

How To Use a TeSys™ island in EcoStruxure Machine Expert User Guide

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All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this information can result in injury or equipment damage.

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Safety Information



Important Information

NOTICE

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.

BEFORE YOU BEGIN

Do not use this product on machinery lacking effective point-of-operation guarding. Lack of effective point-of-operation guarding on a machine can result in serious injury to the operator of that machine.

WARNING

UNGUARDED EQUIPMENT

- Do not use this software and related automation equipment on equipment which does not have point-of-operation protection.
- Do not reach into machinery during operation.

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

This automation equipment and related software is used to control a variety of industrial processes. The type or model of automation equipment suitable for each application will vary depending on factors such as the control function required, degree of protection required, production methods, unusual conditions, government regulations, etc. In some applications, more than one processor may be required, as when backup redundancy is needed.

Only you, the user, machine builder or system integrator can be aware of all the conditions and factors present during setup, operation, and maintenance of the machine and, therefore, can determine the automation equipment and the related safeties and interlocks which can be properly used. When selecting automation and control equipment and related software for a particular application, you should refer to the applicable local and national standards and regulations. The National Safety Council's Accident Prevention Manual (nationally recognized in the United States of America) also provides much useful information.

In some applications, such as packaging machinery, additional operator protection such as point-of-operation guarding must be provided. This is necessary if the operator's hands and other parts of the body are free to enter the pinch points or other hazardous areas and serious injury can occur. Software products alone cannot protect an operator from injury. For this reason the software cannot be substituted for or take the place of point-of-operation protection.

Ensure that appropriate safeties and mechanical/electrical interlocks related to point-of-operation protection have been installed and are operational before placing the equipment into service. All interlocks and safeties related to point-of-operation protection must be coordinated with the related automation equipment and software programming.

NOTE: Coordination of safeties and mechanical/electrical interlocks for point-of-operation protection is outside the scope of the Function Block Library, System User Guide, or other implementation referenced in this documentation.

START-UP AND TEST

Before using electrical control and automation equipment for regular operation after installation, the system should be given a start-up test by qualified personnel to verify correct operation of the equipment. It is important that arrangements for such a check be made and that enough time is allowed to perform complete and satisfactory testing.

WARNING

EQUIPMENT OPERATION HAZARD

- Verify that all installation and set up procedures have been completed.
- Before operational tests are performed, remove all blocks or other temporary holding means used for shipment from all component devices.
- Remove tools, meters, and debris from equipment.

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

Follow all start-up tests recommended in the equipment documentation. Store all equipment documentation for future references.

Software testing must be done in both simulated and real environments.

Verify that the completed system is free from all short circuits and temporary grounds that are not installed according to local regulations (according to the National Electrical Code in the U.S.A, for instance). If high-potential voltage testing is necessary, follow recommendations in equipment documentation to prevent accidental equipment damage.

Before energizing equipment:

- Remove tools, meters, and debris from equipment.
- Close the equipment enclosure door.
- Remove all temporary grounds from incoming power lines.
- Perform all start-up tests recommended by the manufacturer.

OPERATION AND ADJUSTMENTS

The following precautions are from the NEMA Standards Publication ICS 7.1-1995 (English version prevails):

- Regardless of the care exercised in the design and manufacture of equipment or in the selection and ratings of components, there are hazards that can be encountered if such equipment is improperly operated.
- It is sometimes possible to misadjust the equipment and thus produce unsatisfactory or unsafe operation. Always use the manufacturer's instructions as a guide for functional adjustments. Personnel who have access to these adjustments should be familiar with the equipment manufacturer's instructions and the machinery used with the electrical equipment.
- Only those operational adjustments actually required by the operator should be accessible to the operator. Access to other controls should be restricted to prevent unauthorized changes in operating characteristics.

About the Book



At a Glance

Document Scope

This document describes the steps required in EcoStruxure Machine Expert for creating a project with a TeSys™ island and a logic/motion controller by using the EtherNet/IP or Modbus TCP protocol.

The following knowledge is required:

- Information on functionality, structure, and configuration of the TeSys™ island
- Information on functionality, structure, and configuration of the controller

Validity Note

This document has been updated for the release of EcoStruxure™ Machine Expert V1.1.

Related Documents

Document title	Reference
TeSys™ island System Guide	www.schneider-electric.us/en/download/
TeSys™ island DTM Library Online Help	www.schneider-electric.us/en/download/
Modicon M241 Logic Controller Hardware Guide	EIO0000001456 (ENG); EIO0000001457 (FRE); EIO0000001458 (GER); EIO0000001459 (SPA); EIO0000001460 (ITA); EIO0000001461 (CHS)
Modicon M251 Logic Controller Hardware Guide	EIO0000001486 (ENG); EIO0000001487 (FRE); EIO0000001488 (GER); EIO0000001489 (SPA); EIO0000001490 (ITA); EIO0000001491 (CHS)
Modicon M262 Logic/Motion Controller Hardware Guide	EIO0000003659 (ENG); EIO0000003660 (FRE); EIO0000003661 (GER); EIO0000003662 (SPA); EIO0000003663 (ITA); EIO0000003664 (CHS)

Document title	Reference
EcoStruxure Machine Expert Programming Guide	EIO0000002854 (ENG); EIO0000002855 (FRE); EIO0000002856 (GER); EIO0000002858 (SPA); EIO0000002857 (ITA); EIO0000002859 (CHS)

Product Related Information

WARNING

LOSS OF CONTROL

- The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical control functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop and overtravel stop, power outage and restart.
- Separate or redundant control paths must be provided for critical control functions.
- System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delays or failures of the link.
- Observe all accident prevention regulations and local safety guidelines.¹
- Each implementation of this equipment must be individually and thoroughly tested for proper operation before being placed 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.

Terminology Derived from Standards

The technical terms, terminology, symbols and the corresponding descriptions in this manual, 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 13849-1:2015	Safety of machinery: Safety related parts of control systems. General principles for design.
EN 61496-1:2013	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 62061:2015	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 61784-3:2016	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.

General Information

Overview

This document describes the steps required in EcoStruxure Machine Expert for creating a project with a TeSys™ island and a logic/motion controller by using the EtherNet/IP or Modbus TCP protocol.

- Integrating the TeSys™ island into the EcoStruxure Machine Expert project.
- Accessing the TeSys™ island DTM (Device Type Manager) via EcoStruxure Machine Expert for configuring the TeSys™ island modules and processes by using avatars.
- Using the function blocks of the TeSys island library that is available in EcoStruxure Machine Expert for developing applications and to control avatar modules.

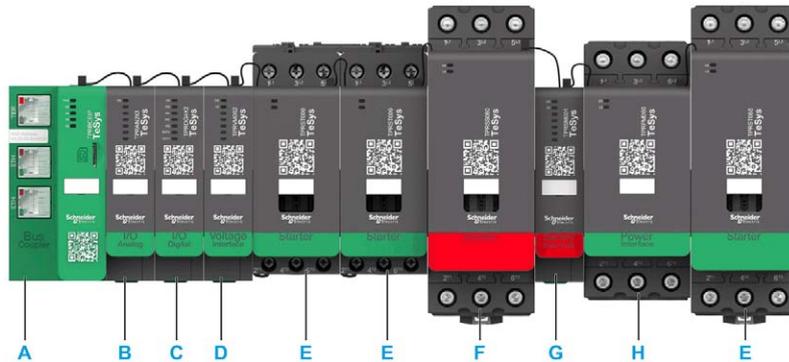
System Requirements

The following components are required for communication via EtherNet/IP or Modbus TCP:

Component	Type and Version
Software	EcoStruxure Machine Expert V1.1 or later
Controller	<ul style="list-style-type: none">● TM241CE*** logic controller supporting EtherNet/IP and Modbus TCP/IP● TM251MESE logic controller supporting EtherNet/IP and Modbus TCP/IP● TM262L10/20 logic controller● TM262M15/25/35 motion controller

Overview of the TeSys™ island Concept

TeSys™ island describes an open, modular distributed input/output system comprising different modules residing on a DIN rail backplane:



- A Bus coupler
- B Analog input / output module
- C Digital input / output module
- D Voltage interface module
- E Standard starter
- F SIL (Safety Integrity Level) starter
- G SIL interface module
- H Power interface module

The entire TeSys™ island acts as a node in a fieldbus network. The bus coupler is the core module that provides internal communication with the TeSys™ island modules via ribbon cables and external communication via EtherNet/IP or Modbus TCP. For further information, refer to the TeSys™ island System Guide.

The integration of this bus coupler as a TeSys™ island communication node in your EcoStruxure Machine Expert project is described in the next topic Integrating the TeSys™ island into the EcoStruxure Machine Expert Project ([see page 15](#)).

Integrating the TeSys™ island into the EcoStruxure Machine Expert Project

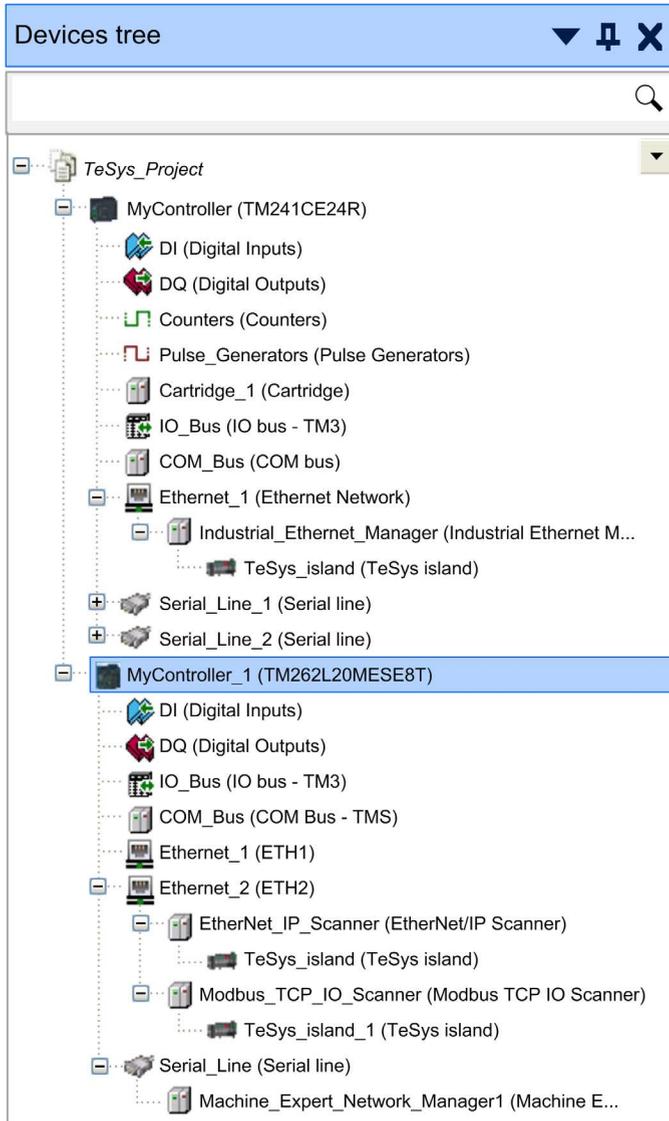
How to Add the TeSys™ island to the EcoStruxure Machine Expert Project

As the bus coupler acts as a single communication node for the complete TeSys™ island, you have to add the bus coupler as communication node to your EcoStruxure Machine Expert project.

Proceed as follows:

Step	Action	Comment
1	Create or open your EcoStruxure Machine Expert project.	–
2	Add a controller supporting EtherNet/IP or Modbus TCP/IP from the Hardware Catalog → Controller to your project. Result: A controller node is added to the Devices tree with several subnodes.	For further information, refer to the chapter <i>Adding Devices by Drag and Drop</i> in the Programming Guide (<i>see EcoStruxure Machine Expert, Programming Guide</i>).
3	From the hardware catalog, select the following communication manager, depending on the controller you use: <ul style="list-style-type: none">• For M241 or M251 controllers, select Industrial Ethernet Manager.• For M262 controllers, select EtherNet/IP Scanner or Modbus TCP IO Scanner depending on whether EtherNet/IP or Modbus TCP scanner services are required. Result: The selected communication manager is added as a subnode below the Ethernet node in the Devices tree .	For further information, refer to the chapter <i>Adding Communication Managers</i> in the Programming Guide (<i>see EcoStruxure Machine Expert, Programming Guide</i>).
4	Right-click the communication manager subnode, and execute the command Add Device to add a TeSys island element. Result: A TeSys_island subnode is added below the selected communication manager node in the Devices tree .	For further information, refer to the chapter <i>Adding Devices to a Communication Manager</i> in the Programming Guide (<i>see EcoStruxure Machine Expert, Programming Guide</i>).

The figure illustrates the **TeSys_island** configuration in the **Devices tree** for M241 and M262 controllers:



Configuring the TeSys™ island in EcoStruxure Machine Expert

TeSys™ island Configuration

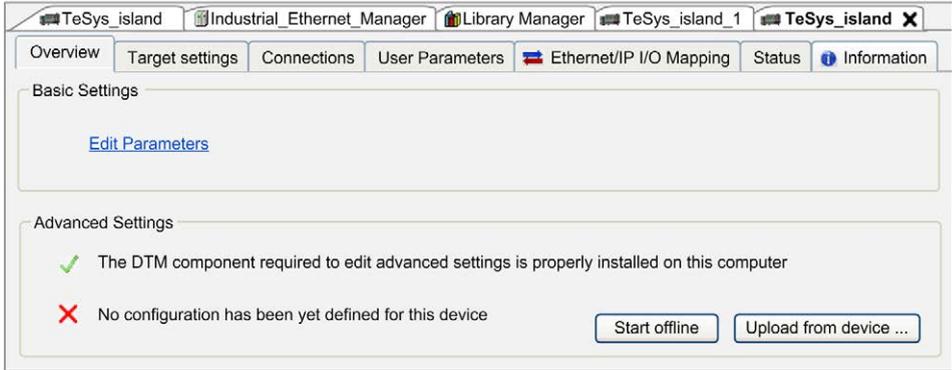
To configure the TeSys™ island, double-click the **TeSys_island** node in the **Devices tree**.

Result: The **TeSys_island** device editor is displayed in the multi-tabbed editor view of the Logic Builder with the default settings and the default device editor tabs (for example, **Configuration**, **Parameters**, **I/O Mapping**).

For further information, refer to the chapter *Common Device Editor Dialogs* in the Programming Guide (see *EcoStruxure Machine Expert, Programming Guide*).

Opening the Configuration Tab

To open the **Configuration** tab for TeSys™ island configuration, proceed as follows:

Step	Action
1	<p>Double-click the TeSys_island node in the Devices tree.</p> <p>Result: The TeSys_island device editor is displayed in the multi-tabbed editor view of the Logic Builder.</p> 

Step	Action
2	<p>For initial configuration, click the Start offline button to load the default configuration, and then click the Edit configuration... link.</p> <p>Result: The Configuration tab opens in the TeSys_island device editor, allowing configuration of the TeSys™ island in an FDT (Field Device Tool) frame.</p>

The offline configuration mode is indicated as follows:

- By the blue line in the toolbar and the status **Device not connected**.
- By the red status **Disconnected** in the status bar.

You can now configure the TeSys™ island parameters in offline mode using the avatar concept.

Avatar Concept of the TeSys™ island DTM

The TeSys™ island DTM is using an avatar concept. Avatars are functional and digital representations of the physical modules and processes that are available in the TeSys™ island.

The following types of avatars are available:

Avatar	Representing	Description
System	Bus coupler	Managing and integrating the TeSys™ island.
Device	Individual modules (such as starter, input / output modules)	Managing modules as stand-alone devices.
Load	Module operation relating to a specific load	Managing different load type applications. For example, a forward-reverse motor avatar includes a forward and reverse starter, along with pre-programmed forward-reverse operating logic.

For further information, on the avatar concept and the TeSys™ island parameters, refer to the TeSys™ island DTM Library Online Help that is provided via context-sensitive help of EcoStruxure Machine Expert.

Downloading the Configuration to the TeSys™ island

After you have performed the configuration of the TeSys™ island parameters in offline mode, you must download the settings to your TeSys™ island by executing one of the following commands:

- Click the **Download** button from the **Configuration** tab of the device editor.
- Right-click the **TeSys_island** node in the **Devices tree**, and execute the command **Download to Device**.

Result: A connection to the TeSys™ island is established:

- The status line in the toolbar changes color into orange and indicates **Device connected**.
- The status bar changes to green and indicates **Connected**.

This indicates that the configuration settings have successfully been transferred to the TeSys™ island.

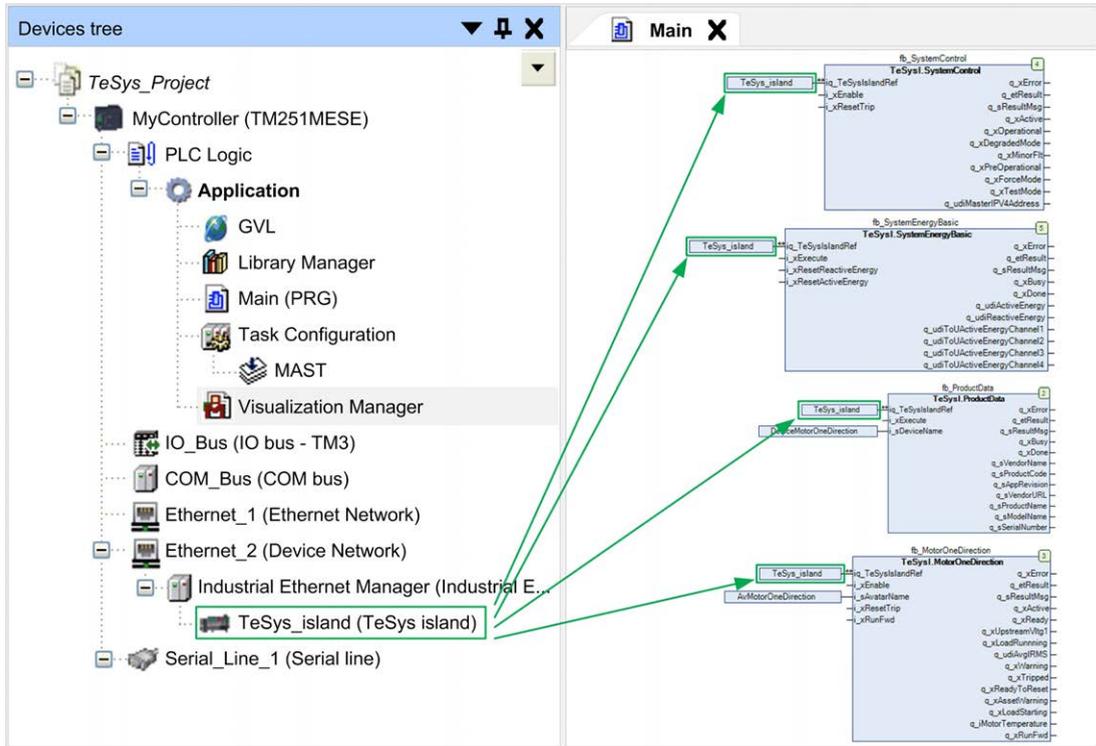
Using the TeSys island Library for Developing Applications

Overview

The TeSys island library is added to the **Library Manager** with the integration of the **TeSys_island** element in your EcoStruxure Machine Expert project. It provides function blocks to support you in developing applications and to control avatar modules.

Referencing the TeSys™ island Bus Coupler from the Function Blocks

A reference to the TeSys™ island bus coupler is required by each function block of the TeSys island library. To achieve this, configure the name you assigned to the **TeSys_Island** node in the **Devices tree** as input `iq_TeSysIslandRef` of the function blocks.



Referencing Avatars

The name you assign to each avatar with the parameter **Avatar Name** in the **MY AVATAR** tab, section **AVATAR PARAMETERS** of the **Configuration** tab in the **TeSys_island** device editor, must be referenced in the library with the input `i_sAvatarName`.

The name is used to select the avatar to be controlled by the function block. It is available at the avatar function blocks, except the asset management function blocks. If the parameter **Avatar Name** is not configured or not correctly configured, the error message `AvatarNotAvailable` is returned. Modifying this name during the execution of the function block will be ignored.

The following figure provides an example of the `DigitalIO` function block that is only available for **Digital I/O** avatars:

The screenshot displays the configuration interface for the **TeSys_island** device. The top navigation bar includes tabs for **MY ISLAND**, **MY AVATAR**, **SETTINGS**, **DIAGNOSTICS**, and **ENERGY MONITORING**. The **MY AVATAR** tab is active, showing a list of avatars: **System** (AvSystem1), **Digital I/O** (AvDigitalIO), **Analog I/O** (AvAnalogIO3), and **Switch**. The **Digital I/O** avatar is highlighted in green. To the right, the **AVATAR PARAMETERS** section shows the **Avatar Name** parameter set to `AvDigitalIO`. Below this, the **DEVICE PARAMETERS** section shows **Name Tag** set to `Device2` and **Power Supply Type** set to `TPRDG4X2`. At the bottom, a schematic diagram shows the **TeSysIsland** block with the **AvDigitalIO** avatar connected to the **fb_DigitalIO** function block. The **fb_DigitalIO** block has several input and output ports, including `i_sAvatarName`, `i_xDQ0`, `i_xDQ1`, `q_xError`, `q_etResult`, `q_sResultMsg`, `q_xActive`, `q_xReady`, `q_xDI0`, `q_xDI1`, `q_xDI2`, and `q_xDI3`.

The following figure provides an example of the Energy function block that is available for all avatars, except for the **System** avatar:

The screenshot displays a software interface for configuring an avatar. The top navigation bar includes tabs for MY ISLAND, MY AVATAR, SETTINGS, DIAGNOSTICS, and ENERGY MONITORING. The MY ISLAND section shows a progress bar for 'MyIsland' with a 'Max Length: 112.5 cm' and 'Available Space: 65 %'. Below this is a list of avatars: Analog I/O (AvAnalogIO3), Switch (AvSwitch4), Motor One Direction (AvMotorOneDirection), and Motor Two Directions. The Motor One Direction avatar is highlighted in green. The AVATAR PARAMETERS section for 'AvMotorOneDirection' includes: Power Supply Type (Three Phase), Upstream Voltage (380-415 V), Rating (1.10 kW), Rating (1 A), and Type of Utilization (Start/Stop). The DEVICE PARAMETERS section shows a Name Tag of 'Device5'. Below the interface, a system diagram shows a block 'TeSys_Energy' with various input and output ports. A yellow arrow points from the 'AvMotorOneDirection' avatar in the list to the 'TeSys_Energy' block in the diagram.

Referencing Devices

The name you assign to each device of the TeSys™ island with the parameter **Name Tag** in the **MY AVATAR** tab, section **DEVICE PARAMETERS** of the **Configuration** tab in the **TeSys_island** device editor, must be referenced in the library with the input `i_sDeviceName`.

The name is used to select the device at the function blocks for asset management. If the parameter **Name Tag** is not configured or not correctly configured, the error message `DeviceNotAvailable` is returned. Modifying this name during the execution of the function block will be ignored.

The following figure provides an example of the asset management `ProductData` function block that is available for all devices, except for the bus coupler (system device):

The screenshot displays the TeSys configuration interface. The top navigation bar includes tabs for MY ISLAND, MY AVATAR, SETTINGS, DIAGNOSTICS, and ENERGY MONITORING. The MY AVATAR tab is active, showing a list of avatars on the left and configuration parameters on the right. The avatars listed are:

- Analog I/O (AvAnalogIO3) - A3
- Switch (AvSwitch4) - A4
- Motor One Direction (AvMotorOneDirection) - A5 (highlighted in green)
- Motor Two Directions (AvMotorTwoDirection6) - A6

The AVATAR PARAMETERS section on the right shows the following settings:

- Avatar Name: AvMotorOneDirection
- Power Supply Type: Three Phase
- Upstream Voltage: 380-415 V
- Rating: 1.10 kW
- Rating: 1 A
- Type of Utilization: Start/Stop

The DEVICE PARAMETERS section at the bottom right shows the Name Tag set to Device5, which is highlighted with a yellow box. An arrow points from this box to the `i_sDeviceName` input of the `fb_ProductData` function block in the lower diagram. The function block also shows other inputs like `q_TeSysIslandRef` and `i_Execute`, and a list of outputs including `q_xError`, `q_etResult`, `q_sResultMsg`, `q_xBusy`, `q_xDone`, `q_sVendorName`, `q_sProductCode`, `q_sAppRevision`, `q_sVendorURL`, `q_sProductName`, `q_sModelName`, and `q_sSerialNumber`.

System Function Blocks Automatically Referencing the Bus Coupler

In contrast to the above described function blocks, the system functions blocks do not require references to avatars or devices.

The `SystemControl` and `SystemEnergyBasic` function blocks, for example, do not have inputs referencing avatars or devices because they are directly linked to the bus coupler (system device):

The screenshot displays a control interface with several tabs: MY ISLAND, MY AVATAR, SETTINGS, DIAGNOSTICS, and ENERGY MONITORING. The MY AVATAR tab is active, showing a list of avatars and their parameters.

MY ISLAND
Max Length: 112.5 cm
Available Space: 65 %

Avatars:

- System (AvSystem1) A1
- Digital I/O (AvDigitalIO) A2
- Analog I/O (AvAnalogIO3) A3
- Switch A4

AVATAR PARAMETERS

Avatar Name: AvSystem1
Fieldbus Protocol: EtherNet/IP

DEVICE PARAMETERS

Name Tag: Device1
Power Supply Type: TPRBCEIP
Firmware Version: 1.0

Function Block Diagrams:

- fb_SystemControl (TeSys1.SystemControl):** 4 inputs from TeSys_island: q_TeSysIslandRef, x_Enable, x_ResetTrip, x_Execute. Outputs: x_Error, et_Result, s_ResultMag, x_Active, x_Operational, x_DegradedMode, x_MinorFlt, x_PreOperational, x_ForceMode, x_TestMode, udi_MasterIPV4Address.
- fb_SystemEnergyBasic (TeSys1.SystemEnergyBasic):** 3 inputs from TeSys_island: q_TeSysIslandRef, x_Execute, x_ResetReactiveEnergy, x_ResetActiveEnergy. Outputs: x_Error, et_Result, s_ResultMag, x_Busy, x_Done, udi_ActiveEnergy, udi_ReactiveEnergy, udi_ToUActiveEnergyChannel1, udi_ToUActiveEnergyChannel2, udi_ToUActiveEnergyChannel3, udi_ToUActiveEnergyChannel4.