

PV Monitoring System Offers Solution for Plant's Solar Array

dataTaker DT85 Monitors Electrical and Environmental Parameters

A customer inquired with CAS DataLoggers about a plant monitoring systems for a photovoltaic (PV) system. Their request was not only for a device to measure the current and voltage output of the solar array, but also for [environmental monitoring](#) of local conditions since the plant is in a location where extreme temperature excursions often occur.



Parameters:

The requirements for the project included not just the DC voltage and current generated by the solar panels, but also:

- Temperature of the solar panels
- Ambient temperature
- Relative Humidity
- Solar Radiation
- Wind Speed

Data Logging System:

The [dataTaker DT85](#) is the heart of the proposed PV monitoring system. This rugged data logger is the ideal solution for this application, with 16 universal analog input channels that are suitable for use with a wide range of different sensor types. In addition to its basic measurement capabilities, this intelligent data logger provides an extensive array of features which allow it to be used across many different types of applications. This robust low-power data logger offers extensive local programming functions including calculations, logic and alarms, flexible communications including Ethernet, RS232/422/485 Serial, USB, Modbus, and SDI-12 connections, expandability up to 320 channels or 960 single ended inputs, 18-bit measurement resolution, digital I/O and counter channels.

The DT85 internal non-volatile data memory for up to 10 million data points and an embedded web server, together with the ability to operate for months in standalone mode on its internal lead-acid battery.

DC Current Measurement:

For measurement of the DC current output of the solar array, current transducers from CR Magnetics, model [CR5220S](#), are installed on the electrical cables and connected to the data logger. These devices offer a standard 4-20mA current output and split core design to make installation a snap. A standard 100 ohm shunt resistor is used at the logger to convert the 4-20 mA signal to a voltage which is then read and scaled by the data logger. Similar to a normal CT, these transducers are available in a range models for DC currents up to 300ADC and provide full isolation from the current being measured.

DC Voltage Measurement:

Because the PV array contained a number of panels wired in series, the total voltage output was well beyond the 50 VDC maximum that the data logger could measure directly. To capture the voltage in a safe and reliable way, we used a CR Magnetics [CR5320 DC voltage transducer](#). It is available in different models that can accommodate up to 600 VDC and provide full voltage isolation from the inputs to the output. Similar to the dc current transducer, this unit provides a 4-20 mA output which was passed through a shunt resistor at the data logger, measured and scaled back to the appropriate voltage value.

Temperature & Humidity Measurement:

There are numerous vendors of temperature and humidity sensors, however many are not compatible with the extreme conditions of outdoor monitoring. For this application, the meteorological grade [MP400A](#) probe from Rotronic was used. The sensor has a measurement range of 0 to 100% rh and -40 to 85°C. Like the DC voltage and current transducers, the 400A offer standard 4-20mA current outputs for both the humidity and temperature. The measurement set-up was identical to the 2 previous sensors; the 4-20 mA current was passed through a shunt resistor, the resulting voltage was measured by the data logger and scaled to the appropriate units.

Solar Radiation Measurement:

A device called a pyranometer is commonly used to measure solar radiation. For this PV monitoring project, an [Apogee Instruments SP110-SS pyranometer](#) was used. This sensor outputs a millivolt level signal that is proportional to both the solar intensity and the angle of incidence. This allows the sensor to more accurately determine the amount of light that is shining directly down on the solar array. It is based on a silicon cell sensor, which the best solar radiation measurement technology for the photovoltaic

industry. The output signal was fed directly into the datalogger as the DT85 has no issue accurately measuring voltages in the mV range. In the logger, the voltage is scaled to standard intensity units of W/m².

Wind Speed Measurement:

An anemometer is required to measure the wind speed, a device normally used in weather stations. The simple, classical wind-cup type is still the most reliable anemometer for this kind of application; here we use the [Novalynx 200-WS-01 wind speed sensor](#). This unit uses a small magnetic reed switch which is opened and closed as the cups spin. This switch is attached to one of the high-speed counter inputs on the DT85. The datalogger counts the number of switch closures (pulses) in a given interval and makes the conversion between pulse count and wind speed.

Web Setup

With the dataTaker DT85 no other configuration/analysis software package is needed. Users can monitor data on the web using a PC, tablet or smartphone. Trends are shown in charts via the Web browser interface and also stored for further analysis. Data can also be exported to a CSV file for use with spreadsheet applications.



Data Transfer and Alarms

The Ethernet port built in to the DT85 can be used to send data via FTP or email as CSV text files. Alarms are easily set up through the web server. When user-set thresholds are reached, alarms can also be sent via SMS and email.

Conclusion

The PV monitoring system described about provides a cost-effective example of data collection with the [dataTaker DT85 Universal Input Data Logger](#), including not only measurements related to the power produced by the solar panels, but also various environmental monitoring including solar radiation and wind speed measurement. With the on-board Ethernet port, the customer can obtain a complete remote monitoring of the plant, with the ability to automatically send data and alarms.

For further information on the [DT85 data logger](#), other [dataTaker products](#), or to find the ideal solution for your application-specific needs, contact a CAS Data Logger Applications Specialist at **(800) 956-4437** or visit our website at www.DataLoggerInc.com.