Modicon M340 with Unity Pro

Counting Module BMX EHC 0800
User Manual

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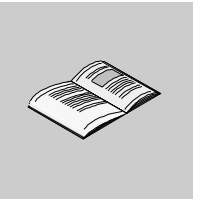
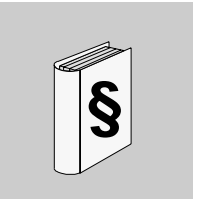


Safety Information



Important Information

NOTICE

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, 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 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 an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

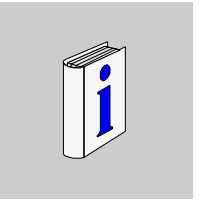
NOTICE is used to address practices not related to physical injury.

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



At a Glance

Document Scope

This manual describes the hardware and software implementation of the BMX EHC 0800 counting module for Modicon M340 PLCs and X80 drops.

Validity Note

This document is valid from Unity Pro v7.0.

Product Related Information

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

The application of this product requires expertise in the design and programming of control systems. Only persons with such expertise should be allowed to program, install, alter, and apply this product.

Follow all local and national safety codes and standards.

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

User Comments

We welcome your comments about this document. You can reach us by e-mail at techcomm@schneider-electric.com.

Introduction to the BMX EHC 0800 Counting Function

I

Subject of this Part

This part provides a general introduction to the counting function and the operating principles of the module.

What Is in This Part?

This part contains the following chapters:

General Information on the BMX EHC 0800 Counting Function

1

General Information on Counting Functions

At a Glance

The counting function enables fast counting using couplers, Unity Pro screens and specialized language objects. The general operation of expert modules also known as couplers is described in the section Presentation of the Counting Module Operation BMX EHC 0800.

In order to implement the counting, it is necessary to define the physical context in which it is to be executed (rack, supply, processor, modules etc.) and to ensure the software implementation *(see page 91)*.

This second aspect is performed from the different Unity Pro editors:

- in offline mode
- in online mode

Presentation of BMX EHC 0800 Counting Module

2

Subject of this Chapter

This chapter deals with the BMX EHC 0800 counting mode of the Modicon M340 range.

What Is in This Chapter?

This chapter contains the following topics:

General Information about Counting Module

Introduction

The BMX EHC 0800 counting module is a standard format module that enable pulses from a sensor to be counted at a maximum frequency of 10 KHz.

This module has 8 channels.

This module may be installed in any available slot in a Modicon M340 PLC station rack.

Sensors Used

The sensors used on each channel may be:

- 24 VDC two-wire proximity sensors
- 24 VDC three-wire proximity sensors
- Incremental signal encoders with 10/30 VDC output and push-pull outputs.

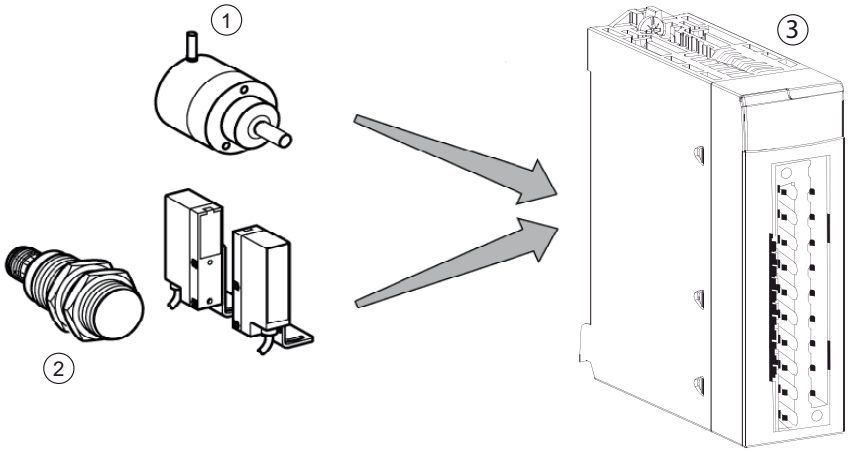
Illustration

The illustration below shows the following:

1) Incremental encoder

2) Proximity sensors

3) BMX EHC 0800 counting module



General Information about the Counting Module Operation

Introduction

The BMX EHC 0800 module is a counting module from the Modicon M340 modular PLC range. It support all Unity Pro software functionalities.

This module has:

- Counting-related functions (comparison, capture, homing, reset to 0)
- Event generation functions designed for the application program
- Outputs for actuator use (contacts, alarms, relays)

Characteristics

The main characteristics of this module are as follows.

Type	Application	Number of channels per module	Number of physical inputs per channel	Number of physical outputs per channel	Maximum frequency
BMX EHC 0800	• Counting • Downcounting • Frequency meter • Encoder interface	8	2 in single mode 3 in special dual phase mode	0	10 KHz

Presentation of the BMX EHC 0800 Counting Module

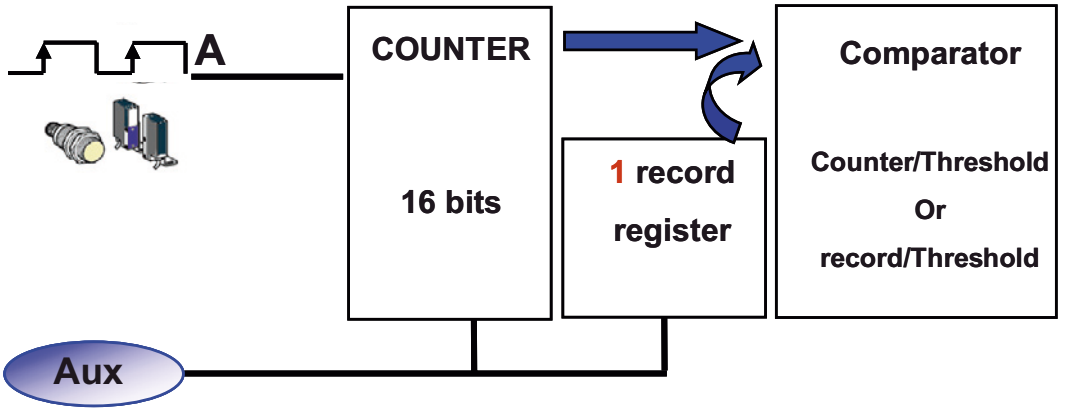
At a Glance

The BMX EHC 0800 counting module enables the counting or downcounting of pulses to be performed. It has the following functions:

- Enable
- Capture
- Comparison
- Load to preset value or reset to 0

16 bits structure

The following illustration shows the 16 bits structure of a counter channel:

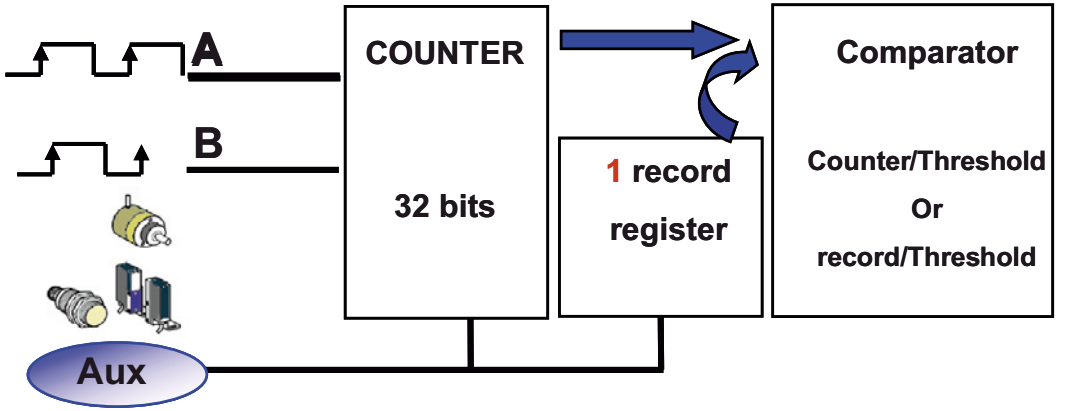


The diagram above is applicable for the following 5 counting modes:

- Frequency mode
- Event counting mode
- One shot counter mode
- Modulo loop counter mode
- Up and down counter mode

32 bits structure

The following illustration shows the 32 bits structure using 2 channels:



The illustration shown above is only applicable for the dual-phase counter mode.

In this mode, with the counting module it is possible to merge 2 single channels into 1 dual-phase channel. As such, it is possible to build up to 4 encoder interfaces.

Modicon M340H (Hardened) Equipment

M340H

The Modicon M340H (hardened) equipment is a ruggedized version of M340 equipment. It can be used at extended temperatures (-25...70°C) (-13...158°F) and in harsh chemical environments.

This treatment increases the isolation capability of the circuit boards and their resistance to:

- condensation
- dusty atmospheres (conducting foreign particles)
- chemical corrosion, in particular during use in sulphurous atmospheres (oil, refinery, purification plant and so on) or atmospheres containing halogens (chlorine and so on)

The M340H equipment, when within the standard temperature range (0...60°C) (32...140°F), has the same performance characteristics as the standard M340 equipment.

At the temperature extremes (-25... 0°C and 60... 70°C) (-13...32°F) and (140...158°F) the hardened versions can have reduced power ratings that impact power calculations for Unity Pro applications.

If this equipment is operated outside the -25...70°C (-13...158°F) temperature range, the equipment can operate abnormally.

⚠ CAUTION
UNINTENDED EQUIPMENT OPERATION Do not operate M340H equipment outside of its specified temperature range. **Failure to follow these instructions can result in injury or equipment damage.**

Hardened equipment has a conformal coating applied to its electronic boards. This protection, when associated with appropriate installation and maintenance, allows it to be more robust when operating in harsh chemical environments.

Presentation of the BMX EHC 0800 Counting Module Operation

3

Overview of BMX EHC 0800 Module Functionalities

At a Glance

This part presents the different types of user applications for the BMX EHC 0800 module.

Measurement

The following table presents the measurement functionality for the BMX EHC 0800 module:

User application type	Mode
Speed measurement/stream measurement	Frequency
Random events monitoring	Event counting

Counting

The following table presents the counting functionality for the BMX EHC 0800 module:

User application type	Mode
Grouping	One shot counter
Level 1 packaging/labeling	Modulo loop counter
Accumulator	Up and down counting
Encoder interface	Dual phase counting

NOTE: In case of a user application such as level 1 packaging/labeling, the machine makes constant spacing between parts.

Interface

The BMX EHC 0800 module may be interfaced with the following components:

- mechanical switch
- 24 VDC two-wire proximity sensor
- 24 VDC three-wire proximity sensor
- 10/30 VDC encoder with push-pull outputs

BMX EHC 0800 Counting Module Hardware Implementation

II

Subject of this Part

This part presents the hardware implementation of the BMX EHC 0800 counting module.

What Is in This Part?

This part contains the following chapters:

General Rules for Installing BMX EHC 0800 Counting Module

4

Subject of this Chapter

This chapter presents the general rules for installing the BMX EHC 0800 counting module.

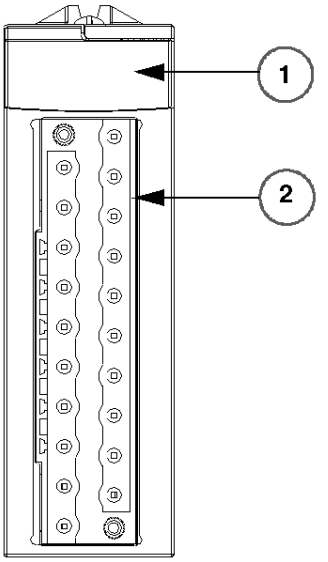
What Is in This Chapter?

This chapter contains the following topics:

Physical Description of the Counting Module

Illustration

The figure below present the counting module BMX EHC 0800:



BMX EHC 0800

Physical Elements of the Module

The table below presents the elements of the counting module:

Module	Number	Description
BMX EHC 0800	1	Module state LEDs: • State LEDs at module level • State LEDs at channel level
	2	20-pin connector compatible with discrete inputs/outputs

Accessories

The BMX EHC 0800 module requires the use of a BMX FTB 2000/2010/2020 terminal block and a BMX XSP 0400/0600/0800/1200 electromagnetic compatibility kit *(see Modicon M340 Using Unity Pro, Processors, Racks, and Power Supply Modules, Setup Manual)*.

Fitting of Counting Module

At a Glance

The counting module is powered by the rack bus. The module may be handled without turning off power supply to the rack, without causing any danger and without there being any risk of damage or disturbance to the PLC.

Fitting operations (installation, assembly and disassembly) are described below.

Installation Precautions

The counting module may be installed in any of the positions in the rack except for the first two (marked PS and 00) which are reserved for the rack's power supply module (BMX CPS ••••) and the processor (BMX P34 ••••) respectively. Power is supplied by the bus at the bottom of the rack (3.3 V and 24 V).

Before installing a module, you must take off the protective cap from the module connector located on the rack.

⚠ DANGER

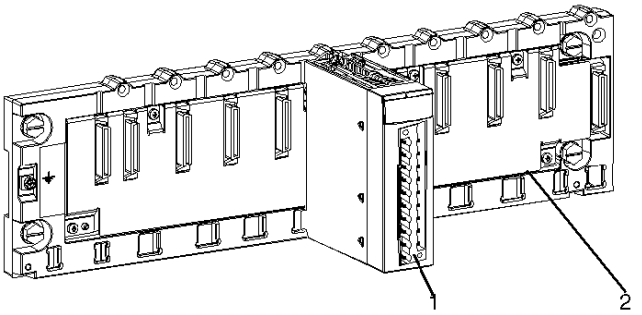
HAZARD OF ELECTRIC SHOCK

- disconnect voltage supplying sensors and pre-actuators before plugging / unplugging the terminal block on the module.
- remove the terminal block before plugging / unplugging the module on the rack.

Failure to follow these instructions will result in death or serious injury.

Installation

The diagram below shows counting module mounted on the rack:

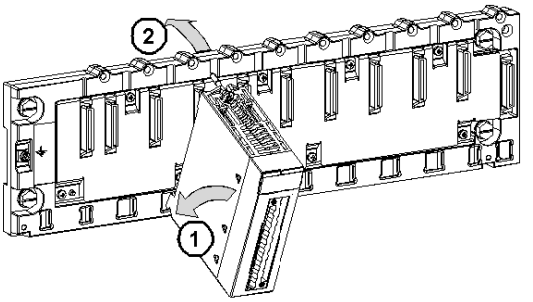
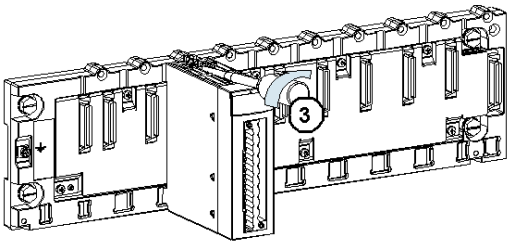


The following table describes the different elements which make up the assembly below:

Number	Description
1	BMX EHC 0800 counting module
2	Standard rack

Installing the Module on the Rack

The following table shows the procedure for mounting the counting module in the rack:

Step	Action	Illustration
1	Position the locating pins situated at the rear of the module (on the bottom part) in the corresponding slots in the rack. Note: Before positioning the pins, make sure you have removed the protective cover *(see Modicon M340 Using Unity Pro, Processors, Racks, and Power Supply Modules, Setup Manual)*.	Steps 1 and 2 
2	Swivel the module towards the top of the rack so that the module sits flush with the back of the rack. It is now set in position.	
3	Tighten the safety screw to ensure that the module is held in place on the rack. Tightening torque: Max. 1.5 N.m	Step 3 

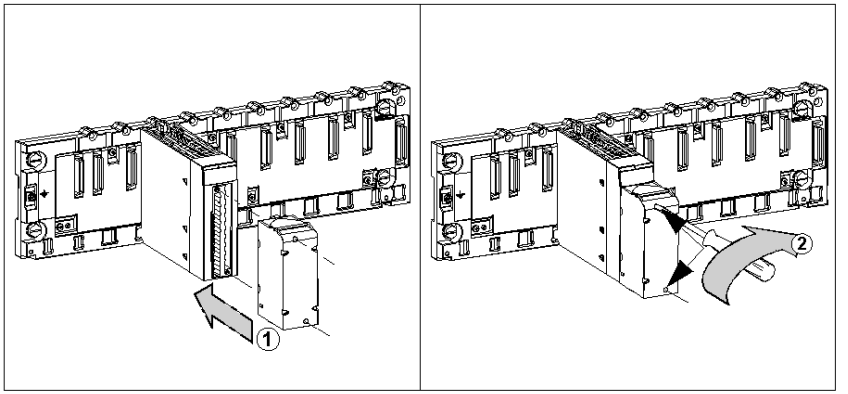
Fitting a 20-Pin Terminal Block to a BMX EHC 0800 Counting Module

At a Glance

The BMX EHC 0800 counting module with 20-pin terminal block connections require the latter to be connected to the module. These fitting operations (assembly and disassembly) are described below.

Installing the 20-Pin Terminal Block

The following table shows the procedure for assembling the 20-pin terminal block onto a BMX EHC 0800 counting module:



⚠ DANGER

ELECTRICAL SHOCK

Terminal blocks must be connected or disconnected with sensor and pre-actuator voltage switched off.

Failure to follow these instructions will result in death or serious injury.

Assembly procedure:

Step	Action
1	Once the module is in place on the rack, install the terminal block by inserting the terminal block encoder (the rear lower part of the terminal) into the module's encoder (the front lower part of the module), as shown above.
2	Fix the terminal block to the module by tightening the 2 mounting screws located on the lower and upper parts of the terminal block. Tightening torque: 0.4 N.m.

NOTE: If the screws are not tightened, there is a risk that the terminal block will not be properly fixed to the module.

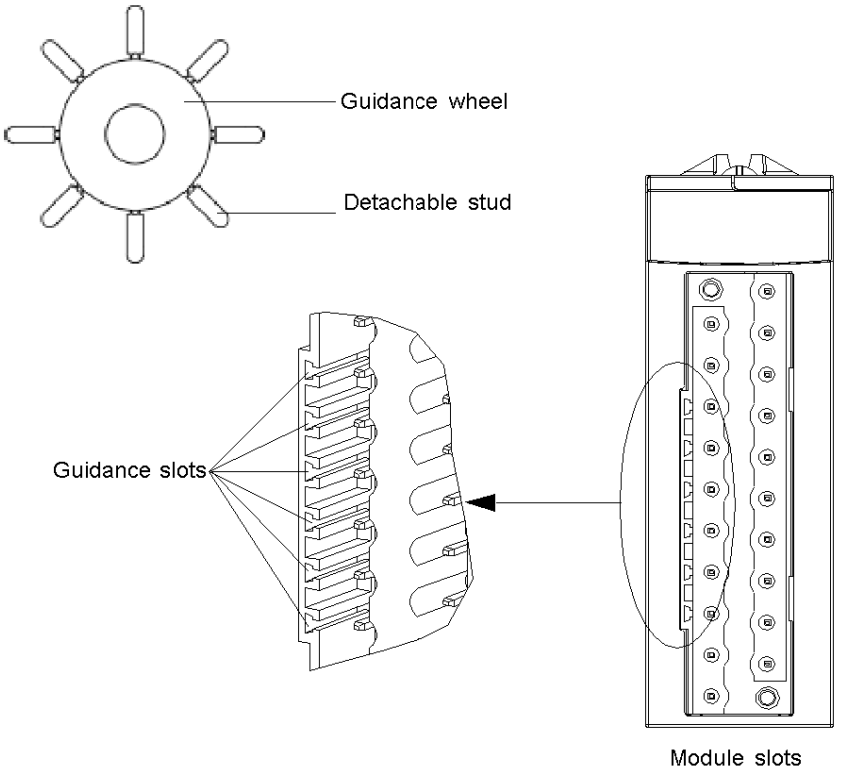
Coding the 20-Pin Terminal Block

When a 20-pin terminal block is installed on a module dedicated to this type of terminal block, you can code the terminal block and the module using studs. The purpose of the studs is to prevent the terminal block from being mounted on another module. Handling errors can then be avoided when replacing a module.

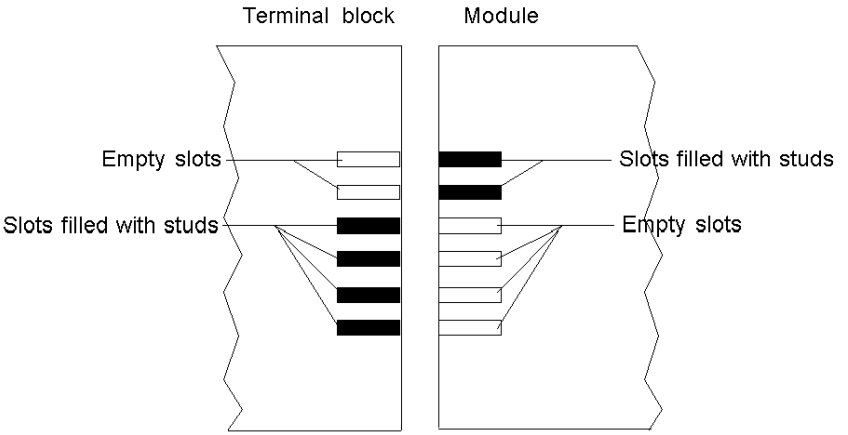
Coding is done by the user with the STB XMP 7800 guidance wheel's studs. You can only fill the 6 slots in the middle of the left side (as seen from the wiring side) of the terminal block, and can fill the module's 6 guidance slots on the left side.

To fit the terminal block to the module, a module slot with a stud must correspond to an empty slot in the terminal block, or a terminal block with a stud must correspond to an empty slot in the module. You can fill up to and including either of the 6 available slots as desired.

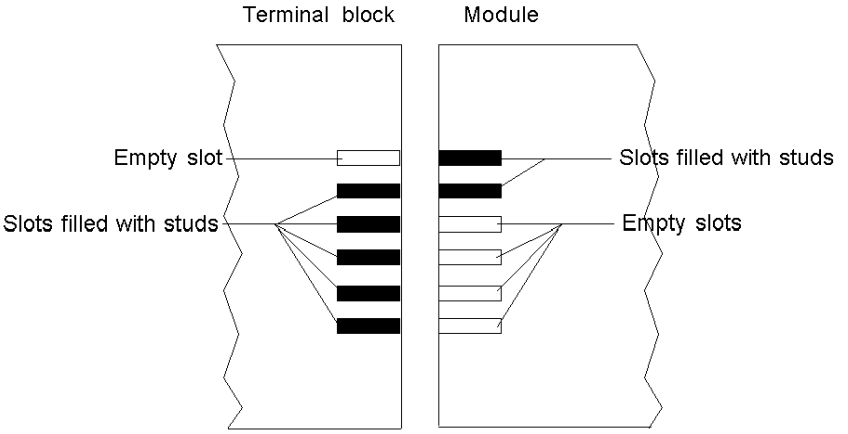
The diagram below shows a guidance wheel as well as the slots on the module used for coding the 20-pin terminal blocks:



The diagram below shows an example of a coding configuration that makes it possible to fit the terminal block to the module:



The diagram below shows an example of coding configuration with which it is not possible to fit the terminal block to the module:



⚠ DANGER

ELECTRICAL SHOCK

Terminal blocks must be connected or disconnected with sensor and pre-actuator voltage switched off.

Failure to follow these instructions will result in death or serious injury.

⚠ CAUTION

DESTRUCTION OF THE MODULE

Code the terminal block as described above to prevent the terminal block from being mounted on another module.

Plugging the wrong connector could cause the module to be destroyed.

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

⚠ CAUTION

UNEXPECTED BEHAVIOUR OF APPLICATION

Code the terminal block as described above to prevent the terminal block from being mounted on another module.

Plugging the wrong connector could cause unexpected behaviour of the application.

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

NOTE: The module connector have indicators which show the proper direction to use for terminal block installation.

How to Connect the BMX EHC 0800 Counting Module: Connecting a 20-Pin Terminal Block

At a Glance

There are 3 types of 20-pin terminal blocks:

- BMX FTB 2010 screw clamp terminal blocks,
- BMX FTB 2000 caged terminal blocks,
- BMX FTB 2020 spring terminal blocks.

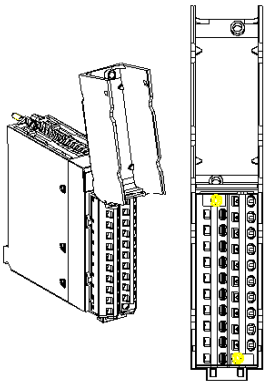
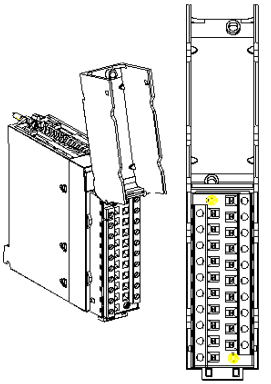
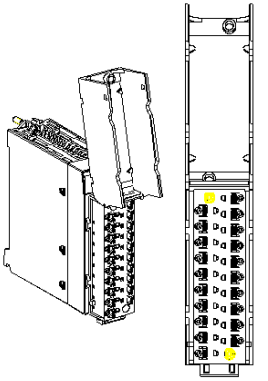
Cable Ends and Contacts

Each terminal block can accommodate:

- Bare wires
- Wires with DZ5-CE type cable ends: 

Description of the 20-Pin Terminal Blocks

The table below shows the description of the 3 types of 20-pin terminal blocks:

		Screw clamp terminal blocks	**Caged terminal blocks**	**Spring terminal blocks**
Illustration				
Number of wires accommodated		2	1	1
Number of wire gauges accommodated	minimum	AWG 24 (0.34 mm^2)		
	maximum	AWG 16 (1.5 mm^2)		

	Screw clamp terminal blocks	**Caged terminal blocks**	**Spring terminal blocks**
Wiring constraints	Screw clamps have slots that accept: ● flat-tipped screwdrivers with a diameter of 5 mm, ● posidriv n°1 cross-tipped screwdrivers. Screw clamp terminal blocks have captive screws. On the supplied blocks, these screws are not tightened.	Caged terminal blocks have slots that accept: ● flat-tipped screwdrivers with a diameter of 3 mm, ● posidriv n°1 cross-tipped screwdrivers. Caged terminal blocks have captive screws. On the supplied blocks, these screws are not tightened.	The wires are connected by pressing on the button located next to each pin. To press on the button, you have to use a flat-tipped screwdriver with a maximum diameter of 3 mm.
Maximum screw tightening torque	0.5 N.m.	0.5 N.m.	-

⚠ DANGER

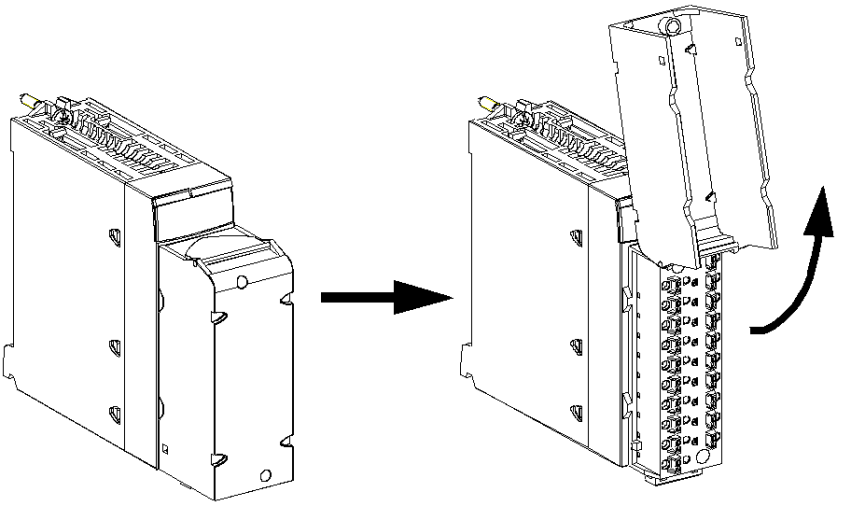
ELECTRICAL SHOCK

The terminal block must be connected or disconnected with sensor and pre-actuator voltage switched off.

Failure to follow these instructions will result in death or serious injury.

Connection of 20-Pin Terminal Blocks

The following diagram shows the method for opening the 20-pin terminal block door so that it can be wired:



NOTE: The connection cable is installed and held in place by a cable clamp positioned below the 20-pin terminal block.

Labeling of 20-Pin Terminal Blocks

The labels for the 20-pin terminal blocks are supplied with the module. They are to be inserted in the terminal block cover by the customer.

Each label has two sides:

- One side that is visible from the outside when the cover is closed. This side features the commercial product references, an abbreviated description of the module as well as a blank section for customer labeling.
- One side that is visible from the inside when the cover is open. This side shows the terminal block connection diagram.

BMX EHC 0800 Counting Module Hardware implementation

5

Subject of this Chapter

This chapter deals with the harware characteristics and diagnostics of the BMX EHC 0800 module.

What Is in This Chapter?

This chapter contains the following topics:

Characteristics of the BMX EHC 0800 Module and its Inputs

General Characteristics

This table presents the general characteristics for the **BMX EHC 0800** and BMX EHC 0800H *(see page 20)* modules:

Module type		8 counting channels	
Counter size		16 bits	
Maximum frequency at counting inputs		10 kHz	
Number of inputs/outputs per counting channel	Inputs	2 inputs in single mode 3 inputs in special dual phase mode	
	Outputs	0	
Power Supply	Sensor supply voltage	19.2...30 VDC	
	Module consumption	Does not take into account sensors or encoder consumption • All inputs OFF: typical: 15 mA • All inputs ON: typical: 80 mA	
Power distribution to sensors		No	
Hot replacement		Yes, under the following conditions: The module may be removed and reinserted into its location while the rack is switched on, but the counter may have to be revalidated when it is reinserted into its base.	
Dimensions	Width	Module only	32 mm
		On the rack	32 mm
	Height	Module only	103.76 mm
		On the rack	103.76 mm
	Depth	Module only	92 mm
		On the rack	104.5 mm
Encoder compliance		10...30 VDC incremental encoder model with push-pull at outputs	
Insulation voltage	Of the ground to the bus	1500 V RMS for 1 min	
Rack 24 V supply bus	Current for the 24 V bus	Typical: 40 mA	
Rack 3 V supply bus	Current for the 3 V bus	Typical: 200 mA	
Cycle Time		5 ms	

⚠ WARNING

OVERHEATING MODULE

Do not operate the **BMX EHC 0800H** at 70°C (158°F) if the sensor power supply is greater than 26.4 V or less than 21.1 V.

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

Input Characteristics

This table presents the general characteristics of the input channels for the module:

Number of inputs per channel			Two 24 VDC inputs
Inputs: IN_A, IN_AUX	Voltage		30 VDC
	At state 1	Voltage	11 VDC...30 VDC
		Current	4.5 mA (up to 30 VDC)
	At state 0	Voltage	< 5 VDC
		Current	< 1.5 mA
	Current at 11 VDC		> 2 mA

Display and Diagnostics of the BMX EHC 0800 Counting Module

At a Glance

The BMX EHC 0800 counting module has LEDs that enable the following to be viewed:

- the status of the module: RUN, ERR, I/O
- the input status of every channel

Illustration

The following drawing shows the display screen of the BMX EHC 0800 module:

Fault Diagnostics

The following table enables the diagnostics of errors according to the various LEDs.

Module status	LED indicators										
	RUN	ERR	I/O	C0	C1	C2	C3	C4	C5	C6	C7
The module is inoperative or switched off	○										
The module has an error	○	●	○								
The module is not configured	○	◍	○								
The module has lost communication	●	◍									
The sensors have a supply error	●	○	●	⊗							
The channels are operational	●	○	○								
The voltage is present at input IN_A of counter 0				●							
The voltage is present at input IN_A of counter 1					●						
The voltage is present at input IN_A of counter 2						●					
The voltage is present at input IN_A of counter 3							●				
The voltage is present at input IN_A of counter 4								●			
The voltage is present at input IN_A of counter 5									●		
The voltage is present at input IN_A of counter 6										●	
The voltage is present at input IN_A of counter 7											●

Module status	LED indicators										
	RUN	ERR	I/O	A0	A1	A2	A3	A4	A5	A6	A7
The channels are operational	●	○	○								
The voltage is present at input IN_AUX of counter 0				●							
The voltage is present at input IN_AUX of counter 1					●						
The voltage is present at input IN_AUX of counter 2						●					
The voltage is present at input IN_AUX of counter 3							●				
The voltage is present at input IN_AUX of counter 4								●			
The voltage is present at input IN_AUX of counter 5									●		
The voltage is present at input IN_AUX of counter 6										●	
The voltage is present at input IN_AUX of counter 7											●
Legend											
● LED on											
○ LED off											
⊗ LED flashing slowly											
⊘ LED flashing fast											
An empty cell indicates that the state of the LED(s) is not taken into account											

BMX EHC 0800 Module Wiring

At a Glance

The BMX EHC 0800 counting module uses a standard BMX FTB 2000/2010/2020 20-pin connector (wiring terminal) .

⚠ DANGER

HAZARD OF ELECTRIC SHOCK

- disconnect voltage supplying sensors and pre-actuators before plugging / unplugging the terminal block on the module.
- remove the terminal block before plugging / unplugging the module on the rack.

Failure to follow these instructions will result in death or serious injury.

Field Sensors

The module has type 3 inputs that support signals from mechanical switching equipment such as contact relays, push-buttons, limit switch sensors and two or three-wire switches that have:

- a voltage drop of less than 8V,
- current when ON more than or equal to 2 mA,
- current when OFF up to 1.5 mA.

The module complies with all encoders that have a supply of between 10 and 30 VDC and push-pull outputs. Shielding is required if there is no filtering.

Pin Assignments

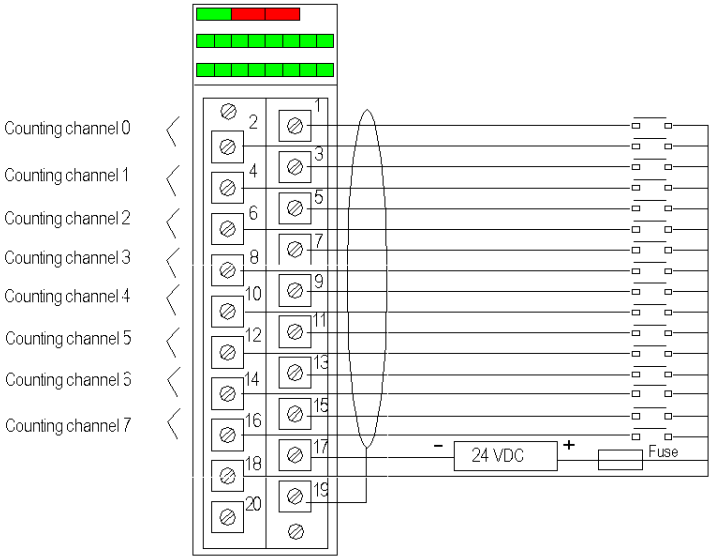
The following table describes the assignment of the 20-pin wiring terminal:

IN_A input for channel 0	2	1	IN_AUX input for channel 0
IN_A input for channel 1 or IN_B input for channel 0	4	3	IN_AUX input for channel 1
IN_A input for channel 2	6	5	IN_AUX input for channel 2
IN_A input for channel 3 or IN_B input for channel 2	8	7	IN_AUX input for channel 3
IN_A input for channel 4	10	9	IN_AUX input for channel 4
IN_A input for channel 5 or in_B input for channel 4	12	11	IN_AUX input for channel 5
IN_A input for channel 6	14	13	IN_AUX input for channel 6

IN_A input for channel 7 or IN_B input for channel 6	16	15	IN_AUX input for channel 7
VDC + power supply for sensors	18	17	Return + 24 V power supply for sensors
Functional earth, for shield continuation	20	19	Functional earth, for shield continuation

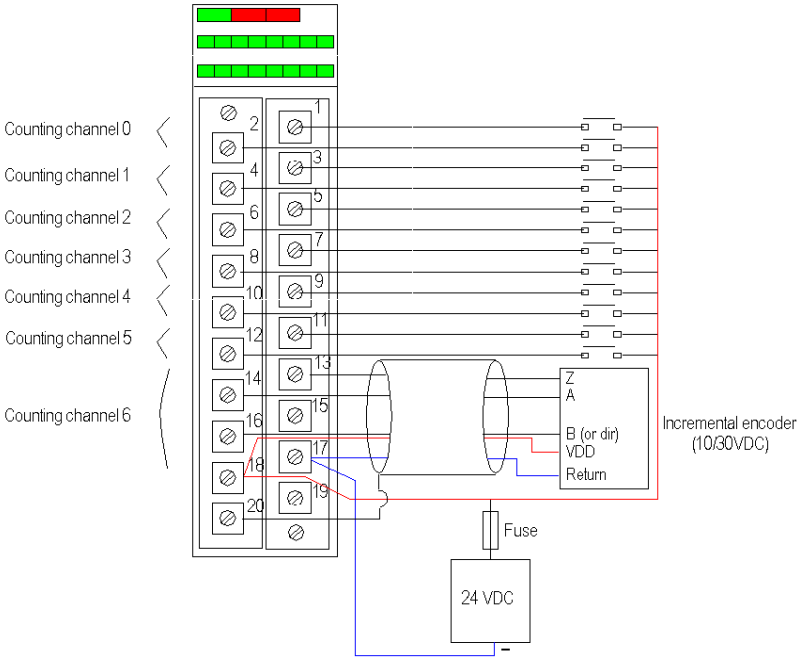
Sensor Connection Example

The example below shows the most complete application using sensors:



Encoder Connection Example

The example below shows an incremental encoder connection used for axis control connected to the counter's channel 6 used in dual phase counting mode:



Channels 0 to 5 are still used in single mode.

Channel 7 is no longer available.

Safety Instructions

⚠ WARNING

UNEXPECTED EQUIPMENT OPERATION

Follow those instructions to reduce electromagnetic perturbations:

- adapt the programmable filtering to the frequency applied at the inputs, or
- use a shielded cable (connected to the functional ground) connected to pins 15 and 16 of the connector when using an encoder or a fast detector.

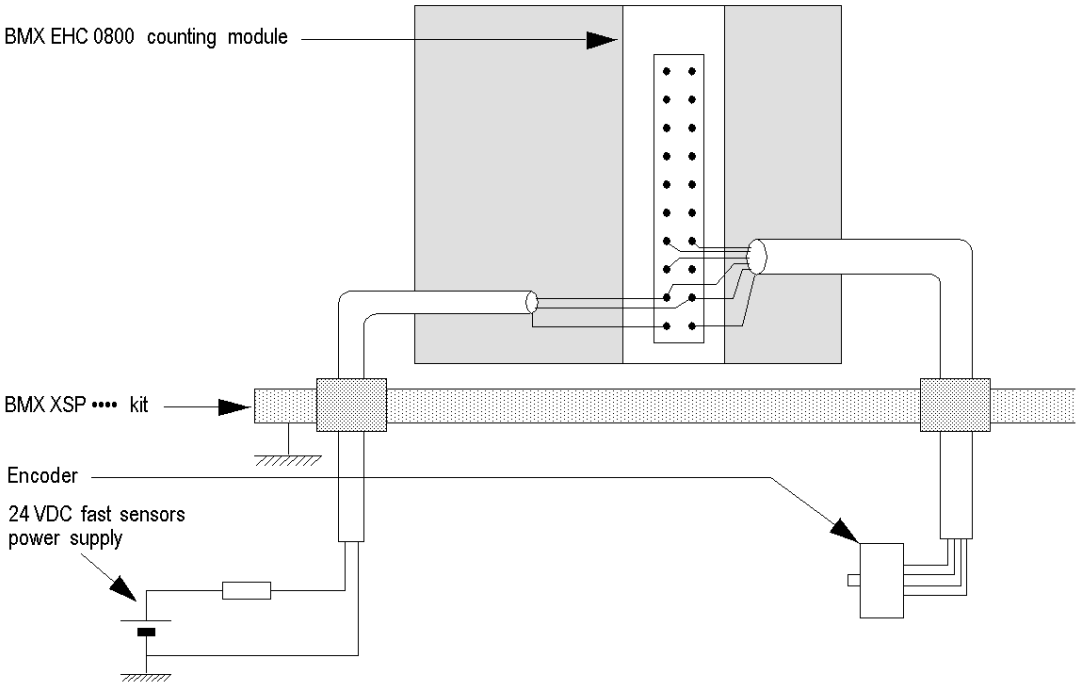
In a highly disturbed environment,

- use the BMX XSP 0400/0600/0800/1200 electromagnetic protection kit *(see Modicon M340 Using Unity Pro, Processors, Racks, and Power Supply Modules, Setup Manual)* (See Modicon M340 using Unity Pro, Processors, Racks and Power Supply Modules, BMX XSP xxx Protection Bar) to connect the shielding without programmable filtering and
- use a specific 24 VDC supply for inputs and a shielded cable for connecting the supply to the module.

Electromagnetic perturbations may cause the application to operate in an unexpected manner.

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

The figure below shows the recommended circuit for a highly disturbed environment using the BMX XSP 0400/0600/0800/1200 electromagnetic protection kit:



⚠ CAUTION

POTENTIAL MODULE DAMAGE - IMPROPER FUSE SELECTION

Use fast acting fuses to protect the electronic components of the module from overcurrent and reverse polarity of the input/output supplies. Improper fuse selection could result to damage to the module.

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

BMX EHC 0800 Counting Module Functionalities

III

BMX EHC 0800 Counting Module Functionalities

6

Subject of this Chapter

This chapter deals with functionalities and counting modes of the BMX EHC 0800 module.

What Is in This Chapter?

This chapter contains the following sections:

6.1 BMX EHC 0800 Module Configuration

Subject of this Section

This section deals with the configuration of the BMX EHC 0800 module.

What Is in This Section?

This section contains the following topics:

Input Interface Blocks

Description

The BMX EHC 0800 counting module has three fast inputs:

Fast Inputs

The table below presents the module's fast inputs.

Input	Use with available sensors	Use with an encoder
IN_A input	Clock input for measurement or single upcounting	For signal A
IN_B input From the following channel	Second clock input for differential counting or measurement	For signal B
IN_AUX input	Multi-function input used for: ● synchronization ● preset and start ● reset and record ● capture ● counting direction (upcounting/downcounting mode)	For signal Z Used for preset

Programmable Filtering

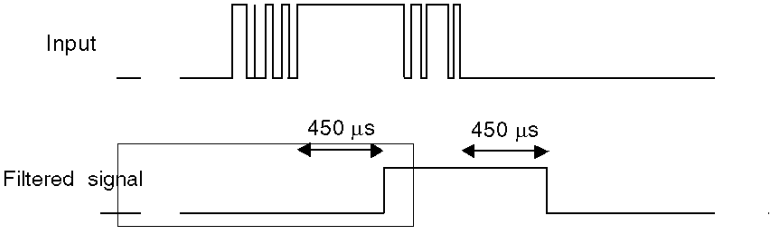
At a Glance

The BMX EHC 0800 counting module's two (or three) inputs are compatible with the use of mechanical switches.

A programmable debounce filter with 3 levels (low, medium and high) is available at every input.

Debounce Filter Diagram

The figure below shows the debounce filter in low mode:



In this mode, the system delays all transitions until the signal is stable for 450 µs.

Selecting the Filtering Level

The table below specifies the characteristics of each input for the selected level of filtering:

Filtering level	Input	Minimum pulse	Maximum frequency
None	IN_A, IN_B	50 µs	10 KHz
	IN_AUX	50 µs	40 Hz
Low for bounces > 2 KHz	IN_A, (IN_B)	450 µs	1 KHz
	IN_AUX	450 µs	40 Hz
Resource for bounces > 1 KHz	IN_A, IN_B	1.25 ms	350 Hz
	IN_AUX	1.25 µs	40 Hz
High for bounces > 250 Hz	IN_A, IN_B	4.2 ms	100 Hz
	IN_AUX	4.2 ms	40 Hz

Comparison

At a Glance

The comparison block operates automatically when it is enabled. It is available in all the BMX EHC 0800 module's counting modes.

It compares the current value of the counter together with the capture value at the defined threshold.

Comparison Threshold

The comparison block has one threshold only. Its value is contained in the `lower_th_value` double word (`%QDr.m.c.2`).

The threshold format is identical to the counter value format.

Comparison Status Register

The result of the comparison is stored in the comparison status register.

The value of the capture register and the current value of the counter are compared with the thresholds.

The possible results are:

- Low: The counter value is less than the lower threshold value.
- Equal: The counter value is equal to the threshold.
- High: The counter value is greater than the threshold.

The comparison status register consists of:

Position of the status register bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Compared element											Capture			Counter		
Comparison result											High	Equal	Low	High	Equal	Low

Update

When the `compare_enable_bit` is set to 0, the comparison status register is deleted.

When the `compare_suspend_bit` is set to 1, the comparison status register is frozen at its last value.

The comparison with capture register value is performed every time the registers are loaded.

The comparison with the counter current value is performed as follows:

Counting mode	**Comparison register update**
Frequency	Period intervals of 10 ms
Event counting	Period intervals defined by the user
Modulo loop counter	One of the following conditions: ● intervals of 5 ms ● counter reloading or resetting to 0 ● counting direction change ● counter stops ● crossing of threshold
One shot counter	
dual phase counting	
Up and down counting	

Diagnostics

Consistency Rules for Inputs Interface

The input interface requires that the sensor power supply remains active for counting operations.

When the sensor power supply interrupts lasts 1 ms or less, the counter remains stable.

In case of power interrupt is greater than 1 ms, all counter values are disabled.

By default, the sensor supply an error makes the `CH_ERROR` (`%Ir.m.c.ERR`) global status bit at the high level and the red led IO lighted.

The configuration screen allows to unlink the sensor supply an error to the `CH_ERROR` bit by configuring the parameter `Input Supply Fault` as `local` instead of `General IO Fault`.

In all cases, after having executed the `READ_STS (IODDT_VAR1)` instruction, the application provides the `%MWr.m.c.2` and `%MWr.m.c.3` standard status words including the supply an error information.

`IODDT_VAR1` is of the type `T_Unsigned_CPT_BMX` or `T_Signed_CPT_BMX`.

Explicit channel status words

The table below presents the composition of the `%MWr.m.c.2` and `%MWr.m.c.3` status words.

Status Word	Bit position	Designation
`%MWr.m.c.2`	0	External error at inputs
	4	Internal error or self-testing.
	5	Configuration Fault
	6	Communication Error
	7	Application error
`%MWr.m.c.3`	2	Sensor supply error

IO Data

All input/output statuses are provided in the channel data bits.

The table below shows the channel data bits:

Input/Output data field	Designation
`%Ir.m.c.4`	Electrical state of IN_A input
`%Ir.m.c.5`	Electrical state of IN_B input
`%Ir.m.c.6`	Electrical state of IN_AUX input

Synchronization, Enable, Reset to 0 and Capture Functions

Introduction

This section presents the functions used by the various counting modes of the BMX EHC 0800 module:

- Synchronization function
- Enable function
- Reset to 0 function
- Capture function

Each function uses at least one of the following two bits:

- `valid_(function)` bit: Setting this bit to 1 allows you to take into account the occurrence of an external event which activates the function. If this bit is set to 0, the event is not taken into account and does not activate the function. The `functions_enabling` word (`%QWr.m.c.0`) contains all the `valid_(function)` bits.
- `force_(function)` bit: Setting this bit to 1 allows you to activate the function irrespective of the status of the external event. All the `force_(function)` bits are `%Qr.m.c.4`...`%Qr.m.c.8` language objects.

Synchronization Function

The synchronization function is used to synchronize the counter operation upon a transition applied to the IN_AUX physical input or the `force_sync` bit set to 1.

This function is used in the following counting modes:

- Dual phase counting
- Modulo loop counter
- One shot counter
- Event counting
- Up and down counting (using the `force_sync` bit only)

In all of the counting modes specified above, with the exception of the up and down counting mode, the user may configure the `synchro edge` parameter in the configuration screen by choosing from the following two possibilities to configure the external event:

- Rising edge of the IN_AUX input
- Falling edge of the IN_AUX input

The following table presents the `force_sync` bit in bold which is an element of the `%Qr.m.c.d` output command word:

Language object	Standard symbol	Meaning
`%Qr.m.c.0`	OUTPUT_0	Forces OUTPUT_0 to level 1
`%Qr.m.c.1`	OUTPUT_1	Forces OUTPUT_1 to level 1
`%Qr.m.c.2`	OUTPUT_BLOCK_0_ENABLE	Implementation of output 0 function block
`%Qr.m.c.3`	OUTPUT_BLOCK_1_ENABLE	Implementation of output 1 function block
`%Qr.m.c.4`	**FORCE_SYNC**	**Counting function synchronization and start**
`%Qr.m.c.5`	FORCE_REF	Set to preset counter value
`%Qr.m.c.6`	FORCE_ENABLE	Implementation of counter
`%Qr.m.c.7`	FORCE_RESET	Reset counter
`%Qr.m.c.8`	SYNC_RESET	Reset SYNC_REF_FLAG
`%Qr.m.c.9`	MODULO_RESET	Reset MODULO_FLAG

The following table presents the `valid_sync` bit in bold which is an element of the `%QWr.m.c.0` function enabling word:

Language object	Standard symbol	Meaning
`%QWr.m.c.0.0`	**VALID_SYNC**	**Synchronization and start authorization for the counting function via the IN_SYNC input**
`%QWr.m.c.0.1`	VALID_REF	Operation authorization for the internal preset function
`%QWr.m.c.0.2`	VALID_ENABLE	Authorization of the counter enable via the IN_EN input
`%QWr.m.c.0.3`	VALID_CAPT_0	Capture authorization in the capture0 register
`%QWr.m.c.0.4`	VALID_CAPT_1	Capture authorization in the capture1 register
`%QWr.m.c.0.5`	COMPARE_ENABLE	Comparators operation authorization
`%QWr.m.c.0.6`	COMPARE_SUSPEND	Comparator frozen at its last value

The following table presents the synchronization principle:

Edge	Status of the `valid_sync` bit	Status of the counter
Rising or falling edge on IN_AUX (depending on the configuration)	Set to 0	Not synchronized
Rising or falling edge on IN_AUX (depending on the configuration)	Set to 1	Synchronized
Rising edge on `force_sync` bit	Set to 0 or 1	Synchronized

When the synchronization occurs, the application can react using:
- either the SYNC_REF_FLAG input (%IWr.m.c.0.2) *(see page 63)*
- or the EVT_SYNC_PRESET input (%IWr.m.c.10.2) *(see page 66)*.

Enable Function

This function is used to authorize changes to the counter value via software command.

This function is used in the following counting modes:
- Dual phase counting
- Up and down counting
- Modulo loop counter
- One shot counter

The following table presents the `force_enable` bit in bold which is an element of the `%Qr.m.c.d` output command word:

Language object	Standard symbol	Meaning
`%Qr.m.c.0`	OUTPUT_0	Forces OUTPUT_0 to level 1
`%Qr.m.c.1`	OUTPUT_1	Forces OUTPUT_1 to level 1
`%Qr.m.c.2`	OUTPUT_BLOCK_0_ENABLE	Implementation of output 0 function block
`%Qr.m.c.3`	OUTPUT_BLOCK_1_ENABLE	Implementation of output 1 function block
`%Qr.m.c.4`	FORCE_SYNC	Counting function synchronization and start
`%Qr.m.c.5`	FORCE_REF	Set to preset counter value
`%Qr.m.c.6`	**FORCE_ENABLE**	**Implementation of counter**
`%Qr.m.c.7`	FORCE_RESET	Reset counter
`%Qr.m.c.8`	SYNC_RESET	Reset SYNC_REF_FLAG
`%Qr.m.c.9`	MODULO_RESET	Reset MODULO_FLAG

The function is activated by setting the `force_enable` bit to 1. There is no `valid_enable` bit because the function is not activated by any physical input.

Reset to 0 Function

This function is used to load the value 0 into the counter via software command.

This function is used in the following counting modes:
- Dual phase counting
- Up and down counting
- Modulo loop counter
- One shot counter

The following table presents the `force_reset` bit in bold which is an element of the `%Qr.m.c.d` output command word:

Language object	Standard symbol	Meaning
`%Qr.m.c.0`	OUTPUT_0	Forces OUTPUT_0 to level 1
`%Qr.m.c.1`	OUTPUT_1	Forces OUTPUT_1 to level 1
`%Qr.m.c.2`	OUTPUT_BLOCK_0_ENABLE	Implementation of output 0 function block
`%Qr.m.c.3`	OUTPUT_BLOCK_1_ENABLE	Implementation of output 1 function block
`%Qr.m.c.4`	FORCE_SYNC	Counting function synchronization and start
`%Qr.m.c.5`	FORCE_REF	Set to preset counter value
`%Qr.m.c.6`	FORCE_ENABLE	Implementation of counter
`%Qr.m.c.7`	**FORCE_RESET**	**Reset counter**
`%Qr.m.c.8`	SYNC_RESET	Reset SYNC_REF_FLAG
`%Qr.m.c.9`	MODULO_RESET	Reset MODULO_FLAG

The function is activated by the rising edge of the `force_reset` bit. There is no `valid_reset` bit because the function is not activated by any physical input.

Capture Function

This function is used to load the current counter value into the `capt_0_val` register (`%IDr.m.c.14`) at the same condition defined by the synchro edge parameter configured in the configuration screen *(see page 58)*.

Each BMX EHC 0800 module channel has one capture register.

This function is used in the following counting modes:
- Dual phase counting
- Modulo loop counter

The synchronization and capture functions may be enabled independently:

Status of the `valid_capt_0` bit (`%QWr.m.c.0.3`)	**Status of the `valid_sync` bit (`%QWr.m.c.0.0`)**	**Behavior while the capture condition (condition defined by the `synchro edge` parameter) is true**	
		Current counter value	**`Capture` register value (`%ID r.m.c.14`)**
Set to 0	Set to 0	No change	No change
Set to 0	Set to 1	Reload or clear	No change
Set to 1	Set to 0	No change	Reload with current counter value
Set to 1	Set to 1	Reload or clear	Reload with current counter value The storage will occur just before reseting the counter value.

Modulo Flag and Synchronization Flag

At a Glance

This section presents the operation of the bits relating to the following events:

- Counter synchronization event
- Counter rollovers the modulo or its limits in forward or reverse.

The table below presents the counting modes that may activate synchronization and modulo events:

Flag	Counting mode concerned
`sync_ref_flag` bit (`%IWr.m.c.0.2`)	• Dual phase counting: When the counter presets and (re)starts • Up and down counting: When the counter presets and (re)starts • Modulo loop counter: When the counter resets • One shot counter: When the counter presets and (re)starts • Event counting: When the internal time base restarts to the beginning.
`modulo_flag` bit (`%IWr.m.c.0.1`	• Dual phase counting: When the counter rollovers its limits • Up and down counting: When the counter rollovers its limits • Modulo loop counter: When the counter rollovers the modulo or 0.

You can use these 2 flags without declaring any event task in configuration screen. These 2 flag bits are refreshed by the task declared with the module channel (MAST or FAST task).

Operation of the Flag Bits

The synchronization event's flag bit is set to 1 when a counter synchronization occurs.

The modulo event's flag bit can be set to 1 in the following counting modes:

- Dual phase counting: The flag bit is set to 1 when the counter rollovers its limits in forward or reverse
- Up and down counting: The flag bit is set to 1 when the counter rollovers its limits in forward or reverse
- Modulo loop counter: The flag bit is set to 1 when the counter rollovers the modulo.

Location of the Flag Bits

The following table presents the `modulo_flag` and `sync_ref_flag` bits which are elements of the `%IWr.m.c.d` status word:

Language object	Standard symbol	Meaning
`%IWr.m.c.0.0`	RUN	The counter operates in one shot mode only
`%IWr.m.c.0.1`	**MODULO_FLAG**	**Flag set to 1 by a modulo switch event**
`%IWr.m.c.0.2`	**SYNC_REF_FLAG**	**Flag set to 1 by a preset or synchronization event**
`%IWr.m.c.0.3`	VALIDITY	The current numerical value is valid
`%IWr.m.c.0.4`	HIGH_LIMIT	The current numerical value is locked at the upper threshold value
`%IWr.m.c.0.5`	LOW_LIMIT	The current numerical value is locked at the lower threshold value

Resetting the Flag Bits to 0

The user application must reset the flag bit to 0 (if it is active) by using the appropriate command bit from the following two bits:

- `sync_reset` bit to reset the synchronization event's flag bit to 0
- `modulo_reset` bit to reset the modulo event's flag bit to 0

Location of Reset to 0 Commands

The following table presents the `sync_reset` and `modulo_reset` bits which are elements of the `%Qr.m.c.d` output command word:

Language object	Standard symbol	Meaning
`%Qr.m.c.0`	OUTPUT_0	Forces OUTPUT_0 to level 1
`%Qr.m.c.1`	OUTPUT_1	Forces OUTPUT_1 to level 1
`%Qr.m.c.2`	OUTPUT_BLOCK_0_ENABLE	Implementation of output 0 function block
`%Qr.m.c.3`	OUTPUT_BLOCK_1_ENABLE	Implementation of output 1 function block
`%Qr.m.c.4`	FORCE_SYNC	Counting function synchronization and start
`%Qr.m.c.5`	FORCE_REF	Set to preset counter value
`%Qr.m.c.6`	FORCE_ENABLE	Implementation of counter

Language object	Standard symbol	Meaning
%Qr.m.c.7	FORCE_RESET	Reset counter
%Qr.m.c.8	**SYNC_RESET**	**Reset SYNC_REF_FLAG**
%Qr.m.c.9	**MODULO_RESET**	**Reset MODULO_FLAG**

Sending Counting Events to the Application

At a Glance

The event task number must be declared in the module's configuration screen to enable the events sending.

The BMX EHC 0800 module has eight event sources contained in the `events_source` word at the address `%IWr.m.c.10`:

Address	Standard Symbol	Description	Counting mode concerned
`%IWr.m.c.10.0`	EVT_RUN	Event due to start of counting.	One Shot Counter mode
`%IWr.m.c.10.1`	EVT_MODULO	Event due to counter being equal to modulo value - 1 or equal to value 0.	• Modulo Loop Counter mode • Up and Down Counter mode • Dual Phase Counter mode
`%IWr.m.c.10.2`	EVT_SYNC_PRESET	Event due to a synchronization or counter homing.	• Event Counter mode • One Shot Counter mode • Modulo Loop Counter mode • Dual Phase Counter mode
`%IWr.m.c.10.3`	EVT_COUNTER_LOW	Event due to counter being less than threshold.	• Frequency Counter mode • Event Counter mode • One Shot Counter mode • Modulo Loop Counter mode • Up and Down Counter mode • Dual Phase Counter mode
`%IWr.m.c.10.4`	EVT_COUNTER_ WINDOW	Event due to counter being equal to threshold.	
`%IWr.m.c.10.5`	EVT_COUNTER_HIGH	Event due to counter being greater than threshold.	• Frequency Counter mode • Event Counter mode • One Shot Counter mode • Modulo Loop Counter mode • Up and Down Counter mode • Dual Phase Counter mode
`%IWr.m.c.10.6`	EVT_CAPT_0	Event due to capture 0.	• Modulo Loop Counter mode • Up and Down Counter mode • Dual Phase Counter mode
`%IWr.m.c.10.7`	EVT_CAPT_1	Event due to capture 1.	
`%IWr.m.c.10.8`	EVT_OVERRUN	Event due to overrun.	• Frequency Counter mode • Event Counter mode • One Shot Counter mode • Modulo Loop Counter mode • Up and Down Counter mode • Dual Phase Counter mode

All the events sent by the module, whatever their source, call the same single event task in the PLC.

There is normally only one type of event indicated per call.

The evt_sources (%IWr.m.c.10) is updated at the start of the event task processing.

Enabling Events

In order for a source to produce an event, the validation bit corresponding to the event must be set to 1:

Address	Description
%QWr.m.c.1.0	Start of counting event validation bit.
%QWr.m.c.1.1	Counter rollovering modulo, 0 or its limits event validation bit.
%QWr.m.c.1.2	Synchronization or counter homing event validation bit.
%QWr.m.c.1.3	Counter less than threshold event validation bit.
%QWr.m.c.1.4	Counter equal to threshold event validation bit.
%QWr.m.c.1.5	Counter greater than threshold event validation bit.
%QWr.m.c.1.6	Capture 0 event validation bit.

Input Interface

The event only has one input interface. This interface is only updated at the start of the event task processing. The interface consists of:

- The evt_sources word (%IWr.m.c.10)
- The current value of the counter during the event (or an approximate value) contained in the counter_current_value word (%IDr.m.c.12)
- The capt_0_val register (%IDr.m.c.14) updated if the event is the capture 0.

Operating Limits

Each counter channel can produce a maximum of one event per millisecond, but this flow may be slowed down by simultaneously sending events to several modules on the PLC bus.

Each counter channel has a two slot transmission buffer which can be used to store several events while waiting to be sent.

If the counter channel is unable to send all of the internally produced events, the overrun_evt bit (address %IWr.m.c.10.8) of the events_source word is set to 1.

The following two points should be taken into account before using the "Counter equal", "Counter high" and "Counter low" events:

- For frequency mode: due to the accuracy (+/-1 Hz), a frequency near the threshold can cause redundant events.
- For counting function modes: when the counter matches the threshold value, the input frequency must be lower than 400 Hz in order to detect the event.

6.2 BMX EHC 0800 Module Operation Modes

Subject of this Section

This section deals with the different counting modes of the BMX EHC 0800 module.

What Is in This Section?

This section contains the following topics:

BMX EHC 0800 Module Operation in Frequency Mode

At a Glance

Using the frequency counting mode allows you to measure the flow frequency, speed, rate and control.

Basic Principle

In this mode, the module monitors the pulses applied only to the IN_A input and calculates the number of pulses in time intervals of 1s. The current frequency is then shown in number of events per second (Hertz). The counting register is updated at the end of each 10 ms interval.

Counter Status Bits in Frequency Mode

The table below shows the composition of the counter's `%IWr.m.c.0` status word in frequency mode.

Bit	Label	Description
`%IWr.m.c.0.3`	VALIDITY	Validity bit is used to indicate that the counter current value (frequency) and compare status registers contain valid data. If the bit is set to 1, the data is valid. If the bit is set to 0, the data is not valid.
`%IWr.m.c.0.4`	HIGH_LIMIT	The bit is set to 1 when the input frequency signal is out of range.

Type of the IODDT

In this mode, the type of the IODDT must be T_UNSIGNED_CPT_BMX.

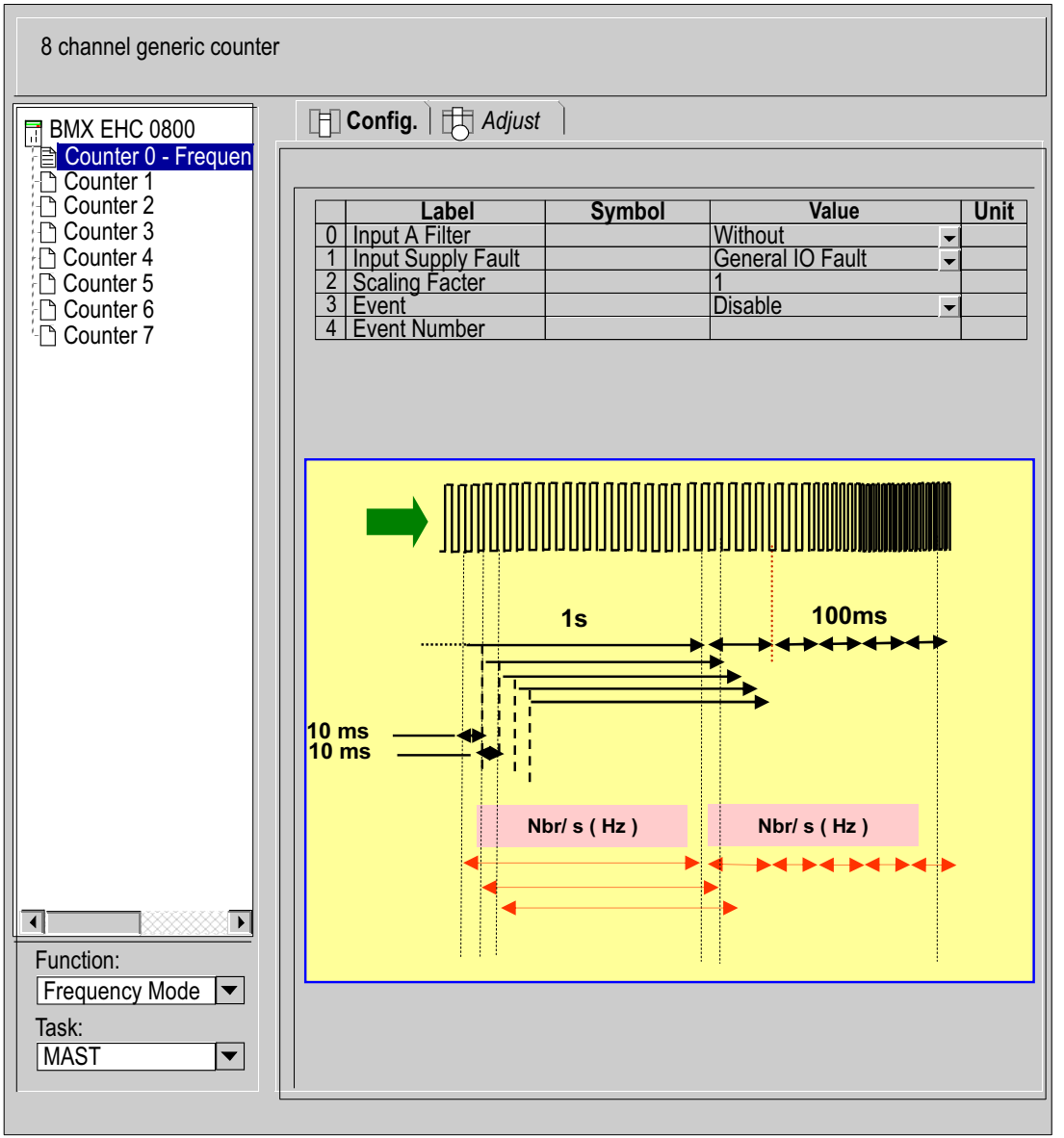
Operating Limits

The maximum frequency that the module can measure on the IN_A input is 10 kHz. Beyond 10 kHz, the counting register value may decrease until it reaches 0.

At 10 KHz, the duty cycle is 40% to 60%.

NOTE: You have to check the `validity` bit (`%IWr.m.c.0.3`) before taking into account the numerical values such as the counter and the capture registers. Only the `validity` bit at the high level (set to 1) guarantees that the mode will operate correctly within the limits.

The following diagram presents the BMX EHC counting module operation in frequency mode.



BMX EHC 0800 Module Operation in Event Counting Mode

At a Glance

Using the event counting mode allows you to determine the number of events received in a scattered manner.

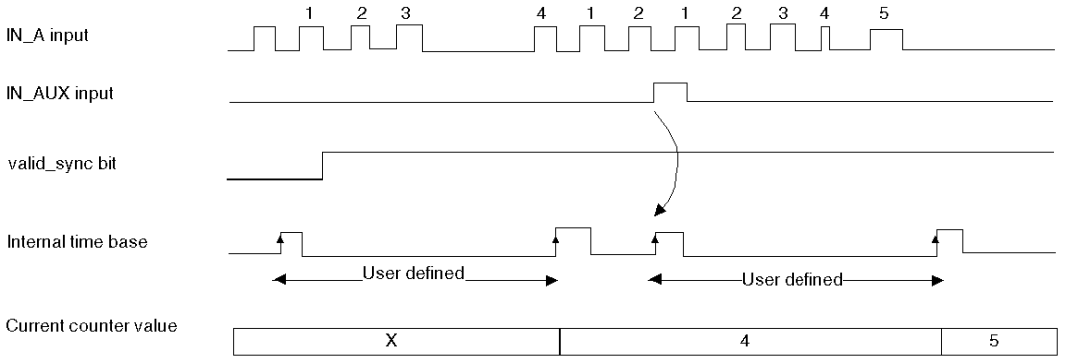
Basic Principle

In this mode, the counter assesses the number of pulses applied at the IN_A input, at time intervals defined by the user. The counting register is updated at the end of each interval with the number of events received.

It is possible to optionally use the IN_AUX input over a time interval, provided that the validation bit is set to 1. This leads to restarting the event counting for a new predefined time interval. Depending on the selection made by the user, the time interval starts at the rising edge or at the falling edge on the IN_AUX input.

Operation

The trend diagram illustrates the counting process in event counting mode



When the synchronization occurs, the application can react using :

- either the SYNC_REF_FLAG input (%IWr.m.c.0.2) *(see page 63)*
- or the EVT_SYNC_PRESET input (%IWr.m.c.10.2) *(see page 66)*.

Counter Status Bits in Event Counting Mode

The table below shows the composition of the counter's %IWr.m.c.0 status word in event counting mode.

Bit	Label	Description
%IWr.m.c.0.2	SYNC_REF_FLAG	The bit is set to 1 when the internal time base has been synchronized. The bit is set to 0 when the sync_reset command is received (rising edge of the %Qr.m.c.8 bit).
%IWr.m.c.0.3	VALIDITY	Validity bit is used to indicate that the counter current value (events number) and compare status registers contain valid data. If the bit is set to 1, the data is valid. If the bit is set to 0, the data is not valid.
%IWr.m.c.0.4	HIGH_LIMIT	The bit is set to 1 when the number of received events exceeds the counter size. The bit is reset to 0 at the next period if the limit is not reached.
%IWr.m.c.0.5	LOW_LIMIT	The bit is set to 1 when more than one synchronization is received within 25 ms period. The bit is reset to 0 at the next period if the limit is not reached.

Type of the IODDT

In this mode, the type of the IODDT is T_UNSIGNED_CPT_BMX.

Operating Limits

The module counts the pulses applied at the IN_A input every time the pulse is at least 50 µs (without debounce filter).

Pulses within 100 ms from synchronization are lost.

The synchronization of the counter must not be done more than one time per 25 ms.

NOTE: You have to check the validity bit (%IWr.m.c.0.3) before taking into account the numerical values such as the counter and the capture registers. Only the validity bit at the high level (set to 1) guarantees that the mode will operate correctly within the limits.

BMX EHC 0800 Module Operation in One Shot Counter Mode

At a Glance

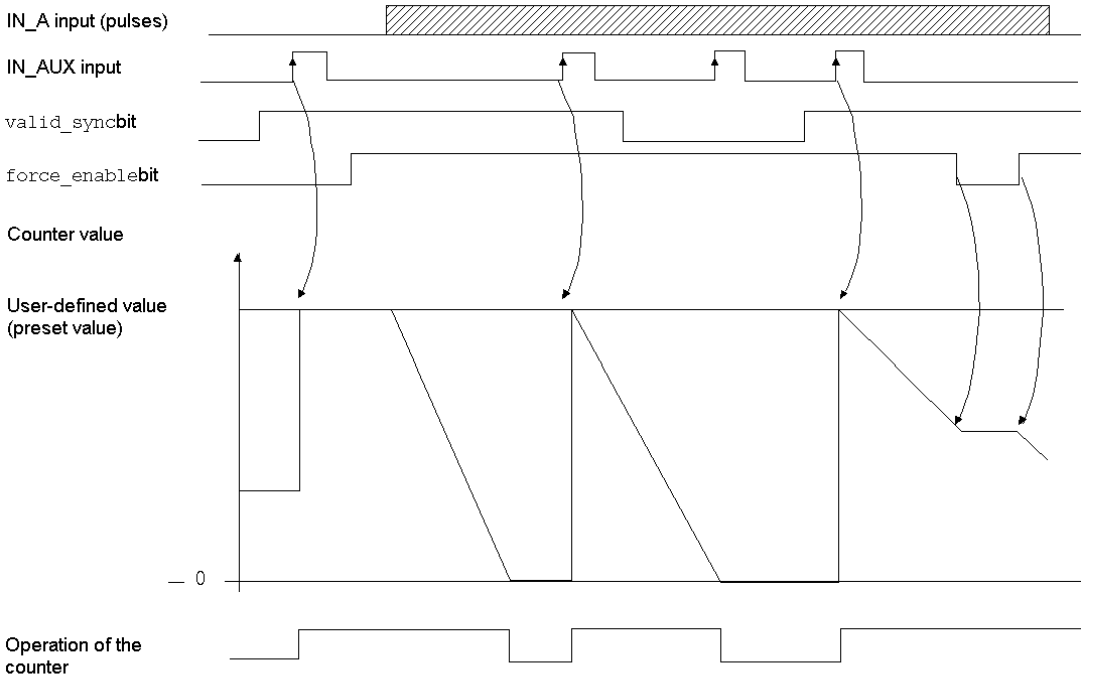
Using the one shot counter mode allows you to quantify a group of parts.

Basic Principle

In this mode, activating the synchronization function starts the counter which, starting from a value defined by the user in the adjust screen (`preset value`), decreases with every pulse applied to the IN_A input until it reaches the value 0. Downcounting is made possible when the enable function is activated. The counting register is thus updated every 5 ms.

Operation

The trend diagram illustrates the one shot counter mode process:



In the trend diagram above, we can see that the counter starts downcounting at the IN_AUX input's rising edge. The counter loads the value defined by the user and decrements the counting register with every pulse applied to the IN_A input. When the register is set to 0, the counter awaits a new signal from the IN_AUX input. The IN_A input pulses have no effect on the register value as long as the counter is set to 0.

The `force_enable` command must be at the high level during the counting. When this command is at the low level, the last value reported in the counting register is maintained and the counter ignores the pulses applied to the IN_A input. However, it does not ignore the IN_AUX input status. In all cases, the counting resumes when the command reverts to the high level.

Counter Status Bits in One shot Counter Mode

The table below shows the composition of the counter's %IWr.m.c.0 status word in one shot counter mode:

Bit	Label	Description
%IWr.m.c.0.0	RUN	The bit is set to 1 when the counter is running. The bit is set to 0 when the counter is stopped.
%IWr.m.c.0.2	SYNC_REF_FLAG	The bit is set to 1 when the counter has been set to the preset value and (re)started. The bit is reset to 0 when the sync_reset command is received (rising edge of the %Qr.m.c.8 bit).
%IWr.m.c.0.3	VALIDITY	Validity bit is used to indicate that the counter current value and compare status registers contain valid data. If the bit is set to 1, the data is valid. If the bit is set to 0, the data is not valid.

Type of the IODDT

In this mode, the type of the IODDT is T_UNSIGNED_CPT_BMX.

Operating Limits

The maximum frequency that can be applied to the IN_AUX input is 1 pulse every 25 ms.

The maximum preset value is 65,535.

NOTE: You have to check the validity bit (%IWr.m.c.0.3) before taking into account the numerical values such as the counter and the capture registers. Only the validity bit at the high level (set to 1) guarantees that the mode will operate correctly within the limits.

BMX EHC 0800 Module Operation in Modulo Loop Counter Mode

At a Glance

The use of the modulo loop counter mode is recommended for packaging and labeling applications for which actions are repeated for series of moving objects.

Basic Principle

The counter increases with every pulse applied to the IN_A input until it reaches the modulo value -1, the modulo value being defined by the user. At the following pulse, the counter is reset to 0 and the counting resumes.

In the modulo loop counter mode, the counter must be synchronized at least one time to operate. The current counter value is cleared each time the synchronization occurs.

The current counter value can be recorded into the capture0 register *(see page 61)* when the condition of synchronization occurs *(see page 58)*.

The modulo value defined by the user is contained in the `modulo_value` word (`%MDr.m.c.4`). The user may change this value by specifying the value of this word:

- In the adjust screen
- In the application, using the `WRITE_PARAM(IODDT_VAR1)` Function. `IODDT_VAR1` is of the type `T_UNSIGNED_CPT_BMX`.

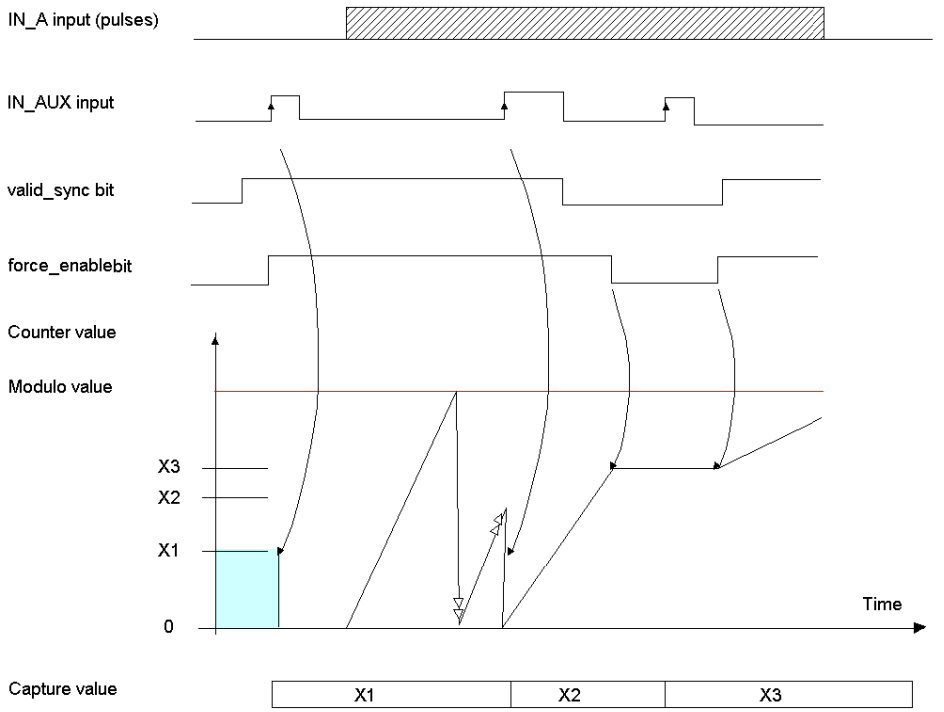
The `force_enable` command must be at the high level during the counting. When this command is at the low level, the last value reported in the counting register is maintained and the counter ignores the pulses applied to the IN_A input. However, it does not ignore the IN_AUX input status. In all cases, the counting resumes when the command reverts to the high level.

In this mode, the counting register is updated at 5 ms intervals.

Unlike for the BMX EHC 0200 module, there is no downcounting.

Operation

The trend diagram below illustrates the modulo counting process:



Counter Status Bits in Modulo Loop Counter Mode

The table below shows the composition of the counter's %IWr.m.c.0 status word in modulo loop counter mode:

Bit	Label	Description
%IWr.m.c.0.1	MODULO_FLAG	The bit is set to 1 when the counter rollovers the modulo and is . The bit is reset to 0 when the command MODULO_RESET (%Qr.m.c.9) is received (rising edge of the MODULO_RESET bit).
%IWr.m.c.0.2	SYNC_REF_FLAG	The bit is set to 1 when the counter have been set to 0 and (re)started. The bit is reset to 0 when the command SYNC_RESET (%Qr.m.c.8) is received (rising edge of the SYNC_RESET bit).
%IWr.m.c.0.3	VALIDITY	Validity bit is used to indicate that the counter current value and compare status registers contain valid data. If the bit is set to 1, the data is valid. If the bit is set to 0, the data is not valid.

Type of the IODDT

In this mode, the type of the IODDT must be T_UNSIGNED_CPT_BMX.

Operating Limits

The maximum frequency applied to the IN_A input is 10 kHz.

The shortest pulse applied to the IN_AUX input varies according to the level of filtering selected.

The maximum frequency that can be applied to the IN_AUX input is 1 pulse every 5 ms.

The maximum frequency for the modulo event is once every 5 ms.

The minimum acceptable modulo value varies according to the frequency at the IN_A input. E.g.: for a frequency of 10 kHz applied to the IN_A input, the modulo must be greater than 50.

The maximum modulo value is 65,535.

NOTE: When the modulo value is configured to 0, it is possible to count up to 65,536.

NOTE: You have to check the `validity` bit (`%IWr.m.c.0.3`) before taking into account the numerical values such as the counter and the capture registers. Only the `validity` bit at the high level (set to 1) guarantees that the mode will operate correctly within the limits.

BMX EHC 0800 Module Operation in Upcounting and Downcounting Mode

At a Glance

Using the upcounting and downcounting mode allows for an accumulation, upcounting or downcounting operation on a single input.

Basic Principle

In this mode, the counting starts with the `force_sync` software command. On the rising edge, the counting register is updated with the preset value predefined by the user. The preset value is contained in the `preset_value` word (`%MDr.m.c.6`). The user may change this value by specifying the value of this word:

- In the adjust screen
- In the application, using the `WRITE_PARAM(IODDT_VAR1)` Function. `IODDT_VAR1` is of the type `T_SIGNED_CPT_BMX`.

The following processing occurs at each pulse applied to the IN_A input:

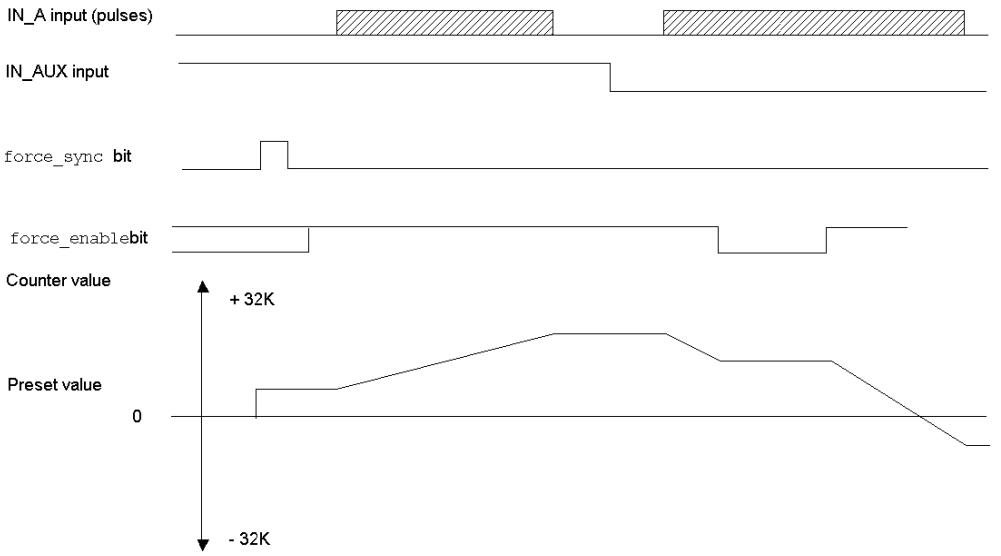
- Pulse counting if the IN_AUX input is high
- Pulse downcounting if the IN_AUX input is low

The `force_enable` software command must be at the high level during the counting. When this command is at the low level, the last value reported in the counting register is maintained and the counter ignores the pulses applied to the IN_A input. The counting resumes when the command reverts to the high level.

Counting values vary between –32,768 and +32,767.

Operation

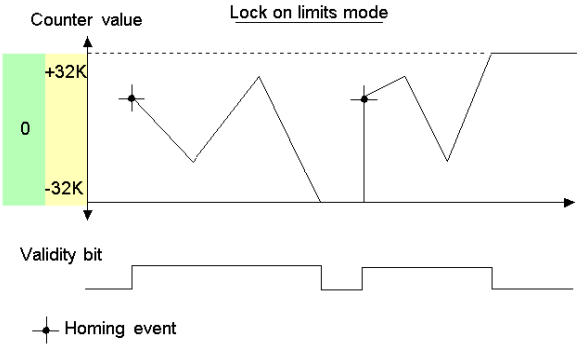
The trend diagram below illustrates the modulo up & down counting mode process:


IN_A input (pulses)
IN_AUX input
force_sync bit
force_enablebit
Counter value
+ 32K
Preset value
0
- 32K

Behavior at the Counting Limits

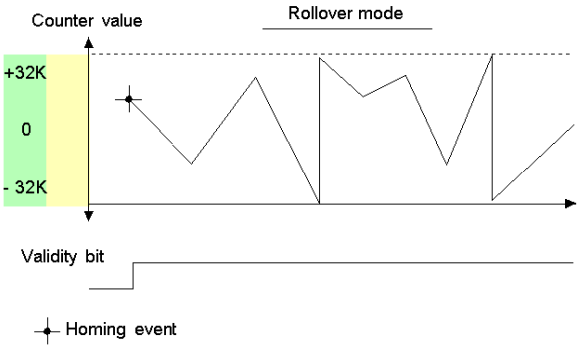
When the upper or lower limit is exceeded, the counter behaves differently according to its configuration.

In the lock on limits sub-mode, the counting register maintains the limit value and the counting validity bit changes to 0:



NOTE: Overflow and underflow are indicated by two bits `LOW_LIMIT` and `HIGH_LIMIT` until the application reloads the counting value predefined by the user (`force_sync` bit set to 1 or preset condition true). The upcounting or downcounting may therefore be resumed.

In the rollover sub-mode, the counting register automatically switches to the limit value opposed to overflow:



Counter Status Bits in Up and Down Counting Mode

The table below shows the composition of the counter's %IWr.m.c.0 status word in up and down counting mode:

Bit	Label	Description
%IWr.m.c.0.1	MODULO_FLAG	The bit status changes in the rollover mode. The bit is set to 1 when the counter rollovers its limits (-32,768 or +32,767). The bit is reset to 0 when the command MODULO_RESET (%Qr.m.c.9) is received (rising edge of the MODULO_RESET bit).
%IWr.m.c.0.2	SYNC_REF_FLAG	The bit is set to 1 when the counter have been set to the preset value and (re)started. The bit is reset to 0 when the command SYNC_RESET (%Qr.m.c.8) is received (rising edge of the SYNC_RESET bit).
%IWr.m.c.0.3	VALIDITY	Validity bit is used to indicate that the counter current value and compare status registers contain valid data. If the bit is set to 1, the data is valid. If the bit is set to 0, the data is not valid.
%IWr.m.c.0.4	HIGH_LIMIT	The bit status changes in the lock on limits mode. The bit is set to 1 when the counter reaches +32,767. The bit is reset to 0 when the counter presets or resets.
%IWr.m.c.0.5	LOW_LIMIT	The bit status changes in the lock on limits mode. The bit is set to 1 when the counter reaches -32,768. The bit is reset to 0 when the counter presets or resets.

Type of the IODDT

In this mode, the type of the IODDT must be T_SIGNED_CPT_BMX.

Operating Limits

The maximum frequency applied to the IN_A input is 10 kHz.

Pulses applied at the IN_A input, after a change of direction, are only upcounted or downcounted after a delay that corresponds to the delay in acknowledging the IN_AUX input status due to the level of filtering programmable on this input.

Preset value must be between –32,768 and +32,767.

NOTE: You have to check the validity bit (%IWr.m.c.0.3) before taking into account the numerical values such as the counter and the capture registers. Only the validity bit at the high level (set to 1) guarantees that the mode will operate correctly within the limits.

BMX EHC 0800 Module Operation in Dual Phase Counting Mode

At a Glance

The dual phase counting mode is available for channels 0, 2, 4, and 6 (channels 1, 3, 5 and 7 become inactive). It behaves like the up and down counting mode and uses up to three physical inputs. It enables simultaneous upcounting and downcounting.

Basic Principle

In the Dual phase counting mode, the counter must be synchronized at least one time to operate. The current counter value is preset each time the synchronization occurs. The current counter value can be recorded into the `capture0` register when the condition of synchronization occurs.

For further information, you may see the synchronization function *(see page 58)* and the capture function *(see page 61)*.

The `force_enable` software command must be at the high level during the counting. When this command is at the low level, the last value reported in the counting register is maintained and the counter ignores the pulses applied to the IN_A and IN_B inputs. The counting resumes when the command reverts to the high level.

Counting values vary between the limits -2,147,483,648 and +2,147,483,647 (31-bit word and one sign bit).

The preset value is predefined by the user and is contained in the `preset_value` word (`%MDr.m.c.6`). The user may change this value by specifying the value of this word:

- In the adjust screen
- In the application, using the `WRITE_PARAM(IODDT_VAR1)` Function. `IODDT_VAR1` is of the type `T_Signed_CPT_BMX`.

Counting Configurations

In this mode, the user may select one of the following counting configurations:

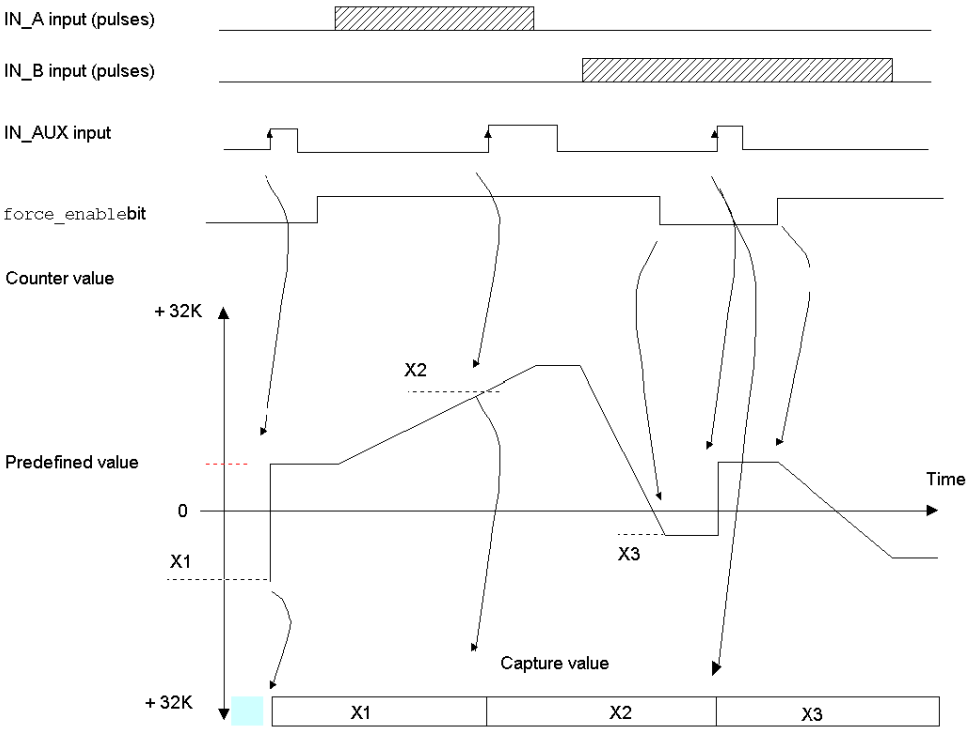
- A = Up, B = Down (default configuration)
- A = Impulse, B = Direction
- Normal Quadrature X1
- Normal Quadrature X2
- Normal Quadrature X4
- Reverse Quadrature X1
- Reverse Quadrature X2
- Reverse Quadrature X4.

The following table shows the upcounting and downcounting principle according to the selected configuration:

Selected configuration	Upcounting condition	Downcounting condition
A = Up, B = Down	Rising edge at the IN_A input.	Rising edge at the IN_B input.
A = Impulse, B = Direction	Rising edge at the IN_A input and low state at the IN_B input.	Rising edge at the IN_A input and high state at the IN_B input.
Normal Quadrature X1	Rising edge at the IN_A input and low state at the IN_B input.	Falling edge at the IN_A input and low state at the IN_B input.
Normal Quadrature X2	Rising edge at the IN_A input and low state at the IN_B input. Falling edge at the IN_A input and high state at the IN_B input.	Falling edge at the IN_A input and low state at the IN_B input. Rising edge at the IN_A input and high level at the IN_B input.
Normal Quadrature X4	Rising edge at the IN_A input and low state at the IN_B input. High state at the IN_A input and rising edge at the IN_B input. Falling edge at the IN_A input and high state at the IN_B input. Low state at the IN_A input and falling edge at the IN_B input.	Falling edge at the IN_A input and low state at the IN_B input. Low state at the IN_A input and rising edge at the IN_B input. Rising edge at the IN_A input and high level at the IN_B input. High state at the IN_A input and falling edge at the IN_B input.
Reverse Quadrature X1	Falling edge at the IN_A input and low state at the IN_B input.	Rising edge at the IN_A input and low state at the IN_B input.
Reverse Quadrature X2	Falling edge at the IN_A input and low state at the IN_B input. Rising edge at the IN_A input and high level at the IN_B input.	Rising edge at the IN_A input and low state at the IN_B input. Falling edge at the IN_A input and high state at the IN_B input.
Reverse Quadrature X4	Falling edge at the IN_A input and low state at the IN_B input. Low state at the IN_A input and rising edge at the IN_B input. Rising edge at the IN_A input and high level at the IN_B input. High state at the IN_A input and falling edge at the IN_B input.	Rising edge at the IN_A input and low state at the IN_B input. High state at the IN_A input and rising edge at the IN_B input. Falling edge at the IN_A input and high state at the IN_B input. Low state at the IN_A input and falling edge at the IN_B input.

Operation

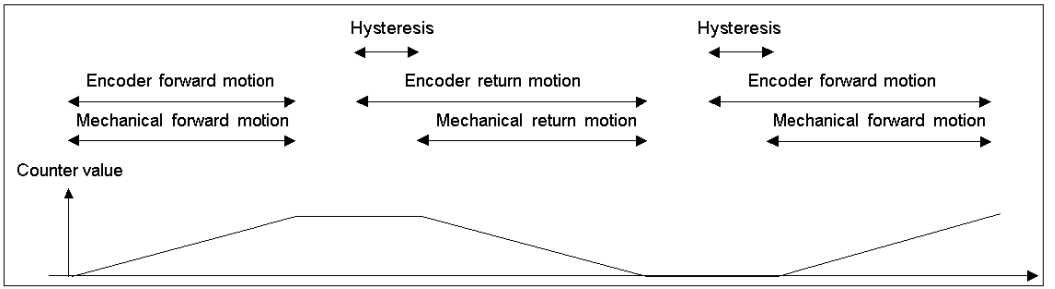
The trend diagram below illustrates the counting process for the dual phase counting mode in default configuration:



Slack Delete

In the free large counter mode, the counter may apply a hysteresis if the rotation is inverted. The `hysteresis` parameter configured with the adjust screen defines the number of points that are not acknowledged by the counter during the rotation inversion. This aims to take into account the slack between the encoder/motor axis and the mechanical axis (e.g. an encoder measuring the position of a mat).

This behavior is described in the following figure:



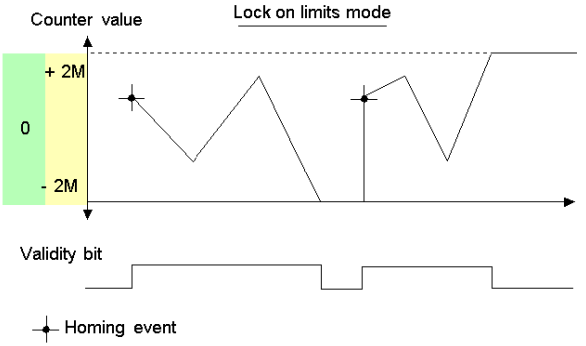
The value defined by the user as the `Hysteresis (slack)` value is contained in the `%MWr.m.c.9` word. The user may change this value by specifying the value of this word (this value is from 0 to 255):

- In the adjust screen
- In the application by using the `WRITE_PARAM(IODDT_VAR1)` Function. `IODDT_VAR1` is of the type `T_Signed_CPT_BMX`.

Behavior at the Counting Limits

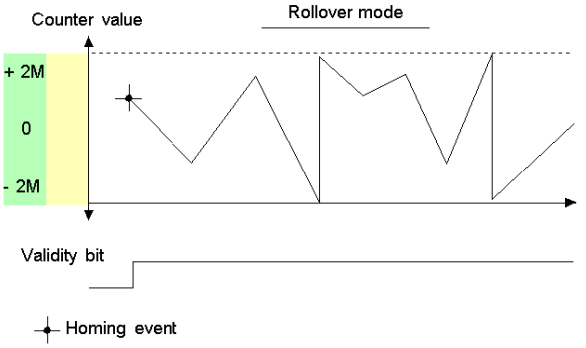
When the upper or lower limit is exceeded, the counter behaves differently according to its configuration.

In the lock on limits default configuration, the counting register maintains the limit value and the counting validity bit changes to 0 until the next preset condition occurs:



NOTE: Overflow and underflow are indicated by two bits `LOW_LIMIT` and `HIGH_LIMIT` until the application reloads the counting value predefined by the user (`force_ref` bit set to 1 or preset condition true). The upcounting or downcounting may therefore resume.

In the rollover configuration, the counting register automatically switches to the limit value opposed to overflow



Counter Status Bits in Dual Phase Counting Mode

The table below shows the composition of the counter's %IWr.m.c.0 status word in dual phase counting mode:

Bit	Label	Description
%IWr.m.c.0.1	MODULO_FLAG	The bit status changes in the rollover mode. The bit is set to 1 when the counter rollovers its limits (-2,147,483,648 or +2,147,483,647). The bit is reset to 0 when the command MODULO_RESET (%Qr.m.c.9) is received (rising edge of the MODULO_RESET bit).
%IWr.m.c.0.2	SYNC_REF_FLAG	The bit is set to 1 when the counter have been set to the preset value and (re)started. The bit is reset to 0 when the command SYNC_RESET (%Qr.m.c.8) is received (rising edge of the SYNC_RESET bit).
%IWr.m.c.0.3	VALIDITY	Validity bit is used to indicate that the counter current value and compare status registers contain valid data. If the bit is set to 1, the data is valid. If the bit is set to 0, the data is not valid.
%IWr.m.c.0.4	HIGH_LIMIT	The bit status changes in the lock on limits mode. The bit is set to 1 when the counter reaches +2,147,483,647. The bit is reset to 0 when the counter presets.
%IWr.m.c.0.5	LOW_LIMIT	The bit status changes in the lock on limits mode. The bit is set to 1 when the counter reaches -2,147,483,648. The bit is reset to 0 when the counter presets.

Type of the IODDT

In this mode, the type of the IODDT must be T_SIGNED_CPT_BMX.

Operating Limits

The maximum frequency applied to the IN_A and IN_B inputs is 10 kHz.

The shortest pulse applied to the IN_AUX input is defined according to the level of filtering applied to the input.

The maximum loading frequency for the value predefined by the user is once every 25 ms.

NOTE: You have to check the `validity` bit (`%IWr.m.c.0.3`) before taking into account the numerical values such as the counter and the capture registers. Only the `validity` bit at the high level (set to 1) guarantees that the mode will operate correctly within the limits.

BMX EHC 0800 Counting Module Software Implementation

IV

Subject of this Part

This part describes the software implementation and functions of the BMX EHC 0800 counting module.

What Is in This Part?

This part contains the following chapters:

Software Implementation Methodology for the BMX EHC 0800 Counting Module

7

Installation Methodology

At a Glance

The software installation of the BMX EHC **** counting modules is carried out from the various Unity Pro editors:

- in offline mode,
- in online mode.

The following order of installation phases is recommended but it is possible to change the order of certain phases (for example, starting with the configuration phase).

Installation Phases

The following table shows the different installation phases:

Phase	Description	Mode
Declaration of variables	Declaration of IODDT-type variables for the application-specific modules and variables of the project.	Offline(1)
Programming	Project programming.	Offline(1)
Configuration	Declaration of modules.	Offline
	Module channel configuration	
	Entering the configuration parameters **Note:** All the parameters are configurable online except the `event` parameter.	Offline(1)
Association	Association of IODDTs with the channels configured (variable editor)	Offline(1)
Build	Project generation (analysis and editing of links)	Offline
Transfer	Transfer project to PLC	Online

Phase	Description	Mode
Adjustment/Debugging	Debug project from debug screens, animation tables	Online
	Debugging the program and adjustment parameters	
Documentation	Building documentation file and printing miscellaneous information relating to the project	Online(1)
Operation/Diagnostic	Displaying miscellaneous information necessary for supervisory control of the project	Online
	Diagnostics of project and modules	
Key:		
(1)	These various phases can also be performed in online mode	

Accessing the Functional Screens of the BMX EHC xxxx Counting Modules

8

Subject of this Chapter

This chapter describes the various functional screens of the BMX EHC •••• counting modules to which the user has access.

What Is in This Chapter?

This chapter contains the following topics:

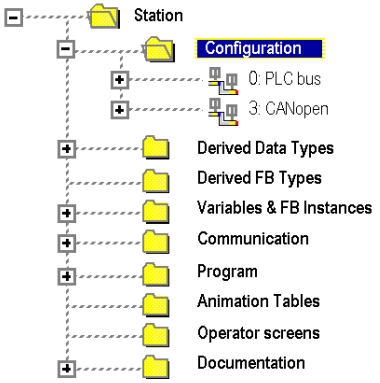
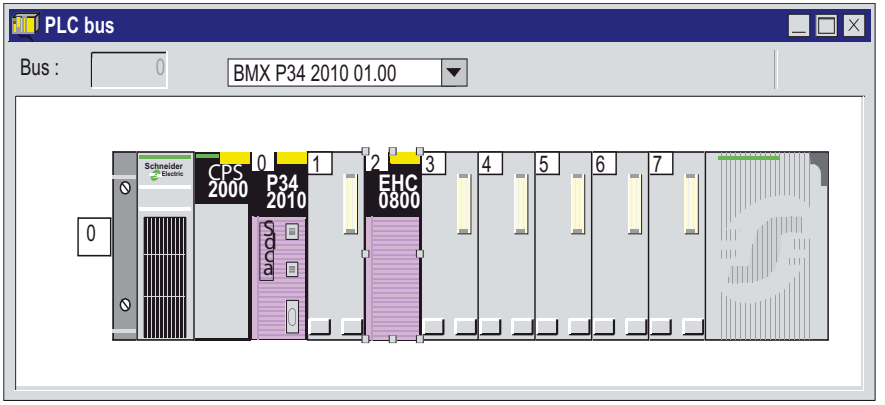
Accessing the Functional Screens of the BMX EHC 0800 Counting Modules

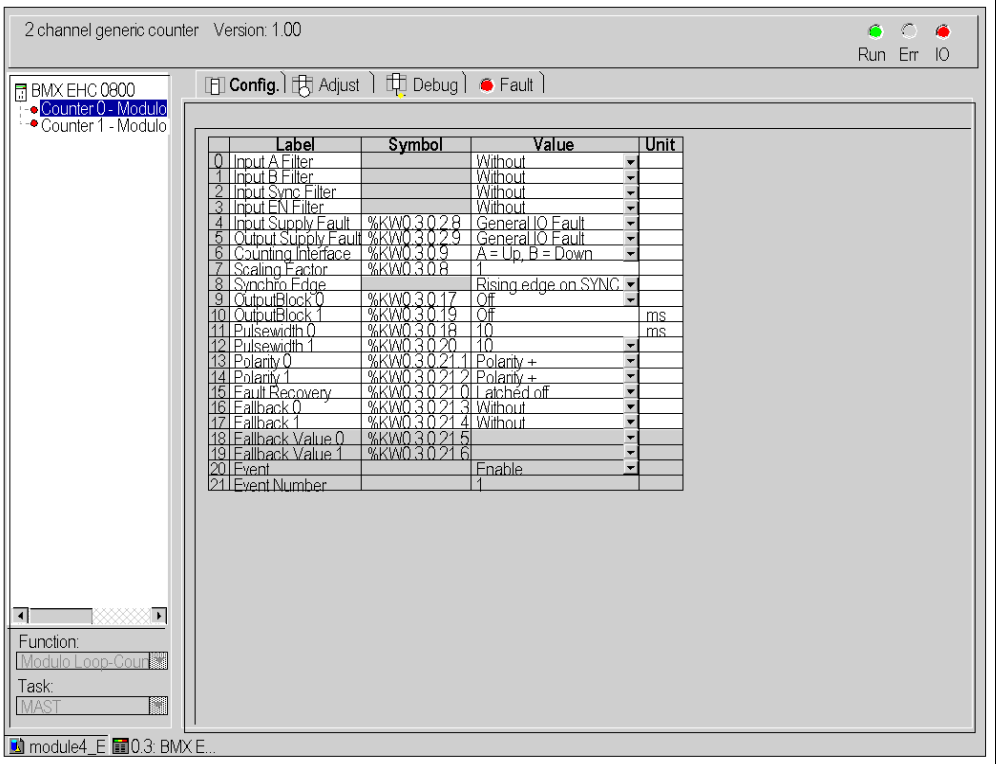
At a Glance

This section describes how to access the functional screens of the BMX EHC 0800 counting module.

Procedure

To access the screens, execute the following actions:

Step	Action
1	Expand the Configuration directory in the project browser. **Result**: the following screen appears: 
2	Double-click on the PLC Bus directory. **Result**: the following screen appears: 

Step	Action
3	Double-click on the counting module. **Result**: the module screen appears: 

Description of the Counting Module Screens

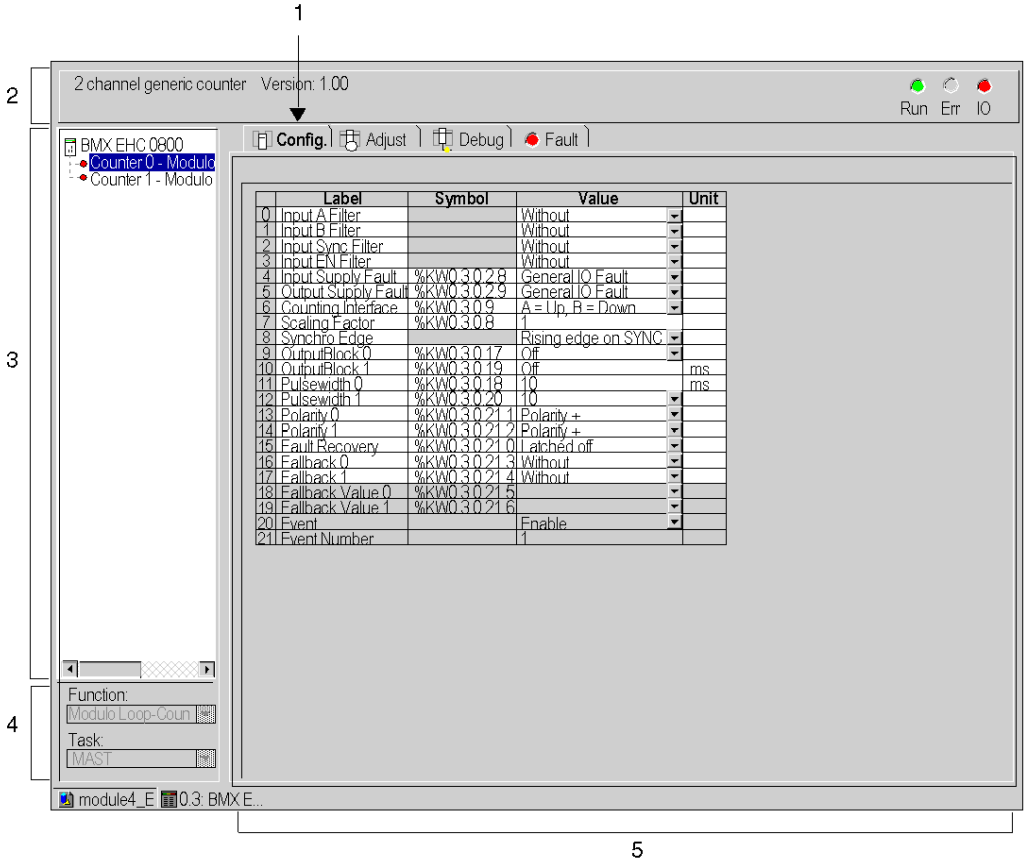
Introduction

The various available screens for the BMX EHC 0800 counting module are:

- Configuration screen
- Adjust screen
- Debug screen (can only be accessed in online mode)
- Faults screen (can only be accessed in online mode)

Description of the Screens

The following diagram presents the counting modules configuration screen.



The following table presents the parts of the various screens.

Number	Element	Function
1	Tabs	The tab in the foreground indicates the mode in progress (**Configuration** in this example). Every mode can be selected using the respective tab. The available modes are: ● **Configuration** ● **Adjust** ● **Debug** (which can only be accessed in online mode) ● **Faults** (which can only be accessed in online mode)
2	**Module** area	Provides an abbreviation as a reminder of the module and module status in online mode (LEDs).

3	**Channel** area	Is used:
		● By clicking on the reference number, to display the tabs:
		  ● **Description** which gives the characteristics of the device.
		  ● **I/O Objects** which is used to presymbolize the input/output objects.
		  ● **Faults** which shows the device errors (in online mode).
		● To select a channel.
		● To display the **Symbol**, name of the channel defined by the user (using the variable editor).

4	**General parameters** area	Allows you to select the counting function and the task associated with the channel: ● **Function:** counting function among those available for the modules involved. Depending on this choice, the headings of the configuration area may differ. By default, no function is configured. ● **Task:** defines the **MAST** or **FAST** task through which the channel's implicit exchange objects will be exchanged. These choices are only possible in offline mode.
5	**Parameters in progress** area	This area has various functionalities which depend upon the current mode: ● **Configuration**: is used to configure the channel parameters. ● **Adjust**: consists of various sections to be completed (parameter values), displayed according to the choice of counting function. ● **Debug**: displays the status of the inputs and outputs, as well as the various parameters of the current counting function. ● **Faults**: displays the errors that have occurred on the counting channels.

Configuration of the BMX EHC 0800 Counting Module

9

Subject of this Chapter

This chapter deals with the configuration of the BMX EHC 0800 counting module. This configuration can be accessed from the Configuration tab on the functional screens of BMX EHC 0800 *(see page 98)* module.

What Is in This Chapter?

This chapter contains the following sections:

9.1 Configuration Screen for BMX EHC xxxx Counting Modules

Subject of this Section

This section presents the configuration screen for BMX EHC •••• counting modules in a Modicon M340 local rack and in X80 drop.

What Is in This Section?

This section contains the following topics:

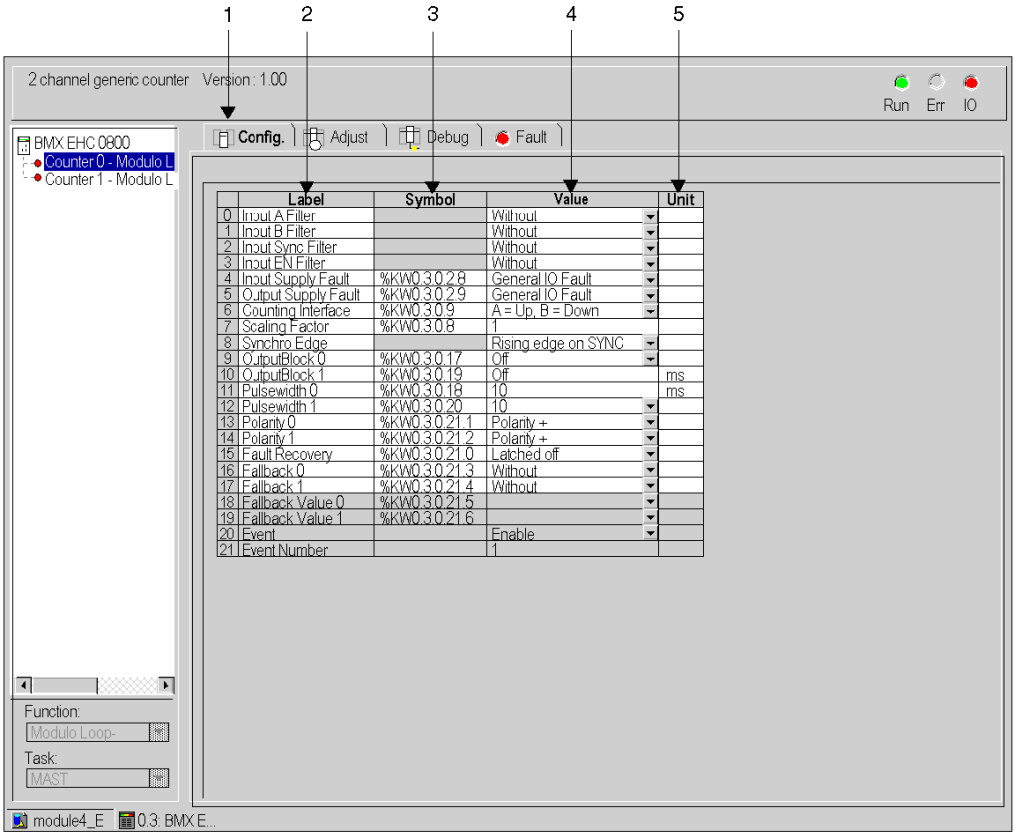
Configuration Screen for the BMX EHC 0800 Counting Module in a Modicon M340 Local Rack

At a Glance

This section presents the configuration screen for the BMX EHC 0800 counting module.

Illustration

The figure below presents the configuration screen for the BMX EHC 0800 module in modulo loop counter mode:



NOTE: When adding a BMX EHC 0800 in a local rack the defaut function is **Frequency mode**

Description of the Screen

The following table presents the various parts of the above screen:

Number	Element	Function
1	Tab	The tab in the foreground indicates the current mode. The current mode is therefore the configuration mode in this example.
2	**Label** field	This field contains the name of each variable that may be configured. This field may not be modified.
3	**Symbol** field	This field contains the address of the variable in the application. This field may not be modified.
4	**Value** field	If this field has a downward pointing arrow, you can select the value of each variable from various possible values in this field. The various values can be accessed by clicking on the arrow. A drop-down menu containing all the possible values is displayed and the user may then select the required value of the variable.
5	**Unit** field	This field contains the unit of each variable that may be configured. This field may not be modified.

Configuration Screen for the BMX EHC 0800 Counting Module in X80 Drop

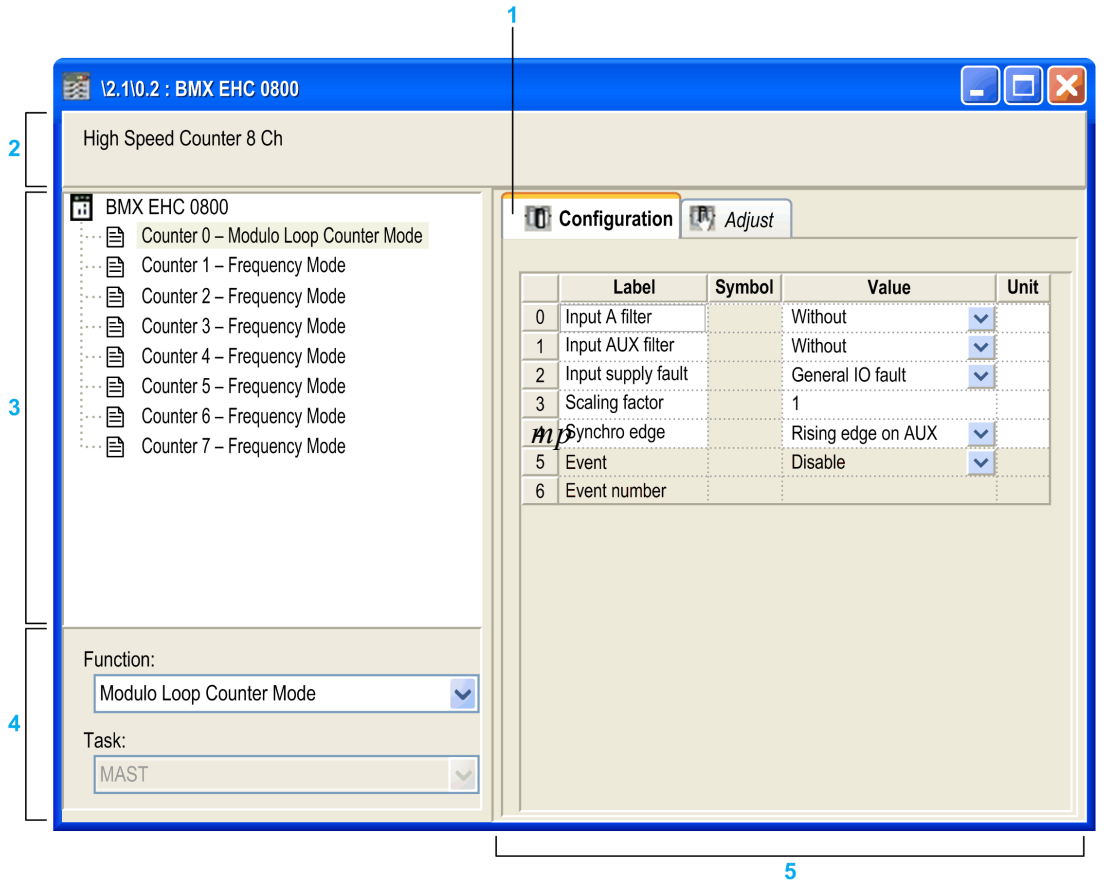
Introduction

The various available screens for the BMX EHC 0800 counting module are:

- **Configuration** screen
- **Adjust** screen

Description of the Screens

The following diagram presents the counting modules configuration screen.



The following table presents the parts of the various screens.

Number	Element	Function
1	Tabs	The tab in the foreground indicates the mode in progress (**Configuration** in this example). Every mode can be selected using the respective tab. The available modes are: ● **Configuration** ● **Adjust**
2	**Module** area	Provides an abbreviation as a reminder of the module and module status in online mode (LEDs). Is used: ● By clicking on the reference number, to display the tabs: ● **Device DDT**

3	**Channel** area	Is used:
		● By clicking on the reference number, to display the tabs:
		  ● **Description** which gives the characteristics of the device.
		  ● **Device DDT**
		● To select a channel.
		● To display the **Symbol**, name of the channel defined by the user (using the variable editor).
		NOTE: All channel are activated and a channel can not be desactivated to **None**

4	**General parameters** area	Allows you to select the counting function and the task associated with the channel: ● **Function:** counting function among those available for the modules involved. Depending on this choice, the headings of the configuration area may differ. By default, **Frequency Mode** is configured. ● **Task:** defines the **MAST** task through which the channel's implicit exchange objects will be exchanged. These choices are only possible in offline mode.
5	**Parameters in progress** area	This area has various functionalities which depend upon the current mode: ● **Configuration**: is used to configure the channel parameters. ● **Adjust**: consists of various sections to be completed (parameter values), displayed according to the choice of counting function. **NOTE:** The Input and Output fault parameters are set by default with the value **Local** or **General IO Fault**.

9.2 Configuration of Modes for the BMX EHC 0800 Module

Subject of this Section

This section deals with the configuration of the modes for the BMX EHC 0800 counting module.

What Is in This Section?

This section contains the following topics:

Frequency Mode Configuration

At a Glance

The configuration of a counting module is stored in the configuration constants (%KW).

The parameters r,m and c shown in the following tables represent the topologic addressing of the module. Each parameter had the following signification:

- r: represents the rack number,
- m:represents the position of the module on the rack,
- c: represents the channel number.

Configuration Objects

The table below presents the frequency mode configurable elements.

Label	Address in the configuration	Configurable values
Counting mode	%KWr.m.c.2 (least significant byte)	Frequency mode. The value of the least significant byte of this word is 1.
IN_A input filter	%KWr.m.c.3 (least significant byte)	The least significant byte can take the following values: • 0: none, • 1: low, • 2: medium, • 3: high.
Input power supply error	%KWr.m.c.2.8	General input/output error (bit set to 0) Local (bit set to 1)
Scale factor	%KWr.m.c.6 (least significant byte)	Edit (value in the range 1...255)
Event Event number	%KWr.m.c.0	Activated (if activated is selected, the entered event number is coded on the most significant byte of this word) Deactivated (all bits of the most significant byte of this word are set to 1)

Event Counting Mode Configuration

At a Glance

The configuration of a counting module is stored in the configuration constants (%KW).

The parameters r,m and c shown in the following tables represent the topologic addressing of the module. Each parameter had the following signification:

- r: represents the rack number,
- m:represents the position of the module on the rack,
- c: represents the channel number.

Configuration Objects

The table below presents the event counting mode configurable elements.

Label	Address in the configuration	Configurable values
Counting mode	%KWr.m.c.2 (least significant byte)	Event counting mode. The value of the least significant byte of this word is 2.
IN_A input filter	%KWr.m.c.3 (least significant byte)	The least significant byte can take the following values: • 0: none, • 1: low, • 2: medium, • 3: high.
IN_AUX input filter	%KWr.m.c.4 (least significant byte)	The least significant byte can take the following values: • 0: none, • 1: low, • 2: medium, • 3: high.
Input power supply error	%KWr.m.c.2.8	General input/output error (bit set to 0) Local (bit set to 1)
Synchronization edge	%KWr.m.c.10.8 (most significant byte)	Rising edge at the IN_SYNC input (bit set to 0) Falling edge at the IN_SYNC input (bit set to 1)
Time base	%KWr.m.c.7	This word can take the following values: • 0: 0.1 s, • 1: 1 s, • 2: 10 s, • 3: 1 min
Event Event number	%KWr.m.c.0	Activated (if activated is selected, the entered event number is coded on the most significant byte of this word) Deactivated (all bits of the most significant byte of this word are set to 1)

One Shot Counter Mode Configuration

At a Glance

The configuration of a counting module is stored in the configuration constants (%KW).

The parameters r,m and c shown in the following tables represent the topologic addressing of the module. Each parameter had the following signification:

- r: represents the rack number,
- m:represents the position of the module on the rack,
- c: represents the channel number.

Configuration Objects

The table below presents the one shot counter mode configurable elements.

Label	Address in the configuration	Configurable values
Counting mode	%KWr.m.c.2 (least significant byte)	One shot counter mode. The value of the least significant byte of this word is 3.
IN_A input filter	%KWr.m.c.3 (least significant byte)	The least significant byte can take the following values: • 0: none, • 1: low, • 2: medium, • 3: high.
IN_AUX input filter	%KWr.m.c.4 (least significant byte)	The least significant byte can take the following values: • 0: none, • 1: low, • 2: medium, • 3: high.
IN_EN input filter	%KWr.m.c.4 (most significant byte)	The most significant byte can take the following values: • 0: none, • 1: low, • 2: medium, • 3: high.
Input power supply error	%KWr.m.c.2.8	General input/output error (bit set to 0) Local (bit set to 1)
Scale factor	%KWr.m.c.6 (least significant byte)	Edit (value in the range 1...255)
Synchronization edge	%KWr.m.c.10.8 (High)	Rising edge (bit set to 0) Falling edge (bit set to 1)
Event Event number	%KWr.m.c.0	Activated (if activated is selected, the entered event number is coded on the most significant byte of this word) Deactivated (all bits of the most significant byte of this word are set to 1)

Modulo Loop Counter Mode Configuration

At a Glance

The configuration of a counting module is stored in the configuration constants (%KW).

The parameters r,m and c shown in the following tables represent the topologic addressing of the module. Each parameter had the following signification:

- r: represents the rack number,
- m:represents the position of the module on the rack,
- c: represents the channel number.

Configuration Objects

The table below presents modulo loop counter mode configurable elements.

Label	Address in the configuration	Configurable values
Counting mode	%KWr.m.c.2 (least significant byte)	Modulo loop counter mode. The value of the least significant byte of this word is 4.
IN_A input filter	%KWr.m.c.3 (least significant byte)	The least significant byte can take the following values: • 0: none, • 1: low, • 2: medium, • 3: high.
IN_AUX input filter	%KWr.m.c.4 (least significant byte)	The least significant byte can take the following values: • 0: none, • 1: low, • 2: medium, • 3: high.
Input power supply error	%KWr.m.c.2.8	General input/output error (bit set to 0) Local (bit set to 1)
Scale factor	%KWr.m.c.6 (least significant byte)	Edit (value in the range 1...255)
Synchronization edge	%KWr.m.c.10.8	Rising edge (bit set to 0) Falling edge (bit set to 1)
Event Event number	%KWr.m.c.0	Activated (if activated is selected, the entered event number is coded on the most significant byte of this word) Deactivated (all bits of the most significant byte of this word are set to 1)

Up and Down Counting Mode Configuration

At a Glance

The configuration of a counting module is stored in the configuration constants (%KW).

The parameters r,m and c shown in the following tables represent the topologic addressing of the module. Each parameter had the following signification:

- r: represents the rack number,
- m:represents the position of the module on the rack,
- c: represents the channel number.

Configuration Objects

The table below presents the up and down counting mode configurable elements.

Label	Address in the configuration	Configurable values
Counting mode	%KWr.m.c.2 (least significant byte)	Up and down counting mode. The value of the least significant byte of this word is 5.
IN_A input filter	%KWr.m.c.3 (least significant byte)	The least significant byte can take the following values: • 0: none, • 1: low, • 2: medium, • 3: high.
IN_AUX input filter	%KWr.m.c.4 (least significant byte)	The least significant byte can take the following values: • 0: none, • 1: low, • 2: medium, • 3: high.
Input power supply error	%KWr.m.c.2.8	General input/output error (bit set to 0) Local (bit set to 1)
Counting operation	%KWr.m.c.11.0	Overrun locking (bit set to 0) Reversal (bit set to 1)
Synchronization edge	%KWr.m.c.10.8 (High)	Rising edge (bit set to 0) Falling edge (bit set to 1)
Event Event number	%KWr.m.c.0	Activated (if activated is selected, the entered event number is coded on the most significant byte of this word) Deactivated (all bits of the most significant byte of this word are set to 1)

Dual Phase Counting Mode Configuration

At a Glance

The configuration of a counting module is stored in the configuration constants (%KW).

The parameters r,m and c shown in the following tables represent the topologic addressing of the module. Each parameter had the following signification:

- r: represents the rack number,
- m:represents the position of the module on the rack,
- c: represents the channel number.

Configuration Objects

The table below presents the dual phase counting mode configurable elements.

Label	Address in the configuration	Configurable values
Counting mode	%KWr.m.c.2 (least significant byte)	Dual phase counting mode. The value of the least significant byte of this word is 6.
IN_A input filter	%KWr.m.c.3 (least significant byte)	The least significant byte can take the following values: • 0: none, • 1: low, • 2: medium, • 3: high.
IN_B input filter	%KWr.m.c.3 (most significant byte)	The most significant byte can take the following values: • 0: none, • 1: low, • 2: medium, • 3: high.
IN_AUX input filter	%KWr.m.c.4 (least significant byte)	The least significant byte can take the following values: • 0: none, • 1: low, • 2: medium, • 3: high.
Input power supply error	%KWr.m.c.2.8	General input/output error (bit set to 0) Local (bit set to 1)

Label	Address in the configuration	Configurable values
Input mode	%KWr.m.c.9	This word can take the following values: ● 0: A = High, B = Low ● 1: A = Pulse, B = Direction ● 2: normal quadrature 1 ● 3: normal quadrature 2 ● 4: normal quadrature 4 ● 5: inverse quadrature 1 ● 6: inverse quadrature 2 ● 7: inverse quadrature 4
Scale factor	%KWr.m.c.6 (least significant byte)	Edit (value in the range 1...255)
Synchronization edge	%KWr.m.c.10.8	Rising edge (bit set to 0) Falling edge (bit set to 1)
Counting operation	%KWr.m.c.11.0	Overrun locking (bit set to 0) Reversal (bit set to 1)
Event Event number	%KWr.m.c.0	Activated (if activated is selected, the entered event number is coded on the most significant byte of this word) Deactivated (all bits of the most significant byte of this word are set to 1)

BMX EHC 0800 Counting Module Adjusts

10

Subject of this Chapter

This chapter deals with the possible adjusts for the counting modes of the BMX EHC 0800 module. These adjusts can be accessed from the Configuration tab on the functional screens of BMX EHC 0800 module *(see page 98)*.

What Is in This Chapter?

This chapter contains the following topics:

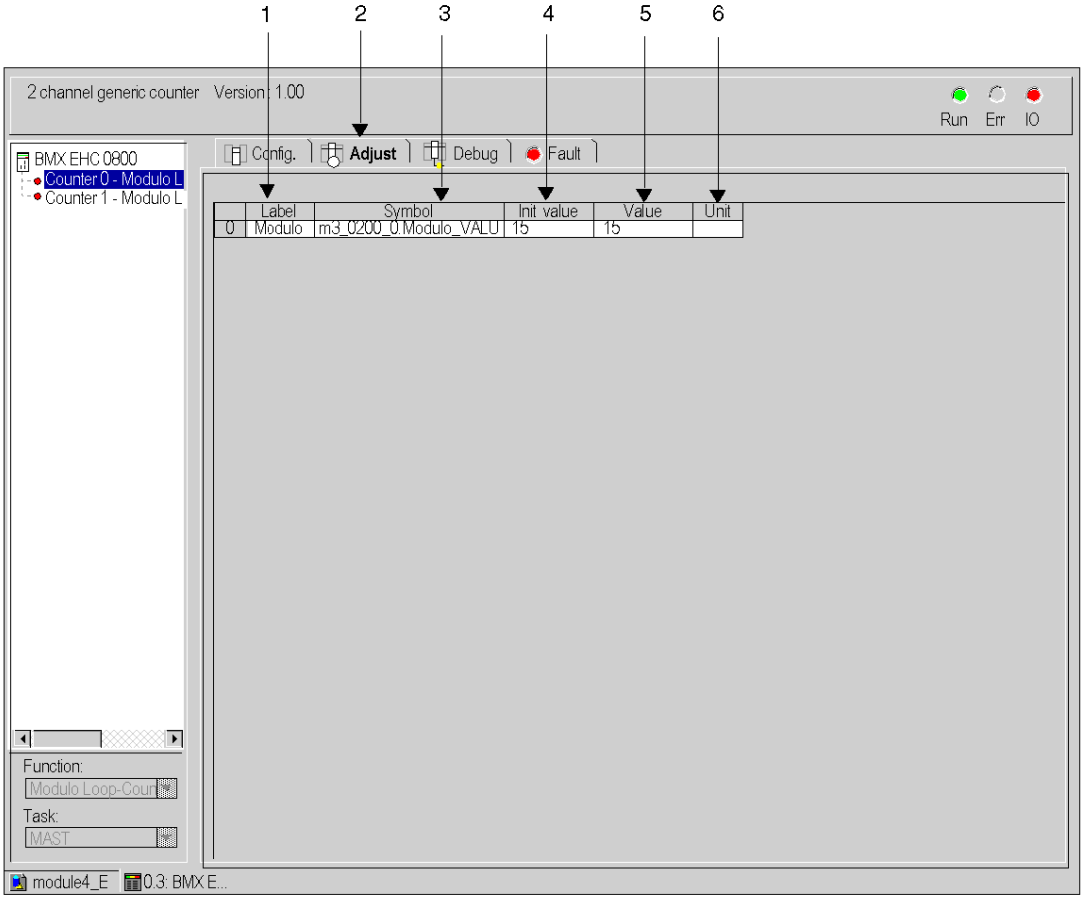
Adjust Screen for BMX EHC 0800 Counting Module

At a Glance

This section presents the adjust screen for BMX EHC 0800 counting module.

Illustration

The figure below presents the adjust screen for the BMX EHC 0800 module in modulo loop counter mode:



Description of the Screen

The following table presents the various parts of the above screen:

Number	Element	Function
1	**Label** field	This field contains the name of each variable that may be adjusted. This field may not be modified and can be accessed in both local and online modes.
2	Tab	The tab in the foreground indicates the current mode. The current mode is therefore the adjust mode in this example.
3	**Symbol** field	This field contains the mnemonics of the variable. This field may not be modified and can be accessed in both offline and online modes.
4	**Initial value** field	This field displays the value of the variable that the user has adjusted in offline mode. This field is only accessible in online mode.
5	**Value** field	The function of this field depends on the mode in which the user is working: • **In offline mode**: this field is used to adjust the variable. • **In online mode**: this field is used to display the current value of the variable.
6	**Unit** field	This field contains the unit of each variable that may be configured. This field may not be modified and can be accessed in both offline and online modes.

Adjust the Preset Value

Introduction

The preset value concerns the following counting modes:

- for the BMX EHC 0800 module:
  - dual phase counting mode
  - up and down-counting mode.

Description

The following table shows the preset value adjust:

Number	Address in the configuration	Value	Default value
Preset value	%MDr.m.c.12 (Low)	Edit	0

Adjust the Calibration Factor

Introduction

The calibration factor concerns the frequency mode for the BMX EHC 0800 module.

Description

The following table shows the calibration factor adjust:

Number	Address in the configuration	Value	Default value
Calibration factor	%MWr.m.c.14	Edit	0

Modulo Adjust

Introduction

The modulo concerns the modulo loop counter modes for the counting modules BMX EHC ****.

Description

The following table shows the modulo adjust:

Number	Address in the configuration	Value	Default value
Modulo	%MDx.y.v.10 (Low)	Edit	0xFFFF

Adjust the Hysteresis Value

Introduction

The hysteresis value concerns dual phase counting mode for BMX EHC 0800 module.

Description

The following table shows the adjust for the hysteresis value:

Number	Address in the configuration	Value	Default value
Hysteresis (release value)	%MWr.m.c.9	Edit	0

Debugging the BMX EHC 0800 Counting Module

11

Subject of this Chapter

This chapter deals with the debugging settings applicable to the BMX EHC 0800 module. These settings can be accessed from the Debug tab on the functional screens of the BMX EHC 0800 *(see page 96)* module.

What Is in This Chapter?

This chapter contains the following sections:

11.1 Debug Screen for BMX EHC xxxx Counting Modules

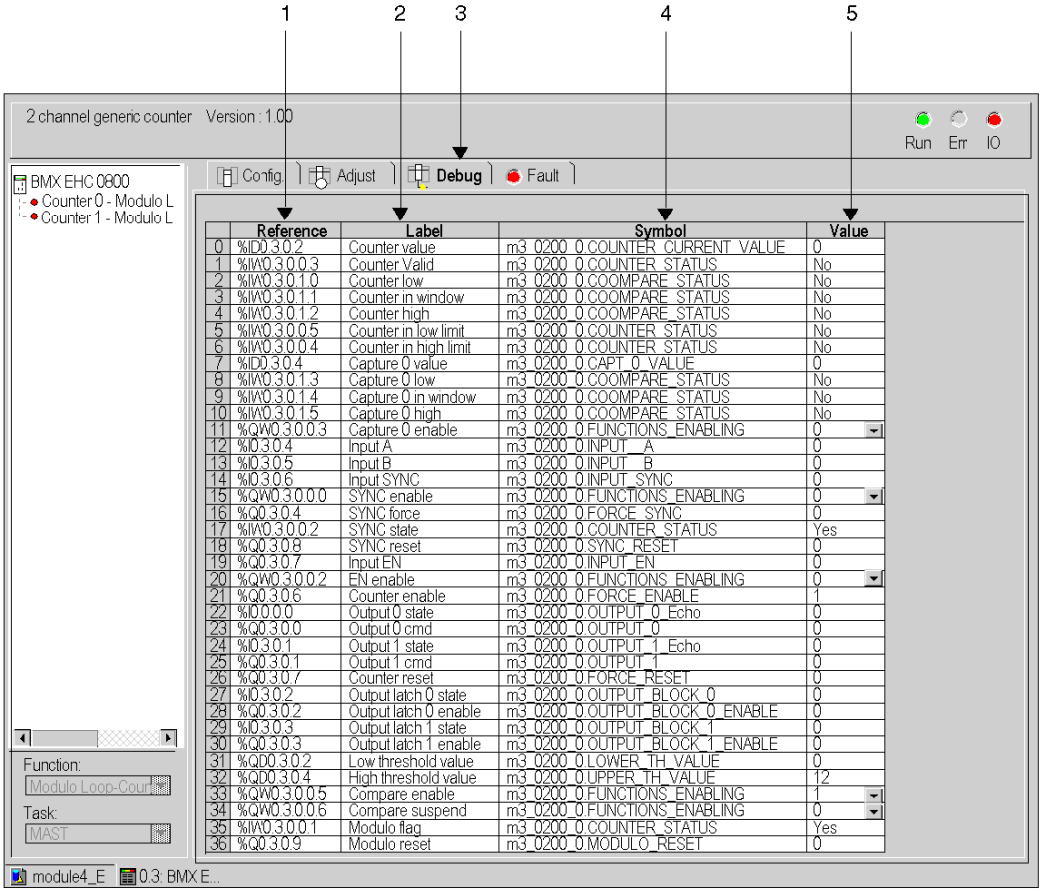
Debug Screen for the BMX EHC 0800 Counting Module

At a Glance

This section presents the debug screen for the BMX EHC 0800 counting module. A module's debug screen can only be accessed in online mode.

Illustration

The figure below presents the debug screen for the BMX EHC 0800 module in modulo loop counter mode:



	Reference	Label	Symbol	Value
0	%ID0.3.0.2	Counter value	m3_0200_0.COUNTER_CURRENT_VALUE	0
1	%IW0.3.0.0.3	Counter Valid	m3_0200_0.COUNTER_STATUS	No
2	%IW0.3.0.1.0	Counter low	m3_0200_0.COOMPARE_STATUS	No
3	%IW0.3.0.1.1	Counter in window	m3_0200_0.COOMPARE_STATUS	No
4	%IW0.3.0.1.2	Counter high	m3_0200_0.COOMPARE_STATUS	No
5	%IW0.3.0.0.5	Counter in low limit	m3_0200_0.COUNTER_STATUS	No
6	%IW0.3.0.0.4	Counter in high limit	m3_0200_0.COUNTER_STATUS	No
7	%ID0.3.0.4	Capture 0 value	m3_0200_0.CAPT_0_VALUE	0
8	%IW0.3.0.1.3	Capture 0 low	m3_0200_0.COOMPARE_STATUS	No
9	%IW0.3.0.1.4	Capture 0 in window	m3_0200_0.COOMPARE_STATUS	No
10	%IW0.3.0.1.5	Capture 0 high	m3_0200_0.COOMPARE_STATUS	No
11	%QW0.3.0.0.3	Capture 0 enable	m3_0200_0.FUNCTIONS_ENABLING	0
12	%I0.3.0.4	Input A	m3_0200_0.INPUT_A	0
13	%I0.3.0.5	Input B	m3_0200_0.INPUT_B	0
14	%I0.3.0.6	Input SYNC	m3_0200_0.INPUT_SYNC	0
15	%QW0.3.0.0.0	SYNC enable	m3_0200_0.FUNCTIONS_ENABLING	0
16	%Q0.3.0.4	SYNC force	m3_0200_0.FORCE_SYNC	0
17	%IW0.3.0.0.2	SYNC state	m3_0200_0.COUNTER_STATUS	Yes
18	%Q0.3.0.8	SYNC reset	m3_0200_0.SYNC_RESET	0
19	%Q0.3.0.7	Input EN	m3_0200_0.INPUT_EN	0
20	%QW0.3.0.0.2	EN enable	m3_0200_0.FUNCTIONS_ENABLING	0
21	%Q0.3.0.6	Counter enable	m3_0200_0.FORCE_ENABLE	1
22	%I0.0.0.0	Output 0 state	m3_0200_0.OUTPUT_0_Echo	0
23	%Q0.3.0.0	Output 0 cmd	m3_0200_0.OUTPUT_0	0
24	%I0.3.0.1	Output 1 state	m3_0200_0.OUTPUT_1_Echo	0
25	%Q0.3.0.1	Output 1 cmd	m3_0200_0.OUTPUT_1	0
26	%Q0.3.0.7	Counter reset	m3_0200_0.FORCE_RESET	0
27	%I0.3.0.2	Output latch 0 state	m3_0200_0.OUTPUT_BLOCK_0	0
28	%Q0.3.0.2	Output latch 0 enable	m3_0200_0.OUTPUT_BLOCK_0_ENABLE	0
29	%I0.3.0.3	Output latch 1 state	m3_0200_0.OUTPUT_BLOCK_1	0
30	%Q0.3.0.3	Output latch 1 enable	m3_0200_0.OUTPUT_BLOCK_1_ENABLE	0
31	%QD0.3.0.2	Low threshold value	m3_0200_0.LOWER_TH_VALUE	0
32	%QD0.3.0.4	High threshold value	m3_0200_0.UPPER_TH_VALUE	12
33	%QW0.3.0.0.5	Compare enable	m3_0200_0.FUNCTIONS_ENABLING	1
34	%QW0.3.0.0.6	Compare suspend	m3_0200_0.FUNCTIONS_ENABLING	0
35	%IW0.3.0.0.1	Modulo flag	m3_0200_0.COUNTER_STATUS	Yes
36	%Q0.3.0.9	Modulo reset	m3_0200_0.MODULO_RESET	0

Description of the Screen

The following table presents the various parts of the above screen:

Number	Element	Function
1	**Reference** field	This field contains the address of the variable in the application. This field may not be modified.
2	**Label** field	This field contains the name of each variable that may be configured. This field may not be modified.
3	Tab	The tab in the foreground indicates the current mode. The current mode is therefore the debug mode in this example.
4	**Symbol** field	This field contains the mnemonics of the variable. This field may not be modified.
5	**Value** field	If the field has a downward pointing arrow, you can select the value of each variable from various possible values in this field. The various values can be accessed by clicking on the arrow. A drop-down menu containing all the possible values is displayed and the user may then select the required value of the variable. If there is no downward pointing arrow, this field simply displays the current value of the variable.

11.2 BMX EHC 0800 Module Debugging

Subject of this Section

This section deals with the debugging of the BMX EHC 0800 counting module modes.

What Is in This Section?

This section contains the following topics:

Frequency Mode Debugging

At a Glance

The table below presents the frequency mode debugging elements:

Label	Language object	Type
Frequency value	%IDr.m.c.2	Digital
Frequency valid	%IWr.m.c.0.3	Binary
Frequency low	%IWr.m.c.1.0	Binary
Frequency equal	%IWr.m.c.1.1	Binary
Frequency high	%IWr.m.c.1.2	Binary
Frequency in high limit	%IWr.m.c.0.4	Binary
Input A state	%Ir.m.c.4	Binary
Threshold value	%QDr.m.c.2	Digital
Compare enable	%QWr.m.c.0.5	Binary
Compare suspend	%QWr.m.c.0.6	Binary

For a description of each language object refer to T_UNSIGNED_CPT_BMX IODDT *(see page 152)*.

Event Counting Mode Debugging

At a Glance

The table below presents the event counting mode debugging elements.

Label	Language object	Type
Counter value	%IDr.m.c.2	Digital
Counter valid	%IWr.m.c.0.3	Binary
Counter low	%IWr.m.c.1.0	Binary
Counter equal	%IWr.m.c.1.1	Binary
Counter high	%IWr.m.c.1.2	Binary
Counter in low limit	%IWr.m.c.0.5	Binary
Counter in high limit	%IWr.m.c.0.4	Binary
Input A state	%Ir.m.c.4	Binary
Input AUX state	%Ir.m.c.6	Binary
SYNC enable	%QWr.m.c.0.0	Binary
SYNC force	%Qr.m.c.4	Binary
SYNC state	%IWr.m.c.0.2	Binary
SYNC reset	%QWr.m.c.8	Binary
Threshold value	%QDr.m.c.2	Digital
Compare enable	%QWr.m.c.0.5	Binary
Compare suspend	%QWr.m.c.0.6	Binary

For a description of each language object refer to T_UNSIGNED_CPT_BMX IODDT *(see page 152)*.

One Shot Counter Mode Debugging

At a Glance

The table below presents the one shot counter mode debugging elements:

Label	Language object	Type
Counter value	%IDr.m.c.2	Digital
Counter valid	%IWr.m.c.0.3	Binary
RUN	%IWr.m.c.0.0	Binary
Counter reset	%Qr.m.c.7	Binary
Counter enable	%Qr.m.c.6	Binary
Counter low	%IWr.m.c.1.0	Binary
Counter equal	%IWr.m.c.1.1	Binary
Counter high	%IWr.m.c.1.2	Binary
Input A state	%Ir.m.c.4	Binary
Input AUX state	%Ir.m.c.6	Binary
SYNC enable	%QWr.m.c.0.0	Binary
SYNC force	%Qr.m.c.4	Binary
SYNC state	%IWr.m.c.0.2	Binary
SYNC reset	%QWr.m.c.8	Binary
Threshold value	%QDr.m.c.2	Digital
Compare enable	%QWr.m.c.0.5	Binary
Compare suspend	%QWr.m.c.0.6	Binary

For a description of each language object refer to T_UNSIGNED_CPT_BMX IODDT *(see page 152)*.

Modulo Loop Counter Mode Debugging

At a Glance

The table below presents the modulo loop counter mode debugging elements:

Label	Language object	Type
Counter value	%IDr.m.c.2	Digital
Counter valid	%IWr.m.c.0.3	Binary
Counter reset	%Qr.m.c.7	Binary
Counter enable	%Qr.m.c.6	Binary
Counter low	%IWr.m.c.1.0	Binary
Counter equal	%IWr.m.c.1.1	Binary
Counter high	%IWr.m.c.1.2	Binary
Capture value	%IDr.m.c.4	Digital
Capture low	%IWr.m.c.1.3	Binary
Capture equal	%IWr.m.c.1.4	Binary
Capture high	%IWr.m.c.1.5	Binary
Capture enable	%QWr.m.c.0.3	Binary
Input A state	%Ir.m.c.4	Binary
Input AUX state	%Ir.m.c.6	Binary
SYNC enable	%QWr.m.c.0.0	Binary
SYNC force	%Qr.m.c.4	Binary
SYNC state	%IWr.m.c.0.2	Binary
SYNC reset	%Qr.m.c.8	Binary
Threshold value	%QDr.m.c.2	Digital
Compare enable	%QWr.m.c.0.5	Binary
Compare suspend	%QWr.m.c.0.6	Binary
Modulo state	%IWr.m.c.0.1	Binary
Modulo reset	%Qr.m.c.9	Binary

For a description of each language object refer to T_UNSIGNED_CPT_BMX IODDT *(see page 152)*.

Up and Down Counting Mode Debugging

At a Glance

The table below presents the up and down counting mode debugging elements:

Label	Language object	Type
Counter value	%IDr.m.c.2	Digital
Counter valid	%IWr.m.c.0.3	Binary
Counter reset	%Qr.m.c.7	Binary
Counter enable	%Qr.m.c.6	Binary
Counter low	%IWr.m.c.1.0	Binary
Counter equal	%IWr.m.c.1.1	Binary
Counter high	%IWr.m.c.1.2	Binary
Counter in low limit	%IWr.m.c.0.5	Binary
Counter in high limit	%IWr.m.c.0.4	Binary
Input A state	%Ir.m.c.4	Binary
Input AUX state	%Ir.m.c.6	Binary
SYNC force	%Qr.m.c.4	Binary
SYNC state	%IWr.m.c.0.2	Binary
SYNC reset	%Qr.m.c.8	Binary
Threshold value	%QDr.m.c.2	Digital
Compare enable	%QWr.m.c.0.5	Binary
Compare suspend	%QWr.m.c.0.6	Binary
Modulo state	%IWr.m.c.0.1	Binary
Modulo reset	%Qr.m.c.9	Binary

For a description of each language object refer to T_SIGNED_CPT_BMX IODDT *(see page 152)*.

Dual Phase Counting Mode Debugging

At a Glance

The table below presents the dual phase counting mode debugging elements:

Label	Language object	Type
Counter value	%IDr.m.c.2	Digital
Counter valid	%IWr.m.c.0.3	Binary
Counter reset	%Qr.m.c.7	Binary
Counter enable	%Qr.m.c.6	Binary
Counter low	%IWr.m.c.1.0	Binary
Counter equal	%IWr.m.c.1.1	Binary
Counter high	%IWr.m.c.1.2	Binary
Counter in low limit	%IWr.m.c.0.5	Binary
Counter in high limit	%IWr.m.c.0.4	Binary
Capture value	%IDr.m.c.4	Digital
Capture low	%IWr.m.c.1.3	Binary
Capture equal	%IWr.m.c.1.4	Binary
Capture high	%IWr.m.c.1.5	Binary
Capture enable	%QWr.m.c.0.3	Binary
Input A state	%Ir.m.c.4	Binary
Input B state	%Ir.m.c.5	Binary
Input AUX state	%Ir.m.c.6	Binary
SYNC enable	%QWr.m.c.0.0	Binary
SYNC force	%Qr.m.c.4	Binary
SYNC state	%IWr.m.c.0.2	Binary
SYNC reset	%Qr.m.c.8	Binary
Threshold value	%QDr.m.c.2	Digital
Compare enable	%QWr.m.c.0.5	Binary
Compare suspend	%QWr.m.c.0.6	Binary
Modulo state	%IWr.m.c.0.1	Binary
Modulo reset	%Qr.m.c.9	Binary

For a description of each language object refer to T_UNSIGNED_CPT_BMX IODDT *(see page 152)*.

Display of BMX EHC xxxx Counting Module Error

12

Subject of this Chapter

This chapter deals with the display of possible errors for the BMX EHC•••• modules.

What Is in This Chapter?

This chapter contains the following topics:

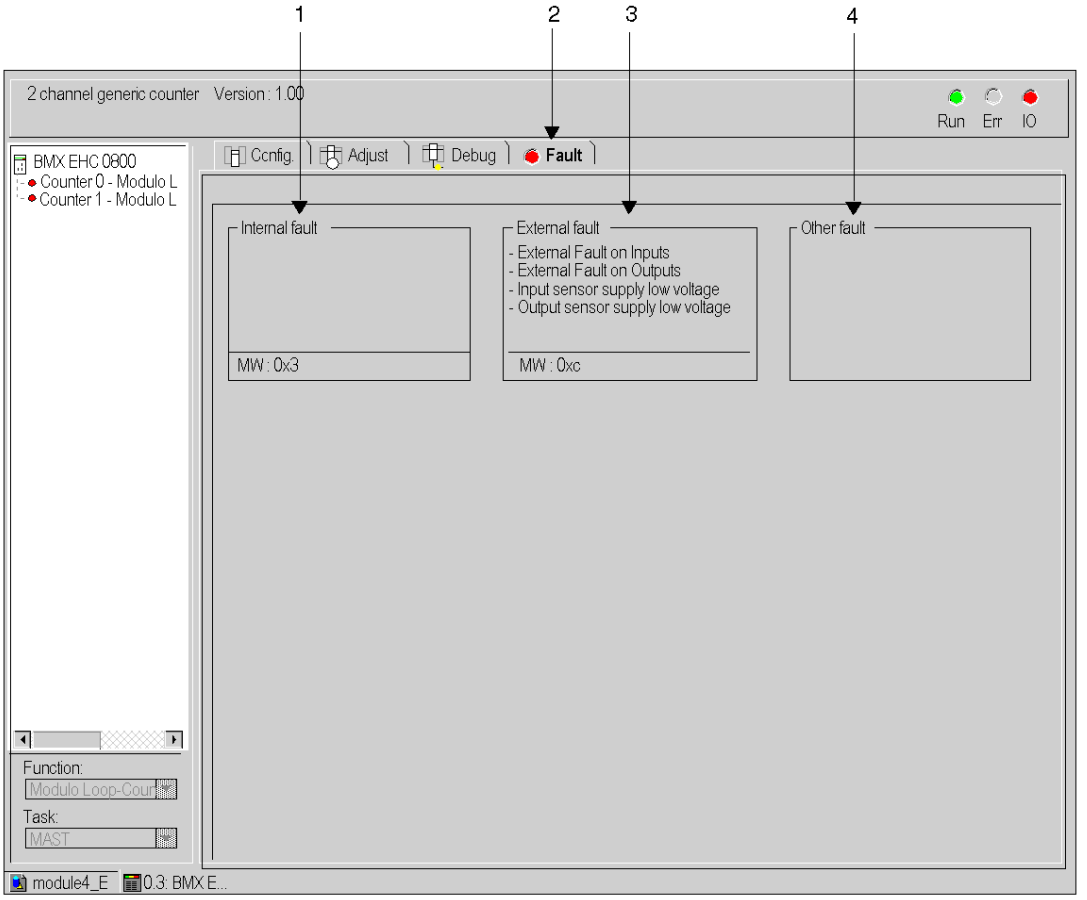
Fault Display Screen for the BMX EHC 0800 Counting Module

At a Glance

This section presents the fault display screen for the BMX EHC 0800 counting module. A module's fault display screen may only be accessed in online mode.

Illustration

The figure below presents the fault display screen for the BMX EHC 0800 module in modulo loop counter mode.



Description of the Screen

The following table presents the various parts of the above screen.

Number	Element	Function
1	Internal faults field	This field displays the module's active internal faults.
2	Tab	The tab in the foreground indicates the current mode. The current mode is therefore the fault display mode in this example.
3	External faults field	This field displays the module's active external faults.
4	Other faults field	This field displays the module's active faults, other than internal and external faults.

Faults Diagnostics Display

At a Glance

The diagnostic screens *(see page 95)* on the module or channel are only accessible in connected mode. When an un-masked error appears, it is reported:

- in the configuration screen of the rack, with the presence of a red square in the position of the inoperative counting module,
- in all screens at module level (**Description** and **Fault** tabs),
  - in the module field with the LED
- in all channel level screens (**Configuration**, **Adjustment**, **Debug** and **Fault** tabs),
  - in the module zone with the LED
  - in the channel zone with the error LED
- in the fault screen that is accessed by the **Fault** where the fault diagnostics are described.

The error is also signaled:

- On the module, on the central display,
- by dedicated language objects: CH_ERROR (`%Ir.m.c.ERR`) and MOD_ERROR (`%Ir.m.MOD.ERR`), `%MWr.m.MOD.2`, etc. and status words.

NOTE: Even if the error is masked, it is reported by the flashing of the **I/O** LED and in the fault screen.

List of Errors

At a Glance

The messages displayed on the diagnostics screens are used to assist with debugging. These messages must be concise and are sometimes ambiguous (as different errors may have the same consequences).

These diagnostics are on two levels: module and channel, the latter being the most explicit.

The lists below show the message headings with suggestions for identifying issues.

List of the Module Error Messages

The table below provides a list of the module error messages.

Error indicated	Possible interpretation and/or action.
Module failure	The module has a error. Check the module mounting. Change the module.
Inoperative channel(s)	One or more channels have a error. Refer to channel diagnostics.
Self-test	The module is running a self-test. Wait until the self-test is complete.
Different hardware and software configurations	There is a lack of compatibility between the module configured and the module in the rack. Make the hardware configuration and the software configuration compatible.
Module is missing or off	Install the module. Fasten the mounting screws.

BMX EHC 0800 Module Errors

The table below provides a list of errors that may appear on the BMX EHC 0800 module.

Language object	Description
%MWr.m.c.2.0	External error at inputs
%MWr.m.c.2.4	Internal error or self-testing.
%MWr.m.c.2.5	Configuration Error
%MWr.m.c.2.6	Communication Error
%MWr.m.c.2.7	Application error
%MWr.m.c.3.2	Sensor power supply error

List of Channel Error Messages

The table below gives the list of error messages at channel level.

Error indicated. Other consequences.	**Possible interpretation and/or action.**
External error or counting input error: ● encoder or proximity sensor supply error ● line break or short circuit of at least one encoder differential signal (1A, 1B, 1Z) ● specific error on absolute encoder Outputs are set to 0 in automatic mode. **Invalid measurement** message.	Check the sensor connections. Check the sensor power supply. Check the sensor operation. Delete the error and acknowledge if the error storing is configured. Counting pulses or incremental encoder: preset or reset to acknowledge the **Invalid measurement** message.
Counting application error: ● measurement overrun ● overspeed Outputs are set to 0 in automatic mode. **Invalid measurement** message.	Diagnose the error more precisely (external causes). Check the application again, if necessary. Delete the error and acknowledge if the error storing is configured. Counting pulses or incremental encoder: preset or reset to 0 to acknowledge the **Invalid measurement** message.
Auxiliary input/output error: ● power supply ● short circuit of at least one output Outputs are set to 0 in automatic mode	Check the output connections Check the input/output power supply (24V) Diagnose the error more precisely (external causes) Delete the error and acknowledge if the error storing is configured
Internal error or channel self-testing: ● module inoperative ● module missing or off ● module running self-test	Module error has gone down to channel level. Refer to module level diagnostics.
Different hardware and software configurations	Module error has gone down to channel level. Refer to module level diagnostics.
Invalid software configuration: ● incorrect constant ● bit combination not associated with any configuration	Check and modify the configuration constants.
Communication error	Check the connections between the racks.
Application error: refusal to configure or adjust	Diagnose the error more precisely.

The Language Objects of the Counting Function

13

Subject of this Chapter

This chapter describes the language objects associated to the counting tasks as well as the different ways of using them.

What Is in This Chapter?

This chapter contains the following sections:

13.1 The Language Objects and IODDT of the Counting Function

Subject of this Section

This section describes the general features of the language objects and IODDT of the counting function.

What Is in This Section?

This section contains the following topics:

Introducing Language Objects for Application-Specific Counting

General

The counting modules have only two associated IODDTs. These IODDTs are predefined by the manufacturer and contains language objects for inputs/outputs belonging to the channel of an application-specific module.

The IODDT associated with the counting modules are of T_ Unsigned_CPT_BMX and T_Signed_CPT_BMX types.

NOTE: IODDT variables can be created in two different ways:

- Using the **I/O objects** *(see Unity Pro, Operating Modes)* tab.
- Using the Data Editor *(see Unity Pro, Operating Modes)*.

Language Object Types

Each IODDT contains a set of language objects allowing its operation to be controlled and checked.

There are two types of language objects:

- **Implicit Exchange Objects:** these objects are automatically exchanged on each cycle revolution of the task associated with the module.
- **Explicit Exchange Objects:** these objects are exchanged on the application's request, using explicit exchange instructions.

Implicit exchanges concern the inputs/outputs of the module (measurement results, information and commands). These exchanges enable the debugging of the counting modules.

Explicit exchanges enable the module to be set and diagnosed.

Implicit Exchange Language Objects Associated with the Application-Specific Function

At a Glance

An integrated application-specific interface or the addition of a module automatically enhances the language objects application used to program this interface or module.

These objects correspond to the input/output images and software data of the module or integrated application-specific interface.

Reminders

The module inputs (%I and %IW) are updated in the PLC memory at the start of the task, the PLC being in RUN or STOP mode.

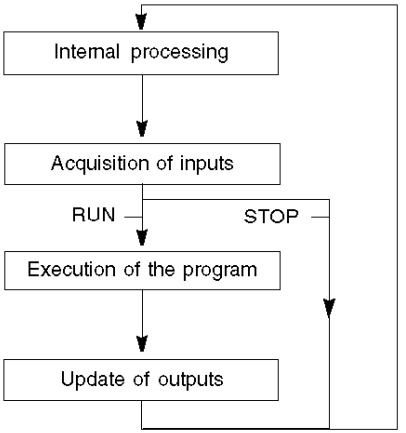
The outputs (%Q and %QW) are updated at the end of the task, only when the PLC is in RUN mode.

NOTE: When the task occurs in STOP mode, either of the following are possible, depending on the configuration selected:

- outputs are set to fallback position (fallback mode)
- outputs are maintained at their last value (maintain mode)

Figure

The following diagram shows the operating cycle of a PLC task (cyclical execution).



Explicit Exchange Language Objects Associated with the Application-Specific Function

Introduction

Explicit exchanges are performed at the user program's request using these instructions:

- READ_STS *(see Unity Pro, I/O Management, Block Library)* (read status words)
- WRITE_CMD *(see Unity Pro, I/O Management, Block Library)* (write command words)
- WRITE_PARAM *(see Unity Pro, I/O Management, Block Library)* (write adjustment parameters)
- READ_PARAM *(see Unity Pro, I/O Management, Block Library)* (read adjustment parameters)
- SAVE_PARAM *(see Unity Pro, I/O Management, Block Library)* (save adjustment parameters)
- RESTORE_PARAM *(see Unity Pro, I/O Management, Block Library)* (restore adjustment parameters)

These exchanges apply to a set of %MW objects of the same type (status, commands or parameters) that belong to a channel.

These objects can:

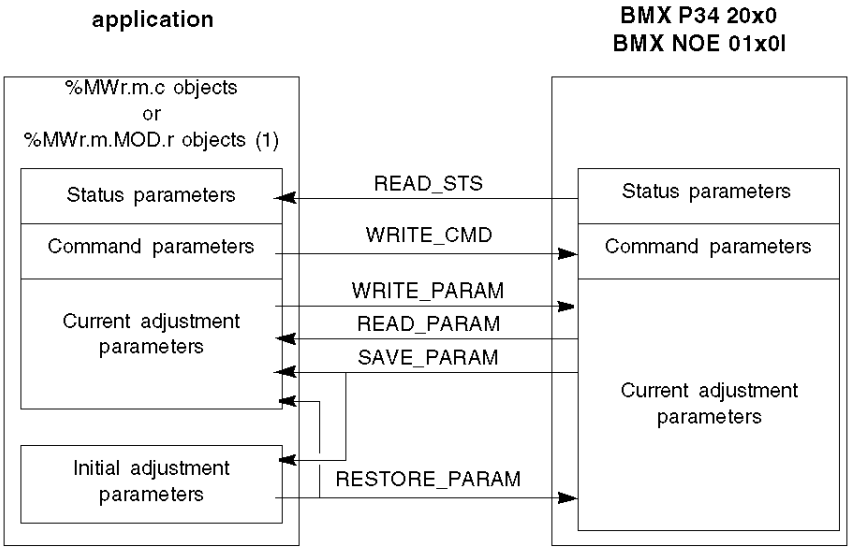
- provide information about the module (for example, type of error detected in a channel)
- have command control of the module (for example, switch command)
- define the module's operating modes (save and restore adjustment parameters in the process of application)

NOTE: To avoid several simultaneous explicit exchanges for the same channel, it is necessary to test the value of the word EXCH_STS (`%MWr.m.c.0`) of the IODDT associated to the channel before calling any EF addressing this channel.

NOTE: Explicit Exchanges are not supported when Modicon M340 Analog and Digital I/O modules are configured behind a M340 Ethernet Remote I/O adapter module in a Quantum EIO Ethernet Configuration. As a consequence, it is not possible to setup a module's parameters from the PLC application during operation.

General Principle for Using Explicit Instructions

The diagram below shows the different types of explicit exchanges that can be made between the application and module.



(1) Only with READ_STS and WRITE_CMD instructions.

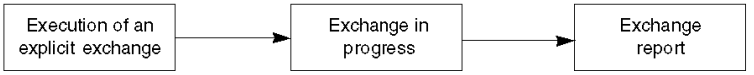
Managing Exchanges

During an explicit exchange, check performance to see that the data is only taken into account when the exchange has been correctly executed.

To do this, two types of information is available:

- information concerning the exchange in progress *(see page 149)*
- the exchange report *(see page 150)*

The following diagram describes the management principle for an exchange.



NOTE: In order to avoid several simultaneous explicit exchanges for the same channel, it is necessary to test the value of the word EXCH_STS (`%MWr.m.c.0`) of the IODDT associated to the channel before calling any EF addressing this channel.

Management of Exchanges and Reports with Explicit Objects

At a Glance

When data is exchanged between the PLC memory and the module, the module may require several task cycles to acknowledge this information. All IODDTs use two words to manage exchanges:

- `EXCH_STS` (`%MWr.m.c.0`): exchange in progress
- `EXCH_RPT` (`%MWr.m.c.1`): report

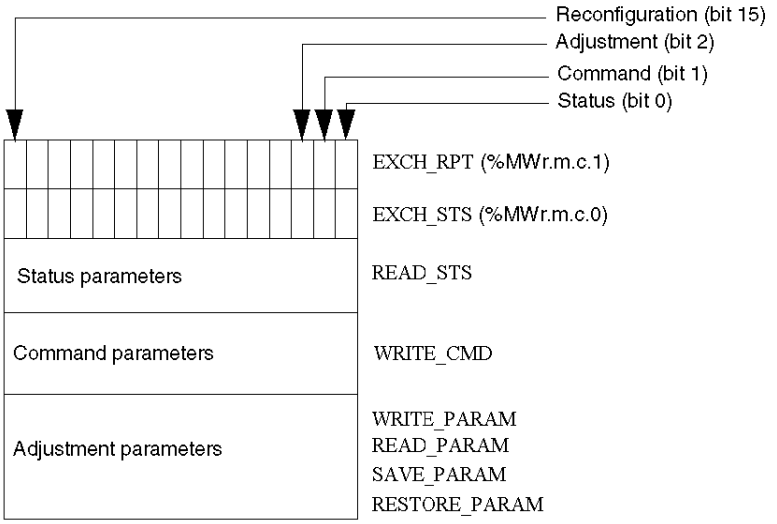
NOTE:

Depending on the localization of the module, the management of the explicit exchanges (`%MW0.0.MOD.0.0` for example) will not be detected by the application:

- For in-rack modules, explicit exchanges are done immediately on the local PLC Bus and are finished before the end of the execution task. So, the `READ_STS`, for example, is always finished when the `%MW0.0.mod.0.0` bit is checked by the application.
- For remote bus (Fipio for example), explicit exchanges are not synchronous with the execution task, so the detection is possible by the application.

Illustration

The illustration below shows the different significant bits for managing exchanges:



Description of Significant Bits

Each bit of the words EXCH_STS (%MWr.m.c.0) and EXCH_RPT (%MWr.m.c.1) is associated with a type of parameter:

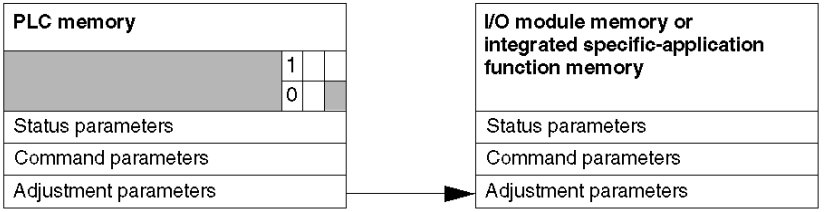
- Rank 0 bits are associated with the status parameters:
  - The STS_IN_PROGR bit (%MWr.m.c.0.0) indicates whether a read request for the status words is in progress.
  - The STS_ERR bit (%MWr.m.c.1.0) specifies whether a read request for the status words is accepted by the module channel.
- Rank 1 bits are associated with the command parameters:
  - The CMD_IN_PROGR bit (%MWr.m.c.0.1) indicates whether command parameters are being sent to the module channel.
  - The CMD_ERR bit (%MWr.m.c.1.1) specifies whether the command parameters are accepted by the module channel.
- Rank 2 bits are associated with the adjustment parameters:
  - The ADJ_IN_PROGR bit (%MWr.m.c.0.2) indicates whether the adjustment parameters are being exchanged with the module channel (via WRITE_PARAM, READ_PARAM, SAVE_PARAM, RESTORE_PARAM).
  - The ADJ_ERR bit (%MWr.m.c.1.2) specifies whether the adjustment parameters are accepted by the module. If the exchange is correctly executed, the bit is set to 0.
- Rank 15 bits indicate a reconfiguration on channel **c** of the module from the console (modification of the configuration parameters + cold start-up of the channel).
- The *r*, *m* and *c* bits indicates the following elements:
  - the **r** bit represents the rack number.
  - The **m** bit represents the position of the module in the rack.
  - The **c** bit represents the channel number in the module.

NOTE: r represents the rack number, **m** the position of the module in the rack, while **c** represents the channel number in the module.

NOTE: Exchange and report words also exist at module level EXCH_STS (%MWr.m.MOD) and EXCH_RPT (%MWr.m.MOD.1) as per IODDT type T_GEN_MOD.

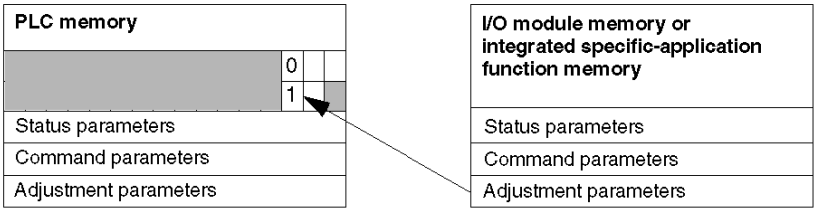
Example

Phase 1: Sending data by using the WRITE_PARAM instruction



When the instruction is scanned by the PLC processor, the **Exchange in progress** bit is set to 1 in %MWr.m.c.

Phase 2: Analysis of the data by the I/O module and report.



When the data is exchanged between the PLC memory and the module, acknowledgement by the module is managed by the ADJ_ERR bit (%MWr.m.c.1.2).

This bit makes the following reports:

- **0:** correct exchange
- **1:** faulty exchange)

NOTE: There is no adjustment parameter at module level.

Execution Indicators for an Explicit Exchange: EXCH_STS

The table below shows the control bits of the explicit exchanges: EXCH_STS (%MWr.m.c.0)

Standard symbol	Type	Access	Meaning	Address
STS_IN_PROGR	BOOL	R	Reading of channel status words in progress	%MWr.m.c.0.0
CMD_IN_PROGR	BOOL	R	Command parameters exchange in progress	%MWr.m.c.0.1

Standard symbol	Type	Access	Meaning	Address
ADJ_IN_PROGR	BOOL	R	Adjust parameters exchange in progress	%MWr.m.c.0.2
RECONF_IN_PROGR	BOOL	R	Reconfiguration of the module in progress	%MWr.m.c.0.15

NOTE: If the module is not present or is disconnected, explicit exchange objects (`READ_STS` for example) are not sent to the module (`STS_IN_PROG` (%MWr.m.c.0.0) = 0), but the words are refreshed.

Explicit Exchange Report: EXCH_RPT

The table below shows the report bits: `EXCH_RPT` (`%MWr.m.c.1`)

Standard symbol	Type	Access	Meaning	Address
STS_ERR	BOOL	R	Error reading channel status words (1 = failure)	%MWr.m.c.1.0
CMD_ERR	BOOL	R	Error during a command parameter exchange (1 = failure)	%MWr.m.c.1.1
ADJ_ERR	BOOL	R	Error during an adjust parameter exchange (1 = failure)	%MWr.m.c.1.2
RECONF_ERR	BOOL	R	Error during reconfiguration of the channel (1 = failure)	%MWr.m.c.1.15

Counting Module Use

The following table describes the steps realised between a Couting Module and the system after a power-on.

Step	Action
1	Power on.
2	The system sends the configuration parameters.
3	The system sends the adjust parameters by WRITE_PARAM method. **Note:** When the operation is finished, the bit %MWr.m.c.0.2 switches to 0.

If, in the begining of your application, you use a WRITE_PARAM command, you must wait until the bit %MWr.m.c.0.2 switches to 0.

13.2 Language Objects and IODDT Associated with the Counting Function of the BMX EHC xxxx Modules.

Subject of this Section

This section presents the language objects and IODDTs associated with the counting function of BMX EHC •••• modules.

What Is in This Section?

This section contains the following topics:

Details of Implicit Exchange Objects for the T_Unsigned_CPT_BMX and T_Signed_CPT_BMX-types IODDTs

At a Glance

The tables below present the `T_Unsigned_CPT_BMX` and `T_Signed_CPT_BMX`-types IODDTs implicit exchange objects which are applicable to all **BMX EHC ••••** counting modules.

Counter Value and Sensor Values

The table below presents the various IODDT implicit exchange objects:

Standard symbol	Type	Access	Meaning	Language object
COUNTER_CURRENT_VALUE	DINT	R	Current counter value	`%IDr.m.c.2`
CAPT_0_VALUE	DINT	R	Counter value when captured in register 0	`%IDr.m.c.4`
CAPT_1_VALUE	DINT	R	Counter value when captured in register 1	`%IDr.m.c.6`
COUNTER_VALUE	DINT	R	Current counter value during event	`%IDr.m.c.12`
CAPT_0_VAL	DINT	R	Capture value 0	`%IDr.m.c.14`
CAPT_1_VAL	DINT	R	Capture value 1	`%IDr.m.c.16`

%Ir.m.c.d Word

The table below presents the meanings of the `%Ir.m.c.d` words:

Standard symbol	Type	Access	Meaning	Language object
CH_ERROR	BOOL	R	Channel error	`%Ir.m.c.ERR`
OUTPUT_0_Echo	BOOL	R	Logical state of output 0	`%Ir.m.c.0`
OUTPUT_1_Echo	BOOL	R	Logical state of output 1	`%Ir.m.c.1`
OUTPUT_BLOCK_0	BOOL	R	State of output block 0	`%Ir.m.c.2`
OUTPUT_BLOCK_1	BOOL	R	State of output block 1	`%Ir.m.c.3`
INPUT_A	BOOL	R	Physical state of IN_A input	`%Ir.m.c.4`
INPUT_B	BOOL	R	Physical state of IN_B input	`%Ir.m.c.5`
INPUT_SYNC	BOOL	R	Physical state of the IN_SYNC input (or IN_AUX)	`%Ir.m.c.6`
INPUT_EN	BOOL	R	Physical state of IN_EN input (enable)	`%Ir.m.c.7`
INPUT_REF	BOOL	R	Physical state of the IN_REF input (preset)	`%Ir.m.c.8`
INPUT_CAPT	BOOL	R	Physical state of IN_CAP input (capture)	`%Ir.m.c.9`

Counter Status, %IWr.m.c.0 Word

The following table presents the meanings of the bits of the %IWr.m.c.0 status word:

Standard symbol	Type	Access	Meaning	Language object
RUN	BOOL	R	The counter operates in counting mode only	%IWr.m.c.0.0
MODULO_FLAG	BOOL	R	Flag set to 1 by a modulo switch event	%IWr.m.c.0.1
SYNC_REF_FLAG	BOOL	R	Flag set to 1 by a preset or synchronization event	%IWr.m.c.0.2
VALIDITY	BOOL	R	The current numerical value is valid	%IWr.m.c.0.3
HIGH_LIMIT	BOOL	R	The current numerical value is locked at the upper threshold value	%IWr.m.c.0.4
LOW_LIMIT	BOOL	R	The current numerical value is locked at the lower threshold value	%IWr.m.c.0.5

Comparison Status, %IWr.m.c.1 Word

The following table presents the meanings of the bits of the %IWr.m.c.1 status word:

Standard symbol	Type	Access	Meaning	Language object
COUNTER_LOW	BOOL	R	Current counter value less than lower threshold (%QDr.m.c.2)	%IWr.m.c.1.0
COUNTER_WIN	BOOL	R	Current counter value is between lower threshold (%QDr.m.c.2) and upper threshold (%QDr.m.c.4)	%IWr.m.c.1.1
COUNTER_HIGH	BOOL	R	Current counter value greater than upper threshold (%QDr.m.c.4)	%IWr.m.c.1.2
CAPT_0_LOW	BOOL	R	Value captured in register 0 is less than lower threshold (%QDr.m.c.2)	%IWr.m.c.1.3
CAPT_0_WIN	BOOL	R	Value captured in register 0 is between lower threshold (%QDr.m.c.2) and upper threshold (%QDr.m.c.4)	%IWr.m.c.1.4
CAPT_0_HIGH	BOOL	R	Value captured in register 0 is greater than upper threshold (%QDr.m.c.4)	%IWr.m.c.1.5
CAPT_1_LOW	BOOL	R	Value captured in register 1 is less than lower threshold (%QDr.m.c.2)	%IWr.m.c.1.6
CAPT_1_WIN	BOOL	R	Value captured in register 1 is between lower threshold (%QDr.m.c.2) and upper threshold (%QDr.m.c.4)	%IWr.m.c.1.7
CAPT_1_HIGH	BOOL	R	Value captured in register 1 is greater than upper threshold (%QDr.m.c.4)	%IWr.m.c.1.8

Event Sources, %IWr.m.c.10 Word

The following table presents the meanings of the bits of the %IWr.m.c.10 word:

Standard symbol	Type	Access	Meaning	Language object
EVT_SOURCES	INT	R	Event sources field	%IWr.m.c.10
EVT_RUN	BOOL	R	Event due to start of counter.	%IWr.m.c.10.0
EVT_MODULO	BOOL	R	Event due to modulo switch	%IWr.m.c.10.1
EVT_SYNC_PRESET	BOOL	R	Event due to synchronization or preset	%IWr.m.c.10.2
EVT_COUNTER_LOW	BOOL	R	Event due to counter value being less than lower threshold	%IWr.m.c.10.3
EVT_COUNTER_WINDOW	BOOL	R	Event due to counter value being between the two thresholds	%IWr.m.c.10.4
EVT_COUNTER_HIGH	BOOL	R	Event due to counter value being greater than upper threshold	%IWr.m.c.10.5
EVT_CAPT_0	BOOL	R	Event due to capture function 0	%IWr.m.c.10.6
EVT_CAPT_1	BOOL	R	Event due to capture function 1	%IWr.m.c.10.7
EVT_OVERRUN	BOOL	R	Warning: lost event(s)	%IWr.m.c.10.8

Output Thresholds and Frequency

The table below presents the various IODDT implicit exchange objects:

Standard symbol	Type	Access	Meaning	Language object
LOWER_TH_VALUE	DINT	R/W	Lower threshold value	%QDr.m.c.2
UPPER_TH_VALUE	DINT	R/W	Upper threshold value	%QDr.m.c.4
PWM_FREQUENCY	DINT	R/W	Output frequency value (unit = 0.1 Hz)	%QDr.m.c.6
PWM_DUTY	INT	R/W	Duty cycle value of the output frequency (unit = 5%)	%QDr.m.c.8

%Qr.m.c.d Words

The following table presents the meanings of the bits of the %Qr.m.c.d words:

Standard symbol	Type	Access	Meaning	Language object
OUTPUT_0	BOOL	R/W	Forces OUTPUT_0 to level 1	%Qr.m.c.0
OUTPUT_1	BOOL	R/W	Forces OUTPUT_1 to level 1	%Qr.m.c.1
OUTPUT_BLOCK_0_ENABLE	BOOL	R/W	Implementation of output 0 function block	%Qr.m.c.2
OUTPUT_BLOCK_1_ENABLE	BOOL	R/W	Implementation of output 1 function block	%Qr.m.c.3

Standard symbol	Type	Access	Meaning	Language object
FORCE_SYNC	BOOL	R/W	Counting function synchronization and start	%Qr.m.c.4
FORCE_REF	BOOL	R/W	Set to preset counter value	%Qr.m.c.5
FORCE_ENABLE	BOOL	R/W	Implementation of counter	%Qr.m.c.6
FORCE_RESET	BOOL	R/W	Reset counter	%Qr.m.c.7
SYNC_RESET	BOOL	R/W	Reset SYNC_REF_FLAG	%Qr.m.c.8
MODULO_RESET	BOOL	R/W	Reset MODULO_FLAG	%Qr.m.c.9

FUNCTIONS_ENABLING, %QWr.m.c.0 Word

The following table presents the meanings of the bits of the %QWr.m.c.0 words:

Standard symbol	Type	Access	Meaning	Language object
VALID_SYNC	BOOL	R/W	Synchronization and start authorization for the counting function via the IN_SYNC input	%QWr.m.c.0.0
VALID_REF	BOOL	R/W	Operation authorization for the internal preset function	%QWr.m.c.0.1
VALID_ENABLE	BOOL	R/W	Authorization of the counter enable via the IN_EN input	%QWr.m.c.0.2
VALID_CAPT_0	BOOL	R/W	Capture authorization in the capture0 register	%QWr.m.c.0.3
VALID_CAPT_1	BOOL	R/W	Capture authorization in the capture1 register	%QWr.m.c.0.4
COMPARE_ENABLE	BOOL	R/W	Comparators operation authorization	%QWr.m.c.0.5
COMPARE_SUSPEND	BOOL	R/W	Comparator frozen at its last value	%QWr.m.c.0.6

EVENT_SOURCES_ENABLING, %QWr.m.c.1 Word

The following table presents the meanings of the bits of the %QWr.m.c.1 words:

Standard symbol	Type	Access	Meaning	Language object
EVT_RUN_ENABLE	BOOL	R/W	EVENT task call at start of the counting function	%QWr.m.c.1.0
EVT_MODULO_ENABLE	BOOL	R/W	EVENT task call when there is a counter reversal	%QWr.m.c.1.1
EVT_REF_ENABLE	BOOL	R/W	EVENT task call during counter synchronization or preset	%QWr.m.c.1.2
EVT_COUNTER_LOW_ENABLE	BOOL	R/W	EVENT task call when the counter value is less than lower threshold	%QWr.m.c.1.3

Standard symbol	Type	Access	Meaning	Language object
EVT_COUNTER_WINDOW_ENABLE	BOOL	R/W	EVENT task call when the counter is between the lower and upper threshold	%QWr.m.c.1.4
EVT_COUNTER_HIGH_ENABLE	BOOL	R/W	EVENT task call when the counter value is greater than the upper threshold	%QWr.m.c.1.5
EVT_CAPT_0_ENABLE	BOOL	R/W	EVENT task call during capture in register 0	%QWr.m.c.1.6
EVT_CAPT_1_ENABLE	BOOL	R/W	EVENT task call during capture in register 1	%QWr.m.c.1.7

Details of the Explicit Exchange Objects for the T_CPT_BMX-type IODDT

At a Glance

This section presents the explicit exchange objects for the T_Unsigned_CPT_BMX and T_Signed_CPT_BMX- types IODDTs which are applicable to all BMX EHC •••• counting modules. They includes word type objects whose bits have a specific meaning. These objects are described in detail below.

Sample variable declaration: T_Unsigned_CPT_BMX and T_Signed_CPT_BMX-types IODDT_VAR1.

NOTE:

- in general, the meaning of the bits is given for bit status 1.
- not all bits are used.

Preset Values

The table below shows the meaning of the status bits.

Standard symbol	Type	Access	Meaning	Language object
MODULO_VALUE	DINT	R/W	Modulo value	%MDr.m.c.4
PRESET_VALUE	DINT	R/W	Preset value	%MDr.m.c.6
CALIBRATION_FACTOR	INT	R/W	Calibration factor -10% to +10% (unit = 0.1%)	%MWr.m.c.8
SLACK_VAL	INT	R/W	Offset value	%MWr.m.c.9

Exchange Status: EXCH_STS

The table below shows the meaning of channel exchange status bits from the EXCH_STS channel (%MWr.m.c.0).

Standard symbol	Type	Access	Meaning	Language object
STS_IN_PROG	BOOL	R	Status parameter read in progress	%MWr.m.c.0.0
ADJ_IN_PROG	BOOL	R	Adjust parameter exchange in progress	%Mwr.m.c.0.2
RECONF_IN_PROG	BOOL	R	Reconfiguration in progress	%MWr.m.c.0.15

Channel Report: EXCH_RPT

The following table presents the meanings of the report bits of the EXCH_RPT channel (%MWr.m.c.1).

Standard symbol	Type	Access	Meaning	Language object
STS_ERR	BOOL	R	Error while reading channel status	%MWr.m.c.1.0
ADJ_ERR	BOOL	R	Error while adjusting the channel	%Mwr.m.c.1.2
RECONF_ERR	BOOL	R	Error while reconfiguring the channel	%MWr.m.c.1.15

Channel Error: CH_FLT

The table below presents the meaning of the error bits on the CH_FLT channel (%MWr.m.c.2).

Standard symbol	Type	Access	Meaning	Language object
EXTERNAL_FLT_INPUTS	BOOL	R	External error at inputs	%MWr.m.c.2.0
EXTERNAL_FLT_OUTPUTS	BOOL	R	External error at outputs	%MWr.m.c.2.1
INTERNAL_FLT	BOOL	R	Internal error: channel inoperative	%MWr.m.c.2.4
CONF_FLT	BOOL	R	Hardware or software configuration error	%MWr.m.c.2.5
COM_FLT	BOOL	R	Bus Communication error	%MWr.m.c.2.6
APPLI_FLT	BOOL	R	Application error	%MWr.m.c.2.7

Channel Error: %MWr.m.c.3

The table below presents the meaning of the error bits on the %MWr.m.c.3 word.

Standard symbol	Type	Access	Meaning	Language object
SENSOR_SUPPLY	BOOL	R	Low input power supply for the sensors	%MWr.m.c.3.2
ACTUATOR_SUPPLY_FLT	BOOL	R	Output power supply failure	%MWr.m.c.3.3
SHORT_CIRCUIT_OUT_0	BOOL	R	Short circuit on output 0	%MWr.m.c.3.4
SHORT_CIRCUIT_OUT_1	BOOL	R	Short circuit on output 1	%MWr.m.c.3.5

13.3 Device DDTs Associated with the Counting Function of the BMX EHC xxxx Modules.

Counter Device DDT Names

Introduction

This topic describes the Unity Pro **Counter Device DDT**.

The default device DDT name contains the following information:
- module input and or output (***X*** symbol)
- module insertion number (***#*** symbol)

Example: `MOD_CPT_`***`x`***`_`***`#`***

The default device DDT type contains the following information:
- platform with:
  - M for Modicon M340
- device type (CPT for counter)
- function (STD for standard)
- direction:
  - IN
  - OUT
- max channel (2 or 8)

Example: For a Modicon M340 with 2 standard inputs: T_M_CPT_STD_IN_2

Adjustment Parameter limitation

Adjustment parameters cannot be changed from the PLC application during operation (no support of `READ_PARAM`, `WRITE_PARAM`, `SAVE_PARAM`, `RESTORE_PARAM`).

Modifying the adjustment parameters of a channel from Unity Pro during a CCOTF operation causes the channel to be re-initialized.

The concerned parameters are:
- `PRESET_VALUE`
  Preset value
- `CALIBRATION_FACTOR`
  Calibration Factor
- `MODULO_VALUE`
  Modulo value
- `SLACK_VAL`
  Offset value
- `HYSTERESIS_VALUE`
  Hysteresis value

List of Implicit Device DDT

The following table shows the list of the Modicon M340 devices and their corresponding device DDT name and type:

Device DDT Name	Device DDT Type	Modicon M340 Devices
MOD_CPT_2_#	T_M_CPT_STD_IN_2	BMX EHC 0200
MOD_CPT_8_#	T_M_CPT_STD_IN_8	BMX EHC 0800

Implicit Device DDT Description

The following table shows the T_M_CPT_STD_IN_x status word bits:

Standard Symbol	Type	Meaning	Access
MOD_HEALTH	BOOL	0 = the module has a detected error	read
		1 = the module is operating correctly	
MOD_FLT	BYTE	internal detected errors byte of the module	read
CPT_CH_IN	ARRAY [0...x-1] of T_M_CPT_STD_CH_IN	Array of structure	

The following table shows the T_M_CPT_STD_CH_IN_x[0...x-1] status word bits:

Standard Symbol	Type	Bit	Meaning	Access
FCT_TYPE	WORD		1 = Frequency	read
			2 = EvtCounting	
			3 = PeriodMeasuring	
			4 = Ratio1	
			5 = Ratio2	
			6 = OneShotCounter	
			7 = ModuleLoopCounter	
			8 = FreeLargeCounter	
			9 = PulseWidthModulation	
			10 = UpDownCounting	
			11 = DualPhaseCounting	
CH_HEALTH	BOOL		0 = channel is inactive	read
			1 = channel is active	
ST_OUTPUT_0_ECHO	EBOOL		logical state of output 0	read
ST_OUTPUT_1_ECHO	EBOOL		logical state of output 1	read

Standard Symbol		Type	Bit	Meaning	Access
ST_OUTPUT_BLOCK_0		EBOOL		status of physical counting output block 0	read
ST_OUTPUT_BLOCK_1		EBOOL		status of physical counting output block 1	read
ST_INPUT_A		EBOOL		status of physical counting input A	read
ST_INPUT_B		EBOOL		status of physical counting input B	read
ST_INPUT_SYNC		EBOOL		physical state of the IN_SYNC input (or IN_AUX)	read
ST_INPUT_EN		EBOOL		physical state of IN_EN input (enable)	read
ST_INPUT_REF		EBOOL		physical state of the IN_REF input (preset)	read
ST_INPUT_CAPT		EBOOL		physical state of IN_CAP input (capture)	read
COUNTER_STATUS [INT]	RUN	BOOL	0	the counter operates in counting mode only	read
	MODULO_FLAG	BOOL	1	flag set to 1 by a modulo switch event	read
	SYNC_REF_FLAG	BOOL	2	flag set to 1 by a preset or synchronization event	read
	VALIDITY	BOOL	3	the current numerical value is valid	read
	HIGH_LIMIT	BOOL	4	the current numerical value is locked at the upper threshold value	read
	LOW_LIMIT	BOOL	5	the current numerical value is locked at the lower threshold value	read

Standard Symbol		Type	Bit	Meaning	Access
COMPARE_STATUS [INT]	COUNTER_LOW	BOOL	0	current counter value less than lower threshold (LOWER_TH_VALUE)	read
	COUNTER_WIN	BOOL	1	current counter value is between lower threshold (LOWER_TH_VALUE) and upper threshold (UPPER_TH_VALUE)	read
	COUNTER_HIGH	BOOL	2	current counter value greater than upper threshold (UPPER_TH_VALUE)	read
	CAPT_0_LOW	BOOL	3	Value captured in register 0 is less than lower threshold (LOWER_TH_VALUE)	read
	CAPT_0_WIN	BOOL	4	Value captured in register 0 is between lower threshold (LOWER_TH_VALUE) and upper threshold (UPPER_TH_VALUE)	read
	CAPT_0_HIGH	BOOL	5	Value captured in register 0 is greater than upper threshold (UPPER_TH_VALUE)	read
	CAPT_1_LOW	BOOL	6	Value captured in register 1 is less than lower threshold (LOWER_TH_VALUE)	read
	CAPT_1_WIN	BOOL	7	Value captured in register 1 is between lower threshold (LOWER_TH_VALUE) and upper threshold (UPPER_TH_VALUE)	read
	CAPT_1_HIGH	BOOL	8	Value captured in register 1 is greater than upper threshold (UPPER_TH_VALUE)	read
COUNTER_CURRENT_ VALUE_S[1]		DINT		Current counter value during event	read
CAPT_0_VALUE_S[1]		DINT		Value captured in register 0	read
CAPT_1_VALUE_S[1]		DINT		Value captured in register 1	read
COUNTER_CURRENT_ VALUE_US[2]		UDINT		Current counter value during event	read
CAPT_0_VALUE_US[2]		UDINT		Value captured in register 0	read

Standard Symbol		Type	Bit	Meaning	Access
CAPT_1_VALUE_US[2]		UDINT		Value captured in register 1	read
OUTPUT_0		EBOOL		forces OUTPUT_0 to level 1	read / write
OUTPUT_1		EBOOL		forces OUTPUT_1 to level 1	read / write
OUTPUT_BLOCK_0_ENABLE		EBOOL		implementation of output 0 function block	read / write
OUTPUT_BLOCK_1_ENABLE		EBOOL		implementation of output 1 function block	read / write
FORCE_SYNC		EBOOL		counting function synchronization and start	read / write
FORCE_REF		EBOOL		set to preset counter value	read / write
FORCE_ENABLE		EBOOL		implementation of counter	read / write
FORCE_RESET		EBOOL		reset counter	read / write
SYNC_RESET		EBOOL		reset SYNC_REF_FLAG	read / write
MODULO_RESET		EBOOL		reset MODULO_FLAG	read / write
FUNCTIONS_ENABLING [INT]	VALID_SYNC	BOOL	0	synchronization and start authorization for the counting function via the IN_SYNC input	read / write
	VALID_REF	BOOL	1	operation authorization for the internal preset function	read / write
	VALID_ENABLE	BOOL	2	authorization of the counter enable via the IN_EN input	read / write
	VALID_CAPT_0	BOOL	3	capture authorization in the capture 0 register	read / write
	VALID_CAPT_1	BOOL	4	capture authorization in the capture 1 register	read / write
	COMPARE_ENABLE	BOOL	5	comparators operation authorization	read / write
	COMPARE_SUSPEND	BOOL	6	comparator frozen at its last value	read / write
LOWER_TH_VALUE_S[1]		DINT		lower threshold value	read / write
UPPER_TH_VALUE_S[1]		DINT		upper threshold value	read / write
PWM_FREQUENCY_S[1]		DINT		output frequency value (unit = 0.1 Hz)	read / write
LOWER_TH_VALUE_US[2]		UDINT		lower threshold value	read / write
UPPER_TH_VALUE_US[2]		UDINT		upper threshold value	read / write

Standard Symbol	Type	Bit	Meaning	Access
PWM_FREQUENCY_US[2]	UDINT		output frequency value (unit = 0.1 Hz)	read / write
PWM_DUTY	INT		duty cycle value of the output frequency (unit = 5%)	read / write

1: Signed application specific function (ASF) must be used
2: Unsigned application specific function (ASF) must be used

Here below is all the signed ASF that must be used with a counter ••• EHC 0200:
- Free Large counter Mode
- Ratio 1
- Ratio 2

Here below is all the unsigned ASF that must be used with a counter ••• EHC 0200:
- Event Counting Mode
- Frequency Mode
- Modulo Loop Counter Mode
- One Shot Counter Mode
- Period Measuring Mode
- Pulse Width Modulation Mode

Here below is all the signed ASF that must be used with a counter ••• EHC 0800:
- Up Down Counting Mode

Here below is all the unsigned ASF that must be used with a counter ••• EHC 0800:
- Event Counting Mode
- Frequency Mode
- Modulo Loop Counter Mode
- One Shot Counter Mode

Explicit Device DDT instances Description

Explicit exchanges (Read Status) - only applicable to Modicon M340 I/O channels - are managed with `READ_STS_QX` EFB instance.
- Targeted channel address (`ADDR`) can be managed with ADDMX *(see Unity Pro, Communication, Block Library)* EF (connect `ADDMX OUT` to `ADDR`)
- READ_STS_QX *(see Unity Pro, I/O Management, Block Library)* output parameter (`STATUS`) can be connected to a "`T_M_xxx_yyy_CH_STS`" DDT instance (variable to be created manually), where:
  - `xxx` represents the device type
  - `yyy` represents the function

  Example: `T_M_CPT_STD_CH_STS`

The following table shows the `T_M_CPT_STD_CH_STS` status word bits:

Type	Type	Access
STRUCT	`T_M_CPT_STD_CH_STS`	

The following table shows the T_M_CPT_STD_CH_STS status word bits:

Standard Symbol		Type	Bit	Meaning	Access
CH_FLT [INT]	EXTERNAL_FLT_INPUTS	BOOL	0	external detected error at inputs	read
	EXTERNAL_FLT_OUTPUTS	BOOL	1	external detected error at outputs	read
	INTERNAL_FLT	BOOL	4	internal detected error: channel inoperative	read
	CONF_FLT	BOOL	5	hardware or software configuration detected error	read
	COM_FLT	BOOL	6	bus communication detected error	read
	APPLI_FLT	BOOL	7	application detected error	read
	COM_EVT_FLT	BOOL	8	communication event detected fault	read
	OVR_EVT_CPU	BOOL	9	CPU overflow event	read
	OVR_CPT_CH	BOOL	10	counter channel overflow	read
CH_FLT_2 [INT]	SENSOR_SUPPLY	BOOL	2	low input power supply for the sensors	read
	ACTUATOR_SUPPLY	BOOL	3	output power supply loss	read
	SHORT_CIRCUIT_OUT_0	BOOL	4	short circuit on output 0	read
	SHORT_CIRCUIT_OUT_1	BOOL	5	short circuit on output 1	read

13.4 The IODDT Type T_GEN_MOD Applicable to All Modules

Details of the Language Objects of the IODDT of Type T_GEN_MOD

Introduction

All the modules of Modicon M340 PLCs have an associated IODDT of type T_GEN_MOD.

Observations

In general, the meaning of the bits is given for bit status 1. In specific cases an explanation is given for each status of the bit.

Some bits are not used.

List of Objects

The table below presents the objects of the IODDT.

Standard Symbol	Type	Access	Meaning	Address
MOD_ERROR	BOOL	R	Module detected error bit	%Ir.m.MOD.ERR
EXCH_STS	INT	R	Module exchange control word	%MWr.m.MOD.0
STS_IN_PROGR	BOOL	R	Reading of status words of the module in progress	%MWr.m.MOD.0.0
EXCH_RPT	INT	R	Exchange report word	%MWr.m.MOD.1
STS_ERR	BOOL	R	Event when reading module status words	%MWr.m.MOD.1.0
MOD_FLT	INT	R	Internal detected errors word of the module	%MWr.m.MOD.2
MOD_FAIL	BOOL	R	module inoperable	%MWr.m.MOD.2.0
CH_FLT	BOOL	R	Inoperative channel(s)	%MWr.m.MOD.2.1
BLK	BOOL	R	Terminal block incorrectly wired	%MWr.m.MOD.2.2
CONF_FLT	BOOL	R	Hardware or software configuration anomaly	%MWr.m.MOD.2.5
NO_MOD	BOOL	R	Module missing or inoperative	%MWr.m.MOD.2.6
EXT_MOD_FLT	BOOL	R	Internal detected errors word of the module (Fipio extension only)	%MWr.m.MOD.2.7
MOD_FAIL_EXT	BOOL	R	Internal detected error, module unserviceable (Fipio extension only)	%MWr.m.MOD.2.8
CH_FLT_EXT	BOOL	R	Inoperative channel(s) (Fipio extension only)	%MWr.m.MOD.2.9
BLK_EXT	BOOL	R	Terminal block incorrectly wired (Fipio extension only)	%MWr.m.MOD.2.10

Standard Symbol	Type	Access	Meaning	Address
CONF_FLT_EXT	BOOL	R	Hardware or software configuration anomaly (Fipio extension only)	%MWr.m.MOD.2.13
NO_MOD_EXT	BOOL	R	Module missing or inoperative (Fipio extension only)	%MWr.m.MOD.2.14

Quick Start: Example of Counting Module Implementation

V

Subject of this Part

This part presents an example of implementation of the counting modules.

What Is in This Part?

This part contains the following chapters:

Description of the Application

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Overview of the Application

At a Glance

The application described in this document is used for sticking labels on boxes.

The boxes are carried on a conveyor. A label is stuck onto the box when the latter passes by the two dedicated points.

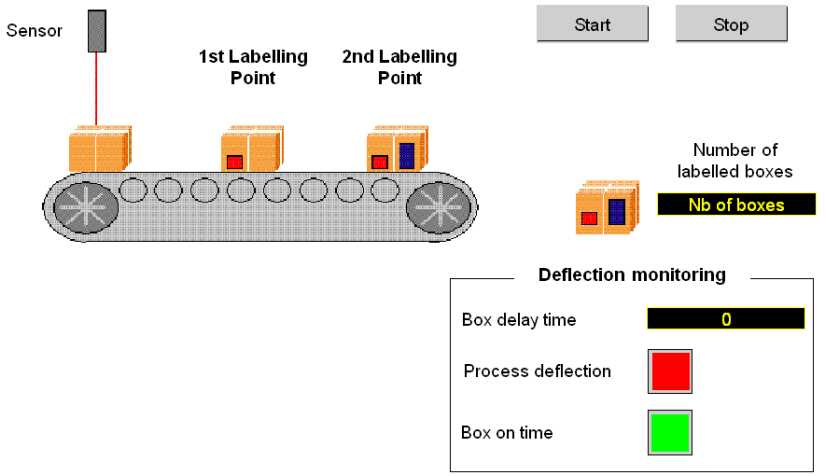
A sensor placed below the conveyor detects any new incoming box. The boxes should arrive at constant intervals.

The conveyor motor is fitted with an encoder connected to a counting input module. Any process deflection is monitored and displayed.

The application's control resources are based on an operator screen displaying all box positions, the number of labeled boxes and the deflection monitoring.

Illustration

This is the application's final operator screen:



Operating Mode

The operating mode is as follows:

- A **Start** button is used to start the labelling process.
- A **Stop** button interrupts the labelling process.
- When the box arrives at the right time, the **Box on time** indicator lights on.
- In case of process deflection, the box delay time is displayed. If this time has been too long, a **Process deflection** indicator lights on.

Installing the Application Using Unity Pro

15

Subject of this chapter

This chapter describes the procedure for creating the application described. It shows, in general and in more detail, the steps in creating the different components of the application.

What Is in This Chapter?

This chapter contains the following sections:

15.1 Presentation of the Solution Used

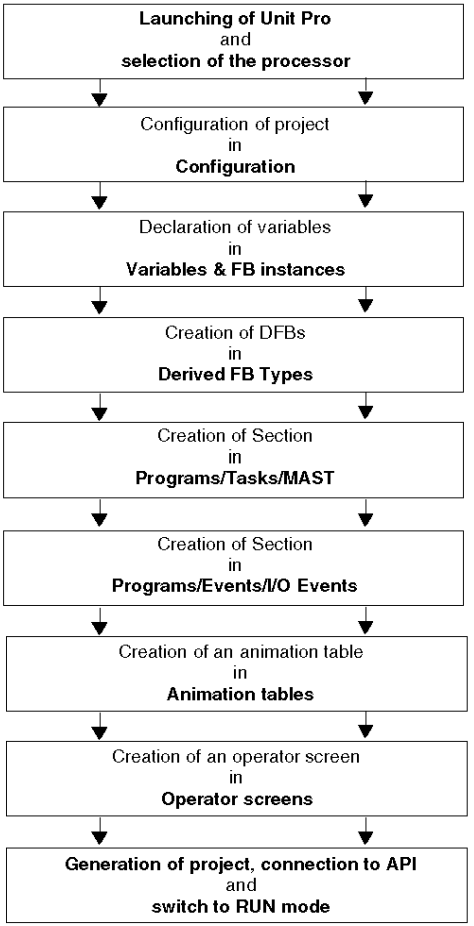
Process Using Unity Pro

At a Glance

The following logic diagram shows the different steps to follow to create the application. A chronological order must be respected in order to correctly define all of the application elements.

Description

Description of the different types:



15.2 Developing the Application

Subject of this Section

This section gives a step-by-step description of how to create the application using Unity Pro.

What Is in This Section?

This section contains the following topics:

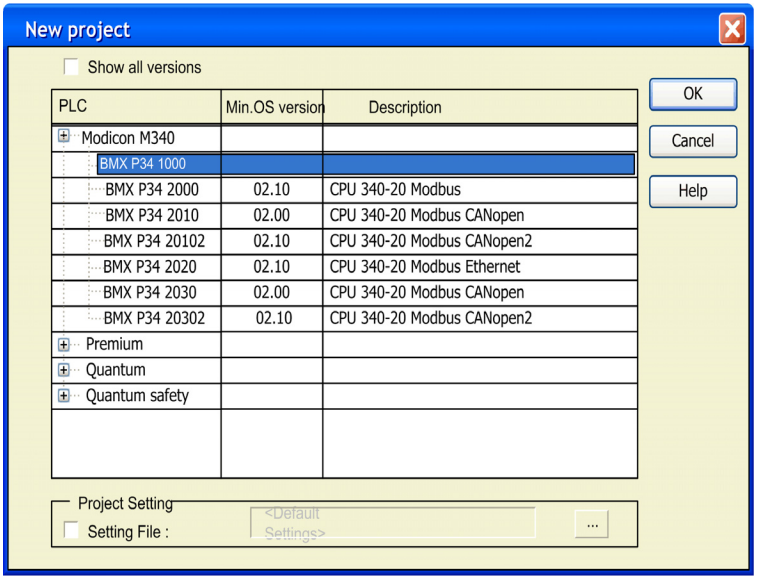
Creating the Project

At a Glance

Developing an application using Unity Pro involves creating a project associated with a PLC.

Procedure for Creating a Project

The table below shows the procedure for creating the project using Unity Pro.

Step	Action
1	Launch the Unity Pro software.
2	Click on File then New to select a PLC. 
3	To see all PLC versions, click on the box Show all versions.
4	Select the processor you wish to use from those proposed.
5	To create a project with specific values of project settings, check the box **Settings File** and use the browser button to localize the .XSO file (Project Settings file). It is also possible to create a new one. If the **Settings File** box is not checked , default values of project settings are used.
6	Terminate your configuration, insert a BMX EHC 0200 input module *Configuration of the Counting Module, page 178*.
7	Confirm with OK.

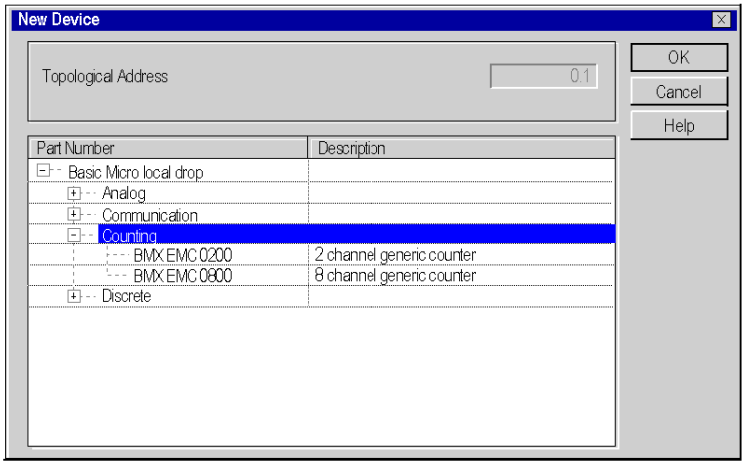
Configuration of the Counting Module

At a Glance

Developing a counting application involves choosing the right module and appropriate configuration.

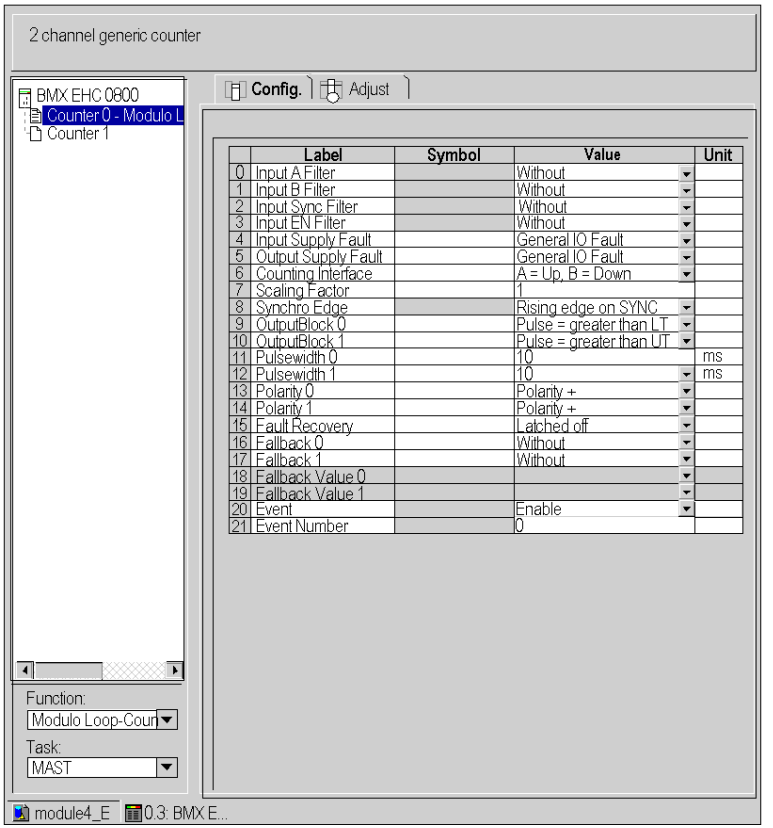
Module Selection

The table below shows the procedure for selecting the counting input module.

Step	Action
1	In the `Project browser` double-click on `Configuration` then on `0:Bus X` and on `0:BMX XBP •••` (Where 0 is the rack number)
2	In the `Bus X` window, select a slot (for example slot 1) and double-click
3	Choose the `BMX HEC 0800` counting input module 
4	Confirm with OK.

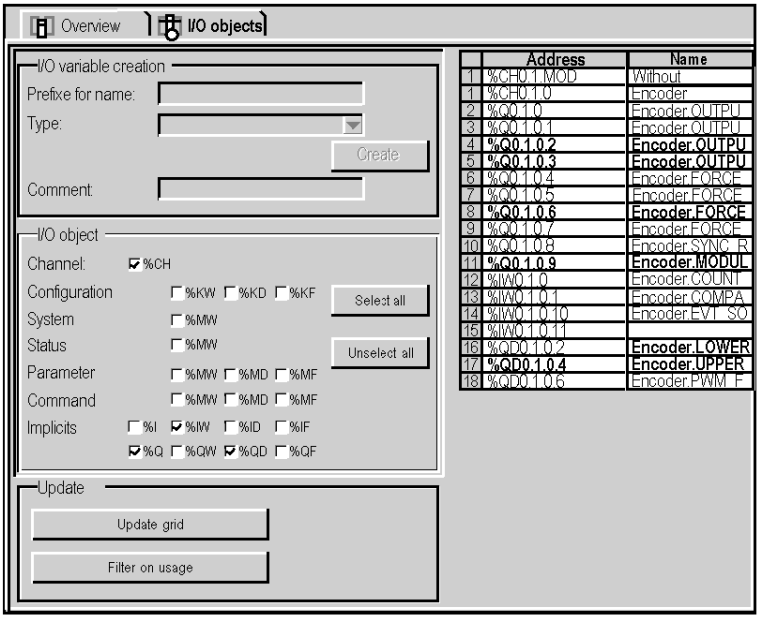
Counting Module Configuration

The table below shows the procedure for selecting the counting function and configuring the module reflex outputs.

Step	Action
1	In the `Bus X` window, double-click on the `BMX EHC 0800` counting input module
2	Select a channel (for example Counter 0) and click
3	Select the module function `Modulo Loop Counter Mode`
4	In the `Config` tab, configure the OutputBlock 0 reflex output with a pulse when the counting is greater than the Lower Threshold (`Pulse = greater than LT`) and the OutputBlock 1 reflex output with a pulse when the counting is greater than the Upper Threshold (`Pulse = greater than UT`). Then click on the `Event` value and select `Enable`. 
5	Click on the Adjust tab and enter the modulo value (for example 50).

Declaration of I/O objects

The table below shows the procedure for declaring the I/O Derived Variable

Step	Action
1	In the `BMX EHC 0800` window, click on the `BMX EHC 0800` and then on the `I/O objects` tab
2	Click on the `I/O object` prefix address `%CH` then on the `Update grid` button, the channel address appears in the `I/O object` grid
3	Click on the line `%CH0.1.0` and then enter a channel name in the `Prefix for name` zone
4	Now click on different Implicit I/O object prefix addresses then `Update grid` button to see the names and addresses of the implicit I/O objects. 

Declaration of Variables

At a Glance

All of the variables used in the different sections of the program must be declared.

Undeclared variables cannot be used in the program.

NOTE: For more information, see Unity Pro online help (click on ?, then `Unity`, then `Unity Pro`, then `Operate modes`, and `Data editor`).

Procedure for Declaring Variables

The table below shows the procedure for declaring application variables.

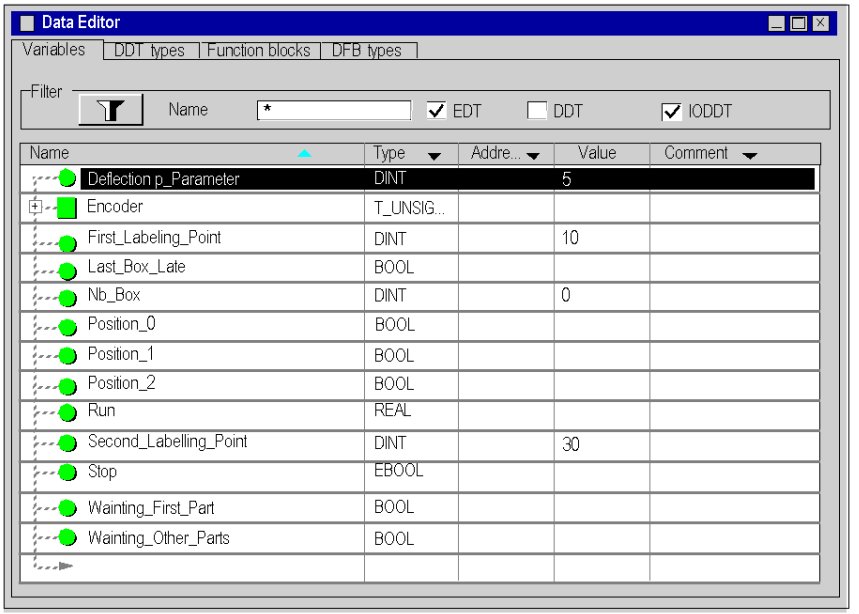
Step	Action
1	In `Project browser / Variables & FB instances`, double-click on `Elementary variables`
2	In the `Data editor` window, select the box in the Name column and enter a name for your first variable.
3	Now select a Type for this variable.
4	When all your variables are declared, you can close the window.

Variables Used for the Application

The following table shows the details of the variables used in the application.

Variable	Type	Definition
Run	EBOOL	Startup request for the labelling process.
Stop	EBOOL	Stop the labelling process.
Last_Box_late	BOOL	The process is in deflection.
Nb_Box	DINT	Number of labelled boxes.
Position_0	BOOL	Box at the beginning of the conveyor.
Position_1	BOOL	Box with the first label.
Position_2	BOOL	Box with the two labels.
First_Labelling_Point	DINT	Lower Threshold value.
Second_Labelling_Point	DINT	Upper Threshold value.
Deflection_Parameter	DINT	Deflection alarm triggering value.
Waiting_First_Part	BOOL	The first box is waited.
Waiting_Other_Parts	BOOL	The first box has already passed.

The following screen shows the application variables created using the data editor :



NOTE: Click on ⊞ in front of the derived variable **Encoder** to expand the I/O objects list.

Creating the Program for Managing the Counter Module

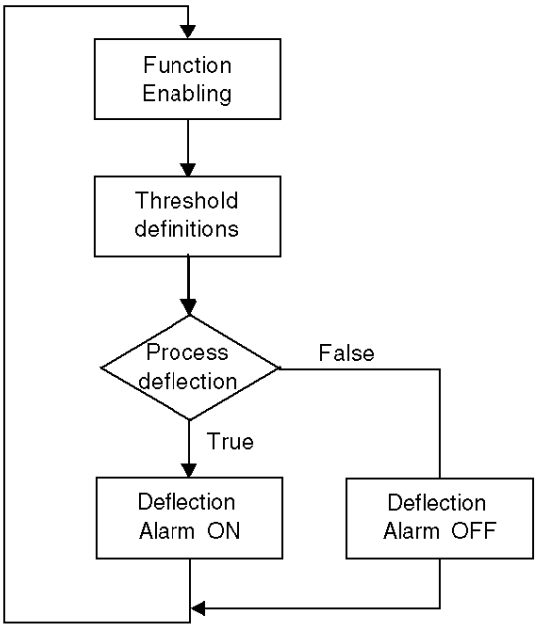
At a Glance

Two sections are declared in the MAST task:

- The `Labelling_Program section` (See *Creating the Labelling Program in ST, page 185*), written in ST, initiates and uses the Modulo Loop Counter Mode functions and I/O objects,
- The `Application section` (See *Creating a Program in LD for Application Execution, page 188*), written in LD, executes the counting start-up and the operator screen animation.

Process Chart

The following screen shows the process chart.



Description of the Labelling _Program Section

The following table describes the different steps of the process chart.

Step	Description
Functions enabling	Enables the Modulo Mode functions used in the application.
Threshold definitions	The values of the thresholds, on which depend the reflex outputs, are defined in this step.
Process deflection	Test if the capture value is greater than the deflection parameter
Deflection Alarm ON	If the result of the process deflection test is true, the alarm is ON.
Deflection Alarm OFF	If the result of the process deflection test is false, the alarm is OFF.

Creating the Labelling Program in ST

At a Glance

This section initiates and uses the Modulo Loop Counter Mode functions and objects.

Illustration of the Labelling _Program Section

This section below is part of the MAST task. It has no condiction defined for it so it is permanently executed:

```
(*Functions Enabling*)
(*Authorizes Input SYNC to synchronize and start the counting
function*)
Encoder.VALID_SYNC:=Waiting_First_Part;
IF Waiting_First_Part
 THEN nb_box := 0;
END IF;
(*Once the first part has passed below the sensor, the other
functions are enabled.*)
IF Waiting_Other_Parts
 THEN
 (*Authorizes captures into the Capture 0 register*)
 Encoder.VALID_CAPT_0:=1;
 (*Authorizes comparators to produce its results*)
 Encoder.COMPARE_ENABLE:=1;
 (*Call Event task when Counter Roll over*)
 Encoder.EVT_MODULO_ENABLE:=1;
 (*Enable the output block functions*)
 Encoder.OUTPUT_BLOCK_0_ENABLE:=1;
 Encoder.OUTPUT_BLOCK_1_ENABLE:=1;
ELSE
(*Function disabling when the conveyor is stopped*)
 Encoder.VALID_CAPT_0:=0
 Encoder.COMPARE_ENABLE:=0
 Encoder.EVT_MODULO_ENABLE:=0
 Encoder.OUTPUT_BLOCK_0_ENABLE:=0
```

```
 Encoder.OUTPUT_BLOCK_1_ENABLE:=0
END IF
(*Definition of the lower and upper threshold values*)
Encoder.LOWER_TH_VALUE:=First_Labelling_Point;
Encoder.UPPER_TH_VALUE:=Second_Labelling_Point;
(*Process Deflection Watching*)
IF Encoder.CAPT_0_VALUE>deflection_parameter=true
  THEN last_box_late:=1; (*Default light set ON*)
  ELSE last_box_late:=0; (*Default light set OFF*)
END IF
(*If the next part arrives just in the right time, the green
indicator lights on*)
IF Encoder.CAPT_0_VALUE = 0
 THEN Last_Box_On_Target :=1 (*Green light set ON*)
 ELSE Last_Box_On_Target :=0 (*Green light set OFF*)
END IF
```

Procedure for Creating an ST Section

The table below shows the procedure for creating an ST section for the application.

Step	Action
1	In `Project Browser\Program\Tasks`, double-click on MAST,
2	Right-click on `Section` then select `New section`. Give your section a name and select `ST language`.
3	The name of your section appears and can now be edited by double-clicking on it.
4	To use the I/O object, right-click in the editor then click on `Data selection` and on  . Click on on the front of the I/O derived variable `Encoder` and the list of the I/O objects appears. Click on the one you need and confirm with OK.

NOTE: In the Data selection windows, the IODDT checkbox must be checked to have access to the I/O derived variable `Encoder`.

Creating the I/O Event Section in ST

At a Glance

This section is called when the modulo value is reached.

Illustration of the Event Section

The section below is part of the Event task:

```
(*Number of labelled boxes is incremented at the Modulo Event
*)
INC(Nb_Box);
```

Procedure for Creating an ST Section

The table below shows the procedure for creating an I/O Event.

Step	Action
1	In `Project Browser\Program\`, double-click on `Events`
2	Right click on `I/O Events` then select `New Event` section. Give your section a number, for this example `select 0`, and then select `ST language`
3	Confirm with OK and the edition window appears.

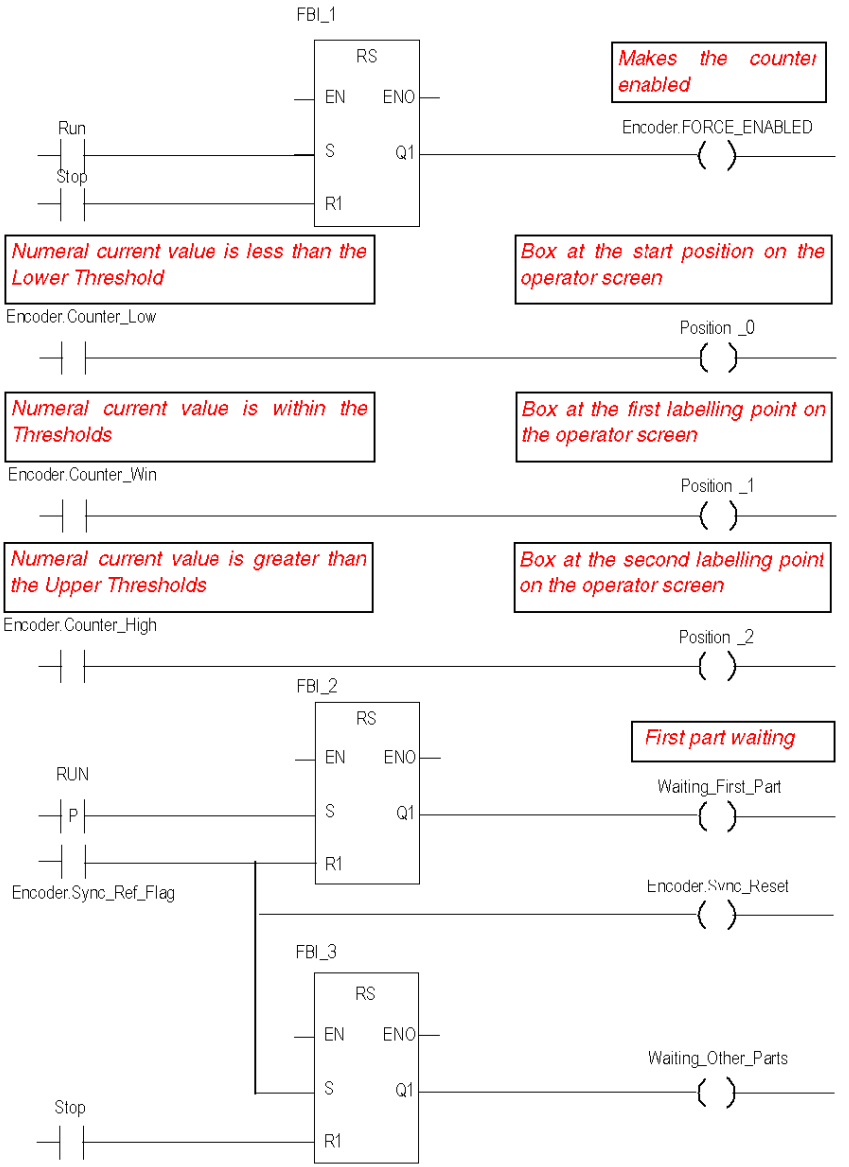
Creating a Program in LD for Application Execution

At a Glance

This section executes the counting start up and the operator screen animation.

Illustration of the Application Section

The section below is part of the MAST task:



Description of the Application Section

- The first line is used to commande the counter.
- The other three lines are used to simulate the different box positions on the conveyor.
- The last part is used to control the variables which allow the function enabling (See *Illustration of the Labelling _Program Section, page 185*
- When `Run` switches to '1', `Waiting_First_Part` is set to '1'.
- A sensor signal triggers the flag `Sync_ref_flag` which resets `Waiting_first_part` to '0' and sets `Waiting_other_parts` to '1'.

Procedure for Creating an LD Section

The table below describes the procedure for creating part of the **Application** section.

Step	Action
1	In `Project Browser\Program\Tasks`, double-click on `MAST`.
2	Right click on `Section` then select `New section`. Name this section Application, then select the language type LD. The Edit window opens.
3	To create the contact Encoder.Sync_Ref_Flag, click on ⊣⊢ then place it in the editor. Double-click on this contact then on ... . The `Instance Selection` window opens. Validate the `Inside structure` checkbox and click on □ in front of the `Encoder` variable and select Sync_Ref_Flag in the list. Confirm with OK.
4	To use the RS block you must instantiate it. Right click in the editor then click on `Select data` and on ... . Click on the `Function and Function Block Types` tab. Click on `Libset` and select the RS block in the list then confirm with OK and position your block. To link the Encoder.Sync_Ref_Flag contact to the S Rnput of the RS block, align the contact and the input horizontally, click on ⇹ and position the link between the contact and the input.

NOTE: For more information on creating an LD section, see Unity Pro online help (click on ?, then `Unity`, then `Unity Pro`, then `Operate modes`, then `Programming` and `LD editor`).

Creating an Animation Table

At a glance

An animation table is used to monitor the values of variables, and modify and/or force these values. Only those variables declared in `Variables & FB instances` can be added to the animation table

NOTE: Note: For more information, consult the Unity Pro online help (click ?, then `Unity`, then `Unity Pro`, then `Operate modes`, then `Debugging and adjustment` then `Viewing and adjusting variables` and `Animation tables`).

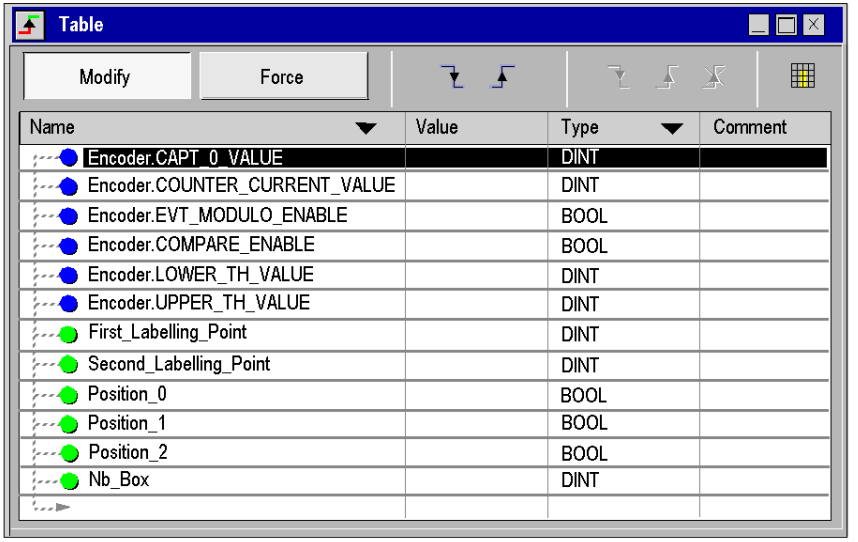
Procedure for Creating an Animation Table

The table below shows the procedure for creating an animation table.

Step	Action
1	In the `Project browser`, right click on `Animation tables`. The edit window opens.
2	Click on first cell in the Name column, then on the … button, and add the variables you require.

Animation Table Created for the Application

The following screen shows the animation table used by the application:



NOTE: The animation table is dynamic only in online mode (display of variable values)

Creating the Operator Screen

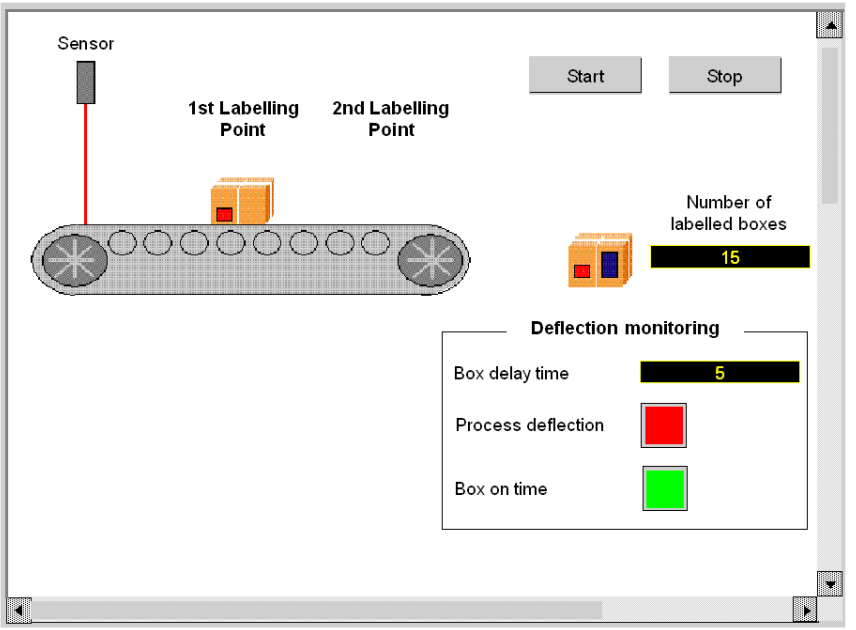
At a Glance

The operator screen is used to animate graphic objects that symbolize the application. These objects can belong to the Unity Pro library, or can be created using the graphic editor.

NOTE: For more information, see Unity Pro online help (click on ?, then `Unity`, then `Unity Pro`, then `Operate modes`, and `Operator screens)`.

Illustration on an Operator Screen

The following illustration shows the application operator screen:



NOTE: To animate objects in online mode, you must click on  . By clicking on this button, you can validate what is written.

Procedure for Creating an Operator Screen

The table below shows the procedure for creating the Start button.

Step	Action
1	In the `Project browser`, right click on `Operator screens` and click on `New screen`. The operator screen editor appears.
2	Click on the button and position the new button on the operator screen. Double click on the button and in the `Control` tab, select the Run variable by clicking the button ... and confirm with OK. Then, enter the button name in the text zone.

The table below shows the procedure for inserting and animating the conveyor.

Step	Action
1	In the Tools menu, select `Operator screens Library`. Double click on `Machine` then `Conveyor`. Select the dynamic conveyor from the runtime screen and Copy (Ctrl+C) then Paste (Ctrl+V) it into the drawing in the operator screen editor.
2	The conveyor is now in your operator screen. You now need a variable to animate the wheels. Select your conveyor then click on . A line on the wheel is selected. Press enter and the object properties window opens. Select the `Animation` tab and enter the concerned variable, by clicking on ... (in the place of %MW0). In our application, this will be Encoder.INPUT_A, the physical input A state. Confirm with Apply and OK.
3	Click on to select the other lines one by one and apply the same procedure.

NOTE: In the `Instance Selection`, tick the IODDT checkbox and click on + to access the I/O objects list.

The table below shows the procedure for inserting and animating a display.

Step	Action
1	Click on Aa and position it on the operator screen. Double click on the text and select the `Animation` tab.
2	Tick the Animated Object checkbox, select the concernd variable by cliking on ... and confirm with OK.

Starting the Application

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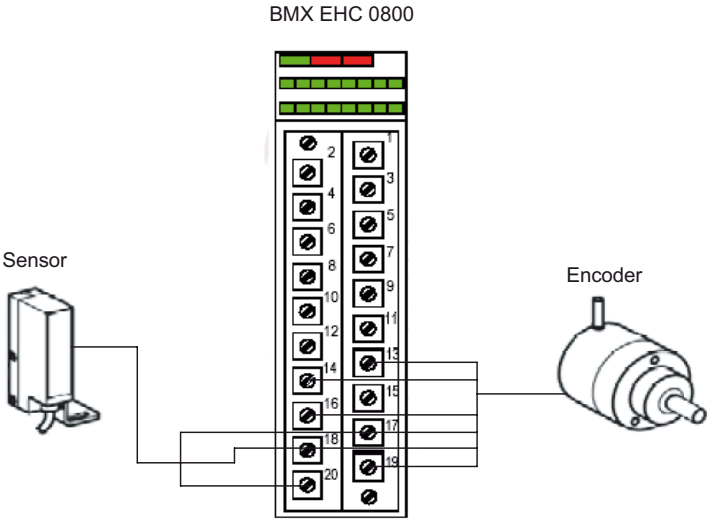
Execution of Application in Standard Mode

At a Glance

Standard mode working requires the use of a PLC and a BMX EHC 0800 with an encoder and a sensor linked to its inputs.

Inputs Wiring

The encoder and the sensor are connected as follows:



Description:

Pin number	Symbol	Description
1	IN_AUX	Input for channel 0
2	IN_A	Input for channel 0
3	IN_AUX	Input for channel 1

Pin number	Symbol	Description
4	IN_A or IN_B	Input for channel 1 or Input for channel 0
5	IN_AUX	Input for channel 2
6	IN_A	Input for channel 2
7	IN_AUX	Input for channel 3
8	IN_A or IN_B	Input for channel 3 or Input for channel 2
9	IN_AUX	Input for channel 4
10	IN_A	Input for channel 4
11	IN_AUX	Input for channel 5
12	IN_A or IN_B	Input for channel 5 or Input for channel 4
13	IN_AUX	Input for channel 6
14	IN_A	Input for channel 6
15	IN_AUX	Input for channel 7
16	IN_A or IN_B	Input for channel 7 or Input for channel 6
17	24V_SEN	Return + 24 V power supply for sensors
18	VDC	VDC + power supply for sensors
19, 20	FE	Functional earth, for shield continuation

Application Execution

The table below shows the procedure for launching the application in standard mode:

Step	Action
1	In the `PLC` menu, click on `Standard Mode`,
2	In the `Build` menu, click on `Rebuild All Project`. Your project is generated and is ready to be transferred to the PLC. When you generate the project, you will see a results window. If there is an error in the program, Unity Pro indicates its location if you click on the highlighted sequence.
3	In the `PLC` menu, click on `Connection`. You are now connected to the PLC.
4	In the `PLC` menu, click on `Transfer project to PLC`. The `Transfer project to PLC` window opens. Click on `Transfer`. The application is transferred to the PLC.
5	In the `PLC`, click on `Execute`. The `Execute` window opens. Click on `OK`. The application is now being executed (in RUN mode) on the PLC.

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