

**PRINCIPAL LEARNING
LEVEL 3**

ENGINEERING

Instrumentation and Control Engineering

F559

Candidates answer on the Question Paper

OCR Supplied Materials:

None

Other Materials Required:

- Scientific calculator

**Wednesday 19 May 2010
Morning**

Duration: 2 hours



Candidate Forename		Candidate Surname	
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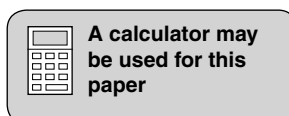
Centre Number						Candidate Number				
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INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions in **Section A** and any **four** questions from **Section B**.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your Candidate Number, Centre Number and question number(s).

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **60**.
- This document consists of **16** pages. Any blank pages are indicated.



Section A

Answer **all** questions in the spaces provided.

- 1 The table in Fig.1 shows some of the components found in a domestic washing machine.

Complete the table by filling in the empty boxes.

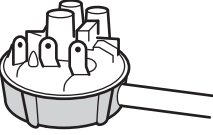

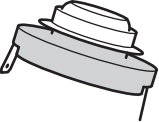

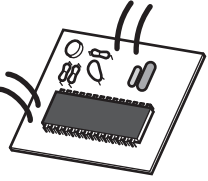
Component	Function	Input/process/output
 Pressure Switch		Input
 Heating element	Heating up the water to bring it up to the working temperature	
 Temperature sensor		Input
 Solenoid valve		Output
 Programmer	A micro-processor that controls the sequence of operations during the 'wash cycle'	

Fig. 1

[5]

2 Draw a labelled block diagram of a system that has feedback.

[2]

3 State which **three** of the following are passive transducers:

thermistor, thermocouple, solar cell, strain gauge, light dependent resistor.

(i)

(ii)

(iii) [3]

4 Part of a digital multi-meter is shown in Fig. 2.

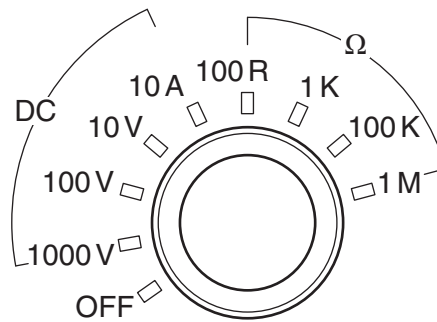


Fig. 2

Draw the pointer on the dial set to the correct position for checking the value of a 10K resistor. [1]

5 Give **three** advantages of watching a video that simulates a production line, over visiting a factory that produces motor cars on an automated production line.

Advantage 1

Advantage 2

Advantage 3 [3]

6 State **two** difficulties encountered when transmitting signals using wires when the frequency of the system increases above 2500 MHz.

(i)

(ii) [2]

7 Explain how a logic probe is used in the testing of a circuit.

.....

.....

.....

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..... [3]

8 State the formula for overall gain in a system using negative feed back.

..... [1]

[Section A Total: 20]

Section B

Answer any **four** questions in the spaces provided.

1 (a) Give **two** practical applications of a strain gauge.

- 1
- 2 [2]

(b) Explain why it is necessary to measure strain.

-
-
-
-
-
- [3]

(c) Describe in detail, with the aid of a labelled diagram, how a strain gauge can be used in a control system.

-
-
-
-
-
-
-
-
- [5]

[Total: 10]

2 (a) Give **two** practical applications of the use of a proportional controller.

1

2 [2]

(b) The error input to a controller is shown in Fig. 3. Sketch and label a graph of the output for a proportional controller.

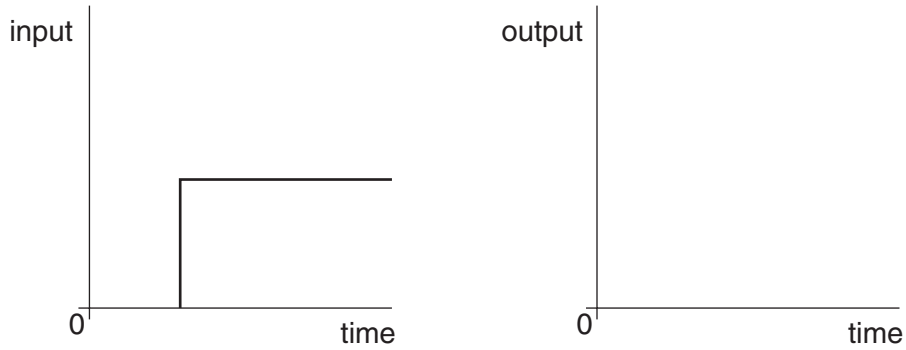


Fig. 3

[3]

(c) Describe in detail, with the aid of a labelled diagram, a float-lever proportional controller.

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..... [5]

[Total: 10]

3 (a) Show, with the aid of block diagrams, the difference between a digital-to-analogue (D to A) converter and an analogue-to-digital (A to D) converter.

[2]

(b) Explain why a multiplexer is used with an analogue to digital converter.

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..... [3]

(c) Describe in detail, with the aid of a labelled diagram, the principles of a parallel analogue to digital converter that uses three operational amplifiers in its circuit.

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..... [5]

[Total 10]

4 (a) Give **two** practical applications of the use of a thermistor in a control circuit.

1

2 [2]

(b) The characteristics of a thermistor are shown in the graph in Fig. 4.

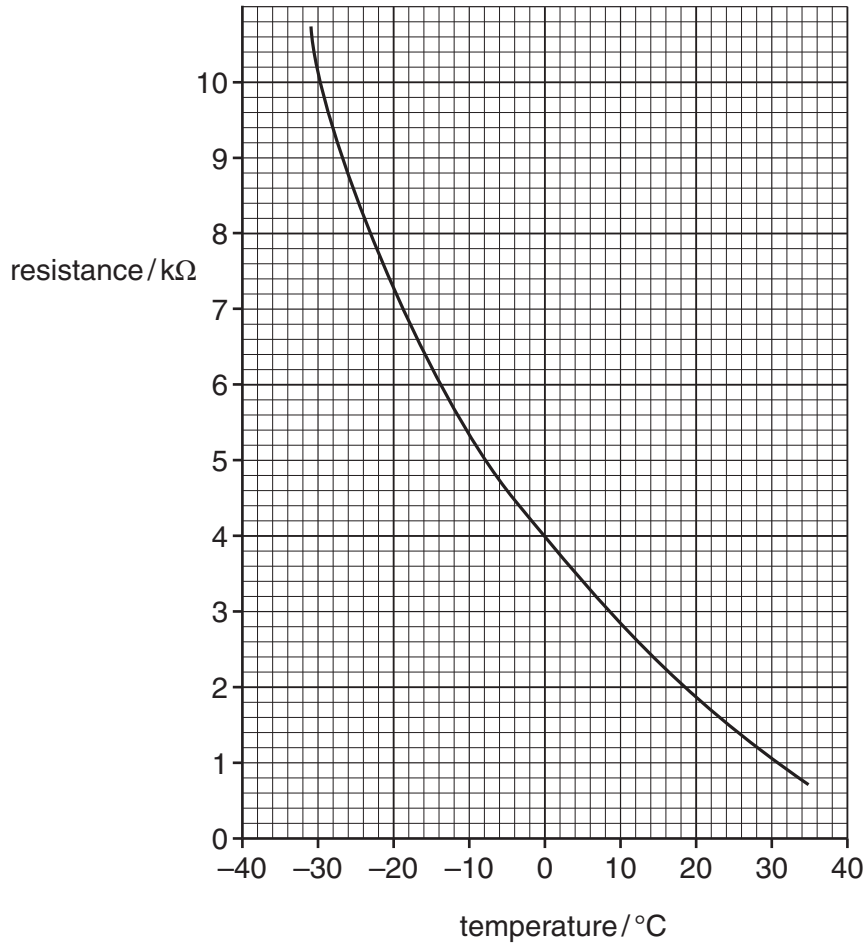


Fig. 4

(i) Use the graph to read off the resistance of the thermistor at $+30^{\circ}C$ and $-30^{\circ}C$.

.....

[2]

(ii) Use the graph to read off the temperature of the thermistor at $4 k\Omega$.

[1]

(c) Describe with the aid of a labelled block diagram and a labelled circuit diagram, how a thermister can be used in a control circuit.

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..... [5]

[Total: 10]

5 (a) State two features you would expect to find on an alarm system that is protecting a factory unit.

1

2 [2]

(b) Explain why it is often necessary to include a security camera in an alarm system.

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..... [3]

(c) Describe in detail, with the aid of a circuit diagram, how an alarm system would operate when a sensor is activated.

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..... [5]

[Total: 10]

6 (a) Give the meaning of the term open loop control.

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..... [2]

(b) Explain, using examples, the advantage of a closed loop control system over an open loop control system.

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..... [3]

(c) Describe, with the aid of a labelled block diagram and a labelled circuit diagram, how an open loop system can be used as a water level alarm.

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..... [5]

[Total: 10]

7 (a) Give **two** practical applications that uses a single acting pneumatic cylinder.

1

2 [2]

(b) Describe the difference between a single acting cylinder and a double acting cylinder.

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..... [3]

(c) Explain in detail, with the aid of a labelled diagram, how a single-acting cylinder can be controlled from two positions.

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..... [5]

[Total: 10]

8 (a) Give **two** practical industrial applications where you may find a pressure gauge being used.

1

2 [2]

(b) Describe the difference between absolute pressure and gauge pressure.

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..... [3]

(c) Explain in detail, with the aid of a diagram, the construction and action of a pressure gauge of your choice.

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..... [5]

[Total: 10]

[Section B Total: 40]

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