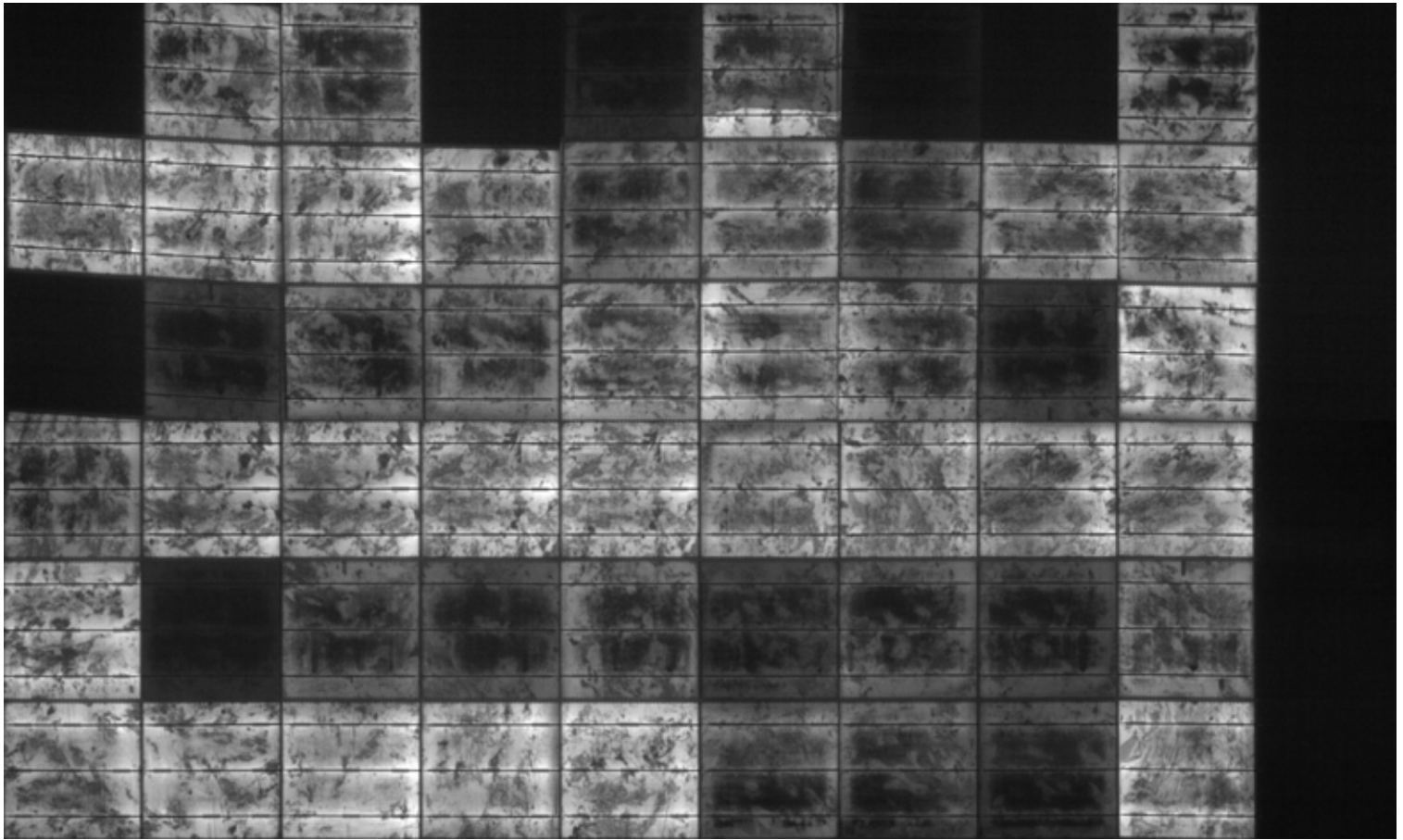


PID KILLER

2°K
2DEGREESKELVIN

PID SOLUTION DETECTION & HEALING

SECURE DETECTION & SUCCESSFUL HEALING OF POTENTIAL INDUCED DEGRADATION



© 2 DEGREES KELVIN

ELECTROLUMINESCENCE IMAGE OF PID AFFECTED MODULE

PID - THE HIDDEN THREAT

Potential induced degradation (PID) is a phenomenon that has only recently become a concern in the photovoltaic industry. PID impacts the ions of a solar cell and results in the degradation of the module output.

PID can significantly reduce the power output of a PV module. Power losses as high as 70% in the first 18 months are not uncommon. With the slow developing degradation, PID can significantly impact your power output before it is detected.

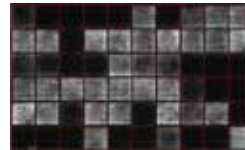
Potential induced degradation is often seen as a module defect but requires changes at system level. The occurrence of PID depends mainly on the electrical configuration of the system and module design /construction. However, system voltage, temperature, humidity, and irradiance also contribute to the occurrence of PID.

PID is everywhere, even in so-called 'PID Free Modules', it exists. Most modules contain PID even if its in its infancy or when its difficult to detect. In these instances, PADCON technology uplifts the performance of your solar asset.

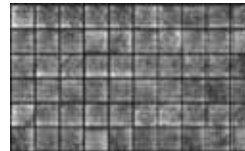
2DegreesKelvin & PADCON Implementation:



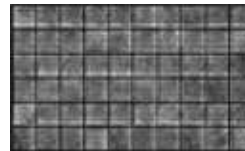
Document Recovery Through Installation of PADCON Float Controller:



Measurement: output
Performance: 58%



Measurement: 6 weeks
Performance: 85%



Measurement: 16 weeks
Performance: 100%

Healing Effect



THE PARTNERSHIP

The service & technology companies 2DegreesKelvin and PADCON are now offering a joint all-in-one service package which detects and eliminates potential induced degradation (PID) throughout the UK & Ireland.

The PID effect occurs in crystalline photovoltaic modules and directly leads to output losses. If not treated in time, yield losses of up to 90% are the consequence. The 2DegreesKelvin and PADCON strategic partnership offers asset owners & managers all necessary services from a single source beginning with PID detection to the sustainable regeneration.

With our professional solution even seriously degraded modules recover to their nominal output in a few weeks time. 2DegreesKelvin and PADCON have a proven track record with PID detection & healing and as a partnership have carried out over 100MWp of large-scale solar installations in the UK to date.

Protect your investment and contact us for more information.

WHAT OUR FOUNDERS SAY...



CONSTANTIN WENZLIK
Managing Director of PADCON

"We are thrilled to have 2DK as our installation on partner for the UK & Ireland. Their professional approach and installation standards align with the PADCON brand. Together we can provide asset owners with an end-to-end solution."



JOHN DAVIES
CEO of 2DegreesKelvin

"Our strategic partnership with PADCON fits perfectly with our suite of advanced engineering services. Now we can not only detect and diagnose PID, but we can eradicate it all together. An absolute no-brainer for site owners and managers to deploy."

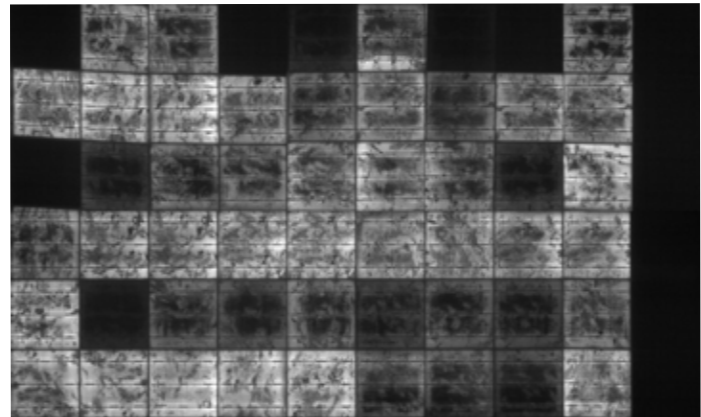
PID DETECTION

PID is a slow developing problem affecting first the modules at the negative end of the string. Surrounding conditions of the installation affect the PID problem and can accelerate the degradation. Detection is best performed through lab-grade electroluminescence testing.

PID detection requires not only the right measurement equipment but also experience in the subject. 2DegreesKelvin have extensive experience in Electroluminescence testing, having tested over 20,000 modules in the field using our tripod and mobile testing equipment.

2DegreesKelvin deploy a range of Electroluminescence tripod systems to capture repeatable, high quality EL images in-situ (no need to disturb the modules).

Early detection assures minimum yield loss and faster recovery. Investors should incentivise their O&M companies to have a close look at performance data. In case of yield loss, sample tests of affected strings should quickly be carried out.



FLOAT CONTROLLER INSTALLATION

THE SOLUTION FOR STRING & CENTRAL INVERTERS

Negatively grounded systems create heightened risk of electrocution on sites and excessive health & safety controls. The PADCON Float Controller offers a practical alternative. It allows the operation of a non-earthed system whilst simultaneously combating the PID effect and uplifting production. Thanks to single-fault tolerance, the PV system creates a higher yield than an earthed system, whereby the earth short-circuit results in an immediate yield loss.

The PADCON Float Controller can be installed both in new systems as well as in existing systems. The product range offers an appropriate solution for all types of inverters.



PADCON SYSTEM VS NEGATIVE GROUNDING

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



Float Controller CI



Float Controller SI

PLANT RECOVERY

Successful plant recovery is well documented from our installed references. In this example we have compiled the output data at string level to demonstrate the effect. Since the inverter has 5 individual performance parts, PADCON installed in addition to the Float Controller CI 30, a Multi Connector, to supply all the power units / MPPT on the common DC bus.

In addition to the comparison measurements at each string package, PADCON recorded and documented the recovery development of the PV plant through the monitoring system. By connecting the Float Controller with the monitoring system, we could easily supervise the individual parameters and the operation of the device.

It is interesting to note that in this reference installation, the individual strings packages returned to the same proficiency of performance (PR) within the same time even though their original level of degradation was different. Following the successful tests the entire system was equipped with PADCON Float Controllers and a high level of performance since then has been maintained (> 83% PR).



PROTECTION & MONITORING

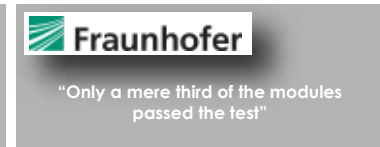
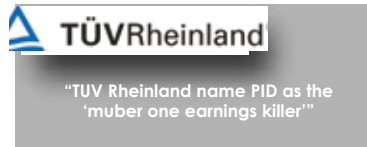
On average, sites affected by PID that have PADCON solution installed, experience a production uplift of between 10-20%, which bodes for a very positive ROI. However, even on sites that have no detectable PID, where PADCON float controllers are installed, they are experiencing production uplifts between 3-5%. Add to this the safety advantages of removing negatively grounded sites, the PADCON system becomes one of the most advanced, retrofit-able, performance enhancing solutions in the world.

The installed float controllers are robust in the field and supported by our international service network. Installation solutions can be adapted to all inverter types (internal & external centralised inverters, and string inverters). The lasting effect of the 'PID Killer' should be ensured by ongoing monitoring.

2DegreesKelvin & PADCON guarantee a professional service level to increase site-wide yields and thus permanently protect and enhance your PV investments.



WHAT EXPERTS SAY ABOUT PID...



NEXT STEPS

BOOK YOUR FREE TRIAL TODAY

As part of 2DK & PADCON's partnership, in certain circumstances, we are offering trial installations on a single inverter on large-scale sites. 2DK will install a float controller unit at no cost to yourself, but on the understanding that if suitable production uplifts are achieved, that you will invest in deploying solutions for the entire site.

PADCON are so confident with their technology that they will guarantee >3% performance improvements, and if this is not achieved the unit will be removed from your system.

If you suspect PID on any of your sites, 2DK have a fast & deployable EL quickcheck service to confirm the presence of PID.

Book your no obligation PID consultation today.



info@2degreeskkelvin.org





HIGH VOLUME ELECTROLUMINESCENCE IMAGE GATHERING ON POLYCRYSTALLINE MODULES



PADCON FLOAT CONTROLLER INSTALLED IN IP RATED ENCLOSURE ON UK SOLAR FARM



WEBSITE - www.2degreeskelvin.org

TELEPHONE - +44 (0)7772 373 648

EMAIL - info@2degreeskelvin.org



WEBSITE - www.padcon.com

TELEPHONE - +49 9321 2680 201

EMAIL - info@padcon.com