

# Certification Test

CT.MotionWorksIEC 01.IECbasic.CertificationTest

# YASKAWA

**Student Name:** \_\_\_\_\_

**Company Name:** \_\_\_\_\_

**Address:** \_\_\_\_\_

**Phone:** \_\_\_\_\_

**Email:** \_\_\_\_\_

**Test Date:** \_\_\_\_\_

## Answers:

|    |    |    |  |
|----|----|----|--|
| 1  | 26 | 51 |  |
| 2  | 27 | 52 |  |
| 3  | 28 | 53 |  |
| 4  | 29 | 54 |  |
| 5  | 30 | 55 |  |
| 6  | 31 | 56 |  |
| 7  | 32 | 57 |  |
| 8  | 33 | 58 |  |
| 9  | 34 | 59 |  |
| 10 | 35 | 60 |  |
| 11 | 36 | 61 |  |
| 12 | 37 | 62 |  |
| 13 | 38 | 63 |  |
| 14 | 39 |    |  |
| 15 | 40 |    |  |
| 16 | 41 |    |  |
| 17 | 42 |    |  |
| 18 | 43 |    |  |
| 19 | 44 |    |  |
| 20 | 45 |    |  |
| 21 | 46 |    |  |
| 22 | 47 |    |  |
| 23 | 48 |    |  |
| 24 | 49 |    |  |
| 25 | 50 |    |  |

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## Taking the Test

- The purpose of this test is to validate the learning experience corresponding to the topics in the training course *IEC 61131-3 Basics with MotionWorks IEC* (Class Number: TRM011-MotionWorksIEC-Basic)
- The test is open book. You may use any website, manuals, software, demo, etc. The test must be taken individually; you may not contact another person for help.
- The software MotionWorks IEC Pro Version 2 is required to take this test. Version 3 of the software may also be used. Go to [www.yaskawa.com/iecs](http://www.yaskawa.com/iecs) for details.
- The following project files are required to take this test. There is one set of project files for use with Version 2 of the software and a separate set for Version 3 of the software.
  1. CertTest\_Project1.zwt
  2. CertTest\_Project2.zwt
  3. CertTest\_Project3.zwt
  4. CertTest\_Project4.zwt
  5. CertTest\_Project5.zwt
  6. CertTest\_Project6.zwt
  7. CertTest\_Project7.zwt
  8. CertTest\_Project8.zwt
  9. CertTest\_Project9.zwt
- Each question has only one correct answer unless otherwise noted. Please clearly record all answers on the answer sheet. All questions are equally weighted. A passing score is 90%.

## Returning the Test

- Please return **only the first page** of the test (the answer sheet) with completed answers and contact information.

**Option 1:** e-mail a scan, photo, or edited pdf of the answer sheet with all answers and contact information to [training@yaskawa.com](mailto:training@yaskawa.com).

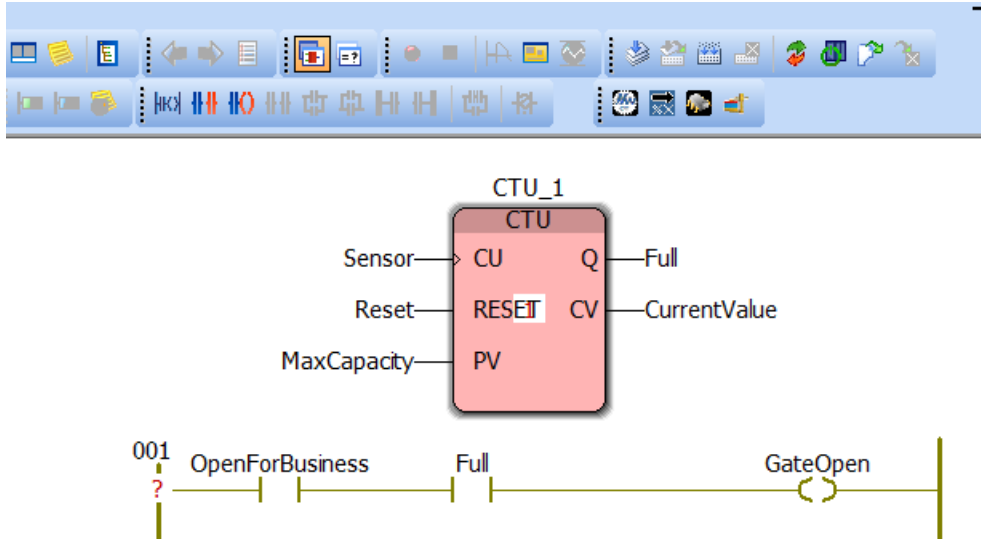
**Option 2:** Fax the answer sheet to **Yaskawa Technical Training Services** at (847) 887-7185.

## Receiving Your Score

You will receive a system-generated email with your score. Please allow up to 5 business days.

## Programming Quick Start

1. The CTU block shown below was running in the PLC simulator. Then the ladder network below it was created. Which button will save the project, compile the code, and send it to the PLC simulator in one click?



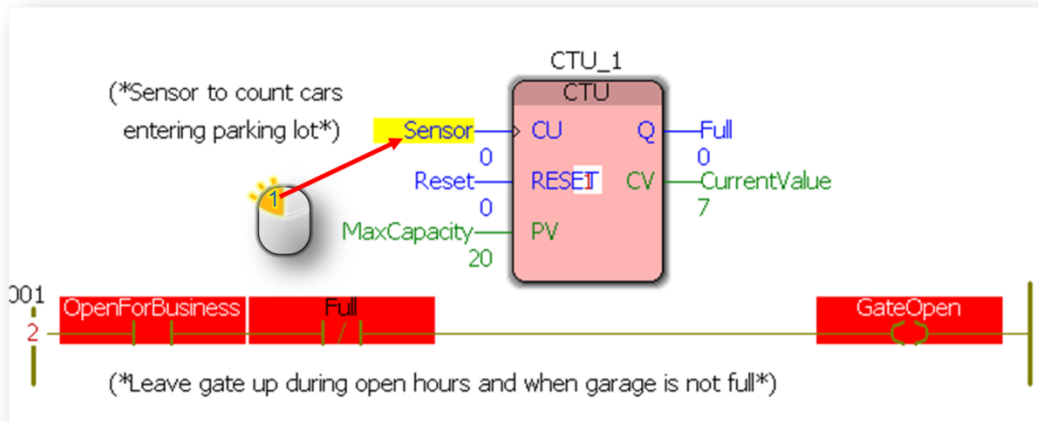
- A. Compile Worksheet
- B. Make
- C. Debug Mode
- D. Project Control
- E. Download Changes
- F. No such button exists

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2. What must be done in order to be able to click on a Boolean variable in debug mode to change its state?



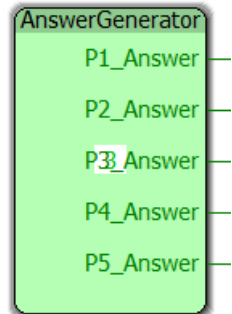
- A. Set the variable property TB and download changes
- B. Set the variable property Retain and download changes
- C. Set the variable initial value and download changes
- D. Activate Online – Toggle Boolean Values
- E. Answers A & C
- F. Answers A, B, C, & D
- G. Answers A & D

*Use MotionWorks IEC Pro to Open/Unzip the file*

*CertTest\_Project1.ZWT. The code has at least 5 errors and will not run correctly. Please edit the 'Money' POU to resolve all errors until the code runs and calculates the equation for the global variable  $G\_Income = \$29.99 \times G\_NumberOfCars$ . Simulate cars hitting the sensor. Then open the Main logical POU and refer to the AnswerGenerator function block in debug mode.*

- 3. Write down the letter given by AnswerGenerator in P1\_Answer
- 4. Write down the letter given by AnswerGenerator in P2\_Answer
- 5. Write down the letter given by AnswerGenerator in P3\_Answer
- 6. Write down the letter given by AnswerGenerator in P4\_Answer
- 7. Write down the letter given by AnswerGenerator in P5\_Answer

AnswerGenerator\_1

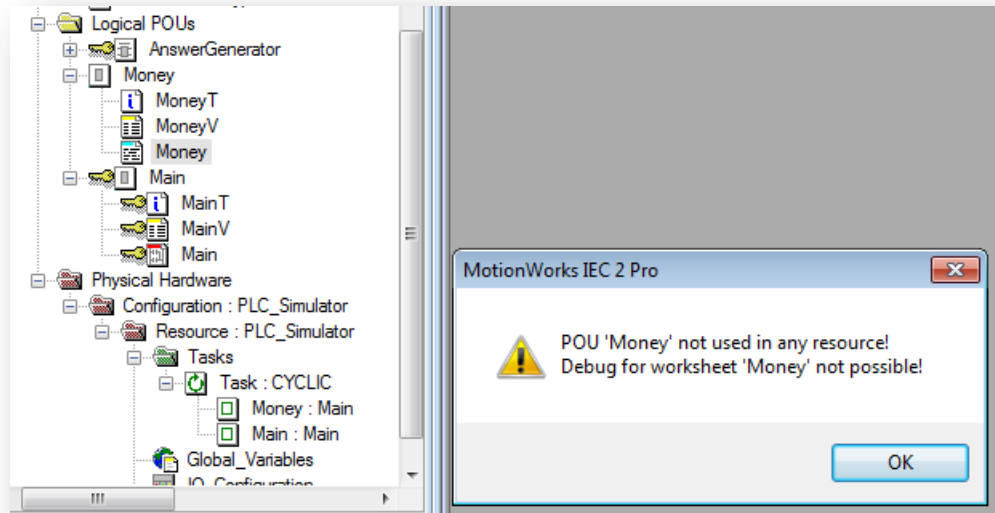


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8. The “Money” program POU was created. The project was successfully compiled and downloaded. However, in debug mode the following message appears. Based on the image below, what must be done for proper operation of the Money POU?

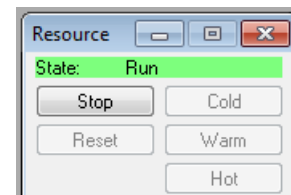


- A. Rebuild project and warm start the PLC simulator
- B. Adjust the properties of the program instance 'Money' in the task
- C. Delete 'Money' from the Logical POUs folder

## Help System

9. 'Run' is one PLC state as shown in the illustration. Use the help system to find a table of states of the PLC. To prove you truly found this table, what is the name of the PLC state at the bottom of the table, as shown in the help?

- A. RUN
- B. HALT
- C. STOP
- D. LOADING
- E. TIMEOUT
- F. POWER ON



10. Use the help to find which single function or function block would be used to calculate  $14^6$  (fourteen to the sixth power)
- A. EXP
  - B. EXPT

## Using I/O

11. A variable in a real PLC (not the simulator) has the address %QB100. What item in MotionWorks IEC shows which PLC output module corresponds to this address?
- A. Data Types
  - B. Global\_Variables
  - C. IO\_Configuration
  - D. Cross Reference

12. The variable G\_OutputBlock is shown below. The variable starts at byte 100. What is the correct address?

|  | Name          | Type | Usage      | Desc... / | Address | Init |
|--|---------------|------|------------|-----------|---------|------|
|  | System        |      |            |           |         |      |
|  | G_OutputBlock | WORD | VAR_GLOBAL |           |         |      |
|  | G_Sensor      | BOOL | VAR_GLOBAL |           | %I0.0   |      |

- A. %100
- B. %B100
- C. %W100
- D. %QB100
- E. %QW100
- F. %QX100.0
- G. %IB100
- H. %IW100
- I. %IX100.0

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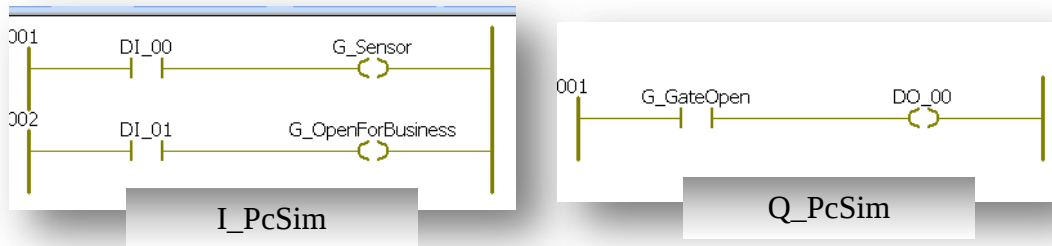
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13. The image below shows that Input 0 of the PLC simulator is on. What is the most likely reason that G\_Sensor in the global variable list is not TRUE?

| Name              | Online value | Type | Usage      | Desc... | Address |
|-------------------|--------------|------|------------|---------|---------|
| <b>System</b>     |              |      |            |         |         |
| G_OutputBlock     | 16#0000      | WORD | VAR_GLOBAL |         |         |
| G_Sensor          | FALSE        | BOOL | VAR_GLOBAL |         | %IX0.0  |
| G_OpenForBusiness | FALSE        | BOOL | VAR_GLOBAL |         |         |
| G_GateOpen        | FALSE        |      |            |         |         |
| PLCMODE_RUN       | FALSE        |      |            |         |         |
| PLCMODE_STOP      | TRUE         |      |            |         |         |
| PLCMODE_HALT      | FALSE        |      |            |         |         |
| PLCDEBUG_BPSET    | FALSE        |      |            |         |         |
| PLCDEBUG_FORCE    | FALSE        |      |            |         |         |
| PLCDEBUG_POWE...  | FALSE        |      |            |         |         |
| PLC_TICKS_PER_SEC | 100          |      |            |         |         |

- A. Debug mode is not activated
- B. The PLC is in the wrong state
- C. The address for G\_Sensor is incorrect

14. The program "I\_PcSim" writes input variables to global variables, and "Q\_PcSim" writes global variables to output variables as shown...



... Which organization of the task most closely follows best practice?

- A. Task : CYCLIC
  - Q\_PcSim : Q\_F
  - I\_PcSim : I\_Pc
  - Money : Money
  - Main : Main
- B. Task : CYCLIC
  - I\_PcSim : I\_Pc
  - Q\_PcSim : Q
  - Money : Mone
  - Main : Main
- C. Task : CYCLIC
  - I\_PcSim : I\_P
  - Q\_PcSim : Q
  - Money : Mone
  - Main : Main
- D. Task : CYCLIC
  - Q\_PcSim : Q\_PcSim
  - Money : Money
  - Main : Main
  - I\_PcSim : I\_PcSim

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Use MotionWorks IEC Pro to Open/Unzip the file CertTest\_Project2.ZWT. The project has compile errors and will not run correctly. Please resolve all errors until the code runs on the simulator. Simulate cars hitting the sensor. Refer to the output of the AnswerGenerator function block in the POU "Main"

15. Write down the letter given by AnswerGenerator in P1\_Answer
16. Write down the letter given by AnswerGenerator in P2\_Answer
17. Write down the letter given by AnswerGenerator in P3\_Answer
18. Open the POU "Main" from CertTest\_Project2. What best practice is not being followed
  - A. The I/O variables are defined as VAR instead of VAR\_GLOBAL
  - B. The I/O variables are defined as VAR\_GLOBAL instead of VAR
  - C. The I/O variables do not start with G\_
  - D. The I/O variables are not used in separate program POUs

## Monitoring

19. In the illustration below, which variables are forced?

The screenshot shows the Yaskawa MotionWorks IEC Pro software interface. The top part displays a ladder logic diagram with two rungs. Rung 001 contains a normally open contact labeled 'DI\_00' in a pink box, connected to a coil labeled 'G\_Sensor' in a red box. Rung 002 contains a normally open contact labeled 'DI\_01' in a red box, connected to a coil labeled 'G\_Open' in a red box. Below the diagram is a table titled 'Global variables: Configuration.Resource - Configuration.Resource:Global\_variables'. The table has columns: Name, Online val..., Type, Init, Retain, and Usi. Under the 'PC Simulator' section, the following variables are listed:

| Name     | Online val... | Type | Init | Retain                   | Usi    |
|----------|---------------|------|------|--------------------------|--------|
| DO_PcSim | 16#04         | BYTE |      | <input type="checkbox"/> | VAR_GL |
| DO_02    | TRUE          | BOOL |      | <input type="checkbox"/> | VAR_GL |
| DO_01    | FALSE         | BOOL |      | <input type="checkbox"/> | VAR_GL |

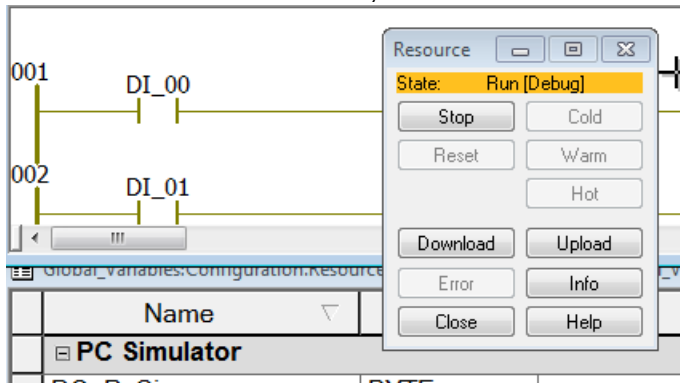
- A. DI\_00
- B. G\_Sensor
- C. DI\_01
- D. G\_Open
- E. DO\_01
- F. DO\_02
- G. DI\_00 and DI\_01
- H. G\_Sensor and G\_Open
- I. DI\_00, DI\_01, and DO\_02
- J. DI\_00, DI\_01, DO\_01, and DO\_02
- K. DI\_00 and DO\_02

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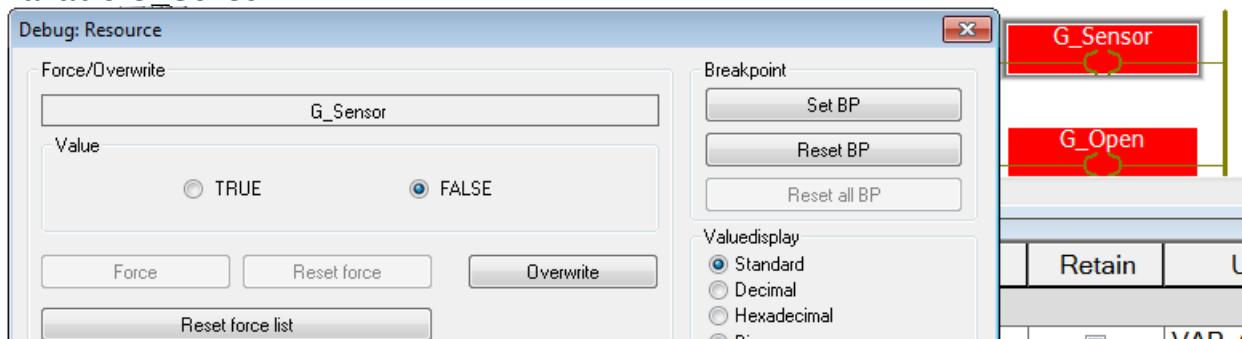
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20. In the condition illustrated, what is true about the system?



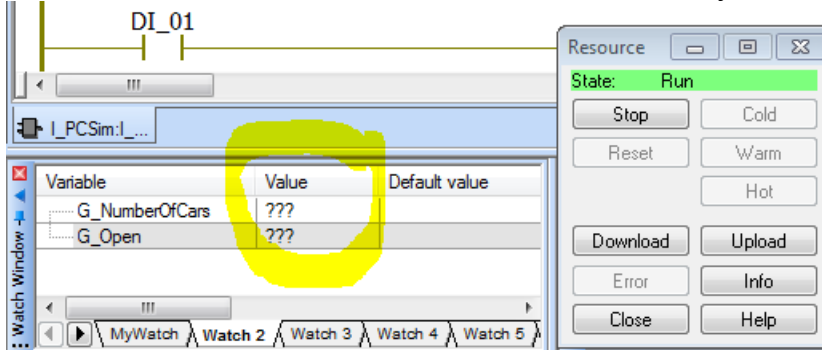
- A. The PLC requires a warm start
- B. An I/O variable is forced
- C. Task instances may not be deleted
- D. The PLC is stopped
- E. Debug mode is ON
- F. Answers B, C, and D
- G. Answers A, B, and E
- H. Answers B and C
- I. Answers A, B, C, D, and E

21. In the illustration below, why is the button for force disabled (grayed-out) for the variable G\_Sensor?



- A. PLC is in Run mode
- B. PLC is in Run [Debug] mode
- C. Debug mode is ON
- D. G\_Sensor is not an I/O variable
- E. G\_Sensor is already forced

22. As shown, the variables G\_NumberOfCars and G\_Open were recently added to the watch window. The “value” was updating moments ago. Then a simple code change was made and downloaded. The problem is that now the Watch Window “value” column reads “???”. What is the most likely cause of this problem?



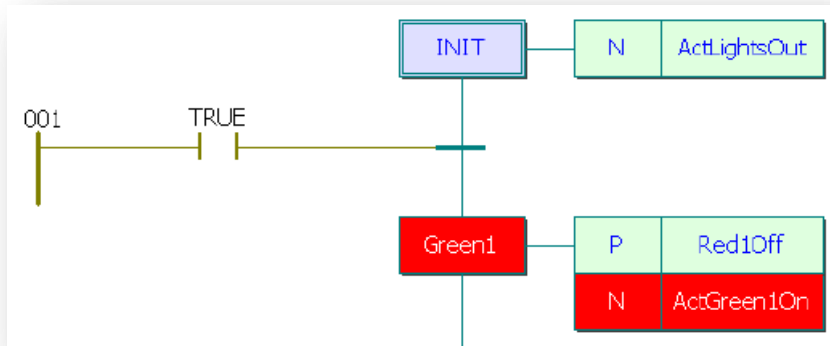
- A. The PLC requires a warm start
- B. The PLC is in Run mode
- C. The PLC is stopped
- D. The variables have no online value
- E. Debug mode is ON
- F. Debug mode is OFF

*Use MotionWorks IEC Pro to Open/Unzip the file CertTest\_Project3.ZWT. Use the Cross Reference feature to answer the following questions.*

23. In the Global\_Variables list, navigate to MO1\_DI\_07 (Under the group <LIO-01>). In what POU is this variable used?
- A. Initialize
  - B. HMI
  - C. Enable
  - D. ZeroSet
  - E. Monitor
24. What **function block** is indirectly executed by MO1\_DI\_07?
- A. G\_ResetLeft
  - B. MC\_Reset
  - C. MC\_ReadAxisError
  - D. G\_CyclePower
  - E. Y\_ResetMechatrolink

## IEC-61131-3 Programming Overview

25. What is the abbreviation for the IEC 61131-3 programming language illustrated below? Write the 2-letter or 3-letter abbreviation on the answer sheet.



26. What physical device does the term RESOURCE represent in IEC 61131-3?

- A. Machine
- B. Assembly
- C. Controller/PLC
- D. Configuration
- E. Network

27. Which POU type(s) appear as instances in the Tasks folder on the “project” tab of the project tree window?

- A. Program
- B. Function
- C. Function Block
- D. Program and Function
- E. Program and Function Block
- F. Function and Function Block
- G. Program, Function and Function Block
- H. None of the above

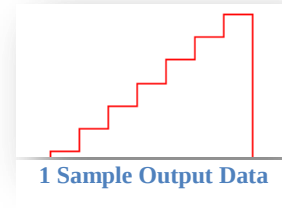
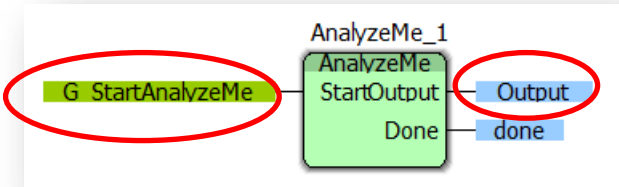
## Multi-Task

*Use MotionWorks IEC Pro to Open/Unzip the file CertTest\_Project4.ZWT. Fix the compile error and warm start the program. Open the Main POU. Refer to this project to answer the following questions.*

28. Write down the value of P1\_Answer in the Main POU (debug mode on). Refer to **CertTest\_Project4**.
29. Which task(s) can interrupt the Slow task as the PLC runs? Refer to **CertTest\_Project4**.
- A. BckGnd
  - B. Cold
  - C. Warm
  - D. Fast
  - E. BckGnd and Fast
  - F. Cold and Warm
30. What type of task is BckGnd? Refer to **CertTest\_Project4**.
- A. LowestPriority
  - B. Cyclic
  - C. Startup
  - D. System
  - E. BckGnd
31. In what sequence are the output variables (%Q) written to the output module? Refer to **CertTest\_Project4**.
- A. Immediately **before** the **Slow** task execution begins
  - B. Immediately **before** the **Fast** task execution begins
  - C. Immediately **before** the **Cold** task execution begins
  - D. Immediately **before** the **BckGnd** task execution begins
  - E. Immediately **after** the **Slow** task execution completes
  - F. Immediately **after** the **Fast** task execution completes
  - G. Immediately **after** the **Cold** task execution completes
  - H. Immediately **after** the **BckGnd** task execution completes

## Logic Analyzer

*Use the same project file from the previous section: CertTest\_Project4.ZWT. Set up the logic analyzer to capture the data of G\_StartAnalyzeMe and Output. Use input 2 on the simulator to start execution of the AnalyzeMe function block.*



32. What is the time between each change in value of the stair-step Output?

- A. 2 ms
- B. 4 ms
- C. 10 ms
- D. 20 ms
- E. 40 ms
- F. 80 ms
- G. 100 ms

33. What is the maximum value of Output?

- A. 8
- B. 10
- C. 11
- D. 12
- E. 20
- F. 24

## Program Data Transfer

34. Where does the compiled code reside after a successful MAKE?

- A. PC
- B. PLC Flash
- C. PLC Ram
- D. All of the above
- E. None of the above

35. What is the purpose of the Bootproject?

- A. Contains a copy of the editable project file
- B. Loads from Flash to PLC Ram and runs at power up
- C. Causes the PLC to reboot
- D. Runs directly on the PLC
- E. All of the above

36. The Source...

- A. ... is a copy of the editable project file
- B. ... loads from flash to RAM
- C. ... is always on the PLC
- D. ... runs directly on the PLC
- E. All of the above
- F. Answers A, C and D only

*The PLC is running and the variables have the following online values. No variable is written in the code. Then the PLC is stopped.*

|  | Name                | Online value | Type  | Usage      | Description | Address | Init ▾    | Retain                              |
|--|---------------------|--------------|-------|------------|-------------|---------|-----------|-------------------------------------|
|  | Default             |              |       |            |             |         |           |                                     |
|  | HomeVel             | 55.000       | LREAL | VAR        |             |         | 45.0      | <input type="checkbox"/>            |
|  | HomeAccDec          | 360000.000   | LREAL | VAR        |             |         | 360_000.0 | <input type="checkbox"/>            |
|  | HomeOffsetLeft      | -332.800     | LREAL | VAR        |             |         | 20.0      | <input checked="" type="checkbox"/> |
|  | HomeOffsetRight     | -126.000     | LREAL | VAR        |             |         | 0.0       | <input checked="" type="checkbox"/> |
|  | HomePosition        | 0.000        | LREAL | VAR        |             |         | 0.0       | <input type="checkbox"/>            |
|  | G_AbsResetDoneRight | FALSE        | BOOL  | VAR_EXT... |             |         |           | <input type="checkbox"/>            |

37. What will be the value of HomeOffsetLeft after Cold Start?

- A. -332.800
- B. 20.000
- C. 0.000
- D. None of the above

38. What will be the value of HomeVel after Warm Start?

- A. 55.000
- B. 45.000
- C. 0.000
- D. None of the above

## Variables

*Use MotionWorks IEC Pro to Open/Unzip the file CertTest\_Project5.ZWT. The project has compile errors and will not run correctly. Please resolve all errors until the code runs on the simulator. Simulate cars hitting the sensor. Refer to the output of the AnswerGenerator function block in the POU "Answer"*

- 39. Write down the letter given by AnswerGenerator in P1\_Answer
- 40. Write down the letter given by AnswerGenerator in P2\_Answer
- 41. Write down the letter given by AnswerGenerator in P3\_Answer
  
- 42. Referring to CertTest\_Project5, which global variable in the Main POU does not follow Yaskawa's suggested naming convention?
  - A. G\_Sensor
  - B. Reset
  - C. Full
  - D. Timer
  - E. G\_DelayTime
  - F. G\_OpenForBusiness
  - G. G\_GateOpen
  - H. G\_NumberOfCars

## Timers

*Use MotionWorks IEC Pro to Open/Unzip the file CertTest\_Project6.ZWT. The project has compile errors and will not run correctly. Please resolve all errors until the code runs on the simulator. Simulate cars hitting the sensor. Refer to the output of the AnswerGenerator function block in the POU "Answer"*

- 43. Write down the letter given by AnswerGenerator in P1\_Answer
- 44. Write down the letter given by AnswerGenerator in P2\_Answer
- 45. Write down the letter given by AnswerGenerator in P3\_Answer
- 46. Write down the letter given by AnswerGenerator in P4\_Answer
- 47. Write down the letter given by AnswerGenerator in P5\_Answer

## Arrays, Structures

*Use MotionWorks IEC Pro to Open/Unzip the file CertTest\_Project7.ZWT. The project has compile errors and will not run correctly. Refer to the POU "Answer" and create the required array and structure and to set the elements to specific values.*

48. Write down the letter given by AnswerGenerator in P1\_Answer
49. Write down the letter given by AnswerGenerator in P2\_Answer
50. Write down the letter given by AnswerGenerator in P3\_Answer
51. Write down the letter given by AnswerGenerator in P4\_Answer
52. Write down the letter given by AnswerGenerator in P5\_Answer
53. Write down the letter given by AnswerGenerator in P6\_Answer
54. Write down the letter given by AnswerGenerator in P7\_Answer
55. Write down the letter given by AnswerGenerator in P8\_Answer

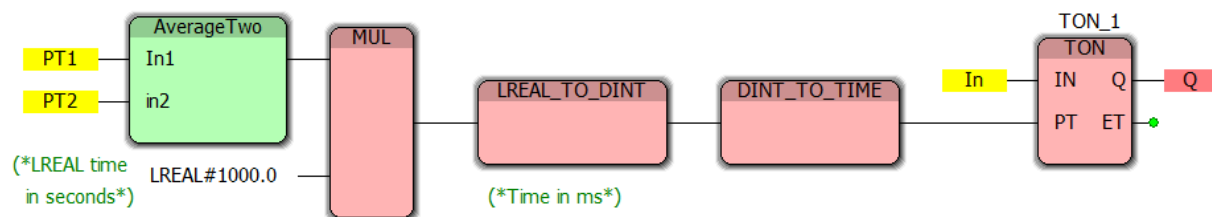
## Functions

*Use MotionWorks IEC Pro to Open/Unzip the file CertTest\_Project8.ZWT. The project has compile errors and will not run correctly. Create the missing function YTTS\_AverageTwo. Refer to the Main POU.*

56. Write down the letter given by AnswerGenerator in P1\_Answer
57. Write down the letter given by AnswerGenerator in P2\_Answer
58. Write down the letter given by AnswerGenerator in P3\_Answer
59. Write down the letter given by AnswerGenerator in P4\_Answer

## Function Blocks

*Use MotionWorks IEC Pro to Open/Unzip the file CertTest\_Project9.ZWT. Create the missing function block POU named YTTS\_AverageTON. The code for this block is shown below. Then refer to AnswerGenerator in the Main POU.*



60. Write down the letter given by AnswerGenerator in P1\_Answer
61. Write down the letter given by AnswerGenerator in P2\_Answer
62. Write down the letter given by AnswerGenerator in P3\_Answer
63. Write down the letter given by AnswerGenerator in P4\_Answer