

Planting the Pond: Programmable Logic Control

The screenshot displays the Allen-Bradley Connected Components Workbench Standard Edition interface. The main window is titled "Micro820" and shows the configuration for a Micro820 controller. The interface is divided into several sections:

- Project Organizer (Left):** Shows a tree view of the project structure. The selected project is "East_MS_Final". Under "Micro820", there are folders for "Programs", "Timer", "Timer_setpoint", "Output_Control", "Global Variables", "User-Defined Function Blocks", "User-Defined Functions", and "DataTypes". A specific application "PV800_App1" is listed under "DataTypes".
- Controller Image (Center):** A 3D rendering of the Micro820 controller hardware, showing its physical components and connectors.
- Controller - General (Right):** A configuration panel for the controller. It includes the following fields:
 - Name:
 - Description:
 - Vendor Name: Allen-Bradley
 - Catalog ID: 2080-LC20-20AWB
 - Controller Project: 11
 - Version:

The status bar at the bottom indicates "Error List Output" and "Ready".

East_MS_Final - Connected Components Workbench Standard Edition

File Edit View Device Tools Communications Window Help

Suspend [Icons] Terminal Application Language: [Dropdown] Theme: Default [Dropdown]

Project Organizer Name: East_MS_Final*

- Devices
- Trends
- Micro820*
 - Programs
 - Timer
 - Local Variables
 - Timer_setpoint
 - Local Variables
 - Output_Control
 - Local Variables
 - Global Variables
 - User-Defined Function Blocks
 - User-Defined Functions
 - DataTypes
 - PV800_App1

Timer_setpoint-POU* [X] Timer-POU* Micro820 Start Page

```
1 (* This Structured Text code allows operator to adjust the timers *)
2
3 (* This is to change the value sent from the HMI for time input*)
4 Main_Pump_convert_min := (ANY_TO_DINT(Main_pump_setpoint_from_HMI)*60000);
5 Main_pump_timer_setpoint := ANY_TO_TIME(Main_Pump_convert_min);
6 main_pump_convert_back_to_HMI := (ANY_TO_DINT(main_pump_timer.et)/60000);
7 Main_pump_time_to_HMI := any_to_real(main_pump_convert_back_to_HMI);
8
9 Cycle_time_convert_min := (ANY_TO_DINT(Time_between_cycles_from_HMI)*60000);
10 Time_between_cycles_setpoint := ANY_TO_TIME(Cycle_time_convert_min);
11 Cycle_time_convert_back_to_hmi := (ANY_TO_DINT(time_between_cycles.et)/60000);
12 Time_between_cycle_to_hmi := ANY_TO_REAL(Cycle_time_convert_back_to_hmi);
13
14 Day_convert_min := (ANY_TO_DINT(Daylight_set_point_from_HMI)*60000);
15 Daylight_timer_setpoint := ANY_TO_TIME(Day_convert_min);
16 Day_convert_back_to_hmi := (any_to_dint(daylight_time.et)/60000);
17 Day_time_to_hmi := ANY_TO_REAL(Day_convert_back_to_hmi);
18
19 Night_convert_min := (ANY_TO_DINT(Night_set_point_from_HMI)*60000);
20 Night_timer_setpoint := ANY_TO_TIME(Night_convert_min);
21 Night_convert_back_to_HMI := (ANY_TO_DINT(night_timer.et)/60000);
22 Night_time_to_hmi := ANY_TO_REAL(Night_convert_back_to_HMI);
23
24 (* This part of the code is to send newly created time from above to the timer setpoints*)
```

Error List Output

Ready Ln 24 Col 91 Ch 91

East_MS_Final - Connected Components Workbench Standard Edition

File Edit View Device Format Tools Communications Window Help

Suspend

Terminal Application Language: Theme: Default

Project Organizer

Name: East_MS_Final*

Devices Trends

- Micro820*
- Programs
- Timer
- Local Variables
- Timer_setpoint
- Local Variables
- Output_Control
- Local Variables
- Global Variables
- User-Defined Function Blocks
- User-Defined Functions
- DataTypes
- PV800_App1

Output_Control-POU

Logic Diagram:

- XOR gate: i1 = IO_EM_DI_01, i2 = Fish_protect_test, o1 = AND1.i1
- AND gate: i1 = AND1.o1, i2 = System_enable, i3 = Main_Pump_enable, o1 = OR1.i1
- AND gate: i1 = AND1.o1, i2 = Main_pump_enable_from_HMI, i3 = Daylight_enable, o1 = AND2.o1
- AND gate: i1 = AND2.o1, i2 = Lighting_override_from_HMI, i3 = Light_enable_from_HMI, o1 = AND3.o1
- OR gate: i1 = AND1.o1, i2 = AND2.o1, o1 = OR1.o1
- OR gate: i1 = AND2.o1, i2 = AND3.o1, o1 = OR2.o1
- OR gate: i1 = AND3.o1, i2 = AND1.o1, o1 = OR3.o1
- Comparison gate: i1 = T#30s, i2 = Main_pump_timer_setpoint, o1 = main_tection
- Comparison gate: i1 = T#30s, i2 = Daylight_timer_setpoint, o1 = Daylig_protect

Output List Output

Ready Ln 47 Col 40 Ch 0

East_MS_Final - Connected Components Workbench Standard Edition

File Edit View Device Tools Communications Window Help

Suspend [Icons] Theme: Default Terminal Application Language: [Dropdown]

Project Organizer: East_MS_Final*

Micro820-VAR Output_Control-POU Timer_setpoint-POU* Timer-POU* Micro820 Start Page

| Name | Alias | Data Type | Dimension | Project Value | Initial Value | Comment | Retained | String Size |
|----------------------------|--------------------|-----------|-----------|---------------|---------------|---------|--------------------------|-------------|
| _JO_EM_DO_00 | Lights | BOOL | | TRUE | | | <input type="checkbox"/> | |
| _JO_EM_DO_01 | Main_Pump | BOOL | | TRUE | | | <input type="checkbox"/> | |
| _JO_EM_DO_02 | | BOOL | | TRUE | | | <input type="checkbox"/> | |
| _JO_EM_DO_03 | | BOOL | | FALSE | | | <input type="checkbox"/> | |
| _JO_EM_DO_04 | | BOOL | | FALSE | | | <input type="checkbox"/> | |
| _JO_EM_DO_05 | | BOOL | | FALSE | | | <input type="checkbox"/> | |
| _JO_EM_DO_06 | | BOOL | | FALSE | | | <input type="checkbox"/> | |
| _JO_EM_DI_00 | Water_cycle_float | BOOL | | TRUE | | | <input type="checkbox"/> | |
| _JO_EM_DI_01 | Fish_protect_float | BOOL | | FALSE | | | <input type="checkbox"/> | |
| _JO_EM_DI_02 | | BOOL | | FALSE | | | <input type="checkbox"/> | |
| _JO_EM_DI_03 | | BOOL | | FALSE | | | <input type="checkbox"/> | |
| _JO_EM_DI_04 | | BOOL | | FALSE | | | <input type="checkbox"/> | |
| _JO_EM_DI_05 | | BOOL | | FALSE | | | <input type="checkbox"/> | |
| _JO_EM_DI_06 | | BOOL | | FALSE | | | <input type="checkbox"/> | |
| _JO_EM_DI_07 | | BOOL | | FALSE | | | <input type="checkbox"/> | |
| _JO_EM_DI_08 | | BOOL | | FALSE | | | <input type="checkbox"/> | |
| _JO_EM_DI_09 | | BOOL | | FALSE | | | <input type="checkbox"/> | |
| _JO_EM_DI_10 | | BOOL | | FALSE | | | <input type="checkbox"/> | |
| _JO_EM_DI_11 | | BOOL | | FALSE | | | <input type="checkbox"/> | |
| _JO_EM_AI_00 | | WORD | | 4095 | | | <input type="checkbox"/> | |
| _JO_EM_AI_01 | | WORD | | 1 | | | <input type="checkbox"/> | |
| _JO_EM_AI_02 | | WORD | | 0 | | | <input type="checkbox"/> | |
| _JO_EM_AI_03 | | WORD | | 0 | | | <input type="checkbox"/> | |
| _JO_EM_AO_00 | | WORD | | 0 | | | <input type="checkbox"/> | |
| System_enable | | BOOL | | TRUE | | | <input type="checkbox"/> | |
| Start_Button_on_HMI | | BOOL | | FALSE | | | <input type="checkbox"/> | |
| Stop_Button_on_HMI | | BOOL | | FALSE | | | <input type="checkbox"/> | |
| Main_Pump_enable | | BOOL | | TRUE | | | <input type="checkbox"/> | |
| Main_pump_enable_from | | BOOL | | FALSE | | | <input type="checkbox"/> | |
| Light_enable_from_HMI | | BOOL | | FALSE | | | <input type="checkbox"/> | |
| Lighting_override_from_HMI | | BOOL | | FALSE | | | <input type="checkbox"/> | |
| Dialight_enable | | BOOL | | TRUE | | | <input type="checkbox"/> | |

Micro820*
 Programs
 Timer
 Local Variables
 Timer_setpoint
 Local Variables
 Output_Control
 Local Variables
 Global Variables
 User-Defined Function Blocks
 User-Defined Functions
 Data Types
 PV800_App1

Error List Output

Ready INS

East_MS_Final - Connected Components Workbench Standard Edition

File Edit View Device Tools Communications Window Help

Suspend [Icons] Theme: Default

Terminal Application Language: [Dropdown]

Project Organizer: East_MS_Final*

Micro820-VAR Output_Control-POU Timer_setpoint-POU* Timer-POU* Micro820 Start Page

| Name | Alias | Data Type | Dimension | Project Value | Initial Value | Comment | Retained | String Size |
|-------------------------|-------|-----------|-----------|---------------|---------------|------------------------|--------------------------|-------------|
| Cycle_time_convert_min | | DINT | | 300000 | | | <input type="checkbox"/> | |
| Main_pump_time_to_HM | | REAL | | 7.0 | | | <input type="checkbox"/> | |
| Time_between_cycle_to_H | | REAL | | 0.0 | | | <input type="checkbox"/> | |
| Day_time_to_hmi | | REAL | | 9.0 | | | <input type="checkbox"/> | |
| Night_time_to_hmi | | REAL | | 0.0 | | | <input type="checkbox"/> | |
| main_pump_output_prot | | BOOL | | TRUE | | | <input type="checkbox"/> | |
| Daylight_output_protect | | BOOL | | TRUE | | | <input type="checkbox"/> | |
| main_pump_convert_bac | | DINT | | 7 | | | <input type="checkbox"/> | |
| Cycle_time_convert_back | | DINT | | 0 | | | <input type="checkbox"/> | |
| Day_convert_back_to_hm | | DINT | | 9 | | | <input type="checkbox"/> | |
| Night_convert_back_to_H | | DINT | | 0 | | | <input type="checkbox"/> | |
| __SYSVA_CYCLECNT | | DINT | | 5233659 | | Cycle counter | <input type="checkbox"/> | |
| __SYSVA_CYCLEDATE | | TIME | | T#3h36m16s861 | | Timestamp of the beg | <input type="checkbox"/> | |
| __SYSVA_KVBPERR | | BOOL | | FALSE | | Kernel variable bindir | <input type="checkbox"/> | |
| __SYSVA_KVBCERR | | BOOL | | FALSE | | Kernel variable bindir | <input type="checkbox"/> | |
| __SYSVA_RESNAME | | STRING | | 'CONTROLLER' | | Resource name (max | <input type="checkbox"/> | |
| __SYSVA_SCANCNT | | DINT | | 5233662 | | Input scan counter | <input type="checkbox"/> | |
| __SYSVA_TCYCYCTIME | | TIME | | T#0s | | Programmed cycle ti | <input type="checkbox"/> | |
| __SYSVA_TCYCURRENT | | TIME | | T#3ms | | Current cycle time | <input type="checkbox"/> | |
| __SYSVA_TCYMAXIMUM | | TIME | | T#5ms | | Maximum cycle time | <input type="checkbox"/> | |
| __SYSVA_TCYOVERFLOW | | DINT | | 0 | | Number of cycle ove | <input type="checkbox"/> | |
| __SYSVA_RESMODE | | SINT | | 3 | | Resource execution n | <input type="checkbox"/> | |
| __SYSVA_CCEXEC | | BOOL | | FALSE | | Execute one cycle wh | <input type="checkbox"/> | |
| __SYSVA_REMOTE | | BOOL | | TRUE | FALSE | Remote status | <input type="checkbox"/> | |
| __SYSVA_SUSPEND_ID | | UINT | | 0 | 0 | Last Suspend ID | <input type="checkbox"/> | |
| __SYSVA_TCYWDG | | UDINT | | 2000 | 2000 | Software Watchdog | <input type="checkbox"/> | |
| __SYSVA_MAJ_ERR_HALT | | BOOL | | FALSE | FALSE | Major Error Halted st | <input type="checkbox"/> | |
| __SYSVA_ABORT_CYCLE | | BOOL | | FALSE | FALSE | Aborting Cycle | <input type="checkbox"/> | |
| __SYSVA_FIRST_SCAN | | BOOL | | FALSE | TRUE | First scan bit | <input type="checkbox"/> | |
| __SYSVA_USER_DATA_LO | | BOOL | | FALSE | FALSE | User data lost | <input type="checkbox"/> | |
| __SYSVA_POWERUP_BIT | | BOOL | | FALSE | TRUE | Power-up bit | <input type="checkbox"/> | |
| __SYSVA_POWERUP_COM | | UDINT | | 0 | 0 | Power-up complete | <input type="checkbox"/> | |

Micro820*
 Programs
 Timer
 Local Variables
 Timer_setpoint
 Local Variables
 Output_Control
 Local Variables
 Global Variables
 User-Defined Function Blocks
 User-Defined Functions
 Data Types
 PV800_App1

Error List Output

Ready INS

East_MS_Final - Connected Components Workbench Standard Edition

File Edit View Device Tools Communications Window Help

Suspend [Icons] Theme: Default [Icons] Terminal Application Language: [Icons]

Project Organizer: East_MS_Final*

Micro820-VAR Output_Control-POU Timer_setpoint-POU* Timer-POU* Micro820 Start Page

| Name | Alias | Data Type | Dimension | Project Value | Initial Value | Comment | Retained | String Size |
|-------------------------|-------|-----------|-----------|---------------|---------------|------------------------|--------------------------|-------------|
| Time_between_cycle_to_h | | REAL | | 0.0 | | | <input type="checkbox"/> | |
| Day_time_to_hmi | | REAL | | 9.0 | | | <input type="checkbox"/> | |
| Night_time_to_hmi | | REAL | | 0.0 | | | <input type="checkbox"/> | |
| main_pump_output_prob | | BOOL | | TRUE | | | <input type="checkbox"/> | |
| Daylight_output_protect | | BOOL | | TRUE | | | <input type="checkbox"/> | |
| main_pump_convert_bac | | DINT | | 7 | | | <input type="checkbox"/> | |
| Cycle_time_convert_back | | DINT | | 0 | | | <input type="checkbox"/> | |
| Day_convert_back_to_hm | | DINT | | 9 | | | <input type="checkbox"/> | |
| Night_convert_back_to_H | | DINT | | 0 | | | <input type="checkbox"/> | |
| __SYSVA_CYCLECNT | | DINT | | 5233659 | | Cycle counter | <input type="checkbox"/> | |
| __SYSVA_CYCLEDATE | | TIME | | T#3h36m16s861 | | Timestamp of the beg | <input type="checkbox"/> | |
| __SYSVA_KVBPERR | | BOOL | | FALSE | | Kernel variable bindir | <input type="checkbox"/> | |
| __SYSVA_KVBCERR | | BOOL | | FALSE | | Kernel variable bindir | <input type="checkbox"/> | |
| __SYSVA_RESNAME | | STRING | | 'CONTROLLER' | | Resource name (max | <input type="checkbox"/> | |
| __SYSVA_SCANCNT | | DINT | | 5233662 | | Input scan counter | <input type="checkbox"/> | |
| __SYSVA_TCYCYCTIME | | TIME | | T#0s | | Programmed cycle ti | <input type="checkbox"/> | |
| __SYSVA_TCYCURRENT | | TIME | | T#3ms | | Current cycle time | <input type="checkbox"/> | |
| __SYSVA_TCYMAXIMUM | | TIME | | T#5ms | | Maximum cycle time | <input type="checkbox"/> | |
| __SYSVA_TCYOVERFLOW | | DINT | | 0 | | Number of cycle over | <input type="checkbox"/> | |
| __SYSVA_RESMODE | | SINT | | 3 | | Resource execution n | <input type="checkbox"/> | |
| __SYSVA_CCEXEC | | BOOL | | FALSE | | Execute one cycle wh | <input type="checkbox"/> | |
| __SYSVA_REMOTE | | BOOL | | TRUE | FALSE | Remote status | <input type="checkbox"/> | |
| __SYSVA_SUSPEND_ID | | UINT | | 0 | 0 | Last Suspend ID | <input type="checkbox"/> | |
| __SYSVA_TCYWDG | | UDINT | | 2000 | 2000 | Software Watchdog | <input type="checkbox"/> | |
| __SYSVA_MAJ_ERR_HALT | | BOOL | | FALSE | FALSE | Major Error Halted st | <input type="checkbox"/> | |
| __SYSVA_ABORT_CYCLE | | BOOL | | FALSE | FALSE | Aborting Cycle | <input type="checkbox"/> | |
| __SYSVA_FIRST_SCAN | | BOOL | | FALSE | TRUE | First scan bit | <input type="checkbox"/> | |
| __SYSVA_USER_DATA_LO | | BOOL | | FALSE | FALSE | User data lost | <input type="checkbox"/> | |
| __SYSVA_POWERUP_BIT | | BOOL | | FALSE | TRUE | Power-up bit | <input type="checkbox"/> | |
| __SYSVA_PROJ_INCOMPL | | UDINT | | 0 | 0 | Project Incomplete | <input type="checkbox"/> | |
| * | | | | | | | <input type="checkbox"/> | |

Micro820-VAR Output_Control-POU Timer_setpoint-POU* Timer-POU* Micro820 Start Page

Error List Output

Ready

East_MS_Final - Connected Components Workbench Standard Edition

File Edit View Device Tools Communications Window Help

Suspend Disconnected Theme: Default Terminal Application Language: English (United States) (1033)

Project Organizer Name: East_MS_Final*

Devices Trends

- Micro820*
 - Programs
 - Timer
 - Local Variables
 - Timer_setpoint
 - Local Variables
 - Output_Control
 - Local Variables
 - Global Variables
 - User-Defined Function Blocks
 - User-Defined Functions
 - DataTypes
 - PV800_App1
 - Tags
 - Alarms
 - Recipes
 - Screens
 - 1 - Lighting_control
 - 2 - Home
 - 3 - Pump_control
 - 1001 - Diagnostics
 - 1002 - Alarm Banner

Tag Editor Settings Micro820-VAR Output_Control-POU Timer_setpoint-POU* Timer-POU* Micro820 Start Page

External Memory System Global Connections

Add Delete Undo Redo Import [Advanced >>](#)

| Tag Name | Data Type | Address | Controller | Description |
|---------------------|----------------|------------------|------------|-------------|
| Start system | Boolean | Start_Button_on | PLC-1 | |
| Stop system | Boolean | Stop_Button_on_ | PLC-1 | |
| Run status | Boolean | System_enable | PLC-1 | |
| Main_pump_en... | Boolean | Main_pump_enab | PLC-1 | |
| Light enable | Boolean | Light_enable_fr | PLC-1 | |
| Lighting override | Boolean | Lighting_overrid | PLC-1 | |
| Daylight Setpoint | Real | Daylight_set_poi | PLC-1 | |
| Night setpoint | Real | Night_set_point_ | PLC-1 | |
| Main Pump tim... | Real | Main_pump_setp | PLC-1 | |
| Time Between c... | Real | Time_between_cy | PLC-1 | |
| Force lights on ... | Boolean | Lighting_enable_ | PLC-1 | |
| Cycle time in m... | 32 bit integer | Time_between_cy | PLC-1 | |
| Main Pump tim... | 32 bit integer | Main_pump_conv | PLC-1 | |
| Main_pump_ti... | Real | Main_pump_time | PLC-1 | |
| Time_between_... | Real | Time_between_cy | PLC-1 | |
| Day_time_to_hmi | Real | Day_time_to_hmi | PLC-1 | |
| Night_time_to_... | Real | Night_time_to_h | PLC-1 | |

Tag Count : 17

East_MS_Final - Connected Components Workbench Standard Edition

File Edit View Device Terminal Layout Tools Communications Window Help

Suspend Terminal Application Language: English (United States) (1033)

Project Organizer Name: East_MS_Final*

- Devices
- Trends
- Micro820*

 - Programs
 - Timer
 - Local Variables
 - Timer_setpoint
 - Local Variables
 - Output_Control
 - Local Variables
 - Global Variables
 - User-Defined Function Blocks
 - User-Defined Functions
 - DataTypes
 - PV800_App1
 - Tags
 - Alarms
 - Recipes
 - Screens
 - 1 - Lighting_control
 - 2 - Home
 - 3 - Pump_control
 - 1001 - Diagnostics
 - 1002 - Alarm Banner

Screens: 2 - Home

System Off EAST RAPTORS

Enter time values before starting system. 2/26/2020 2:24:24 PM

Start Stop Lighting screen Pump Screen OS

Error List Output

Ready

East_MS_Final - Connected Components Workbench Standard Edition

File Edit View Device Terminal Layout Tools Communications Window Help

Suspend | Theme: Default | Terminal Application Language: English (United States) (1033)

Project Organizer

Name: East_MS_Final*

Devices Trends

- Micro820*
- Programs
 - Timer
 - Local Variables
 - Timer_setpoint
 - Local Variables
 - Output_Control
 - Local Variables
 - Global Variables
 - User-Defined Function Blocks
 - User-Defined Functions
 - DataTypes
- PV800_App1
 - Tags
 - Alarms
 - Recipes
 - Screens
 - 1 - Lighting_control
 - 2 - Home
 - 3 - Pump_control
 - 1001 - Diagnostics
 - 1002 - Alarm Banner

Screens: 1 - Lighting_control

Tag Editor Settings Micro820-VAR Output_Control-POU Timer_setpoint-POU* Timer-POU*

Lighting Control Screen
2/26/2020
2:24:24 PM

| | | |
|---------------------------|---|---------------------------|
| Day cycle adjust in min | 0 | Min. counting to setpoint |
| Night cycle adjust in min | 0 | |

Manual Lighting enable

Manual Lighting Override

System Control

Pump Control

Error List Output

Ready

East_MS_Final - Connected Components Workbench Standard Edition

File Edit View Device Terminal Layout Tools Communications Window Help

Suspend Terminal Application Language: English (United States) (1033) Theme: Default

Project Organizer Name: East_MS_Final*

- Devices
- Trends
- Micro820*
 - Programs
 - Timer
 - Local Variables
 - Timer_setpoint
 - Local Variables
 - Output_Control
 - Local Variables
 - Global Variables
 - User-Defined Function Blocks
 - User-Defined Functions
 - DataTypes
 - PV800_App1
 - Tags
 - Alarms
 - Recipes
 - Screens
 - 1 - Lighting_control
 - 2 - Home
 - 3 - Pump_control
 - 1001 - Diagnostics
 - 1002 - Alarm Banner

Screens: 3 - Pump_control Tag Editor Settings Micro820-VAR Output_Control-POU Timer_setpoint-POU Timer-POU

Pump Control Screen

Main Pump Enable

Waste Pumping Time Adjust 0 Min. counting to setpoint

Time Between Cycles Adjustment 0 Min. counting to setpoint

System Control Lighting Control

Properties

Error List Output

Ready