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# DAS 2.0 *Spec Sheet*



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**kiwa** ExTEL

# DAS 2.0 *Spec Sheet*

A novel soiling monitoring solution for  
PV power plant operation

## Colophon

|                 |                                    |
|-----------------|------------------------------------|
| Title           | DAS 2.0 Spec Sheet                 |
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## 1. System Concept

The accumulation of dust (“soiling”) on photovoltaic (PV) module surface is one of the major environmental factors which deteriorates the photovoltaic energy generation. This phenomenon is further magnified on the PV power plants located in the dusty (“desert”) or long dry season areas. For commercial scale PV power plants (either ground-based or rooftop), high soiling level could lead to energy loss up to thousands of kWh and hence reduce the return of investment for the owners or investors.

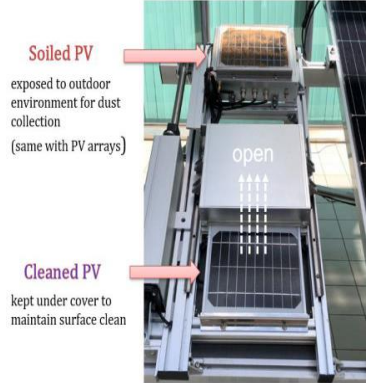
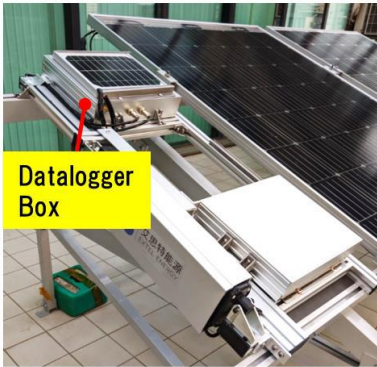
Dust Analysis System (DAS 2.0) is a novel platform designed to monitor the on-site power loss of photovoltaic (PV) module due to the dusts or pollutants falling and adhering onto the module surfaces. The information DAS 2.0 provides can truly represent the revenue loss of the plant to owners or investors. DAS 2.0 also offers the critical information for maintenance staff to plan for the module cleaning activities.

DAS 2.0 is equipped with two compact size PV modules – one module is kept under a cover to maintain a clean surface (hence as a reference) and the other module is exposed to the surrounding environment for dust collection (and to represent the soiling condition of the plant). DAS 2.0 is a standalone unit which can be easily mounted on the racks or frames of the existing PV arrays.

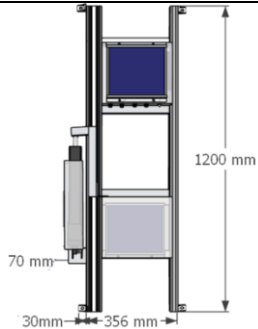
## 2. System Configuration

This section covers the hardware information of DAS 2.0 including system configuration - both electrical and mechanical structure, dimensions and weight.

### 2.1. Hardware Components Overview

|       | Item                        | Description                                                                                                                                                                                                                                                                                                      | Photo                                                                                | Remark |
|-------|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|--------|
| 2.1.1 | Soiling Monitoring Platform | The platform is equipped with two compact size PV modules – one PV module is kept under a cover to maintain the surface clean and the other module is exposed to the actual environment for dust collection                                                                                                      |    |        |
| 2.1.2 | Data Logger Box             | The data logger box (underneath the soiled module) is equipped with an industrial PC and I/O devices. It has two functions: one is to collect the soiling data and upload it to Google cloud server or transfer it to the customer's SCADA system; the other is to control the timing of the soiling measurement |   |        |
| 2.1.3 | Electric Actuator           | The actuator is used to open and close the cover of the reference module for soiling measurement; it receives the command from the data logger box                                                                                                                                                               |  |        |

2.2. Mechanical Specification

|       | Item       |                                                                                                  | Standard                                              | Remark                                                                                          |
|-------|------------|--------------------------------------------------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| 2.2.1 | Weight     | Platform (Included PV modules, Data Logger box and Actuator)                                     | 14 [kg]                                               |                                                                                                 |
| 2.2.2 | Dimensions |                 | 1200(L)x426(W)x125(H)<br>[mm]                         |                                                                                                 |
| 2.2.3 | Packing    | Carton Box<br> | 1295(L)x521(W)x225(H)<br>[mm]<br>Gross Weight:19 [kg] | Content<br> |

## 2.3. Components Details

|       | Item                            | Standard                                                                                                                                   | Remark                                                                                |
|-------|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
|       | Soiling Monitoring Platform     |                                                                                                                                            |                                                                                       |
| 2.3.1 | Compact Size PV Module          | 5 Watt, 5 Volt                                                                                                                             | X2 modules are included                                                               |
| 2.3.2 | Electric actuator               | 24 V, Stroke Length 300 mm                                                                                                                 | Controlled by IPC                                                                     |
|       |                                 |                                                                                                                                            |                                                                                       |
|       | Electrical Components           |                                                                                                                                            |                                                                                       |
| 2.3.3 | Data Logger Box                 | Aluminum enclosure                                                                                                                         |                                                                                       |
| 2.3.4 | Controller                      | Please refer to 4.1.3                                                                                                                      |                                                                                       |
| 2.3.5 | DC Current Meter                | Resolution: 0.01A±1%                                                                                                                       | Measure current readings of the compact size PV modules                               |
|       | Peripheral Sensors              |                                                                                                                                            |                                                                                       |
| 2.3.6 | Module Temperature Sensor       | Accuracy: ±0.5°C (at 50°C )                                                                                                                | X1 unit is included                                                                   |
|       |                                 |                                                                                                                                            |                                                                                       |
|       | Others                          |                                                                                                                                            |                                                                                       |
| 2.3.7 | GPRS/3G/4G communication module | LTE FDD: B1/B3/B5/B8<br>LTE TDD: B34/B38/B39/B40/B41<br>WCDMA: B1/B8 GSM: B3/B8                                                            | SIM card provided by local                                                            |
| 2.3.8 | Modbus communication port       | Modbus RTU Communication<br>Modbus-RTU /Slave<br>Baud rate: 9600<br>Parity: None<br>Data bits: 8<br>Stop bits: 2<br>Default address: 0x01. |  |



### 3. Utility Requirement

In order to guarantee the functionality of DAS 2.0, the listed utility requirement needs to be ready for installation.

#### 3.1. Requirement Description

|       | Item                                                        | Standard                                                | Remark                                                |
|-------|-------------------------------------------------------------|---------------------------------------------------------|-------------------------------------------------------|
| 3.1.1 | AC Power Supply                                             | AC 100-250[V]                                           | Max daily electricity consumption is 0.3 kWh          |
| 3.1.2 | Mounting space                                              | PV Rack with no shadow impact from the surroundings     |                                                       |
| 3.1.3 | Communication cable in case SCADA is used for data transfer | Modbus communication protocol is used for data transfer |                                                       |
| 3.1.4 | PV array rack structure                                     | PV Rack with no shadow impact from the surroundings     | For DAS 2.0 installation, PV rack structure is needed |

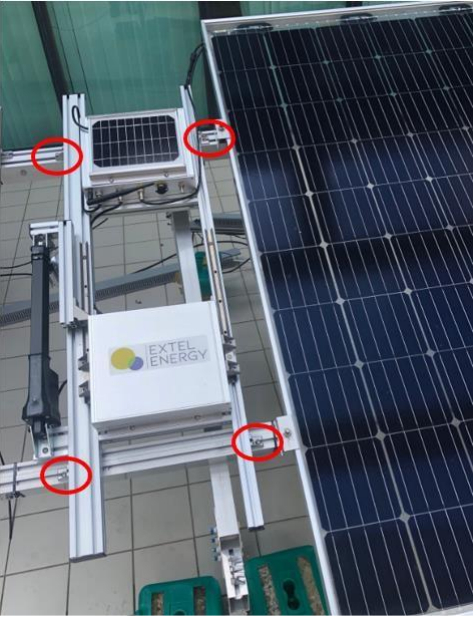
## 4. Data Collection System

An embedded data acquisition software is pre-installed in the industrial PC to collect the real-time data measured by DAS 2.0. All the collected data will be uploaded to EXTEL Cloud Server and display on DAS2.0 Web page which is browser-based user interface for customer access with authorized log-in account and password. An option for data integration with on-site SCADA system is also provided through Modbus/RTU communication port.

### 4.1. System Descriptions

|       | Item                                           | Standard                                                                                                                                                                                  | Remark                                                        |
|-------|------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|
| 4.1.1 | Data Collection                                | Soiling data will be collected during the 15 minutes of cover-open period                                                                                                                 |                                                               |
| 4.1.2 | Data Storage                                   | 1) Saved log file at local drive<br>Upload to Cloud Server through internet and display on DAS2.0 Webpage<br><br>2) Upload to Cloud Server through internet and display on DAS2.0 Webpage | Option:<br>Direct communication via Modbus with on-site SCADA |
| 4.1.3 | Controller (Industrial PC) for Data Collection | HD Storage: 64GB SSD<br>CPU: Intel Atom N3350<br>OS: MS Windows10 IOT                                                                                                                     |                                                               |
| 4.1.4 | Collecting Parameters                          | PV Module Temperature<br>PV Module DC Current (Reference)<br>PV Module DC Current (Dusty)                                                                                                 |                                                               |

## 5. Installation

|       | Item                               | Standard                                                                                                                                                                                    | Remark                                                                               |
|-------|------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| 5.1.1 | Mounting method                    | DAS 2.0 comes with 4 sets of L-brackets that can be used to mounting DAS2.0 on to the PV array racks.<br> |   |
| 5.1.2 | Connect the AC power               | DAS 2.0 is supplied with a 4-meter AC power cable (3 cores) that can be connect to the 3 pin water proof connector.                                                                         |  |
| 5.1.3 | Connect RS-485 communication cable | DAS 2.0 is supplied with a 2-meter communication cable used to connect to the RS485 communication port.                                                                                     |  |