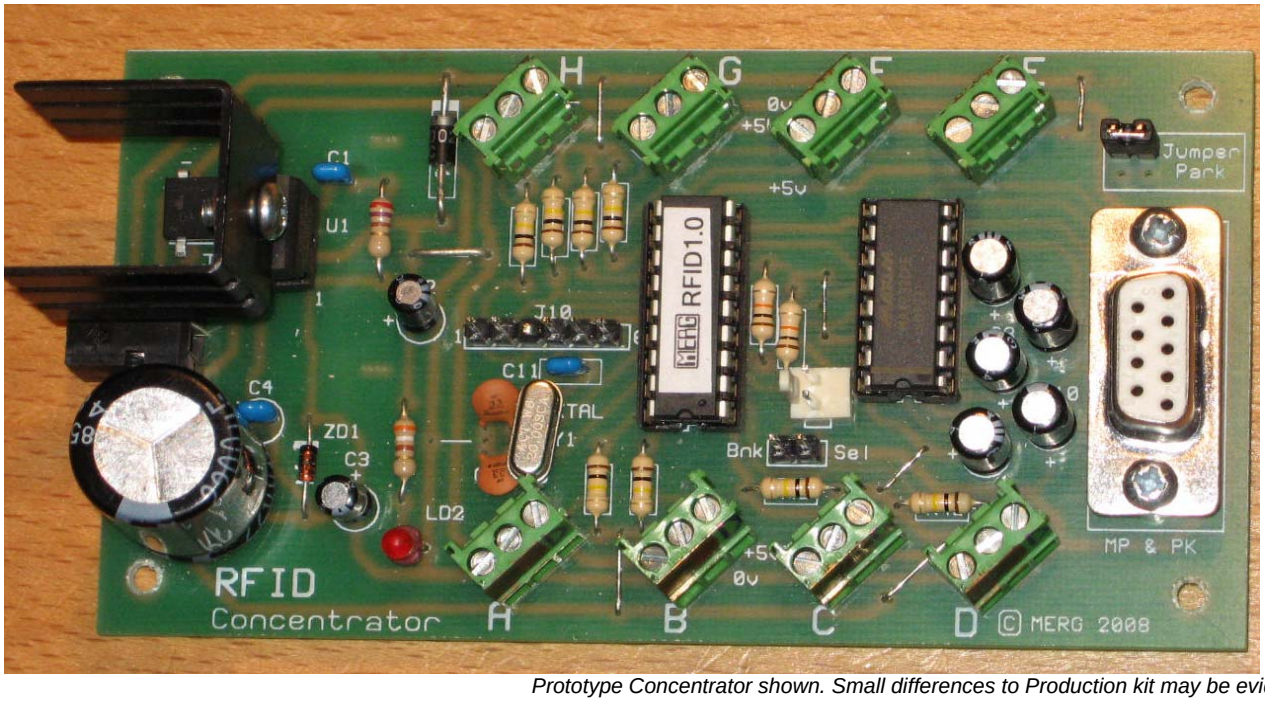
MERG Kit No.33 RFID 8 channel Concentrator

As with all kits, a thorough read through of the Instructions and other notes is recommended so that you have a good overall idea of the assembly, and any points needing special attention. This is particularly important with this kit if you are upgrading from the RFID Starter Kit as there are a number of modifications you will need to do to the Reader pcb that came with it. Integrated Circuits U2 and U3 are static sensitive. Do not remove them from their protective tubes until ready to install.

Kit Contents – see the reverse of the kit front label**.** Some larger components are 'carded' using the PCB. They *should* be correctly orientated but your kit packer is only human. They can be left in situ until needed but please follow the instructions below to ensure correct orientation before soldering.



Prototype Concentrator shown. Small differences to Production kit may be evident

Assembly Instructions

Heat Sink mounting. This is best tackled before populating the pcb with components. The heat sink is fixed to the PCB by three lugs, for which holes are needed. Three sets of closely-spaced holes have been drilled, but require opening to form slots approx. 1mm x 3mm. A sharp 1mm drill, with no more than 6mm protruding from a pin vice can be used to nibble away the remaining material until the lugs will enter all three slots. But *do not fit and secure the heatsink yet.*

Wire links. *With the heat sink location to the left*, there are 4 vertical, 2 horizontal, and 2 diagonal links to be fitted. They are identified by white lines between holes in the pcb. None are more than 0.3" long and can be cut from the resistor leads. Form to fit and solder in place.

Fit resistors R1(390R), R2(270R), R4a,b,c & d, R5a,b,c & d (all 8 items 100K), R3 and R6 (both 10K)

Fit diode D1 (1N4002) and Zener diode ZD1 (4v3), matching the end band to that on the printed overlay.

Fit the 5mm 2 wayTerminal Block J1, wire entries towards the edge of the PCB

Fit Bridge Rectifier D4 (BR1), with the AC (~ ~) markings towards the Terminal Block.
You may well need to use a magnifying glass to check the markings. Angle the face of the device under a good light until you can see the idents.

Fit the DIL IC sockets for U2 and U3, matching the 'bites' to those on the pcb overlay.

Fit the 2 x 2-way 0.1" Headers adjacent to R3 and R6. The white RST one above the black 'Bnk Sel' one

From the 6-way 0.1" black ICSP header J10, **extract one pin at position '3'** before fitting with the blank 'way' over the undrilled pad. *(The pin can be removed by a firm pull with a pair of pliers)*

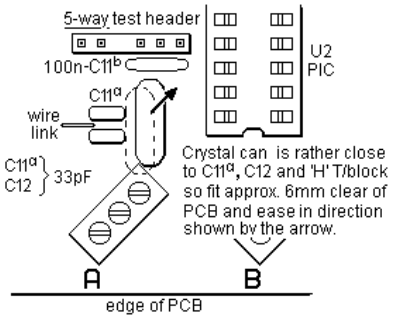
Fit the 2 black 2 pin headers as the 'Jumper Park'. These are included to provide a home for the bank jumper and RST jumper if not to be used.

Omitting C5 for the time being, fit the power supply electrolytic capacitors C2 and C3 (10uF/16v), observing polarity: the white stripe indicates the *negative* lead. The other (positive) lead is fitted adjacent to the '+' ident.

Fit electrolytic capacitors C6, C7, C8, C9, C10 (all 1uF/63v) and clustered around U2. All *must be correctly orientated* as for C2 and C3.

Fit C1 and C4 (100nF, marked 104): both are circular ceramic caps. and may be fitted either way round. *(C4 has a circular 'footprint' on the PCB with a polarity '+' sign. This can be ignored for this capacitor.)*

Now refer to the adjacent sketch for identifying the duplicated 'C11' capacitors and the extra care needed in fitting the components in this area. All may be fitted 'either way round': i.e., none are 'polarised'



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Fit C11^{b}, 100nF, adjacent to the 5-way pin header.

Fit C11^{a} and C12, both 33pF.

Then fit Crystal X1 at least 6mm clear of the face of the PCB. It is important that this does not foul the edges of the 33pF ceramic capacitors as a short may result. Once soldered, ease it as shown to be clear of C11^{a}, C12, and the 'A' terminal block when it is fitted.

Fit LED LD1, longer leg to the ' + ' pad. (LED could be wired away to a panel if desired.)

Fit the 8 3.5mm 3-way terminal blocks A to H, wire entries facing outwards. Readers will connect here.

Fit the 9-way 'D' socket. Although disconnections once the Concentrator is up and running should be infrequent, you may wish to cut short lengths of tube as spacers, and secure the connector with screws, spring washers and nuts.

Fit the large capacitor C5 (2200uF/25v), observing polarity.

Fit the Heat sink, bending the legs inwards just enough to secure it in place, making sure none will make contact with other component pads or tracks. Slot the LM317T Voltage Regulator, U1, into its pcb holes but do not solder yet. Its metal tag faces to the left side of the pcb and must be flat against the heat sink. If you have access to Heat Sink compound, add a trace to the metal face, then secure using screw, spring washer and nut. In the absence of the compound, make sure both faces are clean and free from anything that could prevent good thermal contact. Solder the three Regulator legs only *after* tightening the heatsink fixing nut.

Using a magnifying or eye glass, and working under a good light, check all soldered joints. A good joint will resemble 'Mount Fuji' with nicely curved sides: a dry joint is more like a tomato with a stalk ! If you find one (or more) touch with a clean iron and a trace of solder and make sure that it flows to fully 'wet' the solder pad. Check also for any solder bridges between closely spaced tracks (especially where they run between pads), and also for fine solder 'whiskers' between pads. (A very few adjacent pads are intended to be linked and have a copper track running between them.)

Do not install either of the Integrated Circuits until basic ‘power-on’ tests have been conducted.

Basic Testing.

When satisfied with the visual inspection connect a 9 - 12v AC or DC supply to the 2-way Terminal block J1, the lower the voltage the better as it will keep heat dissipation in the LM317 regulator to a minimum. 5.6V DC should then appear at the centre terminals of all 8 3-way terminal blocks, with respect to the outer terminals adjacent to the A – H lettering (0v). Should this not appear, trace back to the centre leg of the Voltage Regulator. (*you may ignore the 5v and 0v white markings on the pcb itself*)

Now check that 5.0v appears at the outer end of Diode D1. This diode reduces the main 5.6v supply for U2 and U3 only to 5v, leaving the slightly higher voltage to be fed out to the eight Readers. Diode D1 should not get hot. If it does then switch off the power and check for pcb shorts and orientation of all components.

If all is well, switch off the power supply and wait for at least ten seconds for C4 to lose its charge. *Inserting the two main ICs U2 ‘RFID1.1’ and U3 (MAX232) comes next and full electrostatic precautions must be observed.* Either using an electrostatic wrist strap or at least grounding yourself on a nearby radiator, carefully remove the ICs from their protective tubes and insert them into their DIL sockets. Ensure you match the 'bites' of socket and IC, check that all pins are inserted correctly and none are bent back under the IC. Switch the power back on, and recheck the 5.6v and 5.0v voltages as above.

This completes assembly of the Concentrator

Functional Testing.

Further testing and putting to work must wait on assembly and testing of at least one RFID Reader and Reader PCB (kit 31) which must be assembled as for use with a Concentrator and not for use with the RFID Starter Kit. The appropriate options are detailed in the Reader PCB Instructions (31ReaderPCBBuildIns1.doc)

IMPORTANT - If you are intending to reuse the Reader/PCB that you purchased/used with a Starter kit then follow the simple modifications in this paragraph. If not then you can skip to the next paragraph. Demount the Starter Kit Reader/PCB, disconnect it from its PSU and Output modules which can be stored in your spares box for reuse elsewhere. Recover the unused additional components that came with the kit and locate the 1N4148 diode D1 and 47uF/16v electrolytic capacitor C02. These must now be installed on the Reader pcb as detailed in the kit instructions and correct orientation is necessary. Take a 3mm dia drill and carefully drill out the pad marked 'X' so that diode D1 is no longer short-circuited. This can be checked with a multimeter set on its resistance range but ensure the black meter lead is at the banded end of the diode and the red lead on the unbanded end. You should find infinite resistance in this configuration. If not then check that the 'X' pad is properly removed.

Having got a usable Reader/PCB you can now conduct a simple functional test on the Concentrator. With the Concentrator power disconnected attach 3, 20cm long (8") wires to the Reader PCB pads marked V+ (red), 0v (black) and 'o/p' (yellow/orange) at the right hand end of the pcb. Connect the other ends to one of the Concentrator 3–way A – H terminal blocks, black wire to the outer terminal, red wire to the centre terminal and yellow/orange wire to the inner terminal. This must be correct to avoid damage to the expensive reader.

Reconnect Concentrator power and check that 5.6v can be measured across the V+ and 0v pads of the reader pcb. Additionally check that 5.0v can be measured across the 100nF ceramic capacitor C01 on the underside of the Reader pcb.

Take an RFID ID tag and pass it across the face of the RFID reader. If all is well the Reader LED will flash. If it does not then disconnect power, check all soldered joints on the Reader pcb and remove any potential shorts.

Putting to Work.

This requires a computer or other device capable of receiving ASCII data over a serial link and displaying the data. The output interface of the RFID Concentrator is a standard serial RS232 link which must be connected to a computer's COM port with a straight 9 way serial cable. If your computer only has USB ports then a suitable USB-to-RS232 converter must be used. The following applies to use with an IBM PC running Windows XP and its Hyperterminal program but other 'terminal' programs such as Tera Term work just as well. Hyperterminal is found in

Programs/Accessories/Communications

Open Hyperterminal and set up a new Connection. Configure it to use the COM Port to which you have connected the Concentrator and set the serial data rate to:

9600bps, 8 bits, no parity, hardware flow control

If a connection is successfully established, this will be shown in the lower left hand side of the screen. Connect power to the Concentrator and it should send '>' to the screen.

Pass a tag across the face of the RFID reader and check that the 'read indication' LED flashes. Hyperterminal should now display the channel ID of the Concentrator A-H input to which you have connected the reader and the ID of the tag you have chosen. Its protocol is:

ChID, 10 Alphanumeric characters, 2 checksum characters, *CR, LF*, > (*The final > character will appear at the start of the line below as carriage return (CR) and line feed (LF) are not visibly displayed.)*

This completes testing of your RFID Concentrator and you may now progress to installation on your layout.

Installation Notes

It is envisaged that your RFID Concentrator will be installed in a convenient central location on your layout within serial cable distance from your computer and, as seen above, the Readers connect to it with only three wires. Be aware that the frequency components of the RFID serial links and DCC train control systems (if used) share the same portion of the electromagnetic spectrum and therefore disabling cross interference to RFID communication could occur. Suitable consideration should therefore be given to the distance of the

readers from the Concentrator, the intended layout operating system (DC or DCC) and consequently the type of connecting cable to be used. Single pair cable with two internal 7/0.2mm conductors (+5v and serial data) and an overall screen (0v) might be advisable especially if routing RFID reader cables close to DCC busses. Suitable cable types could be Maplin XS23A or Rapid Electronics 02-0626. The Concentrator has been successfully tested with 45m of the latter cable connecting a reader.

Should you require more than 8 readers on your layout it is possible to employ a second Concentrator on a further COM port on your computer. The kit is designed with a bank jumper that, when linked on the second Concentrator, raises the channel ID range output from A – H to I – P.

The RST jumper is used for resetting the Concentrator in the event of its ceasing to function. Depending on the location of the Concentrator board when installed, you may wish to attach a momentary-contact RST pushbutton on a nearby panel rather than rely on the jumper. A 2-way housing and crimp connectors are included in the kit for this purpose.