
Module 1 Overview

ControlLogix5000



Module Overview

This module takes a fundamental approach to a ControlLogix system. It begins with an overview of the architecture and migrates into an introduction of RSLogix5000, the programming environment. Students will receive a basic understanding of the structure of a ControlLogix program, which includes an introductory look at Routines and the Tag Database.

Included Lessons

- Lesson 1 – ControlLogix Hardware Overview
- Lesson 2 – RSLogix5000 Introduction
- Lesson 3 – RSLogix5000 Project Basics
- Lesson 4 – RSLogix5000 Tasks, Programs and Routines
- Lesson 5 – RSLogix5000 Programming Basics
- Lesson 6 – RSLogix5000 Communications
- Lesson 7 – RSLogix5000 Discrete I/O

Lesson Design

Most lessons include the following sections:

Lesson Objectives: The main objectives or what the lesson, the instructor and the student will accomplish throughout the lesson.

Terminology: Most lessons have a glossary of important terms, which will be needed to understand concepts within the lesson.

The Main Lesson Body: Although this section does not have a header this is the main portion of the lesson, covering the required material.

Exercise: Gives the student the opportunity for hands-on practical experience.

RSLogix5000

Hardware Overview



Lesson Objectives

This lesson is designed to introduce the student to the standard hardware and system components used in a typical ControlLogix system.

The following hardware topics and components are covered in this lesson:

- ❑ System Overview
- ❑ Chassis & the ControlBus backplane
- ❑ Power Supplies
- ❑ Logix5000 Processors & Memory options
- ❑ Discrete and Analog I/O
- ❑ Communication Bridge Modules
- ❑ Motion Control Modules
- ❑ Software Overview

Terminology

Tag: A text based address

RTB: Removable Terminal Block, or the harness that plugs into most modules that interface with field devices

RIUP: Remove and Insert Under Power. All ControlLogix modules can be inserted or removed with power applied to the chassis.



ControlLogix 5000 System Overview

The ControlLogix 5000 architecture was designed to provide a single platform to cover the needs of many applications. The variety of applications include the following:

- ❑ Sequential, or traditional PLC control
- ❑ Modular communications including Gateway functionality
- ❑ Process control, or traditional DCS control
- ❑ Drive System and Motion Control

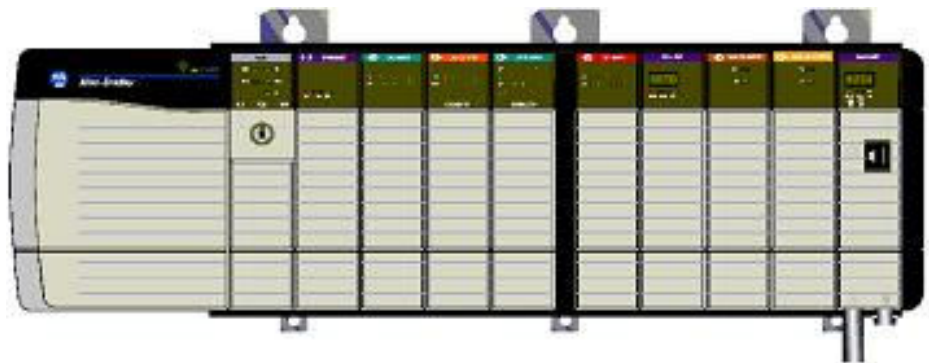
ControlLogix systems include the following features

- ❑ Projects downloaded to the processor include Logic, Data and Tags or text base addresses
- ❑ True multitasking with multiple processors in the chassis
- ❑ Pre-emptive multitasking within each processor
- ❑ Modular memory in many sizes
- ❑ Chassis are modular, allowing placement of modules, including the processor in any slot

Chassis and the ControlBus Backplane

The chassis used in ControlLogix systems come in several different sizes: 4, 7, 10, 13, and 17 slots. Series A chassis are designed for 10amp backplane current draw and the Series B chassis provides 13Amps.

The backplane, or pc board that is inside the chassis, is called the ControlBus backplane. It operates as a mini network, fashioned after the communications platform ControlNet.



Power Supplies

There are several different power supplies available. The following chart shows there are two groups of supplies, and within each group there are two different sizes, rated by the current levels of their internal 5v supplies.

	24V Supply	120VAC Supply
1756-PB72	10amp	
1756-PB75	13amp	
1756-PA72		10amp
1756-PA72		13amp

There are also supplies available for 48Vdc and 125Vdc input.

RIUP

RIUP, or Remove and Insert Under Power is a feature of the ControlLogix system that allows modules to be removed from the chassis without powering down. From a hardware perspective, looking at the card edge connector shows two different sizes of pins. As the card is removed from the chassis the shorter pins, or the data lines are broken first, then the longer ones, the supply pins are disconnected. From a software perspective RIUP is accomplished during the maintenance portion of the processor scan.



Warning: Removing modules while power is applied to the chassis may cause arcing as the power supply pins are disconnected from the backplane. This may cause a safety concern in some environments

Logix5000 Processors

At the heart of a ControlLogix system are the Logix5000 controllers. Other members of the family include CompactLogix™, FlexLogix™ and SoftLogix™. Features of the family include:

Part of the speed of the Logix5000 processor comes from a compilation process that happens when the project is downloaded to the processor. This process is transparent to the user.

- ❑ A project download includes user entered program, data, and tags.
- ❑ Processors are 32-bit.
- ❑ The original processor, 1756-L1, is up to 7 times faster than a comparable PLC5.
- ❑ Offers Controller to Controller communications without ladder logic
- ❑ Allows multiple controllers in the chassis, facilitating application load sharing
- ❑ Programming options include the full PLC-5 instruction set and a complete set of logic motion instructions. Block transfer instructions can be performed using a MSG instruction, but are only required when using legacy remote I/O hardware



Logix5000 Processors cont.

The following list outlines specific features of each of the processors in the Logix 5000 family

- ❑ 1756-5550 – The first ControlLogix processor was 7 times faster than a comparable PLC5 system. This processor ships with 160Kbytes of memory on board, which can be expanded by up to 2 Mbytes. **This processor is not supported past Revision 13**
- ❑ 1756-5555 – As the main upgrade to both of the previous processors, this processor is 7 times faster than the original 5550. There is no base memory included, but memory modules are available up to 7.5 Mbytes.
- ❑ 1756-5563 – The 5563 is 2-3 times faster than the 5555. This processor's memory is fixed at 8meg.

1756-L5555 available memory modules

M12 – 750kbytes
M13- 1.5Mbytes
M14- 3.5Mbytes
M16- 7.5Mbytes
M22, M23, M24 provide further enhancements.

As a point of reference the original processor, the 5550, with a 512k memory module has the same memory capacity of a PLC5-40. The 5550 with the 1 Mbyte memory module is equivalent to a PLC5-80.



The graphic on the left shows an exploded view of the processor and the memory module.

ControlLogix Hardware Overview

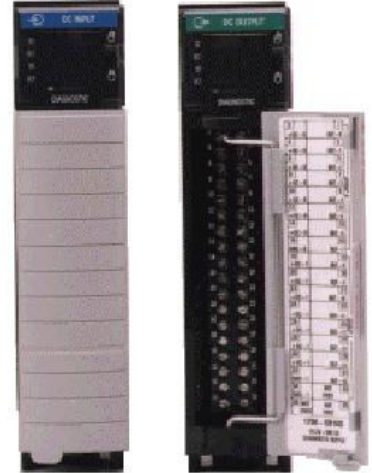
A comparison chart of ControlLogix features is shown below. (This chart has been extracted from Rockwell Automation Brochure #1756-SG1.

Common Characteristics	1756 ControlLogix	1769 CompactLogix	1789 SoftLogix5800	1794 FlexLogix	PowerFlex 700S with DriveLogix
controller tasks: <ul style="list-style-type: none"> continuous periodic event 	<ul style="list-style-type: none"> 32 tasks (only 1 continuous) event tasks: supports all event triggers 	<ul style="list-style-type: none"> 1769-L35x: 8 tasks 1769-L32x: 6 tasks 1769-L31: 4 tasks only 1 continuous event tasks: supports consumed tag trigger and EVENT instruction 	<ul style="list-style-type: none"> 32 tasks (only 1 continuous) event tasks: supports all event triggers, plus outbound and Windows events 	<ul style="list-style-type: none"> 8 tasks (only 1 continuous) event tasks: supports consumed tag trigger and EVENT instruction 	<ul style="list-style-type: none"> 8 tasks (only 1 continuous) event tasks: supports axis and motion event triggers
user memory	1756-L55M12: 750 Kbytes 1756-L55M13: 1.5 Mbytes 1756-L55M14: 3.5 Mbytes 1756-L55M16: 7.5 Mbytes 1756-L55M22: 750 Kbytes 1756-L55M23: 1.5 Mbytes 1756-L55M24: 3.5 Mbytes 1756-L61: 2 Mbytes 1756-L62: 4 Mbytes 1756-L63: 8 Mbytes	1769-L31: 512 Kbytes 1769-L32x: 750 Kbytes 1769-L35x: 1.5 Mbytes	1789-L10: 2 Mbytes 3 slots no motion 1789-L30: 64 Mbytes 5 slots 1789-L60: 64 Mbytes 16 slots	1794-L34: 512 Kbytes	256 Kbytes 768 Kbytes with memory expansion
nonvolatile user memory	1756-L55M12: none 1756-L55M13: none 1756-L55M14: none 1756-L55M16: none 1756-L55M22: yes 1756-L55M23: yes 1756-L55M24: yes 1756-L6x: CompactFlash	CompactFlash	none	yes	yes (expansion memory)
built-in communication ports	1 port RS-232 serial (DF1 or ASCII)	<ul style="list-style-type: none"> 1769-L31 has 2 RS-232 ports (one DF1 only, other DF1 or ASCII) 1769-L32C, -L35CR has 1 ControlNet port and 1 RS-232 serial port (DF1 or ASCII) 1769-L32E, -L35E has 1 EtherNet/IP port and 1 RS-232 serial port (DF1 or ASCII) 	depends on personal computer	<ul style="list-style-type: none"> 1 port RS-232 serial (DF1 or ASCII) 2 slots for 1788 communication cards 	<ul style="list-style-type: none"> 1 port RS-232 serial (DF1 or ASCII) 1 slot for 1788 communication cards

Discrete I/O Modules

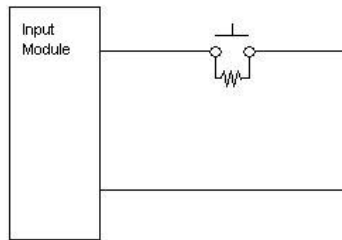
Discrete I/O Modules are available in a variety of configurations:

- ❑ Non-isolated, and individually isolated modules
- ❑ Diagnostics modules
- ❑ Electronic fusing
- ❑ Electronic keying
- ❑ 8, 16, and 32 point densities
- ❑ AC and DC versions



The diagnostics included in several of the I/O cards are

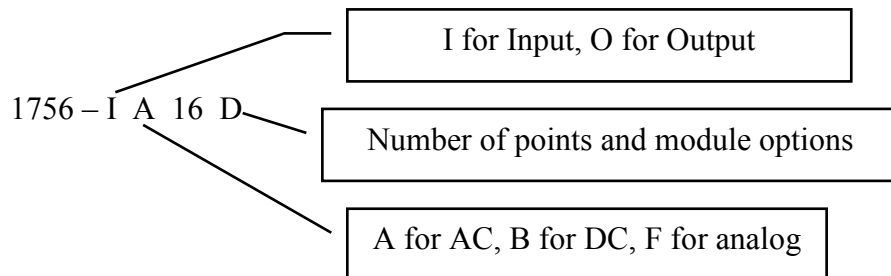
- ❑ Electronic fusing on output cards.
- ❑ Open wire detection on input cards
- ❑ No load and output verification on output modules



- ❑ Open Wire diagnostics detection requires a resistor installed across normally open field devices.

Diagnostics features can be configured on a per-terminal basis. Diagnostic bits can be latched on to trap intermittent faults: The latched diagnostic bits can be reset online, by the user, or by using a message instruction.

The Bulletin number for an I/O module has the following format:



Analog I/O Modules

Analog modules convert DC voltage or current signals to a value that can be interpreted by the controller. Features of Analog I/O cards include:

- Both current and voltage type modules available
- Scaling to engineering units
- Alarming on input modules
- Output clamping on output modules

Communications Bridge Modules

Communications is no longer the responsibility of the processor module. This has been off loaded to what are called communication bridge modules. These modules are dedicated to a specific network protocol. The following network communication cards are available:

- DH+/RIO modules for legacy networks
- CNB modules for ControlNet
- DNB modules for DeviceNet
- EtherNet 10/100 modules

The processor comes with a standard RS232 communications port, which allows full access to the ControlLogix chassis.

The name bridge module is actually fairly descriptive. These modules can provide a bridging or gateway function, which allows communications to bridge, or jump from one network to another without processor intervention

Motion Control Modules

There are numerous motion control modules in the ControlLogix family:

- The 1756 – MO2AE, 2 Axis Analog module
- The 1756 – MO3SE, 3 Axis Sercos Module
- The 1756 – MO8SE, 8 Axis Sercos Module
- The 1756 – MO16SE, 16 Axis Sercos Module

There are other modules available to include hydraulic motion. Motion is programmed with ladder instructions; no additional software is required in a motion system.

RTB's

Most discrete and analog I/O modules use RTB's, or Removable Terminal Blocks. Field devices are wired to the RTBs, not the module, making it easier to swap out a faulty module. Several features of RTB's are:

- ❑ On the edge of the RTB, there are key slots allowing the user to “KEY” the RTB to a specific module
- ❑ There are two pieces to an RTB: The terminal strip and the shroud. The shroud can be removed from the RTB to expose the terminal strip

Each module equipped with an RTB has a plastic locking clip that can be set to one of two positions: In the up position, next to the picture of the open padlock the RTB can be removed without pulling the I/O module out of the chassis. In the down position, next to the picture of the closed padlock, pulling on the swing arm will pull the entire module out: Be sure to examine the locking clip before removing a swing arm.

RTB's are not included with modules because they come in two main versions, screw clamp and spring clamp. Spring clamp versions are suggested for high vibration environments.

Software Packages

To program, configure, and maintain a ControlLogix system you will need the following software packages:

- RSLogix5000 – The main programming and configuration package
- RSLinx Lite – Communication software
- Control Flash – Firmware updating tool
- RSNetworks CNET / DNET – Network Configuration package if your system includes a ControlNet or a DeviceNet network

RSLogix5000

RSLogix5000 is used to create, modify and troubleshoot ControlLogix projects. The base package ships with Ladder Logic, but FBD, SFC and Structured Text are available for an additional cost.

- Version 10 and later releases includes the Control Flash software package
- Software registration keys are required to run all RSLogix5000 packages
- Prior to version 10 only one release could be installed on a computer, or more accurately on a hard drive partition
- Version 10 allows multiple future release installations and one backwards release installation

RSLogix requires Microsoft Windows 2000 or Windows XP.

RSLogix is not compatible with Windows95, 95, 98, and ME.

RSLinx

RSLinx is the main communications software, RSLinx provides a means for software packages running on a computer to talk via its drivers to nodes on a network.

ControlFlash and Revisions

Each module in the ControlLogix family contains firmware, which is “burned” into the module using the Control Flash software package. Upgradeable firmware allows module designers an extremely fast method to update, change or fix features in a module. Registered and in support RSLogix users may download Firmware from the internet and are free of charge.

Warning: When flashing the firmware of any module allow the process to complete. Use a reliable, fast driver to flash modules. (Flashing a processor using the serial port will take 45 minutes: Flashing via 100 Megabit EtherNet will take 30 seconds)

There are several ways to determine the firmware revision of a module:

- Check the firmware sticker on the side of the module:
- This method is unreliable, since it only indicates what revision firmware the module shipped with at time of purchase
- Use an existing RSLinx driver to access the ControlLogix chassis. Right click a module and select *Device Properties*
- Use Internet Explorer or Netscape Navigator to connect to an existing EtherNet module in the chassis. ControlLogix EtherNet modules have HTML code built in to the firmware, allowing users to access hardware information across a network.

ControlNet / DeviceNet

RSNetworkx is available in multiple versions; one for ControlNet and one for DeviceNet. These are software packages used to build and configure ControlNet and DeviceNet networks. They are available at an additional cost. There is now a version of RSNetworkx for EtherNet IP – it is a diagnostic tool only.

Exercise A

1. Inspect your demo unit and complete the table below

Slot Number	Module Type	Catalog Number	Firmware
0			
1			
2			
3			
4			
5			
6			
7			
8			
9			

2. Remove a few of the modules, note the amount of force required to remove and then reinsert the module in the chassis. **Remember the locking tab on the I/O modules!!**
3. What is the 5-volt current rating of your power supply? _____ A
4. Examine the front of the EtherNet module: It should be located in the far right hand slot of the chassis. The window on the top of the module will have a number scrolling across it with the format of 172.168.1.XXX. This is the IP or Internet Protocol address that has been assigned to the communications module. Record your IP address:

5. Launch Internet Explorer or Netscape Navigator.
 - a. In the Address Bar, located at the top of your browser, type in the IP address you recorded in the step above.
 - b. Select Chassis Who and double click on the processor module. Verify that the firmware revision level you recorded using RSLinx was accurate.