

AMF / ALF SERIES

Albedometer mounting and levelling fixtures: combine 2 pyranometers into 1 albedometer with our AMF03 and AMF02 albedometer kits

Hukseflux offers a practical range of mounting and levelling fixtures to construct albedometers from its popular pyranometers and make installation and levelling easy. Albedometers are increasingly popular in bifacial PV module monitoring. AMF03 allows you to combine pyranometers with housings similar to those of models SR30-M2-D1 and SR300-D1 into one albedometer. AMF02 does so for two SR11 or two SR20 series pyranometers. The modular design facilitates maintenance and calibration of the pyranometers. Both albedometer kits include a mounting fixture and a glare screen. ALF01 is a levelling fixture that may be combined with AMF03, AMF02 or SRA series albedometers, and helps levelling the instrument.

Introduction

With the AMF03 or AMF02 mounting fixture, you may construct albedometers from popular Hukseflux **pyranometers** yourself. AMF03, AMF02 and SRA series albedometers can be levelled with the ALF01 levelling fixture.



Figure 1 AMF02 or AMF03 albedometer kits are used to mount both an up- and a downfacing pyranometer, and construct an albedometer. The image shows the AMF02 mounting fixture and its rod. A glare screen for the downfacing sensor is also included.



Figure 2 ALF01 albedometer levelling tool, can be rotated around the axis of the crossarm to which it is connected, and tilted over $\pm 2^\circ$.

Albedo and Albedometers

Albedo, also called solar reflectance, is defined as the ratio of the reflected to the global radiation. It is a dimensionless number smaller than 1. It is a property of the ground surface.

An albedometer is an instrument that measures both global and reflected solar radiation and, by calculation, the solar albedo, or solar reflectance for a particular ground surface. An albedometer is composed of two pyranometers, both installed horizontally, the downfacing one measuring reflected solar radiation.

In the open field, the solar albedo depends on the directional distribution of incoming radiation and on surface properties at ground level. It is usually expressed as a single number, determined by taking an average over a day with solar elevation $> 10^\circ$. Changes of albedo are typically slow and seasonal, except when it snows. Albedos of typical surfaces range from about 4 % for fresh asphalt and 15 % for green grass to 90 % for fresh snow.

Albedometers are increasingly popular in bifacial PV module performance monitoring.

You may use one **AMF03** albedometer kit and two pyranometers with housings similar to those of models SR30-M2-D1 and SR300-D1 to construct an albedometer. Likewise, the **AMF02** albedometer kit may be used to construct an albedometer out of two SR20 pyranometers.

Depending on the pyranometer used, the albedometer will either be Class A, the highest accuracy class, or the lower accuracy Class B. The modular design facilitates the maintenance and calibration of the pyranometers. By taking

the instrument apart you can use normal indoor calibration facilities for instrument calibration. The Class A models SR300-D1, SR200-D1 and SR30-M2-D1 and Class B models SR100-D1 and SR15 are supplied with several outputs; analogue millivolts, 4-20 mA current loop and Modbus over RS-485 are the most commonly used.

Glare screen

AMF02 and AMF03 are supplied with glare screens. A glare screen is a metal ring, mounted on the downfacing sensor. At solar elevations of $< 5^\circ$, when the sun is just above the horizon, the glare screen prevents that direct solar radiation is measured by the downfacing sensor. This is important, because it would otherwise lead to unrealistic albedo measurements. Modern data quality assurance can also attain the data quality by calculating solar elevation and rejecting any data at solar elevations below a certain value, for example $< 10^\circ$. You may decide to mount the glare screen after transport and on-site installation, so that the dome protector can remain on the dome until the albedometer is firmly installed.

AMF03

AMF03 is easy to use. It allows you to combine two separate pyranometers, creating an albedometer. All you need are two mechanically compatible pyranometers and the AMF03 kit. Mounting instructions and a set of hex keys are delivered with AMF03.

AMF02

AMF02 is easy to use as well. It allows you to combine two separate SR20 pyranometers into one albedometer. Mounting instructions and a set of hex keys are delivered with AMF02.

ALF01

ALF01 is a levelling tool that can be used with AMF02, AMF03 or SRA series albedometers to easily level the instrument. ALF01 is mounted on a 1 inch outer diameter crossarm, and can be rotated around the tube axis for 360° as well as tilted over $\pm 2^\circ$.

AMF / ALF series specifications

AMF03 and AMF02

Purpose	construction of an albedometer when combined with 2 pyranometers
Rod diameter	$15 \times 10^{-3} \text{ m}$

Albedometer

Measurand	global solar radiation and reflected solar radiation
Optional measurand	albedo or solar reflectance
Optional measurand	net solar radiation

AMF03

Instrument compatibility	2 x SR300, SR200, SR100, SR30, SR15
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Included in AMF03:

- (1 x) glare screen
- (1 x) AMF03 fixture with rod
- (1 x) conical positioner
- (2 x) M5x12 socket head cap screw
- (1 x) M6x8 socket head cap screw
- (2 x) M8x12 set screw
- (1 x) mounting instruction sheet

AMF02

Instrument compatibility	2 x SR20
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Included in AMF02:

- (1 x) glare screen
- (1 x) AMF02 fixture with rod
- (2 x) o-ring
- (1 x) conical positioner
- (2 x) plug
- (2 x) M5x12 socket head cap screw
- (1 x) M6x10 socket head cap screw
- (2 x) M6x12 set screw
- (1 x) mounting instruction sheet

ALF01

Instrument compatibility	AMF02, AMF03 and SRA series
Tilt angle adjustment range	$\pm 2^\circ$
Rotation angle adjustment range	360°
Required Crossarm outer diameter	1 inch
Required rod diameter	$15 \times 10^{-3} \text{ m}$

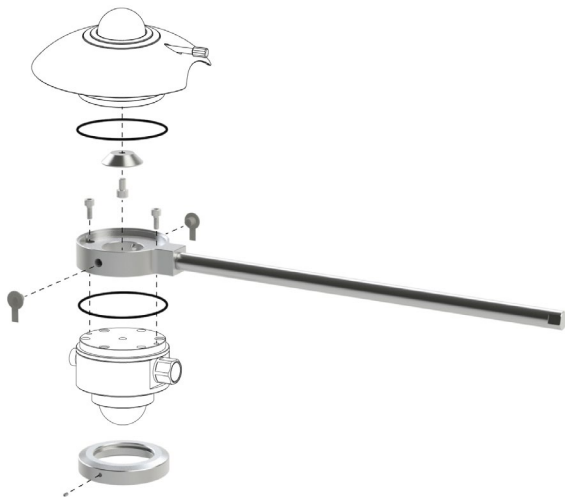


Figure 3 Clear instructions are included with AMF series.

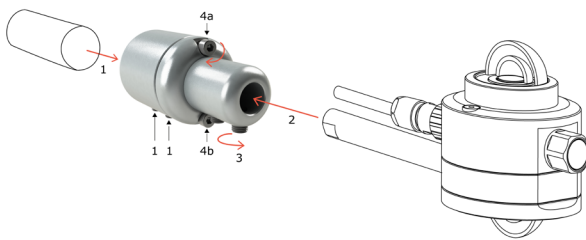


Figure 4 ALF01 allows levelling when mounting an albedometer rod onto a crossarm.

Standards

The applicable instrument classification standards are ISO 9060 and WMO-No. 8. Calibration is according to ISO 9847 and ASTM G207. The use of albedometers for performance monitoring of bi-facial PV systems is covered by IEC 61724-1. The use for meteorological observations is covered by WMO-No 8.

Suggested use

- PV monitoring with bifacial solar modules
- high-accuracy meteorological observations
- building physics, roof reflectance studies

Example: AMF03 combined with SR30's

The SRA30-M2-D1 albedometer consists of two identical pyranometers model SR30-M2-D1, one facing up, one facing down. The two sensors are delivered with one AMF03 fixture with rod for mounting purposes. A glare screen is part of the AMF03 delivery, too. The user assembles these modular components into an SRA30-M2-D1 albedometer. A mounting instruction is included with AMF03. Levelling and mounting may be completed by using the ALF01 levelling fixture and CMF01 crossarm mounting fixture to mount the crossarm to a mast.

Table 1 Overview of versions in AMF / ALF series.

VERSIONS OF AMF / ALF SERIES	
AMF03	albedometer mounting fixture for combining an upward- and a downward-facing pyranometer, to construct an albedometer for 2 x SR300, SR200, SR100, SR30 or SR15 pyranometers
AMF02	albedometer mounting fixture for combining an upward- and a downward-facing pyranometer, to construct an albedometer for 2 x SR20 pyranometers
ALF01	albedometer levelling fixture for AMF02, AMF03 and SRA series albedometers

See also

- **SRA300-D1** industrial Class A albedometer with heating and tilt sensor
- **SRA200-D1** industrial Class A albedometer
- **SRA100-D1** industrial Class B albedometer
- **SRA01** spectrally flat Class C albedometer
- **SR30-M2-D1** digital spectrally flat Class A pyranometer with heating and tilt sensor
- **SR15 series** analogue and digital spectrally flat Class B pyranometers
- alternative instrument: **NR01** 4-component net-radiometer for solar and longwave radiation balance
- **PMF01** and **PMF02** pyranometer mounting fixtures
- **CMF01** crossarm mounting fixture



About Hukseflux

Hukseflux is the leading expert in measurement of energy transfer. We design and manufacture sensors and measuring systems that support the energy transition. We are market leaders in solar radiation- and heat flux measurement. Customers are served through the main office in the Netherlands, and locally owned representative sales offices in the USA, Brazil, India, China, Southeast Asia and Japan.

Interested in this product?
E-mail us at: info@hukseflux.com

Figure 5 The end result using AMF03 and two SR300-D1 pyranometers: the SRA300-D1 albedometer.



Figure 6 Installation of AMF02 albedometer mounting kit and two SR20 pyranometers, mounted with ALF01 leveling fixture on a crossarm with crossarm bracket CMF01.