GOODWE
SOLAR ACADEMY

2023

TECHNICAL DOCUMENT

GoodWe Shadow Scan Solution

Why shadow scan is needed?

As we know, the MPPT or Maximum Power Point Tracking function in a converting system ensures the solar inverter work at its maximum power by tracking DC voltage and current. This works for all inverters under normal conditions (without shadowing).

When the inverter works, the MPP tracker starts working (Fig 1), scanning from the right side (Open-Circuit Voltage) to the left side (Minimum MPP tracking voltage) to track the first maximum power point.

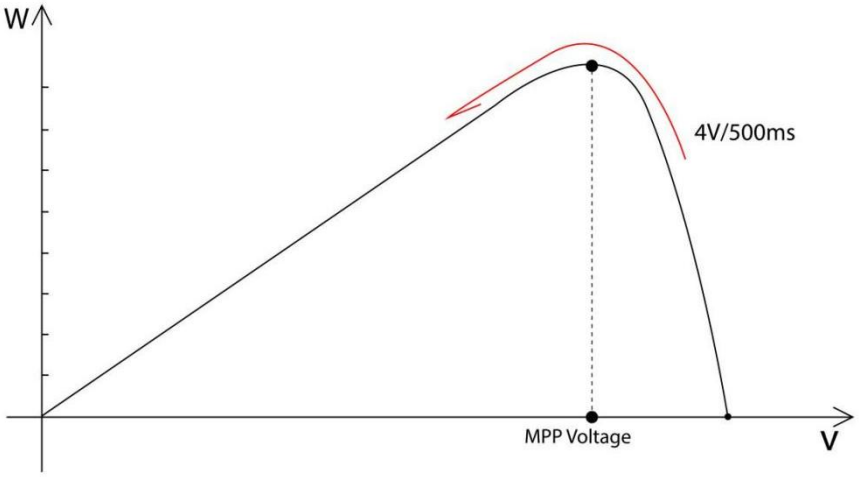


Fig 1. MPP Tracking Under Uniform Condition

So what will happen when there is shadow on PV module strings? MIGHT NOT BE AT ITS MAX POWER! When there's a shadow, the output power has multiple extreme power points instead of one maximum power point only. (Fig 2) However, the tracker will still stop at the first maximum power point it tracks, which will cause a power loss of the solar system.

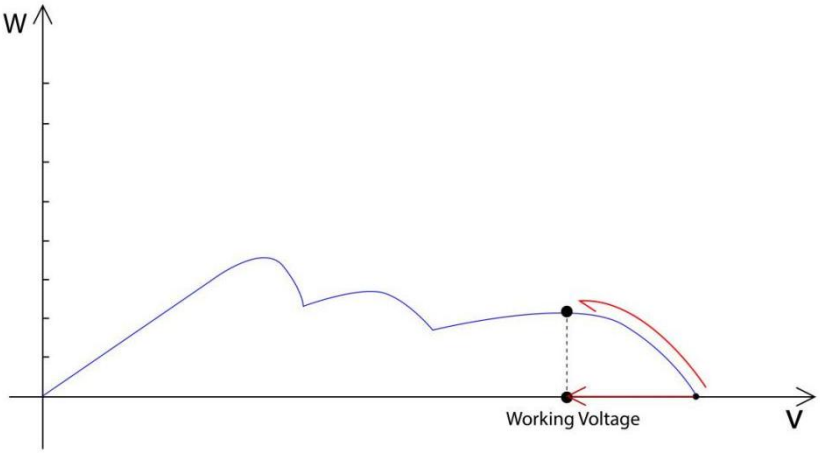


Fig 2. MPP Tracking Under Shaded Condition

That is why the shadow scanning function or optimizer is adopted in solar systems.

What is shadow scan?

When the shadow scan function is activated, the MPP will scan the whole voltage range regularly to help locate the real maximum power point from multiple fake MPP points like in Fig 3.

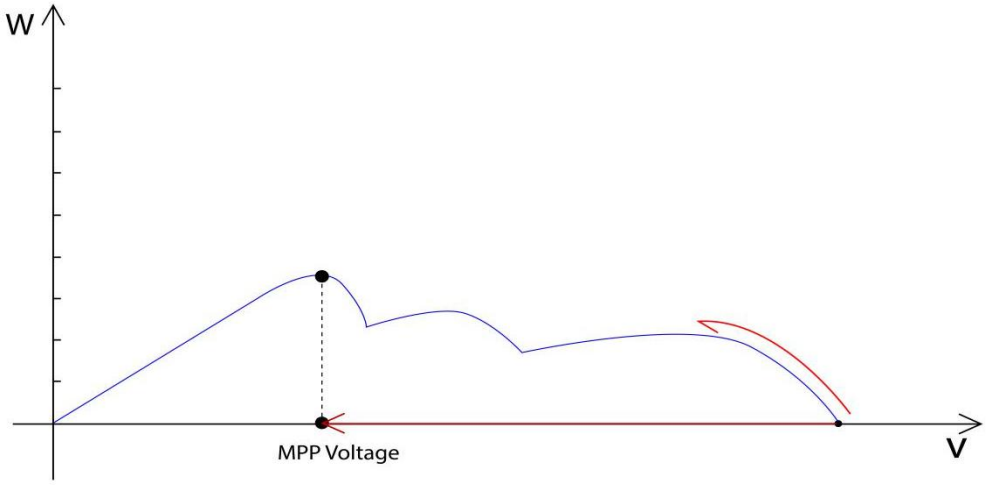


Fig 3. Shadow Scan Result Under Shaded Condition

How GoodWe shadow scan works?

Shadow scanning function, an optional and periodical operation, is available on all GoodWe residential and commercial inverters. The operation principle is as following:

*** FIRST STEP:** Ready for scanning (Fig 4)

When the function is activated, MPP tracker will track back to the original voltage point to get ready for scanning the whole voltage range.

Speed: 15V/500ms

Start Point: Present Working Voltage

Back-track Point: PV String Open-Circuit Voltage or Max MPPT Range, or PV power ＜50W

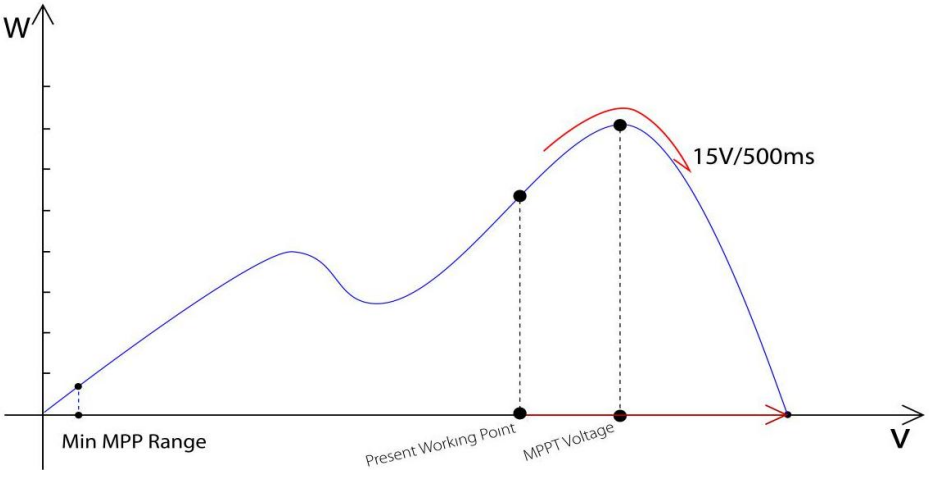


Fig 4. Ready for Scanning

*** SECOND STEP:** Scan Whole Voltage Range (Fig 5)

By scanning the whole voltage range to find out the real highest power point.

Speed: 4V/500ms

Start Point: Ready Point - PV String Open-Circuit Voltage or High MPPT Range, or PV power ＜50W

Back-track Point: Low MPPT Range

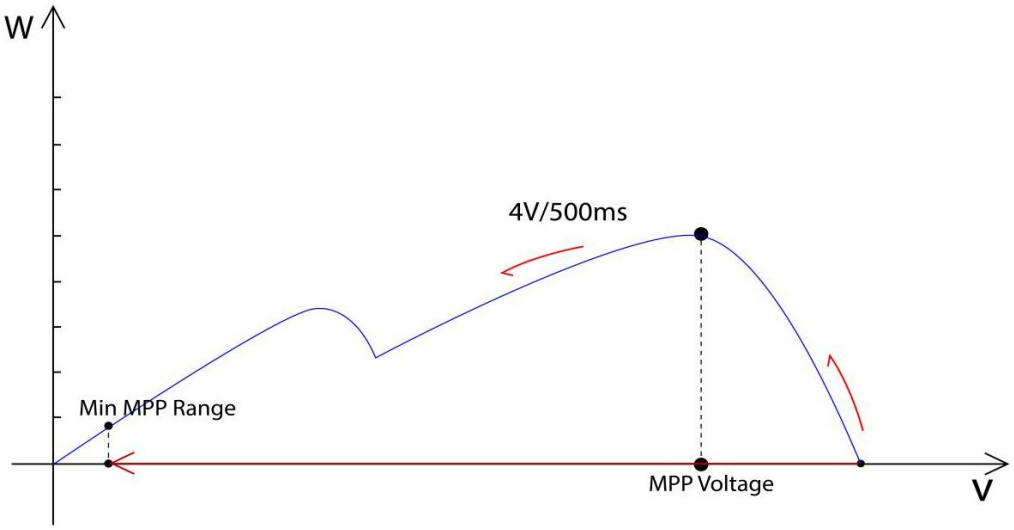


Fig 5. Scan Whole Voltage Range

*** THIRD STEP:** Track Back to The MPP Voltage (Fig 6)

As the tracker find out the real maximum power point, it will track back to the point to make sure the inverter works at the max power of PV strings.

Speed: 15V/500ms

Start Point: Low MPPT Range

Back-track Point: MPP Voltage / Maximum Power Point

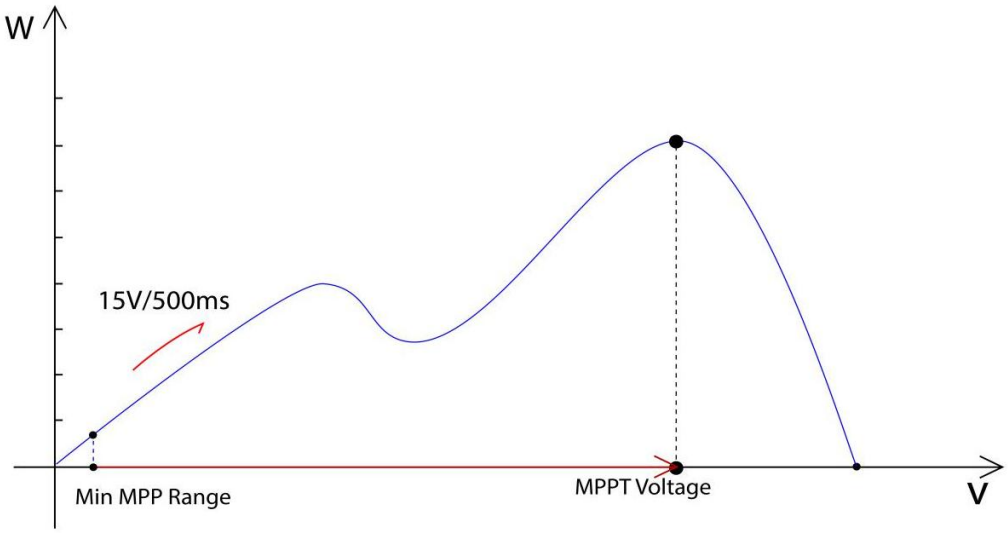


Fig 6. Track Back to The MPP Voltage

NOTE: During scanning, the scanned MPPT will not stay on the maximum power point. The real power will change following the scanning process.

SCANNING INTERVALS

The GoodWe solar inverters differ in shadow scan interval. We defined shadow scan interval time as the overall scan time of the specific inverter. The overall scan time is equivalent to the number of MPPTs times the scan interval between MPPTs as following.

Inverter Model	Number of MPPTs	Scan Interval Between MPPTs	Shadow Scan Interval Time
XS	1 MPPT	30 mins	30 minutes
DNS/SDT G2	2 MPPTs	30 mins	60 minutes
MS	3 MPPTs	30 mins	90 minutes
SMT	3-6 MPPTs	20 mins	60 - 120 minutes
MT	4 MPPTs	15 mins	60 minutes
ET15-30	2-3 MPPTs	20 mins	40-60 minutes
ES G2	1-2 MPPTs	20 mins	20-40 minutes
EH	2 MPPTs	20 mins	40 minutes
AES	4 MPPTs	20 mins	80 minutes

NOTE:

1. All MPPTS on one inverter are scanned one by one, Multi MPPTs will not be scanned at the same time.

2. Shadow scan function is turned off as default setting on each inverter. If it needs to be activated, please do the commission on the display or through SolarGo APP (Fig 7)

3. *Shadow scanning function is not available on ET5-10kW series now.*



Fig 7. Activate Shadow Scan Function On Inverter display or SolarGo

GoodWe Smart Shadow Scan Function

Smart Shadow Scan

Smart shadow scan function is upgraded on the new models like SDT G2 Plus+, DNS G3 and MS G3 Series.So this smart shadow scan function is upgraded with a settable scan interval time, which is between 5 to 300 minutes. For example, if you turn on the shadow scan function and set the shadow scan interval time at 10 minutes. The MPPTs of inverters will start the shadow scan every 10 minutes and different MPPTs work independently.

Inverter Model	Number of MPPTs	Shadow Scan Interval Time
DNS G3	2 MPPTs	5-300 minutes (60 minutes by default)
MS G3	3 MPPTs	5-300 minutes (60 minutes by default)
SDT G2 Plus+	2 MPPTs	5-300 minutes (60 minutes by default)

NOTE:

Shadow scan interval time can be set on the display or SolarGO APP after turning on the shadow scan function. The input range for shadow scan interval time is 5 to 300 minutes. Please note that the shadow scan time is the scan interval for each MPPT and MPPTs work independently .

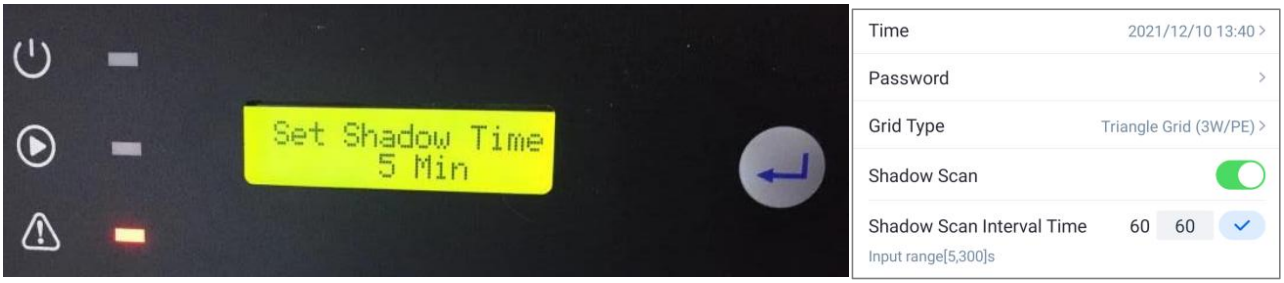


Fig 8. Setting Shadow Scan Interval Time on inverter display or SolarGo

POWER LOSS OF SHADOW SCAN

The power generation loss after each cycle of shadow scan is about 8Wh.
To achieve this value, we did the following test:

1. Preparation

Test model: GoodWe single-phase model(2 MPPT)
Test conditions: 1) DC: Vmppt=300V, Pmppt=4300W;
2) AC: Vac=220V, Frequency=50Hz(grid connection)
Test period: 142min

2. Procedure

1) Turn on Shadow Scan and conduct twice of the scan (around 35 seconds for each scan)for a certain period of time and record the total amount of power generation;
2) Turn off Shadow Scan and record the total amount of power generation for a same length of time;
3) The figures below show the AC output curve comparison during the shadow scan.

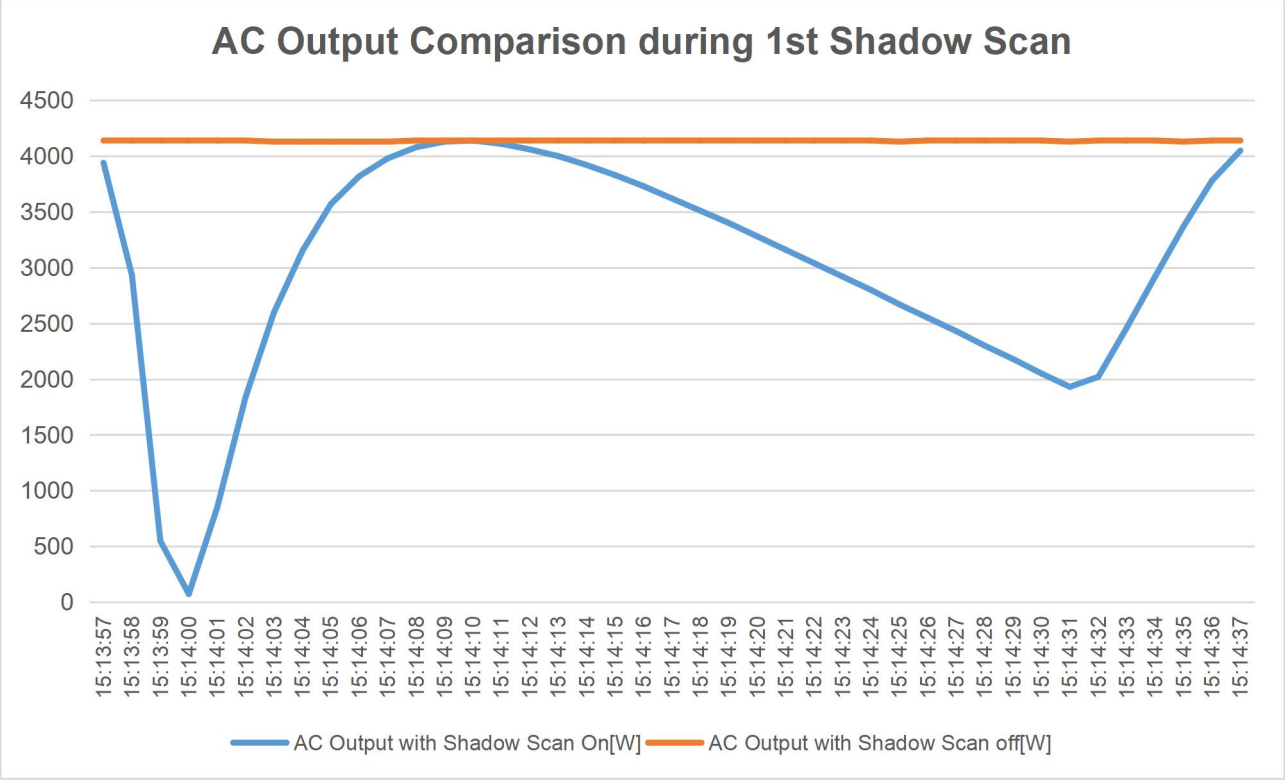


Figure 1

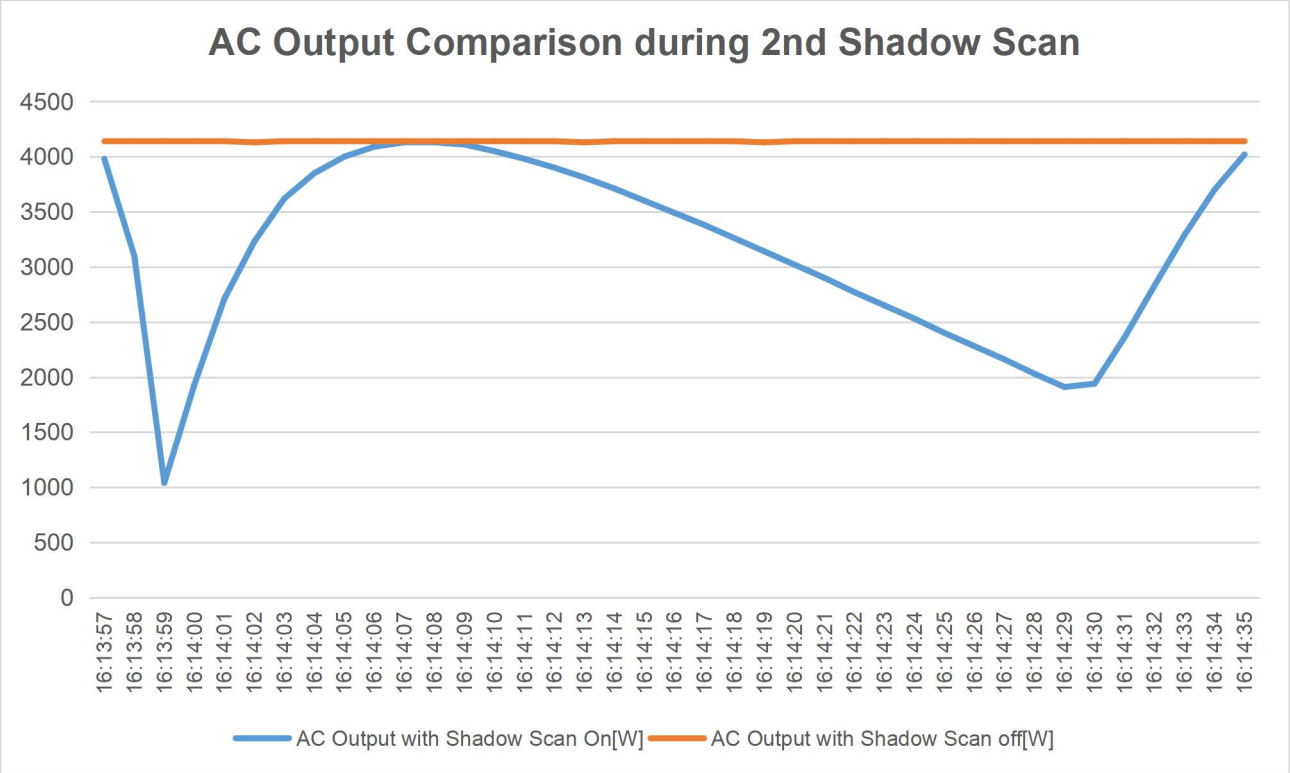


Figure 2

3. Result

The total amount of power generation of step 1 is 9785.57 Wh, and the amount of step 2 is 9802.30 Wh. So the average power generation loss of each cycle of shadow scan is:

$$\frac{9802.3 - 9785.570}{2} = 8.365Wh$$

Smart shadow scan are more flexible for different shadow situations with a settable scan interval to minimize the power generation loss.

GoodWe Models equipped with Shadow Scan Function

At present, GoodWe XS, DNS, DNS G3, MS, MS G3, SDT G2, SDT G2 Plus+, SMT, MT, AES, ES G2, EH and ET15-30kW series are all equipped with shadow scan functions.

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