About

The ECO series are reliable and small battery backups for use with access systems, locking systems and other loads. The battery backups have controlled charging* which prevents batteries from over-charging, which significantly prolongs their service life.

NOTICE

This unit should be installed on a wall or in a 19" rack, indoors.

The temperature must be 15 - 30 ° C.

Mains voltage must be disconnected during installation.

Only authorized persons should install and maintain the unit.

Product Identification

Table 1. Product designation, article number and e-number.

Product designation	Article number	E-number (SE)
ECO 24V 5A FLX S	FS01C10124P050	52 136 45

Revisions and the edition of this document

The current and most recently published edition of this document is available at www.milleteknik.com.

The validity of this document can not be guaranteed, as new editions are published without prior notice.

Original instructions for use: Swedish.[1].

Instructions for use, technical data and translations thereof may contain errors. It is always the responsibility of the installer to install the product in a safe manner.

Symbols

Table 2. Symbol Explanation

Symbols	Name	Explanation
	Warning	Risk of electric shock, improper installation or hot surfaces. Appears in some manuals
	Note	Used for supplementary information that clarifies the text.
	Caution/Important	Indicates the risk of equipment damage or malfunction. Also used for information that is important but not security-related
	Tips	Displays practical advice or shortcuts for installation, operation, or service.

[1]Translations in languages other than Swedish are indicative only and not verified. Translation should always be checked against the Swedish original to ensure accurate information

Symbols	Name	Explanation
CE	CE marking	The product complies with applicable EU directives and harmonised standards.
	Read the manual	Please read manual before installation and service.
	Do not dispose of in household waste	The product is covered by the WEEE Directive and must not be disposed of with household waste, it must be recycled and delivered to a recycling centre.
	Recycling	Packaging, products and other materials that do not contain electronics must be recycled in accordance with local environmental regulations.

Component overviews

Component overview

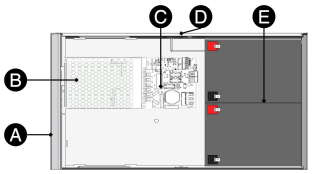


Table 3. Component overview

Number	Explanation
A	Cabinet in black powder-coated sheet metal.
B	The power supply, location and type vary with configuration.
C	Motherboard.
D	Cable entries.
E	Batteries.

Enclosures

General assembly instructions

Mounting - wall mounting

- Enclosure must be mounted vertically.
- For good ventilation, at least 100 mm of free space should be provided above and on the sides of the enclosure. Do not block the flow of air on the sides
- The device should be mounted at a comfortable working height, normally between 1.4 and 1.8 m.
- Recommended distance between screw head and wall should be 1.5-2 mm.
- Avoid placement in direct sunlight, near heat sources, or in environments with high humidity or dust.
- Installation shall be carried out in accordance with the applicable installation rules and by a competent installer.

Indoor mounting in 19" rack

- The product should be mounted in a standardized 19" rack or cabinet with sufficient carrying capacity for the weight of the enclosure including batteries.
- The device should be mounted at a comfortable working height, normally between 1.4 and 1.8 m.

- The device is mounted horizontally in the rack with the included rack ears or corresponding brackets.
- Check that the rack posts are properly aligned and that the spacing corresponds to the 19" standard (465—470 mm between the inner edge of the posts).
- Use at least two mounting points (on each side) on the rack ears for stable attachment. Recommended screw size is M5 or M6
- When assembling, cage nuts or locking washers should be used to ensure that the screws fit securely.
- For good ventilation, at least 100 mm of free space should be provided above and below the unit. Do not block the air flow on the front or back.
- Batteries should always be placed as directed and must not block ventilation openings or wiring.
- Installation shall be carried out in accordance with the applicable installation rules and by a competent installer.

Mounting

Use the appropriate screw for mounting on a wall or in a 19" rack. Screws for mounting on a wall or in a rack are not included.

For wall mounting in concrete, concrete screws must be used. For rack mounting, M6 with basket nut is used

Screw length should be adjusted according to wall material and load. The specified screw length is the minimum allowable length

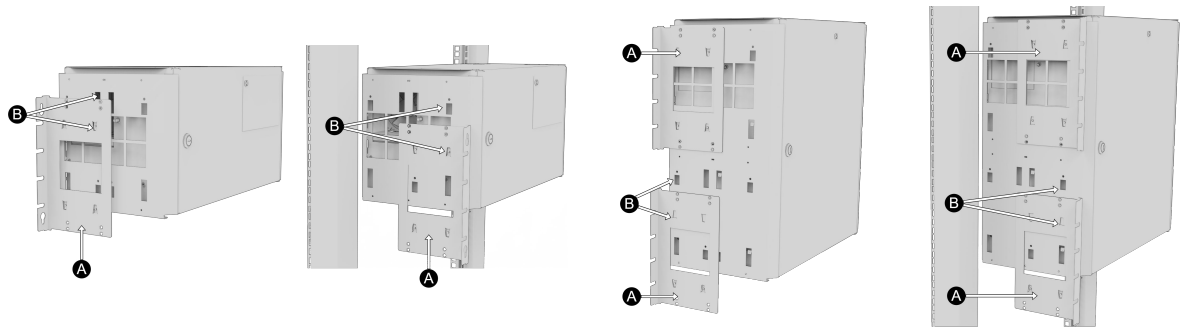
Table 4. Screw when mounting

Kaspling	Number	Screw[a.]
FLX S	4	Concrete screw 5,0×40 mm

[a.]Screw for mounting is not included.

Bracket

The supplied brackets can be attached in two ways: When mounting on a wall, the brackets must sit backwards, against the wall. When mounting in a 19" rack, the bracket must sit at the front of the unit.



The FLX S and FLX M use a bracket on each side of the cabinet.

Table 5. Bracket

Letter	Explanation
A	Bracket is pushed in from the bottom up.
B	Clip clicks in when bracket is pushed in correctly.

Batteries - placement and connection

Connection of batteries, 12 V

Battery wiring is mounted on the circuit board upon delivery. Pictures below only show how to connect wiring.

- Place the batteries in the cabinet with the battery terminals facing outwards, against the cabinet door.
- Connect the battery cable. Red cable on plus and black cable on minus.
- Disconnect the mains power (if possible) before replacing batteries.

Table 6. Plugging in batteries

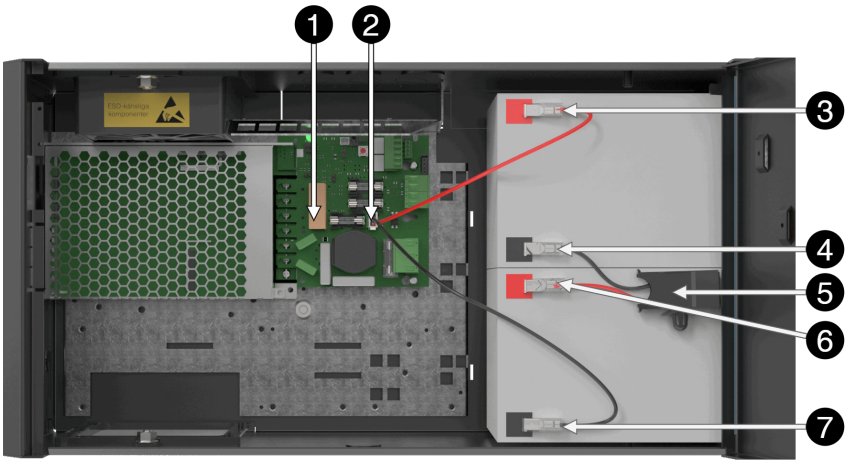
No.	Explanation
B1+	Connects to + fuse
B1 -	Connects - fuse and motherboard.
B2+	Connects to + fuse and motherboard.
B2 -	Connects - fuse.

Connecting batteries in FLX S, 24 V

CAUTION

Check battery voltage before switching on. Before installation, the voltage of each individual battery must be measured. Never connect two batteries if their terminal voltage differs by more than 0.3 V (max 0.4 V). Too large a voltage difference may indicate a damaged battery and lead to performance degradation, battery damage or overheating with the risk of fire.

Figure 1. Connection of batteries in FLX S. Motherboards may differ depending on the configuration, but connection of batteries is the same.



Note that cards (4) differ from different configurations.

Table 7. Connecting batteries.

No	Explanation
1	Motherboard, varies with configuration.
2	Battery cables are located on the motherboard.

No	Explanation
3	Plus terminal for battery cable from 2.
4	Minus terminal is connected to 5, battery fuse.
5	Battery fuse.
6	Plus pole is connected to 5, battery fuse.
7	Minus terminal for battery cable from 2.

CEO3 v5 Up

Motherboard description

The card has several connections, below they are described those that are needed to connect the device.

Connect in this order

To minimize the risk of short-circuit errors, connect the components to the motherboard in the following order.

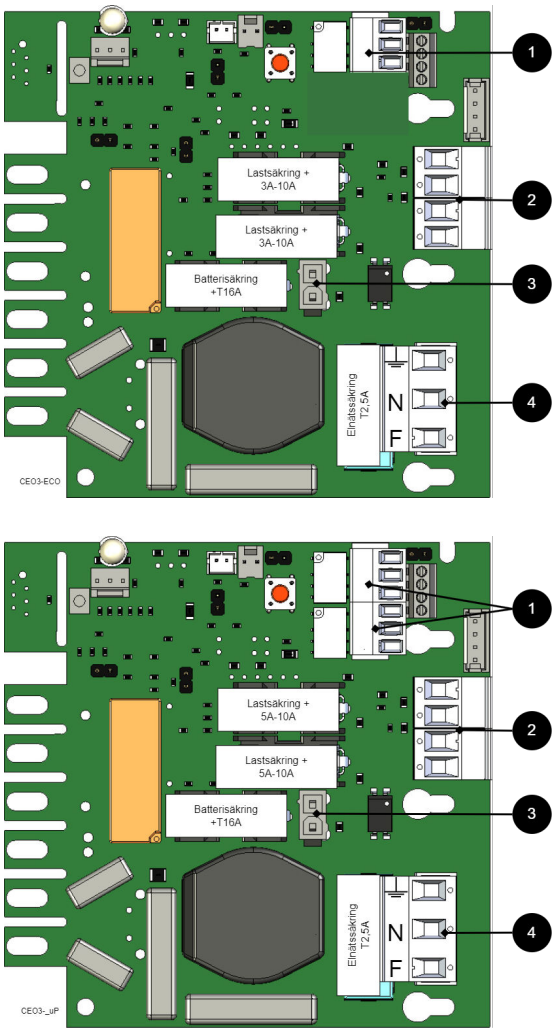


Table 8. Connect in this order

Nr	Explanation
1	Connect alarm.

Nr	Explanation
2	Connect load.
3	Connect batteries
4	Connect mains.

Connect alarm

Connect alarm on terminal P3.

Table 9. Connect alarm P3

P3: 4-6	Explanation
Sum-alarm	
P3: 4	NC
P3: 5	Com
P3: 6	NO

Connect load

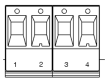


Table 10. Load connections

Circuit board number	Explanation
P2: 1	Connection for load 1 +
P2: 2	Connection for load 1 -
P2: 3	Connection for load 2 +.
P2: 4	Connection for load 2 -.

MAX CURRENT

The maximum current must not be exceeded. Max current is indicated on the rating plate on the device.

DANGER

Mains voltage must be disconnected when working with stripped cables. It is the installer's responsibility to ensure that the correct skills are available for connecting 230 V to the unit. Maximum cable area is 4 mm^2

Connect mains

Before connecting, the supply circuit should be disconnected and voltage-free. Verify that the conductor area and cable type meet the applicable installation rules and that the strain relief and insulation levels comply with the requirements for 230 V AC

After connection, all screw connections should be checked and tightened. Tensioning shall only take place after mechanical protection, caps and housing have been reassembled and comply with the contact protection according to EN 62368-1

Secure F and N with cable ties.

IMPORTANT

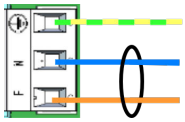
Protective earth (PE) must be connected to the PE terminal on the motherboard. The motherboard is grounded via its mounting points in the enclosure, ensuring proper potential equalization between PCB and enclosure. Also the cover is grounded through ground cable/earth braid between cover and enclosure to maintain continuity and EMC

Mains wiring must be kept separate from other wiring to avoid EMC interference.

The protective earth (PE) must be connected to the PE terminal on the motherboard. The motherboard is grounded via its mounting points in the enclosure, ensuring correct equipotential bonding between the circuit board and the enclosure. The cover is also grounded via a grounding cable / grounding braid between the cover and the enclosure to maintain continuity and EMC function.

Check that the marking on the circuit board matches the wiring order on the terminal block.

Figure 2. Mains connection is made to the terminal block on the motherboard.



Connect the mains cable to the terminal block before it is re-inserted into the motherboard. Secure L (F in picture) and N with cable ties for electrical safety.

Table 11. Electrical network connections

Letter	Explanation
L	Fas
N	Neutral
PE	

Control alarm limit

Alarm for low battery voltage in battery operation can be controlled.

Table 12. Low battery voltage alarm limit

Low battery voltage alarm limit	JU2 with jumper[a.]	JU2 without jumper
24 V	24.0V	26.5V

[a.] The unit is delivered with jumper on JU2

Fuses

Table 13. Fuses.

Unit	Fuse	Type	Explanation
All units	F1	T2,5A	Mains fuse

Unit	Fuse	Type	Explanation
ECO 24V 5A FLX S.	F2, F6	T5A	Load fuse +
All units	F7	T16A	Battery fuse

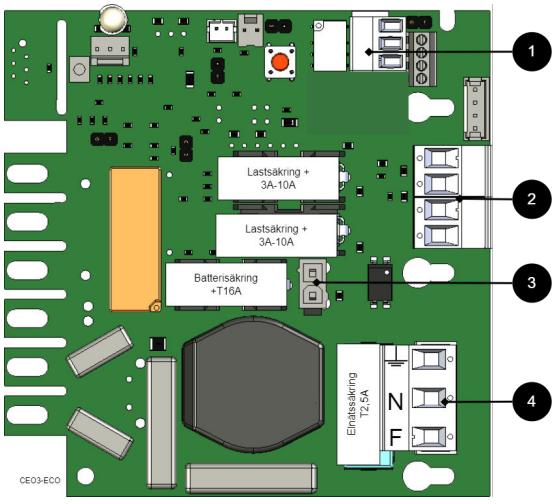
WARNING FOR REPLACING FUSES (CURRENT STRENGTH, A)

There is a risk of damage if the fuse is changed to a larger one than what the unit is delivered with. The function of the fuse is to protect the connected load and cables against damage and fire. It is not possible to change the fuse to a larger one to increase the power output.

Commissioning - how to start the unit

Connect in this order

To minimize the risk of short-circuit errors, connect the components to the motherboard in the following order.



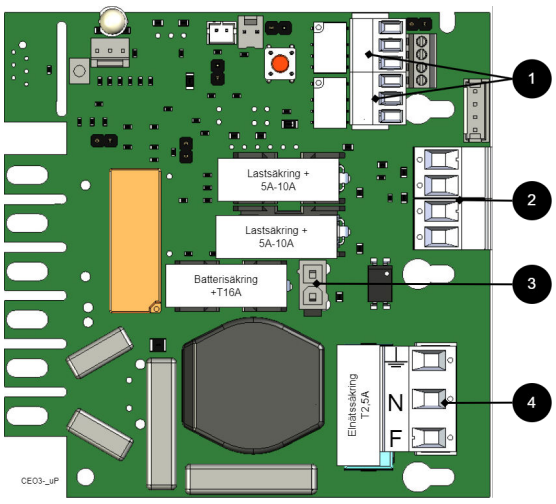


Table 14. Connect in this order

Nr	Explanation
1	Connect alarm.
2	Connect load.
3	Connect batteries
4	Connect mains.

Table 15. Commissioning - the scheme

Step	Explanation
1	Connect motherboard cables to battery terminals.
2	Connect load, alarm and other connections.
3	Connect fuse holder with fuse between batteries.
4	Connect mains. Screw the mains cable into the terminal and attach the terminal to the motherboard.
5	Switch on mains voltage.

The unit works normally when the indicator LED on the outside of the cabinet door lights up with a solid green light. See front panel for other status indications.

It may take up to 72 hours for the batteries to be fully charged.

Alarm displayed on cabinet door

In normal mode, the indicator LED shows a solid green light.

Table 16. Alarm displayed on cabinet door / indicator diode.

The display LED shows	Explanation
Solid green light	Normal operation.
Solid red light	Undervoltage, LED is green in the event of a power failure until the battery voltage drops below the alarm limit.

When operating system: If the indicator LED is off, deep discharge protection has come into force.

ECO product sheet

Product sheet / technical data

Figure 3. ECO FLX S

ECO FLX S The unit can be mounted on wall or in 19"-rack.

Technical specifications

These technical specifications are subject to change without notice.

Product Identification

Table 17. Product designation, article number and e-number.

Product designation	Article number	E-number (SE)
ECO 24V 5A FLX S	FS01C10124P050	52 136 45

About

The ECO series are reliable and small battery backups for use with access systems, locking systems and other loads. The battery backups have controlled charging* which prevents batteries from over-charging, which significantly prolongs their service life.

- For AGM batteries.
- Can be tested with only batteries connected.
- Has controlled charging for better operating economy.

Areas of use

Most used in:

Alarm

The device alarms for:

Undervoltage/low battery voltage.

Fixed installation

The product is intended for fixed installation. The battery backup must be installed by a qualified installer.

Test before installation of 230 V

"Cold start" means that the battery backup can be commissioned with only the batteries connected without the battery backup being connected to 230 V. This is practical if the installer is not a qualified electrician but still wants to be able to test the system.

Regulations and certifications

Requirements that the product meets

Table 18. The product meets the following requirements.

EMC:	EMC Directive 2014/30/EU
Electricity:	Low Voltage Directive 2014/35/EU
CE marking:	Regulation (EC) No 765/2008
Machinery Directive	The product is part of electrical systems, is subject to the relevant electrical and safety directives and is not a machine according to the Machinery Directive (2006/42/EC).
Ecodesign	Milleteknik's products are intended for professional use and are therefore not directly covered by the Ecodesign Regulation (EU 2019/1782). As some components may be covered, we nevertheless disclose relevant information to give our customers confidence in their choice

Denomination	Efficiency (%)[a.]	Standby consumption, typical (W):
	89%	1.70 W

[a.] At rated load.

CE

Expected operating time in the event of a power failure (with new batteries)

System voltage	Number of batteries	Battery type	Load: 0.5 A	Load: 1 A	Load: 2 A	Load: 4 A	Load: 6 A	Load: 8 A
24 V	2 pcs	7.2 Ah	12 h	5 h	2 h	1 h	30 min.	15 min.
24 V	2 pcs	14 Ah	24 h	12 h	5 h	2 h	1 h	45 min.

Circuit boards - Technical data

Technical data: CEO 3

Table 19. CEO3-ECO

Info	Explanation
Article name	CEO3-ECO
Product description	CEO 3 is the next generation circuit board for simpler battery backups. Advanced functions that were not previously possible in simpler battery backups are now available as standard. CEO 3 is manufactured with fewer components than before, which reduces the environmental impact.
Measure	120 x 55 mm x 52 mm
Own consumption	50 mA
Fuses	See table: Fuses.
Outputs	Output: two load outputs.
Insurance	Load output: + secured.
Max load	Maximum load is 10 A per load output (T2A is mounted from the factory) and the card's total load must not exceed 16 A.
Alarm outputs	Alarm outputs: Sum alarm in case of fuse fault, see indication below. Alarm on potential-free relay contact.
Alarm	Undervoltage, lights up red in the event of a power failure until the battery voltage drops below the alarm limit.
Alarm via	Triggered load securing, potential-free shifting, CO / NO.
Indication	Display showing operating status, alarms and faults. Operating indication: one indication diode per load output +/-. Solid green light = normal operation.

Control alarm limit with JU2

Control alarm limit

Alarm for low battery voltage in battery operation can be controlled.

Table 20. Low battery voltage alarm limit

Low battery voltage alarm limit	JU2 with jumper[a.]	JU2 without jumper
24 V	24.0V	26.5V

[a.]The unit is delivered with jumper on JU2

Fuses

Table 21. Fuses.

Unit	Fuse	Type	Explanation
All units	F1	T2,5A	Mains fuse
ECO 24V 5A FLX S.	F2, F6	T5A	Load fuse +
All units	F7	T16A	Battery fuse

WARNING FOR REPLACING FUSES (CURRENT STRENGTH, A)

There is a risk of damage if the fuse is changed to a larger one than what the unit is delivered with. The function of the fuse is to protect the connected load and cables against damage and fire. It is not possible to change the fuse to a larger one to increase the power output.

Power supply

Power supply - Technical Data LRS-150-12

In:

Info	Explanation
Output voltage	13,6 V
Output current	0 A - 12.5 A
Output voltage, ripple	150 mVp-p
Overvoltage	13,8 V - 16,2 V
Voltage recharge, ripple / current limitation	Less than 0.6 Vp-p
Efficiency	87.5%
Current limitation	110% - 140%
Constant voltage	+/- 0.5%
Regulatory accuracy	* / - 1.0%
Input current (230 V)	1,7 A
Mains voltage frequency	47 Hz- 63 Hz
Mains voltage	230 V AC - 240 V AC
Brand effect	150 W
Temperature range	-30°C - +70°C
Humidity range	20% - 90% RH non-condensed

The power supply is adapted and calibrated with the battery / hardware of the battery backup. Only power and calibrated power supplies may be used. Contact support when changing power supplies. Use of power supplies coming from another source may cause damage not covered by the warranty. Warranty is canceled if power supplies (from a source other than support / designated by support) that are not correctly calibrated are used.

Power supply - Technical Data LRS-150-24

In:
ECO 24V 5A FLX S

Info	Explanation
Output voltage	27.3 V
Output current:	0 A - 6.5 A
Output voltage, ripple	200 mVp-p
Overvoltage	28.8 V - 33.6 V
Voltage recharge, ripple / current limitation	Less than 0.6 Vp-p
Efficiency	89%
Current limitation	110% - 140%
Constant voltage	+/- 0.5%
Regulatory accuracy	+ / - 1.0%
Input current (230 V)	1,7 A
Mains voltage frequency	47 Hz- 63 Hz
Mains voltage	230 V AC - 240 V AC
Brand effect	156 W
Temperature range	-30°C - +70°C
Humidity range	20% - 90% RH non-condensed

The power supply is adapted and calibrated with the battery / hardware of the battery backup. Only power and calibrated power supplies may be used. Contact support when changing power supplies. Use of power supplies coming from another source may cause damage not covered by the warranty. Warranty is canceled if power supplies (from a source other than support / designated by support) that are not correctly calibrated are used.

Power supply - Technical Data RSP-320-24

In:

Info	Explanation
Output voltage	27.3 V
Output current	0 A - 13.4 A
Output voltage, ripple	150 mVp-p
Overvoltage	27.6 V - 32.4 V
Voltage recharge, ripple / current limitation	Less than 1.2 Vp-p
Efficiency	89%
Current limitation	105% - 135%
Constant voltage	+/- 0.5%
Regulatory accuracy	+/- 1.0%
Input current (230 V)	2 A

Info	Explanation
Mains voltage frequency	47 Hz- 63 Hz
Mains voltage	230 V AC - 240 V AC
Brand effect	321.6 W
Temperature range	-30°C - +70°C
Humidity range	20% - 90% RH non-condensed
The power supply is adapted and calibrated with the battery / hardware of the battery backup. Only power and calibrated power supplies may be used. Contact support when changing power supplies. Use of power supplies coming from another source may cause damage not covered by the warranty. Warranty is canceled if power supplies (from a source other than support / designated by support) that are not correctly calibrated are used.	

Technical data enclosures

Enclosures - Technical Data FLX S

Info	Explanation
Name	FLX S
Enclosure class	IP 32
Measure	Height: 222 mm, width 437 mm, depth 145 mm
Height units	5 HE
Mounting	Wall or 19 "rack
Ambient temperature	+ 5 ° C - + 40 ° C. For best battery life: + 15 ° C to + 25 ° C.
Environment	Environmental class 1, indoors. 20% ~ 90% relative humidity
Material	Powder coated sheet
Color	Black
Cable entries, number	4
Batteries that fit	2 pcs 7.2 Ah or 4 pcs 7.2 Ah.
Place for fan	Yes

Link to the latest information

Products and software are subject to updates, you will always find the latest information on our website.

ECO

Warranty, support, country of manufacture and country of origin

Warranty

The product has a two-year warranty, from the date of purchase (unless otherwise agreed). Support during the warranty period can be reached at support@milleteknik.se or telephone, +46 31-34 00 230. Compensation for travel and / or working hours in connection with locating faults, installing repaired or replaced goods is not included in the warranty. Contact Milleteknik for more information. Milleteknik provides support during the product's lifetime, however, no later than 10 years after the date of purchase. Switching to an equivalent product may occur if Milleteknik deems that repair is not possible. Support costs may (at Milleteknik's discretion) occour after the warranty period has expired.

CE marking

Each product has a CE label with information about the product and contact information for the manufacturer. If you are missing something or need more information, you should firstly turn to retailers who will also be able to answer questions about warranty and support. You can always contact the manufacturer if you have questions about the product's performance.

CE

Support

Do you need help with installation or connection?

You will find answers to many questions at: www.milleteknik.se/support

Phone: +46 31-340 02 30

Support is open: Monday-Thursday 08:00-16:00, Fridays 08:00-15:00. Closed 11:30-13:15.

Spare parts
Contacted support for questions about spare parts.

Support after the warranty period
Milleteknik provides support during the life of the product, but no longer than 10 years after the date of purchase. Replacement for an equivalent product may occur if the manufacturer deems that repair is not possible. Costs for support and replacement are added after the warranty period has expired.

Questions about product performance?
Contact sales: 46 31-340 02 30, e-mail: sales@milleteknik.se

Contact us

Milleteknik AB

Ögärdesvägen 8 B

S-433 30 Partille

Sweden

+46 31-34 00 230

www.milleteknik.se

Country of manufacture

Country of manufacture / country of origin is Sweden. For more information, contact your seller.

Designed and produced by: Milleteknik AB

Designed and produced by Milleteknik AB

Batteries - recommended, not included

Batteries are not included they are sold separately

Batteries are sold separately.

7.2 Ah, 12 V AGM battery

Fits in	Number of batteries

Battery type	V	Ah
Maintenance-free AGM, lead-acid battery.	12 V	7.2 Ah

Table 22. 10+ Design life * battery

Article number	E-number	Article name	Terminal	Measure. Height width depth	Weight per piece	Make
MT113-12V07-01	5230536	UPLUS 12V 7.2Ah 10+ Design Life battery	Flat pin 6.3 mm	151 x 65 x 100 mm.	2.4 kg	UPLUS

*Design life is the shelf life in years for an unused battery. Environmental factors such as heat and load affect the service life. Batteries that have a durability (+10 Design Life) of 10+ years usually need to be replaced after 5-6 years.

14 Ah, 12 V AGM battery

Fits in	Number of batteries

Battery type	V	Ah
Maintenance-free AGM, lead-acid battery.	12 V	14 Ah

Table 23. 10+ Design life * battery

Article number	E-number	Article name	Terminal	Measure. Height width depth	Weight per piece	Make
MT113-12V14-01	5230537	UPLUS 12V 14Ah 10+ Design Life battery	Flat pin 6.3 mm	151x98x101 mm	4.2 kg	UPLUS

*Design life is the shelf life in years for an unused battery. Environmental factors such as heat and load affect the service life. Batteries that have a durability (+10 Design Life) of 10+ years usually need to be replaced after 5-6 years.

Reserve operating times for different alarm classes - overview

The table shows the requirements for backup operating time and recharging of batteries for different alarm classes.

IMPORTANT

This is a guide and all times are approximate and may differ from actual times. Load, temperature and other factors come into play, which is why exact time can not be provided.

Applies to new batteries.

Amperage and batteries vary with configuration, check if the configuration can handle batteries and amperage.

Table 24. Backup operating times 24 V units - without battery box

Medium current	7.2 Ah	14 Ah	28 Ah	45 Ah
Loading	Backup operating time (approx.), Minutes			
0.5 A	450	820	1650	2350
1 A	260	485	970	1460
2 A	150	280	560	920
4 A	90	165	335	550
6 A	67	125	245	405

Medium current	7.2 Ah	14 Ah	28 Ah	45 Ah
8 A	57	105	210	350
10 A	44	80	160	270
12 A	38	70	140	235
14 A	33	60	120	200
16 A	28	50	100	170
18 A	25	45	89	150
20 A	23	42	84	142

Table 25. Backup operating times 24 V units - with battery box, 28 Ah - 70 Ah

Medium current	28 Ah	42 Ah	65 Ah	70 Ah
-	4 batteries (14 Ah)	6 batteries (14 Ah)	4 batteries (20Ah + 45 Ah)	10 batteries (7 Ah)
Loading	Backup operating time (approx.), Minutes			
0.5 A	1650	2090	5574	3440
1 A	970	865	3252	2118
2 A	560	815	1770	1329
4 A	335	490	930	864
6 A	245	360	600	605
8 A	210	310	426	544
10 A	160	240	342	414
12 A	140	210	270	363
14 A	120	180	234	311
16 A	100	150	204	286
18 A	90	130	150	254
20 A	84	126	138	241

Subject to typos.

Maintenance

The system with the exception of batteries is maintenance-free when installed in an indoor environment.

Inspect the fan annually. The fan should rotate smoothly without any noise. Clean the fan from dust and dirt. The fan must be replaced if it does not rotate smoothly or is so dirty that it cannot be completely cleaned. If the fan does not work well, the air flow in the unit will be obstructed, whichcauses heat to build up inside the enclosure, which can lead to reduced battery capacity and to a significantly shorter battery replacement interval.

battery change

- If possible, disconnect mains (voltage) when replacing the battery.
- Disconnect battery cables. Note how battery cables are mounted before removing them.
- Remove battery fuse between batteries.
- Insert and fasten the new batteries.
- Connect the battery cables in the same way as before.
- Connect battery fuse between batteries.
- Switch on mains voltage. The indicator LED may not be green (up to 72 hours), until the batteries are charged.
- Test the system by briefly disconnecting the mains voltage, (= the load is driven by the batteries), and then switch on the mains voltage again.

Maintenance schedule batteries

The maintenance schedule applies to batteries made by UPLUS and with the following serial names: US, USL, USF, and for batteries made by XLENT POWER with serial names XLT and XLL. For maintenance instructions see separate document "care instructions valve-regulated lead-acid battery".

Table 26. Battery replacement

Series designation	Battery type	Replace battery after
XLT	3-5 years	2-3 years
US	6-9 years	3-5 years
USL	10-12 years	5-7 years
USF	12 years	8-10 years
* battery life depends mainly on ambient temperature and charging current. An AGM battery should never be charged with more than 30% of its rated capacity. The battery will be fully charges, but the charning current must not excced 30% of its rated capacity.		

Table 27. Charging voltages

Charging voltage from power supply	12 V units	24 V units	48 V units
Minimum charging voltage	13.6 V	27.2 V	54.4 V
Maximum charging voltage	13.7 V	27.4 V	54.8 V
Tolerance	+/- 0.5%	+/- 0.5%	+/- 0.5%

Table 28. terminal voltage

terminal voltage	After 15 minutes of rest / charging.
Minimum terminal voltage	12.9 V
Maximum allowable difference between battery pairs	0.5 V
New battery with terminal voltage below 12.0 V is defective and should be reported to the supplier.	

Table 29. Ambient temperature for batteries

Temperature in battery backup	Temperature
Lowest	15 ° C
Recommended	20 ° C - 25 ° C
Highest	32 ° C
Warranty is valid only if the temperature is within these levels.	

Installation control batteries

1. Check that the battery is completely clean and that the terminals are free from corrosion.
2. Check and note the temperature in the battery compartment.
3. Check the terminal voltage of each battery before installation. If the difference between the batteries exceeds 0.5 V, the battery loop should be equalized in connection with installation. If any battery has a terminal voltage of less than 12V, this battery must be replaced with a new battery and reported to the supplier.
4. Connect the battery and check the charging voltage. The charging voltage should be between 2.25 V - 2.27 V per cell = between 13.5 V - 13.62 V for a 12 V system and between 27.0 V - 27.24 V for a 24 V system.

Year-round inspection

1. Check that the battery is completely clean and that the terminals are free from corrosion. If there is corrosion on the terminals: Check that the battery does not leak acid. Then clean the terminals and reconnect the battery. Then lubricate with battery terminal grease over the connected terminal.
2. Check and note the temperature in the battery compartment.
3. Check and note the average current.
4. Check that all connections are securely fastened and that there is no gap in the connection.
5. Check that the fan (if units have a fan) is working properly. Clean the fan if necessary.
6. Check the charging voltage by measuring with a multimeter between the connection points + & amp; -. The charging voltage should be between 2.25-2.27 volts per cell = between 13.5-13.62V for a 12V system and between 27-27.24V for a 24V system.
7. Turn off the rectifier and let the batteries rest for 10 - 15 minutes. Then measure the terminal voltage of each battery. After resting, the terminal voltage must be between 12.9 V - 13.5 V.

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