

TECHNICAL TRAINING SOLUTIONS



ELECTRICAL COURSES

INSTRUMENTATION COURSES

MECHANICAL COURSES

ELECTRONIC FAULT FINDING

COURSE 570: 5 DAYS: Max 8 Candidates

Many specialised electronic circuits used in industry do not have modern replacements available. This course provides participants with the knowledge and skills necessary to fault-find electronic circuits like these to component level. It also provides the skills and knowledge required to understand electronic circuits and make repairs and modifications to them. It complements the Soldering Course (No 560).

PARTICIPANTS

The course is intended for those who have an electrical background and who wish to extend their work into the field of electronics. An eligibility assessment for access to this course is available on request.

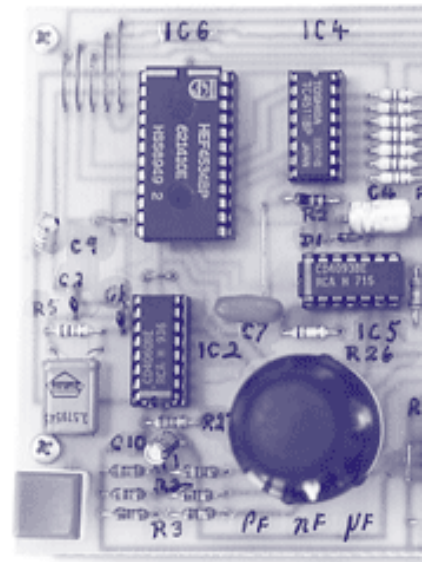
COURSE PRESENTATION

The course provides participants with an understanding of electronic components and how they would be used in electronic circuits. Participants then develop their knowledge and their testing, measurement and fault-finding skills on a range of industrial electronic circuits with switched faults, using oscilloscopes, logic probes and other test equipment to diagnose them. Comprehensive course notes are provided.

COURSE OBJECTIVES

On completion of the course, participants will be able to

- apply suitable precautions when working on electronic equipment (*anti-static precautions, electric shock hazards etc*)
- identify electronic components and read their values (*passive components, transistors, voltage regulators, ICs etc*)
- understand the operation of electronic components within circuits
- read electronic circuit diagrams
- use electronic test equipment to analyse circuits (*oscilloscopes, logic probes etc*)
- apply a systematic approach to fault-finding
- locate a range of faults to component level (*on a range of simple to complex electronic circuit boards*).



Successful completion of the course leads to the award of the Technical Training Solutions Certificate of Competence 570: Electronic Fault finding.

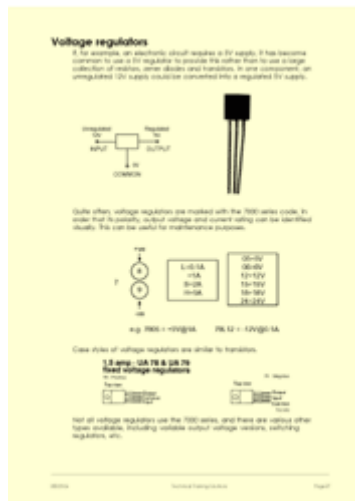
What do candidates on the Electronic Fault Finding course actually do?

We begin by analysing the full range of electronic components used in commercial and industrial equipment and get the candidates to think about how these devices would be used in various applications. We also look at the faults that these components might develop.

The following are some extracts from the course notes, showing how LEDs should be tested, how voltage regulators are commonly marked and how ICs should be inserted and extracted.



Page 30 of the course notes, showing how LEDs and diodes should be tested

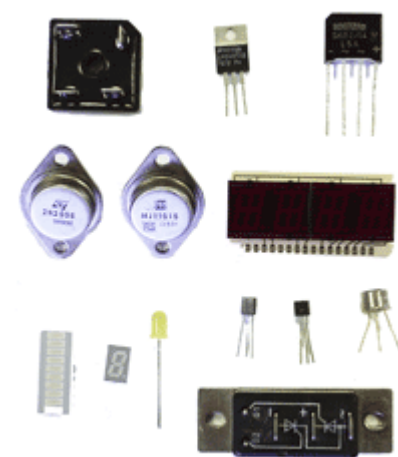


Page 37 of the course notes, showing how voltage regulators are typically marked and their common terminal layouts



Page 55 of the course notes, showing how ICs should be removed or inserted into IC sockets

We have a range of passive (resistors, capacitors, inductors etc) and active (transistors, diodes, LEDs, thyristors etc) demonstration components which the candidates inspect. Candidates are expected to read the values of the components and gain an understanding of how and where they would typically be used.



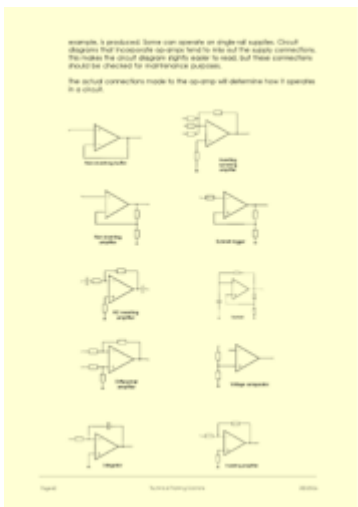
Candidates are shown a wide range of common passive electronic components. They are shown how to read the values of these components, where and how they would typically be used and they also use test equipment to confirm the serviceability of these components

Candidates are shown a wide range of common active electronic components.

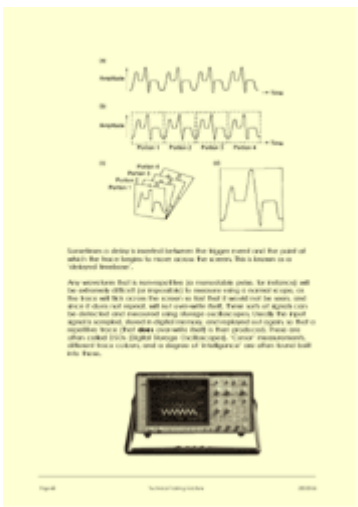
They are shown how to read the markings of these components, where and how they would typically be used, their common lead-outs and they also use test equipment to confirm the serviceability of these components

Candidates use a precision multimeter to make measurements of the various electronic components. From this they can confirm that the components are serviceable and that their values are as expected.

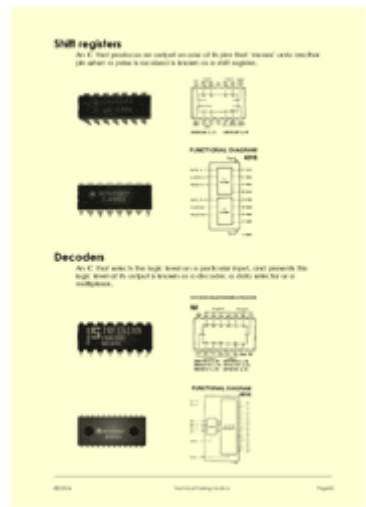
We then go on to look at op-amps, voltage comparators and other ICs. The various ways in which these are used is analysed. We also look at how oscilloscopes should be used. The following are some pages from this part of the course notes, showing how op-amps can be connected, how oscilloscopes should be set up and an explanation of some of the more common digital logic ICs like shift registers and decoders.



Page 60 of the course, showing the various configurations of op-amps



Page 68 of the course, showing how oscilloscopes should be triggered properly



Page 83 of the course, showing typical digital logic ICs like shift registers and decoders

We ensure that the candidates are able to use oscilloscopes properly, so that they can capture repetitive and single-shot signals correctly and make measurements of them.

This is one of our bench power supply units.

Candidates learn how to set the output voltage and current trip level correctly so that any damage to the circuit under test is avoided.



This is our arbitrary function generator.

We use this to feed a range of different signals to the candidates' scopes to ensure that they learn how to set up and use the oscilloscopes properly. Using this we can generate almost any sort of signal and we are especially interested to ensure they can capture single-shot events correctly.

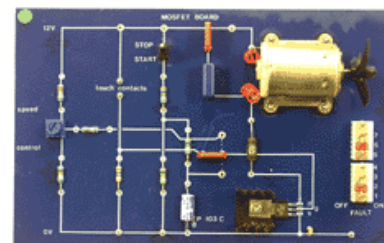
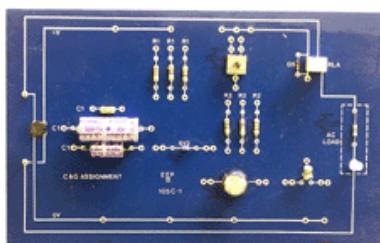


This is one of our digital storage scopes.

It's essential that the candidates gain the ability to use the oscilloscopes correctly.

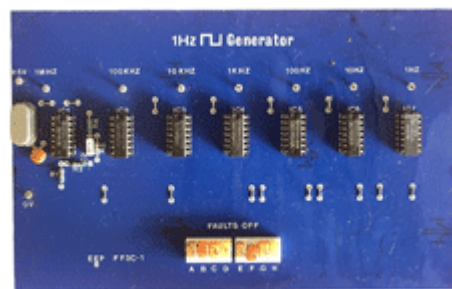


We use a range of circuit boards to explore the application of various components and candidates can thereby reinforce their knowledge of reading component values and how the components are used as well as gaining more experience of using the oscilloscopes to see what is actually happening in the circuits. Some of these boards have switched faults on them so that the candidates start to gain some fault-finding experience.

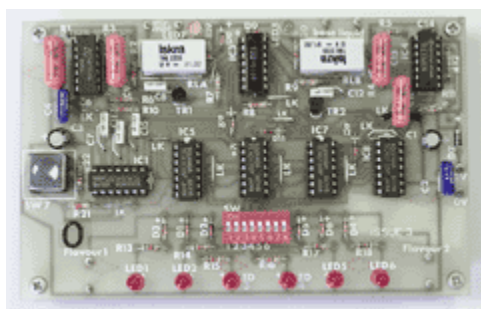


Candidates use a range of circuit boards to explore the function of the various electronic components. Some of these also have switched faults.

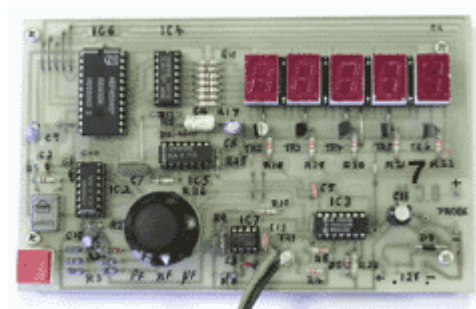
To help the candidates gain more experience of using the oscilloscopes we then introduce a fairly simple circuit that generates a range of different frequencies from 1MHz to 1Hz. We also use these to explore various fault finding strategies, in particular the half split fault finding method. They also provide a valuable introduction to the TTL Logic Family, since these boards use a crystal locked high frequency oscillator and a series of TTL binary counters. They also have switched faults so we can provide more experience of fault finding.



We then introduce some more complex circuit boards (used for many years in the City & Guilds 224 Electronics Servicing Course). The circuits for these are quite complex and candidates are expected to understand them fully, helping to strengthen their understanding of electronic circuitry. A range of faulty boards (10 of each board) provide candidates with the opportunity for more practice of their fault-finding skills. Two of these boards are shown here.

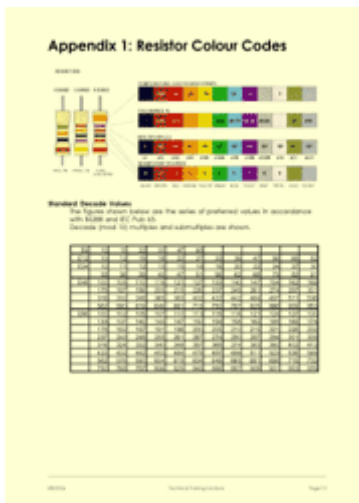


Candidates explore the workings of complex circuits incorporating IC timers, logic gates etc. There are 10 of these boards with different faults on and candidates can practice their fault-finding skills on these.

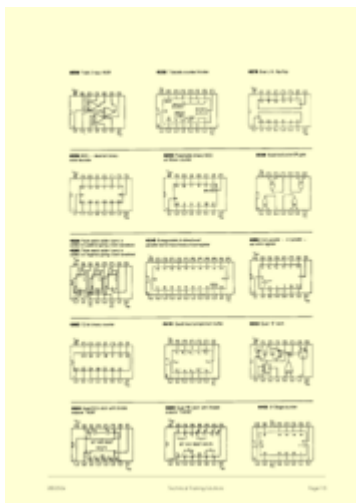


Candidates explore the workings of complex circuits incorporating voltage comparators, multiplexed display driver ICs, logic gates etc. There are 10 of these boards with different faults on and candidates can practice their fault-finding skills on them.

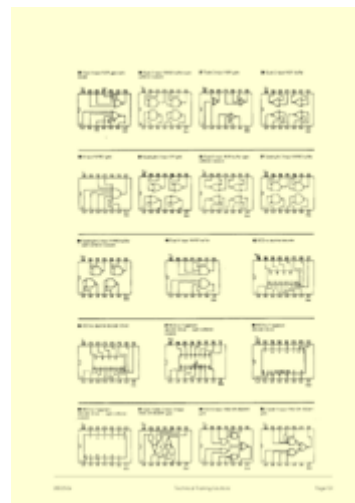
The course also provides candidates with a range of useful reference material, for example the resistor colour code and preferred values in the E6 to E96 sets, the pinout for the industry-standard CMOS 4000 series ICs and the 7400 series TTL Logic ICs.



Page 111 of the course notes, showing the resistor colour codes and preferred values in the E6 to E96 sets



Page 115 of the course notes, showing pin-outs for the industry standard CMOS logic IC series



Page 131 of the course notes, showing pin-outs for the industry standard TTL logic IC series

A variant on this course is used for training the entrants to the WorldSkills UK Electronics competition. The team selected from the winners of this goes on to compete in the World Skills Olympics Competition, held throughout the world every two years in locations like Canada, Japan, and Korea. The competition was held in London in 2011.

If you would like to see some of the equipment used on the electronics course for yourself, then please call us to arrange a visit to our offices in Kent. Alternatively, we can visit you anywhere in the British Isles.



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