

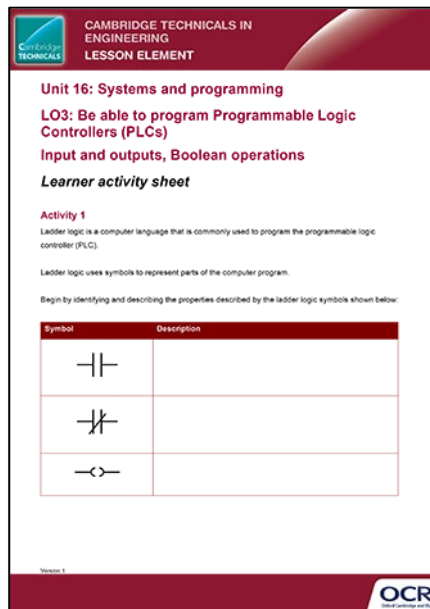
## Unit 16: Systems and programming

### LO3: Be able to program Programmable Logic Controllers (PLCs)

#### Input and outputs, Boolean operations

#### *Instructions and answers for teachers*




*These instructions should accompany the OCR resource 'Input and outputs, Boolean operations' activity which supports Cambridge Technicals in Engineering Level 3.*



The screenshot shows a lesson element page with the following content:

**Unit 16: Systems and programming**  
**LO3: Be able to program Programmable Logic Controllers (PLCs)**  
**Input and outputs, Boolean operations**  
**Learner activity sheet**

**Activity 1**  
 Ladder logic is a computer language that is commonly used to program the programmable logic controller (PLC).  
 Ladder logic uses symbols to represent parts of the computer program.  
 Begin by identifying and describing the properties described by the ladder logic symbols shown below.

Symbol	Description
	
	
	

Version 1

**OCR**  
Oxford Cambridge and RSA

#### **The Activity:**

For Activity 1 learners are required to identify and describe three ladder logic symbols.

In Activity 2 learners are required to complete truth tables for common logic functions/Boolean operations and draw their ladder logic equivalent.

#### **Suggested timings:**

1 hour

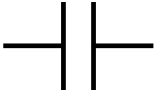


## Activity 1

For Activity 1 learners are required to identify and describe three ladder logic symbols.

Learners may require some introduction to ladder logic, including the concept of input contacts and outputs (coils). The relationship between ladder logic and conventional relay logic might also require explaining.

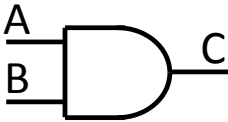
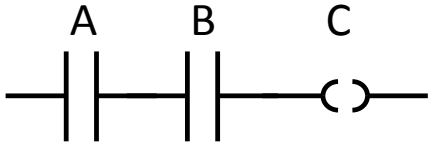
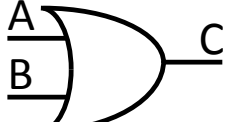
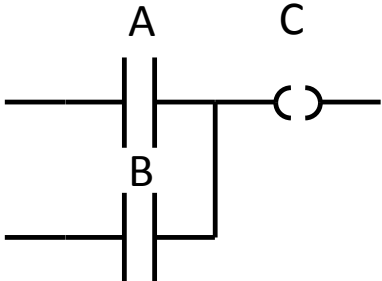
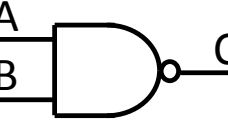
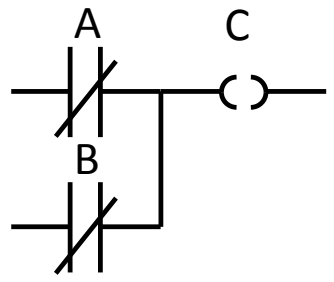
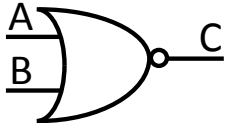
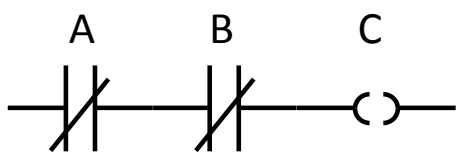
This activity is therefore complementary to teaching the fundamentals of ladder logic.

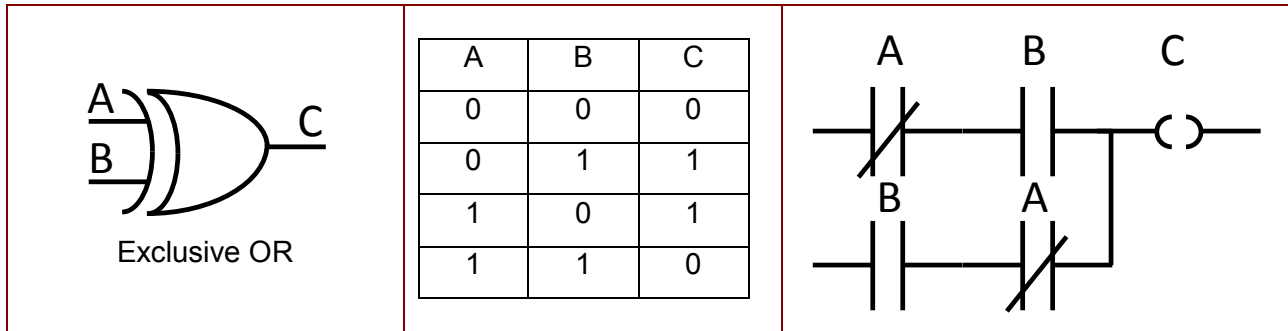
The three symbol types are explained below. Learners will be required to use these in Activity 2.

Symbol	Description
	A regular contact - closed when its corresponding input is energised.
	A NOT contact – closed when its corresponding input is not energised.
	A regular coil – energised whenever its rung is closed.

### Activity 2

In Activity 2 learners are required to complete truth tables for common logic functions/Boolean operations and draw their ladder logic equivalent. Learners may already be familiar with these logic/Boolean operations from previous work. A recap may be required. Solutions are given below.

Logic Diagram/Boolean Operation	Truth Table	Ladder Logic Equivalent Diagram															
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Teachers could extend this activity with the addition of further combinational logic problems to be performed using ladder logic.

Learners could use simulation software to test the operation of ladder logic solutions, or run these on a physical programmable logic controller (PLC).

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