

Accredited



# ICT LEVEL 1/2

UNIT R010 – Developing control systems

## DELIVERY GUIDE

VERSION 1 APRIL 2013



# CONTENTS

Introduction	Page 3
Unit R010 - Developing control systems	Page 4
Learning Outcome 1 - Be able to design control systems	Page 5
Learning Outcome 2 - Be able to implement control systems	Page 7
Learning Outcome 3 - Be able to test control systems	Page 8
Possible control system software	Page 8

To give us feedback on, or ideas about the OCR resources you have used, email [resourcesfeedback@ocr.org.uk](mailto:resourcesfeedback@ocr.org.uk)

**OCR Resources: the small print**

OCR's resources are provided to support the teaching of OCR specifications, but in no way constitute an endorsed teaching method that is required by the Board and the decision to use them lies with the individual teacher. Whilst every effort is made to ensure the accuracy of the content, OCR cannot be held responsible for any errors or omissions within these resources.

© OCR 2013 - This resource may be freely copied and distributed, as long as the OCR logo and this message remain intact and OCR is acknowledged as the originator of this work.

OCR acknowledges the use of the following content:  
Maths and English icons: Air0ne/Shutterstock.com

# INTRODUCTION

This Delivery Guide has been developed to provide practitioners with a variety of creative and practical ideas to support the delivery of this qualification. The Guide is a collection of lesson ideas with associated activities, which you may find helpful as you plan your lessons.

OCR has collaborated with current practitioners to ensure that the ideas put forward in this Delivery Guide are practical, realistic and dynamic. The Guide is structured by learning objective so you can see how each activity helps you cover the specification.

We appreciate that practitioners are knowledgeable in relation to what works for them and their learners. Therefore, the resources we have produced should not restrict or impact on practitioners' creativity to deliver excellent learning opportunities.

Whether you are an experienced practitioner or new to the sector, we hope you find something in this guide which will help you to deliver excellent learning opportunities.

If you have any feedback on this Delivery Guide or suggestions for other resources you would like OCR to develop, please email [resourcesfeedback@ocr.org.uk](mailto:resourcesfeedback@ocr.org.uk).

## PLEASE NOTE

The activities suggested in this Delivery Guide **MUST NOT** be used for assessment purposes. (This includes the Consolidation suggested activities).

The timings for the suggested activities in this Delivery Guide **DO NOT** relate to the Guided Learning Hours (GLHs) for each unit.

Assessment guidance can be found within the Unit document available from [www.ocr.org.uk](http://www.ocr.org.uk).

# OPPORTUNITIES FOR ENGLISH AND MATHS SKILLS DEVELOPMENT

We believe that being able to make good progress in English and maths is essential to learners in both of these contexts and on a range of learning programmes. To help you enable your learners to progress in these subjects, we have signposted opportunities for English and maths skills practice within this resource. These suggestions are for guidance only. They are not designed to replace your own subject knowledge and expertise in deciding what is most appropriate for your learners.

## KEY



English



Maths

# UNIT R010 - DEVELOPING CONTROL SYSTEMS

Guided learning hours : 30

## PURPOSE OF THE UNIT

This unit builds on Unit R001 and learners will need to apply the knowledge and understanding developed in that unit. This unit will enable learners to increase their knowledge and understanding of control systems and to develop valuable transferable logical skills.

Control systems form part of everyday life. For example, they are used in games consoles, street lamps, domestic appliances, transport systems, alarm systems, manufacturing systems and theme park rides. Exposure to real life examples of control systems will really aid learners' understanding of control systems, and educational trips are encouraged.

On completion of this unit learners will be able to explore the different components which can be used to build control systems and the rules which are written to ensure they work properly, and be able to communicate technical concepts effectively using terminology appropriately. Learners will build working control systems using either real components or simulation software to show they understand the concepts.

<b>Learning Outcome - The learner will:</b>
LO1: Be able to design control systems
LO2: Be able to implement control systems
LO3: Be able to test control systems

## LEARNING OUTCOME 1 – BE ABLE TO DESIGN CONTROL SYSTEMS

Suggested content	Suggested activities	Suggested timings	Possible relevance to
1 What is a computer control system? 	Teachers could explain what a computer control system is and the fundamentals behind them – INPUT, PROCESS, OUTPUT. The concept of data logging could be explored first where computers are used to record data from different sensors, to illustrate the concept of input. Then move on to discuss how the collected data could be used, in real time, to control different electronic devices (output) if criteria are met (processing). Some basic control systems at this point could be explored, for example a PIR sensor controlling a light. An outcome of the activity is an expectation that learners can talk about control systems with some confidence.	2 hours	R001: Understanding computer systems
2 Sensors 	Learners could research different sensors which could be used to input data into a control system. Worksheets with pictures could be provided or real life examples could be used to support this learning. The learners need to appreciate what conditions can be sensed by each and the data as a result which will be input into the control system. An outcome of the lesson is an expectation that learners will be able to select and justify appropriate sensors when designing their own control systems. Light, temperature, sound, position and pressure sensors, amongst others, could be explored.	2 hours	R001: Understanding computer systems
3 Actuators 	Learners could identify actuators which could be used as an output from a control system. Worksheets with pictures could be provided or real life examples could be used to support this learning. The learners need to appreciate what output will be generated by each device. An outcome of the lesson is an expectation that learners will be able to select and justify appropriate sensors when designing their own control systems. Motors, buzzers and LEDs, amongst others could be explored.	2 hours	R001: Understanding computer systems
4 The use of variables within control systems 	Variables are used to store inputs and are used in comparison against fixed values. Learners could practice writing statements to compare variables against fixed conditions. Teachers could explain about relational operators (<, >, =, >=, <=, <>) as well as Boolean operators (AND, OR, NOT) so that complex conditions can be written.	1 hour	R002: Using ICT to create business solutions
5 The role of feedback within control systems	The concept of feedback loops within control systems could be taught where the system is constantly monitoring input from sensors and making changes. A green house, central heating or manufacturing control system could be explored here, where input from sensors is being continually compared to fixed values and adjustments being made to the actuators so that conditions are kept stable.	1 hour	

Suggested content	Suggested activities	Suggested timings	Possible relevance to
6 The use of control systems within society  	Once the underlying theory of control systems has been taught learners could broaden their knowledge and explore a wide range of different real life control systems. The properties of each, (sensors used, data input, processes, output, feedback and actuators controlled), benefits and impacts of their use could be noted. Security systems, environmental control, safety systems, CAM, robotics are a few control systems which could be looked at. Visits to local factories and seeing control systems in real life would be best, however this is not always logistically possible. Other ways of exposing learners to control systems could be through videos from the internet or television programs including 'How It's Made' and 'How Do They Do That!'.	1 hour	R001: Understanding computer systems
7 Use block diagrams to define and represent control systems	Teachers could explain how to construct block diagrams to show the key inputs, processes and outputs which occur in a control system. Practice is the way forward where learners draw diagrams for control systems. These could be for real examples looked at earlier in the unit or for hypothetical ones proposed on a worksheet. Learners could practice drawing diagrams from user requirements. This could be taught later in the unit after learners have practised identifying user requirements from a given brief.	1 hour	R002: Using ICT to create business solutions  R008: Introduction to programming
8 Design sets of instructions for control systems  	Flow charts are an obvious way to plan the instructions which will be used within a control system and learners could be taught how to construct them. Standard notation could be presented and learners could be given the opportunity to practice drawing the diagrams. Structured English/pseudo code could also be taught as an alternative way of designing the instruction sets.	3 hours	R008: Introduction to programming
9 Identify success criteria for control system designs  	Learners could practice reading briefs and pulling out what the user requires the control system to be able to do. They could also practise proposing a control system including the justification of components in different scenarios. Pairing stronger learners with weaker ones during this activity may lead to some peer learning.	1 hour	R001: Understanding computer systems  R002: Using ICT to create business solutions  R008: Introduction to programming

## LEARNING OUTCOME 2 - BE ABLE TO IMPLEMENT CONTROL SYSTEMS

Suggested content	Suggested activities	Suggested timings	Possible relevance to
1 Implement control systems from designs which use a range of sensors and actuators 	Learners could identify some designs to copy to help them learn particular software. Learners could then try to extend the designs using prompts on a worksheet or implement some of the practice designs worked on in LO1. Real kit would provide the best learning experience however there are lots of simulation software available if components and interface boards are not available.	3 hours	R008: Introduction to programming
2 Be precise in framing instructions	During practice work, learners will quite quickly realise that if they enter instructions without precision then the control system is likely not to function properly. Learners could adopt more efficient ways of framing instructions and could be taught the concept of subroutines. Subroutines reduce the need for repetitive instructions and could be demonstrated with a class decision.	2 hours	R008: Introduction to programming

## LEARNING OUTCOME 3 - BE ABLE TO TEST CONTROL SYSTEMS

Suggested content	Suggested activities	Suggested timings	Possible relevance to
1 Devise test plans to ensure functionality of control systems.	Learners could be introduced to the concept of testing and why it is important. They could be shown how to produce a test plan and how to document testing which has taken place. Teachers could explain that testing needs to fully examine any conditions and test the control system with normal, abnormal and extreme data. Learners could practice writing some simple test routines for everyday life activities for example testing if a cup of tea is correctly made.	1 hour	R005: Creating an interactive product using multimedia components  R007: Creating dynamic products using sound and vision  R008: Introduction to programming

## POSSIBLE CONTROL SYSTEM SOFTWARE

Software	Website
Yenka Technology	<a href="http://www.yenka.com/technology/">http://www.yenka.com/technology/</a>
Logicator v7	<a href="http://www.logicator.co.uk/">http://www.logicator.co.uk/</a>
Flowol v4	<a href="http://www.flowol.com/">http://www.flowol.com/</a>
Picaxe	<a href="http://www.picaxe.com/">http://www.picaxe.com/</a>

[cambridgenationals.org.uk](http://cambridgenationals.org.uk)

## Contact us

Staff at the OCR Customer Contact Centre are available to take your call between 8am and 5.30pm, Monday to Friday.

Telephone 02476 851509

Email [cambridgenationals@ocr.org.uk](mailto:cambridgenationals@ocr.org.uk)

