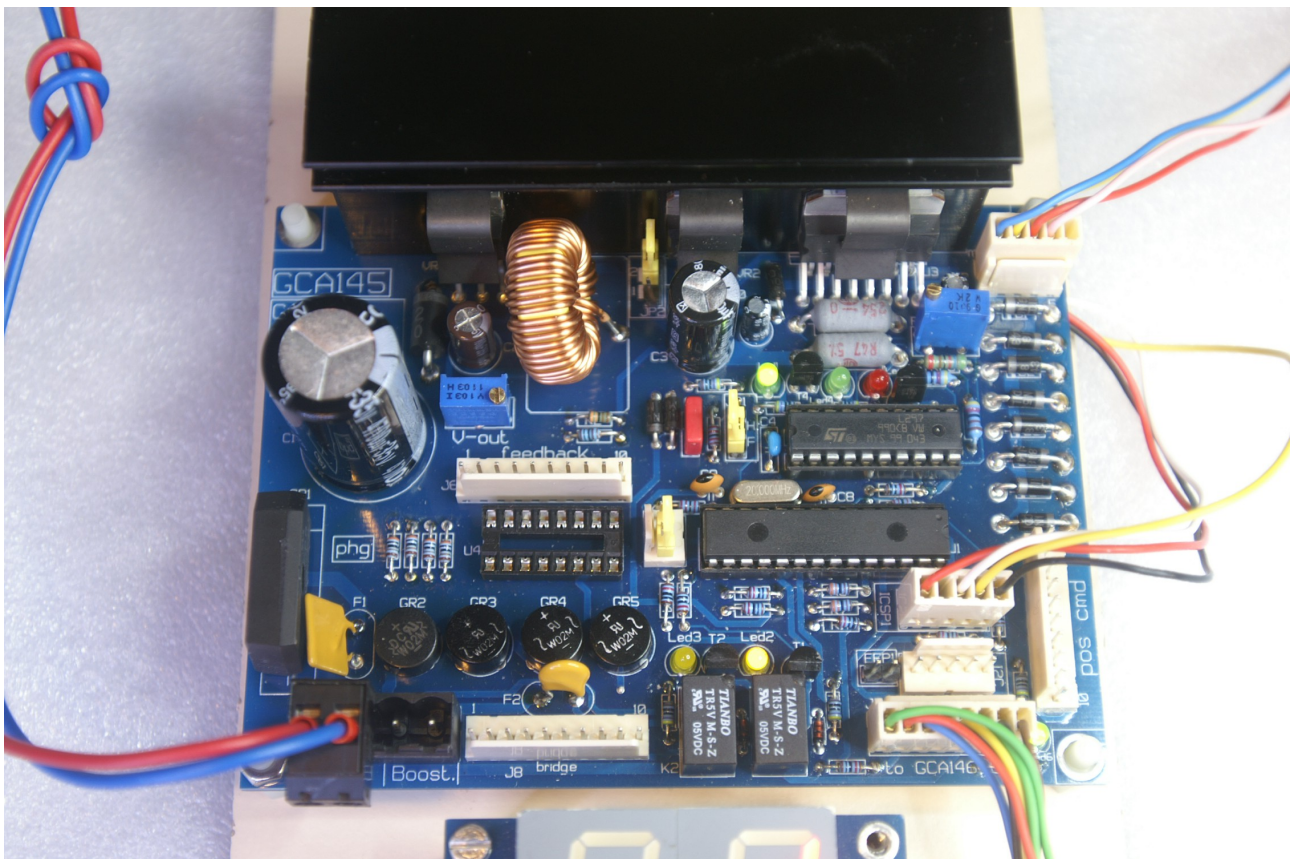


User manual use of MGV145 / GCA145
with Fiddle yard and Turntables.
Firmware Version N_3_4 Update Dec 28, 2017

By Peter Giling



Hardware remarks.

- 1) The term fiddle yard, as mentioned in this manual, is used to describe a shifting area with 3 or more parallel situated rails, which can move in such a way that one of these rails can be used to enter or leave a train in either direction.

Fiddle yard and Turntable need at least one limit switch, beyond the first rail. This could be a microswitch, hallsensor or reed contact. This switch is used for two reasons.

- a) To be able to have an automatic adjustment after the first set-up,
- b) for adjustment when the FY /TT is out of position for any reason

An extra limit switch beyond the last rail is optional.

Both switches can be connected to ICSP1 according appendix 1.

For TT, position of this switch should be between position 1 and the maximum position.

This switch should be mounted in a way that TT can pass this switch in both directions.

- 2) Special remarks on Version 1,4+ :

The little tumble switch and Led on GCA146 is no longer used.

Entering and leaving the program mode is now achieved by pressing the knob on GCA146 for more than 3 seconds.

- 3) The maximal Switch is not always needed, but can be used for safety reasons.

If this switch is not connected, set menu 1.3 to '1'.

Software settings.

After startup, there are just a few settings preset in the Firmware.

To avoid that adjustment will be a lot of work, the processor can do the important issues automatically.

For further info about the menus, please refer to chapter MENU.

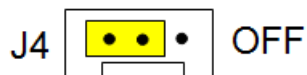
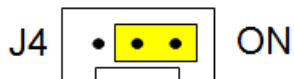
Each position of a rail has to be determined. And because there is no info yet how many steps are needed, the processor needs to find out.

This is done in the way as explained on the following page..

It can only be done if a switch for zero point detection is installed and working.

Calculation of all exact positions settings.

- Activate menu-settings and select menu 1. Select the maximum positions you need.
- The first rail position is always 1. Select menu 0.8 and change setting to desired control type (see Appendix 2).
- Cancel menu settings .



- Set jumper J4 to ON
- Choose position 62 on GCA146 and press the selector.
- With control type setting of 1 or 2, the motor starts moving forwards one full circle. This needed to avoid wire twisting. If motor runs in the wrong direction, switch off power immediately, and swap wires 1 & 2 of the motor in connector J2, and select pos 62 again, it should now be running in the right direction, towards zero switch.
- The motor starts moving backwards to zero switch. Also here when motor runs in wrong direction handle as described in previous alineas.
- The motor will stop when the zero-switch is activated.
- If control type 1, 2 or 3 is selected, the motor will make another full round, to calculate the amount of steps for a full circle.
- Next, the motor starts running on slow speed towards first rail connection.
- On the right moment , when rails are nicely inline, press selector.
- This position will be stored, display will show 1 and motor continues. Remember that fine adjustments can be made later.
- Again, when rails are in line, press selector.
- Repeat this until all positions are acknowledged.
- Motor will run back to zero switch and after that returns to position 1.
- After finishing put jumper J4 in OFF position.

Hardware differences between boards MGV145 and GCA145..

Based on experiences and feed-back from many satisfied users (thanks folks !) some parts, no longer needed, are removed from the new batch of PC-boards.

Basically, everything is made in such a way that Firmware is 00% adapted to both PC-boards.

There are no differences on that issue.

But a few improvements have been made on the GCA145 board :

1. +5v and ground on ICSP1 were not compatible with ICSP connectors on boards like GCA50, GCA136 etc. It is important to realise that it makes a different connection for Hall-sensors or switches for zero and max-limit detection. In this manual a drawing is available for both situations.
2. P2 is adapted for setting to maximum current for the motor. More about that in Appendix 3.
3. A few resistors were to be soldered at the bottom of MGV145. They are on-board now on GCA145.
4. The value of the used relays was rather critical, to make them work. This was mainly because the specification of the PIC is sometimes a little bit less powerful than given. Relays are now driven by transistors, taking away the load from the PIC.
5. Eep1.
On MGV45 it should always be in "ON" position.
On GCA145 it is no longer in use, do NOT assemble it.
6. J4 is a jumper now. It is used to enable (if set to ON) the calculation of all positions.
7. A number of leds are provided, to be able to watch several functions.
8. Power supply can now go as high as 24 Volt. This of course if suitable transformer is used. But with 24 V, the power over C1, and thus at the input of VR2 is way too high. In that case jumper JP2 can be set, so that VR2 gets power from 24V (pos 1) . Basically it is OK to leave jumper JP2 on pos 1, when you are running on 12V, but the minimum should be 10V. Any lower, jumper JP2 must be set to pos 2.
9. Diode D10 is added for supply of J5 connector. No further need for soldering diode at bottom of board.

Led functions.

MGV145 board only has 1 led, which simply shows power on.

GCA145 board has 6 Leds.

- Led1 Power on
- Led2 Bridge power on
- Led3 Reverse bridge power on
- Led4 Motor running forward
- Led5 Motor running reverse
- Led6 System ready

Jumper JP1 Full/half step motor control

Motor control is possible in full or half step mode.

On board indications 'F' (=full) and 'H' (=half) are visible.

Half step means that motor will need twice as much steps from one to position to the next.

Depending on motor type, it is not always sure that when a motor is stopped, it will remain in this position, and not fall back or forwards to the full step position. GCA145 can do nothing about it, unless you set menu 1.4 to 1, which will keep the motor powered after position is reached.

Please read the conditions under menu 1.4

Jumper JP2 Supply adaption

As mentioned already on page 4 (item 8) this jumper is needed for correct power for 5 V regulator.

Jumper setting	used for
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pos 1	Voltage on C1 higher than 24V
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pos 2	Adjusted voltage for motor lower than 10Volt
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In case adjusted motor voltage is lower than 10Volt, the power feeded to the board should NOT exceed 24Vdc OR 16V ac.

Fine adjustment of positions

Fine adjustment can be made for each position by activating the menu settings, then select menu 0 , then press knob to select data settings where the display will show the actual FY/TT position.

Now , with the selector, you can fine tune the position, to make the rails perfect in-line.

Cancel the program mode, run the FY /TT to the next position and redo the same procedure for fine adjustment adjust of positions.

Menu.

Press knob on GCA146 for more than 3 seconds, to enter menu/data setting mode,

There are two menus modes, indicated by the points on display:

Option 1 is indicated by centre point in display. Here the menu can be chosen by turning the position selector

Option 2 is indicated by right hand point in display. Now the value,stored for the selected menue can be altered.

Pressing the knob for more that 3 seconds again, will leave the menu/data setting mode and rreturn to normal running mode.

In normal running mode only the actual position of the FY/TT can be selected, but only if menu 1.2 is set to either 0 or 2. With value = 1 , only remote control via J5 will be possible.

Turn the selector to get a position, and press the selector. FY/TT will start moving according to that.

When a higher position is selected, the motor will stop a little bit further the desired , and then will run backwards after one second. The amount of steps, of the runback is to be set in menu 5.

This is done to correct the free space in gearing, if applicable. Value can also be set to 0.

List of menus.

The available menus are:

0,0 Fine tuning of actual position

Adjust the actual position of the fiddle yard. When turning the selector , the motor will turn backwards or forward step by step, making a very fine adjustment possible. All changes are stored in internal eeprom. Please remind not to leave this menu 0 active for a longer time, because the motor is constantly powered on, and will be getting rather warm after some time. When selecting a next menu, or deactivating the menus, the power to motor will be off.

0.1 Total rail positions

Positions are counting from 1.

0.2 Minimum speed

Two speed limits are used for the motor., making it possible to make a slow or fast ramp up and ramp down when start en stop moving. A higher number means longer interval between the motor steps, so a slower movement.

0.3 Maximum speed

The maximum speed. Same as menu 0.2. A higher number means a longer interval of timing, so that makes a slower movement. Depending on motor type and power consumption, mostly the lowest speed setting you can have is 4 or 5, If the motor makes strange reactions, try a larger number for this speed. Maximum speed setting can not be lower value than minimum speed

0.4 Delay of speed change

The actual speed from low to high or v.v. is incremented (in microseconds) with this number. In Version 1.7 ramp-up and down is calculated in steps of 10% each.

The set value is the time in 1/100 of a second between the steps.

If minimum and maximum speed are set equal, there will be no change at all.

0.5 Correction steps.

When FY is running from a higher to a lower er position, it will make this amount of steps further, and after that run the same steps back . That option can reduce the influence of any 'slack' in the gear system. If you do not need it, just the better, just set it to zero.

0.6 Rail power reverse position.

This only applies to turntables, control type 1..3, where the power of the bridge should be reversed in certain positions, to match the connecting rails. The setting you do here is the first position, counting from 1, where power should be reversed. This setting is of no influence in control type 4. It is also possible to disable this function by setting to zero.

0.7 Rail power off at movement.

The rails can be powered off while moving the bridge. This is usually an extra safety precaution, specially for Fiddle yards. But on turntables, where only one train is involved, it might be not so nice to shut off lights of the loc, while moving. Setting menu 7 to zero, disable the power while moving, setting to 1 will leave power enabled. If reversing power is obsolete, it will be activated after the bridge has come to halt.

0.8 Control type. See also page 12

Possible settings are:

1 : turntable control with no shortest way option.

- 2 : turntable control with shortest way option. Amount of zero crossings are limited.
- 3 : turntable control with shortest way option. No limits in zero crossing.
- 4 : Fiddle yard version. This type is mostly equal to type 1, except for polarisation relay.
and the optional end switch.

0.9 Position match delay.

After the bridge has reached its position, this will give an extra delay before the indication “system ready” is given to pt 10 of J5. The number is in 10th of second, so 50 will be 5 seconds.
This delay shows in action of right hand display

1.0 Motor start delay

This is the time in 10th of a second, before the motor will start when a new position is commanded.
This delay shows in action on both displays together.

1.1 Relay-ON delay

After position has been reached, this is the delay before bridge rail is switched on.
Setting also in 10th of a second. This delay shows in action on left hand display

1.2 Selection of commanding inputs

In some occasions it might be useful to disable the commanding inputs from either manual or computer control. One occasion might be to disable the manual control on an exhibition or show. Also, if J5 is not connected to any commanding module, the open inputs could cause problems.

Three options to choose from:

- 0. Only Manual control is possible
- 1. Only computer control (via J5) is possible
- 2. Both options are enabled.

1.3 Setting speed for Position 62 and 63

Previous version used the minimum speed-setting for position 62 and 63.

In some occasions, this might take too long.

This setting allows you to define the speed that is used for these correction positions.

The default setting will be 10.

1.4 Motor on or off after position is reached.

Sometimes it might be desirable to keep motor power on. After position is reached.

BE SURE TO USE THIS SETTING ONLY WITH GREAT CARE.

When power is not switched off after position is reached, it will hold more strongly to its position.

But when motor remains powered up for longer time, it can be overheat as well.

The default setting will be 0, so motor is switched off.

It is advisable to lower the motor current when you are using this option.

1.5 Main speed correction. (default =1) (Starting from version N_3_0)

All speeds can be set between 1 and 99, due to the limit of the display.

If this 99 is still too fast, all speeds can be corrected by this factor.

Factor is adjustable between 1 and 5, default setting is 1.

1.6 Write pulse on/off (default = 1)

In some occasions it might be possible to control the GCA145 without write pulse.

This signal should come in at J5 pin9. Select 0 to disable this write pulse.

Remark on delays:

After new position is finished, the two delays from menu 11 and 9 are sequential timed out.

This means that sum of these delays is waited before a new position can be selected.

Specially keep that in mind with automatic traffic., when the 'bridge ready' signal is not used!

A new position command might be missed in that case..

1.7 Reverse action for incremental switch of GCA146. (Default =0)

There are a number of incremental switches , which are different i n the way the contacts work.

That shows, when the incremental switch appears to function the wrong direction.

Setting 1.7 to '1'will correct that.

Manual operating mode

Apart from pos 1 to xx (the max amount of rails) there are two more positions to select.

1) Position 63.

This position will move the FY/TT to the zero-limit switch and after that the will run to position 1. Now FY/TT is synchronised to position 1.

Display will show position 1 when finished.

2) Positon 62.

This position can only be activated if J4 jumper is set to ON.

See for further instructions: Calculation of all exact position settings.

Computer controlled mode

There is no setting to get in this mode.

GCA145 simply reacts when new positions are given trough connector J5 (Position cmd).

On <http://wiki.rocrail.net/doku.php?id=gca145-en> page, you will find more info about how settings should be made to get this computer control settled.

Rocrail included a complete controlsetup for either Turntable or Fiddle yard.

This setup includes control vie LocoNet, CANBUS, RocNet, DCC or Motorola.

For the last two controls, a special function decoder GCA174 is available, to be fitted as a piggy back to J5 on GCA145/MGV145.

Imergency / safety switch

Using GCA145 controller on larger setups with fiddle yard, specially if public is able to approach it, there might be a reason to have some way of emergency stop.

The max limit switch can be used for that.

Numerous ways are available to make some kind of emergency or safety switch.

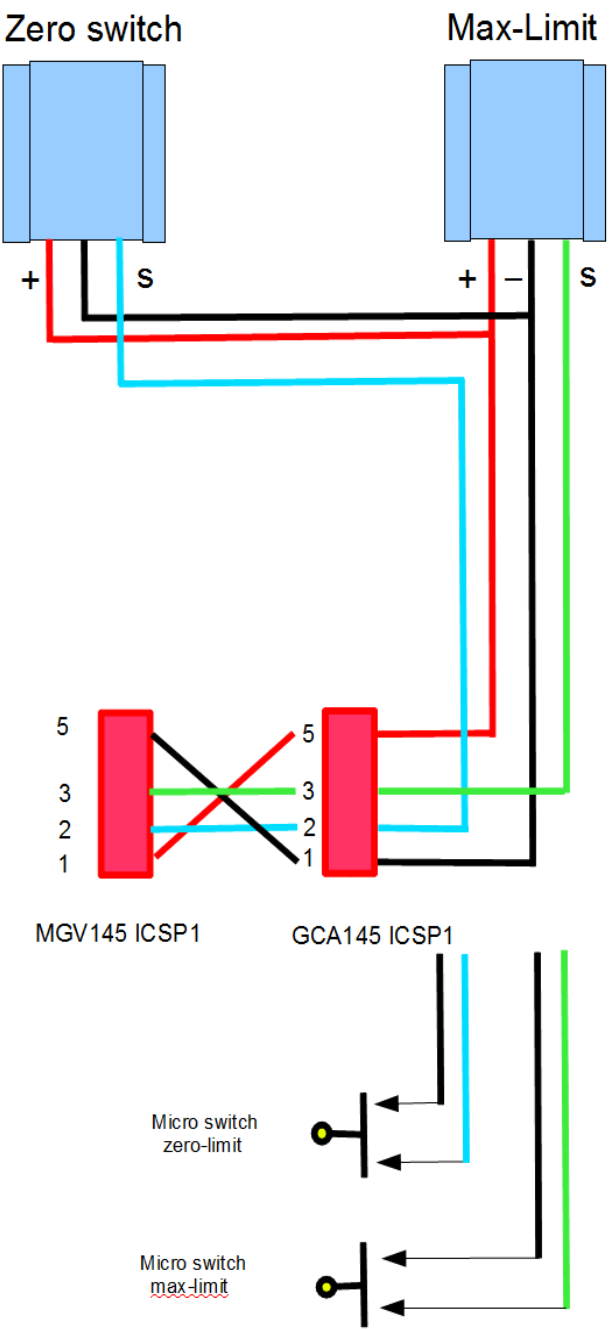
If you need any advice on that issue, please ask peter@phgiling.net.

Appendix 1:

Connection of limit switches.

Limit switches for GCA145 / MG145

Hallsensor TLE 4095



Appendix 2:

Control types.

Control type setting is important to get the right control for the task.

There are small differences for turntable or fiddle yard control.

Control type 1 ,2 and 3 are made for turntables.

Control type 4 is made for fiddle yard.

Control type 1: turntable control , no shortest way possible

Turntable will never take shortest way.

It will never pass zero.

Control type 2:

Turntable will take shortest way, but this is restricted to a maximum of 3 times consistently in one direction.

It is very useful when cables are connected to the bridge.

Control type 3:

Turntable will take shortest way, without any restriction.

When the bridge is having contact rings for connection of power, there is no need to limit the turns in either direction.

Control type 4:

Fiddle yard control.

This is to control one linear movement.

Two limit switches are needed. This is special important at first initialisation. Because all kind of settings have to be made, it can be harmful for your construction if motor runs out of its limits.

These switches will at least stop the motor before that happens.

Appendix 3 :

Motor voltage :

Setting correct motor voltage.

Any voltage output from 5 to 24V is possible with this board. To be able to adapt to the required voltage, the used transformer should also be able to give the correct voltage and current. Here are some demands for the used transformer:

Output	Transformer
5V	9V minimal
12V	14 V minimal
18 V	20 V minimal
24V	24V minimal

It is , by all means, allowed to use DC Power supplies.

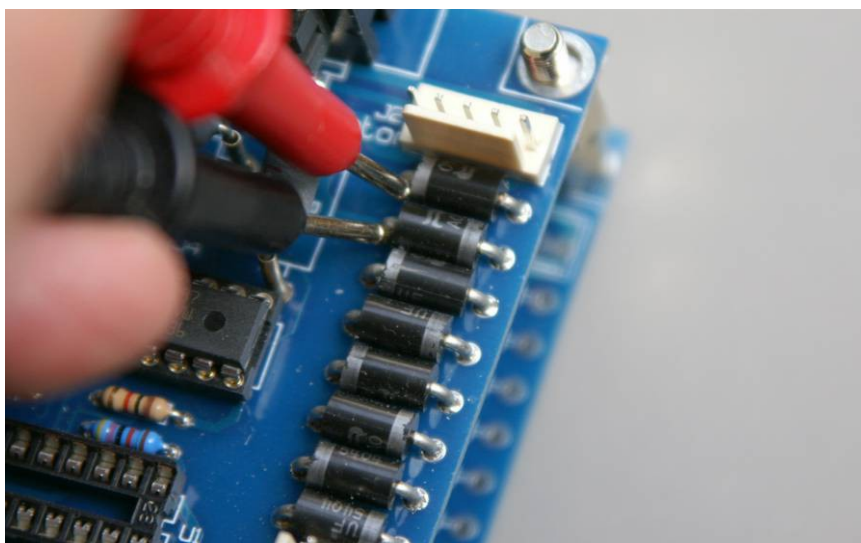
But please remind different minimal limits:

Output	DC Power supply
5V	10 Volt minimal
12V	16 Volt minimal
18V	24 Volt minimal
24V	30 Volt minimal

For max power options, a transformer of minimum 50 VA will be sufficient in all cases.

P1 is able to adjust output voltage for the stepper-motor.

This voltage can be measured like on this picture.:



10% higher than needed is no problem.

Appendix 4:

Output current:

1. Current stepmotor unknown:

The setting should be done in an experimental way.

Simply turn P2 clockwise until you can hear soft clicking inside the trimmer.

It is now set to maximum current.

Now, slowly during the times that motor is running, turn the trimmer counterclockwise 1 turn at the time. Once found that the stepmotor suddenly does not have enough power left to move, you have gone too far, turn trimmer a few turns clockwise and that is the approximate setting.

1. Current stepmotor known:

If the output current of the motor is known, it can be adjusted .

It is done by setting the right voltage on pin 15 of U2, according to this formula :

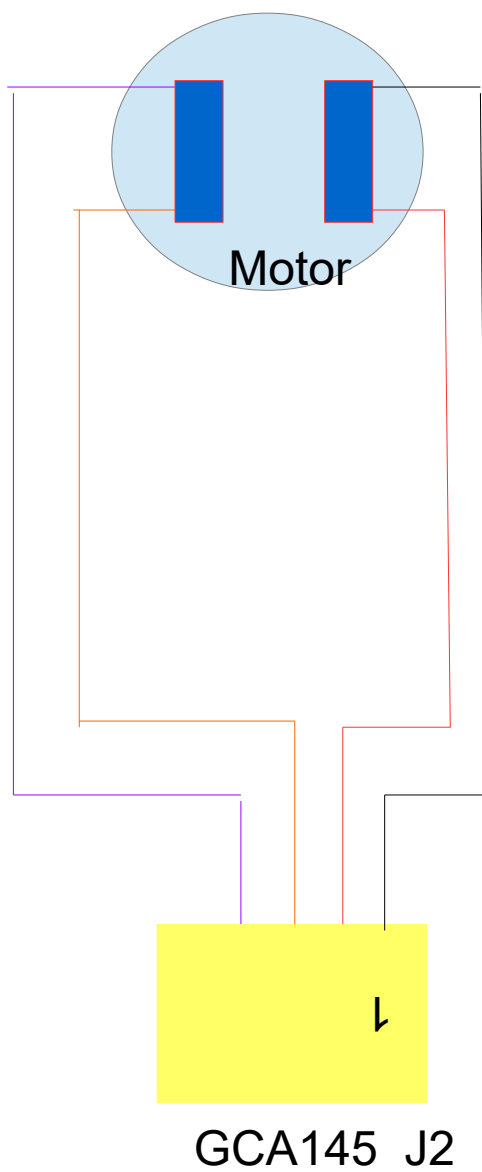
$$V (U2 \text{ pin15}) = I(\text{stepmotor}) / 2$$

So if motor needs 0,5 A, this voltage should be 0,25V.

Appendix 5: Stepmotor connection 4 wires

Step Motor connections to GCA145 with 4 wires

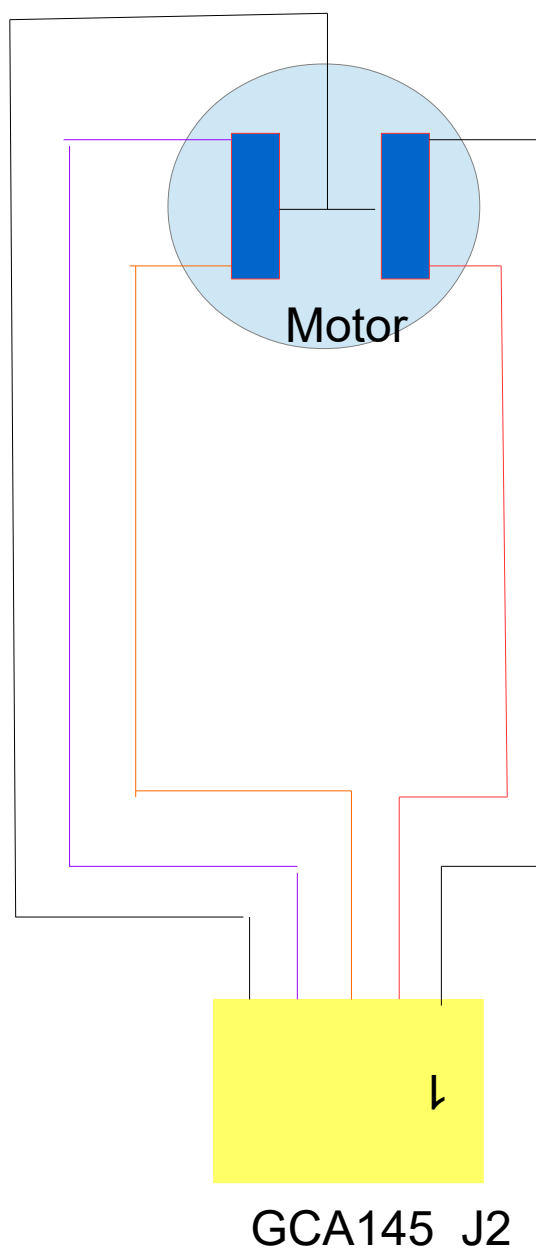
Schrittmotor Anschluss zum GCA145 mit 4 Punkte



Appendix 6: Stepmotor connection 5 wires

Step Motor connections to GCA145 with 5 wires

Schrittmotor Anschluss zum GCA145 mit 5 Punkte



Appendix 7: Connection bridge power (standard 2-rail).

The power to the rails on the bridge is switched by the relays on GCA145.

They also take care for reversing this power, if activated with (menu 0.6).

When using the standard sliding contacts as available on some factory made turntables, you have to make your solution for the sensors.

Using current detection, as also included in GCA145, means that also this current detection needs to be reversed.

All that is taken care for.

Connection of bridge rails are done with J6.

A maximum of 4 railsections with current detection are possible, but do not have to be all used of course.

Connection as follows :

booster / central station:

connect to	wire
J1 pin 3	black wire (brown with Märklin)
J1 pin 4	red wire.

Bridge rails:

J8 Pin#	description
1	feed-back section 1
2	feed-back section 2
3	feed-back section 3
4	feed-back section 4
5	other rail on bridge

4 more connections are available, suitable for a sign on the bridge in both ways, These signs are directly linked to J6 pin 9 & 10, to be controlled externally.

6	Ground
7	+5V
8	n.c.
9	led-sign in reverse direction (do not forget 470 Ω resistor)
10	led-sign in fwd direction (do not forget 470 Ω resistor)

Appendix 8: Connection bridge rail power (3-rail option)

The power to the rails on the bridge is switched by the relays on GCA145.

In this case we do not want reversing the power on turning, so menu 0.6 should be set to 0.

The same current detection (either rails or mid contact could be used in several sections) could be used, in this case just refer to Appendix 7.

But also the rails , used as a switch like in normal Märklin rails, could be done.

In thos case small modifications need to be done to 4 resistors:

R10, R11, R12, R13.

These 33 Ω resistors should be changed to 2,2 K Ω .

GR2,GR3,GR4,GR5 should be removed, cq not assembled.

Connection goes as follows:

Central-station / booster:

connect to	wire
J1 pin 3	brown wire (rails)
J1 pin 4	red wire. (mid rails)

J8 Pin#	description
1	separated rail section 1
2	separated rail section 2
3	separated rail section 3
4	separated rail section 4
5	mid rails on bridge

The other side of bridge rails should be connected directly with brown wire.

Appendix 9: Jumper settings

JP1 Setting.

The L293 chip allows also half step mode.

Normal use is jumper set to F (full).

Setting the jumper to H (half) the motor will have double amount of steps for one rotation.

Not all stepper motors will be happy with it, and also when there is a force on the bridge in any direction, the motor might drop to fullstep when halted.

Then there will be one step fault position in the bridge..

It all depends on motor type, so just try if you like.

But changing this jumper in other position also needs a full adjust of all positions. (menu 62).

JP2 Setting.

The previous version MGV145 board was limited for 18 Volt maximum stepmotor.

GCA145 is adjustable up to 24V .

In normal situations jumper JP2 is set to position 2.\\

But there is an exception.\\

If you need 24V for the stepmotor, the transformer need to be at least 24V.\\

A dc power unit should be at least 30V.\\

In that case, the voltage feeded to VR2 is too high for regulator VR2,\\

and JP2 should be set to position 1.\\

