HORNBY®

DIGITAL

R8247

Point and Accessory Decoder

Version 2.0

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Contents

Introduction

The R8247 Point and Accessory Decoder (PAD) version 2 is an enhanced release over the original R8247 (released in 2006.) This new version supports programmable pulse duration and number of pulses per port. Also, support for Channel grouping has been added allowing multiple point control etc from a single address. Finally, there are now 3 address modes, further expanding the flexibility of the unit.

Connection

The R8247 is configured with 4 addressable Channels. Each Channel has two ports. There are 3 physical connections per Channel.

The 3 connections per Channel are labelled **+**, **–** and **C**. These are only used to differentiate the connections they do not represent polarities. Note that the actual pulsed or continuous voltage appearing at either of the **+** or **–** outputs is actually negative (12V) going relative the **C** (common) connection. These three connections make up the two Ports of the Channel.

All **C** connections are connected together internally.

There is a track signal input/power connection at one end of the unit. It is recommended that this is connected to the main power bus of the layout or accessory bus if separate. The connection is not Polarity sensitive.

Programming Method

Programming is carried out via the "track input signal" connection (see above)

DIRECT mode programming is recommended. i.e.. "Service Mode" via the programming output of your controller. If required Paged mode and Register Mode are supported. Note: Register mode is not recommended due to limitation of CV support.

Programming via "OPERATE Mode" (On the Main) is also supported. This may be convenient in some instances. However, connecting directly to the Programming output of your Controller for programming (SERVICE MODE) is the recommended programming method. The unit has quite a complex set of features, so using the Programming connection on your controller may be advantageous as it should support READBACK of the CV values.

Please refer to the full CV list for more details.

Address Modes

There are now 3 address modes supported.

Standard Mode
Special Mode 1
Special Mode 2

Each mode can be used in many different ways to control elements on your layout. e.g. point motors, motorised points, LED lights, small motors, relays (both latching and non-latching) etc.

Each mode is fully described in the following sections.

The address mode is selectable via **CV33** please refer to the full CV table for more details.

Standard Mode (CV33=0) Standard solenoid point motor and Lamp/LED Operation

4 Channels with independent address numbers.

This is the basic mode of operation of R8247 PAD as originally released. Extra features have now been added to this mode. You may now group channels together and add pulse duration and number of pulses generated.

Please note... pulse length is set on a per channel basis, i.e. both ports in a channel will operate with the same pulse duration. See "Port Output Configuration"

Channel Grouping:

There is now a new feature which allows you to set up multiple Channel switching from one address. This feature is only supported under "Standard Mode."

For Example Channels 2,3, and 4 could be linked to activate when Channel 1 is called. Or, perhaps Channel 4 when Channel 2 is called. It is possible to set up any combination required via CVs.

Channel Grouping is configured with CV34, CV35, CV36 and CV37.

Please refer to the full CV list for more details.

Practical Notes re Channel Grouping:

Depending on the type of point motor used there may be limits to how many point motors can be driven in one instance from a single PAD. This is due to their loading and/or installation, state of the point mechanisms and other layout factors. If this is the case it would be advisable to install an extra PAD programmed to the same address and connect the point motors required to complete the desired "route" setup. (Another possible approach would be to use multiple non-latching relays connected to an external CDU (capacitor discharge unit) to serve the multiple points desired.)

When activating several points, under a single command it is essential that the on-board CDU (capacitor discharge unit) is given time to fully recharge after the previous activation. Please wait at least 7 seconds between each activation.

Standard mode grouping is a convenient way of setting up point and signal light control to work in tandem. One channel will be set for "normal" point motor connection and control via a single "pulse," the other channel will be set for continuous operation to operate light signals.

Other types of signal e.g. semaphore types may utilise a solenoid for activation, in these cases they will require a pulsed output from the connected Channel.

Special Mode One (CV33=1) 8 Independently addressed ports

8 Ports with independent address numbers.

In 8 port mode; each port can be set individually to provide a preset number of pulses. The ports can also be set to be permanently "on," or to continuous pulsing.

Please note... pulse length is set on a per channel basis, i.e. both ports in a channel will operate with the same pulse duration. See "Port Output Configuration"

Programming Addresses in Special Mode 1

As previously discussed the PAD is normally configured with 4 addresses which are allocated to each channel in sequence.
The address range used is set by the PADs "Group Number" held in most cases in CV1. See Table Appendix 2:

See Programming Addresses: for a description of the programming process.

To support 8 addresses two "Group" numbers will be allocated to the PAD. i.e. the first group of 4 ports will be allocated the addresses dictated by the "Group" number stored in CV1. The second 4 ports will be allocated the address range in the following "Group" number.

e.g…

CV1=1 (Group address) the full port address range will be 1-8… (i.e. as per "Groups" 1 and 2.)

CV1=2 (Group address) the full port address range will be 5-12… (i.e. as per "Groups" 2 and 3.)

CV1=3 (Group address) the full port address range will be 9-16… (i.e. as per "Groups" 3 and 4.)

On read-back only the lowest Group number will be reported. i.e.

If the full port address range is 1-8 then, on read back the controller display will report Group 1.

If the full port address range is 5-12 then, on read back the controller display will report Group 2.

If the full port address range is 9-16 then, on read back the controller display will report Group 3.

Unless you really need to do so.. do not overlap address ranges.
e.g… If PAD 1 is set to Group 1 and another PAD set to Group 2 then you will find that Addresses 5-6 will overlap on each of the two PADs.. i.e. The first PAD is set to address range 1-8 while the other is set to address range 5-12.

Special Mode Two (CV33=2) 4 Independent groups of 2 ports

4 Channels with independent address numbers.

This mode allows the configuration of the unit to offer 4 independent addresses controlling 2 ports in tandem.
This mode is similar to the Standard mode but in this case both Ports within the Channel are activated simultaneously.

In this mode; each Port in a Channel can be set individually to provide a preset number of pulses. The ports can also be set to be permanently "on," or to continuous pulsing.

Please note... pulse length is set on a per channel basis, i.e. both ports in a channel will operate with the same pulse duration. See "Port Output Configuration"

Programming Group Numbers and Addresses

The PAD can support an address range from 1 to 2040. These are arranged in consecutive groups of 4 addresses which are referred to as "Groups."

The PAD is configured as having 4 channels made up of 2 ports, thus addresses may be associated with each of the 4 Channels (giving control of the two ports in that Channel under a single address i.e. 4 consecutive addresses), or each of the 8 ports may be addressed individually (i.e. 8 consecutive addresses) thus giving individual control of each port. The address Group is stored in CV1 (CV513) and CV9. However, CV9 only comes in to play when the address range required exceeds 252. At default CV9=0.

As discussed above the PAD uses a "Group Number" to identify the actual address range allocated across the 4 Channels (or possibly 8 ports in Special Mode 1)

The following procedure explains how to programme the PAD with an address range within the range 1-252 i.e. Group numbers 1-63. For address numbers above 252 (Group Numbers above 63) please refer to Appendix 3.

Programming the Group Number:

First decide which mode you are going to using the PAD in, and programme CV33 as required. If using the PAD in "Special Mode One", i.e. 8 individual ports operation. Please refer to the section "Special Mode One" for more information.

It is recommended that you read the following information to gain an understanding of "Addresses and Groups" and the programming method.

Some controllers do not have a programming mode specifically for programming PADs. Other controllers, like the ELITE or SELECT, have a specific programming mode for dealing with PADs. The PAD can be programmed with either type of controller. The only difference is the way address and Group Numbers are dealt with.

The Hornby ELITE and SELECT have a special modes for programming accessories (ACC mode in the programming menu.) When using these controllers the user selects any address number and the controller calculates the associated "Group" number to be programmed into the PAD using the table (see appendix 2.)

For example, if the user selects 6 for an address the unit will be programmed with "Group" number 2. "Group Number" 2 allocates the 4 channels as 5 though to 8. The second channel on the PAD in this case will be address 6.

If your controller has no specific mode for dealing with programming PADs, then the "Group Number" desired can be programmed directly into CV1 manually. Please refer to Appendix 2 for the full list of address ranges and associated "Group Numbers. SELECT and ELITE users can also use this method of programming Group Numbers if they wish.

In the description we are ONLY referring to programming addresses in the range 1-252, i.e. programming the relevant "Group Number" in to CV1. This will cover most users, however, there may be specific reasons why a higher address number may be desired. Please refer to Appendix 3 for more information re programming "Group Numbers" above 63.

Note regarding using the PAD as an 8 port controller.. i.e. 8 individual address allocation under Special Mode 1. If using this mode the way Group Numbers are handled is different...
See earlier description of Special Mode 1 (Page 5)

Ports Output Configuration

Setting Number of Pulses and Pulse Length. Setting continuous pulsing and constant on.
The following options can be used in all 3 "Address Modes."

Number of Pulses per port:

All Ports can be individually set to provide a specific number of pulses in the range 1-255. It is also possible to set an individual Port to continuous operation. **Use CV38-CV45.**

Pulse length:

Please note... pulse length is set on a per channel basis, i.e. both ports in a channel will operate with the same pulse duration. However, if a port is set to "continuous" operation by CV3-CV6 then that specific port will operate continuously, even if the number of pulses has been set by CV38-CV45… i.e. continuously "on" and not "pulsed".

Pulse length may be set between 100mS to 25.5 Seconds. (i.e. values 1-255) **Use CV3-CV6.**

Note: Any pulse durations set have will have a 50% mark/space ratio (dwell time); e.g. if the number of pulses set by CV38-CV45 is greater than 1; then for a 500mS pulse duration there will be a 500mS gap between pulses.

Quick Rules..

To set a port to continuous pulsing, set pulse length to any value except continuous (CV3-CV6) and then set the number of pulses to 0. (CV38-CV48).

To set a port to continuous "on" set CV3-CV6 to 0. Pulse setting CV38-CV45 will have no effect.

To set a Port to a specific number of pulses and duration.. set CV3-CV6 to pulse length, set CV38-CV45 to number of pulses required.

Please refer to the full CV list for more details.

Appendix 1 : Description of CVs

CV#	Default	Range	Comment	Function	Note
CV1	1	0-63	Allows address range 1 to 252.	Group Address Lower Range	CV513
CV3	1	0-255	0 = Continuous, 1 to 255 = 100mS to 25.5 Seconds	Pulse Duration Channel 1	CV515
CV4	1	0-255	0 = Continuous, 1 to 255 = 100mS to 25.5 Seconds	Pulse Duration Channel 2	CV516
CV5	1	0-255	0 = Continuous, 1 to 255 = 100mS to 25.5 Seconds	Pulse Duration Channel 3	CV517
CV6	1	0-255	0 = Continuous, 1 to 255 = 100mS to 25.5 Seconds	Pulse Duration Channel 4	CV518
CV7			Initial release V135 - Subject to change	Firmware Version	CV519
CV8		Read Only	Reset (Write 8 to reset)	Manufacturer ID	CV520
CV9	0	0-7	Used with controllers capable of addressing 511 Groups, thus giving 2044 points.	Setting Group Numbers <63 - See Appendix 3	CV521
CV33	0	0-2	Standard Mode, for point solenoids etc	Enhanced Mode Select	
	1	0-2	Special mode for 8 addresses to 8 output ports		
	2	0-2	Special mode for 4 addresses to 4 x 2 port tandem operation		

CV#	Default	Range	Comment	Function
CV38	1	0-255	0 = Continuous	Specifies number of pulses: Port 1 - Channel 1 (Address 1)
CV39	1	0-255	0 = Continuous	Specifies number of pulses: Port 2 - Channel 1 (Address 2)
CV40	1	0-255	0 = Continuous	Specifies number of pulses: Port 1 - Channel 2 (Address 3)
CV41	1	0-255	0 = Continuous	Specifies number of pulses: Port 2 - Channel 2 (Address 4)
CV42	1	0-255	0 = Continuous	Specifies number of pulses: Port 1 - Channel 3 (Address 5)
CV43	1	0-255	0 = Continuous	Specifies number of pulses: Port 2 - Channel 3 (Address 6)
CV44	1	0-255	0 = Continuous	Specifies number of pulses: Port 1 - Channel 4 (Address 7)
CV45	1	0-255	0 = Continuous	Specifies number of pulses: Port 2 - Channel 4 (Address 8)

Appendix 1 Continued: Description of CVs

Channel Grouping: This feature applies only to Standard Mode operation

CV34 — Channel 1 Grouping

Bit Table: Channel Grouping

B0	B1	B2	B3	Channels fired with address Channel 1
-	X			Channel 2
		X		Channel 3
			X	Channel 4
-	2	4	8	Decimal (Add Values for Decimal number)

Examples:
CV34 = 4 .. Channel 3 will activate when Channel 1 is activated.
CV34 = 6 .. Channels 2 and 3 will activate when Channel 1 is activated.

CV35 — Channel 2 Grouping

Bit Table: Channel Grouping

B0	B1	B2	B3	Channels fired with address Channel 1
X	-			Channel 1
		X		Channel 3
			X	Channel 4
1	-	4	8	Decimal (Add Values for Decimal number)

Examples:
CV35 = 1 .. Channel 1 will activate when Channel 2 is activated.
CV35 = 12 .. Channels 3 and 4 will activate when Channel 2 is activated.

CV36 — Channel 3 Grouping

Bit Table: Channel Grouping

B0	B1	B2	B3	Channels fired with address Channel 1
X				Channel 1
	X	-		Channel 2
			X	Channel 4
1	2	-	8	Decimal (Add Values for Decimal number)

Examples:
CV36 = 8 .. Channel 4 will activate when Channel 3 is activated.
CV36 = 11 .. Channels 1, 2 and 4 will activate when Channel 3 is activated (All Channels)

CV37 — Channel 4 Grouping

Bit Table: Channel Grouping

B0	B1	B2	B3	Channels fired with address Channel 1
X				Channel 1
	X			Channel 2
		X	-	Channel 3
1	2	4	-	Decimal (Add Values for Decimal number)

Examples:
CV37 = 2 .. Channel 2 will activate when Channel 4 is activated
CV37 = 6 .. Channels 2 and 3 will activate when Channel 4 is activated

To conform with NMRA practices it is possible to use the following CVs to access lower value CVs described in the basic CV tables.

CV513 for CV1
CV515 for CV3
CV516 for CV4
CV517 for CV5
CV518 for CV6
CV519 for CV7
CV520 for CV8
CV521 for CV9

Appendix 2: Group Numbers (1-63), Address Ranges (1-252)

This table shows the Group Number range that can be set by CV1 only. i.e. Group Number 1-63 giving an address range of 1-252. For Group Numbers higher than 63, CV9 is used to programme higher Group Numbers. C9 works in conjunction with CV1.

See Appendix 3 (Page 11) for more information re programming high range Group Numbers.

The following rules apply to the full range of Group Numbers/ Addresses supported by the R8247; i.e. Low range Group Numbers (1-63) and High range Group Numbers (64-511.)

Rule 1

First Address in group
= (Group Number x 4) - 3

Rule 2

The Group Number containing any address may easily be calculated.

Group Number = Address / 4

Then apply the following rules:

- If the result of the calculation is a whole number then this is the Group Number.

- If the result of the calculation is a number with a decimal remainder, then the result is rounded up to the nearest whole number.

Examples

Address 306/4 = 76.5, rounded up reveals a group number of 77.

Address 508/4 = 127, no rounding required.

Address 22/4 = 5.75, rounded up reveals a group number of 6.

Address 3/4 = 0.75, rounded up reveals a group number of 1.

Group Number	Start Address	Last Address
1	1	4
2	5	8
3	9	12
4	13	16
5	17	20
6	21	24
7	25	28
8	29	32
9	33	36
10	37	40
11	41	44
12	45	48
13	49	52
14	53	56
15	57	60
16	61	64
17	65	68
18	69	72
19	73	76
20	77	80
21	81	84
22	85	88
23	89	92
24	93	96
25	97	100
26	101	104
27	105	108
28	109	112
29	113	116
30	117	120
31	121	124
32	125	128
33	129	132
34	133	136
35	137	140
36	141	144
37	145	148
38	149	152
39	153	156
40	157	160
41	161	164
42	165	168
43	169	172
44	173	176

Group Number	Start Address	Last Address
45	177	180
46	181	184
47	185	188
48	189	192
49	193	196
50	197	200
51	201	204
52	205	208
53	209	212
54	213	216
55	217	220
56	221	224
57	225	228
58	229	232
59	233	236
60	237	240
61	241	244
62	245	248
63	249	252

Appendix 3 : Group Numbers (64-511), Address Ranges (253-2044)

Advanced address range programming - high number addresses.

If you have more than 252 accessories on your layout, or you just want to use a high number range for addresses in your accessory control system, then there is an option for using high number addresses.

Basically, CV9 comes into play. CV9 can be used as a multiplier to allow access to up to 511 groups thus giving 2044 possible addresses.. However, a suitable DCC controller will be required to access point addresses in this number range.

CV9 allows the basic group number stored in CV1 to be modified. i.e. depending on the value stored in CV9, 64 or multiples of 64 are added to the group number stored in CV1.

The formula below shows how this works.

Group Number = CV1 + (CV9 x 64)

CV1 can contain a value between 1 - 63 ... the default is 1.
CV9 can contain a value between 0 - 7 .... the default is 0.

Note: Only when CV9 has a value greater the 0 (e.g. 1) can CV1 be set to = 0.

CV9 must be programmed first before CV1 when dealing with higher Group Numbers.
i.e. it is not possible to set CV1 to 0 while CV9 is at default 0.

Advanced Group Address Programming Examples..

CV1 = 0
CV9 = 1 Note: entering 1 will effectively add 64 to the value entered in CV1.
This is equivalent to.. 0 + 64 = 64
So the PAD Group number is 64.. Which gives the address range 253-256.

CV1 = 15
CV9 = 1 Note: entering 1 will effectively add 64 to the value entered in CV1.
This is equivalent to.. 15 + 64 = 79
So the PAD Group number is 79. Which gives the address range 313-316.

CV1 = 45
CV9 = 4 Note: entering 4 will effectively add 4 x 64 to the value entered in CV1.
This is equivalent to.. 45 + 256 = 301
So the PAD Group number is 301. Which gives the address range 1201-1204.

CV1 = 63
CV9 = 7 Note: entering 7 will effectively add 448 to the value entered in CV1.
This is equivalent to.. 448 + 63 = 511
So the PAD Group number is 511. Which gives the address range 2041-2044... the maximum Group Value and highest address.

See Appendix 4 .. list of Group Numbers greater than 63.

Appendix 4 : Advanced Group Number Table

Group Number	Start Address	Last Address
64	253	256
65	257	260
66	261	264
67	265	268
68	269	272
69	273	276
70	277	280
71	281	284
72	285	288
73	289	292
74	293	296
75	297	300
76	301	304
77	305	308
78	309	312
79	313	316
80	317	320
81	321	324
82	325	328
83	329	332
84	333	336
85	337	340
86	341	344
87	345	348
88	349	352
89	353	356
90	357	360
91	361	364
92	365	368
93	369	372
94	373	376
95	377	380
96	381	384
97	385	388
98	389	392
99	393	396
100	397	400
101	401	404
102	405	408
103	409	412
104	413	416
105	417	420
106	421	424
107	425	428
108	429	432
109	433	436
110	437	440
111	441	444
112	445	448
113	449	452
114	453	456
115	457	460
116	461	464
117	465	468
118	469	472
119	473	476
120	477	480
121	481	484
122	485	488
123	489	492
124	493	496
125	497	500
126	501	504
127	505	508
128	509	512
129	513	516
130	517	520
131	521	524
132	525	528
133	529	532
134	533	536
135	537	540
136	541	544
137	545	548
138	549	552
139	553	556
140	557	560
141	561	564
142	565	568
143	569	572
144	573	576
145	577	580
146	581	584
147	585	588
148	589	592
149	593	596
150	597	600
151	601	604
152	605	608
153	609	612
154	613	616
155	617	620
156	621	624
157	625	628
158	629	632
159	633	636
160	637	640
161	641	644
162	645	648
163	649	652
164	653	656
165	657	660
166	661	664
167	665	668
168	669	672
169	673	676
170	677	680
171	681	684
172	685	688
173	689	692
174	693	696
175	697	700
176	701	704
177	705	708
178	709	712
179	713	716
180	717	720
181	721	724
182	725	728
183	729	732
184	733	736
185	737	740
186	741	744
187	745	748
188	749	752
189	753	756
190	757	760
191	761	764
192	765	768
193	769	772
194	773	776
195	777	780
196	781	784
197	785	788
198	789	792
199	793	796
200	797	800
201	801	804
202	805	808
203	809	812
204	813	816
205	817	820
206	821	824
207	825	828
208	829	832
209	833	836
210	837	840
211	841	844
212	845	848
213	849	852

Appendix 4 Continued : Advanced Group Number Table

Group Number	Start Address	Last Address
214	853	856
215	857	860
216	861	864
217	865	868
218	869	872
219	873	876
220	877	880
221	881	884
222	885	888
223	889	892
224	893	896
225	897	900
226	901	904
227	905	908
228	909	912
229	913	916
230	917	920
231	921	924
232	925	928
233	929	932
234	933	936
235	937	940
236	941	944
237	945	948
238	949	952
239	953	956
240	957	960
241	961	964
242	965	968
243	969	972
244	973	976
245	977	980
246	981	984
247	985	988
248	989	992
249	993	996
250	997	1000
251	1001	1004
252	1005	1008
253	1009	1012
254	1013	1016
255	1017	1020
256	1021	1024
257	1025	1028
258	1029	1032
259	1033	1036
260	1037	1040
261	1041	1044
262	1045	1048
263	1049	1052
264	1053	1056
265	1057	1060
266	1061	1064
267	1065	1068
268	1069	1072
269	1073	1076
270	1077	1080
271	1081	1084
272	1085	1088
273	1089	1092
274	1093	1096
275	1097	1100
276	1101	1104
277	1105	1108
278	1109	1112
279	1113	1116
280	1117	1120
281	1121	1124
282	1125	1128
283	1129	1132
284	1133	1136
285	1137	1140
286	1141	1144
287	1145	1148
288	1149	1152
289	1153	1156
290	1157	1160
291	1161	1164
292	1165	1168
293	1169	1172
294	1173	1176
295	1177	1180
296	1181	1184
297	1185	1188
298	1189	1192
299	1193	1196
300	1197	1200
301	1201	1204
302	1205	1208
303	1209	1212
304	1213	1216
305	1217	1220
306	1221	1224
307	1225	1228
308	1229	1232
309	1233	1236
310	1237	1240
311	1241	1244
312	1245	1248
313	1249	1252
314	1253	1256
315	1257	1260
316	1261	1264
317	1265	1268
318	1269	1272
319	1273	1276
320	1277	1280
321	1281	1284
322	1285	1288
323	1289	1292
324	1293	1296
325	1297	1300
326	1301	1304
327	1305	1308
328	1309	1312
329	1313	1316
330	1317	1320
331	1321	1324
332	1325	1328
333	1329	1332
334	1333	1336
335	1337	1340
336	1341	1344
337	1345	1348
338	1349	1352
339	1353	1356
340	1357	1360
341	1361	1364
342	1365	1368
343	1369	1372
344	1373	1376
345	1377	1380
346	1381	1384
347	1385	1388
348	1389	1392
349	1393	1396
350	1397	1400
351	1401	1404
352	1405	1408
353	1409	1412
354	1413	1416
355	1417	1420
356	1421	1424
357	1425	1428
358	1429	1432
359	1433	1436
360	1437	1440
361	1441	1444
362	1445	1448
363	1449	1452

Appendix 4 Continued : Advanced Group Number Table

Group Number	Start Address	Last Address
364	1453	1456
365	1457	1460
366	1461	1464
367	1465	1468
368	1469	1472
369	1473	1476
370	1477	1480
371	1481	1484
372	1485	1488
373	1489	1492
374	1493	1496
375	1497	1500
376	1501	1504
377	1505	1508
378	1509	1512
379	1513	1516
380	1517	1520
381	1521	1524
382	1525	1528
383	1529	1532
384	1533	1536
385	1537	1540
386	1541	1544
387	1545	1548
388	1549	1552
389	1553	1556
390	1557	1560
391	1561	1564
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Appendix 5 : Electrical Characteristics

Output Ports.. voltage and current.

A maximum of 240mA continuous may be drawn from the R8247 .. i.e. this is shared between all channels/ports.
Each port provides approximately 14VDC under normal loads.

The ports are labelled + and – with a common internal connection "C."

These labels are only used to differentiate the two ports of the channel.
They do not indicate polarity of the port signal/voltage.

All Ports provide a switched negative 14VDC output using a common return via the connection indicated by the symbol "C."

Standby Current and Charging Cycle Information.

The R8247 has a built in CDU (capacitor discharge unit) to ensure efficient operation of pulsed loads, e.g solenoid point motors.

The CDU is made up of 4 x 4700uf capacitors.

Recharge Cycle is approximately 4 seconds to 90% charge.

Standby/idle current for the PAD is approximately 70mA.

Peak recharge current is 245mA + (Standby Current) = total 315mA.

Appendix 6 : Connection Ideas

Current Limits and Load Types.

As specified, the PAD has a total current capability of 240mA, i.e. about quarter of an Amp.

LEDs: The PAD can drive up to 8 LEDs, provided their total current draw is below the maximum the PAD can supply. We recommend (if running 8 LEDs at one time) to not use an LED current higher than 20mA each.
If the LEDs are connected in reverse by mistake, they will not light... but, as long as you do not leave them connected for more than a few seconds, it is likely they will be undamaged and may be successfully reconnected in the correct polarity. For more information re LEDs see the section below. (Further notes regarding using LEDs)

Filament Bulbs/Incandescent Lamp etc: Ordinary incandescent lamps are not polarity sensitive and may be connected "anyway round." Check their current requirement before connecting to the PAD. Most "Grain of Rice" type bulbs draw approximately 60mA. *** You will not require a series resistor. *** e.g. Skaledale Lighting... However, at maximum limit you will only be able to really drive 3 lamps directly from the PAD. Four lamps adds up to the PAD's current limit of 240mA. Consider a relay arrangement if you are likely to exceed the current limit of a PAD.… See Connection Ideas: Diagrams.

Relays: There are two basic types of relay, i.e. latching or non-latching... Non-Latching relays have an advantage that you could run up to 8 controlled circuits from the PAD. However, this type of relay requires continuous current flow through the relay coil. Latching types only require a short duration pulse to operate. A second pulse is sent to the "reset" coil to flip the relay back to the starting point. Thus, "Standard Mode" configuration is most suitable. However, you are limited to 4 relays per PAD.
You will need to ensure that as before the total current draw of the relay coils is less than the PAD limit. Alternatively, if Latching relays are used, there is no constant current draw.

When searching for suitable relays try the following search terms **"12V coil bistable latching relay" or "12V coil relay."**

Further Notes regarding using LEDs

The switched voltage from each single port is approximately 14VDC. It is usual to run LEDs at a current of between 10 and 20mA for general purposes. Lower or higher currents maybe desired for some types of LED. This will depend on the LED type selected. However, for our purposes we will talk about the types of LEDs found in model railways and other similar applications.

At 14VDC all LEDs without internal resistors will require a series resistor to be fitted. The value of this resistor is easy to work out, however, it is almost guaranteed that the value will be between **500 and 1000 ohms**, depending on colour of the LED and brightness desired. Because the value of the resistor is fairly wide it is best to experiment with a few resistor values and LEDs, to see what can be done.

All LEDs have a "working voltage;" this is called their "forward voltage." All you have to do is subtract the "forward voltage" from the supply voltage (in this case 14VDC), and divide the result by the current you want to flow through the LED. The result of this bit of arithmetic will give the resistance value of the resistor required.

Example… So… If we have a red LED with a "forward voltage" of 2VDC, (14VDC-2VDC = 12VDC.) Then all we have to do is divide 12VDC by the current desired. Let's choose 20mA. So… 12VDC / 0.02 = 600 ohms.

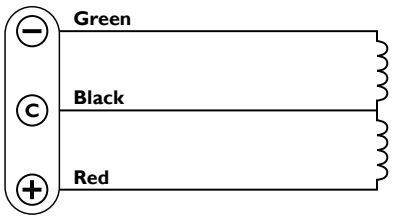
As a rule of thumb halving the current will double the resistance. Double the current, halves the resistance.

When you come to buy resistors you will find that they come in a preset range of values, which may not match your calculations. Buy the one closest in value as you will find out with experience none of this is very critical.

Here is a list of "forwards voltages" and typical current levels that could be used for different colour LEDs.

Red LED: 2V … @ 15mA
Green LED: 2.1V … @ 20mA
Blue LED: 3.2V … @ 25mA
White LED: 3.2V … @ 25mA

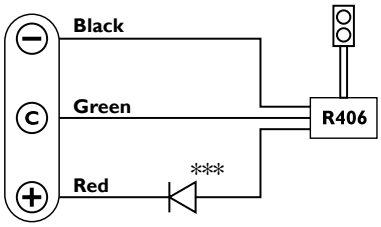
Appendix 6 Continued : Connection Ideas: Diagrams



Colours shown are for Hornby Point Solenoid motors R8014 or R8243.

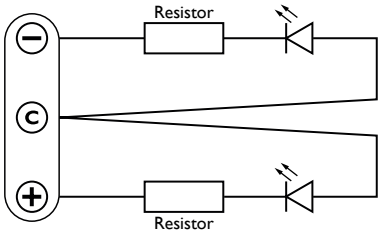
This is the standard way of connecting a Hornby Point motor to a single channel of the PAD. In this case both ports are used. Other Manufacturer's point motors may use a different wiring colour code. This configuration re point motors is used with the PAD in "Standard mode"... Default.

This configuration may be used with non-latching and latching relays. Ensure that a pulse is used when driving latching relays.



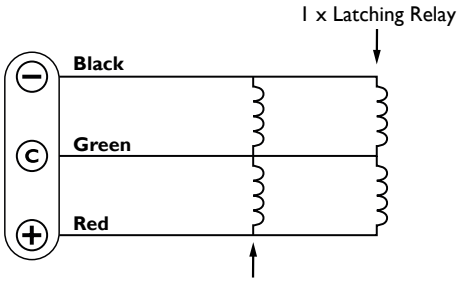
Standard connection of the R406 LED/Bulb signal light to a PAD. The configuration used in the PAD is usually "Standard Mode" with the pulse dwell setting for each port in the channel set to "Continuous Operation".

*** R406 with LEDs. In PAD configurations where both LEDs are required to be on at the same time, a diode is required to ensure the Green LED illuminates. The diode type can be 1N4001 or similar, it is not critical. (The diode is not required with R406 signals manufactured after mid 2020.)



This is how to connect multiple LEDs to the PAD.
The resistor values will depend on the amount of current required for the LED. Different colour LEDs will have different value resistors. See page 16.

The configuration usually used for this type of connection will be "Special Mode 1" with 8 port operation or "Special Mode 2" i.e tandem port operation.

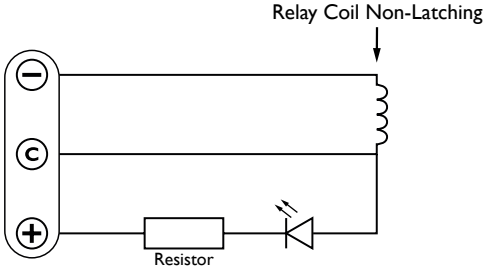


Colours shown are for Hornby Point Solenoid motors R8014 or R8243.

In some cases, it is useful to control a R406 signal in tandem with a point motor. Connect the "On/Off" coils of a "Latching" relay in parallel with the coils of the point motor. The relay type should be "high sensitivity" meaning that the relay draws very little current.

Using the switch contacts of the relay, arrange connection to your signal utilising a dedicated external power supply for the signal light.

Use with "Standard mode" i.e default



This diagram shows how to mix the use of ports on a channel. e.g a relay and a LED.

As before the resistor value will depend on LED current and the colour of the LED. See page 16.

Since dwell time applies to both ports in a single channel you will probably use this configuration in "Special Mode 1" i.e 8 port operation or "Special Mode 2" i.e tandem ports.

Notes: (If you have printed out this guide, use the following pages for your notes)

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