HYBRYD

LIGHTING THE WAY TO SAFETY

HVCBS

OPERATION AND MAINTENANCE MANUAL

HIGH VOLTAGE CENTRAL BATTERY SYSTEM

CONTENTS

INTRODUCTION

High Voltage Central Battery System (HVCBS) enables power supply and control of emergency lighting luminaires.

Emergency lighting luminaires connected to Central Battery System are located in so-called end circuits. Communication with luminaires takes place via power line. Controller with a touch display has a simple, intuitive interface that allows for quick system configuration.

Automatic test execution (in accordance with PN-EN 50172: 2005) takes place from the controller level. Both test results and reports are saved and stored on SD card. It is also possible to download test results and reports to an external memory. This solution facilitates reporting and keeping an Event Log (in accordance with PN-EN 50172: 2005 standard).

HVCBS system uses sealed, maintenance-free batteries, paired in terms of internal resistance and voltage, which allows for proper operation for many years. The choice of batteries depends on HVCBS voltage and emergency work time. A temperature probe is used to monitor temperature where the batteries are located. The system has a battery discharge indicator in accordance with PN-EN 50171: 2007 standard. The use of dedicated circuit protection, automation and battery increases level of safety.

HVCBS system is designed to supply emergency and evacuation lighting circuits operating in IT network at battery operation.

ATTENTION! BATTERIES
AND CHARGERS ARE OPTIONAL

IT IS POSSIBLE TO CONNECT BATTERIES FROM
AN EXTERNAL DC SOURCE,
SUPPLIED BY ANOTHER SYSTEM

The system should be set up in such a position that it is easy to access. It is important that no ventilation openings are covered.

After installation and commissioning, the system should be closed, with no unauthorized access.

The type of cables supplying the system and luminaires as well as a method of their introduction into the cabinet should be agreed with the manufacturer of the device. Cables connecting the system with accumulators should be as short as possible. Cross-section of wires and the way of mounting the terminals should take into account operating conditions and ensure appropriate serviceability of the system. The type of AC cables, circuits and the method of their introduction into the cabinet should be agreed with cabinet manufacturer. Cables connecting the system to batteries and connections between the batteries should be of the shortest possible length. Cross-section of the wires and the way of mounting the terminals should take into account the operating conditions and ensure the appropriate serviceability of the system.

HVCBS SYSTEM

The system has been designed in accordance with the standards (PN-EN 50171:2007, PN-EN 50172:2005, PN-EN IEC 62485-2:2018-09).

It can consist of a main station and a substation, or just a main station.

Due to the possibility of expansion with substations, the HVCBS system is suitable for applications in small, medium and large facilities.

TECHNICAL DATA

Power supply	3 x 230V AC / 216V DC
Frequency	50Hz
Network type	TN-S / IT
Power	up to 16kW
Emergency work time	depends on the system

Number of circuits	up to 64
Number of substations	up to 32
Protection class	I
Ingress protection	depends on the system

AMBIENT CONDITIONS

Ambient temperature at nominal load and natural convection	20°C – 25°C
Relative humidity (non-condensing)	40% – 100%
Air pressure	84kPa – 107kPa
Environmental factors acc. to PN-EN IEC 60721-3-3	3K22

Biological resistance acc. to PN-EN IEC 60721-3	3B2
Dust resistance acc. to PN-EN IEC 60721-3	3S5
Insolation	impermissible
Sinusoidal vibrations allowed during operation	amplitude 0.15mm frequency 10Hz-55Hz
Impacts during operation	impermissible

ROOM REQUIREMENTS

A room designated HVCBS system with VRLA batteries should meet all requirements of PN-EN IEC 62485-2: 2018-09 standard, which is directly referenced in PN-EN 50172: 2005 standard for Emergency and Evacuation Lighting Systems.

Below are some of the most important issues related to ensuring safe operation of batteries, concerning rooms where these batteries are used.

Under abnormal operating conditions, VRLA batteries emit hydrogen, which accumulates in the ceiling layer and forms a mixture with oxygen from the air, which at a hydrogen concentration greater than 4% (lower explosion limit – LEL) becomes explosive. A small amount of energy, such as from static electricity, is then sufficient to initiate an explosion.

In order to ensure safety during service works in the battery room, an anti-electrostatic floor should be made within the arms reach of the batteries, meeting the condition of 50KΩ <R <10MΩ, where R is the floor resistance in relation to the grounding point. Hydrogen concentration in the ceiling space depends on intensity of gassing of the batteries and intensity of air exchange in the room. In order to neutralize the mixture, adequate ventilation of the room should be provided, its basic requirements are specified in PN-EN IEC 62485-2: 2018-09 standard.

Table below shows required minimum air flow and minimum free cross-section of ventilation openings (inlet, outlet) for natural ventilation.

C_{10} [Ah]	Q [m³/h]	A [cm²]	C_{10} [Ah]	Q [m³/h]	A [cm²]
7	0,04	1,2	70	0,38	10,7
9	0,05	1,4	75	0,41	11,5
12	0,07	2,0	80	0,44	12,4
18	0,10	2,8	90	0,49	13,8
20	0,11	3,1	100	0,54	15,2
26	0,15	4,2	120	0,65	18,2
28	0,16	4,5	135	0,73	20,5
33	0,18	5,1	150	0,81	22,7
40	0,22	6,2	180	0,98	27,5
45	0,25	7,0	200	1,08	30,3
55	0,30	8,4	225	1,22	34,2
60	0,33	9,3	240	1,30	36,4
65	0,36	10,1	260	1,41	39,5

C_{10} - VRLA battery capacity for 10 hours of discharge time
Q - required minimum air flow in m³/h
A - free cross-sectional area of air inlet and outlet in cm².

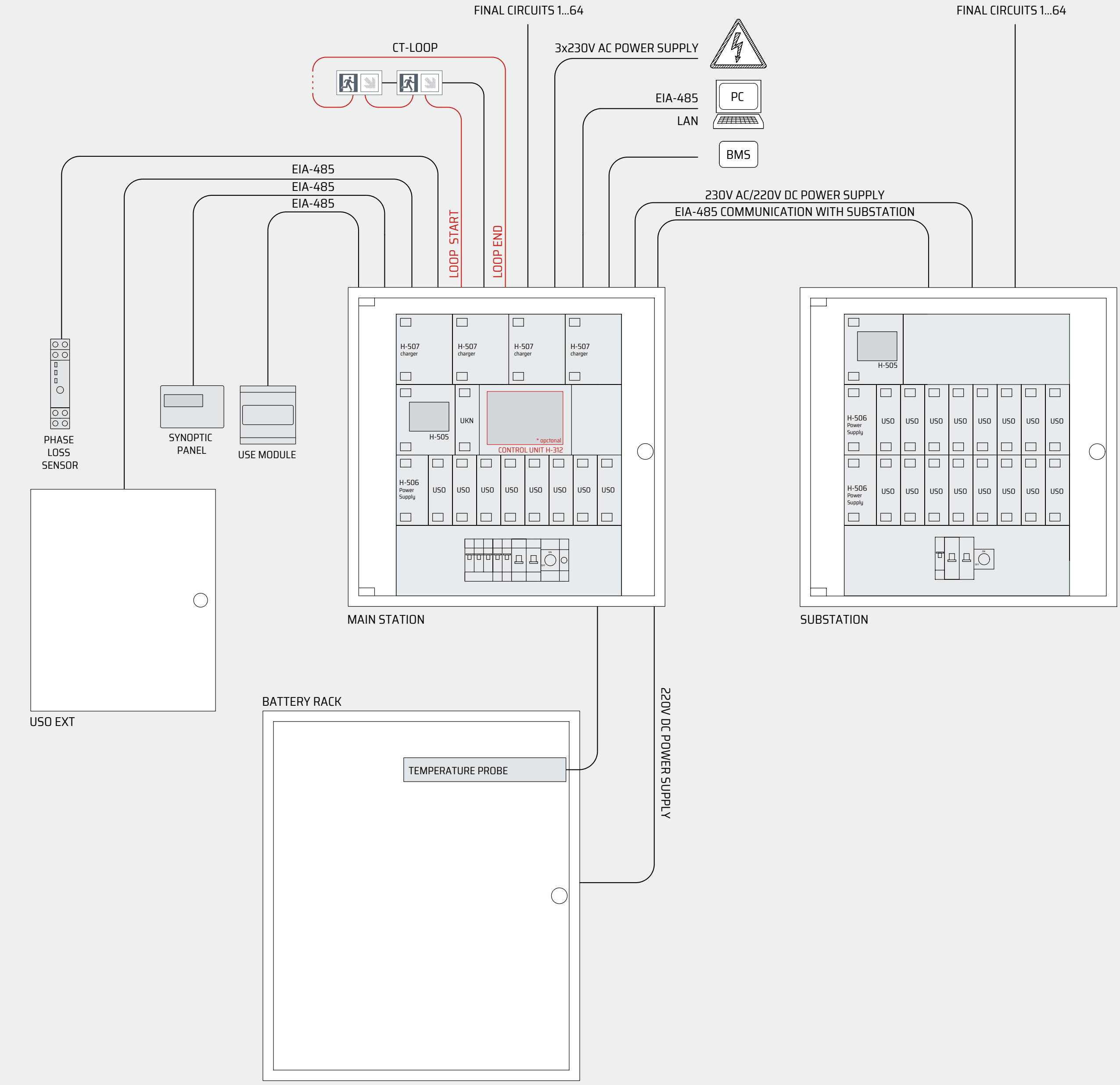
It is important that air inlet and outlet should be located in such a way that they create optimal conditions for air exchange, i.e. they are located on opposite walls, or if the openings are located on the same wall, the minimum distance between them is 2 m.

Room temperature must be kept in range of 20-25° C, unless otherwise specified in building design and electrical installations. Changing the above temperature range entails the necessity to increase the reserve of battery capacity in HVCBS/LVDBS systems.

Each 10°C increase in temperature above 25°C shortens the service life of the batteries by half. Lowering the temperature below 20°C results in a reduction of battery capacity, which for 0°C will decrease by 15%.

Lowering the temperature below 20°C may, in extreme cases (if the situation was not predicted in a design and an adequate reserve of battery capacity has not been added), result in failure to maintain emergency operation time of HVCBS/LVDBS system.

HVCBS WIRING DIAGRAM



HVCBS SYSTEM CONSTRUCTION

HVCBS system can consist of a main station and a substation, or just a main station. Due to the possibility of expansion with substations, HVCBS system is suitable for applications in small, medium and large facilities..

HVCBS main station has a system for charging and controlling battery parameters (not applicable to version with an external emergency power source). It can function as an independent unit.

The role of the main station is to collect information from the entire system and keep it in one place. Test schedules can be set in the main station.

A substation is an extension of the system with additional output circuits. It has its own driver, but does not have a system for switching the power source of the luminaires. System marking, for the main station and substations, is described below.

HVCBS SYSTEM HALLMARKING

HVCBS system hallmarking defines clearly how the system should be made.

An example of hallmarking of HVCBS main station is presented below, along with an explanation of individual hallmarking parameters:

Terminal type – specifies manufacturer of connectors used in the system

Language version – specifies system language

Housing type – specifies type of system housing

Nominal power – maximum power of the system

Number of installed circuits – number of circuits that can be connected

Number of circuits (max) – maximum number of circuits for system expansion

Number of potential-free inputs – number of potential-free inputs from local phase loss sensors

Battery housing type – specifies a type of a rack (cabinet) for batteries. Normal or fire – resistant closed cabinet or an open battery rack

Number of battery strings connected in parallel – specifies number of used battery packs and their connection

Battery voltage – specifies a type of nominal battery voltage 6 or 12V. It is also possible to power the system from another source, in this case you should select an option without a battery

Emergency work time – specifies minimum emergency work time defined for a given project.

Total battery capacity – specifies capacity of batteries used in the package

Central unit powering – determines a type of AC power supply for the system. The system can be single-phase or three-phase

Emergency output power – defines AC/DC or AC/AC power supply type

First substation protection – determines collateral value in the first branch of substation

Second substation protection – determines collateral value in the second branch of substation

Third substation protection – determines collateral value in the third branch of substation

EXAMPLE:

HVCBS SYS	0001	- EN	- S	- 049	- N08	- N16	- 05	- C	- 1	- 12	- 020	- 1h	- 3F	- DC	- 0	- 0	- 0	

0001 – WAGO terminal type

EN – english system language

S – one section housing

049 – system power 4,9kW

N08 – 8 output circuits

N16 – the system can be expanded to a maximum of 16 circuits

05 – 5 potential-free inputs can be connected

C – battery cabinet

1 – package of 18 batteries in one branch

12 – 12V batteries

020 – 20Ah battery capacity

1h –emergency work time 1h

3F – three-phase system

DC – AC/DC output voltage

0 – first branch of substation security 6A

0 – second branch of substation security 6A

0 – third branch of substation security 6A

MAIN STATION ORDERING

HVCBS SYS 0 0 0 1 - EN - S - 049 - N08 - N16 - 05 - C - 1 - 12 - 020 - 1h - 3F - DC - 0 - 0 - 0

Type of terminal blocks:
0 – standard
1 – WAGO
2 – WEIDMULLER
3 – PHOENIX CONTACT
4 – WIELAND
...

Language version:
EN – english

Type of central unit housing:
D – double section housing
S – single section housing
P – mounting plate
H – ingress protection increased to IP65 housing
F – fireproof housing

Nominal power:
005 – 0,5KW
007 – 0,7KW
008 – 0,8KW
011 – 1,1KW
012 – 1,2KW
013 – 1,3KW
014 – 1,4KW
015 – 1,5KW
016 – 1,6KW
017 – 1,7KW
018 – 1,8KW
021 – 2,1KW
023 – 2,3KW
025 – 2,5KW
026 – 2,6KW
030 – 3,0KW
033 – 3,3KW
035 – 3,5KW
039 – 3,9KW
043 – 4,3KW
049 – 4,9KW
052 – 5,2KW
058 – 5,8KW
065 – 6,5KW
071 – 7,1KW
078 – 7,8KW
087 – 8,7KW
097 – 9,7KW
117 – 11,7KW
139 – 13,9KW
156 – 15,6KW
160 – 16,0KW

verte

HVCBS SYS 0 0 0 1 - EN - S - 049 - N08 - N16 - 05 - C - 1 - 12 - 020 - 1h - 3F - DC - 0 - 0 - 0

Number of lines installed:

N02 – 2 lines

N04 – 4 lines

...

N64 – 64 lines

Maximum number of lines:

N06 – 6 lines

N16 – 16 lines

N32 – 32 lines

N48 – 48 lines

N64 – 64 lines

Number of potential-free inputs:

05 – 5 inputs

13 – 13 inputs

21 – 21 inputs

29 – 29 inputs

Battery housing type:

X – none

C – cabinet

R – rack

F – fireproof housing

Number of branches connected in parallel:

X – no battery and charging system

1 – single branch with 18 batteries of 12V or 36 batteries of 6V

2 – two branches with 18 batteries of 12V or 36 batteries of 6V

...

Battery voltage:

12 – VRLA AGM batteries of 12V

06 – VRLA AGM batteries of 6V

00 – no batteries and charging system

Total battery capacity:

000 – no batteries

012 – 12Ah

018 – 18Ah

020 – 20Ah

026 – 26Ah

028 – 28Ah

033 – 33Ah

040 – 40Ah

055 – 55Ah

060 – 60Ah

075 – 75Ah

090 – 90Ah

120 – 120Ah

150 – 150Ah

200 – 200Ah

...

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HVCBS SYS 0 0 0 1 - EN - S - 049 - N08 - N16 - 05 - C - 1 - 12 - 020 - 1h - 3F - DC - 0 - 0 - 0

Emergency operation time:

1h – 1 hour

2h – 2 hours

3h – 3 hours

Central unit power supply method:

1F – single-phase supply

3F – three-phase supply

Emergency power supply:

DC – 216V DC

AC – 230V AC 50Hz

First substation protection:

X – no protection and connector

0 – 6A fuse protection

1 – 10A fuse protection

2 – A fuse protection

3 – 20A fuse protection

4 – 25A fuse protection

5 – 35A fuse protection

6 – 40A fuse protection

7 – 50A fuse protection

8 – 63A fuse protection

Second substation protection:

X – no protection and connector

0 – 6A fuse protection

1 – 10A fuse protection

2 – A fuse protection

3 – 20A fuse protection

4 – 25A fuse protection

5 – 35A fuse protection

6 – 40A fuse protection

7 – 50A fuse protection

8 – 63A fuse protection

Third substation protection:

X – no protection and connector

0 – 6A fuse protection

1 – 10A fuse protection

2 – A fuse protection

3 – 20A fuse protection

4 – 25A fuse protection

5 – 35A fuse protection

6 – 40A fuse protection

7 – 50A fuse protection

8 – 63A fuse protection

The main station consists of the following modules:

- **H-505** module
- **UKN** module
- **USI** module (quantity depends on system specification)
- **USO** module (quantity depends on system specification)
- **H-507** charger (quantity depends on system specification), for systems without batteries – no chargers.

SUB-STATION ORDERING

HVCBS SUB 0 0 0 1 - EN - S - N08 - N16 - 05 - 0 - 0

- Terminal type
- Language version
- Housing type
- Number of installed circuits
- Number of circuits (max)
- Number of potential-free inputs
- Substation power supply protection
- Protection of the next substation

Terminal type – specifies manufacturer of connectors used in the system

Language version – specifies system language

Main station housing type – specifies type of main station housing

Number of installed circuits – number of circuits that can be connected

Number of circuits (max) – maximum number of circuits for system expansion

Number of potential-free inputs – Number of potential-free inputs from local phase -loss sensors

Substation power supply protection – protection of a given substation

Next substation protection – substation branch protection

EXAMPLE:

HVCBS SUB	0 0 0 1	-	EN	-	S	-	N08	-	N16	-	05	-	0	-	0

0001 – WAGO terminal type

EN – system in English language

S – one section housing

N08 – the system has 8 output circuits

N16 – the system can be expanded to a maximum of 16 circuits

05 – 5 potential-free inputs can be connected

0 – substation security 6A

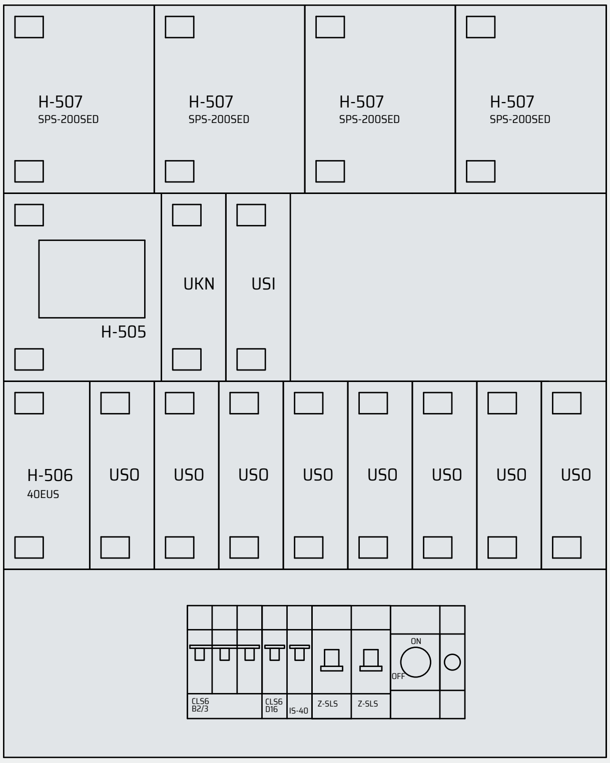
0 – securing the next branch of substation 6A

A substation consists of the following modules:

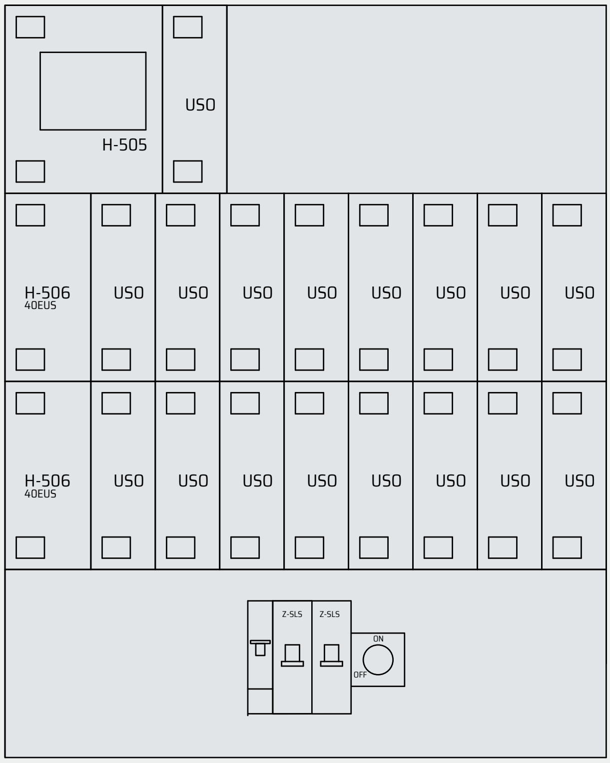
- **H-505** module
- **USI** module (quantity depends on system specification)
- **USO** module (quantity depends on system specification)

Description of individual modules and their exemplary arrangement for particular HVCBS system versions are presented below.

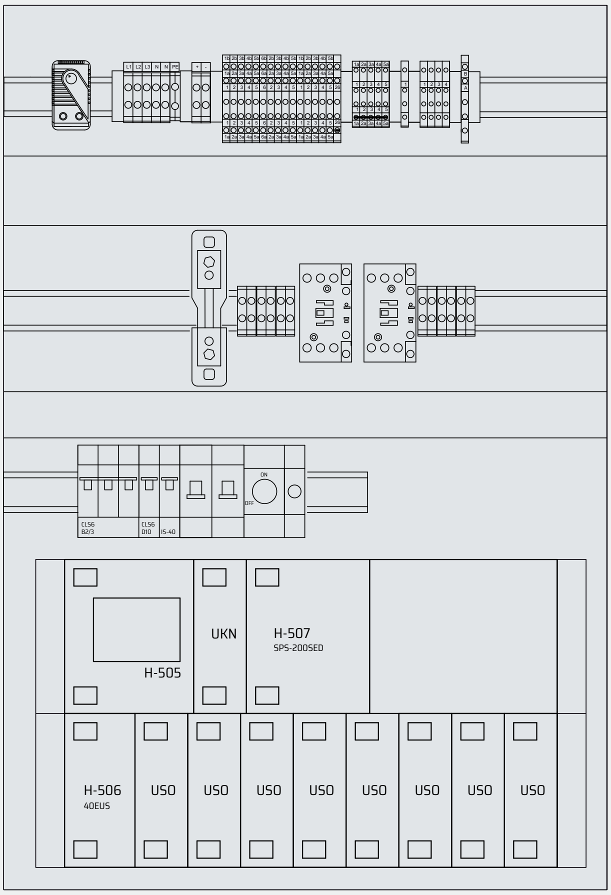
LOCATION OF MODULES



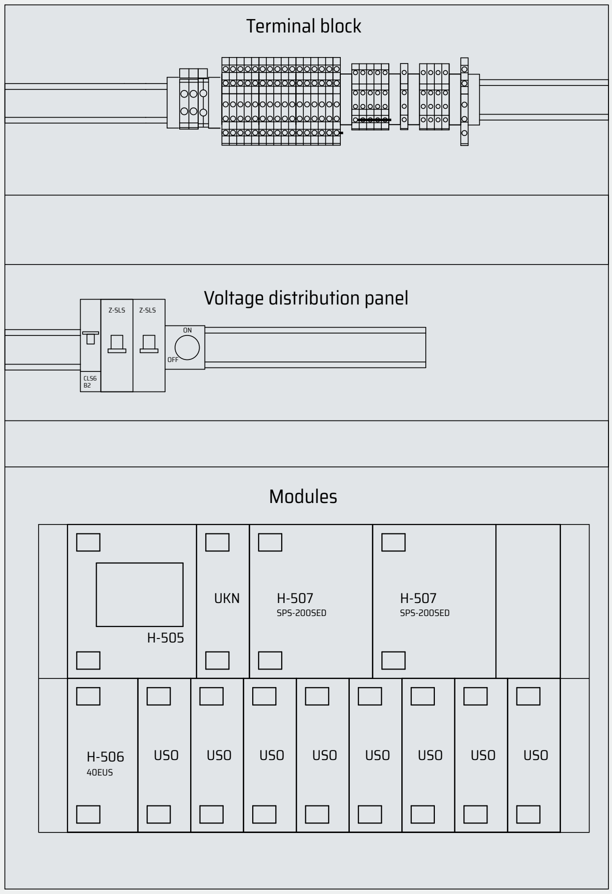
Exemplary arrangement for systems in a two-section and one-section housing – main station



Exemplary arrangement for systems in a two-section and one-section housing – substation

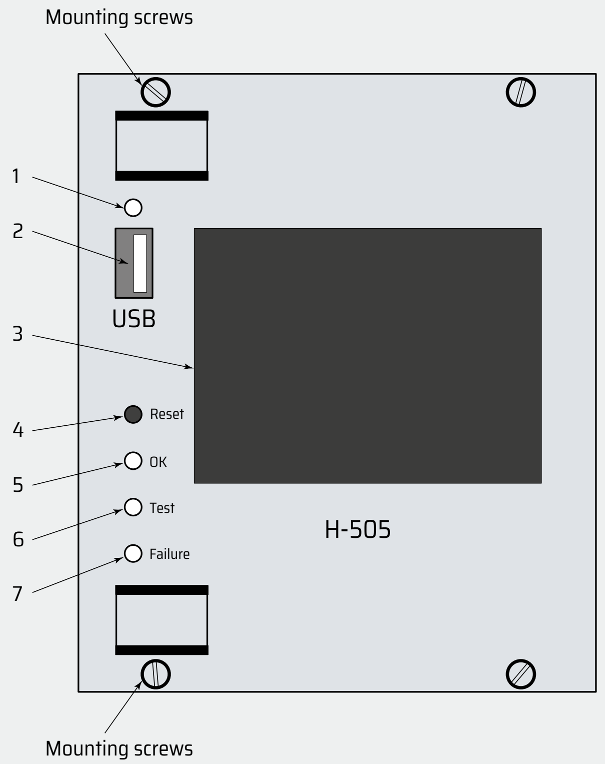


An example of modules arrangement for systems made on a mounting plate, in an IP65 housing or a fireproof housing – main station



An example of modules arrangement for systems made on a mounting plate, in an IP65 housing or a fireproof housing – substation

H-505 MODULE



H-505 is the main control unit of the HVCBS system, its most important functions are:

- Monitoring and control of all internal system components
- Communication with substations
- Communication with building management systems (BMS)
- User interface (LCD touch display)
- Automatic performance of tests in accordance with PN-EN 50172:2005 standard
- Saving test results on an SD card
- Saving test results and settings in an external memory.

H-505 made in EURO 3U/160mm mechanical system.

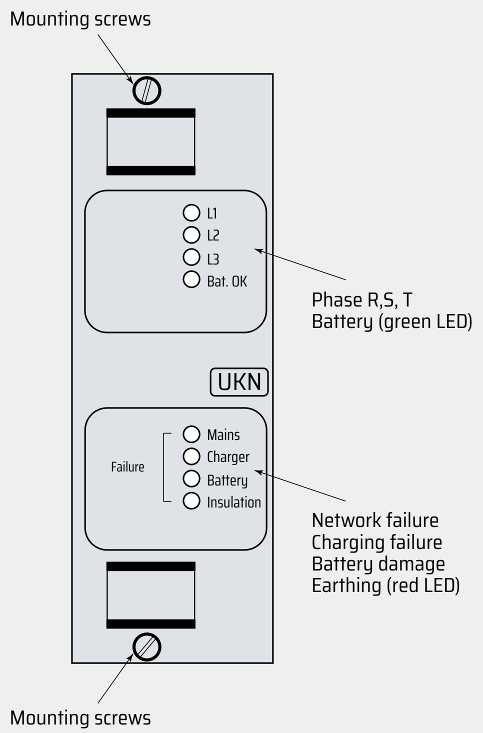
1. LED indicating USB port operation
2. USB port
3. Display
4. Reset button
5. LED indicating correct system operation
6. LED indicating the test execution
7. LED indicating system failure.

When inserting an external memory into a **USB port (2)** LED indicating correct operation of the port should blink green. A **touch display (3)** works as a user interface. From this level, it is possible to change settings and navigate through the menu. Additionally, detailed information on tests and errors is displayed. During correct operation of the system, the **OK LED (5)** lights up in green. **Test LED (6)** should flash yellow/orange while the STD and A tests are being run. In case there are errors in the system, the **Failure LED (7)** will blink red.

UKN MODULE

UKN module allows you to measure parameters such as battery voltage, battery charging and discharging current, load current and insulation condition monitoring.

- LEDs **Phase L1, L2, L3** (green) – indicates phase presence
- LED **Bat. OK** (green) – indicates correct battery operation
- LED **Network** (red) – indicates network failure
- LED **Charg.** (red) – indicates charger failure
- LED **Battery** (red) – indicates battery damage
- LED **Insulation** (red) – indicates ground fault.



USO MODULE

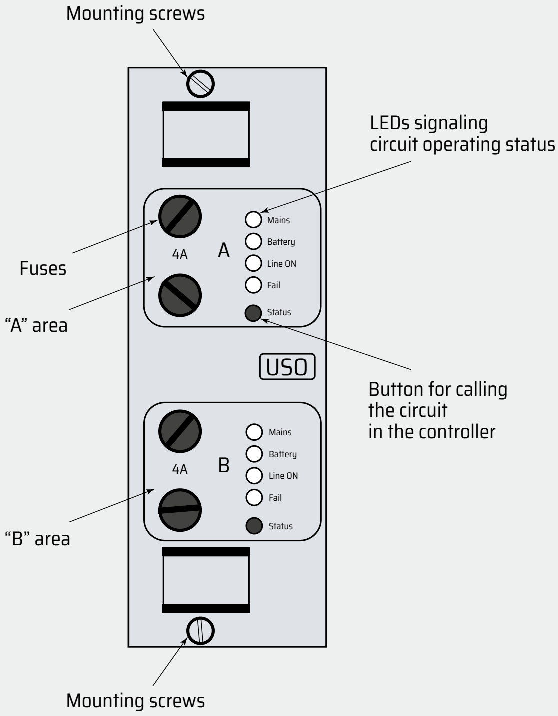
USO module is designed to control efficiency of lighting luminaires that are part of a final circuit. One module can serve two final circuits in a line control or luminaire control system. Parameters are configured from controller level – H-505 module. Each module has an address that corresponds to its place in the euro cassette.

LEDs indicating operating status of a circuit:

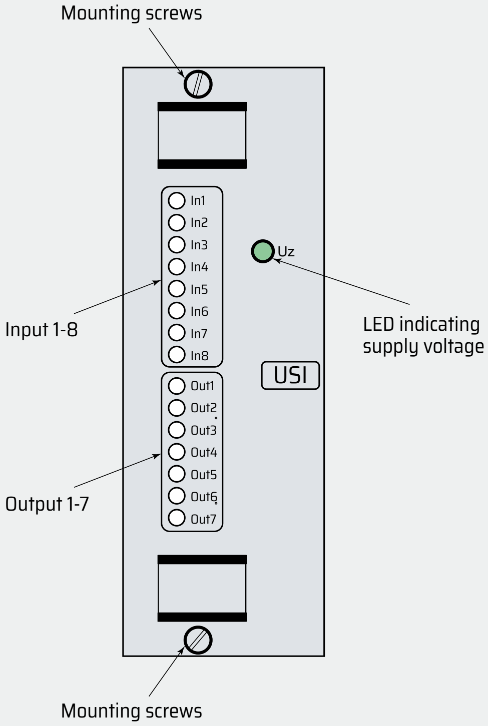
- **Mains** (green) – indicates whether the module works in a mode of 230V AC
- **Battery** (orange) – indicates operation in emergency mode or performing a test
- **Line on** (green) – indicates presence of voltage on a line
- **Failure** (red) – indicates a blown fuse or negative test result (lines or luminaires).

Status button allows you to call up the circuit in H-505 controller.

Each module is divided into two areas **A and B** (one area corresponds to one end circuit) with the same functionality. Each circuit is protected by two 4A fuses.



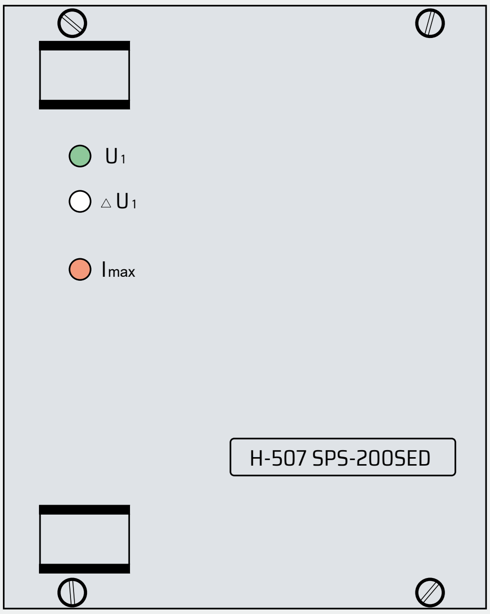
USI MODULE



USI module has potential-free contact inputs and relay outputs. Dry contact inputs can be associated with and controlled by any circuit. There are two variants of the module: with a front plate and LEDs and a short version, located behind H-505 controller or a blanking plate.

- LEDs **In1-In8** (green) indicate active inputs
- LEDs **Out1-Out7** (green) indicate active outputs
- LED **Uz** (green) indicate supply voltage presence.

H-507 CHARGER



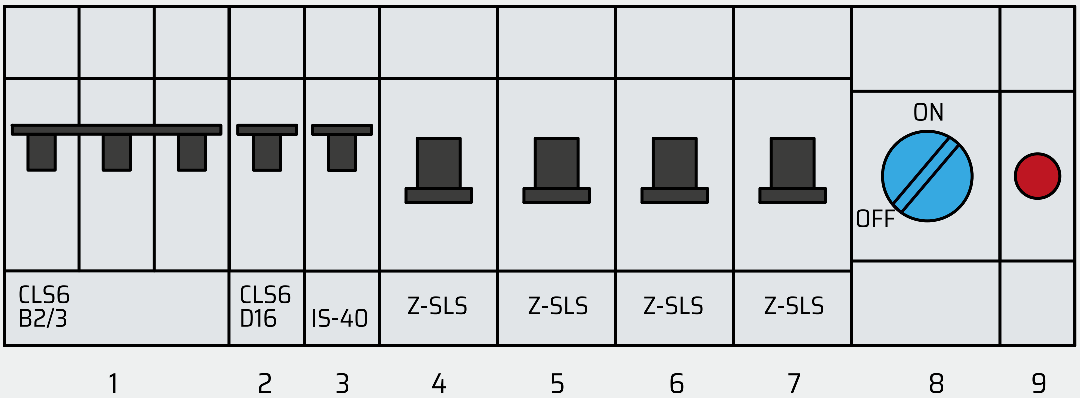
H-507 rectifier is made in a form of a module. The charger is designed to charge batteries. For nominal voltage U0 = 245V, maximum output current is 1A.

Thanks to solutions adopted in H-507 module, current surge limitation is ensured when connected to mains. Rectifier output characteristics with impulse output current limitation of constant voltage, constant current type.

It has an over-voltage protection at level of 110-120% of nominal voltage (smooth regulation).

Output voltage is adapted to temperature changes, in accordance with requirements of battery manufacturers.

VOLTAGE DISTRIBUTION PANEL



1. **Internal circuit protection –** protection of internal circuits of the system
2. **AC line protection* –** total protection of output lines in AC operation mode
3. **Charger protection**
4. **Battery protection „+” –** protection of positive battery terminal
5. **Battery protection „-” –** protection of negative battery terminal
6. **Substation protection +** –** protection of positive pole of a substation
7. **Substation protection -** –** protection of negative pole of a substation
8. **Main switch –** cuts off power to contactors, lockout function
9. **Battery discharge indication –** indicates that battery voltage has dropped below 175V and the system has been cut off from battery supply.

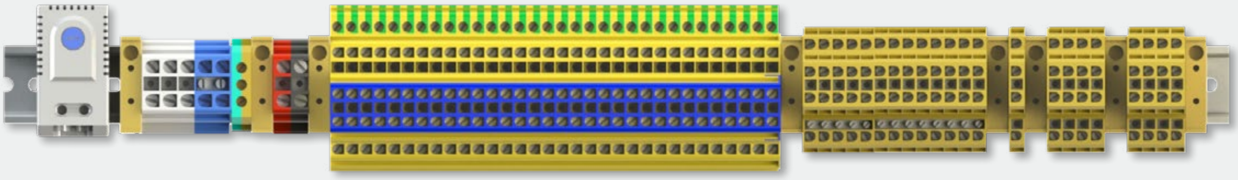
* Protection depends on system specification

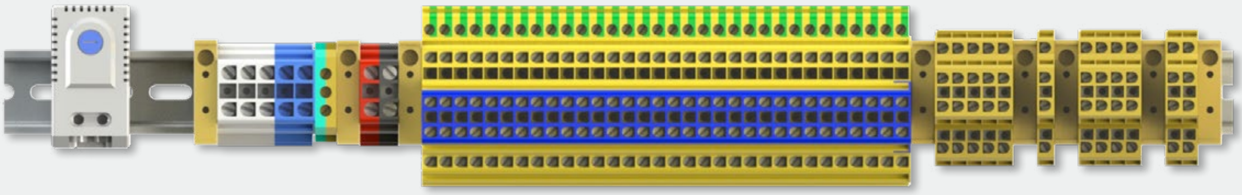
** Only for systems with substations, it also protects a system in AC mode

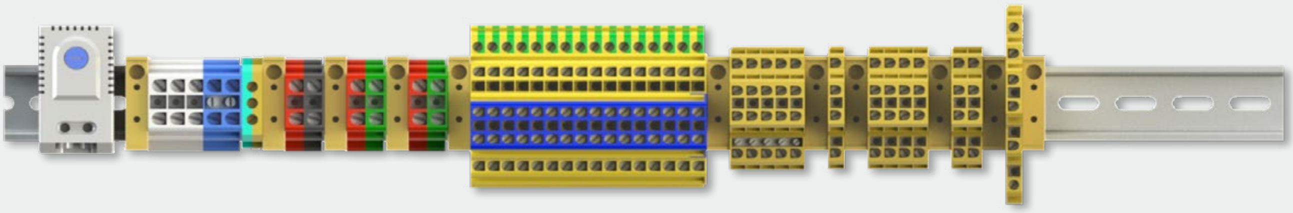
TERMINAL BLOCK

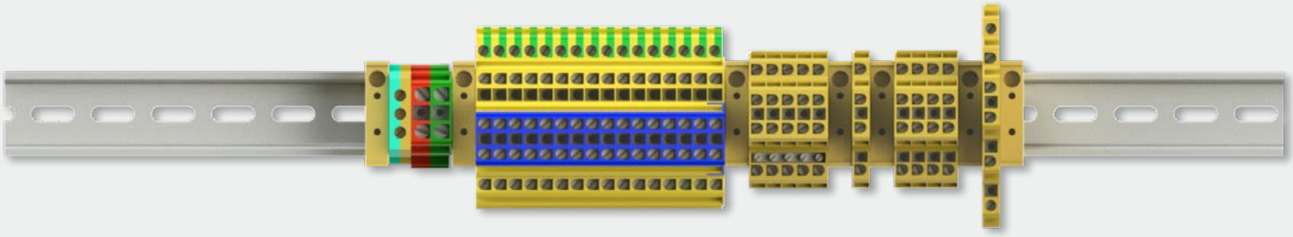
Mains supply, battery supply, substation supply, terminal circuits (luminaires), control circuits, signalling circuits, temperature probes, transmission to a substation and additional modules should be connected to a terminal strip at the back of HVCBS housing. A detailed description of a connection is presented in the following sections.

Examples:









SAFETY

During installation and subsequent use, national safety regulations as well as generally accepted rules and principles of technology must be respected.

All work should be performed by qualified personnel with appropriate qualifications and authorizations, familiar with safety rules.

Because of rechargeable battery installed inside, all activities related to the commissioning and servicing of HVCBS should be performed with extreme caution, and also after disconnecting AC supply voltage and battery voltage.

The system is made in I class insulation according to PN-EN 60950, i.e. a metal housing connected to a protective terminal is used for protection against electric shock.

SYSTEM ASSEMBLY AND MAINTENANCE

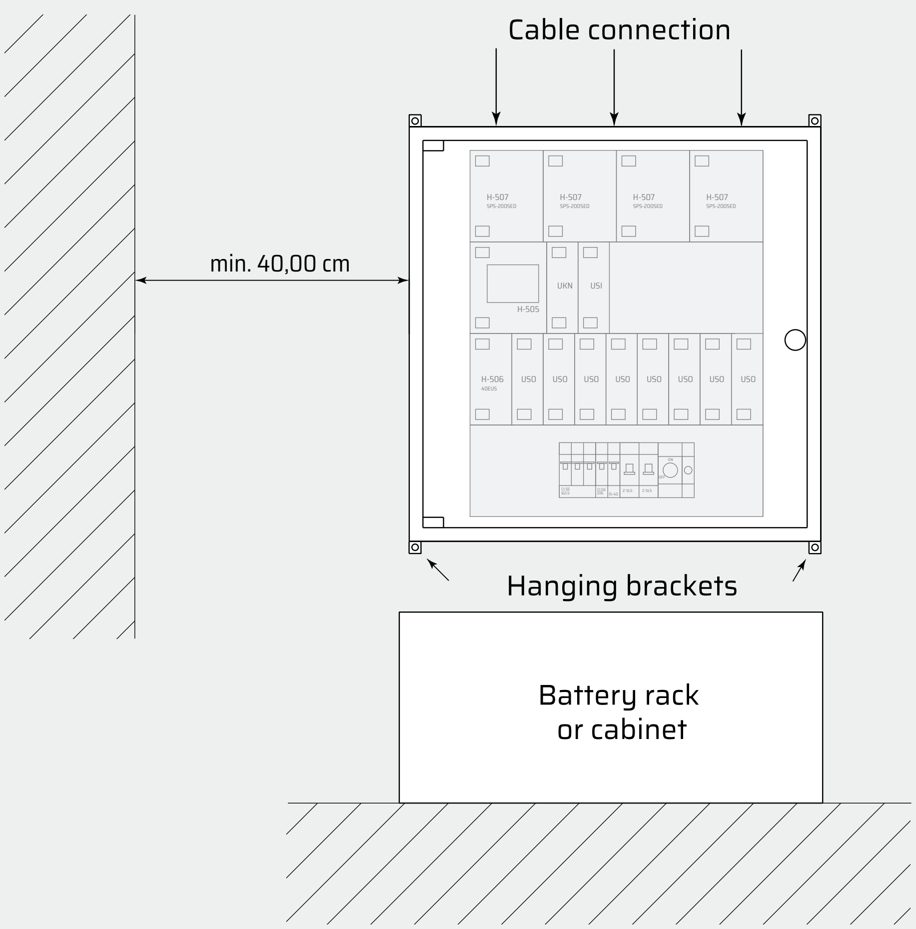
Installation method depends on system design – housing type.

SYSTEM ASSEMBLY – DOUBLE-SECTION HOUSING

HVCBS system made in a two-section housing, should be mounted on the wall in such a way that it is easily accessible. Inside cabinet's package, there is a template that allows for precise arrangement of holes for system installation. Hanging brackets are also attached, they should be mounted in the rear part of the cabinet with M8 screws.

The cabinet should be installed so that the H-505 computer display is at eye level. About 40 cm of free space should be provided on the left side to allow easy opening of the cabinet.

System cables are connected from the top.

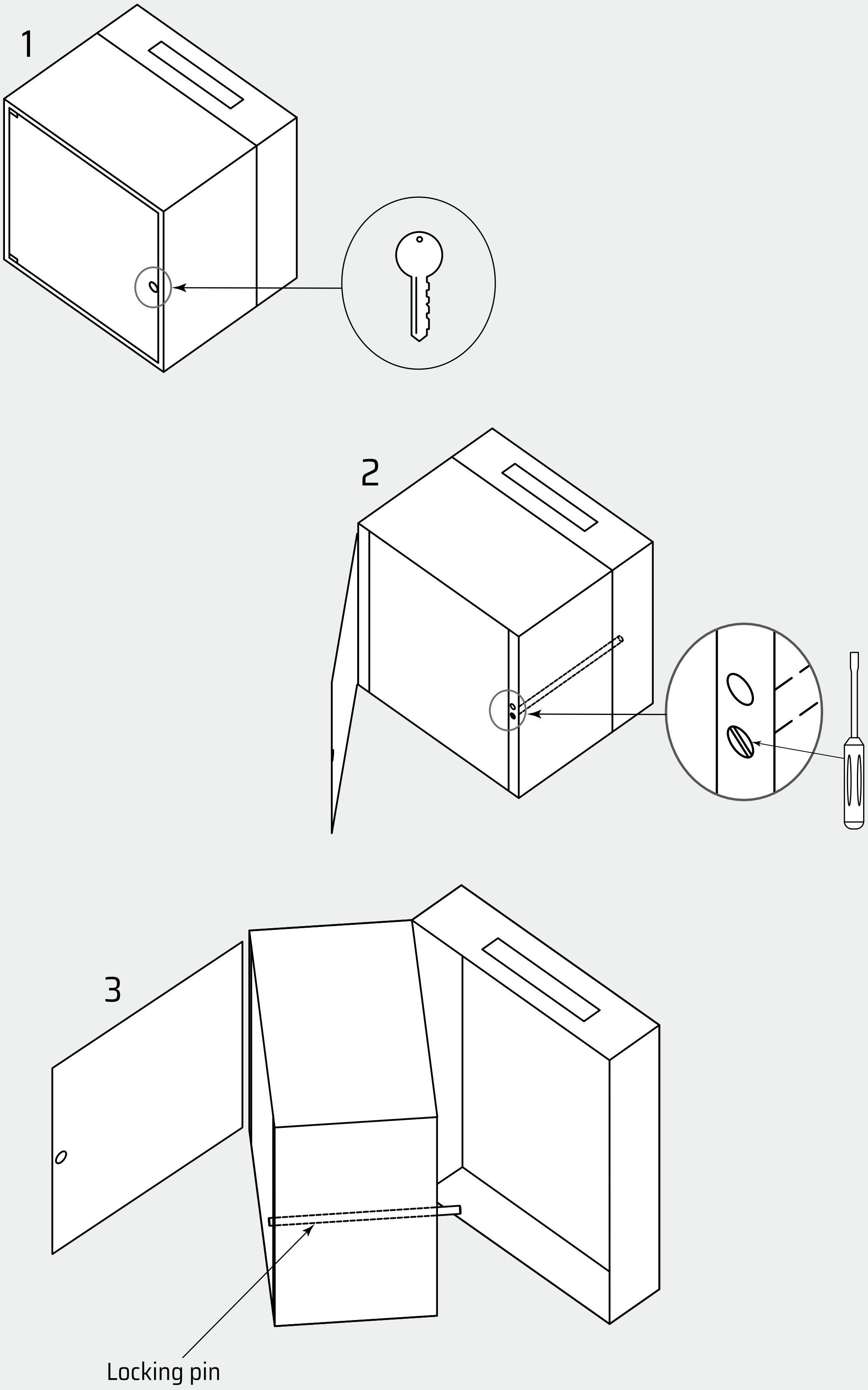


OPENING A DOUBLE-SECTION HOUSING

In order to connect the system, fasten the cables to the terminals on the rear part of the housing.

To open the cabinet, use the system key (point **1**), and then unscrew the locking pin next to the lock (point **2**).

Correct way to open the cabinet is shown below.



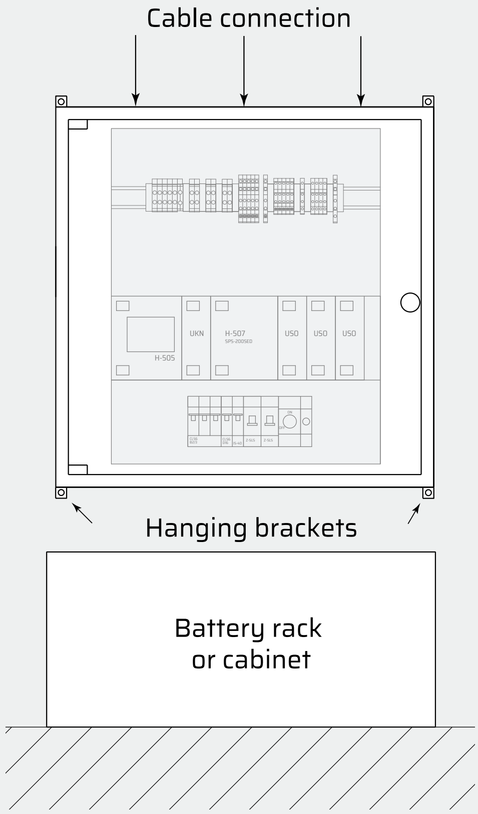
SINGLE-SECTION HOUSING ASSEMBLY

HVCBS system made in a single-section housing, should be mounted on the wall in such a way that it is easily accessible. Inside cabinet's package, there is a template that allows for precise arrangement of holes for system installation. Hanging brackets are also attached, they should be mounted in the rear part of the cabinet with M8 screws .

The cabinet should be installed so that the H-505 computer display is at eye level. About 40 cm of free space should be provided on the left side to allow easy opening of the cabinet.

System cables are connected from the top. In order to connect the system, fasten the cables to the terminals in the upper part of the housing.

To open the cabinet use the system key.



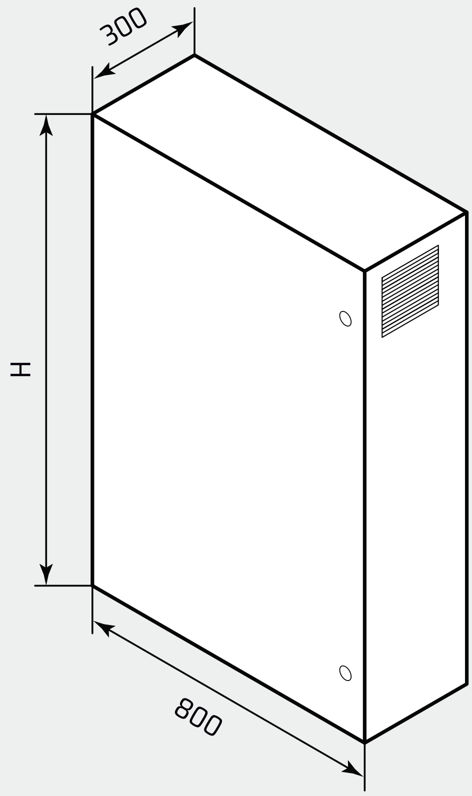
IP65 HERMETIC HOUSING

HVCBS system in IP 65 hermetic housing should be mounted on the wall in such a way that it is easily accessible.

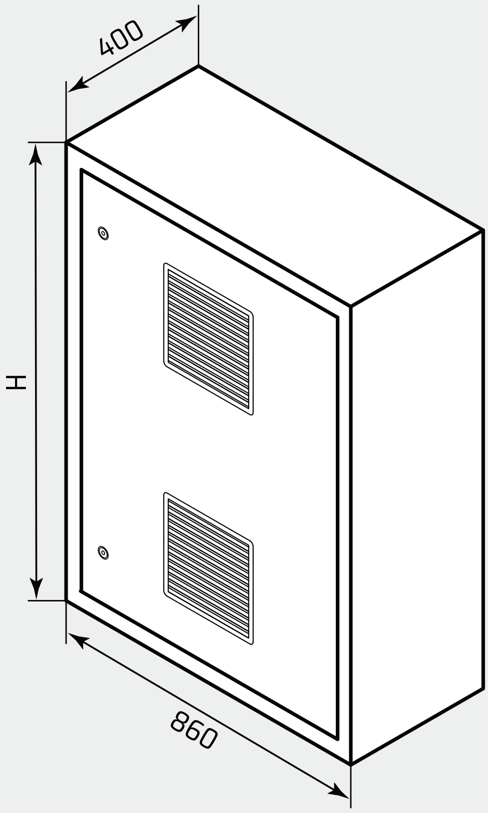
The cabinet should be installed so that the H-505 computer display is at eye level.

System cables are connected from the top or the bottom depending on the order. In order to connect the system, fasten the cables to the terminals located inside the housing.

To open the cabinet use the system key.



FIREPROOF HOUSING



HVCBS system in fireproof housing should be mounted on the wall in such a way that it is easily accessible.

The cabinet should be installed so that the H-505 computer display is at eye level.

System cables are connected from the top or the bottom depending on the order. In order to connect the system, fasten the cables to the terminals located inside the housing.

To open the cabinet use the system key.

CONNECTING X0/LZ1 TERMINAL – POWER SUPPLY

Power cable should be connected to the terminals in a place marked x0/Lz1. Cable cross-section depends on each system power. It is recommended to use a cable with a 5-wire cross-section

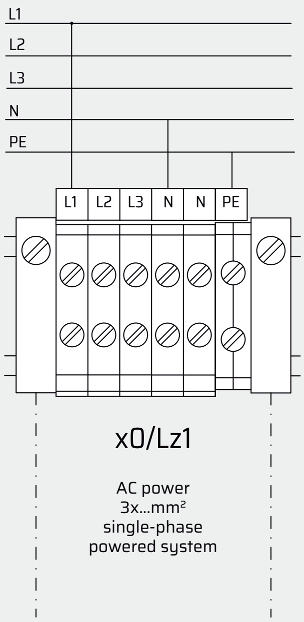
for both 1-phase and 3-phase systems.

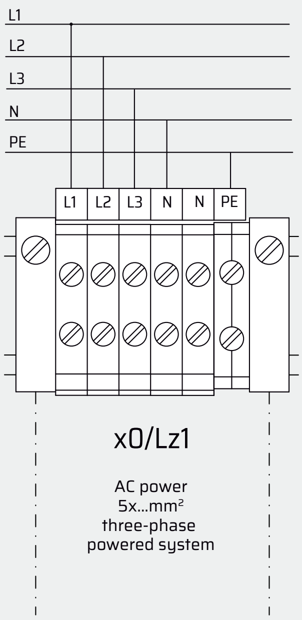
In case of single-phase system, lighting circuits are powered from 1 phase and the remaining phases are used to monitor the supply voltage.

One-phase system can also be powered by a 3-wire cable.

If a single-phase power supply is used, during the loss of one of the uncontrolled phases, the system will not be switched to emergency operation.

Connection of the power cables is shown in the picture on the right.



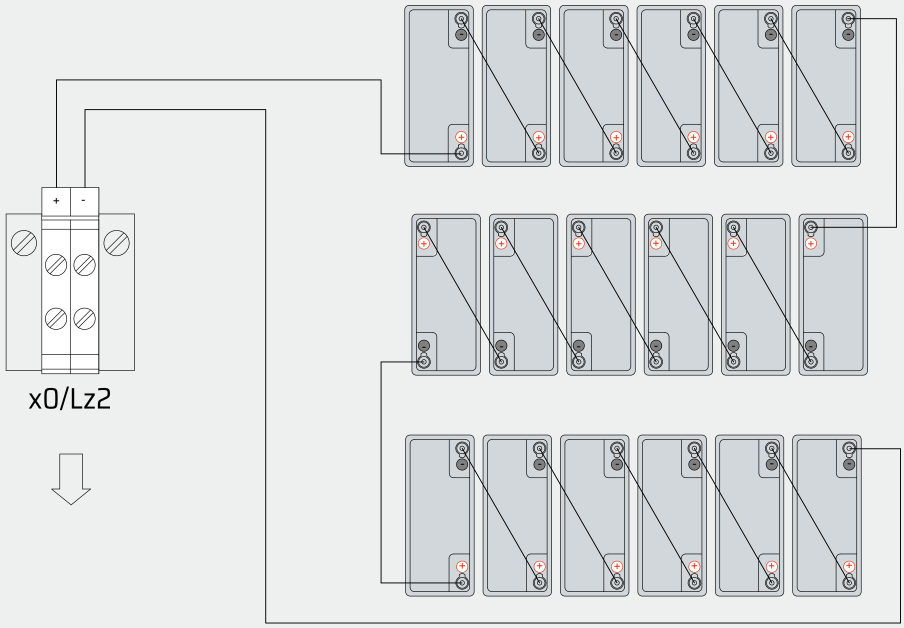


ATTENTION: AFTER CONNECTING THE MAINS, DO NOT TURN ON THE POWER SUPPLY FROM THE HVCBS!

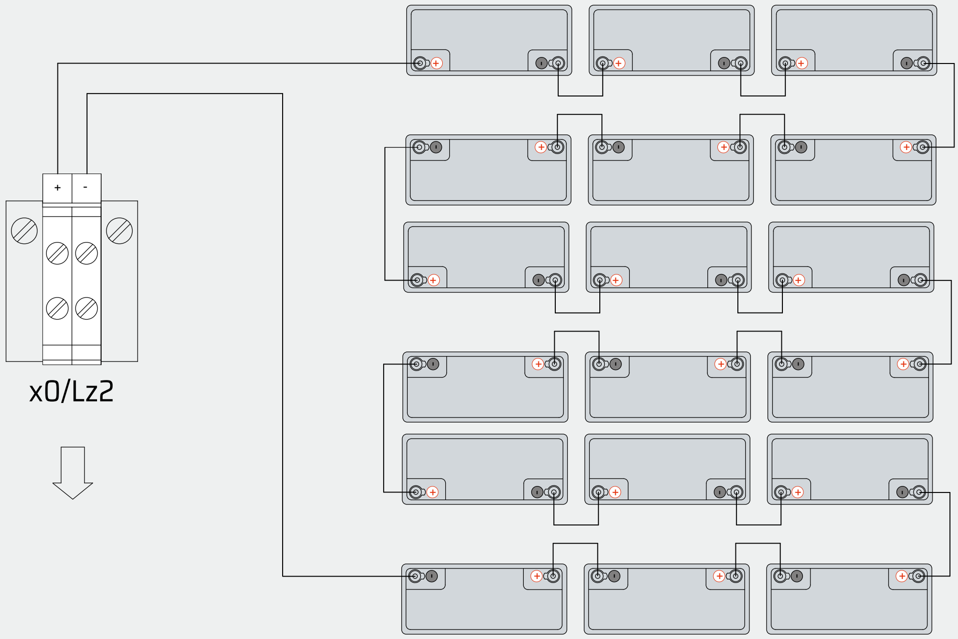
CONNECTING X0/LZ2 TERMINAL – BATTERIES

CAUTION: BEFORE CONNECTING BATTERY PACK TO HVCBS, TURN OFF BATTERY FUSES "BATTERY PROTECT +" AND "BATTERY PROTECT -"

After mounting battery cabinet or battery rack, place the batteries (18 pieces) connected in series. The correct way to connect the batteries to the rack or to the cabinet is shown below. Battery end cables marked with red "+" and **black "-"** should be connected to the terminal block x0/Lz2 marked with a red "+" and black "-". After connecting the batteries, check the voltage (correct voltage should be within 210V-230V) and polarity (whether it is consistent with the marking on the terminal block).



Battery connection – battery rack



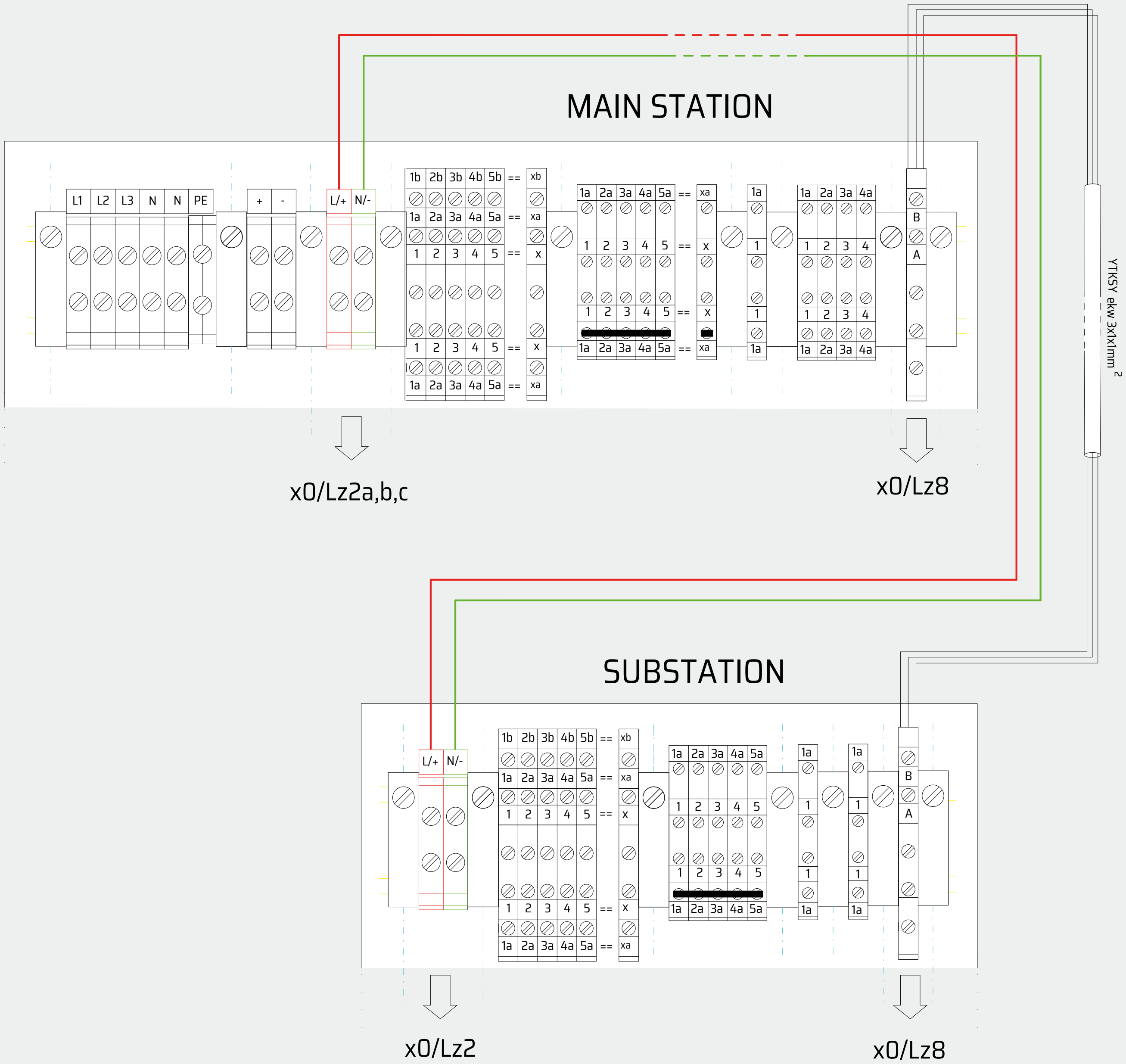
Battery connection – cabinet

CONNECTING X0/LZ2A,B,C TERMINAL – SUBSTATION POWER SUPPLY

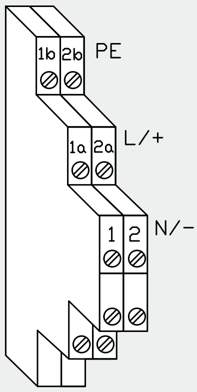
Connect power supply between the main station and substations, to x0/Lz2a,b,c terminal marked **red+/L** and **green -/N**.

Correct way to connect main station and a substation is shown in the figure below.

The way of connecting communication cable between the main station and the substation is described on page 21.



CONNECTING X0/LZ3 TERMINAL – LUMINAIRES



Power supply circuit of the luminaires should be connected in a space marked x0/Lz3. The number on the terminal block corresponds to the number of the given circuit. Connect the protective conductor in PE space, power supply in L / +, neutral N/- (Fig.).

Maximum cross-section of cables that can be used is 2.5mm².

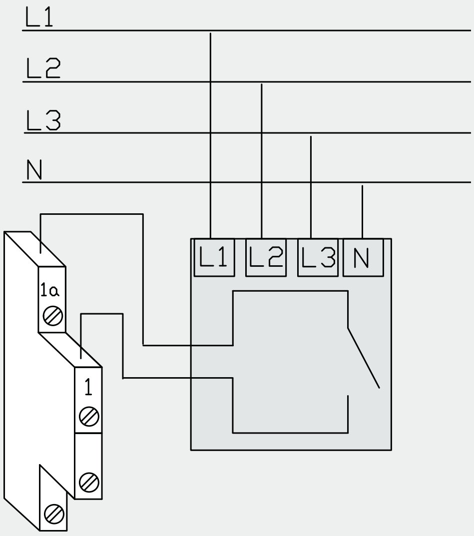
CAUTION: BEFORE CONNECTING LUMINAIRE POWER SUPPLY CIRCUIT TO HVCBS SYSTEM, CHECK IF THE CIRCUIT DOES NOT SHOW AN EARTH FAULT OR A SHORT CIRCUIT. VERIFICATION CAN BE PERFORMED WITH AN INSTALLATION METER OR BY CONNECTING A CIRCUIT TO A RESIDUAL CURRENT BREAKER

CONNECTING X0/LZ4 TERMINAL – CONTROL CIRCUITS

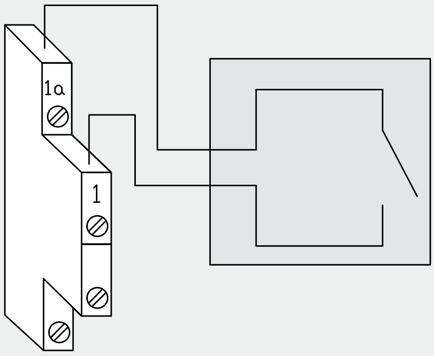
Control circuits should be connected in a space marked x0/Lz4. Maximum cross-section of the cable that can be connected is 2.5mm². Cable that has to be used is YDY 2x1.5mm².

CAUTION: BEFORE CONNECTING THE CABLES, PLEASE CHECK IF THERE IS NO VOLTAGE IN THEM.

CONTROL IS DONE BY VOLTAGE-FREE CONTACTS (POTENTIAL-FREE CONTACTS) OF ANY CONFIGURATION (NO AND NC CONTACT)



CONNECTING X0/LZ5 TERMINAL – CIRCUITS WORKING IN MAINTAINED MODE SWITCH



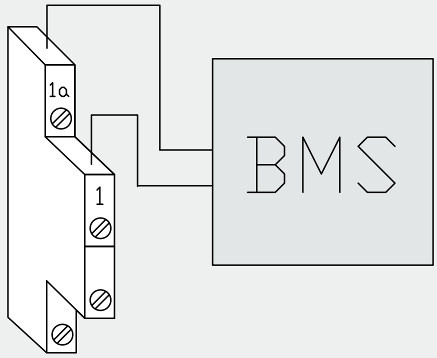
In a space marked as x0/Lz5 connect the switch of circuits operating in maintained mode. Maximum cross-section of the cable that can be connected is 2.5mm². Cable that has to be used is YDY 2x1.5mm².

Circuits working in non-maintained mode will be switched on when the system enters emergency mode.

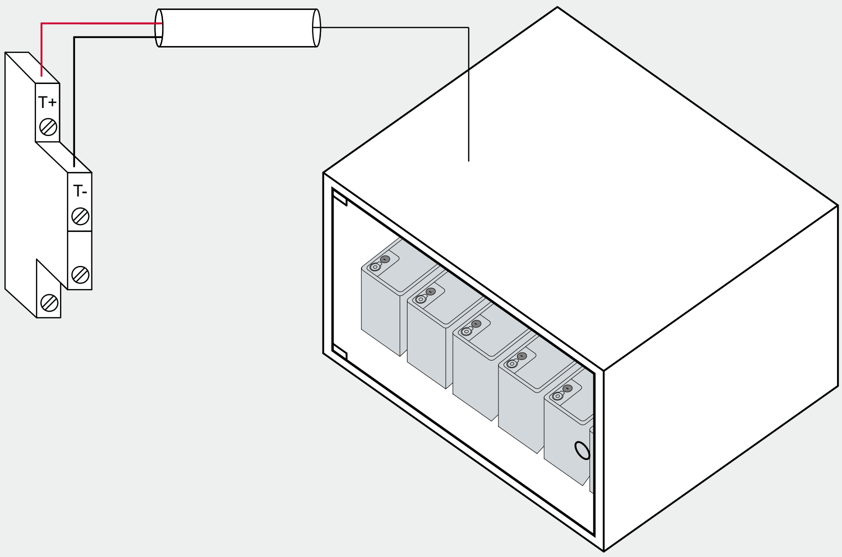
CONNECTING X0/LZ6 TERMINAL – SIGNALING CIRCUITS

BMS signaling circuits are connected to terminals located on x0/Lz6 connector. Maximum cross-section of the cable that can be connected is 2.5mm². Cable that has to be used is YDY 2x1.5mm².

Signaling circuits are made as potential-free contacts.



CONNECTING X0/LZ7 TERMINAL – TEMPERATURE PROBE



The number of temperature probes depends on the number of chargers installed in the system. There is one probe per charger.

ALL probes supplied with the system must be.

It is necessary to maintain correct polarity, i.e. T+ wire to T+ socket and T- wire to T- socket.

If there is more than one probe, each one should be connected to a separate terminal block in sequence. Cross-connection is not possible. The other end of the probe should be placed inside battery cabinet, about 5-10cm above the upper level of the batteries.

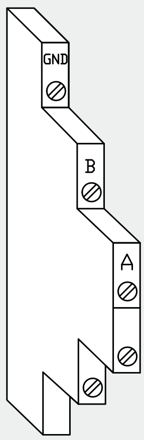
* If you are using a battery rack, the probes must be attached to one of the batteries

CONNECTING X0/LZ8 TERMINAL – COMMUNICATION CONNECTION TO SUBSTATION AND SYNOPTIC PANEL PW-01

The wire enabling communication (external) between main station and a substation or PW-01 synoptic panel is connected to terminals on the x0 / Lz8 connector.

Maximum cross-section of cables that can be connected is 2.5mm². Connection is made with a cable, e.g. HTKSHekw 1x2x0.8. Maximum cable length is 1000m.

A detailed description of PW-01 module connection can be found in the module's manual.

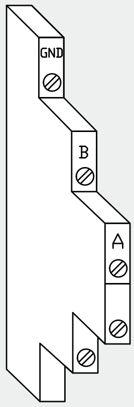


CONNECTING XO/LZ9 TERMINAL – CONNECTION OF RS ECU TRANSMISSION

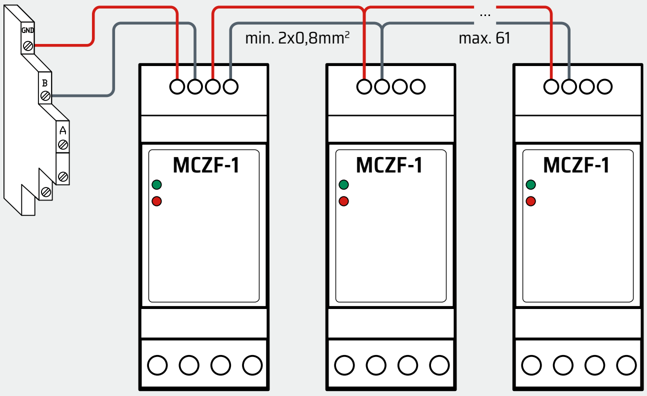
Internal transmission connection between USOext or USE and HVCBS is done by two wires of a cable type, e.g. HTKSHekw 1x2x0.8.

Maximum length of the connection is 500m.

Detailed description of the connection can be found in USOext and USE manual.



CONNECTING XO/LZ10 TERMINAL – CONNECTION OF PSCL ECU COMMUNICATION



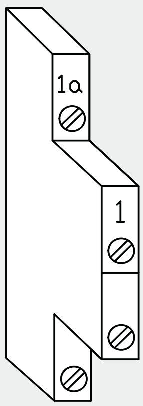
Communication connection to MCZF phase loss sensors is made via HTKSHekw 1x2x1.5 cable.

Maximum bus length for MCZF is 400m.

Details on the connection of MCZF sensors can be found in MCZF manual.

CONNECTING XO/LZ12 TERMINAL – 24VDC POWER

Power connection between HVCBS system and USE or PW-01 modules is made using the YDY 2x1.5mm² cable with a maximum length of 1000m.



CONNECTING XO/LZ12 TERMINAL – TOTAL STOP

Total stop allows the HVCBS to be completely shut down using an external switch. Total stop responds to a break contact.

USER MANUAL

GENERAL OPERATING NOTES

No special operating procedures are required when the system is switched on.

Failures are indicated on the computer screen and on the front panel of UKN module.

OPERATION

When the system is turned on, lighting output circuits are switched off (also in battery operation) using the main switch.

The main switch does NOT switch off voltage to the entire system.

Insulation of battery circuits is checked continuously. However, since the primary mode of operation is mains operation, lighting circuits are then not connected to the battery. In order to check line insulation condition, switch the lines to battery operation, simulating power failure. UKN module "**Insulation**" LED lights red when the insulation is damaged. The insulation test is performed automatically according to adopted schedule. In case of insulation damage, you should locate damaged area manually.

A room where HVCBS system is located should have a moderate temperature, i.e. the temperature in the room must not exceed 25°C.

At higher temperatures, battery lifetime decreases rapidly.

Regular servicing of HVCBS system is essential. A competent person trained in service and operation of the system should be appointed.

Following tests are performed in HVCBS system:

STD test – standard test performed daily according to agreed schedule. During STD test, correct operation of the entire system is measured through communication with internal modules and a test of insulation condition inside the system. Details about test settings and a description of test results are described in following sections.

Test A – short luminaire test that enables efficiency check. The test takes approximately 3 minutes. It is performed according to a set schedule, every 30 days as recommended.

Details about test settings and a description of test results are described in following sections.

Test B – long battery and luminaire test. Test duration corresponds to declared system backup time. The test consists in an automatic attempt to work from the battery in a declared time in order to check its capacity. The test is performed according to a set schedule.

Details about test settings and a description of test results are described in following sections.

ATTENTION: DUE TO THE RISK OF GENERAL LIGHTING FAILURE SHORT TIME AFTER TESTING EMERGENCY LIGHTING SYSTEM OR DURING BATTERY CHARGING

IT IS RECOMMENDED TO CARRY OUT TESTS IN HOURS AT POSSIBLE LOW RISK OF OCCURRENCE

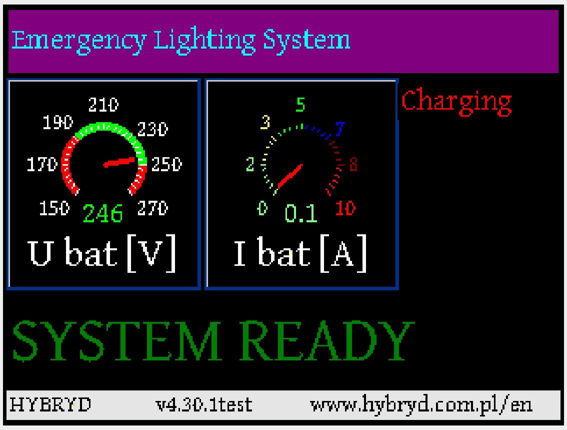
IT IS NOT RECOMMENDED TO PERFORM TESTS AT SHORT INTERVALS BECAUSE

IT COULD DAMAGE THE BATTERY

H-505 MENU

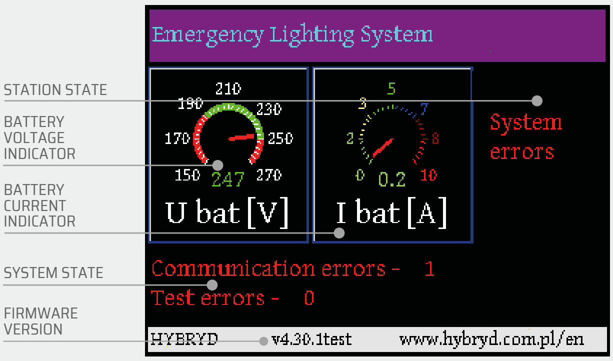
Home page

On H-505 control unit home page, current and voltage of batteries as well as basic information about the system state are displayed.



Information on the home page

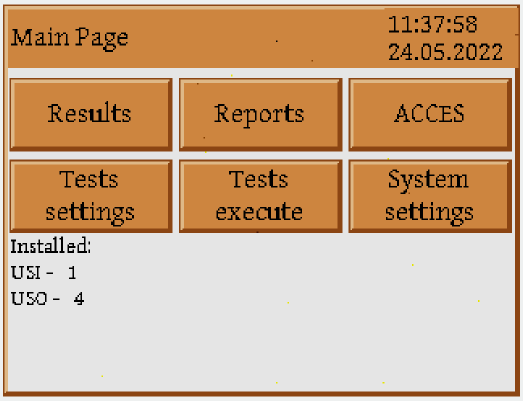
- **System operational** – there were no errors during operation and testing
- **Battery discharged** – battery voltage has dropped below 175V
- **System lockout** – the system is locked by the main switch and there is no voltage on USO output circuits
- **Communication errors and test errors** – quantitative summary of communication errors and test errors.



Station status information

- **Charging** – battery is being charged or charged
- **Err tx UKN** – communication error with UKN module
- **Err tx USI** – communication error with one USI module
- **System errors** – other errors
- **Fuses** – defective fuse in USO module

Main page

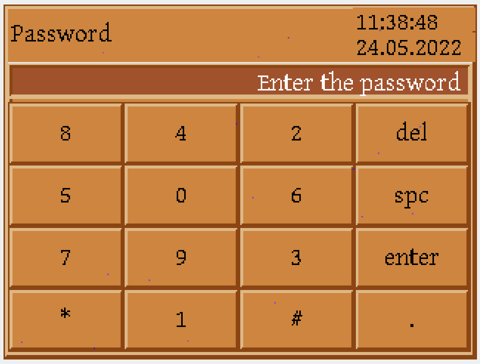


Function buttons available:

- **Results** – for viewing test results
- **Reports** – for saving reports and system settings on USB flash drive
- **Access** – accessing service functions
- **Test settings** – allows to configure a schedule of STD and A tests
- **Test execute** – allows you to perform STD and A tests out of schedule
- **Sys. settings** – allows you to configure the system.

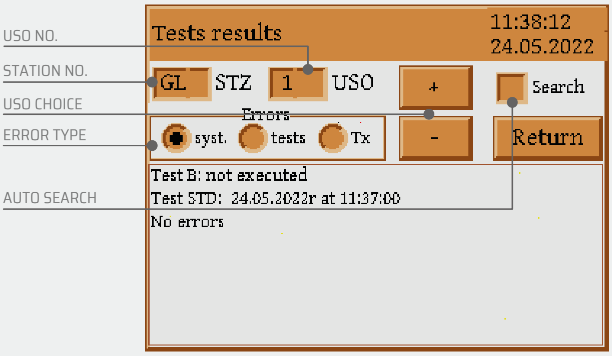
Additionally, the main page contains information about installed USI and USO modules and lighting luminaires.

To return to the home page, touch the bar at the top of the screen.



To get access to system functions, select **ACCESS**, and then enter an appropriate password and confirm by **ENTER**.

Test results



It allows to see test results.

- **Station no** – station number whose results are displayed
- **USO no** – USO number , whose results are displayed
- **USO choice** – switching results preview between USO modules using + and -
- **Automatic error search** – allows for automatic error search, navigation between error results with + and -
- **Error type** – error type selection:
    - **Syst.** – information about STD i A test
    - **Tests** – luminaire test results
    - **Tx** – communication errors between modules such as USI, USO, UKN.

STD, A and B test results

- **Charging error** – rectifier failure
- **Battery circuit interrupted** – interruption in battery circuit
- **Earth fault measurement error PLUS** – improper earth fault measurement of battery positive pole
- **Earth fault measurement error MINUS** – improper earth fault measurement of battery negative pole
- **Earth fault** – low resistance between one of battery poles and protective terminal
- **SD card** – no SD card
- **SD card write lock –** the card is write-protected. Slide the SD card's write-protect switch to remove the lock
- **SD card uninitialized –** SD card has not been initialized
- **U bat<215V** – incorrect battery voltage, battery voltage below 215V during A-test
- **U bat<190** – battery voltage below 190V during B-test
- **Incorrect battery voltage and current** – incorrect battery parameters during the test**.**

Luminaire test results

- **USO blocked** – selected circuit is blocked
- **USO not installed** – selected USO has not been installed
- USO A test executed dd.mm.yyyy mm.hh.ss
  Error: Current measurement error.

USO circuit is configured to measure current in the circuit. The current measured in the circuit is below current threshold value for selected USO. Warning about a failure in selected circuit.

• USO A-test executed dd.mm.yyyy mm.hh.ss Errors: luminaires

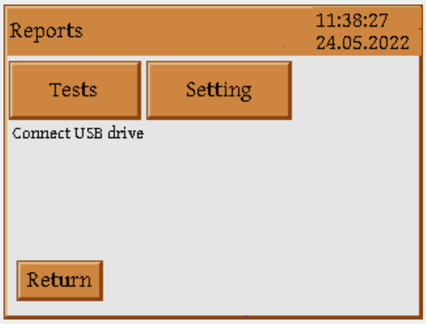
Err – list of luminaires where light source error has occurred
Tx – list of luminaires where a communication error with the luminaires has occurred

USO circuit is configured for addressed luminaires. A field marked as Err contains a list of luminaires that are not working properly, Tx – contains a list of luminaires with communication problems (luminaires marked as present in USO circuit configuration). Please note that only luminaires marked as present are verified. This error may also mean duplicate addresses of the luminaires.

Internal communication errors with the card (Tx)

To check internal communication errors with the card, select the Tx field and search, and then using "+" and "-" move between searched errors.

Reports



Reports allows you to download test results and system settings to an external memory (flash drive).

To download reports you need to:

- Put an external memory (USB flash drive) in USB port
- Select **Tests** (1) or **Settings** (2)
- Downloading status is indicated by a LED diode and messages on H-505 screen
- After saving, remove the memory from the USB port. Files (.txt) containing reports are located in created **REPORT** folders.

Test execution

Test execution function allows you to run STD, A and B tests outside the schedule. In addition, it allows to test the controls.

STD test

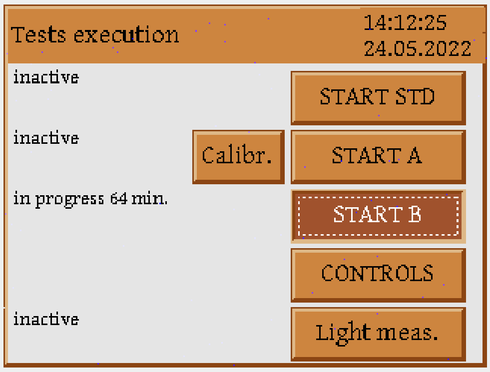
To perform a standard test (STD), select **START STD** button (1). Test status (inactive, in progress) is displayed on the left side (2).

Test A

To perform luminaire test (A), select **START A** button (1). Test status (inactive, in progress) is displayed on the left side (2).

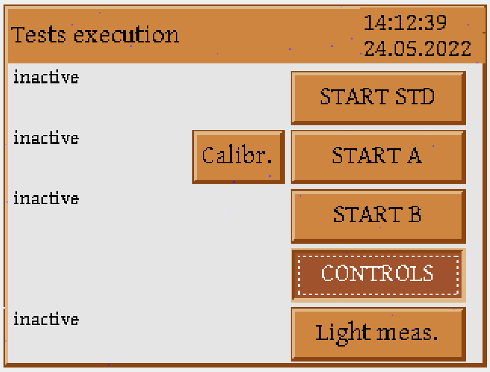
Test B

To perform battery test (B), select **START B** (1). Test status (inactive, in progress) is displayed on the left side (2).



LED Controls

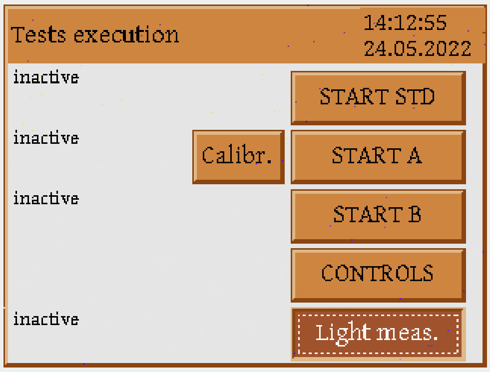
To test LED controls, select **CONTROLS** button. LED controls on all modules should be on when the test is initiated.



Lighting measurement

To perform the test (lighting measurement), select the **MEASUREMENT** button.

When the test is initiated, the luminaires connected to HVCBS will light up.

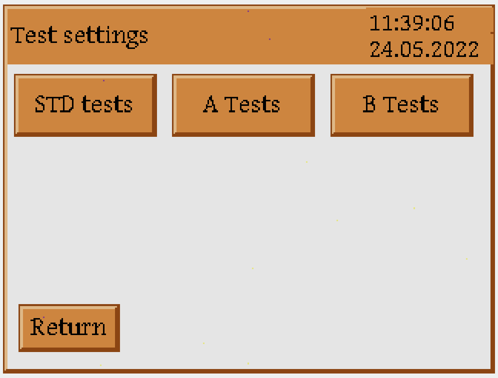


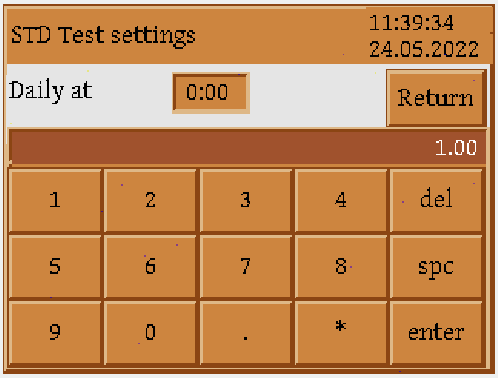
Test settings

Test settings function allows you to schedule tests to be performed. To do the configuration, select **STD tests**, **A Tests** or **B Tests**, respectively.

STD tests

STD test setting function allows you to set the time when STD test is to be performed. The time should be entered according to the format **hh.mm.**, where **h** – hour, **m** – minute (24-hour clock). Confirm the settings by pressing ENTER.



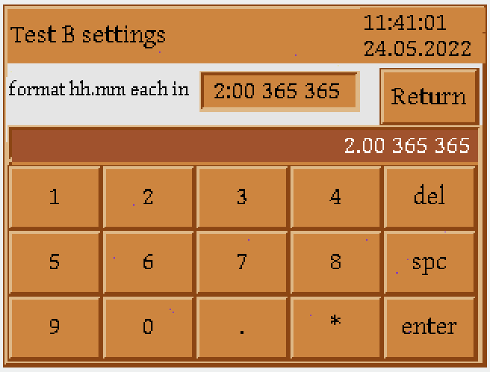


Tests A

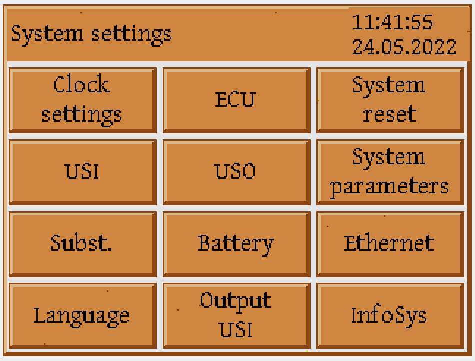
Test A settings function allows you to define the time when the test will be run. The data should be entered according to the format: **hh.mm.co.za** , where **h** – hour, **m** – minute, **co** – how often the test is to be performed, **za** – in how many days the test should be performed (24-hour clock). Confirm the settings by pressing ENTER.

Tests B

Test B settings function allows you to define the time when the test will be run. The data should be entered according to the format: **hh.mm.co.za**, where **g** – hour, **m** – minute, **co** – how often the test is to be performed, **za** – in how many days the test should be performed (24-hour clock). Confirm the settings by pressing ENTER.



System settings

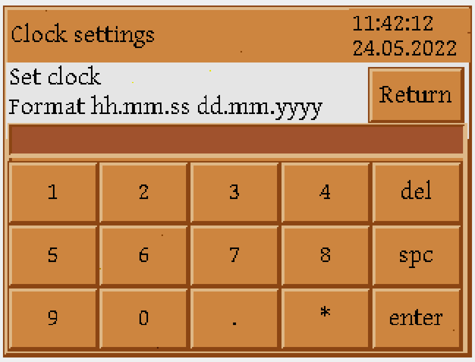


System settings tab allows you to configure settings and parameters:

- **Clock settings** – setting date and time
- **ECU** – configuration of ECU module
- **System reset** – system reset
- **USI** – USI inputs configuration
- **USO** – output circuits configuration
- **System Parameters** – system parameters configuration
- **Subst.** – substation configuration
- **Battery** – setting work time in emergency mode
- **Ethernet** – network settings
- **Language** – setting menu language version
- **Output USI** – USI outputs configuration
- **InfoSys** – system information.

Clock settings

The time should be set according to the following format: **hh.mm.ss**, where **h** – hour, **m** – minute, **s** – second, and date: **dd.mm.yyyy**, where **d** – day, **m** – month, **y** – year. Remember to separate the time and date with SPC button or with the dot. Entered data must be accepted by pressing ENTER.

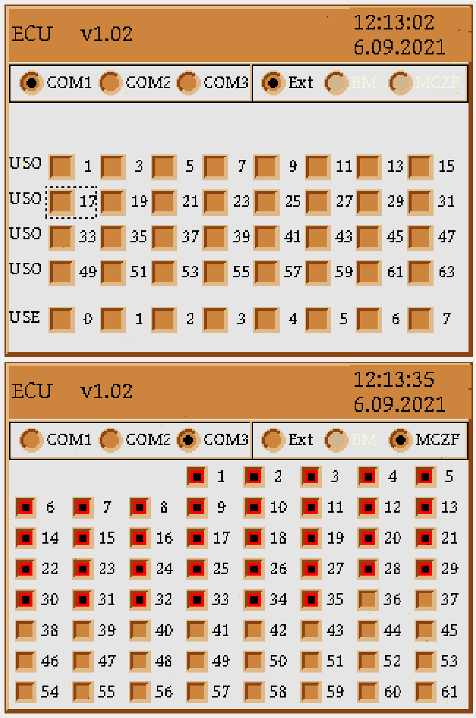


ECU

To configure which communication modules are installed in ECU module, select an-appropriate function in **ECU** menu for **COM1**, **COM2** and **COM3** respectively. For UART module (USOext and USE), select **EXT** option, and for PSCM, **MCZF** function. After selecting appropriate modules, you can configure combined USOext and USE output circuits. Addresses of modules connected to the line cannot be duplicated, the module does not increase the pool of available lines (64 lines). The same module address cannot be selected simultaneously in several COM lines. After initialization in the **ECU**, the module must also be activated in the "**USO**" menu.

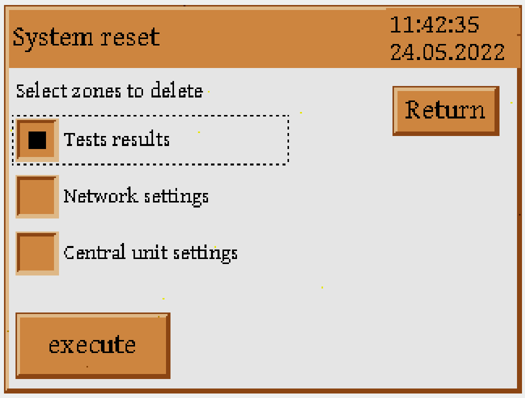
In case of USE modules, it is possible to address 7 modules, but the total number of USI and USE modules in the system cannot exceed 8 (i.e. 7 additional modules).

Configuration of **MCZF** modules is limited to selection of appropriate modules. The address pool is the same as USI input pool! Selected MCZF module masks operation of USI input.



System reset

System reset function allows to restore factory settings. There are three areas that can be reset: **test results, network settings** and **panel settings**.



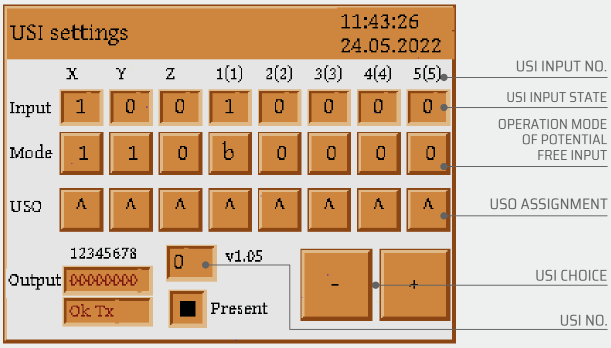
Test results – results of tests performed are deleted

Network settings – restoring factory settings of internal communication network (including settings of USO and USI cards)

Control panel settings – restoring factory settings of H-505 (including settings of meters, Ethernet, etc.)

USI settings

USI settings option allows to configure operation mode of individual potential-free contact inputs and to assign appropriate USO circuits to them.



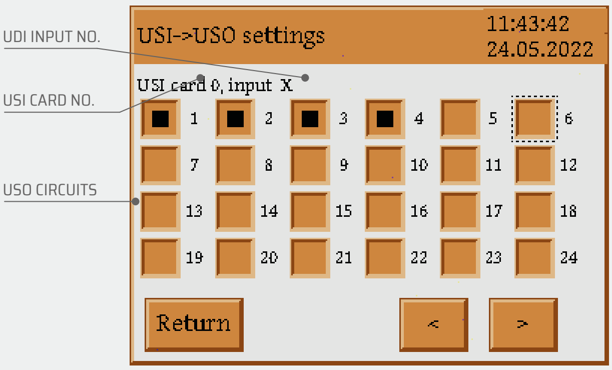
As standard, the system is equipped with one USI card. This card has the address 0 in H-505 controller. First three inputs, X, Y, and Z, are reserved. Each input has its own number, the first number corresponds to the number on a terminal block x0/Lz4, while a number in parentheses is the number of input for each USI card. Each USI module has its own individual address. "+" and "-" buttons are used to navigate between USI cards.

Possible operating modes of potential-free contact inputs:

- a (0) – short-circuit controlled input
- b (1) – input controlled by open-circuit
- d (3) – impulse-controlled input, N/C contact.

USI -> USO settings

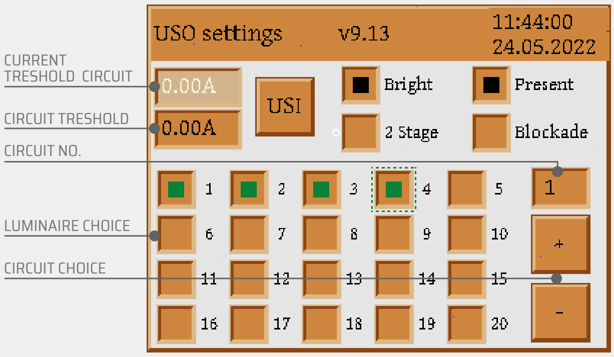
This function allows to assign USO circuits to specific USI inputs. To declare USO circuits for an appropriate USI input, select chosen fields.



USO settings

USO settings function allows to configure and view the status of individual end circuits.

- **Present** – when this field is checked, USO card is active
- **Blockade** – when this field is checked the given circuit is inactive
- **Circuit number**
- **Navigation between circuits**
- **Value of a current on a circuit**
- **Luminaires** – to declare a luminaire, select the field with an appropriate address. Efficiency of luminaires after the last test performed is signaled as follows:
  - Luminaire OK
  - Light source error
  - Communication error with a luminaire
- **Maintained** – when this function is active the circuit works in maintained mode
- **2 Stage** – when this function is active, circuit will run until batteries are fully discharged. This option should also be declared in system parameters.



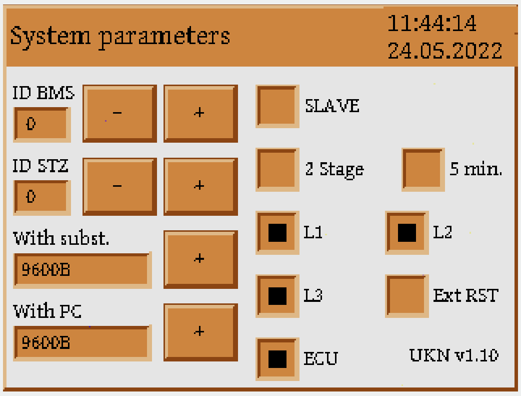
If a circuit operates in **line control mode** (TypeT function is disabled), calibrate circuit current, assuming that all luminaires in the given circuit are operational. During operation, a value of circuit current consumption is displayed. To calibrate, in USO settings tab, hold at the circuit current threshold value. The value displayed in a window will be decreased by 8.3% of circuit current value. If current consumption of the circuit decreases over time below memorized value, it is treated as a damage to the luminaire. This can be done locally or globally.

Locally – Initiate test A, B or switch the system to battery operation mode. During operation, the value of circuit current consumption is displayed. To calibrate, in USO settings for a given circuit, hold at the circuit current threshold. The value displayed in a window will be decreased by 7% of circuit current value.

Globally – To start circuits calibration, run A Test and select **Calibr**. option after switching to battery operation mode. Appropriate threshold values for the circuits submitted for circuit check will be saved.

If a circuit operates in **luminaire control mode** (TypeT function is enabled), the luminaires must be declared. Each luminaire has its individual address, which corresponds to the numbering in H-505 controller.

System parameters



- EIA-485 address set to 0 when communicating with a PC
- HVCBS system unit address, 0 for main station, 1-31 for substations
- Transmission (communication) speed between stations in the system. MUST BE THE SAME FOR ALL STATIONS. Speeds available: 9600, 19200, 38400, 57600
- PC transmission speed. Speeds available: 9600, 19200, 38400, 57600.

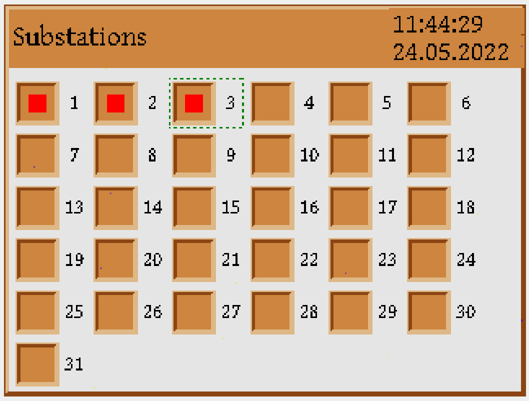
Parameter setting using "+" and "-" buttons

- **L1,L2,L3 phase** – declared phases are monitored by the system
- **SLAVE** – when this function is active, main station works as a substation, if there are more than one main station, they can be combined into a system so that one main station collects results from the others. Additionally, every system units works autonomously
- **2 Stage** – this function makes it possible to declare circuits so that they will function until the batteries are fully discharged, they will be supplied longer than declared back-up time of the system. When using this option, remember to choose batteries properly. Additionally, selected circuits which are to operate in such a configuration should be declared in USO circuits settings
- **5 min** – if this option is enabled, the luminaires will continue to work in a battery mode for 5 minutes after the power is restored.

ECU

To initialize ECU module operation in the system, select its presence in "**SYSTEM PARAMETERS**" menu. After initializing the module, you will be able to enter "**ECU**" menu in the main menu.

Substations



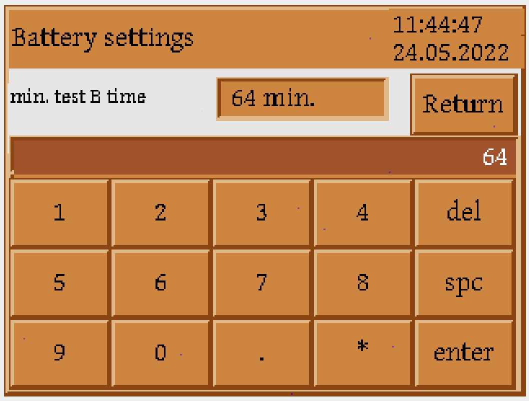
Substations function (available from main station level) allows you to declare the substations which are to cooperate with the main station (central unit).

Additionally, it allows for basic communication control:

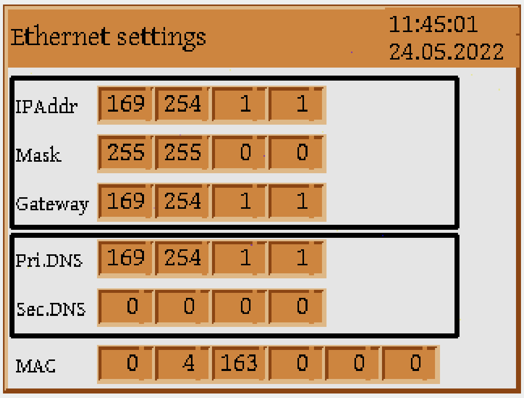
- Correct communication with a substation
- Communication error with a substation.

Battery

This function allows to define the time during which the system will operate in emergency mode, from battery backup. To set this parameter, enter the time, in minutes, and then confirm by pressing ENTER. The time should be between 0 and 255 minutes.



Ethernet



This function allows you to set parameters such as:

- IP address
- Netmask
- gateway IP address
- primary DNS server address
- secondary DNS server address
- MAC address.

Dynamic addresses are not supported. IP address, netmask, gateway IP address, primary and secondary DNS server address should be entered in a basic form of four bytes, and decimal values should be separated with dots. MAC address should be given in six bytes (not hexadecimal), and separated by dots. After entering, confirm with ENTER.

Language

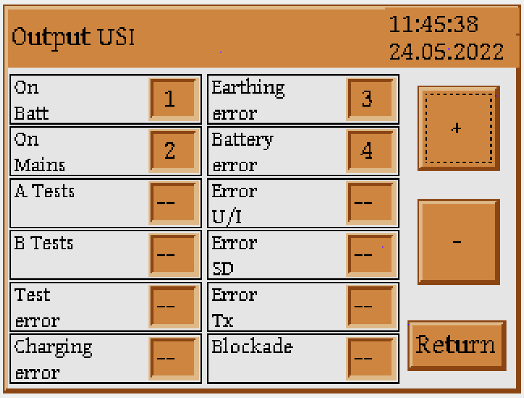
This function allows you to set an appropriate language.

Following languages can be set:

- Polish
- English
- Hungarian
- Czech
- German.

USI output settings

This option allows you to assign USI relay outputs so that operating states of HVCBS system unit are signaled.



The following functions are available:

- **DC operation** – the system is operating in battery mode
- **AC operation** – the system operates in mains operation mode
- **A tests** – active A test
- **B tests** – active B test
- **Test error** – an error occurred during the test
- **Charging error** – rectifier failure
- **Earth fault error** – error on USO circuits
- **Battery error** – battery failure
- **U/I error** – low battery voltage during A or B test
- **SD error** – SD card error
- **Tx error** – communication error
- **Lockout** – HVCBS system lockout.

Select output number using "+" and "-".

MAINTENANCE

All procedures should be performed with system disconnected from power supply.

In case of significant dustiness, it is recommended to clean the interior with compressed air.

CHECKUPS

Tips for inspections of emergency lighting:

Pursuant to the Ordinance of Minister of Interior and Administration of April 21, 2006 on fire protection of buildings, other structures and areas (Journal of Laws No. 80 item 563), evacuation lighting should be inspected at least once a year.

PN-EN 50172 standard specifies exactly when and how emergency lighting should be controlled.

- There should be a "Log book" on the site - it is used to record the reports of emergency lighting inspections
- Log book should be accompanied by a project or a diagram of emergency lighting arrangement with specific intensities of the lighting (average 1 Lx, work time 2h)
- Monthly maintenance should be recorded in the log (when using an automatic test device) or daily when using other systems
- Annual by authorized entities
- All devices used in the facility must have necessary and correct certificates and declarations of conformity. Declarations of conformity may only be issued by the manufacturer on the basis of tests carried out in his laboratories or authorized bodies.

Steps to be taken when checking the emergency lighting:

I. Checking the log and complete documentation

II. Checking the arrangement of emergency lighting in the facility (PN-EN 50172 – Pkt 4.1 i Pkt 5,2)

Point 4.1

Emergency lighting should be activated not only in case of complete damage to main lighting supply, but also in the event of local damage, such as damage to the final circuit.

Point 5.2

Emergency lighting should operate in an event of failure of any part of main lighting supply. Non-maintained emergency luminaires and switch-maintained emergency luminaires must operate in an event of damage to the final primary lighting circuit. In all cases, arrangements should be made to ensure that emergency lighting will function in an event of failure of main power supply to area concerned.

III. Verification of emergency lighting luminaires arrangement – placing the luminaires at least 2 m above the floor (Evacuation lighting, point 4.1)

- At every emergency exit door
- Near the stairs, so that each step is directly illuminated
- Near every level change
- Mandatory at emergency exits and safety signs
- Near every direction change
- At each corridor crossing
- Outside and near each final exit
- Near every first aid station (except for the escape route 5lx)
- Near every fire extinguisher and emergency alarm button (except for escape route 5lx, distance on the floor 2 m).

Signs at all emergency exits and along escape routes should be illuminated so that they clearly indicate escape route to a safe place.

SYMPTOMS OF INCORRECT OPERATION AND TROUBLESHOOTING

Description of basic errors

Error type/Signaling method	Reason	What to do
Blown circuit fuse in USO module	Circuit short-circuit	Check and remove the cause of short circuit Replace the fuse
Mains LED on UKN module	No mains voltage	Check whether supply voltage of HVCBS system is correct and if all phases are present In HVCBS system, check automation protection
Charg. LED on UKN module	Charger module damaged or no voltage in charging circuit	Check whether the dis-connector The "rectifier switch" is turned on Check if $\mathbf{U_1}$ LED is on, if not, it means charger damage If the charger is damaged, contact Hybryd service center
Battery LED on UKN module	Battery circuit break	Check whether the dis-connector The "rectifier switch" is turned on Check if $\mathbf{U_1}$ LED is on, if not, it means charger damage If the charger is damaged, contact Hybryd service center
Insulation LED on UKN module	Ground fault in end circuits	Check the installation and correct earth faults
Failure LED on USO module	An error during A test	Check which luminaire or end circuit has the error, remove the error and perform A test
$\mathbf{U_1}$ LED on the power supply module is off	Defective power supply	Contact Hybryd service center

The main symptom of incorrect operation is a loss of output voltage. This could mean a long-lasting power failure, exceeding system uptime.

Similar symptoms may occur if a charger that charges battery pack is not working for an extended period of time. This may be due to the lack of voltage supplying the charger or its damage. Another type of fault is missing line voltage.

It is possible that this is due to a blown fuse on a given line. If fuses are blown continuously, this may indicate a short circuit on the line. Then, the short circuit should be removed first. If a blown fuse on a given line occurs only when operating from the battery, it may be a sign of damage to the insulation in the line circuit. Usually, LED indicating insulation failure lights up.

In case of doubts as to the type of damage, specialized service unit should be called. It performs warranty and post-warranty repairs. Due to the complex structure of the system and the presence of dangerous voltages in its circuits, it is not recommended to perform repairs by users. All repairs should be carried out by highly qualified personnel, familiar with the principles of work safety. Extreme caution should be taken during repairs and related examinations.

Immediately after repair (element replacement), and before switching on the system, it is absolutely necessary to check the electrical strength of the insulation.

TRANSPORT AND STORAGE

System must be transported in a manner that protects it against weather conditions.

It is recommended to transport the system in a vertical position, preventing the package from moving.

Particular attention should be paid to the marking:

CAUTION!!! GLASS

– warning that a glass door on this side.

Until they are installed in their final location, system components should be stored protected against weather conditions and at an appropriate temperature.

Batteries should be stored in a stable position, in a dry and cool place, away from fire sources, metal and other conductive materials, heat, sunlight and water.

During transport, batteries should be in an upright position and should not be subject to large shocks and vibrations. Each increased temperature causes the battery to self-discharge, thus shortening its life and deteriorating parameters.

The room should be clean and have properly functioning natural gravity ventilation.

Batteries should not be stored in humid rooms. Recommended storage temperature is between +5 and + 35 ° C. Storage time affects battery self-discharge, therefore after an indicated time it is necessary to carry out an equalizing charge.

Regardless of the time criterion, the voltage criterion applies – if the voltage drops below 2.1 V / cell (12.6V for a 12V battery), equalizing charging should be performed.

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