

Fall 2010

A PLC Overview for Non-I&C Engineers



PLC Session Outline

- What is a PLC?
- What are the types of PLCs?
- History of the PLC
- What is Ladder Logic?
- What is Function Block Programming?
- What functions are there in a PLC?
- Review current major manufacturers
 - Allen Bradley
 - GE Fanuc
 - Siemens
 - Modicon
- Demonstration

What is a PLC ?

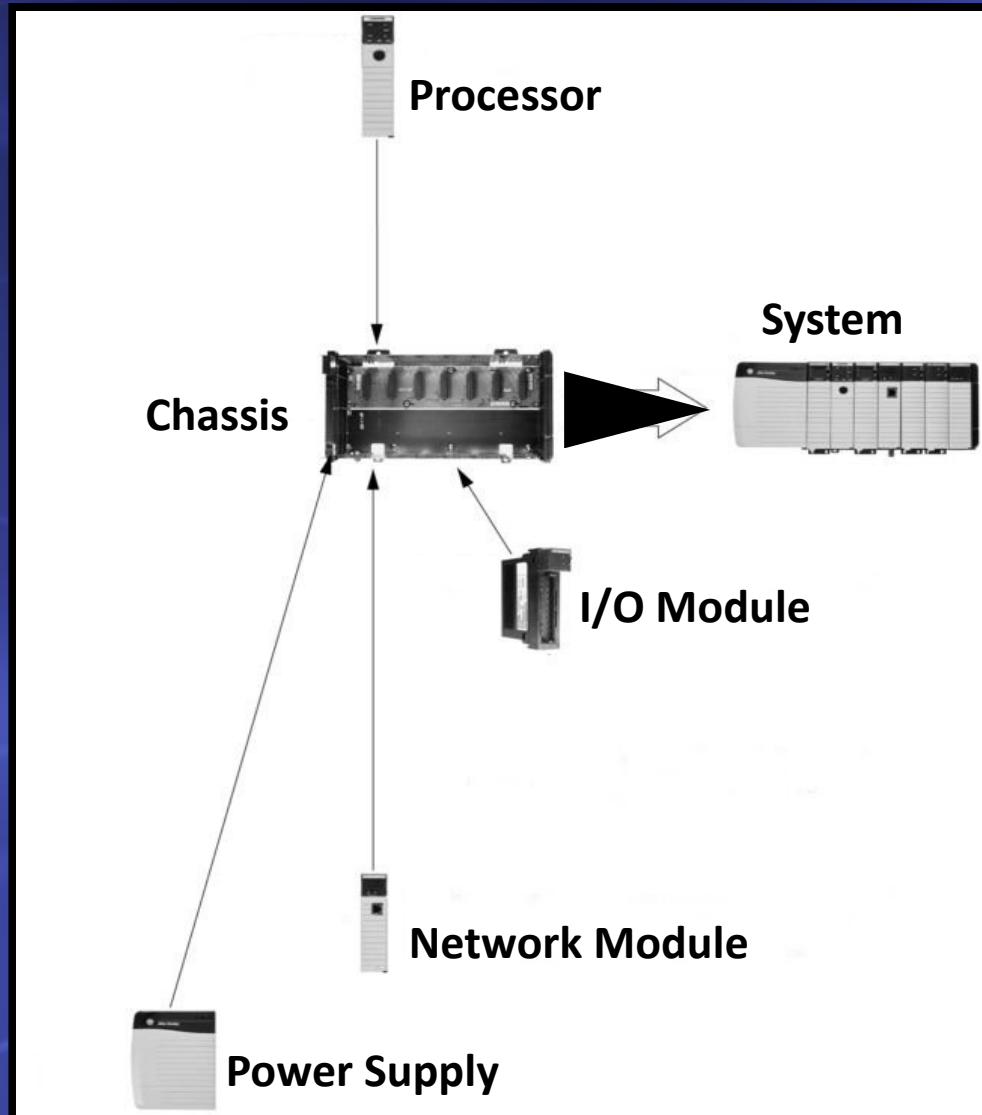
- PLC = Programmable Logic Controller
- Major components: power supply, processor, I/O, and network connection
- Processor uses its own operating system and application development software
- I/O cards interface with standard real-world electrical signals
 - 110 VAC inputs and outputs for motor starters
 - 24 VDC inputs for switches
 - 4-20mA for levels, pressures and flows
 - RTD and thermocouple cards for temperatures
 - 4-20 mA outputs to control valves and VFD speeds
- Ethernet networking available

What is a PLC?

(Continued)

- In general, each manufacturer offers two PLC types:
 - Modular design for larger applications
 - Integrated “brick” design with fixed I/O for smaller applications

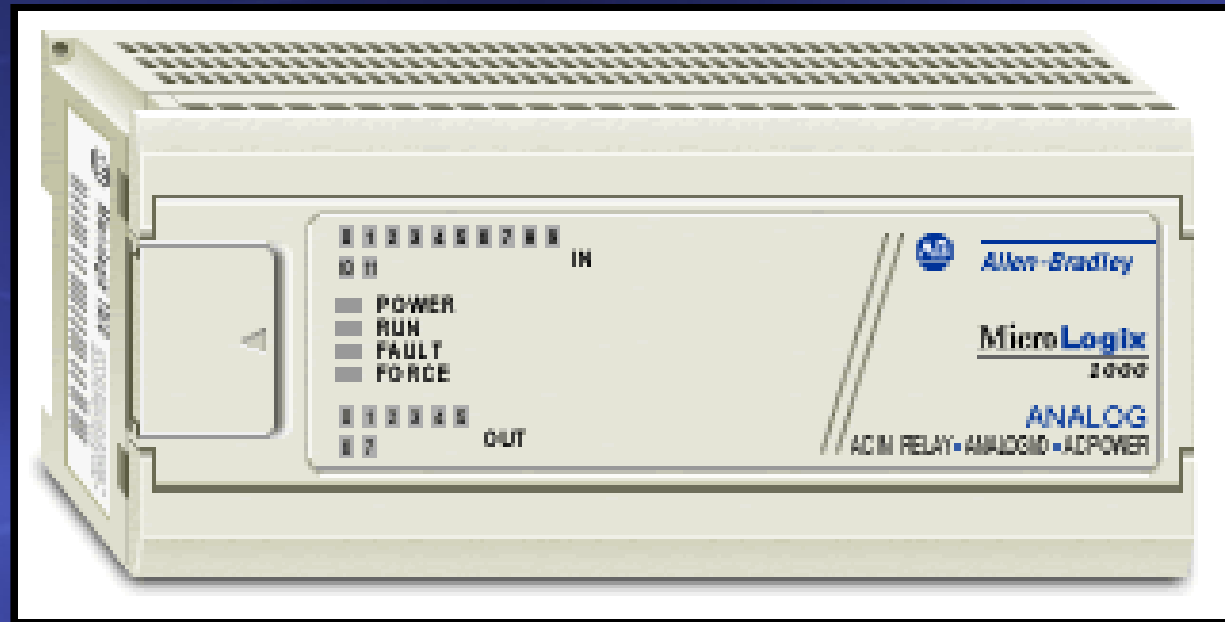
Typical Modular PLC Design



Typical “Brick” PLC Design

I/O Connections

Network
Connection



Embedded Processor
and Power Supply

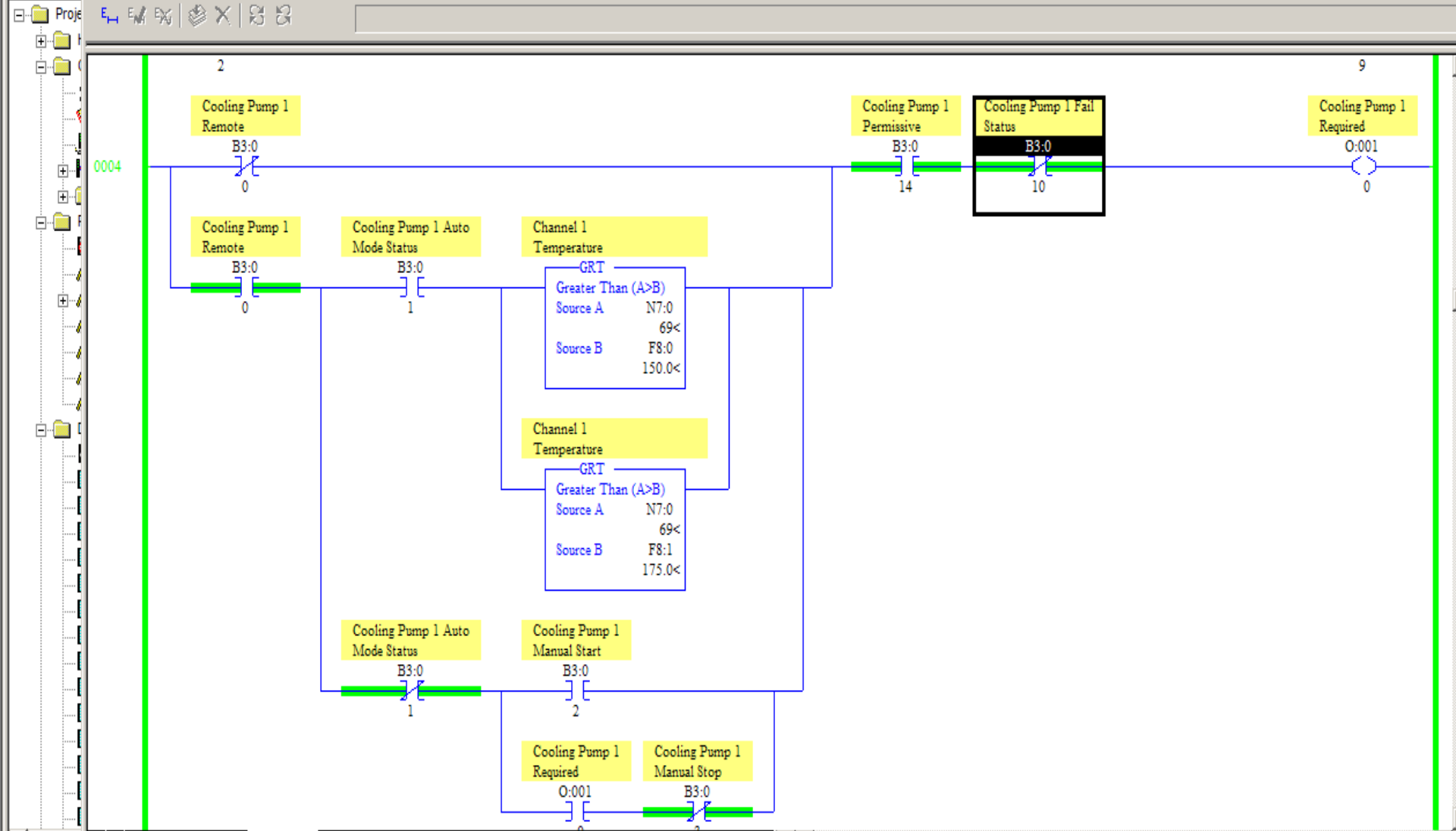
History of the PLC

- Invented in the early 1970s by Modicon Corporation
- Based originally on a General Motors Specification to replace relays
- Meant to reduce capital and changeover costs
- Analog capability was added by the early 1980s

What is Ladder Logic?

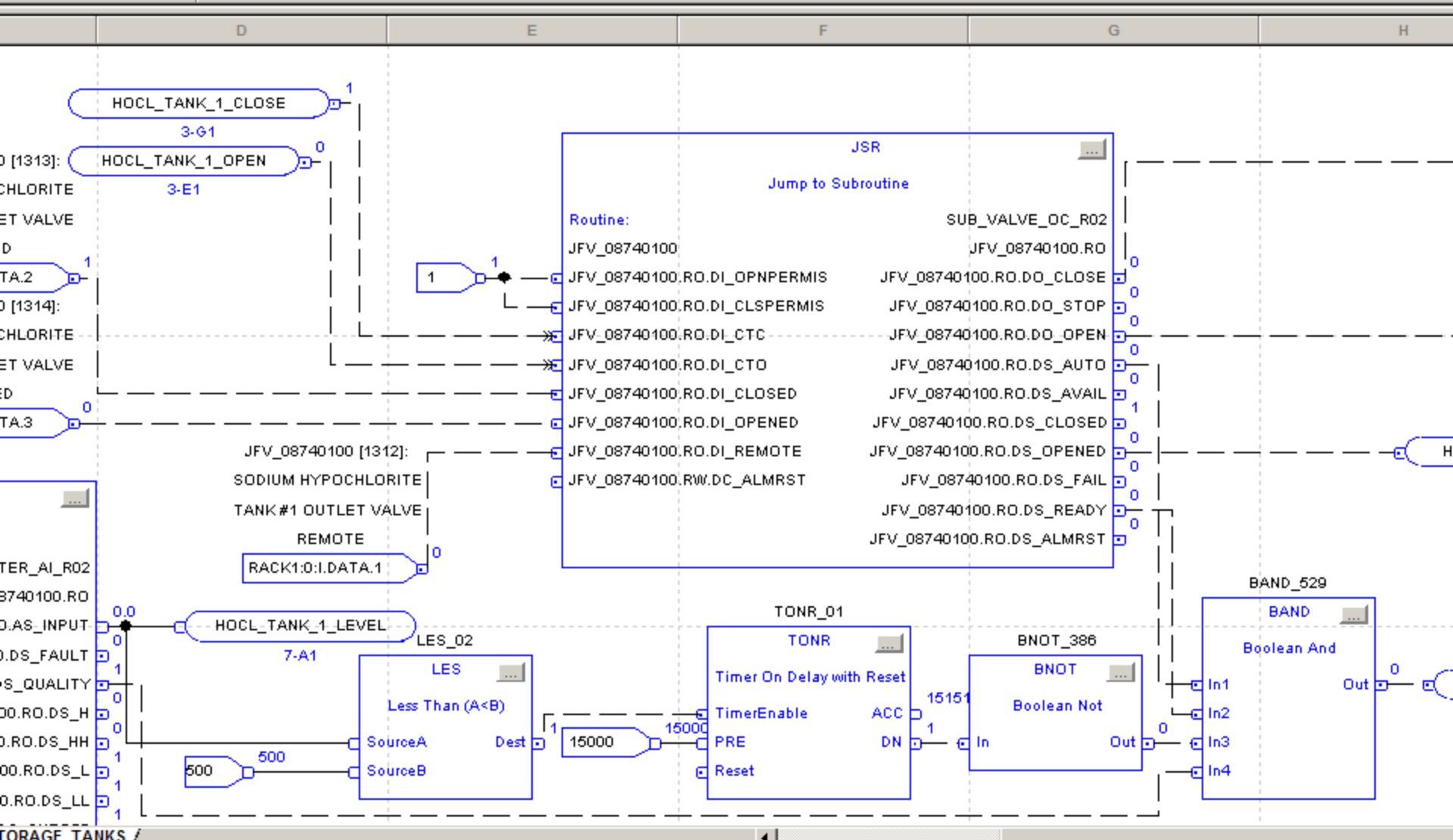
- Graphic language meant to look like Relay Logic Diagrams
- Primarily comprised of:
 - Relay coils and contacts
 - Timers
 - Compares
 - Math functions
 - Program control
 - File functions

LWWW LAD 4 - PUMP 1



What is Function Block Programming?

- Graphic language meant to look like flow diagrams
- Preferred by chemical/process types
- Primarily comprised of:
 - Input and Output control
 - Logic functions (AND, OR, XOR)
 - Scaling, filters and control functions (PID)
 - Math functions
 - Compare functions (< > =)
 - Timers
 - Program control



What Functions are in a PLC?

- PLC programming is similar to learning chess:
It does not take long to learn the moves but it can take a lifetime to get good at the game.

RSLogix 5000 Instruction Set

For information about an [instruction](#), click on the category or [mnemonic](#). You can also use the [alphabetical listing](#) to find more information on a particular instruction.

Note: For more information on Structured Text programming syntax, refer to [Structured Text Syntax](#)

Instruction Categories

Supported Instructions by Language *

[Advanced Math Instructions](#)



Same as Relay Ladder



[Array \(File\)/Shift Instructions](#)



Not available

Not available

[ASCII Conversion Instructions](#)



Not available

Same as Relay Ladder

[ASCII Serial Port Instructions](#)



Not available

Same as Relay Ladder

[ASCII String Instructions](#)



Not available

Same as Relay Ladder


[Bit Instructions](#)




Same as Function Block

RSLogix 5000 Instruction Set

Compare Instructions

 CMP LIM MEQ EQU NEQ LES GRT LEQ GEQ


 LIM MEQ EQU NEQ LES GRT LEQ GEQ

 Not available


Compute/Math Instructions


 CPT ADD SUB MUL DIV MOD SQR NEG ABS

 ADD SUB MUL DIV MOD SQR NEG ABS

 SQR ABS

Drives Instructions


 These instructions are not available in relay ladder.

 PMUL SCRVI PI INTG SOC UPDN

 Same as Function Block


File Misc. Instructions

 FAL FSC COP FLL AVE SRT STD SIZE CPS

 Not available

 COP SRT SIZE CPS

Filter Instructions


 These instructions are not available in relay ladder.


 HPF LPF NTCH LDL2 DERV

 Same as Function Block

For Break Instructions

 FOR BRK

 Not available

 Not available


Input/Output Instructions

 MSG GSV SSV IOT

RSLogix 5000 Instruction Set

[Math Conversion Instructions](#)





 Same as Relay Ladder



[Motion Configuration Instructions](#)





 Not available

 Same as Relay Ladder

[Motion Coordinated Instructions](#)




 Not available

 Same as Relay Ladder

[Motion Event Instructions](#)





 Not available

 Same as Relay Ladder

[Motion Group Instructions](#)





 Not available

 Same as Relay Ladder

[Motion Move Instructions](#)



 Not available

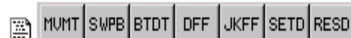
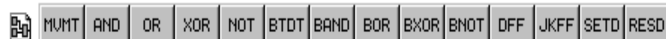
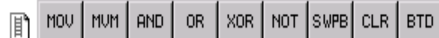
 Same as Relay Ladder

[Motion State Instructions](#)



RSLogix 5000 Instruction Set

Move/Logical Instructions



Process Control Instructions

These instructions are not available in relay ladder.

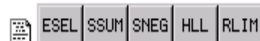
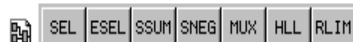


Program Control Instructions

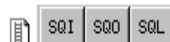


Select/Limit Instructions

These instructions are not available in relay ladder.



Sequencer Instructions



Not available

Not available

Special Instructions




Not available

Not available

RSLogix 5000 Instruction Set

Statistical Instructions

 These instructions are not available in relay ladder.

 MAVE MSTD MIN MAX

 Same as Function Block

Timer/Counter Instructions


 TON TOF RTO CTU CTD RES


 TONR TOFR RTOR CTUD

 Same as Function Block




Trigonometric Instructions

 SIN COS TAN ASN ACS ATN

 Same as Relay Ladder

 Same as Relay Ladder

* Programming languages are designated as follows:

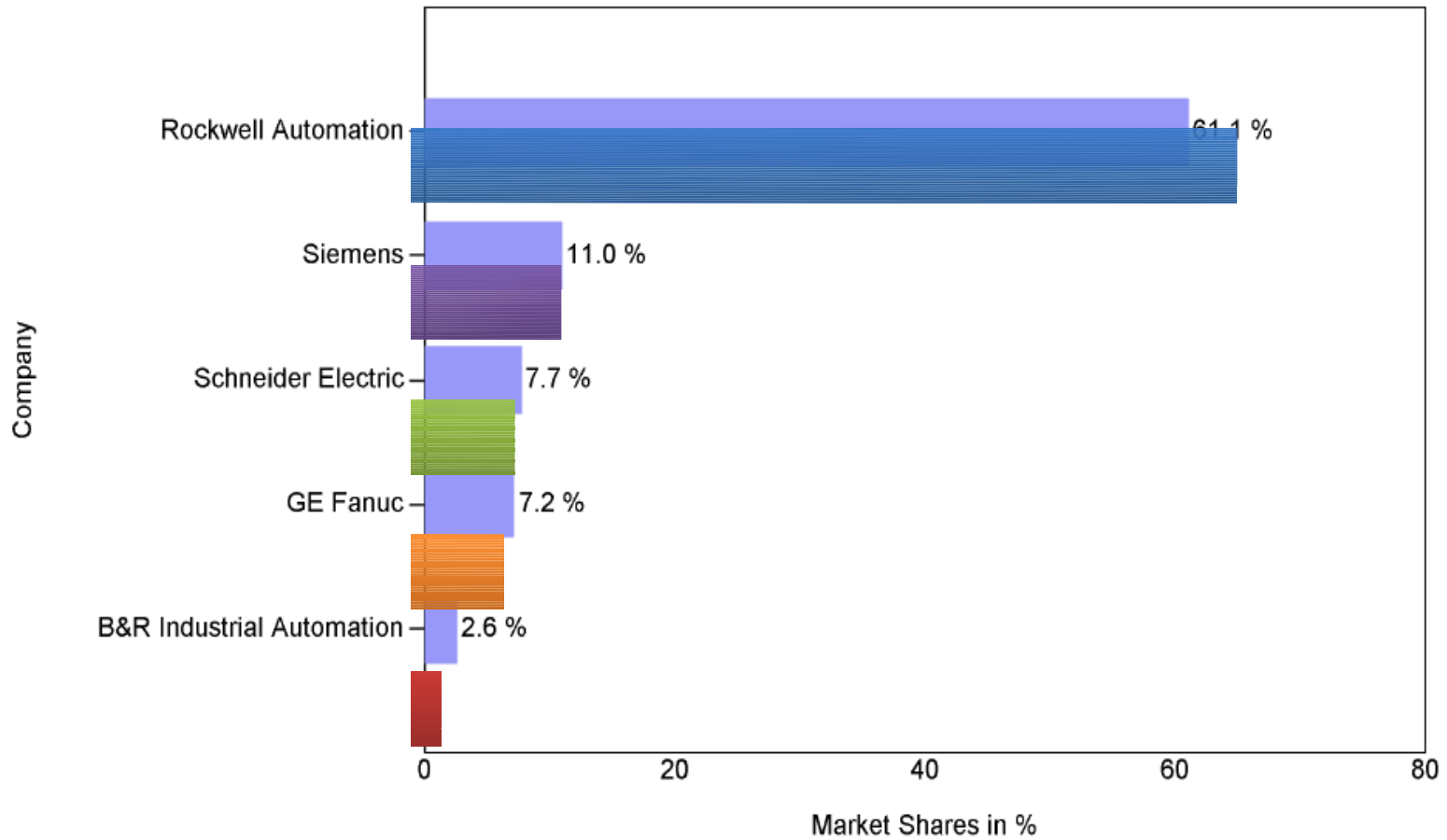
-  - Relay Ladder Logic
-  - Function Block
-  - Structured Text

Current Major US PLC Brands

- Allen Bradley
- GE Fanuc
- Siemens
- Modicon

Leading Suppliers of Programmable Logic Controllers for North America

2008 = 1,921.2 Million US Dollars



Allen Bradley Company

- Headquarters: Milwaukee, WI
- Manufacturing: Highland Heights, OH
- Company history
 - Offering industrial control equipment for over 100 years
 - One of first makers of PLCs
 - Currently the most dominant US PLC manufacturer: 61% of market share
 - Worldwide: second behind Siemens

GE Fanuc Company

- Headquarters: Charlottesville, VA
- Manufacturing: Charlottesville, VA
- Company history
 - 1970s started as GE & Fanuc joint venture
 - Currently has 7.5% of US market share
 - Part of the GE Infrastructure Group (considered to be the core growth area for GE)

Siemens Company

- Headquarters: Germany
- Manufacturing: worldwide
- Company history
 - One of world's oldest electrical component manufacturers
 - Currently the most dominant worldwide
 - Currently has 11% of US market share
 - Claims double digit sales growth in the US over the last 5 years

A Warning When Using

Achtung!

ALLES LOOKENSGEPEEPERS: Dieses computenmaschine is nicht für gefinger pokken und mittengraben. Ist is easy schnappen der springenwerks, blowen fusen, und poppencorken mit spitzensparken. Es ist nicht für gewerken by das Dummkopf. Das rubbernechen sightseeren keepen hands in dem pockets—relaxen und watchen dem lights blinken.

Modicon

- Headquarters: Andover, MA
- Manufacturing: Andover, MA
- Company history
 - Inventor of the PLC
 - Purchased by Groupe Schneider
 - Currently has 8% of US market share

PLC Demonstration

PLC-5/20E

A Thermocouple Module with 2 Type T Thermocouples

A I/O Simulator Module

A 120VAC Digital Output Module

RS View SE as the HMI

Questions?