higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

STORED PROGRAMME SYSTEMS
NQF LEVEL 3

(10040103)

2 March 2018 (X-Paper)
09:00–12:00

This question paper consists of 8 pages.

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TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions.
2. Read ALL the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. All drawings must be correctly labelled.
5. All terminals should be correctly numbered.
6. All symbols must be drawn according to the IEC standard.
7. Write neatly and legibly.

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QUESTION 1

1.1 A PLC unit is essentially a microcomputer, tailored specifically for certain industrial control tasks, made up of hardware, firmware and software.

Briefly explain each of the following:

1.1.1 Hardware

1.1.2 Firmware

1.1.3 Software

(3 × 2) (6)

1.2 Name the FIVE major sections found in a PLC unit. (5)

1.3 Draw the PLC three-step scanning process. (4)

[15]

QUESTION 2

2.1 Study FIGURE 1 and the system operation description below and answer the questions.

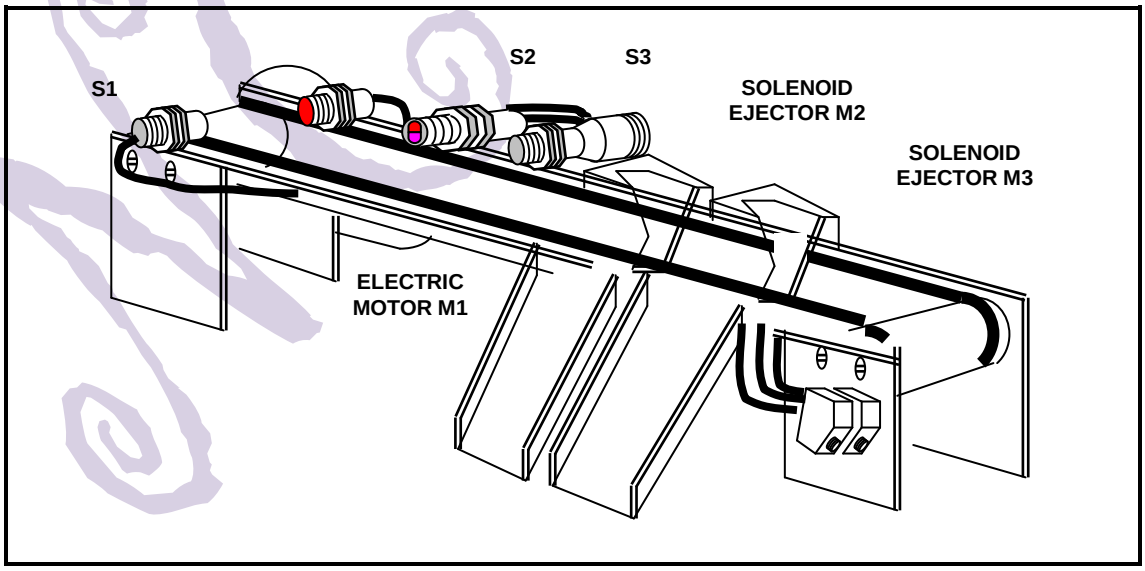


FIGURE 1

System operation:
The application has three types of sensors: S1 to start the conveyor belt when a work piece is detected (metallic, red or black), S2 to detect a red work piece to be ejected, and S3 to eject a metallic work piece allowing the black work piece to run off the conveyor.

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2.1.1 What type of sensor is S1? (1)

2.1.2 Explain how the sensor in QUESTION 2.1.1 works. (2)

2.1.3 What type of sensor is S2? (1)

2.1.4 Explain how the sensor in QUESTION 2.1.3 works. (2)

2.1.5 What type of sensor is S3? (1)

2.1.6 Explain how the sensor in QUESTION 2.1.5 works. (2)

2.2 The sensor is essentially used to gather information on the status of the machine using contact type sensors where physical contact takes place, or proximity type sensors where no physical contact is apparent, and sends information to the system controller which is indicated in the wiring/connection diagram as symbols.

Draw the IEC symbols that represent each of the following proximity sensors:

2.2.1 The magnetic sensor

2.2.2 The capacitor sensor

2.2.3 The inductive sensor

2.2.4 The photo-electric sensor

2.2.5 The ultrasonic sensor

(5 × 1) (5)

2.3 Demonstrate, by means of a drawing, how two of the above proximity sensors are connected to a PLC input. (6)

[20]

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QUESTION 3

3.1 Give FOUR reasons for having an installation check list. (4)

3.2 Explain the purpose of the terminal allocation list. (2)

3.3 Study FIGURE 2 below. Determine the terminal allocation list that will link the gravity-feeder ejecting process via the terminal rack X1 to the PLC.

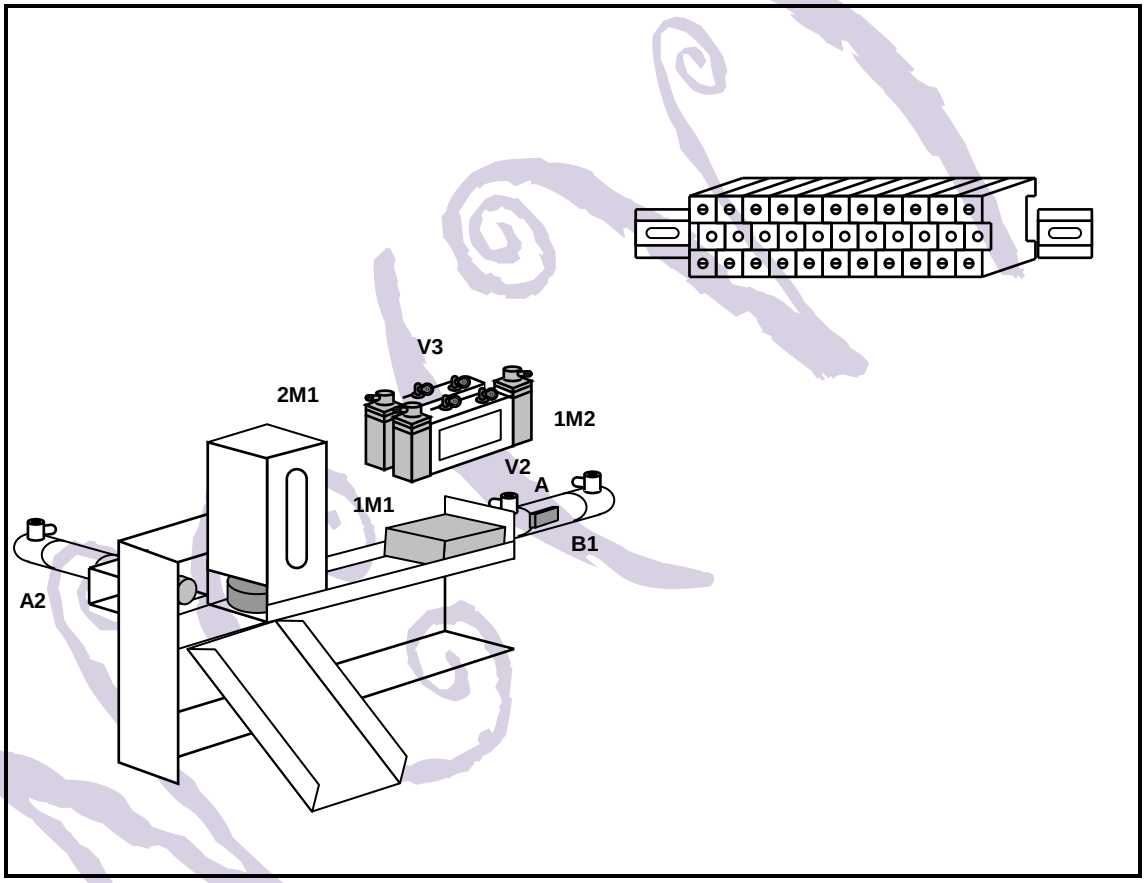


FIGURE 2 (7)

3.4 Study FIGURE 3 below. Draw the PLC electrical wiring/connection diagram.

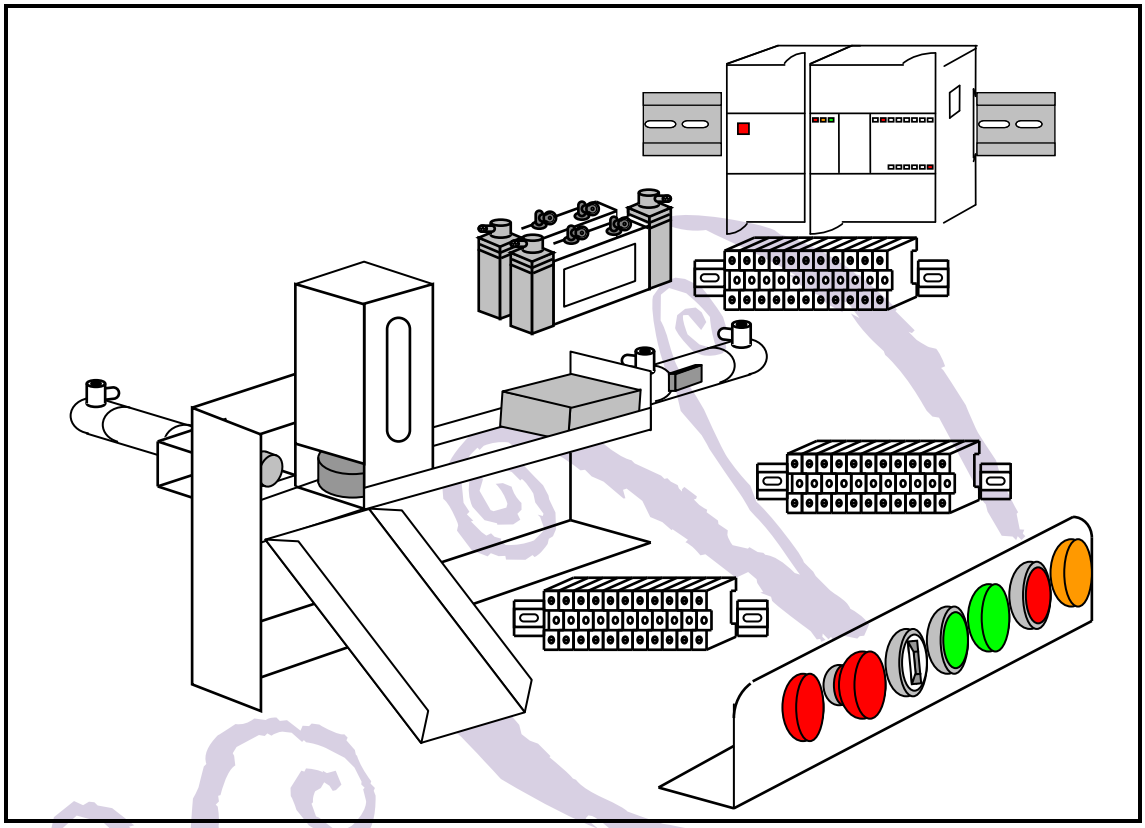


FIGURE 3

(7)
[20]

QUESTION 4

4.1 Write the sub-ladder program of a PLC automated sorting system that will count SIX work pieces.
Stop a conveyor belt after a 10-count has been reached.
Turn on a flashing indication lamp.
After 10 seconds the flashing lamp must go out and the conveyor belt must restart.

NOTE:
The requested program must use auxiliary relay as a starting point.
The starting/stopping and indication lamps are not required. Answer only what has been asked. (8 × 1) (8)

4.2 Explain what type of programming is used to automate an application. (2)

4.3 Different virtual component symbols are used in the creation of a PLC program.

Draw the virtual symbols used to represent each of the following field components:

4.3.1 Push button normally open

4.3.2 Motor control coil

4.3.3 Solenoid valve

4.3.4 Indication lamp

4.3.5 Push button normally closed

(5 × 1) (5)

4.4 Study FIGURE 4 below. Modify the ladder program controlling of a conveyor belt system so that the program no longer is a one-shot fed program but an automatic fed program.

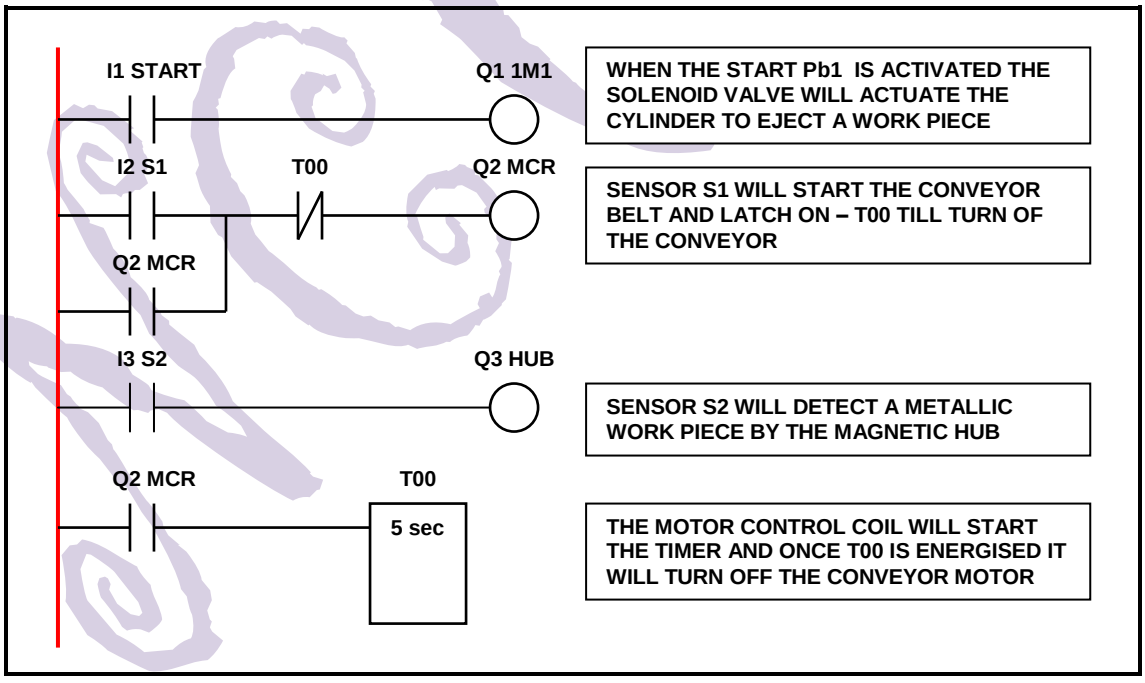


FIGURE 4 (5)

4.5 Write a PLC ladder program that will meet the following outcome:

A red hazard light will flash when the safety relay is de-energised. (5)

4.6 State FIVE of the PLC programming rules to be used when programming in ladder language. (5)

[30]

QUESTION 5

5.1 Draw up a check list that is relative to an automated system commissioning procedure. (6 × 1) (6)

5.2 Explain the checks that must be done when programming a PLC controlled system. (3 × 2) (6)

5.3 Give THREE guidelines for preventative maintenance. (3 × 1) (3)

[15]

TOTAL: 100

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