



Operating Guide

ENS2



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1. General

1.1 About this document

1.1.1 Retention and use

This document is to be kept in the vicinity of the equipment for future reference and explanation of the operation of the device. This document is to be delivered and kept with the equipment in case of change of location and/or user.

1.1.2 Copyright

Reprinting, copying, also partially, usage for other purposes as foreseen of this manual are forbidden and breach may lead to legal process.




1.1.3 Validity

This manual is valid for the following equipment including derived variants.

Product	Article number
ENS2	33 200 499
ENS2 10.5kW	33 200 498
ENS2 30kW	33 200 500

1.1.4 Explanation of symbols

Warning and safety notices as well as general notices in this document are shown in a box with a symbol as follows:

	Symbol for a life threatening danger
	Symbol for general safety notices (instructions and damage protection bans) or important information for operation
	<i>Symbol for general notices</i>

1.2 Warranty

EA Elektro-Automatik guarantees the functional competence of the applied technology and the stated performance parameters. The warranty period begins with the delivery of free from defects equipment.

Terms of guarantee are included in the general terms and conditions (TOS) of EA Elektro-Automatik.

1.3 Limitation of liability

All statements and instructions in this manual are based on current norms and regulations, up-to-date technology and our long term knowledge and experience. The manufacturer accepts no liability for losses due to:

- Usage for purposes other than designed
- Use by untrained personnel
- Rebuilding by the customer
- Technical changes
- Use of not authorized spare parts

The actual delivered device(s) may differ from the explanations and diagrams given here due to latest technical changes or due to customized models with the inclusion of additionally ordered options.

1.4 Disposal of equipment

A piece of equipment which is intended for disposal must, according to European laws and regulations (ElektroG, WEEE) be returned to the manufacturer for scrapping, unless the person operating the piece of equipment or another, delegated person is conducting the disposal. Our equipment falls under these regulations and is accordingly marked with the following symbol:



1.5 Intended usage

The equipment is intended to be used solely as automatic isolation unit (AIU, other names: BISI, ENS) , which is an independent installation between an energy recovery device or system and the public energy supply grid with the purpose of protecting the grid from distortions. It is furthermore intended to be used only inside facilities.

The equipment must not be altered or modified in any form and not be used other than intended.

Install and use the equipment only according to this operating guide.

Typical application for equipment of this type is supervision of energy supply grid parameters like voltage, frequency and phase angle when using an energy recovery device, for example an electronic load.



- Claims of any sort due to damage caused by non-intended usage will not be accepted.
- All damage caused by non-intended usage is solely the responsibility of the operator.

1.6 Safety

1.6.1 Safety notices

Mortal danger - Hazardous voltage



- **Electrical equipment operation means that some parts can be under dangerous voltage. Therefore all parts under voltage must be covered!**
- **All work on connections must be carried out under zero voltage (output not connected to load) and may only be performed by qualified and informed persons. Improper actions can cause fatal injury as well as serious material damage!**



- The equipment must only be used as intended!
- The equipment is only approved for use within the connection limits stated on the product label.
- Do not insert any object, particularly metallic, through the ventilator slots
- Avoid any use of liquids near the equipment. Protect the device from wet, damp and condensation.

1.6.2 Responsibility of the user

The equipment is in industrial operation. Therefore the operators are governed by the legal safety regulations. Alongside the warning and safety notices in this manual the relevant safety, accident prevention and environmental regulations must also be applied. In particular the users of the equipment:

- must be informed of the relevant job safety requirements
- must work to the defined responsibilities for operation, maintenance and cleaning of the equipment
- before starting work must have read and understood the operating manual
- must use the designated and recommended safety equipment.

Furthermore, anyone working with the equipment is responsible for ensuring that the device is at all times technically fit for use.

1.6.3 Responsibility of the operator

Operator is any natural or legal person who uses the equipment or delegates the usage to a third party, and is responsible during its usage for the safety of the user, other personnel or third parties.

The equipment is in industrial operation. Therefore the operators are governed by the legal safety regulations. Alongside the warning and safety notices in this manual the relevant safety, accident prevention and environmental regulations must also be applied. In particular the operator has to

- be acquainted with the relevant job safety requirements
- identify other possible dangers arising from the specific usage conditions at the work station via a risk assessment
- introduce the necessary steps in the operating procedures for the local conditions
- regularly control that the operating procedures are current
- update the operating procedures where necessary to reflect changes in regulation, standards or operating conditions.
- define clearly and unambiguously the responsibilities for operation, maintenance and cleaning of the equipment.
- ensure that all employees who use the equipment have read and understood the manual. Furthermore the users are to be regularly schooled in working with the equipment and the possible dangers.
- provide all personnel who work with the equipment with the designated and recommended safety equipment

Furthermore, the operator is responsible for ensuring that the device is at all times technically fit for use.

1.6.4 User requirements

Any activity with equipment of this type may only be performed by persons who are able to work correctly and reliably and satisfy the requirements of the job.

- Persons whose reaction capability is negatively influenced by e.g. drugs, alcohol or medication may not operate the equipment.
- Age or job related regulations valid at the operating site must always be applied.



Danger for unqualified users

Improper operation can cause person or object damage. Only persons who have the necessary training, knowledge and experience may use the equipment.

Delegated persons are those who have been properly and demonstrably instructed in their tasks and the attendant dangers.

Qualified persons are those who are able through training, knowledge and experience as well as knowledge of the specific details to carry out all the required tasks, identify dangers and avoid personal and other risks.

1.7 Technical data

1.7.1 Approved operating conditions

- Use only inside dry buildings
- Operational altitude: max. 2000 m above sea level
- Max 80% RH up to 30 °C, linear decrease to 50% RH at 50 °C

1.7.2 Specifications

	<i>Model</i>		
	<i>ENS2</i>	<i>ENS2 10.5kW</i>	<i>ENS2 30kW</i>
AC supply			
AC voltage, nominal	230 V (L-N) / 400 V (L-L)	230 V (L-N) / 400 V (L-L)	230 V (L-N) / 400 V (L-L)
AC frequency, nominal	50 Hz	50 Hz	50 Hz
AC frequency, range	48...52 Hz	48...52Hz	48...52Hz
Required phases	L1, L2, L3, N, PE	L1, L2, L3, N, PE	L1, L2, L3, N, PE
External contactors supply			
AC supply I _{AC} max.	6 A	-	-
AC supply U _{AC} max.	250 V	-	-
Protection			
Fusing	3x 3 A	3x 3 A	3x 3 A
Protection class (acc. IEC62103)	II	II	II
Overtoltage category (acc. IEC664-1)	III	III	III
Measurement accuracy	1%	1%	1%
General			
Dimensions (WxHxD)	19" x 3U x ca. 126 mm	19" x 3U x ca. 131 mm	19" x 3U x ca. 150 mm
Weight	2.25 kg	2.7 kg	2.9 kg
Consumption	1 W	ca. 2.5 W	ca. 3.5 W
Degree of protection	IP 20	IP 20	
Compatible series	ELR 9000, ELR 9000 HP, PSB 9000, ELR 10000, PSB 10000	ELR 9000	ELR 9000, ELR 9000 HP, PSB 9000, ELR 10000, PSB 10000
Ambient temperature	0...50 °C	0...50 °C	0...40 °C
Features			
Terminals / Phases	1x AC input (L1,L2,L3,N,PE), 2x Maker contacts for external contactors	1x AC input (L1,L2,L3,N,PE), 1x AC output (L1,L2,L3,N,PE)	1x AC input (L1,L2,L3,N,PE), 1x AC output (L1,L2,L3,N,PE)
Cross sections	Screw terminal AC input: 1.5 mm ² (AWG 14)	Screw terminal AC input: 2.5 mm ² ...10 mm ² (AWG 12-8) AC output: 2.5 mm ² (AWG 12)	Screw terminal AC input: 2.5 mm ² ...10 mm ² (AWG 12-8) AC output: 10 mm ² ...16 mm ² (AWG 6)
Display and indication	LCD, 2 LEDs	LCD, 2 LEDs	LCD, 2 LEDs
Manual control	3 pushbuttons	3 pushbuttons	3 pushbuttons
Certificates/Approvals	CE, VDE-AR-N 4105, CEI-021	CE, VDE-AR-N 4105, CEI-021	CE, VDE-AR-N 4105, CEI-021
Switching elements	-	2x Contactor 16A, 4-phase	2x Contactor 45A, 4-phase
Article number	33 200 499	33 200 498	33 200 500

1.7.3 Views

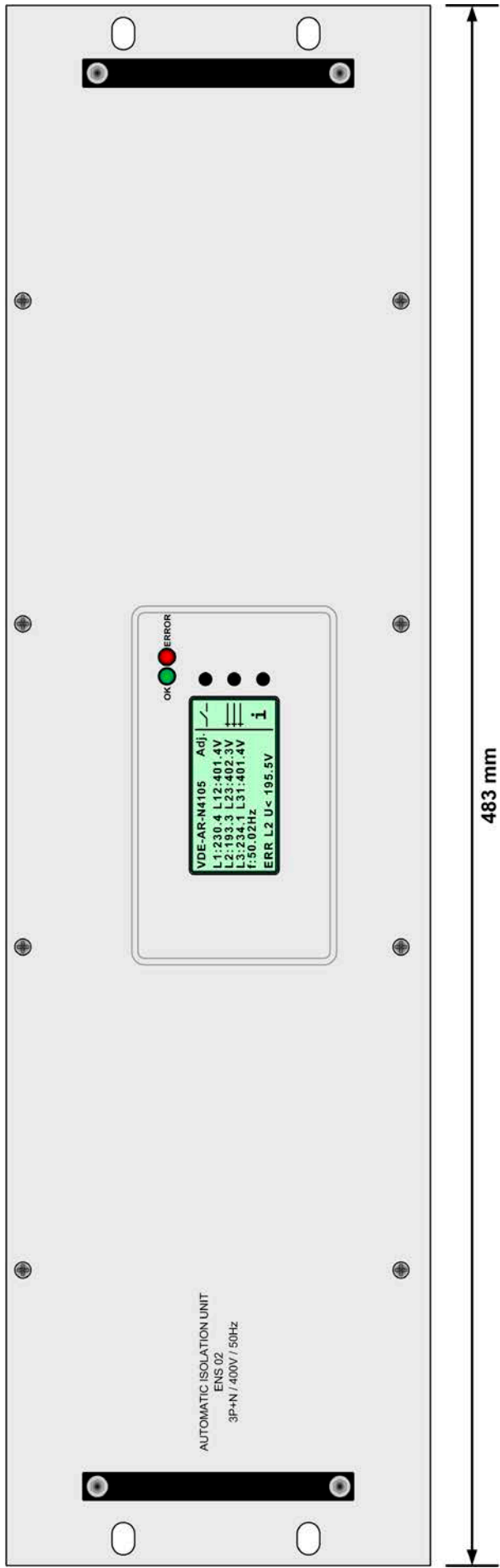


Figure 1 - Front view of ENS2 (all variants)

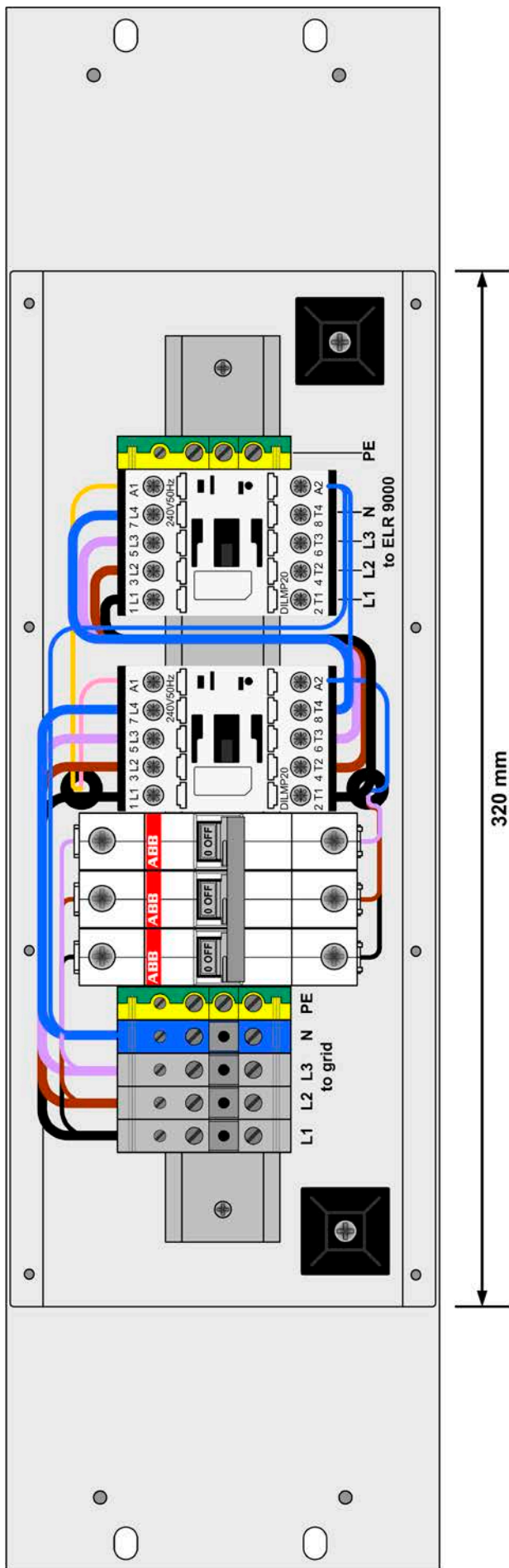


Figure 2 - Rear view of ENS2 10.5kW (with contactors)

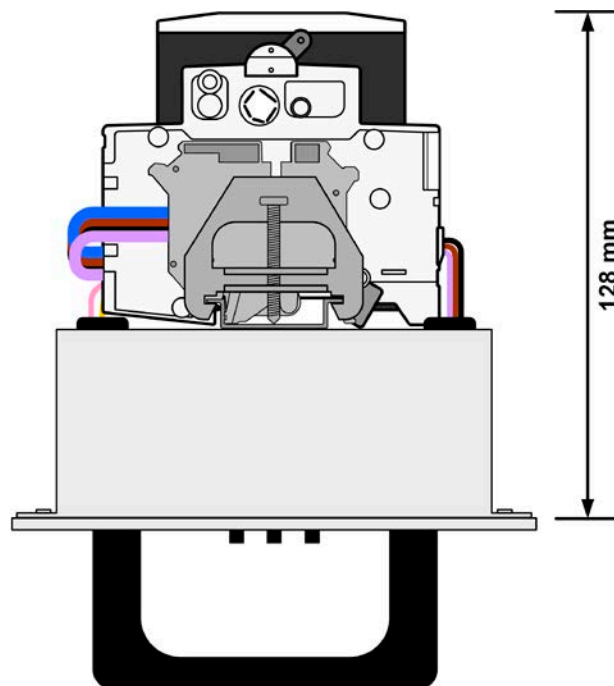


Figure 3 - Side view of ENS2 10.5kW

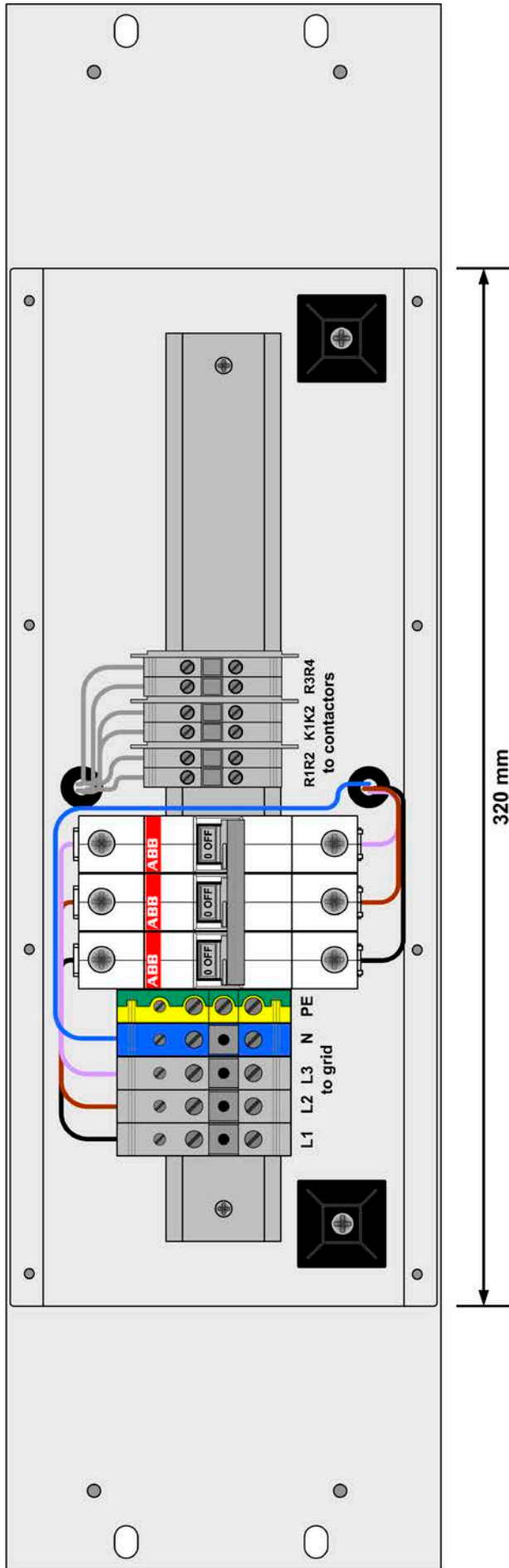


Figure 4 - Rear view of ENS2 (without contactors)

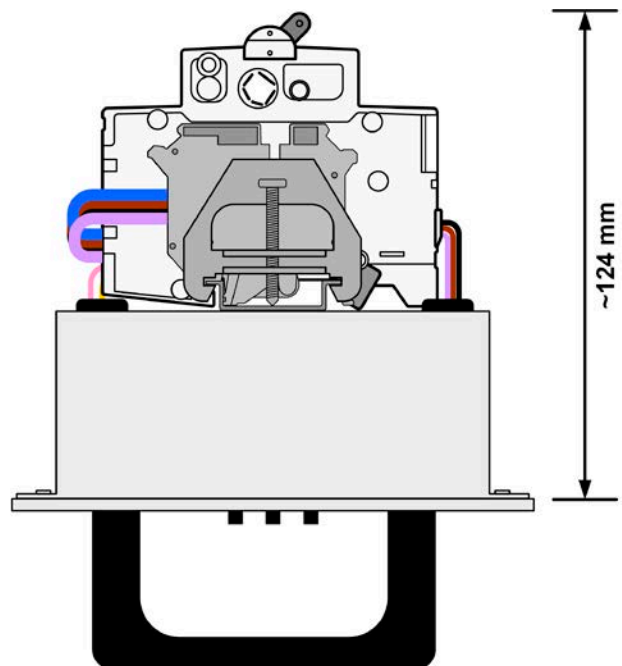


Figure 5 - Side view of ENS2

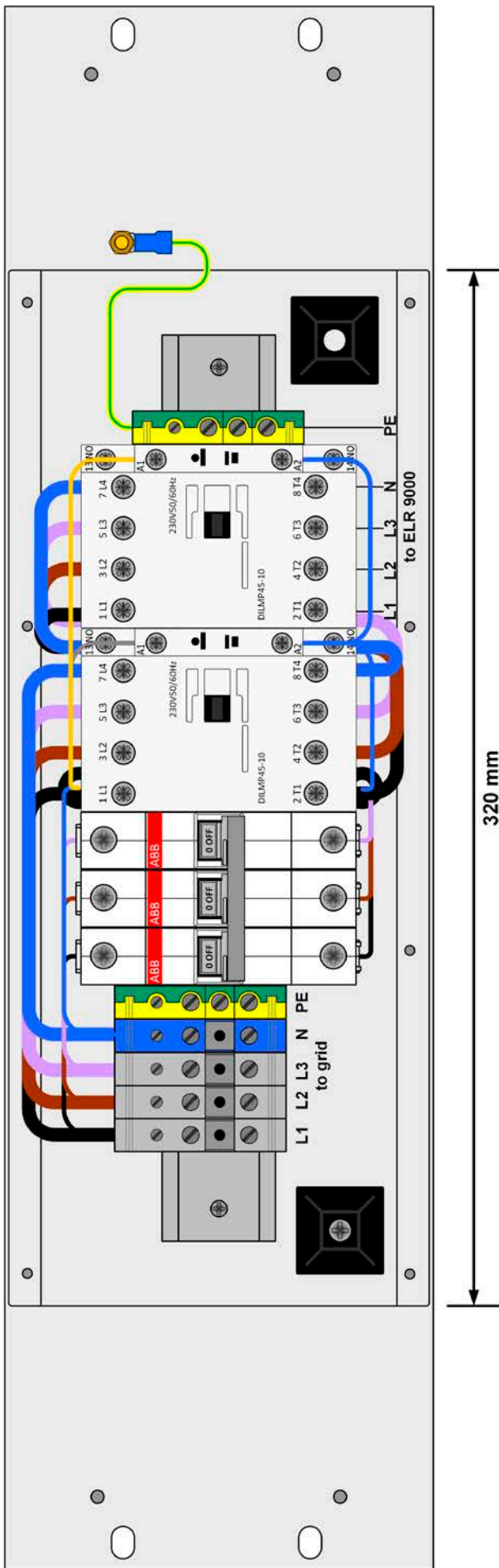


Figure 6 - Rear view of ENS2 30kW (with contactors)

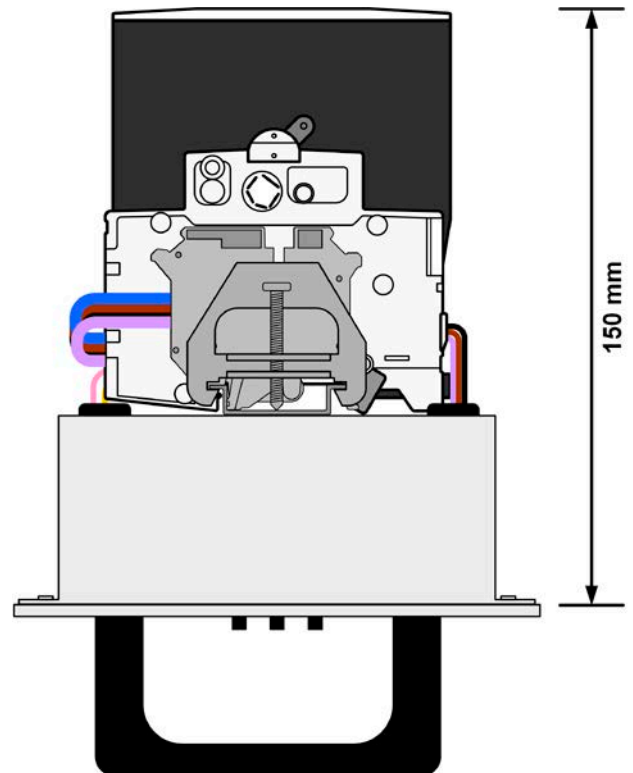


Figure 7 - Side view of ENS2 30kW

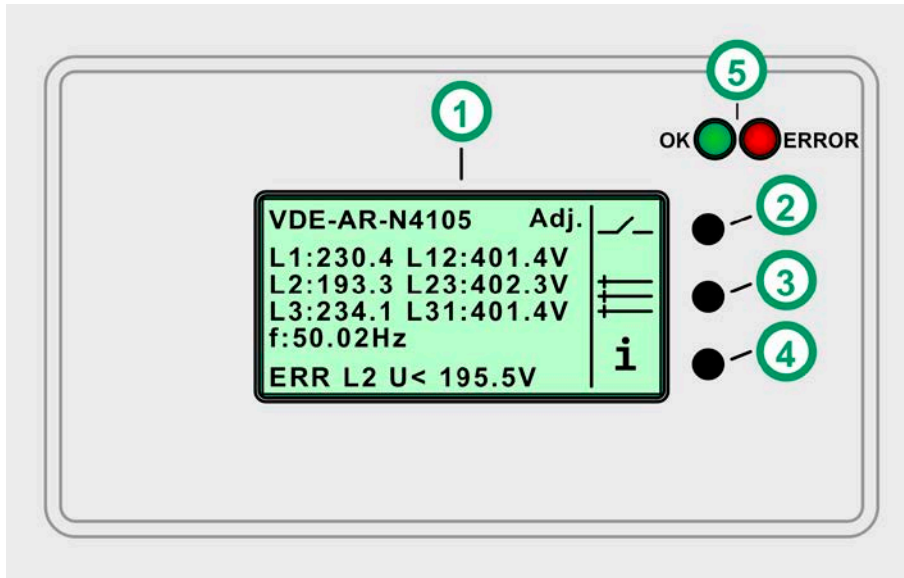


Figure 8 - Control panel

1.7.4 Control panel overview

(1)	Display, illuminated Displays the supervised values of AC supply voltage of all phases, as well as frequency and a status (bottom row)
(2) - (4)	Pushbuttons Multifunctional buttons, used to trigger actions or to select parameters in the menu
(5)	LEDs which show alarms and status, additionally to what's in the display

Meaning of the symbol, which can be assigned to the buttons:

	Relay triggering test
	Main menu
	Error messages
	Scroll line by line
	Scroll page by page
	Submit selection
	Go back

1.7.5 Scope of delivery

- 1 x ENS2 as 3U 19" module
- 1 x Printed operating guide

1.8 Construction and function

1.8.1 General description

The module ENS2 is a separately installed, integrated grid protection equipment, also called automatic isolation unit (AIU), designed to meet german standard VDE-AR-N 4105. The specifications of that standard are suitable for most european countries running three-phase supplies 400V (L-L) resp. 230V (L-N). The AIU is intended to cut the connection between a power generating or energy recovering device (here: electronic load with energy recovery feature) and the public AC supply grid on distortions regarding voltage or frequency, by means of controlling two serial contactors (with or without feedback contact).

The internal supervision circuit monitors the three phases of the public grid for fluctuations of voltage and frequency. In case certain supervision thresholds, as defined by the standard, are exceeded it will cut the power generation device from the public grid by means of two breakers (contactors, two pieces for safety of 100% cutting off).

When operating electronic loads with energy recovery feature, such as of series ELR 9000, ELR 9000 HP, ELR 10000, or recuperating power supplies such as PSB 9000 and PSB 10000, this kind of supervision equipment is absolutely required if it can occur that the device runs in a so-called "isolated operation" or in case the local electric supply company demands such a supervision device. Isolated operation means, that the device might be supplying energy back to the grid (local or public), but there are no consumers in proximity which partly or fully consume the energy which is usually the case when a main supply point has been shut down for reasons of maintenance and there is no voltage expected anymore on the line.

The above mentioned VDE standard only defines the parameters for operation of this equipment in Germany. Whether the german standard meets specifications in different countries can not be determined by the manufacturer of the equipment, but the end user. In case of doubt it must be found out whether it's required to install grid protection equipment to allow operation of such a recuperating device. It's supposed that other european countries have similar standards and/or provisions for this type of equipment and its operation.



- This grid protection equipment is not suitable for 60 Hz grids!
- This grid protection equipment only works on 400 V resp. 230 V supply voltage"

1.8.2 Factory settings of german standard VDE-AR-N 4105

The ENS2 is delivered with following default parameters, which can also work in most european countries running 230V mains voltage for single phase and 400V for three-phase:

Cut-off delays		
Supervision parameter	Limit	Delay
Undervoltage N-L	184V	100ms
Overvoltage N-L (10 minute average)	253V	10min
Overvoltage N-L	264,5V	100ms
Undervoltage L-L	320 V	100ms
Overvoltage L-L (10 minute average)	440V	10mins
Overvoltage L-L	460V	100ms
Low frequency	47.5Hz	100ms
High frequency	51.5Hz	100ms

Switch-on delays			
Supervision parameter	Limit	Switch-on delay (normal) *	Switch-on delay (short-term interruption) **
Undervoltage N-L	195.5V	60s	5s
Overvoltage N-L	253V	60s	5s
Undervoltage L-L	340V	60s	5s
Overvoltage L-L	440V	60s	5s
Low frequency	47.5Hz	60s	5s
High frequency	50.05Hz	60s	5s

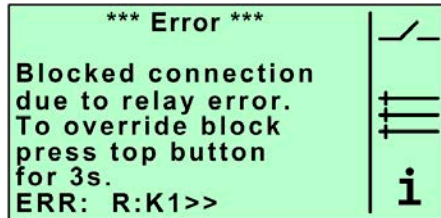
* Within the time of switch-on delay, supervised values must remain within the limits

** A short-term interruption of the supply, according to VDE-AR-N 4105, is less than a maximum of 3 seconds

1.8.3 Relay blockade

The Italian standard CEI 0-21 requires to start a "relay blockage" in case of relay failure and if the AIU is installed with two contactors ("Number of relays" = 2). If any of the contactors would not break correctly after a cut-off has been initiated, the AIU would be blocked and could only switch on again after the blockade has been acknowledged manually, but pushing a button.

The blockage would even remain after a reset of the AIU. In order to avoid an unintended blockade, the relay feedback test, which precedes a probable blockade, is only executed 2 s after a mains failure occurred. It means, mains failures shorter than 2 s do not cause a relay blockade. If a blockade occurs, the LEDs on the front panel will start to blink alternately and the LCD display will be overlaid with:



- The actual error is displayed in the bottom row.
- K1 = Relay on R1R2 has acted, but on K1 there is still a feedback in form of voltage
- K2 = ditto, for relay on R3R4 and terminal K2

After releasing the blockade by pushing the top button, the overlaid display will vanish and the AIU can switch on again.

1.8.4 The differences of the „country data sets“

The so-called "country data set" is a general term for a set of parameters derived from a country specific standard, like the German VDE-AR-N4105 or the Italian CEI-021. Those two are supported by the ENS2 device, which means it can be operated in Germany and other European countries, but also in Italy.

By default, the manufacturer has selected the following country data set:

- VDE-AR-N4105

Depending on the selection, there are differences:

- Parameter "Number of relays"
 - a. VDE-AR-N-4105: Parameter is set to 2 and can not be changed.
 - b. CEI-021: Parameter is set to 2 by default, but can be changed to 1 when using an installation with <20kW. The installation then only runs with one relay/contactor (R1R2, K1).
- Function "Relay blockade"
 - a. VDE-AR-N-4105: There is no relay blockade.
 - b. CEI-021: If the installation is running with two relays/contactors, the relay blockade function is activated by "Number of relays" = 2. It will initiate a relay blockade in case of a contactor not cutting off, i.e. break correctly (see 1.8.3).



Switching to a country data other than set by factory is possible, but requires a password, which can be requested from the manufacturer of the ENS2 device.

2. Installation & commission

2.1 Unpacking and visual check

After every transport, with or without packaging, or before commissioning, the equipment should be visually inspected for damage and completeness using the delivery note and/or parts list (see section „1.7.5. Scope of delivery“). An obviously damaged device (e.g. loose parts inside, damage outside) must under no circumstances be put in operation.

2.2 Installation

2.2.1 Preparation

The ENS2 module is intended to be installed in 19“ cabinets or 19“ racks. Due to the short depth of the module, compared to other units in a cabinet/rack, it is recommended to do the necessary wiring before the ENS2 unit is finally mounted in the cabinet/rack.

Depending on the version of the ENS2 you will only have the modular unit with integrated supervision hardware or you will have two additional pre-installed and wired contactors for 16 A (model ENS2 10.5kW) resp. 45 A (models ENS2 30kW), which are intended to be used for direction connection of 1 to 3 energy recovering devices, depending on the total AC current.

The ENS2 version without installed contactors is intended to control bigger, external contactors for installations of higher total power. For such an installation, the external contactors are not included in the delivery and have to be obtained and installed by a local electrician or other qualified personnel. Those contactors must meet the specifications of the total current of the installation, as well as the requirements of the AIU unit regarding control. Upon request, we can obtain and ship suitable contactors for you. We recommend to use contactors of series “DILMP” from manufacturer Eaton, because this series covers a big range of currents.

For the selection of two identical contactors, as they are required for a typical installation according to VDE-AR-N 4105, it applies:

The rated current of a single contactors has to be at least as high as the maximum output current of the energy recovery device or system.



- *The cross section of cables must at minimum meet the requirements for the maximum output current of a single ELR unit or the entire installation.*
- *When installing the ENS2 module in a cabinet, along with multiple ELR 9000 or PSB 9000 units, we dis advise to install the module between two of these units*

2.2.2 Types of installation

2.2.2.1 Type 1: Without feedback contact

This type of installation uses standard 4-pole contactors. Here the feedback signal is missing, which tells the supervision unit that the contactors have acted (make or break). The main fuses on L1, L2, L3 in the schematic below are not part of the AIU unit.



Type 1 is the wiring scheme as already implemented in versions “ENS2 10.5kW” and “ENS2 30kW” (both with contactors).

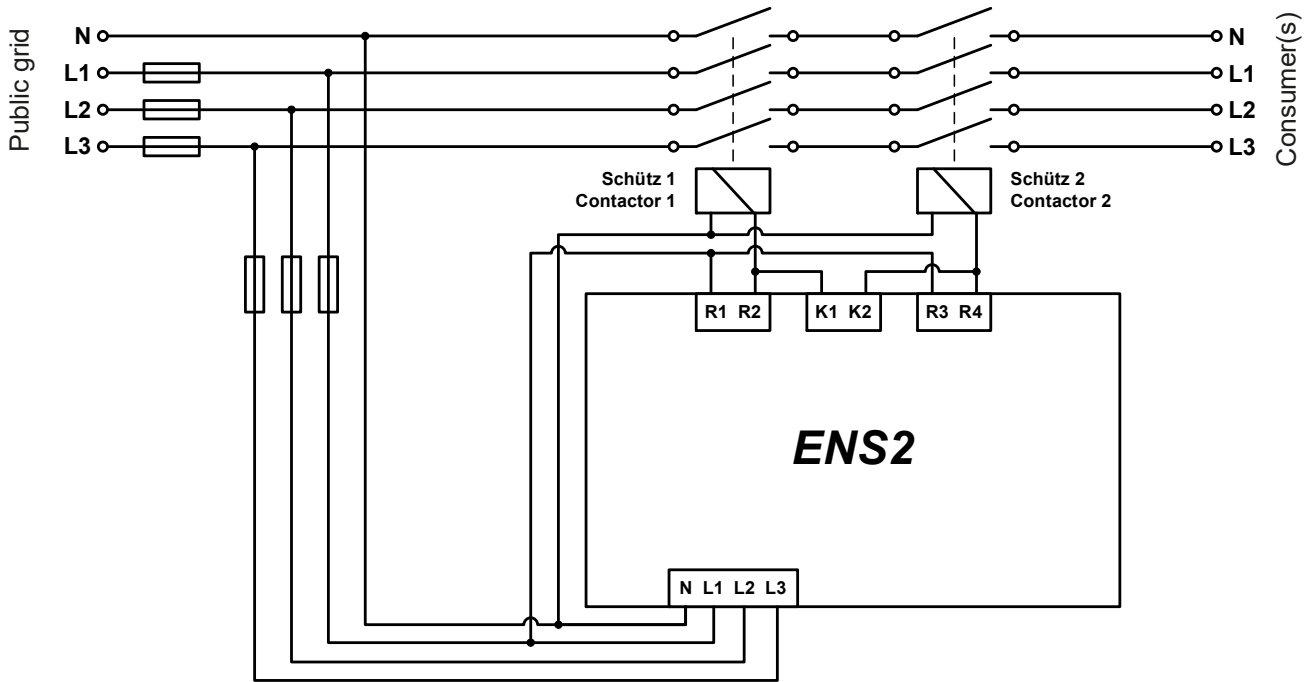


Figure 9 - Wiring scheme of installation without feedback contact

2.2.2.2 Type 2: With feedback contact

Installation type 2 and its wiring uses 5-pole or 4-pole contactors with extra feedback contact. The feedback signal helps the supervision circuit of the AIU to definitely detect whether the contactors have acted (make or break) or not. The main fuses on L1, L2, L3 in the schematic below are not part of the AIU unit. This type of installation is especially suitable for bigger installations where the version “ENS2” is required and where the installer can determine to use contactors with out without feedback contact.

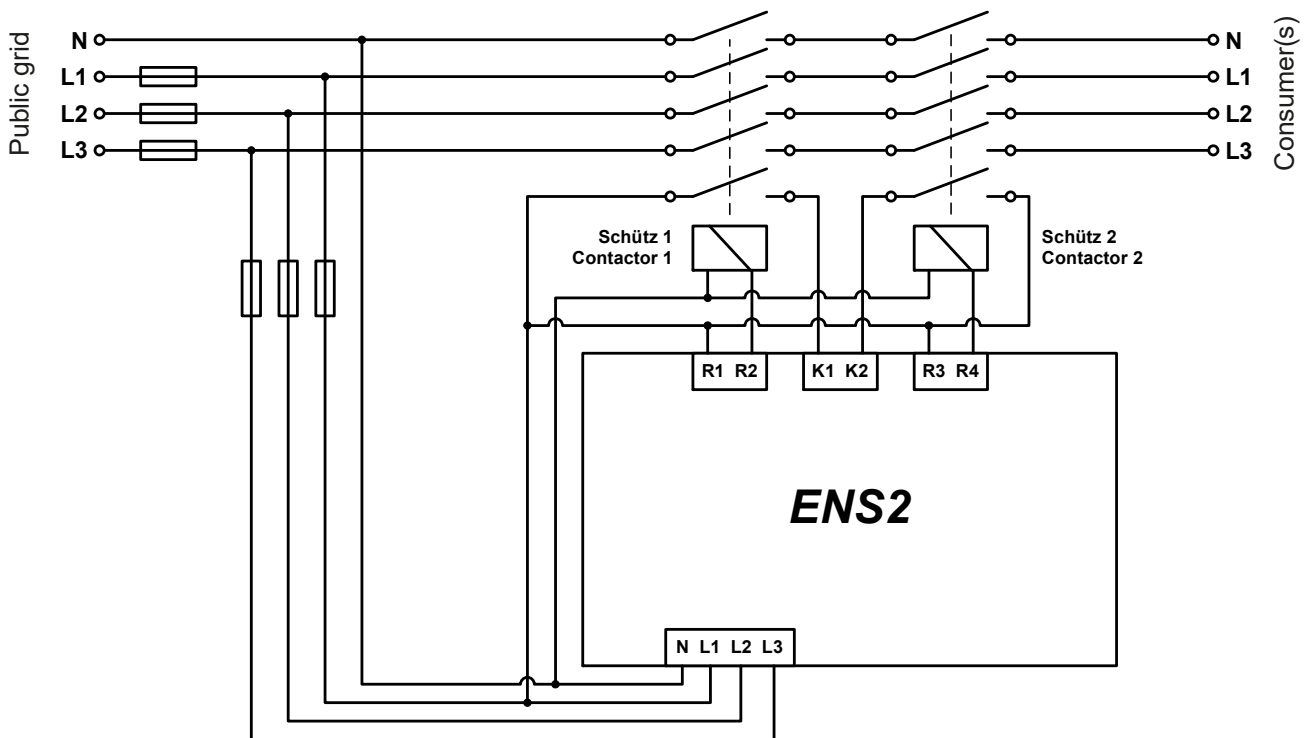


Figure 10 - Wiring scheme of installation with feedback contact

2.2.3 Wiring of version „ENS2“



Version „ENS2“ is delivered without contactors. Connections from and to the module are lead out to screw terminals and are wired by the installer according to one of the wiring schemes above (type 1 or 2) and connected to the external contactors.

2.2.3.1 Additionally required material (not included)

- 4-wire or 5-wire, inflexible or flexible cables with a cross section matching the max. output current of the energy recovery system
- When using flexible cables: cable end sleeves matching the cross section
- Suitable main fuses for the unit(s) respectively the whole installation, depending on the total current

2.2.3.2 Steps to wire version „ENS2“

Also see the wiring schemes in „2.2.2. Types of installation“. Assuming that the contactors, which are installed separately, are already mounted:

1. Prepare the cables (cut to required length).
2. Strip cable ends (~ 8mm) and, if flexible cables are used, crimp cable end sleeves.
3. Loosen the screws in the screw terminals.
4. Connect the ENS2 AC input connectors in parallel to the input of the 1st contactor.
5. Connect the contactors to each other.
6. Connect the coils of the contactors to the ENS2: Coil of contactor 1 to terminal R2 and N wire, coil of contactor 2 to R4 and N wire, furthermore bridges between phase L1 and R1, as well as phase L1 and R3
7. If wiring type 1 (without feedback contact): Bridge between R2 and K1, as well as R4 and K2
If wiring type 2 (with feedback contact): Feedback contact of contactor 1 to terminal K1, contact of contactor 2 to K2
8. Connect the contactor 1 via main circuit breakers (or fuses) to the grid (public or local).
9. Connect the AIU to mains (see rear view of ENS2, left-hand terminals).

2.2.4 Wiring of versions „ENS2 10.5kW“ and “ENS2 30kW”

These two versions are delivered with included, mounted and wired contactors which allow for following load:

- Model **ENS2 10.5kW** (max. 16 A of current, max. 10.5 kW of power):
 - » up to 3x ELR 9000 device possible
- Model **ENS2 30kW** (max. 45 A of current, max. 30 kW of power):
 - » up to 6x ELR 9000 HP / PSB 9000
 - » up to 3x ELR 9000
 - » 1x PSB 10000 / ELR 10000

The installer just needs to connect the module to the public grid and the ELR 9000 to the ENS2, via the terminals according to the print on the rear side of the module.

2.2.4.1 Additionally required material (not included)

- 4-wire or 5-wire, inflexible or flexible cables with a cross section matching the max. output current of the energy recovery system
- When using flexible cables: cable end sleeves matching the cross section
- Suitable main circuit breakers (type K) for the whole installation

2.2.4.2 Steps to wire version „ENS2 10.5kW“

Also see the wiring schemes in „2.2.2. Types of installation“.

1. Prepare the cables (cut to required length), strip cable ends (~ 11 mm) and, if flexible cables are used, crimp cable end sleeves.
2. Loosen the screws in the screw terminals.
3. Connect the device's AC connector to contactor 2 output on the ENS2 module (see print on the rear side of ENS2).
4. Connect the ENS2 to mains (see rear view of ENS2, screw terminals on the left side).
5. Tighten the screws in the screw terminals (1.5 Nm).

2.2.5 Commission

1. Switch on main circuit breaker for the entire ENS2 + devices system
2. Switch on extra circuit breakers for the device(s), if there are any.
1. Switch on ENS2 circuit breakers (installed on the rear side of the module). The module will start.
2. Optional settings:



The following two parameters are factory set to certain defaults, but can be changed if required. In order to do so, a password is needed, which can be requested from the manufacturer.

- a. Selection of the „Country data set“: „VDE-AR-N4105“ (german standard) or „CEI-021“ (italian standard)
For details and differences about both standards see 1.8.4.
- b. In case of CEI-021 has been selected: checking and possibly changing the parameter “Number of relays”, because standard CEI-021 allows for installation of below 20kW to use just one contactor.



For the versions “ENS2 10.5kW” and “ENS2 30kW” this settings must remain “2” or be set to “2”.

3. Check the display of the ENS2 module:
 - a. Correct: after a self-test and a “mains check”, it shows the „Overview“ screen
 - b. Wrong: after the “mains check”, it shows an error
Possible cause: ENS2 not wired correctly --> check and possibly apply corrections

If mains supply voltage and frequency are within the allowed limits for at least 60 s, the supervision circuit should switch the contactors on. Only then it is possible for the device(s) to run and also start energy recovery because the devices cannot run differently.

4. Switch on power generation device and operate it according to the operating guide.





3. Setup & handling

3.1 Menu structure

Language	Deutsch, Italiano, English
Parameter display	Can be used to view the supervision parameters
Voltage N-L	Displays the supervision limits of voltage and cut-off times for the single phases against N conductor
Voltage L-L	Displays the supervision limits of voltage and cut-off times of one phase to the next one
Frequency	Displays the supervision limits of frequency and the cut-off times for frequency deviation
Connection limits	Displays an overview of all supervision limits of voltage and frequency
Connection times	Displays an overview of all cut-off times of voltage and frequency
Error messages	Displays the last 12 error messages
Configuration	Can be used to clear the error message buffer and set up parameters. Access to parameters requires a password
Clear errors	Clear error buffer
Info	Display serial number and firmware version of the supervision circuit.
Overview	Display of actual voltage, frequency and status

3.2 Start screen / Overview

Short after the ENS2 unit has been connected to mains or while it is running and any button has been pushed to activate the display, it will show the "Overview" screen. This screen can also be accessed from the main menu:

VDE-AR-N4105	Adj.		●
L1:230.4 L12:401.4V			●
L2:193.3 L23:402.3V			●
L3:234.1 L31:401.4V			
f:50.02Hz			
ERR L2 U< 195.5V			

The first row shows the name of the standard which is currently active for supervision. In case of one or multiple supervision parameters differ from the standard, it will additionally show "Adj." to indicate the modification.

The next rows show actual values from the supervision, such as the voltage of the single phases (L1, L2, L3), plus the phase-to-phase voltage (L12, L23, L31) and the frequency (f). The voltage values are defined this way:

L1: Voltage between phase 1 and N

L2: Voltage between phase 2 and N

L3: Voltage between phase 3 and N

L12: Voltage between phase 1 and phase 2

L23: Voltage between phase 2 and phase 3

L31: Voltage between phase 3 and phase 1

The last row shows the status, which can also contain the last occurred error. See section „3.3. The status row“ for details. On the right-hand side there is a small menu that shows the current assignment of the three pushbuttons. Pushing the top button manually triggers a relay test. Details about this function can be found in „3.4. Relay triggering test“. The middle button is used to access the main menu (see „4. Main menu“).

The little "i", which is assigned to the lower button, is usually used to access status information. In case it is blinking, an error has occurred, which has caused the supervision circuit to act the internal relays and thus the contactors. Pushing the button then takes you to an error display of the last 12 errors. This error overview can also be accessed from the main menu. Error messages are explained in „4.2. Error messages“. Accessing the error overview also acknowledges the blinking of the "i".

3.3 The status row

Following statuses can be displayed in the status row of the main screen:

LOCKED

While any parameter is currently changed, the ENS2 module is prevented from switching the contactors on. Then the power generation device is cut from the grid.

START

Displayed during the start-up phase of the supervision circuit after powering it. This take about a minute. The contactors are switched off (break) during this period.

R12 ON, wait for K1

Mains is OK, the process of switching on is initiated. The contact between R1 (see wiring scheme) and R2 is closed, so contactor 1 is switched on, and the process is waiting for the voltage on feedback contact K1 to reach 75% of phase L1. If no feedback contact is used (installation type 1), then connector K1 is usually tied to connector R2 (see 2.2.2.1) and this message only appears for a very short time or not at all.

R34 ON, wait for K2

Mains is OK, the process of switching on is initiated. The contact between R3 (see wiring scheme) and R4 is closed, so contactor 2 is switched on, and the process is waiting for the voltage on feedback contact K2 to reach 75% of phase L1. If no feedback contact is used (installation type 1), then connector K2 is usually tied to connector R4 (see 2.2.2.1) and this message only appears for a very short time or not at all.

ON

Mains is OK, both contactors are switched on.

ERR

An error has occurred, both contactors are switched off.

W

Usually, after a certain time after an error occurred, the mains will be OK again. But it is required that the mains stays OK for another while before the supervision circuit can switch the contactors on again. The process of waiting is marked as status "W". Next to it, the status shows the remaining wait time in seconds.

If there was an error ("ERR") or the system is waiting after an error occurred ("W"), additional information is displayed. See below in 3.3.1.

3.3.1 Hardware errors

3.3.1.1 Parameter errors

One or multiple parameters with erroneous values have been set up. This error should not occur in normal operation, but can probably solved by the user on location. Please contact the manufacturer for support in this case.

3.3.1.2 Relay errors

A relay/contactor error is displayed with a leading “R:”, derived from the “relay”, because there are internal relays which switch the bigger, external contactors. These errors are related to both.

List of possible relay errors:

K1>>	The voltage on feedback contact K1 (from contactor 1) is too high. This can mean that the feedback signal from contactor 1 is permanent, because of connector K1 being directly connected to phase L1 instead of only after switching the relay on R1R2.
K2>>	The voltage on feedback contact K2 (from contactor 2) is too high. This can mean that the feedback signal from contactor 2 is permanent, because of connector K2 being directly connected to phase L1 instead of only after switching the relay on R3R4.
K1?	Switching contactor 1 on has failed (voltage in feedback contact K1 too low). Possible cause: Connector K1 not wired
K2?	Switching contactor 2 on has failed (voltage in feedback contact K2 too low). Possible cause: Connector K2 not wired
K1??	Though contactor 1 has successfully switched on, the feedback voltage on contact K1 is too low or not present. Possible cause: connector K1 not wired or the connection has been interrupted (wire interruption)
K2??	Though contactor 2 has successfully switched on, the feedback voltage on contact K2 is too low or not present. Possible cause: connector K2 not wired or the connection has been interrupted (wire interruption)
K1<->K2	The feedback signals on K1 and K2 have been interchanged
RELTEST	A manual relay test has been triggered. Though this is not an error, this is listed as error in the error history screen. It will vanish automatically after one minute.

3.3.2 Mains error

Voltage errors

At first, it shows on which phase(s) the error has been detected: L1, L2, L3, L12, L23 or L31. The meaning of these abbreviations is described in section 3.2. Next to this, the kind of error is specified:

U<	Undervoltage
U>	Overvoltage within the 10 minute average
U>>	Overvoltage


As a third value, the currently active voltage limit is display, which caused the undervoltage or overvoltage situation. For example, the screenshot in 3.2 shows an undervoltage error on phase L2.

Frequenzfehler

Possible frequency error:

f<	Frequency too low
f>	Frequency too high

Similar to voltage errors, the status will display the active frequency limit, which caused the error.

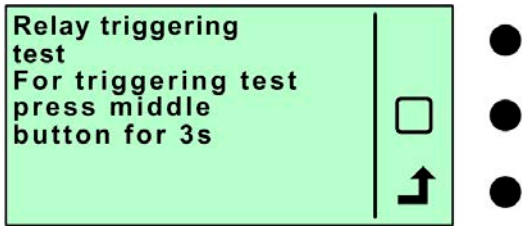


The standard VDE-AR-N4105 partly defines different limits for cutting off than for switching on again. After an error, the display will always indicate the limit which caused the cut-off. It means, when it is about to switch on, only the switch-on limits matter. An example: the screenshot in 3.2 shows “L2 U< 195.5V”. The limit to cut off at undervoltage is at 184V, but the limit to switch on again is at 195.5 V and this is what’s displayed here.

Another example: L1 has a voltage of 183V, which causes error “U<“. Later, the voltage of L1 rises to 254V. In this case, the display would show “L1 U>>253.0V“. At the first glance this looks like a malfunction of the supervision circuit, because the cut-off limit on overvoltage (U>>) is defined at 264.5V. In fact, everything is correct, because the contactors are currently switched off and the voltage limit to switch on again is at 253V.

3.4 Relay triggering test

A manual relay test can be triggered by pushing the middle button for longer than 3s. This causes both relay/contacts to switch off and the display to show an error which will vanish automatically after one minute. Before you can trigger the test, push the top button shortly (main display), so the display changes to show this:



After the test has started, the display will additionally show "→ Relay action triggered".

4. Main menu

The main menu can be accessed from the standard display, by pushing the middle button:



In the menu, the middle pushbutton is used to enter submenus and the other two buttons are for navigation. The single menu items are explained below.

4.1 Parameter display

The parameter display screen gives an overview over all active supervision parameters:

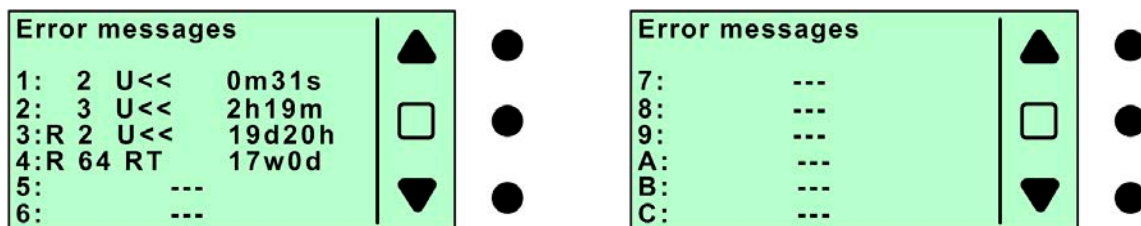


Other screens, accessible with the navigation buttons:

- Voltage N-L
- Connection times (switch-on delay)
- Frequency
- Connection limits (switch-on thresholds)
- Other parameters

4.2 Error messages

This screen lists the last 12 error messages, which caused the AIU to cut off.



Error entries in the list is built like this:

Error number: (R) ID ERROR ABBREVIATION TIME ELAPSED SINCE OCCURRENCE

The higher the error number (1-9, A=10, B=11, C=12), the longer ago. A leading "R" indicates, that the error occurred the last time before the supervision was disconnected from mains. Next is an ID, which identifies the error. Then there a three letter abbreviation, which characterises the error source.

Summary of all errors, IDs and abbreviations:

Voltage errors		
ID	Abbreviation	Meaning
1	U<<	Undervoltage L1
2	U<<	Undervoltage L2
3	U<<	Undervoltage L3
4	U<<	Undervoltage L12
5	U<<	Undervoltage L23
6	U<<	Undervoltage L31
7	U>>	Overvoltage L1
8	U>>	Overvoltage L2
9	U>>	Overvoltage L3
10	U>>	Overvoltage L12
11	U>>	Overvoltage L23
12	U>>	Overvoltage L31
13	U<	Undervoltage L1
14	U<	Undervoltage L2
15	U<	Undervoltage L3
16	U<	Undervoltage L12
17	U<	Undervoltage L23
18	U<	Undervoltage L31
19	U>	Overvoltage L1
20	U>	Overvoltage L2
21	U>	Overvoltage L3
22	U>	Overvoltage L12
23	U>	Overvoltage L23
24	U>	Overvoltage L31
31	Ua>	Overvoltage long-term average L1
32	Ua>	Overvoltage long-term average L2
33	Ua>	Overvoltage long-term average L3
34	Ua>	Overvoltage long-term average L12
35	Ua>	Overvoltage long-term average L23
36	Ua>	Overvoltage long-term average L31

Frequency errors		
ID	Abbreviation	Meaning
52	f<<	Frequency too low
53	f>>	Frequency too high
54	f<	Frequency too low

Frequency errors		
ID	Abbreviation	Meaning
55	f>	Frequency too high
56	fc<	Frequency too low
57	fc>	Frequency too high

Hardware errors		
ID	Abbreviation	Meaning
73	PAR	Erroneous parameter(s)
82	PAR	The "country data sets" of both microcontrollers do not match

At the end of an error entry there is a value to tell the time that has elapsed since the error occurred:

s = seconds, m = minutes, h = hours, d = days, w = weeks, y = years.

In case there is an "R" in the beginning, the supervision unit (ENS2) has been disconnected from mains at least once and the errors were stored. Then the elapsed time can not be referenced as accurate. The time counter of the supervision circuit is stored in an internal EEPROM every 60 minutes. After the next start of the ENS2 unit, the stored time is added 70 minutes. As soon as an error occurs, the current time stamp is added to the error entry. The error list can then only show the difference between stored time counter and current counter value. This restarts make these time values fuzzy, but they can still be used to estimate the time of occurrence and probably connect it with the external cause of the error.

5. Trouble-shooting

This section deals about errors solely connected to manual handling of the ENS2 on the control panel.

5.1 LOCKED in status row

Status "LOCKED" should never occur in normal operation. If it's displayed, however, try to clear it by cutting the supervision circuit from mains, by switching the circuit breakers on the rear side to off. After the restart, the error should be gone. Because the ENS2 module is usually mounted in 19" cabinet or rack, it suffices to remove the front to access the rear side 3-line breakers.

5.2 LED signals

Also on the front panel, next to the display, there are two LEDs (red & green), which can also indicate statuses:

Red LED	Green LED	Description and instruction
on	off	Mains error (voltage or frequency)
flashing 1x	off	Hardware error <ul style="list-style-type: none"> • Contact support of the manufacturer
flashing 2x	off	Error at the contactors <ul style="list-style-type: none"> • Make sure the ENS2 module is correctly wired • Make sure the contactors work faultless. Probably replace contactors.
off	flashing cont.	Initialisation or switch-on process
flashing cont.	flashing cont.	Parameter are edit mode. Contactors are switched off.
off	on	Normal operation

6. Service & Support

6.1 Repairs

Repairs, if not otherwise arranged between supplier and customer, will be carried out by the manufacturer. For this the device must generally be returned to the manufacturer. No RMA number is needed. It is sufficient to package the equipment adequately and send it, together with a detailed description of the fault and, if still under guarantee, a copy of the invoice, to the following address.

6.2 Contact options

Questions or problems with operation of the device, use of optional components, with the documentation or software, can be addressed to technical support either by telephone or e-Mail.

Address	e-Mail	Telephone
EA Elektro-Automatik GmbH & Co. KG Helmholtzstr. 31-37 41747 Viersen Germany	All issues: ea1974@elektroautomatik.de	Switchboard: +49 2162 / 37850 Support: +49 2162 / 378566



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