

PID

KILLER.

OUR PARTNERS



More: www.padcon.com

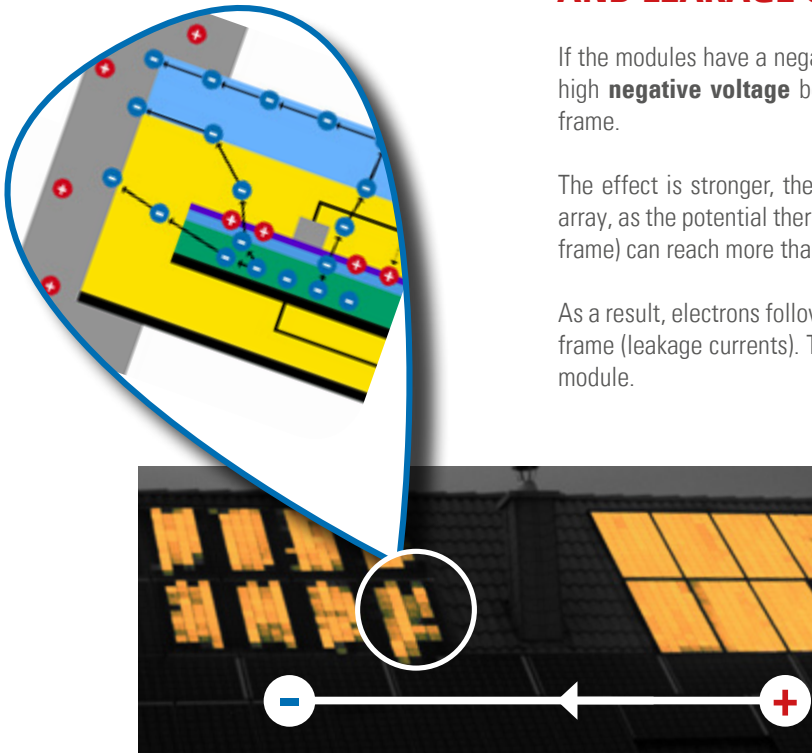
PID - WHAT'S THAT?

A DEGRADATION CAUSED BY POLARIZATION AND LEAKAGE CURRENTS IN THE PV MODULE

If the modules have a negative potential to earth in operation, there is an equally high **negative voltage** between the cells of the PV module and the aluminum frame.

The effect is stronger, the closer the module is to the **negative pole** of the PV array, as the potential there (and thus the voltage between cells and the aluminum frame) can reach more than half the amount of the array voltage.

As a result, electrons follow this electric field and finally flow out via the aluminum frame (leakage currents). The result is an increasing charge (**polarization**) of the module.



✘ CAUSES

- ✘ The quality of your modules (e.g. the material composition).
- ✘ The system configuration (e.g. the length of the module strings, the inverter type).
- ✘ Climatic conditions (High ambient temperature, high irradiation, high humidity, ...).

▶ CONSEQUENCES

- ▶ Falling performance of your photovoltaic system by up to 50% in a very short time.
- ▶ Permanent damage to the photovoltaic modules.
- ▶ Earnings losses and declining returns can put your loan repayment at risk.

✔ SOLUTION

- ✔ Increasing the entire PV generator to a high positive potential relative to the earth potential by using the Float Controller.
- ✔ Use of PV system monitoring for the continuous supervision of earnings.

📈 OUTCOME

- 📈 Immediate PID protection for your photovoltaic system.
- 📈 Regeneration of your pv-installation on up to 100% of the nominal capacity.
- 📈 Securing your returns.

pv magazine
PHOTOVOLTAIK, MÄRKTE & TECHNOLOGIE

„In principle PID can occur with every producer“.

Source: www.pv-magazine.de

TÜVRheinland®
Genau. Richtig.

TÜV Rheinland names PID as the “number one earnings killer”.

Source: www.photovoltaikeforum.com

PI PHOTOVOLTAIK-INSTITUT BERLIN

PID on solar modules is ever more frequently identified as the cause of performance and earnings problems in power plants.

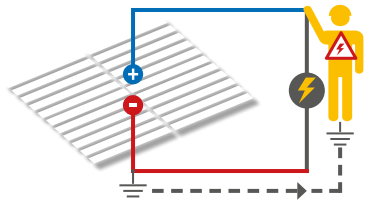
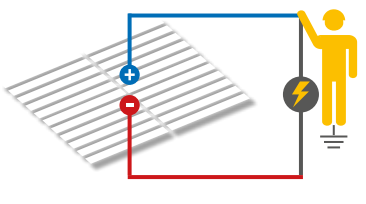
Source: www.pi-berlin.com

Fraunhofer
CSP

Only a mere third of the modules passed the test.

Source: www.csp.fraunhofer.de

» THERE ARE TWO WAYS TO PROTECT YOUR PLANT AGAINST PID BUT JUST **ONE** REASONABLE «

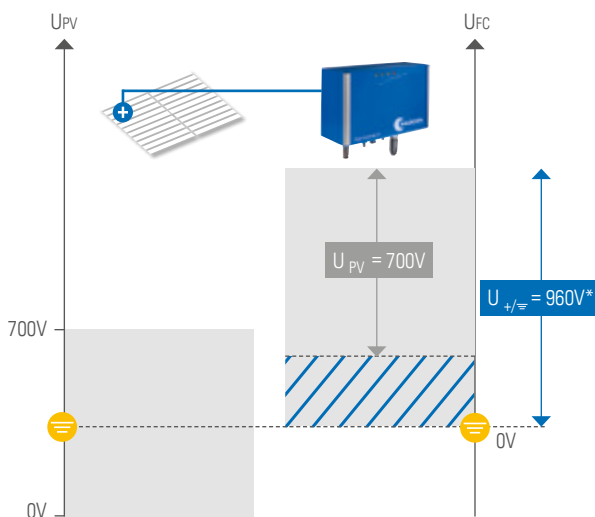
	GROUNDING / GFDI	PADCON FLOAT CONTROLLER
PID prevention	✓	✓
PID recovery	partially	✓
Easy to retrofit	✓	✓
Inverter independent	✓	✓
Single-fault tolerance	-	✓
String inverters	-	✓
Central inverters	✓	✓
Leakage current - monitoring	-	✓
Personal Safety	 <p>DANGER TO LIFE AND LIMB</p>	 <p>EASY AND SAFE</p>

» RECOVER EXISTING PLANTS, PROTECT NEW PLANTS FROM THE VERY BEGINNING «

	DAYTIME OPERATION	NIGHTTIME OPERATION	
EXISTING PV PLANTS	Stop Loss (thin-film modules)	Recovery (crystalline modules)	STAKEHOLDER INTERESTS INVESTOR: Protection of asset and expected revenues FINANCING INSTITUTE: Protection of refinancing TECHNICAL ADVISOR: Technical Due Diligence ASSET MANAGER/O&M: Bonus-malus system
NEW PV Plants	PID Protection (crystalline & thin-film modules)	Recovery of daily loss (crystalline modules)	

DAY MODE (FLOAT CONTROLLER CI)

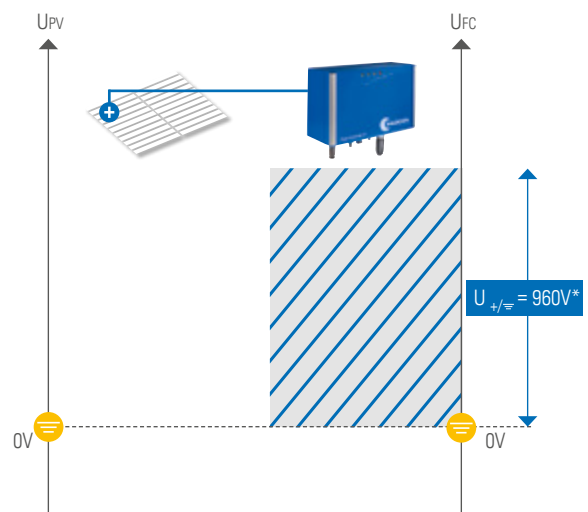
The **Float Controller CI** also offers the possibility of daytime operation. By increasing the positive potential to max. 960V, the modules have no negative potential relative to earth during operation and are therefore in a permanently safe condition due to that PID and TCO can be prevented from happening. Especially for construction of new PV plants this functionality offers big advantages, exceptionally by using thin film modules.



*Default values (individually configurable)

NIGHT MODE (FLOAT CONTROLLER CI & SI)

As soon as the generator voltage drops below a defined threshold value in the evening, the **Float Controller** increases the PV field to a high, positive potential thus reversing the polarisation effect that arises during operation. When the generator voltage rises again over a defined threshold value in the morning, the **Float Controller** automatically switches to standby mode. Both the threshold values and the maximum output voltage can be individually adapted.

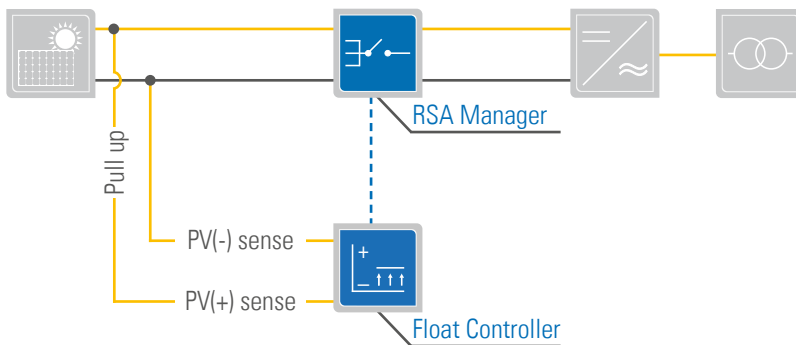
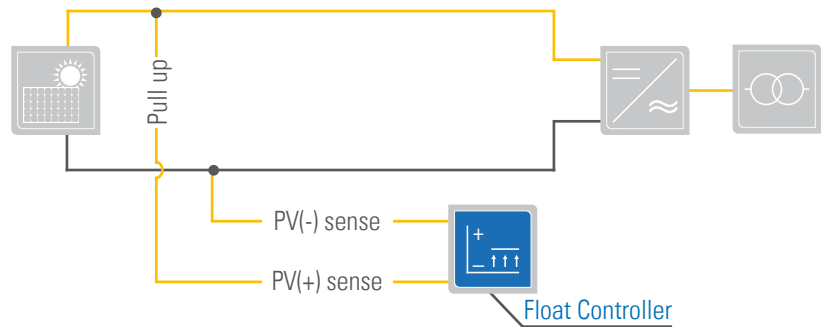


*Default values (individually configurable)

TECHNICAL SPECIFICATIONS

PARALLEL OPERATION

- Easy and fast installation
- Approved by many inverter manufacturer
- Day & night mode possible



SERIAL OPERATION

- RSA Manager separates PV array
- Inverter independent recovery with maximum voltage
- Master-Slave mode possible

General Information	FLOAT CONTROLLER CI70	FLOAT CONTROLLER CI30	FLOAT CONTROLLER SI
Operation mode	Day or night mode / Adjustable thresholds	Day or night mode / Adjustable thresholds	Night mode / Adjustable thresholds
MPPT / device	1-20*	1-20*	1-3
Rise in potential (to ground)	≤ 960 VDC	≤ 960 VDC	≤ 960 VDC
Minimum insulation resistance of PV plant	15 kΩ	35 kΩ	300 kΩ
Input parameters			
Supply voltage	24 VDC	24 VDC	24 VDC
Power input	max. 100 W	max. 50 W	max. 4 W
Protection	6,3 A	6,3 A	1,6 A
Measurement PV-	MC4 plug	MC4 plug	Screw connection / screwing M16 / 6mm ²
Measurement PV+	MC4 socket	MC4 socket	Screw connection / screwing M16 / 6mm ²
Output parameters			
PV+ Pull up	MC4 socket	MC4 socket	Screw connection / screwing M16
Rated output voltage	≤ 1000 VDC	≤ 1000 VDC	≤ 1000 VDC
Rated output current	≤ 70 mA	≤ 30 mA	≤ 3,5 mA

PID KILLER

FLOAT CONTROLLER CI

MODULE PROTECTION TO FIGHT THE PID-EFFECT AND TCO-CORROSION

The **Float Controller CI** is designed for larger PV plants with system voltages from 1000V to 1500V and is the perfect solution for central or string inverters.



FLOAT CONTROLLER SI

MODULE PROTECTION TO FIGHT THE PID-EFFECT

PV plants with string inverters or small central inverters can easily be protected by **Float Controller SI**. This device handles up to 110kWp and is operating only during inverter inactivity.



YOUR BENEFITS AT A GLANCE



FLOAT CONTROLLER CI

- // Ideal for central or string inverters
- // Connection of up to 20 MPPTs per device thanks to Multi Connector
- // Day or night mode selectable

FLOAT CONTROLLER SI

- // Especially designed for string inverters
- // Connection of up to 3 MPPTs per device
- // Handles up to 110kWp

SUCCESS STORIES

ISRAEL // FLOAT CONTROLLER CI

PV-PLANT

- Plant size: 3,0 MW
- Inverter: Central inverter (5 DC Input / 5 MMPT)
- Modules: 245W / polycrystalline

TEST SET UP

- 1x Central inverter
- 1x **Float Controller CI 30**
- 1x **Multi Connector**

TEST PERIOD

13.01.2018 - 23.02.2018

TEST SET UP

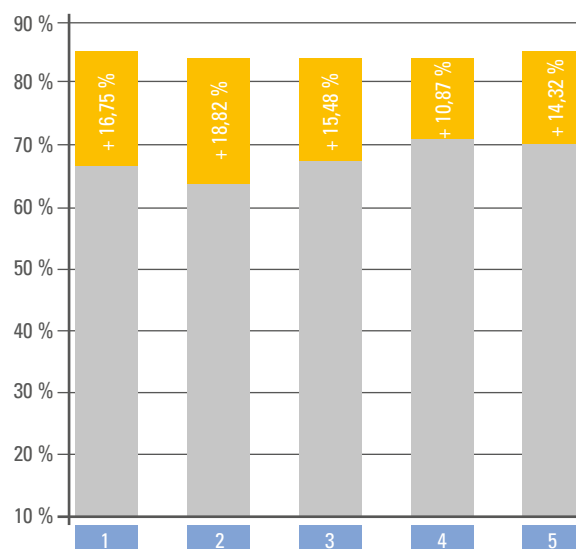
First, we equipped only a part of the plant with Float Controller, for testing purposes. Since the inverter has 5 individual performance parts, we installed in addition to the **Float Controller CI 30** a Multi Connector, to supply all the power units / MPPTs. In addition to the comparison measurements at each string package we observed the recovery development of the photovoltaic plant on the monitoring system. Through connecting the Float Controller with the monitoring system, we could easily supervise the individual parameters and the operation of the device. In this test installation, in addition to the enormous recovery rate, it is positive to see, that the individual string packages returned within the test period to the same proficiency of performance (PR), although they were differently affected with PID at test launch. Following the announcement of the test results, the entire system was equipped with Float Controllers and performed since then at a high level (> 83% PR).



IMPROVING MODULE POWER OUTPUT BY 18,82%

The graphic demonstrates the recovery process based on the PR-performance:

String / String package	Before	After
1	67,36 %	84,11 %
2	64,36 %	83,18 %
3	67,68%	83,16 %
4	72,43 %	83,30 %
5	70,18 %	84,50 %



SUCCESS STORIES

NORTHERN GERMANY // FLOAT CONTROLLER SI

PV-PLANT

- Plant size: 12 MW (different modules)
- Inverter: String inverters
- Modules: 235W / polycrystalline

TEST SET UP

- 6x String inverters
- 6x **Float Controller SI**
- Inspected modules: 235W

TEST PERIOD

11.08.2017 - 30.09.2017

TEST SET UP

EL recordings of our customer demonstrate us, that certainly the majority of the modules are affected with PID. In order to assess the trend of the recovery process, measurements were carried out on 8 String packets before the test installation.

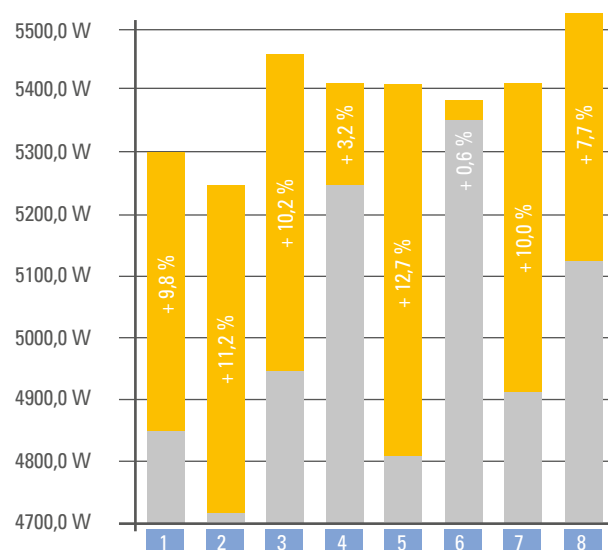
Since the plant is equipped with string inverters, therefore we used **Float Controller SI**. This device is specially designed for string inverters, can supply up to a total of 3 MPPT / max. 110kW. After the test period of 50 days, the measurements revealed an amazing improvement of up to 12.7% of the string packages output.



IMPROVING MODULE POWER OUTPUT BY 12,7%

The graphic demonstrates the recovery process based on the output of the string package:

String / String package	Before	After
1	4858,5 W	5295,2 W
2	4725,7 W	5257,1 W
3	4954,7 W	5461,7 W
4	5257,6 W	5425,7 W
5	4810,5 W	5424,5 W
6	5353,2 W	5385,9 W
7	4919,4 W	5412,1 W
8	5141,6 W	5540,9 W



PID FREE MODULES?

» PID FREE DOES NOT MEAN NO DEGRADATION WILL OCCUR! «

Potential Induced Degradation (PID) occurs on all photovoltaic panels, often without the owner of the installation being aware of it. Because of this phenomenon the solar panels degrade faster and therefore don't achieve the expected return during their lifetime.

-5%

Modules will be deemed to be PID-free if power loss is less than **5%** and there is no evidence of any major defect.

IEC 62804
STANDARD

Test conditions:

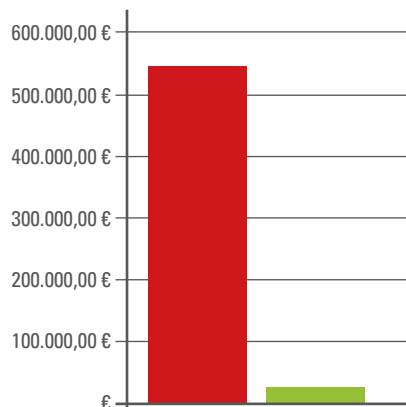
Relative Humidity: 85 ± 3%RH
Ambient Temperature: 85 ± 2°C,
Applied Potential: 1.000V
Test duration: 3 Cycles of 96 Hours

Test criteria:

Power loss <5% at 1000W/m² after PID Test.

LOSSES!
DISPITE PID FREE MODULES

Plant size kWp	Irradiation kWh/kWp	Feed-in tarif €	PID Degradation %	Remaining term years
10.000	1.100	0,10	2,50	20



TOTAL LOSS
550.000,00 €

INVEST PID PROTECTION
18.000,00 €

KEY FACTS

**THERE'S NO POSSIBILITY TO
GROUND PV PLANTS WITH
STRING INVERTERS**

**TO PROTECT THIN-FILM MODULES
EFFECTIVELY DAYTIME OPERATION
OF PID KILLER IS MANDATORY**

**PADCON PID KILLER CAN BE
INSTALLED IN PARALLEL OR
SERIAL AND CAN RUN DURING
DAYTIME OR NIGHTTIME**

**PID IS CAUSED BY SYSTEM DESIGN AND
PID PROTECTION THEREFORE PART OF
ELECTRICAL ENGINEERING**

**THERE ARE TWO WAYS TO PROTECT
YOUR PLANT AGAINST PID ...**

BUT JUST ONE REASONABLE!

**PID-FREE MODULES
MEANS NOT MORE THAN
5% LOSS DUE TO PID
WILL OCCUR IN STC
(IEC 62804)**

PADCON GmbH
Steigweg 24 / Gebäude 44
97318 Kitzingen
Germany

Tel.: +49 (0)9321 2680 - 200
Fax: +49 (0)9321 2680 - 9200
E-Mail: info@padcon.de
Web: www.padcon.de



Please note: All product illustrations in this brochure may differ from the original.

©PADCON 2018