

TAFE METAL & ENGINEERING NATIONAL CURRICULUM PROJECT

1. Module details

Module name	Programmable Controllers - Basics
Nominal duration	Half module It is anticipated that a student possessing the skills and knowledge developed in the prerequisites will achieve the module purpose in 18 to 20 hours.
Module code	NE176
Discipline code	0703325

2. Module purpose

The aim of this module is to provide students with an introduction to programmable logic controllers (PLCs) and PLC systems.

3. Prerequisites

Electrical Principles 1 (NE160) or
Basic Electrical and Electronics (NBB15) or
Fluid Power (NM30)

4. Relationship to competency standards

This module provides some of the knowledge and skills underpinning competence in the following standards.

Federal Metals Industry Award Standards, Unit 10.4A, 18.48A.

Electrical Contracting Industry Award Standards

Electrical Stream Units 5.5, 5.6, 5.7, 5.10

Electronic Stream Units 5.1, 5.2, 5.4, 5.5, 5.6, 5.7

Instrumentation Stream Units 5.1, 5.4, 5.5

5. Content

Summary of content

1. Introduction to Control Systems
 - block diagram of any Control System (input, process, output)
 - methods of control
 - relay
 - static logic
 - programmable
 - introduction to PLC systems
 - brief history of PLCs
 - modern trends
 - typical applications
 - advantages and disadvantages of PLCs
 - block diagram of PLC system
2. Basic PLC operation
 - definitions and terminology
 - PLC
 - I/O
 - memory (RAM, ROM, E²PROM)
 - CPU
 - power supply
 - scan cycle
 - basic programming rules
 - addressing for I/O
 - halt
 - run
3. Programming (using a hand programmer)
 - flowcharts/steps to use when programming
 - clearing memory
 - ladder format
 - boolean/mnemonic/statement list format
 - series circuits
 - parallel circuits
 - latching circuits
 - stack register operation
 - combination series/parallel circuits
 - inversion elements
 - timers (DOE)
 - counters
 - monitor discrete I/O and timer/counter values
 - edit (insert and delete elements)
4. Connect discrete input and output devices to a PLC

6. Assessment strategy

Assessment method	Short-answer questions, written and oral Practical exercises Projects
Conditions of assessment	Normally learning and assessment will take place in a classroom/laboratory environment.

7. Learning outcome details

On completion of this module the learner will be able to:

Learning outcome 1

Describe the major differences between three basic forms of electrical control.

Assessment criteria

- 1.1 State the major differences between relay, static and programmable control.
- 1.2 Draw a block diagram representation of a programmable logic controller.
- 1.3 List advantages and/or disadvantages of programmable control over relay control.
- 1.4 List applications for programmable controllers.

Learning outcome 2

State the basic operating principles of PLC.

Assessment criteria

- 2.1 List the steps in a basic scan cycle.
- 2.2 Define terms such as I/O, CPU, RAM, ROM.
- 2.3 Describe a typical addressing systems for a PLC and give examples.
- 2.4 For a given PLC, identify inputs and outputs.

Learning outcome 3 Write, test, edit and monitor programs which include series elements, parallel elements, combination series parallel elements, basic timers and counters by using a hand program loader.

- Assessment criteria**
- 3.1 Write programs to suit given conditions.
 - 3.2 Load programs into a PLC.
 - 3.3 Test the operation of programs written.
 - 3.4 Use the monitoring function to verify circuit conditions and check the current values of timers and counters.
 - 3.5 Use editing features to make minor program changes.

Learning outcome 4 Connect I/O devices to a PLC and prove their operation.

- Assessment criteria**
- 4.1 With the aid of a diagram connect input and output devices to a PLC.
 - 4.2 Explain the implications of programming normally closed, field devices.
 - 4.3 State the hardware changes necessary when converting a relay controlled process of a programmable controlled process.

8. Delivery of the module

Delivery strategy This module contains learning outcomes that require the application of theory and practical skills. The resources required will need to facilitate individual hands simulation using PLC hardware.

Strategies should be selected that will reflect the nature of the learning outcomes, focussing at all times on an industry context.

Project work may be a major factor in the assessment and delivery of this module.

Resource requirements

“Shoe-box” style Programmable Controller for each student with a suitable input simulator and hand program loader.

Normally open and normally closed pushbuttons (or similar) that can be physically connected to the input terminals of a PLC.

Contact/lamp that can be physically connected to the output terminals of a PLC.

Useful references include:

Stenerson, Jon 1993, *Fundamentals of Programmable Logic Controllers, Sensors and Communications*, Regents, Prentice Hall, New Jersey.

Simpson, Colin D. 1994, *Programmable Logic Controllers*, Regents, Prentice Hall, Eaglewood Cliffs.

Occupational health and safety requirements

A safe and healthy environment will be provided for students in regards to classroom and laboratory safety.