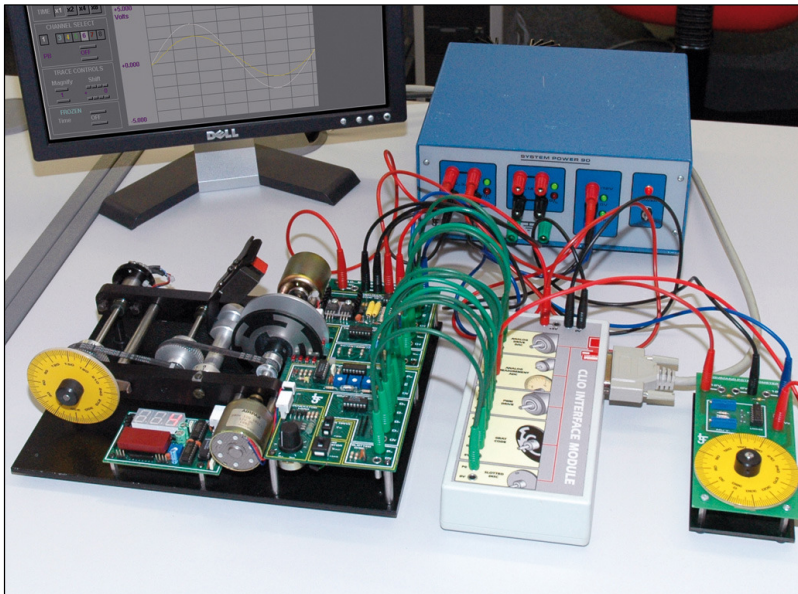




CA07 - Analog and Digital Motor Control



The CA07 teaching set introduces students to the fundamental principles of analog and digital motor control, through a wide range of practical activities.

This comprehensive teaching set includes a DC motor control module, command potentiometer, PID controller, Windows-based control software, input/output interface module, and curriculum manual. A power supply unit and connection leads are also provided.

The curriculum manual is fully compatible with the ClassAct computer managed learning system. It is divided into a series of chapters, each covering a specific topic area and providing background theory, practical activities and student assessment questions.

Each chapter is designed around a list of performance objectives. These objectives are used by the ClassAct management system to generate a student competency report.

A student workbook is also provided, allowing students to record basic theory and practical results as they work through the curriculum manual.

Finally, the teaching set includes an instructor's guide. This provides solutions to all of the questions and practical activities contained in the curriculum manual.

Typical topic areas include:

- The Digital Storage Oscilloscope
- Transient and Steady State Response
- Proportional Speed Control
- Proportional Position Control
- Second Order Response Parameters
- Velocity and Transient Velocity Feedback
- Controller Characteristics
- Integral Speed Control
- Proportional Plus Integral Speed Control
- Proportional Plus Integral Plus Derivative Position Control
- Instability

- Introduction to Control Systems
- Time Response
- Frequency Response
- Principles of Feedback
- Proportional Position Control
- Behavior of Second Order Systems
- Positional Control with Velocity Feedback
- Three-Term or PID Control
- Stability
- The Use of Computers for Control
- Analog Interfacing
- Direct Digital Control
- Digital Interfacing

Typical activities include:

- Describe the Main Elements of a PID Controller.
- Investigate the data capture features of a digital storage oscilloscope.
- Conduct simple step, ramp and frequency response tests.
- Demonstrate Proportional Speed control.
- Outline the reasons for adding velocity feedback.
- Demonstrate the change in following error when transient velocity feedback replaces velocity feedback.
- Discuss the effects of noise when subjected to derivative action.
- Demonstrate various combinations of PID control.
- Demonstrate the stabilizing effect of a proportional action on a system controlled with integral action.
- Operate the software controls to drive the DC Motor and observe its behavior.
- Measure the parameters of a plant using step tests.
- Account for the excellent steady state performance of a proportional servo position system.
- Set up a servo system to respond to ramp inputs using proportional gain and transient velocity feedback.
- Show how positive feedback can occur in a negative feedback system.
- Explain Gain Margin and Phase Margin.
- Describe the advantages and disadvantages of using computers in real-time control.
- Outline the problems arising from low resolution and slow sampling.
- Describe Gray code position measurement and other absolute and relative digital position measurement techniques.

The CA07 teaching set comprises:

- MS15 DC motor control module
- AS3 Command potentiometer
- AS4 PID Controller
- VCL1 Virtual Control Laboratory, comprising:
 - Input/output interface module
 - Windows-based control software
 - Curriculum Manual, Instructor's Guide and Student Workbook
- CS1 Set of 36 x 4mm leads
- Power supply unit

Additional items required:

- Windows-based personal computer (PC)
- Digital Storage Oscilloscope
- Function Generator
- Digital Multimeter

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	No.	Average time
Chapters (Analog)	14	90 minutes
Total		21 hours
Chapters (Digital)	23	50 minutes
Total		20 Hours