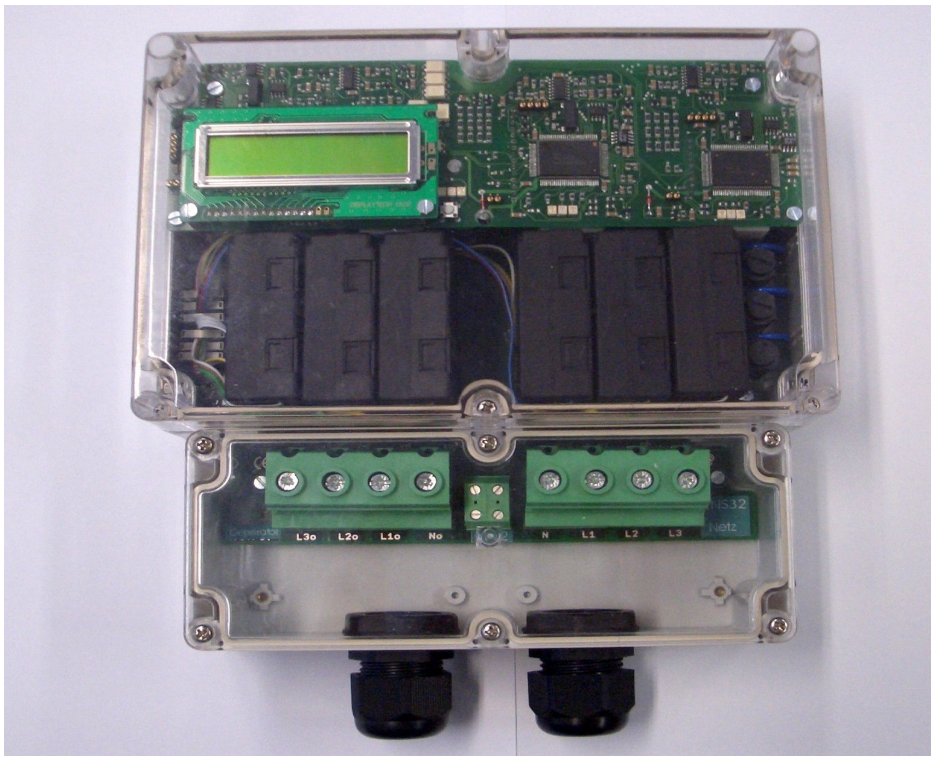
ENS32



Three-Phase ENS Islanding Control Device
with integrated relays

Simplified grid connection of 3-phase systems:

Until now a 3-phase ENS had to be installed together with two external contactors. Auxiliary contacts had to be wired for monitoring the switching status of each of the contactors.

Contactors saved:

With the new ENS32 the switching elements are already integrated. This brings a few benefits:
Costs for contactors and wiring are saved, also some space in the electrical cabinet. The new housing with separated terminal box could also be installed without an electrical cabinet.

Energy saved:

The polarized trip relays used by the ENS32 hardly need any energy for driving. Contact pressure is performed by permanent magnets. Only switching needs some energy for a few milliseconds. With PV-systems and their EEG based high energy prices, around 20-60 Euros per year could be saved compared to conventional permanently powered contactors. This will sum up to 400-1200 Euros in 20 years!. With the extremely low power consumption a compact design of the new ENS was possible.

Safety:

The use of polarized trip relays is a novelty in safety related electric applications because energy is needed to switch to a safe condition. The new ENS is storing this energy in capacitors. The capacity and charge of these capacitors are permanently monitored by microprocessors. With any fault in the system all relays are switched off instantly using this energy. For there are two sets of relays connected in series, switching off is guaranteed even if a relay itself is failing. The ENS combine different methods for detection of uncontrolled islanding:

- ✔ **Multiple steps of three phased voltage monitoring**
- ✔ **Frequency monitoring**
- ✔ **RoCoF (Rate of Change of Frequency)**
- ✔ **Impedance step monitoring**
- ✔ **Phase Symmetry Monitoring**

The switching levels of Impedance step and Phase Symmetry Monitoring are adapted automatically to the grid conditions with the use of a special self-learning method.

Independent research and tests by the ISET Institute in Kassel demonstrated excellent performance even under hardest electrical conditions. The tests were performed with parallel operation with up to eight different Inverters and 15 ENS or BISI systems (another system using impedance step monitoring)
This is a precondition for the use of a low underfrequency limit and a support to grid stability without loss of safety.

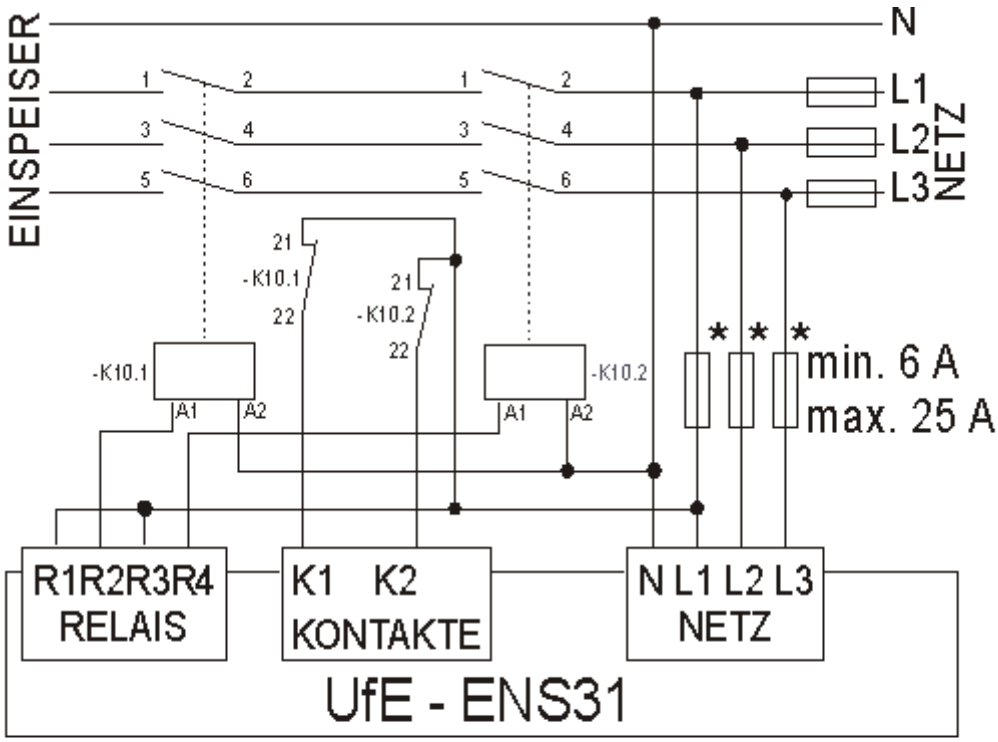
Substitution of a contactor:

There is a control input and output terminal in the ENS32 that could be used to control the second set of relays and save another contactor by this way. If the grid conditions are within the limits the control output S1 is activated giving the grid o.k.-Signal to the system control unit. The system can start up and give a signal to the control input S2 of the ENS releasing the second set of relays. The operation of the relays is very silent compared to contactors.

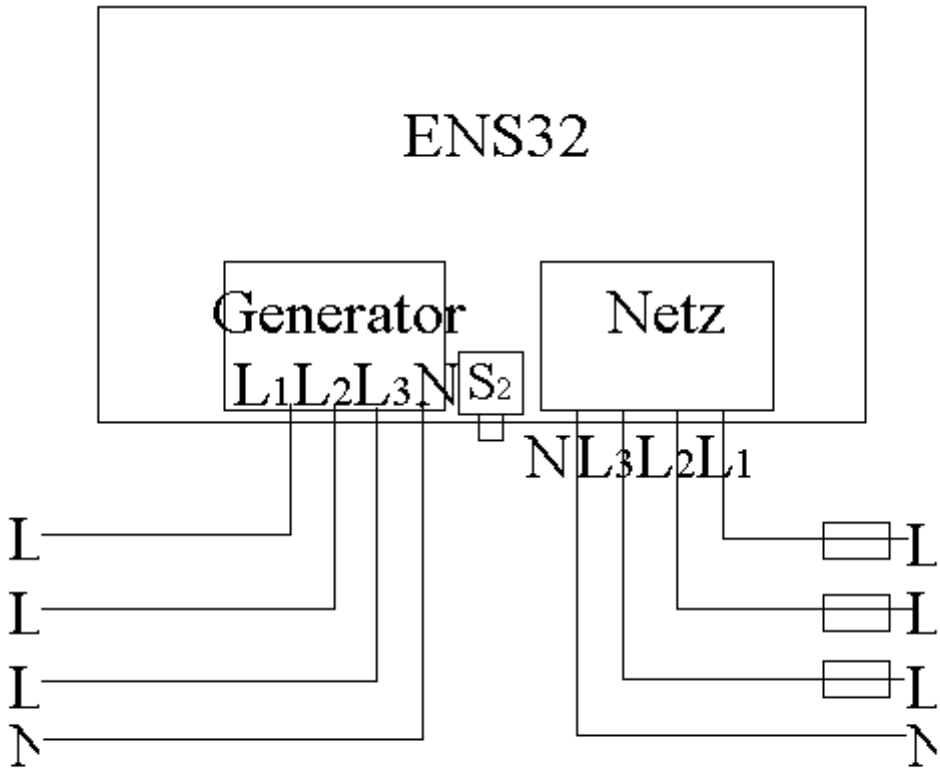
Automatic Synchronisation:

This function is able to synchronize an inverter or synchronous generator automatically to the grid. If the ENS is off and voltage is detected at the generator side of the ENS the switching -on process of the second set of relays is delayed. The switching-on is only performed in the moment of synchronous conditions of grid and generator. The relays are switching very fast compared to contactors. This allows exact synchronisation and fast reaction in case of unsafe grid conditions. This function could be used to design energy systems with automatic power back-up function. The combination of automatic grid separation and resynchronization could be a model for future switching devices in the grid. Combined with autonomous and automatic load and generation management a future energy network could be designed that might be operated even in fragments. This could avoid blackout disasters and make the energy network tolerant against natural disasters, war or terrorist attacks.

Wiring of the ENS32 is simplified significantly:



Wiring ENS31



Wiring ENS32

Technical Specifications:

switching capacity:	30 kVA
power consumption:	ca. 3 W
housing:	IP54, with separate terminal box
terminals:	up to 25mm² flexible
dimensions:(BxHxT)	220mm x 230mm x 75mm
environment:	-20°C - +50°C
	10 bis 90% relative humidity not condensing

Grid separation under the following conditions:

Setting for Germany according to DIN VDE 0126 1.1
other country setting possible

overvoltage (fast):	>300V (reaction time 20ms)
overvoltage (medium, acc. VDE0126):	>264V (reaction time 200ms)
overvoltage (slow):	>253V (10 minutes average)
	(other settings per code switch)
undervoltage (fast):	<130V (reaction time 20ms)
undervoltage (medium):	<185V (reaction time 200ms)
frequency deviation:	+0,2Hz / - 2,5Hz (reaction time 200ms)
RoCoF (Rate of Change of Frequency):	>1Hz/s
impedance step detection:	0,2-1Ohm (automatically adapted to grid conditions, reaction time 5s)
phase symmetry:	+- 5-20° (automatically adapted to grid conditions, reaction time 0,2s)

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Money and Energy saved estimation for 1 system and 20 years operation

The next table estimates the savings in money and energy you get through the use of the improved ENS32 3-phase network monitoring device.

That means that the ENS32 give you back in less than 4 years not only its additional cost but also let you save more money and energy.

	ENS31	**ENS32**
Network monitoring device	495. €	850. €
Contactors (2 units)	198. €	n/a
System costs	693. €	850. €
ENS device power consumption	[1] 3 W	[1] 3 W
Contactors (2 units) power consumption	[2] 12 W	[3] n/a
System energy consumption	15 Wh	3 Wh
1 year system energy consumption and costs	131 ,40 kWh [4] 52,56 €	26,28 kWh [4] 10,51 €
Energy saved (1 year)		**105,12 kWh**
Money saved (1 year)		**> 42,05 €**
Energy saved (20 year)		**1051,2 kWh**
Money saved (20 year)		**> 840,96 €**

(n/a) not applicable
[1] Due to the electronic components
[2] Data sheet of the LC1D65P7
[3] The ENS32 uses permanent magnet type relays
[4] An average energy price of 0,40 € / kWh is considered
(average for the next five year energy tariff)
(politik.pege.org/2007-forum-d/photovoltaik-eeg.htm)