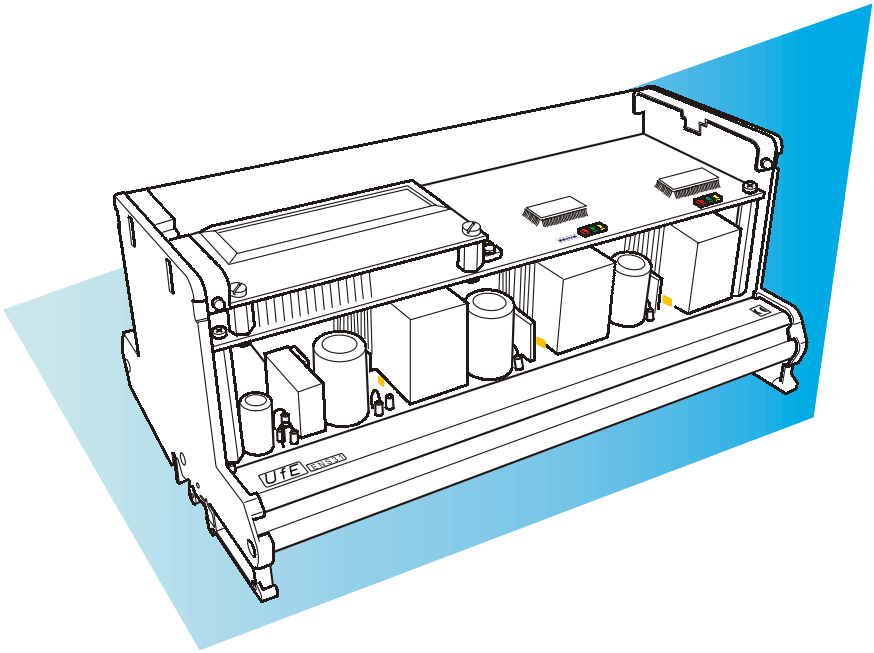

ENS31 Automatic Isolation Unit
Operating Manual

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Note
If you have any queries and need to contact UfE GmbH, always have the serial number close to hand in order to make reference to it. We do not claim the documentation is free of errors and mistakes. Please inform UfE GmbH of any errors found in the documentation.

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Note
The ENS31 isolation unit and the measuring method are protected by patent.

We

UfE Umweltfreundliche Energieanlagen GmbH
Joachim-Jungius-Straße 9
18059 Rostock

declare in sole responsibility that the product

Type: **ENS31 Automatic Isolation Unit**
Serial number: _____

fulfils the applicable health and safety requirements in the EU Directives
89/336/EEC (Electromagnetic Compatibility EMC) and
73/23/EEC (low voltage guidelines) and the law reorganising the safety of technical apparatus and consumer products (law on equipment and product safety),
as well as the requirements stipulated in other applicable, harmonised European Norms

In addition, the following directive is also fulfilled:
89/391/EEC (employee safety and health protection)

Rostock, _____

K.-W. Köln
Manager

1 Safety

1.1 General information

This chapter contains information on safety and rules of conduct. It is essential to observe the information and rules so that any residual risks represented by the product do not lead to a fault or an accident.

The device must be connected to the local power supply. Therefore, all the normal risks involved in the use of electrical power are present here, too.

1.2 Safety symbols used in this operating manual

The following symbols are used at the relevant points throughout this manual. Pay strict attention to the information provided in these sections and proceed with the utmost care.

Meaning of the safety symbols:

Danger
This symbol indicates the risk of fatal or personal injury if certain rules of conduct are disregarded. When this symbol appears in the operating manual, take all the necessary safety precautions.

Attention
This symbol indicates the risk of property damage as well as financial and legal disadvantages (e.g. loss of rights to claims under the terms of guarantee, liability, etc.).

Note
This symbol indicates important information on working efficiently, economically and ecologically.

1.3 Obligations

1.3.1 Obligations of the proprietor

The proprietor is obliged only to allow suitably trained personnel to work with the ENS31 isolation unit who

- are familiar with the basic regulations on safety and accident prevention,
- have read the operating manual, the chapter on safety and the safety symbols, have understood them and confirmed this with their signature.

The proprietor must always ensure the entire product documentation is at the disposal of operating personnel.

Danger
The proprietor bears the responsibility for safety. This responsibility cannot be delegated.

1.3.2 Obligation of personnel

Personnel must:

- be in possession of a license to connect electronic equipment to the public electricity supply,
- always ensure for themselves that third-parties and the equipment are safe,
- maintain the safety and connection regulations of the power supply provider,
- have read and understood the operating instructions, the chapter on safety and warning labels,
- observe the applicable regulations concerning industrial safety and accident prevention.

Danger
This concerns the safety of yourself and other persons in the vicinity of the ENS31 as well as safety when working with the mains electricity supply.

1.4 Guarantee and liability

Our "General Terms of Sale and Delivery" apply. The proprietor has claim to these on conclusion of the contract at the latest. Rights to claims under the terms of guarantee and liability in respect of persons and property are considered void when they are the result of one or more of the following causes:

- Unintended use of the ENS31,
- Improper start up, operation and service of the ENS31,
- Failure to observe information in the overall documentation in respect of
  - installation, connection
  - starting up
  - operation
  - cleaning/servicing
- Unauthorised constructional modifications to the ENS31,
- Damage through overvoltage, overload, short circuit, mechanical interference, moisture,
- Case of catastrophe caused by foreign body or Act of God.

Attention
No modification may be carried out on the ENS31 without the approval of the manufacturer.

Attention
Never attempt to repair the device yourself. All rights to claims under the terms of guarantee are annulled in the case of tampering.

1.5 Accident prevention regulations

Any faults which occur that affect safety must be eliminated immediately. The ENS31 may not be operated until the fault has been cleared.

Danger
Solar modules conduct electricity as soon as they are exposed to daylight. Observe this when laying and connecting the cables and take the necessary precautions.

Danger
It is forbidden to open the unit. The box can continue to conduct dangerous residual voltage some minutes after being switched off.

1.6 Intended use

The ENS31 has been built according to state-of-the-art technology and accepted safety regulations.

However, when the unit is used, there remains a risk of fatal and personal injury to the user and third-parties as well as impairment of the unit and other property damage.

1.6.1 Exclusive purpose

The ENS31 is exclusively intended for monitoring voltage, frequency and impedance of the electricity network at the feeding point of a power generating system. On detecting over- and undervoltages, frequency deviation or impedance jumps, the ENS31 disconnects the feeding point from the public electricity supply by means of contactors.
Any other use is considered unintended use. The manufacturer is not liable for any consequential damage in such cases.

1.6.2 Observe information and regulations

Intended use also includes

- observing all information provided in this operating manual and
- maintaining the connection and installation conditions prescribed by the manufacturer.

1.7 Installation and connection

Observe the separate Installation Manual with regard to installing and connecting the ENS31.

Danger
It is forbidden to open the unit. The unit can continue to conduct dangerous residual voltage some minutes after being switched off.

1.8 Operation

Operation of the ENS31 is impermissible:

- for monitoring tasks for which the unit is not designed,
- when using accessories which have not been approved by the manufacturer,
- when the proprietor has made constructional modifications.

Functional faults must be analysed immediately. If necessary, the proprietor must request specialist assistance. The equipment may only be put into operation again when there is no doubt about its safety.

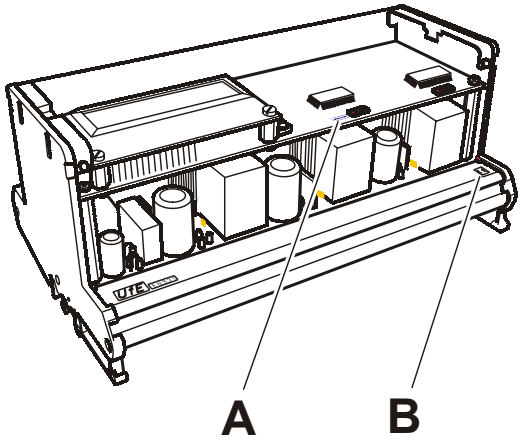
The ENS31 is intended for operation at room temperatures between - 20 °C and + 40 °C (also refer to Chapter 5, Technical Data).

Contact a suitably trained electrician or the manufacturer in the following cases:

- connection cable is damaged,
- liquids or foreign bodies have got inside the unit,
- the unit has been exposed to water or rain,
- the unit has fallen down or is mechanically damaged,
- the unit behaves in a way indicating a fault (e.g. indicator on the LCD, constant switching).

1.9 Rating plate and CE symbol

The manufacturer has provided the following information on the ENS31 at the positions indicated:



A) Serial number
The manufacturer's serial number for the ENS31 is provided at this point.

B) CE symbol
The CE symbol is located at the bottom right corner of the front side:

CE

Note
Always make reference to the ENS31 serial number in the case of inquiries, orders and contracts. This simplifies communication with the manufacturer and prevents errors when processing requests.

2 System Description

2.1 Principles of functioning

The automatic, three-phase ENS31 isolation unit is an automatic switch which is used to connect decentralised electricity generators to the public electricity supply.

In the event of faults in the mains supply, the ENS31 interrupts the feeding of electricity into the mains to prevent an island effect.

The following deviations are monitored:

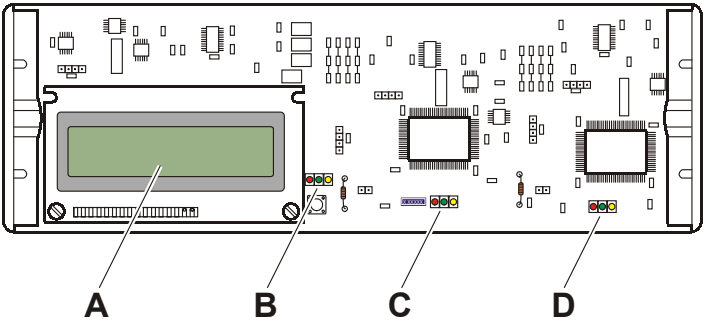
- overvoltage and undervoltage
- frequency deviation
- impedance jumps

The isolation unit replaces an otherwise prescribed manual isolation unit to which the power supply authorities must have permanent access.

Note
Further information on the principles of functioning is available on our Internet site at www.ufegmbh.de.

2.2 LCD display and LEDs

The following indicators are provided on the front side of the ENS31:



A) LCD display

The equipment and mains status are provided in a 2-line LC display. Each line can contain 16 characters.

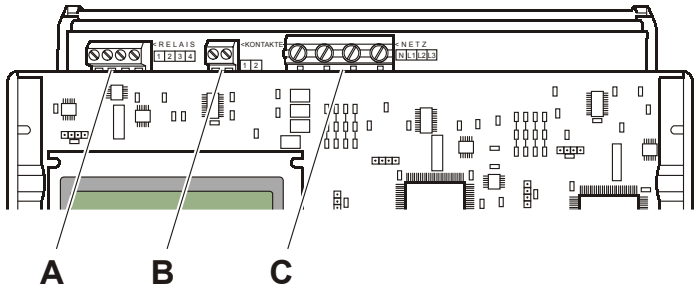
B to D) LEDs

In addition to the LCD display, the unit and mains power status are also indicated by the three LEDs (red, green, yellow):
B = LED indicator for Phase 1 (L1)
C = LED indicator for Phase 2 (L2)
D = LED indicator for Phase 2 (L3).

Note
The meaning of the LCD display and LED indicators is described in Chapter 3 Operation and Chapter 4 Troubleshooting.

2.3 Connections

The following connections are provided at the top edge of the ENS31:



A 4 connection terminals for contactor control, potential-free.

B 2 connection terminals to connect positively driven auxiliary contacts.

C 4 connection terminals to connect three phases and the neutral conductor.

Note
The connection of the unit is described in the Installation Manual.

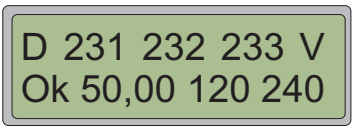
3 Operation

3.1 Switching the system on

The ENS31 starts up automatically after switching on the mains power supply.

3.1.1 LCD displays during the power-on routine

The LCD indicates the status of the power-on routine:

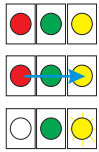


The first character indicates the status of the ENS. The following states can occur during the power-on routine:

Indicator	Meaning
i	Following a reset, the ENS31 is in its initialised state.
w	After initialisation, all the error bits are deleted and the system waits a fixed time.
r	The ENS31 is waiting for a return signal.
^	The ENS31 switches on after the waiting period.
D F I	The ENS31 is switched on, the mains power is within a permissible range and power is fed. The mains power is monitored constantly. The letters indicate: D = Setting for Germany, Austria and Switzerland, F = Setting for France, I = Setting for Italy.
X	The ENS31 has interrupted power feed.

3.1.2 LED indicators during the power-on routine

LEDs are provided for each individual phase and light up as follows during the power-on routine:

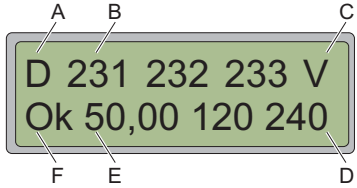
Indicator	Meaning
	All LEDs light up to begin with. After approx. 1 sec., a running light is activated. The mains power is in order and the ENS31 switches it on. During operation, the yellow LED can flash or light up continually.

3.2 LCD displays during operation

The LCD runs through the following display modes cyclically:

First display

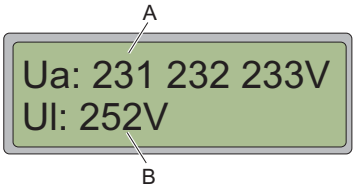
Error status, mains voltages, power-on routines since last rest, mains frequency, phase angle and error messages.



Indicator	Meaning
A	Country identification plus error status. Country identification letters signify the following: D = Setting for Germany, Austria and Switzerland, F = Setting for France, I = Setting for Italy.
B	Mains voltage of the individual phases plus error status. L1 = left, L2 = middle, L3 = right.
C	Number of power-ons since the last reset.
D	Phase angle plus error status. The phase angle L1-L3 is to the right, phase angle L1-L2 is to the left.
E	Mains frequency and error status.
F	Mains power status ok.

Second display

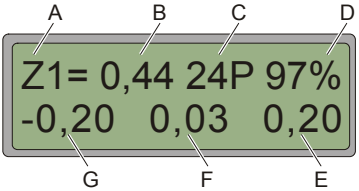
Data from the 10-minute average values.



Indicator	Meaning
A	10-minute average value of voltages plus error status. L1 = left, L2 = middle, L3 = right.
B	Upper shutdown threshold for the 10-minute average value.

Third to fifth display

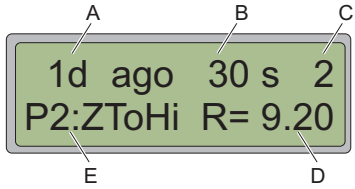
Impedances of the three phases and shutdown thresholds.



Indicator	Meaning
A	Phase identification (L1, L2 or L3) and error status.
B	Estimated value for absolute impedance of this phase.
C	Number of measuring pulses per second.
D	Own share of the ENS31 in the total measuring signal.
E	Dynamic upper shutdown threshold for the impedance jump.
F	Last established impedance jump.
G	Dynamic lower shutdown threshold for the impedance jump.

Sixth display

Last error which occurred, information is lost following ENS reset.



Indicator	Meaning
A	Time since last error (s = seconds, m = minutes, h = hours, d = days, w = weeks, a = years)
B	Duration of last error (s = seconds, m = minutes, h = hours, d = days, w = weeks, a = years)
C	Power-on routines since last reset.
D	Error text (also refer to Chapter 4)
E	Error value (in the example: the impedance of 9.2 ohm was too high on phase 2)

If hardware or impedance errors occur, the bottom line of the first display contains an error text.

Note
The meaning of the error texts and error status displays are described in Chapter 4 "Troubleshooting".

Attention
Check the functionality of the ENS31 regularly. If, for example, a red LED lights up constantly, the ENS31 may be defective and no power is fed in (also refer to Chapter 4 "Troubleshooting").

3.3 Switching the system off

The ENS31 cannot be switched off. The unit switches to an idling state if no voltage is supplied. It resumes its tasks as soon as sufficient power is available.

4 Troubleshooting

4.1 General information

In the case of repeated problems with the mains supply (e.g. frequent deactivation due to mains overvoltage or undervoltage), contact the public electricity supply authority and have the mains power quality checked at the feeding point.

A frequent disconnection from the mains power supply can be observed particularly in rural areas and areas with strong power fluctuations due to the proximity of industrial plants.

4.2 Error indications in the LCD

4.2.1 Error status for voltage

LCD indication	Cause	Recommended action
^250	Overvoltage	If the mains power fluctuations occur frequently, contact your public electricity supply authority.
v150	Undervoltage	
/280	Undervoltage in the case of fast shutdown	
_130	Undervoltage in the case of fast shutdown	
M250	Overvoltage in 10-minute average value	

4.2.2 Error status for frequency

LCD indication	Cause	Recommended action
^50.90	Frequency is too high	If the mains power fluctuations occur frequently, contact your public electricity supply authority.
v48.00	Frequency is too low	
j48.00	Frequency jump was detected (RoCoF)	

4.2.3 Error status for phase angle

LCD indication	Cause	Recommended action
!170	Phase angle deviates too far from setpoint.	If the mains power fluctuations occur frequently, contact your public electricity supply authority.
!240!120	Wrong direction of rotation of mains.	Swap phases L1 and L2 at the connection terminals.

4.2.4 Error status for impedance

LCD indication	Cause	Recommended action
^ 9,25	Impedance is implausibly too high.	If the mains power fluctuations occur frequently, contact your public electricity supply authority.
v -0,99	Impedance is implausibly too low (negative).	
n 0,33 p 0,44	Impedance jumps have been detected.	

4.2.5 Faults in the ENS 31 isolation unit

In the event of errors, the following text appears in the bottom line of the first or sixth display:

LCD indication	Meaning
HRD1Err###	A measuring error or hardware error has caused in the ENS31 has caused a shutdown. The 3 digits (###) are error codes for reference by the manufacture. If the error occurs only briefly, it is probably due to a measuring error. If the ENS31 does not switch on at all, it must be replaced.
HRD2Err###	
HRD3Err###	
TMRErr###	

Note
The ENS31 cannot be repaired on site. Please inform the specialist workshop that a replacement is required.

4.2.6 Error texts for mains power fluctuations

In the event of a power fluctuation, one of the following texts appears in the bottom line of the first or sixth display:

LCD indication	Meaning
P* : ZPJp dR= 1.20 P* : ZNJp dR=-1.20	An impedance jump has been detected.
P* : ZToHi R= 9.20 P* : ZToLo R=-0,99	The impedance is too high or too low.
P* : FToHi F=50.83 P* : FToLo F=46.83	The frequency is too high or too low.
P* : FrqJp dF=-600	Shutdown following RoCoF, value in mHz/s
P* : F Pha2 W=180° P* : F Pha2 W=200° P* : F Pha2 W=664°	Shutdown due to too great a phase angle deviation. Phase L2/L3 mixed up
P* : UTHi Ua=260.0	The mains voltage is too high, response time 10 minutes.
P* : UToHi U=265.3 P* : UToLo U=130.4	The mains voltage is too high or too low, response time 200 ms.
P* : UTHi Uf=310.0 P* : UTLo Uf=120.3	The mains voltage is too high or too low, response time 20 ms, fast shutdown to protect unit

* stands for 1, 2 or 3 and indicates the phase affected L1, L2 or L3

4.2.7 Harware errors ENS31

Errors of connection / relays

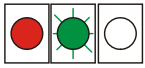
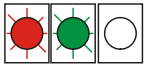
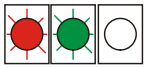
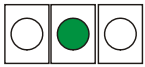
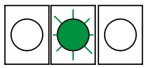
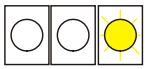
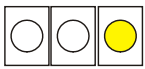
HRD1

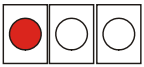
LCD indication	Meaning	Cause
HRD1 01 00 00	Feeback contact of relay 1 is open before relay 1 is switched.	Feedback contact not accurately connected according to installation manual 4.3. Cicuitry.
HRD1 02 00 00	Feedback contact of relay 2 is open before relay 2 is switched.	Feedback contact not accurately connected according to installation manual 4.3. Cicuitry.
HRD1 04 00 00	Relay 1 switches in spite of no control command.	Control system is faulty / Relay not accurately connected.
HRD1 08 00 00	Feedback contact of relay 1 doesn't open in spite of switching command to relay 1.	Relay 1 doesn't switch accurately. Relay or feedback contact not accurately connected. Feedback contacts mixed up.
HRD1 40 00 00	Relay 2 is switched in spite of no control command.	Control system is faulty / Relay not accurately connected.
HRD1 80 00 00	Feedback contact of relay 2 doesn't open in spite of switching command to relay 2.	Relay 1 doesn't switch accurately. Relay or feedback contact not accurately connected.

HRD2

LCD indication	Meaning	Cause
HRD2 01 00 00	Relay 1 switches off in spite of no such command.	Relay 1 defective.
HRD2 0 00 00	Relay 2 switches off in spite of no such command. Feedback contact of relay 2 it opening incorrectly.	Relay 2 defective. Feedback contacts mixed up. Only one relay controls both contacts.

4.3 Error indication through LEDs

LCD indication	Cause	Recommended action
 Red lights up, green flashes	Frequency error	Wait until the mains is switched on again. Contact the pubic electricity authority in the case of longer power failures.
 Red and green flash simultaneously	Voltage error	
 Red and green flash alternately	Impedance error	
 Green lights up with short interruptions	Measured value(s) outside the factory tolerance	Mains power is ok.
 Green flashes rapidly	ENS31 waiting for acknowledgement from inverse rectifier	Mains power is ok.
 or 	Display of impedance jump threshold value: lights up briefly = 0.1 ohm lights up longer = 0.5 ohm. short, short, long = 0.1 + 0.1 + 0.5 = 0.7 Ohm LED continually on: threshold is set to 1 ohm or more.	

LCD indication	Cause	Recommended action
 Red lights up	Measuring error or ENS31 has failed	If the LED lights up longer than 1 minute with mains available, the ENS31 is defective. Have the ENS31 replaced by a specialist workshop.

Note
The ENS31 cannot be repaired on site. Please inform the specialist workshop that a replacement is required.

5 Technical Data

Switched power (max.)	Dependent on the contactors assigned
Own consumption	3.5 W
Housing	Plastic, suitable for assembly on the top hat rail
Overall dimensions (W x H x D)	220 mm x 111 mm x 80 mm
Cut-out dimensions (W x H)	220 mm x 73 mm
Ambient conditions	- 20 °C to + 40 °C, 10 to 90 % relative humidity, non-condensating
Nominal current of power feeder	According to max. switching power of the contactors
The unit disconnects the mains under the following defined conditions (complying with standard DIN VDE 0126):	
Overvoltage (fast shutdown)	> 300 V (response time 0.02 s)
Overvoltage	> 264 V (response time 0.2 s)
Overvoltage (average)	230 V + 10% over 10 minutes
Undervoltage (fast shutdown)	< 130 V (response time 0.02 s)
Undervoltage	< 185 V (response time 0.2 s)
Frequency deviation	+ 0,2 Hz / -2,5 Hz (response time 0.2 s)
Impedance jump detection	> 0.5 Ohm (response time 0.5 s)