

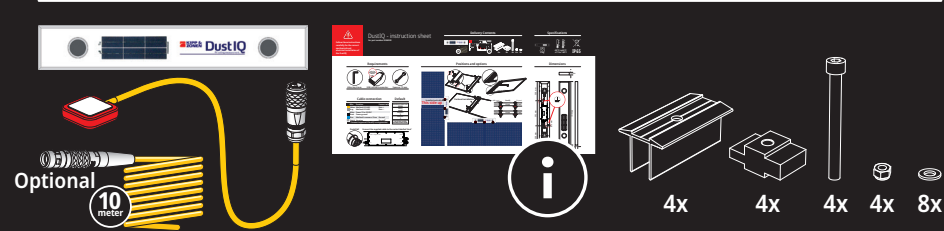


Follow these instructions carefully for the correct mechanical and electrical installation of the DustIQ

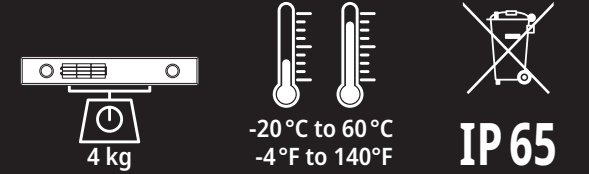
1/4 DustIQ - instruction sheet

During indoor pre-installation follow the instruction in the manual

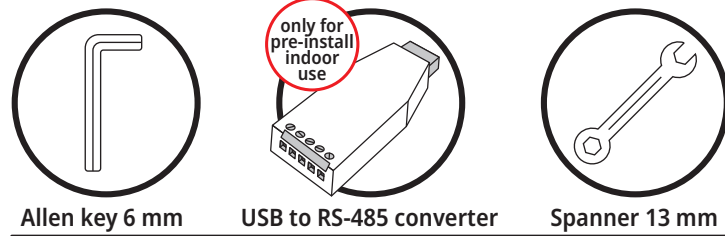
Delivered Contents



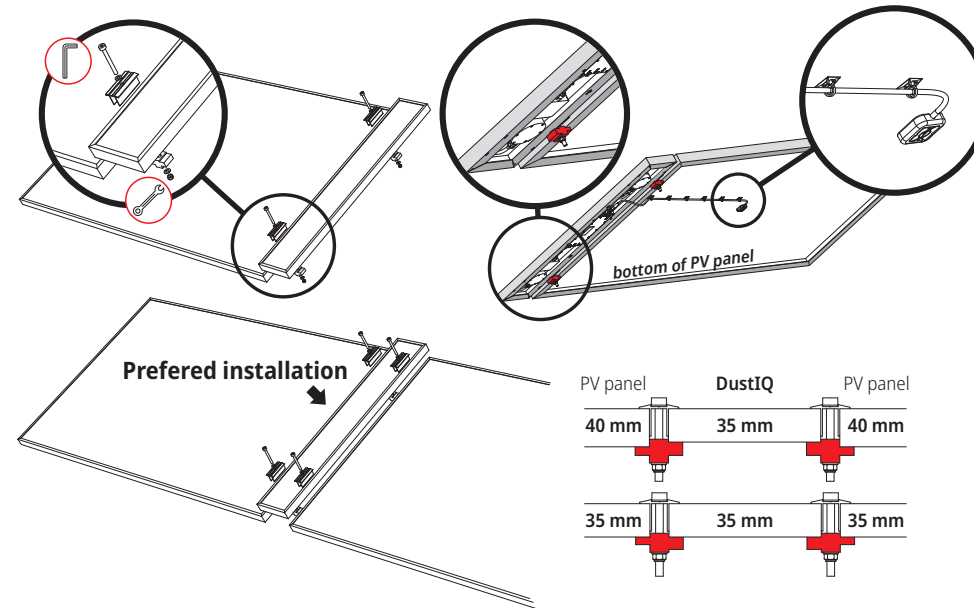
Specifications



Requirements



Positions and options



Cable connection

Wire	Function	Connect with
Yellow	Modbus® RS-485	Data +
Grey	Modbus® RS-485	Data -
White	Power 12 to 30 VDC	
Black	Power ground	
Blue	Modbus® common / Ground	Ground
Shield	Housing	Ground*

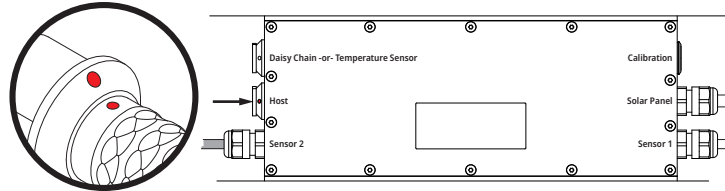
* Connect to ground if DustIQ is not grounded

Default

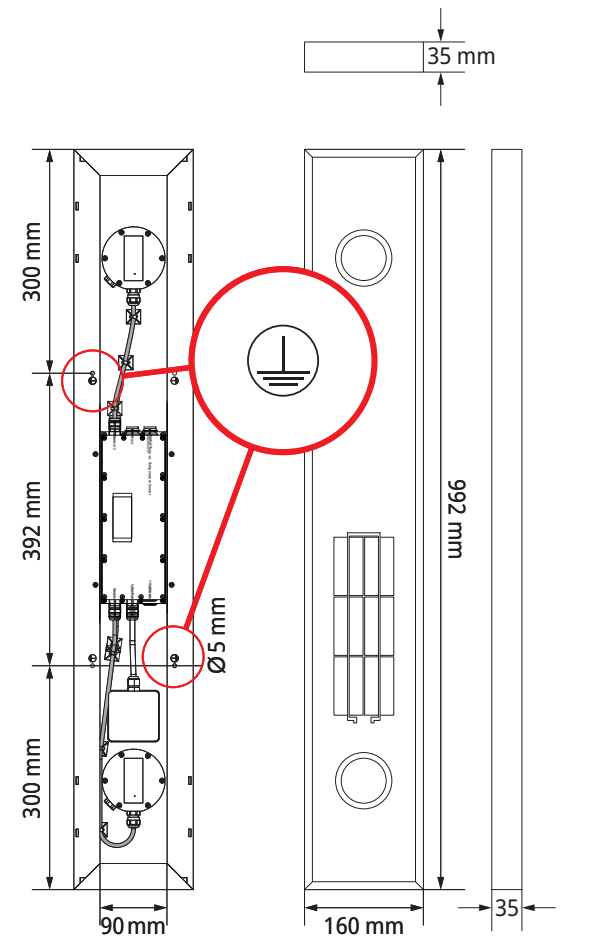
Modbus® baud rate	19200
Data bits	8
Parity	even
Stop bits	1
Address	1
Factory dust profile	Common desert dust

Push-Pull

Connect the supplied cable to the socket labelled 'Host'



Dimensions



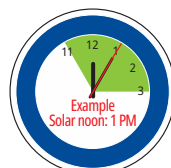
2/4 TARE INSTRUCTIONS

Needed before tare

1. Connected, working clean DustIQ with software version 2.15 or higher
2. DustIQ must be operative for minimal 3 minutes
3. Modbus® registers 20-40 must be read and logged for soiling ratio's, transmission losses, status flags, dust slopes etc. (see manual, Appendix A, Section 2.1)
4. A person on-site ① and a remote person reading DustIQ data and the manual ②.
5. If moving from the back of the DustIQ to the front takes more than 20 seconds, then consider adding a third person, just to push the button.



Time needed is 15 minutes
 Die benötigte Zeit beträgt 15 min
 Le temps nécessaire est de 15 min
 El tiempo necesario es de 15 min
 所需时间为15分钟



Between 2 hours before and after solar noon
 Zwischen 2 Stunden vor und nach Sonnenmittag
 Entre 2 heures avant et après midi solaire
 Entre 2 horas antes y después del mediodía solar.
 中午前后2小时之间



No clouds
 Keine Wolken
 Pas de nuages
 Sin nubes
 无云



Clean, demineralised water and a sponge
 Sauberes, demineralisiertes Wasser und ein Schwamm
 De l'eau propre et déminéralisée et une éponge
 Agua limpia y desmineralizada y una esponja.
 用海绵和淡水清洁



Clear, sunny day
 Klarer, sonniger Tag
 Journée claire et ensoleillée
 Día claro y soleado
 晴朗的晴天



Clean, dry cloth
 Sauberes, trockenes Tuch
 Chiffon propre et sec
 Paño limpio y seco
 用干布擦拭清洁

DustIQ LED light interpretation

Regular operation, 5 seconds of blue led light with a 60 second interval

Feedback during the Tare or field calibration are given by the 2 sensors and the calibration button.
 There are 2 cases:

1. Slow blinking is 1x per second, confirmation and DustIQ awaiting next input
2. Fast blinking is 10x per second, this is the error signal for further information see error code in register 27

Both signals last 30 seconds in total, before normal operation restarts.

On-Site



During the procedure:
 - Do not cast a shadow on the DustIQ
 - Do not cover the sensors

Remote office (or direct connection)



	On-Site	Remote office (or direct connection)
Validate installation	<ol style="list-style-type: none"> 1. The DustIQ is mounted properly as per instructions 2. Power cable is connected to the DustIQ 3. DustIQ is cleaned 	No action needed
Wait	Wait 3 full minutes for the DustIQ to stabilize	No action needed
Push button 3 times	<p>Push the Calibration button on the underside of the DustIQ 3 times in rapid succession</p> <p>Blue LED ring follows blue sensor LEDs Do NOT block the sunlight on the DustIQ 3-5 sec</p>	No action needed
Wait	Sensors and button light up continuously for 1 minute	No action needed
Check sensors or button	<p>Slow blinking = OK and finished Inform person ② of successful completion</p> <p>Fast blinking = error Inform person ②</p>	<p>Confirm successful calibration in register 27 (see manual, Appendix A, Section 2.2.2)</p> <p>If unsuccessful read error code in register 27 for possible reasons and solutions</p>

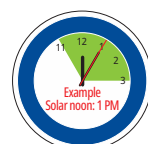
3/4 BEFORE CALIBRATION

Needed before calibration

1. Connected, working, soiled DustIQ (3% transmission loss) with software version 2.15 or higher
2. DustIQ must be operative for minimal 3 minutes
3. Modbus® registers 20-40 must be read and logged for soiling ratio's, transmission losses, status flags, dust slopes etc. (see manual, Appendix A, Section 2.1)
4. A person on-site ① and a remote person reading DustIQ data and the manual ②.
5. If moving from the back of the DustIQ to the front takes more than 20 seconds, than consider adding a third person, just to push the button.
6. A clear sunny sky



Time needed is 15 minutes
 Die benötigte Zeit beträgt 10 min
 Le temps nécessaire est de 10 min
 El tiempo necesario es de 10 min
 所需时间为10分钟



Between 2 hours before and after solar noon
 Zwischen 2 Stunden vor und nach Sonnenmittag
 Entre 2 heures avant et après midi solaire
 Entre 2 horas antes y después del mediodía solar.
 中午前后2小时之间



No clouds
 Keine Wolken
 Pas de nuages
 Sin nubes
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Clean, demineralised water and a sponge
 Sauberes, demineralisiertes Wasser und ein Schwamm
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 用干布擦拭清洁

The sky must be free of clouds and airplane contrails for at least 10 minutes.

The DustIQ calibration button must be pressed a second time within 2 minutes of the first push. The time available for cleaning and drying is therefore 2 minutes. Otherwise the calibration procedure will stop, nothing will change and normal operation will resume.

For local dust calibration it is strongly advised to take close up pictures of the PV modules nearby, DustIQ sensors and PV cell before and after cleaning. This to help identify possible errors that might be made during the calibration.

DustIQ LED light interpretation

Regular operation, 5 seconds of blue led light with a 60 second interval

Feedback during the Tare or field calibration are given by the 2 sensors and the calibration button. There are 2 cases:

1. Slow blinking is 1x per second, confirmation and DustIQ awaiting next input
2. Fast blinking is 10x per second, this is the error signal for further information see error code in register 27

Both signals last 30 seconds in total, before normal operation restarts.

DURING AND AFTER CALIBRATION

	On-Site	Remote office
	① During the procedure: - Do not cast a shadow on the DustIQ - Do not cover the sensors	②
Contact Remote Office	Contact Remote Office	Check register 26 for enough soiling and sun and inform on-site person ① (the expected value is 3), for further details check the cheat sheet
Local Check	Check for clear sky and no clouds Inform person ② of start of calibration when OK Do not cast a shadow on the DustIQ during the calibration process!	No action needed
Push calibration button for 3 seconds		No action needed
Check sensors or button flash	Slow blinking = proceed with next step Fast blinking = stop and inform person ②	During calibration 0 will be presented in register 27. If an error occurs register 27 is updated with a specific code (see manual, Appendix A, Section 2.2.2)
Clean and dry the whole DustIQ front		No action needed
Push button again (for 3 sec.)		No action needed
Wait	Sensors and button light up continuously for 1 minute Do not cast a shadow on the DustIQ Do not touch the DustIQ	No action needed. Wait for update from on-site person ①
Check sensors or button	Slow blinking = OK and finished Inform person ② of successful completion Fast blinking = error Inform person ②	Confirm successful calibration in register 27 (see manual, Appendix A, Section 2.2.2) and optionally read and use new dust slopes (see manual, Appendix A, Section 2.1) If unsuccessful read error code in register 27 for possible reasons and solutions

Total duration 2 minutes

4/4 REMOTE OFFICE cheat sheet

Register 26 before calibration

Value	Meaning	Remarks
0	There is not enough sun light and not enough soiling on the sensors	On-site check for clear sky and local time is between 2 hours before and after local solar noon. Check if there is >3% transmission loss in registers 21 and 25.
1	Enough sunlight	There is > 500 W/m ² solar irradiation on the DustIQ. But not (yet) enough soiling so wait for more soiling.
2	Enough soiling on both sensors	There is >3% transmission loss in registers 21 and 25. But not enough sunlight (yet).
3	Enough sunlight and soiling on both sensors. Calibration possible.	Contact people on-site to check readiness, time window and sky conditions and if OK they can start the 2 minute waiting time followed by pushing the button and cleaning.
4	Unstable soiled measurements	Before calibration the DustIQ, must have had 2 minutes of stable sunlight and the two sensors must have had 2 minutes of stable soiling.

Register 27 after tare

Value	Meaning	Remarks
3000	Tare successful	Tare procedure is completed.
3006	Tare started within 2 minutes of start up	Attempted to start tare procedure without waiting the required 2minutes to allow for stabilization.
3010	Hardware error	Signal is to low possible hardware failure.

Register 27 after calibration

Value	Meaning	Remarks
1	Successful calibration	The dust slopes in registers 36 and 38 have changed. Refer to chapter 4.1 to see how older data or data from other DustIQs on the same PV plant can be updated with the new calibration values. Valid values for register 36 and 38 are from 30 (extreme white soiling) to 300 (very dark soiling)
1000	Attempted to start without enough sun	Calibration was halted. Nothing has been changed. Register 26 should be checked before pushing the button.
1001	Attempted to start without enough soiling	Calibration was halted. Nothing has been changed. Register 26 should be checked before pushing the button.
1002	Attempted to start with unstable sunlight on PV cell	Clouds or a person has blocked the sunlight. the sunlight in the 2 minutes before pushing the button.
1003	Attempted to start with unstable dust measurement.	On-site personnel touched the glass area of sensor 1 or 2 during the 2 minutes before pushing the button.
1004	Button pushed but too short. This prevents accidental start.	Push the button 3-5 seconds for the calibration to start.
1005	Time out. The button hasn't been pushed a second time within 2 minutes from first push.	Could be by accident. Not pushing the button a second time is also a safe escape from the calibration procedure.
1006	Field calibration started withing 3 minutes of start-up (without waiting)	
2010	Sensor 1 showed too little soiling change.	Sensor 1 not properly cleaned or dried.
2020	Sensor 2 showed too little soiling change.	Sensor 2 not properly cleaned or dried.
2030	PV cell showed unreliable little change.	PV cell not properly cleaned or dried. Or PV cell much cleaner than the sensors by e.g. accidental cleaning. OR Clouds or a person has blocked the sunlight.
2040	Clean measurement unstable	Disturbance during clean measurement.
2050	Dustslope out of range	Dustslope is higher than expected but procedure was correct.
2060	Dustslope factor out of range	Dustslope is higher than expected but procedure was correct.