Chapter 14

Appendix I: Connecting a Brake (Relay) module

14.1 Introduction

In this Appendix we explain how you can connect a Brake (Relay) module. The Brake module is used to prevent (heavy) Z-axis components from falling downward after e.g. a power failure. Next to braking, the relay module can be used for a variety of purposes.

14.2 Hardware Connection procedure

If you are using this module for a Brake, please continue reading. When you intend to use the module for an other purpose than for braking, please continue reading in the Relay section.

This Brake section is set up as follows:

Brake

- Hardware Setup

  1. You have a DamenCNC RTR Performance (standard with a brake(relay) module) set and you would like to connect a brake
  2. You have a DamenCNC RTR set without a brake(relay) module inside
  3. You have an external USBCNC CPU V4.0 and a brake(relay) module

- Software Setup

Relay

- Hardware Setup
- Software Setup

Connecting procedure
1. You have a DamenCNC RTR Performance (standard with a brake module) set and you would like to connect a brake

If you have a DamenCNC RTR Performance and you wish to connect your brake, verify that you have the Brake component which is shown on the left and ensure that it is connected as can be seen on the right. The other end of the cables should be attached to the **NO** terminal from the brake PCB.
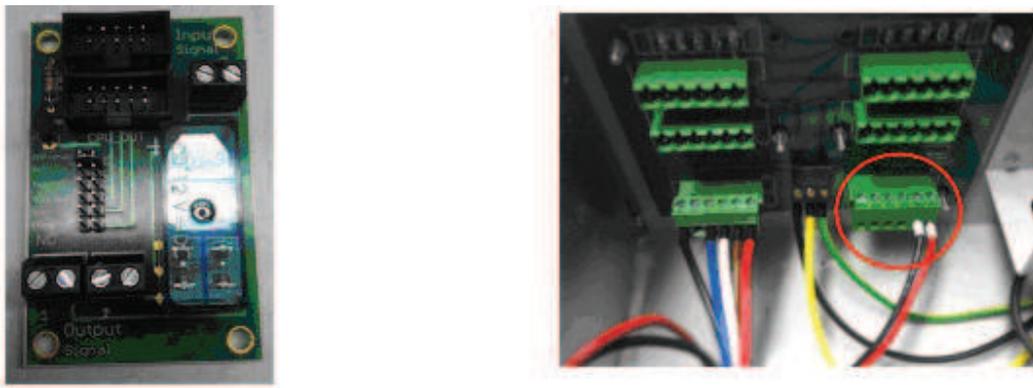

Figure 14.1: The components and wiring for the brake module. The brake PCB may look slightly different. Verify that on the right figure, +Vcc is on the right of the connector (as seen from the figure's perspective), and GND is left.

The Brake (relay) module is engaged by the AMP-enable signal from US-BCNC. This standard setting can be altered by switching the jumper at the Brake (relay) Module. For normal brake operations, ensure that it is set to the AMP-enable setting.
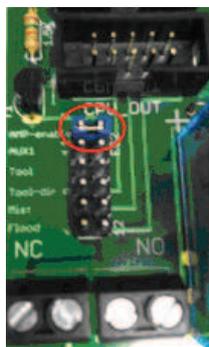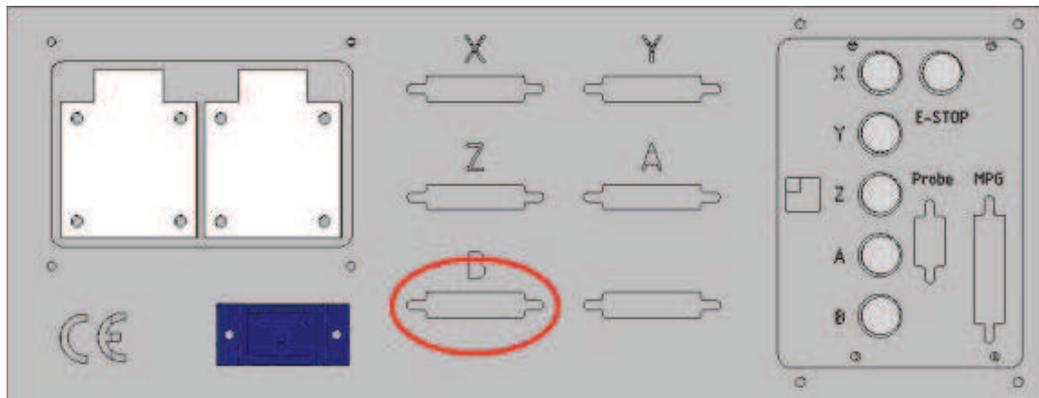

Figure 14.2: Verify that the jumper is set to AMP-enable

When all the wiring is set up correctly you can insert the connector of the brake into the hub on your RTR set:

Continue with the Software Setup Relay to test the brake.

2. You have a DamenCNC RTR set without a brake (relay) module inside

In this section the installation of the Brake inside your RTR set is discussed. In order to do so, the following information about the Brake module is essential:
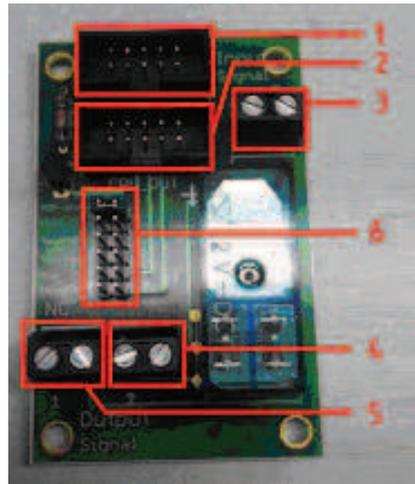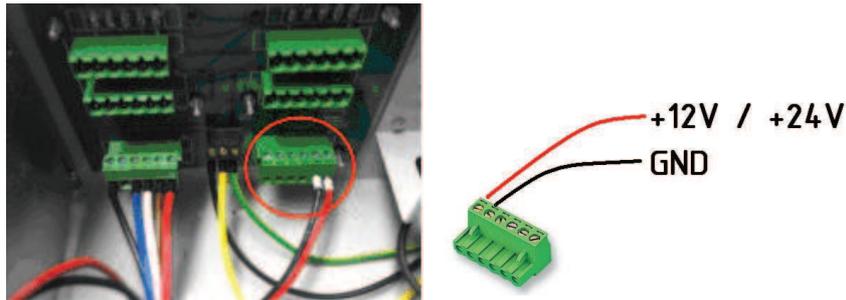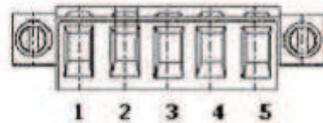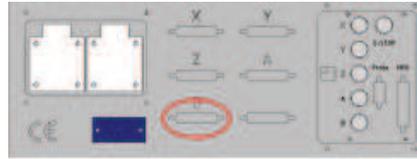

The wiring scheme is as follows:

- 1. USBCNCAXIS
- 2. USBCNCOUT
- 3. Signal Input Terminal
- 4. Signal Output Terminal NO
- 5. Signal Output Terminal NC
- 6. Jumpers

The Brake can be installed by performing the following procedure:

- 1. Make sure the jumper is correctly set to the AMP enable position

- 2. Make a connection between the Signal Input from the Brake (relay) Module and the 12V power supply.
  Signal 1 should be connected with +12V and Signal 2 with the GND.
  The 12V power can be recognized because it also supplies power to the cooling fan and USBCNC CPU.
  In case of doubt, use a Multimeter to verify, if you are indeed connecting the wiring to a 12V powersource.

- 3. Establish a connection between USBCNC and Brake (relay) Module.
  The Brake (relay) Module has 2 terminals for ribbon cable connectors.
  One is labeled CPUOUT and the other is labeled CPUAXIS.
  CPUOUT should be connected with the OUT terminal from USBCNC CPU.
  CPUAXIS should be connected with any axis terminal from the USBCNC CPU. Most common is to use axis 5 or 6 since most customers have a 3 or 4 axis system, which leaves axis 5 and 6 open for use.

- 4. Establish a connection between the Brake (relay) Module and the interface card inside the RTR that provides the output.
  Connect the output terminals NO to the interface card as shown in the following figure:

The connection on the outside of the RTR controller should be as follows:

The wiring scheme is as follows:

- 1. +12V (+24V)
- 2. GND
- 3. NC
- 4. NC
- 5. NC

The brake (relay) module is now ready to be attached nside the RTR. Sticky feet prove to be a good solution to fix the brake PCB inside a RTR system. Please bear in mind that the brake (relay) module is sensitive for electronic noise originating from the USBCNC CPU. For this reason it must be placed as far as possible from the USBCNC CPU.
DamenCNC RTR systems are factory assembled with the Brake PCB mounted on the backside of the CPU holder, which proves to be a good solution.

When you have performed all these steps successfully, you can proceed to test your Brake module in the Test section.

3. You have an external USBCNC CPU V4.0 and a Brake (relay) module

For this operation it is necessary to have the following information about the Brake PCB
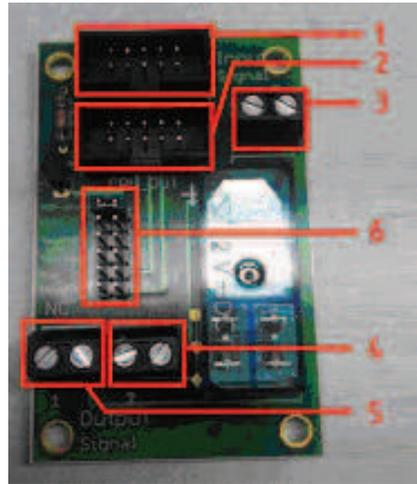
The wiring scheme is as follows:

1. USBCNCAXIS

2. USBCNCOUT

3. Signal Input Terminal

4. Signal Output Terminal NO

5. Signal Output Terminal NC

6. Jumpers

- **1. Input signals**

  The Brake (relay) Module contains a relay that connects two inputs signals (signal 1 and signal 2) with four output signals (Signal 1 NC, Signal 1 NO, Signal 2 NC and Signal 2 NO).
  In order to use a brake you need to connect 12V or 24V as input signal. The brake itself should be connected with signal 1 and 2 from the **NO** output.

- **2. Connection from Brake (relay) Module and USBCNC CPU**
  In order to control the relay from USBCNC the following connections have to be made:
  The Brake (relay) Module has 2 terminals for ribbon cable connectors. One is labelled CPUOUT and the other is labelled CPUAXIS.
  CPUOUT should be connected with the OUT terminal from USBCNC CPU.
  CPUAXIS should be connected with any axis terminal from the USBCNC CPU.

Warning:
The relay uses the external power input of the USBCNC CPU that has to be 12V.
Without this input or an input with different voltage the Brake (relay) Module will not function and will be damaged.

Testing the Brake and Software setup

Now the brake is connected, we can test the brake functionality.

We assume that the system is correctly configured and that the machine is working properly.

This implicates that the only change performed to your system is adding this brake module. If you don't have the XYZ(AB) axis of your machine working properly, first address this issue. This is because the signal that enables the brake is the same signal that enables the stepper drives. In the case that you invert this signal, both the brake module and the stepper drives will get affected.

For that reason it is important the steppermotors are correctly functioning before attaching the brake module.

1. Start your PC and start the USBCNC Software

2. Ensure that USBCNC is not running in Simulation mode!

3. When you are in the USBCNC operating environment, look at the top left where the buttons can be found as shown in the figure below:

Click on the drivers such that the LED turns red and the drivers are thus engaged. With the drives engaged, the brake should be disabled. If the drivers are disabled, the brake should be enabled.

Hardware Setup

The Brake relay module can also be used to control other functionalities using USBCNC Software. If you want more information about how to connect your Brake relay module and which signals can be used, please continue reading.
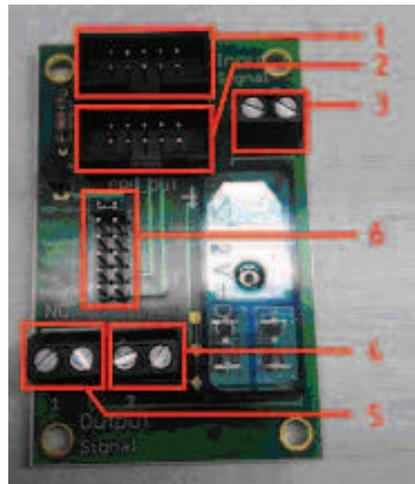

Figure 14.3: Your Brake module may look slightly different

On the following page you can find the wiring scheme corresponding with Figure 13.3

The wiring scheme is as follows:

- 1. USBCNCAXIS
  This connector is for the AXIS signal of your USBCNC CPU. Connect this slot with an AXIS signal from the USBCNC CPU if you wish to trigger the relay using the AMP-Enable signal. (**Note:** the OUT signal also needs to be connected in order to use the AMP-Enable signal)

- 2. USBCNCOUT
  This connector needs to be connected with the OUT signal of your USBCNC CPU. Without this connection the brake relay module does not function.

- 3. Signal Input Terminal
  There are 2 Signal inputs. The input signal should be within the range of (AC/DC) 50V and approximately 500mA. These values are not equal to the specifications from the relay, but these are limited because of the PCB specifications.

- 4 and 5. Signal Output Terminal NC
  There are two different output terminals; **NO** (4) (Normally open) and **NC** (5) (Normally Closed). The output signals are the same as the used input signals.

- 6. Jumpers
  In this section you can chose which signal must control the relay. You can choose from the following options:

  1. AMP-Enable

  2. AUX 1

  3. Tool

  4. Tool - dir

  5. Mist

  6. Flood

  Please bear in mind that it is not possible to have more than one signal controlling the relay.

Warning:

- When you are using one of the signals (except signal 1), make sure there are no other devices such as relays connected with the same signal you want to use.
  For example; when the OUT from the CPU is also connected with one of our Tool/Flood modules (and the jumpers are set on Tool and Flood of the PCB from the Tool/Flood module), you can't use signal 3 and 6.

- When you also use a **0-10V Spindle Speed Control**, you can **NOT** use signal 3 and 4.

Software Setup Relay
The Relay can be controlled from USBCNC with the following M-codes.
The Relay will only switch when the jumper is attached to the signal with the corresponding M-codes.

Nr.	Signal	M-Code	
		ON	OFF
1	AMP-enable	M80	M81
2	AUX1	M82	M83
3	Tool	M3/M4	M5
4	Tool-dir	M4	M5
5	Mist	M7	M9
6	Flood	M8	M9

14.3 Brake Module FAQ

- **I have connected the brake as specified but it doesn't seem to work properly.**

  Answer: Did you remove the springs from the brake?

- **I have connected the brake as specified but it works exactly the wrong way around. So it is already disabled when the drives are still disabled too.**

  Answer: On the The Brake (relay) Module there are two output terminals: **NO** and **NC**. Our standard connection is made with **NO** so when the brake works inverted at your machine the connection should be changed to **NC**.

  Note: Do **NOT** invert the AMP enable input in the software.
  The steppermotors use the AMP enable, so when the signal is inverted the steppermotors not to work anymore with your current machine configuration.