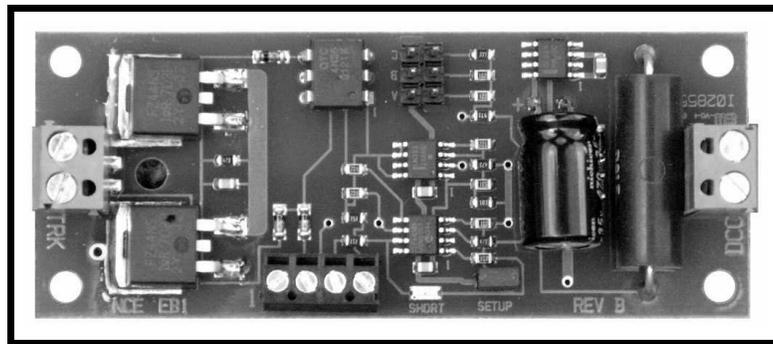# NCE
The Power of DCC

EB1 Circuit Breaker

$29.95
Electronic circuit breaker for use on DCC layouts only.

Features of the EB1:

- ✓ Provides short circuit protection for one power district
- ✓ Trip current adjustable for 2.5 to 8 Amps
- ✓ Easy hookup using screw terminals, no soldering
- ✓ Status indication LED
- ✓ Additional output for remote LED
- ✓ Optional manual reset
- ✓ Adjustable short circuit response time
- ✓ Adjustable power-up response time to accommodate startup of sound decoder equipped locomotives

05240225

Age
14+

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Description:
It is usually desirable to divide a layout into separate track power sections (power districts). Multiple EB1 circuit breakers can be used to divide the power output of one DCC booster into independent power districts each with its own short circuit protection. Note: The EB1 is designed to be used only with DCC systems. It will not work with any power system other than DCC.

Mechanical Installation:
The EB1 has 4 mounting holes that can be used to mount it to a convenient place on your layout. We recommend using #4 x 3/4" round head wood screws with #4 flat washers. Do not over tighten the screws. Lightly snug the screws up just enough to keep the circuit board in place without bending it. Bending the circuit board can fracture the fragile ceramic electronic components.

Electrical Connections:
The diagram below illustrates the wiring of the EB1 to your layout. The terminal strips on the EB1 accept up to #12 AWG wire. For distances to 20 feet (6.5 meters) from the booster to the EB1 you should use at least #16 AWG wire, #14 for runs out to 40 feet and #12 for longer runs. Wiring from the EB1 to the track should be the same gauge for runs of the same distance. We recommend track feeder wires every 8-10 feet when using code 83 or larger rail size. If you're using code 70 or smaller rail we suggest feeders every 6 feet. Insufficient feeders can cause enough voltage drop to prevent the circuit breaker from working. The drawing below shows booster (DCC power) and track connections as well as hookups for optional manual reset and a remote status LED.
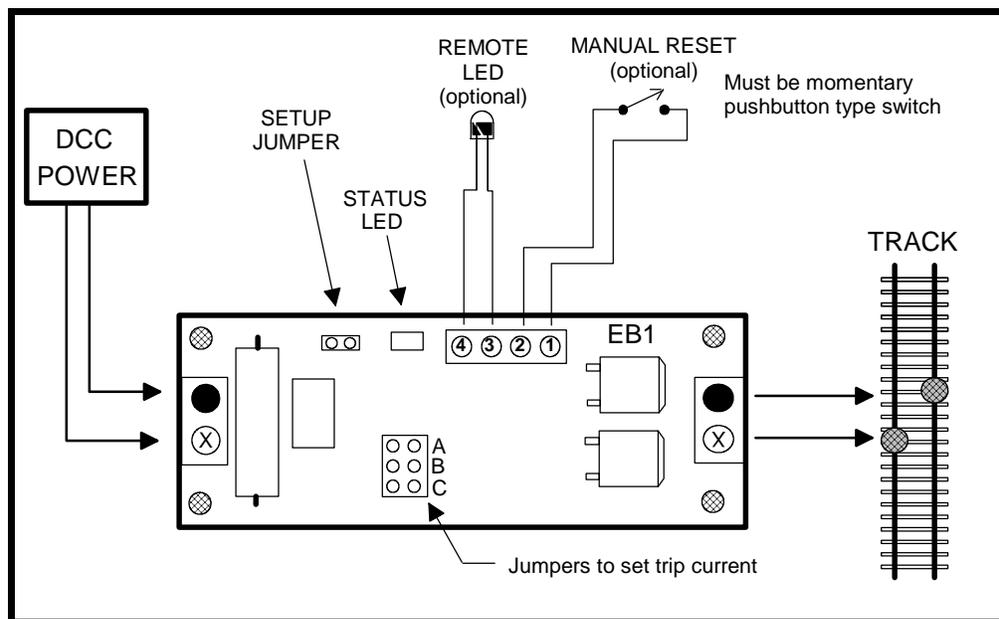
Note: The screw terminals marked with black dots (drawing above) are directly connected together on the EB1 circuit board. If you are using common rail make sure the terminals marked in black above are connected to the common rail (left rail in the diagram). When the EB1 "trips" only the screw terminals marked with an X are disconnected during a short circuit.

When the power and track connections are made the EB1 is ready to use. Factory settings have been chosen to provide suitable operation with most HO and N scale layouts. If desired you can fine tune the operating parameters of the EB1 to more closely match your DCC system and layout using the information presented on the following pages. Before jumping in and changing any settings we suggest trying the EB1 with the original factory settings.

Setting trip current:
The EB1 comes from the factory with the trip current set to 2.5 Amps. You can set the trip current for each district higher by using circuit "shunts". Shunts are the small black plastic pieces supplied with the EB1.   If no shunt is installed the trip current is 2.5 Amps. The diagram below illustrates the locations of shunts to set the trip current in 8 increments from 2.5 to 8 Amps.

To install a shunt simply slip it over the indicated pins on the circuit board.   The diagram below shows the settings.

TRIP CURRENT JUMPER SETTINGS

2.5 AMP	3.5 AMP	4 AMP	5 AMP
A B C	A B C	A B C	A B C

6 AMP	7 AMP	7.5 AMP	8 AMP
A B C	A B C	A B C	A B C

Black "bar" indicates location of shunt
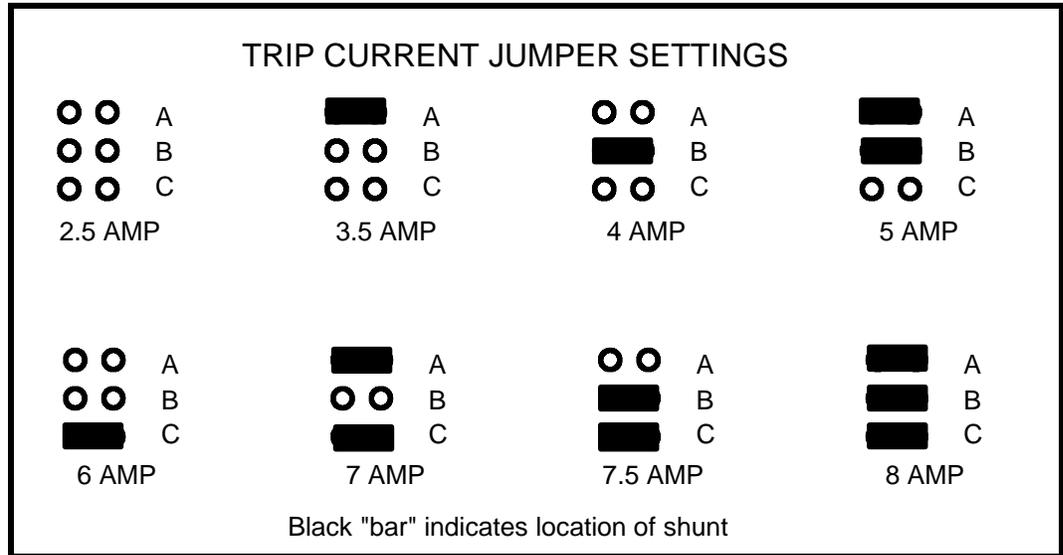
Testing the installation:
After setting the trip current we recommend testing your wiring. The "quarter test" is the fastest way to test your wiring. Use a coin or other piece of metal to short across the rails at various places in a power district. The EB1 should trip and shut down the power district at every place you short out the track. Once shut down the EB1 will try to restore power about once every 2 seconds. If there is still a short the EB1 will kill the power again, until the short is removed.

Status Indicator:
There is a status indicator LED near the "SETUP" connector. The LED will light steadily if everything is OK.   A flashing LED indicates the circuit breaker for the power district has tripped.   LED off usually indicates the DCC power booster is turned off.

Optional External Status Indicator:
You may connect an LED for use as a remote status indicator to terminals 3 and 4 of the the EB1. This LED will duplicate the actions of the small status LED mounted on the EB1. Current limiting resistors are already mounted on the EB1 so all you need is an LED. The cathode (minus polarity) of the LED should be connected to terminal 4. Use the diagram on page 2 as reference for connecting this LED.

Optional Manual Reset:
You may connect an external pushbutton switch (normally open type) as a manual reset to recover manually from a short circuit. The EB1 must be setup for manual reset for this feature to work (see the following section on Fine Tuning the EB1). The switch should be connected between terminals 1 and 2. Use the diagram on page 2 as reference for connecting this switch.

Two ways to setup the EB1:

Method 1:
Any DCC system that has OPs mode programming (Program On the Main) for _locomotives_ can program CVs. Whenever the "SETUP" shunt is installed the EB1 will respond to loco OPS mode programming no matter what locomotive address is used. We recommend choosing an address that is not in use on your layout (we use 9999).   Remember that the shunt must be installed to use this method of setting CVs. ***Do not forget to remove the shunt when done programming***.

Method 2:
If you have an NCE (or other system) that supports OPs mode programming of _accessories_ you can program CVs without having to install the "SETUP" shunt.

The EB1 comes from the factory preprogrammed to the accessory address of 2044 (the accessory broadcast address).
To change the address:
  ▪ Install the "SETUP" shunt
  ▪ Press SELECT ACCY on your controller
  ▪ Type in the new address you want to EB1 to use followed by ENTER
  ▪ Press 1 (for NORMAL) when prompted on your controller
  ▪ Remove the shunt
The EB1 will now respond to Accessory Programming at the address you just programmed.

You _will not_ need to install the shunt again to program CVs when using PROGRAM ACCESSORIES mode on an NCE system.

Fine Tuning the EB1

CV129 - Adjustment of short circuit response time (if necessary):
You can adjust the time delay between the occurrence of a short circuit and the time the track actually gets shut down. The EB1 comes factory set to 16mS (16 milliseconds = 16 thousandths of a second). This setting has been chosen because it can be used without problem on most layouts.   You can lengthen this delay from 16ms (1/60th second) out to 512mS (1/2 second).   Program CV129 to the number of milliseconds (divided by 16) you desire between 16mS and 500mS. A value of 1 = 16mS, a value of 32 = 512mS, etc.

CV130 - Adjustment of short circuit shutdown time (if necessary):
You can adjust the time the track power stays off after a short circuit is detected. The EB1 comes factory set to 2 seconds. This setting has been chosen because it can be used without problem on most layouts.   You can change this delay from 16mS to 4 seconds. Program CV130 to the number of milliseconds (divided by 16) you desire. A value of 1 = 16mS, a value of 128= 2 seconds, 256 = 4 seconds, etc.

CV131 - Manual reset enable.
If CV131 is set to 0 the manual reset is disabled and the EB1 will automatically try to turn on track power after a short circuit. If CV131 is set to 1 the EB1 will not automatically restore track power after a short circuit until a connection (usually with a pushbutton) is made between terminals 1 and 2 of the four position terminal strip. You can also turn the track power back on by selecting the accessory address and setting the accessory to ON (also known as Normal, Thrown or +) .

CV132/133 - Accessory address
CV132 default = 143 high byte of accessory address
CV133 default = 191 Low byte of accessory address
Don't try to set these CVs by manually programming CVs.
Use the "setup" jumper method above to set the accessory address.

If manual reset is enabled, track power through the EB1 can be turned on/off (or turned back on after a short circuit shutdown) by controlling the EB1 as accessory (turnout). ON/Normal turn track power on and OFF/reverse turns it off/

CV135-CV146 - Custom Startup Table (Note: this if for the technically inclined)
The custom startup table provides a programmable method to pulse the track power on and off several times before the EB1 tests for overcurrent. You can program the on and off times in increments of 1mS. Generally you will not use this table with most boosters but it may be useful with a booster that has weak startup capability.

An "off" time of 0 indicates the last entry of table. With the factory default of CV144 = 0 indicates the EB1 will not try to use the 6th "on" time.

If CV135 = 0 the table is disabled.

CV135 default = 0 Custom startup table initial "on" time
CV136 default = 4 Custom startup table initial "off" time
CV137 default = 8 Custom startup table 2nd "on" time
CV138 default = 4 Custom startup table 2nd "off" time
CV139 default = 16 Custom startup table 3rd "on" time
CV140 default = 4 Custom startup table 3rd "off" time
CV141 default = 32 Custom startup table 4th "on" time
CV142 default = 4 Custom startup table 4th "off" time
CV143 default = 80 Custom startup table 5th "on" time
CV144 default = 0 Custom startup table 5th "off" time
CV145 default = 0 Custom startup table 6th "on" time
CV146 default = 0 Custom startup table 6th "off" time

CV147 Factory reset
Set CV147 = 85 to do a factory reset of the EB1 to the following values.

CV129 default = 1   16mS allowable short circuit
CV130 default = 128   2 seconds power off time
CV131 default = 0   Manual reset off
CV132 default = 143   High byte of accessory address 2044
CV133 default = 191   Low byte of accessory address 2044
CV135 default = 0   Custom startup table disabled
CV136 default = 4
CV137 default = 8
CV138 default = 4
CV139 default = 16
CV140 default = 4
CV141 default = 32
CV142 default = 4
CV143 default = 80
CV144 default = 0
CV145 default = 0
CV146 default = 0

EB1 Specifications:

Dimensions: .... 3.75 x 1.25 inches
Max. input current:.................... 10 Amps
Max. DCC voltage:..................... 22 Volts
Short circuit response:............... 16mS to 512mS
Over current trip points:..............2.5 Amp +/- 75mA
                                           3.50 Amp +/- 90mA
                                           4.00 Amp +/- 120mA
                                           5.00 Amp +/- 100mA
                                           6.00 Amp +/- 150mA
                                           7.00 Amp +/- 150mA
                                           7.50 Amp +/- 100mA
                                           8.00 Amp +/- 200mA
Ext. LED maximum current........17mA (300 Ohms in series with 5 volts)
Accessory address range...........1-2044 (2041-2044 are NMRA broadcast addresses)

Device Warranty
This device is fully factory tested and warranted against manufacturing defects for a period of 1 year. As the circumstances under which it is installed can not be controlled, failure of the device due to installation problems can not be warranted.   This includes misuse, miswiring, or operation under loads beyond the design range of the device. For warranty or non-warranty replacement send the device (and any payment, if required) to:

NCE Warranty Center
82 Main Street
Webster, New York 14580

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