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# DTCv3

## Manual

## Release management

This manual applies to:

- Module DTC version 3.1
- Firmware DTC 6.01
- Software DTCnewConfig version 1.1

### Modifications Manual

- Since mid-2023, the DTC Set is supplied including a mounting kit for the power supply unit. Added in manual.

### Software Modifications

#### 6.01 Build 1:

- Initial version including DTx support

#### 6.01 Build 2:

- Emergency stop procedures improved

#### 6.01 Build 3:

- DTx was not always recognized at startup: corrected.
- Undesirable emergency stop behavior during initialization DTx: corrected

#### 6.01 Build 4:

- Added: DTx magnetic field strength reporting
- Avoiding abusive detection of DTx sensor in case of defective DTS or DTx sensor

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## 5 Firmware Update

When new firmware is released for your DTCv3, you can install these updates yourself.

Firmware update (currently) only works on a **Windows** computer.

To perform an update, follow these steps:

- Download (if you have not already done so) the program "mikroBootloader" from [www.dinamousers.net](http://www.dinamousers.net) Unpack the .zip file in a place where you can find it.
- Download the firmware you want to install. Please make sure this firmware is for the DTCv3. You need a \*.hex file. Normally this is packed in a .zip file. Extract the .zip file to a place where you can find it.
- Make sure the DTCv3 is connected to the PC via USB and apply power to the DTC.
- Start mikroBootloader by double clicking on mikroBootloader.exe
- Make sure that "PIC18" is selected in the top right corner next to "Select MCU".
- "Change Settings" of the COM port:
  - Port = the COM-port with which your DTCv3 is connected
  - Baud rate = 115200
  - Data bits = 8
  - Stop bits = 1
  - Parity = none
  - Flow control = none
 Click "OK".
- Click "Connect". The text "Waiting MCU response ..." appears on the right. Press the RESET button on your DTCv3. In mikroBootloader will appear "Connected."
- Click "Browse for HEX". Locate and select the .hex file you want to install.
- Click "Start uploading".
- The "Bootloading progress bar" at the bottom now fills up. Get coffee, wash the dishes, walk the dog. It may take a while (although significantly faster than the older DTCs).
- When it is ready you will get a pop-up window that it is ready. Click OK.
- Close mikroBootloader.
- Reset the DTCv3 with the RESET button.

Your DTCv3 now works with the new firmware.

If you have adjusted settings and you want to activate/save them in the DTC, click on the button "Write Settings"

If you have the impression that you have adjusted things and messed up, click the "Factory Reset" button. Then everything is back as when you received your DTC and you can (happy) start again.

## 4.6 Advanced Settings

The settings directly below the "Calibrate" button are automatically filled and cannot be adjusted. This is possible though if you check the "Manual" checkbox. You then have the following settings available:

- "Acceleration" (applicable only with DTS/DTZ).  
This is the time in ms between two (internal) speed steps when accelerating/decelerating. If you notice that the bridge brakes too early and therefore runs at minimum speed for quite a long time before reaching the target, you can adjust this time slightly upwards. If you notice that the bridge is not reaching minimum speed, you can adjust the step time slightly downwards. Always adjust in small steps.

**Note that Acceleration Delay is no longer calculated automatically when sliding Maximum Speed and Positions for Slowdown as long as "Manual" is checked!**

- "Motor Factor" is an internal factor that determines the relationship between the speed setting and the desired EMF value of the motor. This factor is determined during calibration. If you increase the Motor Factor, this means that the motor is oversteered at high speeds and the speed can no longer be controlled properly. However, you can set the Motor Factor lower if you wish. This can be useful if, for example, you have set the maximum speed very low for your desired speed (eg 60% or lower). By setting the Motor Factor lower you will get a larger control range back. Note that the calculated Acceleration Delay is no longer correct if you adjust the Motor Factor. You must therefore always set these manually.
- "PID Kp" and "PID Ki" are the internal parameters for PID control of the motor. If you notice that the engine is running a bit jerky, you may be able to improve a bit with these parameters. However, you do realize that worn carbon brushes, poor contact of the sliding contacts or the relay contact in the bridge can also cause the motor to run poorly. And an auxiliary relay that is still in the bridge and is connected to the motor connections also has a very counterproductive effect (see paragraph 3.2.3-> "Fleischmann "C" series"). A PID control does improve this, but is not a panacea for everything. So make sure that the other things are in order before you start adjusting these parameters.

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# 1 Introduction

## 1.1 Intro

The DTC Turntable Control (Dinasys Turntable Controller) controls various turntables for scale HO, HOm, TT, N and Z. The DTC provides a strong improvement compared to the standard control. The rotational speed of the bridge can be accurately controlled so that it starts up slowly and slows down again at the destination track. An important premise is that only minimal adjustments to the turntable are required.

The DTC can be controlled digitally by train control software on a PC. The DTC is currently supported by iTrain, Rocrail, WinDigipet, Traincontroller and MpC. The actual position of the bridge is always fed back to the PC software by the DTC, so that this position can also be made visible on the screen. In addition, the DTC can be operated by means of an optionally available DTM hand control.

The DTCv3 is the latest version of the central control unit. This has a number of improvements compared to its predecessors. Most importantly for the user, the DTCv3 measures the actual rotational speed of the bridge motor, allowing for even more precise control. This not only leads to an even more realistic behaviour, but also greatly simplifies the adjustment of the turntable.

In order to work, the DTC must be able to measure the position of the bridge. For this purpose, the DTC is always combined with a magnetic sensor module that is mounted under the turntable. The adjustment to the turntable itself is in many cases the mounting of a magnet in the bridge.

There are 4 types of sensor modules available for the DTC:

- DTS-100 For turntables with 48 fixed positions and a center-to-center distance of 100mm between the bridge axis and the magnet. For example, these are:
- Fleischmann 6052, 6152 (HO)
  - Märklin 6652, 7286 (HO)
- DTS-75 For turntables with 48 (or 24) fixed positions and a center-to-center distance of 75mm between the bridge axis and the magnet. For example, these are:
- Fleischmann 6154 (HO)
  - Fleischmann 6680 (TT en HOm)
  - Fleischmann 9152 (N)
- DTZ For the Märklin Z turntable with 24 fixed positions:
- Märklin 8998 (Z)
- DTx For turntables whose shaft is externally driven. The exits do not have to be in fixed positions, but can be distributed arbitrarily over the circumference. One of the turntables based on this principle is the Roco 42615 (HO) turntable. In addition, there are various turntables from small series providers and DIY turntables in various scales (possibly also larger than HO) based on this principle.

- “Angle at Slowdown” (DTx) is the number of degrees before the target position at which the bridge begins to decelerate. Acceleration from the starting position occurs over the same turning angle. Note that the maximum turning speed of the bridge is only achieved if the turning angle to be bridged is at least 2x the angle you set here.

Below you find 7 additional settings:

- “Bridge Relay Hold Current”. The bridge unlock-relay remains engaged during rotation over multiple positions. To avoid too much heat development, this is done with a lower current (attracting the relay takes more force than holding a retracted relay). The default setting is 100% for DTZ and 25% for all others. It turns out that a single turntable doesn't respond well to the default setting. If that is the case, you can adjust it here in steps of 12.5%. Before you do that: check that there is no hardware cause for your problems (bad/dirty sliding contacts, loose connections, etc)
- “Automatic Polarity”. The polarity on the rails of the bridge can (with 2-rail) be reversed by the DTC. Whether or not the polarity should be reversed depends on the position of the bridge and the polarity of the tracks that connect to the turntable. Bridge polarity is normally set by the software. Some software (e.g. TrainController) does not support the bridge polarity command. In order for it to work correctly, you then need an additional reverse loop module. To prevent this, you can also let the DTC regulate the polarity reversal itself. If you set a value here other than 0 (“—”) the DTC inverts the bridge from position <set value> to <set value + 23>. Of course, that also works across the zero point, so if you set it to “40”, for example, the DTC will invert polarity over exits 40, 41, 42 ... 14 and 15. Note: If you have enabled “Automatic Polarity”, the DTC will no longer respond to polarity commands from the software!
- “Start Delay” is the delay between issuing the turning command and actually starting the turning process. Set as desired.
- “Bell Delay” was once conceived to sound an (external) sound signal before the bridge starts to rotate. As far as VPEB is known, this has never been implemented, but the parameter is in place in case we ever do. Leave it at 0, otherwise it's just an extra delay at start.
- “E-Stop Sensor Delay” is the time to reach the next sensor on the DTS/DTZ. If the bridge should rotate according to the DTC but does not according to the measurement of the DTS/DTZ sensor, the DTC will perform an emergency stop. A common cause is that a locomotive has stopped somewhere halfway between the bridge and the exit and the bridge is blocked. Continuing to operate indefinitely could then lead to the motor burning out. Set this value slightly higher than the value at which the bridge correctly reaches the end position in normal situations. You can also set value = 0 if desired. In that case, the emergency stop, triggered by sensor delay, is disabled (not recommended).
- “Delay at End” is the time the DTC waits between reaching the end position according to the internal calculation and reporting to the control PC that the bridge rotation has stopped. With a DTS or DTZ sensor, the DTC cannot measure when the unlock-relay of the bridge actually “falls into the lock” and therefore builds in a safety margin for this. The controlling software should not initiate a train movement before receiving the bridge stopped message. This setting is less relevant for the DTx sensor. After all, the DTx can determine exactly when the final position has been reached. With DTx, you mainly use this setting to set an extra delay between the stop of the bridge and the moment the train could start moving.
- “Motor Shutdown Delay” is the time that the motor continues to be controlled after the message “End position reached and bridge stopped” has been given. Note that, in a DTS/DTZ system, the motor should then no longer be powered because the relay in the bridge has switched off the motor. It is therefore an extra safety to ensure that the bridge reaches the end position in any case. With the DTx, this setting has no function (yet) and also no effect.

“Erase Positions” **erases all positions from the DTC!** You don't have to use this. Simply restarting, going through and completing the setup process will overwrite all positions in the DTC. Just experience from other products/projects shows that if such a button is not there, users still want it.

“Exit Setup” exits the setup process and returns to the “normal screen”

In the lower half of the right part you will see a number of fields next to the label “Position” and the label “Change”. By clicking the up/down arrows to the right of “Position” you can view the set angles of the different positions. The positions are always displayed in pairs.

With the buttons (Change:) “Green Side”, “Red Side” and “Status” you can make adjustments afterwards. **Note:** These buttons only work when the setup process is complete or if you have read the positions from the DTC with “Read Positions”.

“Change Status” makes a position active or inactive. “Active” shows a long line in the image at the top left and the numbers of the exits, “Inactive” only shows short lines.

“Change Green Side” allows you to adjust the position of the bridge with the green side of the bridge towards the green part of the perimeter. If you click on this, the bridge will automatically rotate to the appropriate position. You can then adjust the bridge with the well-known arrows and set it with “Record Position”.

“Change Red Side” does the same, but for the position of the bridge with the green side of the bridge to the red half of the perimeter.

If you have changed anything (Green Side, Red Side or Status), you can save the changes in the DTC with “Update DTC”. “Update DTC” writes the settings to the DTC of the position selected above (with the up/down arrows).

The ability to adjust positions is intended to fine-tune the position of the bridge afterwards, in case something is not quite right. In principle, you can also use this to remove or add exits afterwards. If you want to add an exit, you can only do so if it is approximately in a place where an unused position has already been defined. So you cannot just add a position between two active positions if there is no inactive position in between. Unused positions are not (yet) automatically redistributed by DTCnewConfig. So if the adjustments are large, this may not lead to a good result, unless you manually move everything and redistribute it neatly. In that case, starting over is probably a better and faster method.

## 4.5 Modify Settings

In the main settings screen you can adjust a number of settings if you wish:

- “Minimum Speed” is the minimum speed at which the bridge turns when approaching the stop position. Set it to a speed at which the bridge just turns nicely.
- “Maximum Speed” is the maximum speed at which the bridge rotates. This maximum speed is only achieved if sufficient positions have to be bridged. It is best to test these with a 180 degree turn.
- “Positions for Slowdown” (DTS/DTZ) is the number of positions before the target position at which the bridge starts to decelerate. Acceleration from the starting position occurs over the same turning angle. Note that the maximum rotational speed of the bridge is only achieved if the number of positions to be bridged is at least 2x the number of positions you set here. It's a matter of taste. Most users think 3 or 4 is a nice value, but if you are a bit impatient you can lower it. The Z-turntable (sensor DTZ) has only 24 positions. In addition, this bridge is already running quite slow by itself. With the Z version it is therefore usually better to choose 2 positions here

Note that the “Acceleration Delay” (DTS/DTZ only) changes automatically as you modify the parameters “Maximum Speed” and “Positions for Slowdown”. Based on the calibration values, DTCnewConfig calculates itself what the optimal deceleration should be to make the bridge stop properly at the target. Usually this is pretty much ok.

## 1.2 Scope of Delivery

The DTCv3 normally comes in two parts:

1. DTCv3 Set consisting of:
  - DTCv3 control unit with firmware, mounting frame and connectors
  - Power supply unit, mains cable, mounting set
  - Power cable DTC
  - USB cable
- 2a. DTS Sensor-Set (DTS-100 Set, DTS-75 Set), consisting of:
  - DTS Sensor Module
  - Cable set to connect the sensor module to the DTC
  - Mounting set for the sensormodule
  - Magnet + bracket
- 2b. DTZ Sensor-Set, consisting of:
  - DTZ Sensor Module
  - Cable set to connect the sensor module to the DTC
  - Magnet + bracket
- 2c. Roco 62615 Sensor Set, consisting of:
  - DTx Sensor
  - Cable to connect the DTx sensor to the DTC
  - Mounting set for the sensor
  - Magnet + bracket
- 2d. DTx Sensor Set, consisting of:
  - DTx Sensor
  - Cable to connect the DTx sensor to the DTC
  - Magnet

For a working system you need to purchase Set 1 and one of the Sets 2. There is one exception: For practical reasons, Set 2b is sold as one piece with the DTC Set

The DTS-100, the DTS-75 and the DTx for the Roco 42615 are supplied with a mounting kit.

No mounting kit is required for the DTZ. The DTZ is screwed directly against the underside of the turntable.

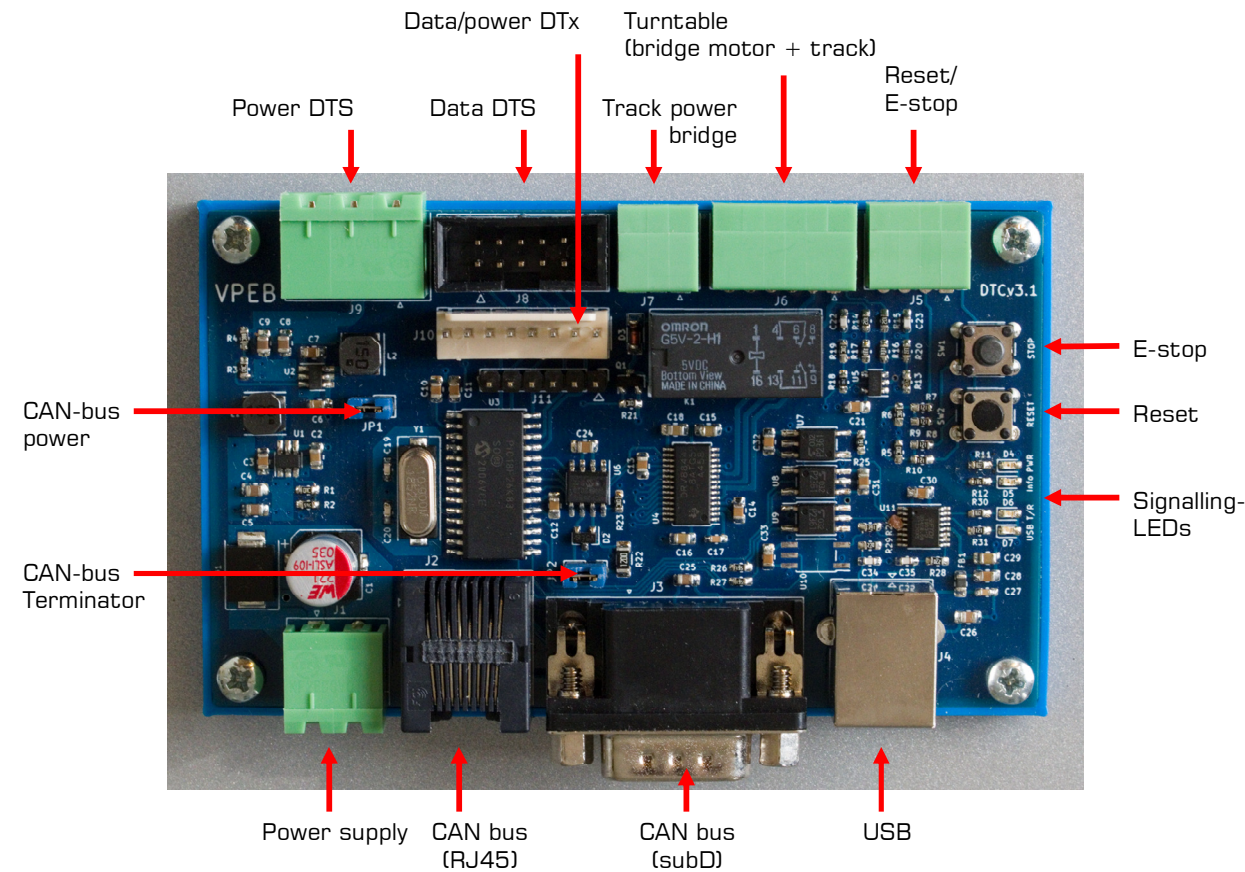
No mounting kit is supplied with the DTx for turntables other than the Roco 42615. Such turntables generally have a high self-assembly character and the user must therefore in principle devise a suitable solution for the assembly himself. If a certain type of turntable is more common and is available in the regular trade, a mounting set may also be developed on request.



## 2 DTCv3

### 2.1 Overview

Below you see an image of the DTCv3 with an overview of connections and functions. These are described in more detail in the next paragraphs.



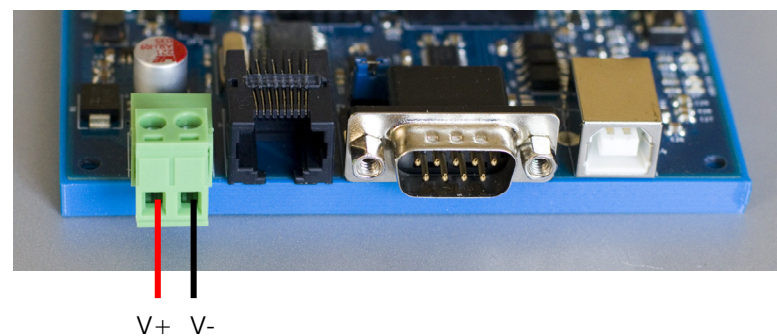
### 2.2 Power (J1)

Power supply is intended for

- the DTCv3 itself
- the sensor module
- the motor of the turntable
- the CAN bus and the connected accessories

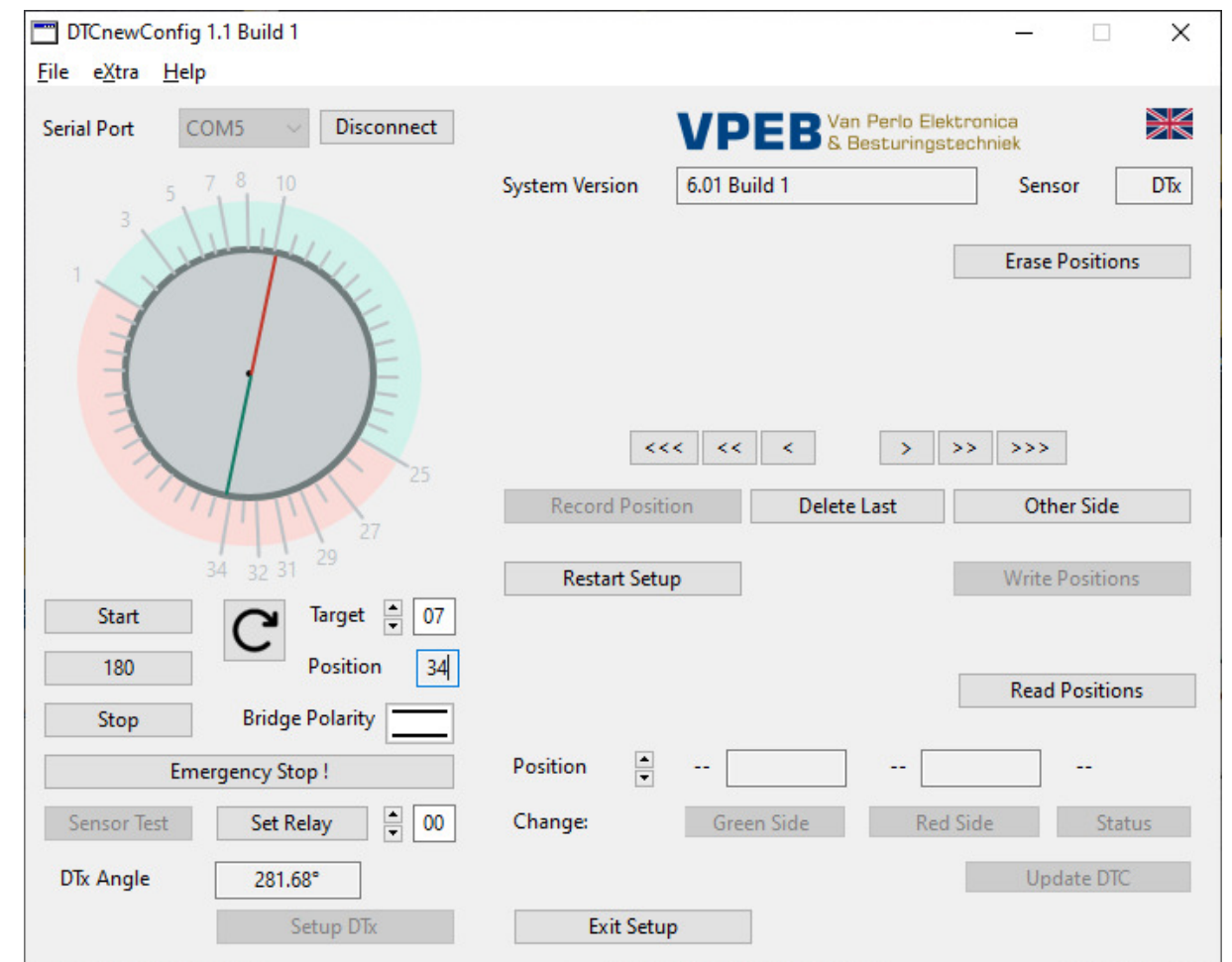
The power supply is therefore **NOT** intended for locomotives on the turntable. The power for the rolling stock must be supplied by a digital system, a Dinamo system or possibly an analog transformer.

The power supply must be a **DC voltage** between 12V and 20V. A set usually includes a power supply and pre-wired power cable with connector that you can plug into the DTCv3. The red wire is plus, the black is minus. If you want to make another cable yourself, you will find the connections on the right.



circumference of the turntable. There are probably other positions between your chosen positions. The reason is that most software expects a turntable with 48 fixed exits and in this way the DTx will simulate a turntable with 48 exits as adequate as possible, whereby, if the software supports this, you can show the actual position of the bridge on the screen as accurate as possible. The positions defined by you have long lines and numbers, the intermediate positions have short lines. These will also be positions in the future and the bridge could even turn towards them, but their exact location is not relevant because they will not be used in practice anyway.

The second thing that happens is that the bridge automatically turns clockwise to exit 1/25, but now with the bridge in reverse position. So with the green end of the bridge to the red side. The bridge will stop approximately at exit 1/25. How accurately that is depends, among other things, on how accurately you have centered the DTx sensor and the magnet. Wait until the bridge has come to a standstill and turn the bridge with the arrow-buttons into exactly the right position. Click on "Record Position". This process repeats until you have had all the positions. After the last position, the "Record Position" button remains disabled. You can now click on "Write Positions". All positions are now stored in the DTC.



You will find some other buttons in the right side of the window, which are (or may be) useful.

You can use "Restart Setup" at any time during the setup process if something went wrong. Everything is then deleted (locally in DTCnewConfig, so not in the DTC) and you can (must) start again from scratch.

"Read Positions" reads the stored positions from the DTC. Of course, that only makes sense if something has already been saved. This is the case, for example, if you have already configured the DTC and reopen this setup window with "Setup DTx"

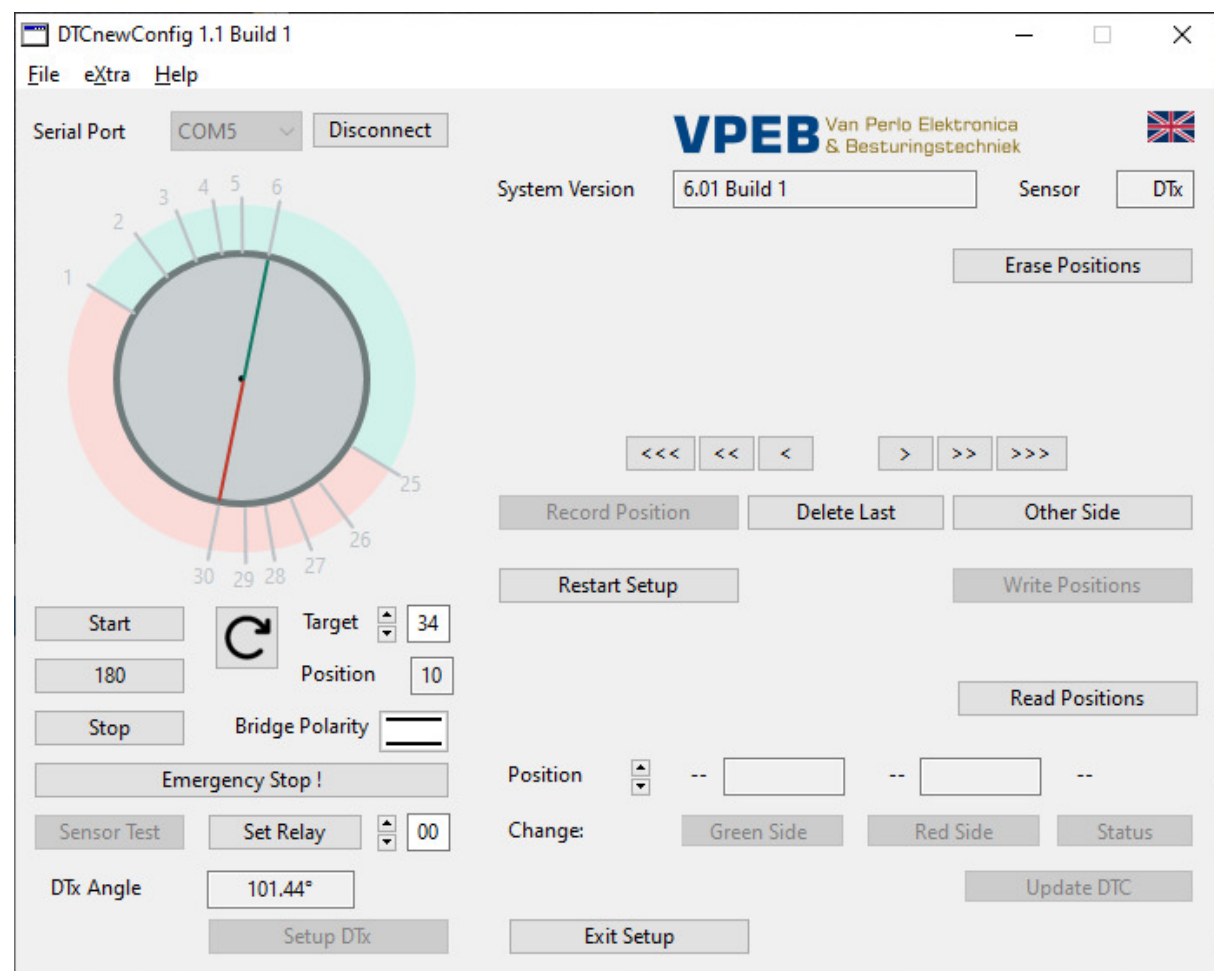
If you now start to turn, you will see that the green/red outline moves with the bridge. That's because you haven't yet determined how both halves of the turntable are divided. Choose at your turntable which exit you want to call "1" and turn the bridge until the cabin (or the side of the bridge where you have something of an imaginary control) is exactly on track 1. Turn (if necessary back and forth) until the tracks form a nice straight line. Then click on "Record position". You now see that exits 1 (on the green side) and 25 (on the red side) are displayed as an extension of the bridge.

Now rotate with the arrows clockwise to the next position. Note: this can also be an exit on the other side of the bridge. Note that the colored outline of the turntable no longer moves with it. When you have properly aligned the bridge to the next exit, click on "Record Position" again. You will see that 2 and 26 are now displayed.

Repeat this process until you've had all the exits. It is always the case that the next position you want to capture must be at least 1 degree clockwise from the previous one and all positions must be in the green half. As long as you do not meet these conditions, the button "Record Position" is disabled.

Should you make a mistake during this process (e.g. accidentally overlooking an exit on the other side). Then you can go back one step (or several steps) with the "Delete Last" button and then continue the process from the last point where you did it right.

When you have completed all the positions with the green side of the bridge in the green part of the perimeter, look at the picture at the top left. For example, if you defined 6 positions, you now have exits 1..6 on the green side and 25..30 on the red side.



Click on the "Other Side" button. Two things are happening now. First, you see that the positions 1..6 and 25..30 (or as much more/less as you have) are probably no longer called 1..6/25..30, but have been given different numbers. DTCnewConfig distributes the positions according to a mathematical algorithm as evenly as possible over 48 positions over the

## 2.3 CAN bus (J2, J3)

The CAN bus is intended to connect additional accessories. You can think of DTR relay modules to provide sidings with driving current (applicable with block-controlled systems, such as Dinamo or MpC), a manual control or interfaces with other systems.

You will find two connections for the CAN bus: an RJ45 and a 9p-subD connection. The accessories originally developed by PiCommIT have a subD connection. Later accessories, developed by VPEB, have an RJ45 connection.

**NOTE:** The RJ45 is **not an Ethernet** connection and **not an RS485** bus. So do not connect a network cable from a computer network to this, nor a cable from a Dinamo system.

The accessories on the CAN bus are normally powered by the DTCv3. The DTCv3 has a stabilizer that supplies 9V for the CAN bus. With jumper JP1, the output of the stabilizer is routed to the CAN bus. Normally this jumper will be placed. If there is a reason to power the CAN bus in a different way, JP1 can be removed.

A CAN bus is formed by linking modules together as a stringing system. Normally you start with the DTCv3. From the DTCv3 you go with a cable to the first CAN module, from that CAN module you go to the second CAN module and possibly continue until the last. Only the first and last module in the CAN bus should have a **Terminator**. On the DTCv3, activate the terminator with JP2. Since the DTCv3 is normally the first module on the bus, the terminator is enabled by default.

## 2.4 USB (J4)

The DTCv3 is connected to a PC via the USB connection. From the PC you can configure, control and update the DTC with new firmware.

The USB connection is galvanically isolated from the rest of the DTC. This means that there is no electrical connection between the USB connection and the other connections on the DTC. This greatly reduces the chance of malfunctions and increases the reliability of the USB connection.

The USB part on the DTC is powered from the USB connection of the PC. This means that the USB connection becomes active when you plug in the USB cable (and the PC is switched on), so even if the DTC itself is not (yet) powered. A USB port is then visible on the PC, but communication is of no use if the DTC itself is not supplied with power. There is then nothing to receive or send messages.

The USB chip on the DTCv3 is automatically recognized by the current operating systems (Windows, MacOS and Linux) **PROVIDED** your PC is connected to the Internet when you connect to the DTCv3 for the first time. Your PC will then download and install the necessary drivers itself. If that doesn't work, for example because your PC has no Internet connection or because your operating system is very dated, you can manually download the drivers from <http://www.ftdichip.com>

## 2.5 Reset/Emergency Stop (SW1, SW2, J5)

The DTCv3 has two push buttons: RESET and (Emergency) STOP

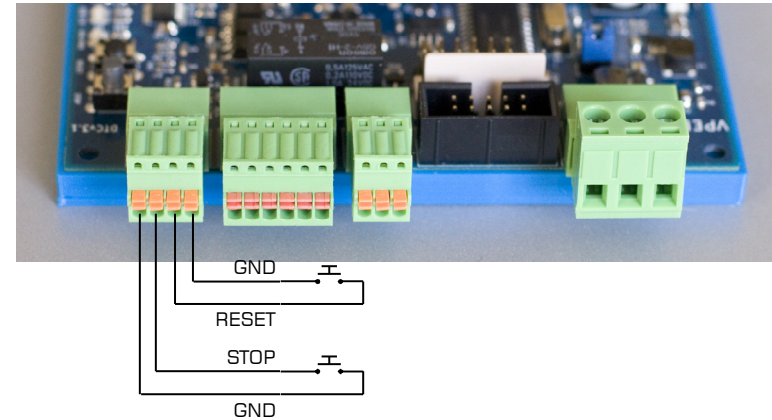
Reset is intended to reboot the DTC. Normally this will never be necessary, but a manual reset is necessary to start the bootloader in the DTCv3, which allows you to load new firmware (software) into the DTC yourself when it is made available by VPEB.

Emergency stop is intended to stop a rotation of the bridge, for example when it is blocked by a locomotive that has ended up half on the bridge. Emergency stop does **NOT** stop a possibly moving locomotive on the bridge. This is controlled by your used (digital) system.

The Reset and Emergency stop buttons have different heights, so that you can feel the difference even when the module is mounted under the layout. Since you will need Emergency Stop more urgently than Reset, the Emergency Stop is the highest button.



You can also operate the Emergency Stop and Reset functions externally. You can connect one or two external push buttons to the 4-pole connector J5. **NOTE:** The connections on J5 are for push buttons and NOT electrically isolated. They can withstand a voltage of up to +5V compared to GND (the negative connection of your DTC). So if you want to be able to generate an emergency stop from, for example, another system, then preferably use a relay or optocoupler.

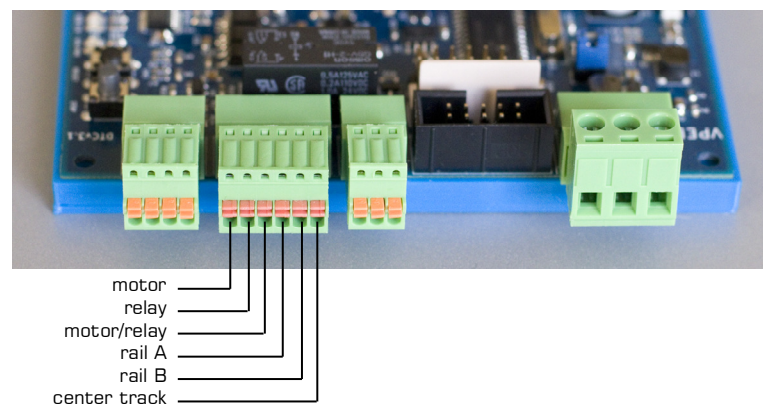


## 2.6 Turntable (J6)

You connect the turntable (bridge motor and track on the bridge) via connector J6. The connections on J6 are, from left to right:

1. Bridge motor
2. Unlock-solenoid (relay)
3. Common Bridge motor/Solenoid
4. Rail A
5. Rail B
6. Center rail

The center-rail (6) applies only to 3-rail systems. In 2-rail systems this is therefore not connected.



**Attention DTCv1 and DTCv2 users: Connections 2 and 3 are reversed on the DTCv3 with respect to the DTCv1/DTCv2.**

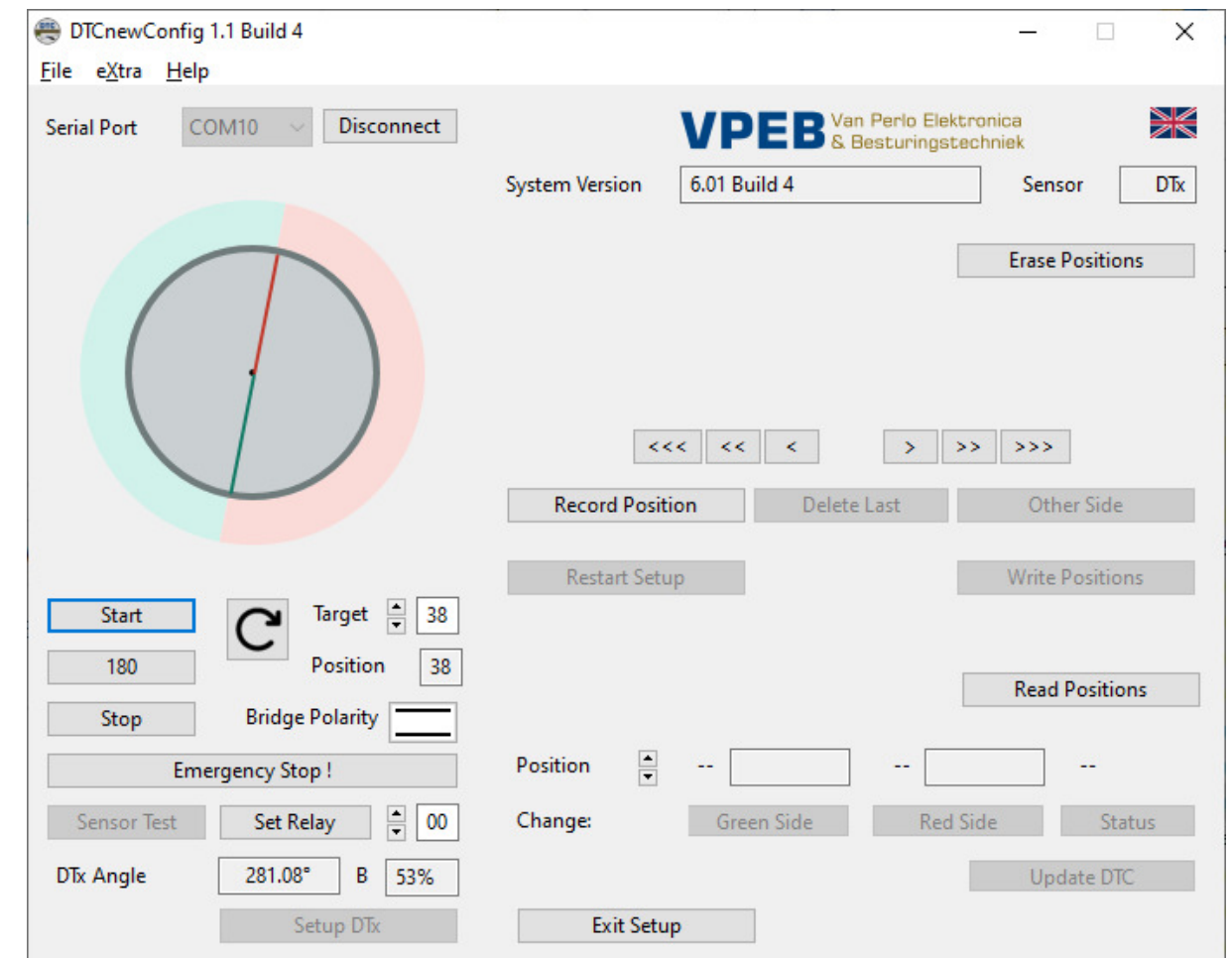
## 2.7 Track Power for the Bridge (J7)

On J7 you need to connect the track power for rolling stock on the bridge. The pin assignment of J7 is as below:

1. Rail A
2. Rail B
3. Center rail

At the bottom left, a box has also been added "DTx Angle". This shows the real-time angular deflection of the bridge with respect to the zero point of the sensor. That zero point depends on the mounting of the sensor and the magnet. The absolute value is not important at all for the operation, but you should realize that if you ever reassemble the magnet that it may be impossible to get it back in the same position, so this zero point is no longer correct and neither are the settings of the exits. You then have to start all over again.

From DTCnewConfig 1.1 Build 4 and Firmware 6.01 Build 4, you will see an additional value called "B" right of the displayed real-time angle. This indicates the magnetic field strength that the sensor measures. If it says "Low!!" this means that the magnet is too far from the sensor. Then it usually still works, but not reliably. If it says "High!!" it means that the field strength is too great for the sensor and the magnet is too close to the sensor, but you can hardly achieve that with the standard magnet that is supplied.



You can rotate the bridge with the arrow-buttons <<< << < > >> and >>>. More arrows is faster<sup>4</sup>. It actually shows itself. Press and hold as long as you want to turn. To "lock" a button, click on it and drag it away while holding down the mouse button. For some reason, that trick doesn't work on a Mac. Unfortunately for now, a solution has yet to be devised.

So, on balance, you can define 24 exits at almost arbitrary positions over half the circumference of the turntable. This is where the colored outlines of the turntable come into play. The green part contains a maximum of 24 positions (1..24), the red part contains the reversed positions (25..48).

<sup>4</sup> The single arrows rotate the bridge at the speed you have defined in the main settings as "Minimum Speed". The triple arrows rotate the bridge at the speed you have defined as "Maximum Speed". The double arrows are the average of these.



You can (possibly) test whether all sensors are working correctly by performing a 180 degree turn twice (in the same direction). Afterwards, all sensors must be green or red.

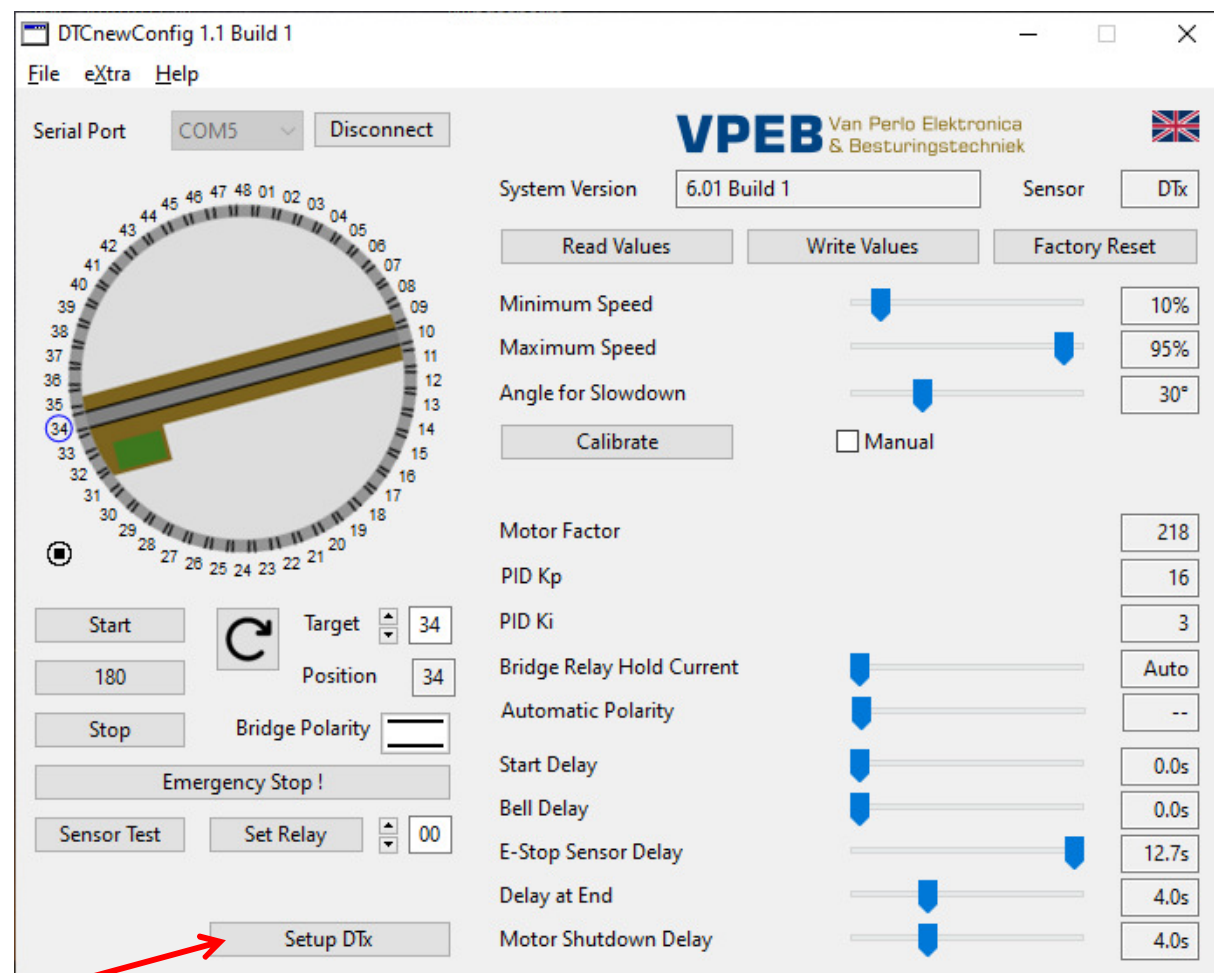
Sensor Test can be closed by pressing the same button. This is now called "Sensor Reset". All numbers then turn black again.

It is wise to perform the calibration procedure again after adjusting the DTS.

#### 4.4 DTx define Exits

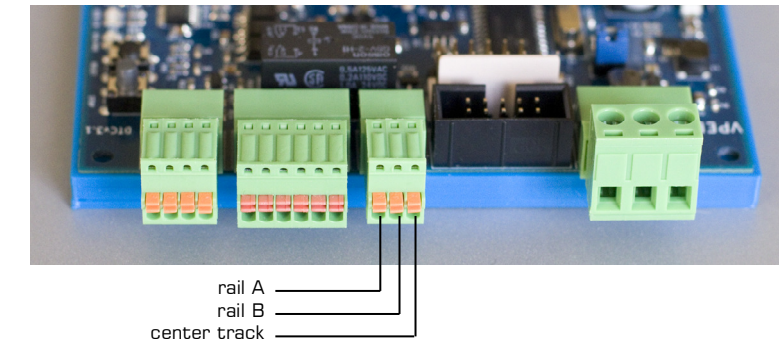
The DTx offers you the possibility to define 48 exits. Those exits can be located in almost completely arbitrary places. You could even lay exit ramps half over each other. The only restrictions are, that the distance between two exits must be at least 1 degree and that it can be a maximum of 24 pairs in total. You do not record exits, but positions of the bridge where you can drive to certain exits. If in a certain position of the bridge there is only an exit on one side, you will still have to define two positions for the bridge, after all, the bridge must also be able to be rotated 180 degrees to be able to turn a locomotive and the control software must "have a position" to command the bridge to go to. We follow the logic that a position of the bridge corresponds to the exit it connects to on the side of the control cabin. If there is no exit there, then at that moment the other side of the bridge is at the exit with the corresponding number +24 or -24.

To set up the DTC with DTx sensor, make sure the DTC is connected and turned on. Connect DTCnewConfig to the DTC. You will then see approximately the following:



Click "Setup DTx" at the bottom of the window. The right half of the screen and the appearance of the turntable change. The bridge is now a line, consisting of a green and a red half and around the circumference of the turntable a colored border has appeared, half green and the other half red.

The center-rail (6) applies only to 3-rail systems. In 2-rail systems this is therefore not connected.



The DTCv3 can reverse the polarity of the track on the bridge to ensure it is identical to the polarity of the exits. Rail A and B are interchanged between J6 and J7 when polarity is reversed.

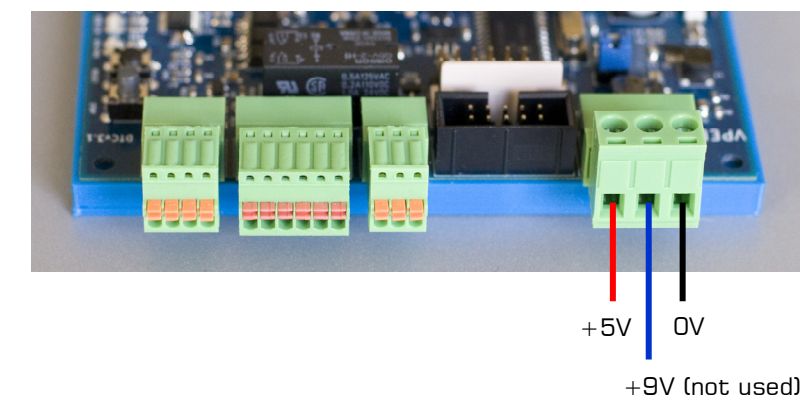
#### 2.8 Data DTS/DTZ (J8)

The DTS/DTZ sensor board transfers information to the DTC via a 10-core ribbon cable. This ribbon cable including connectors is supplied as standard with the DTS/DTZ module.

The length of the data cable DTC-DTS/DTZ is standard 40cm. It is strongly recommended not to extend this cable. Cables longer than the supplied 40cm can lead to unreliable operation.

#### 2.9 Power Supply to DTS/DTZ (J9)

The DTS/DTZ sensor board requires a stabilized 5V power supply. The power supply for the DTS/DTZ is supplied via J9. In addition to the 5V required for the DTS/DTZ, J9 also supplies a stabilized voltage of 9V. It is not used for the DTS/DTZ. A pre-wired cable to power the DTS comes standard with the DTS/DTZ.



#### 2.10 DTx Sensor (J10)

The DTx angle sensor can be connected to J10. J10 takes care of both the data connection and power supply for the DTx sensor. A connection cable is supplied as standard with the DTx sensor.

The length of the DTC-DTx connection cable is 40cm as standard. It is strongly recommended not to extend this cable. Cables longer than the supplied 40cm can lead to unreliable operation.

## 2.11 Signalling-LEDs

At the side of the module you find four signalling LEDs:

- Blue: USB connection to the PC active. I.e. the DTC is connected to the PC and the drivers on the PC are loaded.
- Green: Send/receive USB data.
- Red: Supply voltage present on the DTC.
- Yellow: Info. This LED can have various functions. With the current firmware:
  - On = Bootloader active
  - Blink = Bridge-motor is active

The position of the bridge represents the detected position (in this case 10). That value is also listed next to "Position".

On the right it says in red: NOT calibrated!

## 4.2 Calibrating

The next action you need to perform is to calibrate your turntable. To do this, click on the "Calibrate" button. You will then see a pop-up screen and the procedure will continue automatically. The bridge turns twice to the right and twice to the left (on the DTx once to the right/left). The DTC now knows what the maximum achievable speed of the motor in the bridge is with the the supplied supply voltage and what the actual rotational speed is at 50% speed of the motor.

Note that the "Acceleration/Deceleration Delay" and "Motor Factor" have probably changed.

You can now test the turntable. Set a "Target" with the arrows, or type a number in the box. Note that the perimeter of the turntable has a blue circle around the exit number set as the target. You can adjust the direction of rotation with the button in the middle under the turntable. The "Start" button starts turning the bridge to the set position. The "180" button sets the target to 180 degrees from the current position and immediately starts the turn command.

At this point, the bridge may not stop at the correct exit. At the DTx, the bridge probably won't stop at an exit at all, but somewhere random. That is because you have not yet adjusted the DTS properly or have not yet set exits for DTx.

The bridge may turn extremely slowly or too quickly when approaching the end position. If this causes problems when adjusting the DTS or setting the DTx, you can adjust this now with the setting "Minimum Speed" (see paragraph 4.5).

## 4.3 Tuning DTS Sensor Module

For correct operation it is important that the DTS sensor is correctly adjusted. You can turn the DTS under the turntable 7.5 degrees to the left/right to position the sensors exactly under the exits. To do this, activate the "Sensor Test" with the button at the bottom left. The exit numbers around the turntable now get a color:

- Red = sensor active now
- Green = sensor has been active
- Black = sensor not (yet) detected

Now give the command to rotate one position clockwise. Note that the next sensor becomes active (red) a few degrees before reaching the destination. The previous sensor can sometimes also remain red, which is not bad in itself, the DTC takes that into account. Now repeat this a few times and measure (by counting or with a stopwatch) how long it takes for the next sensor to become active after giving the turn command. Then do the same, but counter-clockwise.

If you notice that the bridge stops at a different position when rotating counterclockwise than when rotating clockwise, then the DTS is misaligned. Then initially turn the DTS clockwise or counterclockwise to the stop and check whether the bridge stops clockwise/clockwise at the same track. Then repeat the above measurement at the new position.

If it takes longer to activate the next sensor counterclockwise than clockwise, turn the DTS slightly clockwise and vice versa. Repeat the above test until the times clockwise/counterclockwise are as equal as possible. If you can't turn the DTS any further because the end point has been reached, just turn it all the way in the other direction and continue adjusting. The only thing is that the exit numbers move one position. That doesn't matter, because the numbers themselves are fairly random.

When you're happy with the result, retighten the DTS's wing nuts.

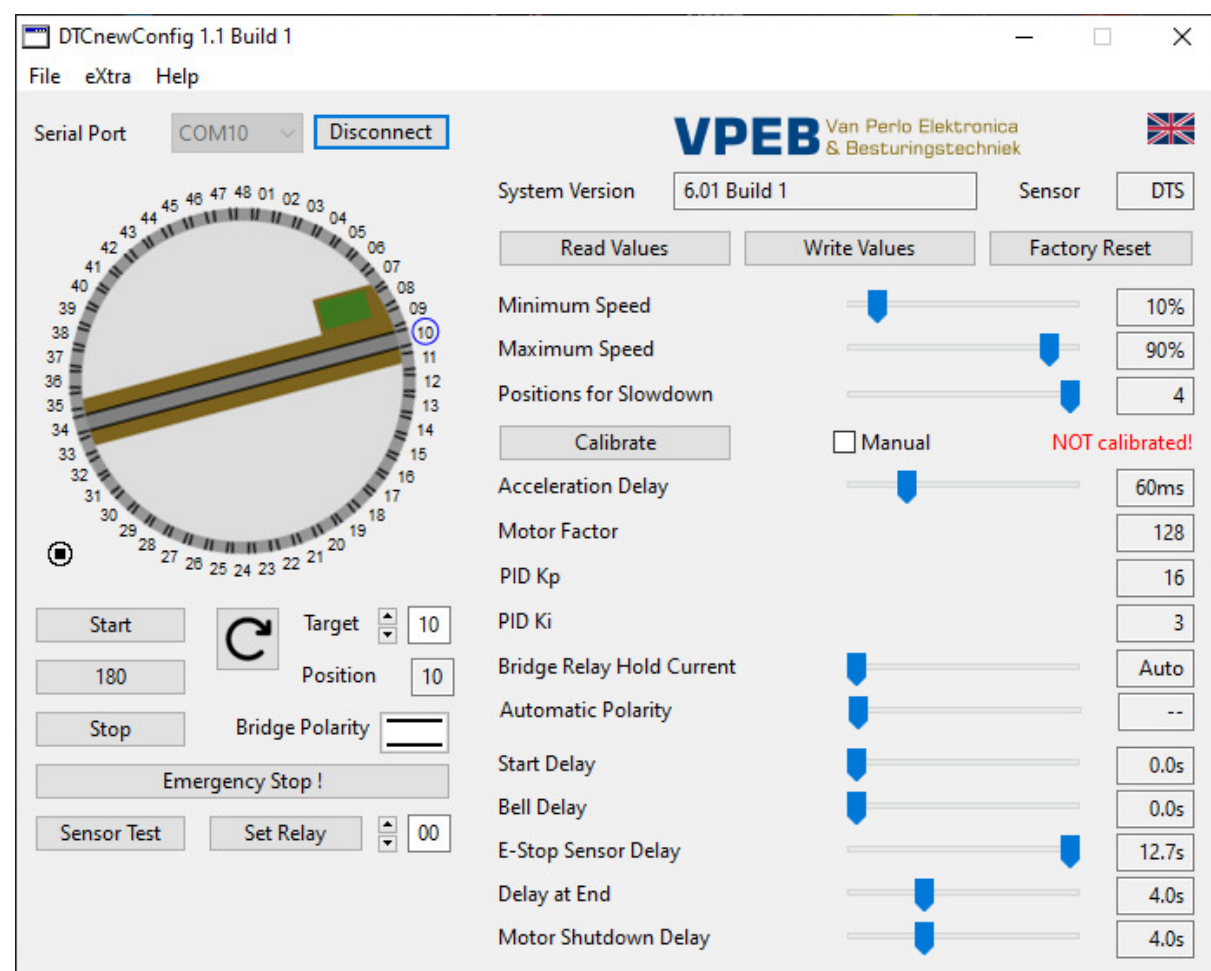


Clicking on the arrow box to the right of the “Serial Port” text will bring up a drop-down list of available com ports. If you don't know which one to use, this is the most convenient method:

- Close the drop-down list by clicking the box again
- Unplug the USB cable from your PC or from the DTC
- Wait 5s
- Open the list of com ports and see which ones you have. If there are many, write them down
- Close the drop-down list
- Restore PC-DTC connection
- Wait 5s
- Open the list of com ports

You should now have one extra port that you didn't have before. That's the one you need.

Select the correct serial port and click “Connect”. You should now see approximately the following window:<sup>3</sup>



In this case, we have selected COM10 as the serial port. System version indicates the firmware version in your DTC, in this case 6.01 Build 1. The detected sensor is a DTS. You will see that some settings have been added to the right. That's because DTCnewConfig has detected that the DTC is a v3. A bridge has now appeared in the picture on the left. If you don't see it, it's because the sensor module has not detected a position. In that case, check the mounting of the magnet under the bridge or the mounting height of the DTS module. It is also possible that the DTS is not yet properly aligned with the ramps and that the sensor happens to not measure any active position. Then turn the DTS a few degrees counterclockwise or clockwise.

<sup>3</sup> When you have a DTZ, you see a turntable with 24 positions

## 3 Mouting and Connections

### 3.1 General

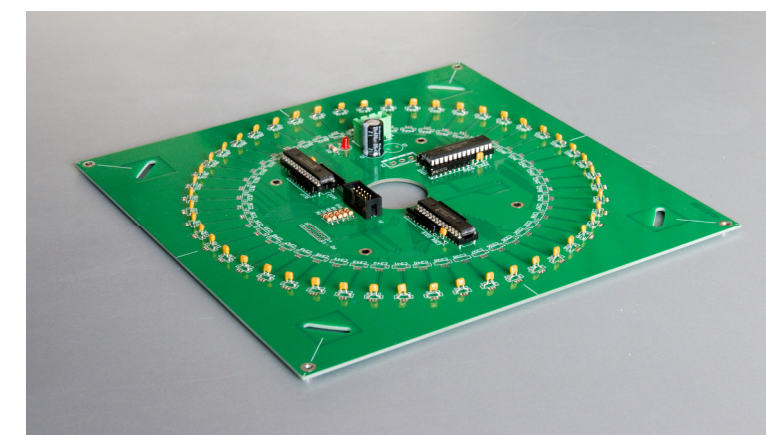
The DTCv3 must be combined with a sensor module that is mounted directly below the turntable. The supplied cable(s) between sensor and DTC are approximately 40cm long. It is strongly recommended not to extend these cables. This means that the DTC must be mounted close to the turntable.

The DTCv3 comes with a mounting frame and screws. Use these to screw the DTC to a flat surface (usually and preferably wood). Make sure that you leave enough space around to insert the various plugs and it is also useful if the push buttons are still accessible.

### 3.2 DTS

The DTS Sensor Module is intended for 48-position turntables. The DTS comes in two versions: DTS-100 and DTS-75. In paragraph 1.1 you will find an overview of which module can be used for which turntable.

Separate installation instructions are available for the DTS-100 and DTS-75. Please refer to these to mount the module correctly.



#### 3.2.1 Connecting DTS Sensor Module

**NOTE** that the wires coming from (the center of) the turntable come down through the hole in the center of the DTS and are routed under the DTS (not between the DTS and the bottom of the turntable). The intention is that the DTS comes as close as possible to the pit of the turntable. Often there are still some lugs and clamps against the bottom with which the wiring was secured. You no longer use these clamps, so it is best to remove what is in the way.

The DTS itself is connected to the DTCv3 with two cables:

- A power cable, 2-wire with a 3-pin plug on both sides.
- A 10-core flat cable with a connector on both sides.

Plug both cables into the DTS with one end and the other end in the DTC. They only fit in one place, so in principle you can't go wrong. The connectors on the ribbon cable are mounted differently at both ends. It doesn't technically matter which end you put in where, but take a look at how it fits most conveniently.



### 3.2.2 Connecting the Turntable

The Fleischmann turntables for 2-rail have a 5-core "ribbon cable" that you connect to the 6-pole connector J6 on the DTCv3 as follows (see also paragraph 2.6)

From left to right:

1. Yellow = Bridge motor
2. Grey = Unlock-Solenoid
3. Red = Common Bridge motor/Solenoid
4. Yellow = Rail A
5. Yellow = Rail B
6. --

Fleischmann turntables for 3-rail with 6 leads are connected as follows.  
From left to right:

1. Yellow = Bridge motor
2. Grey = Unlock-Solenoid
3. Red = Common Bridge motor/Solenoid
4. Yellow = Rail A (gnd)
5. Yellow = Rail B (feedback)
6. White = Center

Märklin turntables for 3-rail with 6 leads usually have the following color coding.  
From left to right:

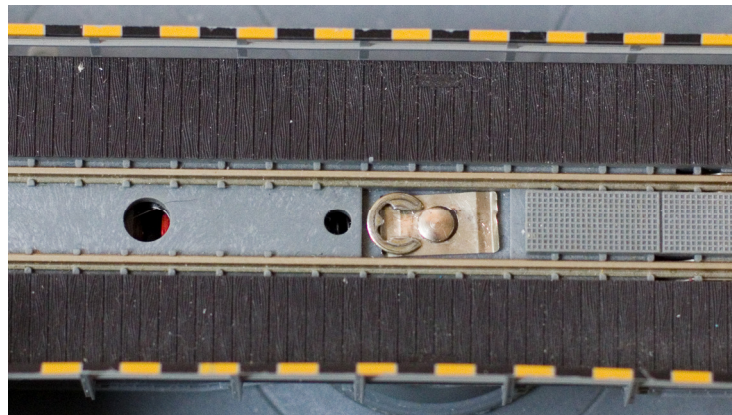
1. Green = Bridge motor
2. Blue = Unlock-Solenoid
3. Red = Common Bridge motor/Solenoid
4. Brown = Rail A (gnd)
5. Orange = Rail B (feedback)
6. Yellow = Center

### 3.2.3 Adaptations to the Bridge

In a number of cases you have to make a small adjustment to the bridge of your turntable. In any case, you have to mount the magnet to activate the DTS sensor.

Remove the bridge from the turntable. In most cases it is sufficient to remove about four edge segments, flip up the cover between the rails and slide the spring plate on the axle to the side. By turning the bridge so that one of the ends is on the opening created by removing the four edge segments, you can tilt it out. Refer to the turntable's documentation for further details and instructions, if necessary.

Below as an example a picture of the Fleischmann 9152C.



Reinstalling after the adjustments, is done in reverse order.

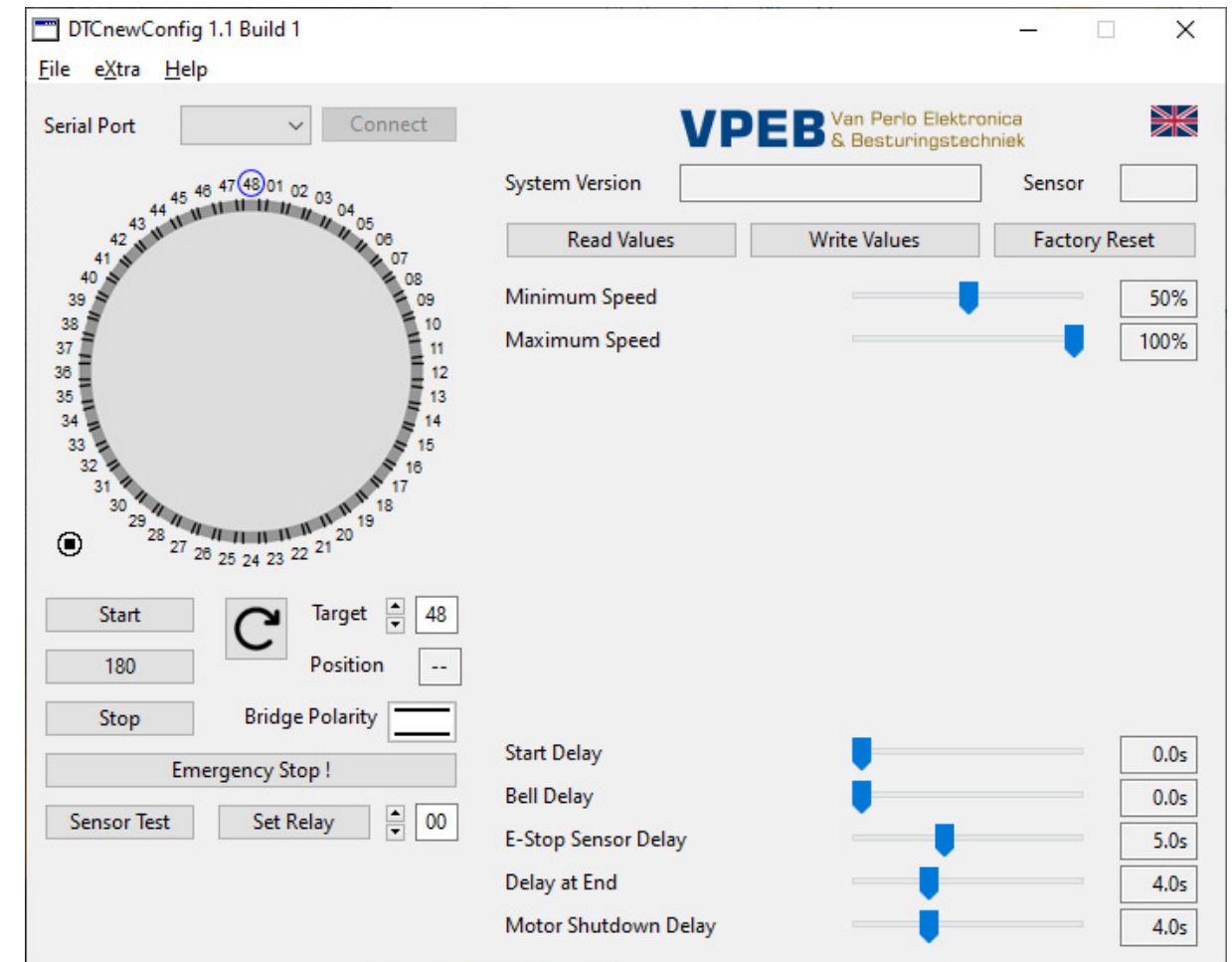
## 4 Calibrating en testing

### 4.1 DTCnewConfig

If you haven't already, download the DTCnewConfig program. The release version of this manual is 1.1 Build 4.

DTCnewConfig is available for Windows, MacOS (Intel and M1 processors) and Linux. The download is a compressed .zip (or .tar.gz) file. Extract this file somewhere on your PC.

Run DTCnewConfig. You will then see the window as below: <sup>1,2</sup>



Make sure the DTS, DTZ or DTx sensor is connected to the DTC and turn on the power supply to the DTC. **NOTE:** This order is important because the DTC tests what type of sensor it has at startup. Optionally, you can force a restart by pressing the RESET button.

If the DTCv3 has power, this is indicated by the red LED on the module.

Make sure the USB cable is connected. If this is the case and the drivers for the USB port have been loaded and activated, the blue LED on the DTCv3 will be lit.

At the top right is an English flag by default. By clicking on this you can switch to Dutch and German.

<sup>1</sup> Images are from Windows. On Mac and Linux look and feel can be different.

<sup>2</sup> Most of the screenshots in this section are from Build1. Only where there are substantive differences will you find newer images.

### 3.8 Communication to the PC

Communication between PC and DTC is via a USB connection. A USB cable is normally included in the set. Plug the cable into a free USB port of the PC and the other end into J4 of the DTC. For any further details, see section 2.4.

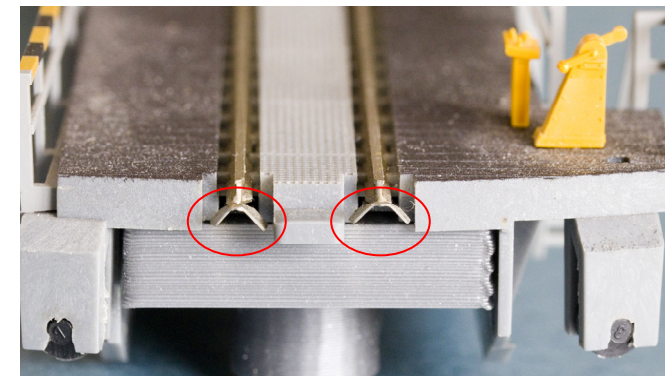
### 3.9 Manual Control

An optionally available manual control (DTM) is available for the DTC turntable control. The DTM is connected to the CAN bus with the supplied cable.



### Feather Contacts

Most bridges have spring contacts on both ends, with which the rails on the bridge make contact with the rails of the rail segment to which the bridge is pointing. The idea of the manufacturer is that in this way the relevant rail segment is supplied with track power "intelligently". We recommend that you remove, bend or otherwise block these feather contacts so that they no longer make electrical contact with the exits. Control software works optimally if it can see when a locomotive is completely on the bridge. The bridge, and preferably only the bridge itself, should therefore be one occupancy reporting section.

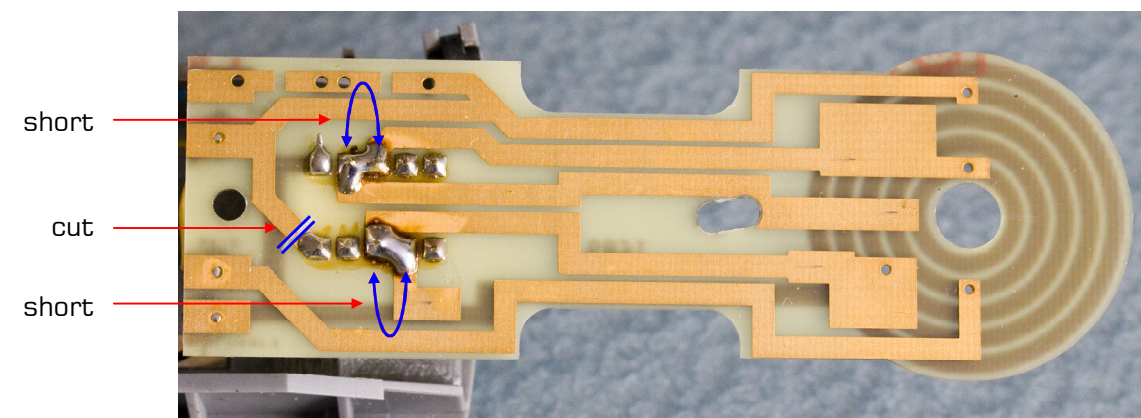


### Fleischmann "C" series

Fleischmann has a series of turntables with suffix "C". A small piece of rail is insulated on both sides of the bridge. These segments are relayed to the rest of the track on the bridge. The idea of the manufacturer is here again that you can supply the siding on one side or that on the other side with track power via the bridge by turning the control switch to the clockwise or counterclockwise position. With automated operation this does not work and moreover it does not work if you have removed the spring contacts as advised above.

The relay that switches the relevant pieces of track is connected to the contacts of the bridge motor. The problem with the DTCv3 is that the relay-coil disrupts the measurement that feeds the speed of the bridge motor back to the DTC. So you have to permanently connect the pieces of isolated track to the rest of the track and disconnect the relay from the motor connections.

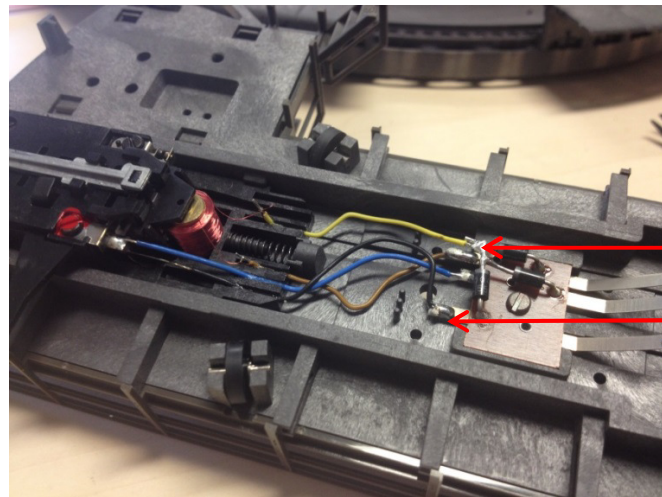
In the bridge there is a PCB (with relay) that you can loosen with two screws and then flip it over. Solder two jumpers to the contacts of the relay and make one interruption in the PCB as shown below. Then you can put the print back on.





## Märklin

There are 3 diodes in the bridge of the Märklin turntable. A yellow wire is soldered to the star point of the three diodes. Solder the yellow wire from the diodes and solder it on the point where the black wire is soldered. You can leave the diodes themselves.

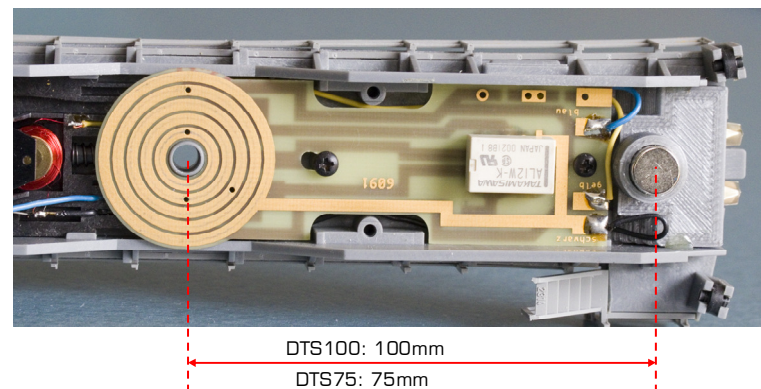


Disconnect here

Solder there

## Mounting the Magnet

The DTS set comes with a magnet in a plastic holder. Mount the magnet under the bridge opposite the end where the control cabin is located. When using a DTS-100, the distance between the center of the magnet and the axis of the turntable must be 100mm. With the DTS-75 this distance should be 75mm. When the bridge is mounted again, the magnet must hang just above the bottom of the pit. Below is an example of the Fleischmann 9152C.



Flip the transparent cover from the terminal block.

The power supply cable between mains power supply and the DTCv3 is a 2-wire cable with a 2-pole connector and unterminated wires on the opposite side.

The color coding of the supplied cable is:

- Red = plus (V+)
- Black = minus (V-)

Connect these wires to the corresponding screw terminals of the power supply.

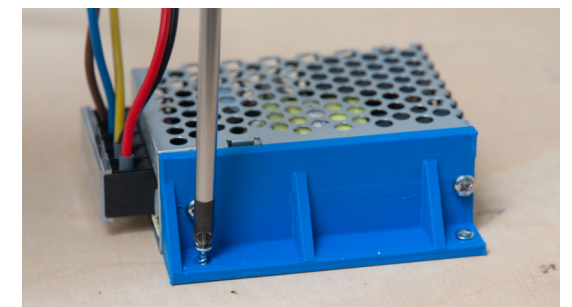
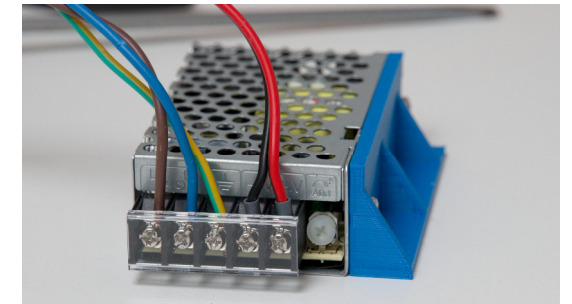
The color coding on the mains power cable is:

- Brown = L (Live)
- Blue = N (Neutral)
- Green/Yellow = GND (Earth)

Connect the wires from the mains cable to the corresponding screw terminals of the power supply.

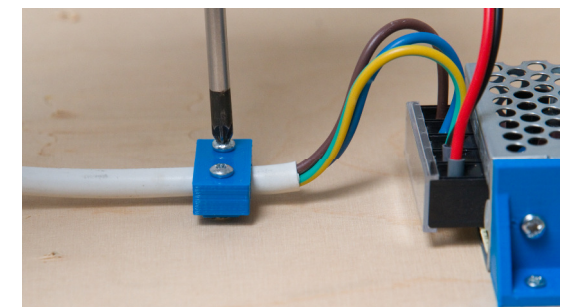
**Click the transparent cover back in place!**

Mount the power module with mounting bracket in the selected location using the 2.4 x 12mm countersunk screws.



**Secure the mains power cord near the power module with the supplied strain relief.**

Place the small part on the surface with the notch facing upwards. The larger part goes on top of it. Screw both parts to the surface, using the supplied 2.9x16 screws, with the cable between the parts, so that the cable can no longer be pulled loose from the terminals.



It is best to plug the power cord into a junction box with a built-in switch.

Do not turn on the DTC's power supply (do not insert the plug into the socket) until you are **completely finished** with the installation!

**NOTE: In some countries, working on mains voltage is restricted to qualified professionals. If so, please follow local regulations. And in all cases, when working with mains voltage, if you have no idea what to do, ask someone who does know to help.**

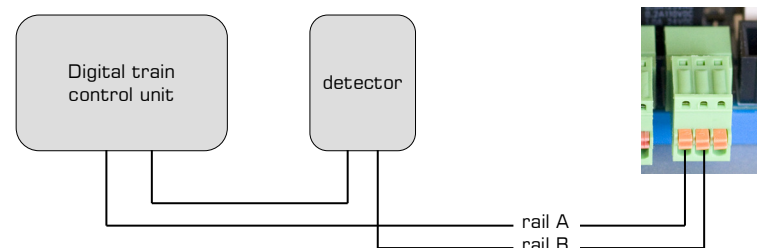
## 3.7 Track power for ramps and sidings

With a digital system, you simply connect the exit-ramps and sidings directly, whether or not via an occupancy detector.

With a block-controlled system (such as Dinamo and MpC), you must supply the exits and sidings with power each with a separate block output. To save block outputs, the DTC provides an optional relay module (DTR) that allows you to power all sidings from one block output.

The DTR can be connected to the CAN bus of the DTCv3. A separate manual is available for the DTR.

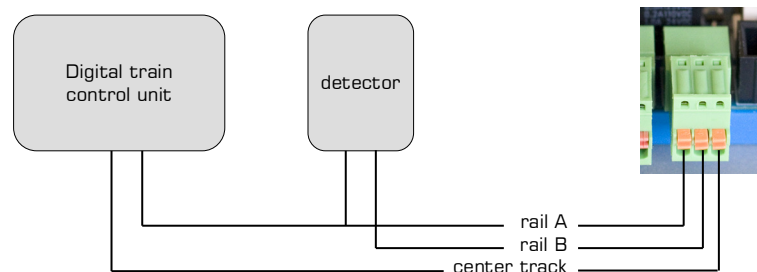




When using a Dinamo system you use a free block output of a TM44 or TM H+CD16. The A terminal to pin 1, one of the B terminals to pin 2.



With 3-rail you connect the connection for the center rail of your digital system to pin 3. The connection for the rails of your digital system goes to pin 1 and the same connection for the rails goes to pin 2 via an occupancy detector.

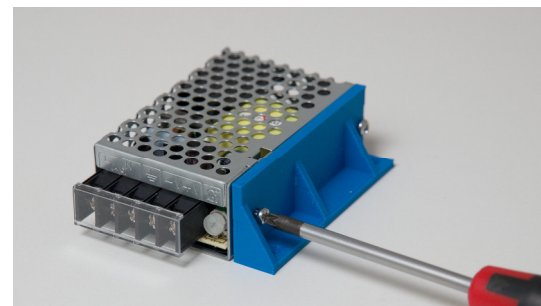
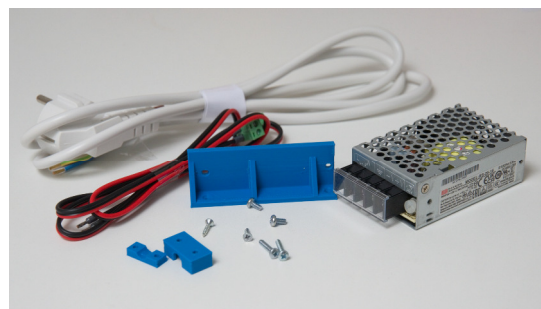


### 3.6 Power Supply

The DTCv3 normally ships with a power supply module, a mains power cord, a power cord for the DTCv3 and a mounting set.

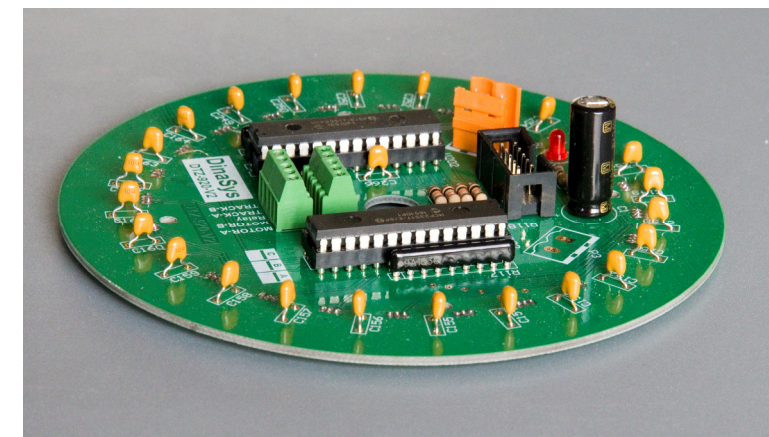
Find a safe place to mount the power supply, preferably somewhere near the side of your layout. The power cable to the DTC is about 1.5 meters long and you can extend it or replace it with a longer cable with sufficient cross-section. The supplied cable is 0.75mm<sup>2</sup>. If you use a longer cable, a size larger is recommended.

Bolt the mounting bracket to the side of the power supply unit, using the supplied M3 x 6 screws.



### 3.3 DTZ

The DTZ Sensor Module is intended for the Märklin 8998 (Z) turntable with 24 positions. The DTZ is mounted directly against the underside of the turntable. No special mounting kit is included.



#### 3.3.1 Mounting the Magnet

The DTZ set comes with a magnet in a plastic holder. With the Z-turntable it is best to mount the magnet before mounting the DTZ, otherwise you will not be able to access it without first dismounting the DTZ.

Remove the bridge. To do this, you have to slide a spring clip to the side on the shaft of the turntable. Then you can take the bridge from the top. Mount the magnet under the bridge opposite the end where the control box is located. The distance between the center of the magnet and the axis of the turntable must be 48mm. When the bridge is mounted again, the magnet must hang just above the bottom of the pit.

Reassemble the bridge.

#### 3.3.2 Mounting Sensormodule DTZ

At the bottom of the disc are 5 sockets into which plugs can be inserted. These sockets are in the way of the DTZ sensor module and should therefore be removed. The DTZ module has a screw terminal in which you can reattach the relevant wires.

Unscrew the plate containing the bushings and disconnect the wires from the bushings. It is best to cut them as close to the sockets as possible. Make sure that the wires do not break off the turntable itself, it is difficult to get them back there. Strip a piece of insulation of about 5mm from the end of the wires that you just disconnected. This is now (probably) easier than after you mounted the DTZ.

Feed the wires through the center hole of the DTZ and mount the DTZ against the bottom of the turntable. There are 4 mounting holes in the DTZ that should match 4 screw holes in the bottom of the disc. You can reuse the screws that previously held the socket plate. Secure the DTZ crosswise.

Mount the wires from the turntable in the screw terminal. There are inscriptions at the terminal, but the order does not technically matter, as it is really just a terminal block to neatly assemble and extend the wires. For use with the DTCv3, we suggest that you follow this sequence, which then matches the sequence on connector J6 of the DTC:

1. Blue = Bridge motor
2. Yellow = Unlock-Solenoid
3. Grey = Common Bridge motor/Solenoid
4. Red = Rail A
5. Brown = Rail B

### 3.3.3 Connecting Sensor Module DTZ to DTC

The DTZ connects to the DTCv3 with three cables.

- A 2-wire power cable with a 3-pin plug (DTC) on one side and a 2-pin plug (DTZ) on the other side.
- A 10-core flat cable with a connector on both sides.
- A cable for controlling the turntable, 5 wires between the terminal block on the DTZ and J6 of the DTC

The DTZ power cable has a 2-pin connector and a 3-pin connector. The 2-pin connector goes into the DTZ, the 3-pin into J9 of the DTC.

**NOTE: The power cable for the DTC has the same 2-pin connector as the connector that goes into the DTZ. NEVER plug the power cord for the DTC directly into the DTZ. This will seriously damage your DTZ and possibly even the DTC.**

Plug the 10-wire flat cable with one end into the DTZ and the other end into the DTC. It only fits in one place, so basically it can't go wrong. The connectors on the ribbon cable are mounted differently at both ends. So it doesn't technically matter which end you put in where, but take a look at how it fits most conveniently.

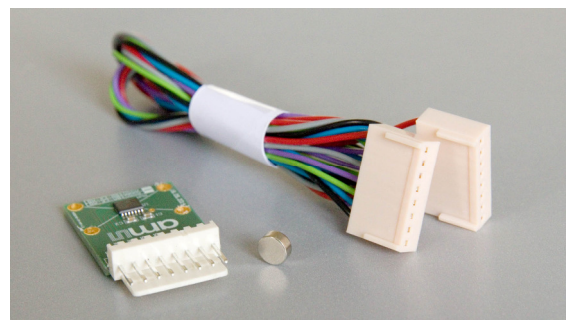
The third cable is the connection between the screw terminal and J6 of the DTC. Use 5 cores of normal model wire 0.14mm<sup>2</sup>, preferably in the same colors as the cores that are connected from the turntable on the other side of the screw terminal. Bundle the wires between DTZ and DTC. The connection to J6 of the DTCv3 is:

1. Blue = Bridge motor
2. Yellow = Unlock-Solenoid
3. Grey = Common Bridge motor/Solenoid
4. Red = Rail A
5. Brown = Rail B
6. --

### 3.4 DTx

The DTx sensor works essentially differently from the DTS and DTZ sensors. The DTx uses a magnetic angle sensor with 14-bit resolution, which is mounted below the turntable. When using the DTx, it is not necessary for exits to be on a 7.5° grid. It is not even necessary that they are equidistant from each other. At the DTx, exits can be in arbitrary positions. Also, DTx does not necessarily require an unlocking solenoid. Because the position of the bridge is measured in real time, the bridge can be turned exactly into the desired position by the DTC. The only requirement is then that there is sufficient mechanical friction that the bridge also remains in that position. However, if there is an electromechanical lock, it can be controlled by the DTC.

In order to be able to use the DTx, it is essential that the axis of the bridge is extended to the outside (bottom) so that the position can be measured on the basis of this. This is almost always the case if the bridge is equipped with an underfloor drive. This is the case, for example, with the Roco 42615. In addition, the DTx is often used for DIY turntables.

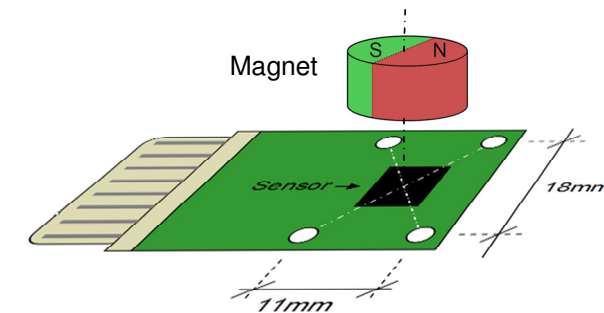


For the Roco 42615 a special mounting set is available and a corresponding mounting manual. With other turntables, the user will have to come up with a solution for correct mounting of the sensor. If a certain type of turntable occurs more often, a mounting set can be developed for this on request.

The DTx Sensor consists of a sensor PCB with sensor and a diametrically magnetized magnet. The intention is that the magnet is mounted on the shaft, which comes out from under the turntable. Make sure the center of the magnet is aligned as exactly as possible with the center of the shaft. It is also important that the magnet is not mounted directly on the shaft if the latter is made of a ferrous metal (iron, steel, nickel, etc). In that case, make sure that you have or make a holder of non-magnetic material, such as aluminum, copper or plastic.

The sensor must be mounted under the magnet. Here too, the center of the magnet must be aligned as precisely as possible with the center of the sensor. The heart of the sensor is the intersection of the mounting holes in the PCB. The distance between magnet and sensor should be as small as possible, preferably 0.5 to 2.5mm and a maximum of 5mm.

Even more important than the exact alignment of shaft, magnet and sensor is that the arrangement is rigid. An incorrect alignment can be corrected to a certain extent in the software settings. A (too) flexible setup means that positions are not reproducible and you will never get that corrected properly.



Connecting the DTx sensor to the DTCv3 is easy. Plug one end of the supplied cable into the sensor board and the other end into J10 of the DTCv3.

The connection of the motor and any unlocking relay depends on the type of turntable. The bridge motor must be connected between pin 1 and 3 of J6 (see paragraph 2.6). You connect any unlocking relay between pins 2 and 3. If the motor and relay share a common connection, it will be on pin 3, otherwise you connect one of the wires of the motor and one of the wires of the relay on pin 3.

Note that only the motor is connected to the connections for the motor and not other things as well. Also pay attention to any large capacitors. All this significantly distorts the EMF signals and makes proper PID control impossible. In general, interference suppression coils and interference suppression capacitors can remain in place.

### 3.5 Track Power for the Bridge

The control of the bridge motor and the unlock solenoid comes from the DTC. The track power for the rolling stock on the bridge comes from your digital or analog system and you must supply it externally via the 3-pin connector J7 (see also paragraph 2.7).

You probably use occupancy detection to pass on the position of the trains to your control system. The entire bridge of the turntable is then one occupancy detector.

With 2-rail you connect the driving voltage from your digital system to the 3-pin connector J7. One of the connections goes directly to pin 1, the other goes via a busy detector to pin 2. The third pin remains empty.