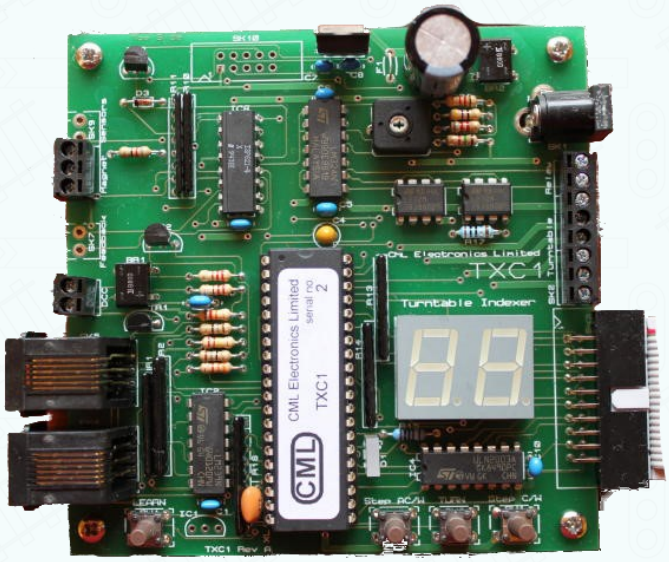
Sig-naTrak®
Model railway electronics by GFB Designs

TXC1
Turntable Controller



User Manual

Advanced Turntable Control with DC or DCC input.

Includes TXC1-LED Display Board.

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Model railway electronics by GFB Designs

IMPORTANT NOTICE

CHANGE OF OWNERSHIP AND TRADING NAME

Please note that following the purchase of CML Electronics by GFB Designs, some of the product manuals may still refer to "CML Electronics Limited".

*This should now be read as "**Sig-naTrak® by GFB Designs**".*

Contact details listed in this manual are also incorrect and the details at the bottom of this page should take precedence over any found in this manual for CML Electronics.

This includes our website which is now

www.signatrak.co.uk

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1. Introduction

The TXC1 is an advanced turntable controller for DC and DCC controlled railways. It is compatible with any DCC system, and allows the turntable to be positioned using DCC or manual commands. It can also be used on conventional DC layouts for manual, indexed control. The TXC1 indexes the turntable to particular track exits automatically, freeing the operator for other train control functions. Simply choose the required track, and the turntable will turn itself to that position automatically.

The unit supports turntables supplied by Atlas, Hornby and Fleischmann. It can also be used with the Marklin 9 track traverser. The manufacturer provided mechanism is used intact; the TXC1 controls the motor to position the turntable to particular track exits.

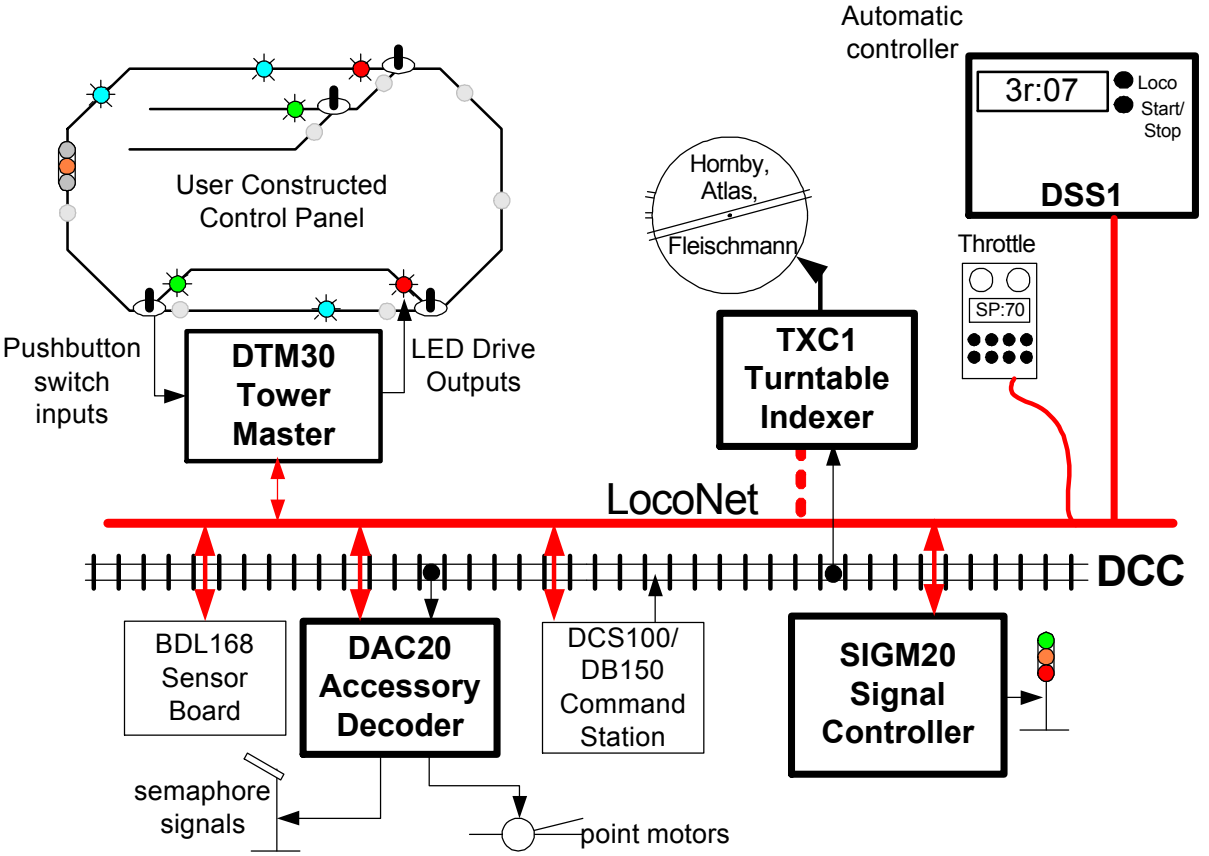
The turntable can be controlled is several ways:

- Using manual controls: “step clockwise” and “step anticlockwise” pushbuttons move the turntable by one track position. A “turn” pushbutton moves the turntable by 180º in one operation.
- Track exits can be blocked, so that the turntable doesn’t stop at them. This allows the turntable to be positioned quickly to the tracks that are used on your railway.
- The on-board display shows the current track exit number.
- Remote pushbuttons can be used: for example the unit may be hidden behind a panel, with remote pushbuttons available to the user. LEDs can be added to show the selected track exit.
- A “front panel display board” is available as an optional extra. This has LEDs for each track exit position to show the turntable position, and a rotating knob selects clockwise / anticlockwise movement or 180º turn.
- DCC accessory (point) commands can be used to set the turntable. This allows operation from a throttle.

For advanced users with computer control, the TXC1 can be controlled by PC software. It can give feedback information to “LocoNet” so that the track position is known to the network. PC software packages such as Railroad & Co’s “Traincontroller” will know the turntable position after power is applied, they can control the turntable, and know its position if the turntable is turned under manual control.

The settings for the TXC1 can be programmed in several ways. There is an intuitive “LEARN” mode to set most of the required parameters. DCC “on the main” programming can be used to set individual CVs, and a programming track can also be used.

The TXC1 is one of several advanced DCC and LocoNet accessories available from CML Electronics Limited. With our products you can begin with a DCC controller and build up, step by step, to a full system.



Contents

2. Installation & Connections

The TXC1 unit comprises a single circuit board with dimensions 100mm x 100mm as shown in Figure 2.1. It may be mounted onto spacers or pillars using four screws into the four corner holes: 6BA or M2.5mm screws will be ideal. Alternatively small self tapping screws can be used.

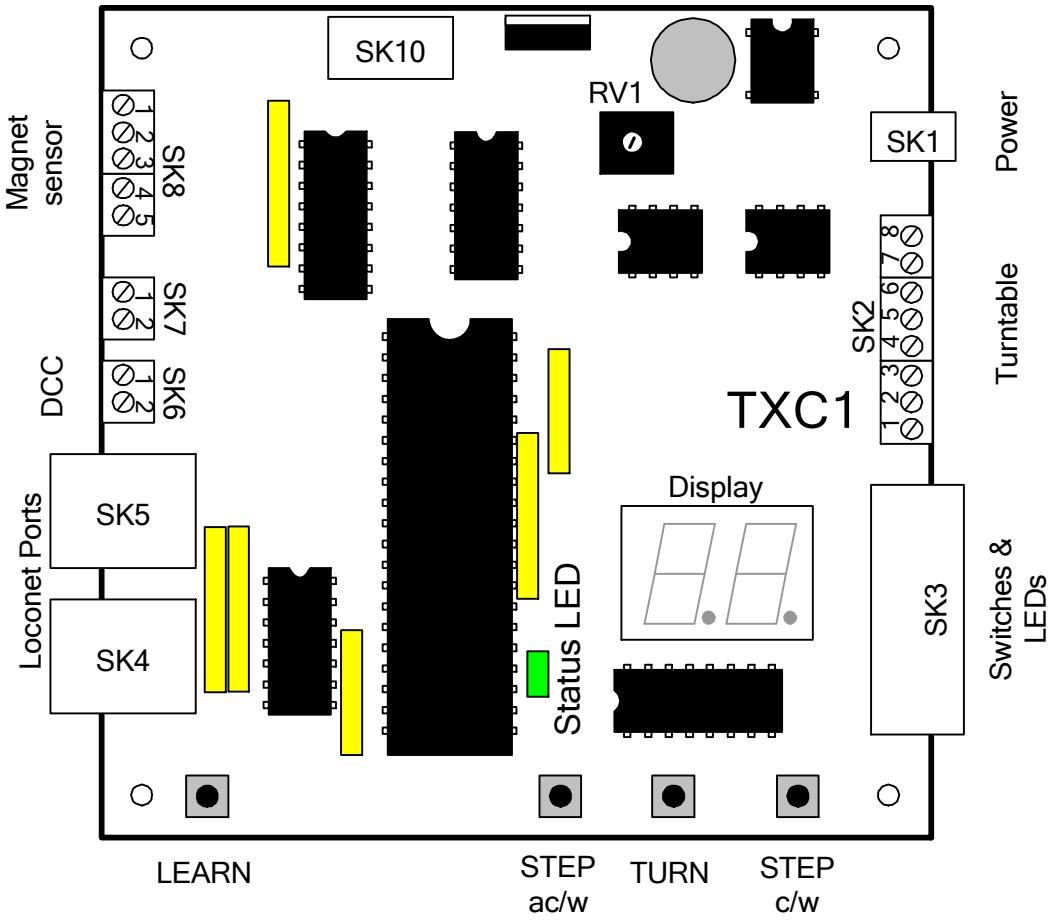


Figure 2.1: TXC1 Connections

All connections to the TXC1 are made through the following connectors:

SK1	Power
SK2	Turntable
SK3	Front panel LEDs & Pushbuttons
SK4, 5	LocoNet ports (not required for non Digitrax systems)
SK6	DCC track connection
SK7	(likely to be deleted)
SK8	Magnetic sensor input
SK10	factory configuration port – do not connect

Safety First! Before beginning to use the TXC1, there are a few safety points to remember:

Don't rest the board on its bag when operating: it is conductive!
Hold the board by its edges. By the nature of its construction, some of the pins on the reverse side of the board are sharp and could cause skin abrasions etc if handled incorrectly.
Don't touch components on the board when operating. Some components can get quite warm. There is also a self-resetting fuse to allow for short circuits which will become very hot if tripped.
Allow airflow around the board. Some of its components may run warm in use. Do not obstruct free circulation of air, or allow cloths etc to cover the board.
Do not exceed rated operating voltage. The board could be damaged if an excessive input voltage is applied. The DCC operating voltage should not exceed 20v; the power supply input must not exceed 16v AC or 18v DC.
Do not handle the board when in use. The voltages present on the board (<25v DC) are not considered hazardous to health. However if they should come into contact with sensitive parts of the body (e.g. the mouth) a nasty shock might result. The same is true of the voltage on the rails of a DCC (or other model railway) system, so take care!

2.1 SK1: Power Connections

Power is connected through a 2.1mm DC power connector. Power should be 12-16v DC or AC (but DC preferred). Either polarity may be used on this connector.

"Wall wart" style transformers and power supplies are readily available that are already wired to a suitable connector. The connector is readily available. CML can supply a connector mounted onto a twin cable if required.

Do not turn off the power while the turntable is moving! Doing so will make the unit lose its memorised track position. If this happens, follow the instructions in section 5.2.3 to reset track 1 position.

2.2 SK2: Turntable connector

This is an 8 position screw connector. It provides the signals to control the turntable motor. The connections are shown in Table 2.1

Pin	Function
1	Board Ground
2	Motor output 4 (connect as shown below)
3	Motor output 3(connect as shown below)
4	Motor output 2(connect as shown below)
5	Motor output 1(connect as shown below)
6	+12v out. Do not connect unless instructed specifically!
7	Track polarity relay. Connect relay from here to Ground, if required: see section 3.4.2.
8	spare output. Do not connect.

Table 2.1: SK2 Turntable Connections

For Hornby and Atlas turntables: connect the turntable motor to pins 4&5. Pin 5 is positive to rotate clockwise: check using a separate power supply first.

For Fleischmann turntables: connect the three motor wires as follows. Grey = pin 4, yellow = pin 3, red = pin 2.

The TXC1 has sufficient power output to operate these turntables. As with DCC locomotive decoders, bear in mind that the TXC1 cannot overcome mechanical or wiring reliability problems with the turntable. Check that:

- The turntable moves freely
- Its motor moves freely
- That any "slip rings" providing electrical connections to the turntable bridge are clean and making good contact
- (for Fleischmann turntables) the "latching" bar under the turntable bed moves freely

2.3 SK3: Front Panel Pushbuttons & LEDs

This is a 20 pin ribbon cable header to connect optional front panel LEDs and pushbuttons, or to connect the optional CML Front panel PCB. The connections are shown in Table 2.2. More details for how to use these connections can be found in Appendix A.

Pin	Signal	Pin	Signal
1	Row A	2	Row B
3	Row C	4	Row D
5	Row E	6	Row F
7	Row G	8	Row H
9	Col 2	10	GND
11	Col 3	12	GND
13	Col 4	14	Encoder select
15	TURN	16	GND
17	Move ac/w	18	GND
19	Move c/w	20	GND

Table 2.2: SK3 Connections

2.4 SK4, SK5: LocoNet Connections

These two identical connectors allow for connection to a LocoNet network using conventional 6 pin RJ12 (US style telephone) connectors. The two connectors are wired in parallel: the LocoNet wiring may be connected to either port, or may be daisy-chained through the TXC1.

The board does not require a LocoNet connection. Only connect this is you require feedback of turntable position through LocoNet.

2.5 SK6: DCC Track

This is a 2 pin screw terminal connector. If you are a DCC user other than Digitrax, you can connect your track power to this connector and the turntable can be operated by DCC point (accessory) commands.

(Digitrax users should **not** connect to SK6 if a LocoNet cable has been connected.)

2.6 SK7: likely to be deleted

(this provides an opto isolated feedback output while the bridge is turning).

2.7 SK8: Magnet sensor

For users with Hornby and Atlas turntables, it will be necessary to add a magnet and magnetic sensor to your turntable. This connector connects the 3 pin magnetic sensor; see section 3.1. Its connections are shown in Table 2.3.

The sensor and its magnet are provided by CML Electronics.

(pins 1,2 likely to be deleted)

Pin	Signal
1	Ground
2	spare sensor input. +12v=active; 0v = inactive
3	+ve power to magnetic sensor
4	Ground
5	magnetic sensor input.

Table 2.3; SK8 connections

2.8 SK9: Factory configuration port

Do not make any connections to this connector!

2.9 Status LED

A status LED is provided on the main board itself. This provides indications of the TXC1's function, as follows:

- The LED is lit continuously GREEN while the board has power and is receiving proper DCC signals.
- The led is lit continuously RED when the board has power, but no DCC signal.
- If the LED is off, the unit is not powered.
- The LED flickers off momentarily when a DCC command for this unit is received. This is useful for checking the address is correctly set.
- If the unit is in LEARN mode, the LED will blink on and off equally once per second. Programming operations can be carried out in LEARN mode.
- If the unit does not have a serial number set, the LED will flash briefly on once per second. This will only happen if the serial number is accidentally erased by programming. When the LED blinks in this way, read the serial number from the label on the board and use a DCC throttle set that switch address to THROWN; the board will then resume normal operation. (This is normally done in factory configuration).

3. Setting Up a Turntable

3.1 Hornby, Atlas Types

As manufactured, Hornby and Atlas turntables index to the next track position by having a rotating disc in the turntable mechanism that turns one complete turn per track exit position. The disc turns once per track exit; the turntable does not rotate smoothly – instead it is halted for about half of the disc's revolution.

To use these turntables, it is necessary to prepare the turntable by mounting a magnet to that disc and mounting a magnetic sensor above or below the disc. This is not difficult, and examples are provided on our web page. The procedure for the Atlas N scale turntable is described in Appendix E.

Once the magnet and sensor have been mounted, they need to be wired to the turntable and TXC1 as shown in Figure 3.1. Then follow the instruction in section 5.2.1 to set the turntable type, and the instructions in section 5.2.3 to set the "track 1" position.

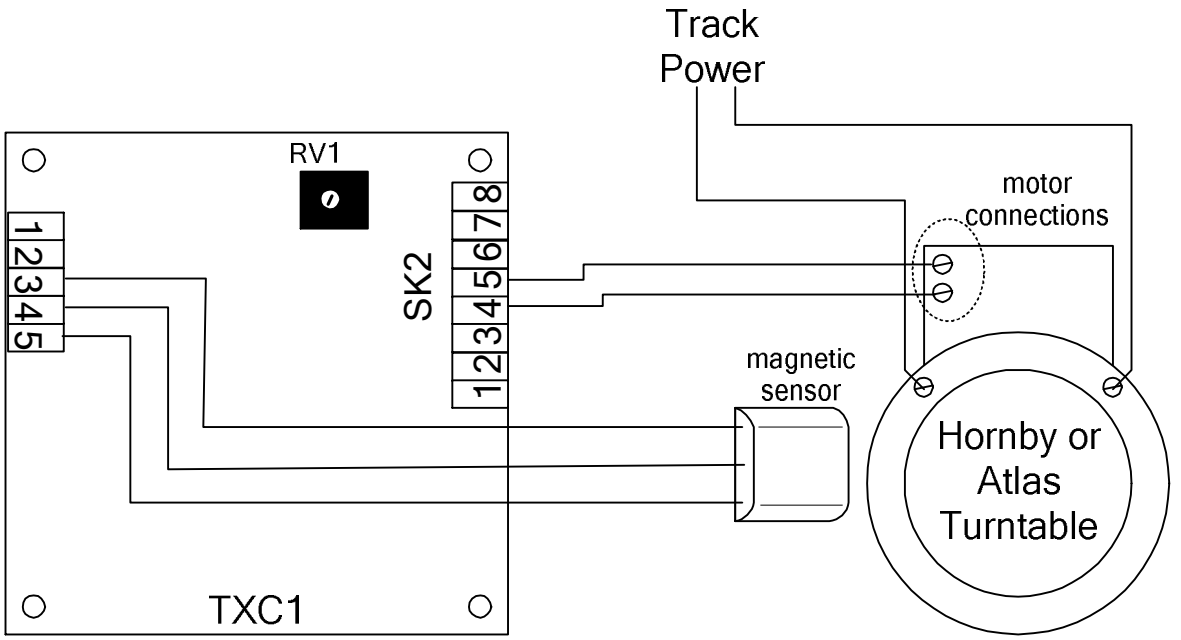


Figure 3.1: ATLAS or Hornby Turntable Connections

The ATLAS turntable has internal wiring to reverse the track polarity on the bridge as the turntable turns: simply follow the manufacturer provided instructions for wiring. A Hornby turntable will normally need the track bed to be powered by a relay or DCC autoreverser: see section 3.4.

If your turntable rotates in the wrong direction when driven – swap the two wires to the motor around.

3.2 Fleischmann Type

The Fleischmann turntable requires no preparation. Simply connect the turntable as shown in Figure 3.2. Then follow the instruction in section 5.2.1 to set the turntable type to “Fleischmann 48 track” or “Fleischmann 24 track” depending on which variant of turntable you have; then follow the instructions in section 5.2.3 to set the “track 1” position.

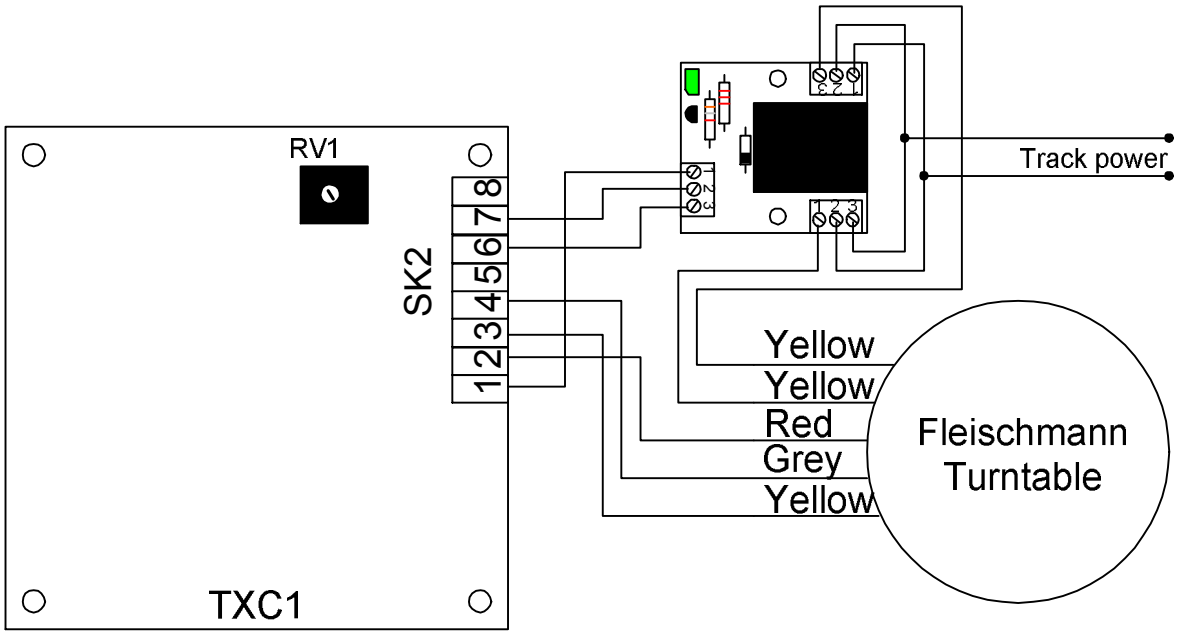


Figure 3.2: Fleischmann Turntable Connections

The track bed will normally need to be powered through a relay or DCC autoreverser: see section 3.4. The connections are shown for an RLY2 relay.

It is necessary to adjust RV1 so that the TXC1 detects the turntable bridge arriving at each track exit position. When moving through several positions there should be a distinct “click” from the bridge at each track exit position. Adjust RV1 so that this happens, and the right hand “dot” on the TXC1 display lights up while the bridge is moving. The RV1 position is usually close to its anticlockwise limit of travel.

3.3 Marklin Traverser

The Marklin transfer table / traverser requires no preparation. Simply connect it as shown in Figure 3.3. Then follow the instruction in section 5.2.1 to set the turntable type, and the instructions in section 5.2.3 to set the “track 1” position: this needs to be the bottom of the table, with the “straight through” path.

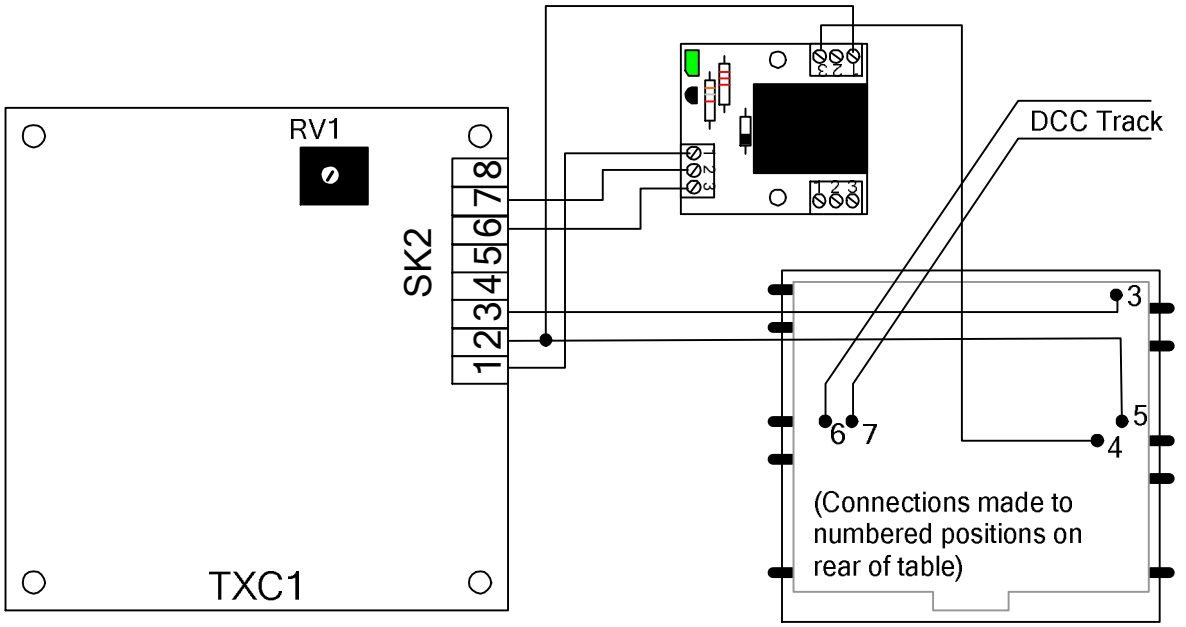


Figure 3.3: Marklin Traverser Connections

The track bed can be fed directly with a DCC feed; make sure you get the two track wires aligned to the track feeds for the entry and exit rails.

It is necessary to adjust RV1 so that the TXC1 detects the table bridge arriving at each track exit position. When moving through several positions there should be a distinct "click" from the relay at each track exit position. Adjust RV1 so that this happens, and the right hand "dot" on the TXC1 display lights up while the bridge is moving. The RV1 position is usually about 1/3 of the way along from anticlockwise limit.

3.4 Powering the track bridge

Most turntables are supplied in a form that allows the track on the bridge to be powered by the track exits it aligns to. That means the turntable's track will not be powered while it rotates. The Fleischmann turntable uses the opposite approach – its track bed is powered by slip rings and it powers the track exits that it aligns to.

DCC users typically want all track to be powered always, so that locomotive lights and sound decoders will continue to work. This presents a problem: the track polarity needs to swap over as the turntable rotates. There are several ways to do this:

- ATLAS turntables have this built into them – just follow the instructions;
- A relay can be used for Hornby & Fleischmann turntables;
- A DCC autoreverser can be used for Hornby & Fleischmann turntables.

3.4.1 Using an autoreverser

This is simple. Simply wire the autoreverser between the command station or booster's track output, and the wires to the turntable's bridge tracks. As the turntable rotates to some positions, a short circuit will cause the reverser to swap over the track outputs.

3.4.2 Using a Relay

The TXC1 provides controls to drive a relay to swap the track polarity over automatically. This approach requires that the track exits are all wired carefully. If this isn't possible, then use the "autoreverser" method.

TXC1 SK2 pin 7 provides an output that will drive low current relay coils. A double pole, double throw (DPDT) relay may be connected between SK2 pin 7 and SK2 pin 1; alternatively the CML Electronics RLY2 relay can be used, which includes a driver circuit.

The procedure to follow is as follows:

1. draw an imaginary line across the turntable bed, with the first exit clockwise after the line being track 1, as shown in figure Figure 3.4.
2. For all the tracks on one side of the line: the LEFT hand track at each exit, as you look into the turntable, wires to the booster output connection A.
3. For all the tracks on the other side of the line: the RIGHT hand track at each exit, as you look into the turntable, wires to the booster output connection A.
4. The turntable bridge tracks are fed via a changeover relay wired as shown.
5. If the booster short circuits at each track exit, reverse the wires from the relay to the bridge track.

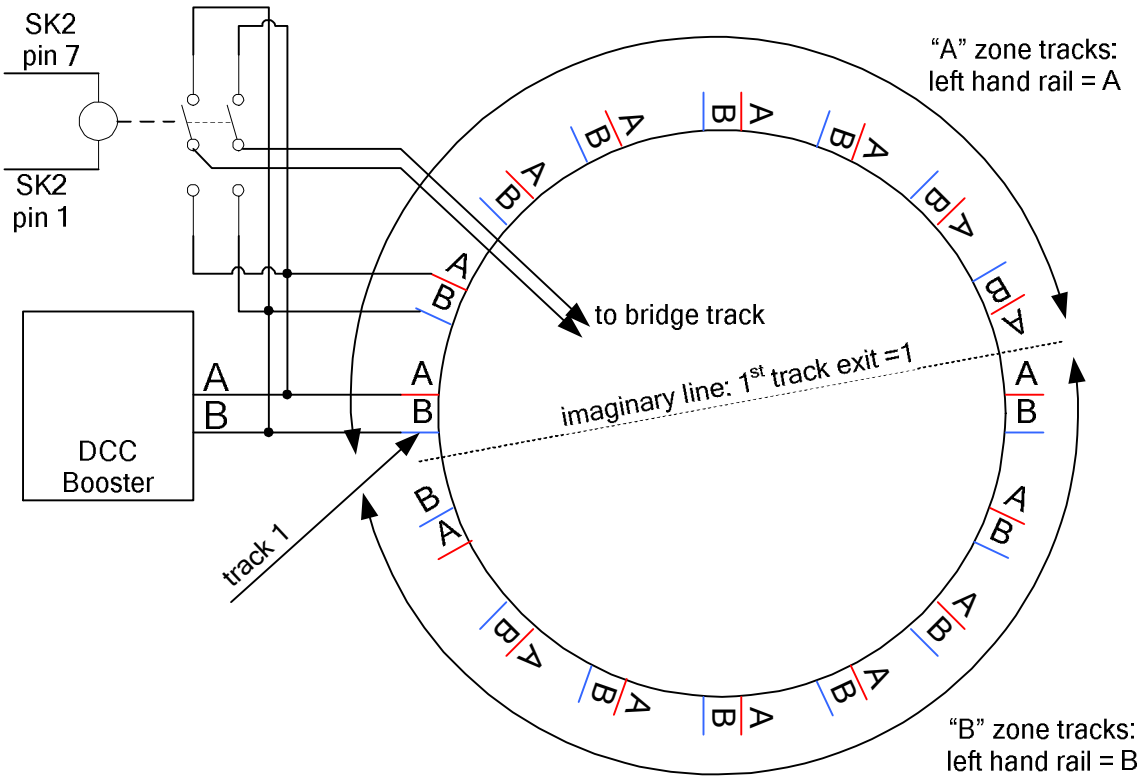


Figure 3.4: Using a Relay to Power the Turntable Bridge Track

4. Operating The Turntable

4.1 Displays

Whether the turntable is operated manually or by DCC commands, there are two possible displays to show the current track position. A 7 segment LED display on the TXC1 shows the current track position numerically:

- If the turntable is stationary, this display shows the current track exit number.
- If the turntable is moving to a new position, the display flashes with the number of the exit it is moving to. This shows the "destination" track.

It is also possible to connect LEDs for each track exit position, to illuminate in a visual display of track position. Instructions for this are shown in Appendix A.

4.2 Manual operation

The turntable is operated manually using the "TURN", "STEP anticlockwise" and "STEP clockwise" pushbuttons.

- The "STEP clockwise" pushbutton will move the turntable by one track position clockwise. If it is already moving, its destination track will move by one position clockwise. In this way, three button presses will always move the turntable three positions.
- The "STEP anticlockwise" pushbutton will move the turntable by one track position anticlockwise, in a similar way.
- The "TURN" pushbutton moves the turntable by 180º in one operation. The direction of turn is the last direction the turntable moved in.

As shipped, the turntable will stop at all track exits from the turntable whether there is a track there or not. The unused track exits can be disabled, so the turntable does not stop at them: see section 5.3.

4.3 DCC operation – by hand

The turntable can be controlled by a DCC command station or throttle, using its "change point" commands. A simple set of commands has been provided to drive the turntable to a specific track exit. To use these commands, the DCC "base address" needs to be set: this is the first point number to which the board responds (see section 5.2.2). The board occupies 24 point numbers, starting from that number.

After the base address has been set, point commands to CLOSED and THROWN operate the turntable as shown in Table 4.1. (If your turntable has fewer track positions, DCC commands for track positions beyond the turntable's capacity are ignored0.

Switch addr	when set to THROWN	when set to CLOSED
base addr	Move clockwise to track 1	move anticlockwise to track 1
base addr + 1	Move clockwise to track 2	move anticlockwise to track 2
base addr + 2	Move clockwise to track 3	move anticlockwise to track 3
base addr + 3	Move clockwise to track 4	move anticlockwise to track 4
base addr + 4	Move clockwise to track 5	move anticlockwise to track 5
base addr + 5	Move clockwise to track 6	move anticlockwise to track 6
base addr + 6	Move clockwise to track 7	move anticlockwise to track 7
base addr + 7	Move clockwise to track 8	move anticlockwise to track 8
base addr + 8	Move clockwise to track 9	move anticlockwise to track 9
base addr + 9	Move clockwise to track 10	move anticlockwise to track 10
base addr + 10	Move clockwise to track 11	move anticlockwise to track 11
base addr + 11	Move clockwise to track 12	move anticlockwise to track 12
base addr + 12	Move clockwise to track 13	move anticlockwise to track 13
base addr + 13	Move clockwise to track 14	move anticlockwise to track 14
base addr + 14	Move clockwise to track 15	move anticlockwise to track 15
base addr + 15	Move clockwise to track 16	move anticlockwise to track 16
base addr + 16	Move clockwise to track 17	move anticlockwise to track 17
base addr + 17	Move clockwise to track 18	move anticlockwise to track 18
base addr + 18	Move clockwise to track 19	move anticlockwise to track 19
base addr + 19	Move clockwise to track 20	move anticlockwise to track 20
base addr + 20	Move clockwise to track 21	move anticlockwise to track 21
base addr + 21	Move clockwise to track 22	move anticlockwise to track 22
base addr + 22	Move clockwise to track 23	move anticlockwise to track 23
base addr + 23	Move clockwise to track 24	move anticlockwise to track 24

Table 4.1: Manual DCC Commands

4.4 DCC operation – using a computer

There is an additional set of point motor commands, with a different base address, that can be used with computer control. This allows a PC software program – such as Traincontroller – to operate the turntable automatically. These follow the Marklin 7286 commands supported by Traincontroller. (There is no reason why these commands can't be used from a throttle; but we haven't found them very intuitive).

To use these commands, the auxiliary DCC "base address" needs to be set: this is the first point number to which the board responds (see section 5.4.1). The board occupies 16 point numbers, starting from that number.

After the base address has been set, point commands to CLOSED and THROWN operate the turntable as shown in Table 4.2.

Switch addr	when set to THROWN	when set to CLOSED
base addr	stop turntable moving at next exit	Not used.
base addr + 1	not used.	Rotate turntable 180º
base addr + 2	step clockwise one track position	step anticlockwise one track position
base addr + 3	start moving clockwise	start moving anticlockwise
base addr + 4	stop turntable at track 1 position	stop turntable at track 2 position
base addr + 5	stop turntable at track 3 position	stop turntable at track 4 position
base addr + 6	stop turntable at track 5 position	stop turntable at track 6 position
base addr + 7	stop turntable at track 7 position	stop turntable at track 8 position
base addr + 8	stop turntable at track 9 position	stop turntable at track 10 position
base addr + 9	stop turntable at track 11 position	stop turntable at track 12 position
base addr + 10	stop turntable at track 13 position	stop turntable at track 14 position
base addr + 11	stop turntable at track 15 position	stop turntable at track 16 position
base addr + 12	stop turntable at track 17 position	stop turntable at track 18 position
base addr + 13	stop turntable at track 19 position	stop turntable at track 20 position
base addr + 14	stop turntable at track 21 position	stop turntable at track 22 position
base addr + 15	stop turntable at track 23 position	stop turntable at track 24 position

Table 4.2: Computer DCC Commands

For Digitrax systems, feedback is supplied to LocoNet about turntable position. This allows a program such a Traincontroller to find out the starting position of the turntable after the layout powers up.

The board also sets a LocoNet sensor output active while the bridge is turning. This can be used by programs such as Traincontroller to determine when the turntable movement is complete. Sensor 1 is used; the sensor board number is programmed as described in section 5.4.2.

5. Programming

There are several ways to program the TXC1 unit. It has a built-in "LEARN" mode, which uses its pushbuttons and display to set most functions. CVs can be accessed directly using "programming on the main", and it can if required be programmed on a programming track. A "factory reset" to initial as-shipped settings is also available.

5.1 Programming Needs

The unit needs very little programming to get started; many users will not need more than that. The settings are grouped into three categories:

1. Elementary settings: DCC base address, turntable type, track 1, factory reset
2. Medium complexity: enable or disable each track position
3. Advanced: set 2nd DCC base address, sensor board number, enable LocoNet commands. Set A/B track split position.

5.2 Elementary Programming With LEARN mode

The LEARN mode provides a simple way to make most of the TXC1 settings without needing other equipment. The LEARN mode is entered by pressing and holding the LEARN pushbutton for longer than 5 seconds; it is exited by pressing and releasing the LEARN button momentarily.

The sections that follow describe how to use this mode to make most of the settings needed by a TXC1 unit.

5.2.1 Setting the Turntable Type

There are several turntable types recognised by the TXC1. The first setting made should be to select the correct type.

1. Press and hold the "LEARN" button for 5 seconds
   (The green LED begins to flash, and scrolls "Learn track")
2. Press and hold the "LEARN" button for 5 seconds again
   (The green LED continues to flash, and scrolls "Learn turntable type")

The display will now show "t" followed by a letter indicating the turntable type. The turntable type can be selected using the "step clockwise" or "step anticlockwise" buttons. Either button will step through a list of the possible types, and a message will scroll. The following types are available:

Display letters	scrolled message	Type of turntable
“th”	Hornby	Hornby OO gauge 16 track turntable
“tA”	Atlas	Atlas HO or N gauge 24 track turntable
“tF”	Fleischmann 48 track	Fleischmann 48 track turntable
“tF”	Fleischmann 24 track	Fleischmann 24 track turntable
“tt”	Marklin transfer table	Marklin Z gauge 9 track traverser

When the correct type is displayed, exit learn mode by pressing and releasing the LEARN pushbutton momentarily. Normal operation will resume.

5.2.2 Setting the DCC Base Address

The DCC base address is selected by using a DCC command station / throttle to select the first address of the unit to THROWN while in LEARN mode.

1. Press and hold the “LEARN” button for 5 seconds
   (The green LED begins to flash, and scrolls “Learn track”)
2. Using your DCC command station / throttle, set the required start address to THROWN.
   (The display will scroll “set base address nn” where nn is the number you selected)

For example: to set a base address of “101” you would select “point 101 thrown”

5.2.3 Set “Track 1” Position

The turntables do not have any kind of sensor to know that it is aligned to track 1. Instead it counts the turns, and stores them in between turntable movements. If for any reason it loses synchronisation, then the “TRACK1” position needs to be re set.

In normal operating mode:

- Position the turntable so it is aligned to track 1 using the “step clockwise” and “step anticlockwise” buttons.
- Press and hold the TURN button for more than 5 seconds, then release it.
  (The display shows “=1”)
- (you can also step the turntable in steps of one actual exit position in this mode)
- Press and hold the TURN button for more than 5 seconds again, then release it
  (The current turntable position is memorised as track 1)

The track 1 position can be lost for several reasons, for example:

- Power is turned off while the turntable is moving

- A mechanical problem prevents the turntable from moving when it should do
- For Fleischmann types, if the track bed does not "unlatch" from the outer edge of the turntable because of friction, or because of poor slip-ring contacts.

5.2.4 Factory Reset

If you lose control of the TXC1 settings, it can be restored to "as shipped" state using the factory reset mode. This will reset everything, and you can begin again.

1. Press and hold the "LEARN" button for 5 seconds, then release it.
   (The green LED begins to flash, and scrolls "Learn track")
2. Press and hold the "LEARN" button for 5 seconds again, then release it.
   (The green LED continues to flash, and scrolls "Learn turntable type")
3. Press and hold the "LEARN" button for 5 seconds again, then release it.
   (The green LED continues to flash, and scrolls "Factory reset")

The display now shows "Fr". If LEARN is immediately pressed for more than five seconds again, then all settings will be restored to their "as shipped" values. If no button is pressed within 5 seconds, it returns to "LEARN turntable type" mode. Press the LEARN button momentarily to return to normal operation.

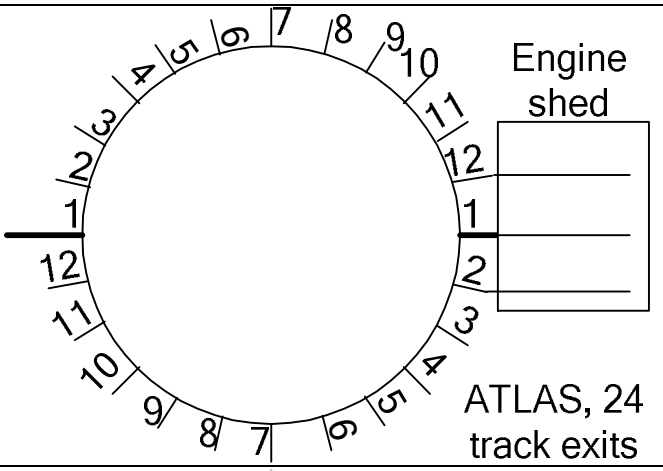
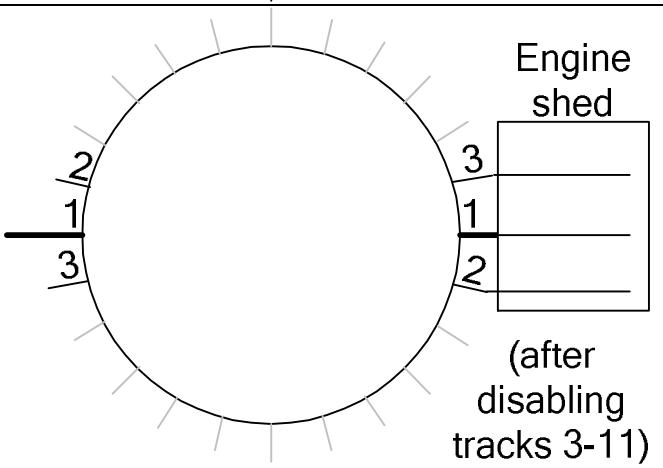
5.3 Enabling / Disabling Track Positions

Most railways do not have tracks on any thing like all of the possible track exits. Typically, there may be one track into the turntable and possibly 3-4 tracks to an engine shed. An obvious exception to this is the "roundhouse" kind of engine workshop.

The TXC1 can be programmed so that it does not stop at track positions where there is no rail connection. This means that it will only stop at tracks where a train can actually drive on or off the turntable. The "LEARN Track" mode is used for this. In this mode, each track position is selected in turn and set as to whether the turntable should stop there or not.

5.3.1 Track Numbering

It is important to understand the numbering system used before undertaking this process. The TXC1 treats the two tracks opposite each other as being the same turntable position. Consequently the numbering process starts with half the number of turntable positions as there are track exits. The TXC1 then counts and displays the track positions where the turntable can stop. If some track exists are disabled so the turntable doesn't stop there, then those positions don't have a position display number.

Example: An Atlas turntable has 24 possible track exits. The "input" track is to be track number 1. the track 180º opposite that runs into the engine shed, as do the two tracks that are either side of it. The turntable should only stop at those three positions. Before the unused roads are disabled, the track numbers would be as shown:	
Start on track 1; enable that position. Move to track 2; enable that position. Positions 3-11 are visited, and disabled. Finally go to position 12, and enable that position. After this process, the turntable will only visit three possible positions that will now be numbered 1-3. Moving clockwise from position 2, the turntable will next stop at position 3 as shown:	

5.3.2 Programming in "LEARN Track" mode

To operate the track enable/disable mode:

1. Press and hold the "LEARN" button for 5 seconds
   (The green LED begins to flash, and scrolls "Learn track")
2. Use the "Step clockwise" and "step anticlockwise" buttons to visit each turntable position.
3. At each position, the display scrolls a message and then indicates track state:
   a. If the track position is enabled: displays "rY"
   b. If the track position is <u>not</u> enabled: displays "rn"
4. To change the state of the track exit: press the TURN button. The new track state is displayed. If you need to change it back again, simply press TURN again.
5. When complete, press and release the LEARN button. The TXC1 will restart in normal mode, but with the track exits numbered as described.

If the LEARN process is exited with the turntable on an exit that is not enabled, it will display "0". After it has been moved, it will not stop there again.

5.4 Advanced Programming

5.4.1 Setting "computer control" DCC Base Address

The TXC1 uses a second set of DCC commands for computer control. These commands are recognised by PC software packages such as "Traincontroller". It will occupy 16 point numbers starting at this address. The commands are not very intuitive for manual operation, which is why a more usable set of commands has been provided. (See section 4.4 for these commands).

The "computer control" DCC base address is selected by using a DCC command station / throttle to select the first address of the unit to THROWN while in "LEARN turntable type" mode.

1. Press and hold the "LEARN" button for 5 seconds
   (The green LED begins to flash, and scrolls "Learn track")
2. Press and hold the "LEARN" button for 5 seconds again
   (The green LED continues to flash, and scrolls "Learn turntable type")
3. Using your DCC command station / throttle, set the required start address to THROWN.
   (The display will scroll "set aux base address nn" where nn is the number you selected)

For example: to set a base address of "201" you would select "point 201 thrown"

5.4.2 Setting LocoNet Sensor Board Number

The LocoNet sensor board address is only required if you want to use LocoNet feedback to for example a PC software package such as Traincontroller. This number is between 1 & 255, and should be different from any other sensor products you have e.g. BDL168, SIGM20, DAC10, DAC20, DS64.

It is programmed by using a DCC command station / throttle to set a point number to CLOSED while in LEARN mode.

1. Press and hold the "LEARN" button for 5 seconds
   (The green LED begins to flash, and scrolls "Learn track")
2. Using your DCC command station / throttle, set a point number CLOSED corresponding to the number of the board base address required.
   (The display will scroll "set sensor board address nn" where nn is the number you selected)

For example: to set a sensor board address of "41" you would select "point 41 closed"

5.4.3 Enable LocoNet Commands

For Digitrax users, the TXC1 can be made to operate from LocoNet commands, instead of LocoNet commands. This means it will operate even if track power is turned off.

To select this mode, it is necessary to make a manual change to CV13. Use the commands described in section 5.5.

- To use DCC commands, set CV13 to 0
- To use LocoNet commands, set CV13 to 1.

5.4.4 A/B Track Split

Section 3.4.2 showed how the track exits need to be wired for Atlas turntables, or other turntables with a relay driving the track bridge. As shipped, the TXC1 will change over the relay when it is aligned to the "track 1" position. If it is necessary to wire the track exists differently, with the split at a different position, then it is possible to change the TXC1 programming.

- Use the "step clockwise" and "step anticlockwise" buttons to position the turntable on the 1st track exit on the "A" zone. (All the other "A" zone exists should be clockwise from this one).
- Press and hold the "LEARN" button for 5 seconds
    a. (The green LED begins to flash, and scrolls "Learn track)
- Press and hold the "turn" button for 5 seconds. The setting is reprogrammed.

5.5 Manual CV Programming

Some commands can only be accessed via their Configuration Variables (CVs). There are two ways by which these can be accessed, using a DCC system. They can be programmed "live" on the main track, or on a programming track.

5.5.1 "On the Main"

To program CVs "on the main" follow the following steps:

- Connect the DCC input (SK6) to the DCC command station's track output, as normal.
- Connect a power feed to SK1, as normal.
- The green LED will be lit.
- Use your DCC system to program on the main, following its handbook.
- Select a locomotive number that you do **not** have on the railway.
- Press and hold the "LEARN" button on the TXC1 for 5 seconds.
- After releasing the button, the green LED will now be flashing.
- To read a CV value:

    - Follow your DCC command station instructions to select “operations” mode (also known as programming on the main) CV access, and read the required register value
    - The TXC1 display scrolls “read CV xx = yy”. (xx= CV number; yy= value read from it)
    - Ignore and “fail” message on your throttle!
- To write a CV value:
    - Follow your DCC command station instructions to select “operations” mode (also known as programming on the main) CV access, and write the required register value
    - The TXC1 display scrolls “write CV xx = yy” . (xx= CV number; yy= value written to it)

5.5.2 Programming Track

To use a programming track:

- Connect the DCC input (SK6) to the DCC command station’s programming track output.
- Remove any LocoNet cable.
- Connect a power feed to SK1, as normal.
- Now use your DCC system to access the programming track, following its handbook.
- The green LED will flicker to green during programming.

Appendix A Front Panel Switches & LEDs

Some users may want to mount the TXC1 remotely – for example under a layout, near the turntable – but still control the turntable manually. Additional pushbuttons can be connected to the unit, and LEDs can be lit up which indicate the track selected. These functions are enabled by connections to SK3. Suitable cables can be purchased from CML, or are widely available: see our website for details.

Connections can be made direct to the unit, if desired. Alternatively an add-on "front panel PCB" module is available as a kit.

Using the Add-on PCB

CML supplies a PCB that can mount up to 48 LEDs to indicate the turntable position. One LED lights up at each end to show the active track position; while the turntable is in motion, the LEDs for the stopping position will flash. To control the turntable, a rotary switch is fitted in the centre. Move it one position anticlockwise to step the turntable by one track exit anticlockwise; move it one position clockwise to step the turntable by one track exit clockwise. The knob can also be pressed, to initiate a 180º turn.

The front panel PCB provides spaces for up to 48 LEDs: one per possible track position. Most users will only want to fit LEDs to the "active" track positions (typically 4-10 at most).

- Most Fleischmann turntables have 48 track exits, and all LED positions can be used.
- Atlas and some Fleischmann turntables have 24 track exits and only every second LED position on the PCB should be used.
- Hornby turntables have 16 track exists, and every third LED position on the PCB should be used.
- Appropriate markings are on the PCB to indicate which positions should be used. Instructions are supplied with the PCB.

The intention is that this PCB would be mounted into some kind of control panel. Red display filters are readily available if required. The "track 1" LED is marked. If this needs to be at some position other that to the right, then simply mount the PCB at a different angle so that LED is in the required position.

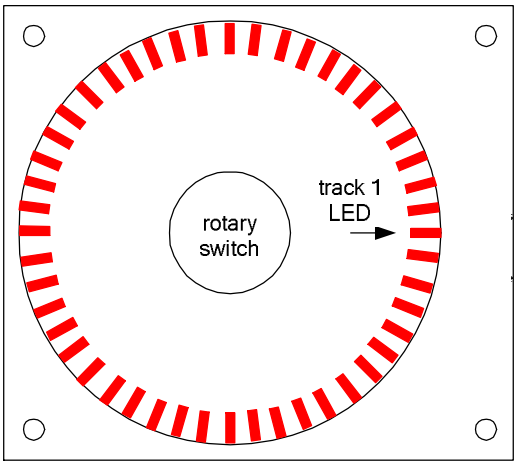


Figure 5.1: The add-on Front panel control PCB

Please note that if you use this PCB, with its convenient rotary switch for track selection, the corresponding "STEP" and "TURN" pushbuttons on the TXC1 main board should NOT be pressed. These may cause errors!

Connecting Pushbuttons and LEDs

If you do not wish to use the add-on PCB, then suitable LEDs and pushbuttons can be mounted into a user constructed panel and can be wired directly to SK3. The connections to the ribbon cable as shown in Table 5.1 below.

Pin	Signal	Pin	Signal
1	Row A	2	Row B
3	Row C	4	Row D
5	Row E	6	Row F
7	Row G	8	Row H
9	Column 2	10	Ground
11	Column 3	12	Ground
13	Column 4	14	Encoder select (no connect)
15	TURN	16	Ground
17	Move ac/w	18	Ground
19	Move c/w	20	Ground

Table 5.1: SK3 connections

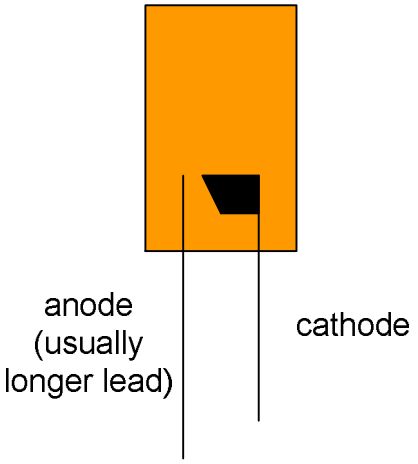
The pushbuttons connect simply to pins 15,17 & 19; the other side of the pushbutton connects to ground. The ribbon cable can have the last six strands separated into pairs to go to the switches.

The LEDs need to be wired into a "matrix". 24 Connections are available for LEDs at one end of the bridge in up to 24 track positions. If both ends of the bridge are to be lit, simply wire two LEDs in parallel. The connections are as shown in Table 5.2 below. The LED anode (positive) connects to the row; the cathode (negative) to the column.

	Column 2	Column 3	Column 4
Row A	LED 1	LED 9	LED 17
Row B	LED 2	LED 10	LED 18
Row C	LED 3	LED 11	LED 19
Row D	LED 4	LED 12	LED 20
Row E	LED 5	LED 13	LED 21
Row F	LED 6	LED 14	LED 22
Row G	LED 7	LED 15	LED 23
Row H	LED 8	LED 16	LED 24

Table 5.2: LED Matrix wiring

Atlas Turntables would only have at most every 2nd LED used (i.e. 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23). Hornby turntables would only have every 3rd LED used (i.e. 1, 4, 7, 10, 13, 16, 19, 22).



Appendix B TXC1 Configuration Variables (CVs)

CV	Function	Meaning	Initial Value
1,2	Reserved		
3,4	Reserved		
5,6	DCC base address	Sets the accessory address the decoder responds to.	CV5=101; CV6=0
7	Version id	Software version number	1+
8	manufacturer id	DCC manufacturer ID	1
9	not used		
10	Sensor board number	Used for sensor response to LocoNet.	240
11	Turntable type	=0: Hornby =1: Atlas =2: Fleischmann	0
12	A/B position	Physical track number for start of "A" zone(1-48)	1
13	Use LocoNet	=0: DCC commands !=0: use LocoNet commands	0
14	output state memory addr	sets a location (0-19) where output state stored.	1
15, 16	"Computer control" DCC base address	Sets the accessory address the decoder responds to for Marklin 7686 commands.	CV15=201; CV16=0
17-28	unused		
29	configuration CV	NMRA defined read-only CV	128
30	unused		
31-54	Exit road type	1: active 0: inactive (note these refer to pairs of exit roads, so only 24 CVs)	1
55	page register	Don't use!	0
56-75	Current position	current physical track number; used to find next track number. (1-48).	

Appendix C Decoder Address Chart

This chart tabulates the decoder base addresses obtained from different settings of CV5 & CV6 **for non ZTC systems**. It is also used for route address setting Although this table shows steps of 10, note that all intermediate addresses can be used. Examples of addresses:

- Base address = 71: set CV6=0, CV5=71
- Base address = 645: set CV6=2, CV5=133

CV5 (X value)	CV6 (Y value)							
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
1	1	257	513	769	1025	1281	1537	1793
11	11	267	523	779	1035	1291	1547	1803
21	21	**277**	533	789	1045	1301	1557	1813
31	31	287	543	799	1055	1311	1567	1823
41	41	297	553	809	1065	1321	1577	1833
51	51	307	563	819	1075	1331	1587	1843
61	61	317	573	829	1085	1341	1597	1853
71	71	327	583	839	1095	1351	1607	1863
81	81	337	593	849	1105	1361	1617	1873
91	91	347	603	859	1115	1371	1627	1883
101	101	357	613	869	1125	1381	1637	1893
111	111	367	623	879	1135	1391	1647	1903
121	121	377	633	889	1145	1401	1657	1913
131	131	387	643	899	1155	1411	1667	1923
141	141	397	653	909	1165	1421	1677	1933
151	151	407	663	919	1175	1431	1687	1943
161	161	417	673	929	1185	1441	1697	1953
171	171	427	683	939	1195	1451	1707	1963
181	181	437	693	949	1205	1461	1717	1973
191	191	447	703	959	1215	1471	1727	1983
201	201	457	713	969	1225	1481	1737	1993
211	211	467	723	979	1235	1491	1747	2003
221	221	477	733	989	1245	1501	1757	2013
231	231	487	743	999	1255	1511	1767	2023
241	241	497	753	1009	1265	1521	1777	2033
251	251	507	763	1019	1275	1531	1787	2043

Avoid address ranges 1017-1020 (these are used by Digitrax for a special purpose)

For ZTC systems, use the “LEARN” method to set the base address

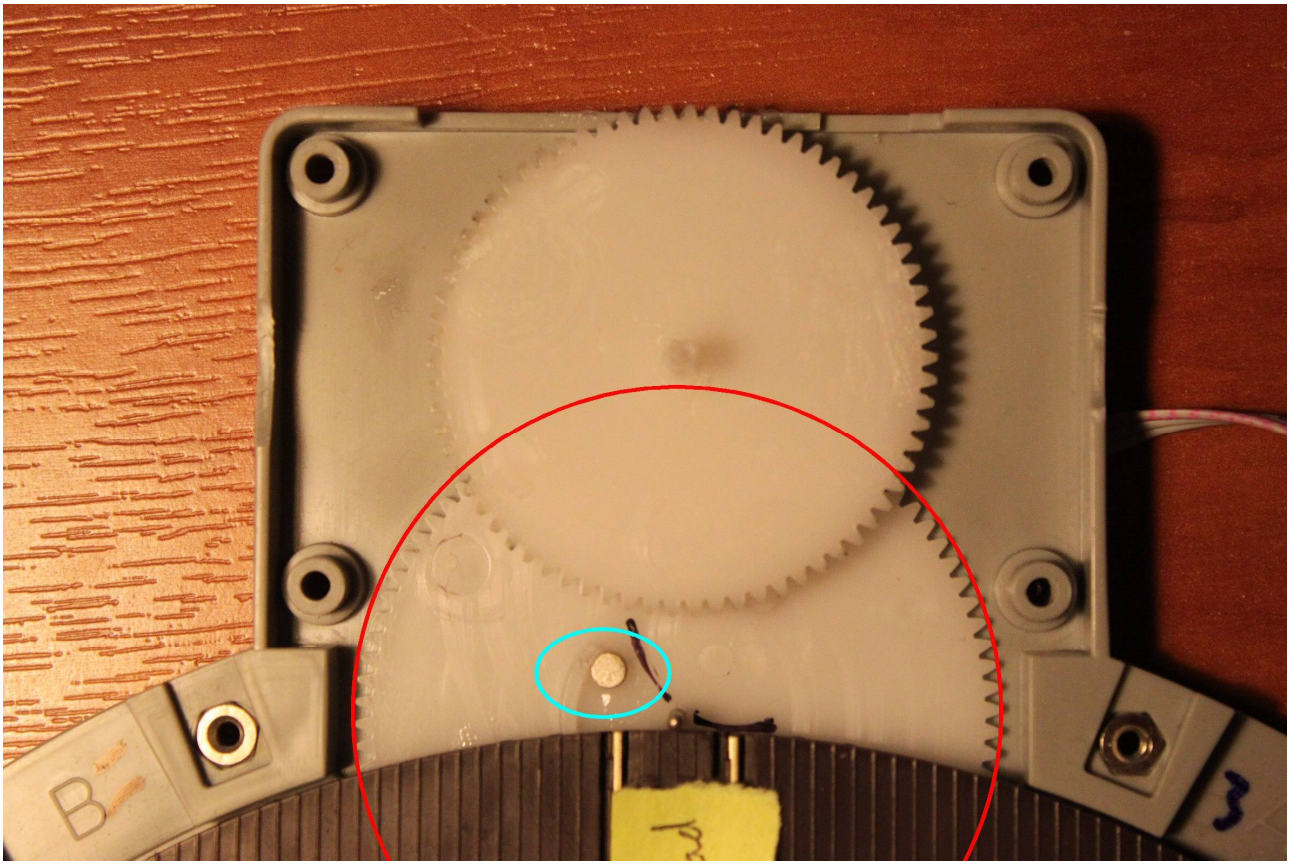
Appendix D Hexadecimal Conversion Chart

If your DCC system needs "hexadecimal" values for programming, use this chart to convert from decimal values to hex values. (This usually applies to old systems only)

dec	hex	dec	hex	dec	hex	dec	hex	dec	hex	dec	hex
0	00	44	2C	88	58	132	84	176	B0	220	DC
1	01	45	2D	89	59	133	85	177	B1	221	DD
2	02	46	2E	90	5A	134	86	178	B2	222	DE
3	03	47	2F	91	5B	135	87	179	B3	223	DF
4	04	48	30	92	5C	136	88	180	B4	224	E0
5	05	49	31	93	5D	137	89	181	B5	225	E1
6	06	50	32	94	5E	138	8A	182	B6	226	E2
7	07	51	33	95	5F	139	8B	183	B7	227	E3
8	08	52	34	96	60	140	8C	184	B8	228	E4
9	09	53	35	97	61	141	8D	185	B9	229	E5
10	0A	54	36	98	62	142	8E	186	BA	230	E6
11	0B	55	37	99	63	143	8F	187	BB	231	E7
12	0C	56	38	100	64	144	90	188	BC	232	E8
13	0D	57	39	101	65	145	91	189	BD	233	E9
14	0E	58	3A	102	66	146	92	190	BE	234	EA
15	0F	59	3B	103	67	147	93	191	BF	235	EB
16	10	60	3C	104	68	148	94	192	C0	236	EC
17	11	61	3D	105	69	149	95	193	C1	237	ED
18	12	62	3E	106	6A	150	96	194	C2	238	EE
19	13	63	3F	107	6B	151	97	195	C3	239	EF
20	14	64	40	108	6C	152	98	196	C4	240	F0
21	15	65	41	109	6D	153	99	197	C5	241	F1
22	16	66	42	110	6E	154	9A	198	C6	242	F2
23	17	67	43	111	6F	155	9B	199	C7	243	F3
24	18	68	44	112	70	156	9C	200	C8	244	F4
25	19	69	45	113	71	157	9D	201	C9	245	F5
26	1A	70	46	114	72	158	9E	202	CA	246	F6
27	1B	71	47	115	73	159	9F	203	CB	247	F7
28	1C	72	48	116	74	160	A0	204	CC	248	F8
29	1D	73	49	117	75	161	A1	205	CD	249	F9
30	1E	74	4A	118	76	162	A2	206	CE	250	FA
31	1F	75	4B	119	77	163	A3	207	CF	251	FB
32	20	76	4C	120	78	164	A4	208	D0	252	FC
33	21	77	4D	121	79	165	A5	209	D1	253	FD
34	22	78	4E	122	7A	166	A6	210	D2	254	FE
35	23	79	4F	123	7B	167	A7	211	D3	255	FF
36	24	80	50	124	7C	168	A8	212	D4		
37	25	81	51	125	7D	169	A9	213	D5		
38	26	82	52	126	7E	170	AA	214	D6		
39	27	83	53	127	7F	171	AB	215	D7		
40	28	84	54	128	80	172	AC	216	D8		
41	29	85	55	129	81	173	AD	217	D9		
42	2A	86	56	130	82	174	AE	218	DA		
43	2B	87	57	131	83	175	AF	219	DB		

Appendix E Setting up An Atlas N Scale Turntable

To use the Atlas N scale turntable, you will need to purchase the N scale turntable and its motorising kit. The instructions provided with the motorising kit describe how to open up the turntable and install the motor in place of the manual crank. A magnet and sensor needs to be added, to detect complete turns of the indexing disc: this can be done at the same time.



In the Atlas N gauge turntable, the relevant disc is highlighted in the large red circle above. Under the turntable bed is a raised arc, one end of which is by the blue ellipse. This "arc" moves the turntable for half of one turn of the disc, and latches it in position for the other half. As shown above, the disc is in the "latched" position. A magnet needs to be attached using epoxy in the position shown: level with the end of the arch, and just inside it. BE VERY CAREFUL in applying it: the epoxy must not get onto the arc itself.

Once the magnet has been attached, the magnetic sensor needs to be mounted. This needs to be mounted above the magnet when it is in approximately the position shown, and within approx 3mm (1/8") of the top or bottom of the magnet. On the N scale turntable, the sensor can be mounted inside the top of the motorising kit, or it can be mounted under the bottom of the turntable. We recommend using epoxy adhesive, as follows.

1. Use a ruler to measure the distance from the disc's axle to the centre of the magnet.
2. Mark a point on the base or the motorising unit that is at that radius from the axle hole, and approximately above or below the position shown in the photograph.
3. Use epoxy adhesive to mount the centre of the sensor's body at that position. It does not matter which way up the sensor is.
4. Carefully solder three wires to the sensor's terminals (or use a socket available from us).
5. Reassemble the turntable following the instructions supplied by Atlas.

Better pictures needed

Appendix F LocoNet Interrogation Sequence

The TXC1 participates in the LocoNet accessory and sensor interrogation sequence which is controlled by Digitrax command stations. This sequence is invoked after power is applied to the layout by the command station sending accessory commands to special addresses. The TXC1 responds by generating LocoNet output state & sensor feedback messages according to the turntable position.

This behaviour allows the LocoNet system to "discover" the position of the turntable after power is applied. Software packages such as "Traincontroller" will identify and display the correct position.

6. Other issues

Describe “self test” command
Describe how to test / set up magnetic sensor
Consider making the two “flash” modes for the Led flash different colours
For section 4 – check whether Hornby uses the terms “thrown” & “closed”.
Look at “LEARN” code and make sure it always has sensible behaviour immediately after factory reset. Malcolm had problems possibly by not releasing the button??