Sensor Positioning for "Brake on DC: We will use three sensors for this. We will call then "DC" for track circuit, "SS" For signal sensor and "CS" for clear signal sensor. Place DC, the sensor that will activate "brake on DC" approximately 45cm inside the approach end of the section and place the SS sensor that will trip the signal appx 45cm past end of the section that is controlled by the signal. This positioning will (a) ensure that even a long loco is past the signal when it is red and (b) ensure that when the following train trips the "DC" sensor or it will be fully inside the section. Place the CS sensor alongside the following signal (the one at the end of the following section that will clear the SS signal)

Sensor order and setting for "Brake on DC": Use three sensors that are next to each other. Order is important. If you use 1, 2, 3 then 1 will be DC, 2 will be SS, 3 will be CS. With the DIP switch, set sensor DC to turn off when any other sensor is triggered, SS and CS to turn off when the following sensor is triggered. If you have several such sections, then choose 1+2 for DC1 and DC2 sections, with 3,4,5,6 for SS1, CS1, SS2, CS2 respectively...

Wiring the sensors: *(For each DC section ou will also need one MASTERswitch® PLUS which features 2x DPDT latching relays - see section on interfacing with MASTERswitch®).*

(a) Wire the SS sensor to change the signal from green to red via either the LED or relay outputs of MASTERswitch® PLUS (b) Wire the DC sensor via one of the relays so that it is only connected to the detector when the SS sensor is triggered. (c) Wire Sensor CS so it changes the following signal AND so that it changes the MASTERswitch® PLUS back to disconnect and clear the Brake on DC section sensor and return track to DCC signal.

Wiring the track Section: The bus for this section should be wired to the common terminals of one of the DPDT relays on MASTERswitch® PLUS. Two pairs of droppers should come from the track section, one pair directly to the terminals on one side of that relay, the other pair should be connected to the DC side of a bridge rectifier with the AC side of the rectifier connected to the remaining terminals of the relay.

Result: Train #1 passes through the braking section, triggering the SS sensor, setting its signal to red and arming sensor DC. Train #2 enters braking section... as it hits the DC sensor the track changes to DC power, making it slow to a stop at the signal. Meanwhile, train #1 is continuing and as it clears the following signal adjacent to the CS sensor, the CS sensor is tripped and returns The SS signal to clear and disarms the DC sensor, restoring DCC signal and allowing train #2 to go... it accelerates away at the rate you set into momentum.

Creating this manual took far longer than it might have taken to implement many of the ideas it contains. Look closely at the MASTERswitch® range ….think Laterally... and you will quickly find you can control almost anything!

This product was designed and made by DCCconcepts Pty Ltd (www.DCCconcepts.com)

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Postal address: Unit 3, 13 Lionel Street, Naval Base 6165 Western Australia.

Please do not hesitate to ask if we can be of assistance to you - We are always happy to advise on wiring, installation, application and interface for any kind of layout or model related application for this or any other MASTERswitch® product. DCCconcepts markets these products globally and we are also happy to supply retailers in your country - simply have them contact us and we'll do the rest!. **Time zone:** DCCconcepts local time is GMT + 8 hrs.

MASTERswitch® "Ultimate Detector"

The "Ultimate Detector" contains eight separately controllable detectors able to do many things on your layout. It has been designed to be versatile yet easy to understand, easy to wire, easy to set up and easy to adjust.

The "Ultimate Detector" is supplied with all sensors and materials needed to install it except wire and solder. Most importantly the "Ultimate detector is totally independent of your track and its wiring, so there is NO need at all to cut rail or change your layout wiring in order to install, wire it or use it.

ONE YEAR Goof Proof Warranty!

Your "ultimate detector" is supplied complete with all accessories as follows:

- One "Ultimate Detector" PCB with eight detectors
- Eight CDS LDR Cells for detection
- Eight LEDs for your control panel
- Eight 560 ohm resistors for panel LEDs
- Two super bright 5mm RED LEDs for use in tunnels and dark areas
- Two 560 ohm resistors for the super bright 5mm RED LEDs
- 35pcs of heat-shrink material for insulation of CDR and LED Leads
- One instruction sheet.

About the MASTERswitch® "Ultimate Detector":

Power: The "Ultimate Detector" can be powered by DCC, DC or AC, 9~20 volts

Connections: All connections are by clearly marked screw terminals

Sensitivity adjustment: Use a small flat blade screwdriver to individually adjust each sensor.

Programming: There are four operating modes. These are simply selected by changing the position of the DIP switch of the chosen detector. Each can be configured individually. The choices are * momentary * stay on for ten seconds * stay on until next detector is triggered * Stay on until any other detector is triggered.

Sensors: The "Ultimate Detector" utilizes LDR (light dependent resistor) type photo-sensors. We chose LDRs as they are much easier to install reliably than any other form of light dependent device such as phototransistors or IR devices. They need only a 1/8 or 3mm hole between sleepers, require no special "alignment" and will respond to a wide range of light levels. (Each detector also has its own adjustment pot for easy set-up). Where detection is wanted in hidden or dark areas such as hidden yards or tunnels, adding a super bright red LED pointing at the LDR will give easy and reliable results in places you cannot easily see.

Outputs: The output of the "Ultimate detector" is +4.5 volts. It is adequate for IO detection, connection to panel lamps or can directly drive the many other product such as the MASTERswitch® V2 or MASTERswitch® PLUS.. Or the DCCconcepts MASTERswitch® quad relay board directly (This relay board has four independent DPDT relays).

Wiring: The "Ultimate Detector" can be connected using standard fine stranded wire and there is no special requirement for special cables of any kind.

Detector wiring & connection information

Connections:

Your MASTERswitch® Detector PCB contains eight separate detectors. Each has its inputs, sensitivity adjustment, DIP switch for mode selection and outputs is a direct line with each other so you should have no trouble at all in installation and setup. To further assist you we have printed onto the PCB all key connection information such as polarity information.

Mounting the detector board.

We have provided four 2mm holes, one at each corner of the board. These can be carefully opened out to appx 3mm if you do not have 2mm screws, however please be careful that you do not damage PCB tracks or bridge two PCB tracks when installing them.

Power Connection:

You may use AC or DC to power your detector (9~20 volts).

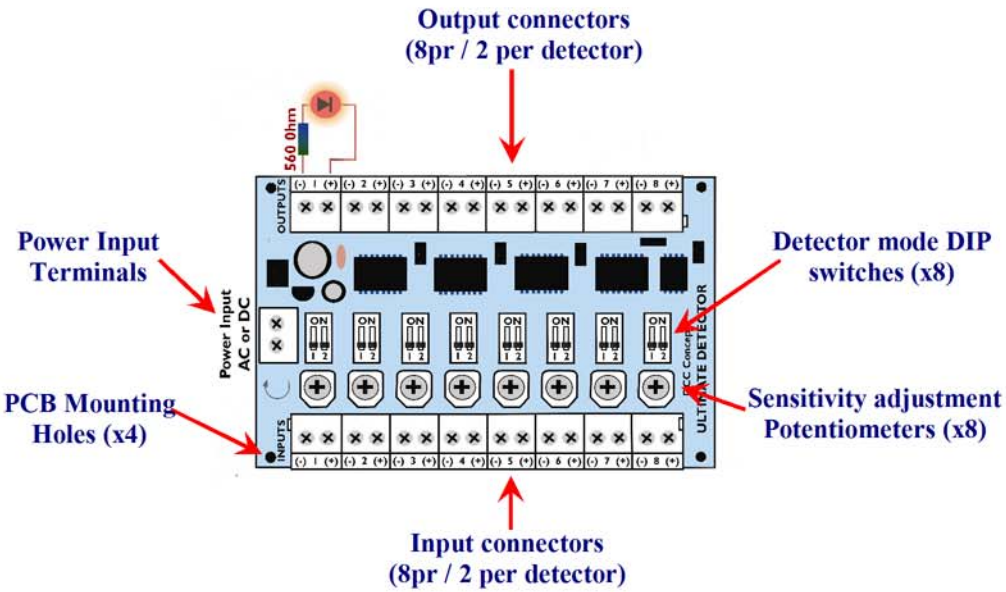
The detector will draw very little current however as it does use processors in its logic and detection circuitry consistent power is helpful so do use a reasonably stable power supply.

The "Input" side:

There are eight pairs of inputs on the PCB, one for each of the eight CDS LDR's (Cadmium sulphide Light dependent resistors) provided. These are not polarity sensitive. There is little or no current draw on the input side so fine stranded wire is quite acceptable.

The "Output" side:

This may be connected to a panel LED (with series resistor) or be directly connected to our MASTERswitch® Quad relay board. The output is +5v so is also appropriate to drive any standard IO or computer interface card. Output terminals are clearly marked with polarity.



The concept is very simple: (each detector channel will need to be connected to a device that will change signal aspect or position of course - we recommend our Quad relay board).

(1) Order for detector #1 is channel 8, 1, 2, 3, 4, 5, 6, 7. Place detector channel 8 any distance you like but a realistic distance from the first active signal then place each detector correctly in relation to its signal so it changes to red as the train passes it.

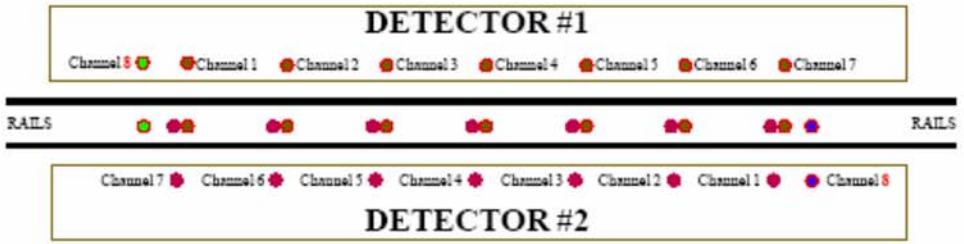
(2) Order for detector #1 is channel 7,6,5,4,3,2,1,8 Place detector channel 8 about 100mm from channel 1, then place each detector correctly in relation to its signal so it changes to red as the train passes it.

(3) On both detectors, set channel 1,2,3,4,5,6 to "stay active until next detector is triggered". Set channel 7 to stay on for ten seconds, set channel 8 to momentary.

(4) Connect channel 8 of each detector toe either side of a MASTERswitch® PLUS or a latching low current relay so when it is triggered, it will turn ON its own power and turn OFF the other detectors power.

Now, when a train enters the signaled territory, the first thing it will do is trigger channel 8, turning on the detector that controls signals in its running direction AND turning off the opposing signals detection. (default for all signals should be red when detector is off).

ONLY the signals needed for the active train will now react. When any detector is triggered, it will release the previous detectors circuit or signal and latch the current signal for as long as its in the section. As the train clears the area, it will cross sensor # 8 of the other detector. re-setting all of the detection ready for the next train. BONUS - Because the operation is totally optical with NO track circuiting involved, it will also work perfectly for trains running in reverse, reacting to rolling stock exactly as it reacts to locomotives! It is also ideal for triggering Brake on DC circuits to give realistic slowing and stopping at red or stop signals.



Automating DCC's "Brake on DC" feature!

The "Brake on DC" function of NMRA compatible/compliant decoders is a very under appreciated function that is seldom used as many do not understand it, however it can really add life to the layouts operations.

Activating "Brake on DC": This is as simple as turning off DC running by changing CV29. To do this, read CV29 then reduce the number in CV29 by 4. ie: If CV29 is 6, change to 2.

Section length for "Brake on DC": This too is simple. (1) Set momentum to a value that will give a realistic braking speed when brake on DC is engaged (2) measure how far the average loco will travel with this setting and add say 60cm to this distance. (3) make a separate track section (cut both rails both ends) which is the same as the length in 2 with one end by the signal that will indicate "stop".

Automation of Turnout or solenoid powered accessory via MASTERswitch® V2:

Again this is done by utilising the small opto isolation PCB already supplied free with every MASTERswitch®. (Note Please: the Opto board was added to the packs in April 08—if you bought your MASTERswitch® product and it does NOT have the opto board in the pack, please write to us with a copy of your receipt and we will supply tem to you at no charge). The Opto PCB simply goes in between the Detector and the MASTERswitch® PLUS.

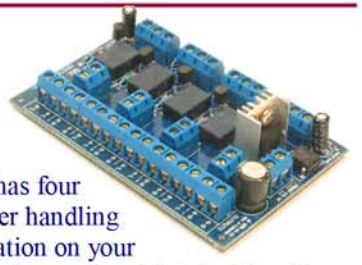
Connections:

The connection structure and logic is exactly the same as for MASTERswitch® PLUS

Please note:

You CAN retain both manual and automatic control of the automated device / signal/point by utilizing momentary pushbutton switches in parallel with the detector connections: DCCconcepts offers a specially designed switch for this purpose, supplied in a pack of 3 switches each with a choice of 3 colours of switch cap - The part number is DCM-MSP2.

DCCconcepts MASTERswitch® Quad relay board:



Automation of just about ANYTHING that can be turned on & off or changed…. including auto reversing, track circuit interlocking and signal control.

The new DCCconcepts MASTERswitch® Quad relay board has four low current relays with double pole double throw 3 amp power handling switch contacts. It can be used for a almost automated application on your layout such as automated turnout control, control of reversing loops, signal interlocking for colour light or semaphore signals, track circuit interlocking or control of almost anything else that can be triggered turned on and off or reversed. Both the Quad Relay Board and the very versatile Ultimate Detector can also be controlled via a computers IO card outputs (+5 volts)

Connection to the MASTERswitch® Ultimate Detector is simplicity itself… connect the outputs of the detector to the "on" and "common" inputs of the quad relay board, and it will trigger the relay for as long as the detector is on. In turn, the DPDT relays of the quad relay board can be connected directly to MASTERswitch® PLUS, MASTERswitch® V2 or to devices such as tortoise point motors, signals, crossing gates or even directly to track circuits to provide safety interlocking on diamonds or create "stopping blocks" using the "Brake on DC" function of DCC decoders - in fact it will control any item you can imagine!

Linking Detectors for easily managed full bi-directional signalling on single track.

You will need TWO of our MASTERswitch® Ultimate detectors., one for each direction, and this will provide a full seven signalling blocks in each direction, with one channel of each detector reserved to establish which detector has priority over the route.... Whilst using two detectors for a single route may seem extravagant, given the very realistic cost of the product at less than half the price of any other system, it is in fact a very cost effective and quite easy to install and simple solution to what is for other signalling systems and related products a very difficult problem.

Detector wiring & connection information

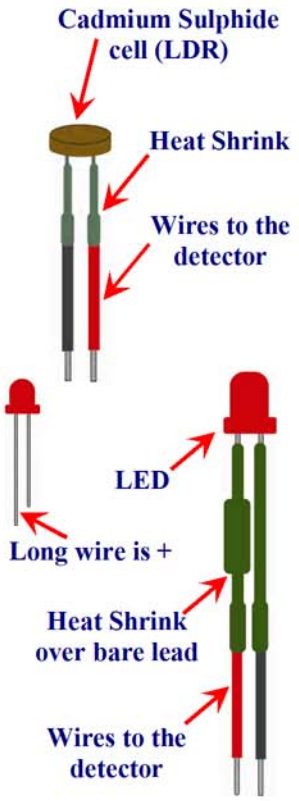
Wiring the Cadmium sulphide LDRs:

Shorten the legs of the LDR as appropriate and carefully solder the legs of the LDR to the wires you will use between LDR and detector. Add the heat-shrink that has been provided to both legs of the LDR to cover the bare wires & solder joints.

Installing the Cadmium sulphide LDRs:

Drill a 3~4mm hole centrally between two of the track sleepers (ties). In OO/HO scale and larger no adjustment of sleepers will be needed to accommodate this hole, however for narrow gauge, TT or N scale you will have to adjust accordingly.

Insert the LDR into the hole and press home flush with the tops of the sleepers (ties). In most cases no adhesive will be needed, however if you prefer use a small amount of PVA or similar glue, taking care to avoid the top of the LDR. (Note - If the glue flows between terminals, it will temporarily prevent adjustment as it will partially short the legs of the LDR until totally dry)



Installing the Indicator LEDs:

The LED's supplied with your MASTERswitch® Detector are standard 3mm T-1 Type. These will mount best, firmly and neatly in a control panel if you drill a 2.5mm hole and ease it slightly with the tip of a fine rat-tail file. (If you use a 3mm drill, it may become a loose or sloppy fit). When installing the LED note the following: The long lead is (+). Add the resistor provided to the positive lead after shortening them both to suit. Always be sure to insulate each leg with the heat-shrink provided.

Detector set-up information - Light Level

All Optical detectors share a preference for natural wide-spectrum ambient light.

Your DCCconcepts MASTERswitch® Detector was created and tested under average layout room conditions and will operate comfortably in any reasonable light conditions that may exist at your layout - ie: with conventional tungsten filament light bulbs, natural daylight, reasonable power fluorescent light, halogen or any combination of these light types.

It will not be bothered by very high brightness as it was also tested outdoors in natural midday summer sun.

Where light will be at a lower level in tunnels or hidden / dark or shaded areas, we suggest that you supplement the light with a super-bright Red or IR LED as a light source. This should be 100~150mm away from the LDR sensor and aligned directly towards it. If you mount the red/IR LED in a plastic or metal tube, it will NOT result in distracting or unnatural light on the layout, as light from LEDs is very directional. (we included 3 LEDs for this use)

If you have a portable layout or change the lighting often don't worry: the adjustment is simple to do and very quick using the built-in sensitivity adjustment potentiometers shown in the diagramme on page 2 of this manual. The easy-to-do procedure for this is shown overleaf.

Initial setup and adjustment.

Preparation: The sensitivity potentiometer has a range of about 270^0. Please don't try to force it beyond its limits or it will be damaged. Use a small screwdriver for adjustment. Before you start check all connections are correct, make sure the power supply for the detector is turned on and ensure that the top surface of the LDR between the sleepers is free of glue, dust and any ballast chips. If you used Glue to install the LDR sensors be sure that it is 100% dry before you commence adjustment. Be sure nothing is on or shading the detectors to be adjusted. ALL of the DIP switches should be set to the "off" position

The test wagon: any wagon or item of rolling stock is adequate—we tend to use a short, high wagon as our guide—US modellers of modern image may want to use a spine car or perhaps a disconnect logging car as these will have the smallest "shadow footprint" so will give the best and most sensitive setting, guaranteeing all other stock will register properly.

The Adjustment: It's a simple process - take your time and it will be done in very little time.

(1) Place the wagon roughly centrally over the LDR sensor to be adjusted.

(2) With the screwdriver, slowly turn the potentiometer clock-wise until the LED turns off. Then, turn it anti-clockwise about 3~5 degrees or until the LED is ON.

(3) Roll the wagon back and forth to ensure it works reliably in both directions.

(4) Repeat with other detectors. That's it - now you are ready to set how they will trigger

Setting the detector activity options

There are FOUR settings for each detector. Each can be independently programmed very simply with the four position DIP switch… there is nothing complicated about it at all!

Case "A" - Both DIP switches off:

The detector will turn on ONLY as long as the light is shaded - When the train creating the shadow is passed, it will turn off. This mode is useful for occupancy detection or to trigger any device to act (It can also change a turnout automatically if fitted with MASTERswitch® PLUS—or it could tell a computer, signalling or DCC system accessory to react).

Case "B" - Switch 1 on, Switch 2 off:

The Detector will remain on for ten seconds - This is useful for grade crossings, simple signalling, triggering a local action accessory such as sounds or motion happen… or even changing a tortoise or similar slow motion turnout

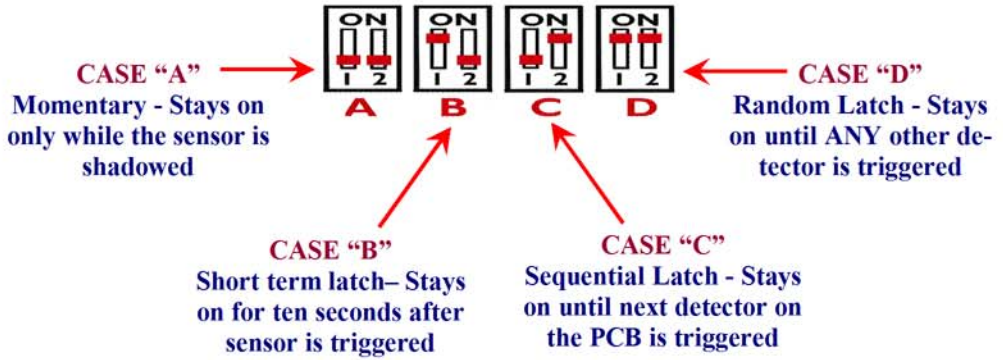
Case "C: - Switch 1 off, Switch 2 on:

The detector will remain on until the next detector on the board is triggered. (ie, if detector 3 is triggered, it will remain on until detector 4 is triggered. This applies to detectors 1~7 only of course, as number 8 has no "next" detector!

This mode is the perfect way to set up a simple yet totally reliable signalling system or progressive occupancy detection system, as a block will show occupied until the train triggering it has entered the following block. Also ideal for protecting diamonds etc.

Case "D" - Both DIP switches on:

The detector will remain on until ANY of the others is triggered: This mode is ideal for interlocking protection, complex signalling or route protection. Nominally similar to case C, combining both case C and D will enable almost any possible turnout/signal combination to be properly interlocked and create huge potential for you to use complex layout control without the need for computer or complex control systems.



Linking your Detector outputs to other MASTERswitch® products.

You can directly link the MASTERswitch® Detector to several of our MASTERswitch® products to create a wide variety of layout automation. In each case, the detector outputs replace the switch which would normally control the other MASTERswitch® product.

Automation of Turnout, Auto reversing or accessory via MASTERswitch® PLUS:

In each case this is done by utilising the small opto isolation PCB already supplied free with every MASTERswitch®. (Note Please: the Opto board was added to the packs in April 08—if you bought your MASTERswitch® product and it does NOT have the opto board in the pack, please write to us with a copy of your receipt and we will supply tem to you at no charge). The Opto PCB simply goes in between the Detector and the MASTERswitch® PLUS.

Connections:

The Opto-Isolation PCB has three black terminals and three Blue Terminals.

The BLACK terminals on the small opto board are towards the device which will do the triggering (ie the detector) and the blue terminals are towards the MASTERswitch® Plus.

(+) and (-) are clearly marked on the detector outputs. The negative output of the Detector that you will use to control the MASTERswitch® PLUS should be connected to the centre of the **black** terminal strip of the Opto board. Note: all negatives on the Detector are in common so only ONE negative lead needs connecting even though we will be using two of the detector circuits to change the MASTERswitch® PLUS in alternate directions.

The Plus (+) outputs of the two detector circuits that you will use to change the MASTERswitch® PLUS should be connected to the two outer black terminals on the Opto Board.

The Blue output terminals of the Opto board are now connected directly to the corresponding "switch" terminal on the MASTERswitch® PLUS. Other connections for MASTERswitch® PLUS power, LEDs, relays or solenoid control should be as per the MS+ manual.

Please note:

You CAN retain both manual and automatic control of the automated device / signal/point by utilizing momentary pushbutton switches in parallel with the detector connections: DCCconcepts offers a specially designed switch for this purpose, supplied in a pack of 3 switches each with a choice of 3 colours of switch cap - The part number is DCM-MSP2.