Experience the fast and easy way to highest productivity

Allen Bradley Control Logix to Siemens Portal Workshop
Workshop Details

• Put together with intermediate to expert users of Studio 5000 (RSLogix 5000) in mind
• Not a TIA Portal Training Class nor a Studio 5000 Training Class
• Will demonstrate how TIA Portal and Studio 5000 are similar
• Will demonstrate how TIA Portal and Studio 5000 are different
• Will hopefully entice participants to want to attend a TIA Portal training class
• Topics will be presented via PowerPoint and overhead examples
• Comparing Studio 5000 V21 with TIA Portal V13
• Hands-on examples will be worked together as a group
Comparing AB to Siemens:
1. Hardware
2. Software
3. Projects
4. Tags
5. Online edits/downloading
6. Programs (routines, AOIs, function, function blocks)
Comparing AB to Siemens:
1. Reference projects
2. Libraries
3. HMI Development
4. Drives
5. Diagnostics
6. Trending
7. PLC to PLC communication
8. Q&A
Hardware Comparison

- ControlLogix
- CompactLogix
- PowerFlex 70
- PanelView Plus
- Point I/O

Ethernet/IP

- S7-1500
- S7-1200
- SINAMICS G120
- Comfort Panel
- ET200SP I/O

ProfiNet
PEOFINET

- Open Protocol
- NOT Profibus on Ethernet
- Flexible architecture:
  (Star, Ring, Tree, Wireless, ect.)
- In depth diagnostics
- Deterministic I/O
- Motion and Safety
- Secure
Software Comparison

Studio 5000 V21
- Logix Designer

Logix Designer for Drives

FactoryTalk View Studio

TIA Portal
- Step 7
- StartDrive

WinCC
One engineering framework for all automation tasks
Including visualization, automation and drives

TIA Portal
I/O Layout of Demo Unit

S7-1500 Analog In Slot 2 Channel 2
S7-1500 Analog In Slot 2 Channel 6
S7-1500 Digital Input Slot 2 Channel 0
S7-1500 Digital Input Slot 2 Channel 1
ET200S Digital Output Slot 2 Channel 0
ET200S Digital Output Slot 2 Channel 1
Studio 5000 Logix Layout

- Menu Bar
- Standard Toolbar
- Instruction Toolbox
- Online Toolbox
- Controller Organizer
- Logic View Window
TIA Portal Step 7 Layout
Network View
TIA Portal Step 7 Layout
Ladder View

- **Project Tree**
- **Menu Bar**
- **Title Bar**
- **Task Cards**
- **Work Area**
- **Editor Bar**
- **StatusBar**
- **Tool Bar**
TIA Portal Step 7 Layout
HMI View
Projects in Studio 5000

- Single ACD file
- Single controller per project
- HMIs require separate software package (FT View Studio)
- Drives are integrated into project
- Limited library support (export and import)
Projects in TIA Portal

- Multiple files in multiple folders
- Multiple controllers per project
- Multiple HMIs per project
- Multiple drives per project
- Projects can be archived down to a single file for e-mailing and sharing.
- Mature library functionality
Creating a new project in Studio 5000 (demo)

- Controller type, chassis type, slot number must all be configured at this time
- MainTask, MainProgram, and MainRoutine are created automatically
- I/O Configuration is empty
Creating a new project in TIA Portal (demo)

- Notice the project tree is mostly empty.
- Notice no controller has been selected. That is because the project can contain multiple controllers, HMIs, drives.
- The default path to the project is My Documents\Automation
- Select Project-Archive to reduce project down to a single shareable file
- Project-Retrieve will expand an archived project back to its original folder structure.
Hardware Configuration

In Studio 5000

- Non-graphical tree interface
- I/O tag-names tied to module location
- I/O tag-names based on module type
- Aliasing versus buffering

In TIA Portal

- Graphical interface
- I/O addresses auto-assigned independent of module location
- “Nice” I/O tag-names assigned at module level
Hardware Configuration
In Studio 5000

• Demonstrate local I/O configuration

• Demonstrate remote I/O configuration
TIA Portal I/O Configuration Demonstration

Network View

Device View
Demo Unit I/O Tags

- PLC_1 Slot 2 CH 0 – “Green_PB”
- PLC_1 Slot 2 CH 1 – “Blue_PB”
- PLC_1 Slot 3 CH 2 – “Pot_1_Raw”
- PLC_1 Slot 3 CH 6 – “Pot_2_Raw”
- IO device_1 Slot 2 CH 0 – “Green_Light”
- IO device_1 Slot 2 CH 1 – “Blue_Light”
- Examine PLC tags and verify creation
Communications

Studio 5000
- BOOTP or DHCP
- RSLinx
- Onboard Communication Options (USB, RS-232)
- Programming station must be on same subnet for Ethernet communication

TIA Portal
- Accessible Devices
- No additional software required (i.e. RSLinx)
- Onboard Communication Options (Profibus, Profinet)
- Additional IP address added to programming station to allow immediate Ethernet communications
Demo Communications

- Press the “Accessible devices” button

- Verify all demo case devices are shown

- Flash LEDs on PLC_1 and PLC_2
Download

Studio 5000
- Path set via “Who Active” and RSLinx
- Project compile occurs automatically
- Processor stopped during download

TIA Portal
- Path set as part of download process
- Project compile occurs automatically
- Processor stopped during download for Hard-Ware Configuration downloads only
Demo Download

- Download PLC_1
- Discuss each dialog screen
Getting Online

Studio 5000

- Path set via “Who Active” and RSLinx
- Offline and Online projects are compared and user is asked to either upload, download, or create new project
- Offline and Online differences are not highlighted without utilizing offline tools
- Software clearly indicates the online state

TIA Portal

- Path set as part of download process
- Offline and Online projects are compared and user is encouraged to rectify differences
- Offline and Online differences are clearly highlighted
- Software clearly indicates the online state
Demo Getting Online

- Go online with PLC-1
- Discuss how software notifies user of online status (i.e. orange header, etc.)
- Discuss how software notifies user of online versus offline differences

<table>
<thead>
<tr>
<th>Icon</th>
<th>Meaning</th>
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<tbody>
<tr>
<td>🔄</td>
<td>Hardware error in lower-level component: The online and offline versions differ (only in the project tree) in at least one lower-level hardware component.</td>
</tr>
<tr>
<td>🔄</td>
<td>Software error in lower-level component: The online and offline versions differ (only in the project tree) in at least one lower-level software component.</td>
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<tr>
<td>🔄</td>
<td>Online and offline versions of the object are different</td>
</tr>
<tr>
<td>🔄</td>
<td>Object only exists online</td>
</tr>
<tr>
<td>🔄</td>
<td>Object only exists offline</td>
</tr>
<tr>
<td>🔄</td>
<td>Online and offline versions of the object are the same</td>
</tr>
</tbody>
</table>
Forcing I/O and Modifying Tag Values

Studio 5000
- Force Via Controller Tags or Program Tags
- Forces can be enabled and disabled
- Software and hardware clearly identify when forces are present
- Non I/O tags can be modified from “Controller Tags or “Program Tags” or directly in Logic

TIA Portal
- Force via Force table
- Forces can be enabled and disabled
- Software and hardware clearly identify when forces are present
- Non I/O tags can be modified from watch table(s) or directly in Logic
Demo Forcing and Watch Tables

- Use Force table to force green light and blue light on
- Add a new watch table and monitor Green_PB, Blue_PB, Pot_1_Raw, Pot_2_Raw
- Multiple watch tables can be created so tags can be grouped logically
Online Editing

Studio 5000
- Start Edits
- Preform Edits
- Accept Edits (compile)
- Test Edits
- Assemble Edits (download)

TIA Portal
- Edits are performed offline
- Compile Edits (offline)
- Download Edits (processor is NOT stopped)
- New Edits are executed next scan, (i.e. bumpless)
Tags Characteristics

Studio 5000
- Controller Scope or Program Scope
- Alias tags
- 40 character limit
- No special characters (underscores only)
- Tags must be defined in Controller Tags or Program Tags
- Assemble Edits (download)

TIA Portal
- All tags are global Scope
- Alias tags (via PLC tags)
- 128 character limit
- Special characters are allowed (except quotation marks)
- User-definable tag tables for increased organization
# IEC 61131-3 Regulations

### Data Type

<table>
<thead>
<tr>
<th>Data Type</th>
<th>Studio 5000</th>
<th>TIA Portal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boolean</td>
<td>BOOL</td>
<td>Bool</td>
</tr>
<tr>
<td>Counter</td>
<td>COUNTER</td>
<td>IEC_COUNTER</td>
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<td>Double Integer</td>
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<td>Date_And_Time</td>
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</tr>
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<td>User Defined</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Arrays</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Studio 5000 Controller Organization

- Tasks (continuous, periodic, event)
- Programs
- Routines
- Controller Tags and I/O
- Program Tags
TIA Portal Controller Organization

- Organization Blocks (OB)
- Function Blocks (FB)
- Functions (FC)
- Instance Data Blocks (DB)
- Global Data Blocks (DB)
TIA Portal
Organization Blocks

- Program Cycle – Main program block (similar to Studio 5000 MainRoutine)
- Startup – Called once when PLC placed in Run (similar to Studio 5000 First Scan bit)
- Cyclic interrupt – Called at periodic intervals (similar to Studio 5000 cyclic tasks)
- Programming error – Called if an error occurs during program execution (similar to Studio 5000 fault routine)
- Others – Time delay, Hardware interrupt, Diagnostic error interrupt, Rack or station failure, etc.
Tia Portal - Functions

- Similar to Studio 5000 routines
- Parameters can be passed in and returned but no local variables are maintained
- Underlying logic can be written in any of the supported languages
TIA Portal – Function Blocks

- Similar to Studio 5000 function blocks and add on instructions (AOIs)
- Parameters can be passed in and returned and local variables can be maintained
- Underlying logic can be written in any of the supported languages
- Instance data blocks are created for each function block call
- Can monitor individual function block calls to aid troubleshooting
Object Oriented Programming

- PLCs were originally just relay replacements
- Added programming languages pushed PLCs to true programming platforms
- Functions, Function Blocks, and user-defined types pushed PLCs to object-oriented programming platforms
- Object oriented programming reduces the amount of code that must be written
- Re-usable code and objects are the key
- Best programming practices are realized
Studio 5000
TIA Portal
TIA Portal Data Blocks

Global Data Blocks
- Similar to Studio 5000 controller tags
- Tag-names of any type can be defined here
- Any function or function block can access tags defined in a global data block

Instance Data Blocks
- Similar to Studio 5000 instance tags attached to function block instructions
- Tag-names defined are based on the design of the function block they reference
- Any function or function block can access tags defined in an instance data block
Working with Blocks

Open “PortalWorkshopStart” project
- PLC_1 Slot 2 Ch 0 – “PumpARunning”
- PLC_1 Slot 2 Ch 1 – “PumpAReset”
- PLC_1 Slot 3 Ch 2 – “TankALevelRaw”
- IO device_1 Slot 2 Ch 0 – “PumpAStart”
- IO device_1 Slot 3 Ch 1 – “PumpAFault”

Create a global data block (DB) named “GeneralData”

- Add tag “TankALevel” of type Real to “GeneralData”
- Add tag “PumpATimer” of type IEC_TIMER to “GeneralData”
Working with Blocks (cont.)

- Add a function (NOT a function block) named “TankControl” using LAD
Working with Blocks (cont.)

- Add call to TankControl in OB1, compile, download, and test.

- TankALevelRaw = Pot 1, PumpARunning = Green Button, PumpAReset = Blue Button, PumpAFault = Red Light

- This code works for TankA but what if we have ten more pumps that are identical?

- Save project, download, and test.

- This code works for TankA but what if we have ten more pumps that are identical?
Working with Blocks (cont.)

- Add function block named TankControlFB using LAD
Working with Blocks (cont.)

- Add call to TankControlFB in OB1. When asked, name the Instance Data Block “TankADB”.

- How does this design make it easier for additional tanks?

- Compile, download, and test.

- Monitor tags in TankADB while testing
Working with Reference Projects

- In Studio 5000, how do you copy logic, tags, or user-defined types from one project to another?
- View Reference projects by clicking View and selecting Reference projects
- Open reference project “Area 300”
- Drag and drop the function ScaleEU from the reference project to PLC_1
- What are some of the drawbacks of this method?
Working with Reference Projects (Cont.)

- Modify TankControlFB as shown below.
Modify the call to TankControlFB in OB1 as shown below.

Save project, compile, download, go online, test.
Working with Libraries

- Libraries provide a way to easily share components of a project with other developers.
- Libraries provide a way to easily share components between projects.
- Projects that use a library-based object can be updated with new versions.
- Different versions of the objects can be maintained.
- Libraries can contain code, objects, I/O layouts, user-defined types, HMIs, tags, DBs.
- Additional information on Libraries is available after class if desired.
Working with Libraries (Cont.)

- Click on “Libraries” tab.
- Open library named “WorkshopLibrary_V13” (deselect read-only checkbox).
- Drag Function block RuntimeHours from Master copies to Program block in PLC_1.
- Call the Function block RuntimeHours from OB1 creating datablock PumpARuntimeHours.
• Drag the function ScaleEU to Master copies in WorkshopLibrary_V13 for later use in other projects

• Drag the function block TankControlFB to Master copies in WorkshopLibrary_V13 for later use in other projects

• Save the WorkshopLibrary_V13

• Compile and download PLC_1

• Test logic
Agenda, Day 1

Comparing AB to Siemens:

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Comparing AB to Siemens:
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8. Q&A
HMI Development

Studio 5000
- FTView Studio external to Studio 5000
- Must configure RSLinx enterprise
- Offline tags can be used by browsing offline ACD file
- Cannot drag-and-drop from PLC to HMI
- Separate application (Application Manager) for archive and retrieve and upload/download

TIA Portal
- WinnCC integrated into TIA Portal
- No additional communication software is required
- Tags can be browsed from any PLC in the project
- Can drag-and-drop from PLC to HMI screens
HMI Integration

- Add SIMATIC Comfort Panel 7” Display TP700 Comfort to PortalWorkshop project using Add new device wizard
- PLC connection to PLC_1 (Ethernet)
- Default screen layout
- Default alarms
- Add a screen from Root screen named “TankA”, “TankB”, and “Diagnostics”
- Add all system screens
- Add “Home” and “Un-ack Alarms” system buttons.
Build the screen below for TankA

GeneralData.TankALevel
TankADB.Running
TankADB.Start
HMI Integration (Cont.)

- Save project, compile, and download

- Test the logic by turning pot to adjust level above 50%

- Press green button to simulate pump running
Drives Integration

- Drives can be added as devices within a project
- Commissioning of the drive is handled through TIA Portal (offline or online)
- Add new device Drives- SINAMICS drives-SINAMICS G120- Control units-CU240E-2 PN-F V4.6
- Add power unit PM340 IP20 FSA U 240V 0.12kW (6SL3210-1SB11-0UA0) (2nd one down)
- 192.168.0.10
- Save project, compile, and download PLC_1
- Go online with Drive_1. Double-click Parameter under Drive_1 and click “Drive on SIMATIC motion control axis” (setup on next slide)
- Double-click Commissioning and use Control panel to verify functionality
Drives Integration for Demo

Data Sets
0 (Active) 0 (Active)

Open-loop/closed-loop
[0] U/f control with linear characteristic

Defaults of the setpoints/command sources
[7] Fieldbus with data set changeover

Drive Setting
[0] IEC-Motor (50 Hz, SI units)
[0] Load duty cycle with high overload for vector drives

Motor
[1] Induction motor (rotating)
p304[0] 230
p305[0] 0.74
p307[0] 0.12
p308[0] 0.75
p310[0] 50
p311[0] 1350
p335[0] [0] Non-ventilated

Important Parameters
Current Limit 1.11
Minimum Speed 0
Maximum Speed 3000
Ramp-up time 0
Ramp-down time 0
OFF3 0

Drive Functions
[0] Inhibited
Calculate motor data only

• Delta configuration
Drives Integration (Cont.)

• Add a new Technology object to PLC_1 (TO_SpeedAxis)

• Link TO_Speed_Axis_1 to Drive_1

• Add new function named PumpControl
Drives Integration (Cont.)

- Add the following to PumpControl

```
Network 1:  .....  

%DB4
"MC_POWER_DB"

MC_POWER
EN  ENO
"TO_SpeedAxis_1"  \text{Axis}
%Q8.0
"PumpAStart"  \text{Enable}
0  \text{StopMode}

Network 2:  .....  

%DB5
"MC_RESET_DB"

MC_RESET
EN  ENO
"TO_SpeedAxis_1"  \text{Axis}
%D0.1
"PumpAReset"  \text{Execute}
false  \text{Restart}
```

CommandAborted
Ok
Error
Errord
Drives Integration (Cont.)

- Add the following to PumpControl

- Then go inside OB1 and call PumpControl
- Compile and download PLC_1. Test by turning Pot_1 above 50%
Diagnostics

Studio 5000

- Major Faults buffer holds last three major faults
- Minor Faults buffer holds last eight minor faults
- Front processor and I/O modules LEDs show the presence of faults
- Scrolling marquee on processor provides limited diagnostic information
- Additional PLC programming (GSV) is required to display hardware diagnostics at the HMI level

TIA Portal

- Built-in diagnostic buffer on CPU holds last 50 entries
- Front processor and I/O modules LEDs show the presence of faults
- Diagnostic messages can be displayed on HMI with no additional programming
- Diagnostic messages can be displayed on 1500 with no additional programming
- Diagnostic messages can be displayed via remote website
Diagnostics (Cont.)

- Open HMI_1 Diagnostics screen in TIA Portal
- Drag “Systems diagnostic view” control to Diagnostics screen and size accordingly
- Modify HMI_1 Runtime settings to include S7 diagnostic alarms and enable HTML pages
- Modify PLC_1 Device configuration to allow Web server access
- Compile and download HMI_1 and PLC_1
- Remove the DQ module from IO Device_1
- Go to Diagnostics screen on HMI_1 display and navigate diagnostic message
- Use display on front of S7-1500 to view diagnostic message
Trend / Trace

Studio 5000 (Trend)
- Sample period range from 1 ms to 30 ms
- Trending data is stored on programming device hard drive
- 8 tags per trend
- Studio 5000 must be running for trend to be active
- Logged data can be exported for offline manipulation

TIA Portal (Trace)
- Variable sample rate based on interrupts, scan rates, etc.
- Trending data is stored in controller
- 16 tags per trace job / 4 concurrent trace jobs (Total 64 tags)
- TIA Portal does not have to be running for trace to be active
TIA Portal Trace

- Open project Area 300 with Simulation, compile, download
- Go online with Traces
- Create a new trace named “Trace1”
- Add the following tags to the trace (drag and drop)
  - TankALevelRaw
  - Pot_2_Raw
  - PumpAStart
- Set the Recording conditions Sampling as follows
  - Sample with: “Main”
  - Record every: 100 Cycle
  - Use max. recording duration
- Set the Trigger characteristics as follows
  - Trigger mode: Record immediately
Move the configured trace “Trace1” to Installed traces

Answer “Yes” to enable trace

Activate trace

Alternate pot 1 and pot 2 and verify recording

Deactivate trace

Move installed trace to Recorded traces

Right-click on the recorded trace and Export to a CSV file.

Import data into Excel (semi-colon as delimiter, comma as decimal, period as thousands)
PLC to PLC Communication

Studio 5000 (Trend)
- MSG Instruction
- Produced and Consumed Tags

TIA Portal (Trace)
- GET and PUT Instructions
- I-Device
TIA Portal I-Device

- **I-Device** = Intelligent I/O Device
- **I-device** is linked as an I/O device to a “Higher-level” I/O controller
- Add new device, Controllers, S7-1200, Unspecified as PLC_2
- Use detect to automatically bring in device configuration
- Set PLC_2 Operating mode as shown, compile and download PLC_1 and PLC_2
TIA Portal I-Device (Cont.)

- Assign the following I/O tags in PLC_2:
  - PumpBRunning = DI 0.0
  - PumpBReset = DI 0.1
  - PumpBStart = DQ 0.0
  - PumpBFault = DQ 0.6
  - TankBLevelRaw = %IW200 (in PLC tags for Transfer area)
TIA Portal I-Device (Cont.)

- Open library WorkshopLibrary_V13
- Drag TankControlFB from library to PLC_2 Program blocks
- Drag ScaleEU from library to PLC_2 Program blocks
- Add a call to TankControlFB in OB1 (use instance DB TankBDB)
TIA Portal I-Device (Cont.)

- Assign the following I/O tags in PLC_1:
  - TankBLevelRaw = %QW200 (in PLC tags for Transfer area)

- Add the following instruction to OB1 in PLC_1

```
MOVE %W14 "Pot_2_Raw" IN OUT1 "TankBLevelRaw" %QW200
```
Agenda, Day 2

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Thank You

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