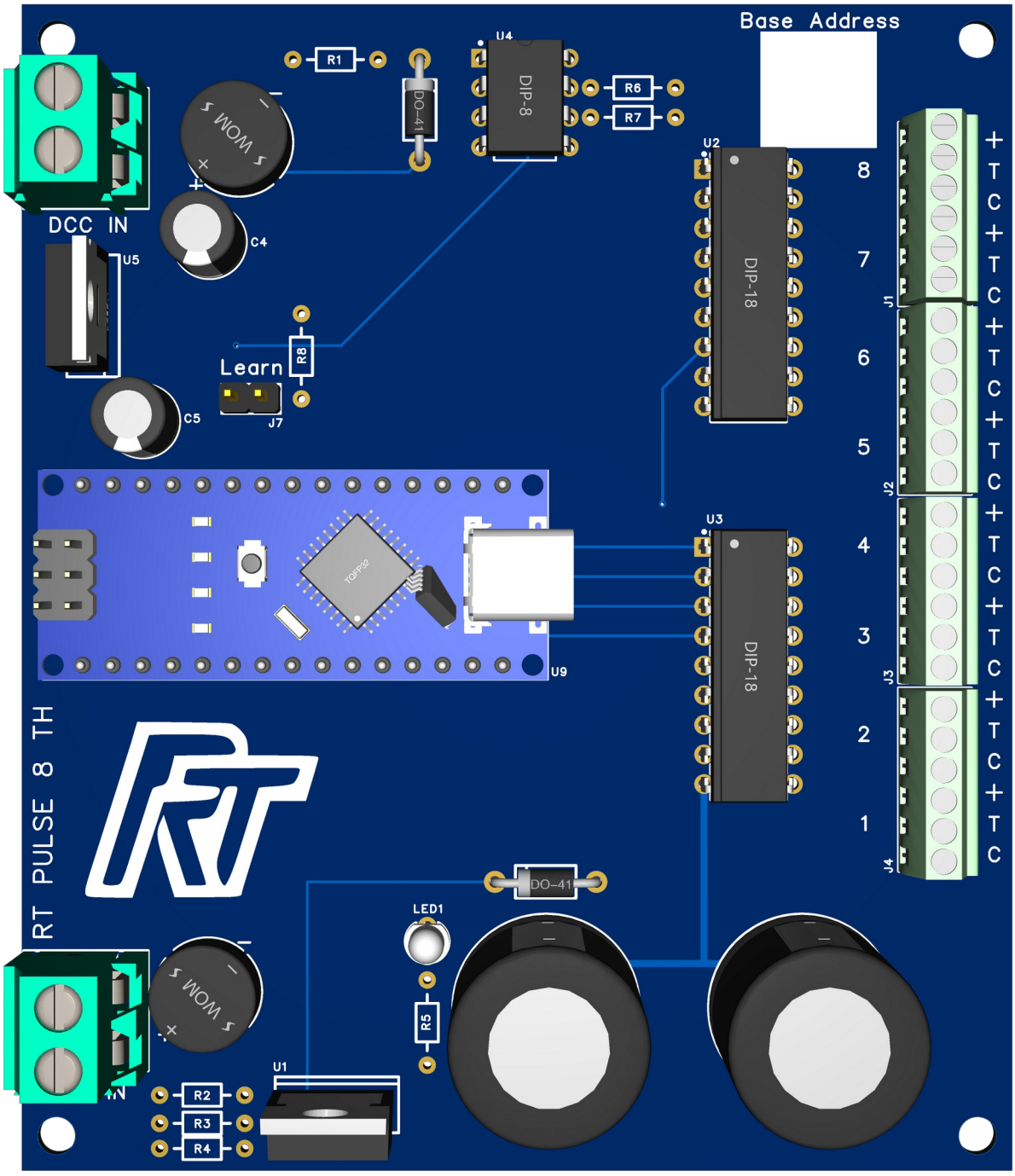
CONSTRUCTION MANUAL

Model Railroad DCC accessory decoder.



CONSTRUCTION MANUAL

This board is a DCC accessory decoder. What can be controlled with it is dependent on the firmware used.

This document describes the construction of the board.

The board can control dual solenoid turnouts such as the Marklin M track 5117, 5202, 5120, 5214, 5207 or 5128 with the firmware available here:

https://github.com/Rosscoetrain/DCC-Turnout-Decoder-Direct

The maximum current for any one solenoid is 500mA, this is limited by the ULN2803 darlington drivers.

The board can also be used for control of lights with different effects. The light control firmware is here:

https://github.com/Rosscoetrain/RT_Light-Decoder

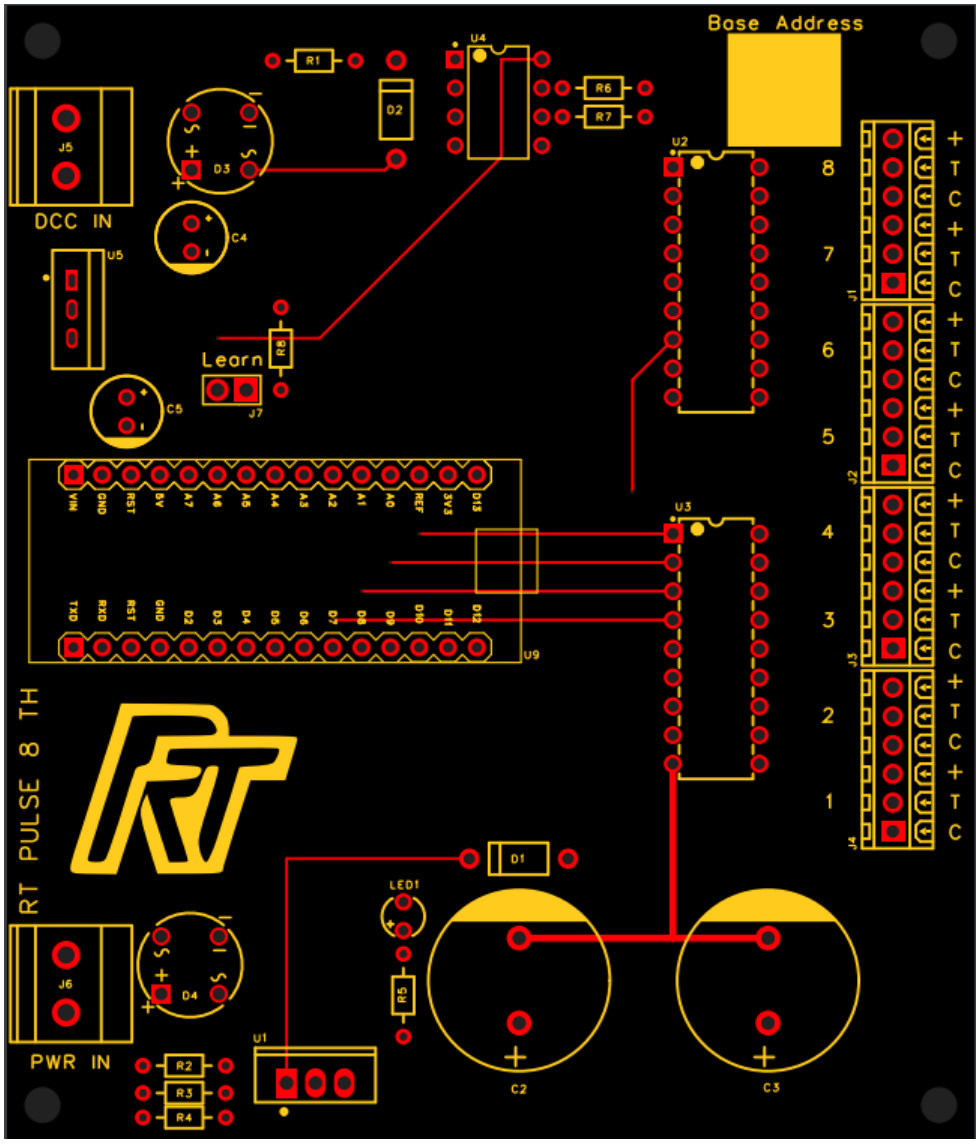
Please read all this document before construction of the PCB.

Bill of Materials

PCB	RT PULSE 8 TH
C2,C3	4700uF electrolytic capacitor
C4	100uF electrolytic capacitor *
C5	10uF electrolytic capacitor *
D1,D2	1N4001
D3,D4	2W10
J1,J2,J3,J4	6 way 2.54mm screw terminal
J5,J6	2 way 5.08mm screw terminal
J7	2 way 2.54mm male header
LED1	3mm blue
R1,R2,R3,R4,R5	1kΩ
R6,R7,R8	10kΩ
U1	TIP120
U2,U3	ULN2803
U4	6N137
U5	7805 *
U9	Arduino Nano
	15 pin female headers x 2 for Arduino Nano *

* see Other Information section

Construction of the board.



As with most PCB construction start with soldering in the lowest profile items first, eg resistors, diodes, leds, etc.

I suggest marking them of the list on the next page as you go.

As with all semiconductor items they are heat sensitive so for the ULN2803 optionally use an 18 pin IC socket. With the TIP120 a heat sink clip (bulldog clip) on the leads is a good idea.

The board is designed so that a larger capacitor can be used at C2 and laid flat on the PCB.

Recommended soldering order:

		Done
R1	1kΩ	
R2	1kΩ	
R3	1kΩ	
R4	1kΩ	
R5	1kΩ	
R6	10kΩ	
R7	10kΩ	
R8	10kΩ	
D1	1N4001 diode	
D2	1N4001 diode	
U1	ULN2803 (or IC socket see previous page) NOTE orientation	
U2	ULN2803 (or IC socket see previous page)	
LED2	3 mm led	
D3	2W10 bridge rectifier NOTE orientation	
D4	2W10 bridge rectifier NOTE orientation	
J1	6 way 2.54mm screw terminal	
J2	6 way 2.54mm screw terminal	
J3	6 way 2.54mm screw terminal	
J4	6 way 2.54mm screw terminal	
J7	2 way 2.54mm male header	
U9	2 x 15 pin female headers for Arduino Nano	
PWR IN	2 way 5.08mm (0.2”) screw terminal or pluggable terminal	
DCC IN	2 way 5.08mm (0.2”) screw terminal or pluggable terminal	
U1	TIP120. NOTE orientation. There is sufficient room to have this flat on the PCB if needed with a small heat sink.	
U5	7805. NOTE orientation. (see Other Information section).	
C4	100uF 35V electrolytic capacitor	
C5	10uF 25V electrolytic capacitor	
C2	4700uF 35V electrolytic capacitor	
C3	4700uF 35V electrolytic capacitor	

Other information.

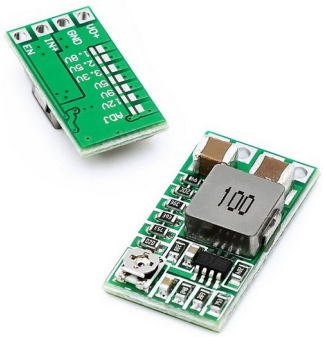
The Arduino Nano should be mounted into 15 pin female headers. If your Nano does not have male headers already installed then you will need to solder them on the underside of that as well.

Optional components.

C2 and C3 can be replaced with any electrolytic capacitor that will fit. There are holes for 7.5mm pitch on the PCB. eg a 10000uF 25V electrolytic capacitor will fit the 7.5mm pitch holes. It's up to you to determine if the electrolytic capacitor will fit. It can also be laid flat on the PCB.

U2 U3 it is recommended to use an ic socket for both of these. I recommend the turned pin IC sockets or strip headers.

U5 the 7805 regulator can be replace with a buck converter board like this and I recommend them as there is virtually no heat generated.



They are available on ebay and aliexpress just search for:

Power Supply DC Buck Step Down Voltage Converter Regulator Mini Module 3A 5V

Note that they are the version that has the holes at the end so that they can be simply solder in place instead of a 7805 voltage regulator.

If you use the converter then C4 and C5 are not required.

Addendum

References.

PCB on pcbway.com:

https://www.pcbway.com/project/shareproject/RT_DCC_Pulse_8_Turnout_Decoder_with_capacitor_discharge_unit_26697a2a.html

5V 3A buck converter on ebay:

https://www.ebay.com.au/itm/325224780087

Dual solenoid accessory decoder firmware:

https://github.com/Rosscoetrain/RT-Hardware/tree/master/RT_Pulse_8_decoder

Lighting accessory decoder firmware:

https://github.com/Rosscoetrain/RT_Light-Decoder