

Manual

UPS-mini

Versions 0.47 | 1.0 | 1.5



UPS-mini 0.47

Item numbers

70-02215-01

70-02216-01



UPS-mini 1.0

Item numbers

70-02225-01

70-02226-01



UPS-mini 1.5

Item numbers

70-02235-01

70-02236-01

Buffer Circuit for Vehicle Decoders
(Uninterruptible Power Supply)

tams elektronik



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Subject to technical modification.

1. Getting started

How to use this manual

This manual gives step-by-step instructions for safe and correct assembly of the kit and fitting and connecting of the ready-built module, and operation. Before you start, we advise you to read the whole manual, particularly the chapter on safety instructions and the checklist for trouble shooting. You will then know where to take care and how to prevent mistakes which take a lot of effort to correct.

Keep this manual safely so that you can solve problems in the future. If you pass the kit or the ready-built module on to another person, please pass on the manual with it.

Intended use

The UPS-mini is designed to be operated according to the instructions in this manual in digital model railroad vehicles. Any other use is inappropriate and invalidates any guarantees.

The UPS-mini should not be assembled and/or connected by children under the age of 14.

Reading, understanding and following the instructions in this manual are mandatory for the user.

Checking the package contents

Please make sure that your package contains:

- a kit consisting of
 - one equipped board
 - one Super-Cap (depending on the version 0.47, 1.0 or 1.5 F)
 - one piece of heat shrink tubing
- or a ready-bulit module (protected against short circuits by shrink tubing) with soldered connection leads
- a CD (containing the manual and further information)

Required materials

To assemble the kit and to connect the module you need:

- an electronic soldering iron (max. 30 Watt) or a regulated soldering iron with a fine tip and a soldering iron stand
- a tip-cleaning sponge
- a heat-resistant mat
- a small side cutter, a wire stripper and a pair of tweezers
- electronic tin solder (0.5 mm diameter)

For the connection of the kit you also need flexible wire (e.g. LiFY).
Recommended cross-section: $> 0.05 \text{ mm}^2$.

2. Safety instructions

**Caution:**

Integrated circuits (ICs) are inserted on the board. They are sensitive to static electricity. Do not touch components without first discharging yourself. Touching a radiator or other grounded metal part will discharge you.

Mechanical hazards

Cut wires can have sharp ends and can cause serious injuries. Watch out for sharp edges when you pick up the PCB.

Visibly damaged parts can cause unpredictable danger. Do not use damaged parts: recycle and replace them with new ones.

Electrical hazards

- Touching powered, live components,
 - touching conducting components which are live due to malfunction,
 - short circuits and connecting the circuit to another voltage than specified,
 - impermissibly high humidity and condensation build up
- can cause serious injury due to electrical shock. Take the following precautions to prevent this danger:
- Never perform wiring on a powered module.
 - Assembling and mounting the kit should only be done in closed, clean, dry rooms. Beware of humidity.
 - Only use low power for this module as described in this manual and only use certified transformers.
 - Connect transformers and soldering irons only in approved mains sockets installed by an authorised electrician.
 - Observe cable diameter requirements.
 - After condensation build up, allow a minimum of 2 hours for dispersion.

- Use only original spare parts if you have to repair the kit or the ready-built module.

Fire risk

Touching flammable material with a hot soldering iron can cause fire, which can result in injury or death through burns or suffocation. Connect your soldering iron or soldering station only when actually needed. Always keep the soldering iron away from inflammable materials. Use a suitable soldering iron stand. Never leave a hot soldering iron or station unattended.

Thermal danger

A hot soldering iron or liquid solder accidentally touching your skin can cause skin burns. As a precaution:

- use a heat-resistant mat during soldering,
- always put the hot soldering iron in the soldering iron stand,
- point the soldering iron tip carefully when soldering, and
- remove liquid solder with a thick wet rag or wet sponge from the soldering tip.

Dangerous environments

A working area that is too small or cramped is unsuitable and can cause accidents, fires and injury. Prevent this by working in a clean, dry room with enough freedom of movement.

Other dangers

Children can cause any of the accidents mentioned above because they are inattentive and not responsible enough. Children under the age of 14 should not be allowed to work with this kit or the ready-built module.



Caution:

Little children can swallow small components with sharp edges, with fatal results! Do not allow components to reach small children.

In schools, training centres, clubs and workshops, assembly must be supervised by qualified personnel.

In industrial institutions, health and safety regulations applying to electronic work must be adhered to.

3. Safe and correct soldering



Caution:

Incorrect soldering can cause dangers through fires and heat. Avoid these dangers by reading and following the directions given in the chapter **Safety instructions**.

- Use a soldering iron with temperature control, which you set to approx. 300 °C.
- Only use electronic solder with a flux.
- Never use soldering water or soldering grease when soldering electronic circuits. These contain an acid that destroys components and conductor paths.
- Insert the connecting wires of the components as far as possible through the holes of the board without using force. The body of the component should be close above the board.
- Make sure that the polarity of the components is correct before soldering them.

- Solder quickly: soldering for too long can cause pads or tracks to become detached or even destroy components.
- Hold the soldering tip on the soldering point in such a way that it touches the component wire and the pad at the same time. Add (not too much) solder simultaneously. As soon as the solder begins to flow, remove it from the soldering point. Then wait a moment for the solder to flow well before removing the soldering iron from the soldering joint.
- Do not move the component you have just soldered for about 5 seconds.
- A clean, non-oxidised (scale-free) soldering tip is essential for a perfect soldering joint and good soldering. Therefore, before each soldering, wipe off excess solder and dirt with a damp sponge, a thick damp cloth or a silicone wiper.
- After soldering, cut off the connecting wires directly above the soldering point with a side cutter.
- After assembly, always check each circuit again to ensure that all components are correctly inserted and polarised. Also check that no connections or tracks have been accidentally bridged with tin. This can lead not only to malfunction, but also to the destruction of expensive components. You can re-liquefy excess solder with the clean hot soldering tip. The solder then flows from the board to the soldering tip.

4. Operation overview

4.1. Problem

An uninterruptible power supply for the vehicle decoders cannot always be guaranteed. Possible causes are e.g.

- rust spots or dirt on the rails
- crossing points
- worn or current collectors on the vehicle

Possible consequences of the short power interruptions are e.g. flickering vehicle lights, disturbances of the sound reproduction and/or dropouts of the vehicle engines (up to the standstill of the vehicles).

In order to supply vehicle decoders with power when needed, external supporting electrolytic capacitors (buffer electrolytic capacitors) can be connected - provided the decoders have appropriate connections. The capacity of supporting electrolytic capacitors connected directly to the decoders is typically between 100 and 470 μF , with some decoders also at 1,000 μF . However, if the current demand is high, the capacities of these buffer electrolytic capacitors are often not sufficient.

Super Caps have significantly higher capacitances despite their comparatively small dimensions. Values of 0.47 F (= 470,000 μF) and more are common. Their disadvantage: Their voltage resistance is only 2.5 to 6 V, so they are not suitable for direct connection to vehicle decoders. To be able to use their large capacity nevertheless, charging circuits (buffer circuits) are absolutely necessary.

4.2. Connection variants

Due to the capacity of the used Super-Caps (0.47, 1.0 or 1.5 F) the use of the UPS-mini is reasonable for scales from N up to H0. If space is very limited, the PCB and Super-Cap can be installed separately in the kit version.

The UPS-mini can basically be connected to all vehicle decoders which have a connection for an external supporting capacitor or an external buffer circuit.

Connection of the control input of the UPS-mini

The following connection options are available:

1. to a free switching output of the vehicle decoder: With the assigned function key the UPS-mini can be switched on and off during operation.
2. to the special control output for buffer circuits of the vehicle decoder (according to RailCommunity standard RCN-530).
3. to the earth connection (-) of the buffer capacitor: This variant should only be used if no switching output is available at the vehicle decoder and the decoder has no special connection for a buffer circuit. The UPS-mini is permanently switched on with this variant.

4.3. Functionality

The mode of operation depends essentially on the selected connection of the control input. When connected to a free switching output or the control output for buffer circuits of the decoder, the functionality fully complies with the requirements of the Railcommunity Standard RCN-530.

When the system is switched on

When the system is switched on, the high charging currents of several Super-Caps would overload the boosters and thus lead to permanent overcurrent shutdown. To prevent this from happening, the UPS-mini limits the charging current for the Super-Cap to 100 mA. Furthermore the UPS "observes" the track voltage and interrupts the charging of the Super-Cap as soon as the existing track voltage falls below 12 V.

The charging current limitation and the switch-off when the track voltage falls below the minimum track voltage are active in all connection variants.

When programming the decoder on the programming track

An active buffer circuit can make it impossible to program a decoder on the programming track. As all decoder outputs are automatically switched off when programming on the programming track, the UPS-mini is also switched off, provided the control input is connected to a decoder output (connection variant 1) or the control output for buffer circuits (connection variant 2).

If the control input is connected to the ground terminal of the buffer capacitor (connection variant 3), the UPS-mini cannot be switched off. With this variant the automatic reduction of the charging current may be sufficient to enable programming on the programming track. The main track programming (POM) is basically possible with the UPS-mini active.

When stopping before signals

If the central unit sends speed level 0 for the locomotive in a stop section (without switching off the track voltage), the UPS-mini has no influence on the running behaviour of the locomotive.

The situation is different in stop sections where the track voltage is completely switched off. To avoid that the locomotive does not stop (or stops too late) because it is still powered by the UPS-mini, the value for the Packet Time Out must be set for the vehicle decoder. This value determines the time that passes between the reception of a digital signal and the (forced) switch-off of the engine. Note: To prevent the decoder from automatically switching to analogue mode after the end of the packet time out, the automatic analogue detection should be switched off.

In turnout streets, which are longer than the stopping distances, the supply of the decoder by the UPS-mini is nevertheless ensured, since in the course of a turnout street a 100% failure of the track voltage is never to be expected. The Packet Time Out is therefore always set to "start" in between.

Undervoltage cut-off

How long the stored power lasts depends on the current power demand. To prevent the locomotive motor from stuttering at the end of the current supply, the UPS-mini has an automatic low voltage cut-off. It ensures that the decoder is switched off when the voltage falls below the voltage required for proper operation.

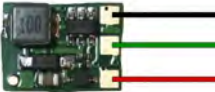
5. Technical specifications

	UPS-mini 0.47	UPS-mini 1.0	UPS-mini 1.5
Capacity	0.47 F	1.0 F	1.5 F
Dimensions of the board approx.	12x9x4.5 mm	12x9x4.5 mm	12x9x4.5 mm
Dimensions of the assembled circuit approx.	18x14x12 mm	2x17x 13.5 mm	27x17x 13.5 mm
Dimensions of the Super-Cap approx.	13.7x13.5 x6.7 mm	17.5x16.5 x8.2 mm	21.5x16.5 x8.2 mm
Weight of the assembled circuit approx.	2.70 g	4.25 g	4.85 g
Protected to	IP 00		
Ambient temperature in use	0 ... +60 °C		
Ambient temperature in storage	-10 ... +80 °C		
Comparative humidity allowed	max. 85 %		

6. Assembling the kit

You can skip this section if you have purchased a ready-built module.

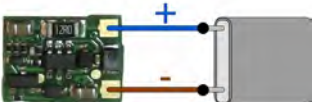
Soldering the connection cables

	black (buffer capacitor -)
	green (control line)
	red (buffer capacitor +)

⚠ Caution:

Use flexible strands as connection cables! Rigid cables or wires are unsuitable because they can tear off the connection pads on the board when bent.

Soldering the Super-Cap

	Super-Cap positive pole (+)
	Super-Cap negative pole (-)

⚠ Please note the correct polarity of the Super-Cap. The negative pole of the Super-Cap is indicated by a mark on the housing and the shorter connecting wire.

If the Super-Cap is connected with the wrong polarity, it will **explode** (possibly only a few minutes after commissioning).

⚠ Attention:

If you bend the stiff connecting wires of the Super-Caps after soldering, you will easily tear off the connection pads on the board! We therefore recommend to connect the Super-Caps with flexible wire.

Protection against short circuits

We recommend to protect the board from short circuits after soldering the strands and the Super-Cap with shrink tubing.



Please note:

If the components on the UPS-mini come into contact with metal parts of the vehicle or other electronic circuits in the vehicle (e.g. the decoder) during operation, a short circuit will occur. This short circuit can cause irreparable damage to both the UPS-mini and the decoder.

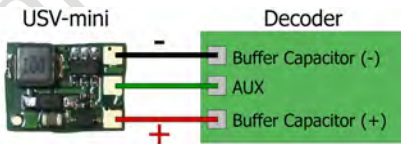
7. Connecting the UPS-mini



Observe the polarity of the connections for the external buffer capacitor when connecting the UPS-mini to the decoder! If the connections are reversed, the UPS-mini will be irreparably damaged during commissioning!

Connection variant 1

You can connect the UPS-mini to any vehicle decoder that has a connection for an external support capacitor (buffer capacitor). If a function output is free at the decoder, you should connect the control line of the UPS-mini to this output. Maximum current of the output and maximum total current of the decoder are not important.



black (-)	Negative pole (-) of the buffer capacitor / buffer circuit
green (control line)	AUX: free switching output or control output of buffer circuit according to RCN-530 circuit
red (+)	Positive pole (-) of the buffer capacitor / buffer circuit

Connection variant 2

For decoders with a control output for a buffer circuit according to RailCommunity Norm RCN 530, connect the control line of the UPS-mini to this output.

Note: The UPS-mini is intended for connection to vehicle decoders whose control output switches to minus (-) according to RCN 530. There are decoders whose control outputs switch to plus (+). If you connect the UPS-mini to a decoder of this type, the UPS-mini is without function, no damage will occur during commissioning. If necessary, check the function of the decoder by means of the manual or ask the decoder manufacturer.

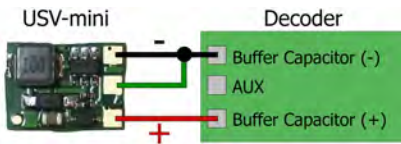


black (-)	Negative pole (-) of the buffer capacitor / buffer circuit
green (control line)	AUX: free switching output or control output of buffer circuit according to RCN-530 circuit
red (+)	Positive pole (-) of the buffer capacitor / buffer circuit

Connection variant 3

If there is no function output available on the decoder, you can still connect the UPS-mini to the connectors for an external support capacitor (buffer capacitor) of the decoder. In this case you have to connect the control line to the negative pole of the buffer capacitor.

Note: In this connection variant the UPS-mini is permanently switched on! Problems may occur when programming the decoder on the programming track (see section 4.3).



black (-)	Negative pole (-) of the buffer capacitor
green (control line)	Negative pole (-) of the buffer capacitor
red (+)	Positive pole (-) of the buffer capacitor

Protection against short circuits

Do not install a UPS-mini in a vehicle without protecting it against short circuits (e.g. with heat-shrink tubing). Take care not to damage the protective layer mechanically during installation. Do not install a mini UPS with a damaged protective layer.



Please note:

If the components on the UPS-mini come into contact with metal parts of the vehicle or electronic components in the vehicle during operation, a short circuit will occur. The short circuit can irreparably damage both the UPS-mini and the decoder.

8. Check list for troubleshooting

- Parts are getting very hot and/or start to smoke.



Disconnect the system from the mains immediately!

Possible cause: The heat shrink tubing that is supposed to protect the UPS-mini from short circuits is not present or damaged and components on the UPS-mini have had contact with metal parts of the vehicle or with other electronic circuits in the vehicle (e.g. the decoder). → In this case the UPS-mini is usually irreparably damaged. Dispose of the circuit. It cannot be excluded that other electronic circuits in the vehicle have also been damaged.

Possible cause: The UPS-mini was connected to the decoder with the wrong polarity. → In this case the UPS-mini is usually irreparably damaged. Dispose of the circuit.

- The Super-Cap explodes, if necessary only a few minutes after start-up.

Possible cause: The Super-Cap was connected with the wrong polarity. → In this case the UPS-mini is usually irreparably damaged. Only send the UPS-mini to us for testing if you have purchased it as a ready-made component. Otherwise dispose of the circuit.

- The mini UPS does not work.

Possible cause: The control output (green cable) has been connected to the positive pole of the support capacitor connection. → Check the connection and correct it. Normally this faulty connection does not cause damage to the UPS-mini.

Possible cause: The control output (green cable) was connected to the control output of the decoder, but the decoder does not switch to minus (-) according to RCN 530, but to plus (+). → Check the functioning of the decoder (instructions, consult the decoder manufacturer). Normally this faulty connection does not cause

damage to the UPS-mini.

Hotline: If problems with your UPS-mini occur, our hotline is pleased to help you (mail address on the last page).

Repairs: You can send in a defective UPS-mini for repair (address on the last page). In case of guarantee the repair is free of charge for you. With damages not covered by guarantee, the maximum fee for the repair is 50 % of the sales price according to our valid price list. We reserve the right to reject the repairing of a decoder when the repair is impossible for technical or economic reasons.

Please do not send in an UPS-mini for repair charged to us. In case of warranty we will reimburse the forwarding expenses up to the flat rate we charge according to our valid price list for the delivery of the product. With repairs not covered by guarantee you have to bear the expenses for sending back and forth.

9. Guarantee bond

For this product we issue voluntarily a guarantee of 2 years from the date of purchase by the first customer, but in maximum 3 years after the end of series production. The first customer is the consumer first purchasing the product from us, a dealer or another natural or juristic person reselling or mounting the product on the basis of self-employment. The guarantee exists supplementary to the legal warranty of merchantability due to the consumer by the seller.


The warranty includes the free correction of faults which can be proved to be due to material failure or factory flaw. With kits we guarantee the completeness and quality of the components as well as the function of the parts according to the parameters in not mounted state. We guarantee the adherence to the technical specifications when the kit has been assembled and the ready-built circuit connected according to the manual and when start and mode of operation follow the instructions.

We retain the right to repair, make improvements, to deliver spares or to return the purchase price. Other claims are excluded. Claims for secondary damages or product liability consist only according to legal requirements.

Condition for this guarantee to be valid, is the adherence to the manual. In addition, the guarantee claim is excluded in the following cases:

- if arbitrary changes in the circuit are made,
- if repair attempts have failed with a ready-built module or device,
- if damaged by other persons,
- if damaged by faulty operation or by careless use or abuse.

10. EU declaration of conformity

 This product conforms with the EC-directives mentioned below and is therefore CE certified.

2004/108/EG on electromagnetic. Underlying standards: EN 55014-1 and EN 61000-6-3. To guarantee the electromagnetic tolerance in operation you must take the following precautions:

- Connect the transformer only to an approved mains socket installed by an authorised electrician.
- Make no changes to the original parts and accurately follow the instructions, connection diagrams and PCB layout included with this manual.
- Use only original spare parts for repairs.

2011/65/EG on the restriction of the use of certain hazardous substances in electrical and electronic equipment (ROHS). Underlying standard: EN 50581.

11. Declarations conforming to the WEEE directive



This product conforms with the EC-directive 2012/19/EG on waste electrical and electronic equipment (WEEE).

Don't dispose of this product in the house refuse, bring it to the next recycling bay.

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