Introduction to Programmable Logic Controllers Ex1_intro

DTU 31343

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Part 1

To fulfil the requirements for the PLC system based on the given system having 4 digital inputs, 2 actuators, and 1 network interface, the Allen-Bradley Micro810 PLC was chosen as a suited PLC.

Specifically, the Micro810 PLC with the catalogue numbers 2080-LC10-12QWB, 2080-LC10-12AWA, or 2080-LC10-12DWD (based on the power supplied to the PLC and required digital input) are able to accommodate up to 8 digital inputs and 4 analogue (relay) outputs [1]. For the required network interface it uses a USB connection, therefore, an adapter may be necessary [2].

Additionally, the PLC's dimensions are $91 \times 75 \times 59\,\text{mm}$, can operate between 0 and 55 °C, and has an IP20 rating [1]. Therefore, it is a relatively small PLC that is able to be used in most factory settings where it won't get in contact with water.

Part 2

A general cycle for a washing machine is as follows:

1. Water mixed with detergent flows into the drum and is heated to a certain temperature,
2. The drum agitates the laundry to soak and remove dirt from the clothes,
3. The liquid is then drained from the drum,
4. Water flows into the drum and agitation commences to remove detergent from the clothes,
5. The water is drained and the previous step commences several times,
6. After several rinsing steps, the clothes are dried by fast spin cycles [3].

The type of cycle that is executed will depend on the selection made before the wash. The main variation between cycles are:

- Water temperature,
- Length of the wash cycle,
- Speed of agitation,
- Speed of spin cycle [3].

It is assumed that the amount of water remains the same between these cycles, as most laundry machines have a recommended weight for the amount of laundry being placed inside the drum.

The information above is summarised in the diagram shown in Figure 1.

It can be seen that the laundry machine must be able to control the flow of water, the temperature of the liquid before the wash cycle, the length of the wash cycle, and the speed with which the drum is being spun at in different cycles. A PLC would be capable of controlling this type of system as the laundry cycle is executed in a linear fashion that must be repeated meticulously, and variations are easily selected based on simple conditions. However, this would not be an optimal application of a PLC as a laundry machine is a serial product that is purpose built for a given specification. The benefit of using a PLC is that it is a reprogrammable device which can handle variable conditions in an automated factory setting. A laundry machine on the other hand, doesn't need to be reprogrammed after it has been sold to the consumer, nor is its environment variable enough to warrant a robustly built controller. Additionally, more cost effective, simpler controllers are better suited for this purpose. Therefore, although a PLC could definitely control this type of device, its use within a laundry machine would not be ideal.

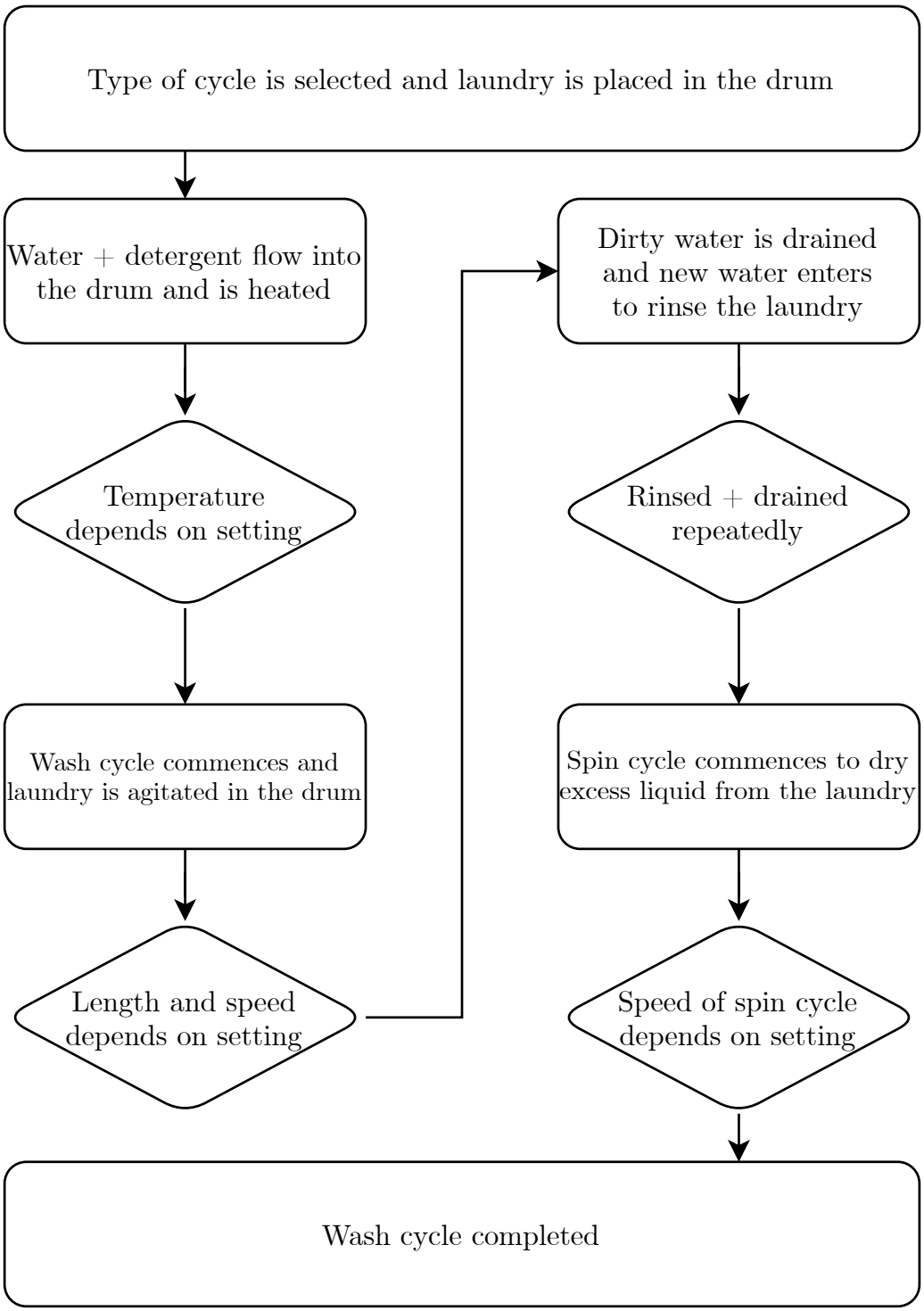


Figure 1: Diagram of a general wash cycle and where variations would occur between cycle settings.

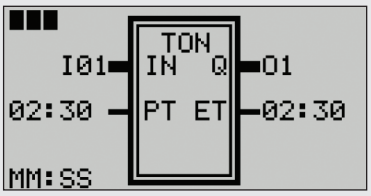
Micro810™ Programmable Logic Controller

Allen-Bradley

Bulletin 2080 Product Profile

Features and Benefits

- Price of a smart relay with the functionality of a Micro PLC
- High current relay outputs (8A) replaces the need for external relays to reduce cost and panel space
  - Can be used in places where flexibility is required over a mechanical timer relay
- 4 channels of embedded analog (0-10V 10 bit)
  - Applications include temperature control, compressor control, elevator control
  - Can reconfigure up to 4 24V DC digital inputs as analog
- Embedded smart relay function blocks configured from optional 1.5" LCD and keypad allows you to program without software
  - LCD also functions as a memory backup module
- Standard version of Connected Components Workbench software available as a free download



Machine builders and end users who need a cost-effective control solution for their small applications will benefit from the new family of Allen-Bradley® Micro800 programmable controllers and Connected Components Workbench™ software from Rockwell Automation.

As the smallest of the Micro800 family, the Micro810 controller is available in a 12pt version, with 8A outputs that eliminate the need for external relays. The Micro810 features embedded smart relay function blocks that can be configured from a 1.5" LCD and keypad. The function blocks include Delay OFF/ON Timer, Time of Day, Time of Week and Time of Year for applications requiring a programmable timer and lighting control. Programming can also be done through a program download via USB programming port, using Connected Components Workbench Software.

Connected Components Workbench software is shared among the entire Micro800 family of controllers, as well as other component products, such as PanelView Component HMIs and PowerFlex drives. Based on proven Rockwell Automation and Microsoft Visual Studio technology, the new software provides controller programming, device configuration and data sharing with the HMI editor for PanelView Component operator products. In addition, the software supports three standard IEC programming languages: ladder diagram, function block diagram and structured text.

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Bulletin 2080

Catalog #	Inputs			Outputs		Analog In 0-10V (shared with DC In
	120/240V AC	24V DC/ V AC	12V DC	Relay	24V DC SRC	
Controllers						
2080-LC10-12QWB	—	8	—	4	—	4
2080-LC10-12AWA	8	—	—	4	—	—
2080-LC10-12QBB	—	8	—	—	4	4
2080-LC10-12DWD	—	—	8	4	—	4
Accessories						
2080-LCD	Micro810 1.5" LCD display with keypad and memory backup.					
2080-USBADAPTER	Micro810 USB adapter. Required when connecting to a PC for programming with Connected Components Workbench. 					

Micro810	12pt
Base Unit	
Power Supply	Embedded 120/240V AC and 12/24V DC options
Base Programming Port	Embedded USB 2.0 (non-isolated) Any standard USB printer cable will work Micro810 12pt requires adapter plug
I/O	
Base Digital I/O (In/Out)	12 (8/4)
Base Analog I/O channels	Four of 24V DC digital inputs can be configured as 0-10V Analog inputs
Additional Functions	
Embedded Real-Time Clock	Yes
1.5" LCD with Memory Backup	Optional

Micro810	12pt
Programming	
Software	Connected Components Workbench
Program Steps (or instructions)	2 KB
Data (Bytes)	4 KB
IEC 61131-3 Languages	Ladder Diagram, Function Block, Structured Text
User Defined Function Blocks	Yes
Floating Point Math	32-bit and 64-bit
PID Loop Control	Yes
Environments	
Certifications	c-UL-us CL1DIV2, CE, C-Tick
Temperature Range	0°…55 °C
Dimensions (HxWxD, mm)	90x75x60

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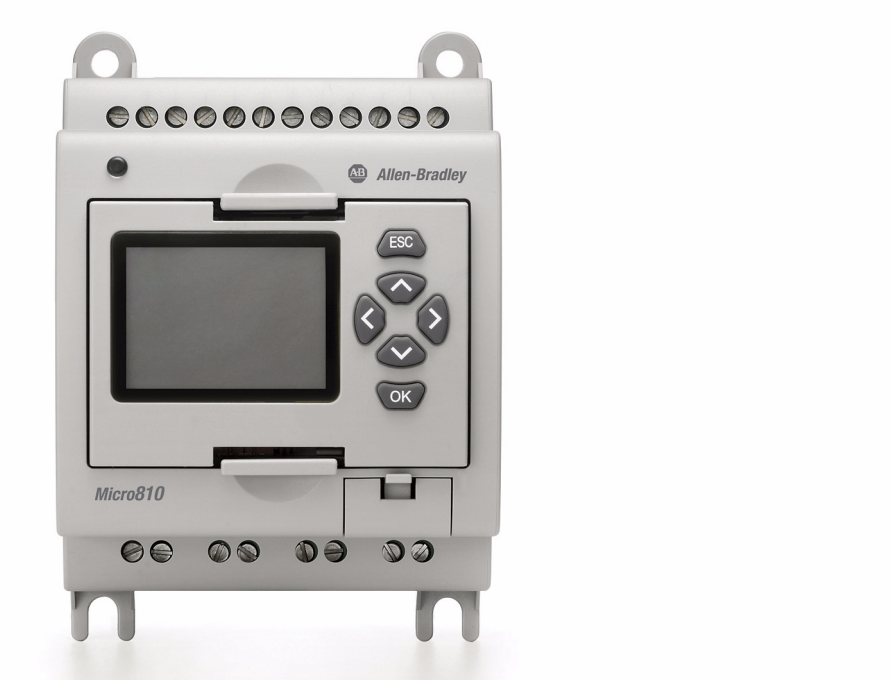
Select a Micro810 Controller



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To help you select a Micro810 controller, consult the specifications for each catalog in the next section.

Number and Types of Inputs/Outputs

Catalog Number	Power	Inputs			Outputs		Analog In 0…10V (shared with DC In)	
		120V AC	240V AC	12…24V DC /V AC	Relay	24 V DC SRC		
2080-LC10-12QWB	24V DC			8	4		4	
2080-LC10-12AWA	120…240V AC	8			4			
2080-LC10-12QBB	12…24V DC			8		4	4	
2080-LC10-12DWD	12V DC			8	4		4	

Specifications[1]

Attribute	2080-LC10-12AWA	2080-LC10-12QWB	2080-LC10-12DWD	2080-LC10-12QBB
Number of I/O	8 Input (4 digital, 4 analog/digital, configurable) 4 Output			
Dimensions HxWxD	91 x 75 x 59 mm (3.58 x 2.95 x 2.32 in.)			
Supply voltage range	85…263V DC	20.4…26.4V DC	10.8V…13.2V DC	11.4V..26.4V DC
Supply frequency range (AC supply)	47…63 Hz	N.A.		
Voltage range	100…240V AC, 50/60 Hz	24V DC Class 2	12V DC Class 2	12/24V DC Class 2
Power consumption	5V A	3 W		
I/O rating	Input: 120…240V AC	Input: 24V DC, 8 mA	Input: 12V DC, 8 mA	Input: 24V DC, 8 mA
	Output: Relay 00 & 01: 8 A @ 240V AC, B300, R300, General Use Relay 02 & 03: 4 A @ 240V AC, C300, R150, General Use			Output: 24V DC 1A, 25 °C, 24V DC 0.5A 55°C
Operating temperature	0…55 °C (32…131 °F)			
Shipping weight, approx.	0.203 kg (0.448 lb)			
Wire size	0.32...2.1 mm² (22...14 AWG) solid copper wire or 0.32...1.3 mm² (22...16 AWG) stranded copper wire rated @ 90 °C (194 °F) insulation max.			
Wiring category	2 – on signal ports 2 – on power ports			
Wiring torque	1.085 Nm (8 lb-in.)			
Wire type	use Copper Conductors only			
Fuse, type	Rated 250V 3.15 A-RADIAL			
Enclosure type rating	Meets IP20			
North American temp code	T5			
Insulation stripping length	7 mm (0.28 in.)			
Isolation voltage	250V (continuous), Reinforced Insulation Type, I/O to Aux and Network, Inputs to Outputs. Type tested for 60 s 3250V DC, I/O to Aux and Network, Inputs to Outputs	250V (continuous), Reinforced Insulation Type, I/O to Aux and Network, Inputs to Outputs Type tested for 60 s at 720V DC, Inputs to Aux and Network, 3250V DC Outputs to Aux and Network, Inputs to Outputs		50V (continuous), Reinforced Insulation Type, I/O to Aux and Network, Inputs to Outputs Type tested for 60 s at 720V DC, I/O to Aux and Network, Inputs to Outputs
AC input filter setting	16 ms for all embedded inputs (In CCW, go to the Embedded I/O configuration window to re-configure the filter setting for each input group			

(1) See the Micro810 User Manual, publication 2080-UM001, for more Micro810 controller specifications.

References

[1] Allen-Bradley. *Micro800 Programmable Controllers, Plug-In modules, and Accessories*. Rockwell Automation, 2012.

[2] Allen-Bradley. *Micro810 Programmable Logic Controller*. Rockwell Automation, 2011.

[3] Clothes Washing Machines. `https://www.explainthatstuff.com/washingmachine.html`, 2020. Accessed: 2021-05-27.