higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

STORED PROGRAMME SYSTEMS
NQF LEVEL 3

(10040103)

13 November 2018 (X-Paper)
09:00–12:00

This question paper consists of 7 pages.

NCS01

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. Write neatly and legibly.

NCV

QUESTION 1

1.1 Briefly explain the function of the following PLC terminology:

1.1.1 PLC processing unit

1.1.2 PLC Input interface

(2 × 2) (4)

1.2 Draw a labelled block diagram that represents a PLC unit. (5)

1.3 A mechatronic system using a stored program system consists of three parts, namely the operator panel, the control panel and the machine/technical system.

Briefly explain the purpose of the operator panel under the following headings:

1.3.1 Input devices

1.3.2 Indication lamps

1.3.3 Human machine interface

(3 × 2) (6)

[15]

QUESTION 2

2.1 What are the detecting characteristics of an inductive sensor? (2)

2.2 What is the range of the measuring distance of the inductive sensor? (1)

2.3 What is the range of the measuring distance of the capacitive sensors? (1)

2.4 What are the detecting characteristics of the ultrasonic sensor? (2 × 2) (4)

2.5 Draw a sketch showing how an ultrasonic sensor can be used to measure the grain level in a container? (2 × 2) (4)

2.6 Briefly explain why you would choose a photoelectric sensor over an inductive sensor to start a conveyor belt when the work pieces consist of various colours and materials. (2 × 2) (4)

2.7 Draw a fully labelled symbol of an ultrasonic sensor. (4)

[20]

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QUESTION 3

FIGURE 1, indicates a technical system consisting of three separate sections including an operator panel, a control panel and a sorting conveyor material transfer system.

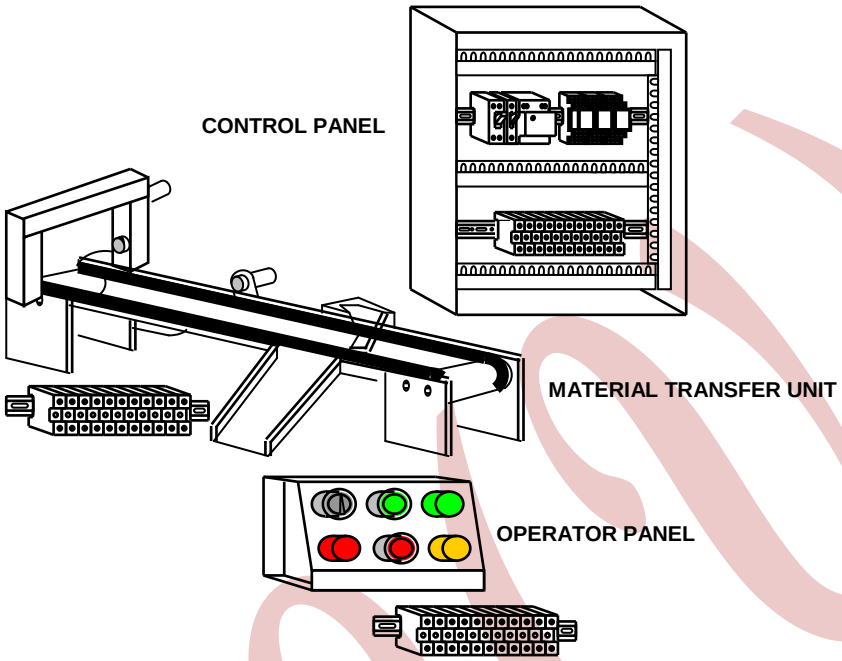


FIGURE 1

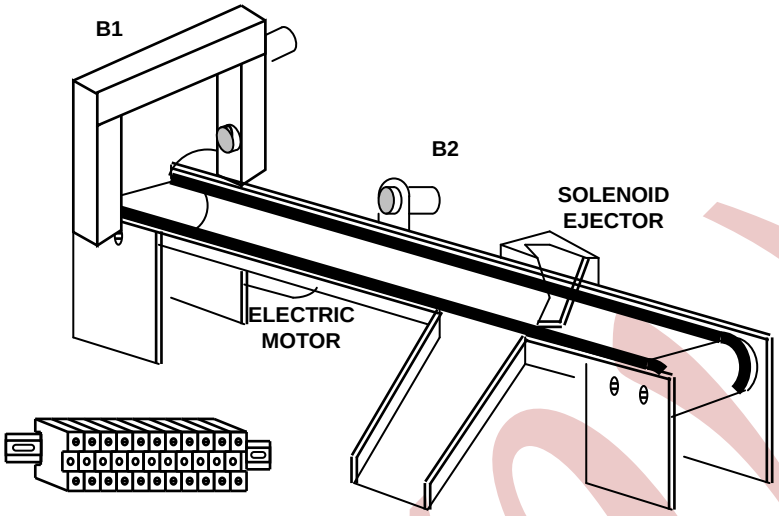
3.1 Briefly explain the purpose of the operator panel. (2 × 2) (4)

3.2 Briefly explain the purpose of the terminal rack on the conveyor belt material transfer system. (2)

3.3 Draw up a list of FOUR tools that you would use when making off ferruled terminations on DIN mounted terminals. (4)

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3.4 Study FIGURE 2 that shows more detail on the material transfer conveyor belt system and the terminal allocation sheet.



Rack	X.1	Conveyor
24V DC +	X1.0	SENSOR 1 +
	X1.1	SENSOR 2
	X1.2	SENSOR 3
0V DC -	X1.3	SENSOR 1 -
	X1.4	SENSOR 2
	X1.5	SENSOR 3
	X1.6	EJECTOR -
PLC I	X1.7	SENSOR 1
PLC I	X1.8	SENSOR 2
PLC I	X1.9	SENSOR 3
PLC Q	X1.10	EJECTOR
K1	X1.11	M1 DC
K2	X1.12	M1 DC
	X1.13	SPARE

FIGURE 2

Draw the wiring diagram of the material transfer conveyor belt system.

The drawing must include the termination numbers and the component symbols must be labelled correctly. (10 × 1) (10)

[20]

QUESTION 4

4.1 Refer to FIGURE 2 and the terminal allocation list and the electrical wiring diagram drawn in QUESTION 3.3.

Write a PLC program that will start a conveyor belt system using a photo-electric sensor (B1) when a work piece is detected. The conveyor belt will run for 5 seconds and then stop.

The system should also have red 'RUN' indication lamp and 'STANDBY' green indication lamp.

When a metal-work piece is detected by the inductive sensor (B2), the ejector will be energised and remove the metal work piece from the conveyor belt system.

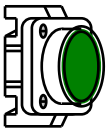
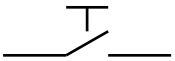
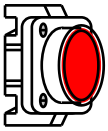
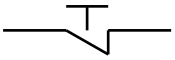
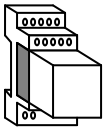
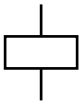
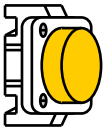
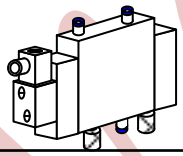
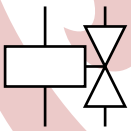
The conveyor belt system must have a system start and system stop function pushbutton. (15 × 1) (15)

4.2 Differentiate between the programming languages that are represented by graphical means and non-graphical means. (2 × 2) (4)

4.3 Briefly discuss THREE ladder programming rules that refer to the output coils. (3 × 2) (6)

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4.4 Complete the TABLE by drawing the virtual symbols (4.4.1–4.4.5) used by the PLC ladder software to represent the physical components of the I/O's connected to the PLC system.

PHYSICAL COMPONENT	COMPONENT SYMBOL	VIRTUAL LADDER SOFTWARE COMPONENT SYMBOL
		**4.4.1**
		**4.4.2**
		**4.4.3**
		**4.4.4**
		**4.4.5**

(5 × 1) (5)
[30]

QUESTION 5

5.1 Briefly explain FOUR methods you can use to check input and output field devices when used in a mechatronic stored program system. (4 × 2) (8)

5.2 Explain how you would eliminate an inductive sensor fault when the control program does not initiate the network output and there is power on the sensor. (2 × 2) (4)

5.3 Indicate by means of a drawing how you would check a limit switch for functional operation using a multi-meter. (3 × 1) (3)
[15]

TOTAL: 100

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