Energy flow management with the 4 digital outputs on the Fronius GEN24 & GEN24 Plus

Whitepaper

Information Class: Public, Fronius International, 01/25, 10.04.2025

Version 01/25

Solar Energy

Table of contents

1 Introduction

The main reason why photovoltaic systems are equipped with controllable loads is to increase self-consumption and self-sufficiency. High self-consumption means using as much of the energy produced as possible yourself. Self-sufficiency means drawing as little energy as possible from the grid, i.e. being as independent as possible.

To achieve these goals, a Fronius Smart Meter is installed at the house connection. This 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 house, this is referred to as PV surplus. If more power is required than the PV system generates, this is referred to as grid consumption.

For better self-consumption and greater self-sufficiency, Fronius offers the Fronius Ohmpilot and Fronius storage solutions that are optimally tailored to the system to generate heat from the excess energy, e.g. for hot water, and to transfer the excess energy from day to night.
The GEN24 [Plus] inverters also offer the option of using four digital outputs to control loads in such a way that they are preferably operated with PV power.

2 Cabling

2.1 Circuit Diagram

The Circuit Diagram shows a typical wiring variant with external relay and manual switchover, e.g. to manually switch on a pool pump for backwashing. Also practical are relays with integrated auto on-off

switching.

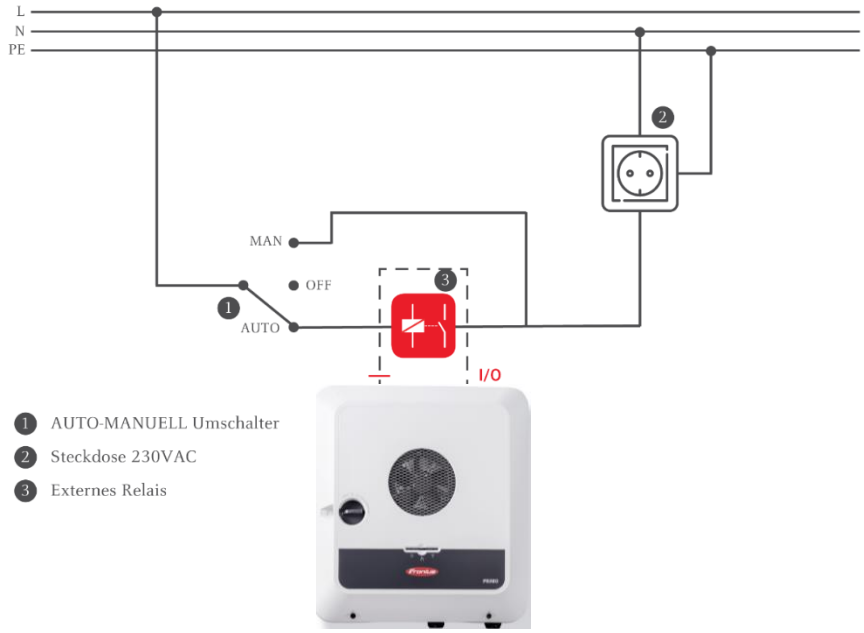


Figure 1 - Circuit Diagram Example

2.2 Examples of relay types

When selecting the relay, the technical specifications must be observed (coil power max. 3.2 W, coil voltage, switching voltage and switching current). The following types are suitable, for example:

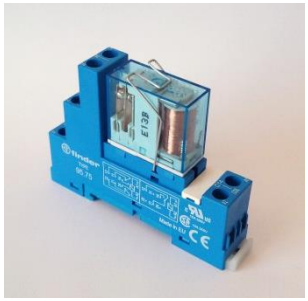


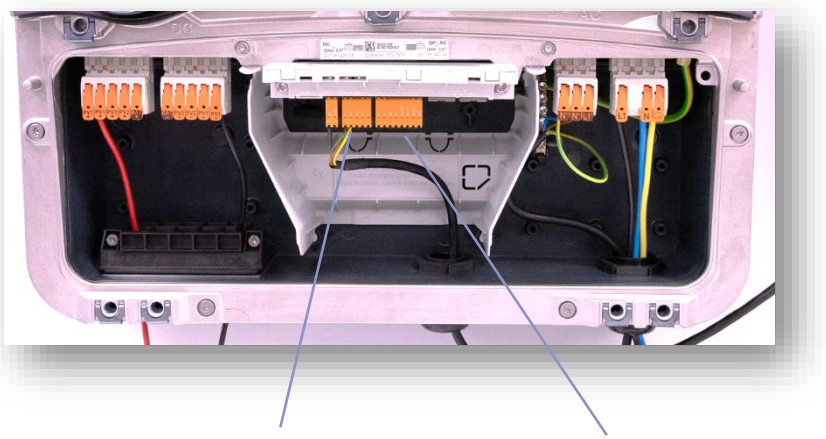
Figure 2 - FINDER relay 48.31.7.012.0050 4C series - 10A, 12VDC + DIN rail mounting Series 48

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 Circuit Diagram

The Fronius GEN24 [Plus] offers some additional functions such as two Modbus RTU (RS 485) connections to the Fronius Smart Meter (M-, M+, Gnd) or the battery (10-pin orange plug). The 16-pin plug next to it contains the Digital On outputs. (For pin assignment, see Figure 5 below).
You can find more detailed information on installing and commissioning the Smart Meter at the following link.



V+	M0+	SHIELD	M1+	V+
GND	M0-	SHIELD	M1-	GND

V+	V+	IO0	IO2	IO4/RG0	IN6/1/5	IN8/3/7	IN10
GND	GND	IO1	IO3	IO5/CL0	IN7/2/6	IN9/4/8	IN11

Figure 5: 10-pin plug - 2 x Modbus RTU, 16-pin plug digital inputs/outputs (IO 0-IO 3)

3 Connection with the web interface

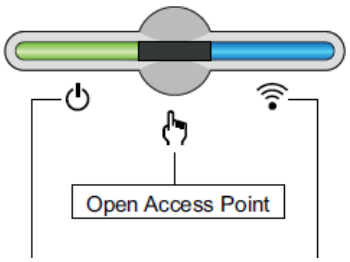


Figure 6 - Activating the access point on the inverter

Connect end device to WiFi access point

a. Search for the grid with the name "FRONIUS_xxx.xxxxx" on the end device
b. Connect to this grid
c. Enter the password located on the nameplate on the side of the inverter: 12345678
d. Enter http://192.168.250.181 (IP address of the WLAN connection) in the browser of the end device. For a LAN connection, enter 169.254.0.180.

Further information on establishing a connection can be found in the Operating Instructions of the Fronius inverters.

4 Activate Digital outputs

It is possible to control loads depending on the PV surplus or PV production.
Four digital outputs on the inverter can be activated for this purpose. A downstream relay can be used to actively control loads such as pool pumps, fountains, electric car charging stations, air conditioning, etc.

The first step is to activate the desired Digital outputs with which loads are to be controlled. The settings for this are enabled on the web interface.

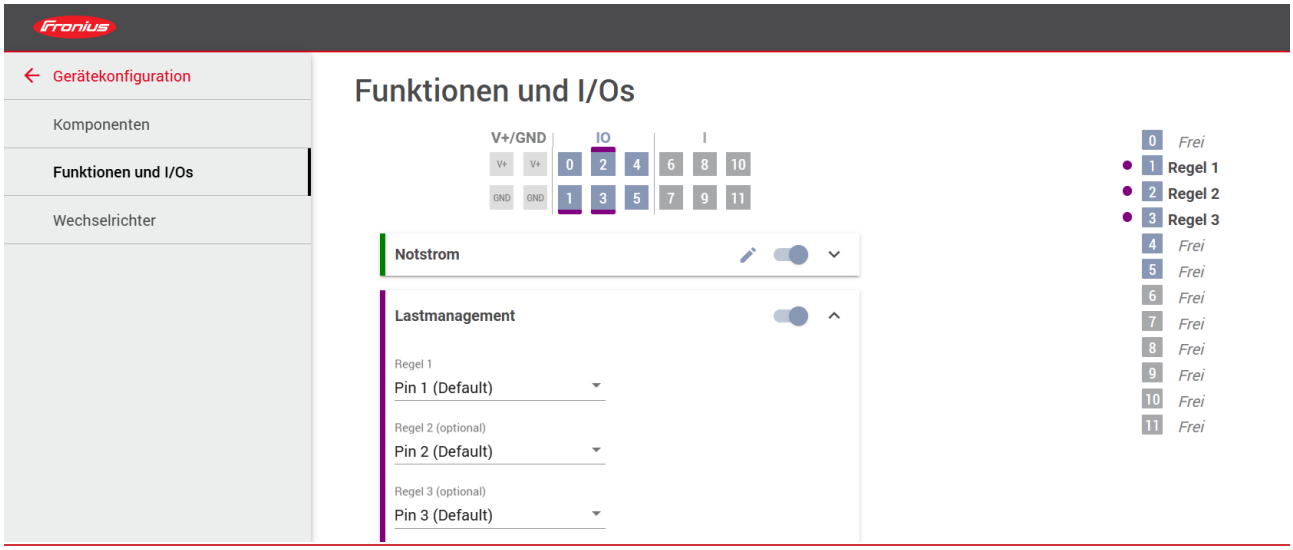


Figure 7 - Activate load management outputs under Functions and pins.

5 Configuring Digital outputs

5.1 Control system

The output can be controlled on the basis of the surplus power at the feed-in point or the PV power produced. The former can only be selected if a Fronius Smart Meter has been connected and activated.

5.2 Thresholds

Thresholds must be defined so that the inverter knows at what power the output is switched on or off. It should be noted that the power of the connected load is taken into account for the switch-off threshold if 'per excess power' has been selected for control. In addition, a hysteresis should be applied so that the load is not switched too often in the event of small changes at the feed-in point.

A pool pump with an output of 1000 watts could be operated with a switch-on threshold of 1200 watts and a switch-off threshold of 0 watts. This results in a hysteresis of 200 watts.

5.3 Running times

The minimum runtime protects against switching too often in the event of constantly changing solar radiation or excess power, thus shortening the service life of the load. Once the load is switched on, it remains switched on for the defined duration, even if it falls below the switch-off threshold.

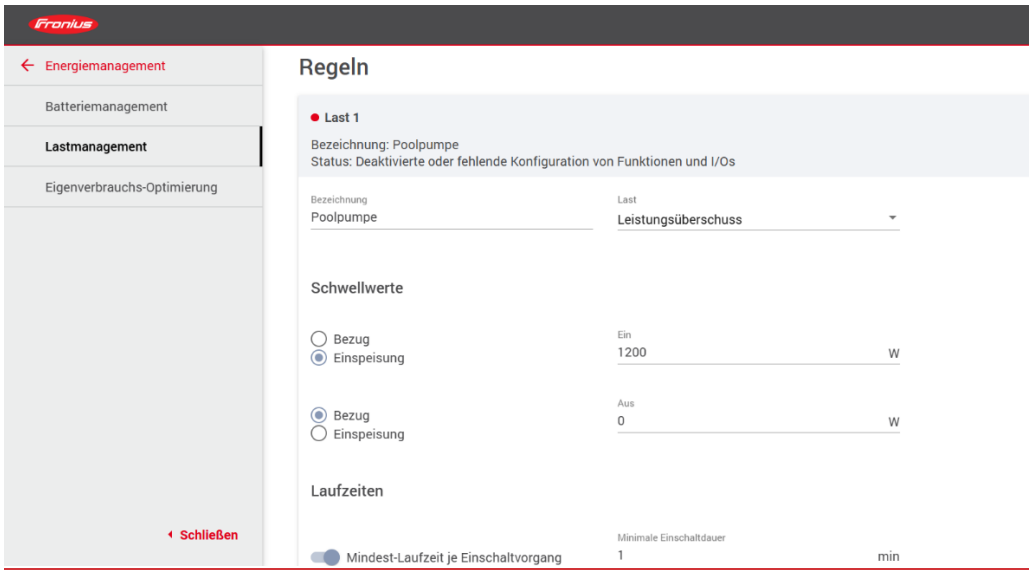
The maximum runtime limits the time during which the load is switched on per day. For example, it makes no sense to operate a pool pump for more than eight hours a day, even if there is still excess power available at the end of the day. The individual running times of the load are added up over the course of the day.

The set runtime guarantees that the load is operated for at least the set time up to the defined time. Using a pool pump as an example, the pump should be operated for at least four hours a day to maintain the water quality. It is recommended that the time until the set runtime is reached is set before sunset in order to use at least some of the excess power for the pool pump if necessary.

5.4 Prioritization

It is necessary to prioritize between the battery, Fronius Ohmpilot and load management IO.
It is important to ensure that the load management IOs are prioritized according to their switch-on threshold.
This means that the load management IO with the lowest power is switched first. If the same switch-on threshold is defined for two load management IOs, the one higher up in the list switches first.

5.5 Prioritization



6 Application examples

6.1 Battery, Fronius Ohmpilot and pool pump

Before energy is stored in the battery, the pool pump connected to load management IO1 via a contactor should be activated. The battery is preferably intended for night-time consumption.
The heating element is controlled continuously using Fronius Ohmpilot with the lowest priority, as a minimum hot water temperature is provided via the central heating system.

Prioritization:

1 ... Load management IO1 with 1000W pool pump, maximum running time per day = 4 hours

2 ... Battery

3 ... Fronius Ohmpilot with 9 kW heating rod

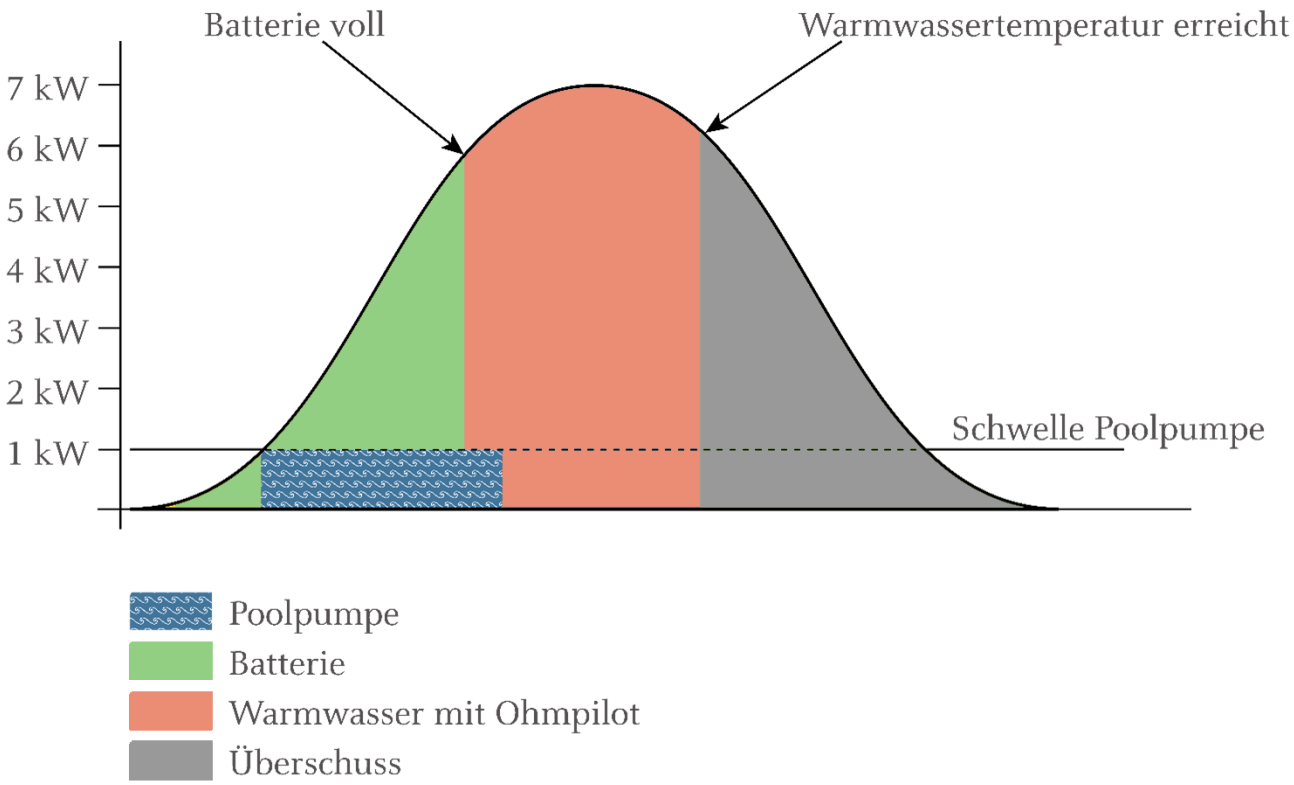


Figure 9 - Power distribution

6.2 Load management & e-car

Fronius does not recommend operating the digital I/Os in parallel with the Fronius Wattpilot. As soon as there is a surplus of more than 1.38 kW, it switches on and taps all the surplus. In addition to the

particularly energy-hungry electric car, other connected loads that are switched via load management would never switch on.

When using the Fronius Wattpilot, the digital I/Os can at best be used for very small loads (e.g. pump with 500 W) where the switch-on threshold is below that of the Wattpilot. However, load management for such small loads will only lead to very small, barely noticeable savings in terms of overall consumption.
If the customer wants their heat pump to be switched on and off depending on the surplus, there is another way to do this. It is possible to coordinate Wattpilot with Ohmpilot and the battery, as opposed to operating them together with load management. The Wattpilot, Ohmpilot and battery can be prioritized in the Wattpilot app (Solar.wattpilot). A heat pump can thus be connected to the Ohmpilot and integrated into the PV system

7 Further information

You can find further documents at www.fronius.com/de/solarenergie/infocenter/support-fuer-installateure

For the visualization of the individual loads in Fronius Solar.web, see "Fronius Energy Profiling".

For hot water generation or to generate any heat from your own electricity, the
Fronius Ohmpilot is the optimal solution, as this PV surplus can be consumed continuously up to 9 kW.

The Fronius storage solution offers an optimal solution for supplying power - especially to loads at night. Excess energy is temporarily stored in a battery.

Further white papers:
"E-mobility solutions - intelligent charging of electric cars with photovoltaics in the Home"

"Connecting a heat pump to the Fronius energy management system"