

# **Uninterruptible Power Supply**

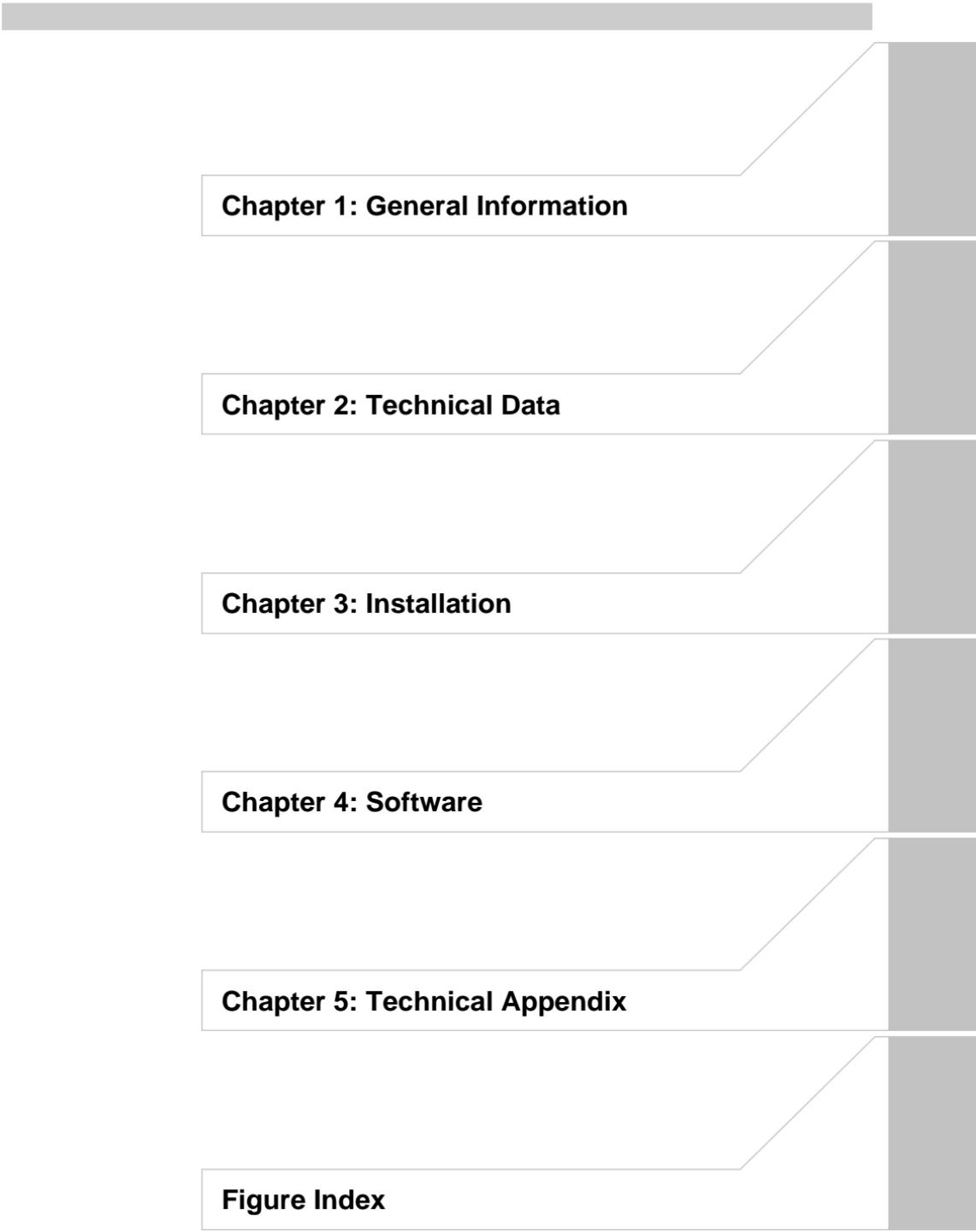
## **User's Manual**

Version: **5.0 (February 2005)**

Model No.: **MAUSV1-E**

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# Chapter 1 • General Information

## Information:

B&R does its best to keep the printed versions of its user's manuals as current as possible. However, sometimes a newer version of the user's manual can be downloaded in electronic form (pdf) from the B&R homepage [www.br-automation.com](http://www.br-automation.com).

## 1. Manual History

Version	Date	Comment
4.3	08.18.2000	First edition
4.4	09.07.2000	Changes / New Features - New layout
4.5	09.29.2000	Changes / New Features
4.6	04.19.2001	Changes / New Features - Mistake in the cable description corrected - Mistake regarding the hand shake signal line corrected
4.7	10.03.2001	Changes / New Features - New manual structure - B&R UPS configuration software added - Mistake regarding the possible storage/operating position for the lead gel rechargeable battery corrected - New layout
4.8	09.23.2002	Changes / New Features - Error in Figure "Dimensions 9A0100.14 <= Revision D0", on Page 32 - Dimensions for the distance between mounting holes corrected - Maximum cable length (15m) for self made RS232 connection cables added - 9A0100.16 UPS type C battery unit 24 V / 4.5 Ah added - 9A0100.17 UPS batteries 2 pcs. 12 V / 4.5 Ah added - Safety guidelines added - Description of new commands starting with UPS firmware version 2.0 - B&R UPS configuration software functions added starting with version 2.0 - Section "Monitoring using Windows XP with Operating System UPS Service", on Page 75 added - Section "Configuring the UPS using HyperTerminal", on Page 79 added - Section "UPS Overload Behavior", on Page 108 added - Description of new UPS configuration software functions - Switching thresholds added

Table 1: Manual History

Version	Date	Comment
4.9	05.05.2003	<p>Changes / New Features</p> <ul style="list-style-type: none"> <li>- New symbols for safety notices</li> <li>- Signal display of "Status LEDs", on Page 26 updated.</li> <li>- Communications settings of the HyperTerminal connection updated. (see table "Terminal program settings", on Page 79) (no HW handshake!)</li> <li>- New commands added for UPS firmware versions 2.10 and up. <ul style="list-style-type: none"> <li>- DIB (Digital Input Button) command</li> <li>- LTL (Life Time LED) command</li> <li>- CCD (Charge Count Down) command</li> <li>- RCL (Remain Current Low) command</li> <li>- RCH (Remain Current High) command</li> <li>- RBS (Reset Battery Status) command</li> <li>- UPS read command RHDM</li> </ul> </li> <li>- Description of the function of the measurement of the charge maintenance current expanded.</li> <li>- Additions to the "Glossary" due to the new UPS commands (firmware version 2.10 and up).</li> <li>- Section "Warnings", on Page 68 added</li> <li>- Changeover to a new A5 book template (B&amp;R HB template V32_07_2003)</li> <li>- HMI Drivers &amp; Utilities CD (order number 5S0000.01-090) added</li> <li>- Section "UPS Firmware Differences", on Page 102 added</li> </ul>
5.0	02.23.2004	<p>Changes / New Features</p> <ul style="list-style-type: none"> <li>- Changeover to a new B&amp;R HB book template V33_09_2003 (TIF--&gt;EPS)</li> <li>- Mounting of battery units revised (see Chapter 3 "Installation", Section 3 "Mounting Guidelines for Battery Units" on Page 45)</li> <li>- Mounting of UPS charging unit revised (see Chapter 3 "Installation", Section 2 "Mounting the UPS Charging Unit" on Page 42)</li> <li>- Data sheet for the Hawker Cyclon batteries added</li> <li>- Correction and revision of the state diagrams and signal lines (see Chapter 5 "Technical Appendix")</li> <li>- "UPS Command Sequences" section is now described in more detail in Chapter 4 "Software" Section 5 "Configuring the UPS using HyperTerminal".</li> <li>- New images of the battery units and the null modem cable.</li> </ul>

Table 1: Manual History (cont.)

## 2. Safety guidelines

### 2.1 Introduction

Programmable logic controllers (PLCs, etc.), operating and monitoring devices (industrial PCs, Power Panels, MobilePanels, etc.) as well as the B&R uninterruptible power supplies have been designed, developed or manufactured for conventional use in industry. They were not designed, developed and manufactured for any use involving serious risks or hazards that could lead to death, injury, serious physical damage or loss of any kind without the implementation of exceptionally stringent safety precautions. In particular, such risks and hazards include the use of these devices to monitor nuclear reactions in nuclear power plants, as well as flight control systems, flight safety, the control of mass transportation systems, medical life support systems, and the control of weapons systems.

Both when using programmable logic controllers and when using operating and monitoring devices as control systems in conjunction with a Soft PLC (e.g. B&R Automation Runtime or comparable products) or a Slot PLC (e.g. B&R LS251 or comparable products), the safety precautions applying to industrial control systems (e.g. the provision of safety devices such as emergency stop circuits, etc.) in accordance with applicable national and international regulations must be observed. The same applies for all other devices connected to the system, such as drives.

All tasks such as installation, commissioning and service may only be carried out by qualified personnel. Qualified personnel are persons who are familiar with the transport, mounting, installation, commissioning and operation of the product and have the appropriate qualifications (e.g. IEC 60364). National accident prevention guidelines must be followed. The safety guidelines, connection descriptions (rating plate and documentation) and limit values listed in the technical data must be read carefully before installation and commissioning and must be observed.

### 2.2 Intended Use

Electronic devices are generally not fail-safe. In the event of a failure on the programmable control system, operating or monitoring device or uninterruptible power supply, the user is responsible for ensuring that other devices that may be connected, such as motors, are made safe.

### 2.3 Transport and Storage

During transport and storage, devices must be protected from excessive stress (mechanical load, temperature, humidity, aggressive atmosphere).

## **2.4 Mounting**

- The installation must take place according to the documentation using suitable equipment and tools.
- The devices are only allowed to be installed without voltage applied and by qualified personnel.
- General safety regulations and nationally applicable accident prevention guidelines must be observed.
- Electrical installation must be carried out according to the relevant guidelines (e.g. line cross section, fuse, protective ground connection).

## **2.5 Operation**

### **2.5.1 Protection Against Coming into Contact with Electrical Parts**

To operate programmable logic controllers, operating and monitoring devices and uninterruptible power supplies, certain components must carry dangerous voltage levels of over 42 VDC. A life-threatening electrical shock could occur if you touch these parts. This could result in death, severe injury or material damage.

Before turning on the programmable logic controller, the operational and monitoring devices and the uninterruptible power supply, ensure that the housing is properly connected to protective ground (PE rail). The ground connection must be established even when testing the operating and monitoring devices or the uninterruptible power supply, even when operating them for only a short time.

Before turning the device on, make sure that all voltage carrying parts are securely covered. During operation, all covers must remain closed.

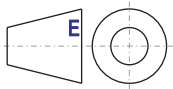
### 3. Safety Notices

The safety notices in this manual are organized as follows:

Safety notices	Description
<b>Danger!</b>	Disregarding the safety regulations and guidelines can be life-threatening.
<b>Caution!</b>	Disregarding the safety regulations and guidelines can result in severe injury or major damage to material.
<b>Warning!</b>	Disregarding the safety regulations and guidelines can result in injury or damage to material.
<b>Information:</b>	Important information for preventing errors

Table 2: Safety guidelines

### 4. Guidelines



All dimension diagrams (e.g. dimension diagrams, etc.) are drawn according to European dimension standards.

## 5. Model Numbers

Model number	Description	Note
5S0000.01-090	<b>HMI Drivers &amp; Utilities CD</b> Include, among other things, the B&R UPS configuration software or current UPS firmware update files.	
9A0017.01	<b>RS232 Null Modem Cable 0.6 m</b> To connect UPS and load system (9-pin DSUB socket - 9-pin DSUB socket)	
9A0017.02	<b>RS232 Null Modem Cable 1.8 m</b> To connect UPS and load system (9-pin DSUB socket - 9-pin DSUB socket)	
9A0100.11	<b>UPS 24 VDC</b> 24 VDC input, 24 VDC output, serial interface	
9A0100.12	<b>UPS Battery Unit Type A</b> 24 V; 7 Ah; including battery cage	
9A0100.13	<b>UPS Battery Unit Type A (replacement part)</b> 2 x 12 V; 7 Ah; for battery unit 9A0100.12	
9A0100.14	<b>UPS Battery Unit Type B</b> 24 V; 2.2 Ah; including battery cage	
9A0100.15	<b>UPS Battery Unit Type B (replacement part)</b> 2 x 12 V; 2.2 Ah; for battery unit 9A0100.14	
9A0100.16	<b>UPS Battery Unit, Type C 24V 4.5Ah</b> 24 ; 4.5 Ah; including battery cage	
9A0100.17	<b>UPS Battery Unit, Type C 24V 4.5Ah (replacement part)</b> 2 x 12 V; 4.5 Ah; for battery unit 9A0100.16	
MAUSV1-0	<b>UPS User's Manual, German</b>	
MAUSV1-E	<b>UPS User's Manual, English</b>	
MAUSV1-F	<b>UPS User's Manual, French</b>	

Table 3: Model Numbers

## Chapter 2 • Technical Data

### 1. General Information

The UPS is used to supply power for systems which cannot be connected directly to the +24 VDC power mains for safety reasons because a power failure could cause data to be lost. The UPS allows the load system (e.g. B&R IPC) to be shut down securely without losing data if a power failure occurs.



Figure 1: UPS - Charging Unit

#### Features:

- 24 VDC input voltage
- 24 VDC output voltage
- Industrial standard installation
- Communication via serial interface
- Status display
- Deep discharge protection
- Short-circuit protection
- Maintenance free battery units

## 2. Charging Unit

### 2.1 9A0100.11 UPS 24 VDC



Figure 2: UPS Charging Unit 9A0100.11

#### 2.1.1 Technical Data

UPS 24 VDC	9A0100.11
Input during Mains Operation Rated Voltage Value Voltage Range	Regulated DC voltage 24 VDC 20 - 30 VDC at a switching threshold of 18 V <sup>1)</sup> 23.5 - 30 VDC at a switching threshold of 21.5 V <sup>1)</sup>
Output during Mains Operation Rated Voltage Value Voltage Range Max. Output Current	24 VDC 20 - 30 VDC or 23.5 - 30 VDC depending on the set switching threshold <sup>1)</sup> 8 A
Output during Battery Operation Switching Threshold Mains / Battery Operation <sup>1)</sup> Rated Voltage Value Voltage Range Max. Output Current Mains Failure Bridging	18 V at 20 - 30 VDC input 21.5 V at 23.5 - 30 VDC input 24 VDC 21 - 26.8 VDC (40 °C) or 28.2 VDC (0 °C) 8 A (load-side) max. 20 minutes with 150 W load (with battery 9A0100.12, 24 V / 7.2 Ah)
Battery Charging Rating Charging Clearing Voltage Charging Current	27.6 VDC Can be set from 0.88 A to 2.88 A adjustable in 0.01 A increments, depending on type: using B&R Configuration Software and HyperTerminal (0.5 - 2.88 A) or 0.25 A: using button (0.88 to 2.88 A)

Table 4: Technical Data 9A0100.11

UPS 24 VDC	9A0100.11
Protection and Monitoring Deep Discharge Protection Short-circuit Protection Fuses Reverse Polarity Protection	Yes; depending on the set switching threshold: 21 V when 18 V <sup>1)</sup> or 21.5 V when 21.5 V <sup>1)</sup> Yes Yes; for mains supply, battery and battery charger <sup>2)</sup> Yes; for mains supply and battery
Status Display Operating Mode Status Battery Charging Current Battery Status Battery Reverse Polarity Fuses	LED green (mains operation, battery operation, etc.) LED yellow (overload, temperature alarm, etc.) LED yellow (charging current strength) LED yellow (battery charge, age, etc.) LED red (battery reverse polarity, not connected) LED red (mains supply, battery, battery charger)
Interface CTS (Clear To Send) DCD (Data Carrier Detect) DTR (Data Terminal Ready)	Serial, RS232 Signals power failure Signals shutdown Signals remote shutdown of the UPS
Standards	UL
Environmental Temperature Operation Storage Transport	0 - 55 °C - 20 °C to +60 °C - 20 °C to +60 °C
Humidity Operation Storage Transport	5 - 95 % (non-condensing) 5 - 95 % (non-condensing) 5 - 95 % (non-condensing)
Vibration Operation Storage Transport	max. 9 - 200 Hz and 1 G (9.8 m/s² 0-peak) max. 2 - 500 Hz and 4 G (39.2 m/s² 0-peak) max. 2 - 500 Hz and 4 G (39.2 m/s² 0-peak)
Shock Operation Storage Transport	max. 15 G (147 m/s² 0-peak) and 11 ms length max. 100 G (980 m/s² 0-peak) and 6 ms length max. 100 G (980 m/s² 0-peak) and 6 ms length
Software Support	Microsoft Windows 95 / 98 / ME / NT4.0 / 2000 / XP
Altitude	Max. 3000 meters above sea level
Dimensions (W x H x D)	185 x 115 x 69 mm (see also figure 3 "Dimensions 9A0100.11" on Page 20)
Weight	Approx. 1.2 kg
Mounting Instructions	see Chapter 3 "Installation" on Page 41

**Table 4: Technical Data 9A0100.11 (cont.)**

1) Can be set using B&R UPS Configuration Software or HyperTerminal (18 or 21.5 VDC).

2) The charging unit fuse is not necessary with Revision L0 and higher.

## 2.1.2 Dimensions

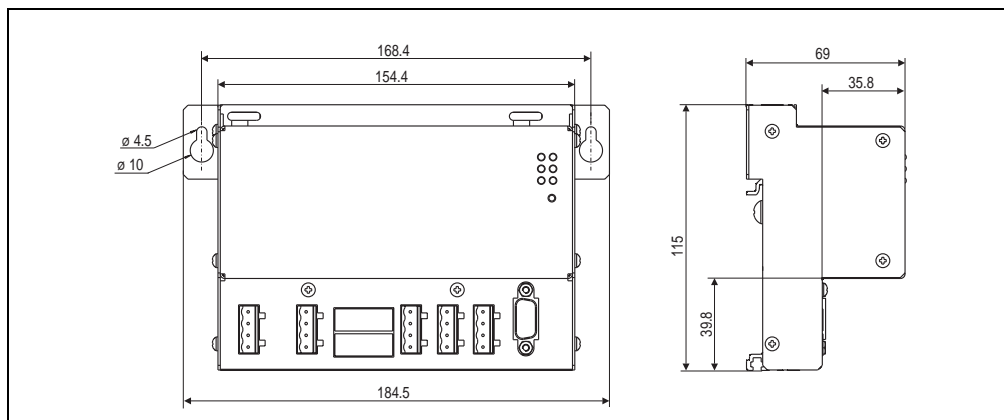


Figure 3: Dimensions 9A0100.11

## 2.1.3 Contents of Delivery

The following components are included in the delivery of the B&R UPS 24 VDC :

Amount	Component
1	UPS Charging Unit
5	orange connection plug (plugged in)

Table 5: Delivery 9A0100.11

### 2.1.4 Device Interfaces

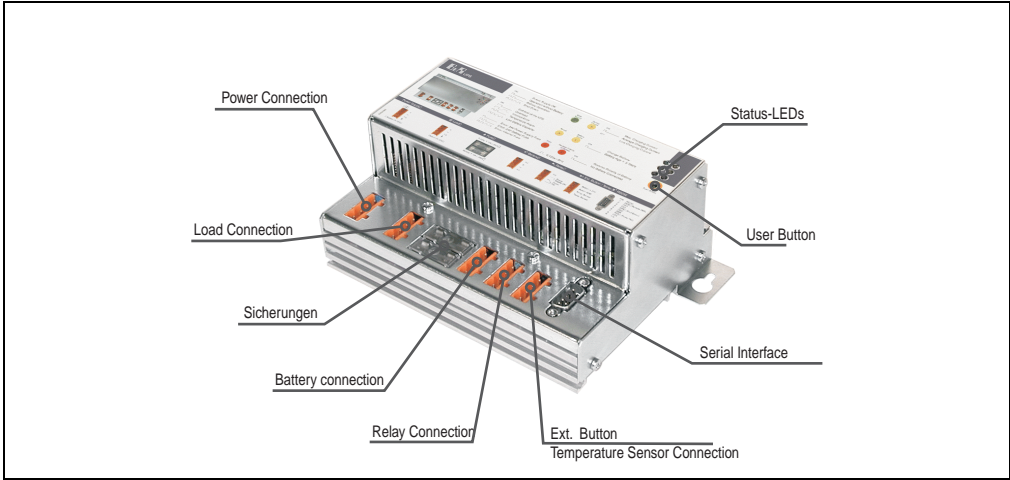


Figure 4: Device Interfaces 9A0100.11

#### Power mains connection

24 V mains supply connection. Regulated DC voltage, rated voltage value 24 VDC, voltage range according to the set switching threshold <sup>1)</sup> when 18 V 20-30 VDC and when 21.5 V 23.5 - 30 VDC:



Power mains connection		
Pin	Assignment	
+	Input VDC +	
-	Input VDC -	
n.c.	Not connected	
	Ground connection	

Table 6: Power mains connection

Correct pin assignments are also indicated on the UPS.

## Warning!

**Applying power over 30 VDC can damage the UPS! The UPS must be grounded using the ground connection provided.**

<sup>1)</sup> Can be set using B&R UPS Configuration Software or HyperTerminal (18 or 21.5 VDC).

## Load Connection

Load connection (e.g. B&R IPC with 24 VDC bus unit).


Power mains connection		
Pin	Assignment	
+	Output VDC +	
-	Output VDC -	
n.c.	Not connected	
⏏	Ground connection	

Table 7: Load Connection

Correct pin assignments are also indicated on the UPS.

## Warning!

**The UPS must be connected with the load system ground connection, using the ground connection provided.**

### For mains operation:

Rated voltage value 24 VDC, voltage range is dependent on the set switching threshold <sup>1)</sup> 18 V: 20-30 VDC, 21.5 V: 23,5-30 VDC; maximum output current: 8 A

### For battery operation:

Rated voltage value 24 VDC, voltage range 21 -26.8 VDC (40 °C) or 28.2 VDC (0 °C); maximum output current: 8 A

<sup>1)</sup> Can be set using B&R UPS Configuration Software or HyperTerminal (18 or 21.5 VDC).

### Fuses

The two replaceable fuses on the front side of the device protect the power mains input and the battery connection from over-current, reverse polarity (using a diode which is controlled by the firmware to make a connection when the polarity is correct) and short circuits (using a fuse and firmware).

Type:      Glass tube fuses 5 x 20 mm:    T 10 A / 250 V


Fuses		
Network	10 A / 250 V	
Battery	10 A / 250 V	

Table 8: Fuses

### Battery Connection

The battery units are connected using the cable included in delivery, using the red (+) and black (-) leads of the battery cable.


Battery Connection		
Pin	Assignment	
n.c.	Not connected	
+	Battery + Pin	
-	Battery - Pin	
n.c.	Not connected	

Table 9: Battery Connection

Correct pin assignments are also indicated on the UPS.

## Warning!

**Disconnecting the battery and reconnecting it with reversed polarity within one minute can damage the UPS!**

### Relay Output

A power failure is also signalled immediately by the UPS by setting a relay output. An external electrical circuit can be switched (closed or opened) using the relay output.

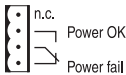


Relay output		
Pin	Assignment	
n.c.	Not connected	
 Power OK  Power fail	Relay output	

Table 10: Relay output

For relay output contact data, see Section "Relay Output", on Page 115.

### External Button, Temperature Sensor Connection

The temperature sensor for the battery unit is connected using the supplied cable. Both of the battery cable's white leads are to be used for this.


Ext. Button, Temperature Sensor Connection		
Pin	Assignment	
Button +	Positive edge input	
Button -	Negative edge input	
Temp.	Temperature sensor	
Temp.	Temperature sensor	

Table 11: Ext. Button, Temperature Sensor Connection

See Section "ExternalButton User Button (Digital Input) and DIB (Digital Input Button)", on Page 109 for connecting an external button..

### RS232 interface

The UPS communicates with the load system (e.g. B&R IPC) via the serial interface.

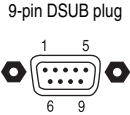
RS232 interface		
Pin	Assignment	
1	DCD	
2	RxD	
3	TxD	
4	DTR	
5	GND	
6	DSR	
7	RTS	
8	CTS	
9	n.c.	

Table 12: RS232 interface

The 7 pin null modem cable required for this must have two 9 pin DSUB sockets (female). The appropriate cable can be ordered directly from B&R under the model number 9A0017.01 (length = 0.6 m) and 9A0017.02 (length = 1.8 m).

The cable can also be made. A self made cable can have a maximum length of 15 meters. The pins must be connected as follows:

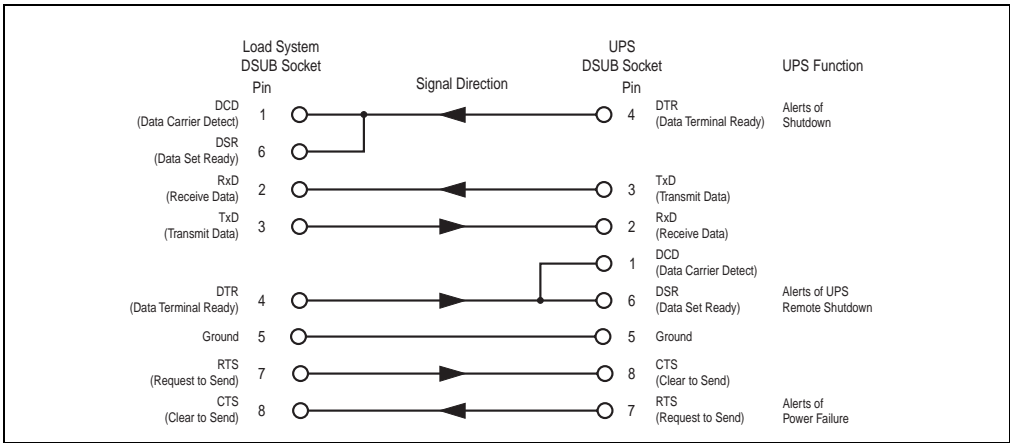


Figure 5: Pin assignment RS232 cable

### User Button

See Section "ExternalButton User Button (Digital Input) and DIB (Digital Input Button)", on Page 109 for possible uses of the user button.

## Status LEDs

The UPS has six status LEDs that show the operating state, indicate any faults or display information about the battery units. The LEDs are also used to manually set the charging current for the battery unit via the user button (see Section "Setting the Maximum Charging Current", on Page 118). Each LED can display several different types of information based on flashing sequence:

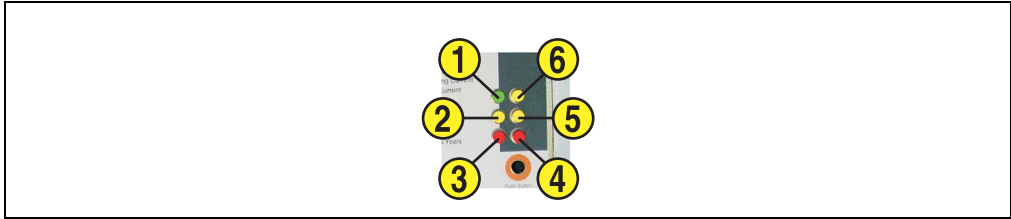


Figure 6: Status LEDs


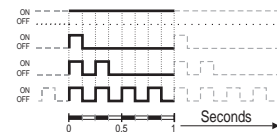
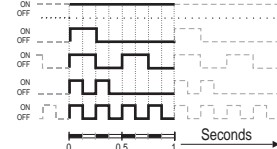
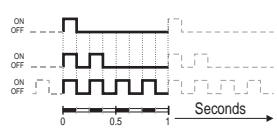
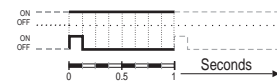
Function	Color	LED Number	Flashing sequences / Interval:  0.125 s = 8 Hz
Operation	Green	1	 <p>Mains operation OK Mains operation with no battery Battery operation Shut Down</p>
Status	Yellow	2	 <p>UPS self-test Overload Internal error Temperature alarm Battery capacity too low</p>
Fuses	Red	3	 <p>Error: 24 V-mains fuse, or mains voltage &lt; 20 V or 23.5 V (depending on the switching threshold 18 or 21,5V) Error: 24 V-battery fuse Error: internal fuse</p>
Battery Reverse Polarity	Red	4	 <p>Battery polarity is reversed No battery attached</p>

Table 13: LED Status - Flashing Sequences and their Meaning


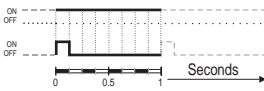
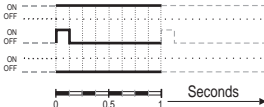
Function	Color	LED Number	Flashing sequences / Interval:  0.125 s = 8 Hz
Battery Status	Yellow	5	 <p>Change battery (battery malfunctioned or did not pass capacity test)</p> <p>Battery lifespan exceeded (dependant on type) or low battery capacity</p>
Battery Charging	Yellow	6	 <p>Maximum Charging Current = max. Charging Current</p> <p>Medium Charging Current = 30 - 60 % of max. Charging C</p> <p>Low Charging Current = 0 - 30 % of max. Charging Current</p>

Table 13: LED Status - Flashing Sequences and their Meaning

- 1) A reliable detection of a defective fuse is guaranteed only if the supply voltage is in the specified range according to the operating mode (switching threshold mains/battery).

### 3. Battery Units

## Warning!

Batteries other than those obtained from B&R cannot be used because the UPS is specified for the charging and discharging characteristics of these battery units.

#### 3.1 9A0100.12 Type A Battery Unit (24 V / 7.2 Ah)

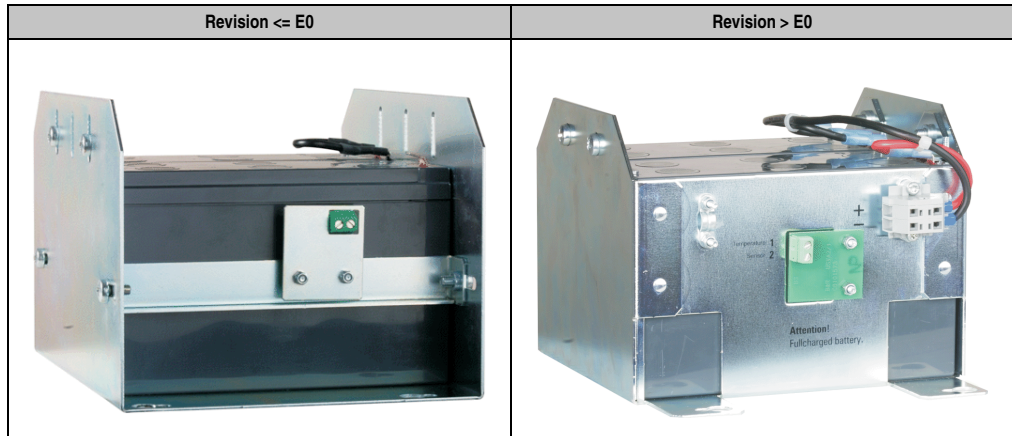


Figure 7: Type A Battery Unit 9A0100.12 Revision Comparison

#### 3.1.1 Technical Data

UPS Type A Battery Unit 24 V / 7.2 Ah)	9A0100.12
Battery Type Type	Panasonic 12 V 7.2 Ah; two rechargeable batteries connected in series Maintenance free lead acid battery
Connection Cable For charger For temperature sensor	Length 3 m; Cross section 2.5 mm <sup>2</sup> Length 3 m; Cross section 0.75 mm <sup>2</sup>
Dimensions (W x H x D)	See figure 8 "Dimensions 9A0100.12 <= Revision E0" on Page 29 or Figure 9 "Dimensions 9A0100.12 > Revision E0" on Page 30
Weight	Approx. 6.1 kg
Environmental Temperature Operation Storage Transport	0 - 40 °C - 15 °C to +40 °C - 15 °C to +40 °C
Humidity Operation Storage Transport	25 - 85 % (non-condensing) 25 - 85 % (non-condensing) 25 - 85 % (non-condensing)

Table 14: Technical Data 9A0100.12

UPS Type A Battery Unit 24 V / 7.2 Ah)	9A0100.12
Altitude	Max. 3,000 meters above sea level
Mounting Instructions	see Chapter 3 "Installation" on Page 41
Lifespan	Up to 10 years (dependent on environmental temperature and the charging and discharging cycles)

Table 14: Technical Data 9A0100.12 (cont.)

### 3.1.2 Dimensions <= Revision E0

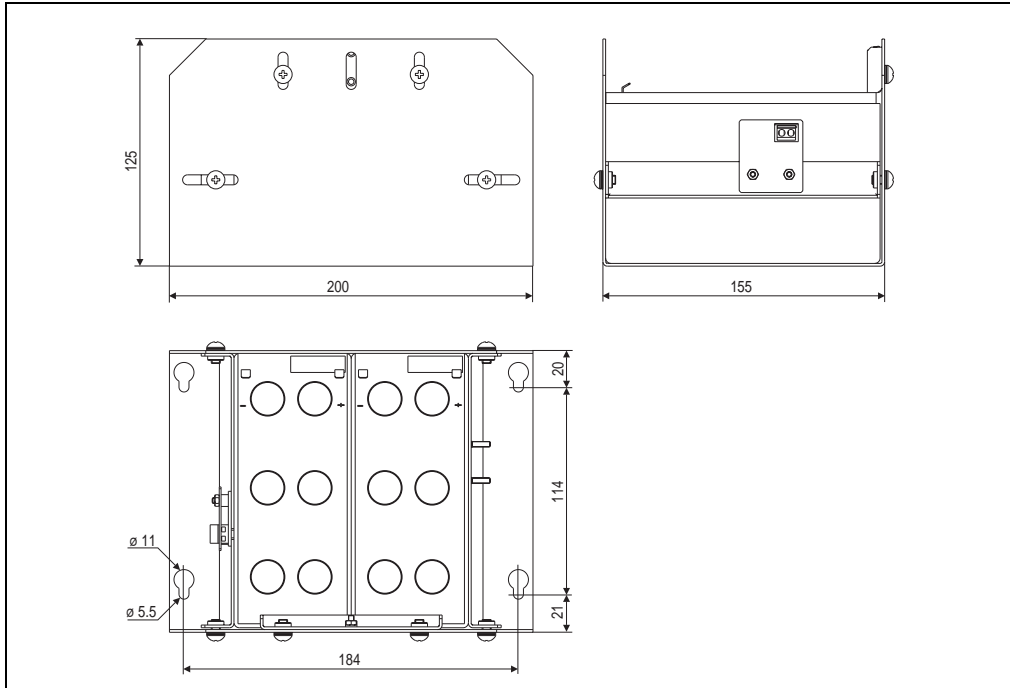


Figure 8: Dimensions 9A0100.12 &lt;= Revision E0

### 3.1.3 Dimensions > Revision E0

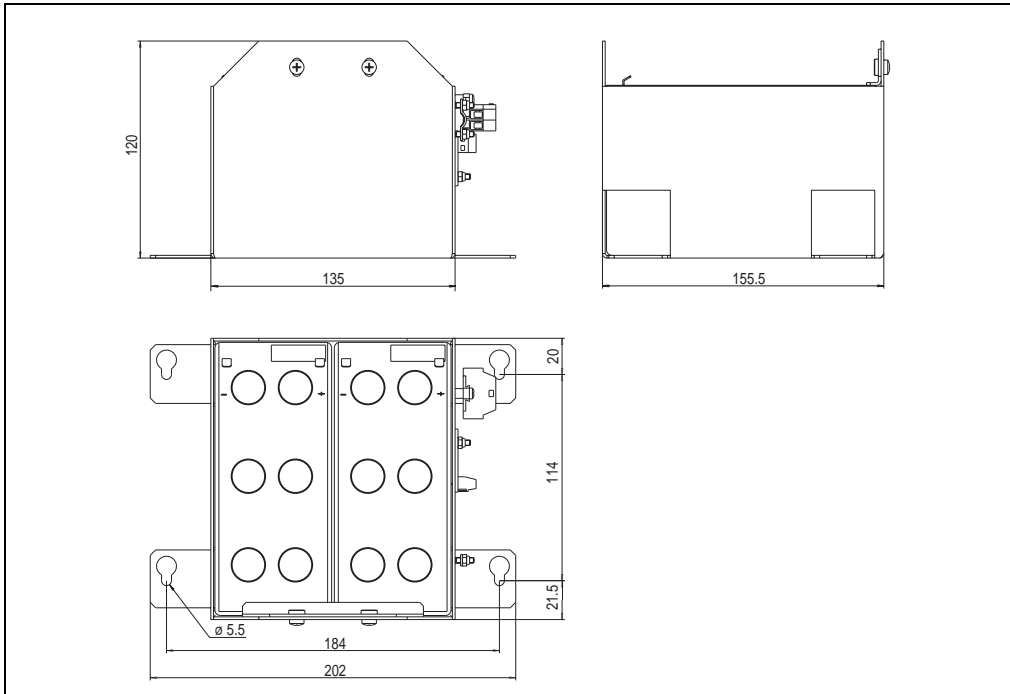


Figure 9: Dimensions 9A0100.12 > Revision E0

### 3.1.4 Contents of Delivery

The following components are included in the delivery of the battery unit 9A0100.12:

Amount	Component
1	Battery unit type A 24 V; 7.2 Ah; incl. battery cage
1	Prefabricated 3 meter long connection cable for connecting the battery unit and temperature sensor to the UPS charging unit.

Table 15: Delivery 9A0100.12

### 3.2 9A0100.14 Typ B Battery Unit (24 V / 2.2 Ah)

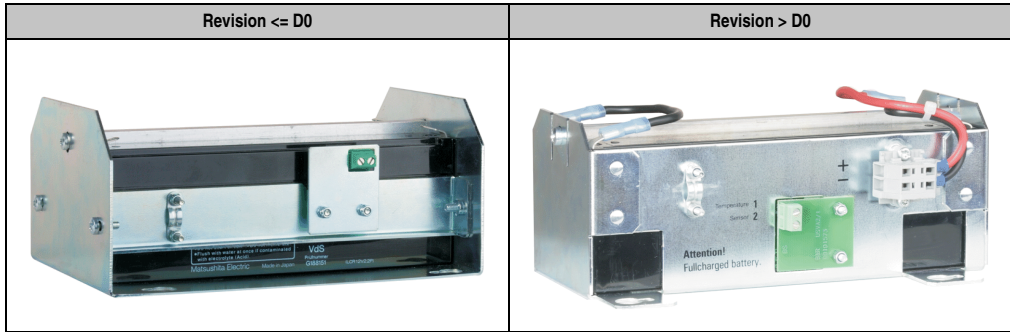


Figure 10: Type B Battery Unit 9A0100.14 Revision Comparison

#### 3.2.1 Technical Data

UPS Type B Battery Unit 24 V / 2.2 Ah)	9A0100.14
Battery Type Type	Panasonic 12V 2.2 Ah; two rechargeable batteries connected in series Maintenance free lead acid battery
Connection Cable For charger For temperature sensor	Length 3 m; Cross section 2.5 mm <sup>2</sup> Length 3 m; Cross section 0.75 mm <sup>2</sup>
Dimensions (W x H x D)	See figure 11 "Dimensions 9A0100.14 <= Revision D0" on Page 32 or Figure 12 "Dimensions 9A0100.14 > Revision D0" on Page 33
Weight	Approx. 2.3 kg
Environmental Temperature Operation Storage Transport	0 - 40 °C - 15 °C to +40 °C - 15 °C to +40 °C
Humidity Operation Storage Transport	25 - 85 % (non-condensing) 25 - 85 % (non-condensing) 25 - 85 % (non-condensing)
Altitude	Max. 3,000 meters above sea level
Mounting Instructions	see Chapter 3 "Installation" on Page 41
Lifespan	Up to 10 years (dependent on environmental temperature and the charging and discharging cycles)

Table 16: Technical Data 9A0100.14

### 3.2.2 Dimensions <= Revision D0

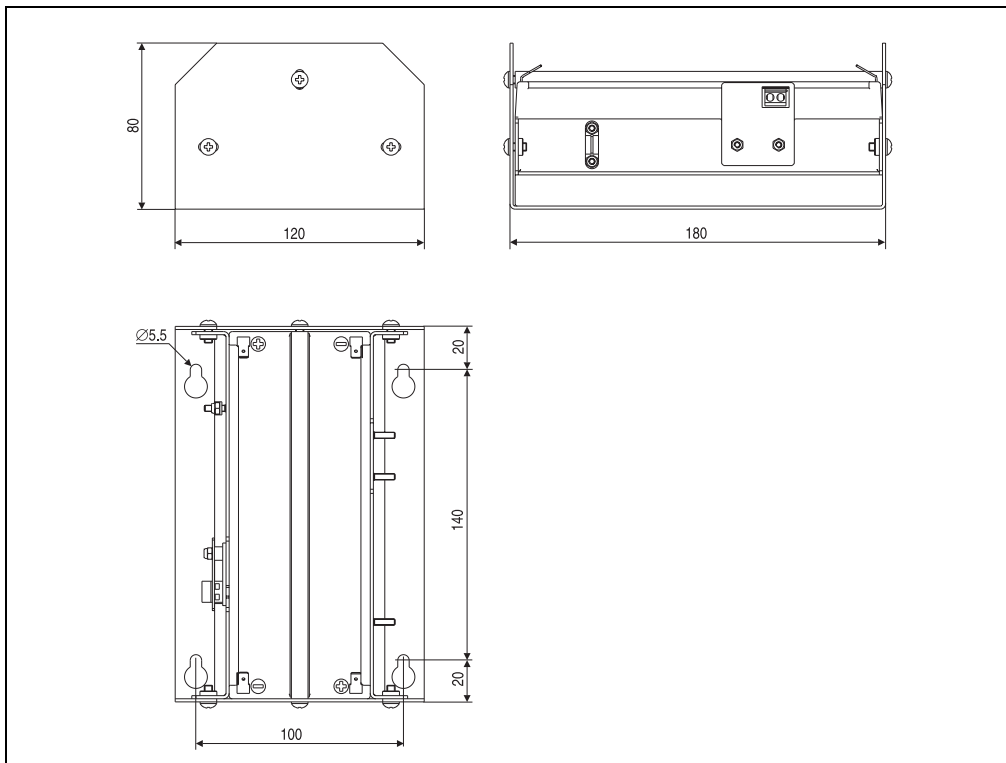


Figure 11: Dimensions 9A0100.14 <= Revision D0

### 3.2.3 Dimensions > Revision D0

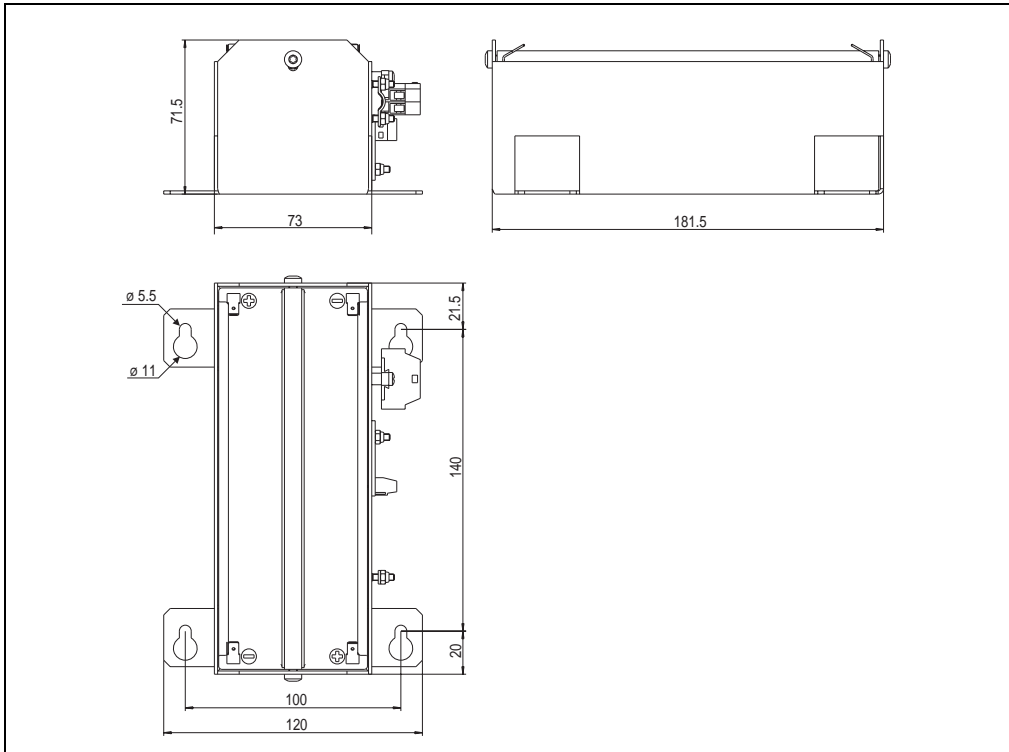


Figure 12: Dimensions 9A0100.14 > Revision D0

### 3.2.4 Contents of delivery

The following components are included in the delivery of the battery unit 9A0100.14:

Amount	Component
1	Battery unit type B 24 V; 2.2 Ah; incl. battery cage
1	Prefabricated 3 meter long connection cable for connecting the battery unit and temperature sensor to the UPS charging unit.

Table 17: Delivery 9A0100.14

### 3.3 9A0100.16 Type C Battery Unit (24 V / 4.5 Ah)

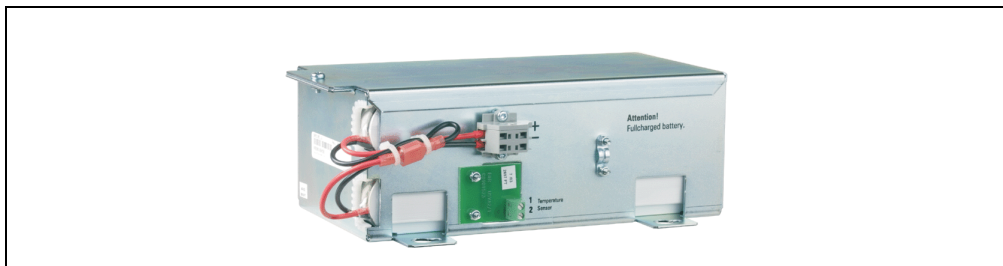


Figure 13: Type C Battery Unit 9A0100.16

#### 3.3.1 Technical Data

UPS Type C Battery Unit 24 V / 4.5 Ah)	9A0100.16
Battery Type Type	Hawker Cyclon 12 V 4.5 Ah; two rechargeable batteries connected in series Single cell
Connection Cable For charger For temperature sensor	Length 3 m; Cross section 2.5 mm <sup>2</sup> Length 3 m; Cross section 0.75 mm <sup>2</sup>
Dimensions (W x H x D)	223.2 x 145 x 78.2 mm
Weight	Approx. 5 kg
Environmental Temperature Operation Storage Transport	-40 °C to +80 °C -65 °C to +80 °C -65 °C to +80 °C
Humidity Operation Storage Transport	5 - 95 % (non-condensing) 5 - 95 % (non-condensing) 5 - 95 % (non-condensing)
Altitude	Max. 3000 meters above sea level
Mounting Instructions	see Chapter 3 "Installation" on Page 41
Lifespan	Up to 15 years (dependent on environmental temperature and the charging and discharging cycles)

Table 18: Technical Data 9A0100.16

### 3.3.2 Dimensions

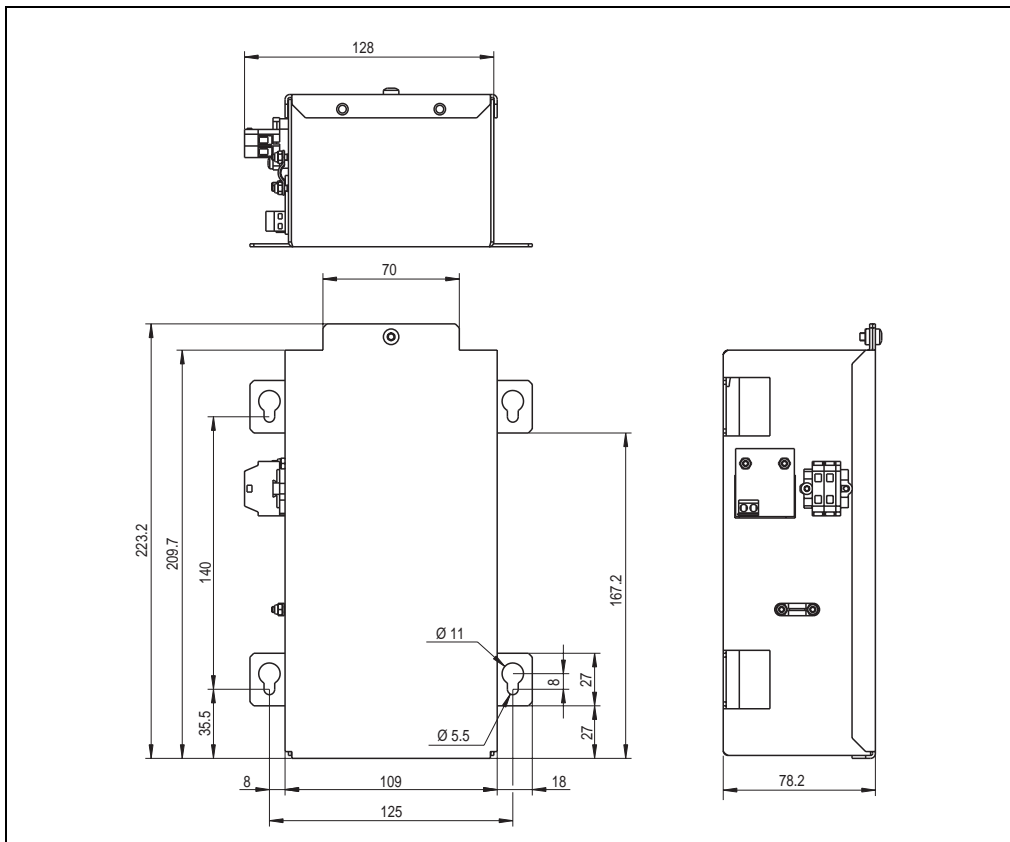


Figure 14: Dimensions 9A0100.16

### 3.3.3 Contents of Delivery

The following components are included in the delivery of the battery unit 9A0100.16:

Amount	Component
1	Battery unit type C 24 V; 4.5 Ah; incl. battery cage
1	Prefabricated 3 meter long connection cable for connecting the battery unit and temperature sensor to the UPS charging unit.

Table 19: Delivery 9A0100.16

## 4. Replacement Batteries

### 4.1 9A0100.13 Batteries; 2 pcs., 12V 7.2 Ah

These are the replacements for the batteries in battery unit 9A0100.12.



Figure 15: Battery Unit 9A0100.13

#### 4.1.1 Technical Data

UPS batteries; 2 pcs., 12V; 7.2 Ah	9A0100.13
Battery Type	Panasonic 12 V 7.2 Ah
Type	Maintenance free lead acid battery
Weight	Approx. 5.2 kg
Environmental Temperature	
Operation	0 - 40 °C
Storage	- 15 °C to +40 °C
Transport	- 15 °C to +40 °C
Humidity	
Operation	25 - 85 % (non-condensing)
Storage	25 - 85 % (non-condensing)
Transport	25 - 85 % (non-condensing)
Lifespan	Up to 10 years (dependent on environmental temperature and the charging and discharging cycles)

Table 20: Technical Data 9A0100.13

# 4.2 9A0100.15 Batteries; 2 pcs., 12V 2.2 Ah

These are the replacements for the batteries in battery unit 9A0100.14.



Figure 16: Battery Unit 9A0100.15

## 4.2.1 Technical Data

UPS batteries; 2 pcs., 12V; 2.2 Ah	9A0100.15
Battery Type Type	Panasonic 12 V 2.2 Ah Maintenance free lead acid battery
Weight	Approx. 1.9 kg
Environmental Temperature Operation Storage Transport	0 - 40 °C - 15 °C to +40 °C - 15 °C to +40 °C
Humidity Operation Storage Transport	25 - 85 % (non-condensing) 25 - 85 % (non-condensing) 25 - 85 % (non-condensing)
Lifespan	Up to 10 years (dependent on environmental temperature and the charging and discharging cycles)

Table 21: Technical Data 9A0100.15

### 4.3 9A0100.17 Batteries; 2 pcs., 12 V 4.5 Ah

These are the replacements for the batteries in battery unit 9A0100.16.



Figure 17: Battery Unit 9A0100.17

#### 4.3.1 Technical Data

UPS batteries; 2 pcs., 12V; 4.5 Ah	9A0100.17
Battery Type Type	Hawker Cyclon 12 V 4.5 Ah; Single cell
Dimensions (W x H x D)	223.2 x 145 x 78.2 mm
Weight	Approx. 3.6 kg
Environmental Temperature Operation Storage Transport	-40 °C to +80 °C -65 °C to +80 °C -65 °C to +80 °C
Humidity Operation Storage Transport	5 - 95 % (non-condensing) 5 - 95 % (non-condensing) 5 - 95 % (non-condensing)
Lifespan	Up to 15 years (dependent on environmental temperature and the charging and discharging cycles)

Table 22: Technical Data 9A0100.17

## 5. Null Modem Cable

This cable is needed for the connection between the UPS and the load system (e.g. B&R IPC) The cable has 2 DSUB sockets. It is available in lengths of 0.6 m and 1.8 m.

### 5.1 9A0017.0x RS232 Null Modem Cable

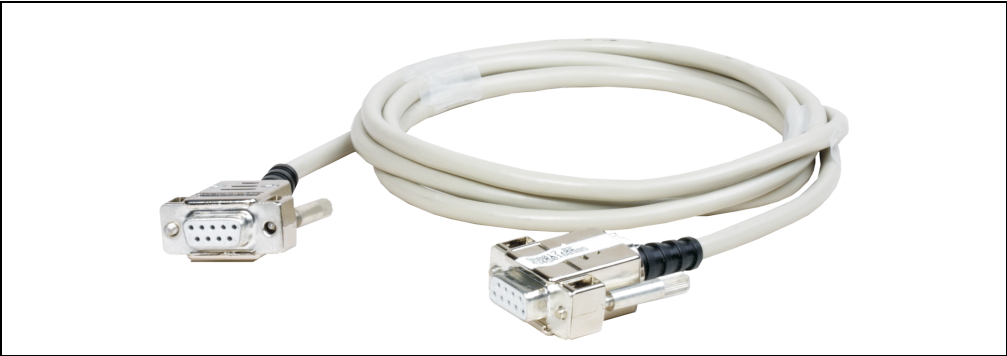


Figure 18: Null Modem Cable 9A0017.0x

RS232 DB9 null modem cable	9A0017.01	9A0017.02
Length	0.6 meters	1.8 meters
Pin assignment	See table "Pin assignment RS232 cable", on Page 25	

Table 23: Null Modem Cable 9A0017.01 and 9A0017.02



## Chapter 3 • Installation

---

### 1. Getting Started

- 1) Unpack the UPS and the battery unit.
- 2) Set up and install the UPS charging unit (see Section 2 "Mounting the UPS Charging Unit" on Page 42). The UPS should be mounted as close to the load system as possible to prevent voltage drops caused by long cables. It can be mounted on a mounting rail (TS35) using the profile on the back side.
- 3) Set up and install the battery unit (see Section "Mounting Guidelines for Battery Units" on Page 45).
- 4) Connect the UPS to the load system using the null modem cable. A B&R null modem cable (Mod.No. 9A0017.01 and 9A0017.02) or a self made null modem cable (see Section "RS232 interface" on Page 25) can be used.
- 5) Connect the UPS load output to the load system that should be supplied. For the connection, use the 4 pin plug included in the delivery and a user-provided cable with a cross section of  $2 \times 2.5 \text{ mm}^2$ . Be sure to check the polarity when making the connection! The UPS must also be connected with the load system ground connection, using the ground connection provided.
- 6) Attaching the connection cable (delivered with the battery unit) to the battery unit according to wiring guidelines (see Section 3.1 "Cable Connection" on Page 46).
- 7) Attaching the battery unit connection cable (red and black leads) to the battery input of the UPS with the 4 pin plug included in the delivery. Be sure to check the polarity when making the connection!
- 8) Connecting the temperature sensor cable (two white leads) to the 4 pin plug extension included in delivery. Button / Temp.
- 9) UPS connection to a 24 VDC power supply: The connection of the 24 VDC supply voltage is made using the 4 pin plug included with the delivery and a user-provided cable with a  $2 \times 2.5 \text{ mm}^2$  cross section. Be sure to check the polarity when making the connection! The UPS must be grounded using the ground connection provided.
- 10) Install the B&R UPS configuration software on the load system (see Chapter 4 "Software" on Page 49).
- 11) Configure the UPS (see Chapter 4 "Software" on Page 49).

12) Enable monitoring (see Chapter 4 "Software" on Page 49).

### Warning!

The operating parameters should be checked and configured on the load system before the UPS is permanently connected to it. If this is not done, Bernecker & Rainer shall not be liable for any loss of data, even if the parameters have not been changed!

## 2. Mounting the UPS Charging Unit

### Warning!

If the UPS device will be subject to vibration and shock, it should be mounted on a mounting rail, and the mounting plates should additionally be fastened with M4 safety screws.

It can be mounted on a mounting rail (TS35), which must conform to the EN50022 standard, using the profile on the back side.

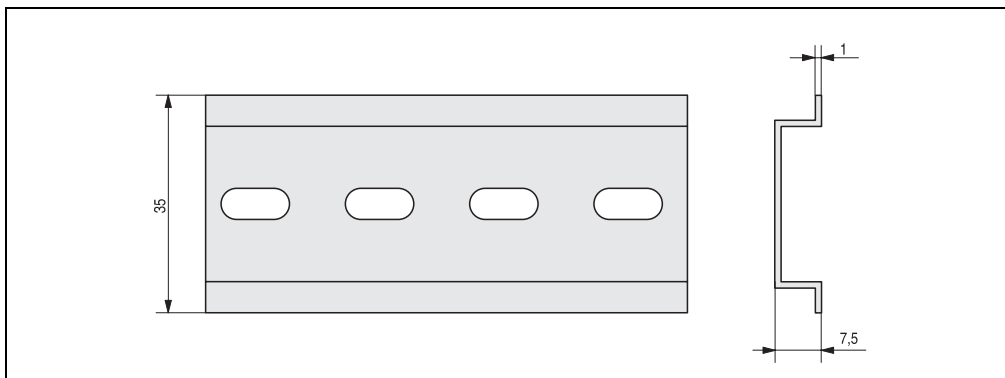


Figure 19: Mounting rail

The USP can also be mounted with the two mounting plates located on the device. The plates are designed for M4 screws, and therefore suitable for mounting.

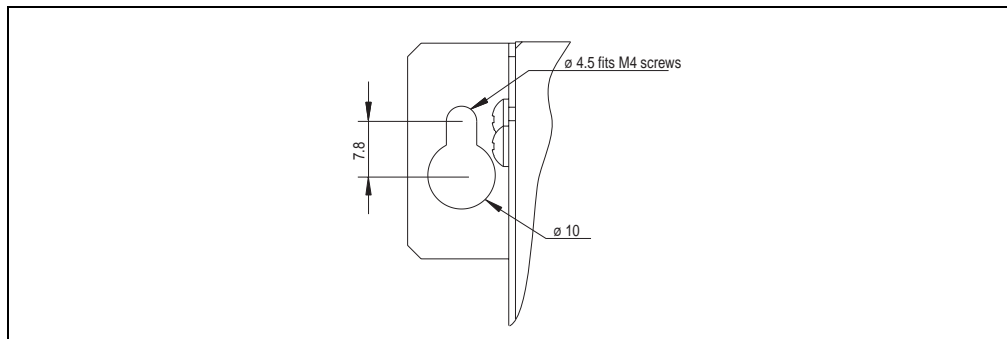


Figure 20: Mounting Plates UPS Charging Unit

The exact positioning of the mounting holes can be taken from the dimension diagram for the UPS device (see diagram 3 "Dimensions 9A0100.11" on Page 20).

There must be at least 10 cm free space above the UPS and at least 7 cm free space underneath it. Do not cover the cooling slots. Air must flow naturally between the bottom (connections) and the top (vents).

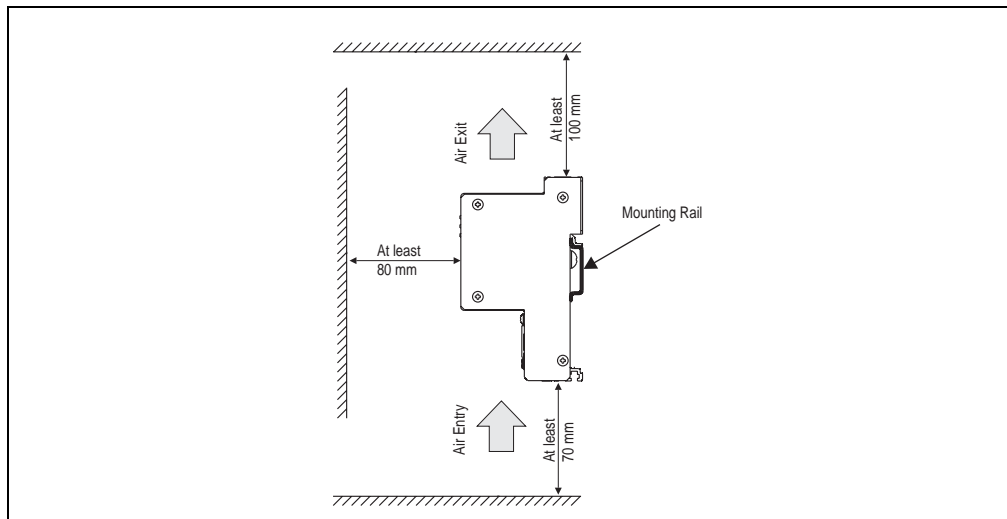


Figure 21: Mounting the UPS 24 VDC

2.1 Cable Connection

The following images show two examples of proper cable connections to the UPS.

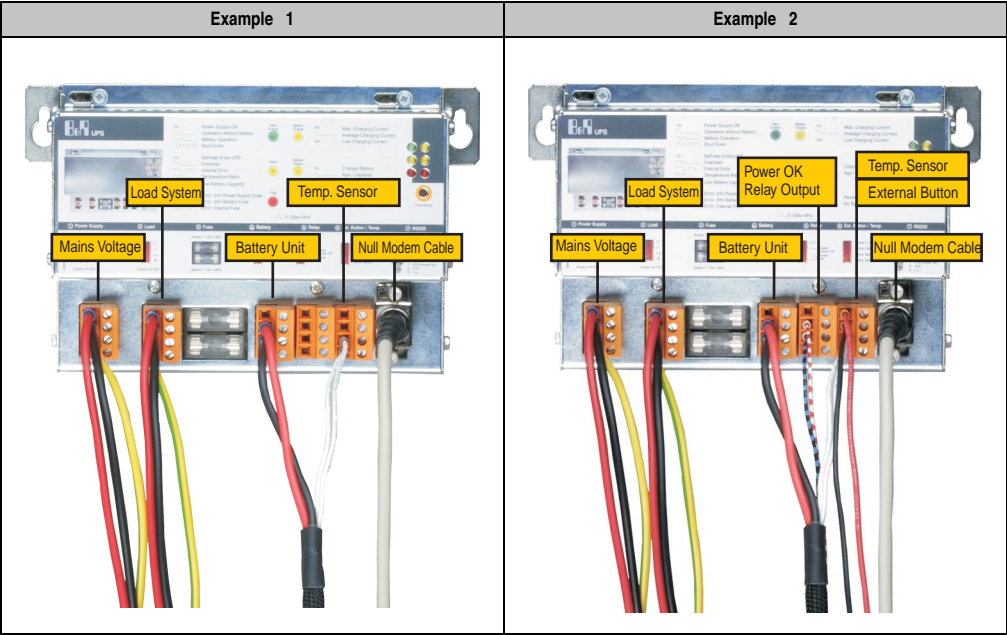


Table 24: Cable Connection Examples

2.2 Mounting Orientation

The UPS can only be installed horizontally, e.g., on mounting rail.

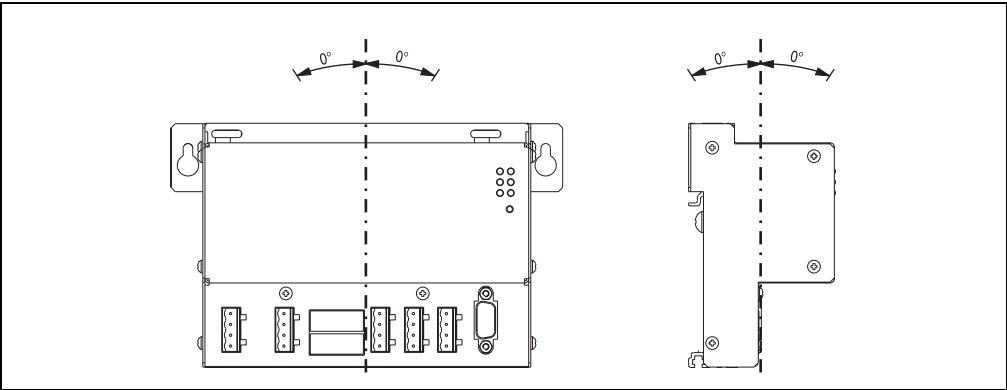


Figure 22: UPS Device Mounting Orientation 9A0100.11

### 3. Mounting Guidelines for Battery Units

The battery units can also be mounted with the 4 mounting plates located on the battery cage. The plates are designed for M5 screws, and therefore suitable for mounting.

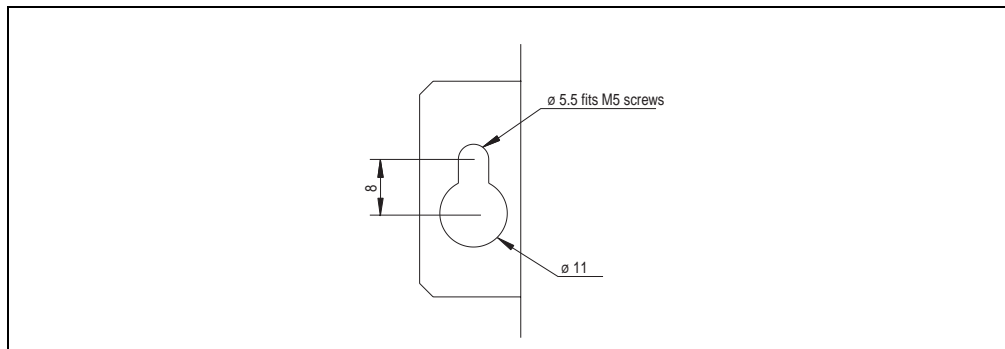


Figure 23: Mounting Plates UPS Charging Unit

The exact positioning of the mounting holes can be taken from the dimension diagram for each battery unit (see dimension diagram for the battery unit).

### 3.1 Cable Connection

The battery unit must be connected to the UPS with the connection cable included in the delivery. It is important to install the connection cable according to the guidelines shown in the following images.

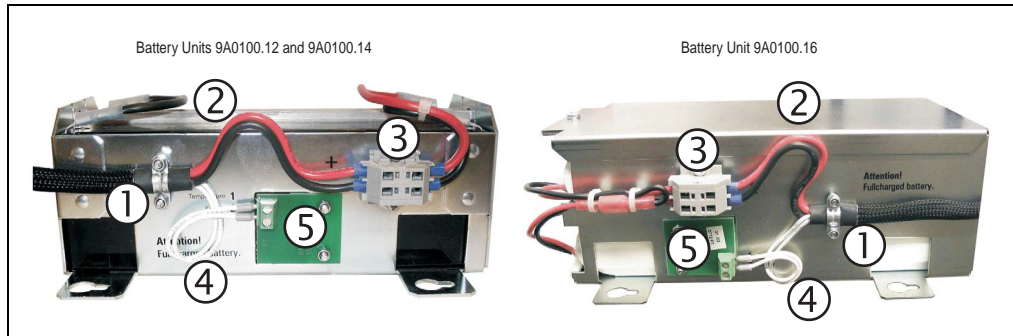


Figure 24: Cable Connection for Battery Units

#### 3.1.1 Procedure

- 1) Fasten the connection cable to the clamps on the battery unit (the two self-locking nuts require a 5.5 mm hex wrench).
- 2) Connect the battery cable (red and black leads) to terminal block (3) as shown in the above picture.
- 3) Connect the red lead of the battery cable to the position on the terminal block marked "+" and the black lead to the position marked "-" (you will need a small screwdriver).
- 4) Loop the temperature sensor cable (white leads) to the temperature sensor plate (5) as shown in the above picture.
- 5) Attach the temperature sensor cable to the temperature sensor plate on the terminal block (with a small screwdriver).

## 3.2 Mounting Orientation

The mounting orientations of the various battery units and replacement batteries will now be explained in more detail.

### 3.2.1 9A0100.12, 9A0100.13, 9A0100.14, 9A0100.15

#### Operation

Care must be taken that the battery cage is assembled so that rechargeable batteries are not installed upside down. They should be installed either right side up or lying on their side (see figure below). It is important that they are not subjected to excessive mechanical stresses such as vibrations and jolts. This would cause the lead plates inside the rechargeable battery to touch and reduce the number of cells and nominal voltage (additionally causing intensive heating due to internal short circuit currents).

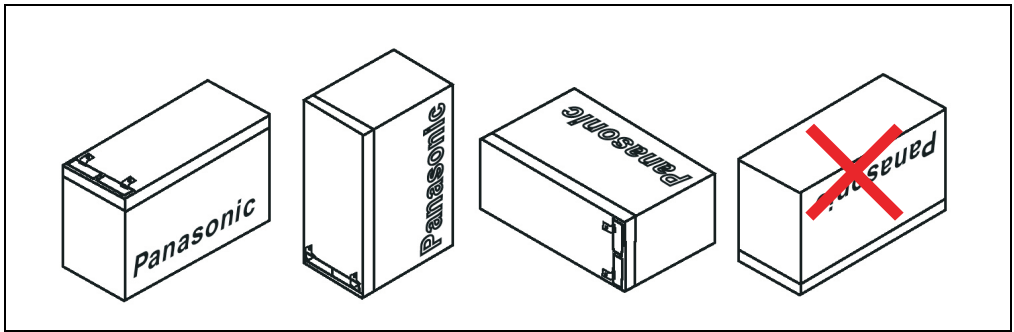


Figure 25: Mounting Methods for Lead-Acid Battery Units During Operation

#### Storage

The maintenance free battery units use a gel instead of liquid acid. This enables the batteries to be stored horizontally or vertically when not in use. The battery units should not be exposed to direct sunlight and/or be stored in a damp environment.

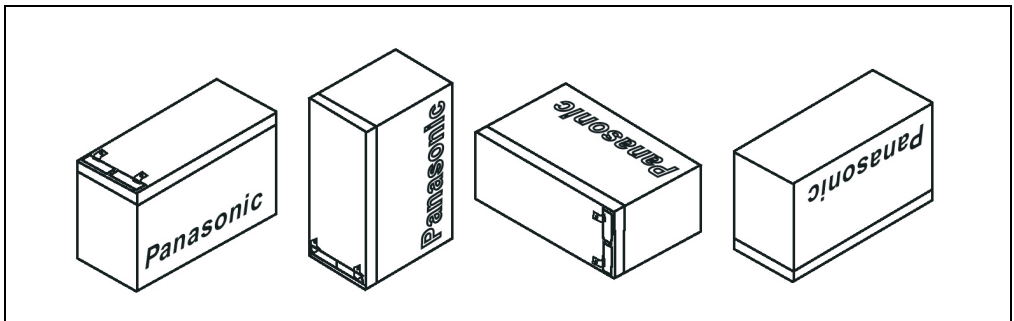


Figure 26: Mounting Methods for Lead-Acid Battery Units in Storage

### **3.2.2 9A0100.16, 9A0100.17**

#### **Operation and Storage**

Due to the unique construction of these batteries, they can be stored and operated in any position.

## Chapter 4 • Software

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### 1. B&R UPS Configuration Software

On operating systems Windows 95/98/ME/NT4.0/2000 and XP, the UPS parameters such as TWL, POT, LCS, SDT, etc., can be changed using this software. Proper shut down can also be guaranteed using these operating systems.

Before configuration can be started, the software must be installed and an operational UPS 24 VDC (9A0100.11) must be properly connected to the load system.


#### 1.1 Installation

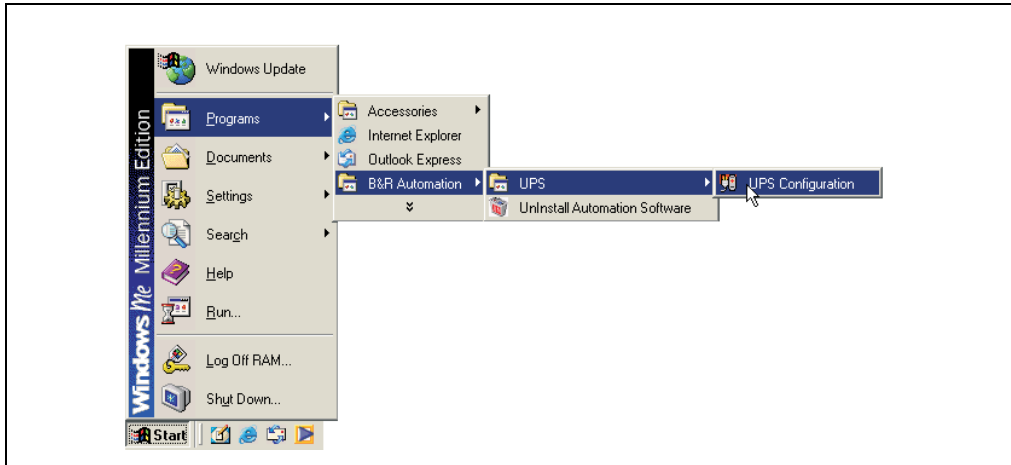
The B&R UPS Configuration Utility is found on the HMI Drivers & Utilities CD-ROM (Mod. No. 5S0000.01-090) starting with V1.40. Otherwise the software can be downloaded free of charge directly from the B&R homepage [www.br-automation.com](http://www.br-automation.com).

B&R UPS configuration software setup consists of 3 diskette images packed in a ZIP file. After unzipping the files, "setup.exe" (in path Disk1) must be started and further instructions followed.

## 1.2 Start

After the **standard installation** (accepting the recommended menu entries and installation path) the B&R UPS Configuration Software is started as follows:

- Click on **Start**  and select **Programs**.
- Then select **B&R Automation / UPS** and click on the program **UPS Configuration**:



Once started, an icon is added to the system tray. The tray icon represents the operation mode as shown here below:



	09:20	Configuration mode
	09:19	Monitoring Mode
	09:21	Connection Interrupted

Table 25: UPS - status indicator

## Information:

If the monitoring mode is enabled, the UPS tool automatically starts with Windows.

The following menu is displayed by right clicking on the icon in the system tray.

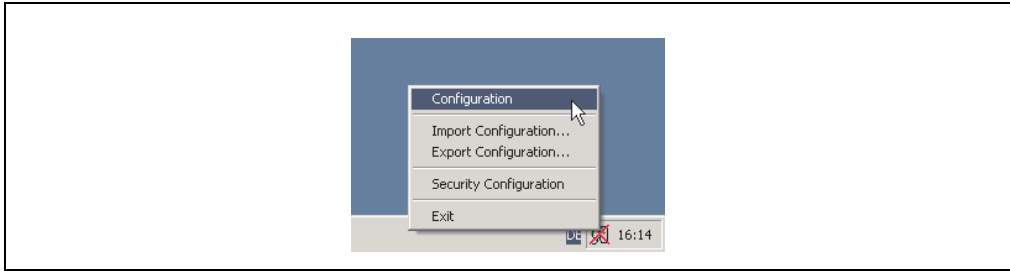


Figure 27: Tray menu selection

Selection	Description
<b>Settings</b>	This selection opens the configuration screen, where the UPS parameters can be read / edited and transferred to the UPS.
<b>Import Configuration...</b>	A previously saved configuration file (containing all UPS parameters) can be selected here. The parameters saved in this file are entered and imported to the B&R UPS configuration tool, but not transferred to the UPS.
<b>Export Configuration...</b>	Using this selection, the current UPS configuration can be exported to a file.
<b>Security Configuration</b>	This function is first implemented in B&R UPS Configuration Software version 1.20. More detailed information on this topic in Section "Security Configuration / Menu Language", on Page 66
<b>Exit</b>	This exits the B&R UPS Configuration Software. Exiting the software ends monitoring as well.

Table 26: Tray menu settings

## Caution!

**Starting the configuration software (select "configuration") ends all previously enabled monitoring services (UPS services from Windows NT4.0 / 2000 / XP). The load system is not monitored during configuration. Monitoring is enabled again as soon as the configuration screen is closed ("OK" button).**

### 1.3 Uninstall

The following procedure must be followed to remove the B&R UPS Configuration Software from the hard drive: Start the uninstall wizard.

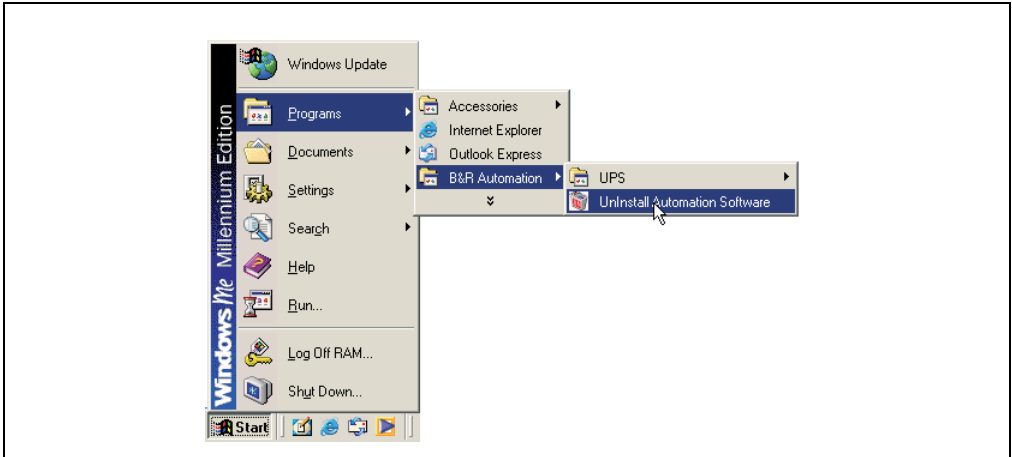


Figure 28: Uninstall

Once the uninstall wizard has been started, all installed B&R software (e.g. B&R Automation Studio™) is displayed: The programs to be removed can now be selected from the following dialog box. If the B&R UPS Configuration Software is the only program installed, then it is the only one which can be selected.

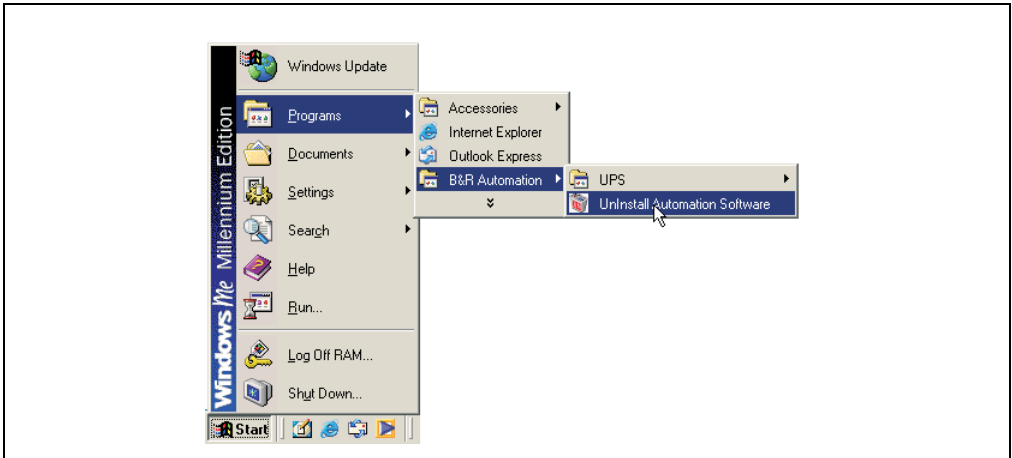


Figure 29: Uninstall wizard selection

The software is then removed by clicking "OK".

## 1.4 Construction

The B&R Configuration Software is divided into the following 5 tabs:

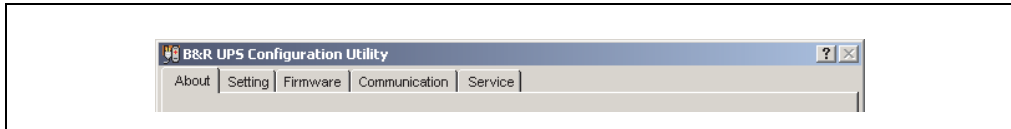


Figure 30: Overview of tabs

The individual tabs can be selected by either clicking on the name of the tab or setting the focus (using the TAB key) on "About" and using the arrow keys (right / left). Each tab is explained in detail in the following pages.

There are buttons at the bottom of the window:

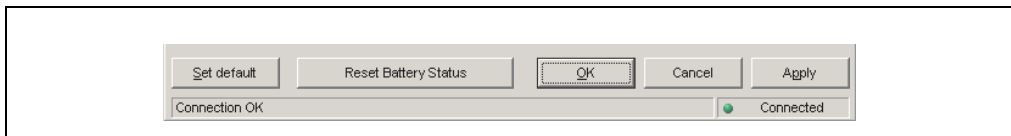


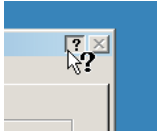
Figure 31: Standard buttons

These buttons are explained here below:

Selection	Description
Default values	Sets all UPS parameters to default values: TWL = 10 seconds, SDT = 5 min, POT = 2 min, LCS = 800 mA, CTS = notification at first or cyclic = 5 seconds or 60 seconds, minutes with battery until shutdown = 2 min. The settings are not transferred to the UPS.
Reset Battery Status	This button is first integrated in UPS Configuration Software version 1.22. Additionally, the UPS firmware version in use must be $\geq 2.10$ . This button only appears if the connected battery unit failed the measurement of the charge maintenance current (more detailed information in Section "Measurement of the Charge Maintenance Current", on Page 97). Pushing this button sets the results of the measurement of the charge maintenance current for BCR and RBS to "Battery OK" status, and the button disappears.  <b>Caution!</b> <b>Pushing this button does not guarantee secure operation of the UPS. The battery unit could be defective.</b>
OK	Transfers all parameters to the UPS and the parameter window is minimized into the system tray. In the event that a UPS service provided by the operating system (can be enabled on Win NT4.0, Win 2000 and WinXP) was enabled, then it is restarted and the UPS configuration program is closed.
Cancel	The parameter window is minimized in the system tray without transferring the parameters to the UPS. In the event that a UPS service provided by the operating system (can be enabled on Win NT4.0, Win 2000 and WinXP) was enabled, then it is restarted and the UPS configuration program is closed.
Apply	Updates all settings and transfers the set parameters to the UPS.

Table 27: Standard button functions

## Software Help



"Tool Tips" can be enabled by first clicking on the "?" in the upper right part of the window then on an input area or information text. This is also used as a quick and easy way to display the value ranges for time settings. See Table 28 "Tool Tips example".

--	--

Table 28: Tool Tips example

## 1.5 Tab Descriptions

### 1.5.1 "About" Tab

Software version and copyright information are shown on this page.

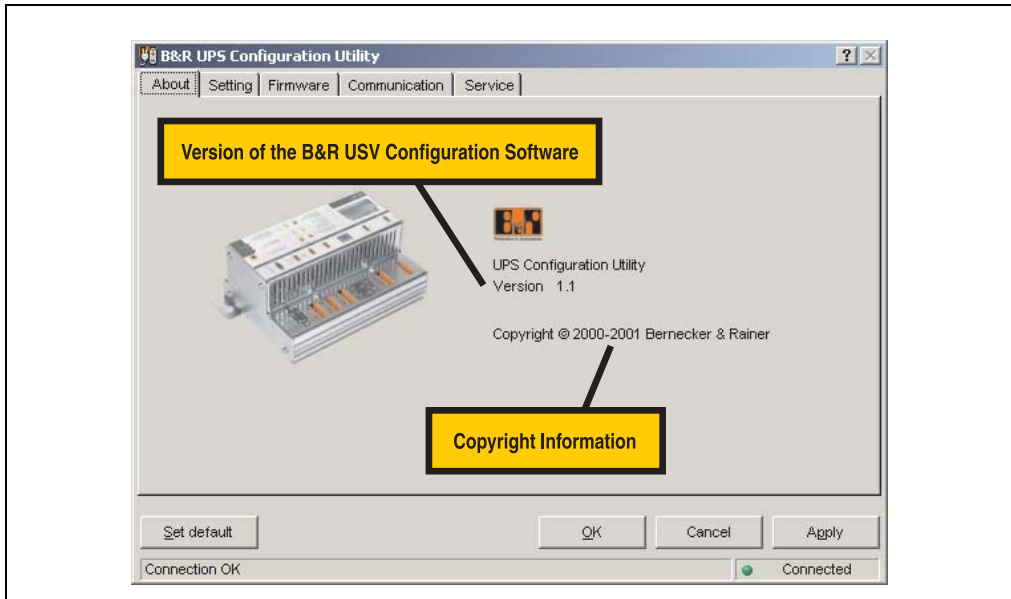


Figure 32: "About" tab description

### 1.5.2 "Settings" tab description

The main B&R UPS parameters can be configured on this page.

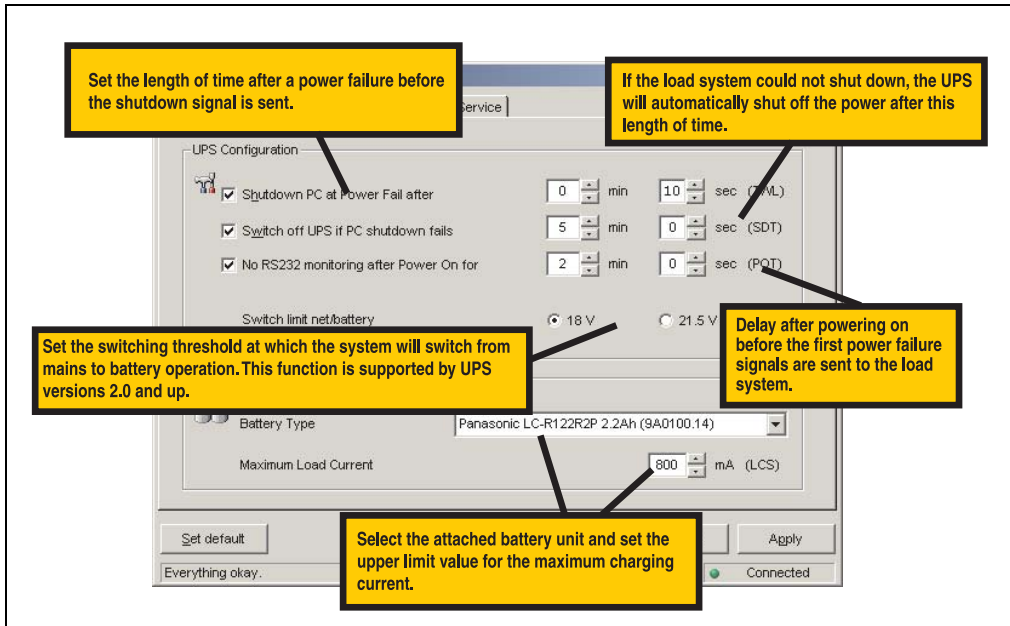


Figure 33: "Settings" tab description

### 1.5.3 "Firmware" Tab

This page offers information about the latest B&R UPS firmware. The creation date and firmware version are displayed here.

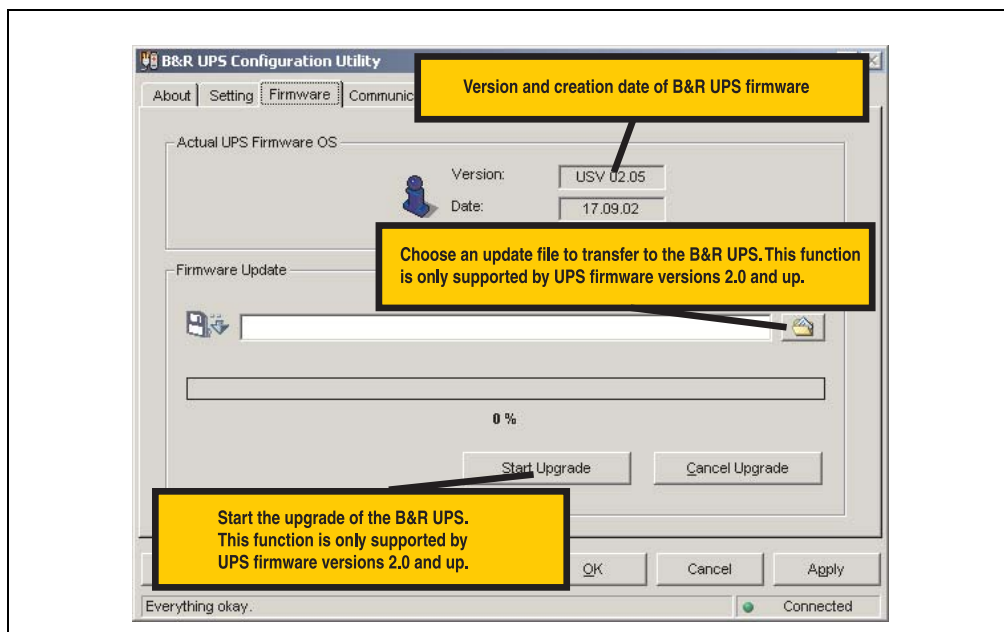


Figure 34: "Firmware" tab description

This B&R UPS operating system can be updated starting with UPS firmware version  $\geq 2.0$ . The B&R UPS Configuration Software function is not provided if a UPS firmware version  $< 2.0$  is detected.

## Caution!

The UPS firmware cannot be upgraded with the load system. Instead, this must be done on a PC which is not supplied by the UPS (e.g. a laptop).

The following message appears after selecting an upgrade file and successfully completing the upgrade:

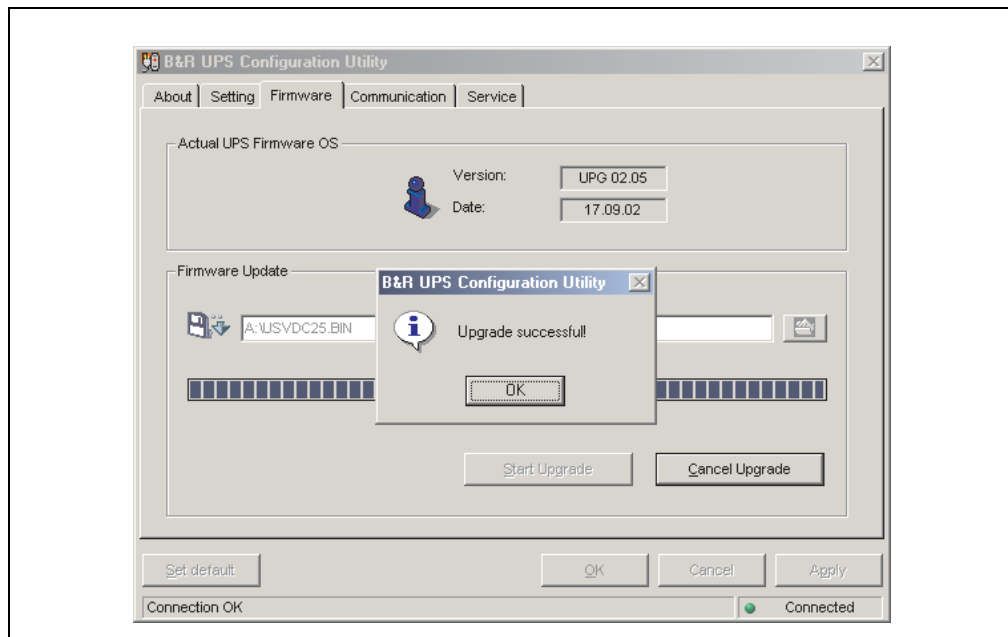


Figure 35: Upgrade successful

The UPS Configuration Software is restarted after clicking "OK" .

The UPS parameters set before the upgrade (e.g. TWL, SDT, POT, etc.) are the same after a firmware upgrade.

### 1.5.4 "Communication" Tab

The COM port used for the UPS is defined on this page.

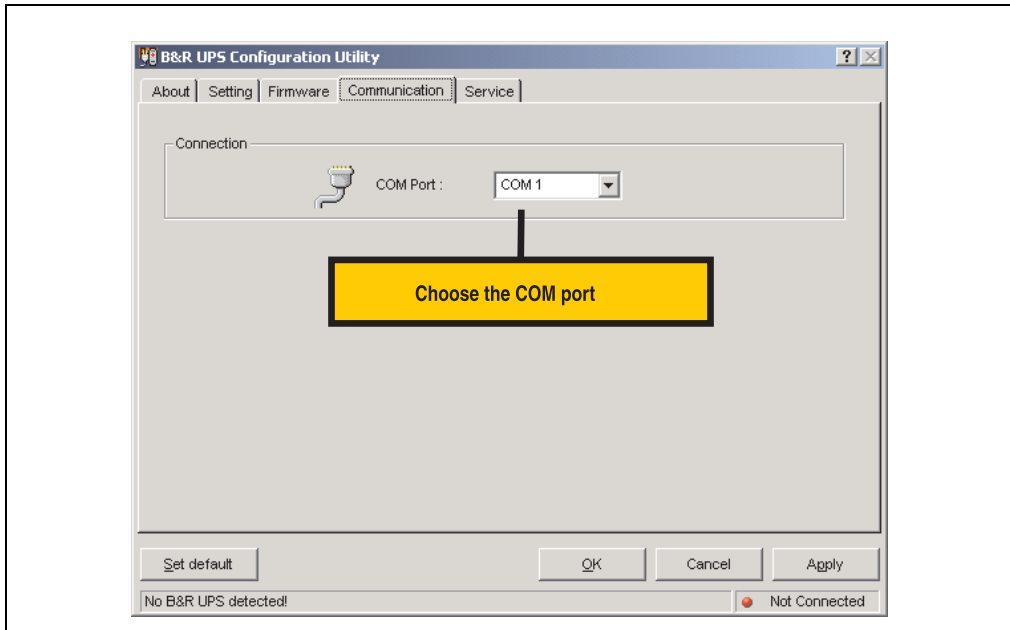


Figure 36: "Communication" tab description

### Information:

Take note that operation of a B&R UPS 24 VDC using COM3 and COM4 on a B&R interface card (5A5000.01, 5A5000.02, 5A5000.05, 5A5000.06) is not possible because of the pin assignments. These interfaces are combined RS232/422 interfaces and do not have the handshake lines required by the UPS service.

### 1.5.5 "Service" Tab

The B&R UPS Configuration Software can also be set to monitor the load system and automatically shut it down. The settings are made under the "service" tab and are described in detail in the following pages. This is only visible or active if there is no UPS service simultaneously enabled on the operating system (on Windows NT4.0/2000/XP).

## Information:

On Windows NT4.0/2000/XP, the UPS services provided by the operating system can also be used for monitoring, see Section "Monitoring using Windows NT4.0 with Operating System UPS Service", on Page 71, Section "Monitoring using Windows 2000 with Operating System UPS Service", on Page 72 and Section "Monitoring using Windows XP with Operating System UPS Service", on Page 75.

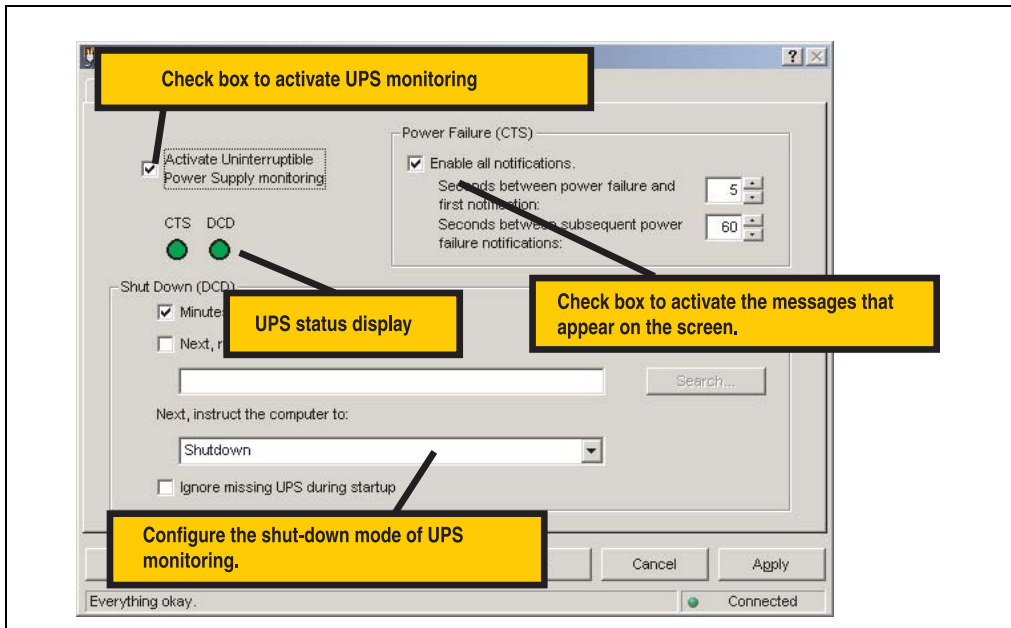


Figure 37: "Service" tab description

On Windows NT4.0, monitoring using the B&R UPS Configuration Software has a few limitations:

## Information:

**Remote shutdown of the UPS does not work with Windows NT (the UPS always switches itself off after the SDT time).**

**The Restart button cannot be hidden in Windows NT. The load system restarts when the Restart button is pressed before the SDT time has expired and the UPS has shut down, although the supply voltage may not yet be available.**

The limitations do not apply when using the UPS services provided by the operating system (see Section "Monitoring using Windows NT4.0 with Operating System UPS Service", on Page 71).

### 1.6 Load System Monitoring

This section applies to operating systems Windows 95/98/ME/NT4.0/2000/XP. On Windows NT4.0, Windows 2000 and Windows XP, the UPS services provided by the operating system can also be set for monitoring. For information on those settings: See sections "Monitoring using Windows NT4.0 with Operating System UPS Service", on Page 71, "Monitoring using Windows 2000 with Operating System UPS Service", on Page 72, and "Monitoring using Windows XP with Operating System UPS Service", on Page 75.

Otherwise it is assumed that an operational UPS is connected to the load system.

## 1.6.1 Monitoring on Windows 95/98/ME/NT4.0/2000/XP

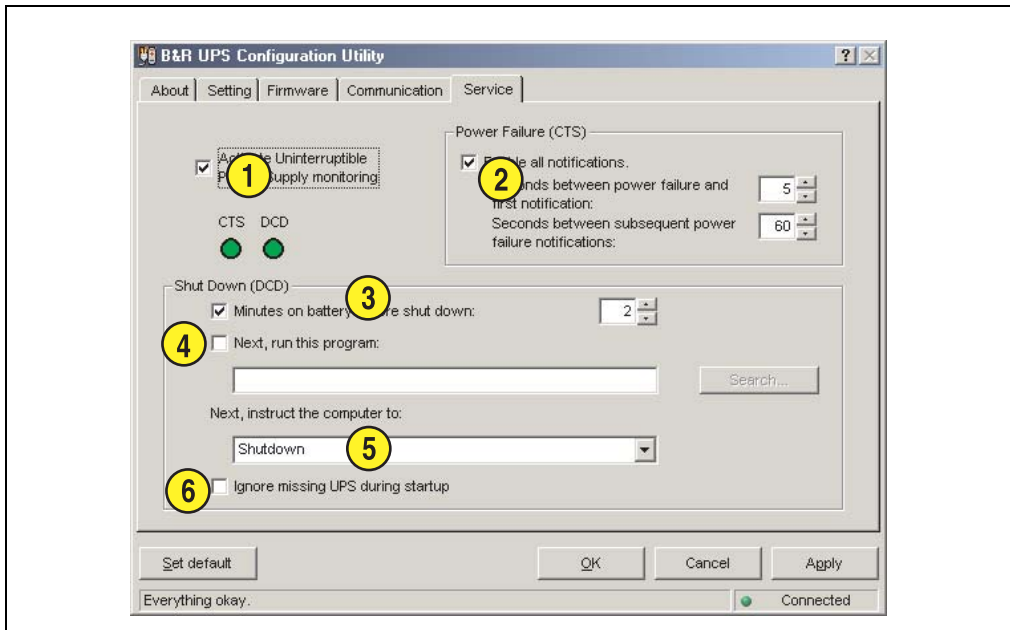


Figure 38: Monitoring settings

### 1 Activate Uninterruptible Power Supply monitoring

Clicking on "Activate Uninterruptible Power Supply monitoring", selects the UPS monitoring on the interface which is defined under the "Communication" tab.

## Information:

If this box is not selected, the remaining options on the "Service" tab cannot be selected or changed.

UPS monitoring is activated by clicking "OK" or "Apply". An error message appears if there is no UPS which is operational and correctly connected to the defined interface (in this case e.g., COM1).

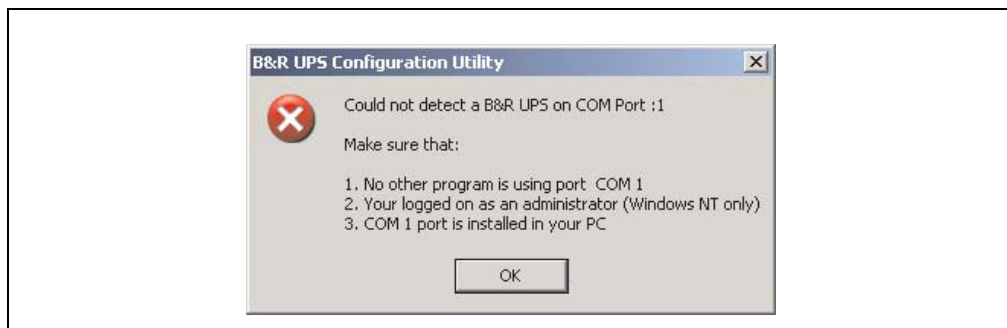


Figure 39: Error message "No UPS found"

**2****Power Failure (CTS)**

If this option is selected, a warning message is given as soon as the load system is powered by the UPS.



Figure 40: Power failure message

The number of seconds which the load system is powered by the UPS until the warning message is displayed and/or how many seconds until another warning message is displayed can be set.

**3****Shutdown (DCD)**

Battery operation time in minutes until shutdown. This option must be selected for the function "Next, run this program", "Next, instruct the computer to" and "Ignore missing UPS during startup" to be selected. Otherwise, these functions are not available.

A message box appears if a shut down command is received from the UPS:



Figure 41: Shut down signal message

If this option is selected, the program waits for a set amount of time for the next action in the shut down cycle to continue.

After this time has expired, the following error message is given:



Figure 42: UPS start shut down message

This message is only given if the options "Enable all notifications" under "Power Failure (CTS)" and "Minutes on battery before shut down" are selected, the corresponding set time has expired and "shut down" has been selected as shut down option.

**4****Next, run this program**

A program can be specified here which is to be executed as soon as the set time for "Minutes on battery before shut down" expires.

Clicking the "Search..." button opens a dialog box where a program can be selected (\*.bat, \*.exe, \*.com, \*.cmd).

The command file must be executed in less than 30 seconds. If the execution of the command file is cancelled or if the 30 seconds have past, the load system is shut down.

This option is only available if "Minutes on battery before shut down" is selected.

## Warning!

**It is recommended to only allow programs to be executed which change their process ID after starting. These are usually all batch files or notepad. For example, Windows Explorer is not recommended!**

**5**

### Next, instruct the computer to

A shut down option is selected here. This option is only available if "Minutes on battery before shut down" is selected.

The following options are available:

- No action
- Shutdown
- Force shut down

Selection	Description
No action	The B&R UPS Configuration Software will <b>not</b> initiate a shut down of the load system. Shutdown must be initiated by an application program.
Shutdown	<p>The B&amp;R Configuration Software initiates the shut down of the load system. An attempt is made to safely end all running programs. Using this option, an application program can react to the shut down command and save all unsaved data.</p> <p><b>The shut down will not proceed if a program cannot be terminated.</b></p>
Force shut down	<p>Using this option, the B&amp;R UPS Configuration Software ends all programs and initiates shut down. An application program cannot react to the shut down when using this option. Therefore, any unsaved data will be lost.</p> <p><b>This option guarantees that the operating system executes a complete shut down!</b></p>

Table 29: Shut down options

**6**

### Ignore missing UPS during startup

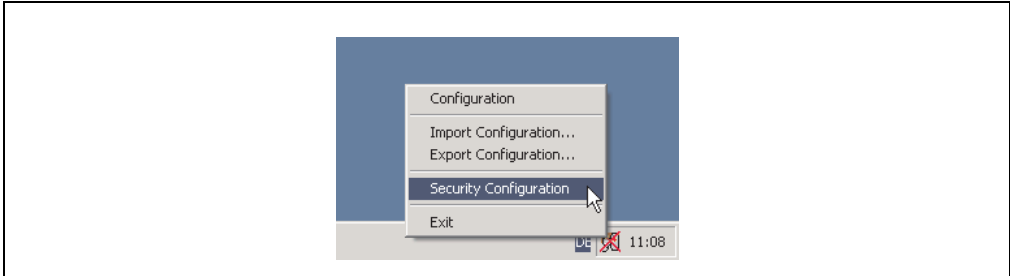
This function is first implemented in B&R UPS Configuration Software version 1.21. If this function is activated, a missing or defective UPS is ignored the first time the operating system is started and shutdown is not initiated.

**In this case the load system is not protected against a power failure.**

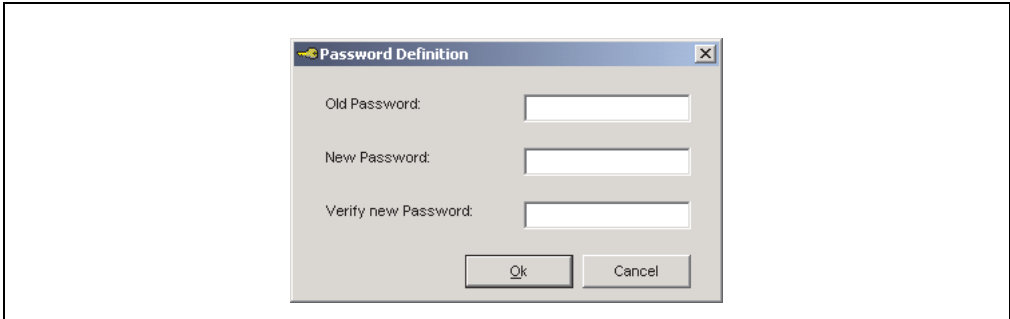
## 1.7 Security Configuration / Menu Language

The B&R Configuration Software function can be used to ensure that an undesired termination of the B&R UPS Configuration Software or undesired changes to the UPS parameters are prevented.

Right clicking on the icon in the system tray opens the following menu. Selecting "Security Configuration" from this menu enables you to change the safety settings for the B&R UPS Configuration Software or to change the language of the B&R Configuration Software (German - English).



The user is prompted to set a password the first time this function is used:



Configurations can be made once a password has been set:

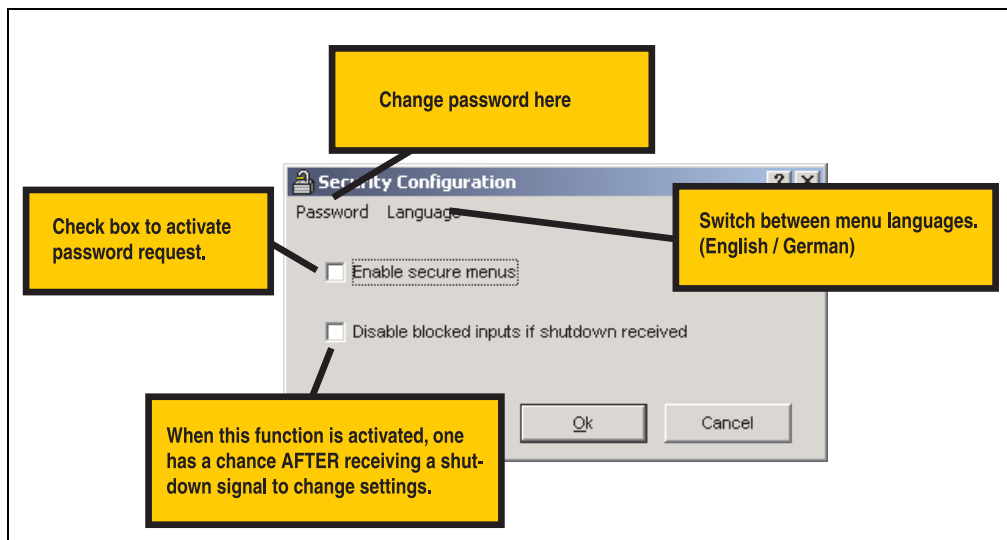


Figure 43: Description of security configuration

### 1.7.1 Menu Functions

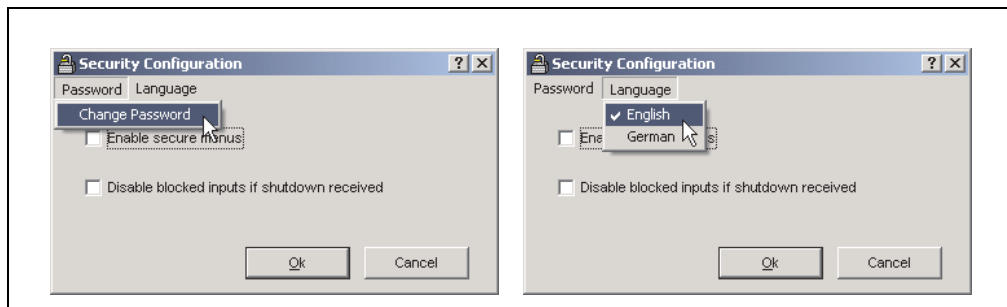


Figure 44: Safety menu functions

## Information:

If the language is changed, the B&R UPS Configuration Software must be closed and restarted for the changes to become effective.

## 1.8 Warnings

If the system is being monitored by B&R UPS Configuration Software, warnings are displayed on the monitor that correspond to errors that occur.

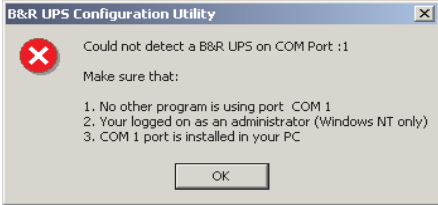
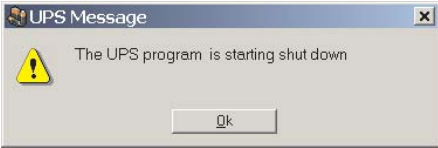
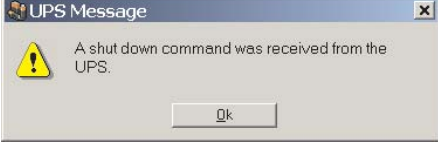


Warning Displayed	Explanation	Repair / Remedy
	<p>No operable, correctly connected UPS was found on the selected COM interface.</p> <p>The warning is only displayed at startup or when transferring the set parameters to or from the B&amp;R Configuration Software.</p>	<p>Check COM Settings</p> <p>Check UPS Connections</p>
	<p>The UPS starts when the load system is shut down.</p> <p>This warning is only displayed in UPS monitoring mode.</p>	<p>Check UPS power supply.</p>
	<p>A shutdown signal was sent from the UPS to the B&amp;R UPS Configuration Software.</p> <p>This warning is only displayed in UPS monitoring mode.</p>	<p>Check UPS power supply.</p>
	<p>A power failure occurred. The load system is now supplied by the battery unit connected to the UPS.</p> <p>This warning is only displayed in UPS monitoring mode.</p>	<p>Check UPS power supply.</p>
	<p>The measurement of the charge maintenance current determined that the quality of the connected battery unit is insufficient for proper UPS operation.</p> <p>This warning is only displayed in when starting the B&amp;R Configuration Software.</p>	<p>Check battery unit.</p>

Table 30: UPS Configuration Software Warnings







Warning Displayed	Explanation	Repair / Remedy
	<p>The measurement of the charge maintenance current determined that the quality of the connected battery unit will soon be insufficient for proper UPS operation.</p> <p>This warning is only displayed in when starting or while operating the B&amp;R Configuration Software.</p>	Check battery unit.
	<p>The measurement of the charge maintenance current determined that the quality of the connected battery unit is no longer sufficient for proper UPS operation.</p> <p>This warning is only displayed in UPS monitoring mode.</p>	Check battery unit.
	<p>A short power interruption has occurred, and power was restored before the TWL had elapsed.</p> <p>This warning is only displayed in UPS monitoring mode.</p>	Check UPS power supply.
	<p>No operable, correctly connected UPS was found on the selected COM interface.</p> <p>This warning is only displayed in when starting the B&amp;R Configuration Software.</p>	Check COM Settings Checking the UPS Connections
	<p>The idle voltage measurement determined that the quality of the connected battery unit is no longer sufficient for proper UPS operation.</p> <p>This warning is only displayed in UPS monitoring mode.</p>	Check battery unit.
	<p>The temperature measurement has determined that the temperature of the connected battery unit is outside the specified range.</p> <p>If the temperature of the battery unit is above or below the limit for 5 minutes, while in operation, the UPS starts the controlled shutdown of the load system to prevent damage to the battery unit.</p> <p>This warning is only displayed in when starting the B&amp;R Configuration Software.</p>	Check temperature of battery unit.

Table 30: UPS Configuration Software Warnings (cont.)

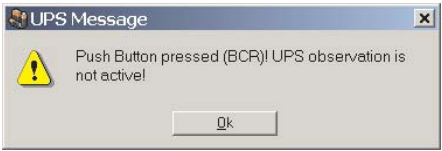


Warning Displayed	Explanation	Repair / Remedy
	<p>This notice appears when the user button or a button connected to the UPS externally has been pressed.</p> <p>This warning is only displayed in when starting the B&amp;R Configuration Software.</p>	-
	<p>The temperature measurement has determined that the temperature of the connected battery unit is outside the specified range.</p> <p>If the temperature of the battery unit is above or below the limit for 5 minutes, while in operation, the UPS starts the controlled shutdown of the load system to prevent damage to the battery unit.</p> <p>This warning is only displayed in UPS monitoring mode.</p>	Check temperature of battery unit.
	<p>The idle voltage measurement determined that the quality of the connected battery unit is no longer sufficient for proper UPS operation.</p> <p>This warning is only displayed in when starting the B&amp;R Configuration Software.</p>	Check battery unit.

Table 30: UPS Configuration Software Warnings (cont.)

## 2. Monitoring using Windows NT4.0 with Operating System UPS Service

The UPS service provided by the operating system can also be used for monitoring with Windows NT4.0.

Go to Start - Settings - Control Panel - UPS

The settings must match with those in the following figure (select the COM port on which the UPS is connected):

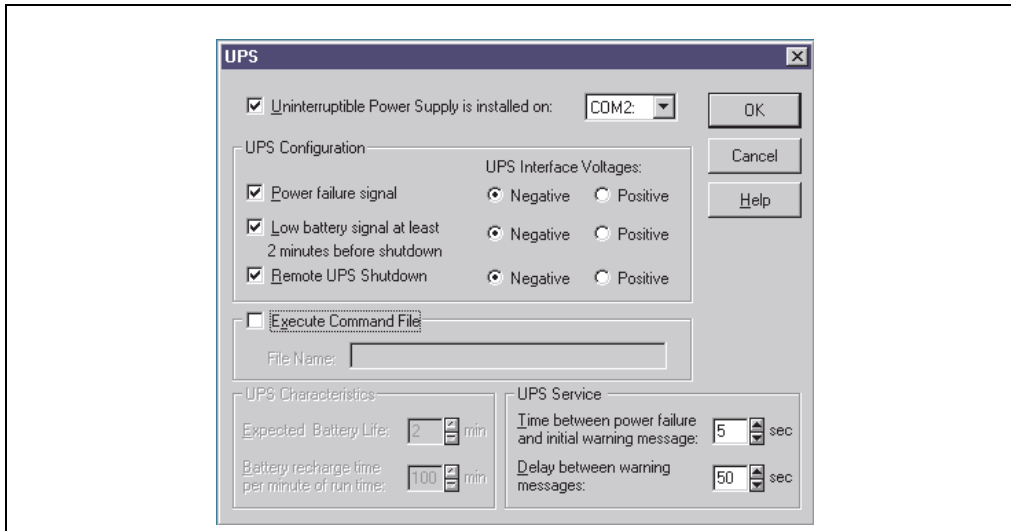


Figure 45: UPS Settings in Windows NT

A program which is to be executed immediately before the system is shut down can also be specified using the "Execute Command File" option.

### Information:

The UPS service warning message which indicates that there is a power failure is only supported by Windows NT if a network card and driver are installed on the load system (e.g. B&R IPC), and a network service is running.

### Information:

Take note that operation of a B&R UPS 24 VDC using COM3 and COM4 on a B&R interface card (5A5000.01, 5A5000.02, 5A5000.05, 5A5000.06) is not possible because of the pin assignments. These interfaces are combined RS232/422 interfaces and do not have the handshake lines required by the UPS service.

### 3. Monitoring using Windows 2000 with Operating System UPS Service

The UPS service provided by the operating system can also be used for monitoring with Windows 2000.

Go to Start - Settings - Control Panel - Power Options - UPS

A manufacturer can be selected under the UPS tab.

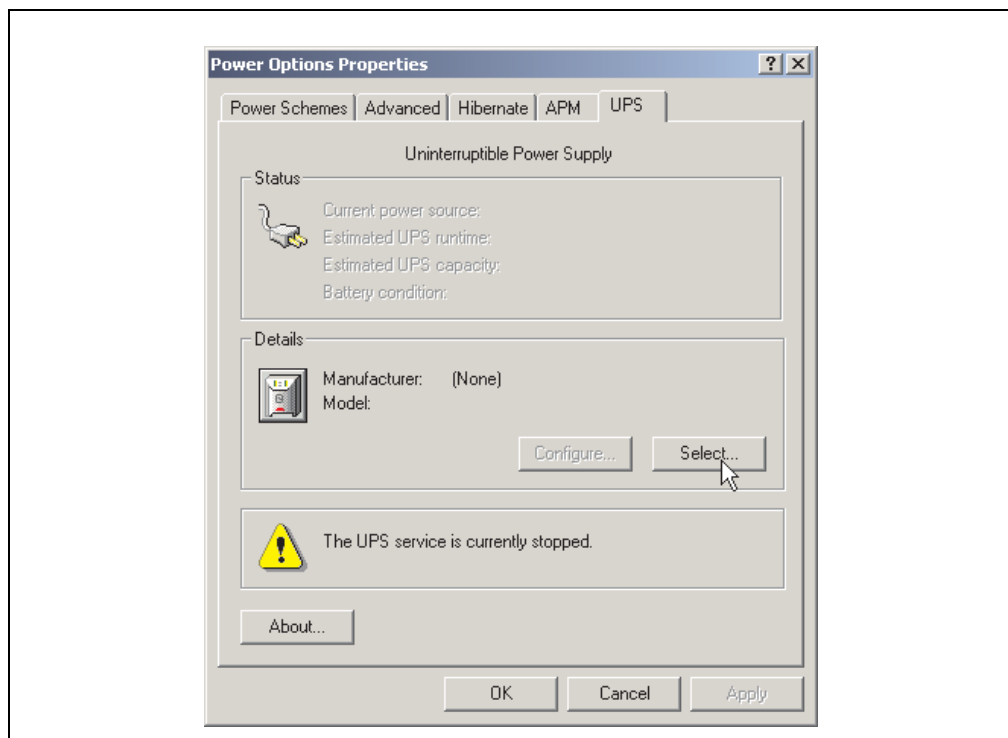


Figure 46: UPS - Windows 2000 settings - Manufacturer

A generic UPS must be selected as manufacturer and the model must be set to "Custom":

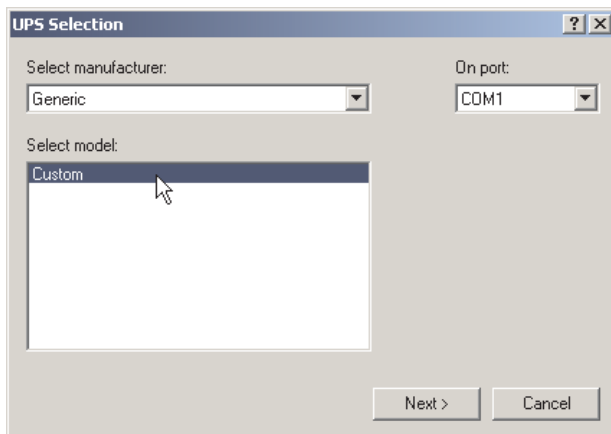


Figure 47: UPS - Windows 2000 settings - Type

## Information:

Take note that operation of a B&R UPS 24 VDC using COM3 and COM4 on a B&R interface card (5A5000.01, 5A5000.02, 5A5000.05, 5A5000.06) is not possible because of the pin assignments. These interfaces are combined RS232/422 interfaces and do not have the handshake lines required by the UPS service.

After clicking the "Next >" button, a window is opened where signal lines for the UPS must be configured. The B&R UPS should be configured as follows:

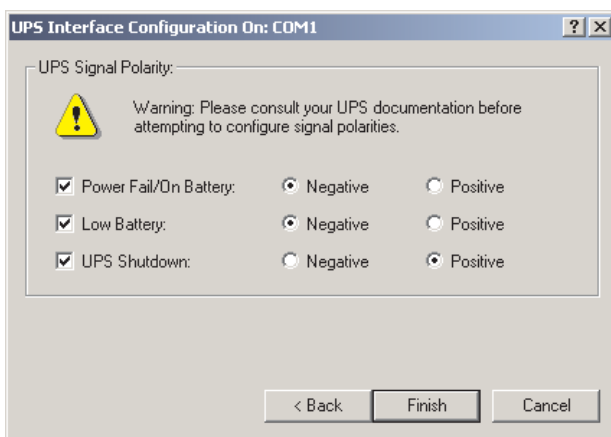


Figure 48: UPS - Windows 2000 settings - Signal Polarity

## Information:

Remote shutdown of the UPS with the default Windows 2000 UPS service does not work (the UPS always switches itself off after the SDT time).

After the settings are confirmed by clicking the "Finish" button, the user is returned to the main configuration window. A few parameters can be changed there by clicking the "Configure..." button. A program which is to be executed immediately before shut down can also be specified by selecting the "When the alarm occurs, run this program:" option.

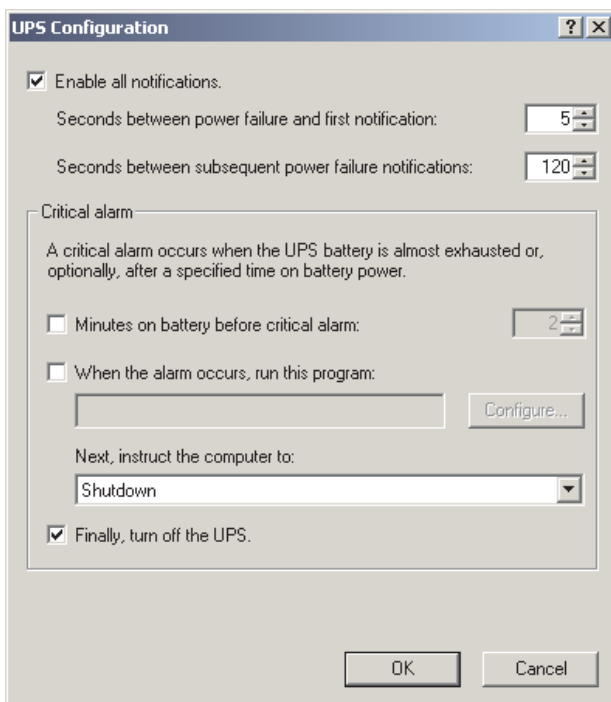


Figure 49: UPS - Configuration dialog box in Windows 2000

## 4. Monitoring using Windows XP with Operating System UPS Service

The UPS service provided by the operating system can also be used for monitoring with Windows XP.

Go to Start - Settings - Control Panel - Power Options - UPS

A manufacturer can be selected under the UPS tab.

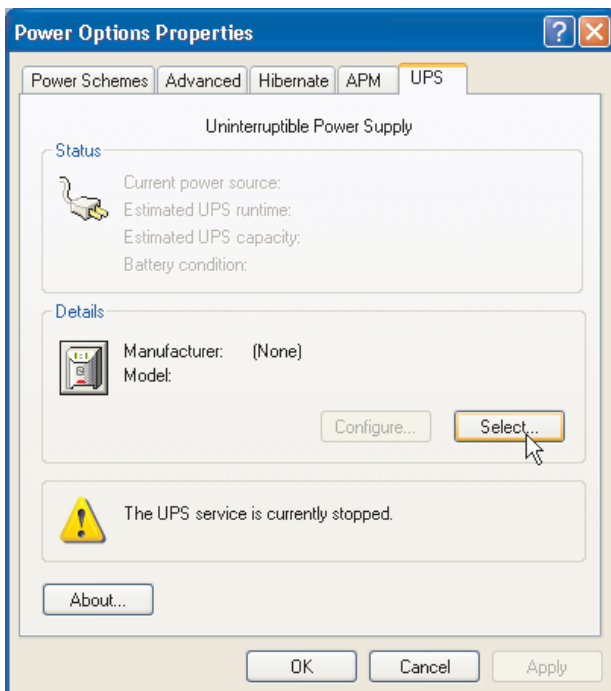


Figure 50: UPS - Windows XP settings - Manufacturer

A generic UPS must be selected as manufacturer and the model must be set to "Custom":

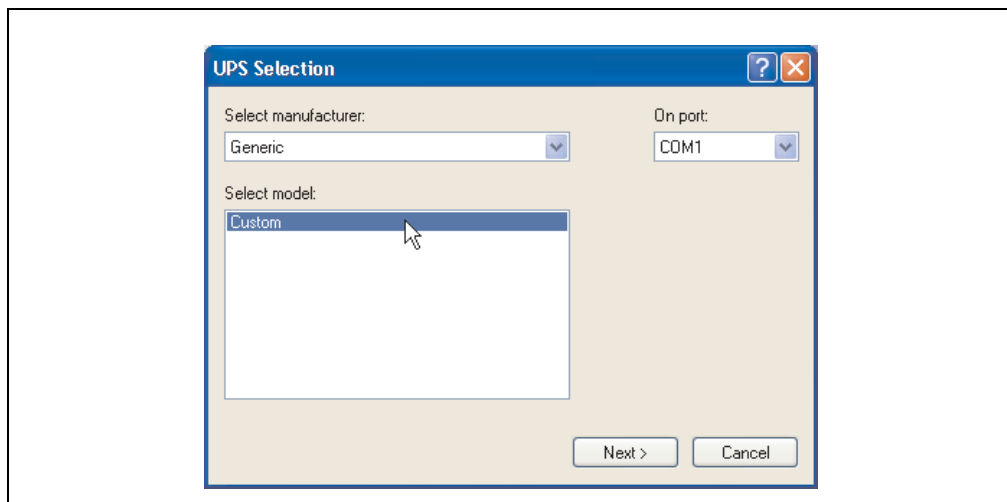


Figure 51: UPS - Windows XP settings - Type

## Information:

Take note that operation of a B&R UPS 24 VDC using COM3 and COM4 on a B&R interface card (5A5000.01, 5A5000.02, 5A5000.05, 5A5000.06) is not possible because of the pin assignments. These interfaces are combined RS232/422 interfaces and do not have the handshake lines required by the UPS service.

After clicking the "Next >" button, a window is opened where signal lines for the UPS must be configured. The B&R UPS should be configured as follows:

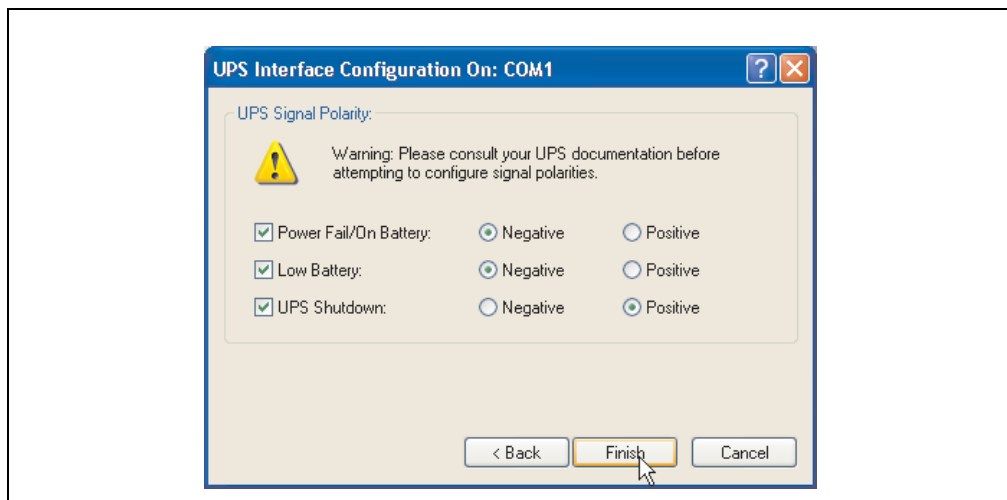


Figure 52: UPS - Windows XP settings - Signal Polarity

## Information:

Remote shutdown of the UPS with the default Windows XP UPS service does not work (the UPS always switches itself off after the SDT time).

After the settings are confirmed by clicking the "Finish" button, the user is returned to the main configuration window. A few parameters can be changed there by clicking the "Configure..." button. A program which is to be executed immediately before shut down can also be specified by selecting the "When the alarm occurs, run this program:" option.

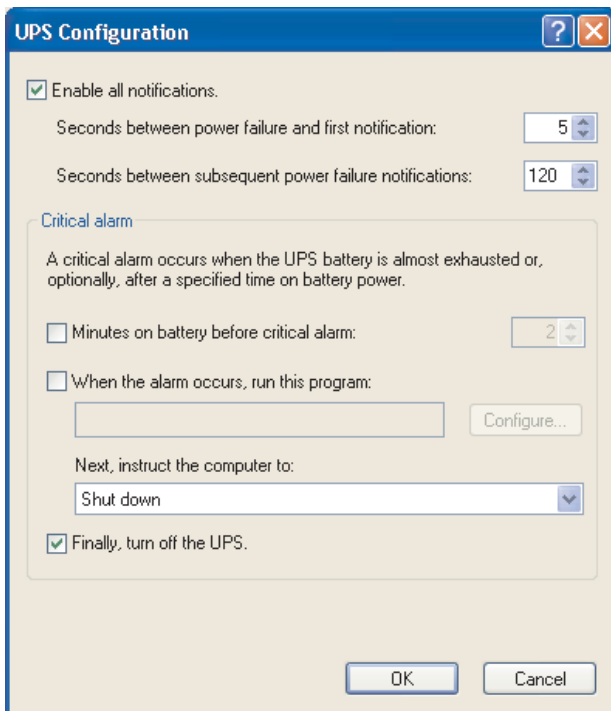


Figure 53: UPS - Configuration dialog box in Windows XP

## 5. Configuring the UPS using HyperTerminal

Various operating parameters can be manually set on the UPS via the serial interface. A standard terminal program is all that is needed (e.g. the "HyperTerminal" program included with Windows) which must be configured as follows:

Approach	Value
COM Port	The COM port where the UPS is installed
Bits per Second	19200 bps
Data Bits	8
Parity	None
Stop bits	1
Flow Control	None

Table 31: Terminal program settings

The setting could look like the following examples for Windows 2000 and Windows XP:

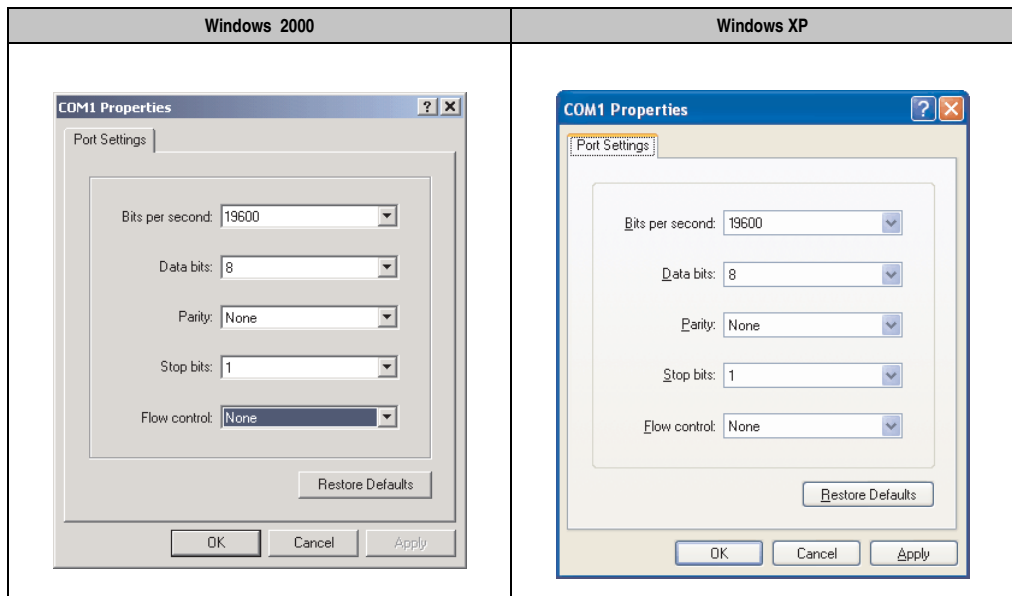


Table 32: Example - HyperTerminal Configuration in Windows 2000 and Windows XP for COM1

If the connection is made with these settings, the respective values can be changed using the following commands. It is not necessary to restart the UPS for the new settings to be effective.

## Information:

It is **NOT** possible to communicate with the UPS via the RS232 interface if a monitoring service is activated on the corresponding load system (using either B&R UPS Configuration Software or using Windows UPS service driver from Windows NT4.0/2000/XP)! If you want to make the UPS settings via the serial interface while the UPS is in operation, the UPS service must be closed then activated again!

All possible commands for the UPS and the UPS return values are described in detail on the following pages. When programming a monitoring program, the additional detailed description is important. Therefore, the special characters (space, carriage return, and line feed) are shown as follows:

Character	Meaning in English	Meaning in German	Hex value
<SP>	Space	Space	20
<CR>	Carriage Return	Carriage Return	0D
<LF>	Line Feed	Line Feed	0A

Table 33: Definition of UPS symbols

## 5.1 Detecting the UPS Operating Mode

Firmware	Command Supported
Version < 2.0	Yes
Version ≥ 2.0	Yes

The command sequence "@#" is used to read the current operating mode of the UPS. If it returns "err02", the UPS is currently in monitoring mode. If it returns "err000", the UPS is currently in update mode (firmware update). If a response is not received, it is assumed that the UPS is not connected to the load system.

### 5.1.1 Command Sequence

**Sending from the load system:**

```
@#<CR><LF>
```

**Response from UPS:**

The following response is sent if the UPS is in monitoring mode:

```
err02<CR><LF>
```

The following response is sent if the UPS is in update mode:

```
err000<CR><LF>
```

## 5.2 Read UPS Parameters

The following commands can be used to determine which parameters are set on the UPS using HyperTerminal, according to the firmware version.

Firmware	Command
Version < 2.0	#
Version ≥ 2.0	#READ
Version ≥ 2.10	#RHDM (Read High-grade Discharge Measurement Status)

The UPS returns the following values (sample values) after confirming the command with "ENTER" according to the firmware version:

### 5.2.1 UPS Firmware < 2.0

Firmware version < 2.0 with command "#"

TWL = 10  
SDT = 281  
LCS = 300  
POT = 120

### Command Sequence

**Sending from the load system:**

```
#<CR><LF>
```

**Response from UPS:**

The values listed here are sample values.

```
invalid<SP>command<CR><LF>
TWL<SP>=<SP>10<CR><LF>
SDT<SP>=<SP>300<CR><LF>
LCS<SP>=<SP>310<CR><LF>
POT<SP>=<SP>120<CR><LF>
```

The length of the response frame is variable. The minimum answer frame length is 59 bytes.

### 5.2.2 UPS Firmware >= 2.0

Firmware version >= 2.0 with command **"#READ"**

The command can be entered and transmitted in either upper or lower case letters.

TWL	= 0010
LCS	= 0281
SDT	= 00300
POT	= 0120
PFL	= 180
CTL	= 0000
CTH	= 0040
TMP	= 00xx ... returns the current temperature of the battery unit
AGE	= 0005

#### Command Sequence

**Sending from the load system:**

```
#READ<CR><LF>
```

**Response from UPS:**

The values listed here are sample values.

```
TWL<SP>=<SP>0010<CR><LF>
LCS<SP>=<SP>0281<CR><LF>
SDT<SP>=<SP>00300<CR><LF>
POT<SP>=<SP>0120<CR><LF>
PFL<SP>=<SP>180<CR><LF>
CTL<SP>=<SP>0000<CR><LF>
CTH<SP>=<SP>0040<CR><LF>
TMP<SP>=<SP>0025<CR><LF>
AGE<SP>=<SP>0005<CR><LF>
```

The response frame has a fixed frame length of 104 bytes. It is also possible to read the UPS parameters TWL, SDT, LCS, and POT with the command "#".

### 5.2.3 USV Firmware >= 2.10

Firmware version  $\geq$  2.10 with command "#RHDM"

The command can be entered and transmitted in either upper or lower case letters.

```
DIB      =0000
LTL      =0001
CCD      =10000
RCL      =1000
RCH      =1000
RBS      =0000
```

#### Command Sequence

##### Sending from the load system:

```
#RHDM<CR><LF>
```

##### Response from UPS:

The values listed here are sample values.

```
DIB<SP>=<SP>0000<CR><LF>
LTL<SP>=<SP>0001<CR><LF>
CCD<SP>=<SP>10000<CR><LF>
RCL<SP>=<SP>1000<CR><LF>
RCH<SP>=<SP>1000<CR><LF>
RBS<SP>=<SP>0000<CR><LF>
```

The response frame has a fixed frame length of 104 bytes. It is also possible to read the UPS parameters TWL, SDT, LCS and POT with the command "#", and the UPS parameters TWL, LCS, SDT, POT, PFL, CTL, CTH, TMP, AGE with the command "#READ".

### 5.2.4 BCR (Battery Change Request)

The battery charging status, which is provided from the idle voltage measurement, can be requested using this command.

Firmware	Command Supported
Version < 2.0	No
Version ≥ 2.0	Yes

#### Command Sequence

##### Sending from the load system:

The command can be entered and transmitted in either upper or lower case letters.

```
#BCR?<CR><LF>
```

##### Response from UPS:

```
STAT<SP>=<SP>x<CR><LF>
CMIN<SP>=<SP>068<CR><LF>
CMAX<SP>=<SP>085<CR><LF>
```

Possible values for **x**:

```
x=0    ...   Battery OK
x=1    ...   Battery faulty
x=2    ...   Battery temperature alarm
x=3    ...   Button pressed
```

The capacity of the connected battery is displayed by % using CMIN and CMAX.

## Caution!

If the status (STAT) is unequal to 0, there is no more UPS operation. In this case, the UPS switches off without buffering when a power failure occurs!

### 5.2.5 whrd (UPS Time Stamp)

Firmware	Command Supported
Version < 2.0	No
Version ≥ 2.0	Yes

The UPS time stamp is needed to calculate the battery lifespan. The command can only be entered and transmitted in lower case letters.

#### Command Sequence

**Sending from the load system:**

```
@whrd<CR><LF>
```

**Response from UPS:**

```
Time=12.58.21<CR><LF>
Date=09.01.2000<CR><LF>
```

Using the returned values, the current elapsed operating time of the UPS with the connected battery unit can be determined by subtracting the basis time stamp "01.01.2000 00:00:00".

### 5.2.6 RBS (Reset Battery Status)

Firmware	Command Supported
Version < 2.10	No
Version ≥ 2.10	Yes

One function of #RHDM is to call up the results of the measurement of the charge maintenance current (see Section "Measurement of the Charge Maintenance Current", on Page 97). The command can be entered and transmitted in either upper or lower case letters.

#### Command Sequence

**Sending from the load system:**

```
#RHDM<CR><LF>
```

**Response from UPS:**

```
DIB<SP>=<SP>0000<CR><LF>
LTL<SP>=<SP>0001<CR><LF>
CCD<SP>=<SP>10000<CR><LF>
RCL<SP>=<SP>1000<CR><LF>
RCH<SP>=<SP>1000<CR><LF>
RBS<SP>=<SP>x<CR><LF>
```

Possible values for x:

x=0000	...	Batterie OK
x=0001	...	Change batteries
x=0002	...	Battery faulty

### Resetting the RBS

It is also possible to reset the RBS (Reset Battery Status). Upon the next measurement of the charge maintenance current, it is chosen and entered again. The command can be entered and transmitted in either upper or lower case letters.

#### Information:

If the RBS command is reset to (=OFF), the time stamp is automatically reset as well (see Section "Resetting the Battery Life-span Stamp", on Page 109).

#### Command Sequence

Sending from the load system:

```
#RBS=OFF
```

#### Information:

After setting the parameter "RBS=OFF" no other command can be made to the UPS for at least one second.

#### Response from UPS:

```
OK! ____RBS<SP>=<SP>0<CR><LF>
```

## 5.3 Set UPS Parameters

### 5.3.1 TWL (Time Worst Low)

Firmware	Command Supported
Version < 2.0	Yes
Version ≥ 2.0	Yes

TWL is the time that passes between a power failure and sending the signal to shut the load system down. This time can be set using the command "TWL" (Time Worst Low). The command can be entered and transmitted in either upper or lower case letters.

#### #TWL=OFF (Buffer operation)

After a power failure, the UPS immediately switches to battery operation. The UPS immediately switches back to mains operation when the supply voltage is available again. The DCD signal is not set until there is a battery power of 22.5 V and the load system is shut down. After 2 minutes (= default time with battery until shut down. This time can be set in the B&R UPS Configuration Software, see section 1.5.2 ""Settings" tab description" on Page 56) the system is shut down remotely by the load system. Otherwise, the UPS shuts down automatically when the battery voltage reaches 21 V.

#### Possible input value range #TWL=000...999

Enter the time, in seconds, after which the load system is to be shut down.

Default value: #TWL=010      TWL = 10 sec

Example:      #TWL=000      TWL = 0 sec (the load system is immediately shut down after a power failure)

                 #TWL=010      TWL = 10 sec

                 #TWL=200      TWL = 200 sec

### Command Sequence

#### Sending from the load system:

```
#TWL=010<CR><LF>
```

#### Response from UPS:

```
OK!____TWL<SP>=<SP>10<CR><LF>
```

### 5.3.2 SDT (Shut Down Time)

Firmware	Command Supported
Version < 2.0	Yes
Version ≥ 2.0	Yes

The SDT time is necessary in case the system is not shut down correctly (i.e. the load system crashes during shut down).

If time SDT passes after the DCD signal (load system shutdown) was set without the remote UPS shutdown signal (DTR signal) from the load system, the UPS switches the output voltage off. This time can be set using the command "SDT" (Shut Down Time). The command can be entered and transmitted in either upper or lower case letters.

## Warning!

**If the time selected is too low, data can be lost when the load system is shut down.**

### #SDT=OFF

The UPS buffers the load system until either the battery is empties (deep discharge protection 22.5 V or 21 V), or until the system is remotely shut down from the DTR.

### Possible input value range #SDT=0000...9999

This can be used to set the time in seconds, after which the UPS automatically disconnects the load system from the mains supply.

Default value:    #SDT=0300   SDT = 300 sec

Example:           #SDT=0000   SDT = 0 sec (the load system is not given any time to shut down)

                  #SDT=0040   SDT = 40 sec

                  #SDT=2500   SDT = 2500 sec

### Command Sequence

#### Sending from the load system:

```
#SDT=0100<CR><LF>
```

#### Response from UPS:

```
OK!___SDT<SP>=<SP>100<CR><LF>
```

### 5.3.3 POT (Power On Time)

Firmware	Command Supported
Version < 2.0	Yes
Version ≥ 2.0	Yes

If the load system is a B&R IPC, the software for communication with the UPS is not yet active when booting up (as long as the monitoring service is not yet completely loaded). If a power failure occurs within this time POT, the UPS changes into battery operation and only sends the respective signals to the load system after the time POT has passed. The load system then shuts down securely after the boot procedure is finished. This time can be set using the command "POT" (Power On Time). The command can be entered and transmitted in either upper or lower case letters.

#### #POT=OFF

Means that the starting time for the load system can be unlimited and the signals RTS and DTR are set. This should only be set when no load system is connected.

#### Possible input value range #POT=000...999

Time in seconds from which the UPS communicates with the load system after switching on the UPS. If a power failure occurs within this time, the load system is supplied from the battery unit and a shut down is executed after POT has passed.

Default value: #POT=120 POT = 120 sec

Example: #POT=000 POT = 0 sec

#POT=300 POT = 300 sec

## Warning!

Ensure that POT is not shorter than the time Windows needs to fully boot (depends on processing power). Otherwise secure shut down is not guaranteed if a power failure occurs when booting.

### Command Sequence

#### Sending from the load system:

```
#POT=100<CR><LF>
```

#### Response from UPS:

```
OK! ____POT<SP>=<SP>100<CR><LF>
```

### 5.3.4 LCS (Load Current Set)

Firmware	Command Supported
Version < 2.0	Yes
Version ≥ 2.0	Yes

The charging current can be set between 0.5 A and 2.88 A using the command "LCS" (Load Current Set). The command can be entered and transmitted in either upper or lower case letters. The decimal point can be entered with either "." or ",".

#### Possible input value range #LCS=0.5...2.88

Default value: #LCS=0.88      Charging current = 0.88 A

Example:      #LCS=0.6      Charging current = 0.60 A  
                  #LCS=2.15      Charging current = 2.15 A

### Information:

The charging current must always be entered to two decimal places.

### Information:

The value entered is returned by the UPS in binary units.

Binary value 1015 corresponds to 2.88 A and an entry of #LCS=2.88

Binary value 282 corresponds to 0.8 A and an entry of #LCS=0.80

### Caution!

The maximum allowable charging current for UPS battery unit 9A0100.14 and replacement batteries (2 pcs. 12 V / 2.2 Ah Panasonic LC-R122R2P, order.nr. 9A0100.14) is 0.88 A. The 0.88 A upper limit is to be observed when changing the charging current using this battery unit!

The charging current can also be set using the hardware (button). See Section "Setting the Maximum Charging Current", on Page 118.

### Command Sequence

#### Sending from the load system:

```
#LCS=2.28<CR><LF>
```

#### Response from UPS:

```
OK! ____LCS<SP>=<SP>802<CR><LF>
```

### 5.3.5 PFL (Power Fail Level)

Firmware	Command Supported
Version < 2.0	No
Version ≥ 2.0	Yes

This command can be used to set the voltage value, at which the UPS is switched from mains to battery operation. The command can be entered and transmitted in either upper or lower case letters. The PFL is displayed in volts and entered in steps of 1/10 Volts (0.1 Volts).

#### Possible input value range #PFL =180 or 215

Default value: #PFL=180 PFL = 18 V

Default value: #PFL=180 PFL = 21.5 V

#### Switching thresholds between battery / mains operation

PFL = 18 V

Switching thresholds for the UPS with no load	
Mains operation --> Battery operation	when supply voltage falls to 18 V, at the latest
Battery operation --> Mains operation	when supply voltage rises to 19 V, at the latest
Switching threshold for the UPS with load	
Mains operation --> Battery operation	when supply voltage falls to 18 V, at the latest
Battery operation --> Mains operation	when supply voltage rises to 20 V, at the latest

PFL = 21.5 V

Switching thresholds for the UPS with no load	
Mains operation --> Battery operation	when supply voltage falls to 21.5 V, at the latest
Battery operation --> Mains operation	when supply voltage rises to 22.5 V, at the latest
Switching threshold for the UPS with load	
Mains operation --> Battery operation	when supply voltage falls to 21.5 V, at the latest
Battery operation --> Mains operation	when supply voltage rises to 23.5 V, at the latest

## Information:

Even when the switching threshold (PFL) is configured to 21.5 V, it is ok if the voltage drops to 18 V during the first 4 seconds after reconnecting the supply voltage.

## Command Sequence

### Sending from the load system:

```
#PFL=180<CR><LF>
```

### Response from UPS:

```
OK! ____PFL<SP>=<SP>180<CR><LF>
```

## 5.3.6 CTL (Charge Temperature Low)

Firmware	Command Supported
Version < 2.0	No
Version ≥ 2.0	Yes

This command can be used to set the minimum charging temperature for the battery unit that is connected. The command can be entered and transmitted in either upper or lower case letters. CTL is measured in degrees celcius.

### Possible input value range #CTL = -068...0180

Default value: #CTL=0000 CTL = 0 °C

Example: #CTL=-040 CTL = -40 °C

#CTL=0010 CTL = 10 °C

## Warning!

If B&R battery units are used, the values listed in the following table must be used!

Model No.:	Battery type	Min. Charging Temperature
9A0100.12	Panasonic LC-R127R2P 7.2Ah	0 °C
9A0100.14	Panasonic LC-R122R2P 2.2Ah	0 °C
9A0100.16	Hawker Cyclon 4.5Ah	-40 °C

Table 34: Minimum Charging Temperature for Battery Units

## Command Sequence

### Sending from the load system:

```
#CTL=0000<CR><LF>
```

### Response from UPS:

```
OK! ____CTL<SP>=<SP>0<CR><LF>
```

### 5.3.7 CTH (Charge Temperature High)

Firmware	Command Supported
Version < 2.0	No
Version ≥ 2.0	Yes

This command can be used to set the maximum charging temperature for the battery unit that is connected. The battery unit is charged until this temperature (battery unit temperature) is reached. The command can be entered and transmitted in either upper or lower case letters. CTH is measured in degrees celcius.

#### Possible input value range #CTL = -68...0180

Default value: #CTL=0040 CTH = 40 °C

Example: #CTL=0080 CTH = 80 °C

## Warning!

If B&R battery units are used, the values listed in the following table must be used!

Model No.:	Battery type	Max. Charging Temperature
9A0100.12	Panasonic LC-R127R2P 7.2Ah	40 °C
9A0100.14	Panasonic LC-R122R2P 2.2Ah	40 °C
9A0100.16	Hawker Cyclon 4.5Ah	80 °C

Table 35: Maximum Charging Temperature for Battery Units

### Command Sequence

#### Sending from the load system:

```
#CTH=0040<CR><LF>
```

#### Response from UPS:

```
OK! ____CTH<SP>=<SP>40<CR><LF>
```

### 5.3.8 AGE (Lifespan of the Battery)

Firmware	Command Supported
Version < 2.0	No
Version ≥ 2.0	Yes

This command is used to set the maximum lifespan of the battery which is connected. The command can be entered and transmitted in either upper or lower case letters. AGE is measured in years.

#### Possible input value range #AGE = 0...100

Default value: #AGE=005 AGE = 5 years

Example: #AGE=010 AGE = 10 years

## Warning!

If B&R battery units are used, the values listed in the following table must be used!

Model No.:	Battery type	Max. Battery Lifespan <sup>1)</sup>
9A0100.12	Panasonic LC-R127R2P 7.2Ah	Up to 5 years
9A0100.14	Panasonic LC-R122R2P 2.2Ah	Up to 5 years
9A0100.16	Hawker Cyclon 4.5Ah	Up to 10 years

Table 36: Maximum Life-span for Battery Units

1) Dependent on environmental temperature and the charging and discharging cycles.

For information about resetting the battery lifespan stamp, see Section "Additional Function of the User Button Starting with UPS Firmware Version 2.0", on Page 109.

Possible input value range #AGE = 0...100The command can be entered and transmitted in either upper or lower case letters.

### Command Sequence

#### Sending from the load system:

```
#AGE=010<CR><LF>
```

#### Response from UPS:

```
OK! ____AGE<SP>=<SP>10<CR><LF>
```

### 5.3.9 DIB (Digital Input Button)

Firmware	Command Supported
Version < 2.10	No
Version ≥ 2.10	Yes

This command is used to operate the button on the UPS and the external input button via software. This makes it possible to supply the load system even when no battery unit is attached or when the attached battery unit is not charged. The command can be entered and transmitted in either upper or lower case letters.

## Caution!

**Secure UPS operation is not guaranteed after activating this function (DIB=ON\_) - until the battery has not reached the minimum load!**

**Unlike with the user button and external button, no current test is performed on the connected battery unit.**

**After it reaches the minimum load the UPS automatically switches to normal operation. At this point, UPS operation is again secure.**

**Possible input value range #DIB = OFF or ON\_**

Default value: #DIB=OFF function deactivated

Example: #DIB=ON function activated

## Information:

**If the UPS parameter DIB is activated or deactivated, the last setting is made permanent (even when the UPS device is turned on or off).**

### Command Sequence

**Sending from the load system:**

```
#DIB=ON_<CR><LF> or
#DIB=OFF<CR><LF>
```

**Response from UPS:**

```
OK!___DIB<SP>=<SP>1<CR><LF> or
OK!___DIB<SP>=<SP>0<CR><LF>
```

### 5.3.10 LTL (Life Time LED)

Firmware	Command Supported
Version < 2.10	No
Version ≥ 2.10	Yes

When the battery's life span (AGE) is exceeded, the "battery status" LED on the UPS device begins to blink. This command is used to turn this blinking (of the battery status LED) on or off. The command can be entered and transferred in either upper or lowercase.

#### Possible input value range #LTL = OFF or ON\_

Default value: #LTL=OFF function deactivated

Example: #LTL=OFF function deactivated

### Command Sequence

#### Sending from the load system:

```
#LTL=ON_<CR><LF> or
#LTL=OFF<CR><LF>
```

#### Response from UPS:

```
OK!___LTL<SP>=<SP>1<CR><LF> or
OK!___LTL<SP>=<SP>0<CR><LF>
```

## 5.4 Measurement of the Charge Maintenance Current

Firmware	Command Supported
Version < 2.10	No
Version ≥ 2.10	Yes

The measurement of the charge maintenance current determines the quality of the connected battery unit. This enables a precise statement about the current condition of the battery unit.

### Information:

**This function is meant for use with B&R battery units, and will therefore ONLY deliver accurate measurements about the condition of these units.**

The measurement of the charge maintenance current is configured through three parameters: CCD, RCH, and RCL.

These are explained later in more detail.

### Information:

**If one of the three parameters is not activated (e.g. is set to "OFF"), the other two are automatically not activated, and the measurement of the charge maintenance current is turned off.**

### 5.4.1 Setting CCD (Charge Count Down)

Firmware	Command Supported
Version < 2.10	No
Version ≥ 2.10	Yes

This command is used to set the length of time after which the UPS should check the charging current for the connected battery unit, in order to produce a quality report about the battery unit. The frequency of the testing is determined by the setting of the CCD (in minutes). The result of the test can be called up using the UPS parameter RBS (Reset Battery Status), which displays the status of the battery (see Section "RBS (Reset Battery Status)", on Page 85). The command can be entered and transmitted in either upper or lower case letters.

#### Possible input value range #CCD = 0..0.9999

Default value: #CCD=OFF measurement of the charge maintenance current deactivated

Example: #CCD=1260 CCD = 1260 minutes

#CCD=3043 CCD = 3043 minutes

### Information:

The condition of the battery unit is only displayed after every uninterrupted completion of the CCD time.

In order to guarantee the battery status measurement, this value should always be set to 1260 minutes (this is the maximum time needed to recharge one empty battery unit to full capacity).

The maximum charging current for the measurement LCS should be higher than the battery capacity/5, or else the charge maintenance current will not be reached, and the battery cannot be completely loaded. To preserve the battery, however, the charging current should not exceed the battery capacity/2.5.

### Command Sequence

#### Sending from the load system:

```
#CCD=1260<CR><LF>
```

#### Response from UPS:

```
OK! ____CCD<SP>=<SP>1260<CR><LF>
```

## 5.4.2 Setting RCL (Remain Current Low)

Firmware	Command Supported
Version < 2.10	No
Version ≥ 2.10	Yes

This command is used to set the lower threshold for the measurement of the charge maintenance current. The lower threshold for the charge maintenance current should be higher than the battery capacity/500 and lower than the battery capacity/50 or RCH. The command can be entered and transmitted in either upper or lower case letters. RCL is measured and displayed in Milliampere.

### Possible input value range #RCL = 000.999

Default value: #RCL=OFF measurement of the charge maintenance current deactivated

Example: #RCL=020 RCL = 20 mA

#RCL=123 RCL = 123 mA

## Warning!

If B&R battery units are used, the values used cannot be lower than those listed in the following table!

Model No.:	Battery type	RCL (lower threshold)
9A0100.12	Panasonic LC-R127R2P 7.2Ah	27 mA
9A0100.14	Panasonic LC-R122R2P 2.2Ah	8 mA
9A0100.16	Hawker Cyclon 4.5Ah	20 mA

Table 37: RCL of Battery Units

## Command Sequence

### Sending from the load system:

```
#RCL=020<CR><LF>
```

### Response from UPS:

```
OK!___RCL<SP>=<SP>20<CR><LF>
```

### 5.4.3 Setting RCH (Remain Current High)

Firmware	Command Supported
Version < 2.10	No
Version ≥ 2.10	Yes

This command is used to set the upper threshold for the measurement of the charge maintenance current. The upper threshold for the charge maintenance current should be lower than the battery capacity/50 and higher than the battery capacity/500 or RCL. The command can be entered and transmitted in either upper or lower case letters. RCH is measured and displayed in Milliampere.

#### Possible input value range #RCH = 000.999

Default value: #RCH=OFF measurement of charge maintenance current deactivated

Example: #RCH=080 RCH = 80 mA

#RCH=234 RCH = 234 mA

## Warning!

If B&R battery units are used, the values used cannot be higher than those listed in the following table!

Model No.:	Battery type	RCH (upper threshold)
9A0100.12	Panasonic LC-R127R2P 7.2 Ah	110 mA
9A0100.14	Panasonic LC-R122R2P 2.2 Ah	30 mA
9A0100.16	Hawker Cyclon 4.5 Ah	80 mA

Table 38: RCH of Battery Units

### Command Sequence

#### Sending from the load system:

```
#RCH=080<CR><LF>
```

#### Response from UPS:

```
OK! ____RCH<SP>=<SP>80<CR><LF>
```

## 6. Battery Operation Parameters

The minimum and maximum values listed here cannot be exceeded according to the battery type and must be transferred to the UPS when using B&R battery units.

Description	Command on the UPS
Load Current Low Load Current High	#LCS -> Value must be between Low and High
Charge Temperature Low	#CTL
Charge Temperature High	#CTH
Change Battery Age	#AGE
Remain Current Low	#RCL
Remain Current High	#RCH

### 6.1 Panasonic LC-R127R2P 7.2 Ah (9A0100.12)

Description	Value	Note
Load Current Low	500 mA	Minimum
Load Current High	2880 mA	Maximum
Charge Temperature Low	0 °C	Minimum
Charge Temperature High	40 °C	Maximum
Change Battery Age	5 years	Maximum
Remain Current Low	27 mA	Minimum
Remain Current High	110 mA	Maximum

### 6.2 Panasonic LC-R122R2P 2.2 Ah (9A0100.14)

Description	Value	Note
Load Current Low	500 mA	Minimum
Load Current High	880 mA	Maximum
Charge Temperature Low	0 °C	Minimum
Charge Temperature High	40 °C	Maximum
Change Battery Age	5 years	Maximum
Remain Current Low	8 mA	Minimum
Remain Current High	30 mA	Maximum

### 6.3 Hawker Cyclon 4.5 Ah (9A0100.16)

Description	Value	Note
Load Current Low	500 mA	Minimum
Load Current High	2880 mA	Maximum
Charge Temperature Low	-40 °C	Minimum
Charge Temperature High	80 °C	Maximum
Change Battery Age	10 years	Maximum

Description	Value	Note
Remain Current Low	20 mA	Minimum
Remain Current High	80 mA	Maximum

## 7. UPS Firmware Differences

Revision	Date	Firmware version (Firmware file)	Changes from earlier versions
C0	15.11.2000	1.05 (UPSDC15.BIN)	<ul style="list-style-type: none"> <li>First version</li> </ul>
D0	03.09.2001		
E0	26.03.2002		
H0	28.10.2002	2.01 (UPSDC21.BIN)	<ul style="list-style-type: none"> <li>Establishment of battery lifespan re-worked due to a Real Time Clock (RTC) read error.</li> <li>The UPS parameter read command (#READ), which is used to read the UPS parameters: TWL, LCS, SDT, POT, PFL, CTL, CTH, TMP and AGE, has been added.</li> <li>The command for reading the battery charge condition (BCR) has been added (see Section "BCR (Battery Charge Request)", on Page 84 for more info).</li> <li>It is now possible to upgrade the UPS firmware using the B&amp;R USP Configuration Software.</li> <li>New UPS battery unit 9A0100.16 Typ C 24 V 4.5 Ah has been implemented.</li> </ul>
I0	29.10.2002	2.05 (UPSDC25.BIN)	<ul style="list-style-type: none"> <li>UPS switching thresholds 18 and 21.5 Volts added. If the switching threshold is set to 21.5 volts, the input current can be around the 18 volt switching threshold for a period of 4 seconds without triggering the UPS to switch to battery operation (see Section "Switching thresholds between battery / mains operation" on Page 91 for more info).</li> </ul>
J0	30.10.2002	2.06 (UPSDC26.BIN)	<ul style="list-style-type: none"> <li>A flickering overload LED was removed due to high frequency over-current load.</li> </ul>
K0	27.01.2003		
K5	14.02.2003	2.10 (UPSDC210.BIN)	<ul style="list-style-type: none"> <li>Error correction: LED status displays synchronized due to blinking irregularities.</li> <li>measurement of the charge maintenance current added for further battery quality testing. Additionally, the new UPS commands (CCD, RCL, RCH, and RBS) have been added (see Section 5.4 "Measurement of the Charge Maintenance Current" on Page 97 for more info).</li> <li>It is now possible to turn the blinking of the battery status LED on or off after expiration of the set battery life-span using the software command LTL (see Section 5.3.10 "LTL (Life Time LED)" on Page 96 for more info). As a default setting, the blinking is activated.</li> <li>It is now possible to operate the buttons found on the UPS (user button and input button) with the software command DIB (see Section 5.3.9 "DIB (Digital Input Button)" on Page 95 for more info).</li> <li>The UPS parameter read command "#RHDM", which is used to read the parameters DIB, LTL, CCD, RCL, RCH and RBS, has been added.</li> <li>The UPS parameter "WHRD" had been added to read the UPS time stamp for the calculation of the battery life-span.</li> </ul>
L0	28.08.2003	2.11 (UPSDC211.BIN)	<ul style="list-style-type: none"> <li>The length of time that the highest allowable output current (8 A) may be exceeded, in the range from 8 to 14 A, has been raised from 10 to 30 seconds (see Section 2.4 "UPS Overload Behavior" on Page 108 for more info).</li> </ul>

Table 39: UPS Firmware Versions

# Chapter 5 • Technical Appendix

## 1. UPS Functions

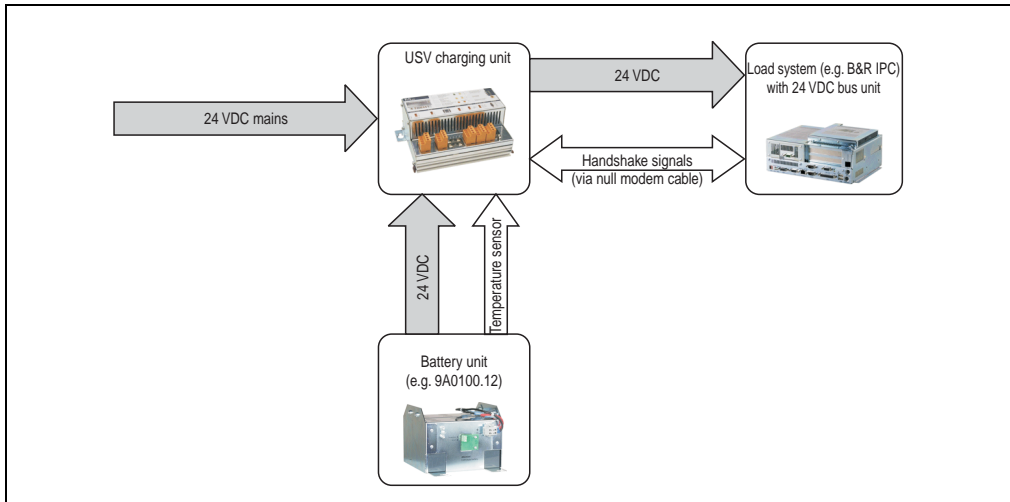


Figure 54: Block diagram of the entire system

In normal operation the 24 VDC supply voltage is switched through directly to the load system. If the supply voltage fails, the rechargeable UPS batteries power the PC to allow controlled shutdown without loss of data.

Data and commands are exchanged between the UPS and the load system via the handshake signals for an RS232 interface.

### Information:

**Independent shutdown of the load system in the case of a power failure is only possible on load systems with Microsoft Windows 95/98/ME/NT4.0/2000/XP when B&R UPS Configuration Software is installed in monitor mode, the UPS and the load system are properly connected and the settings described in Chapter 4 "Software" on Page 49 ff. have been made!**

See Section 2.6.2 "Operation without the RS232 cable" on Page 114 if you want to operate the UPS without connecting it to the load system using an RS232 cable.

## Danger!

Using the UPS to protect the power supply for life support machines is not permitted!

## 2. UPS Behavior

There are two fundamental UPS operating modes:

- Mains operation
- Battery operation

The input voltage is switched directly through to the load system during mains operation. The load system is separated from the mains supply if the load voltage (power voltage at output) falls below  $18\text{ V}^1$  or  $21.5\text{ V}^1$ , and battery operation is started (the load system is then powered completely by the batteries). The UPS prevents the load voltage from dropping below  $18\text{ V}$  or  $21.5\text{ V}^2$ , i.e. when the mains supply voltage fails, the load system continues to operate without interruptions:

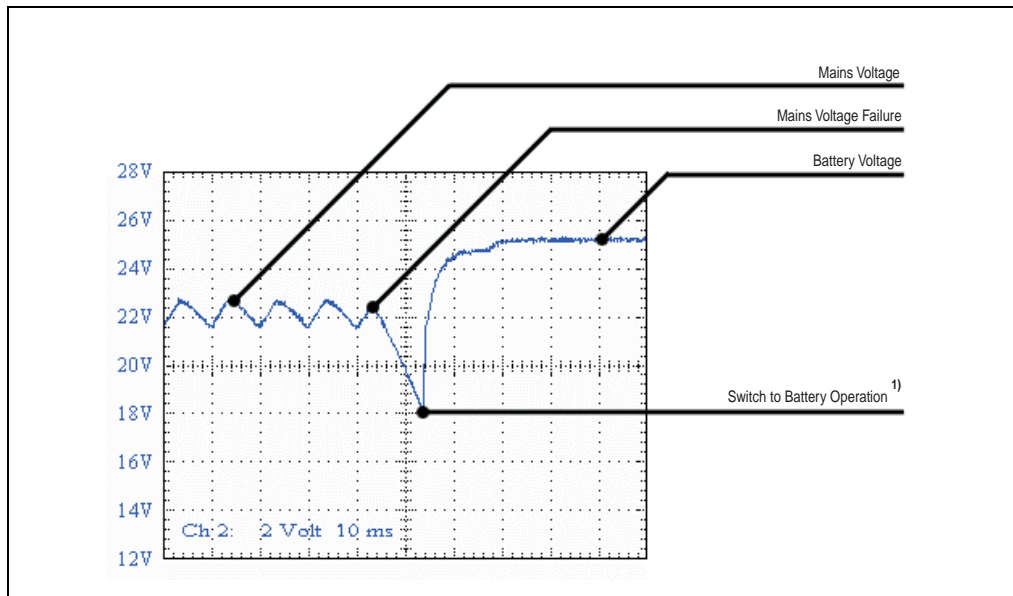


Figure 55: Behavior when the mains supply voltage fails

1) Depends on the switching threshold. Can be set using B&R configuration software or HyperTerminal (18 or 21.5 VDC)

2) Even when the switching threshold (PFL) is configured to 21.5 VDC, it is ok if the voltage drops to 18 VDC during the first 4 seconds after reconnecting the supply voltage.

## 2.1 Buffer Operation

In the case of a power failure, the load system is powered by the battery unit until the battery capacity is exhausted (deep discharge protection). If the supply voltage becomes available again during this time, the UPS switches over to mains operation.

### Information:

**When the mains supply voltage fails, the UPS starts to shut down the load system after 10 seconds (= default TWL time) to guarantee maximum security. This time (TWL) can also be set in the software via the serial interface (see Chapter 4 "Software" on Page 49).**

### 2.1.1 Deep Discharge Protection

If the battery voltage drops below 22.5 V (PFL=18 V) or 22.8 V (PFL=21.5 V) during battery operation, the system that is being supplied is automatically shutdown so that the battery units are not damaged. The UPS switches off automatically at 21 V (PFL=18 V) or 21.5V (PFL=21.5 V) at the latest.

## 2.2 Shutting the Load System Down Safely

The UPS shuts down as quickly as possible during a power failure. This is determined by the time that is allowed to pass between a power failure and system shut down. If the supply voltage has not become available again once this time has passed, the UPS begins shut down. This time (TWL) can be set using the software (see section Chapter 4 "Software" on Page 49). TWL is set to 10 seconds by default.

### Caution!

**The software for communication with the UPS is not yet active when the PC is booting (as long as Windows is not yet completely loaded). If a power failure occurs in this time POT, the UPS changes into battery operation and only sends the respective signals to the load system after the time POT has passed. The load system then shuts down securely after the boot procedure is finished (see also Chapter 4 "Software" on Page 49 and Section "Power Failure", on Page 111).**

## 2.3 Switching on the UPS

After the supply voltage has been connected to the UPS, a check is made to see if the battery is available. This is determined by evaluating the no load voltage.

Battery voltage	State
<22.8 V	Battery faulty To be sure that the battery is faulty, a current test is performed for 1 minute. If the battery voltage rises substantially with full charging current, this is recognized as faulty. Otherwise the battery is charged until "Battery OK" is detected.
>24.2 V	Battery OK
Between 22.8 V and 24.2 V	The battery must be charged. When approximately 26 V is reached (controlled internally and dependent on temperature) the supply voltage is switched through to the load system.

Table 40: Testing the battery when switching on

The ambient temperature of the battery unit is also checked:

- If the temperature is higher than the maximum specified charging temperature (see table "Maximum Charging Temperature for Battery Units", on Page 93), the battery cannot be charged anymore (important for empty batteries).
- If the ambient temperature exceeds or falls below the maximum or minimum temperature, the supply voltage is not switched through to the load system, because discharging the battery unit at this temperature could damage it (battery operation).
- If the temperature of the battery unit is above or below the limit for 5 minutes, while in operation, the UPS starts the controlled shutdown of the load system.

The no load voltage is evaluated to determine the capacity of the battery. The measurement is made while shutting down the UPS, then continuously every 24 hours. Due to the fact that this is a very rough evaluation method, it is possible that not every battery defect is 100% detected. The respective LED signals if no voltage can be measured (no battery, see Section "Status LEDs", on Page 26) and the UPS does not switch the mains power supply through to the load system. Power can be supplied to the load system by pushing the user button, however the user takes full responsibility when doing this (see Section "ExternalButton User Button (Digital Input) and DIB (Digital Input Button)", on Page 109).

### Information:

**If supply voltage fails, the load system is immediately shutdown without buffering.**

The UPS carries out a brief self test (approx. 10 seconds =  $t_{ON}$ ) and checks if the battery is OK. The load system is then supplied with voltage. If the first test reveals that the battery is deep discharged, a second test is started (approximately 1 minute), which determines the capacity of the connected battery. If this test reveals that the capacity of the battery which guarantees safe and proper UPS operation is too low, the user is informed via the "battery status" LED to change the battery.

If the UPS was just switched off, the load system is supplied with power after approx. 2 seconds to prevent damage.

The following diagrams illustrate these states and procedures:

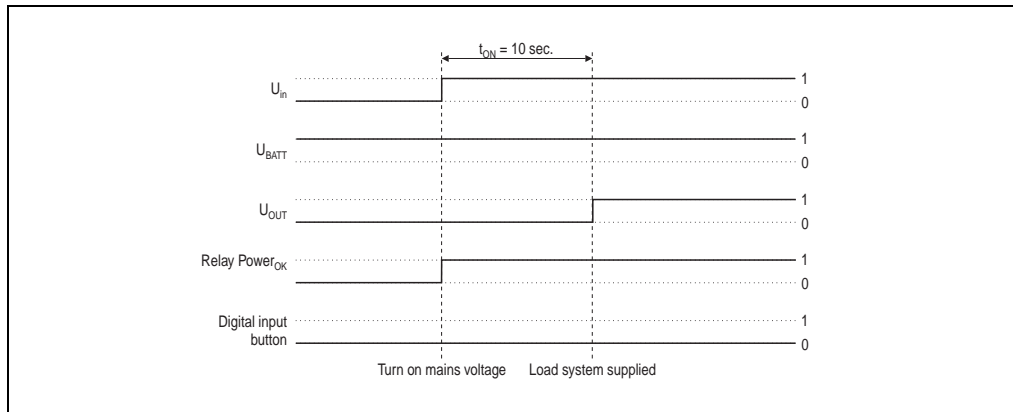


Figure 56: Switching on the UPS, Battery OK

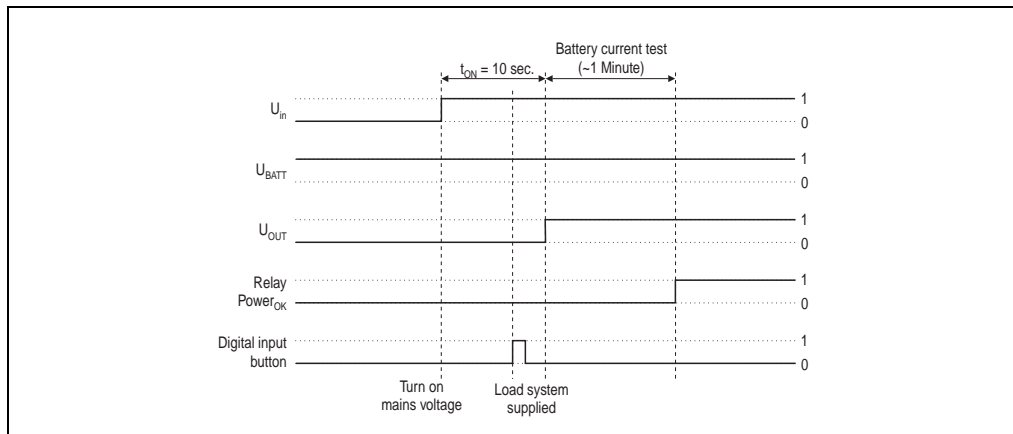


Figure 57: Switching on the UPS, Battery OK (with button)

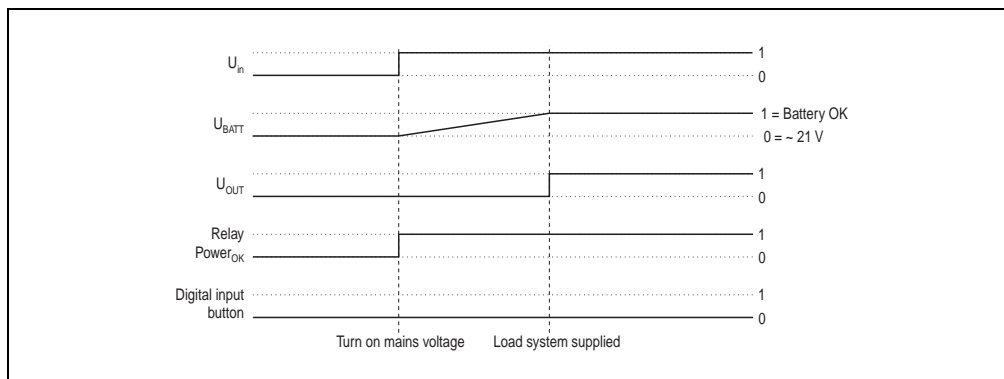


Figure 58: Switching on the UPS, Battery Empty

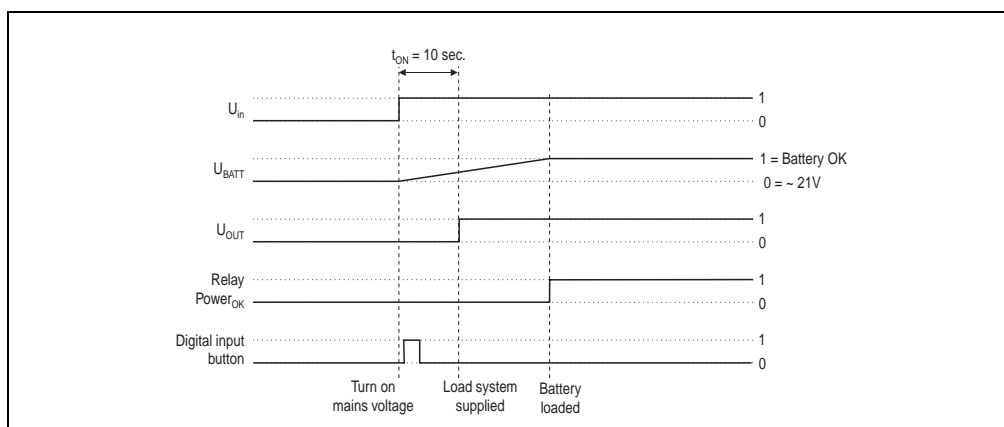


Figure 59: Switching on the UPS, Battery Empty (with button)

## 2.4 UPS Overload Behavior

If the maximum permitted output current of 8 A is exceeded, the following shutdown times apply: Between 8 - 14 A, the UPS shuts down after 30 <sup>1)</sup> seconds. Over 14 A output current, the UPS shuts down in one second.

UPS Overload is signalled via the "Status" LED (clock rate overload).

1) Depends on revision. For a 9A0100.11 UPS 24 VDC < revision L0 10 Sekunden

## 2.5 ExternalButton User Button (Digital Input) and DIB (Digital Input Button)

The user button, the external button (see Section for "Device Interfaces", on Page 21 location), and the software UPS command DIB (firmware version 2.10 and up) all have the same function. In order to guarantee maximum security, the UPS does NOT supply the load system with current if the battery is not connected or when the battery is not sufficiently charged.

To bypass this safety measure (such as temperature alarm, battery temperature too high/low, etc.), mains operation and the load system supply can still be activated via the user button or external button (digital input), or through the software by setting DIT = ON (firmware version 2.10 and up), when switching on the UPS. Pushing the user button or external button (digital input) initiates an additional current-test that does not occur when the DIB is changed in the software.

### Caution!

**Until the battery has reached the minimum load, secure UPS operation after pushing the user button or external button (digital input), or after setting the DIT = ON in the software (firmware version 2.10 and up), is not guaranteed.**

**After it reaches the minimum load the UPS automatically switches to normal operation. At this point, UPS operation is again secure.**

The maximum charging current for the battery unit can also be set with the user button. This is explained in "Setting the Maximum Charging Current", on Page 118. The user button can be accessed using a pointed object.

### 2.5.1 Additional Function of the User Button Starting with UPS Firmware Version 2.0

#### Resetting the Battery Life-span Stamp

With a UPS firmware version 2.0 and higher, the time stamp which is required to calculate the battery life-span, can be reset with the user button.

Procedure:

- The UPS must be switched on without a connected battery unit.
- Wait until "Error: 24V Battery Fuse" and "No Battery Connected" are signaled via the respective LEDs.
- Press and hold the user button
- The "Change Battery" LED lights up after approximately 2 seconds
- Now hold the user button for approximately 30 more seconds until the "Change Battery" LED goes out

The UPS time stamp is now reset to 01.01.2000 00:00:00. This is then the basis for the battery unit life-span calculation.

When resetting the time stamp on a UPS with firmware version 2.10 and higher, the UPS parameter RBS is also reset to "0."

For calculating the battery unit life-span, see Section "whrd (UPS Time Stamp)", on Page 85.

## Digital Input

Digital Input	Electrical Characteristics
Design	Sink
Rated Voltage	24 VDC
Maximum Input Voltage	30 VDC
Switching Threshold	<5 V
Low range	5 V to 15 V
Switching Range	>15 V
High range	
Input Impedance	about 5 k $\Omega$
Input Current	about 5 mA at 24 VDC
Input delay	Max. 1 ms
Separator	No electrical isolation

Table 41: Digital input electrical characteristics

## 2.6 Serial Interface

The UPS is connected to the load system (e.g. B&R IPC via the RS232 interface. The UPS informs the load system of the battery's condition, the operating condition of the UPS, as well as defects and temperature alarms. However, its main task is to securely shut down and switch off the load system in the case of a power failure. This takes place using the handshake signals CTS, DTR and DCD (on the load system side):

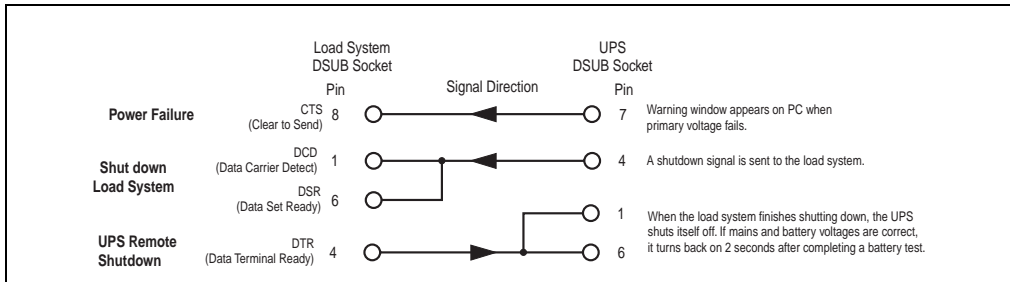


Figure 60: RS232 Interface Handshake Signal

See figure "Pin assignment RS232 cable", on Page 25 for the complete pin assignment of the RS232 cable.

### 2.6.1 Power Failure

a) The voltage briefly sinks below the minimum level:

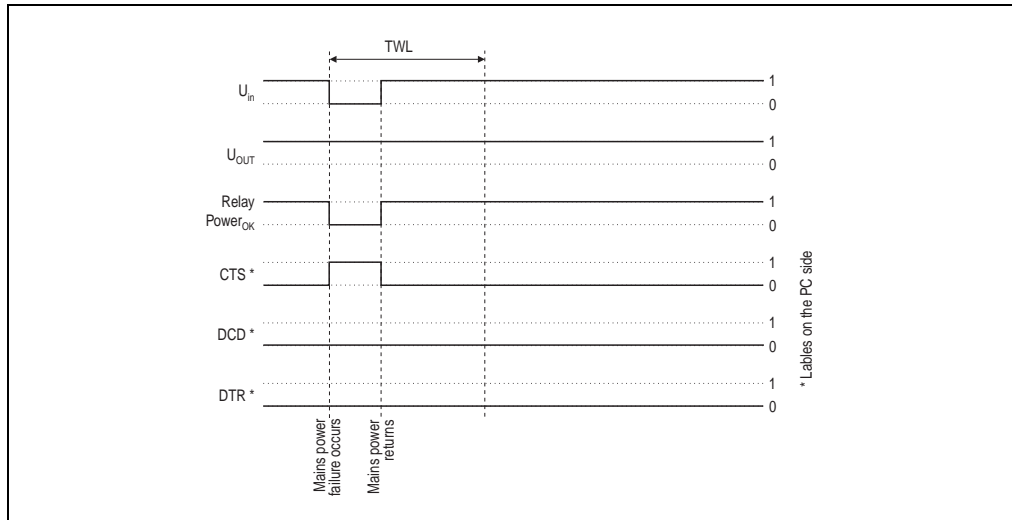


Figure 61: Handshake lines when a brief power failure occurs

If the supply voltage fails, the load system is immediately switched to battery operation. If the supply voltage becomes available again before the time TWL has passed (can be adjusted using software, see Chapter 4 "Software" on Page 49), the load system is not effected.

b) The supply voltage fails for a longer period of time:

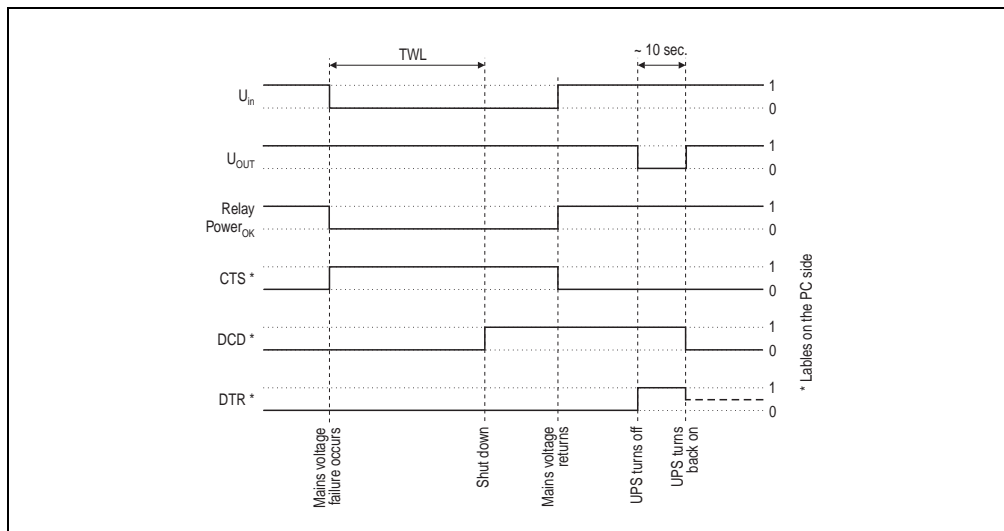


Figure 62: Handshake lines when a power failure occurs

If the supply voltage fails for a longer time than TWL, the UPS switches to battery operation. The CTS signal (signals power failure on the load system) is set immediately after the supply voltage fails. After the time TWL has passed, the DCD signal is set and the load system shuts down.

If the UPS is supplied with power again, it restarts the supply for the load system after completing a positive self test.

## For Windows NT4.0 UPS Service:

If the operating system has completed the shut down sequence, Windows NT 4.0 UPS Service waits for an additional 2 minutes (default time - can be set, see Chapter "Software", on Page 49) until the DTR signal is set by the load system. The UPS stops supplying the load system when this signal is set (remote shutdown). If the power comes back on during shutdown, the load system completes the shutdown process and restarts after completing a self test.

The SDT is necessary in case the system is not shut down correctly (i.e. crash occurs during shutdown). If time SDT passes after the DCD signal (load system shutdown) was set without the remote UPS shutdown signal (DTR signal) from the load system, the UPS switches the output voltage off. The default value for SDT is 5 minutes; this time can be changed using software (see Chapter 4 "Software" on Page 49).

### c) Power failure during POT

If a power failure occurs during POT, the respective handshake signals are set after this time has passed.

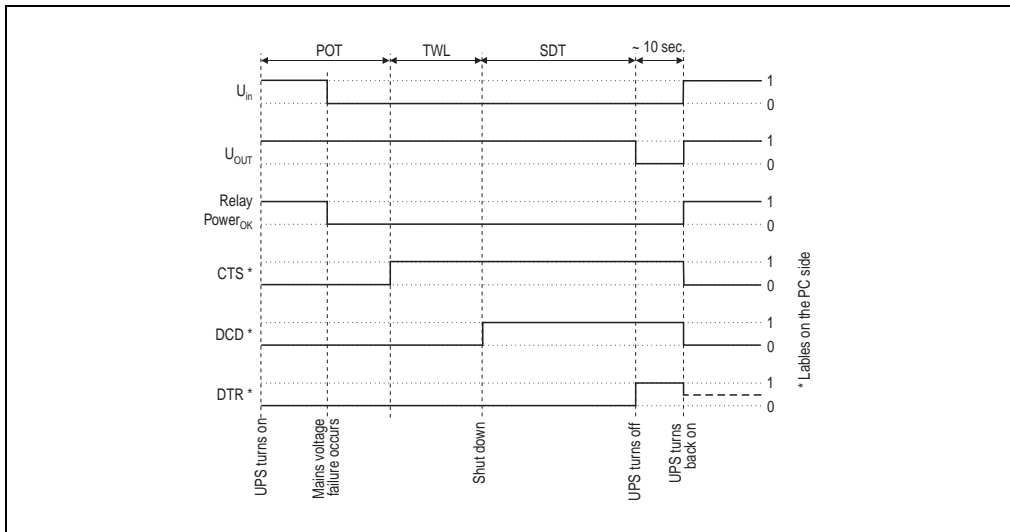


Figure 63: Handshake Lines During POT

A power failure signal is sent to the load system upon completion of POT by setting CTS. After 2 minutes (= default TWL time) DCD is set, which begins to shut down the load system. When shut down of the load system is complete, the UPS sets the DTR signal, and the UPS then disconnects the load system from the mains supply (or, at the latest, after the SDT is expired). As soon as the supply voltage is available again, the load system is supplied with power after a successful self test (about 10 seconds).

## 2.6.2 Operation without the RS232 cable

If you want to run the UPS without connecting it to the load system via an RS232 cable, the UPS behaves as follows during a power failure:

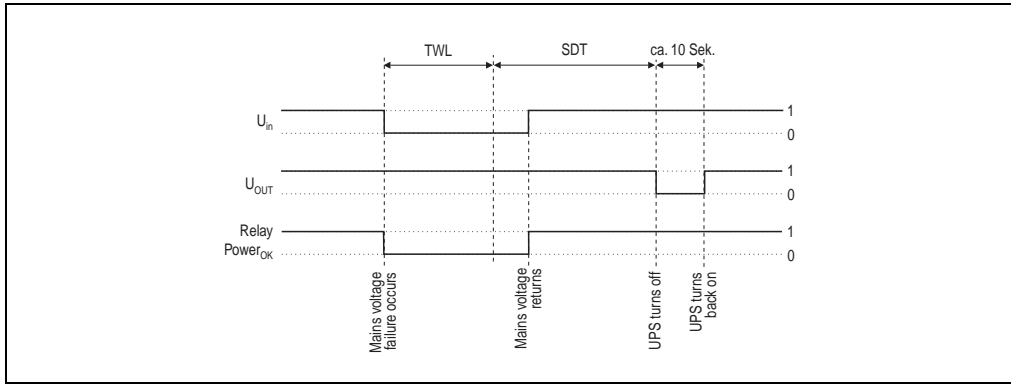


Figure 64: Handshake Lines During Power Failure Without RS232 Cable

As shown in the figure above, the times TWL and SDT (to change the values, see Chapter "Software", on Page 49) determine the behavior of the UPS when a power failure occurs. The load system cannot send a DTR signal to the UPS because there is no connection between the UPS and the load system. For this reason, the UPS switches itself off after the time TWL + SDT has passed, even if the load system has not yet shut down. If the mains supply becomes available again after the time TWL has passed, the UPS switches off after the time TWL + SDT has passed and switches on again after approximately 10 seconds (self test).

### **Danger!**

The load system (e.g. B&R IPC) is not informed of a power failure and is shutdown depending on the UPS settings. This will most likely cause a loss of data.

## 2.7 Relay Output

An external electrical circuit can be switched (closed or open) using the relay output.

### 2.7.1 Contact Data

Relay output	
Contact class	III according to VDE 0435 part 120/10.81, Appendix B
Number and type of contacts	1 change-over contact
Contact design	Single contact
Contact material	AgCdO hard gold-plated
Continuous current limit (at maximum ambient temperature)	8 A
Starting current (max. 4 sec at 10 % ED)	15 A
Switching voltage	440 V~ / 30 V-
Switching capacity (max.)	AC 2000 VA; DC from the load limit curve
Contact resistance (starting value) / Measuring current / Driver current	$\leq 30 \text{ m}\Omega$ / 100 mA / 6 V
Reaction time at rated voltage and 20 °C	Typ. 6 ms
Release time with/without parallel diode	Typically 2.5 ms / 10 ms
Chatter time N.O. / N.C.	Typically 0.5 ms / 4 ms
Max. number of switching cycles without load / at rated load	1200 min <sup>-1</sup> / 30 min <sup>-1</sup>
Coil heating at continuous current limit	Approx. 7 K
Type of protection according to DIN 40050/IEC 529	Wash tight IP67 soldering machine compatible IP50

Table 42: Relay output contact data

### 3. Rechargeable Batteries

#### Warning!

Batteries other than those obtained from B&R cannot be used because the UPS is specified for the charging and discharging characteristics of these battery types.

#### 3.1 Characteristics of Lead Acid Battery 12 VDC 7.2 Ah

Panasonic LC-R127R2P 12 V / 7.2 Ah (UPS batteries; 2 pcs., 12 V 7.2 Ah)		9A0100.12, 9A0100.13
Rated Voltage		12 V
Rated capacity		7.2 Ah
Capacity dependent on discharging current (T = 25 °C)	at 20 h discharging time (360 mA / T = 25 °C)	7.2 Ah
	at 10 h discharging time (680 mA / T = 25 °C)	6.8 Ah
	at 5 h discharging time (1260 mA / T = 25 °C)	6.3 Ah
	at 1 h discharging time (4900 mA / T = 25 °C)	4.9 Ah
Capacity dependent on ambient temperature	at 20 h discharging time (T = 40 °C)	102 %
	at 20 h discharging time (T = 25 °C)	100 %
	at 20 h discharging time (T = 0 °C)	85 %
	at 20 h discharging time (T = -15 °C)	65 %
Self discharge (T = 25 °C)	Charge remaining after 3 months	91 %
	Charge remaining after 6 months	82 %
	Charge remaining after 12 months	64 %
Internal resistance at full charge (T = 25 °C)		Approx. 40 mΩ
Maximum charging current (T = 25 °C)		2.88 A
Maximum charging voltage (T = 25 °C)		13.6 V - 13.8 V
Dimensions in mm (L x W x H)		151 x 64.5 x 100
Weight		2.5 kg

Table 43: Panasonic LC-R127R2P characteristics

### 3.2 Characteristics of Lead Acid Battery 12 V 2.2 Ah

Panasonic LC-R122R2P (UPS batteries; 2 pcs., 12 V, 2.2 Ah)		9A0100.14, 9A0100.15
Rated Voltage		12 V
Rated capacity		2.2 Ah
Capacity dependent on discharging current (T = 25 °C)	at 20 h discharging time (360 mA / T = 25 °C)	2.2 Ah
	at 10 h discharging time (680 mA / T = 25 °C)	2.0 Ah
	at 5 h discharging time (1260 mA / T = 25 °C)	1.8 Ah
	at 1 h discharging time (4900 mA / T = 25 °C)	1.3 Ah
Capacity dependent on ambient temperature	at 20 h discharging time (T = 40 °C)	102 %
	at 20 h discharging time (T = 25 °C)	100 %
	at 20 h discharging time (T = 0 °C)	85 %
	at 20 h discharging time (T = -15 °C)	65 %
Self discharge (T = 25 °C)	Charge remaining after 3 months	91 %
	Charge remaining after 6 months	82 %
	Charge remaining after 12 months	64 %
Internal resistance at full charge (T = 25 °C)		Approx. 70 mΩ
Maximum charging current (T = 25 °C)		0,88 A
Maximum charging voltage (T = 25 °C)		13.6 V to 13.8 V
Dimensions in mm (L x W x H)		177 x 34 x 66
Weight		0.8 kg

Table 44: Panasonic LC-R122R2P characteristics

### 3.3 Characteristics of Hawker Cyclon Rechargeable Battery 12 V, 4.5 Ah

Hawker Cyclon (UPS batteries; 2 pcs., 12 V, 4.5 Ah)		9A0100.16, 9A0100.17
Rated Voltage		12
Rated capacity		4,5 Ah
Storage time (T = 25 °C)		2 Years (without recharging)
Internal resistance at full charge (T = 25 °C)		Approx. 5 mΩ
Maximum charging current (T = 25 °C)		2.88 A
Maximum charging voltage (T = 25 °C)		14.7 V to 15 V
Dimensions in mm (L x W x H)		205 x 38 x 102
Weight		1.77 kg

Table 45: Hawker Cyclon Characteristics

### 3.4 Parallel Connection of Battery Units

Several battery units can be connected in parallel by observing the following points:

- Only use batteries which are available from B&R and designed for operation with a UPS (model numbers: 9A0100.12, 9A0100.13, 9A0100.14, 9A0100.15, 9A0100.16, 9A0100.17).
- Only connect batteries with the same capacity in parallel. Parallel connection of battery units with different capacities (e.g. 7.2 Ah parallel with 2.2 Ah) is not allowed.
- The UPS can only monitor the temperature for one battery, therefore the batteries must be placed so that the environmental conditions are the same (temperature).
- A defect which occurs in an individual battery unit cannot be detected when the batteries are connected in parallel.
- The maximum charging current of 0.88 A cannot be exceeded for the 2.2 Ah battery unit.
- Dividing the charging current increases the charging time required to reach the necessary operating capacity of the battery unit. The charging time depends on the following:
  - Number of batteries connected in parallel
  - Charge of the batteries
  - Charging current
  - Temperature

Parallel operation of batteries does not increase the load current. This is set at 8 A in battery operation. This only increases the buffer time and decreases charging and discharging current for each battery unit.

### 3.5 Setting the Maximum Charging Current

The maximum charging current for the battery is 0.88 A by default. This can however be set between 0.88 A and 2.88 A using the button on the front (a lower charging current increases the life of the battery, but also the charging time):

With the UPS turned off, push the button to start the electric current setting mode. The UPS then switches on. Release the button after approximately 5 seconds. Both red LEDs (fuse and battery reverse polarity) signal the electric current setting mode.

Each time the button is pushed again, the maximum charging current is increased one step (0.25 A). Pushing the button once more when the maximum charging current (2.88 A) is reached sets the default value of 0.88 A.

The electric current which has been set is shown by the UPS status LEDs as a binary code:

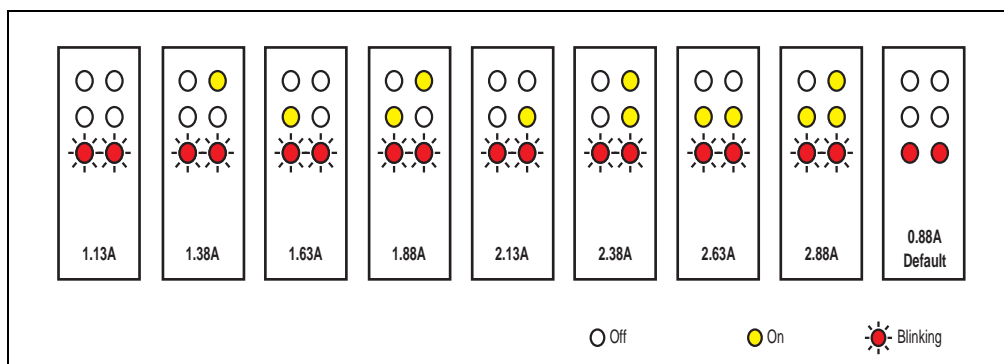


Figure 65: Setting the maximum charging current

If the button is not pushed for approximately 1 minute, the UPS accepts the changed settings and restarts the UPS.

## Caution!

The maximum allowable charging current for UPS battery unit 9A0100.14 and replacement batteries (2 pcs. 12 V / 2.2 Ah Panasonic LC-R122R2P, order.nr. 9A0100.14) is 0.88 A. The 0.88 A upper limit is to be observed when changing the charging current using this battery unit!

## Danger!

When setting the charging current it is not recommended that a load system is connected to the UPS. When the UPS starts again, the load system is switched off without properly shutting down any programs that are running!

The maximum charging current can also be set using the software, as described in Chapter "Software", on Page 49. The lowest value that can be set when using the software is 0.5 A (when using the button configuration it is 0.88 A). Setting the current using the software first (see Section "LCS (Load Current Set)", on Page 90) and changing it using the button during the current setting mode overwrites the value. If this setting mode is changed without saving the current setting (by restarting the UPS), the value set using the LCS command remains.

### 3.6 Charging and Discharging Characteristics of the Lead Acid Battery

A special LED on the front of the UPS shows that the battery is charging (see Section "Status LEDs", on Page 26 for info regarding the status LEDs).

The charging voltage and charging current are dependent on the ambient temperature and are controlled by the UPS microprocessor. If the battery ambient temperature is outside of the permissible values, this influences the operation of the UPS (see also Section "Switching on the UPS", on Page 106).

The voltage limit value when discharging the batteries is 22.5 V (when the switching threshold is set to 18 V) or 22.8 V (when the switching threshold is set to 21.5 V). Should the battery's voltage fall below this limit, the UPS will automatically begin to shut down the load system. Should the battery's voltage reach the limit of 21 V, the UPS will shut down immediately.

The duration of battery operation is dependent on the discharging current, the battery charge available and the ambient temperature.

**Example:**

With a fully charged UPS battery 12 V / 7.2 Ah (Mod.No. 9A0100.13) the available charge is 24 V / 7.2 Ah. This is sufficient to supply a load of 150 W for 20 minutes (at ambient temperatures of -10 °C to 40 °C).

The battery capacity reduces over time, as shown in the following diagram:

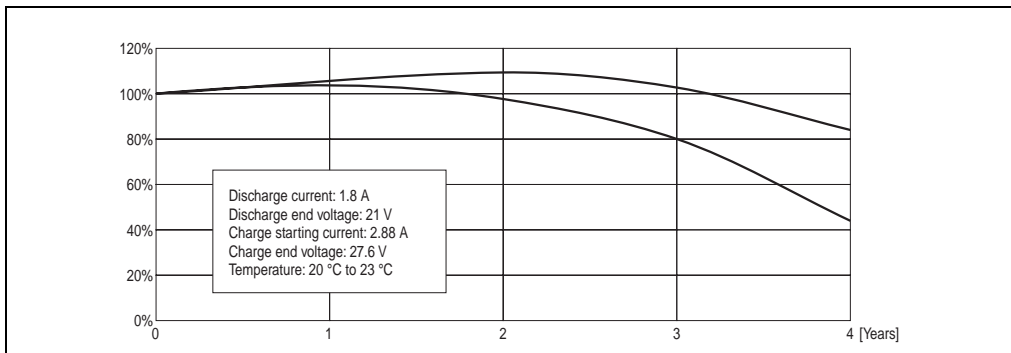


Figure 66: Reduction of rechargeable battery capacity over time

Additional factors include battery charging and discharging cycles as well as the ambient temperature.

### 3.7 Life-span of the Lead Acid Battery

A battery lifespan depends on the number of charge / discharge cycles, the ambient temperature, the charging and discharging currents and the intensity of discharge. The battery capacity reduces during the lifetime of a battery. This means that an older battery cannot store as much energy as a new battery even when it has been completely charged. If the battery is discharged 100% with  $I = 1.8 \text{ A}$  (up to  $V_{\text{batt}} = 21 \text{ V}$ ) e.g. 200 times and then charged with  $I = 2.88 \text{ A}$ , the rated capacity can only be 60% of the 7.2 Ah. If it is only 30% discharged, then this

procedure can be repeated up to 1200 times. For exact details, see the data sheets for Panasonic batteries (see "LC-R122R2P Data Sheet", on Page 122 and "LC-P127R2P Data Sheet", on Page 123).

Temperature influences have the following effect on the the life-span of the battery.

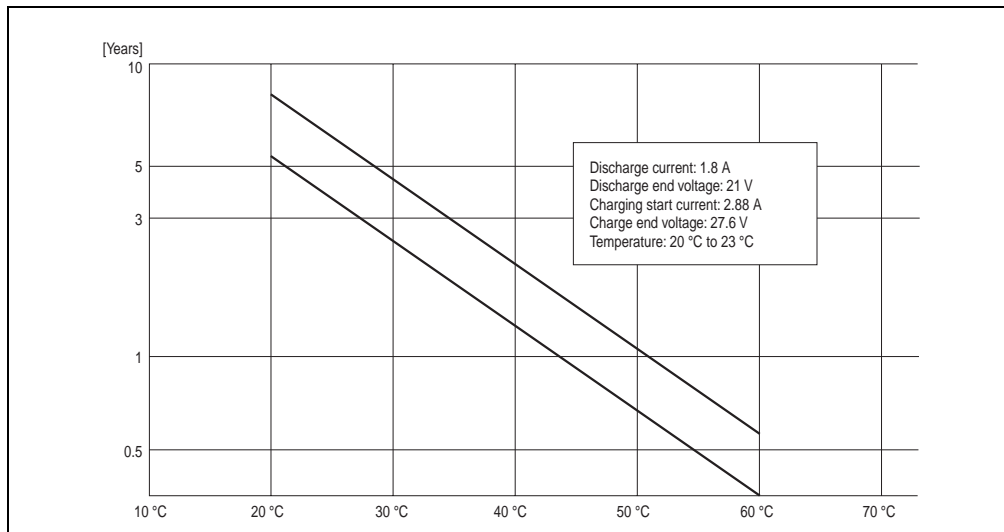


Figure 67: Effect of temperature on the battery life span

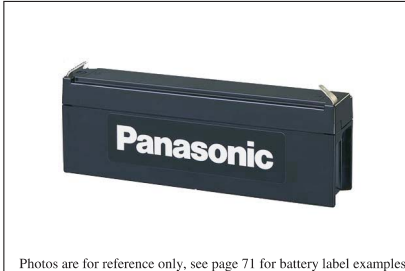
The no load voltage is evaluated to determine the capacity. The measurement is made while shutting down the UPS, then continuously every 24 hours. Due to the fact that this is a very rough evaluation method, it is possible that not every battery defect is 100% detected.

The UPS shows when the battery needs to be changed using the respective status LEDs (see Section "Status LEDs", on Page 26).

### 3.8 LC-R122R2P Data Sheet

The following data sheet contains a section of the battery manufacturer's data sheet.

#### LC-R122R2P(a)(LCR12V2.2P)



Photos are for reference only, see page 71 for battery label examples.

(a) Add applicable codes for terminal type, destination country, etc. (see page 21)

#### Specifications

Nominal voltage		12V
Nominal capacity (20 hour rate)		2.2Ah
Dimensions inch (mm)	Total height	2.598 inch (66mm)
	Height	2.362 inch (60mm)
	Length	6.968 inch (177mm)
	Width	1.339 inch (34mm)
Mass		Approx. 1.76 lbs. (0.8kg)

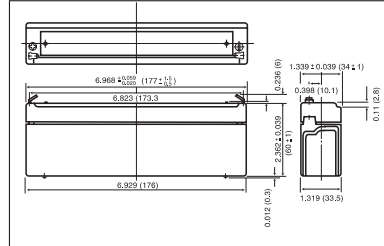
#### Characteristics

Capacity (note) (77°F (25°C))	20 hour rate (110mA)	2.2Ah
	10 hour rate (200mA)	2.0Ah
	5 hour rate (360mA)	1.8Ah
	1 hour rate (1300mA)	1.3Ah
1.5 hour rate discharge Cut-off voltage 10.5 V		0.95A
Internal resistance (77°F (25°C))		Fully charged battery Approx. 70mΩ
Temperature dependency of capacity (20 hour rate)	104°F (40°C)	102 %
	77°F (25°C)	100 %
	32°F (0°C)	85 %
	5°F (-15°C)	65 %
Self discharge (77°F (25°C))	Residual capacity after standing 3 months	91%
	Residual capacity after standing 6 months	82%
	Residual capacity after standing 12 months	64%
Terminal AMP Faston tab (Type 187)		
Charge Method (Constant Voltage)	Cycle use (Repeating use)	0.88 A or smaller Constant voltage; 14.5 to 14.9 V (per 12V cell 77°F (25°C))
	Trickle use	13.6 to 13.8 V (per 12V cell 77°F (25°C))

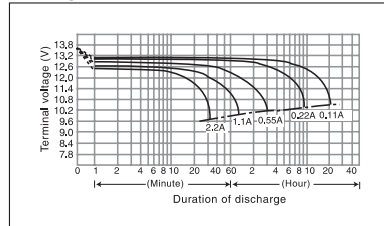
(Note) The above characteristics data are average values obtained within three charge/discharge Cycles not the minimum values.

\* This product adopts UL94HB-compliant resin as the material of the battery case. Product color is black. Optionally, type LC-R122R2P(a) which adopts flame-retardant resin complying with UL94V-0 is also available. Product color is gray.

#### Dimensions inch (mm)



#### Discharge characteristics (77°F (25°C)) (note)



#### Duration of discharge vs. Discharge current (note)

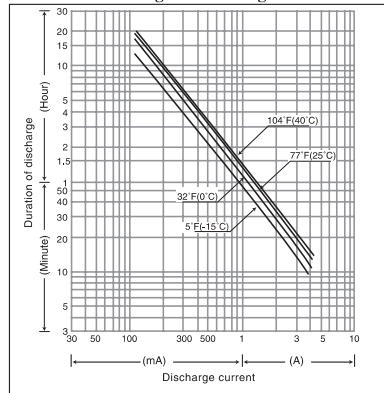
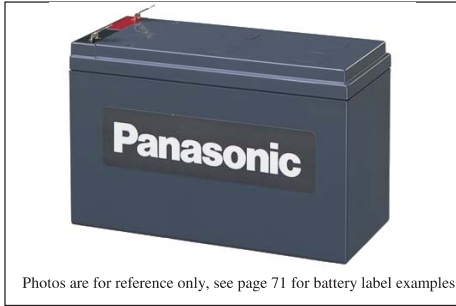


Figure 68: Panasonic battery LC-R122R2P data sheet

### 3.9 LC-P127R2P Data Sheet

The following data sheet contains a section of the battery manufacturer's data sheet.

#### LC-P127R2P(a)



(a) Add applicable codes for terminal type, destination country, etc. (see page 21)

#### Specifications

Nominal voltage		12V
Nominal capacity (20 hour rate)		7.2Ah
Dimensions inch (mm)	Total height	3.937 inch (100mm)
	Height	3.701 inch (94mm)
	Length	5.945 inch (151mm)
	Width	2.539 inch (64.5mm)
Mass		Approx. 5.51 lbs. (2.5kg)

#### Characteristics

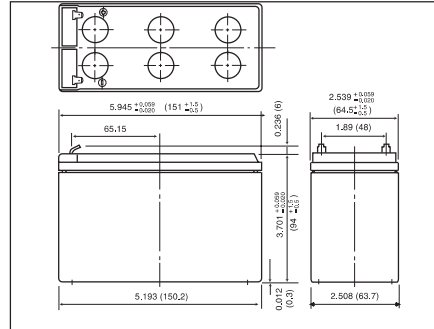
Capacity <sup>(note)</sup> (77°F (25°C))	20 hour rate (360mA)	7.2Ah
	10 hour rate (680mA)	6.8Ah
	5 hour rate (1260mA)	6.3Ah
	1 hour rate (4900mA)	4.9Ah
	1.5 hour rate discharge Cut-off voltage 10.5 V	3.5A
Internal resistance	Fully charged battery (77°F (25°C))	Approx. 40mΩ
Temperature dependency of capacity (20 hour rate)	104°F (40°C)	102 %
	77°F (25°C)	100 %
	32°F (0°C)	85 %
	5°F (-15°C)	65 %
Self discharge (77°F (25°C))	Residual capacity after standing 3 months	91%
	Residual capacity after standing 6 months	82%
	Residual capacity after standing 12 months	64%
Terminal		AMP Faston tab (Type 187/250)
Charge Method (Constant Voltage)	Trickle use	Control voltage 13.6 to 13.8 V (per 12V cell 77°F (25°C))

(Note) The above characteristics data are average values obtained within three charge/discharge Cycles not the minimum values.

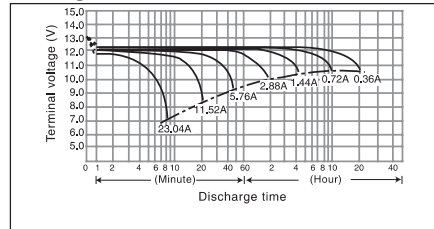
(Note) For cycle use of the battery, please contact us in advance.

\* This product adopts UL94V-0-compliant resin as the material of the battery case. Product color is gray. Optionally, type LC-X127R2P(a) which adopts less-flame-retardant resin complying with UL94HB is also available. Product color is black.

#### Dimensions inch (mm)



#### Discharge characteristics (77°F (25°C)) <sup>(note)</sup>



#### Duration of discharge vs. Discharge current <sup>(note)</sup>

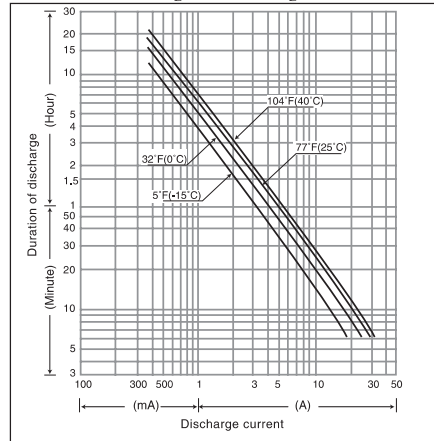


Figure 69: Panasonic battery LC-R127R2P data sheet

### 3.10 Hawker Cyclon Data Sheet

The following data sheet contains a section of the battery manufacturer's data sheet.

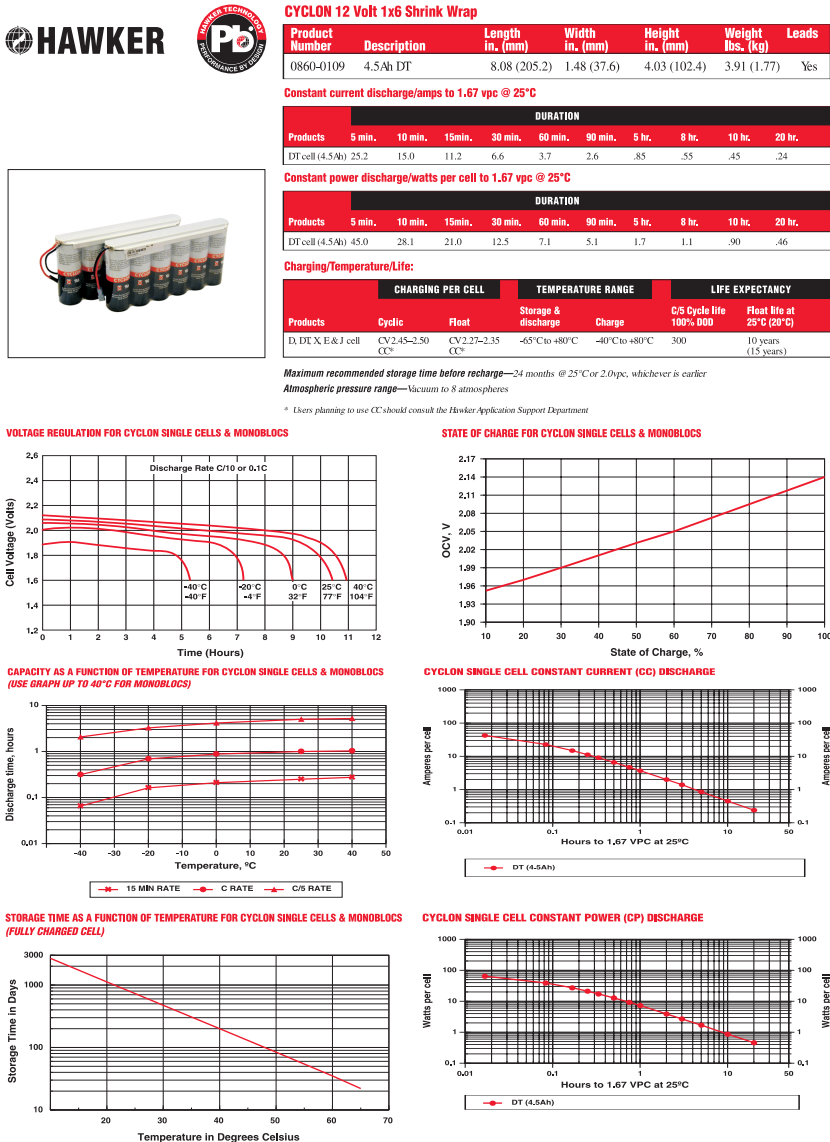


Figure 70: Hawker Cyclon Data Sheet

## 4. Glossary

Term	Description
#AGE	This UPS parameter command is used to set the maximum lifespan of the battery which is connected. Once this time has expired, a battery change is signalled by the lighting of the respective LEDs on the UPS.
#BCR	An abbreviation for "Battery Change Request". This command is used to read the current charging status for the connected battery unit and the current status of the battery unit.
#CCD	An abbreviation for "Battery Change Down". This command is used to set the length of time after which the UPS should check the charging current for the connected battery unit, in order to produce a quality report.
COM	A device name used to access serial ports. The first serial port can be accessed under COM1, the second under COM2 etc. Typically, a modem, mouse or serial printer is connected to a serial port.
#CTH	An abbreviation for "Charge Temperature High". This command is used to set the maximum allowable charging temperature of the connected battery unit. The battery unit is charged until this temperature is reached.
#CTL	An abbreviation for "Charge Temperature Low". This command is used to set the lowest allowable charging temperature of the connected battery unit. When the temperature falls below this value, the battery unit is not charged anymore.
CTS	An abbreviation for »Clear To Send« A signal used when transferring serial data from modem to computer, indicating its readiness to send the data. CTS is a hardware signal which is transferred via line number 5 in compliance with the RS-232-C standard.
DCD	An abbreviation for "Data Carrier Detected". A signal used in serial communication which is sent by the modem to the computer it is connected to, indicating that it is ready for transfer.
#DIB	An abbreviation for "Digital Input Taste [Taste = Button]". This command is used to operate the button found on the UPS and the external input button via the software.
DSR	An abbreviation for "Data Set Ready". A signal used in serial data transfer, which is sent by the modem to the computer it is connected to, indicating its readiness for processing. DSR is a hardware signal which is sent via line number 6 in compliance with the RS-232-C standard.
DTR	An abbreviation for "Data Terminal Ready". A signal used in serial data transfer, which is sent by the computer to the modem it is connected to, indicating the computer's readiness to accept incoming signals.
#LCS	An abbreviation for "Load Current Set". The charging current for the battery unit can be set using this signal.
#LTL	An abbreviation for "Life Time LED". This command is used to turn on or off the blinking of the battery status LED that signals that the battery life-span has expired.
#PFL	An abbreviation for "Power Fail Level". This command is used to set the voltage value, at which the UPS reacts to a power failure and switches from mains to battery operation. Can be set between 18 and 21.5 VDC using software.
#POT	An abbreviation for "Power On Time". The first signals from the UPS to the load system are sent once this time has passed.
RBS	An abbreviation for "Reset Battery Status". This status, which can be checked with the command RHDM, shows the result of the measurement of the charge maintenance current.
#RCH	An abbreviation for »Remain Current High« This command is used to set the upper threshold for the measurement of the charge maintenance current. The upper threshold for the charge maintenance current should be lower than the battery capacity/50 and higher than the battery capacity/500 or RCL. The command can be entered and transmitted in either upper or lower case letters.

Table 46: Glossary

Term	Description
#RCL	An abbreviation for " <b>R</b> emain <b>C</b> urrent <b>L</b> ow". This command is used to set the lower threshold for the measurement of the charge maintenance current. The lower threshold for the charge maintenance current should be higher than the battery capacity/500 and lower than the battery capacity/50 or RCH. The command can be entered and transmitted in either upper or lower case letters.
#READ	This command is used (in UPS firmware versions 2.0 and up) to read the UPS parameters: TWL, LCS, SDT, POT, PFL, CTL, CTH, TMP and AGE.
#RHDM	An abbreviation for " <b>R</b> ead <b>H</b> igh-grade <b>D</b> ischarge <b>M</b> easurement <b>S</b> tatus". This command is used (in UPS firmware versions 2.10 and up) to read the UPS parameters: DIB, LTL, CCD, RCL, RCH and RBS.
RTS	An abbreviation for " <b>R</b> esult <b>T</b> o <b>S</b> end". A signal used in serial data transfer for requesting send permission. For example, it is sent from a computer to the modem connected to it. The RTS signal is assigned to pin 4 according to hardware specifications of the RS-232-C standard.
RXD	An abbreviation for »Receive ( <b>RX</b> ) Data«. A line for the transfer of serial data received from one device to another - e.g. from a modem to a computer. For connections complying with the RS-232-C standard, the RXD is connected to pin 3 of the plug.
#SDT	An abbreviation for " <b>S</b> hut <b>D</b> own <b>T</b> ime". After SDT, the UPS shuts itself down once the DCD signals has been set.
#TWL	An abbreviation for " <b>T</b> ime <b>W</b> orst <b>L</b> ow". TWL is the time that passes between a power failure and sending the signal to shut down the load system.
TXD	An abbreviation for " <b>T</b> ransmit ( <b>TX</b> ) Data". A line for the transfer of serial data sent from one device to another - e.g. from a computer to a modem. For connections complying with the RS-232-C standard, the TXD is connected to pin 2 of the plug.
UPS	An abbreviation for »Uninterruptible Power Supply«
@whrd	This command is needed to read the time stamp, which is needed for the battery life-span calculation.

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