Modicon M262 Logic/Motion Controller

System Functions and Variables

System Library Guide

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Safety Information

Important Information

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of this symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **could result** in minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

About the Book

Document Scope

This document will acquaint you with the system functions and variables offered within the Modicon M262 Logic/Motion Controller. The M262 System library contains functions and variables to get information from and send commands to the controller system.

This document describes the data type functions and variables of the following M262 system libraries:

- M262 PLCSystem
- Serial Line System
- TM3 System
- TMS System

The following knowledge is required:

- Basic information on the functionality, structure, and configuration of the M262 Logic/Motion Controller
- Programming in the FBD, LD, ST, IL, or CFC language
- System variables (global variables)

Validity Note

For more information on the validity of the present document, see the online help for the product.

Available Languages of this Document

This document is available in these languages:

- English (EIO0000003667)
- French (EIO0000003668)
- German (EIO0000003669)
- Spanish (EIO0000003670)
- Italian (EIO0000003671)
- Chinese (EIO0000003672)

Related Documents

Title of Documentation	Reference Number
EcoStruxure Automation Expert - Motion, EcoStruxure Machine Expert - Programming Guide	EIO0000002854 (ENG) EIO0000002855 (FRE) EIO0000002856 (GER) EIO0000002858 (SPA) EIO0000002857 (ITA) EIO0000002859 (CHS)
Modicon M262 Logic/Motion Controller - Hardware Guide	EIO0000003659 (ENG) EIO0000003660 (FRE) EIO0000003661 (GER) EIO0000003662 (SPA) EIO0000003663 (ITA) EIO0000003664 (CHS)
Modicon M262 Logic/Motion Controller - Programming Guide	EIO0000003651 (ENG) EIO0000003652 (FRA) EIO0000003653 (GER) EIO0000003654 (SPA) EIO0000003655 (ITA) EIO0000003656 (CHS)

To find documents online, visit the Schneider Electric download center (www.se.com/ww/en/download/).

Product Related Information

⚠WARNING

LOSS OF CONTROL

- Perform a Failure Mode and Effects Analysis (FMEA), or equivalent risk analysis, of your application, and apply preventive and detective controls before implementation.
- Provide a fallback state for undesired control events or sequences.
- Provide separate or redundant control paths wherever required.
- Supply appropriate parameters, particularly for limits.
- Review the implications of transmission delays and take actions to mitigate them.
- Review the implications of communication link interruptions and take actions to mitigate them.
- Provide independent paths for control functions (for example, emergency stop, over-limit conditions, and error conditions) according to your risk assessment, and applicable codes and regulations.
- Apply local accident prevention and safety regulations and guidelines.[1]
- Test each implementation of a system for proper operation before placing it into service.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

[1] For additional information, refer to NEMA ICS 1.1 (latest edition), *Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control* and to NEMA ICS 7.1 (latest edition), *Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems* or their equivalent governing your particular location.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

- Only use software approved by Schneider Electric for use with this equipment.
- Update your application program every time you change the physical hardware configuration.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Information on Non-Inclusive or Insensitive Terminology

As a responsible, inclusive company, Schneider Electric is constantly updating its communications and products that contain non-inclusive or insensitive terminology. However, despite these efforts, our content may still contain terms that are deemed inappropriate by some customers.

Terminology Derived from Standards

The technical terms, terminology, symbols and the corresponding descriptions in the information contained herein, or that appear in or on the products themselves, are generally derived from the terms or definitions of international standards.

In the area of functional safety systems, drives and general automation, this may include, but is not limited to, terms such as *safety*, *safety function*, *safe state*, *fault*, *fault reset*, *malfunction*, *failure*, *error*, *error message*, *dangerous*, etc.

Among others, these standards include:

Standard	Description
IEC 61131-2:2007	Programmable controllers, part 2: Equipment requirements and tests.
ISO 13849-1:2023	Safety of machinery: Safety related parts of control systems. General principles for design.
EN 61496-1:2020	Safety of machinery: Electro-sensitive protective equipment. Part 1: General requirements and tests.
ISO 12100:2010	Safety of machinery - General principles for design - Risk assessment and risk reduction
EN 60204-1:2006	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
ISO 14119:2013	Safety of machinery - Interlocking devices associated with guards - Principles for design and selection
ISO 13850:2015	Safety of machinery - Emergency stop - Principles for design
IEC 62061:2021	Safety of machinery - Functional safety of safety-related electrical, electronic, and electronic programmable control systems
IEC 61508-1:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: General requirements.
IEC 61508-2:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: Requirements for electrical/electronic/programmable electronic safety-related systems.
IEC 61508-3:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: Software requirements.
IEC 61784-3:2021	Industrial communication networks - Profiles - Part 3: Functional safety fieldbuses - General rules and profile definitions.
2006/42/EC	Machinery Directive
2014/30/EU	Electromagnetic Compatibility Directive
2014/35/EU	Low Voltage Directive

In addition, terms used in the present document may tangentially be used as they are derived from other standards such as:

Standard	Description
IEC 60034 series	Rotating electrical machines
IEC 61800 series	Adjustable speed electrical power drive systems
IEC 61158 series	Digital data communications for measurement and control – Fieldbus for use in industrial control systems

Finally, the term *zone of operation* may be used in conjunction with the description of specific hazards, and is defined as it is for a *hazard zone* or *danger zone* in the *Machinery Directive* (*2006/42/EC*) and *ISO 12100:2010*.

NOTE: The aforementioned standards may or may not apply to the specific products cited in the present documentation. For more information concerning the individual standards applicable to the products described herein, see the characteristics tables for those product references.

M262 PLCSystem

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Introduction

This part describes the M262 PLCSystem Library.

M262 System Variables

What's in This Chapter

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Overview

This chapter:

- gives an introduction to the system variables, page 14
- describes the system variables, page 17 included with the M262 PLCSystem library

System Variables: Definition and Use

Overview

This section defines system variables and how to implement them in the Modicon M262 Logic/Motion Controller.

Understanding System Variables

Introduction

This section describes how system variables are implemented. System variables:

- allow you to access general system information, perform system diagnostics, and command simple actions.
- are structured variables conforming to IEC 61131-3 definitions and naming conventions. You can access the system variables using the IEC symbolic name *PLC_GVL*. Some of the *PLC_GVL* variables are read-only (for example, *PLC_R*) and some are read/write (for example, *PLC_W*).
- are automatically declared as global variables. They have system-wide scope and can be accessed by any Program Organization Unit (POU) in any task.

Naming Convention

The system variables are identified by:

- a structure name that represents the category of system variable. For example, *PLC_R* represents a structure name of read-only variables used for the controller diagnostic.
- a set of component names that identifies the purpose of the variable. For example, *i_wVendorID* represents the controller vendor ID.

You can access the system variables by typing the structure name of the variables followed by the name of the component.

Here is an example of system variable implementation:

```
VAR
myCtr_Serial : DWORD;
myCtr_ID : DWORD;
myCtr_FramesRx : UDINT;
END_VAR
myCtr_Serial := PLC_GVL.PLC_R.i_dwSerialNumber;
myCtr_ID := PLC_GVL.PLC.R.i_wVendorID;
myCtr_FramesRx := SERIAL_R[0].i_udiFramesReceivedOK
```

NOTE: The fully-qualified name of the system variable in the example above is *PLC_GVL.PLC_R*. The *PLC_GVL* is implicit when declaring a variable using the **Input Assistant**, but it may also be entered with the prefix. Good programming practice often dictates the use of the fully-qualified variable name in declarations.

System Variables Location

Two kinds of system variables are defined for use when programming the controller:

- located variables
- unlocated variables

The located variables:

- are accessible through Modbus TCP, Modbus serial, and EtherNet/IP requests both in RUNNING and STOPPED states.
- are used in EcoStruxure Automation Expert - Motion and EcoStruxure Machine Expert programs according to the *structure_name.component_name* convention explained previously.

  %MW addresses from 0 to 59999 can be accessed directly. Addresses greater than this are considered out of range by EcoStruxure Automation Expert - Motion and EcoStruxure Machine Expert and can only be accessed through the *structure_name.component_name* convention.

The unlocated variables:

- are not physically located in the %MW area.
- are not accessible through any fieldbus or network requests unless you locate them in the relocation table, and only then these variables can be accessed in RUNNING and STOPPED states. The relocation table uses the following dynamic %MW areas:
  - %MW60200 to %MW61999 for read-only variables
  - %MW62200 to %MW63999 for read/write variables
- are used in EcoStruxure Automation Expert - Motion and EcoStruxure Machine Expert programs according to the *structure_name.component_name* convention explained previously.

Using System Variables

Introduction

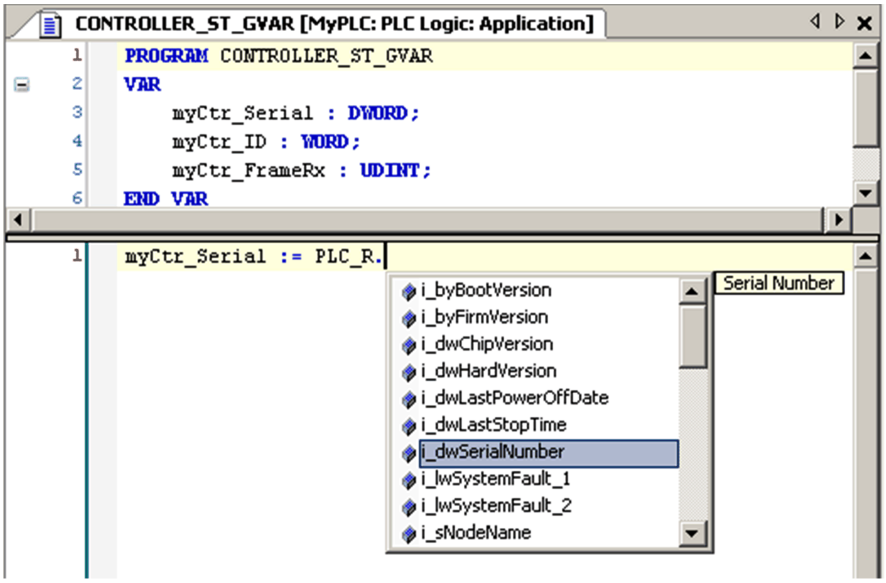
This section describes the steps required to program and to use system variables in EcoStruxure Automation Expert - Motion and EcoStruxure Machine Expert.

System variables are global in scope, and you can use them in all the Program Organization Units (POUs) of the application.

System variables do not need to be declared in the Global Variable List (GVL). They are automatically declared from the controller system library.

Using System Variables in a POU

EcoStruxure Automation Expert - Motion and EcoStruxure Machine Expert have an auto-completion feature. In a **POU**, start by entering the system variable structure name (*PLC_R PLC_W*...) followed by a dot. The system variables appear in the **Input Assistant**. You can select the desired variable or enter the full name manually.



NOTE: In the example above, after you type the structure name *PLC_R*, EcoStruxure Automation Expert - Motion and EcoStruxure Machine Expert offer a pop-up menu of possible component names/variables.

Example

The following example shows the use of some system variables:

```
VAR
myCtr_Serial : DWORD;
myCtr_ID : WORD;
myCtr_FramesRx : UDINT;
END_VAR
myCtr_Serial := PLC_R.i_dwSerialNumber;
myCtr_ID := PLC_R.i_wVendorID;
myCtr_FramesRx := SERIAL_R[0].i_udiFramesReceivedOK;
```

PLC_R and *PLC_W* Structures

Overview

This section lists and describes the different system variables *SEC.PLC_GVL.PLC_R* and *SEC.PLC_GVL.PLC_W* of the library SE_PLCSystem using the Namespace SEC.

The structures of variables are defined in the PLCSystemBase library.

PLC_R: Controller Read-Only System Variables

Library and Namespace

Library name: **SE_PLCSystem**

Namespace: **SEC**

Variable Structure

This table describes the parameters of the *PLC_R* system variable (*PLC_R_STRUCT* type):

Modbus Address (1)	Variable Name	Type	Comment
60000	*i_wVendorID*	WORD	Controller Vendor ID. 101A hex = Schneider Electric
60001	*i_wProductID*	WORD	Controller Reference ID. **NOTE:** Vendor ID and Reference ID are the components of the Target ID of the controller displayed in the communication settings view (Target ID = 101A XXXX hex). Value per controller: • TM262L01MESE8T: 101A 0816 HEX • TM262L10MESE8T: 101A 0813 HEX • TM262L20MESE8T: 101A 0810 HEX • TM262M05MESS8T: 101A 0815 HEX • TM262M15MESS8T: 101A 0814 HEX • TM262M25MESS8T: 101A 0811 HEX • TM262M35MESS8T: 101A 0812 HEX
60002	*i_dwSerialNumber*	DWORD	Controller Serial Number
60004	*i_byFirmVersion*	ARRAY[0..3] OF BYTE	Controller Firmware Version `[aa.bb.cc.dd]`: • i_byFirmVersion[0] = aa • ... • i_byFirmVersion[3] = dd
60006	*i_byBootVersion*	ARRAY[0..3] OF BYTE	Controller Boot Version `[aa.bb.cc.dd]`: • i_byBootVersion[0] = aa • ... • i_byBootVersion[3] = dd
60008	*i_dwHardVersion*	DWORD	Controller Hardware Version. **NOTE:** Reserved parameter for internal use only. For the Product Version (PV), consult the product label.
60010	*i_dwChipVersion*	DWORD	Controller Coprocessor Version.
60012	*i_wStatus*	*PLC_R_STATUS*, page 45	State of the controller.
60013	*i_wBootProjectStatus*	*PLC_R_BOOT_PROJECT_STATUS*, page 44	Returns information about the boot application stored in non-volatile memory.
60014	*i_wLastStopCause*	*PLC_R_STOP_CAUSE*, page 46	Cause of the last transition from RUN to another state.
60015	*i_wLastApplicationError*	*PLC_R_APPLICATION_ERROR*, page 42	Cause of the last controller exception.

Modbus Address (1)	Variable Name	Type	Comment
60016	*i_lwSystemFault_1*	LWORD	Bit field FFFF FFFF FFFF FFFF hex indicates no error detected. A bit at low level (0) means that an error has been detected: • bit 0 = Expert I/O error detected • bit 1 = I/O bus error detected • bit 2 = Ethernet IF1 error detected • bit 3 = Ethernet IF2 error detected • bit 4 = Serial 1 in overcurrent error detected • bit 5 = Serial 2 in overcurrent error detected • bit 6 = CAN 1 error detected • bit 7 = Reserved • bit 8 = Reserved • bit 9 = Communication bus error detected • bit 10 = SD Card error detected • bit 11 = Firewall error detected • bit 12 = DHCPS/FDR server error detected • bit 13 = OPC UA server error detected • bit 14 = Communication bus error detected • bit 15 = Communication bus health error detected • bit 16 = Ethernet IF2 Ring root error detected • bit 17 = Encoder power supply error detected • bit 18 = Encoder communication error detected • bit 19 = TMSES4 IF1 configuration error detected • bit 20 = TMSES4 IF2 configuration error detected • bit 21 = TMSES4 IF3 configuration error detected • bit 22 = Server address error detected • bit 23 = NTP error detected • bit 24 = Syslog error detected • bit 25 = NTP Primary Server error detected • bit 26 = NTP Secondary Server error detected **NOTE:** Bits 25 and 26 are only applicable when the controller is configured as NTP client with the respective servers.
60020	*i_lwSystemFault_2*	LWORD	Bit field FFFF hex indicates no error detected. If *i_wIOStatus1* = *PLC_R_IO_SHORTCUT_FAULT*, the meaning of *i_lwSystemFault_2* is: • bit 0 = 0: short-circuit detected in output group 0 (Q0...Q1) • bit 1 = 0: short-circuit detected in output group 1 (Q2...Q3) • bit 2 = 0: short-circuit detected in output group 2 (Q4...Q7) • bit 3 = 0: short-circuit detected in output group 3 (Q8...Q11) • bit 4 = 0: short-circuit detected in output group 4 (Q12...Q15)
60024	*i_wIOStatus1*	*PLC_R_IO_STATUS*, page 44	Embedded Expert I/O status.
60025	*i_wIOStatus2*	*PLC_R_IO_STATUS*, page 44	TM3 I/O status.
60026	*i_wClockBatterystatus*	WORD	Status of the battery of the RTC: 100 = Battery fully charged Not applicable for M262 Logic/Motion Controller.
60028	*i_dwAppliSignature1*	DWORD	First DWORD of 4 DWORD signature (16 bytes total). The application signature is generated by the software during build.

Modbus Address (1)	Variable Name	Type	Comment
60030	*i_dwAppliSignature2*	DWORD	Second DWORD of 4 DWORD signature (16 bytes total). The application signature is generated by the software during build.
60032	*i_dwAppliSignature3*	DWORD	Third DWORD of 4 DWORD signature (16 bytes total). The application signature is generated by the software during build.
60034	*i_dwAppliSignature4*	DWORD	Fourth DWORD of 4 DWORD signature (16 bytes total). The application signature is generated by the software during build.
n/a	*i_sVendorName*	STRING(31)	Name of the vendor: “Schneider Electric”.
n/a	*i_sProductRef*	STRING(31)	Reference of the controller.
n/a	*i_sNodeName*	STRING(99)	Node name on software Network.
n/a	*i_dwLastStopTime*	DWORD	The time of the last detected STOP in seconds beginning with January 1, 1970 at 00:00 UTC.
n/a	*i_dwLastPowerOffDate*	DWORD	The date and time of the last detected power off in seconds beginning with January 1, 1970 at 00:00 UTC. **NOTE:** Convert this value into date and time by using the function *SysTimeRtcConvertUtcToDate*. For more information about Time and Date conversion, refer to the Systime Library Guide (see Getting & Setting Real Time Clock, SysTimeRtc and SysTimeCore Library Guide).
n/a	*i_uiEventsCounter*	UINT	Number of external events detected on inputs configured for external event detection since the last cold start. Reset by a Cold Start or by the *PLC_W.q_wResetCounterEvent* command.
n/a	*i_wTerminalPortStatus*	*PLC_R_TERMINAL_PORT_STATUS*, page 47	Status of the USB Programming Port (USB Mini-B).
n/a	*i_wSdCardStatus*	*PLC_R_SDCARD_STATUS*, page 45	Status of the SD card.
n/a	*i_wUsrFreeFileHdl*	WORD	Number of available File Handles including system-level sockets and pipes. A File Handle is the resource allocated by the system when you open a file. **NOTE:** This value does not indicate the number of file handles available to the application.
n/a	*i_udiUsrFsTotalBytes*	UDINT	User FileSystem total memory size (in bytes). It is the size of the non-volatile memory for the directory "/usr/".
n/a	*i_udiUsrFsFreeBytes*	UDINT	User FileSystem free memory size (in bytes).
n/a	*i_uiTM3BusState*	PLC_R_TM3_BUS_STATE, page 47	TM3 bus state. *i_uiTM3BusState* can have the following values: • 1: TM3_CONF_ERROR Configuration mismatch between physical configuration and software configuration. • 3: TM3_OK Physical configuration matches software configuration. • 4: TM3_POWER_SUPPLY_ERROR TM3 bus is not powered (for example when the controller is powered by USB).

Modbus Address (1)	Variable Name	Type	Comment
n/a	*i_ExpertIO_RunStop_Input*	BYTE	Run/Stop input location is: • 16...FF hex if the expert I/O is not configured • 0 for `%IX0.0` • 1 for `%IX0.1` • 2 for `%IX0.2` • ...and so on.
n/a	*i_x10msClk*	BOOL	TimeBase bit of 10 ms. This variable is toggling On/Off with period = 10 ms. The value toggles when the controller is in STOPPED and in RUN state.
n/a	*i_x100msClk*	BOOL	TimeBase bit of 100 ms. This variable is toggling On/Off with period = 100 ms. The value toggles when the controller is in STOPPED and in RUN state.
n/a	*i_x1sClk*	BOOL	TimeBase bit of 1 s. This variable is toggling On/Off with period = 1 s. The value toggles when the controller is in STOPPED and in RUN state.
(1) Not accessible through the application as %MW. **n/a** means there is no pre-defined Modbus address mapping for this system variable.			

PLC_W: Controller Read/Write System Variables

Library and Namespace

Library name: **SE_PLCSystem**

Namespace: **SEC**

Variable Structure

This table describes the parameters of the *PLC_W* system variable (*PLC_W_STRUCT* type):

%MW	Variable Name	Type	Comment
n/a	*q_wResetCounterEvent*	WORD	Transition from 0 to 1 resets the events counter (*PLC_R.i_uiEventsCounter*). To reset the counter again, it is necessary to write 0 to this variable before another transition from 0 to 1 can take place.
n/a	*q_uiOpenPLCControl*	UINT	When the value of the variable passes from 0 to 6699, the command previously written in the following *PLC_W.q_wPLCControl* is executed.
n/a	*q_wPLCControl*	*PLC_W_COMMAND*, page 48	Controller RUN / STOP command executed when the system variable *PLC_W.q_uiOpenPLCControl* value passes from 0 to 6699.
n/a means that there is no pre-defined %MW mapping for this system variable			

ETH_R and *ETH_W* Structures

Overview

This section lists and describes the different system variables *SEC.PLC_GVL.ETH_R* and *SEC.PLC_GVL.ETH_W* of the library SE_PLCSystem using the Namespace SEC.

The structures of variables are defined in the PLCSystemBase library.

ETH_R: Ethernet Port Read-Only System Variables

Library and Namespace

Library name: **SE_PLCSystem**

Namespace: **SEC**

Variable Structure

This table describes the parameters of the *ETH_R* system variable (*ETH_R_STRUCT* type). One structure exists for each Ethernet port:

%MW	Var Name	Type	Comment
60050	*i_byIPAddress*	ARRAY[0..3] OF BYTE	IP address of the Ethernet_1 or Ethernet_2 interface `[aaa.bbb.ccc.ddd]`: • i_byIPAddress[0] = aaa • ... • i_byIPAddress[3] = ddd
60052	*i_bySubNetMask*	ARRAY[0..3] OF BYTE	Subnet Mask of the Ethernet_1 or Ethernet_2 interface `[aaa.bbb.ccc.ddd]`: • i_bySub-netMask[0] = aaa • ... • i_bySub-netMask[3] = ddd
60054	*i_byGateway*	ARRAY[0..3] OF BYTE	Gateway address of the Ethernet_1 or Ethernet_2 interface `[aaa.bbb.ccc.ddd]`: • i_byGateway[0] = aaa • ... • i_byGateway[3] = ddd
60056	*i_byMACAddress*	ARRAY[0..5] OF BYTE	MAC address of the Ethernet_1 or Ethernet_2 interface `[aa.bb.cc.dd.ee.ff]`: • i_byMACAddress[0] = aa • ... • i_byMACAddress[5] = ff
60059	*i_sDeviceName*	STRING(15)	Name used to get IP address from server.
n/a	*i_ucIPForwarding*	*ETH_R_IPFROWARDING*, page 50	IP Forwarding.
n/a	*i_wIpMode*	*ETH_R_IP_MODE*, page 50	Method used to obtain an IP address.
n/a	*i_byFDRServerIPAddress*	ARRAY[0..3] OF BYTE	The IP address `[aaa.bbb.ccc.ddd]` of the DHCP or BootP server: • i_byFDRServerIPAddress[0] = aaa • ... • i_byFDRServerIPAddress[3] = ddd Equals 0.0.0.0 if Stored IP or Default IP used.

%MW	Var Name	Type	Comment
n/a	*i_udiOpenTcpConnections*	UDINT	Number of open TCP connections.
n/a	*i_udiFramesTransmittedOK*	UDINT	Number of frames successfully transmitted. Reset at Power ON or with reset command *ETH_W.q_wResetCounter*.
n/a	*i_udiFramedReceivedOK*	UDINT	Number of frames successfully received. Reset at Power ON or with reset command *ETH_W.q_wResetCounter*.
n/a	*i_udiTransmitBufferErrors*	UDINT	Numbers of frames transmitted with detected errors. Reset at Power ON or with reset command *ETH_W.q_wResetCounter*.
n/a	*i_udiReceiveBufferErrors*	UDINT	Numbers of frames received with detected errors. Reset at Power ON or with reset command *ETH_W.q_wResetCounter*.
n/a	*i_wFrameSendingProtocol*	ETH_R_FRAME_PROTOCOL, page 50	Ethernet protocol configured for frames sending (IEEE 802.3 or Ethernet II).
n/a	*i_wPortALinkStatus*	ETH_R_PORT_LINK_STATUS, page 53	Link of the Ethernet Port (0 = No Link, 1 = Link connected to another Ethernet device).
n/a	*i_wPortASpeed*	ETH_R_PORT_SPEED, page 53	Ethernet Port network speed (10Mb/s, 100Mb/s, or 1Gb/s).
n/a	*i_wPortADuplexStatus*	*ETH_R_PORT_DUPLEX_STATUS*, page 52	Ethernet Port duplex status (0 = Half or 1 = Full duplex).
n/a	*i_udiPortACollisions*	UDINT	Number of frames involved in one or more collisions and subsequently transmitted successfully. Reset at Power ON or with reset command *ETH_W.q_wResetCounter*.
n/a	*i_wPortAIpStatus*	*ETH_R_PORT_IP_STATUS*, page 52	Ethernet TCP/IP port stack status.
n/a	*i_ethInterface*	ARRAY[1..6] OF *ETH_R_ITF_STRUCT*, page 51	Ethernet interface common parameters structure.
Modbus TCP/IP Specific			
n/a	*i_udiModbusMessageTransmitted*	UDINT	Number of Modbus messages transmitted. Reset at Power ON or with reset command *ETH_W.q_wResetCounter*.
n/a	*i_udiModbusMessageTransmitted*	UDINT	Number of Modbus messages received. Reset at Power ON or with reset command *ETH_W.q_wResetCounter*.
n/a	*i_udiModbusErrorMessage*	UDINT	Modbus detected error messages transmitted and received. Reset at Power ON or with reset command *ETH_W.q_wResetCounter*.
n/a	*i_byMasterIpTimeouts*	BYTE	Ethernet Modbus TCP Master timeout events counter. Reset at Power ON or with reset command *ETH_W.q_wResetCounter*.
n/a	*i_byMasterIpLost*	BYTE	Ethernet Modbus TCP Master link status: 0 = link OK, 1 = link lost.
EtherNet/IP Specific			
n/a	*i_udiETHIP_IOMessagingTransmitted*	UDINT	EtherNet/IP Class 1 frames transmitted. Reset at Power ON or with reset command *ETH_W.q_wResetCounter*.
n/a	*i_udiETHIP_IOMessagingReceived*	UDINT	EtherNet/IP Class 1 frames received. Reset at Power ON or with reset command `ETH_W.q_wResetCounter`.
n/a	*i_udiUCMM_Request*	UDINT	EtherNet/IP Unconnected Messages received. Reset at Power ON or with reset command *ETH_W.q_wResetCounter*.

%MW	Var Name	Type	Comment
n/a	*i_udiUCMM_Error*	UDINT	EtherNet/IP invalid Unconnected Messages received. Reset at Power ON or with reset command *ETH_W.q_wResetCounter*.
n/a	*i_udiClass3_Request*	UDINT	EtherNet/IP Class 3 requests received. Reset at Power ON or with reset command *ETH_W.q_wResetCounter*.
n/a	*i_udiClass3_Error*	UDINT	EtherNet/IP invalid class 3 requests received. Reset at Power ON or with reset command *ETH_W.q_wResetCounter*.
n/a	*i_uiAssemblyInstanceInput*	UINT	Input Assembly Instance number. See the appropriate Programming Guide of your controller for more information.
n/a	*i_uiAssemblyInstanceInputSize*	UINT	Input Assembly Instance size. See the appropriate Programming Guide of your controller for more information.
n/a	*i_uiAssemblyInstanceOutput*	UINT	Output Assembly Instance number. See the appropriate Programming Guide of your controller for more information.
n/a	*i_uiAssemblyInstanceOutputSize*	UINT	Output Assembly Instance size. See the appropriate Programming Guide of your controller for more information.
n/a	*i_uiETHIP_ConnectionTimeouts*	UINT	Number of connection timeouts. Reset at Power ON or with reset command *ETH_W.q_wResetCounter*.
n/a	*i_ucEipRunIdle*	*ETH_R_RUN_IDLE*, page 54	Run (value = 1)/Idle(value = 0) flag for EtherNet/IP class 1 connection.
n/a means that there is no predefined %MW mapping for this system variable.			

ETH_W: Ethernet Port Read/Write System Variables

Library and Namespace

Library name: **SE_PLCSystem**

Namespace: **SEC**

Variable Structure

This table describes the parameters of the *ETH_W* system variable (*ETH_W_STRUCT* type):

%MW	Variable Name	Type	Comment
n/a	*q_wResetCounter*	WORD	Transition from 0 to 1 resets all *ETH_R* counters. To reset again, it is necessary to write 0 to this variable before another transition from 0 to 1 can take place.
n/a means that there is no predefined %MW mapping for this system variable.			

M262 System Functions

What's in This Chapter

M262 Read Functions....24
M262 Write Functions....30
M262 User Functions....33

Overview

This chapter describes the system functions included in the M262 PLCSystem library.

M262 Read Functions

Overview

This section describes the read functions included in the M262 PLCSystem library.

GetImmediateFastInput: Read Input of an Embedded Expert I/O

Function Description

This function returns the value of the input, which may be different from the logical value of that input. The value is read directly from the hardware at function call time. Only I0 to I3 can be accessed through this function.

Library and Namespace

Library name: **SE_PLCSystem**

Namespace: **SEC**

Graphical Representation

IL and ST Representation

To see the general representation in IL or ST language, refer to the chapter *Function and Function Block Representation*, page 74.

I/O Variable Description

The following table describes the input variables:

Input	Type	Comment
Block	INT	Not used.
Input	INT	Input Index to read from 0...3.

The following table describes the output variable:

Output	Type	Comment
GetImmediateFastInput	BOOL	Value of the input <*Input*> – FALSE/ TRUE.

The following table describes the input/output variables:

Input/Output	Type	Comment
Error	BOOL	FALSE= operation is successful. TRUE= operation error, the function returns an invalid value.
ErrID	*IMMEDIATE_ERR_TYPE*, page 54	Operation error code when *Error* is TRUE.

GetRtc: Get Real Time Clock

Function Description

This function returns RTC time in seconds in UNIX format (time expired in seconds since January 1, 1970 at 00:00 UTC).

Library and Namespace

Library name: **PLCSystemBase**

Namespace: **PLCSystemBase**

Graphical Representation

IL and ST Representation

To see the general representation in IL or ST language, refer to the chapter *Function and Function Block Representation*, page 74.

I/O Variable Description

The following table describes the I/O variable:

Output	Type	Comment
GetRtc	DINT	RTC in seconds in UNIX format.

Example

The following example describes how to get the RTC value:

```
VAR
MyRTC : DINT := 0;
END_VAR
MyRTC := GetRtc();
```

HasForcedIo: Indicate if an Input or an Output is Forced

Function Description

This function returns TRUE if an input or an output is forced.

Graphical Representation

IL and ST Representation

To see the general representation in IL or ST language, refer to the chapter *Function and Function Block Representation*.

I/O Variable Description

The table describes the output variable:

Output	Type	Comment
HasForcedIo	BOOL	TRUE if an input or an output is forced.

Example

The following example describes how to use this function:

```
VAR
hasIo: BOOL;
END_VAR
hasIo := SEC.HasForcedIo();
```

IsFirstMastColdCycle: Indicate if this Cycle is the First MAST Cold Start Cycle

Function Description

This function returns TRUE during the first MAST cycle after a cold start (first cycle after download or reset cold).

Library and Namespace

Library name: **PLCSystemBase**

Namespace: **PLCSystemBase**

Graphical Representation

IL and ST Representation

To see the general representation in IL or ST language, refer to the chapter *Function and Function Block Representation*, page 74.

I/O Variable Description

The table describes the output variable:

Output	Type	Comment
IsFirstMastColdCycle	BOOL	TRUE during the first MAST task cycle after a cold start.

Example

Refer to the function *IsFirstMastCycle*, page 27.

IsFirstMastCycle: Indicate if this Cycle is the First MAST Cycle

Function Description

This function returns TRUE during the first MAST cycle after a start.

Library and Namespace

Library name: **PLCSystemBase**

Namespace: **PLCSystemBase**

Graphical Representation

IL and ST Representation

To see the general representation in IL or ST language, refer to the chapter *Function and Function Block Representation*, page 74.

I/O Variable Description

Output	Type	Comment
IsFirstMastCycle	BOOL	TRUE during the first MAST task cycle after a start.

Example

This example describes the three functions *IsFirstMastCycle*, *IsFirstMastColdCycle* and *IsFirstMastWarmCycle* used together.

Use this example in MAST task. Otherwise, it may run several times or possibly never (an additional task might be called several times or not called during 1 MAST task cycle):

```
VAR
MyIsFirstMastCycle : BOOL;
MyIsFirstMastWarmCycle : BOOL;
MyIsFirstMastColdCycle : BOOL;
END_VAR
MyIsFirstMastWarmCycle := IsFirstMastWarmCycle();
MyIsFirstMastColdCycle := IsFirstMastColdCycle();
MyIsFirstMastCycle := IsFirstMastCycle();
IF (MyIsFirstMastWarmCycle) THEN
(*This is the first Mast Cycle after a Warm Start: all
variables are set to their initialization values except the
Retain variables*)
(*=> initialize the needed variables so that your
application runs as expected in this case*)
END_IF;
IF (MyIsFirstMastColdCycle) THEN
(*This is the first Mast Cycle after a Cold Start: all
variables are set to their initialization values including
the Retain Variables*)
(*=> initialize the needed variables so that your
application runs as expected in this case*)
END_IF;
IF (MyIsFirstMastCycle) THEN
(*This is the first Mast Cycle after a Start, i.e. after a
Warm or Cold Start as well as STOP/RUN commands*)
(*=> initialize the needed variables so that your
application runs as expected in this case*)
END_IF;
```

IsFirstMastWarmCycle: Indicate if this Cycle is the First MAST Warm Start Cycle

Function Description

This function returns TRUE during the first MAST cycle after a warm start.

Library and Namespace

Library name: **PLCSystemBase**

Namespace: **PLCSystemBase**

Graphical Representation

IL and ST Representation

To see the general representation in IL or ST language, refer to the chapter *Function and Function Block Representation*, page 74.

I/O Variable Description

This table describes the output variable:

Output	Type	Comment
IsFirstMastWarmCycle	BOOL	TRUE during the first MAST task cycle after a warm start.

Example

Refer to the function *IsFirstMastCycle*, page 27.

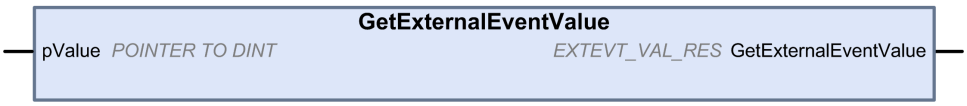
GetExternalEventValue: Get Current Value of an External Event

Function Description

Use this function to get the value associated with an external event task.

NOTE: The function must be called from within an external event task.

Graphical Representation



IL and ST Representation

To see the general representation in IL or ST language, refer to the chapter *Function and Function Block Representation*, page 74.

I/O Variables Description

This table describes the input variables:

Inputs	Type	Comment
pValue	POINTER TO DINT	Address of the variable where the value is copied if the function returns *EXTEVT_VAL_OK*.

This table describes the output variables:

Outputs	Type	Comment
GetExternalEventValue	EXTEVT_VAL_RES	Returns one of the following values: • *EXTEVT_VAL_OK*: Valid value • *EXTEVT_VAL_FAILED*: Unable to obtain value • *EXTEVT_VAL_NOT_IN_EXT_EVT_TASK*: Function was not called from within an external event task • *EXTEVT_VAL_NOT_AVAILABLE*: No value available for this external task

M262 Write Functions

Overview

This section describes the write functions included in the M262 PLCSystem library.

PhysicalWriteFastOutputs: Write Fast Output of an Embedded Expert I/O

Function Description

This function writes a state to the Q0 to Q3 outputs at function call time.

Library and Namespace

Library name: **SE_PLCSystem**

Namespace: **SEC**

Graphical Representation

IL and ST Representation

To see the general representation in IL or ST language, refer to the chapter *Function and Function Block Representation*, page 74.

I/O Variable Description

The following table describes the input variables:

Input	Type	Comment
Q0Value	BOOL	Requested value for the output 0.
Q1Value	BOOL	Requested value for the output 1.
Q2Value	BOOL	Requested value for the output 2.
Q3Value	BOOL	Requested value for the output 3.

The following table describes the output variable:

Output	Type	Comment
PhysicalWriteFastOutputs	WORD	Output value of the function.

NOTE: Only the first 4 bits of the output value are significant and used as a bit field to indicate if the output is written.

- If the bit corresponding to the output is 1, the output is written successfully.
- If the bit corresponding to the output is 0, the output is not written because it is already used by an expert function.
- If the bit corresponding to the output is 1111 bin, all of the 4 outputs are written correctly.
- If the bit corresponding to the output is 1110 bin, Q0 is not written because it is used by an alarm output.

NOTE: Values are applied at the beginning and end of a processing cycle. The function is applying a value within the cycle.

NOTE: If a variable is mapped to more than one of the embedded outputs, the last one of them (ordered from Q0 to Q3) sets the value to the variable at the end of the execution of the function block.

SetRTCDrift: Set Compensation Value to the RTC

Function Description

This function accelerates or slows down the frequency of the RTC to give control to the application for RTC compensation, depending on the operating environment (temperature, …). The compensation value is given in seconds per week. It can be positive (accelerate) or negative (slow down).

NOTE: The *SetRTCDrift* function must be called only once. Each new call replaces the compensation value by the new one. The value is kept in the controller hardware while the RTC is powered by the main supply or by the battery. If both battery and power supply are removed, the RTC compensation value is not available.

Graphical Representation

IL and ST Representation

To see the general representation in IL or ST language, refer to the chapter *Function and Function Block Representation*, page 74.

I/O Variables Description

This table describes the input parameters:

Inputs	Type	Comment
RtcDrift	*SINT (-29..29)*	Correction in seconds per week (-29...+29).

NOTE: The parameters *Day*, *Hour*, and *Minute* are used only to ensure backwards compatibility.

NOTE: If the value entered for *RtcDrift* exceeds the limit value, the controller firmware sets the value to its maximum value.

This table describes the output variable:

Output	Type	Comment
SetRTCDrift	*RTCSETDRIFT_ERROR*, page 55	Returns *RTC_OK* (00 hex) if command is correct otherwise returns the ID code of the detected error.

Example

In this example, the function is called only once during the first MAST task cycle. It accelerates the RTC by 4 seconds a week (18 seconds a month).

```
VAR
MyRTCDrift : SINT (-29..+29) := 0;
MyDay : sec.DAY_OF_WEEK;
MyHour : sec.HOUR;
MyMinute : sec.MINUTE;
END_VAR
IF IsFirstMastCycle() THEN
MyRTCDrift := 4;
MyDay := 0;
MyHour := 0;
MyMinute := 0;
SetRTCDrift(MyRTCDrift, MyDay, MyHour, MyMinute);
END_IF
```

M262 User Functions

Overview

This section describes the following user functions:

Function	Description
FB_GetFreeDiskSpace	Retrieves the amount of free memory space of a memory medium in bytes. See *FB_GetFreeDiskSpace*: Gets the Free Memory Space Asynchronously, page 33
FB_GetLabel	Retrieves the label of a memory medium. See *FB_GetLabel*: Gets the Label of Memory Medium, page 34
FB_GetTotalDiskSpace	Retrieves the size of free memory space of a memory medium in bytes. See *FB_GetTotalDiskSpace*: Gets the Size of Memory Medium, page 35
FB_CheckAllowedControllerMacAddr	Check whether a specific MAC address is within the valid range for the controller. See *FB_CheckAllowedControllerMacAddr*: Check If MAC Address Allowed by Controller, page 36
FB_ControlClone	Enable or disable the controller cloning functionality. See *FB_ControlClone*: Clone the Controller, page 37
DataFileCopy	Copy memory data to a file and vice versa. See *DataFileCopy*: Copy File Commands, page 38
ExecuteScript	Run script commands. See *ExecuteScript*: Run Script Commands, page 40

FB_GetFreeDiskSpace: Gets the Free Memory Space Asynchronously

Function Block Description

This function block retrieves the amount of free memory space of a memory medium (user disk, system disk, SD card) in bytes. The name of the memory medium is transferred.

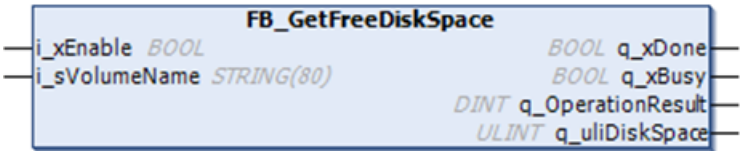
The free memory space of a remote device cannot be accessed. If a remote device is specified as parameter, then the function returns "-1".

Library and Namespace

Library name: **PLCSystemBase**

Namespace: **PLCSystemBase**

Graphical Representation



IL and ST Representation

To see the general representation in IL or ST language, refer to the chapter *Function and Function Block Representation*, page 74.

I/O Variable Description

This table describes the input variables:

Input	Data type	Description
i_xEnable	BOOL	Activation entry, executes the operation when the value is `TRUE`.
i_sVolumeName	STRING[80]	Name of the device whose free memory space must be accessed: • System disk: `'/sys'` • User disk: `'/usr'` • SD Card: `'/sd0'`

This table describes the output variables:

Output	Data type	Description
q_xDone	BOOL	Set to `TRUE` when function block ended.
q_xBusy	BOOL	Set to `TRUE` when function block has been started and is still executing.
q_OperationResult	DINT	Result of the operation, a non zero value indicates an error.
q_uliDiskSpace	ULINT	Memory space in bytes.

FB_GetLabel: Gets the Label of Memory Medium

Function Block Description

This function block retrieves the label of a memory medium. If a device has no label, then an empty string is returned.

Library and Namespace

Library name: **PLCSystemBase**

Namespace: **PLCSystemBase**

Graphical Representation

IL and ST Representation

To see the general representation in IL or ST language, refer to the chapter *Function and Function Block Representation*, page 74.

I/O Variable Description

This table describes the input variables:

Input	Data type	Description
i_xEnable	BOOL	Activation entry, executes the operation when the value is `TRUE`.
i_sVolumeName	STRING[80]	Name of the device whose free memory space must be accessed: • System disk: `'/sys'` • User disk: `'/usr'` • SD Card: `'/sd0'`

This table describes the output variables:

Output	Data type	Description
q_xDone	BOOL	Set to `TRUE` when function block ended.
q_xBusy	BOOL	Set to `TRUE` when function block has been started and is still executing.
q_OperationResult	DINT	Result of the operation, a non zero value indicates an error.
q_sLabel	STRING[11]	Label of the device.

FB_GetTotalDiskSpace: Gets the Size of Memory Medium

Function Block Description

This function block retrieves the amount of free memory space of a memory medium (user disk, system disk, SD card) in bytes.

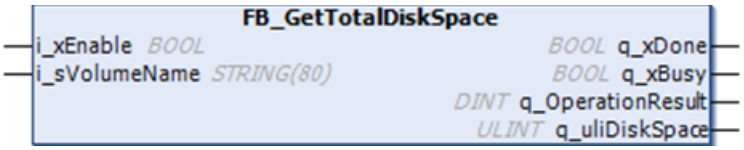
The size of a remote device cannot be accessed. If a remote device is specified as parameter, then the function returns "-1".

Library and Namespace

Library name: **PLCSystemBase**

Namespace: **PLCSystemBase**

Graphical Representation



IL and ST Representation

To see the general representation in IL or ST language, refer to the chapter *Function and Function Block Representation*, page 74.

I/O Variable Description

This table describes the input variables:

Input	Data type	Description
i_xEnable	BOOL	Activation entry, executes the operation when the value is `TRUE`.
i_sVolumeName	STRING[80]	Name of the device whose memory size must be accessed: • System disk: `'/sys'` • User disk: `'/usr'` • SD Card: `'/sd0'`

This table describes the output variables:

Output	Data type	Description
q_xDone	BOOL	Set to `TRUE` when function block ended.
q_xBusy	BOOL	Set to `TRUE` when function block has been started and is still executing.
q_OperationResult	DINT	Result of the operation, a non zero value indicates an error.
q_uliDiskSpace	ULINT	Memory space in bytes.

FB_CheckAllowedControllerMacAddr: Check If MAC Address Allowed by Controller

Function Block Description

This function block checks whether a specified MAC address is within the range of MAC addresses allowed for the controller. The application only continues executing if the MAC address matches. Otherwise, the application stops and the controller goes to the HALT state and the system variable *i_wLastApplicationError*, page 17 is updated appropriately.

Library and Namespace

Library name: **PLCSystemBase**

Namespace: **PLCSystemBase**

Graphical Representation

IL and ST Representation

To see the general representation in IL or ST language, refer to the chapter *Function and Function Block Representation*, page 74.

I/O Variable Description

The following table describes the input variables:

Input	Type	Comment
byAllowedMacAddress	ARRAY[0...5] OF BYTE	MAC address to check `[aa.bb.cc.dd.ee.ff]`: • i_byMACAddress[0] = aa • ... • i_byMACAddress[5] = ff

The following table describes the output variables:

Output	Type	Comment
xControllerMacAddressOk	BOOL	TRUE = indicates that the MAC address is allowed for this controller.

FB_ControlClone: Clone the Controller

Function Block Description

Cloning is possible by SD card or **Controller Assistant**. When user rights are enabled and the View right **FrmUpdate** is denied for the **ExternalMedia** group, the cloning function is not allowed. In this case, the function block enables cloning functionality one time on the next controller power on.

NOTE: You can choose whether user rights are included in the clone on the **Clone Management** page of the Web server (see Modicon M262 Logic/Motion Controller, Programming Guide).

This table shows how to set the function block and the user rights:

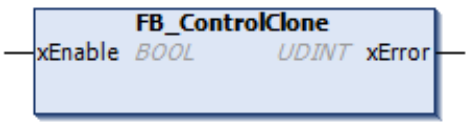
Function block setting	When user rights enabled	When user rights disabled
xEnable = 1	Cloning is allowed	Cloning is allowed
xEnable = 0	Cloning is not allowed	Cloning is not allowed

Library and Namespace

Library name: **PLCSystemBase**

Namespace: **PLCSystemBase**

Graphical Representation



IL and ST Representation

To see the general representation in IL or ST language, refer to the chapter *Function and Function Block Representation*, page 74.

I/O Variable Description

The following table describes the input variables:

Input	Type	Comment
xEnable	BOOL	If `TRUE`, enables the cloning functionality one time. If `FALSE`, disables the cloning functionality.

The following table describes the output variables:

Output	Type	Comment
xError	UDINT	A value of `0` indicates that no error was detected while executing the function block. A non-zero indicates that an error was detected.

DataFileCopy: Copy File Commands

Function Block Description

This function block copies memory data to a file and vice versa. The file is located either within the internal file system or an external file system (SD card).

The *DataFileCopy* function block can:

- Read data from a formatted file or
- Copy data from memory to a formatted file. For further information, refer to Non-Volatile Memory Organization (see Modicon M262 Logic/Motion Controller, Programming Guide).

Library and Namespace

Library name: **PLCSystemBase**

Namespace: **PLCSystemBase**

Graphical Representation

IL and ST Representation

To see the general representation in IL or ST language, refer to the chapter *Function and Function Block Representation*, page 74.

I/O Variable Description

This table describes the input variables:

Input	Type	Comment
xExecute	BOOL	On rising edge, starts the function block execution. On falling edge, resets the outputs of the function block when any ongoing execution terminates. **NOTE:** With the falling edge, the function continues until it concludes its execution and updates its outputs. The outputs are retained for one cycle and reset.
sFileName	STRING	File name without extension (the extension *.DTA* is automatically added). Use only a...z, A...Z, 0...9 alphanumeric characters.
xRead	BOOL	TRUE: copy data from the file identified by *sFileName* to the internal memory of the controller. FALSE: copy data from the internal memory of the controller to the file identified by *sFileName*.
xSecure	BOOL	TRUE: The MAC address is always stored in the file. Only a controller with the same MAC address can read from the file. FALSE: Another controller with the same type of memory can read from the file.
iLocation	INT	0: the file location is */usr/DTA* in internal file system. 1: the file location is */usr/DTA* in external file system (SD card). **NOTE:** If the file does not already exist in the directory, the file is created.

uiSize	UINT	Indicates the size in bytes. Maximum is 65534 bytes.
		Only use addresses of variables conforming to IEC 61131-3 (variables, arrays, structures), for example:
		`Variable : int;`
		`uiSize := SIZEOF (Variable);`

dwAdd	DWORD	Indicates the address in the memory that the function will read from or write to.
		Only use addresses of variables conforming to IEC 61131-3 (variables, arrays, structures), for example:
		`Variable : int;`
		`dwAdd := ADR (Variable);`

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

Verify that the memory location is of the correct size and the file is of the correct type before copying the file to memory.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

This table describes the output variables:

Output	Type	Comment
xDone	BOOL	`TRUE` = indicates that the action is successfully completed.
xBusy	BOOL	`TRUE` = indicates that the function block is running.
xError	BOOL	`TRUE` = indicates that an error is detected and the function block aborted the action.
eError	*DataFileCopyError*, page 48	Indicates the type of the data file copy detected error.

NOTE: If you modify data within the memory (variables, arrays, structures) used to write the file, a CRC integrity error results.

Example

This example describes how to copy file commands:

```
VAR
LocalArray : ARRAY [0..29] OF BYTE;
myFileName: STRING := 'exportfile';
EXEC_FLAG: BOOL;
DataFileCopy: DataFileCopy;
END_VAR
DataFileCopy(
xExecute:= EXEC_FLAG,
sFileName:= myFileName,
xRead:= FALSE,
xSecure:= FALSE,
iLocation:= DFCL_INTERNAL,
uiSize:= SIZEOF(LocalArray),
dwAdd:= ADR(LocalArray),
xDone=> ,
xBusy=> ,
xError=> ,
eError=> );
```

ExecuteScript: Run Script Commands

Function Block Description

This function block can run the following SD card script commands:

- *Download*
- *Upload*
- *SetNodeName*
- *Delete*
- *Reboot*

For information on the required script file format, refer to Creating Script Files (see Modicon M262 Logic/Motion Controller, Programming Guide).

Library and Namespace

Library name: **PLCSystemBase**

Namespace: **PLCSystemBase**

Graphical Representation

IL and ST Representation

To see the general representation in IL or ST language, refer to the chapter *Function and Function Block Representation*, page 74.

I/O Variable Description

This table describes the input variables:

Input	Type	Comment
xExecute	BOOL	On detection of a rising edge, starts the function block execution. On detection of a falling edge, resets the outputs of the function block when any on-going execution terminates. **NOTE:** With the falling edge, the function continues until it concludes its execution and updates its outputs. The outputs are retained for one cycle and reset.
sCmd	STRING	SD card script command syntax. Simultaneous command executions are not allowed: if a command is being executed from another function block or from an SD card script then the function block queues the command and does not execute it immediately. **NOTE:** An SD card script executed from an SD card is considered as being executed until the SD card has been removed.

This table describes the output variables:

Output	Type	Comment
xDone	BOOL	`TRUE` indicates that the action is successfully completed.
xBusy	BOOL	`TRUE` indicates that the function block is running.
xError	BOOL	`TRUE` indicates error detection; the function block aborts the action.
eError	*ExecuteScriptError*, page 49	Indicates the type of the execute script detected error.

Example

This example describes how to execute an *Upload* script command:

```
VAR
EXEC_FLAG: BOOL;
ExecuteScript: ExecuteScript;
END_VAR
ExecuteScript(
xExecute:= EXEC_FLAG,
sCmd:= 'Upload "/usr/Syslog/*"',
xDone=> ,
xBusy=> ,
xError=> ,
eError=> );
```

M262 Library Data Types

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Overview

This chapter describes the data types of the M262 PLCSystem library.

There are 2 kinds of data types available:

- System variable data types are used by the system variables, page 14 of the M262 PLCSystem Library (PLC_R, PLC_W,...).
- System function data types are used by the read/write system functions, page 24 of the M262 PLCSystem Library.

PLC_RW System Variables Data Types

Overview

This section lists and describes the system variable data types included in the *PLC_R* and *PLC_W* structures.

PLC_R_APPLICATION_ERROR: Detected Application Error Status Codes

Library and Namespace

Library name: **PLCSystemBase**

Namespace: **PLCSystemBase**

Enumerated Type Description

The *PLC_R_APPLICATION_ERROR* enumeration data type contains the following values:

Enumerator	Value	Comment	What to do
PLC_R_APP_ERR_UNKNOWN	FFFF hex	Undefined error detected.	Contact your local Schneider Electric representative.
PLC_R_APP_ERR_NOEXCEPTION	0000 hex	No error detected.	–
PLC_R_APP_ERR_WATCHDOG	0010 hex	Task watchdog expired.	Verify your application, and correct if necessary. See System and Task Watchdogs (see Modicon M262 Logic/Motion Controller, Programming Guide). A reset is needed to enter RUNNING mode.
PLC_R_APP_ERR_HARDWAREWATCHDOG	0011 hex	The internal hardware watchdog has expired.	If the problem is reproducible, verify that there are no configured but disconnected communication ports. Otherwise, update the firmware. If the problem still persists, contact your Schneider Electric service representative.
PLC_R_APP_ERR_IO_CONFIG_ERROR	0012 hex	Incorrect I/O configuration parameters detected.	Your application may be corrupted. To resolve this issue, reload the application from the PC. Otherwise, contact your local Schneider Electric representative.
PLC_R_APP_ERR_UNRESOLVED_EXTREFS	0018 hex	Undefined functions detected.	Remove the unresolved functions from the application.
PLC_R_APP_ERR_IEC_TASK_CONFIG_ERROR	0025 hex	Incorrect Task configuration parameters detected.	Your application may be corrupted. To resolve this issue, reload the application from the PC. Otherwise, contact your local Schneider Electric representative.
PLC_R_APP_ERR_TARGET_MISMATCH	0026 hex	Controller is not allowed to execute this IEC application.	The application could not be executed because it is not the correct target or controller type.
PLC_R_APP_ERR_ILLEGAL_INSTRUCTION	0050 hex	Undefined instruction detected.	Debug your application to resolve the problem.
PLC_R_APP_ERR_ACCESS_VIOLATION	0051 hex	Attempted access to reserved memory area.	Debug your application to resolve the problem.
PLC_R_APP_ERR_DIVIDE_BY_ZERO	0102 hex	Integer division by zero detected.	Debug your application to resolve the problem.
PLC_R_APP_ERR_PROCESSORLOAD_WATCHDOG	0105 hex	Processor overloaded by Application Tasks, and system watchdog has expired.	Reduce the application workload by improving the application architecture. Reduce event frequency.
PLC_R_APP_ERR_DIVIDE_REAL_BY_ZERO	0152 hex	Real division by zero detected.	Debug your application to resolve the problem.
PLC_R_APP_ERR_EXPIO_EVENTS_COUNT_EXCEEDED	4E20 hex	Too many events on expert I/Os are detected.	Reduce the number of external event tasks.
PLC_R_APP_ERR_APPLICATION_VERSION_MISMATCH	4E21 hex	Mismatch in the application version detected.	The application version in the controller does not match the version in the software. Refer to Applications found in the EcoStruxure Automation Expert - Motion / EcoStruxure Machine Expert Programming Guide.

PLC_R_BOOT_PROJECT_STATUS: Boot Project Status Codes

Library and Namespace

Library name: **PLCSystemBase**

Namespace: **PLCSystemBase**

Enumerated Type Description

The *PLC_R_BOOT_PROJECT_STATUS* enumeration data type contains the following values:

Enumerator	Value	Comment
PLC_R_NO_BOOT_PROJECT	0000 hex	Boot project does not exist in non-volatile memory.
PLC_R_BOOT_PROJECT_CREATION_IN_PROGRESS	0001 hex	Boot project is being created.
PLC_R_DIFFERENT_BOOT_PROJECT	0002 hex	Boot project in non-volatile memory is different from the project loaded in memory.
PLC_R_VALID_BOOT_PROJECT	FFFF hex	Boot project in non-volatile memory is the same as the project loaded in memory.

Enumerated Type Description

The *PLC_R_BOOT_PROJECT_STATUS* enumeration data type contains the following values:

Enumerator	Value	Comment
PLC_R_NO_BOOT_PROJECT	0000 hex	Boot project does not exist in non-volatile memory.
PLC_R_BOOT_PROJECT_CREATION_IN_PROGRESS	0001 hex	Boot project is being created.
PLC_R_DIFFERENT_BOOT_PROJECT	0002 hex	Boot project in non-volatile memory is different from the project loaded in memory.
PLC_R_VALID_BOOT_PROJECT	FFFF hex	Boot project in non-volatile memory is the same as the project loaded in memory.

PLC_R_IO_STATUS: I/O Status Codes

Library and Namespace

Library name: **PLCSystemBase**

Namespace: **PLCSystemBase**

Enumerated Type Description

The *PLC_R_IO_STATUS* enumeration data type contains the following values:

Enumerator	Value	Comment
PLC_R_IO_OK	FFFF hex	Inputs/Outputs are operational.
PLC_R_IO_NO_INIT	0001 hex	Inputs/Outputs are not initialized.
PLC_R_IO_CONF_FAULT	0002 hex	Incorrect I/O configuration parameters detected.
PLC_R_IO_SHORTCUT_FAULT	0003 hex	Inputs/Outputs short-circuit detected.
PLC_R_IO_POWER_SUPPLY_FAULT	0004 hex	Inputs/Outputs power supply error detected.

PLC_R_SDCARD_STATUS: SD Card Slot Status Codes

Library and Namespace

Library name: **PLCSystemBase**

Namespace: **PLCSystemBase**

Enumerated Type Description

The *PLC_R_SDCARD_STATUS* enumeration data type contains the following values:

Enumerator	Value	Comment
NO_SDCARD	0000 hex	No SD card detected in the slot or the slot is not connected.
SDCARD_READONLY	0001 hex	SD card is in read-only mode.
SDCARD_READWRITE	0002 hex	SD card is in read/write mode.
SDCARD_ERROR	0003 hex	Error detected in the SD card. More details are written to the file FwLog.txt.

PLC_R_STATUS: Controller Status Codes

Library and Namespace

Library name: **PLCSystemBase**

Namespace: **PLCSystemBase**

Enumerated Type Description

The *PLC_R_STATUS* enumeration data type contains the following values:

Enumerator	Value	Comment
PLC_R_EMPTY	0000 hex	Controller does not contain an application.
PLC_R_STOPPED	0001 hex	Controller is stopped.
PLC_R_RUNNING	0002 hex	Controller is running.
PLC_R_HALT	0004 hex	Controller is in a HALT state (see the controller state diagram in your controller programming guide (see Modicon M262 Logic/Motion Controller, Programming Guide)).
PLC_R_BREAKPOINT	0008 hex	Controller has paused at a breakpoint.

PLC_R_STOP_CAUSE: From RUN State to Other State Transition Cause Codes

Library and Namespace

Library name: **PLCSystemBase**

Namespace: **PLCSystemBase**

Enumerated Type Description

The *PLC_R_STOP_CAUSE* enumeration data type contains the following values:

Enumerator	Value	Comment	What to do
PLC_R_STOP_REASON_UNKNOWN	00 hex	Initial value or stop cause is indeterminable.	Contact your local Schneider Electric representative.
PLC_R_STOP_REASON_HW_WATCHDOG	01 hex	Stopped after hardware watchdog timeout.	Contact your local Schneider Electric representative.
PLC_R_STOP_REASON_RESET	02 hex	Stopped after reset.	See reset possibilities in Controller State Diagram (see Modicon M262 Logic/Motion Controller, Programming Guide).
PLC_R_STOP_REASON_EXCEPTION	03 hex	Stopped after exception.	Verify your application, and correct if necessary. See System and Task Watchdogs (see Modicon M262 Logic/Motion Controller, Programming Guide). A reset is needed to enter Run mode.
PLC_R_STOP_REASON_USER	04 hex	Stopped after a user request.	Refer to Stop Command in Commanding State Transitions (see Modicon M262 Logic/Motion Controller, Programming Guide).
PLC_R_STOP_REASON_IECPROGRAM	05 hex	Stopped after a program command request (for example: control command with parameter *PLC_W.q_wPLCControl:=PLC_W_COMMAND.PLC_W_STOP;*).	–
PLC_R_STOP_REASON_DELETE	06 hex	Stopped after a remove application command.	See the **Applications** tab of the Controller Device Editor (see Modicon M262 Logic/Motion Controller, Programming Guide).
PLC_R_STOP_REASON_DEBUGGING	07 hex	Stopped after entering debug mode.	–
PLC_R_STOP_FROM_NETWORK_REQUEST	0A hex	Stopped after a request from the network, USB key, or *PLC_W* command.	–
PLC_R_STOP_FROM_INPUT	0B hex	Stop required by a controller input.	–
PLC_R_STOP_FROM_RUN_STOP_SWITCH	0C hex	Stop required by the controller switch.	–
PLC_R_STOP_REASON_RETAIN_MISMATCH	0D hex	Stopped after an unsuccessful check context test during rebooting.	There are retained variables in non-volatile memory that do not exist in the executing application. Verify your application, correct if necessary, then reestablish the boot application.

Enumerator	Value	Comment	What to do
PLC_R_STOP_REASON_BOOT_APPLI_MISMATCH	0E hex	Stopped after an unsuccessful compare between the boot application and the application that was in the memory before rebooting.	Create a valid boot application.
PLC_R_STOP_REASON_POWERFAIL	0F hex	Stopped after a power interruption.	Refer to reset possibilities in the Controller State Diagram (see Modicon M262 Logic/Motion Controller, Programming Guide).

For more information on the reasons why the controller has stopped, refer to the Controller State Description (see Modicon M262 Logic/Motion Controller, Programming Guide).

PLC_R_TERMINAL_PORT_STATUS: Programming Port Connection Status Codes

Library and Namespace

Library name: **PLCSystemBase**

Namespace: **PLCSystemBase**

Enumerated Type Description

The *PLC_R_TERMINAL_PORT_STATUS* enumeration data type contains the following values:

Enumerator	Value	Comment
TERMINAL_NOT_CONNECTED	00 hex	No PC is connected to the programming port.
TERMINAL_CONNECTION_IN_PROGRESS	01 hex	Connection is in progress.
TERMINAL_CONNECTED	02 hex	PC is connected to the programming port.
TERMINAL_ERROR	0F hex	Error detected during connection.

PLC_R_TM3_BUS_STATE: TM3 Bus Status Codes

Library and Namespace

Library name: **PLCSystemBase**

Namespace: **PLCSystemBase**

Enumerated Type Description

The *PLC_R_TM3_BUS_STATE* enumeration data type contains the following values:

Enumerator	Value	Comment
TM3_CONF_ERROR	01 hex	Error detected due to mismatch in the physical configuration and the configuration in the software.
TM3_BUS_ERROR	02 hex	Error detected in *q_wIOBusErrPassiv*, page 65 in TM3 System library.
TM3_OK	03 hex	The physical configuration and the configuration in the software match.
TM3_POWER_SUPPLY_ERROR	04 hex	Error detected in power supply.

PLC_W_COMMAND: Control Command Codes

Library and Namespace

Library name: **PLCSystemBase**

Namespace: **PLCSystemBase**

Enumerated Type Description

The *PLC_W_COMMAND* enumeration data type contains the following values:

Enumerator	Value	Comment
PLC_W_STOP	0001 hex	Command to stop the controller.
PLC_W_RUN	0002 hex	Command to run the controller.
PLC_W_RESET_COLD	0004 hex	Command to initiate a Controller cold reset.
PLC_W_RESET_WARM	0008 hex	Command to initiate a Controller warm reset.

DataFileCopy System Variables Data Types

Overview

This section lists and describes the system variable data types included in the *DataFileCopy* structures.

DataFileCopyError: Detected Error Codes

Library and Namespace

Library name: **PLCSystemBase**

Namespace: **PLCSystemBase**

Enumerated Type Description

The *DataFileCopyError* enumeration data type contains the following values:

Enumerator	Value	Description
ERR_NO_ERR	00 hex	No error detected.
ERR_FILE_NOT_FOUND	01 hex	The file does not exist.
ERR_FILE_ACCESS_REFUSED	02 hex	The file cannot be opened.
ERR_INCORRECT_SIZE	03 hex	The request size is not the same as size read from file.
ERR_CRC_ERR	04 hex	The CRC is not correct and the file is assumed to be corrupted.
ERR_INCORRECT_MAC	05 hex	The controller attempting to read from the file does not have the same MAC address as that contained in the file.

DataFileCopyLocation: Location Codes

Library and Namespace

Library name: **PLCSystemBase**

Namespace: **PLCSystemBase**

Enumerated Type Description

The *DataFileCopyLocation* enumeration data type contains the following values:

Enumerator	Value	Description
DFCL_INTERNAL	00 hex	Data file with DTA extension is located in */usr/Dta* directory.
DFCL_EXTERNAL	01 hex	Data file with DTA extension is located in */sd0/usr/Dta* directory.
DFCL_TBD	02 hex	Not used.

ExecScript System Variables Data Types

Overview

This section lists and describes the system variable data types included in the *ExecScript* structures.

ExecuteScriptError: Detected Error Codes

Library and Namespace

Library name: **PLCSystemBase**

Namespace: **PLCSystemBase**

Enumerated Type Description

The *ExecuteScriptError* enumeration data type contains the following values:

Enumerator	Value	Description
CMD_OK	00 hex	No error detected.
ERR_CMD_UNKNOWN	01 hex	The command is invalid.
ERR_SD_CARD_MISSING	02 hex	SD card is not present.
ERR_SEE_FWLOG	03 hex	There was an error detected during command execution, see `FwLog.txt`. For more information, refer to File Type (see Modicon M262 Logic/Motion Controller, Programming Guide).
ERR_ONLY_ONE_COMMAND_ALLOWED	04 hex	An attempt was made to execute several scripts simultaneously.
CMD_BEING_EXECUTED	05 hex	A script is already in progress.

ETH_RW System Variables Data Types

Overview

This section lists and describes the system variable data types included in the *ETH_R* and *ETH_W* structures.

ETH_R_FRAME_PROTOCOL: Frame Transmission Protocol Codes

Library and Namespace

Library name: **PLCSystemBase**

Namespace: **PLCSystemBase**

Enumerated Type Description

The *ETH_R_FRAME_PROTOCOL* enumeration data type contains the following values:

Enumerator	Value	Comment
ETH_R_802_3	00 hex	The protocol used for frame transmission is IEEE 802.3.
ETH_R_ETHERNET_II	01 hex	The protocol used for frame transmission is Ethernet II.

ETH_R_IPFORWARDING: IP Forwarding

Library and Namespace

Library name: **PLCSystemBase**

Namespace: **PLCSystemBase**

Enumerated Type Description

The *ETH_R_IPFORWARDING* enumeration data type contains the following values:

Enumerator	Value	Comment
DISABLED	00 hex	IP forwarding is disabled.
ENABLED	01 hex	IP forwarding is enabled.

ETH_R_IP_MODE: IP Address Source Codes

Library and Namespace

Library name: **PLCSystemBase**

Namespace: **PLCSystemBase**

Enumerated Type Description

The *ETH_R_IP_MODE* enumeration data type contains the following values:

Enumerator	Value	Comment
ETH_R_STORED	00 hex	Stored IP address is used.
ETH_R_BOOTP	01 hex	Bootstrap protocol (BOOTP) is used to get an IP address.
ETH_R_DHCP	02 hex	DHCP protocol is used to get an IP address.
ETH_DEFAULT_IP	FF hex	Default IP address is used.

ETH_R_ITF_STRUCT: Ethernet Interface Parameters

Library and Namespace

Library name: **PLCSystemBase**

Namespace: **PLCSystemBase**

Enumerated Type Description

The *ETH_R_ITF_STRUCT* enumeration data type contains the following values:

%MW	Var Name	Type	Comment
n/a	*i_byIPAddress*	ARRAY[0..3] OF BYTE	IP address of this Ethernet interface `[aaa.bbb.ccc.ddd]`: • i_byIPAddress[0] = aaa • ... • i_byIPAddress[3] = ddd
n/a	*i_bySubNetMask*	ARRAY[0..3] OF BYTE	Subnet mask of this Ethernet interface `[aaa.bbb.ccc.ddd]`: • i_bySub-netMask[0] = aaa • ... • i_bySub-netMask[3] = ddd
n/a	*i_byGateway*	ARRAY[0..3] OF BYTE	Gateway address of this Ethernet interface `[aaa.bbb.ccc.ddd]`: • i_byGateway[0] = aaa • ... • i_byGateway[3] = ddd
n/a	*i_byMACAddress*	ARRAY[0..5] OF BYTE	MAC address of this Ethernet interface `[aa.bb.cc.dd.ee.ff]`: • i_byMACAddress[0] = aa • ... • i_byMACAddress[5] = ff
n/a	*i_sDeviceName*	STRING(15)	Name used to get IP address from server.
n/a	*i_wIpMode*	*ETH_R_IP_MODE*, page 50	Method used to obtain an IP address.
n/a	*i_byFDRServerIPAddress*	ARRAY[0..3] OF BYTE	The IP address `[aaa.bbb.ccc.ddd]` of the DHCP or BootP server: • i_byFDRServerIPAddress[0] = aaa • ... • i_byFDRServerIPAddress[3] = ddd Equals 0.0.0.0 if Stored IP or Default IP used.
n/a	*i_udiFramesTransmittedOK*	UDINT	Number of frames successfully transmitted. Reset at Power ON or with reset command *ETH_W.q_wResetCounter*.

%MW	Var Name	Type	Comment
n/a	*i_udiFramedReceivedOK*	UDINT	Number of frames successfully received. Reset at Power ON or with reset command *ETH_W.q_wResetCounter*.
n/a	*i_udiTransmitBufferErrors*	UDINT	Numbers of frames transmitted with detected errors. Reset at Power ON or with reset command *ETH_W.q_wResetCounter*.
n/a	*i_udiReceiveBufferErrors*	UDINT	Numbers of frames received with detected errors. Reset at Power ON or with reset command *ETH_W.q_wResetCounter*.
n/a	*i_wPortALinkStatus*	*ETH_R_PORT_LINK_STATUS*, page 53	Link of the Ethernet Port (0 = No Link, 1 = Link connected to another Ethernet device).
n/a	*i_wPortASpeed*	*ETH_R_PORT_SPEED*, page 53	Ethernet Port network speed (10 Mb/s, 100 Mb/s, or 1 Gb/s).
n/a	*i_wPortADuplexStatus*	*ETH_R_PORT_DUPLEX_STATUS*, page 52	Ethernet Port duplex status (0 = Half or 1 = Full duplex).
n/a	*i_wPortAIpStatus*	*ETH_R_PORT_IP_STATUS*, page 52	Ethernet TCP/IP port stack status.
n/a means that there is no predefined %MW mapping for this system variable.			

ETH_R_PORT_DUPLEX_STATUS: Transmission Mode Codes

Library and Namespace

Library name: **PLCSystemBase**

Namespace: **PLCSystemBase**

Enumerated Type Description

The *ETH_R_PORT_DUPLEX_STATUS* enumeration data type contains the following values:

Enumerator	Value	Comment
ETH_R_PORT_HALF_DUPLEX	00 hex	Half duplex transmission mode is used.
ETH_R_FULL_DUPLEX	01 hex	Full duplex transmission mode is used.
ETH_R_PORT_NA_DUPLEX	03 hex	No duplex transmission mode is used.

ETH_R_PORT_IP_STATUS: Ethernet TCP/IP Port Status Codes

Library and Namespace

Library name: **PLCSystemBase**

Namespace: **PLCSystemBase**

Enumerated Type Description

The *ETH_R_PORT_IP_STATUS* enumeration data type contains the following values:

Enumerator	Value	Comment
WAIT_FOR_PARAMS	00 hex	Waiting for parameters.
WAIT_FOR_CONF	01 hex	Waiting for configuration.
DATA_EXCHANGE	02 hex	Ready for data exchange.
ETH_ERROR	03 hex	Ethernet TCP/IP port error detected (cable disconnected, invalid configuration, and so on).
DUPLICATE_IP	04 hex	IP address already used by another device.

ETH_R_PORT_LINK_STATUS: Communication Link Status Codes

Library and Namespace

Library name: **PLCSystemBase**

Namespace: **PLCSystemBase**

Enumerated Type Description

The *ETH_R_PORT_LINK_STATUS* enumeration data type contains the following values:

Enumerator	Value	Comment
ETH_R_LINK_DOWN	00 hex	Communication link not available to another device.
ETH_R_LINK_UP	01 hex	Communication link available to another device.

ETH_R_PORT_SPEED: Communication Speed of the Ethernet Port Codes

Library and Namespace

Library name: **PLCSystemBase**

Namespace: **PLCSystemBase**

Enumerated Type Description

The *ETH_R_PORT_SPEED* enumeration data type contains the following values:

Enumerator	Value	Comment
ETH_R_SPEED_NA	0 dec	Network speed is 0 megabits per second.
ETH_R_SPEED_10_MB	10 dec	Network speed is 10 megabits per second.
ETH_R_100_MB	100 dec	Network speed is 100 megabits per second.
ETH_R_1_GB	1000 dec	Network speed is 1 gigabits per second.

ETH_R_RUN_IDLE: Ethernet/IP Run and Idle States Codes

Library and Namespace

Library name: **PLCSystemBase**

Namespace: **PLCSystemBase**

Enumerated Type Description

The *ETH_R_RUN_IDLE* enumeration data type contains the following values:

Enumerator	Value	Comment
IDLE	00 hex	EtherNet/IP connection is idle.
RUN	01 hex	EtherNet/IP connection is running.

System Function Data Types

Overview

This section describes the different system function data types of the M262 PLCSystem library.

IMMEDIATE_ERR_TYPE: *GetImmediateFastInput* Read Input of Embedded Expert I/O Codes

Library and Namespace

Library name: **PLCSystemBase**

Namespace: **PLCSystemBase**

Enumerated Type Description

The enumeration data type contains the following values:

Enumerator	Type	Comment
IMMEDIATE_NO_ERROR	Word	No errors detected.
IMMEDIATE_UNKNOWN	Word	The reference of *Immediate* function is incorrect or not configured.
IMMEDIATE_UNKNOWN_PARAMETER	Word	A parameter reference is incorrect.

RTCSETDRIFT_ERROR: *SetRTCDrift* Function Detected Error Codes

Enumerated Type Description

The *RTCSETDRIFT_ERROR* enumeration data type contains the following values:

Enumerator	Value	Comment
RTC_OK	00 hex	RTC drift correctly configured.
RTC_BAD_DAY	01 hex	Not used.
RTC_BAD_HOUR	02 hex	Not used.
RTC_BAD_MINUTE	03 hex	Not used.
RTC_BAD_DRIFT	04 hex	RTC Drift parameter out of range.
RTC_INTERNAL_ERROR	05 hex	RTC Drift settings rejected on internal error detected.

SerialLine System

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Introduction

This part describes the M262 SerialLine Library.

M262 Serial Line System Variables

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Overview

This chapter describes the Serial Line system variables of the M262 PLCSystem library.

SERIAL_R: Serial Line Diagnostic Variables

Library and Namespace

Library name: **SerialLineSystem**

Namespace: **SEC_SLSYS**

Introduction

The *SERIAL_R* system variable (*SERIAL_R_ARRAY_TYPE* type) is an array of *SERIAL_R_STRUCT*.

Variable Structure

This table describes the parameters of the *SERIAL_R_STRUCT*:

Variable Name	Type	Comment
i_udiFramesTransmittedOK	UDINT	Indicates the number of frames transmitted since start by Serial Line bus.
i_udiFramesReceivedOK	UDINT	Indicates the number of frames received since start by Serial Line bus.
i_udiRX_MessagesError	UDINT	Indicates that the *RX Error Counter* register counts the number of frames received with errors detected for all types of frames.
i_uiSlaveExceptionCount	UINT	Indicates the number of bus exception errors detected.
i_uiSlaveMsgCount	UINT	Indicates the number of slave messages.
i_uiSlaveNoRespCount	UINT	Indicates the number of no responses from slaves.
i_uiSlaveNakCount	UINT	Indicates the number of slave NAK indications.
i_uiSlaveBusyCount	UINT	Indicates the number of slave busy indications.
i_uiCharOverrunCount	UINT	Indicates the number of character overruns encountered.

SERIAL_W: Serial Line Diagnostic Variables

Library and Namespace

Library name: **SerialLineSystem**

Namespace: **SEC_SLSYS**

Introduction

The *SERIAL_W* system variable (*SERIAL_W_ARRAY_TYPE* type) is an array of *SERIAL_W_STRUCT*.

Variable Structure

This table describes the parameters of the *SERIAL_W_STRUCT*:

Variable Name	Type	Comment
q_wResetCounter	WORD	Transition from 0 to 1 to reset the events counter. To reset the counter again, it is necessary to write 0 to this variable before another transition from 0 to 1 can take place.

TM3 System

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Introduction

This part describes the TM3 System Library.

TM3 System Variables

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TM3_MODULE_R[0...13]: TM3 Modules Read-Only System Variables

Library and Namespace

Library name: **TM3System**

Namespace: **SEC_TM3Sys**

Introduction

The *TM3_MODULE_R* is an array of 14 *TM3_MODULE_R_STRUCT* type. Each element of the array returns diagnostic system variables for the corresponding TM3 expansion module.

For the Modicon M262 Logic/Motion Controller:

- *TM3_MODULE_R[0]* refers to the TM3 expansion module 0
- ...
- *TM3_MODULE_R[13]* refers to the TM3 expansion module 13

Variable Structure

The following table describes the parameters of the *TM3_MODULE_R[13]* system variable:

%MW	Var Name	Type	Comment
n/a	*i_wProductID*	WORD	TM3 expansion module ID.
n/a	*i_wModuleState*	*TM3_MODULE_STATE*, page 66	Describes the state of the TM3 module.

NOTE: n/a means that there is no predefined %MW mapping for this system variable.

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TM3_GetModuleBusStatus: Get TM3 Module Bus Status 61
TM3_GetModuleInternalStatus: Get TM3 Module Internal Status 62

TM3_GetModuleBusStatus: Get TM3 Module Bus Status

Function Description

This function returns the bus status of the module. The index of the module is given as an input parameter.

Library and Namespace

Library name: **TM3System**

Namespace: **SEC_TM3Sys**

Graphical Representation

IL and ST Representation

To see the general representation in IL or ST language, refer to the chapter *Function and Function Block Representation*, page 74.

I/O Variable Description

The following table describes the input variable:

Input	Type	Comment
ModuleIndex	BYTE	Index of the expansion module (0 for the module closest to the controller, 1 for the second closest, and so on).

The following table describes the output variable:

Output	Type	Comment
TM3_GetModuleBusStatus	*TM3_ERR_CODE*	Returns *TM3_NO_ERR* (00 hex) if command is correct otherwise returns the ID code of the detected error.

TM3_GetModuleInternalStatus: Get TM3 Module Internal Status

Function Description

This function fills the *pStatusBuffer* with the status table of the module *ModuleIndex*.

This function selectively reads the I/O channel status of a TM3 analog or temperature module, indicated by *ModuleIndex*. The function block writes the status for each requested channel starting at the memory location pointed to by *pStatusBuffer*.

NOTE: This function block is intended to be used with analog and temperature I/O modules. To get status information for digital I/O modules, see *TM3_GetModuleBusStatus*, page 61.

NOTE: It is possible to update the value of the diagnostic bytes by calling the *TM3_GetModuleInternalStatus* function only if the **Status Enabled** parameter in the **I/O Configuration** tab is deactivated.

Library and Namespace

Library name: **TM3System**

Namespace: **SEC_TM3Sys**

Graphical Representation

IL and ST Representation

To see the general representation in IL or ST language, refer to the chapter *Function and Function Block Representation*, page 74.

I/O Variable Description

Each analog/temperature I/O channel of the requested module requires one byte of memory. If there is not sufficient memory allocated to the buffer for the number of I/O module channel statuses requested, it is possible that the function will overwrite memory allocated for other purposes, or perhaps attempt to overwrite a restricted area of memory.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

Ensure that *pStatusBuffer* is pointing to a memory area that has been sufficiently allocated for the number of channels to be read.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

The following table describes the input variables:

Input	Type	Comment
ModuleIndex	BYTE	Index of the expansion module (0 for the module closest to the controller, 1 for the second closest, and so on).
StatusOffset	BYTE	Offset of the first status to be read in the status table.
StatusSize	BYTE	Number of bytes to be read in the status table.
pStatusBuffer	POINTER TO BYTE	Buffer containing the read status table (IBStatusIWx / IBStatusQWx).

The following table describes the output variable:

Output	Type	Comment
TM3_GetModuleInternalStatus	*TM3_ERR_CODE*, page 65	Returns *TM3_NO_ERR* (00 hex) if command is correct otherwise returns the ID code of the error. For the purposes of this function block, any returned value other than zero indicates that the module is not compatible with the status request, or that the module has other communication issues.

Example

The following examples describe how to get the module internal status:

```
VAR
TM3AQ2_Channel_0_Output_Status: BYTE;
END_VAR
TM3AQ2 is on position 1
Status of channel 0 is at offset 0
We read 1 channel
TM3_GetModuleInternalStatus(1, 0, 1, ADR(TM3AQ2_Channel_0_
Output_Status));
status of channel 0 is in TM3AQ2_Channel_0_Output_Status
```

TM3AQ2 module (2 outputs)

Getting the status of first output QW0

- *StatusOffset* = 0 (0 inputs x 2)
- *StatusSize* = 1 (1 status to read)
- *pStatusBuffer* needs to be at least 1 byte

```
VAR
TM3AM6_Channels_1_2_Input_Status: ARRAY[1..2] OF BYTE;
END_VAR
TM3AM6 is on position 1
Status of channel 1 is at offset 1
We read 2 consecutive channels
TM3_GetModuleInternalStatus(1, 1, 2, ADR(TM3AM6_Channels_1_
2_Input_Status));
status of channel 1 is in TM3AM6_Channels_1_2_Input_Status
[1]
status of channel 2 is in TM3AM6_Channels_1_2_Input_Status
[2]
```

TM3AM6 module (4 inputs, 2 outputs)

Getting the status of input IW1 & IW2 (IW0 being the first one)

- *StatusOffset* = 1 (1 to skip IW0 status)
- *StatusSize* = 2 (2 statuses to read)
- *pStatusBuffer* needs to be at least 2 bytes

TM3 System Data Types

What's in This Chapter

TM3_BUS_PARAM_ID: TM3 Expansion Module Diagnostics 64
TM3_BUS_W_IOBUSERRMOD: TM3 bus error mode 64
TM3_BUS_W_IOBUSINIT: Reset the Bus Communication 64
TM3_BUS_W: TM3 Bus System Variables 65
TM3_ERR_CODE: TM3 Expansion Module Detected Error Codes 65
TM3_MODULE_R_ARRAY_TYPE: TM3 Expansion Module Read Array Type 66
TM3_MODULE_STATE: TM3 Expansion Module State Codes 66

TM3_BUS_PARAM_ID: TM3 Expansion Module Diagnostics

Enumerated Type Description

The *TM3_BUS_PARAM_ID* enumeration data type contains the following values:

Enumerator	Type	Value	Comment
ID_TM3_MODULE_DIAG	DWORD	10001 dec	-
ID_TM3_BUS_W	DWORD	10002 dec	-

TM3_BUS_W_IOBUSERRMOD: TM3 bus error mode

Enumerated Type Description

The *TM3_BUS_W_IOBUSERRMOD* enumeration data type contains the following values:

Enumerator	Value	Comment
IOBUS_ERR_ACTIVE	00 hex	Active mode. The logic controller stops all I/O exchanges on the TM3 bus on detection of a permanent error. Refer to I/O Configuration General Description (see Modicon M262 Logic/Motion Controller, Programming Guide).
IOBUS_ERR_PASSIVE	01 hex	Passive mode. I/Os exchanges continue on the TM3 bus even if an error is detected.

TM3_BUS_W_IOBUSINIT: Reset the Bus Communication

Enumerated Type Description

The *TM3_BUS_W_IOBUSINIT* enumeration data type contains the following values:

Enumerator	Type	Value
CMD_INIT_OFF	WORD	00 hex
CMD_INIT_ON	WORD	01 hex

TM3_BUS_W: TM3 Bus System Variables

Variable Structure

This table describes the parameters of the *TM3_BUS_W* system variable (*TM3_BUS_W_STRUCT* type):

Var Name	Type	Comment
q_wIOBusErrPassiv	*TM3_BUS_W_IOBUSERRMOD*	When set to *ERR_ACTIVE* (the default), bus errors detected on TM3 expansion modules stop I/O exchanges. When set to *ERR_PASSIVE*, passive I/O error handing is used: the controller attempts to continue data bus exchanges.
q_wIOBusRestart	*TM3_BUS_W_IOBUSINIT*	When set to 1, restarts the I/O expansion bus. This is only necessary when *q_wIOBusErrPassiv* is set to *ERR_ACTIVE* and at least one bit of *TM3_MODULE_R [i] .i_wModuleState* is set to *TM3_BUS_ERROR*.

For more information, refer to I/O Configuration General Description (see Modicon M262 Logic/Motion Controller, Programming Guide).

TM3_ERR_CODE: TM3 Expansion Module Detected Error Codes

Library and Namespace

Library name: **TM3System**

Namespace: **SEC_TM3Sys**

Enumerated Type Description

The *TM3_ERR_CODE* enumeration data type contains the following values:

Enumerator	Value	Comment
TM3_NO_ERR	00 hex	Last bus exchange with the expansion module was successful.
TM3_ERR_FAILED	01 hex	Error detected due to the last bus exchange with the expansion module was unsuccessful.
TM3_ERR_PARAMETER	02 hex	Parameter error detected in the last bus exchange with the module.
TM3_ERR_COK	03 hex	Temporary or permanent hardware error detected on one of the TM3 expansion modules.
TM3_ERR_BUS	04 hex	Bus error detected in the last bus exchange with the expansion module.

TM3_MODULE_R_ARRAY_TYPE: TM3 Expansion Module Read Array Type

Library and Namespace

Library name: **TM3System**

Namespace: **SEC_TM3Sys**

Description

The *TM3_MODULE_R_ARRAY_TYPE* is an array of 0...13 *TM3_MODULE_R_STRUCT*.

TM3_MODULE_STATE: TM3 Expansion Module State Codes

Library and Namespace

Library name: **TM3System**

Namespace: **SEC_TM3Sys**

Enumerated Type Description

The *TM3_MODULE_STATE* enumeration data type contains the following values:

Enumerator	Value	Comment
TM3_EMPTY	00 hex	No module.
TM3_CONF_ERROR	01 hex	Physical expansion module does not match with the one configured in the software.
TM3_BUS_ERROR	02 hex	Bus error detected in the last exchange with the module.
TM3_OK	03 hex	Last bus exchange with this module was successful.
TM3_POWER_SUPPLY_ERROR	04 hex	Error on module external power supply.
TM3_MISSING_OPT_MOD	05 hex	Optional module is not physically present.

TMS System

What's in This Part

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TMS System Data Types 70

Introduction

This part describes the TMS System Library.

TMS System Variables

What's in This Chapter

TMS_BUS_DIAG_R: TMS Bus Diagnostic Error Codes.....68
TMS_MODULE_DIAG_R: TMS Expansion Module Diagnostic Error Codes 68

Overview

This chapter describes the system variables, page 14 included in the TMS System Library.

TMS_BUS_DIAG_R: TMS Bus Diagnostic Error Codes

Library and Namespace

Library name: **TMSSystem**

Namespace: **TMS**

Variable Structure

This table describes the parameters of the *TMS_BUS_DIAG_R* system variable (*STRUCT_TMS_BUS_DIAG* type):

Enumerator	Type	Comment
ConfState	UNIT	Describes the state of the TMS configuration: • 0: No configuration • 1: Configuration not valid (module mismatch) • 2: Configuration valid, but power booster not active • 3: Configuration valid and applied
NbModules	UNIT	Indicates the number of modules detected on the bus.

TMS_MODULE_DIAG_R: TMS Expansion Module Diagnostic Error Codes

Library and Namespace

Library name: **TMSSystem**

Namespace: **TMS**

Introduction

The *TMS_MODULE_DIAG_R* system variable (*TMS_MODULE_R_ARRAY_TYPE* type) is an array of *STRUCT_TMS_MODULE_DIAG*.

Variable Structure

This table describes the parameters of the *STRUCT_TMS_MODULE_DIAG*:

Enumerator	Type	Comment
Name	STRING(15)	Name of the TMS expansion module.
MajorType	WORD	Type of TMS expansion module.
SubType	WORD	Sub-type of TMS expansion module.
Version	STRING(15)	Firmware version of the TMS expansion module.
ModuleState	*TMS_MODULE_STATE*, page 70	State of the TMS expansion module.
IpState	*TMS_IP_STATE*, page 70	TCP IP accessibility of the TMS expansion module from the controller over **COM_Bus**.
PixCmdState	*TMS_PIXCMD_STATE*, page 71	State of the expansion module.

TMS System Data Types

What's in This Chapter

TMS_IP_STATE: TMS Expansion Module IP State 70
TMS_MODULE_STATE: TMS Expansion Module State Codes 70
TMS_PIXCMD_STATE: TMS Expansion Module PIXCMD State 71

TMS_IP_STATE: TMS Expansion Module IP State

Library and Namespace

Library name: **TMSSystem**

Namespace: **TMS**

Description

The *TMS_IP_STATE* enumeration data type contains the following values:

Name	Type	Value	Comment
TMS_IP_PING_SUCCESS	DWORD	0	IP interface is configured.
TMS_IP_CONFIG_CMD_ ERROR	DWORD	1	Configuration send unsuccessful.
TMS_IP_CONFIG_RESP_WAIT	DWORD	2	Waiting for configuration response (transient).
TMS_IP_CONFIG_RESP_ ERROR	DWORD	3	Configuration response error.
TMS_IP_CONFIG_RESP_NONE	DWORD	4	No configuration response.
TMS_IP_CONFIG_SUCCESS	DWORD	5	Configuration successful.
TMS_IP_PING_CMD_ERROR	DWORD	6	Ping command send unsuccessful.
TMS_IP_PING_RESP_WAIT	DWORD	7	Waiting for ping command response (transient).
TMS_IP_PING_RESP_ERROR	DWORD	8	Ping command response error.
TMS_IP_PING_RESP_NONE	DWORD	9	No ping command response.
TMS_IP_NOT_CONFIGURED	DWORD	10	IP interface not configured.

TMS_MODULE_STATE: TMS Expansion Module State Codes

Library and Namespace

Library name: **TMSSystem**

Namespace: **TMS**

Enumerated Type Description

The *TMS_MODULE_STATE* enumeration data type contains the following values:

Name	Type	Value	Comment
TMS_MODULE_POWERED	DWORD	0	Module is powered up.
TMS_MODULE_INITIALIZED	DWORD	1	Module is initialized and has been discovered.
TMS_MODULE_CONFIGURED	DWORD	2	Module is configured and is operating normally.
TMS_MODULE_EXCHANGE_FAULT	DWORD	3	Timeout for module detection expired.
TMS_MODULE_ERROR	DWORD	4	Module detected an error.
TMS_MODULE_HEALTH_SEND_FAULT	DWORD	5	Module health report send unsuccessful.
TMS_MODULE_RCV_TIMEOUT	DWORD	6	Module reception timeout.
TMS_MODULE_RCV_MISC	DWORD	7	Module reception error other than timeout.
TMS_MODULE_RESP_ERR	DWORD	8	Module response error.
TMS_MODULE_DISCOVERY	DWORD	9	Module discovery error.

TMS_PIXCMD_STATE: TMS Expansion Module PIXCMD State

Library and Namespace

Library name: **TMSSystem**

Namespace: **TMS**

Description

The *TMS_PIXCMD_STATE* enumeration data type contains the following values:

Name	Type	Value	Comment
TMS_PIXCMD_EXCHING	DWORD	0	Exchange in progress.
TMS_PIXCMD_CONFIG_NONE	DWORD	1	No configuration.
TMS_PIXCMD_CONFIG_CMD_ERROR	DWORD	2	Configuration send unsuccessful.
TMS_PIXCMD_CONFIG_RESP_WAIT	DWORD	3	Waiting for configuration response (transient).
TMS_PIXCMD_CONFIG_RESP_ERROR	DWORD	4	Configuration response error.
TMS_PIXCMD_CONFIG_ONLY	DWORD	5	Configuration successful, no exchange occurred.
TMS_PIXCMD_CONFIG_SUCCESS	DWORD	6	Configuration successful (transient).
TMS_PIXCMD_ENABLE_CMD_ERROR	DWORD	7	Enable command error.
TMS_PIXCMD_ENABLE_RESP_WAIT	DWORD	8	Waiting for enable command response (transient).
TMS_PIXCMD_ENABLE_RESP_ERROR	DWORD	9	Enable command response error.
TMS_PIXCMD_EXCH_ERROR	DWORD	10	Exchange error.
TMS_PIXCMD_DISABLING	DWORD	11	Exchange being disabled (transient).
TMS_PIXCMD_DISABLED	DWORD	12	Exchange disabled.

Appendices

What's in This Part

Function and Function Block Representation 74

Overview

This appendix extracts parts of the programming guide for technical understanding of the library documentation.

Function and Function Block Representation

What's in This Chapter

Differences Between a Function and a Function Block 74
How to Use a Function or a Function Block in IL Language.....75
How to Use a Function or a Function Block in ST Language 78

Overview

Each function can be represented in the following languages:

- IL: Instruction List
- ST: Structured Text
- LD: Ladder Diagram
- FBD: Function Block Diagram
- CFC: Continuous Function Chart

This chapter provides functions and function blocks representation examples and explains how to use them for IL and ST languages.

Differences Between a Function and a Function Block

Function

A function:

- is a POU (Program Organization Unit) that returns one immediate result.
- is directly called with its name (not through an instance).
- has no persistent state from one call to the other.
- can be used as an operand in other expressions.

Examples: boolean operators (`AND`), calculations, conversion (`BYTE_TO_INT`)

Function Block

A function block:

- is a POU (Program Organization Unit) that returns one or more outputs.
- needs to be called by an instance (function block copy with dedicated name and variables).
- each instance has a persistent state (outputs and internal variables) from one call to the other from a function block or a program.

Examples: timers, counters

In the example, `Timer_ON` is an instance of the function block `TON`:

```
PROGRAM MyProgram_ST
VAR
    Timer_ON: TON;  // Function Block Instance
    Timer_RunCd: BOOL;
    Timer_PresetValue: TIME := T#5S;
    Timer_Output: BOOL;
    Timer_ElapsedTime: TIME;
END_VAR
```

```
Timer_ON(
    IN:=Timer_RunCd,
    PT:=Timer_PresetValue,
    Q=>Timer_Output,
    ET=>Timer_ElapsedTime);
```

How to Use a Function or a Function Block in IL Language

General Information

This part explains how to implement a function and a function block in IL language.

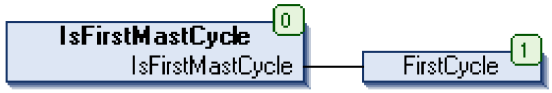
Functions `IsFirstMastCycle` and `SetRTCDrift` and Function Block `TON` are used as examples to show implementations.

Using a Function in IL Language

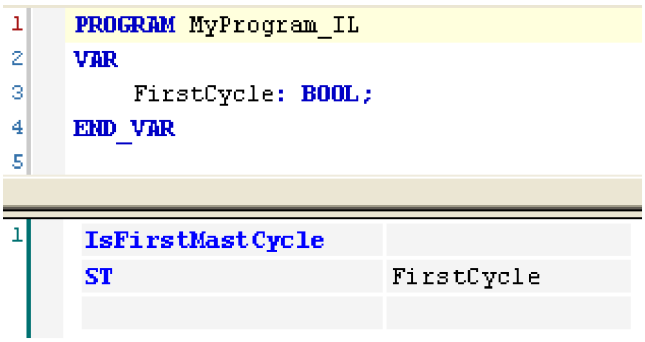
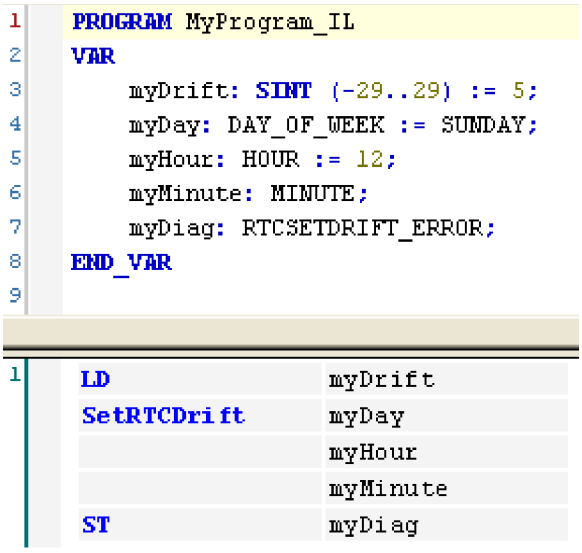
This procedure describes how to insert a function in IL language:

Step	Action
1	Open or create a new POU in Instruction List language. **NOTE:** The procedure to create a POU is not detailed here. For more information, refer to Adding and Calling POUs found in the EcoStruxure Automation Expert - Motion / EcoStruxure Machine Expert Programming Guide.
2	Create the variables that the function requires.
3	If the function has 1 or more inputs, start loading the first input using LD instruction.
4	Insert a new line below and: • type the name of the function in the operator column (left field), or • use the **Input Assistant** to select the function (select **Insert Box** in the contextual menu).
5	If the function has more than 1 input and when Input Assistant is used, the necessary number of lines is automatically created with `???` in the fields on the right. Replace the `???` with the appropriate value or variable that corresponds to the order of inputs.
6	Insert a new line to store the result of the function into the appropriate variable: type ST instruction in the operator column (left field) and the variable name in the field on the right.

To illustrate the procedure, consider the Functions `IsFirstMastCycle` (without input parameter) and `SetRTCDrift` (with input parameters) graphically presented below:

Function	Graphical Representation
without input parameter: `IsFirstMastCycle`	
with input parameters: `SetRTCDrift`	

In IL language, the function name is used directly in the operator column:

Function	Representation in POU IL Editor
IL example of a function without input parameter: `IsFirstMastCycle`	
IL example of a function with input parameters: `SetRTCDrift`	

Using a Function Block in IL Language

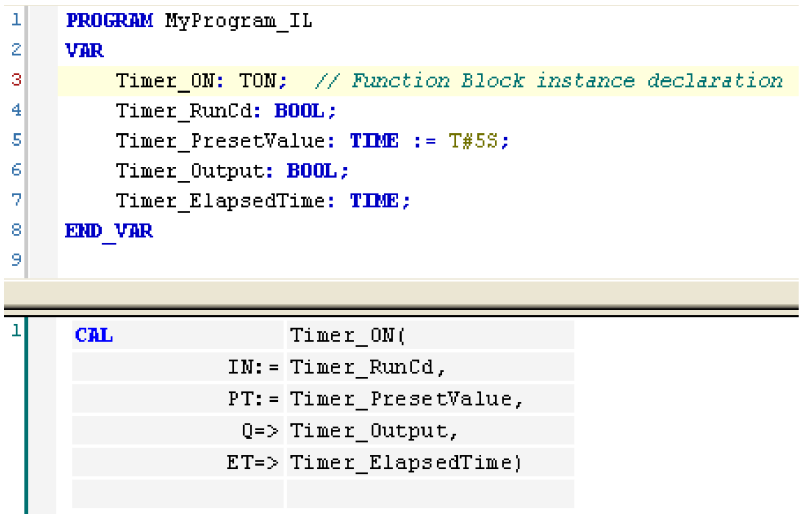
This procedure describes how to insert a function block in IL language:

Step	Action
1	Open or create a new POU in Instruction List language. **NOTE:** The procedure to create a POU is not detailed here. For more information, refer to Adding and Calling POUs found in the EcoStruxure Automation Expert - Motion / EcoStruxure Machine Expert Programming Guide.
2	Create the variables that the function block requires, including the instance name.
3	Function Blocks are called using a `CAL` instruction: • Use the **Input Assistant** to select the function block (right-click and select **Insert Box** in the contextual menu). • Automatically, the `CAL` instruction and the necessary I/O are created. Each parameter (I/O) is an instruction: • Values to inputs are set by ":=". • Values to outputs are set by "=>".
4	In the `CAL` right-side field, replace `???` with the instance name.
5	Replace other `???` with an appropriate variable or immediate value.

To illustrate the procedure, consider this example with the `TON` Function Block graphically presented below:

Function Block	Graphical Representation
TON	

In IL language, the function block name is used directly in the operator column:

Function Block	Representation in POU IL Editor
TON	

How to Use a Function or a Function Block in ST Language

General Information

This part explains how to implement a Function and a Function Block in ST language.

Function `SetRTCDrift` and Function Block `TON` are used as examples to show implementations.

Using a Function in ST Language

This procedure describes how to insert a function in ST language:

Step	Action
1	Open or create a new POU in Structured Text language. **NOTE:** The procedure to create a POU is not detailed here. For more information, refer to Adding and Calling POUs found in the EcoStruxure Automation Expert - Motion / EcoStruxure Machine Expert Programming Guide.
2	Create the variables that the function requires.
3	Use the general syntax in the **POU ST Editor** for the ST language of a function. The general syntax is: `FunctionResult:= FunctionName(VarInput1, VarInput2,.. VarInputx);`

To illustrate the procedure, consider the function `SetRTCDrift` graphically presented below:

Function	Graphical Representation
`SetRTCDrift`	

The ST language of this function is the following:

Function	Representation in POU ST Editor

`SetRTCDrift`	`PROGRAM MyProgram_ST`
	`VAR`
	`myDrift: SINT (-29..+29) := 5;`
	`myDay: sec.DAY_OF_WEEK := SUNDAY;`
	`myHour: sec.HOUR := 12;`
	`myMinute: sec.MINUTE;`
	`myRTCAdjust: sec.RTCDRIFT_ERROR;`
	`END_VAR`
	`myRTCAdjust:= SetRTCDrift(myDrift, myDay, myHour, myMinute);`

Using a Function Block in ST Language

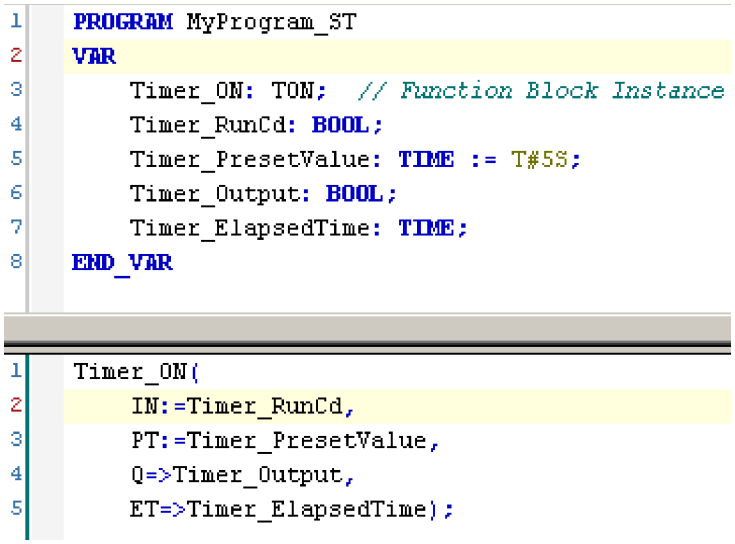
This procedure describes how to insert a function block in ST language:

Step	Action
1	Open or create a new POU in Structured Text language. **NOTE:** The procedure to create a POU is not detailed here. For more information, refer to Adding and Calling POUs found in the EcoStruxure Automation Expert - Motion / EcoStruxure Machine Expert Programming Guide.
2	Create the input and output variables and the instance required for the function block: • Input variables are the input parameters required by the function block • Output variables receive the value returned by the function block
3	Use the general syntax in the **POU ST Editor** for the ST language of a Function Block. The general syntax is: `FunctionBlock_InstanceName(Input1:=VarInput1, Input2:=VarInput2,... Ouput1=>VarOutput1, Ouput2=>VarOutput2,...);`

To illustrate the procedure, consider this example with the `TON` function block graphically presented below:

Function Block	Graphical Representation
`TON`	

This table shows examples of a function block call in ST language:

Function Block	Representation in POU ST Editor
`TON`	

Glossary

A

%:

According to the IEC standard, % is a prefix that identifies internal memory addresses in the logic controller to store the value of program variables, constants, I/O, and so on.

application:

A program including configuration data, symbols, and documentation.

ARRAY:

The systematic arrangement of data objects of a single type in the form of a table defined in logic controller memory. The syntax is as follows: `ARRAY [<dimension>] OF <Type>`

Example 1: `ARRAY [1..2] OF BOOL` is a 1-dimensional table with 2 elements of type `BOOL`.

Example 2: `ARRAY [1..10, 1..20] OF INT` is a 2-dimensional table with 10 x 20 elements of type `INT`.

B

BOOL:

(*boolean*) A basic data type in computing. A `BOOL` variable can have one of these values: 0 (`FALSE`), 1 (`TRUE`). A bit that is extracted from a word is of type `BOOL`; for example, `%MW10.4` is a fifth bit of memory word number 10.

Boot application:

(*boot application*) The binary file that contains the application. Usually, it is stored in the controller and allows the controller to boot on the application that the user has generated.

BOOTP:

(*bootstrap protocol*) A UDP network protocol that can be used by a network client to automatically obtain an IP address (and possibly other data) from a server. The client identifies itself to the server using the client MAC address. The server, which maintains a pre-configured table of client device MAC addresses and associated IP addresses, sends the client its pre-configured IP address. BOOTP was originally used as a method that enabled diskless hosts to be remotely booted over a network. The BOOTP process assigns an infinite lease of an IP address. The BOOTP service utilizes UDP ports 67 and 68.

byte:

A type that is encoded in an 8-bit format, ranging from 00 hex to FF hex.

C

CAN:

(*controller area network*) A protocol (ISO 11898) for serial bus networks, designed for the interconnection of smart devices (from multiple manufacturers) in smart systems and for real-time industrial applications. Originally developed for use in automobiles, CAN is now used in a variety of industrial automation control environments.

CFC:

(*continuous function chart*) A graphical programming language (an extension of the IEC 61131-3 standard) based on the function block diagram language that works like a flowchart. However, no networks are used and free positioning of graphic elements is possible, which allows feedback loops. For each block, the inputs are on the left and the outputs on the right. You can link the block outputs to the inputs of other blocks to create complex expressions.

configuration:

The arrangement and interconnection of hardware components within a system and the hardware and software parameters that determine the operating characteristics of the system.

control network:

A network containing logic controllers, SCADA systems, PCs, HMI, switches, ...

Two kinds of topologies are supported:

- flat: all modules and devices in this network belong to same subnet.
- 2 levels: the network is split into an operation network and an inter-controller network.

These two networks can be physically independent, but are generally linked by a routing device.

CRC:

(*cyclical redundancy check*) A method used to determine the validity of a communication transmission. The transmission contains a bit field that constitutes a checksum. The message is used to calculate the checksum by the transmitter according to the content of the message. Receiving nodes, then recalculate the field in the same manner. Any discrepancy in the value of the 2 CRC calculations indicates that the transmitted message and the received message are different.

D

DHCP:

(*dynamic host configuration protocol*) An advanced extension of BOOTP. DHCP is more advanced, but both DHCP and BOOTP are common. (DHCP can handle BOOTP client requests.)

DWORD:

(*double word*) Encoded in 32-bit format.

E

EtherNet/IP:

(*Ethernet industrial protocol*) An open communications protocol for manufacturing automation solutions in industrial systems. EtherNet/IP is in a family of networks that implement the common industrial protocol at its upper layers. The supporting organization (ODVA) specifies EtherNet/IP to accomplish global adaptability and media independence.

Ethernet:

A physical and data link layer technology for LANs, also known as IEEE 802.3.

F

FB:

(*function block*) A convenient programming mechanism that consolidates a group of programming instructions to perform a specific and normalized action, such as speed control, interval control, or counting. A function block may comprise configuration data, a set of internal or external operating parameters and usually 1 or more data inputs and outputs.

firmware:

Represents the BIOS, data parameters, and programming instructions that constitute the operating system on a controller. The firmware is stored in non-volatile memory within the controller.

function block diagram:

One of the 5 languages for logic or control supported by the standard IEC 61131-3 for control systems. Function block diagram is a graphically oriented programming language. It works with a list of networks where each network contains a graphical structure of boxes and connection lines representing either a logical or arithmetic expression, the call of a function block, a jump, or a return instruction.

function block:

A programming unit that has 1 or more inputs and returns 1 or more outputs. FBs are called through an instance (function block copy with dedicated name and variables) and each instance has a persistent state (outputs and internal variables) from 1 call to the other.

Examples: timers, counters

function:

A programming unit that has 1 input and returns 1 immediate result. However, unlike FBs, it is directly called with its name (as opposed to through an instance), has no persistent state from one call to the next and can be used as an operand in other programming expressions.

Examples: boolean (AND) operators, calculations, conversions (BYTE_TO_INT)

G

GVL:

(*global variable list*) Manages global variables within an EcoStruxure Machine Expert project.

H

hex:

(*hexadecimal*)

I

I/O:

(*input/output*)

ID:

(*identifier/identification*)

IEC 61131-3:

Part 3 of a 3-part IEC standard for industrial automation equipment. IEC 61131-3 is concerned with controller programming languages and defines 2 graphical and 2 textual programming language standards. The graphical programming languages are ladder diagram and function block diagram. The textual programming languages include structured text and instruction list.

IEC:

(*international electrotechnical commission*) A non-profit and non-governmental international standards organization that prepares and publishes international standards for electrical, electronic, and related technologies.

IEEE 802.3:

A collection of IEEE standards defining the physical layer, and the media access control sublayer of the data link layer, of wired Ethernet.

IL:

(*instruction list*) A program written in the language that is composed of a series of text-based instructions executed sequentially by the controller. Each instruction includes a line number, an instruction code, and an operand (refer to IEC 61131-3).

INT:

(*integer*) A whole number encoded in 16 bits.

IP:

(*Internet protocol* Part of the TCP/IP protocol family that tracks the Internet addresses of devices, routes outgoing messages, and recognizes incoming messages.

L

LD:

(*ladder diagram*) A graphical representation of the instructions of a controller program with symbols for contacts, coils, and blocks in a series of rungs executed sequentially by a controller (refer to IEC 61131-3).

legacy projects:

Application projects that were created with SoMachine, SoMachine Motion, or a previous version of EcoStruxure Machine Expert.

LWORD:

(*long word*) A data type encoded in a 64-bit format.

M

MAC address:

(*media access control address*) A unique 48-bit number associated with a specific piece of hardware. The MAC address is programmed into each network card or device when it is manufactured.

MAST:

A processor task that is run through its programming software. The MAST task has 2 sections:

- **IN:** Inputs are copied to the IN section before execution of the MAST task.
- **OUT:** Outputs are copied to the OUT section after execution of the MAST task.

Modbus:

The protocol that allows communications between many devices connected to the same network.

%MW:

According to the IEC standard, %MW represents a memory word register (for example, a language object of type memory word).

N

network:

A system of interconnected devices that share a common data path and protocol for communications.

NVM:

(Non-volatile memory) A non-volatile memory that can be overwritten. It is stored on a special EEPROM that can be erased and reprogrammed.

P

PLC:

(*programmable logic controller*) An industrial computer used to automate manufacturing, industrial, and other electromechanical processes. PLCs are different from common computers in that they are designed to have multiple input and output arrays and adhere to more robust specifications for shock, vibration, temperature, and electrical interference among other things.

POU:

(*program organization unit*) A variable declaration in source code and a corresponding instruction set. POUs facilitate the modular re-use of software programs, functions, and function blocks. Once declared, POUs are available to one another.

program:

The component of an application that consists of compiled source code capable of being installed in the memory of a logic controller.

protocol:

A convention or standard definition that controls or enables the connection, communication, and data transfer between 2 computing system and devices.

R

run:

A command that causes the controller to scan the application program, read the physical inputs, and write to the physical outputs according to solution of the logic of the program.

S

STOP:

A command that causes the controller to stop running an application program.

string:

A variable that is a series of ASCII characters.

ST:

(*structured text*) A language that includes complex statements and nested instructions (such as iteration loops, conditional executions, or functions). ST is compliant with IEC 61131-3.

system variable:

A variable that provides controller data and diagnostic information and allows sending commands to the controller.

T

task:

A group of sections and subroutines, executed cyclically or periodically for the MAST task or periodically for the FAST task.

A task possesses a level of priority and is linked to inputs and outputs of the controller. These I/O are refreshed in relation to the task.

A controller can have several tasks.

TCP:

(*transmission control protocol*) A connection-based transport layer protocol that provides a simultaneous bi-directional transmission of data. TCP is part of the TCP/IP protocol suite.

U

UDINT:

(*unsigned double integer*) Encoded in 32 bits.

UINT:

(*unsigned integer*) Encoded in 16 bits.

unlocated variable:

A variable that does not have an address (refer to *located variable*).

V

variable:

A memory unit that is addressed and modified by a program.

W

watchdog:

A watchdog is a special timer used to ensure that programs do not overrun their allocated scan time. The watchdog timer is usually set to a higher value than the scan time and reset to 0 at the end of each scan cycle. If the watchdog timer reaches the preset value, for example, because the program is caught in an endless loop, an error is declared and the program stopped.

WORD:

A type encoded in a 16-bit format.

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