Power 3/6

Multi-Protocol Power System Booster

by

Uhlenbrock

Manual

Based on Uhlenbrock product manual 60560 (German text) rev. 03/2004.
English translation and revisions provided by ***Modell-Zug Elektronix***.

Rev. 01/2006

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1. General

1.1 Description

The Power 3 and Power 6 are short-circuit protected multi-protocol boosters with an output rating of 3A and 6A, respectively. These boosters are compatible with Motorola and DCC command format central units from Uhlenbrock, Arnold, Lenz, and Märklin. In combination with the Intellibox, the Power 3 and Power 6 can supply DCC, Motorola and Selectrix digital signals to the same layout simultaneously. These boosters also possess many unique operationing features, which allow them to be configured to suit a variety of applications.

The Power 3 and Power 6 have a selectable output voltage limit adjustment. By selecting this operating mode, the maximum output voltage of the booster may be adjusted between 12V and 20V. This is a useful feature for creating reduced speed areas (downgrades, stations, yards, etc.) on the layout. The voltage limit may also be applied to the Power 3 to operate smaller gauge digital layouts such as Z, N, and TT.

Both units are also equipped with a selectable Automatic "Loop-Back" function. This is intended for use on 2-rail layouts, where it prevents the occurrence of short-circuits associated with reversing loops. The separate Loop-Back Track output of the booster automatically senses and controls the track voltage polarity in the reversing loop, with respect to the Normal Track output, as a train travels around the loop - no further components are necessary.

It is also possible to configure the Power 3 or Power 6 as an NMRA-compatible DCC Braking Generator. A single booster in this mode can power several braking sections on the same layout. Through clever application of switching devices, extremely reliable and realistic automatic braking operations can be constructed easily with the Power 3 or Power 6.

CAUTION!!!

The Power 6 must not be used on large Z, N, TT and HO scale model railroad layouts. In operation with such layouts, strong short-circuits through de-railed trains may lead to permanent damage to track and trains.

1.2 Technical Data

Maximum Allowable Input Voltage:	18V AC
Maximum Output Current Load:	3A for Power 3 6A for Power 6
Transformer Rating:	Power 3: 52 – 70 VA Power 6: 150 VA
Dimensions:	180 x 136 x80 mm

2. Operation

The following sections describe the necessary connections and configuration of the Power 3 and Power 6, as well as any additional equipment required.

2.1 Elements on the Rear Panel

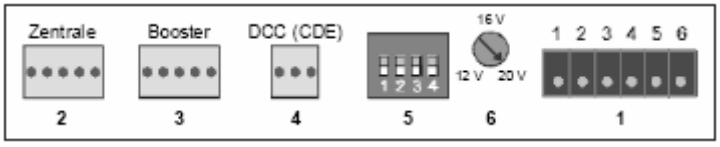


Figure 2.11. Connections on the rear panel of the booster.

1 *6-pole plug:* Transformer, Normal Track, Loop-Back Track
2 *5-pole plug:* Next Booster or Central Unit
3 *5-pole plug:* Next Booster or Central Unit
4 *3-pole plug:* DCC Central Unit
5 *4-pole DIP-switch:* Setting of Operating Mode
6 *Trim-Pot:* Output Voltage Limit Adjustment

2.2 Setting up the Connectors

Two plugs are located on the rear panel of the booster for connecting the transformer, normal track, loop-back track and a DCC central unit. The wires connected to these plugs must have a cross-section of 0.5mm^2 (20 AWG) minimum with approximately 6mm of insulation removed at the ends, carefully re-twisted and preferably solder-tinned afterward.

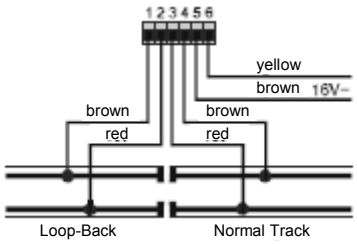
At the 3-pole clamp plug, the clamps are opened by a light press with a small screwdriver (2mm) through the upper opening of the plug. Insert the non-insulated end of the wire into the clamp plug. When installed properly, the wire and clamp will form a secure contact.

The 6-pole plug for the connection of the transformer, normal and loop-back tracks is a standard screw-clamp plug, where the wire becomes fixed through firm tightening of the screw.

2.3 Connecting the Transformer, Normal Track, and Loop-Back Track

The connection of the transformer, normal track, and loop-back track are made together with the 6-pole screw-clamp plug on Connector 1.

Connector 1 has the following pin assignment:



1 – Loop-back (brown)
2 – Loop-back (red)
3 – Digital track voltage (Märklin “red”)
4 – Digital track ground (Märklin “brown”)
5 – 16V AC transformer ground (Märklin “brown”)
6 – 16V AC transformer voltage (Märklin “yellow”)

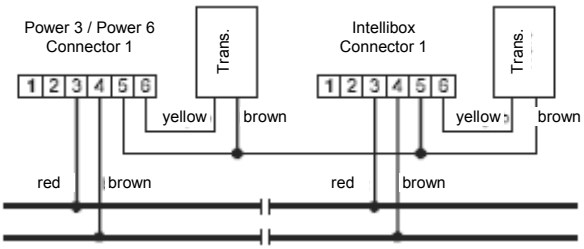
Figure 2.31. Pin-out of the 6-pole plug.

Connecting the Transformer

For proper operation of the Power 3, a transformer with an output of 16V AC and a minimum rating of 52VA should be used. At full output load, a transformer with 70VA (i.e. Uhlenbrock 20070) is recommended. For the operation of the Power 6, the transformer rating should be 150VA, for example Uhlenbrock 20150. The transformer voltage should not exceed 18V AC.

The transformer will be connected to clamps 5 (brown) and 6 (yellow) of the 6-pole plug for Connector 1.

CAUTION: When using the Power 3 or Power 6 with an Intellibox or Märklin central unit, the ground leads of the supply transformers, all boosters, and the central unit must be connected with one another for secure grounding. Otherwise, the booster control output of the Intellibox may become damaged when the track sections supplied by the Intellibox and Booster become bridged.



Connecting 2-Rail Track

Connect 2-rail DC track to clamps 3 & 4 of Connector 1 as shown below:

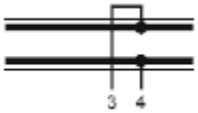


Figure 2.32. Connecting "2-rail" track.

Connecting 3-Rail Track

Connect 3-rail AC (Märklin) track with the brown wire on clamp 4 and the red wire (center rail) on clamp 3 of Connector 1 as shown below:

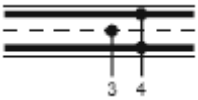


Figure 2.33. Connecting "3-rail" track.

2.4 Connecting an Intellibox or Märklin/Motorola Central Unit

An Intellibox or Märklin central unit is connected to the Power 3 or Power 6 using the supplied flat ribbon cable. Connect this cable between Connector 2 of the booster and Connector 5 of the Intellibox or the booster output of a Märklin central unit.

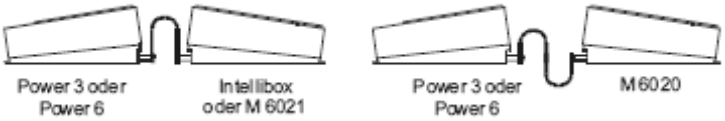


Figure 2.41. Orientation of the flat ribbon cable between Power 3/6 and different central units.

The connectors must be plugged-in such that the cable runs **upward** at the Uhlenbrock equipment and the Märklin Control Unit 6021, and runs **downward** at the Märklin Central Unit 6020.

2.5 Connecting a DCC Central Unit

A Lenz LZ100 or Arnold 86200 DCC central unit may be connected to the Power 3 or Power 6 over Connector 4. (Note that these central units use only the two signal lines, and do not use the short-circuit feedback line.)

1 C = Signal +
2 D = Signal –
3 E = Short-circuit signal line

Figure 2.51. Pin-out of the 3-pole plug.

2.6 Connecting Several Boosters

Additional Power 3, Power 6, or Märklin 6015 and 6017 boosters can be connected to Connector 3 of the Power 3 or Power 6.

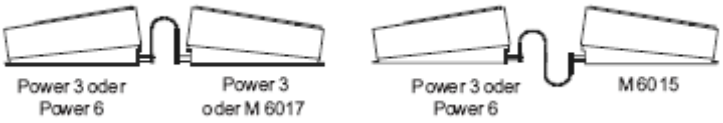
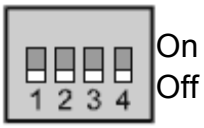


Figure 2.61. Orientation of the flat ribbon cable between Power 3/6 and different boosters.

The connectors must be plugged-in such that the cable runs **upward** at the Uhlenbrock equipment and the Märklin Booster 6017, and runs **downward** at the Märklin Booster 6015.

2.7 Selecting the Operating Mode

DIP switch 5 is used to configure the operating modes of the Power 3 and Power 6.



1 – Switches the input from Intellibox/Märklin to DCC
2 – Brake generator operation
3 – Automatic loop-back operation
4 – Output voltage limit

Figure 2.71. DIP switch on the rear panel of the booster.

DIP Switch	**1**	**2**	**3**	**4**
Input Intellibox or Motorola	Off			
Input DCC	On			
Booster operation w/o automatic loop-back		Off	Off	
Booster operation w/ automatic loop-back		Off	On	
Brake generator operation		On	Off	
Full output voltage of 20 V				Off
Variable output voltage 12 – 20 V				On

Figure 2.72. Setting of the DIP Switches.

3. Booster

3.1 Description

The Power 3 has an output current rating of 3A, while the Power 6 has a rating of 6A. The outputs of both units are fully short-circuit protected.

The boosters can be used together with various central units. In operation with the Intellibox, you can issue Motorola-, DCC-, and Selectrix-protocols to the layout. Together with central units from Märklin, Lenz, or Arnold, you can issue the protocols that these central units transmit. An operation together with Selectrix central units, however, is ***not*** possible for technical reasons.

3.2 Selecting the Connector for the Control Signal

The Power 3 and Power 6 can receive a control signal from Motorola or DCC central units. Aside from the format, these central units interface with the booster over different connections. The DIP switches on the rear panel of the device must be set accordingly.

Switch 1 *OFF* –Intellibox or Märklin central unit connected at Connector 2.
Switch 1 *ON* – DCC central unit (Lenz LZ100, Arnold 86200) connected at Connector 4.

3.3 Variable Output Voltage

The output voltage of the Power 3 and Power 6 is separate from the supply transformer. When used with a standard 16V AC model railroad transformer, the maximum voltage is 20V to the track (under no load). The factory default setting for the Power 3 and Power 6 is fixed at this maximum output voltage.

With DIP switch 4 set to ON, the output voltage of the Power 3 and Power 6 may be freely set from 12V to 20V using the trim-pot next to the DIP switch (with the aid of a small screwdriver).

Switch 4 *OFF* – Fixed output voltage setting of 20V.
Switch 4 *ON* – Variable output voltage of 12V to 20V.

3.4 Operation over the DCC Input without Feedback

Faults will be maintained in track sections supplied by the booster, since no short-circuit information is fed back to a DCC central unit. The booster must be connected over the DCC input (Connector 4) when used with a DCC central unit. In this case, only the C- and D-leads of the booster are to be connected to the central unit (see *Connecting a DCC Central Unit*).

A short-circuit fault will switch off the track voltage at the booster output. After approximately 10 seconds, the track voltage will automatically be switched on again. If the short-circuit has not yet been removed, the booster will automatically switch off again for another 10 seconds, and so forth.

Note: When this operating mode is used with the Intellibox, operation of Selectrix locomotives in the electrical circuit provided by the booster is ***not*** possible.

4. Automatic Loop-Back

4.1 Description

In analog, as well as in digital, the operation of a reversing loop with 2-rail track forces a short-circuit to occur through the track construction. With a "Loop-Back" feature, the track polarity is controlled in such a way that a train is able to travel through the loop normally.

The Power 3 and Power 6 have a separate loop-back output for 2-rail operation (DCC, Märklin 1, Selectrix). This output can be connected to multiple loops, however only one loop at a time can be traversed by a train.

4.2 Activation of Automatic Loop-Back

To operate the Power 3 and Power 6 as a booster with automatic loop-back, the DIP switches on the rear panel of the device must be set accordingly.

Switch 3 *ON* – Activates automatic loop-back operation.
Switch 2 *OFF* – Disables brake generator operation.

Important: To operate in loop-back mode, the brake generator operation of the booster must be disabled.

4.3 Connecting the Loop-Back Output

The reversing loop is connected over the 6-pole plug of Connector 1. As shown in the figure below, the reversing loop track will be connected to clamps 1 and 2 and the normal track to clamps 3 (red) and 4 (brown).

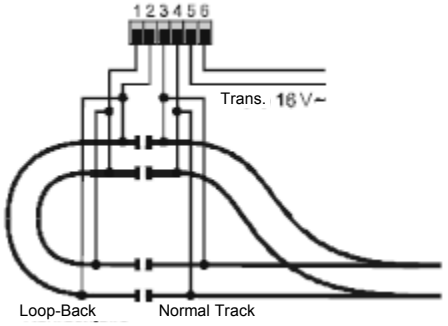


Figure 4.31. Connection of a reversing loop using the Loop-Back output.

Very Important: The reversing loop track must be unconditionally isolated on both sides.

Important: The tracks adjacent to the isolated loop must be supplied from the normal track output of the same booster. The automatic loop-back will be controlled through the bridging of the separation points. The loop track will become connected with the loop-back output and with the normal track output of the booster during operation.

5. Brake Generator

5.1 Description

A brake generator provides for locomotives with DCC digital decoders to stop before a railroad signal using the decoder's own braking delay.

To activate this occurrence, a special brake signal is required. Moreover it must become securely positioned through a special switching of the brake section, so that when the separation point between the normal track section and the brake section is bridged, a short-circuit does not occur.

The brake generator oversees every individual brake section. As soon as a train is found fully within the brake section, the supply is switched over from the normal booster to the brake generator.

5.2 Selecting the Connector for the Control Signal

The Power 3 and Power 6 can receive a control signal from Motorola or DCC central units. Aside from the format, these central units interface with the booster over different connections. Moreover, the DIP switches on the rear panel of the booster must be set accordingly.

Switch 1 *OFF* - Intellibox or Märklin central unit at Connector 2.
Switch 1 *ON* - DCC central unit (Lenz LZ100, Arnold 86200) at Connector 4.

5.3 Selecting the Operating Mode

To operate the Power 3 and Power 6 as a brake generator, the DIP switches on the rear panel of the booster must be set accordingly.

Switch 2 *ON* – Activates brake generator operation
Switch 3 *OFF* – Disables booster operation

5.4 Connecting the Brake Generator

Before every railroad signal, a "drive" and a "stop" section is installed. These sections become switched to brake generator operation as soon as the switchover is activated by a train entering the "stop" section. To avoid short-circuits, the "drive" section preceding the "stop" section must be as least as long as the longest operated train. The length of the "stop" section must be chosen so that all locomotives with the set braking delay come to a stop within the section.

For switchover with train influence, a track occupation sensor with an integrated relay (i.e. Uhlenbrock 43400) may be used. The track voltage can be supplied by the booster of the Intellibox, another Power 3 or Power 6, or a Märklin booster (6015 or 6017).

The switch S1 in the diagram must be set open. This may be a switch contact built-in to a signal, or a switch that is activated through an additional relay. At signal position “green,” the switch S1 will be open, and the track occupation sensor remains inactive. In this situation, the entire block section will be supplied with digital track voltage from the central unit or a booster. At signal position “red,” the switch S1 will be closed, and the track occupation sensor can oversee the “stop” section. When a moving train enters the “stop” section, the track occupation sensor switches the voltage supply of the entire block section to the brake generator.

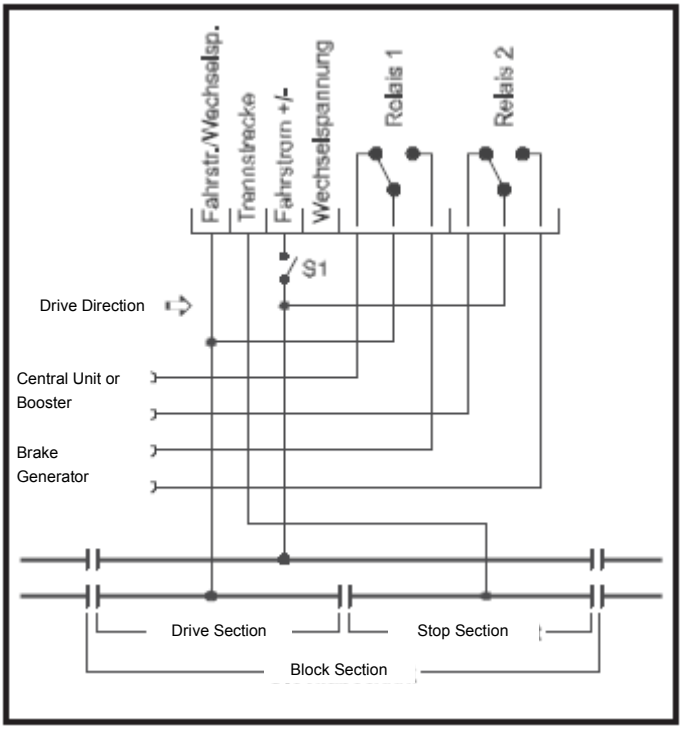


Figure 5.41. A brake section preceding a signal can be constructed with a track occupation sensor.

5.5 Brake Generator without Connection to a Central Unit

If the booster is to be used as brake generator without short-circuit feedback and without the possibility of being switched by the central unit, the operating mode must be set for brake generator and Märklin signal input. The connecting cable to the central unit can then be left off.

A short-circuit fault will switch off the track voltage at the booster output. After approximately 10 seconds, the track voltage will automatically be switched on again. If the short-circuit has not yet been removed, the booster will automatically switch off again for another 10 seconds, and so forth.

6. Failure Information

Operational problems are informed by the Power 3 and Power 6 through various blinking sequences of the red and green status LEDs.

Green LED On – Red LED Off:
"go" key has been pressed
Track voltage switched on (normal operating condition)

Red LED On – Green LED Off:
"stop" key has been pressed
Track voltage switched off through the central unit

Green LED Off – Red LED Blinking:
Short-circuit on the track

LEDs Blinking Alternately 1x Red – 1x Green:
Overheated, track voltage is switched off.

LEDs Blinking Alternately 1x Red – 2x Green:
No input signal at Intellibox/Märklin input

LEDs Blinking Alternately 1x Red – 3x Green:
At turn-on, an odd voltage exists at the track output