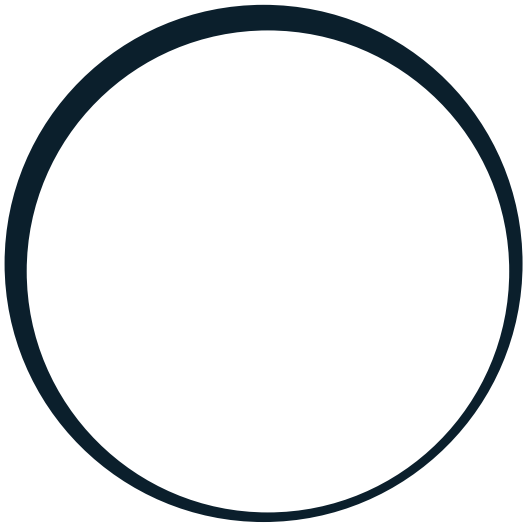

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# Manual | for authorised electricians

## Power meters

EN

IMPORTANT

► **Read this documentation carefully before installation.**

► **Retain this document for reference purposes.**


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# 1 Information about this document

This document is a supplement to the installation instructions for the storage system used. The standard measurement concept with standard power meters is described in the relevant installation instructions. This document contains further information about power measurement, including the following in particular:

- Additional measurement concepts that can be used to operate the storage system if the standard concept is not used.
- Use of multiple power meters.

► Observe the respective installation instructions for the storage system, in particular the safety instructions.

## 1.1 Target group of this document

This document is intended for authorised electricians. The actions described here must only be performed by authorised electricians.

## 1.2 Explanation of symbols

| | |
|---|---|
| DANGER | Extremely dangerous situation leading to certain death or serious injury if the safety information is not observed. |
| WARNING | Dangerous situation leading to potential death or serious injury if the safety information is not observed. |
| CAUTION | Dangerous situation leading to potential injury if the safety information is not observed. |
| Notice | Indicates actions that may cause material damage. |
| | Important information not associated with any risks to people or property. |

| Symbol | Meaning |
|---|---|
| ► | Work step |
| 1. 2. 3. ... | Work steps in a defined order |
| • | List |

*Table 1: Additional symbols*

# 2 Safety

Electrical work may need to be carried out in some cases in order to implement the measurement concepts described in this document. Please note:

**DANGER**

**Electrical work on the electrical distributor**

Danger to life due to electrocution!

- ▶ Disconnect the relevant electrical circuits.
- ▶ Secure against anyone switching on the device again.
- ▶ Check that the device is disconnected from the power supply.
- ▶ Only authorised electricians are permitted to carry out electrical work.

# 3 Energy flows

## 3.1 Energy flows

The following energy flows are relevant for the energy management:

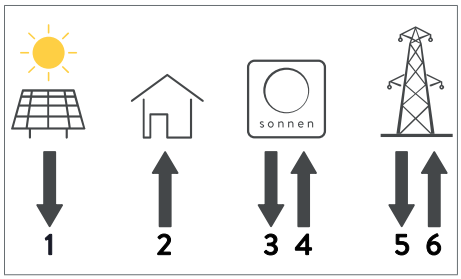


*Figure 1: Relevant energy flows for the energy management*

| | |
|---|---|
| 1 | Production |
| 2 | Consumption |
| 3 | Discharge |
| 4 | Charge |
| 5 | Usage |
| 6 | Feed-in |

**Production (1)**
Electrical energy that is generated by an electrical system (e.g. PV system, wind turbine, etc.).

**Consumption (2)**
Electrical energy that is required to operate electrical consumers.

**Discharge (3)**
Electrical energy that is delivered by the storage system.

**Charge (4)**
Electrical energy that is stored in the battery.

**Usage (5)**
Electrical energy that is taken from the public electricity grid.

**Feed-in (6)**
Electrical energy that is fed into the public electricity grid.

**Notes**

- Discharge/charge and feed-in/usage cannot occur at the same time.
- Charge/discharge is recorded internally (inside the storage system).

## 3.2 Relationship between energy flows

The energy flows relate to each other as follows:

### 3.2.1 Case 1: consumption > production

If consumption is higher than production, there is an electrical energy deficit. In this case the battery is discharged in order to compensate as much as possible for the deficit. If the entire deficit cannot be covered by discharging the battery, the

remainder of the deficit is covered by the public electricity grid.

In general the following applies:

**Consumption = Production + Discharge + Usage**

*Formula 1: General formula when consumption > production*

The following points must be taken into account concerning discharging the storage system:

- The battery can only be discharged if it is not yet fully discharged.
- Discharging the storage system with full power is not always possible. For example, the battery management system may reduce discharging in order to prevent damage to the battery.

### 3.2.2 Case 2: production > consumption

If production is higher than consumption, there is an electrical energy surplus. In this case as much of the surplus is used as possible in order to charge the storage system battery. If the surplus exceeds the amount needed to fully charge the battery, the remainder of the surplus is fed into the public electricity grid.
In general the following applies:

**Production = Consumption + Charge + Feed-in**

*Formula 2: General formula when production > consumption*

The following points must be taken into account concerning charging the storage system:

- The battery can only be charged if it is not yet fully charged.
- If the feed-in limit is activated, the intelligent charging management system may prevent the storage system from being charged even though the battery is not fully charged.
- Charging the storage system with full power is not always possible. For example, the battery management system may reduce charging in order to prevent damage to the battery.

## 3.3 Measurement points

The energy flows set out in section 3.1 (p. 7) can be recorded through power measurements taken at various measurement point.

### 3.3.1 Types of measurement points

There are four different types of measurement point:

### Measurement point C (Consumption)

Consumption is recorded at this measurement point. The energy only flows in one direction (to consumers).

### Measurement point D (Difference)

The difference between consumption and production is recorded at this measurement point. The energy can flow in both directions. Energy flows to consumers correspond to a deficit and are recorded as positive measurement values. Energy flows to the public electricity grid / storage system correspond to a surplus and are recorded as negative measurement values.

### Measurement point G (Grid)

Usage from or feed-in to the public electricity grid is recorded at this measurement point. The energy can flow in both directions. Energy taken from the public electricity grid is recorded as positive measurement values. Energy fed into the public electricity grid / storage system is recorded as negative measurement values.

### Measurement point P (Production)

Production is recorded at this measurement point. The energy only flows in one direction (away from producer).

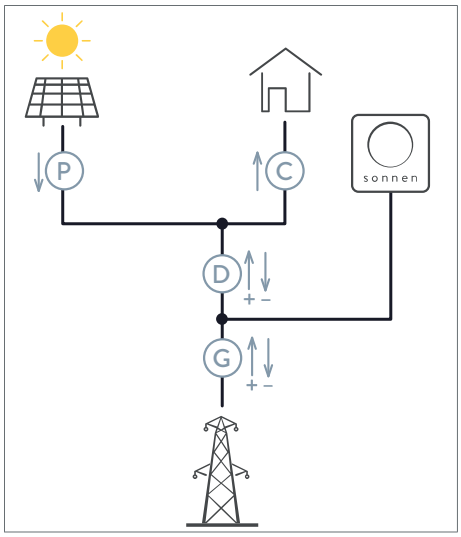


*Figure 2: Overview of all types of measurement points*

A power measurement does not have to be taken at all measurement points. For example, it is sufficient to take readings at measurement points C and P. The rest of the energy flows are calculated by the storage system controls using the formulas from section 3.2 (p. 7).

The following measurement concepts are possible: CP, C, DP and GP (see section 6 – p. 26).

## 3.3.2 Configuring the measurement points

The measurement points can be configured in the commissioning assistant on the 'Power Meter' page.

### Deleting measurement points

All currently configured measurement points are listed under the heading 'Existing Meter Setting'.

▶ Press **Delete** to delete the desired measurement point.

### Adding measurement point

New measurement points can be added under the heading 'Add Meter Setting'.

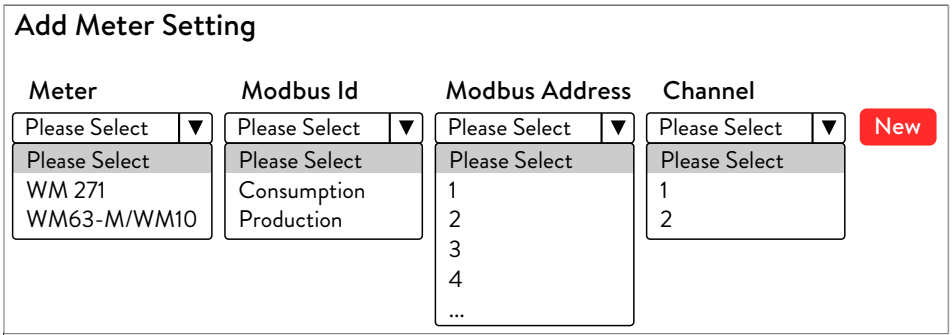


*Figure 3: „Add Meter Setting" on the Power Meter pager within the commissioning assistant*

| Drop down menu | Function |
|---|---|
| **Meter** | ▶ Select the power meter used at this measurement point.<br>The WM271 power meter is the default instrument. The WM63-M or WM10 power meters are only used in exceptional cases. |
| **Modbus Id** | The type of measurement defines whether consumption or production has to be selected here.<br>▶ Select production for measurement point P.<br>▶ Select consumption for all other measurement points (C, D and G). |
| **Modbus Address** | ▶ Select the address of the power meter here.<br>The selected address must match the set address (Default 4) on the power meter. |
| **Channel** | The WM271 power meter has two measurement channels: A1 and A2. One measurement point can be recorded with each channel.<br>▶ If channel A1 is used for this measurement point, select 1.<br>▶ If channel A2 is used for this measurement point, select 2.<br>▶ If the WM63-M or WM10 power meter is used, select 1. |

## 3.4 Checking energy flows

The current energy flows ca be checked as follows:

### 3.4.1 Via the internet portal

► Log onto the internet portal (https://my.sonnen-batterie.com).

► Open the 'Status' page.

The 'Status' page provides an overview of the current energy flows from section 3.1 (p. 7). The power readings displayed are measurements of the active power.

### 3.4.2 Via the web interface of the storage system

► Log onto the web interface of the storage system (https://find-my.sonnen-batterie.com).

The 'Dashboard' page provides an overview of the current energy flows from section 3.1 (p. 7). The power readings displayed are measurements of the active power.

The 'Power Meter' page displays multiple measurement values for each individual measurement point, including the current active power (w_total) and the current reactive power (var_total).

# 4 Power meter WM271

The power meter WM271 records the energy flows on the respective measuring points.

## 4.1 Electrical connection

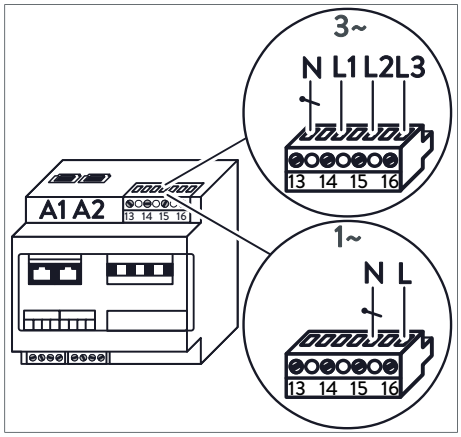


*Figure 4: Connection to the voltage measurement terminal strip at single-phase (1~) and three-phase (3~) mains*

The power meter WM271 can be used in a single-phase as well as a three-phase mains.

**Three-phase connection**

In the case of a three-phase mains:

► Wire the individual strands as shown in the top part of figure 4.

**Single-phase connection**

In the case of a single-phase mains:

► Wire the individual strands as shown in the lower part of figure 4.

## 4.2 Connecting the current transformers

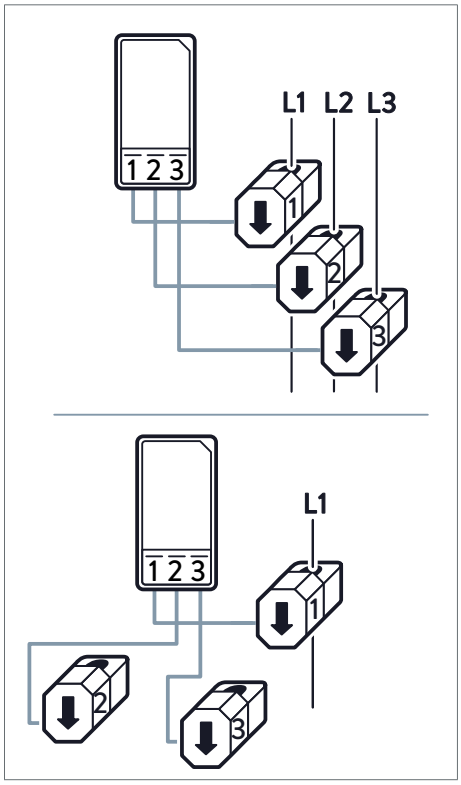


*Figure 5: Connecting the clamp-on current transformers for three-phase and single-phase measurement*

The actual amperage of the respective phase is detected by means of the clamp-on current transformers.

In the case of a one-phase measuring point, only the clamp-on current transformer for the phase in question is connected. The other two clamp-on current transformers must not be connected.

## 4.3 Common errors when connecting the clamp-on current transformers

The following errors are common when connecting the clamp-on current transformers:

- The clamp-on current transformers are installed at the wrong point.
- The clamp-on current transformers (phases) are mixed up.
- The measurement direction of the clamp-on current transformers is incorrect.

These last two errors and their potential consequences are described in the following.

### 4.3.1 Clamp-on current transformers are mixed up

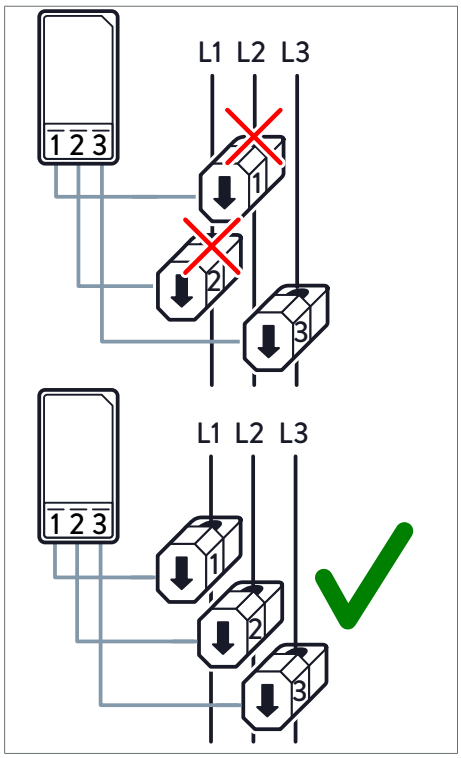


*Figure 6: Connecting the clamp-on current transformers – incorrect (top) and correct (bottom)*

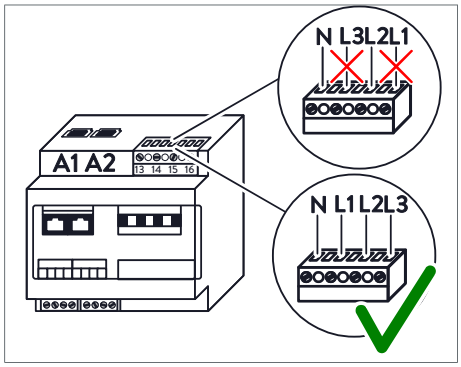


*Figure 7: Connection to the voltage terminal strip – incorrect (top) and correct (bottom)*

Power measurement only works if the current and voltage of the same phase are measured.

The current at the relevant measurement point is measured using the clamp-on current transformer, while the current voltage is measured via the voltage measurement terminal strip. The power is calculated as the product of the current times the voltage.

The power recorded at clamp-on current transformer 1 is the result of the current at clamp-on current transformer 1 multiplied by the voltage at input L1 of the voltage measurement terminal strip. The power recorded at clamp-on current transformer 2 is the result of the current at clamp-on current transformer 2 multiplied by the voltage at input L2, and so on.

**Example of incorrect implementation:**

- The voltage measurement terminal strip is wired correctly.
- Clamp-on current transformers 1 and 2 are mixed up.
- An ohmic consumer with a consumption of 1000 watts is connected at L1.
- The clamp-on current transformers are used as measurement point C (consumption).

In this example, the phase between current and voltage measurement is offset by 120°. This has the following consequences:

- An active power reading of approx. 500 watts is displayed, even though the

actual active power is 1000 watts (because P=U·I·cos(120°) and cos(120°)=-0.5).

- The positive/negative sign in front of the active power reading is reversed.
- A reactive power reading of approx. 866 Var is displayed, even though there is actually no reactive power (because Q=U·I·sin(120°) and sin(120°)≈0.866).

### 4.3.2 Measurement direction of the clamp-on current transformers is incorrect

If the 'Easy Connection' function is deactivated on the WM271 power meter, positive and negative power readings can be recorded (see section 4.5.3 – p. 19). In this case it is important to ensure that the measurement direction of the clamp-on current transformers is correct.

**Example of incorrect implementation:**

All three clamp-on current transformers are installed at measurement point G with the incorrect measurement direction. This has the following consequences:

- Usage of energy is recorded, even though energy is actually being fed into the public electricity grid, and vice versa.
- The storage system is discharged, even though it should actually be charged, and vice versa.

## 4.4 Programming of the WM271

The power meter WM271 can be programmed with the help of a touch display.

### 4.4.1 Mounting the touch display

Tools:

- Touch display
- Screwdriver

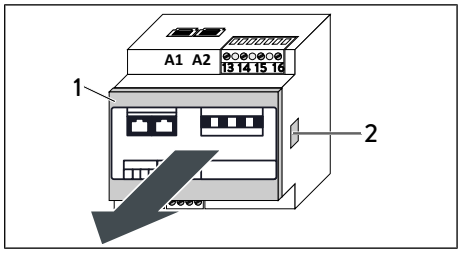


*Figure 8: Removing the front cover*

| | |
|---|---|
| 1 | Front cover of the power meter |
| 2 | Clip to remove the front cover |

► Press the clips (2) on both sides of the power meter.
You might use a small screwdriver.

► Remove the front cover (1).

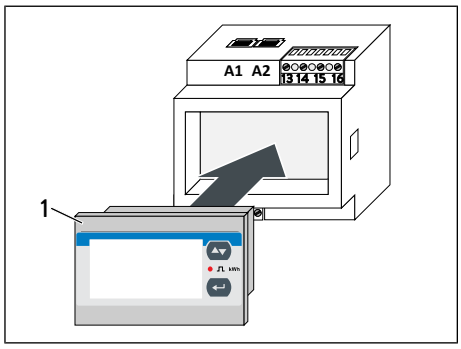


*Figure 9: Inserting the touch display*

| | |
|---|---|
| 1 | Touch display |

► Insert the touch display into the power meter.

► Supply the power meter with energy.

### 4.4.2 Switching to the programming mode

The power meter is in display mode after the touchscreen is mounted. Values are shown on the display but cannot be changed. Switch to the programming mode to change the values. Proceed as follows:

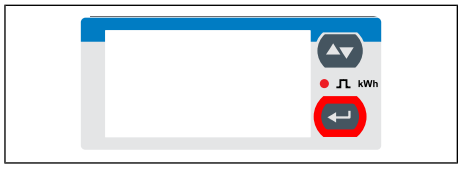


*Figure 10: Touch display*

► Press and hold ↵ for 3 seconds.

The PASS ? screen appears.

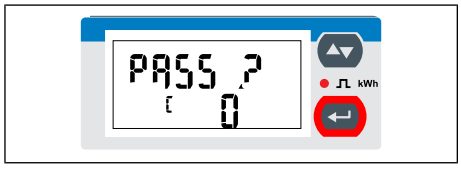


*Figure 11: Password entry screen*

The correct password needs to be entered. The default password is 0.

► Press and hold ↵ for 3 seconds.

The CnGPASS appears.

The power meter is in the programming mode.

### 4.4.3 Operating the touch display in the programming mode

The touch display can be operated by the two keys and .

#### Navigation on the touch display

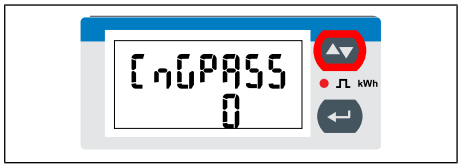


*Figure 12: CnGPASS screen*

You can navigate from the CnGPASS screen to the desired programming page by pressing the key.

#### Changing values in the programming menu

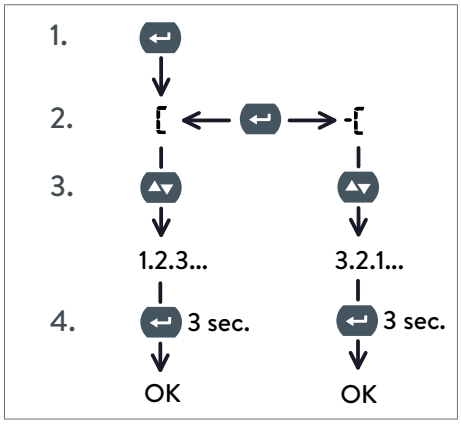


*Figure 13: Procedure for changing values*

1. Press the key to change the desired value. The [ sign appears on the touchscreen.
2. Press the key again to change the sign. Select [ to increase the value and -[ to decrease the value.
3. Press the key (multiple times) to set the desired value.
4. Hold down the key (for approx. three seconds) to apply the set value.

For example, the address of the WM271 can be changed as follows:

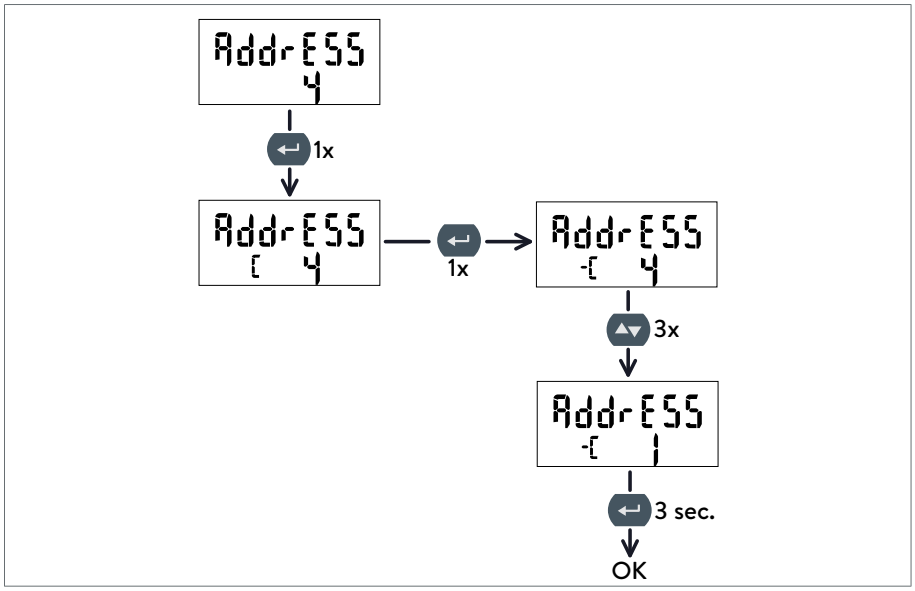


*Figure 14: Example – Changing the address from 4 to 1*

### 4.4.4 Leaving the programming mode

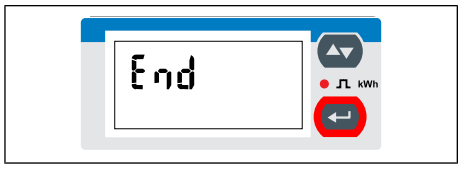


*Figure 15: End screen*

▶ Navigate to the End screen.

▶ Press ↵ to leave the programming mode.

The power meter is in display mode.

## 4.5 Description of the programming pages

All relevant programming pages are described in the following. The programming pages not described here are not important and should not be changed. The values for the programming pages described here can be changed as explained in section 4.4.3 (p. 17).

### 4.5.1 SYS programming page

The configuration of the programming page depends on whether the power meter has been connected to a three-phase or single-phase network (see section 4.1 – p. 12).

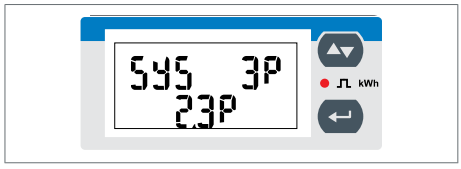


*Figure 16: SYS page*

For a three-phase connection

▶ Select 3P/2.3P.

For a single-phase connection:

▶ Select 1P/6.1P.

The other measurement modes, which can be selected on this programming page, are not important and should not be selected.

### 4.5.2 Address programming page

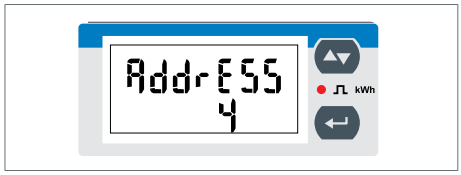


*Figure 17: AddrESS page*

The Modbus address of the power meter (Default 4) can be set on this programming page.

Each Modbus device must have a unique address.

### 4.5.3 Easy Connection (EC) programming page

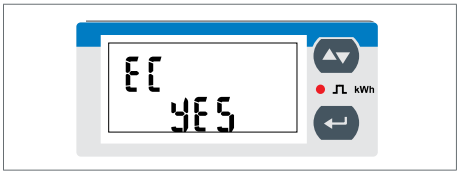


*Figure 18: EC page*

The Easy Connection (EC) function can be activated/deactivated on this programming page. This function can be used to set whether the energy flow direction is taken into account or not. The Easy Connection function is **deactivated** by default.

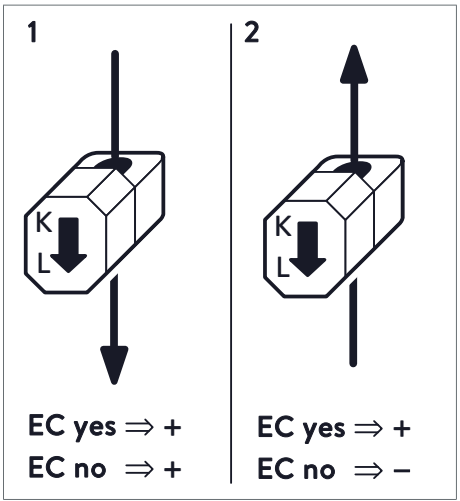


*Figure 19: Case 1 (left): the energy flow in the conductor is from K to L / Case 2 (right): the energy flow in the conductor is from L to K*

**Easy Connection activated**

If the Easy Connection function is activated (EC yes), it does not matter whether the energy in the conductor is flowing from K to L (case 1) or vice versa (case 2). The power meter always uses positive values (amounts) in its calculations.

**Easy Connection deactivated (Default)**

If the Easy Connection function is deactivated (EC no), the energy flow direction determines the positive or negative sign in front of the power reading. If the energy in the conductor is flowing from K to L (case 1), the power reading is positive. In the opposite case 2, the reading is negative.

## 4.6 Using more than one power meter

The measurement concepts described in section 6 (p. 26) sometimes allow for more than one power meter to be connected. The following describes what needs to be taken into account when using multiple power meters.

### 4.6.1 Connecting the communication line

**Notice**

**Observe the maximum line lengths**

► None of the lines connected to the storage system (electrical power, Ethernet line, Modbus line, other data lines, etc.) are allowed to exceed a maximum length of 30 m.

Depending on the communication line, up to 20 power meters (or other devices) can be interconnected:

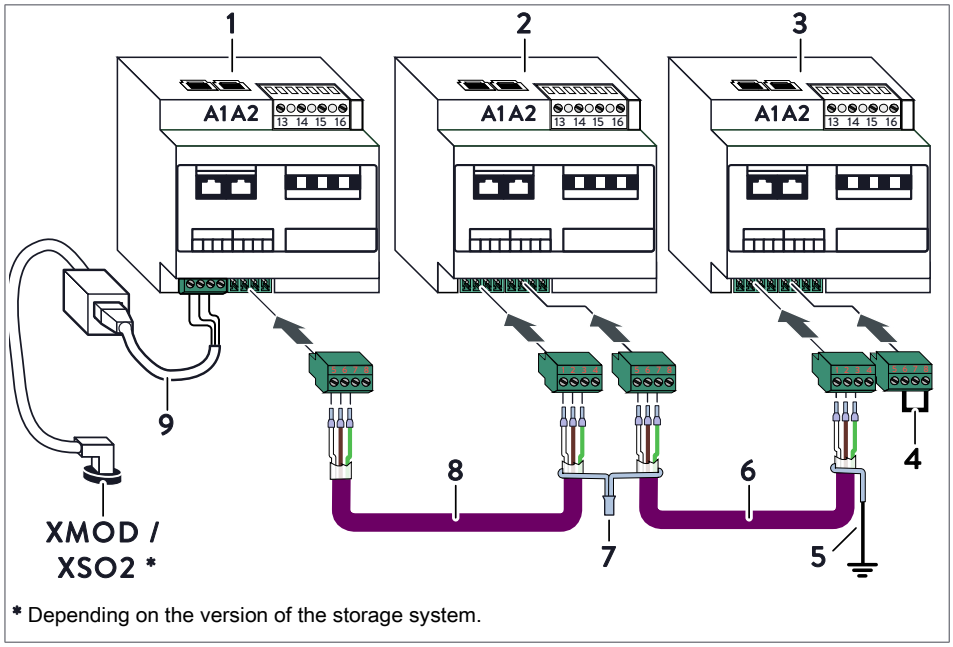


*Figure 20: Example for the connection of three WM271 power meters via communication line*

| | | | |
|---|---|---|---|
| 1 | Power meter 1 | 6 | Communication line |
| 2 | Power meter 2 | 7 | Screen connection |
| 3 | Power meter 3 | 8 | Communication line |
| 4 | Jumper for Modbus termination | 9 | Existing communication line |
| 5 | Screen connection to earthing system | XMOD / XSO2 | Modbus port on storage system |

► Connect the power meters as shown in figure 20.

**Observe the following points:**

- Use cable UNITRONIC® BUS LD 2x2x0.22 (manufactured by Lapp) or a patch cable (Cat 6/screened) as the communication lines.
- Ensure that a jumper is connected to the Modbus terminal strip for the last power meter between pins 6 and 8. If this is not the case, install a jumper between pins 6 and 8 on the Modbus terminal strip for the last power meter.
- Remove the jumpers, if any, on the Modbus terminal strip for the rest of the power meters.
- Connect the screens of the individual communication lines between the power

meters to each other. The screen of the existing communication line (9) **must not** be connected to the screen of communication line (8).

- Earth the screen of the communication line on the last power meter.

### 4.6.2 Defining addresses

Each power meter must be assigned a unique address in order for communication between the power meters and the storage system to function properly.

► Set an address on each power meter as described in section 4.4 (p. 15). Note the following:

- An address must not be used more than once.
- A number between 1 and 20 can be selected for the address.

# 5 Power meter WM10

## 5.1 Presets

The production and consumption power meters have factory presets. All values can be changed on the power meter.

The default values are:

| | |
|---|---|
| Production meter 1: | address 4 |
| Consumption meter: | address 5 |
| Production meter 2: | address 6 |
| Measurement mode: | three-phase |
| Transformer ratio: | 40 |
| Transformer amperage: | 200 A |

## 5.2 Programming the WM10

### 5.2.1 Selecting the programming mode

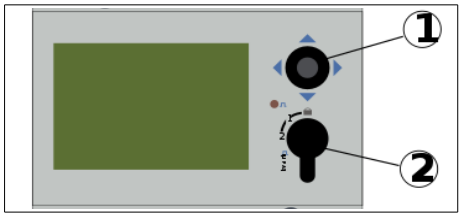


*Figure 21: Joystick and switch of the WM10*

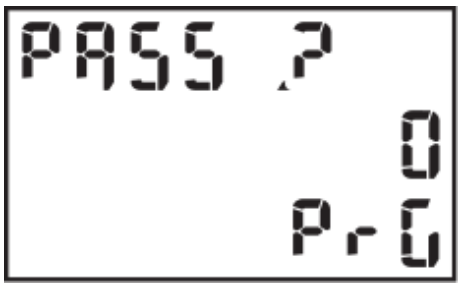


*Figure 22: Password entry screen*

► Twist the switch (2) left to position '2'.

► Press the joystick (1) down in the middle position for at least three seconds.

The Pass ? screen appears.

Enter the correct password here. The default password is '0'.

► Press the joystick down in the middle position.

The power meter is now in programming mode.

### 5.2.2 SYS programming page

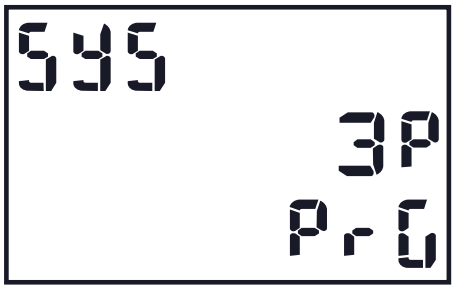


*Figure 23: SYS screen (Default: 3P)*

► Press the joystick multiple times until the SYS screen appears.

► Confirm the setting by pressing the joystick in the middle position.


*Figure 24: One-phase setting*

► Press the joystick down until 1P appears.

► Confirm the setting by pressing the joystick in the middle position.

The one-phase measurement setting is now applied.

### 5.2.3 Ct rAtio programming page (Transformer ratio)

The transformer ratio of the current transformers is set on this programming page. The transformer ratio is calculated using the following formula: max. amperage of transformer divided by 5. Example: Transformer amperage is 100 A. 100 : 5 = transformer ratio of 20.

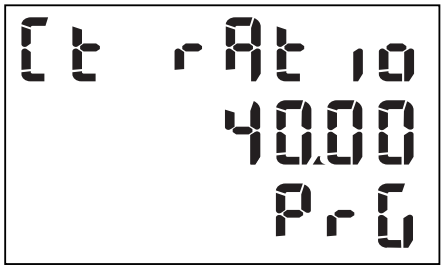


*Figure 25: Ct rAtio screen, set to transformer ratio 40*

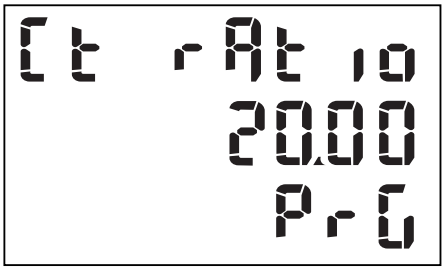


*Figure 26: Ct rAtio screen, set to transformer ratio 20*

► Press the joystick left until the display shows the Ct rAtio page.

► Confirm the setting by pressing the joystick in the middle position.

► Enter the new transformer ratio, e. g. 20 as in Figure 26.

► Confirm the setting by pressing the joystick in the middle position.

The new setting is applied.

### 5.2.4 AddrESS programming page

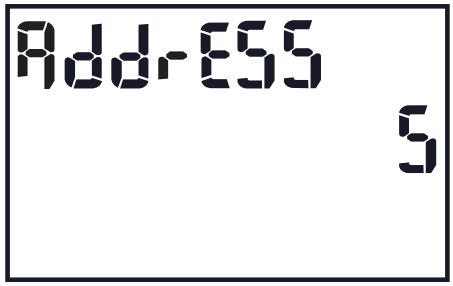


*Figure 27: AddrESS screen*

► Press the joystick left until the display shows the AddrESS page (address 5 is just an example).

► Press the joystick in the middle position.

► Press the joystick up or down until the desired address is displayed.

The new address is programmed.

### 5.2.5 Exiting programming mode


*Figure 28: End screen*

► Press the joystick left until the End display appears.

► Press the joystick in the middle position.

Programming mode closes. The power meter is now in standard mode.

► Turn the switch on the power meter to position ‚0‘.

## 5.3 Example: Connecting the WM10 power meter

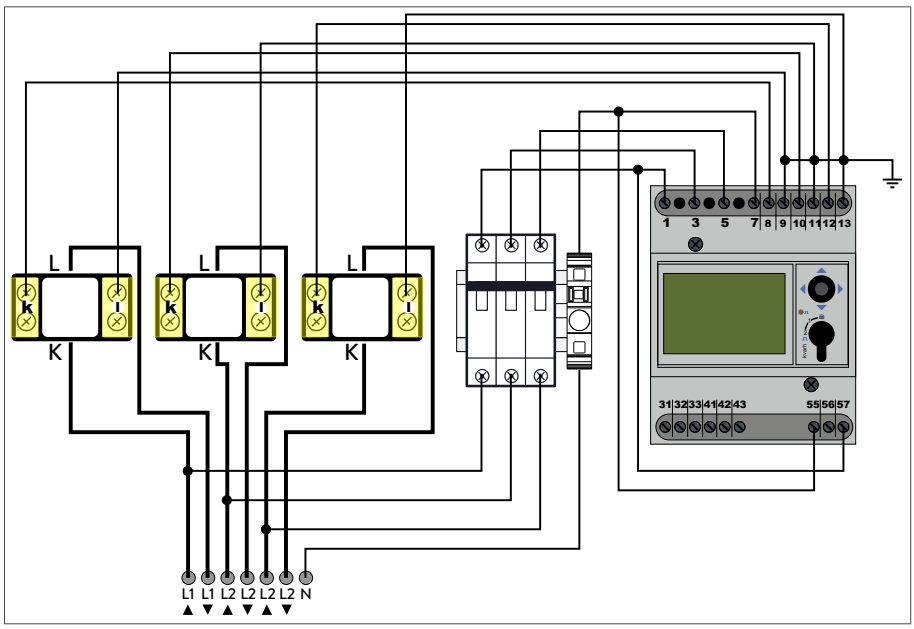


*Figure 29: Connecting WM10 and current transformers*

► Connect the power meter and the current transformers as shown in Figure 29. The transformer shown here is an example of a type of current transformer. Take not of the description of that particular item.

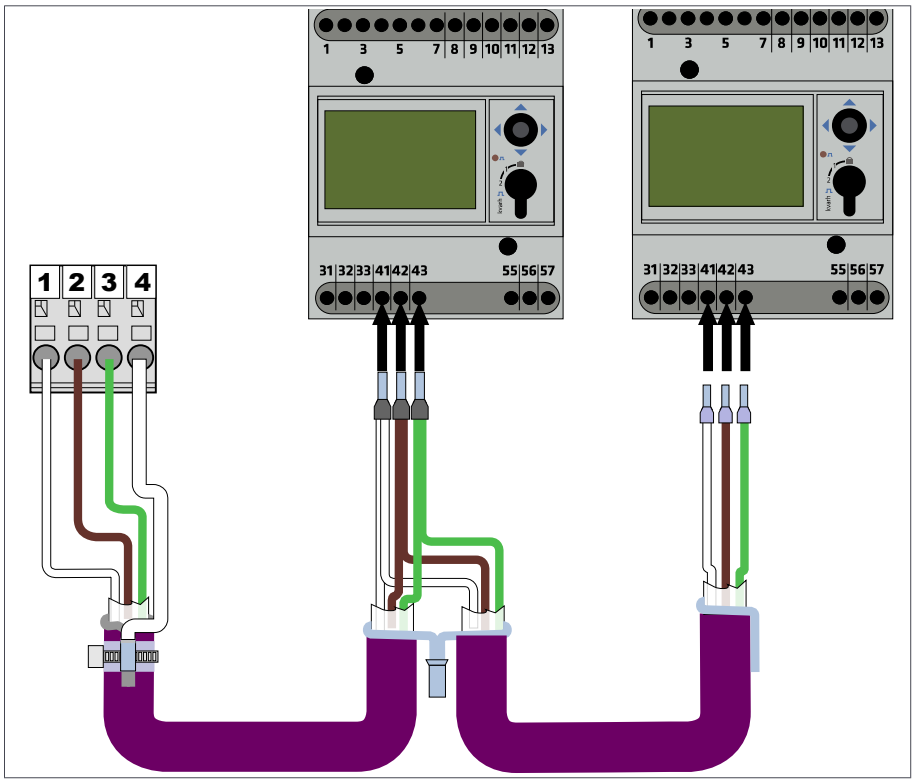


*Figure 30: Connecting the communication line*

► Connect the communication line as shown in figure 30. Please observe the specification in section 4.6.1 - p. 20.

# 6 Measurement concepts

The storage system manages energy on the basis of a number of power measurement concepts. These measurement concepts use different points to measure power. The individual measurement concepts can be implemented independently of the power meters used.

## 6.1 The CP measurement concept (Standard for Germany)

This measurement concept corresponds to the setup 1 and 5 in the commissioning assistant.

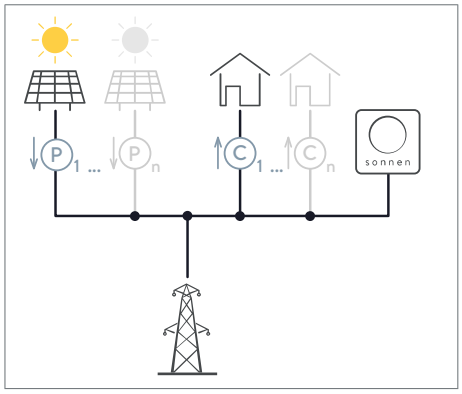


*Figure 31: Measurement concept 1*

| | |
|---|---|
| P1, ..., Pn (Production) | Measuring points for recording the production |
| C1, ..., Cn (Consumption) | Measuring points for recording the consumption |

In this concept the power generated is measured at point P1 and the power consumed is measured at point C1. Further measurement points (P2 to Pn as well as C2 to Cn) can be integrated into the system. In this case the total consumption and the total production result from the sums of the individual measured values.

The following applies:

Cges = C1 + C2 + ...

Pges = P1 + P2 + ...

The power taken from or fed into the public electricity grid is not measured, it is calculated.

Charging is triggered when there is a PV surplus. Discharging is triggered when there is a power deficit (consumption > yield).

### 6.1.1 Calculating the energy flows

Usage/feed-in is not measured, it is calculated.

Usage is calculated using formula 1 (p. 8). The following applies:

**Usage = Consumption – Production – Discharge**

*Formula 3: general formula when consumption > production – solved for usage*

Feed-in is calculated from formula 2 (p. 8) as follows:

**Feed-in = Production – Consumption – Charge**

*Formula 4: General formula when production > consumption – solved for feed-in*

### 6.1.2 Implementing the CP measurement concept

Proceed as follows when implementing this measurement concept:

1. Connect the clamp-on current transformers to measurement point C (consumption). Ensure that the arrows of all connected clamp-on current transformers are pointing towards the consumer.
2. Connect the clamp-on current transformers to measurement point P (production). Ensure that the arrows of the connected clamp-on current transformers are pointing away from the producer.
3. If more than one power meter are used: Proceed as described in section 4.6 (p. 19.
4. Run the commissioning wizard until you reach the 'Power Meter' page.
5. Ensure that the settings of the individual measurement points ('Existing Meter Setting') are correct (see section 3.3.2 – p. 9).
6. Select **Setup 1** or **Setup 5** on the 'Power Meter' page.
7. Scroll down to the bottom of the 'Power Meter' page and click on **Next**.
8. Run the commissioning wizard right to the end.

## 6.2 The C measurement concept (sonnenBatterie hybrid)

This measurement concept corresponds to the setup 2 in the commissioning assistant.

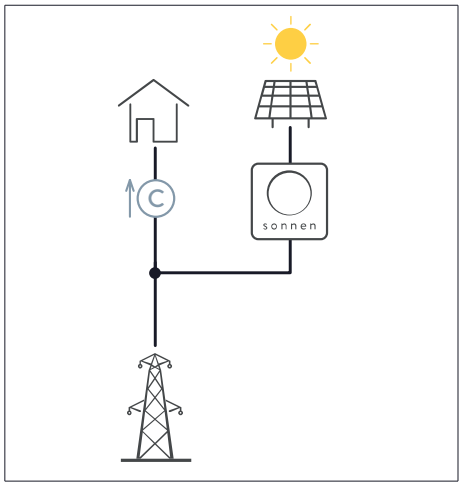


*Figure 32: Measurement concept 2*

| | |
|---|---|
| C | Measuring point for recording the consumption |

This measurement concept only works with a sonnenBatterie hybrid.
In this measurement concept, the power consumed is measured at point C.
As the PV system is directly connected to the storage system, the power generated is measured in the storage system.
The power taken from or fed into the public electricity grid is not measured, it is calculated.

Charging is triggered by a PV surplus, which is directly measured in the storage system.

### 6.2.1 Calculating the energy flows

Just like measurement concept 1, usage/feed-in is not measured, it is calculated.
Usage and feed-in are calculated as described in section 6.1.1 (p. 26).

### 6.2.2 Implementing the C measurement concept

Proceed as follows when implementing this measurement concept:

1. Connect the clamp-on current transformers to measurement point C (consumption). Ensure that the arrows of all connected clamp-on current transformers are pointing towards the consumer.
2. Run the commissioning wizard until you reach the 'Power Meter' page.
3. Ensure that the settings of the individual measurement points ('Existing Meter Setting') are correct (see section 3.3.2 – p. 9).
4. Select **Setup 2** on the 'Power Meter' page.
5. Scroll down to the bottom of the 'Power Meter' page and click on **Next**.
6. Run the commissioning wizard right to the end.

## 6.3 The DP measurement concept

This measurement concept corresponds to the setups 3 and 6 in the commissioning assistant.

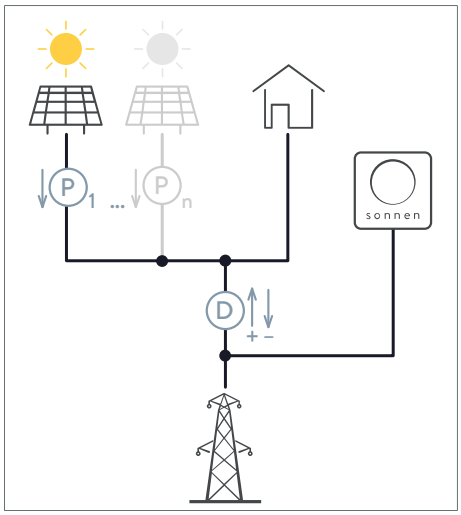


*Figure 33: Measurement concept 3*

| | |
|---|---|
| P1, ...; Pn (Production) | Measuring points for recording the production |
| D (Difference) | Measurement point to record the difference between production and consumption |

In this measurement concept, the power consumed is measured at point P1. Further measurement points (P2 to Pn) can be integrated into the system. In this case the total production results from the sums of the individual measured values. The following applies:

Pges = P1 + P2 + ...

At point D, the difference between production and consumption is recorded.

The power consumed is not measured, it is calculated.

In the same way, the power taken from or fed into the public electricity grid is not measured, it is calculated.

Charging or discharging of the storage system is triggered by the measurement values at measurement point D. Positive values indicate usage and discharging of the storage system. Negative measurement values indicate feed-in to the public electricity grid and charging of the storage system.

### 6.3.1 Calculating the energy flows

The difference between consumption and production is measured at measurement point D. The following applies:

**Difference = Consumption – Production**

*Formula 5: Difference*

Since production at measurement points P1, ..., Pn is also measured, consumption can be calculated from this formula.

#### Case 1: Consumption > Production

In this case the difference is a positive value. This corresponds to a deficit. Electrical

energy flows towards the consumer. Using the difference in formula 1 (p. 8) yields the following:

**Difference = Discharge + Usage**

*Formula 6: Difference – used in the general formula when consumption > production*

**Case 2: Production > Consumption**

In this case the difference is a negative value. This corresponds to a surplus. Electrical energy flows towards the public electricity grid / storage system. Using the difference in formula 2 (p. 8) yiels the following:

**Difference = – Charge – Feed-In**

*Formula 7: Difference – used in the genera formula when production > consumption*

### 6.3.2 Implementing the DP measurement concept

Proceed as follows when implementing this measurement concept:

1. Connect the clamp-on current transformers to measurement point D (difference). Ensure that the arrows of all connected clamp-on current transformers are pointing towards the consumer.
2. The Easy Connection function must be set to **EC no** (Default) on the power meter responsible for measuring power at measurement point D (see section 4.5.3 – p. 19).
3. Connect the clamp-on current transformers to measurement point P (production). Ensure that the arrows of the connected clamp-on current transformers are pointing away from the producer.
4. If more than one power meter are used: Proceed as described in section 4.6 (p. 19).
5. Run the commissioning wizard until you reach the 'Power Meter' page.
6. Ensure that the settings of the individual measurement points ('Existing Meter Setting') are correct (see section 3.3.2 – p. 9).
7. Select **Setup 3** or **Setup 6** on the 'Power Meter' page.
8. Scroll down to the bottom of the 'Power Meter' page and click on **Next**.
9. Run the commissioning wizard right to the end.

## 6.4 The GP measurement concept

This measurement concept corresponds to the setup 4 in the commissioning assistant.

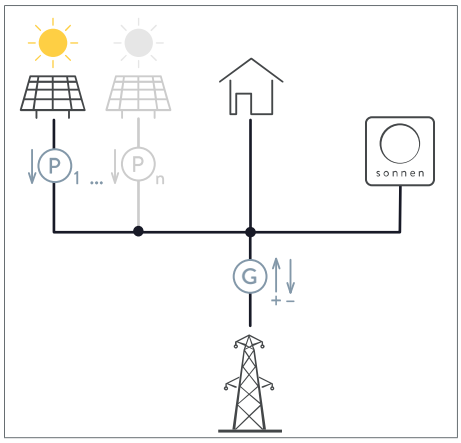


*Figure 34: Measurement concept 4*

| | |
|---|---|
| P1, ...; Pn (Production) | Measuring points for recording the production |
| G (Grid) | Measuring point for recording the power taken from or fed into the public electricity grids |

In this measurement concept, the power consumed is measured at point P1. Further measurement points (P2 to Pn) can be integrated into the system. In this case the total production results from the sums of the individual measured values. The following applies:

Pges = P1 + P2 + ...

The power taken from or fed into the public electricity grid is measured at point G.

The power consumed is not measured, it is calculated.

Charging or discharging of the storage system is triggered by the measurement values at measurement point G. Positive values indicate usage and discharging of the storage system. Negative measurement values indicate feed-in to the public electricity grid and charging of the storage system.

### 6.4.1 Calculating the energy flows

Consumption is not measured, it is calculated

#### Case 1: Consumption > Production

In this case consumption is calculated using formula 1.

**Consumption = Production + Discharge + Usage**

*Formula 1: General formula when consumption > production*

#### Case 2: Production > Consumption

Consumption is calculated from formula 2 (p. 8) as follows:

**Consumption = Production – Charge – Feed-in**

*Formula 8: General formula when production > consumption – solved for consumption*

### 6.4.2 Implementing the GP measurement concept

Proceed as follows when implementing this measurement concept:

1. Connect the clamp-on current transformers to measurement point D (difference). Ensure that the arrows of all connected clamp-on current transformers are pointing towards the consumer.
2. The Easy Connection function must be set to **EC no** (Default) on the power meter responsible for measuring power at measurement point D (see section 4.5.3 – p. 19).
3. Connect the clamp-on current transformers to measurement point P (production). Ensure that the arrows of the connected clamp-on current transformers are pointing away from the producer.
4. If more than one power meter are used: Proceed as described in section 4.6 (p. 19).
5. Run the commissioning wizard until you reach the 'Power Meter' page.
6. Ensure that the settings of the individual measurement points ("Existing Meter Setting") are correct (see section 3.3.2 – p. 9).
7. Select **Setup 4** on the 'Power Meter' page.
8. Scroll down to the bottom of the 'Power Meter' page and click on **Next**.
9. Run the commissioning wizard right to the end.

## 6.5 Example: Implementation of the GP measurement concept

The example shown in figure 35 displays the implementation of the measurement concept GP.

- Measurement point P1 records the production of an PV system.
- Measurement point P2 records the production of an CHP unit.
- Measurement point G records the power taken from or fed into the public electricity grid.

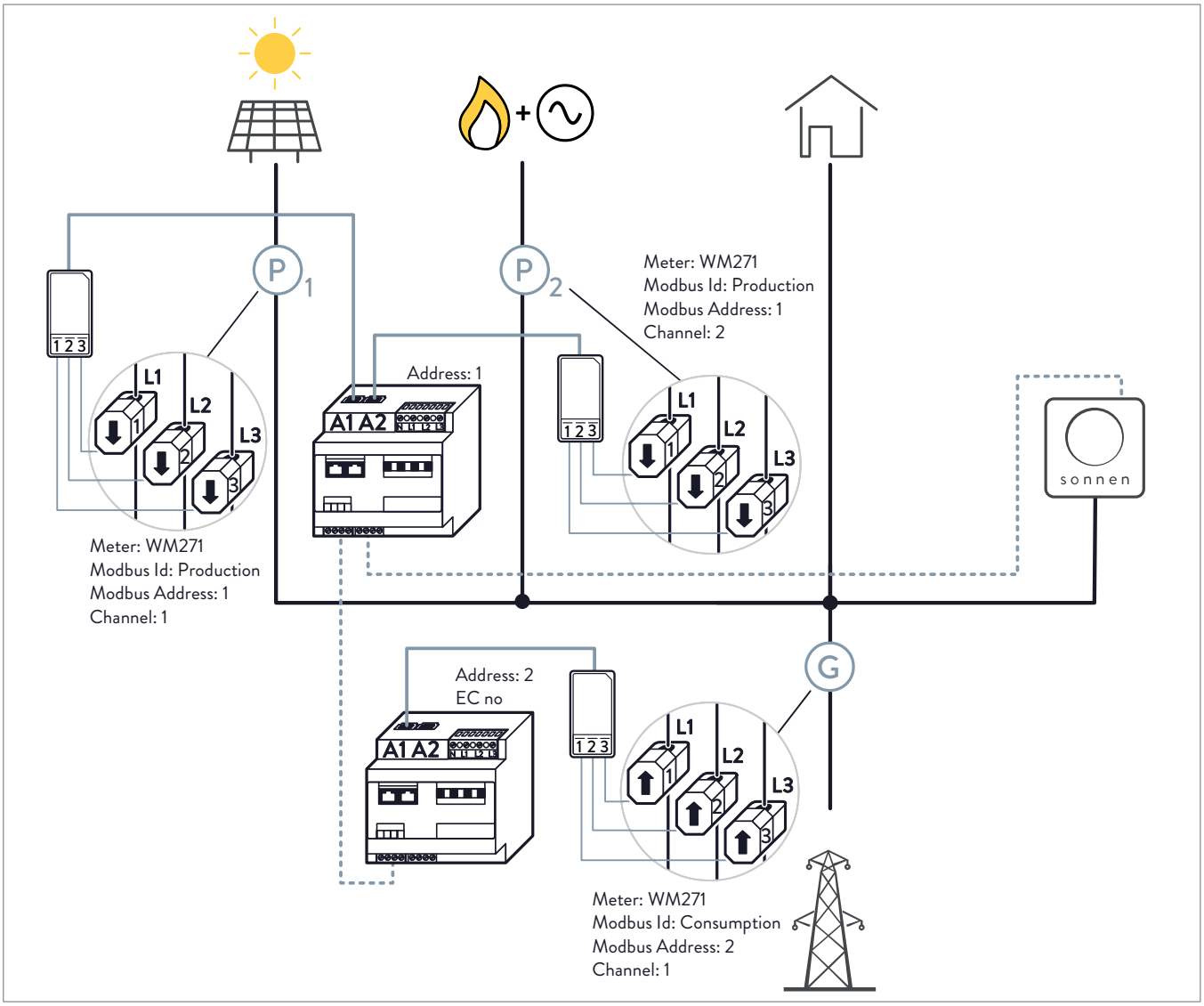


*Figure 35: Example for the implementation of the measurement concept GP – The circles show the connection of the clamp-on current transformers at the three measuring points*

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