Pyranometers – the next generation

100 years ago, the world was introduced to the first generation of pyranometers. These thermal hemispherical viewing devices measured the irradiance of the sun on a horizontal surface. Since that first generation, small design changes have been made to improve this state of the art technology. However, all of those changes have been incremental; small changes, yielding small improvements. An entirely new design was needed to make major improvements. EKO Instruments recently made some very big improvements to the pyranometer design.

The new MS-80 Secondary Standard (highest class sensor) pyranometer performs at a level never seen before. Using unique detector technology and sensor architecture EKO has pushed the performance in a way no one could have predicted. This single dome sensor is less expensive to produce, when these savings are transferred to the customer, combined with the enhanced performance, the result is the best performing sensor in its class with a low cost of ownership.

Why a new detector and with new architecture?

While there are silicon photodiode radiometers that respond very quickly to changes in irradiance, the uncertainty in the measurements is rather high. Meteorologists, as well as the photovoltaic (PV) industry, needed a sensor that had a time constant more similar to the changing atmosphere and not to have smoothing PV power data because of a slow detector.

Typical ISO secondary standard sensors have a response time of a few seconds with some of the faster models approaching times of 3 seconds. The MS-80 has a response time of <0.5 s @ 95%. This is roughly an order of magnitude improvement over the previous technologies. In having a smaller and better detector, EKO realised changes in the sensor architecture were now possible. The traditional design was to have the blackened hot junctions of the thermopile on the surface of the instrument, only covered with a hemispherical dome or two. This practice helped protect the detector as well as being a way to reduce the thermal offset effects.

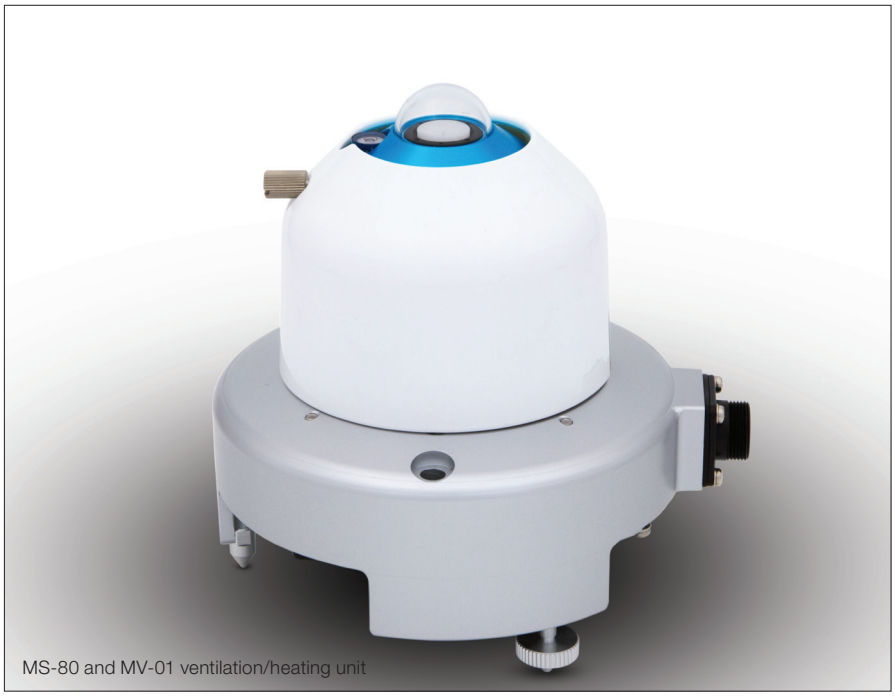
EKO embedded the detector within the sensor body and placed a high quality quartz diffuser over the detector. This diffuser not only enables coverage of the entire spectral range but also allows a true cosine response and a 180° field of view. This is an important issue as these sensors will not be imparting errors in the data at low sun angles. The detector being beneath

MS-80 with STR-22 Sun-Tracker for diffuse irradiance measurement

the surface allows now for a thermally isolated design. As mentioned earlier, the thermal effects seen in all other sensors are now negligible with the MS-80. This is a real triumph as the previous methods for combating this thermal effect was to use expensive outer domes such as quartz or sapphire. While this design seemed rather promising, the cost is simply too high to deploy these expensive sensors in any real monitoring capacity.

5 years Warranty

While thermally isolating the detector, EKO was also able to isolate the detector from changes in pressure, humidity and thanks to the diffuser, the effects from UV degradation. These improvements combine to create a very stable design. So stable in fact that EKO has removed the desiccant cartridge. Now, field personnel no longer need to plan trips to the field, just monitor the desiccant. The calibration sensitivity value is guaranteed by EKO and backed up by ISO 17025 accreditation. There is no drift outside of 0.5% of the original calibration



MS-80 and MV-01 ventilation/heating unit

MS-80 on test in Cedar City Utah

value for at least 5 years. These are impressive and powerful statements. The MS-80 gives users a greater confidence over longer periods of time, removing most of the stress and cost of maintaining a monitoring network.

While meteorologist tend to be very good at electronics and data acquisition, that is not always to case for all users. To make the MS-80 available to more applications and users, multiple signal interfaces were made. Whether you need a small DC voltage output, or a current loop output, or even a Modbus output, the MS-80 can be ordered with the needed electronics installed by the factory, to give the user the flexibility to have the data they need. These converters are not the end of the flexible MS-80 design. While data transmission and fidelity are important, making measurements in harsh environments is important as well. To accomplish this, EKO designed a heated ventilator, the MV-01 for the MS-80.

This ventilator uses very low power technology. While supplying 12VDC, the heater element only draws 7 W and the ventilator draws a very low 2 W. However, do not think these low numbers imply poor performance. Competitive ventilators may only raise the ambient temperature moving across the sensor by one degree Celsius. The MS-80 can increase the ambient air temperature to between 4 and 5 degrees Celsius. This is very important for the users working in high latitude or high elevation areas.

Before the previous best practices explained that the ventilators should be used to reduce thermal offsets of older sensors. The MS-80 not experiencing any of these offsets, primarily uses the ventilator to remove dew, frost, or dust from the single dome. ■

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About EKO Instruments

Established in Tokyo in 1927, EKO Instruments offers a unique range of high precision broadband and spectral radiometers, as well as various I-V measurement devices for the evaluation of photovoltaic components, systems, and energy plants.

All products are manufactured with a high emphasis on quality, innovation and creativity. EKO Instruments is also a center of competence offering know-how and customized services for the photovoltaic industry and instrumental meteorology on an outstanding scientific level.

EKO is also the only solar sensor manufacturer having its own ISO17025 accredited testing laboratory for the calibration of pyranometers and pyrheliometers.

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