DC UPS with battery modules

# DC UPS module 6 A

## Overview

- Compact design, only 50 mm wide
- Simple DIN rail mounting
- Completely uninterruptible mains buffering through immediate electronic connection of the battery as soon as the DC UPS input voltage falls below the value set by means of DIP switches.
- High level of safety and availability through monitoring of operational readiness, battery supply line, battery aging (message "Battery replacement necessary") and battery charge (message "Battery charged >85 %")
- Support for automatic warm restart of industrial PCs through selectable shutdown characteristics.
- Optionally with serial or USB interface.
  SW tool available for download from
  http://www.siemens.de/sitop
  Executes under Windows NT4.0, Windows 2000 and Windows XP.

## Functions

The following timing diagrams show examples of the characteristic of the input and output voltages at the terminals of the DC-UPS module as well as the signal chart of the signals (relay) and of the remote signal (port).

### "Long" power failure with DC UPS without serial or USB port (Fig. 1)

Power restoration only once buffer time tp has expired (t3 follows t4):

Upon failure of the input voltage on the DC UPS module (time t1), the battery "Bat" immediately takes over the DC supply, and the output voltage $V_{out}$ is then retained absolutely without interruption.

The isolated changeover contact "OK/Bat" switches over to its off position "Bat".

At the same point in time t1, the buffer time tp set on the DIP switches is started automatically.

The fact that the DIP switch is set to "Interruption output $V_{out}$" in this example has no effect because the input voltage returns at time t3 only once the set buffer time (time t4) has expired.

### "Short" power failure with DC UPS without serial or USB interface (Fig. 2)

Power restoration before buffer time tp has expired (t3 before t4):

Upon failure of the input voltage on the DC UPS module (time t1), the battery "Bat" immediately takes over the DC supply, and the output voltage $V_{out}$ is then retained absolutely without interruption.

The isolated changeover contact "OK/Bat" switches over to its off position "Bat".

At the same point in time t1, the buffer time tp set on the DIP switches is started automatically.

With the DIP switch set to "Interruption output $V_{out}$", the output voltage $V_{out}$ is automatically interrupted for 5 s once the set buffer time tp (time t4) has expired.

The battery has already been disconnected because the input voltage has returned at the time t3.

If the DIP switch is not set to "Interruption output $V_{out}$", there is no interruption in this example because the input voltage has already returned at time t3 prior to expiry of the set buffer time (time t4).

Buffer time (time t4) automatically interrupted for 5 s and the battery, which has not yet been disconnected because of the missing input voltage, is simultaneously disconnected from the output.

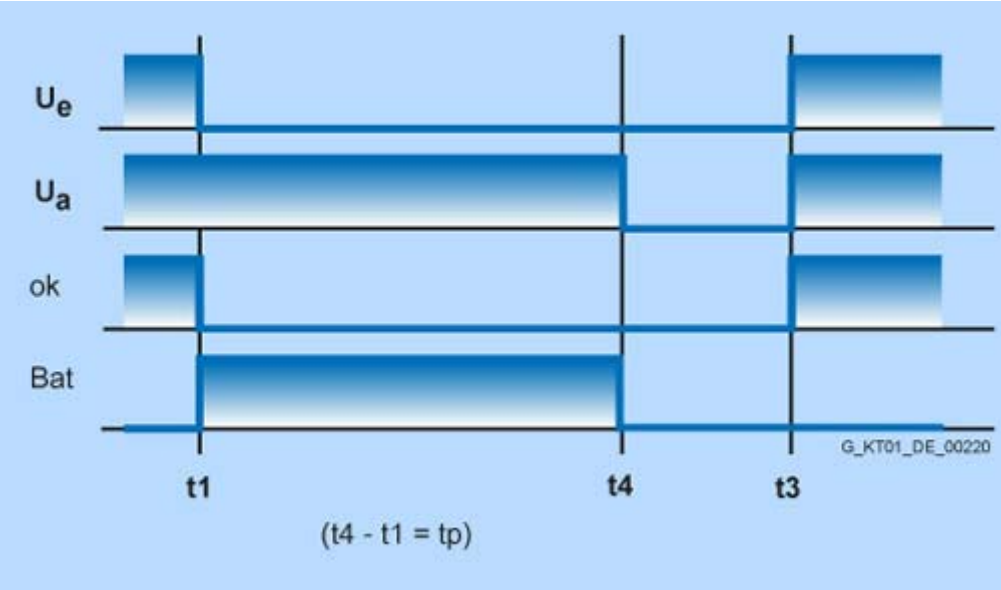


Figure 1 "Long power failure"

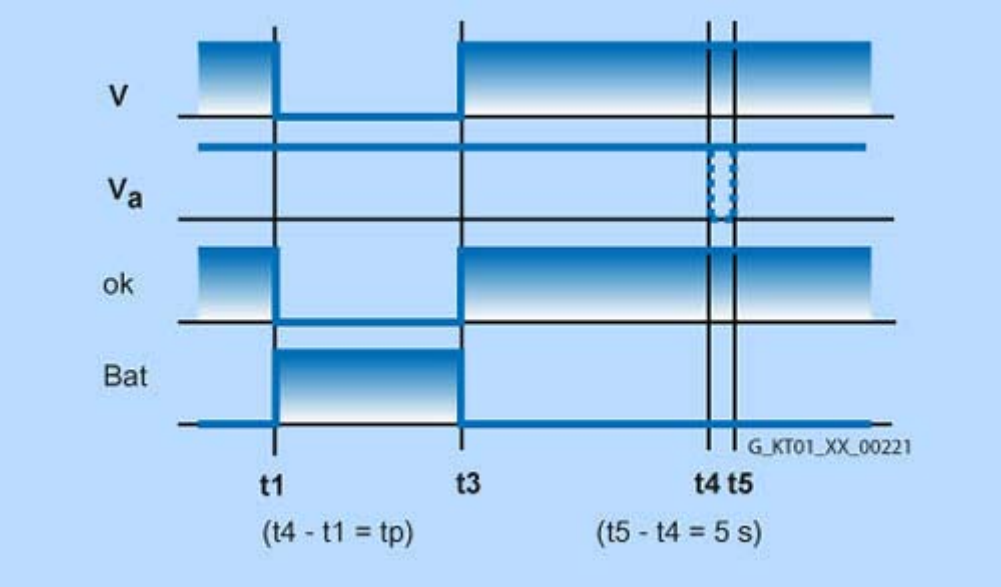


Figure 2 "Short power failure"

DC UPS without serial or USB interface (6EP1 931-2DC21/-2EC21/-2FC21)

DIP switch settings on device: buffer time tp (from 5 s to 635 s with bottom row nos. 2 to 7) /
t = according to setting (with bottom row no. 1 to left)/xxxx = with setting for interruption $V_{out}$ (with bottom row no. 8 to left)

Legend:

$V_{in}$: Input voltage at terminals X1.1 – X1.2

$V_{out}$: Output voltage at terminals X1.3 – X1.4 and X1.5 - X1.6

ok: Signal for input voltage $V_{in}$ OK or above the set battery connection threshold

Bat: signal for battery operation (batteries connected to output, batteries power the load)

Remote: Signal for remote timer start with signal level = 0 at pin 7 of 9-pin serial interface (pin 7 is usually the positive power supply for the interface)

t1: input voltage $V_{in}$ failed or fallen below set connection threshold

t2: Buffer time set on DIP switches is started by remote timer start (signal level = 0)

t3: input voltage $V_{in}$ rises above set connection threshold

t4: end of set buffer time (output is switched off and/or battery is disconnected)

t5: Output is connected again 5 s after shutdown

tp: buffer time set on the DIP switches (bottom row nos. 2 to 7)

## "Long" power failure with DC UPS with serial or USB interface (Fig. 3)

Power restoration only once buffer time tp has expired (t3 follows t4):

Upon failure of the input voltage on the DC UPS module (time t1), the battery "Bat" immediately takes over the DC supply, and the output voltage $V_{out}$ is then retained absolutely without interruption.

The isolated changeover contact "OK/Bat" switches over to its off position "Bat".

The buffer time tp set on the DIP switches is started at the user-selectable time t2 by means of the signal "Remote timer start" (signal level = 0 at pin 7 of the 9-pin serial interface following previous signal chart according to operating instructions).

The fact that the DIP switch is set to "Interruption output $V_{out}$" in this example has no effect because the input voltage returns at time t3 only once the set buffer time (time t4) has expired.

Note: Without a remote signal level = 0 with a setting t = max. duration, there is no interruption to the output voltage in this case because the set buffer time is not started (or interruption only if the exhaustive discharge protection disconnects the battery and the input voltage has not returned by then).

## "Short" power failure with DC UPS with serial or USB interface (Fig. 4)

Power restoration before buffer time tp has expired (t3 before t4):

Upon failure of the input voltage on the DC UPS module (time t1), the battery "Bat" immediately takes over the DC supply, and the output voltage $V_{out}$ is then retained absolutely without interruption.

The isolated changeover contact "OK/Bat" switches over to its off position "Bat".

The buffer time tp set on the DIP switches is started at the user-selectable time t2 by means of the signal "Remote timer start" (signal level = 0 at pin 7 of the 9-pin serial interface following previous signal chart according to operating instructions).

With the DIP switch set to "Interruption output $V_{out}$", the output voltage $V_{out}$ is automatically interrupted for 5 s once the set buffer time tp (time t4) has expired.

The battery has already been disconnected because the input voltage has returned at the time t3.

The interruption to the output voltage $V_{out}$ for 5 s permits an automatic restart for many industrial PCs, even if the line voltage (or the input voltage $V_{in}$ on the DC UPS module) returns during shutdown of the PC, as in this example.

Note: Without a remote signal level=0 with a setting t = max. duration, there is no interruption in the output voltage here because the set buffer time is not started.

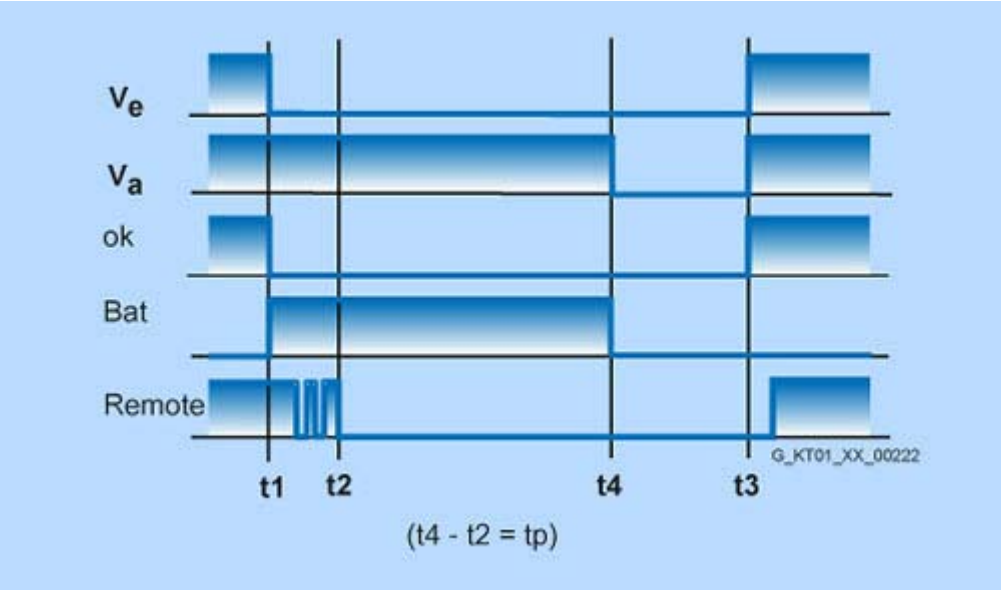


Figure 3 "Long power failure"

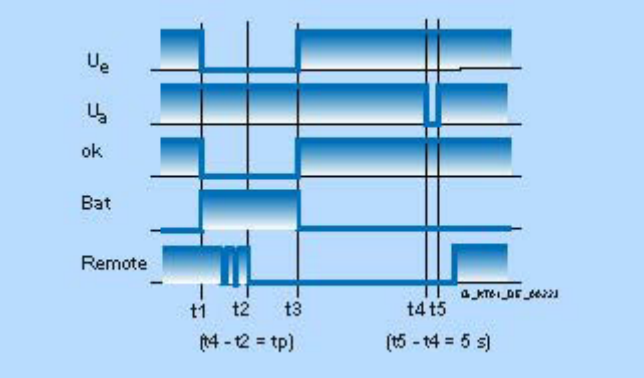


Figure 4 "Short power failure"

DC UPS with serial or USB interface (6EP1 931-2DC31/-2DC42/-2EC31/-2EC42/-2FC42)

DIP switch settings on device: buffer time tp (from 5 s to 635 s with bottom row nos. 2 to 7) /
t = max. time (with bottom row no. 1 to right)/interruption of $V_{out}$ (with bottom row no. 8 to left)

Legend:

$V_{in}$: Input voltage at terminals X1.1 – X1.2

$V_{out}$: Output voltage at terminals X1.3 – X1.4 and X1.5 - X1.6

OK: Signal for input voltage $V_{in}$ OK or above the set battery connection threshold

Bat: signal for battery operation (batteries to output, batteries power the load)

Remote: Signal for remote timer start with signal level = 0 at pin 7 of 9-pin serial interface (pin 7 is usually the positive power supply for the interface)

t1: input voltage $V_{in}$ failed or fallen below set connection threshold

t2: Buffer time set on DIP switches is started by remote timer start (signal level = 0)

t3: input voltage $V_{in}$ rises above set connection threshold

t4: end of set buffer time (output is switched off and/or battery is disconnected)

t5: Output is connected again 5 s after shutdown

tp: buffer time set on the DIP switches (bottom row nos. 2 to 7)

| Integration |
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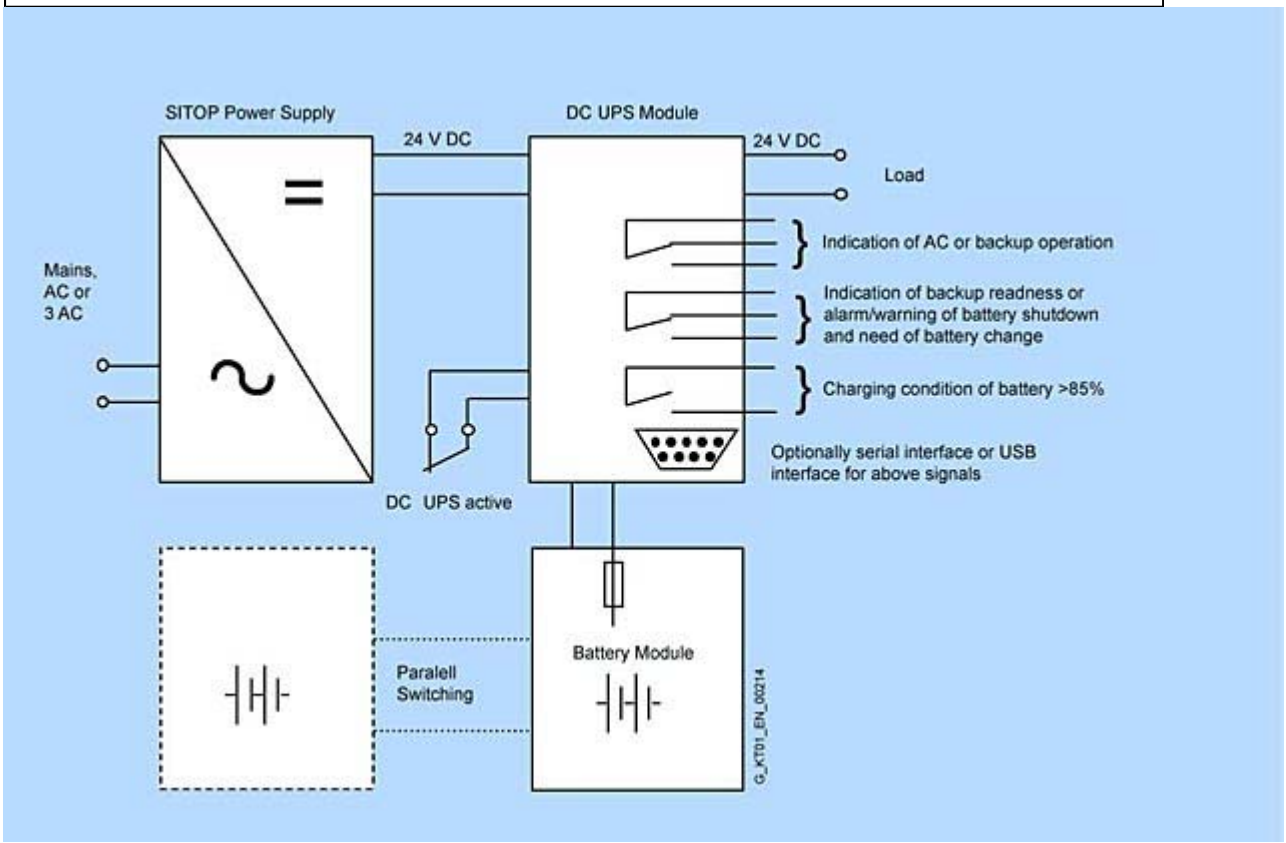

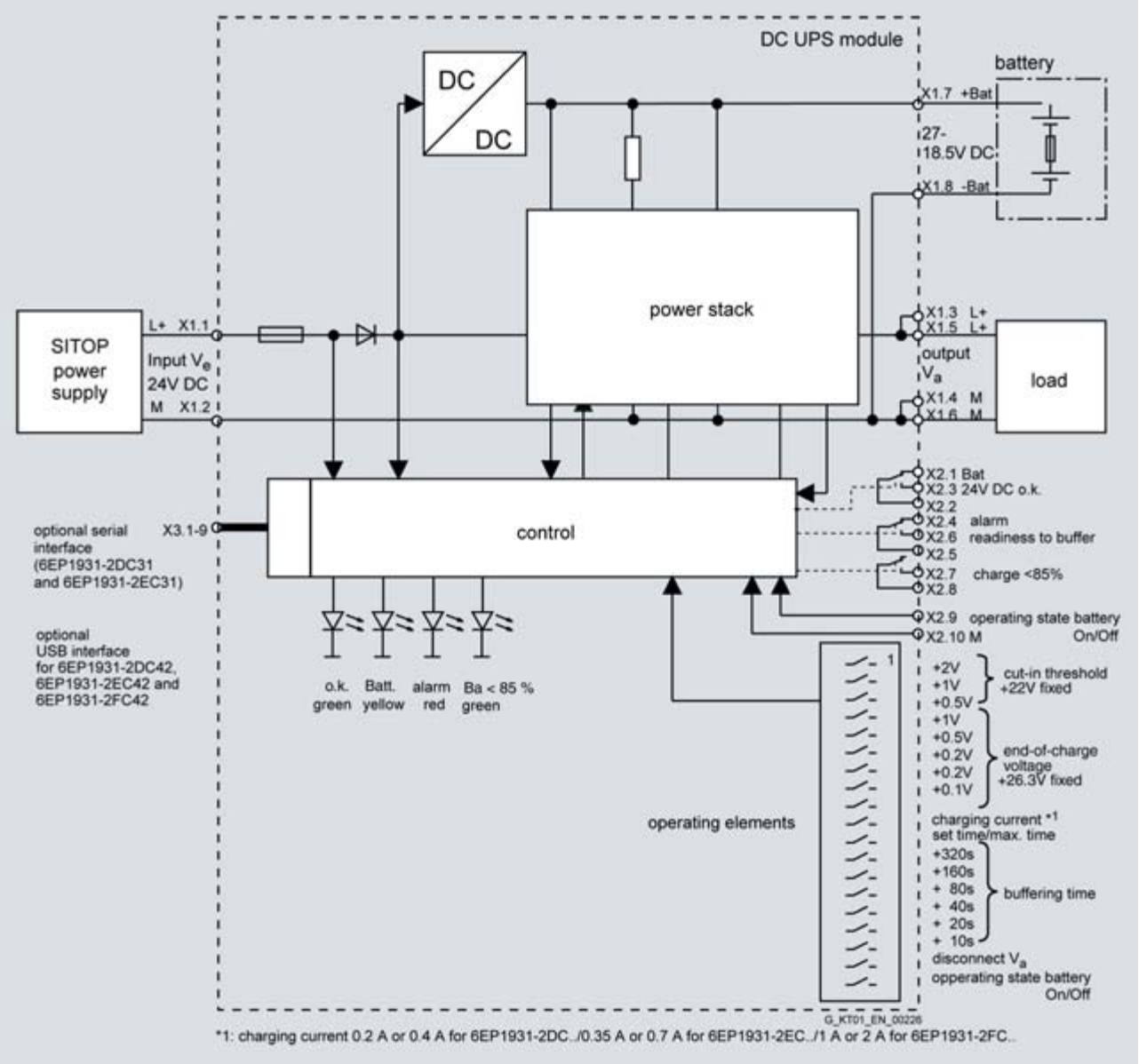


Technical specifications

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| **DC UPS module 6 A** | |
| **Order No.** | **6EP1 931-2DC21**<br>**6EP1 931-2DC31**(with serial interface)<br>**6EP1 931-2DC42**(with USB interface) |
| **Input L+/M in normal operation** | Controlled DC voltage |
| Rated voltage $V_{in\ rated}$ [1)] | **24 V DC** |
| Voltage range | DC 22 ... 29 |
| Connection threshold for battery | 22.5 V DC ± 0.1 V (factory setting),<br>**adjustable in the range 22 ... 25.5 V DC** (in 0.5 V |

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| | increments) |
| Rated current $I_{in\ rated}$ | 6 A + approx. 0.6 A with empty battery |
| **Mains buffering** | |
| Line buffering or buffer time | Dependent on connected battery and load current, see selection table battery module and mains buffering times as well as the relevant important information notes! |
| On/off control circuit | External isolated NO contact required (max. load 15 V DC/max. 10 mA).<br>With an open control circuit, the battery is isolated from output L+, thus canceling mains buffering. If there is no input voltage, a quiescent current of approximately 0.3 mA is drawn from the battery disconnected from the output. |
| Methods of setting the buffering time | **Adjustable** using DIP switches to a maximum buffering time up to forced shutdown through exhaustive discharge protection (at approx. 19 V) or to a time limit of **5 to 635 s**<br>(in 10 s increments) |
| Interruption | Adjustable using DIP switch, either:<br>• Interruption of the output voltage despite returning input voltage for min. 5 s following expiry of set buffering time to support automatic restarting of industrial PCs or<br>• No forced interruption on expiry of the set buffer time |
| **Output L+/M in normal operation** | |
| Rated voltage $V_{out\ rated}$ | **24 V DC** (output voltage of SITOP power supply) |
| Voltage range | Input voltage $V_{in}$ less approx. 0.5 V DC |
| Startup delay | Approx. 1 s |
| Voltage rise | Typ. 60 ms |
| Output current $I_{out}$ | **0 ... 6 A** |
| Dynamic current with overload | Electronic current limitation to 1.05 ... 1.4 x $I_{out\ rated}$ for approx. 80 ms, then electronic shutdown of the output with automatic restart attempts (approx. 20 s intervals between restart attempts) |
| Dynamic current with short-circuit | Electronic current limitation to 1.5 ... 3 x $I_{out\ rated}$ for approx. 20 ms, then electronic shutdown of the output with automatic restart attempts (approx. 20 s intervals between restart attempts) |

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| **Output L+/M with battery operation** | |
| Rated voltage $V_{out\ rated}$ | **24 V DC** (from battery module) |
| Approximate voltage range | 27 ... 19 V DC at $I_{out}$ = 0.05 x C x 1/h or<br>24 V at $I_{out}$ = 1 x C x 1/h or<br>23 V at $I_{out}$ = 2 x C x 1/h<br>(C = total connected battery capacity in Ah), 19 V disconnection threshold for exhaustive discharge protection |
| Output current $I_{out}$ [2)] | **0 ... 6 A** (permanently permissible) |
| Dynamic current with overload | Electronic current limitation to 1.05 ... 1.4 x $I_{out\ rated}$ for approx. 80 ms, then electronic switch-off of output (restart following return to normal operation) |
| Dynamic current with short-circuit | Electronic current limitation to 1.5 ... 3 x $I_{out\ rated}$ for approx. 20 ms, then electronic switch-off of output (restart following return to normal operation) |
| **Output +Bat/-Bat in normal operation** | ***I*- *V* charging characteristic**<br>(first constant current *I*, then constant voltage *V*) |
| End-of-charge voltage *V* | 26.6 V DC ± 0.1 V (factory setting for +40 °C battery temperature),<br>**adjustable in the range 26.3 to 29.3 V** (in 0.1 V increments) |
| Load current *I* | Approx. 0.4 A (factory setting), **adjustable to 0.2 A or 0.4 A**<br>(charging is carried out with closed and open on/off circuit)<br>At a battery voltage of < 6 V (batteries defective), charging is not carried out as a protective measure. |
| **Efficiency/power loss** | |
| At $V_{out\ rated}$, $I_{out\ rated}$ approx. | 95 %/7 W |
| With battery operation, approx. | 94.5 %/8 W |
| **Protection and monitoring** | |
| Polarity reversal protection | Against polarity reversal on input voltage and batteries |
| Overload protection | In accordance with "dynamic current with overload" in normal operation (automatic restart attempts) or in battery mode (restart following return to normal operation) |

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| Short-circuit protection | In accordance with "dynamic current with short-circuit" in normal operation (automatic restart attempts) or in battery mode (restart following return to normal operation). Built-in (not accessible) 16 A fuse (6 A and 15 A on DC UPS module) or 64 A fuse (40 A on DC UPS module). |
| Exhaustive discharge protection | Automatic shutdown when battery voltage falls below approx. 19 V.<br>At a battery voltage of < 6 V (batteries defective), charging is not carried out as a protective measure. |
| Monitoring<br>"Wire breakage in battery circuit" | Alarm signal if battery circuit not closed or if it opens during operation (cyclic check approximately every 20 s) |
| Monitoring<br>"Battery replacement required" | Alarm signal flashing at approx. 0.25 Hz repetition frequency (approx. 2 s alarm, approx. 2 no alarm, approx. 2 s alarm, etc.).<br>Check every 4 hours with 6 ohm load for 1 s if no buffer mode or switch-off has taken place within 4 hours. |
| Monitoring<br>"Battery charge status > 85 %" | Indication whether batteries are charged to at least 85 % of residual capacity still available depending on aging |
| **Signaling** [3)] | |
| Normal operation | Green LED (OK) and isolated changeover contact "24 V DC OK/Bat" at setting "24 V DC OK" [4)] |
| Buffer or battery mode (battery supplies load alone or in addition to PS in the case of overload) | Yellow LED (Bat) and isolated changeover contact "24 V DC OK/Bat" at setting "Bat" (de-energized position) |
| Alarm (buffer not ready, or prewarning at and above < 20.4 V battery voltage) | Red LED (alarm) and isolated changeover contact at setting "Alarm" (=de-energized position).<br>Causes of the buffer not being ready during normal operation can include: Off status or open on/off control circuit, battery module not connected, polarity reversal or defective battery (battery voltage < 18.5 V) or wire breakage between battery and UPS module. Signal is scanned and, thus, updated, every 20 s.<br>Causes of the buffer not being available during buffer operation can include: Battery voltage has dropped below 20.4 V DC (= prewarning before shutdown through exhaustive discharge protection) as well as shutdown of the battery due to overload, short-circuit, exhaustive discharge protection or expired backup time. The red LED then goes out. |
| "Battery replacement | Red LED (alarm) flashing at 0.25 Hz and floating |

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| necessary" | changeover contact (alarm) switching at approx. 0.25 Hz |
| "Battery charge status > 85 %" | Second green LED (Bat > 85%) and isolated NO contact closed (de-energized position = open) |
| **Optional interface and software** | |
| Serial interface | Only on **6EP1 931-2.C31**<br>Output of all signals and receipt of the "Remote Timerstart" signal.<br>Technical design: PC-compatible. 8N1 send and receive, 9600 baud, 8 data bits, 1 stop bit, no parity bit.<br>Required connection to PC: 1 : 1 interconnected 9-pole sub D extension cable (connector/socket), only pin 2 (RXD), pin 3 (TDX) and pin 7 (RTS) are required. |
| USB interface | Only on **6EP1 931-2.C42**<br>Output of all signals and receipt of the "Remote Timerstart“ signal.<br>Technical design: Specification 2.0 at full speed, i.e. 2 Mbit/s. Supplied with +5 V by DC UPS ("self-powered").<br>Required connection to PC: Commercially available 4-core shielded cable, 90 Ohm, max. 5 m, USB series "A" connector to PC and USB series "B" connector to DC UPS |
| Software | A software tool (runs under Windows NT 4.0, Windows 2000 and Windows XP) for reading out and processing the signals can be downloaded from the Internet at<br>http://www.siemens.de/sitop<br>This site also provides more information on the interface. |
| **Control signals** | |
| On/off control signal | Buffering is terminated or the battery is disconnected from the output by opening the control circuit or by means of DIP switches on the device (DIP switch must be in "Off" position). All other functions are retained. |
| "Remote Timerstart" via serial interface or USB | Starts mains buffering for the set buffering time |
| **Safety** | |
| Primary/secondary electrical isolation | No |
| Protection class | Class III (ext. circuit and power-supply unit: SELV in |

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| | accordance with EN 60950 required) |
| **EMC** | |
| Emitted interference | Radio interference suppression according to EN 55022, limit-value curve B |
| Noise immunity | Noise immunity according to EN 61000-6-2 |
| **Environmental conditions** | |
| Ambient temperature during operation | 0 ... +60 °C with natural convection |
| Transport/storage temperature | -40 ... + 70 °C |
| Degree of protection (EN 60529) | IP20 |
| Humidity class | Conditions of use in accordance with EN 60721, climate class 3K3 (relative humidity 5 % ... 85 % and absolute humidity 1 g/$m^3$ ... 25 g/$m^3$; no condensation) |
| **Approvals** | |
| CE marking | Yes |
| UL/cUL (CSA) approval | (UL 508, CSA C22.2 No. 14) File E197259 |
| **Mechanics** | |
| Input connections 24 V DC | 2 screw terminals for 1 ... 4 $mm^2$/17 ... 11 AWG |
| Output connections 24 V DC | 4 screw terminals for 1 ... 4 $mm^2$/17 ... 11 AWG |
| Battery module connections 24 V DC | 2 screw terminals for 1 ... 4 $mm^2$/17 ... 11 AWG |
| Connections for control circuit and alarm signals | 10 screw terminals for 0.5 ... 2,5 $mm^2$/20 ... 13 AWG |
| Dimensions (W x H x D) in mm | 50 x 125 x approx. 125 |
| Required clearances | 50 mm above and 50 mm below the device |
| Weight, approx. | Approx. 0.4 kg (with serial or USB interface: approx. 0.45 kg) |
| Installation | Snaps onto standard mounting rail EN 60715 35x7.5/15 |

[1] All SITOP 24 V DC power supplies are permissible without restriction

[2] Two battery modules connected in parallel are required in order to achieve 40 A

3) Permissible contact rating: 60 V DC/1 A or 30 V AC/1 A.

4) "24 V DC o.k." means: voltage of the power supply unit is greater than the battery connection threshold set on the DC-UPS module 6.

Dimensional drawing