EcoStruxure Automation Expert - Motion
EcoStruxure Machine Expert

EdgeIONTSExpertFunction

Library Guide

EIO000005480.00
02/2025

www.se.com

Legal Information

The information provided in this document contains general descriptions, technical characteristics and/or recommendations related to products/solutions.

This document is not intended as a substitute for a detailed study or operational and site-specific development or schematic plan. It is not to be used for determining suitability or reliability of the products/solutions for specific user applications. It is the duty of any such user to perform or have any professional expert of its choice (integrator, specifier or the like) perform the appropriate and comprehensive risk analysis, evaluation and testing of the products/solutions with respect to the relevant specific application or use thereof.

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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.

Qualification of Personnel

A qualified person is one who has the following qualifications:

- Skills and knowledge related to the construction and operation of electrical equipment and the installation.
- Knowledge and experience in industrial control programming.
- Received safety-related training to recognize and avoid the hazards involved.

The qualified person must be able to detect possible hazards that may arise from parameterization, modifying parameter values and generally from mechanical, electrical, or electronic equipment. The qualified person must be familiar with the standards, provisions, and regulations for the prevention of industrial accidents, which they must observe when designing and implementing the system.

Proper Use

This product is a library to be used together with the control systems and long stator motor segments intended solely for the purposes as described in the present documentation as applied in the industrial sector.

Always observe the applicable safety-related instructions, the specified conditions, and the technical data.

Perform a risk evaluation concerning the specific use before using the product. Take protective measures according to the result.

Since the product is used as a part of an overall system, you must ensure the safety of the personnel by means of the design of this overall system (for example, machine design).

Any other use is not intended and may be hazardous.

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 are 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:

(In case of divergence or contradiction between any translation and the English original, the original text in the English language will prevail.)

- 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 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

Document Scope

This document describes the EdgeIONTSExpertFunction library. For detailed descriptions of the High Speed Counter (HSC) functions, refer to the Modicon Edge I/O NTS Counting Modules User Guide.

Validity Note

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

Related Documents

Document title	Reference
Cybersecurity Best Practices	CS-Best-Practices-2019-340
Cybersecurity Guidelines for EcoStruxure Machine Expert, Modicon and PacDrive Controllers and Associated Equipment User Guide	EIO0000004242
EcoStruxure Automation Expert - Motion, EcoStruxure Machine Expert, Functions and Libraries User Guide	EIO0000002829 (ENG); EIO0000002830 (FRE); EIO0000002831 (GER); EIO0000002832 (ITA); EIO0000002833 (SPA); EIO0000002834 (CHS);
EcoStruxure Automation Expert - Motion, EcoStruxure Machine Expert, Programming Guide	EIO0000002854 (ENG); EIO0000002855 (FRE); EIO0000002856 (GER); EIO0000002857 (ITA); EIO0000002858 (SPA); EIO0000002859 (CHS);
Modicon Edge I/O NTS, Counting Modules, User Guide	EIO0000005262 (ENG)

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.

Before you attempt to provide a solution (machine or process) for a specific application using the POUs found in the library, you must consider, conduct and complete best practices. These practices include, but are not limited to, risk analysis, functional safety, component compatibility, testing and system validation as they relate to this library.

⚠WARNING

IMPROPER USE OF PROGRAM ORGANIZATION UNITS

- Perform a safety-related analysis for the application and the devices installed.
- Ensure that the Program Organization Units (POUs) are compatible with the devices in the system and have no unintended effects on the proper functioning of the system.
- Ensure that the axis is homed and that the homing is valid before usage of absolute movements or POUs using absolute movements.
- Use appropriate parameters, especially limit values, and observe machine wear and stop behavior.
- Verify that the sensors and actuators are compatible with the selected POUs.
- Thoroughly test all functions during verification and commissioning in all operation modes.
- Provide independent methods for critical control functions (emergency stop, conditions for limit values being exceeded, etc.) according to a safety-related analysis, respective rules, and regulations.

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

⚠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.

Incomplete file transfers, such as data files, application files and/or firmware files, may have serious consequences for your machine or controller. If you remove power, or if there is a power outage or communication interruption during a file transfer, your machine may become inoperative, or your application may attempt to operate on a corrupted data file. If an interruption occurs, reattempt the transfer. Be sure to include in your risk analysis the impact of corrupted data files.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION, DATA LOSS, OR FILE CORRUPTION

- Do not interrupt an ongoing data transfer.
- If the transfer is interrupted for any reason, re-initiate the transfer.
- Do not place your machine into service until the file transfer has completed successfully, unless you have accounted for corrupted files in your risk analysis and have taken appropriate steps to prevent any potentially serious consequences due to unsuccessful file transfers.

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

Care must be taken and provisions made for use of this library for machine control to avoid inadvertent consequences of commanded machine operation, state changes, or alteration of data memory or machine operating elements.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

- Place operator devices of the control system near the machine or in a place where you have full view of the machine.
- Protect operator commands against unauthorized access.
- If remote control is a necessary design aspect of the application, ensure that there is a local, competent, and qualified observer present when operating from a remote location.
- Configure and install the Run/Stop input, if so equipped, or, other external means within the application, so that local control over the starting or stopping of the device can be maintained regardless of the remote commands sent to it.

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.

General Information

What’s in This Part

Presentation of the Library

What's in This Chapter

General Information

Library Overview

The EdgeIONTSExpertFunction library provides dedicated function blocks to manage Motion and High Speed Counting Edge I/O NTS modules.

Characteristics of the Library

The table indicates the characteristics of the library:

Characteristic	Value
Library title	EdgeIONTSExpertFunction
Company	Schneider Electric
Category	**Devices > Edge I/O NTS**
Component	**EdgeIONTSRepository**
Default namespace	**EIOEF**
Language model attribute	Qualified-access-only (see Functions and Libraries User Guide)
Forward compatible library	Yes (see Functions and Libraries User Guide)

NOTE: For this library, qualified-access-only is set. The POUs, data structures, enumerations, and constants must be accessed using the namespace of the library. The default namespace of the library is **EIOEF**.

Controller Platforms

The EdgeIONTSExpertFunction library is supported by Modicon M262 Logic/Motion Controllers.

General Considerations

NOTE: Schneider Electric adheres to industry best practices in the development and implementation of control systems. This includes a "Defense-in-Depth" approach to secure an Industrial Control System. This approach places the controllers behind one or more firewalls to restrict access to authorized personnel and protocols only.

⚠WARNING

UNAUTHENTICATED ACCESS AND SUBSEQUENT UNAUTHORIZED MACHINE OPERATION

- Evaluate whether your application environments are connected to your critical infrastructure and, if so, take appropriate steps in terms of prevention, based on Defense-in-Depth, before connecting the automation system to any network.
- Limit the number of devices connected to a network to the minimum necessary.
- Isolate your industrial network from other networks inside your company.
- Protect any network against unintended access by using firewalls, VPN, or other, proven security measures such as an Intrusion Prevention System or Intrusion Detection System.
- Monitor activities within your systems.
- Prevent subject devices from direct access or direct link by unauthorized parties or unauthenticated actions.
- Install certificates that are issued by publicly known Trusted Certificate Authorities.
- Keep your systems up to date and rely only on legitimate sources.
- Prepare a recovery plan including backup of your system and process information.

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

For more information on organizational measures and rules covering access to infrastructures, refer to ISO/IEC 27000 series, Common Criteria for Information Technology Security Evaluation, ISO/IEC 15408, IEC 62351, ISA/IEC 62443, NIST Cybersecurity Framework, Information Security Forum - Standard of Good Practice for Information Security and refer to Cybersecurity Guidelines for EcoStruxure Machine Expert, Modicon and PacDrive Controllers and Associated Equipment.

Common Inputs and Outputs

What's in This Chapter

General Information

Overview

The EdgeIONTSExpertFunction library includes the *HSC_GetParam_NTS*, page 19 and *HSC_SetParam_NTS*, page 27 administrative function blocks.

This chapter provides general information on managing common input and output variables.

Management of Input Variables

When a rising edge is detected at the *Execute* input, the function block starts.

Further modifications of the input variables are not taken into account.

Following the IEC 61131-3 standards, if a variable input to a function block is unavailable, that is, left open or unconnected, then the value from the previous call of the instance of the function block is used. In the first call, the initial, configured value is applied in this case. To help avoid debugging issues, ensure that known values are attributed to the inputs. For HSC function blocks, it is a good practice to use the instance once, and to use the instance in the main task.

Management of Output Variables

The *Done* output is mutually exclusive with the *Busy* and *Error* outputs: only one of them can be TRUE in one function block. If the *Execute* input is TRUE, one of these outputs is TRUE.

At the rising edge of the *Execute* input, the *Busy* output is set. This *Busy* output remains set during the function block execution, and is reset at the rising edge of one of the other outputs (*Done* or *Error*).

The *Done* output is set when the function block execution has been completed successfully.

When a function block execution is terminated due to a detected error, the *Error* output is set and the detected error code is provided with the *ErrorId* output.

The *Done*, *Error*, and *ErrorId* outputs are reset with the falling edge of *Execute*. If the *Execute* input is reset before execution is finished, then the outputs are set for one task cycle at the execution ending.

When an instance of a function block receives another *Execute* before it is finished, the function block does not return feedback, such as *Done*, for the previous action.

Handling a Detected Error

The HSC function blocks have two outputs that can report a detected error during the execution of the function block:

- *Error* = TRUE when an error is detected.
- *ErrorId* returns the error code *HSC_ERROR_NTS*, page 32.

Program Organization Units (POU)

What’s in This Part

Function Blocks

What's in This Chapter

HSC_GetParam_NTS: Returns Parameters of HSC

Function Block Description

The *HSC_GetParam_NTS* administrative function block returns a parameter value of a High Speed Counter (HSC).

Graphical Representation

I/O Variables Description

This table describes the input variables:

Inputs	Type	Comment
HSC_REF_NTS	HSCRef	Reference of the HSC instance. Must not be changed during function block execution.
Execute	BOOL	When a rising edge is detected, the function block starts execution. When a falling edge is detected, the function block stops execution and the outputs are reset.
Param	*HSC_PARAM_TYPE_NTS*, page 31	Parameter to read.

This table describes the output variables:

Outputs	Type	Comment
Done	BOOL	TRUE indicates that *ParameterValue* is valid. Function block execution is finished.
Busy	BOOL	TRUE indicates that the function block is busy processing data.
Error	BOOL	TRUE indicates that an error is detected. Function block execution is finished.
ErrorId	*HSC_ERROR_NTS*, page 32	Indicates the identification number of the detected error when *Error* is TRUE.
ParameterValue	DINT	Value of the parameter that has been read.

NOTE: For more information about the *Done*, *Busy*, *Error*, and *ErrorId* parameters, refer to General Information, page 16.

HSC_Main_NTS: Control a Main Type Counter for Edge I/O

Function Block Description

The *HSC_Main_NTS* function block controls a **Main** type counter with the following functions:

Function	Refer to the chapter in the Modicon Edge I/O NTS Counting Modules User Guide for further information
Frequency meter	Frequency Meter Function
Ratio meter	Ratio Meter Function
Period meter	Period Meter Function
Single event counting	Single Phase Event Counting Function
Single phase counting	Single Phase Counting Function
Dual phase counting	Dual Phase Counting Function
Reflex	Reflex Output Sub Function

The *HSC_Main_NTS* function block is mandatory when using **Main** counter.

The function block instance name must match the name defined by configuration. Hardware related information managed by this function block is synchronized with the MAST task cycle.

⚠WARNING

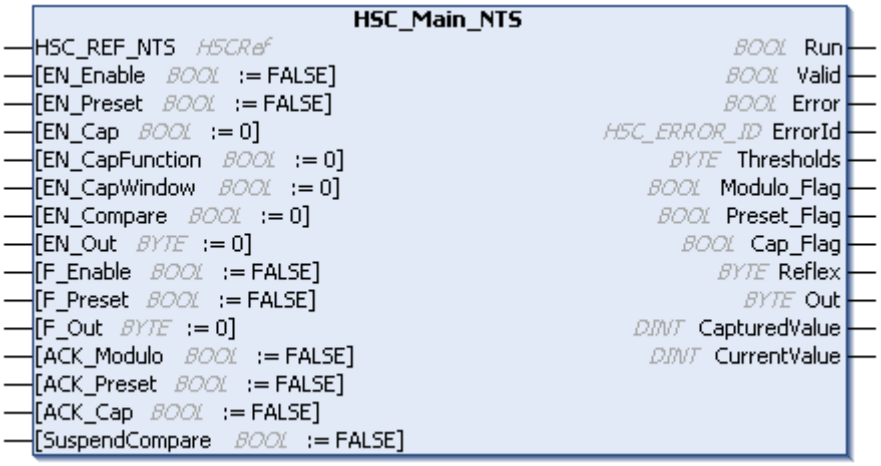
UNINTENDED OUTPUT VALUES

- Only use the function block instance in the MAST task.
- Do not use the same function block instance in a different task.

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

NOTE: Forcing the logical output values of the function block is allowed by EcoStruxure Automation Expert - Motion and EcoStruxure Machine Expert but it will have no impact on physical outputs if the function is active (executing).

Graphical Representation



I/O Variables Description

This table describes the input variables:

Input	Type	Description
HSC_REF_NTS	HSCRef	Reference to the HSC instance. Must not be changed during function block execution.
EN_Enable	BOOL	Corresponds to *OperationalCommand* bit 0. For further information, refer to the Enable Function in the Counting Modules User Guide. TRUE authorizes enabling of the counter using the *Enable* input.
EN_Preset	BOOL	Corresponds to *OperationalCommand* bit 1. For further information, refer to the Preset Function in the Counting Modules User Guide. TRUE authorizes counter synchronization and start using the *Sync* input.
EN_Cap	BOOL	Corresponds to *OperationalCommand* bit 2. For further information, refer to the Capture Function in the Counting Modules User Guide. TRUE enables the *Capture* input (if configured in **Single Phase Counting** and **Dual Phase Counting**).
EN_CapFunction	BOOL	Corresponds to *OperationalCommand* bit 3. For further information, refer to the Capture Function in the Counting Modules User Guide. If TRUE and *EN_Cap* are TRUE, the capture function can operate. **NOTE:** *EN_Cap* is the prerequisite for *EN_CapFunction*. *EN_CapFunction* is the prerequisite for *EN_CapWindow*.
EN_CapWindow	BOOL	Corresponds to *OperationalCommand* bit 4. For further information, refer to the Capture Function in the Counting Modules User Guide. If TRUE, the capture window is enabled. The range of the capture window is configured with *CaptureWindowStartPosition* and *CaptureWindowEndPosition*. If FALSE, the capture function can operate without the restriction of capture window.
EN_Compare	BOOL	Corresponds to *OperationalCommand* bit 5. For further information, refer to the Compare Function in the Counting Modules User Guide. If TRUE, the comparator for reflex output (using thresholds 0, 1, 2, 3) is enabled.
EN_Out	BYTE	Corresponds to *EnableReflexOutput* of the Reflex Output Sub Function in the Counting Modules User Guide. Set bits to `1` to enable the corresponding physical outputs to echo the configured function value (Reflex or Stop) as a result of the comparison function. Only active when outputs are configured in the HSC editor: • Bit 0: Output 0 enabled. • Bit 1: Output 1 enabled. • Bit 2: Output 2 enabled. • Bit 3: Output 3 enabled. • Bits 4...7: Not used. Association of the HSC output *Outx* with the physical output Qy is done by configuration.

Input	Type	Description
F_Enable	BOOL	Corresponds to *OperationalCommand* bit 7. For further information, refer to the Enable Function in the Counting Modules User Guide. TRUE activates the counter and takes into account pulses on the counter input.
F_Preset	BOOL	Corresponds to *OperationalCommand* bit 8. For further information, refer to the Preset Function in the Counting Modules User Guide. When a rising edge is detected, the counting function synchronization is authorized and the counters are started.
F_Out	BYTE	Corresponds to *ForceReflexOutput* of the Reflex Output Sub Function in the Counting Modules User Guide. Set bits to `1` to force the corresponding physical outputs to 1 if associated with HSC by configuration. Takes priority over *EN_Out*. Only active when outputs are configured in the HSC editor: • Bit 0: Output 0 forced. • Bit 1: Output 1 forced. • Bit 2: Output 2 forced. • Bit 3: Output 3 forced. • Bits 4...7: Not used. Association of the HSC output *Out*x with the physical output Qy is done by configuration.
ACK_Modulo	BOOL	Corresponds to *OperationalCommand* bit 10. When a rising edge is detected, the *Modulo_Flag* output is reset.
ACK_Preset	BOOL	Corresponds to *OperationalCommand* bit 11. When a rising edge is detected, the *Preset_Flag* is reset.
ACK_Cap	BOOL	Corresponds to *OperationalCommand* bit 12. When a rising edge is detected, the *Cap_Flag* is reset.
SuspendCompare	BOOL	Corresponds to *OperationalCommand* bit 6. TRUE disables the comparator for the *Reflex* output. When *SuspendCompare* (*OperationalCommand* bit 6) is set to TRUE, the compare function is suspended. The parameters related to the compare function, *ReflexState*, *ThresholdState*, *OutputState* are maintained at their values. **NOTE:** If the compare function is suspended while the *OutputState* is set to TRUE for the duration of a *ReflexOutput●PulseWidth* value, the *OutputState* continues the normal operation and is set to FALSE at the end of the configured duration. For further information, refer to the chapter *Reflex Output Sub Function* in the *Modicon Edge I/O NTS Counting Modules User Guide*.

This table describes the output variables:

Outputs	Type	Comment
Run	BOOL	Corresponds to *OperationalState* bit 0. TRUE activates the counter.
Valid	BOOL	Corresponds to *OperationalState* bit 1. TRUE indicates that valid data is available at the function block output pin.
Error	BOOL	TRUE indicates that an error is detected. Function block execution is finished. For further information, refer to General Information, page 16.
ErrorId	*HSC_ERROR_NTS*, page 32	Indicates the identification number of the detected error when *Error* is TRUE. For further information, refer to General Information, page 16.
Thresholds	BYTE	Corresponds to *ThresholdState* of the Reflex Output Sub Function in the Counting Modules User Guide. The bits are set to 1 when the counter value *CurrentValue* is superior or equal to the *Thresholds* value for the corresponding threshold: • Bit 0: *CurrentValue* ≥ *Threshold0* • Bit 1: *CurrentValue* ≥ *Threshold1* • Bit 2: *CurrentValue* ≥ *Threshold2* • Bit 3: *CurrentValue* ≥ *Threshold3* • Bits 4...7: Not used
Modulo_Flag	BOOL	Corresponds to *OperationalState* bit 2. This output indicates if the counter looped back to 0 after reaching the modulo value. • TRUE when the counter loops back to 0. • FALSE when a rising edge is detected at the *ACK_Modulo* input.
Preset_Flag	BOOL	Corresponds to *OperationalState* bit 3. Set to TRUE when you Sync the counter value.
Cap_Flag	BOOL	Corresponds to *OperationalState* bit 4. TRUE indicates that a value has been latched in the capture register. This flag must be reset before a new capture can occur.
Reflex	BYTE	Corresponds to *ReflexState* of the Reflex Output Sub Function in the Counting Modules User Guide. State of the reflex function: • Bit 0: Reflex 0 • Bit 1: Reflex 1 • Bit 2: Reflex 2 • Bit 3: Reflex 3 • Bits 4...7: Not used

Outputs	Type	Comment
Out	BYTE	Corresponds to *OutputState* of the Reflex Output Sub Function in the Counting Modules User Guide). State of the physical outputs: • Bit 0: Output 0 • Bit 1: Output 1 • Bit 2: Output 2 • Bit 3: Output 3 • Bits 4...7: Not used Only active when the outputs are configured in the **Counters** configuration tab. Association of the HSC output *Outx* with the physical output Qy is done by the configuration.
CapturedValue	DINT	The value of the captured counter value. -2,147,483,648...2,147,483,647
CurrentValue	DINT	The value of the counter. -2,147,483,648...2,147,483,647

HSC_PWM_NTS: Commands a Pulse Width Modulation Signal

Function Block Description

The *HSC_PWM_NTS* function block controls the PWM (Pulse Width Modulated) output.

The function block instance name must match the name defined by configuration. Hardware related information managed by this function block is synchronized with the MAST task cycle.

For detailed information, refer to the PWM Output Function chapter in the Modicon Edge I/O NTS Counting Modules User Guide.

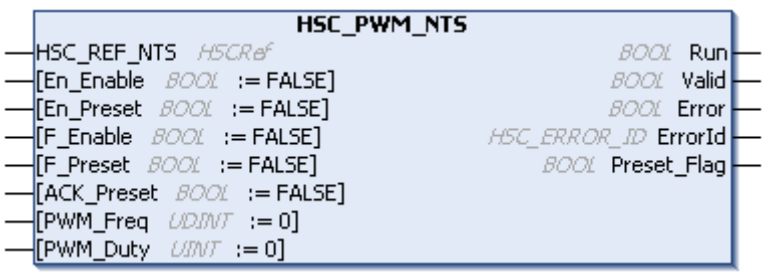
⚠WARNING

UNINTENDED OUTPUT VALUES

- Only use the function block instance in the MAST task.
- Do not use the same function block instance in a different task.

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

Graphical Representation



I/O Variables Description

This table describes the input variables:

Inputs	Type	Comment
HSC_REF_NTS	HSCRef	Reference to the HSC instance. Must not be changed during function block execution.
En_Enable	BOOL	Corresponds to *OperationalCommand* bit 0. For further information, refer to the Enable Function in the Counting Modules User Guide. TRUE authorizes enabling of the Pulse Width Modulation (PWM) using the *Enable* input.
En_Preset	BOOL	Corresponds to *OperationalCommand* bit 1. For further information, refer to the Preset Function in the Counting Modules User Guide. TRUE authorizes PWM output synchronization and start using the *Sync* input.
F_Enable	BOOL	Corresponds to *OperationalCommand* bit 7. For further information, refer to the Enable Function in the Counting Modules User Guide. TRUE activates the *PWM* output.
F_Preset	BOOL	Corresponds to *OperationalCommand* bit 8. For further information, refer to the Preset Function in the Counting Modules User Guide. When a rising edge is detected, the *PWM* output function synchronization is authorized.
ACK_Preset	BOOL	Corresponds to *OperationalCommand* bit 11. When a rising edge is detected, the *Preset_Flag* is reset.
PWM_Freq	UDINT	Frequency of the *PWM* output. Value range: 0...2000000 (20 kHz) For example, `123456` means 1234.56 Hz.
PWM_Duty	UINT	Duty cycle of the *PWM* output. Value range: 0...1000 (100 %) For example, `123` means 12.3 %.

This table describes the output variables:

Outputs	Type	Comment
Run	BOOL	Corresponds to *OperationalState* bit 0. TRUE indicates that the *PWM* output is activated.
Valid	BOOL	Corresponds to *OperationalState* bit 1. TRUE indicates that the *PWM* output is valid. Frequency and duty values are within the allowed range.
Error	BOOL	TRUE indicates that an error is detected. Function block execution is finished. For further information, refer to General Information, page 16.
ErrorId	*HSC_ERROR_NTS*, page 32	Indicates the identification number of the detected error when *Error* is TRUE. For further information, refer to General Information, page 16.
Preset_Flag	BOOL	Corresponds to *OperationalState* bit 3. Set to TRUE when you Sync the *PWM* output.

HSC_SetParam_NTS: Adjusts Parameters of HSC

Function Block Description

The *HSC_SetParam_NTS* administrative function block modifies the value of a parameter of an HSC.

Graphical Representation

I/O Variables Description

This table describes the input variables:

Inputs	Type	Comment
HSC_REF_NTS	HSCRef	Reference to the HSC function block. Must not be changed during function block execution.
Execute	BOOL	When a rising edge is detected, the function block starts execution. When a falling edge is detected, the function block stops execution and the outputs are reset.
Param	*HSC_PARAM_TYPE_NTS*, page 31	Parameter to set.
ParameterValue	DINT	Parameter value to write.

This table describes the output variables:

Outputs	Type	Comment
Done	BOOL	TRUE indicates that the parameter value was written. Function block execution is finished.
Busy	BOOL	TRUE indicates that the function block is busy processing data.
Error	BOOL	TRUE indicates that an error is detected. Function block execution is finished.
ErrorId	*HSC_ERROR_NTS*, page 32	Indicates the identification number of the detected error when *Error* is TRUE.

NOTE: For more information about the *Done*, *Busy*, *Error*, and *ErrorId* parameters, refer to General Information, page 16.

HSC_Simple_NTS: Controls a Simple Type Counter

Function Block Description

The *HSC_Simple_NTS* function block controls a **Simple Counting** counter with the following operating modes:

- One-shot counting
- Modulo-loop counting

The *HSC_Simple_NTS* function block is mandatory when using a **Simple Counting** counter.
For detailed information, refer to the Simple Counting Function chapter in the Modicon Edge I/O NTS Counting Modules User Guide.

The function block instance name must match the name defined by configuration. Hardware related information managed by this function block is synchronized with the MAST task cycle.

⚠WARNING

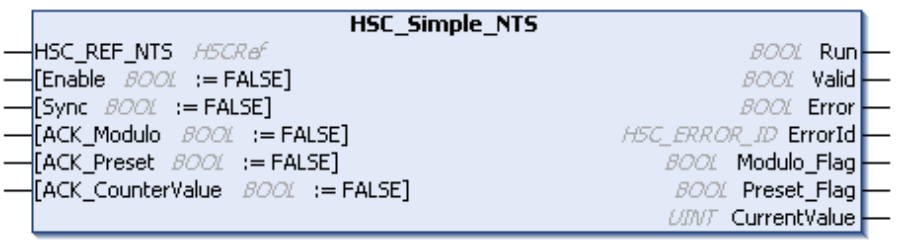
UNINTENDED OUTPUT VALUES

- Only use the function block instance in the MAST task.
- Do not use the same function block instance in a different task.

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

NOTE: Forcing the logical output values of the function block is allowed by EcoStruxure Automation Expert - Motion and EcoStruxure Machine Expert but it will have no impact on physical outputs if the function is active (executing).

Graphical Representation



I/O Variables Description

This table describes the input variables:

Inputs	Type	Comment
HSC_REF_NTS	HSCRef	Reference to the HSC instance.
Enable	BOOL	Corresponds to *OperationalCommand* bit 0. TRUE activates the counter and takes into account pulses on the counter input.
Sync	BOOL	Corresponds to *OperationalCommand* bit 1. One-shot counter: When a rising edge is detected, loads the preset of the counter. Modulo-loop counter: When a rising edge is detected, resets and initializes the counter.
ACK_Modulo	BOOL	Corresponds to *OperationalCommand* bit 2. Modulo-loop mode: When a rising edge is detected, resets the modulo flag *Modulo_Flag*.
ACK_Preset	BOOL	Corresponds to *OperationalCommand* bit 3. When a rising edge is detected, resets the *Preset_Flag*.
ACK_CounterValue	BOOL	Corresponds to *OperationalCommand* bit 4. When a rising edge is detected, resets the current counter value to 0.

This table describes the output variables:

Outputs	Type	Comment
Run	BOOL	Corresponds to *OperationalState* bit 0. TRUE indicates that the counter is activated. In One-shot mode, switches to 0 when *CurrentValue* reaches 0. A rising edge on *Sync* is needed to restart the counter. In Modulo-loop mode, TRUE indicates that the counter is activated.
Valid	BOOL	Corresponds to *OperationalState* bit 1. TRUE indicates that the output values on the function block are valid.
Error	BOOL	TRUE indicates that an error is detected. Function block execution is finished. For further information, refer to General Information, page 16.
ErrorId	*HSC_ERROR_NTS*, page 32	Indicates the identification number of the detected error when *Error* is TRUE. For further information, refer to General Information, page 16.
Modulo_Flag	BOOL	Corresponds to *OperationalState* bit 2. Modulo-loop mode: Set to TRUE when the counter exceeds the modulo value.
Preset_Flag	BOOL	Corresponds to *OperationalState* bit 3. Set to TRUE when you Sync the counter value. • In one-shot mode: preset the counter value. • In modulo-loop mode: reset the counter value.
CurrentValue	UINT	The value of the counter. Value range: 0...65,535

Enumerations and Structures

What’s in This Part

Enumerations

What's in This Chapter

HSC_PARAM_TYPE_NTS

Description

The *HSC_PARAM_TYPE_NTS* enumeration is dedicated to parameters that perform a Get or Set operation on HSC function blocks.

Enumeration Elements

The enumeration data type ENUM contains the following values:

Name	Value	Description
HSC_PRESET	0x01	To get or set the **Preset** value for the counting functions **Simple Counting**, **Single Phase Counting** and **Dual Phase Counting**. For further information, refer to the *Modicon Edge I/O NTS Counting Modules User Guide*.
HSC_TIMEBASE	0x02	To get or set the **Time Base** value for the counting functions **Frequency Meter**, **Ratio Meter** and **Single Phase Event Counting**. For further information, refer to the *Modicon Edge I/O NTS Counting Modules User Guide*.
HSC_CALIBRATION_FACTOR	0x03	To get or set the **Calibration Factor** value for the counting functions **Frequency Meter** and **Ratio Meter**.
HSC_ABSOLUTE_LIMIT	0x04	To get or set the **Absolute Limit** value for the counting function **Ratio Meter**.
HSC_RESOLUTION	0x05	To get or set the **Resolution** value for the counting function **Period Meter**.
HSC_HYSTERESIS	0x06	To get or set the **Hysteresis** value for the counting function dual phase in free-large mode.
HSC_CAPTURE_WINDOW_START_POSITION	0x07	To get or set the capture window start position **CAP Window Start** value for the counting functions **Single Phase Event Counting** and **Dual Phase Counting**.
HSC_CAPTURE_WINDOW_END_POSITION	0x08	To get or set the capture window end position **CAP Window End** value for the counting functions **Single Phase Event Counting** and **Dual Phase Counting**.
HSC_THRESHOLD0	0x09	To get or set the **Threshold0** value for the counting subfunction reflex output.
HSC_THRESHOLD1	0x0A	To get or set the **Threshold1** value for the counting subfunction reflex output.
HSC_THRESHOLD2	0x0B	To get or set the **Threshold2** value for the counting subfunction reflex output.
HSC_THRESHOLD3	0x0C	To get or set the **Threshold3** value for the counting subfunction reflex output.

HSC_ERROR_NTS

Description

The *HSC_ERROR_NTS* enumeration contains the possible values that indicate the errors detected by the function block.

Enumeration Elements

The enumeration data type ENUM contains the following values:

Name	Value	Description
HSC_NO_ERROR	0x00	No error detected.
HSC_UNKNOWN_REF	0x01	The HSC reference is incorrect or not configured.
HSC_UNKNOWN_ PARAMETER	0x02	The parameter reference is incorrect. For valid parameters, refer to *HSC_PARAM_TYPE_NTS*, page 31.

Name	Value	Description
HSC_INVALID_PARAMETER	0x03	The value of the parameter is incorrect. The following conditions must be met: • **HSC_PRESET** ◦ **Simple Counting**: 0 ≤ preset ≤ 65,535 ◦ **Single Phase Counting**: 0 ≤ preset ≤ 2,147,483,647 ◦ **Dual Phase Counting**: – modulo loop: 0 ≤ preset ≤ 2,147,483,647 – free large: -2,147,483,648 ≤ preset ≤ 2,147,483,647 • **HSC_TIMEBASE** ◦ **Frequency Meter** – 0: 10 ms – 1: 100 ms – 2: 1000 ms – 3: 60 s ◦ **Ratio Meter** – 0: 10 ms – 1: 100 ms – 2: 1000 ms ◦ **Single Phase Event Counting** – 0: 1 ms – 1: 10 ms – 2: 100 ms – 3: 1000 ms – 4: 10 s – 5: 60 s • **HSC_CALIBRATION_FACTOR**: -100 ≤ calibration factor ≤ 100 • **HSC_ABSOLUTE_LIMIT**: 10 ≤ absolute limit ≤ 60,000,000 • **HSC_RESOLUTION** ◦ **Period Meter**: – 0: 0.1 µs – 1: 1 µs – 2: 10 µs – 3: 100 µs – 4: 1000 µs • **HSC_HYSTERESIS**: -128 < Hysteresis < 127 • **HSC_CAPTURE_WINDOW_START_POSITION** ◦ The value of *HSC_CAPTURE_WINDOW_START_POSITION* must be less than the value of *HSC_CAPTURE_WINDOW_END_POSITION*. ◦ The value of *HSC_CAPTURE_WINDOW_START_POSITION* must be less than or equal to the **Preset** value. • **HSC_CAPTURE_WINDOW_END_POSITION** ◦ The value of *HSC_CAPTURE_WINDOW_END_POSITION* must be larger than the value of *HSC_CAPTURE_WINDOW_START_POSITION*. ◦ The value of *HSC_CAPTURE_WINDOW_END_POSITION* must be less than or equal to the **Preset** value. • **HSC_THRESHOLD_X**: Threshold 0 < Threshold 1 < Threshold 2 < Threshold 3
HSC_COM_ERROR	0x04	A communication error is detected with the HSC module.
HSC_SHORTWIRE_GROUP0_DETECTED	0x05	An output short-circuit group 0 is detected. (Q0...Q3).

Name	Value	Description
HSC_SHORTWIRE_GROUP1_DETECTED	0x06	An output short-circuit group 1 is detected. (Q4...Q7).
HSC_PDM_ERROR	0x07	A 24 V power supply error is detected.

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