DCCconcepts DCW-DM1 Diode Matrix Kit

The DIODE MATRIX - What is it?

A "Diode" is a small electronic part that can help you to reduce wiring and the number of switches that are needed for route setting.

The "Matrix" is the way that several diodes and one switch are arranged in order to let you change several turnout motors all at once.

Because a Diode Matrix uses one push button switch (PB) to change several solenoids all at once, we suggest that you always use a capacitor discharge unit (CDU) for extra power.

We strongly recommend DCCconcepts CDU-2 as it is guaranteed to be the best CDU available by far. CDU-2 has huge power and will easily power more than 10 solenoids all at once if it is asked to!

## So - How can this help make things easier?

Look at the simple example marked "Diagram 1". As you can see, it needs six pushbutton switches. (PB 1~6) to operate 3 solenoid motors (S1~3). Operation is more complex too as to reach the top siding you would need to press 3 switches... PB2, PB4 and PB6.
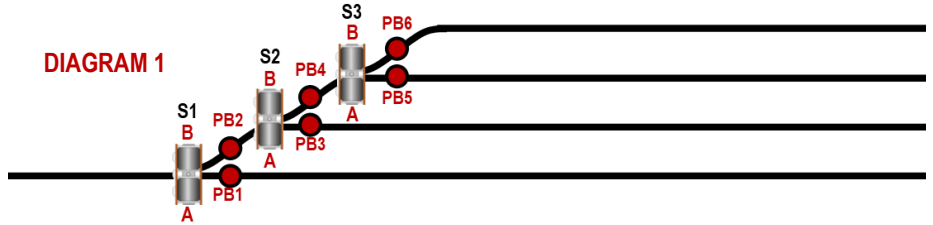
DIAGRAM 1

Now look at the example marked Diagram 2.

If we use a Diode Matrix, we can now use only one pushbutton switch for each siding - and ALL of the motors that lead to it will change at once if we select that siding. 6 switches are reduced to 4, and operation of the yard now takes only one press of a switch to select each route. Much easier!
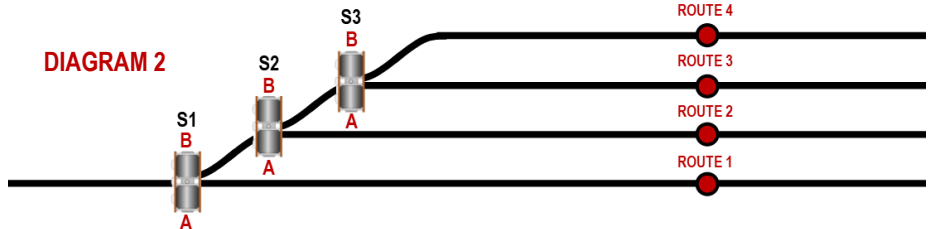
DIAGRAM 2

A simple "Logic Chart" for the diagram above will help.

Look closely. To construct the matrix, just link the route (Switch) to the solenoid coil indicated with one of the diodes.

Route / Solenoid	Solenoid 1 A	Solenoid 1 B	Solenoid 2 A	Solenoid 2 B	Solenoid 3 A	Solenoid 3 B
R1 (PB switch 1)		X				
R2 (PB switch 2)	X			X		
R3 (PB switch 3)	X		X			X
R4 (PB switch 4)	X		X		X	

OK - How do you create a real Diode Matrix?

The example above already shows the logic but it can be difficult without something to help you to clarify the relationships between switch, diode and motor.

DCCconcepts DCW-DM1 actually mimics the chart in its layout so it is simple to do when you use this kit.

The DCW-DM1 kit includes 50 diodes, enough for many routes. You can create more than a dozen routes using just 1 DCW-DM1. (Or link horizontally to let you use more turnout motors or, if you wish, link two vertically to let you create more routes)

The connection logic is quite simple. Please look at the photo to the right and the items we've added.

* The yellow line shows the common connection for all solenoids. It links directly to the CDU connection.

* The green wire shows the common for all the of the switches. It links directly to the CDU connection.

To the CDU   To the Solenoids

To the P.B. Switches

* The turquoise lines to the right of switch 6 & 9 show how all the solder pads are linked for connection of any switch to any motor.

* The red and pink lines are the left & right coil connections for each solenoid. They make it easy to connect any solenoid to any switch.

* The two diode drawings show you connection of switches to motors via a diode. The upper diode connects SW6 to the A (left) coil of solenoid 5. The lower diode connects SW9 to the B (Right) coil of solenoid 5. We've added a solenoid image to clarify its connections.

* As further examples, there are "real world" diodes soldered to the Diode Matrix board at the upper left of the photo - as you can see, they are all oriented the same way and fit nicely at 45 degrees. This angled connection keeps the "horizontal to vertical" linking clear!
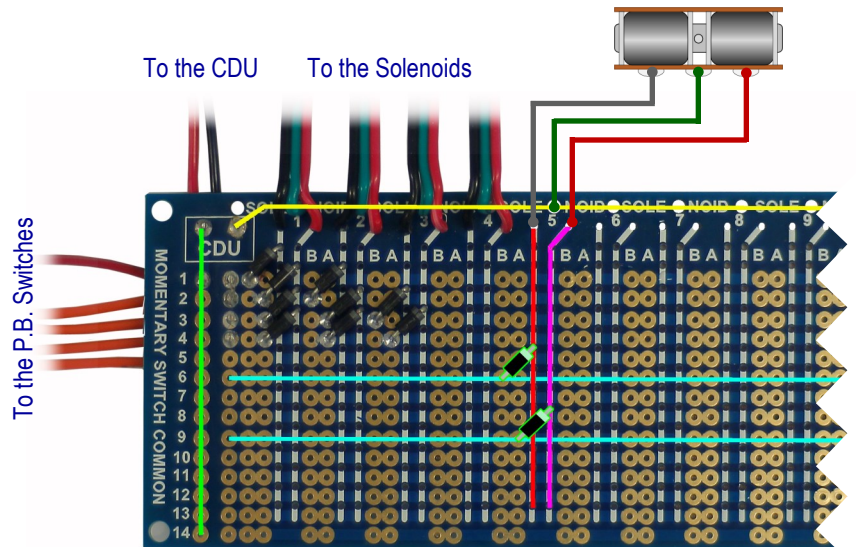
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Example #2 - Here is a slightly more complex set of routes.

If it was a station throat, we might have made it simpler and simply created some "end to end" routes for train arrival and departure, however as it's a yard, we have treated each siding as a route, and added a single pushbutton for the crossover. Even so, wiring ends up much easier than using two pushbuttons per solenoid motor!

Operation is also simplified with any route needing much less attention than with individual turnout motor control.

How you do it is of course, your choice.

However you choose to design your routes, wiring & operation always be made easier when you use the DCCconcepts DCW-DM1!
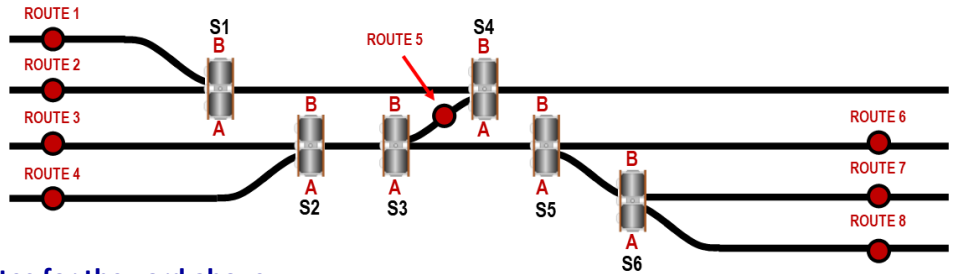
Here is the Logic Diagram" to create routes for the yard above

As before, to construct the matrix, just link the route (switch) to the solenoid coil we indicate with one of the diodes.

| Route / Solenoid	Solenoid 1 A	Solenoid 1 B	S 2 A	S 2 B	S 3 A	S 3 B	S 4 A	S 4 B	S 5 A	S 5 B	S 6 A	S 6 B
R1 (PB switch 1)	X					X	X					
R2 (PB switch 2)		X				X	X					
R3 (PB switch 3)			X									
R4 (PB switch 4)				X								
R5 (PB switch 5)					X			X				
R6 (PB switch 6)						X	X		X			
R7 (PB switch 7)						X	X			X	X	
R8 (PB switch 8)						X	X			X		X

INTERLOCKING a 3-way turnout by using a Diode Matrix

Diodes can also make things easier with more complex point-work.

Example - with any 3-way turnout, we have four possible positions for two turnout motors but only three valid routes, so a form of interlocking is required. With a Diode Matrix, it is actually quite simple.

Often things look complex because we think of them that way. As you can see from the pictures, a 3-way is really only 2 turnouts combined!

Route / Solenoid	S1 A (left)	S1 B (right)	S2 A (left)	S2 B (right)
R1 (PB switch 1)		X		
R2 (PB switch 2)	X			X
R3 (PB switch 3)	X		X	
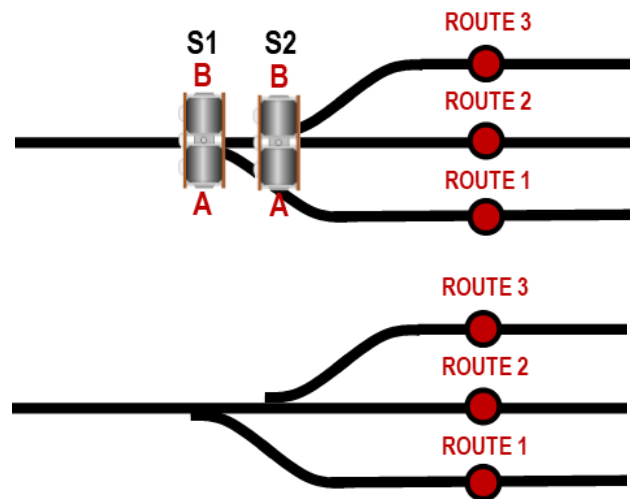
Using a Diode Matrix for OTHER TURNOUT MOTORS or other things like Accessory decoders.

While they were initially conceived for simplified control on analog layouts using twin coil solenoid type turnout motors, a Diode Matrix can also be used for control and route setting of many other devices that offer an option for switched control. - For example, Cobalt iP Digital or Cobalt-SS turnout motors, DCCconcepts DCC Accessory decoders & many similar things.

There WILL be some small important differences though:

* You must not add any external power if you are connecting your diode matrix to anything other than solenoids.
* You should reverse the orientation of all the diodes if connecting to Cobalt & similar products (swap them end for end).
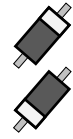
We have added some more examples using Cobalt products - PLUS some tips and tricks for Diode Matrix use on page #3.

INTERLOCKING a 3-way turnout with DCCconcepts Cobalt iP Digital motors with a Diode Matrix

Page 3 of 4

When we created the previous (Solenoid) examples, the diodes went into the DCW-DM1 Board this way.

When we create a Diode Matrix for use with Cobalt iP Digital or Accessory decoders, they go THIS way.

(ALL previous diagrams work with Cobalt - if you reverse the diodes and delete the CDU - Otherwise, it is the same set of logic and application rules as when you are using Solenoids.

TIPS for using Diode Matrix with Cobalt or Accessory decoders

* **ORIENTATION of the TURNOUT MOTORS.** When using Cobalt motors with a 3-way turnout, <u>the two motors will actually face each other</u>, meaning that the A and B (L and R) of the second motor switch will be reversed. If things work the opposite to your expectations, all you will need to do is swap the diodes from one side of the switch to the other (Swap A for B)

* **Added POWER will NOT be needed.** You do not need to connect ANY form of power supply to the diode matrix at all.
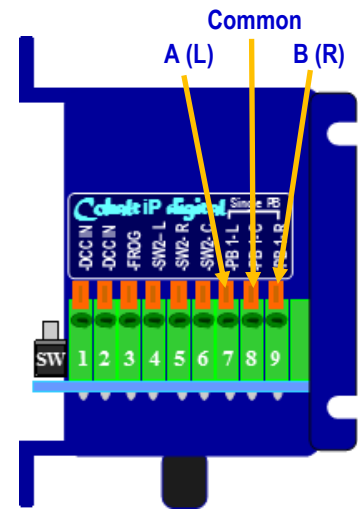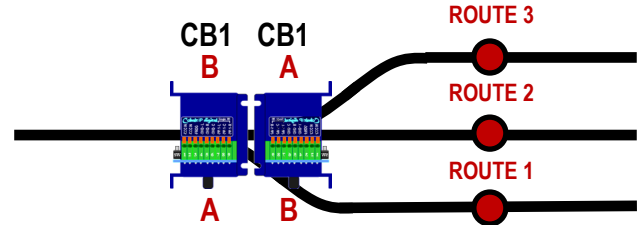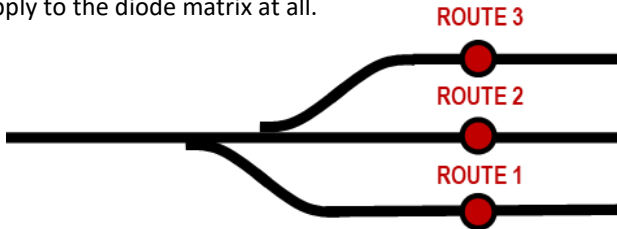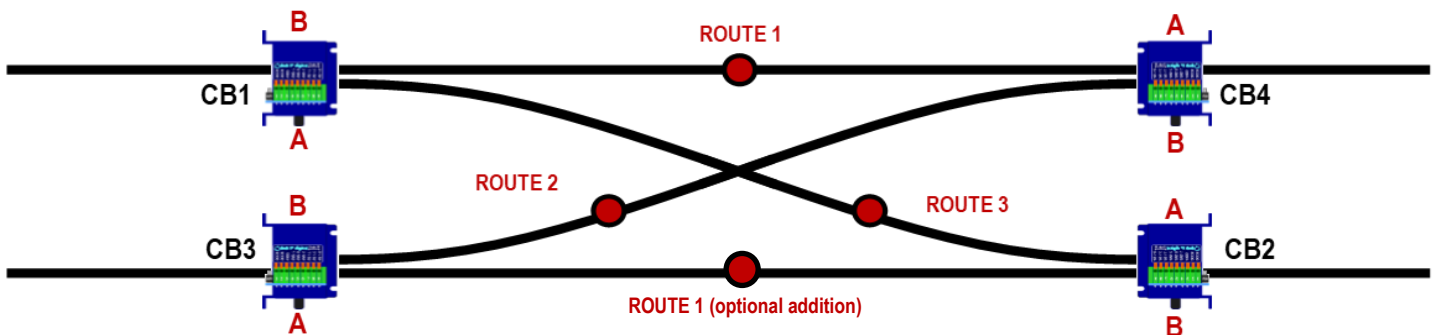
Motor >>	CB1 Normal	Orientation	CB2 Reverse	Orientation
Route/ / SW	S1 A	S1 B	S2 A	S2 B
R1 (PB switch 1)		X		
R2 (PB switch 2)	X		X	
R3 (PB switch 3)	X			X

Finally - The "Scissors Crossover". This example also uses a Diode Matrix with Cobalt iP Digital motors

* **ORIENTATION of the TURNOUT MOTORS.** We have set this one up with all motors oriented with the throw bar facing the turnout heel, therefore the two at the LHS are normal & the two at the RHS are facing them or opposite. A moments thought makes this clear.

* **This approach is usable with DC or DCC power.** Also, because we are using the Cobalt iP Digital's switch terminals for control, this will work equally well with Digital OR Analog power. However - if you are using digital, you will <u>still</u> be able to use digital control if you wish.

* **Simplicity and considerable savings via Diode Matrix!** Interlocked with only 3 buttons not 8 - those 3 simple routes take care of it all.

| Motor >>	CB1 Normal	Orientation	CB2 Reverse	Orientation	CB3 Normal	Orientation	CB4 Reverse	Orientation
Route/ / SW	S1 A	S1 B	S2 A	S2 B	S3 A	S3 B	S4 A	S4 B
R1 (PB switch 1)	X		X			X		X
R2 (PB switch 2)	X		X		X		X	
R3 (PB switch 3)		X		X		X		X

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There is more than one way to plan a Diode Matrix.

Here is an easy alternative that may make planning your own Diode Matrix routes simple—and visually clear

Instead of the computer generated chart we have used here, use graph paper or a simple X-Y set of lines and a pen.

To make it clear in this example * **Blue** represents switches * **Green** represents turnout motor coils * **Red** lines are diodes.

Compare this approach to the chart below it—they both show the same route settings and diode positions quite clearly.

Its time to create your own… Have a go, and if you get stuck, please do not hesitate to call us. We'll be happy to help!
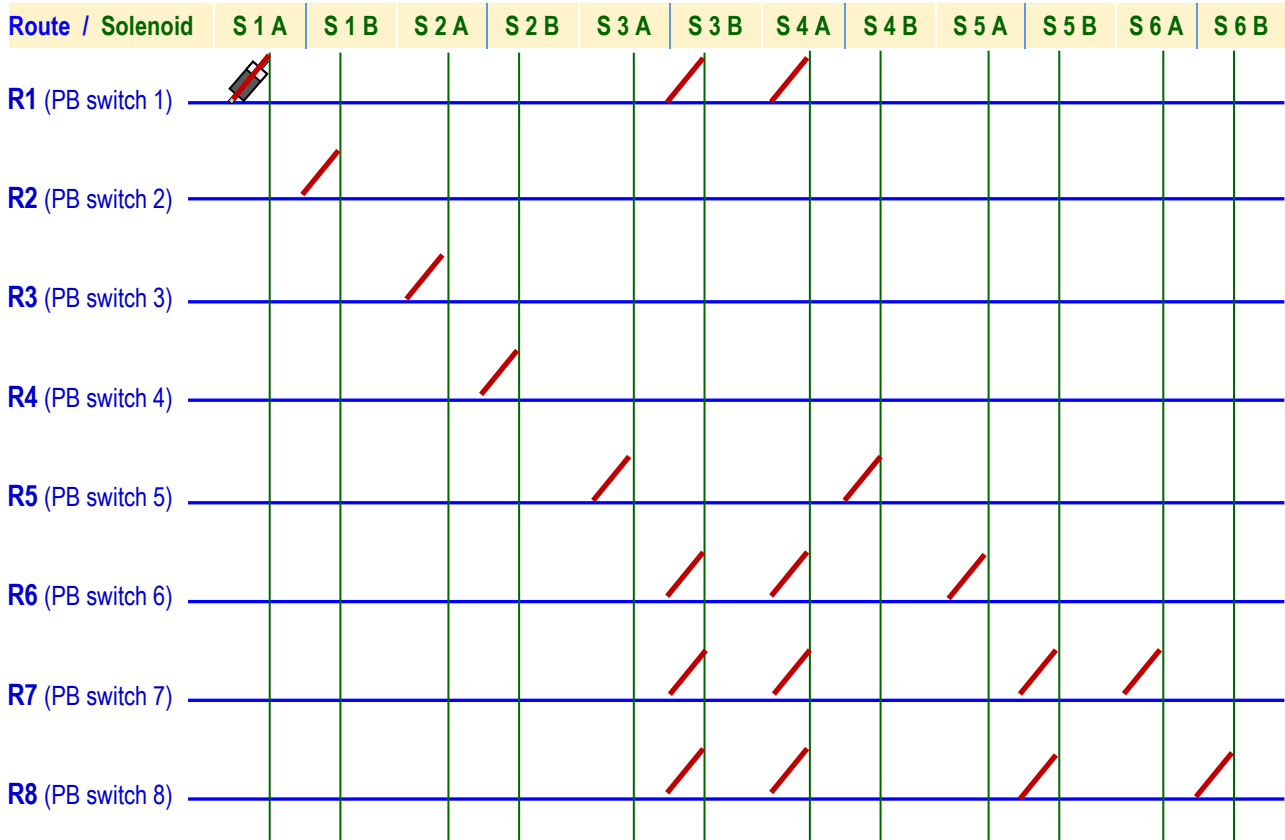
The above "Graph paper approach chart" is exactly the SAME arrangement as this one (from Page 2)

Route / Solenoid	S 1 A	S1 B	S 2 A	S 2 B	S 3 A	S 3 B	S 4 A	S 4 B	S 5 A	S 5 B	S 6 A	S 6 B
R1 (PB switch 1)	X					X	X					
R2 (PB switch 2)		X										
R3 (PB switch 3)			X									
R4 (PB switch 4)				X								
R5 (PB switch 5)					X		X					
R6 (PB switch 6)						X	X	X				
R7 (PB switch 7)						X	X		X	X		
R8 (PB switch 8)						X	X			X		X

The last word....

* The solder pads on your DCW-DM1 are 24 carat gold plated for easy soldering. For the easiest possible soldering we strongly recommend our S179 solder and No-Clean Flux. Use ONLY small amounts of solder and please work carefully.

* If you do not have the right soldering iron, then we can help. Please call us or take a look at www.dccconcepts.com.

ROUTE 1
ROUTE 2
ROUTE 3
ROUTE 4

S1
B
A

ROUTE 5

S4
B
A

B

B

S2

S3

B
A

S5

B
A

ROUTE 6
ROUTE 7
ROUTE 8

B
A

S6

S3
B
PB6

S2
B
PB4

PB5

S1
B
PB2

PB3

A

PB1
A

S1
B

S2
B

ROUTE 3
ROUTE 2
ROUTE 1

A

A

CB1
B

CB1
B

ROUTE 3
ROUTE 2
ROUTE 1

A

A

ROUTE 3
ROUTE 2
ROUTE 1

Cobalt iP digital   Single PB
-DCC IN -DCC IN +FROG -SW2-L -SW2-R -SW2-C -PB 1-L -PB 1-C -PB 1-R
SW   1 2 3 4 5 6 7 8 9

B
ROUTE 1
A
CB1
A
CB4
B

B
ROUTE 2
ROUTE 3
CB3
A
CB2
B

ROUTE 1
A