

**EDEXCEL NC/D ENGINEERING
PROGRAMMABLE LOGIC CONTROLLERS
UNIT 25
ASSIGNMENT 2 PROGRAMMING TECHNIQUES**

NAME:

I agree to the assessment as contained in this assignment. I confirm that the work submitted is my own work.

Signature

Date submitted

On completion of this unit a learner should:

- 1 Understand the selection, hardware and software requirements of a programmable controller
- 2 Be able to use programming techniques to produce a program for a modern programmable controller
- 3 Understand complex programmable controller applications
- 4 Understand data communications media and networks used with modern programmable controllers.

FEEDBACK COMMENTS

This assignment can contribute to achieving P2, P3, M1, M2 and D1.

Grade Awarded:

Assessor Signature _____

Date: _____

Internal verifier Signature _____

Date: _____

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Grading criteria		
To achieve a pass grade the evidence must show that the learner is able to:	To achieve a merit grade the evidence must show that the learner is able to:	To achieve a distinction grade the evidence must show that the learner is able to:
<p>P1 describe the selection criteria and a practical application for a unitary, a modular and a rack-mounted programmable controller</p> <p>P2 explain the system hardware and software requirements for a programmable controller application</p> <p>P3 use a programming method to produce, store and present a program that demonstrates the full range of instruction types</p> <p>P4 explain the program documentation that has been used for a complex engineering application</p> <p>P5 describe the importance of health and safety when working with programmable controlled equipment</p>	<p>M1 select and describe the benefits and limitations of a programmable controller for a specific application</p> <p>M2 justify the choice of a specific programming method and the methods used to produce, store and present the program</p> <p>M3 compare two different networks used for a modern programmable controller system.</p>	<p>D1 evaluate program documentation used to control an automated machine/process and make recommendations for improvement</p> <p>D2 compare the current capabilities and limitations of a programmable controller and identify possible areas of future development.</p>

Grading criteria

To achieve a pass grade the evidence must show that the learner is able to:	To achieve a merit grade the evidence must show that the learner is able to:	To achieve a distinction grade the evidence must show that the learner is able to:
P6 explain how one example of each of the three types of communication media would be selected for a specific programmable controller application P7 describe a network and relevant standards and protocols used for a modern programmable controller system.		

PROGRAMMING TECHNIQUES

PART 1 EXERCISE

Complete the six worksheets and produce the evidence of having completed them along with all diagrams and documentation in a folio.

The first 5 worksheets are designed to be used with the Bytronics - Ladsim software. Worksheet 6 is designed to use the PneusimPro software. Tutors may modify this assignment to suit the equipment and software available.

1. Timers
2. Counters
3. Registers)
4. Car Park
5. Traffic lights
6. SFC programme

WORKSHEET 1

TIMERS

STUDENT NAME _____ DATE _____

On completion of this assignment you should be able to programme a simple timer sequence into a PLC. This will be done with the Bytronics simulation software.

Consider a machine which has to insert a component into a heat treatment oven for a fixed time and then remove it.

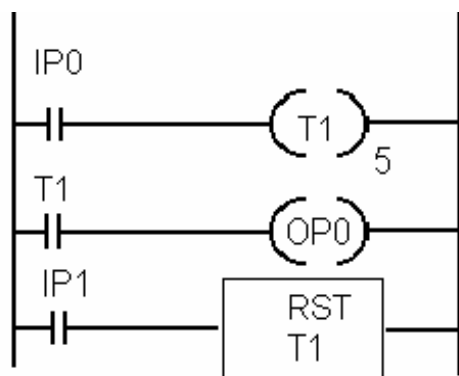
The timer used is tagged T1

The input used to start the timer is tagged IP0

The input used to reset the timer is tagged IP1

The output is tagged OP0

LADDER DIAGRAM



EXPLANATION

When IP0 is closed the timer starts running. After 5 seconds the timer contact closes and switches on output OP0. If IP1 is closed, the timer is reset.

STUDENT EXERCISE

Enter the above programme into your PLC and test it using the DEBUGGER under simulation. When you are satisfied, have it verified by your tutor on the accompanying verification sheet. Enter the details in your folio.

Note that the timer stays on until reset. In other types of PLCs the timer may be automatically reset by opening the contacts of IP0. Demonstrate that this does not happen here.

Verification

Signature of tutor _____ Date _____

WORKSHEET 2

COUNTERS

STUDENT NAME _____ **DATE** _____

On completion of this assignment you should be able to enter a simple counter programme into a PLC. This will be done with the Bytronics simulation software.

A counter might be used to count up or count down and then activate a contact. Note that when entering the counter data you must choose up or down and enter the number of counts.

When counting down, you must also enter a number in the accumulator equal to or smaller than the count. The contacts close when the accumulator is decremented to zero.

When counting up, you should have zero in the accumulator and the contacts close when the accumulator is incremented to the same value as the number of preset counts.

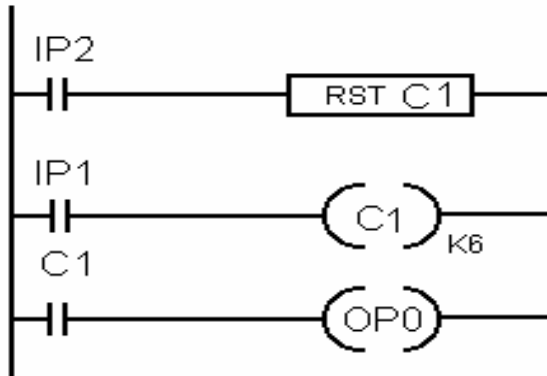
The counter used is tagged C1

The input used to reset the counter is tagged IP1

The input used to count components is tagged IP2

The output used to start the packaging routine is tagged OP0.

LADDER DIAGRAM



EXPLANATION

When contact IP2 is closed the counter is reset to zero. Each time contact IP1 is closed the count is decremented or incremented by 1 depending on whether you set the counter as an up counter or a down counter. When the count is completed, the counter contacts close. When the counter contact closes, OP0 is switched on.

STUDENT EXERCISE

Enter the above programme into your PLC and test it by running the DEBUGGER. Observe the count and accumulator numbers as you open and close IP1. Observe that when the count reached 6 OP0 is activated. Observe closing IP2 resets the counter. When you are satisfied, have it verified by your tutor to sign below.

Verification

Signature of tutor _____ Date _____

WORKSHEET 3

REGISTERS

STUDENT NAME _____ DATE _____

On completion of this assignment you should be able to

- programme a register into a PLC and shift the register.
- monitor the contents of the register.
- understand how a pattern represents a 3 digit binary decimal coded number (BCD)

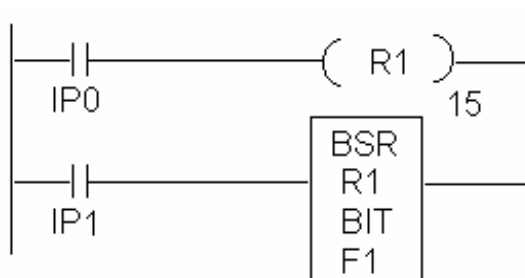
You will use the Bytronics simulation software.

REGISTERS

Typical Uses

Converting a pattern into a BCD and performing numeric operations. See typical examples in the PLC manual.

EXPLANATION



EXPLANATION

Rung 1 shows contact IP0 connected to a register. You must specify the bit to change when IP0 is closed. In this case bit 15 which is the MSB. If IP0 is closed bit 15 is high, if open it is low.

Rung 2 shows IP1 followed by a command BSR (Bit Shift Right). Every time IP1 is closed all the bits are shifted right.

The LSB falls off the end and the MSB is replaced by a 1 or a 0 depending on the state of IP0. Each time a right shift is done with bit 15 being replaced by a 0, the binary number is divided by two.

If BSL is used (Bit Shift Left), all the bits are shifted left with the LSB being replaced by a zero, the binary value is doubled.

Enter the above programme and run the DEBUGGER. Observe the register contents as you open and close IP0 and IP1. When you are satisfied, have it verified by your tutor to sign below.

Verification

Signature of tutor _____ Date _____

WORKSHEET 4

CAR PARK

STUDENT NAME _____ DATE _____

Using the Bytronics software, produce a ladder logic programme for the car park simulation.

You will need to use

- Timers.
- Up counters.
- Down counters.
- Latches.

Demonstrate the system working.

Produce a printout of the ladder diagram.

Get your tutor to verify the programme by signing below.

Verification

Signature of tutor _____ Date _____

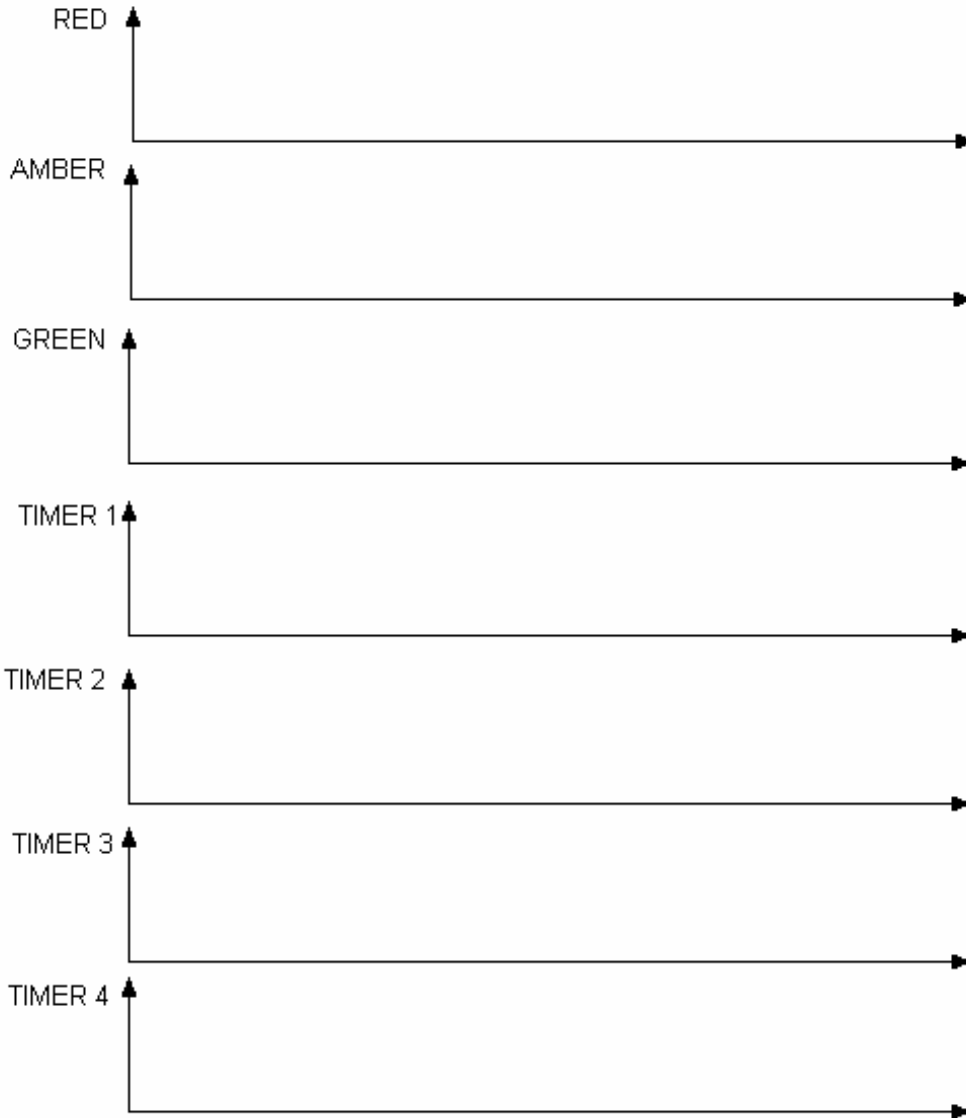
FEED BACK COMMENTS

WORKSHEET 5

TRAFFIC LIGHTS

STUDENT NAME _____ DATE _____

Using the Bytronics software, produce a ladder logic programme for the TRAFFIC LIGHT SIMULATION. Use only timers to produce the control. *Produce a neat timing diagram below and explain your method fully.*



Verification

Signature of tutor _____ Date _____

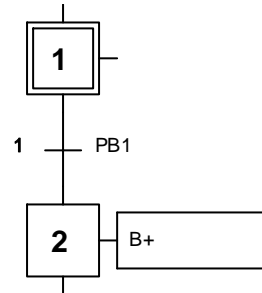
WORKSHEET 6
GRAFSET (SFC) PROGRAMMING.

Introduction to PneuSim Pro

STUDENT NAME _____ DATE _____

Grafset (sequential functional chart) is a method of programming PLC's that is gaining in popularity but few PLC manufacturers have produced software to enable it to be done this way. The method is easiest to use with machines that go through a fixed sequence of operations with feed back after the completion of each step to confirm that it has happened but it is possible to do more advanced things as well. There is an international body that is setting standards so that all PLC will respond in the same way to a programme. A useful website to visit is <http://www.lurpa.ens-cachan.fr/grafset.html>.

The chart starts with an initial step shown as a double box. This is followed by a transition state and here you must enter the tag (PB1) of the input switches that must be activated in order to proceed. In this case PB1 (Push Button 1) must be pressed before you can proceed to step 2. This is followed by the next step (2) and to this is attached an action box. This switches on outputs of the PLC. In the action box you must enter the action to be taken, in this case to switch on a solenoid with a tag B+.



If you want two things to happen together you attach a second action box.

At the end of the programme you must connect the end to the beginning to complete the sequence and make it repeat. The attached circuit shows a simple programme for operating two pneumatic cylinders. The circuit was created on the computer package called PneusimPro and available with Automation Studio. With this package you can simulate the system to see if it really works. For details go to this web site <http://www.automationstudio.com/EDUC/index.htm>

In this kind of circuit it is normal to tag the actuators A, B, C etc. Plus + means extend, minus - means retract. These tags are allocated to the solenoids that produce the required action. The sensors are located at the two positions of each cylinder and are tagged A0 for the retracted position and A1 for the extended position and so on for each cylinder.

YOUR TASK

After experimenting with PneusimPro to find your way around the system, create the circuit diagram attached and run the simulation. When you have done this, modify the SFC to create the sequence allocated to you from the table below. Brackets indicate simultaneous operation. Each movement must be confirmed by feedback.

Demonstrate your circuit working and print off a copy of your circuit. Get your work verified.

Verification

Signature of tutor _____ Date _____

- SEQUENCE 1 A+, B+, B-, A-, (B+ and A+), (B- and A-)
- SEQUENCE 2 A+, A-, (B+ and A+), B-, A-
- SEQUENCE 3 A+, (A- and B+), A+, (A- and B-)
- SEQUENCE 4 B+, B-, (A+ and B+), A-, B-
- SEQUENCE 5 B+, A+, (A- and B-), (A+ and B+), A-, B-
- SEQUENCE 6 B+, A+, A- (A+ and B-), A-
- SEQUENCE 7 A+, B+, B-, (A- and B+), B-
- SEQUENCE 8 A+, A-, (A+ and B+), A-, B-
- SEQUENCE 9 A+, (A- and B+), (B- and A+), A-
- SEQUENCE 10 B+, B-, (B+ and A+), A-, B+

