ENERGY FLOW MANAGEMENT USING THE FOUR DIGITAL OUTPUTS

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Business Unit Solar Energy

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1 INTRODUCTION

Photovoltaic systems are generally equipped with controllable loads to increase the degree of self-consumption and autonomy. High self-consumption means consuming as much of the energy produced as possible at source, while autonomy means drawing as little energy as possible from the grid, i.e. being as self-sufficient as possible.

To achieve these goals, a Fronius Smart Meter is installed on the household connection. This device measures how much power is fed into the grid and how much is drawn from the grid.
If more power is generated by the PV system than is consumed in the household, this results in a PV surplus. If more power is required than is generated by the PV system, electricity is drawn from the grid.

With Fronius Ohmpilot and the Fronius Energy Package, Fronius offers products that can be tailored specifically to the system to help increase self-consumption levels and/or provide a greater degree of autonomy. These solutions enable the system to extract heat from the surplus energy to heat hot water, for example, and allow the surplus energy obtained during the day to be stored so it can be used at night.
And that's not all: with the release of Datamanager version 3.12.1.x and Hybridmanager version 1.10.1.x, consumers can now be controlled using four digital outputs in such a way that they use PV energy as a matter of course.

Fronius Datamanager 2.0 (a plug-in card) is integrated as standard in the Fronius Galvo, Primo, Symo, Eco and Symo Hybrid inverters and can be retrofitted to Fronius IG, IG Plus and CL devices, in which case it can also be used as an external box.

2 CABLING

2.1 Circuit diagram

The circuit diagram shown overleaf is a typical example featuring an external relay and manual switching, e.g. to manually activate a pool pump for backwashing purposes. Relays with integrated Auto-On-Off switching can also be used.

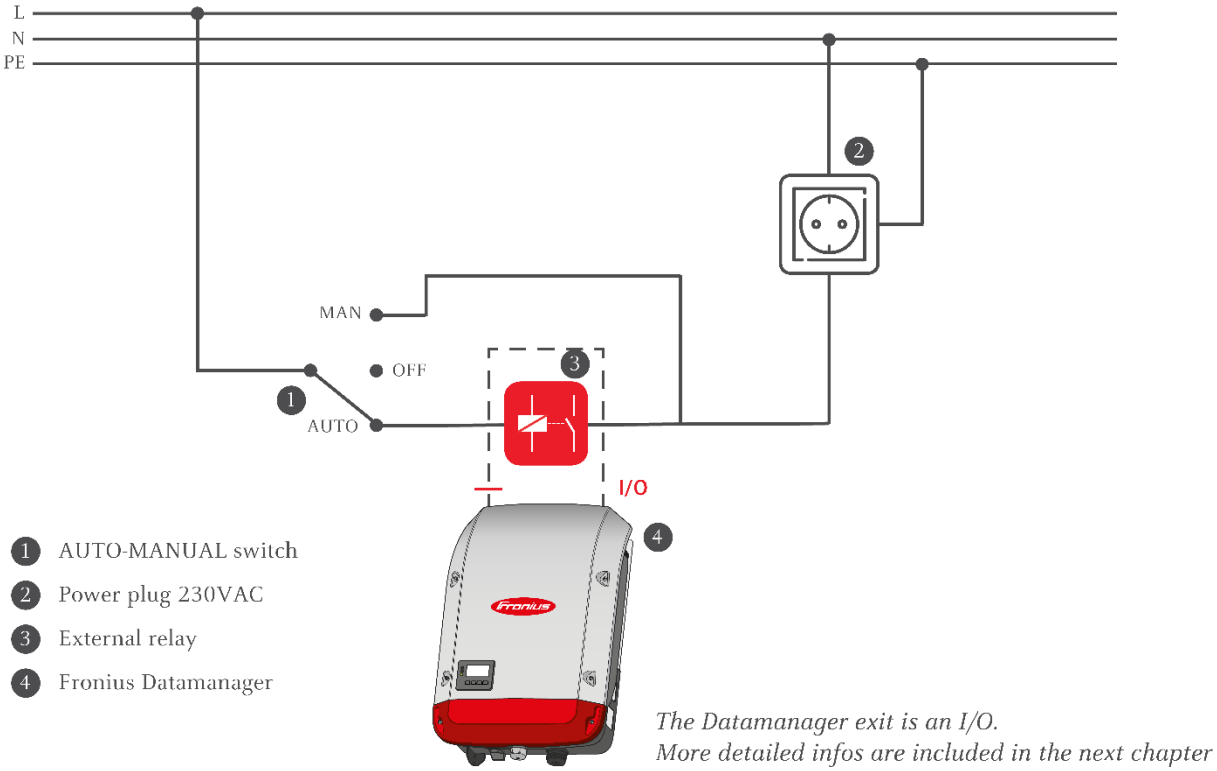

Figure 1 – Typical circuit diagram

2.2 Examples of relay types

Refer to the technical specifications when choosing the relay (coil power max. 3.2 W, coil voltage, switching voltage and switching current). Examples of suitable relays are shown below:

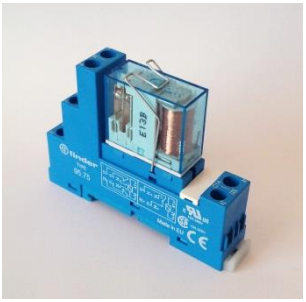

Figure 2 - FINDER relay 48.31.7.012.0050 4C series – 10A, 12VDC + DIN rail mounting; series 48

Figure 3 - Weidmüller relay 6A -MRS 12 VDC 1CO 1 changeover contact

Figure 4 - FINDER 12 V DC Relay 19.91.9.012.4000

2.3 Datamanager 2.0

The Fronius Datamanager 2.0 offers some additional functions, such as a Modbus RTU (RS 485) interface to a Fronius Smart Meter (D-, D+, Gnd). More information about the installation and commissioning of the Smart Meter can be found at www.fronius.com.

The Datamanager 2.0 is installed in all inverters from serial number 25490000 onwards. The card can be retrofitted to older devices.

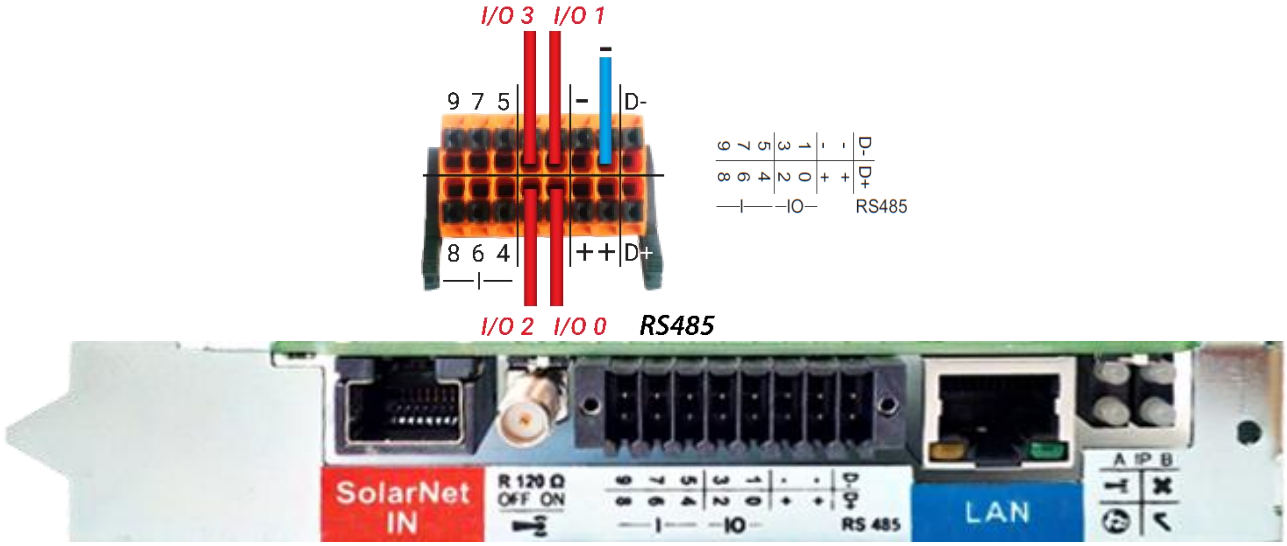

Figure 5 – Datamanager 2.0 – plug-in card

Total switching power for all 4 digital outputs: 3.2 W, 10.8/12.8 V

10.8 V: Fronius IG, Fronius IG Plus, Fronius IG Plus V, Fronius CL, Fronius IG 300–500

12.8 V: Fronius Galvo, Fronius Primo, Fronius Symo, Fronius Eco, Fronius Symo Hybrid

3 CONNECTING USING THE DATAMANAGER INTERFACE

1. Select the menu item “SETUP” on the inverter display
2. Select the menu item “Wi-Fi Access Point”

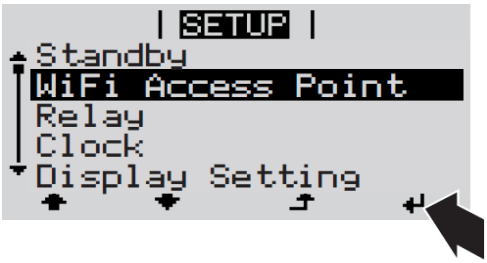

Figure 6 - Activating the Access Point on the inverter display

3. Connect the end device to the Wi-Fi Access Point
   a. Search for the “FRONIUS_xxx.xxxxx” network on the end device
   b. Establish a connection to this network
   c. Enter the password: 12345678
   d. Enter http://datamanager or 192.168.250.181 (IP address of the WLAN connection) from the browser on the end device. If using a LAN, enter 169.254.0.180.

For further information relating to establishing a connection, see the Operating Instructions of the Fronius inverter or Fronius Datamanager 2.0.

4 ACTIVATING THE DIGITAL OUTPUTS

Consumers can be controlled on the basis of the PV surplus or the amount of PV energy produced by activating four digital outputs on the inverter. Consumers such as pool pumps, fountains, electric vehicle charging points, air-conditioning systems, etc. can be controlled using a series-connected relay.

The first step is to activate the digital outputs that are going to be used to control the consumers. This can be done from the Datamanager/Hybridmanager interface.

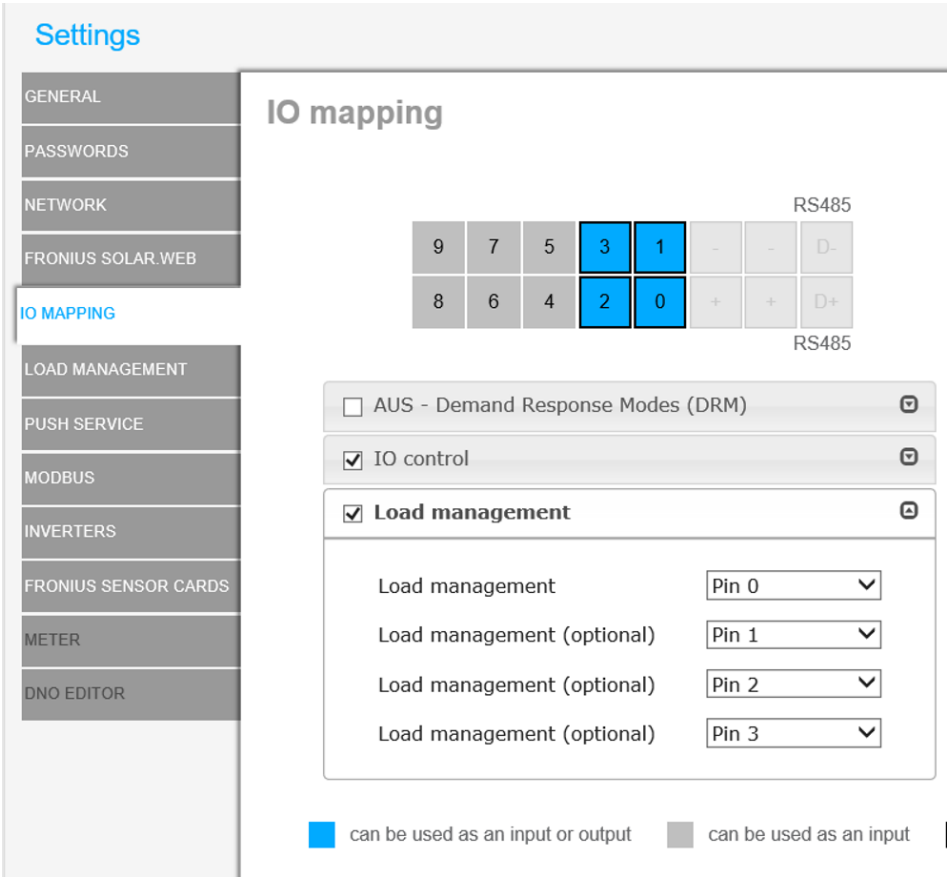

Figure 7 - Activating digital outputs for load management

5 CONFIGURING THE DIGITAL OUTPUTS

The second step involves configuring each output in turn.

5.1 Control

The output can be controlled on the basis of the surplus at the grid feeding-in point or the amount of PV energy produced. The former option can only be selected when a Fronius Smart Meter has been connected and activated at the Datamanager/Hybridmanager interface.

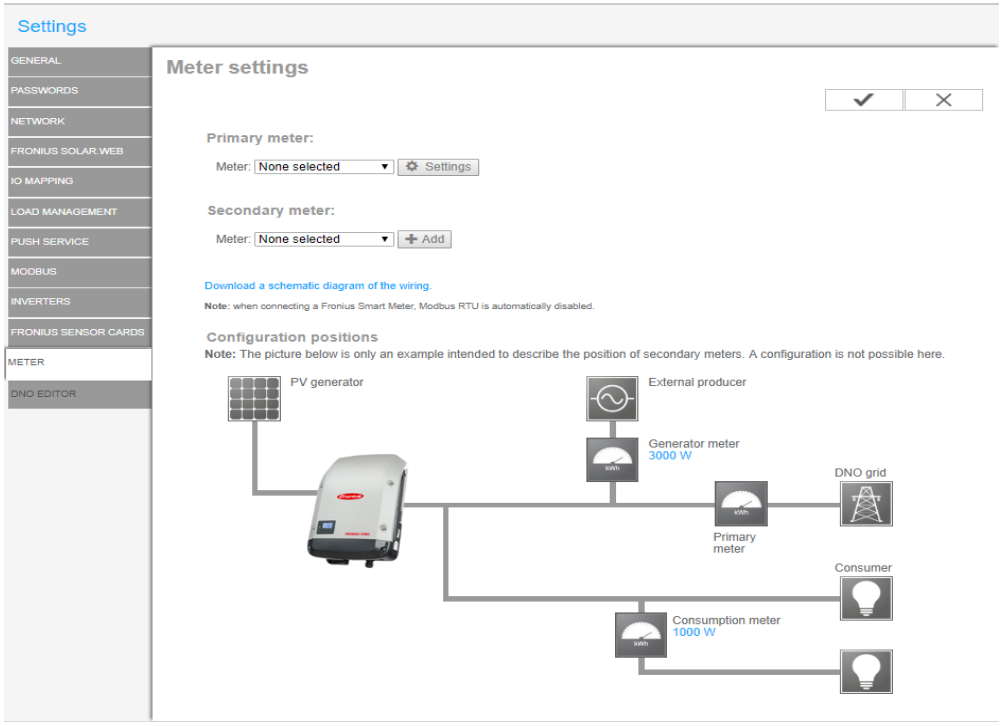

Figure 8 - Activating Fronius Smart Meter

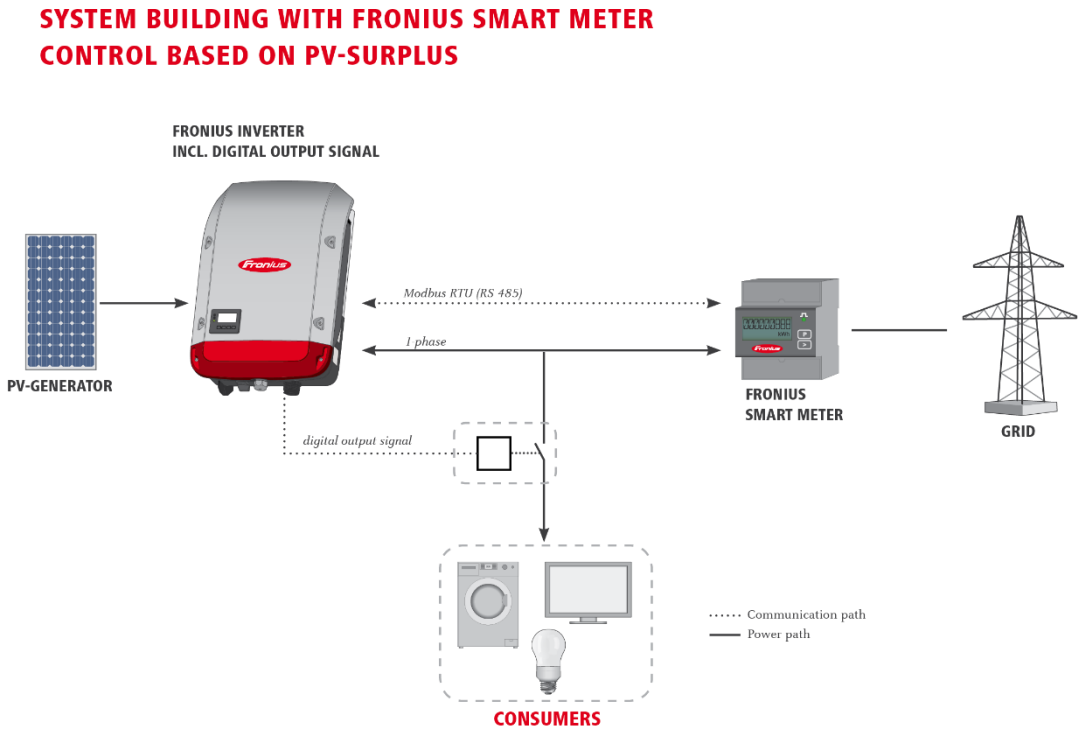

Figure 9 – System configuration featuring Fronius Smart Meter. Controlled on the basis of PV surplus.

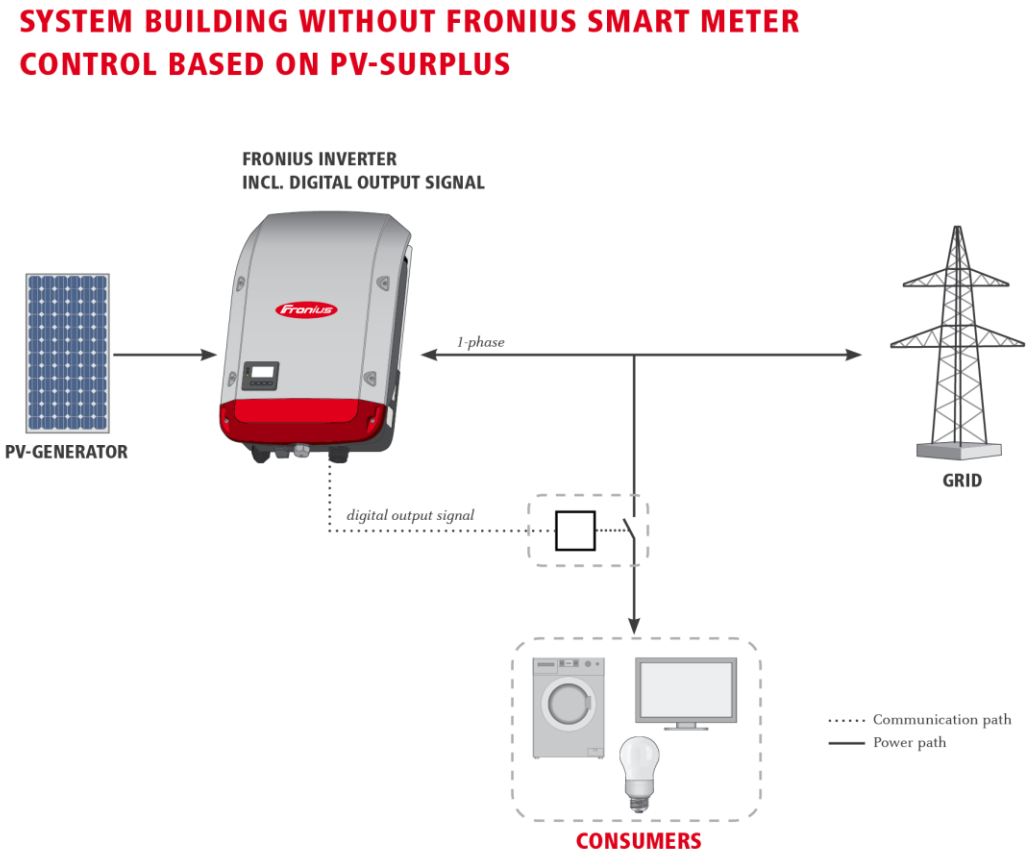

Figure 10 – System configuration featuring Fronius Smart Meter. Controlled on the basis of PV production.
A Fronius Smart Meter is not required.

5.2 Thresholds

Thresholds must be defined so the inverter knows at what power level the output is to be activated or deactivated. Note that in the case of the activation threshold, the power of the connected load consumer will be taken into account if control “on the basis of surplus power” was selected. A hysteresis should also be specified to prevent the load switching too often whenever small changes occur at the feed-in point.

A pool pump rated at 1000 W might operate with an activation threshold of 1200 W and a deactivation threshold of 0 W, giving a hysteresis value of 200 W.

5.3 Durations

Selecting a minimum duration prevents switching occurring too frequently in situations where solar radiation or surplus energy levels are constantly changing, as excessive switching reduces the service life of the consumer. Specifying a minimum duration ensures that once the consumer is activated, it will remain on for that long, even if the relevant parameter falls below the deactivation value.

The maximum duration limits the amount of time the consumer is on every day. For example, there is not much point in operating a pool pump for more than eight hours a day, even if there is still some surplus energy available at the end of the day. The individual durations for each consumer are added up across the day.

The target duration guarantees that the consumer will have been running for at least the defined duration by a specific time. Taking the example of the pool pump again, the pump should run for at least four hours a day in order to maintain water quality. We recommend setting the point at which the target duration will be reached some time before sunset to ensure that at least some of the surplus energy can be used to drive the pump. If the time is set for 6 pm, and the pump has only been running on this particular day for two hours, then the output will be activated at 4 pm.

5.4 Status

Hovering the cursor over the status causes the reason for the present status to be displayed.

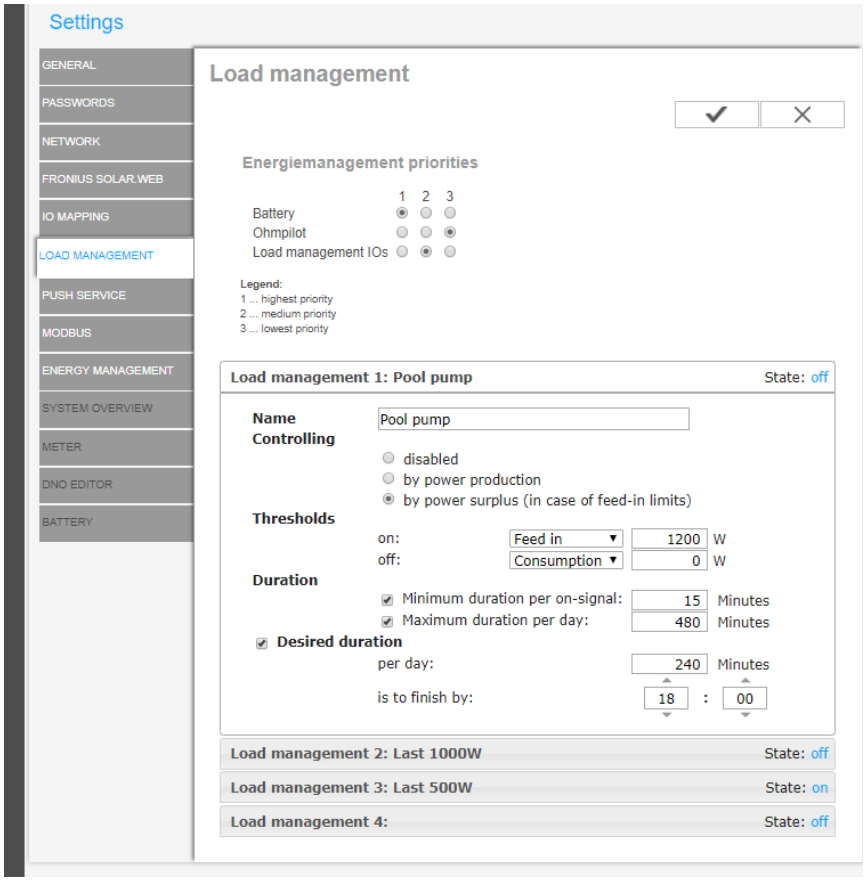

Figure 11 - Configuring a load management output

6 PRIORITISATION

Priorities have to be defined for the battery, Fronius Ohmpilot and load management IOs. Note that the load management IOs are prioritised according to their activation thresholds, meaning that the load management

IO with the lowest power value switches first. If two load management IOs have the same activation threshold, the one higher up the list will switch first.

7 APPLICATION EXAMPLES

7.1 Battery, Fronius Ohmpilot and pool pump

A pool pump connected to load management IO1 via a contactor must be activated before any energy can be stored in the battery, which is intended to be used primarily during the night. The heating rod has the lowest priority, as the minimum water temperature is provided from the central heating system and is regulated by Fronius Ohmpilot.

Prioritisation:
1 … Load management IO1 with 1000 W pool pump, maximum duration per day = 4 hours
2 … Battery
3 … Fronius Ohmpilot with 6 kW heating rod

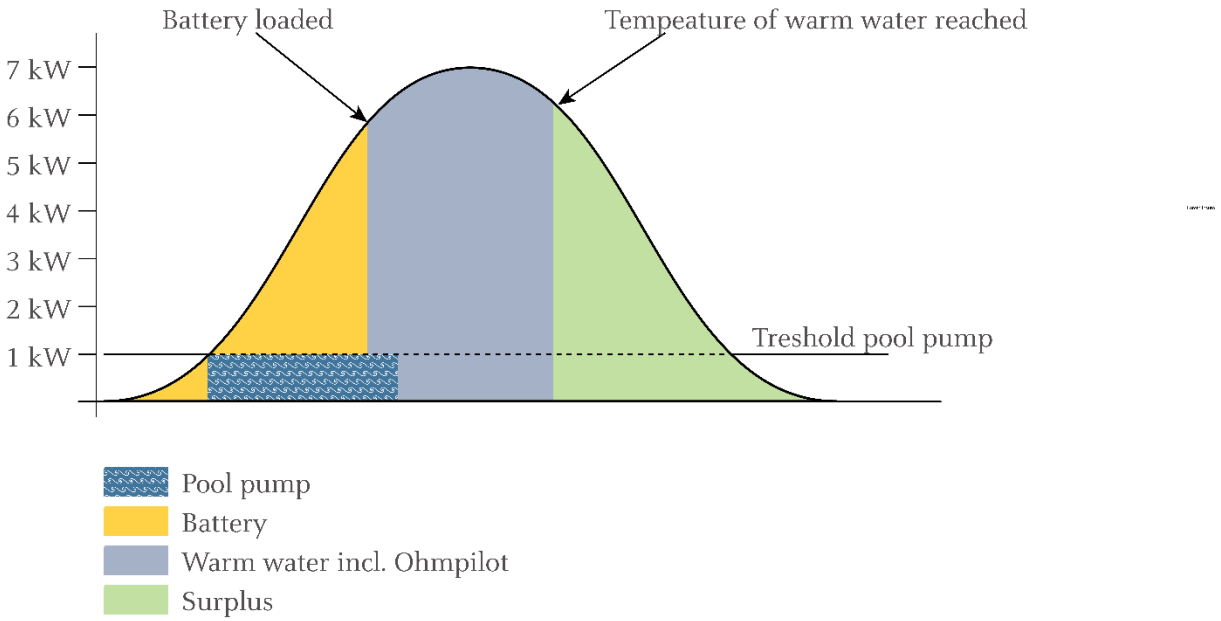

Figure 12 - Power distribution

7.2 Fronius Ohmpilot, pool pump, electric vehicle

The pool pump and wallbox are connected via load management IO1 and IO2. Load management IOs are allocated the highest priority. The lower power threshold means that the pool pump is activated before the wallbox.

Prioritisation:
1 … Load management IO1 with 1000 W pool pump, maximum duration per day = 4 hours

2…..Load management IO2 wallbox with 3000 W activation threshold and -1000 W deactivation threshold

3 … Battery

4 … Fronius Ohmpilot with 9 kW heating rod

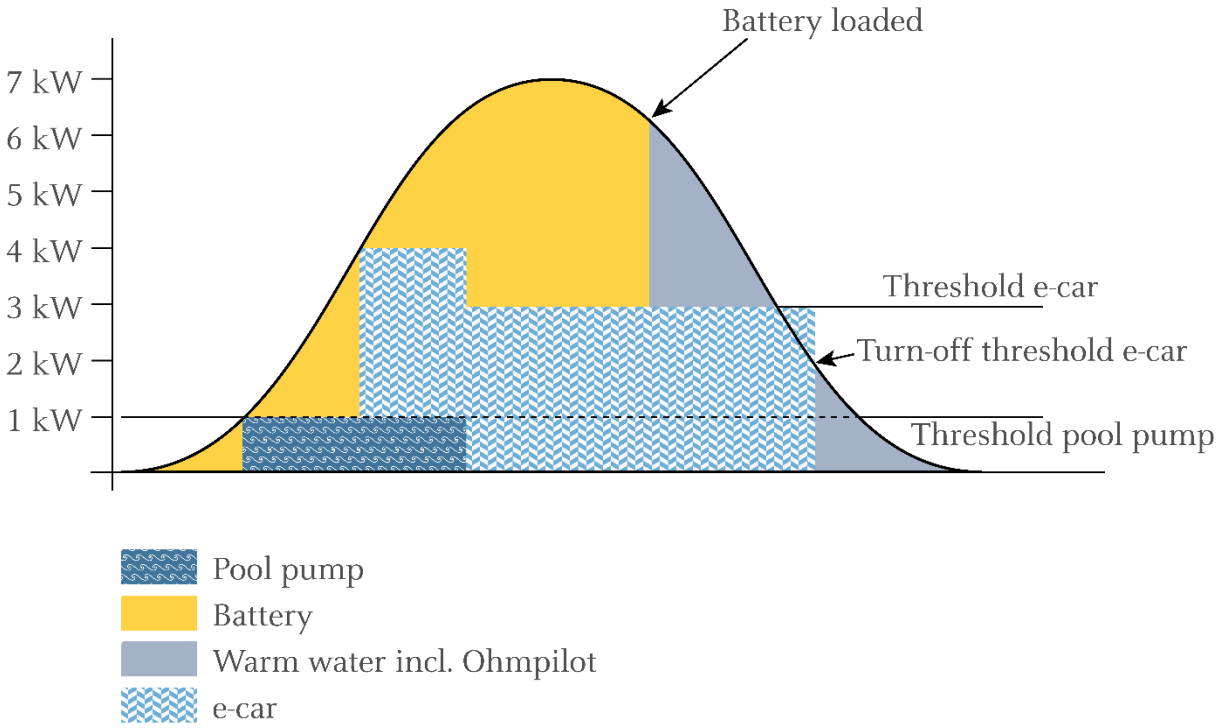

Figure 13 - Power distribution

8 FURTHER INFORMATION

Visit www.fronius.com for additional information on this subject.

Refer to “Fronius Energy Profiling” for a visualisation of the individual consumers in Solar Web.
The Fronius Ohmpilot is the ideal solution for heating hot water or when generating warmth of any sort from your own electricity, as it can consume this PV surplus up to 9 kW.

For consumers that are mainly active during the night, the Fronius Energy Package is the recommended approach, as surplus energy is temporarily stored in a battery.

Other White Papers: “E-Mobility solutions - Intelligently charging an electric car at home with PV energy”
“Connecting a heat pump to a Fronius energy management system with Datamanager 2.0”