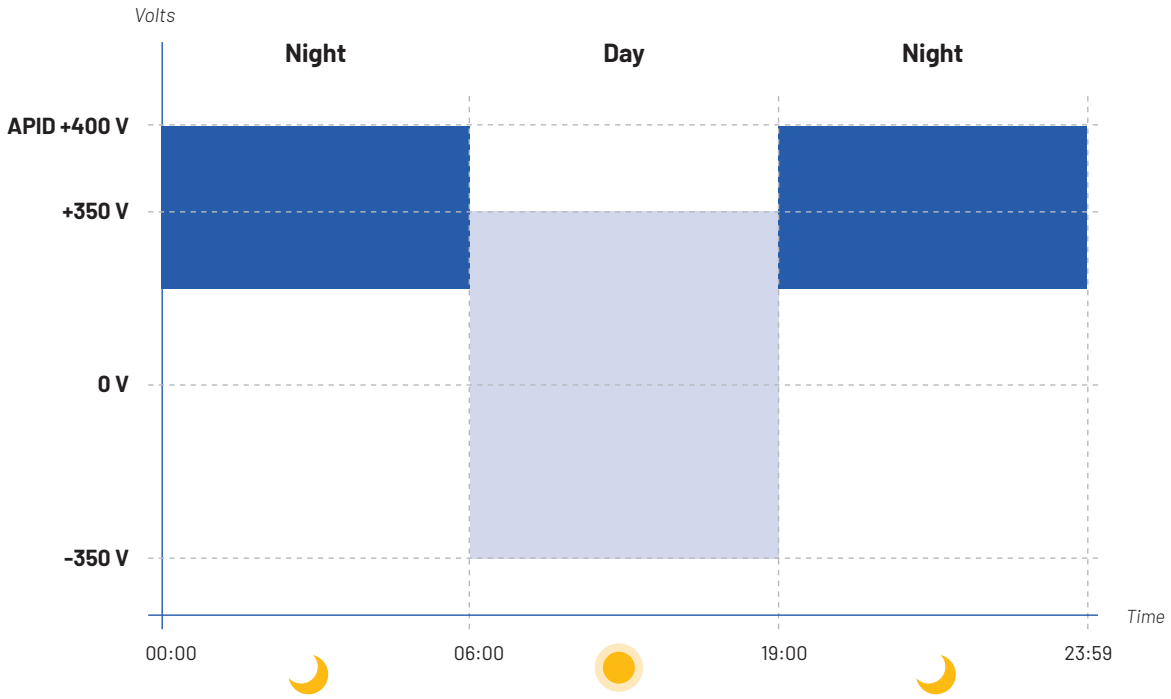


APID/APID³

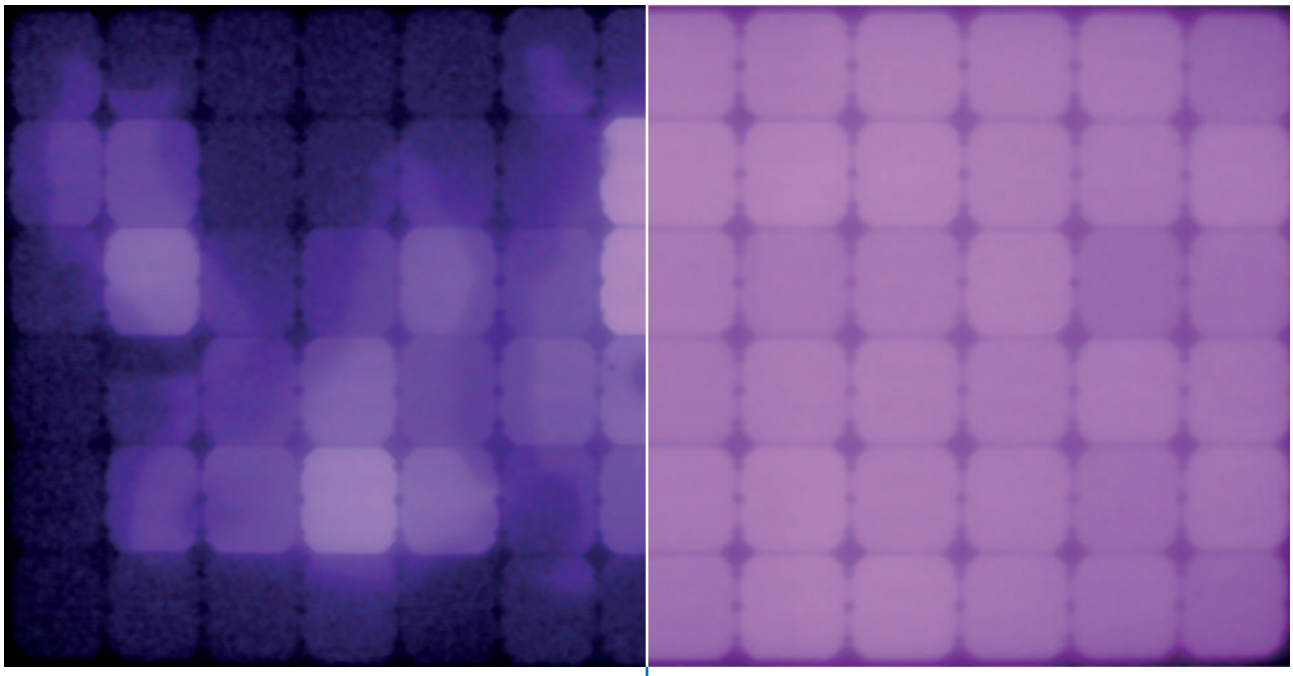
How it works

During the day
Operating mode: standby
Monitoring: voltage on MPPT input
Archive: historical storage

Overnight
Recovery of power (on existing system)
PID prevention (on new system)
Monitoring: operation of the APID generator, string voltage, insulation resistance



Result of treatment



Module
affected by PID

Module
regenerated with APID

Operation and benefits

Prevention

Prevents photovoltaic P.I.D., from the first day of life. APID-NG also enables the inverter to be replaced without having to change all the N-Type PV modules, preventing the onset of P.I.D.

Profitability

Stops the economic damage caused by Potential Induced Degradation and ensures the profitability of the photovoltaic system.

Power

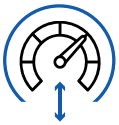
Stops the loss of power in the photovoltaic system.

Regeneration

Regenerates the power of photovoltaic systems by up to 100% in around 30 days.

Protection

Immediately protects new systems with "P.I.D. Free" modules from a possible drop in power by up to 5%.



Resistance

Measures the insulation resistance.

80-day ROI

Indicative timescale for return on investment (ROI), on a 1Mw installation for example, of 80 days.

Quick installation

Easy to install, approximately 30 minutes.

	APID	APID 3	APIDNG
FOR PV MODULES WITH CELLS	P-TYPE	P-TYPE	N-TYPE
MPPT OUTPUTS	2	3	2
POWER	90...275 Vac		
ABSORPTION	< Standby 0.5w Operation 2W, Maximum 20W		
INTERNAL GENERATOR	Voltage with output resistance of 165K Max. 1000 Vdc output power 2.7mAMax at 1000v – 3.9mA Max. at 800v – 6.3mA Max. at 400V – 8mA in short circuit		
AUTOMATIC MANAGEMENT OF OPERATION AND OUTPUT VOLTAGE	✓		
RELAY OUTPUT WITH NC AND NA CONTACTS FOR ALARM SIGNALLING	✓		
CLOCK/CALENDAR WITH 6 MONTHS BACKUP	✓		
ANTI-CONDENSATION VALVE	ØM12 F16 litres/hour at 0.07 bar		
CONNECTIONS TO STRINGS	MC4		
OPERATING TEMPERATURE	-20 °C/+50 °C		
WEIGHT	950 g		
CONTAINER TYPE	IP56		
DIMENSIONS (L X H X D)	240 x 190 x 90 mm		

	LCDAM08
Display	LCD 16x2 backlit with 4 keys
BUTTONS	4: Prog-Exit-Up-Down
CONTAINER	6 Modules, fastened with DIN rail or wall mounted
OPERATING TEMPERATURE	From -10°C to +50°C
DIMENSIONS (L X H X D)	105 x 110 x 65 mm
WEIGHT	180 g

XENIT
by ATEX

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