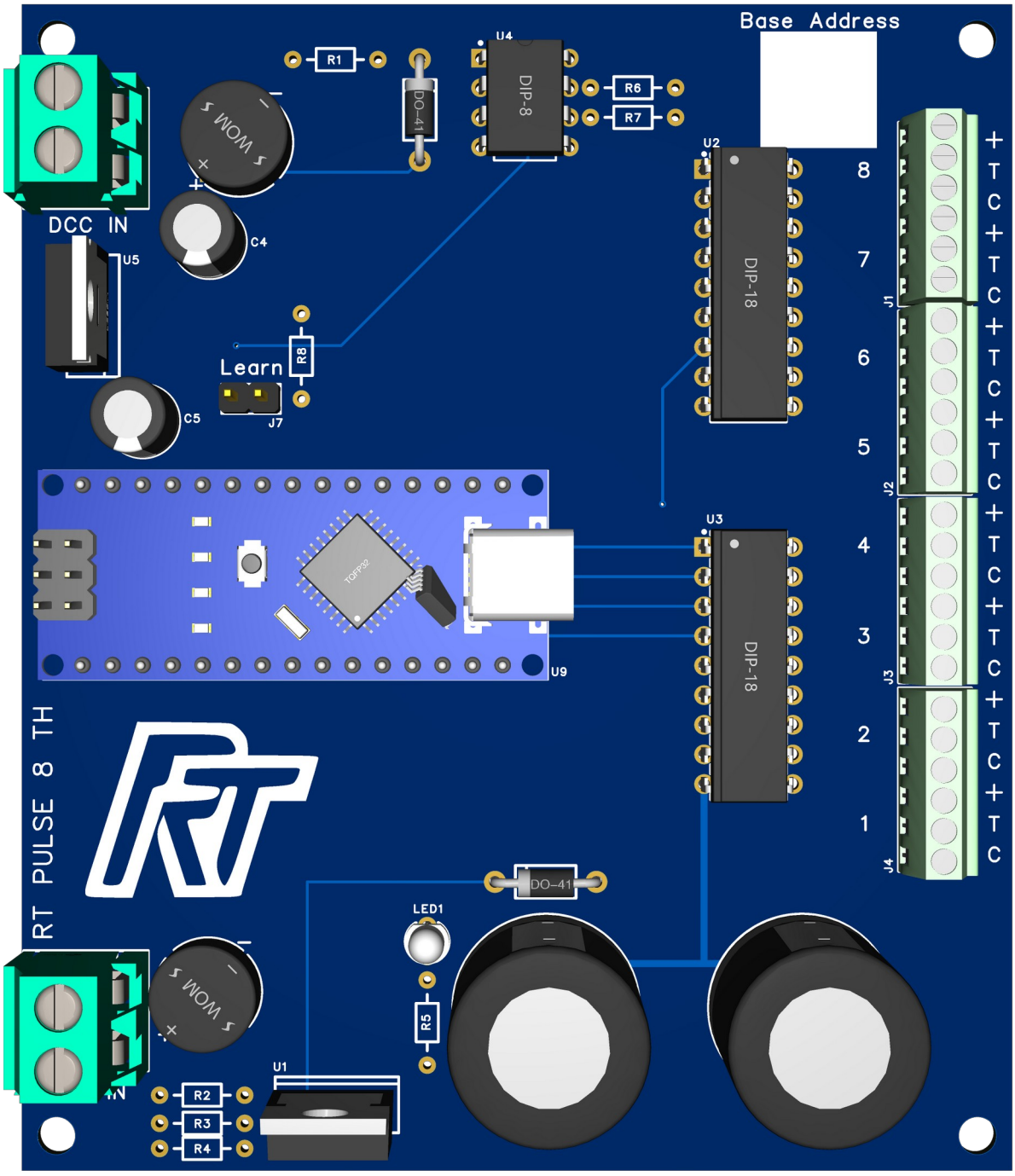
OPERATING MANUAL

DCC lighting accessory decoder.



This document describes the operation of the lighting decoder firmware.

In use.

Using this firmware on github:

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

The firmware currently needs to be uploaded twice to the Arduino Nano to ensure the eeprom on the board is setup correctly.

Please read the instructions in the ino file.

Open the firmware in the Arduino IDE.

Un-comment the line in the ino as described there. (Line 11 - 13)

Upload the firmware to the Arduino Nano.

On the serial monitor you should see: 11:48:31.374 -> Resetting CVs to Factory Defaults

Comment out the line in the ino file as described there. (Line 11 - 13)

Upload the firmware again to the Arduino Nano.

Using the serial monitor enter the following command.

<>

You will then see a response like this:

17:40:32.025 -> CVs are:
17:40:32.025 -> CV1 = 1
17:40:32.025 -> CV9 = 0
17:40:32.025 -> CV33 = 0
…

All is now ready.

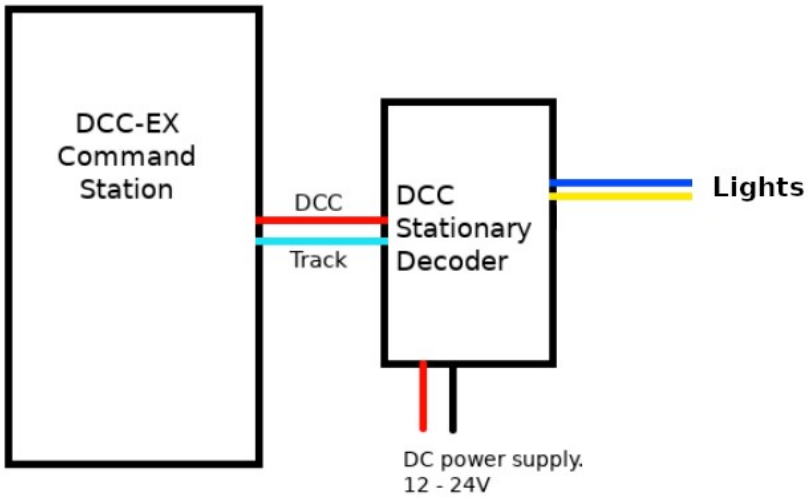
Connection to the layout.

How you connect to your layout is really dependent on your setup.

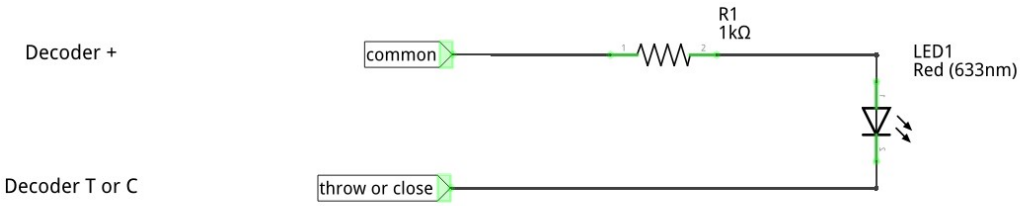
This is a how to connect to a DCC-EX command station with separate power supply for the lighting decoder.

The DCC track is connected to the DCC Input connector on the decoder.

The power supply can be 5 - 24V DC or 5 - 20V AC and is connected to the PWR IN connector on the decoder.



An example of connecting leds to the decoder board is:



Each channel can provide up to 500mA of power. Resistor R1 will depend on the number of leds and the input voltage. R1 value can be calculated here:

https://www.allaboutcircuits.com/tools/led-resistor-calculator/

Controlling the lighting is then a matter of sending a DCC close or throw command to the applicable address.

The address will depend on how you program the CVs for the firmware.

Close command turns the light circuit on, throw command turns the light circuit off.

The default settings are:

DCC Address	Board Connection	Light Mode
1	1 T	On/Off
2	1 C	Oneshot
3	2 T	Flash
4	2 C	Fade Flash
5	3 T	Alternate Flash pin 1
	3 C	Alternate Flash pin 2
6	4 T	Double Strobe
7	4 C	On/Off
8	5 C	On/Off
9	5 T	On/Off
10	6 C	On/Off
11	6 T	On/Off
12	7 C	On/Off
13	7 T	On/Off
14	8 C	On/Off
15	8 T	On/Off
16	8 T	On/Off

Each light circuit has 9 CVs for configuration.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	18
mode	33	43	53	63	73	83	93	103	113	123	133	143	153	163	173	183
ontime	34	44	54	64	74	84	94	104	114	124	134	144	154	164	174	184
ontimeX	35	45	55	65	75	85	95	105	115	125	135	145	155	165	175	185
offtime	36	46	56	66	76	86	96	106	116	126	136	146	156	166	176	186
offtimeX	37	47	57	67	77	87	97	107	117	127	137	147	157	167	177	187
outputPin	38	48	58	68	78	88	98	108	118	128	138	148	158	168	178	188
outputPin2	39	49	59	69	79	89	99	109	119	129	139	149	159	169	179	189
fadein	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190
fadeout	41	51	61	71	81	91	101	111	121	131	141	151	161	171	181	191

mode

0 continuous (stays on until off command received)
1 oneshot (on for ontime once) ms * ontimeX
2 flashing (alternate ontime offtime until off command received)
3 flash/fade (alternate ontime offtime until off command received fade in/out
4 flash alternate (requires two output pins)
5 strobe double

ontime offtime

time in ms / on__X for on or off functions

ontimeX offtimeX

multiplier for on or off times

outputPin

the output pin to use (see below)

outputPin2

the second output pin to use (see below)

fadein

the time to fade the output from off to on

fadeout

the time to fade the output from on to off

outputPin	outputPin2 CV value	Board connection
1		1C
2		1T
3		2C
4		2T
5		3C
6		3T
7		4C
8		4T
9		5C
10		5T
11		6C
12		6T
13		7C
14		7T
15		8C
16		8T

Serial Commands

Several commands are available via the Arduino serial monitor for configuring or displaying information on the decoder.

<?>	Show available commands
<>	Show current Control Variables
<A address>	Change decoder base linear address
<C address>	Close a turnout at address
<T address>	Throw a turnout at address
<Z>	Soft Reset

The address is the decoder linear address to use within the DCC command station. When you set an address it will display the correct base address to use for the decoder at the serial monitor. Eg 4 will give a base address of 1 and the light circuits will be assigned addresses 1 - 16.

The default address is 1, you need to change this if using more than one stationary decoder on your layout. Once the address is set, this address and the next 16 are the addresses you use to control your turnouts. Eg, 1-16, 5-20.

Some examples using the serial monitor are:

<C 1>	Close turnout at address 1
<T 2>	Throw turnout at address 2

How you add them to your DCC Command Station will depend on the command station.

Base addresses are multiples of 4 + 1 eg, 1, 5, 9, 13, 17, …

The address can be between 1 and 2037

In all cases the 16 light circuits will be addressed from the base address for the next 16 address eg, base address 1, addresses are 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16. base address 5 addresses are 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20 etc.

Learning Mode.

To set the address on the decoder in learning mode.

Connect the decoder to your DCC track via the DCC input connector. It’s best not to have any solenoid devices connected at this point.

Put a jumper on the Learn header next to the Arduino nano.

The LED on the nano will flash three times to show it is in learning mode.

Send a throw or close command to the base address you want for the decoder.

Base addresses are multiples of 4 + 1. eg, 1, 5, 9, 13, 17, …

The address can be between 1 and 2037.

Once the address is learnt remove the jumper from the Learn header.

Programming Track Setup.

The CV’s can be set with the decoder connected to a programming track.

Connect the decoder DCC IN to the programming track of your command station.

How you send a write command to the decoder CV will depend on your command station.

Eg Using a DCC-EX command station connected to an Arduino IDE serial monitor send the following command to change the address:

<W 1 address>

Use the table on the following pages to determine the correct value to use for address. The value in the column CV1 is the value to use in the above command. The value in the column base address will then be the base address for the decoder.

It is also possible to program the pulse length, CDU recharge time and active state.

Pulse length

<W 2 xxx> Where xxx is the time in milliseconds / 10 range 1 – 255 (default 25 = 250mS)

CDU recharge time

<W 3 xxx> Where xxx is the time in milliseconds / 10 range 1 – 255 (default 30 = 300mS)

Active state

<W 4 x> Where x is 1 for High output state and 0 is Low output state (default 1)

Address Table (CV9 = 0)

CV1	Base Address	CV1	Base Address	CV1	Base Address	CV1	Base Address
1	1	31	121	61	241	91	361
2	5	32	125	62	245	92	365
3	9	33	129	63	249	93	369
4	13	34	133	64	253	94	373
5	17	35	137	65	257	95	377
6	21	36	141	66	261	96	381
7	25	37	145	67	265	97	385
8	29	38	149	68	269	98	389
9	33	39	153	69	273	99	393
10	37	40	157	70	277	100	397
11	41	41	161	71	281	101	401
12	45	42	165	72	285	102	405
13	49	43	169	73	289	103	409
14	53	44	173	74	293	104	413
15	57	45	177	75	297	105	417
16	61	46	181	76	301	106	421
17	65	47	185	77	305	107	425
18	69	48	189	78	309	108	429
19	73	49	193	79	313	109	433
20	77	50	197	80	317	110	437
21	81	51	201	81	321	111	441
22	85	52	205	82	325	112	445
23	89	53	209	83	329	113	449
24	93	54	213	84	333	114	453
25	97	55	217	85	337	115	457
26	101	56	221	86	341	116	461
27	105	57	225	87	345	117	465
28	109	58	229	88	349	118	469
29	113	59	233	89	353	119	473
30	117	60	237	90	357	120	477

CV1	Base Address	CV1	Base Address	CV1	Base Address	CV1	Base Address
121	481	151	601	181	721	211	841
122	485	152	605	182	725	212	845
123	489	153	609	183	729	213	849
124	493	154	613	184	733	214	853
125	497	155	617	185	737	215	857
126	501	156	621	186	741	216	861
127	505	157	625	187	745	217	865
128	509	158	629	188	749	218	869
129	513	159	633	189	753	219	873
130	517	160	637	190	757	220	877
131	521	161	641	191	761	221	881
132	525	162	645	192	765	222	885
133	529	163	649	193	769	223	889
134	533	164	653	194	773	224	893
135	537	165	657	195	777	225	897
136	541	166	661	196	781	226	901
137	545	167	665	197	785	227	905
138	549	168	669	198	789	228	909
139	553	169	673	199	793	229	913
140	557	170	677	200	797	230	917
141	561	171	681	201	801	231	921
142	565	172	685	202	805	232	925
143	569	173	689	203	809	233	929
144	573	174	693	204	813	234	933
145	577	175	697	205	817	235	937
146	581	176	701	206	821	236	941
147	585	177	705	207	825	237	945
148	589	178	709	208	829	238	949
149	593	179	713	209	833	239	953
150	597	180	717	210	837	240	957

CV1	Base Address	CV1	Base Address	CV1	Base Address	CV1	Base Address
241	961	246	981	251	1001		
242	965	247	985	252	1005		
243	969	248	989	253	1009		
244	973	249	993	254	1013		
245	977	250	997	255	1017		

For addresses above 1017 set CV9 = 1 and CV1 = 0 to 255 and add 1024 to the base address above.

Eg. for base address 1021 - CV9 = 1 and CV1 = 0, for base address 1024 CV9 = 1 and CV1 = 1

For CV9 = 0, the base address can be calculated by the following:

base address = (CV1 - 1) * 4 + 1

The CV1 value can be calculated by the following:

CV1 = (base address - 1) / 4 + 1

Addendum

References.

PCB on pcbway.com:

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

Lighting accessory decoder firmware:

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