

# Modicon M340 Controllers

## Setup Guide

Original Instructions

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

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

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# Safety Information

## Important Information

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



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



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

### **DANGER**

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

### **WARNING**

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

### **CAUTION**

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

### **NOTICE**

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

## Please Note

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

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

## Before You Begin

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

### **▲ WARNING**

#### **UNGUARDED EQUIPMENT**

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

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

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

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

In some applications, such as packaging machinery, additional operator protection such as point-of-operation guarding must be provided. This is necessary if the operator's hands and

other parts of the body are free to enter the pinch points or other hazardous areas and serious injury can occur. Software products alone cannot protect an operator from injury. For this reason the software cannot be substituted for or take the place of point-of-operation protection.

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

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

## Start-up and Test

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

### **▲ WARNING**

#### **EQUIPMENT OPERATION HAZARD**

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

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

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

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

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

Before energizing equipment:

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

## Operation and Adjustments

The following precautions are from the NEMA Standards Publication ICS 7.1-1995:

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

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

# About the Document

## Document Scope

This guide describes the hardware installation of the Modicon M340 controllers and installation of their main accessories.

## Validity Note

This document has been updated for the release of EcoStruxure™ Control Expert 16.1 with Modicon M340 firmware version 3.60.

The characteristics of the products described in this document are intended to match the characteristics that are available on [www.se.com](http://www.se.com). As part of our corporate strategy for constant improvement, we may revise the content over time to enhance clarity and accuracy. If you see a difference between the characteristics in this document and the characteristics on [www.se.com](http://www.se.com), consider [www.se.com](http://www.se.com) to contain the latest information.

## Product Related Information

### DANGER

#### HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Disconnect all power from all equipment, including connected devices, prior to removing any covers or doors or installing or removing any accessories, hardware, cables, or wires except under the specific conditions specified in the appropriate hardware guide for this equipment.
- Always use a properly rated voltage-sensing device to confirm the power is off where and when indicated.
- Replace and secure all covers, accessories, hardware, cables, and wires and confirm that a proper ground connection exists before applying power to the equipment.
- Use only the specified voltage when operating the equipment and any associated products.

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

## ⚠ WARNING

### LOSS OF CONTROL

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

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

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

## ⚠ WARNING

### UNINTENDED EQUIPMENT OPERATION

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

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

## General Cybersecurity Information

In recent years, the growing number of networked machines and production plants has seen a corresponding increase in the potential for cyber threats, such as unauthorized access, data breaches, and operational disruptions. You must, therefore, consider all possible cybersecurity measures to help protect assets and systems against such threats.

To help keep your Schneider Electric products secure and protected, it is in your best interest to implement the cybersecurity best practices as described in the [Cybersecurity Best Practices](#) document.

Schneider Electric provides additional information and assistance:

- [Subscribe to the Schneider Electric security newsletter.](#)
- [Visit the Cybersecurity Support Portal web page to:](#)
  - [Find Security Notifications.](#)
  - [Report vulnerabilities and incidents.](#)
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  - [Access the cybersecurity posture.](#)
  - [Learn more about cybersecurity in the cybersecurity academy.](#)
  - [Explore the cybersecurity services from Schneider Electric.](#)

## Environmental Data

For product compliance and environmental information, refer to the [Schneider Electric Environmental Data Program](#).

## Related Documents

| Title of documentation   | Reference number   |
|--|--|
| Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications        | EIO0000002726 (ENG)<br>EIO0000002727 (FRE)<br>EIO0000002728 (GER)<br>EIO0000002730 (ITA)<br>EIO0000002729 (SPA)<br>EIO0000002731 (CHS) |
| Modicon X80 Backplanes and Power Supplies, Hardware, Reference Manual          | EIO0000002626 (ENG)<br>EIO0000002631 (CHS)<br>EIO0000002627 (FRE)<br>EIO0000002628 (GER)<br>EIO0000002630 (ITA)<br>EIO0000002629 (SPA) |
| EcoStruxure™ Control Expert, Program Languages and Structure, Reference Manual | 35006144 (ENG)<br>35006145 (FRE)<br>35006146 (GER)<br>35013361 (ITA)<br>35006147 (SPA)<br>35013362 (CHS)                               |
| EcoStruxure™ Control Expert, Operating Modes                                   | 33003101 (ENG)<br>33003102 (FRE)<br>33003103 (GER)<br>33003104 (SPA)<br>33003696 (ITA)<br>33003697 (CHS)                               |
| Modicon X80 BMXEIA0100 AS-Interface Bus Module, User Manual                    | EIO0000000138 (ENG)<br>EIO0000000139 (FRE)<br>EIO0000000140 (GER)<br>EIO0000000142 (ITA)<br>EIO0000000143 (CHS)<br>EIO0000000141 (SPA) |

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## Terminology Derived from Standards

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

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

Among others, these standards include:

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

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

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

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

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

## Information on Non-Inclusive or Insensitive Terminology

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

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# Modicon M340 Controllers

## What's in This Part

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## Overview

This part provides an overview of the Modicon M340 controller configurations and the sub-assemblies, as well as the networks and field buses used.

# Modicon M340 Controller Stations

## What's in This Chapter

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## Overview

This chapter provides an overview of Modicon M340 controllers.

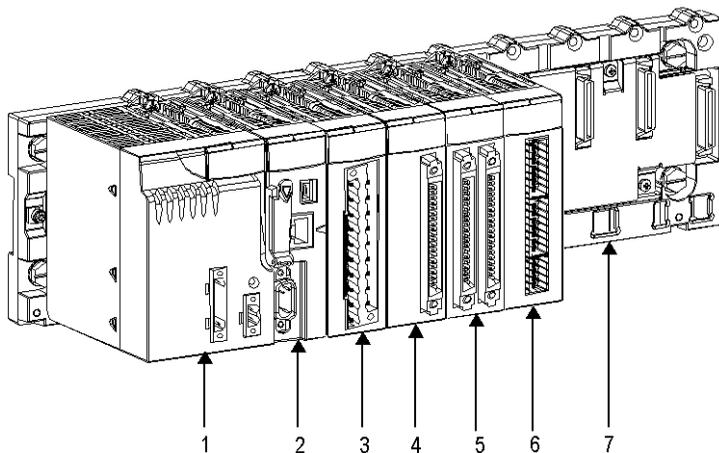
## Modicon M340 Controllers

### Introduction

Modicon M340 controllers manage the entire controller station, which consists of analog and discrete I/O modules, counting modules, expert modules, and communication modules. These are distributed across one or more backplanes connected on the local bus. Each backplane must include a power supply module; the main backplane supports the controller.

## Illustration

The following diagram presents a configuration example for the Modicon M340 controller with one backplane:



Legend:

| Number | Description                        |
|--------|------------------------------------|
| 1      | Power supply module                |
| 2      | Controller                         |
| 3      | 20-pin terminal block I/O module   |
| 4      | 40-pin single connector I/O module |
| 5      | 40-pin 2-connector I/O module      |
| 6      | Counting module                    |
| 7      | 8-slot backplane                   |

# Standards and Certifications

## Download

Click the link that corresponds to your preferred language to download standards and certifications (PDF format) that apply to the modules in this product line:

| Title   | Languages   |
|---|---|
| Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications | <ul style="list-style-type: none"><li data-bbox="663 440 938 461">• English: EIO0000002726</li><li data-bbox="663 472 938 493">• French: EIO0000002727</li><li data-bbox="663 505 943 526">• German: EIO0000002728</li><li data-bbox="663 537 924 558">• Italian: EIO0000002730</li><li data-bbox="663 570 943 591">• Spanish: EIO0000002729</li><li data-bbox="663 602 943 623">• Chinese: EIO0000002731</li></ul> |

# Controller Components

## What's in This Chapter

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## Overview

This chapter provides an overview of the controller components.

## Controllers

### Overview

Each controller has the following characteristics:

- Processing power (number of inputs/outputs managed)
- Memory capacity
- Communication ports

For further information, refer to *BMXP34xxxx Controllers*, page 35.

## Backplanes

### Introduction

The following list presents the number of backplane slots available for the controller and modules for each backplane reference:

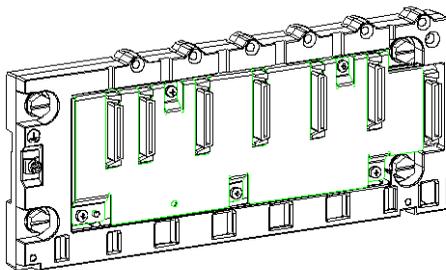
- 4 slots: BMXXBP0400 / BMXXBP0400H or BMEXBP0400 / BMEXBP0400H
- 6 slots: BMXXBP0600 / BMXXBP0600H
- 8 slots: BMXXBP0800 / BMXXBP0800H or BMEXBP0800 / BMEXBP0800H
- 12 slots: BMXXBP1200 / BMXXBP1200H or BMEXBP1200 / BMEXBP1200H
- 16 slots: BMXXBP1600 / BMXXBP1600H
- Backplanes with redundant power supplies:
  - 6 slots: BMEXBP0602 / BMEXBP0602H
  - 10 slots: BMEXBP1002 / BMEXBP1002H

Each backplane includes one extra slot that is reserved for the power supply module, and one slot on the right is reserved for the BMXXBE1000 backplane expansion module.

For further information, refer to the *Modicon X80 Backplanes* chapter (see *Modicon X80, Backplanes and Power Supplies, Hardware Reference Manual*).

## Backplane Illustration

The following illustration presents the BMXXPB0400 backplane:



## Power Supply Modules

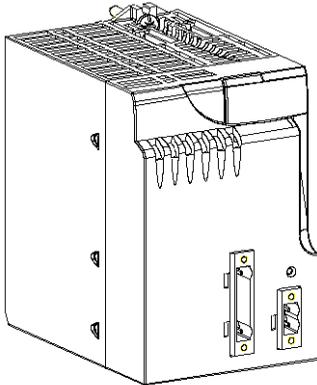
### Introduction

Each backplane requires one power supply module defined according to the current (alternating or direct current) and the power necessary at backplane level.

For further information, refer to the *Modicon X80 Power Supply Modules Description* chapter (see *Modicon X80, Backplanes and Power Supplies, Hardware Reference Manual*).

## Illustration

The following illustration presents a BMXCPS\*\*\*\* power supply module:



## Backplane Expansion Modules

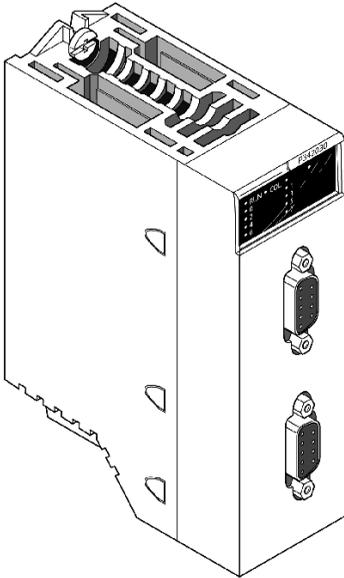
### Introduction

This module enables the connection of up to four chained backplanes, depending on the controller, distributed along a maximum length of 30 meters.

For further information, refer to the *BMXXBE1000 Backplane Extender Module* chapter (see Modicon X80, Backplanes and Power Supplies, Hardware Reference Manual).

## Illustration

Illustration of the BMXXBE1000 backplane expansion module:



## Analog / Discrete Input/Output Modules

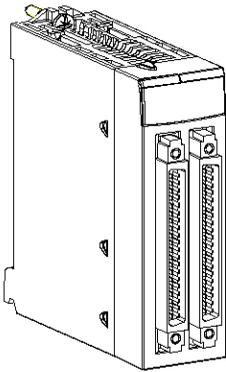
### Discrete Input/Output Modules

The characteristics of the discrete input/output modules differ as follows:

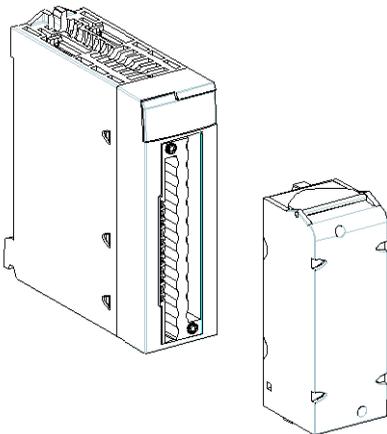
| Characteristics | Description  |
|-----------------|--|
| Modularity      | <ul style="list-style-type: none"> <li>• 8 channels</li> <li>• 16 channels</li> <li>• 32 channels</li> <li>• 64 channels</li> </ul>  |
| Type of Inputs  | <ul style="list-style-type: none"> <li>• Modules with direct current inputs (24 Vdc and 48 Vdc)</li> <li>• Modules with alternating current inputs (24 Vac, 48 Vac and 120 Vac)</li> </ul> |

| Characteristics   | Description  |
|-------------------|--|
| Type of outputs   | <ul style="list-style-type: none"><li>• Modules with relay outputs</li><li>• Modules with direct current transistor outputs (24 Vdc / 0.1 A - 0.5 A - 3 A)</li><li>• Modules with alternating current triac outputs (24 Vdc / 240 Vac / 3 A)</li></ul> |
| Type of connector | <ul style="list-style-type: none"><li>• 20-pin terminal blocks</li><li>• 40-pin connectors allowing connection to sensors and pre-actuators through the TELEFAST prewiring system</li></ul>  |

The following illustration presents a discrete input/output module with 40-pin connectors:



The following illustration presents a discrete input/output module with a 20-pin terminal block:

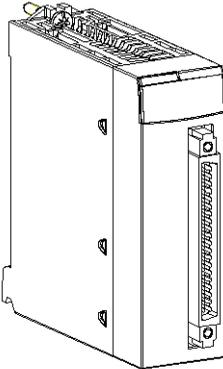


# Analog Input/Output Modules

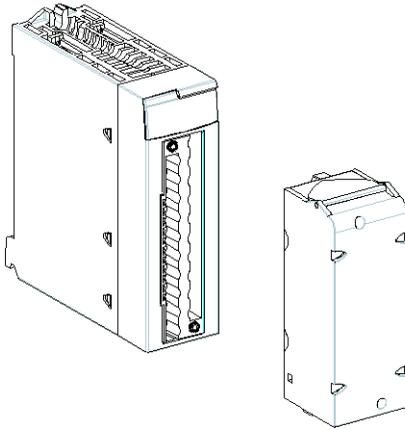
The characteristics of the discrete input/output modules differ as follows:

| Characteristics                          | Description   |
|--|---|
| Modularity                               | <ul style="list-style-type: none"><li>• 2 channels</li><li>• 4 channels</li></ul>   |
| Performance and range of signals offered | <ul style="list-style-type: none"><li>• Voltage/current</li><li>• Thermocouple</li><li>• Thermowell</li></ul>   |
| Type of connector                        | <ul style="list-style-type: none"><li>• 20-pin terminal blocks</li><li>• 40-pin connectors allowing connection to sensors and pre-actuators by way of the TELEFAST prewiring system</li></ul> |

The following illustration presents an analog input/output module with one 40-pin connector:



The following illustration presents an analog input/output module with one 20-pin terminal block:



## Counting Modules

### Introduction

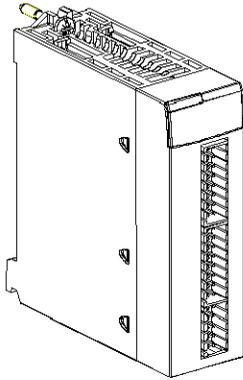
M340 controllers offer counting functions (downcounting, counting, counting/downcounting) through the application-specific counting modules.

Two counting modules are offered:

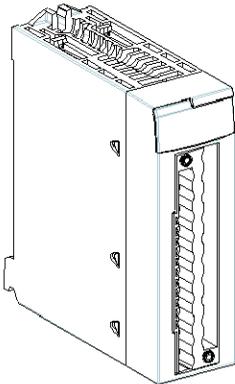
- BMXEHC0200 module with two counting channels and a maximum acquisition frequency of 60 kHz
- BMXEHC0800 module with eight counting channels and a maximum acquisition frequency of 10 kHz

## Illustration

The following illustration presents a BMXEHC0200 counting module:



The following illustration presents a BMXEHC0800 counting module:



## Communication Modes

### Introduction

M340 controllers can be used in different communication modes:

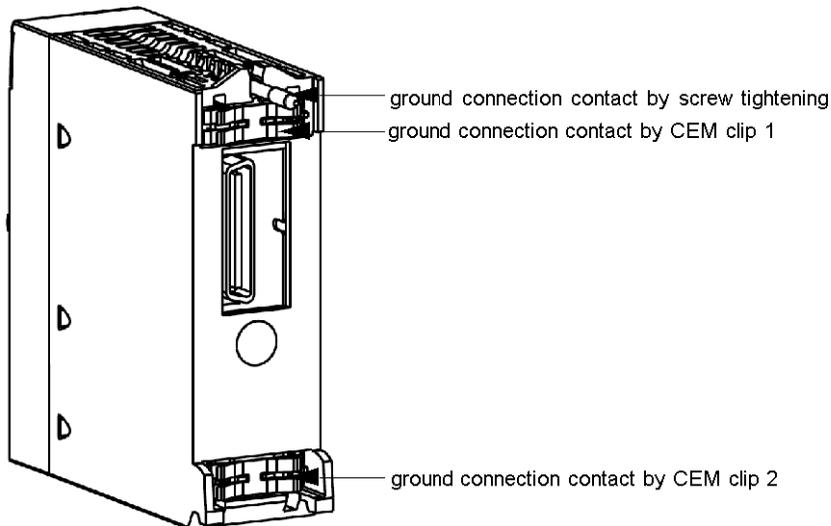
- USB

- Serial
- Ethernet
- CANopen
- AS-Interface

## Grounding

### Grounding Controllers and Power Supply Modules

The M340 controller and X80 I/O modules are equipped with ground connection contacts at the rear for grounding purposes. These contacts connect the grounding bus of the modules to the grounding bus of the backplane.



---

# Hardened Equipment

## Overview

Hardened equipment is a ruggedized version of non-hardened equipment. With conformal coating of the electronic boards, the hardened equipment can be used in harsh chemical environments at extended temperatures -25...+70 °C (-13...+158 °F).

**NOTE:** For more information, refer to the *Installation in More Severe Environments* chapter (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

## Hardened Equipment

The following equipment is available in hardened versions:

- Controllers:
  - BMXP342020H
  - BMXP3420302H
- Power supply modules:
  - BMXCPS3020H
  - BMXCPS3500H
  - BMXCPS4002H
- Backplanes:
  - BMXXBP0400H
  - BMXXBP0600H
  - BMXXBP0800H
  - BMXXBP1200H
  - BMXXBP1600H
  - BMEXBP0400H
  - BMEXBP0800H
  - BMEXBP1200H
  - BMEXBP0602H
  - BMEXBP1002H
- Backplane expansion modules:
  - BMXXBE1000H

- Counting modules:
  - BMXEHC0200H
  - BMXEHC0800H
- Analog input modules:
  - BMXART0414H
  - BMXART0814H
  - BMXAMI0810H
- Analog output modules:
  - BMXAMO0210H
  - BMXAMO0410H
- Analog input/output modules:
  - BMXAMM0600H
- TELEFAST wiring accessories
  - ABE7CPA0410H
  - ABE7CPA0412H
- Digital input modules:
  - BMXDDI1602H
  - BMXDDI1603H
- Digital input/output modules:
  - BMXDAI1602H
  - BMXDAI1603H
  - BMXDAI1604H
  - BMXDAI1614H
  - BMXDAI1615H
  - BMXDDM16022H
  - BMXDDM16025H

- Digital output modules:
  - BMXDAO1605H
  - BMXDAO1615H
  - BMXDDO1602H
  - BMXDDO1612H
  - BMXDRA0805H
  - BMXDRA0815H
  - BMXDRA1605H
  - BMXDRC0805H
- Synchronous serial interface (SSI) modules:
  - BMXEAE0300H

# Controller Networks

## What's in This Chapter

|                         |    |
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| Modbus Protocol.....    | 31 |
| Ethernet Network.....   | 31 |
| CANopen Field Bus ..... | 32 |

## Overview

This chapter provides an overview of M340 controller networks.

## Modbus Protocol

### Introduction

The Modbus protocol creates a hierarchical structure (one client and several servers).

The client manages all exchanges according to two types of dialog:

- The client exchanges with a server and awaits the response.
- The client exchanges with all servers without awaiting a response (broadcast queries).

### Illustration

The following illustration presents a Modbus network:

## Ethernet Network

### Introduction

Ethernet communication is used for:

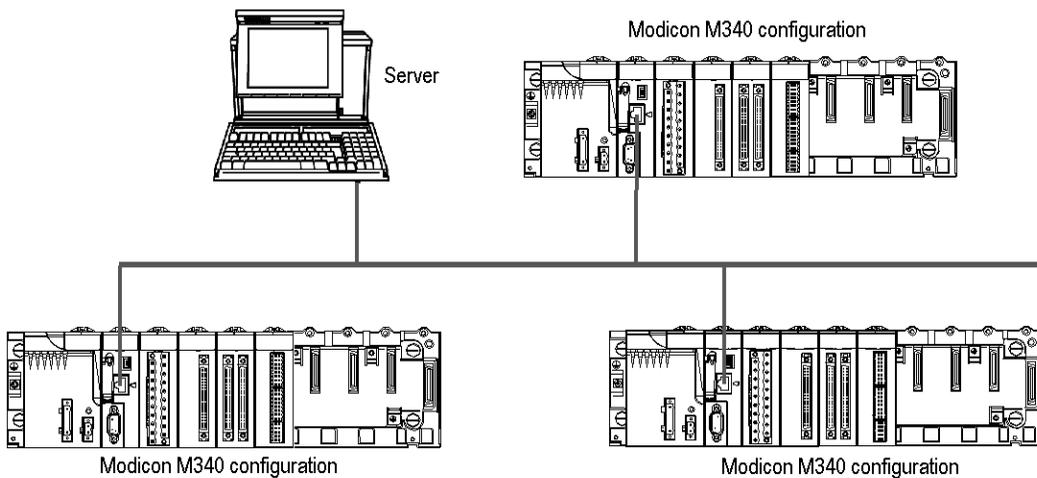
- coordination between controllers

- local or centralized monitoring
- communication with the production management information system
- communication with remote input/output modules

Acting as an agent, Ethernet communication also supports management of the Simple Network Management Protocol (SNMP).

## Illustration

The following illustration presents an Ethernet network:



## CANopen Field Bus

### Introduction

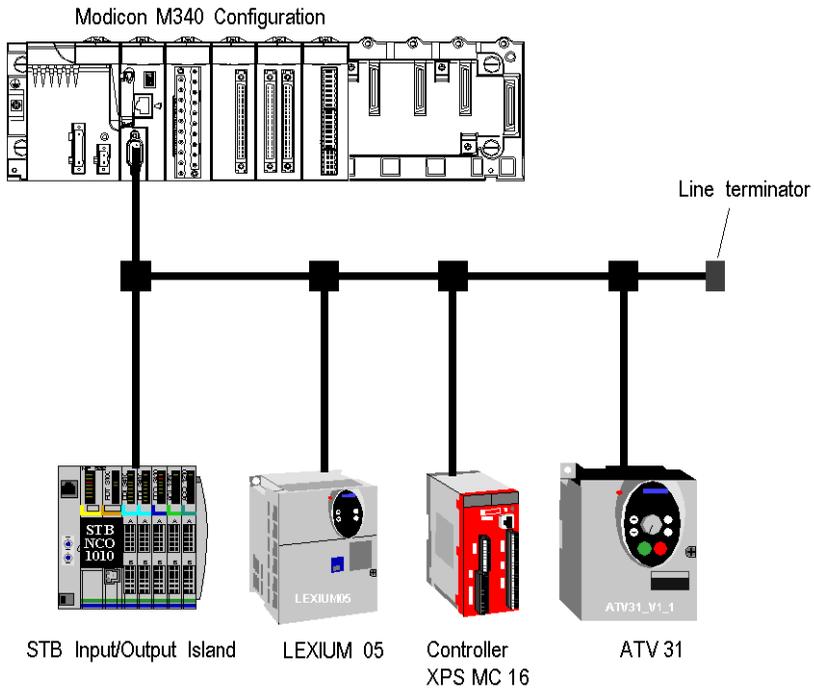
The CANopen structure consists of:

- a primary bus
- secondary devices, also called nodes

For more information, consult the [CANopen consortium website](#).

## Illustration

The following example illustrates a CANopen field bus architecture:



---

# BMXP34xxxx Controllers

## What's in This Part

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## Overview

This part describes the BMXP34•••• controllers and their installation.

# BMXP34xxxx Controllers

## What's in This Chapter

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## Overview

This chapter describes the BMXP34\*\*\*\* controllers.

## BMXP34xxxx Controllers

### BMXP34xxxx Controllers

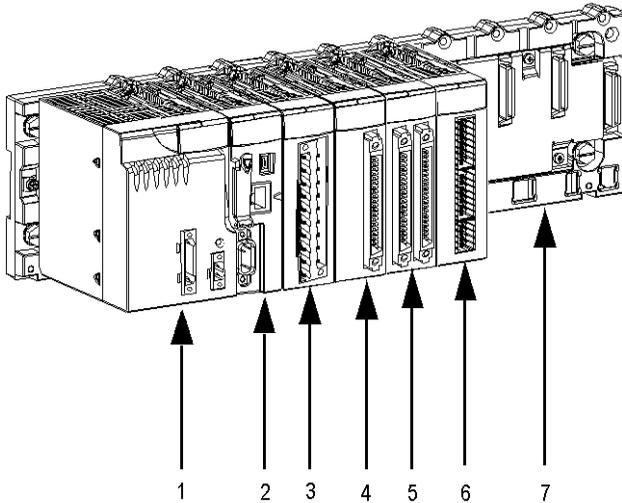
BMXP34\*\*\*\* controllers manage the entire station, which includes the following elements:

- discrete input/output modules
- analog input/output modules
- expert modules
- communication modules

BMXP34\*\*\*\* controllers can be installed on Modicon X80 backplanes.

## Illustration

The following illustration presents a controller-managed architecture:

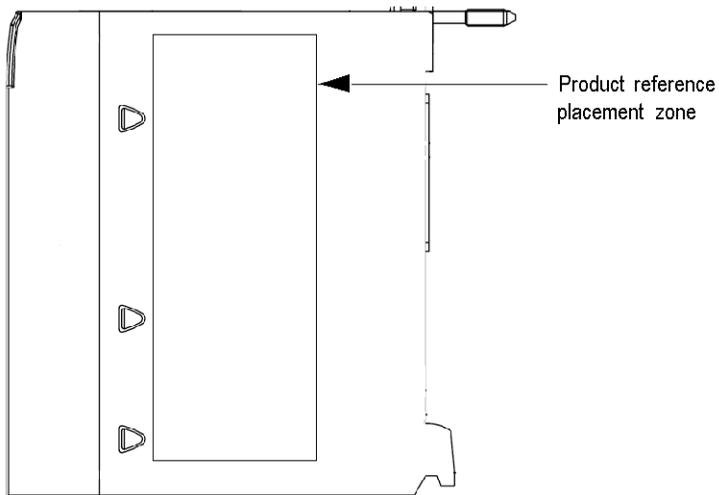


### Legend:

| Number | Description                    |
|--------|--------------------------------|
| 1      | Power supply module            |
| 2      | Controller                     |
| 3      | 20-pin terminal block module   |
| 4      | 40-pin single connector module |
| 5      | 40-pin twin connector module   |
| 6      | Counting module                |
| 7      | Backplane                      |

## Controller Product References

The following diagram presents the location of the product references on the side of the controller:



## Characteristics

The following table describes the key characteristics of the BMXP34••••• controllers.

| Controller           | Global maximum number of discrete inputs/ outputs | Global maximum number of analog inputs/ outputs | Maximum memory size | Modbus Connection | Integrated CANopen Master Connection | Integrated Ethernet Connection |
|----------------------|---|---|---------------------|-------------------|--------------------------------------|--------------------------------|
| BMXP341000           | 512   | 128   | 2048 Kb             | X                 | -                                    | -                              |
| BMXP342000           | 1024  | 256   | 4096 Kb             | X                 | -                                    | -                              |
| BMXP342010/<br>20102 | 1024  | 256   | 4096 Kb             | X                 | X                                    | -                              |
| BMXP342020           | 1024  | 256   | 4096 Kb             | X                 | -                                    | X                              |
| BMXP342030/<br>20302 | 1024  | 256   | 4096 Kb             | -                 | X                                    | X                              |
| <b>Key</b>           |   |   |                     |                   |                                      |                                |
| X available          |   |   |                     |                   |                                      |                                |
| - not available      |   |   |                     |                   |                                      |                                |

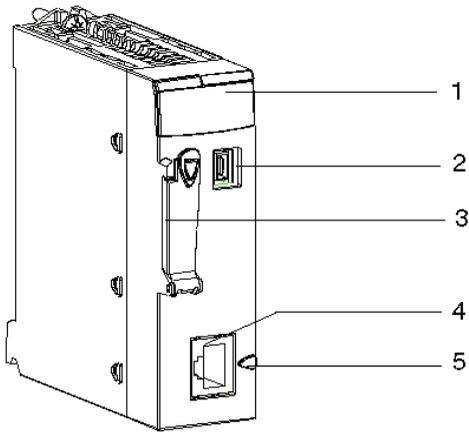
## Physical Description

## Introduction

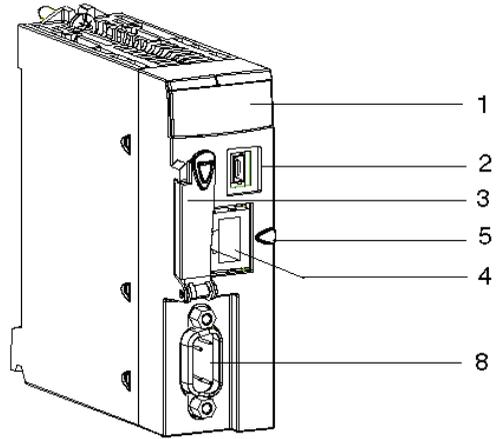
The BMXP34•••• controllers differ according to the various components they include.

## Illustration

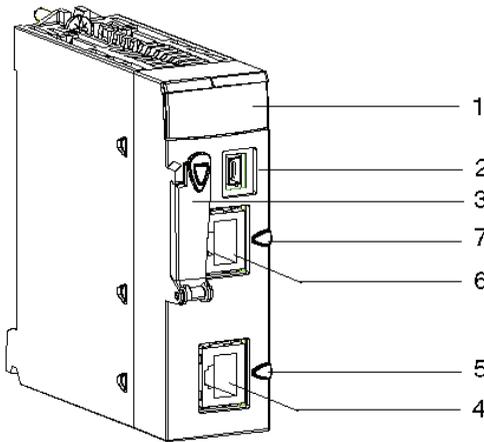
The following diagram presents the components of a BMXP34•••• controller:



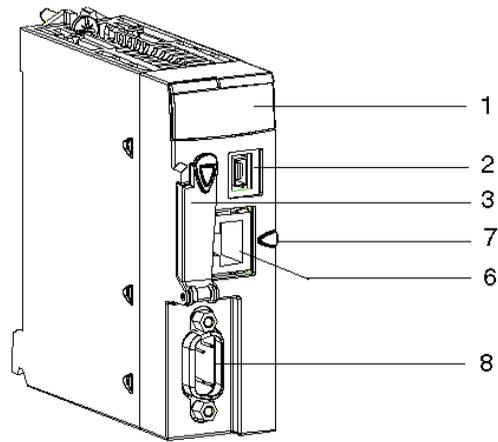
BMX P34 1000/2000 Controller



BMX P34 2010 Controller



BMX P34 2020 Controller



BMX P34 2030 Controller

The following table describes the components of a BMXP34•••• controller.

| Number | Function                                |
|--------|---|
| 1      | Display panel                           |
| 2      | USB port                                |
| 3      | Memory card port                        |
| 4      | Serial port                             |
| 5      | Serial port identification ring (black) |

| Number | Function                                  |
|--------|---|
| 6      | Ethernet port                             |
| 7      | Ethernet port identification ring (green) |
| 8      | CANopen port                              |

## USB Port

### Introduction

All controllers have a USB port.

### Description

Two cables are available to connect a Human-Machine Interface (HMI) to the USB port of the controller:

- BMXXCAUSB018, 1.8 m (5.91 ft) in length
- BMXXCAUSB045, 4.5 m (14.76 ft) in length

Both cables have a connector at each end:

- Type A USB: connects to the console
- Type Mini-B USB: connects to the controller

In a fixed assembly with an XBT type console connected to the controller using the USB port, connect the USB cable to the shielding connection kit (see Modicon X80, Backplanes and Power Supplies, Hardware Reference Manual).

**NOTE:** When configuring an M340 controller, use a USB 2.0 shielded cable that complies with the USB international standard. The BMXXCAUSB018 and BMXXCAUSB045 cables are designed for this type of use and help avoid unintended operation of the backplane. The cables are shielded and tested against electrical interference.

# Modbus Port

## Introduction

The following controllers have a built-in communication channel dedicated to serial communication that supports a Modbus port:

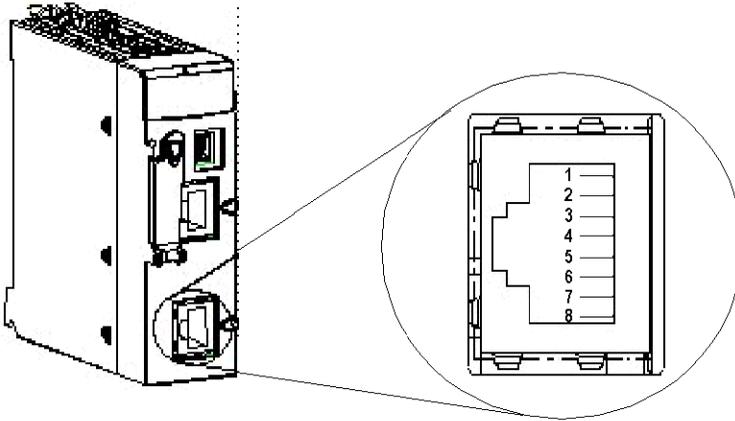
- BMXP341000
- BMXP342000
- BMXP342010/20102
- BMXP342020

## Serial Port

The following table describes the characteristics of the serial communication channels:

| Characteristic      | Description  |
|---------------------|--|
| Channel number      | Channel 0  |
| Protocols supported | <ul style="list-style-type: none"><li>• Modbus protocol (ASCII and RTU)</li><li>• Character mode protocol</li></ul>          |
| Connection          | RJ45 socket type connector   |
| Physical port       | <ul style="list-style-type: none"><li>• RS 485 non-isolated serial port</li><li>• RS 232 non-isolation serial port</li></ul> |

The following illustration presents the RJ45 serial port:



|           |              |
|-----------|--------------|
| 1         | RXD          |
| 2         | TXD          |
| 3         | RTS          |
| 4         | D1           |
| 5         | D0           |
| 6         | CTS          |
| 7         | Power supply |
| 8         | Common       |
| Shielding |              |

The RJ45 connector has eight pins. The pins used differ according to the physical port used.

The pins used by the RS 232 serial port are as follows:

- Pin 1: RXD signal
- Pin 2: TXD signal
- Pin 3: RTS signal
- Pin 6: CTS signal

The pins used by the RS 485 serial port are as follows:

- Pin 4: D1 signal
- Pin 5: D0 signal

Pins 7 and 8 are dedicated to the power supply module of the machine interface through the serial port:

- Pin 7: 5 Vdc/190 mA network power supply
- Pin 8: common of the network power supply (0 V)

## CANopen Port

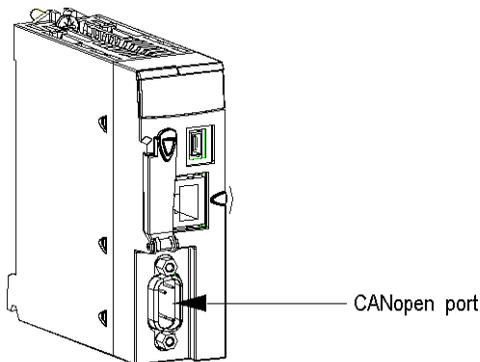
### Introduction

The following controllers have a built-in communication channel dedicated to CANopen communication and support communication using a CANopen port.

- BMXP342010/20102
- BMXP342030/2030

## CANopen Port

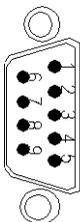
The following illustration presents the position of the CANopen port of the BMXP342030 controller:



## CANopen Connectors

The CANopen port of the controller is fitted with a connector.

The following illustration presents the CANopen port and the pin labels of the controller:



The following table presents the pin assignment of the CANopen port.

| Pin | Signal   | Description   |
|-----|----------|---|
| 1   | -        | Reserved  |
| 2   | CAN_L    | CAN_L bus line (low dominant)   |
| 3   | CAN_GND  | CAN ground  |
| 4   | -        | Reserved  |
| 5   | Reserved | Optional CAN protection   |
| 6   | (GND)    | Optional ground   |
| 7   | CAN_H    | CAN_H bus line (high dominant)  |
| 8   | -        | Reserved  |
| 9   | Reserved | Positive external CAN power supply module<br>(Dedicated to the power supply of optocouplers and transmitters/<br>receivers)<br>Optional |

**NOTE:** CAN\_SHLD and CAN\_V+ are reserved connections and are not installed on M340 controllers.

## Ethernet Port

### Introduction

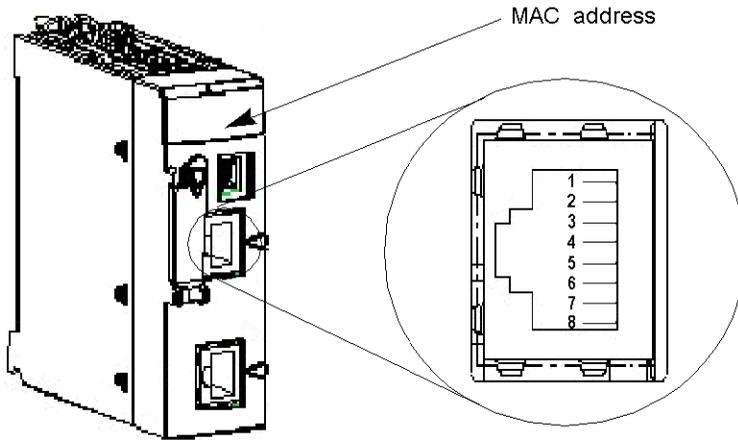
The following controllers have a built-in communication channel dedicated to Ethernet communication, with two rotary switches that allow the selection of the controller IP address.

- BMXP342020
- BMXP342030/20302

**NOTE:** These controllers have only one IP address.

## Ethernet Port

The following illustration presents the RJ45 Ethernet port of the controller:



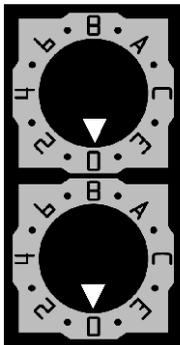
|   |               |
|---|---------------|
| 1 | TD+           |
| 2 | TD-           |
| 3 | RD+           |
| 4 | Not connected |
| 5 | Not connected |
| 6 | RD-           |
| 7 | Not connected |
| 8 | Not connected |

## MAC Address

The MAC address is located on the front panel of the controller, underneath the display panel.

## Rotary Switches

The M340 controller operates as a single node on an Ethernet network. The controller must have a unique IP address. The two rotary switches located on the back of the controller are used to set the Ethernet IP address. They can be set with a small, flat-tipped screwdriver to firmly position the arrow as required.



**NOTE:** Ensure that the switch clicks into the desired position, or the value of the switch may be incorrect or undetermined.

Each rotary switch position that you can use to set a valid IP address is marked on the module.

The following information summarizes the valid address settings:

- Device name: For a switch-set device name, select a numeric value from 00 to 159. You can use both switches.
  - On the upper switch (TENS digit), the available settings are 0 to 15.
  - On the lower switch (ONES digit), the available settings are 0 to 9.

For example, a BMXP342020 controller with the switch setting in the rotary switch illustration is assigned the BMX2020123 DHCP device name.

The selection on the lower switch of the non-numeric parameters BOOTP, STORED, CLEAR IP, and DISABLED (not shown in the illustration above) renders the setting on the upper switch inconsequential.

- BOOTP: To get an IP address from a BOOTP server, select either of the two BOOTP positions on the bottom switch.
- STORED: The device uses the application's configured parameters.
- CLEAR IP: The device uses the default IP parameters.
- DISABLED: The device does not respond to communications.

The functionality of the rotary switch when used in conjunction with the IP Configuration tab (see Modicon M340 for Ethernet, Communications Modules and Controllers, User Manual)

is discussed throughout the IP Address chapter (see Modicon M340 for Ethernet, Communications Modules and Processors, User Manual.

## Switch Labels

To help set the rotary switches in the desired position, a label is affixed to the right side of the controller. The switch settings are described in the following table:

|  |   |
|--|---|
|  | Upper switch  |
|  | 0 to 9: Tens value for the device name (0, 10, 20 . . . 90)                   |
|  | 10(A) to 15(F): Tens value for the device name (100, 110, 120 . . . 150)      |
|  | Lower switch  |
|  | 0 to 9: Ones value for the device name (0, 1, 2 . . . 9)                      |
|  | BOOTP: Set the switch to A or B to receive an IP address from a BOOTP server. |
| Stored: Set the switch to C or D to use the configured (stored) parameters of the application. |   |
| Clear IP: Set the switch to E to use the default IP parameters.                                |   |
| Disabled: Set the switch to F to turn off communications.                                      |   |

## Controller Presentation

## Characteristics

This table describes the characteristics of BMXP34xxxx controllers:

| Characteristic             |   | BMXP341000 | BMXP342000 | BMXP342010<br>BMXP3420102       | BMXP342020 | BMXP342030<br>BMXP3420302       |
|----------------------------|---|------------|------------|---------------------------------|------------|---------------------------------|
| Maximum number of channels | Discrete backplane inputs/outputs               | 512        | 1024       | 1024                            | 1024       | 1024                            |
|                            | Analog input/output modules                     | 128        | 256        | 256                             | 256        | 256                             |
|                            | Expert channels (counting, PTO, MPS, NOM, etc.) | 20         | 36         | 36                              | 36         | 36                              |
|                            | Network communication (TCP/IP)                  | 2          | 3          | 3                               | 3          | 3                               |
|                            | AS-i fieldbus <sup>(1)</sup> communication      | 2          | 4          | BMXP342010: 0<br>BMXP3420102: 4 | 4          | BMXP342030: 0<br>BMXP3420302: 4 |
| Maximum number of modules  | Embedded serial port                            | 1          | 1          | 1                               | 1          | -                               |
|                            | Embedded Ethernet port                          | -          | -          | -                               | 1          | 1                               |
|                            | Embedded CANopen port                           | -          | -          | 1                               | -          | 1                               |
| Memory size                | User application                                | 2048 Kb    | 4096 Kb    | 4096 Kb                         | 4096 Kb    | 4096 Kb                         |

<sup>(1)</sup> The AS-i field bus requires a controller firmware version of 2.10 or later. For more information, see the *Modicon X80 AS-Interface Bus Module, User Manual*.

## Real-Time Clock

### Introduction

Each BMXP34xxxx controller has a real-time clock that manages the:

- present date and time
- date and time of the last application closure

When power is removed from the controller, the real-time clock continues counting for up to four weeks. This duration is typically maintained for temperatures below 45°C (113°F). At higher temperatures, this duration is reduced. No maintenance is required for the real-time clock back up.

## Date and Time

The controller updates the date and time in the following system words: %SW49...%SW53 and %SW70.

This data is in Binary Coded Decimal (BCD) format.

| System word | Most significant byte | Least significant byte  |
|-------------|-----------------------|---|
| %SW49       | 00                    | Days of the week in the range of values 1-7 (1 for Monday and 7 for Sunday) |
| %SW50       | Seconds (0 - 59)      | 00  |
| %SW51       | Hours (0 - 23)        | Minutes (0 - 59)  |
| %SW52       | Month (1 - 12)        | Days of the month (1 - 31)  |
| %SW53       | Century (0 - 99)      | Year (0 - 99)   |
| %SW70       | 00                    | Week (1 - 52)   |

## Accessing the Date and Time

You can access the date and time using the following methods.

- Through the debug screen of the controller
- In the application
  - Reading system words: %SW49 - %SW53 (if the system bit %S50 is at 0).
  - Immediate update: Writing system words %SW50 to %SW53 (if the system bit %S50 is at 1).
  - Incremental update: Writing the system word %SW59. With this word, the date and time can be set field by field from the value (if the system bit %S59 is at 1), or an overall increment/decrement can be done).

The following table presents the function performed by each bit in the word %SW59.

| Bit range | Function                       |
|-----------|--------------------------------|
| 0         | Increments the day of the week |
| 1         | Increments the seconds         |
| 2         | Increments the minutes         |
| 3         | Increments the hours           |
| 4         | Increments the days            |
| 5         | Increments the months          |
| 6         | Increments the years           |
| 7         | Increments the centuries       |
| 8         | Decrements the day of the week |
| 9         | Decrements the seconds         |
| 10        | Decrements the minutes         |
| 11        | Decrements the hours           |
| 12        | Decrements the days            |
| 13        | Decrements the months          |
| 14        | Decrements the years           |
| 15        | Decrements the centuries       |

**NOTE:** The function is performed when the corresponding bit %S59 is at 1.

**NOTE:** The controller does not automatically manage Daylight Saving Time.

## Date and Time of the Last Application Shutdown

The date and time of the last application shutdown are in BCD format in the system words %SW54 - %SW58

| System word | Most significant byte    | Least significant byte                   |
|-------------|--------------------------|--|
| %SW54       | Seconds (0 to 59)        | 00                                       |
| %SW55       | Hours (0 to 23)          | Minutes (0 to 59)                        |
| %SW56       | Month (1 to 12)          | Days of the month (1 to 31)              |
| %SW57       | Century (0 to 99)        | Year (0 to 99)                           |
| %SW58       | Day of the week (1 to 7) | Reason for the last application shutdown |

The reason for the last application shutdown can be found by reading the least significant byte of the system word %SW58 (value in BCD), which can have the following values.

| Word value %sw58 (LSB) | Reason for Application Shutdown  |
|------------------------|--|
| 1                      | Application switched to STOP mode  |
| 2                      | Application stopped by watchdog  |
| 4                      | Power loss or memory card lock operation   |
| 5                      | Stop on hardware error   |
| 6                      | Stop on software error (HALT instruction, SFC errors, application CRC check fail, undefined system function call, and others). Details about the software error type are stored in %SW125. |

# Characteristics of the BMXP34xxxx Controllers

## What's in This Chapter

|  |    |
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| BMXP342010 / BMXP3420102 Controllers .....                         | 57 |
| BMXP342020 Controller .....  | 58 |
| BMXP342030 / BMXP3420302 Controller .....                          | 60 |
| BMXP34xxxxx Controller Memory .....                                | 61 |

## Overview

This chapter describes the characteristics of the BMXP34•••• controllers.

## Electrical Characteristics of the BMXP34xxxxx Controllers

### Introduction

The controllers can support certain devices that do not have their own power supply. Therefore, it is essential to consider the power consumption of these devices when establishing the overall power consumption.

### Controller Power Consumption

The following table presents the power consumption for BMXP34xxxxx controllers with no connected devices.

| Controller | Average Consumption |
|------------|---------------------|
| BMXP341000 | 72 mA               |
| BMXP342000 | 72 mA               |

| Controller       | Average Consumption |
|------------------|---------------------|
| BMXP342010/20102 | 90 mA               |
| BMXP342020       | 95 mA               |
| BMXP342030/20302 | 135 mA              |

When a device consumes power on the controller serial port connection, its power must be added to the power consumed by the controller. The power supplied by the serial port is 5 Vdc/190 mA.

**NOTE:** Use only the power supplies specified in this documentation and only third-party equipment that have been expressly approved by Schneider Electric. For further information, contact your Schneider Electric sales office.

|   |
|---|
| ⚠ WARNING   |
| UNINTENDED EQUIPMENT OPERATION  |
| Only use devices approved by Schneider Electric for use with this equipment.                          |
| <b>Failure to follow these instructions can result in death, serious injury, or equipment damage.</b> |

## Controller Dissipated Power

The following table presents the average dissipated power for all the BMXP34xxxx controllers with no connected devices.

| Controller       | Average Dissipated Power |
|------------------|--------------------------|
| BMXP341000       | 1.7 W                    |
| BMXP342000       | 1.7 W                    |
| BMXP342010/20102 | 2.2 W                    |
| BMXP342020       | 2.3 W                    |
| BMXP342030/20302 | 3.2 W                    |

# BMXP341000 Controller

## Introduction

The characteristics of the BMXP341000 controller are presented in this section.

## Ruggedized Version

The BMXP341000H (hardened) equipment is the ruggedized version of the BMXP341000 (standard) equipment. It can be used at extended temperatures and in harsh chemical environments.

For more information, refer to chapter *Installation in More Severe Environments* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

## Altitude Operating Conditions

The characteristics apply to the modules BMXP341000, and BMXP341000H for use at altitudes up to 2000 m (6560 ft). When the modules operate above 2000 m (6560 ft), apply additional derating.

For detailed information, refer to chapter *Operating and Storage Conditions* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

## BMXP341000 Controller Characteristics

The following table presents the general characteristics of the BMXP341000 controller.

| Characteristic        |                   | Available                         |                              |
|-----------------------|-------------------|-----------------------------------|------------------------------|
| Operating temperature |                   | BMXP341000                        | 0...+60 °C (+32...+140 °F)   |
|                       |                   | BMXP341000H                       | -25...+70 °C (-13...+158 °F) |
| Functions             | Maximum number of | Discrete backplane inputs/outputs | 512                          |
|                       |                   | Analog backplane inputs/outputs   | 128                          |
|                       |                   | Expert channels                   | 20                           |
|                       |                   | Ethernet channels                 | 2                            |
|                       |                   | AS-I Field Bus                    | 2                            |

| Characteristic                           |                                | Available                        |                            |
|--|--------------------------------|----------------------------------|----------------------------|
|  |                                | Simultaneous communication EF    | 8                          |
|  | Maximum number of modules      | USB                              | 1                          |
|  |                                | Embedded Serial Modbus link port | 1                          |
|  |                                | Embedded CANopen master port     | -                          |
|  |                                | Embedded Ethernet port           | -                          |
| Savable real-time clock                  |                                | Yes                              |                            |
| Savable Application Data Memory Capacity |                                | 128 Kb                           |                            |
| Application Structure                    | MAST task                      |                                  | 1                          |
|  | FAST task                      |                                  | 1                          |
|  | Event processing               |                                  | 32                         |
| Application Code Execution Speed         | Internal RAM                   | 100% Boolean                     | 5.4 Kins/ms <sup>(1)</sup> |
|  |                                | 65% Boolean + 35% digital        | 4.2 Kins/ms <sup>(1)</sup> |
| Execution Time                           | One basic Boolean instruction  |                                  | 0.18 $\mu$ s (theoretical) |
|  | One basic digital instruction  |                                  | 0.25 $\mu$ s (theoretical) |
|  | One floating point instruction |                                  | 1.74 $\mu$ s (theoretical) |
| (1) Kins: 1024 instructions (list)       |                                |                                  |                            |

## BMXP342000 Controller

### Introduction

The characteristics of the BMXP342000 controller are presented in this section.

### Altitude Operating Conditions

The characteristics apply to the module BMX P34 2000 for use at altitudes up to 2000 m (6560 ft). When the module operates above 2000 m (6560 ft), apply additional derating.

For detailed information, refer to chapter *Operating and Storage Conditions* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

## Characteristics

The following table presents the general characteristics of the BMXP342000 controller.

| Characteristic                           |                                | Available                         |                            |
|--|--------------------------------|-----------------------------------|----------------------------|
| Operating Temperature                    |                                | 0...+60 °C (+32...+140 °F)        |                            |
| Functions                                | Maximum number of              | Discrete backplane inputs/outputs | 1024                       |
|  |                                | Analog backplane inputs/outputs   | 256                        |
|  |                                | Counting channels                 | 36                         |
|  |                                | Ethernet channels                 | 2                          |
|  |                                | AS-i Field Bus                    | 4                          |
|  |                                | Simultaneous communication EF     | 16                         |
|  | Maximum number of modules      | USB                               | 1                          |
|  |                                | Embedded Serial Modbus link port  | 1                          |
|  |                                | Embedded CANopen master port      | -                          |
|  |                                | Embedded Ethernet port            | -                          |
| Savable real-time clock                  |                                | Yes                               |                            |
| Savable Application Data Memory Capacity |                                | 256 Kb                            |                            |
| Application Structure                    | MAST task                      |                                   | 1                          |
|  | FAST task                      |                                   | 1                          |
|  | Event processing               |                                   | 64                         |
| Application Code Execution Speed         | Internal RAM                   | 100% Boolean                      | 8.1 Kins/ms <sup>(1)</sup> |
|  |                                | 65% Boolean + 35% digital         | 6.4 Kins/ms <sup>(1)</sup> |
| Execution Time                           | One basic Boolean instruction  |                                   | 0.12 µs                    |
|  | One basic digital instruction  |                                   | 0.17 µs                    |
|  | One floating point instruction |                                   | 1.16 µs                    |
| (1) Kins: 1024 instructions (list)       |                                |                                   |                            |

# BMXP342010 / BMXP3420102 Controllers

## Altitude Operating Conditions

The characteristics apply to the modules BMXP342010, and BMXP3420102 for use at altitudes up to 2000 m (6560 ft). When the modules operate above 2000 m (6560 ft), apply additional derating.

For detailed information, refer to chapter *Operating and Storage Conditions* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

## Characteristics

The following table presents the general characteristics of the BMXP342010 / BMXP3420102 controllers.

| Characteristic                           |                           | Available                         |                                 |
|--|---------------------------|-----------------------------------|---------------------------------|
| Operating Temperature                    |                           | 0...+60 °C (+32...+140 °F)        |                                 |
| Functions                                | Maximum number of         | Discrete backplane inputs/outputs | 1024                            |
|  |                           | Analog backplane inputs/outputs   | 256                             |
|  |                           | Expert channels                   | 36                              |
|  |                           | Ethernet channels                 | 2                               |
|  |                           | AS-i field Bus                    | BMXP342010: 0<br>BMXP3420102: 4 |
|  |                           | Simultaneous communication EF     | 16                              |
|  | Maximum number of modules | USB                               | 1                               |
|  |                           | Embedded Serial Modbus link port  | 1                               |
|  |                           | Embedded CANopen master port      | 1                               |
|  |                           | Embedded Ethernet port            | -                               |
| Savable real-time clock                  |                           | Yes                               |                                 |
| Savable Application Data Memory Capacity |                           | 256 Kb                            |                                 |
| Application Structure                    | MAST task                 | 1                                 |                                 |
|  | FAST task                 | 1                                 |                                 |
|  | Event processing          | 64                                |                                 |

| Characteristic                                |                                |                           | Available                  |
|---|--------------------------------|---------------------------|----------------------------|
| Application Code Execution Speed              | Internal RAM                   | 100% Boolean              | 8.1 Kins/ms <sup>(1)</sup> |
|   |                                | 65% Boolean + 35% digital | 6.4 Kins/ms <sup>(1)</sup> |
| Execution Time                                | One basic Boolean instruction  |                           | 0.12 $\mu$ s               |
|   | One basic digital instruction  |                           | 0.17 $\mu$ s               |
|   | One floating point instruction |                           | 1.16 $\mu$ s               |
| <sup>(1)</sup> Kins: 1024 instructions (list) |                                |                           |                            |

**NOTE:** Expert mode functionality is available for BMXP3420102 controllers.

## BMXP342020 Controller

### Introduction

The characteristics of the BMXP342020 controller are presented in this section.

### Ruggedized Version

The BMXP342020H (hardened) equipment is the ruggedized version of the BMXP342020 (standard) equipment. It can be used at extended temperatures and in some harsh chemical environments.

For more information, refer to chapter *Installation in More Severe Environments* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

### Altitude Operating Conditions

The characteristics apply to the modules BMXP342020, and BMXP342020H for use at altitudes up to 2000 m (6560 ft). When the modules operate above 2000 m (6560 ft), apply additional derating.

For detailed information, refer to chapter *Operating and Storage Conditions* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

## Characteristics

The following table presents the general characteristics of the BMXP342020 controller.

| Characteristic                           |                                | Available                         |                            |
|--|--------------------------------|-----------------------------------|----------------------------|
| Operating Temperature                    | BMXP342020                     | 0...+60 °C (+32...+140 °F)        |                            |
|  | BMXP342020H                    | -25...+70 °C (-13...+158 °F)      |                            |
| Functions                                | Maximum number of              | Discrete backplane inputs/outputs | 1024                       |
|  |                                | Analog backplane inputs/outputs   | 256                        |
|  |                                | Expert channels                   | 36                         |
|  |                                | Ethernet channels                 | 3                          |
|  |                                | AS-i Field Bus                    | 4                          |
|  |                                | Simultaneous communication EF     | 16                         |
|  | Maximum number of modules      | USB                               | 1                          |
|  |                                | Embedded Serial Modbus link port  | 1                          |
|  |                                | Embedded CANopen master port      | -                          |
|  |                                | Embedded Ethernet port            | 1                          |
| Savable real-time clock                  |                                | Yes                               |                            |
| Savable Application Data Memory Capacity |                                | 256 Kb                            |                            |
| Application Structure                    | MAST task                      |                                   | 1                          |
|  | FAST task                      |                                   | 1                          |
|  | Event processing               |                                   | 64                         |
| Application Code Execution Speed         | Internal RAM                   | 100% Boolean                      | 8.1 Kins/ms <sup>(1)</sup> |
|  |                                | 65% Boolean + 35% digital         | 6.4 Kins/ms <sup>(1)</sup> |
| Execution Time                           | One basic Boolean instruction  |                                   | 0.12 µs                    |
|  | One basic digital instruction  |                                   | 0.17 µs                    |
|  | One floating point instruction |                                   | 1.16 µs                    |
| (1) Kins: 1024 instructions (list)       |                                |                                   |                            |

# BMXP342030 / BMXP3420302 Controller

## Ruggedized Version

The BMXP3420302H (hardened) equipment is the ruggedized version of the BMXP3420302 (standard) equipment. It can be used at extended temperatures and in harsh chemical environments.

For more information, refer to chapter *Installation in More Severe Environments* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

## Altitude Operating Conditions

The characteristics apply to the modules BMXP342030, BMXP3420302, and BMXP3420302H for use at altitudes up to 2000 m (6560 ft). When the modules operate above 2000 m (6560 ft), apply additional derating.

For detailed information, refer to chapter *Operating and Storage Conditions* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

## Characteristics

The following table presents the general characteristics of the BMXP342030/20302 controller.

| Characteristic                |                   | Available                         |                              |
|-------------------------------|-------------------|-----------------------------------|------------------------------|
| Operating temperature         |                   | BMXP342030/20302                  | 0...+60 °C (+32...+140 °F)   |
|                               |                   | BMXP3420302H                      | -25...+70 °C (-13...+158 °F) |
| Functions                     | Maximum number of | Discrete backplane inputs/outputs | 1024                         |
|                               |                   | Analog backplane inputs/outputs   | 256                          |
|                               |                   | Expert channels                   | 36                           |
|                               |                   | Ethernet channels                 | 3                            |
|                               |                   | AS-i Field Bus                    | BMX P34 2030: 0              |
|                               |                   |                                   | BMX P34 20302: 4             |
| Simultaneous communication EF |                   | 16                                |                              |

| Characteristic                                |                                | Available                        |                            |
|---|--------------------------------|----------------------------------|----------------------------|
|   | Maximum number of modules      | USB                              | 1                          |
|   |                                | Embedded Serial Modbus link port | -                          |
|   |                                | Embedded CANopen master port     | 1                          |
|   |                                | Embedded Ethernet port           | 1                          |
|   | Savable real-time clock        | Yes                              |                            |
| Savable Application Data Memory Capacity      |                                | 256 Kb                           |                            |
| Application Structure                         | MAST task                      |                                  | 1                          |
|   | FAST task                      |                                  | 1                          |
|   | Event processing               |                                  | 64                         |
| Application Code Execution Speed              | Internal RAM                   | 100% Boolean                     | 8.1 Kins/ms <sup>(1)</sup> |
|   |                                | 65% Boolean + 35% digital        | 6.4 Kins/ms <sup>(1)</sup> |
| Execution Time                                | One basic Boolean instruction  |                                  | 0.12 µs                    |
|   | One basic digital instruction  |                                  | 0.17 µs                    |
|   | One floating point instruction |                                  | 1.16 µs                    |
| <sup>(1)</sup> Kins: 1024 instructions (list) |                                |                                  |                            |

**NOTE:** Expert mode function is available for BMXP3420302 controllers.

## BMXP34xxxxx Controller Memory

### Introduction

The following pages present the main characteristics of the BMXP34..... controller memory.

### Size of Located Data

The following table presents the maximum size of located data according to the type of controller:

| Type of objects   | Address            | Maximum size for the BMXP341000 controller | Default size for the BMXP341000 controller | Maximum size for the BMXP3420x0x controller | Default size for the BMXP3420x0x controller |
|---|--------------------|--|--|---|---|
| Internal bits   | %Mi                | 16250                                      | 256  | 32634                                       | 512   |
| Input/output bits   | %Ir.m.c<br>%Qr.m.c | (1)  | (1)  | (1)   | (1)   |
| System bits   | %Si                | 128  | 128  | 128   | 128   |
| Internal words  | %Mwi               | 32464                                      | 512  | 32464                                       | 1024  |
| Constant words  | %Kwi               | 32760                                      | 128  | 32760                                       | 256   |
| System words  | %Swi               | 168  | 168  | 168   | 168   |
| (1) Depends on the equipment configuration declared (input/output modules). |                    |  |  |   |   |

## Size of Unlocated Data

Unlocated data is as follows:

- Elementary Data Types (EDT)
- Derived Data Types (DDT)
- DFB and EFB function block data

## Size of Located and Unlocated Data

The total size of located and unlocated data is limited to:

- 128 kilobytes for the BMXP341000 controller
- 256 kilobytes for the BMXP3420x0x controller

## Size of Located Data in the Case of State RAM

The following table presents the maximum and default size of located data in case of State RAM configuration according to the type of controller.

| Type of objects                 | Address  | BMXP341000 V2.40 controller |              | BMXP342000, 20102, 2020, 20302 controllers (all V2.40) |              |
|---------------------------------|----------|-----------------------------|--------------|--|--------------|
|                                 |          | Maximum size                | Default size | Maximum size   | Default size |
| Output bits and internal bits   | %M (0x)  | 32765                       | 752          | 65530  | 1504         |
| Input bits and internal bits    | %I (1x)  | 32765                       | 752          | 65530  | 1504         |
| Input words and internal words  | %IW (3x) | 32765                       | 256          | 65530  | 512          |
| Output words and internal words | %MW (4x) | 32765                       | 256          | 6553   | 512          |

**NOTE:** To use State RAM configuration, you need Modicon M340 firmware 2.4 or later.

**NOTE:** When changing the controller type from a BMXP342xxx to a BMXP341000, remove the unavailable features (such as DFBs and EFBs) in the sections and in the data editor (Purge Unused FB Instances, Purge Unused Types, Purge Unused Private Data Instance if needed). Otherwise, the application cannot be built.

# Installation of BMXP34xxxx Controllers

## What's in This Chapter

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## Overview

This section deals with the installation of BMXP34xxxx controllers and memory extension cards.

## Installing Controllers

### Overview

BMXP34xxxx controllers are supplied powered by the backplane bus.

Fitting operations (installation, assembly, and disassembly) are described in this section.

## Installation Preparation

Always install a BMXP34xxxx controller on the backplane in slot **00**.

Before installing a controller, you must remove the protective cap from the controller connector located on the backplane.

### **⚠ DANGER**

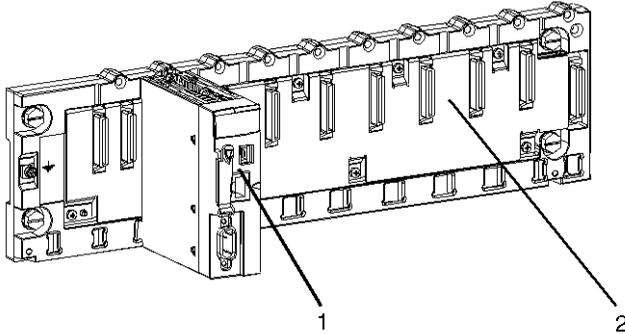
#### **HAZARD OF ELECTRIC SHOCK**

Disconnect all power sources before installing the controller.

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

## Installation

The following illustration presents a BMXP342010 controller mounted on a BMXXBP0800 backplane:

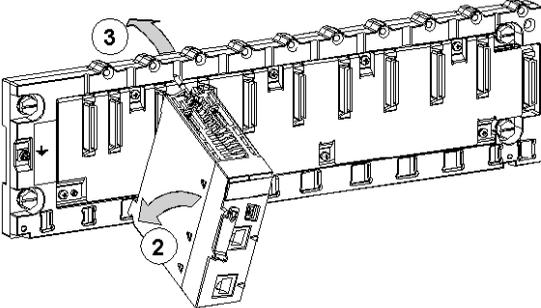


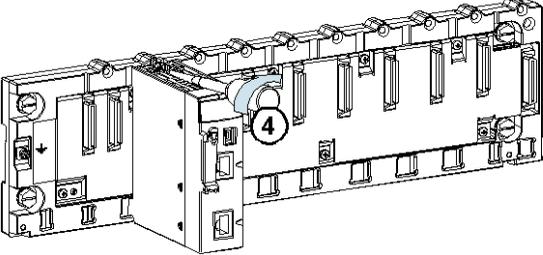
The following table describes the different elements which make up the assembly.

| Number | Description        |
|--------|--------------------|
| 1      | Controller         |
| 2      | Standard backplane |

## Installing the Controller on the Backplane

The following table presents the procedure for installing a controller on a backplane.

| Step | Action   |
|------|--|
| 1    | <p>Remove all power and confirm that the memory card is correctly inserted into the memory card slot.</p> <div data-bbox="384 245 1233 516" style="border: 1px solid black; padding: 10px;"><p style="text-align: center;"><b>⚠ WARNING</b></p><p><b>UNINTENDED EQUIPMENT OPERATION</b></p><p>Verify that the correct memory card is installed before installing a new controller on the backplane.</p><p><b>Failure to follow these instructions can result in death, serious injury, or equipment damage.</b></p></div> <p>Refer to %SW97 to determine the status of the card.</p> |
| 2    | If you have not already done so, remove the protective cover from the controller connectors on the rack.   |
| 3    | <p>Align the locating pins situated at the rear of the controller with the corresponding slots in the backplane.</p>   |

| Step | Action  |
|------|---|
| 4    | Swivel the controller towards the top of the backplane so that the controller sits flush with the back of the backplane. It is now set in position.   |
| 5    | <p>Tighten the mounting screw to help ensure that the controller is held in place on the backplane.</p> <p>Tightening torque: 0.4...1.5 N•m (0.30...1.10 lbf-ft).</p>  |

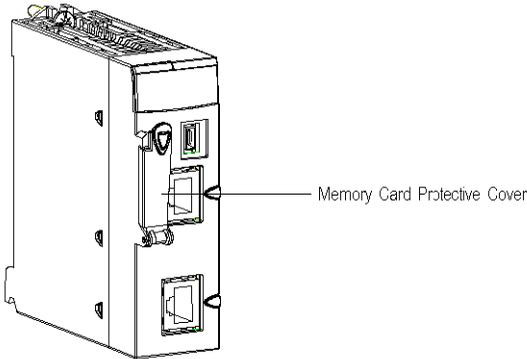
## Memory Cards

### Introduction

BMXP34•••• controllers support the use of BMXRMS008 / BMXRMS128MPF memory cards.

## Memory Card Slot

The following illustration presents the memory card slot on a BMXP34 •••• controller with a protective cover in place:



### **▲ WARNING**

#### **UNINTENDED EQUIPMENT OPERATION**

Ensure that the protective cover is closed when the controller is running to maintain enclosure environmental ratings.

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

## Memory Card Characteristics

The following presents the main characteristics of the memory cards.

| Memory card reference | File storage   | Compatible modules   | Data storage |
|-----------------------|--|--|--------------|
| BMXRMS008MP           | <ul style="list-style-type: none"> <li>• Applications</li> <li>• Web pages</li> </ul>  | <ul style="list-style-type: none"> <li>• BMXP341000</li> <li>• BMXP342000</li> <li>• BMXP342010</li> <li>• BMXP3420102</li> <li>• BMXP342020</li> <li>• BMXP342030</li> <li>• BMXP3420302</li> </ul> | No           |
| BMXRMS008MPF          | <ul style="list-style-type: none"> <li>• Applications</li> <li>• Web pages</li> <li>• Files created by the application with file management function blocks or files transferred using FTP</li> <li>• Files transferred through FTP</li> </ul> | <ul style="list-style-type: none"> <li>• BMXP342000</li> <li>• BMXP342010</li> <li>• BMXP3420102</li> <li>• BMXP342020</li> <li>• BMXP342030</li> <li>• BMXP3420302</li> </ul>                       | 8 MB         |
| BMXRMS128MPF          |  |  | 128 MB       |

**NOTE:** An FTP server can support a maximum of 256 files.

**NOTE:** The memory card is formatted for use with Schneider Electric products. Do not attempt to use or format the card in any other tool. Doing so will prevent program and data transfer usage in a Modicon M340 controller.

**NOTE:** For further information about the memory structure of the memory cards, see the Memory Structure of Modicon M340 controllers (see EcoStruxure™ Control Expert, Program Languages and Structure, Reference Manual) page.

**NOTE:** For further information about Ethernet services provided by memory cards, see the Modicon M340 Memory cards (see Modicon M340 for Ethernet, Communications Modules and Controllers, User Manual) page in the Ethernet Communication part.

## Memory Card Maintenance

To maintain functionality of the memory card, follow these measures:

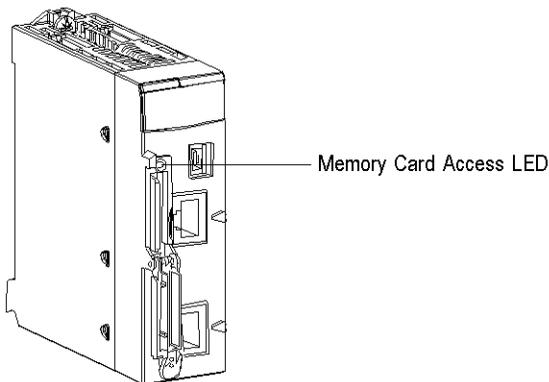
- Avoid removing the memory card from its slot when the controller accesses the card (green access LED is ON or flashing).
- Avoid touching the memory card connectors.
- Keep the memory card away from electrostatic and electromagnetic sources, as well as heat, sunlight, water, and moisture.
- Avoid impact to the memory card.

- Before mailing a memory card, review the postal service security policy for both the sending and receiving countries. In some countries, the postal service exposes mail to high levels of radiation as a security measure. These high levels of radiation can erase the contents of the memory card and render it unusable.
- If a card is extracted without generating a rising edge on bit %S65 and without verifying that the CARDAC LED is OFF, the data (including files and applications) may be lost or become unreliable.

## Memory Card Access LED

Modicon M340 controllers are equipped with a memory card access LED. This LED serves to alert you when the memory card can be removed.

The following illustration presents the memory card access LED:



This LED is green and has several different states:

- **ON:** The card is recognized, and the controller has access to it.
- **Intermittent:** The LED goes off each time the controller accesses it and comes on again at the end of access.
- **OFF:** The card may be removed as the controller has no access to it.

**NOTE:** The memory card access LED is only visible if the cover is open.

## LED States on Power Cycle

The following table presents the different states of the controller, memory card access LED and CARDERR LED on a power cycle or a controller reset.

| Controller/memory card status             |   | Controller state | Memory card access LED            | CARDERR LED                  |
|---|---|------------------|-----------------------------------|------------------------------|
| No memory card                            | -   | No configuration | OFF                               | ON                           |
| Memory card error                         | -   | No configuration | OFF                               | ON                           |
| Memory card without project               | -   | No configuration | ON                                | Flashing                     |
| Memory card with a non-compatible project | -   | No configuration | ON                                | Flashing                     |
| Memory card with a compatible project     | Error detected when the restore project from memory card to the controller RAM    | No configuration | Flashing during transfer, then ON | Flashing                     |
| Memory card with a compatible project     | No error detected when the restore project from memory card to the controller RAM | —                | Flashing during transfer, then ON | ON during transfer, then OFF |

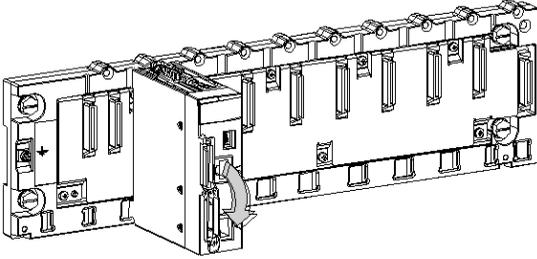
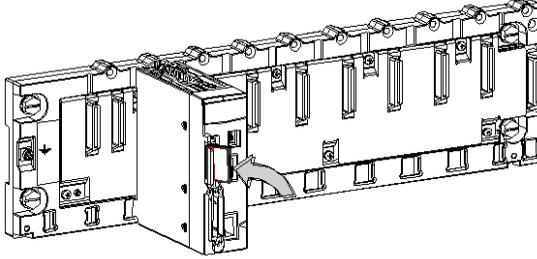
## Memory Card Insertion Procedure

Inserting an incorrect card could lead to unintended or unanticipated equipment operation.

|   |
|---|
| <b>⚠ WARNING</b>  |
| <b>UNINTENDED EQUIPMENT OPERATION</b>   |
| Verify that the correct memory card is installed before plugging a controller on the backplane.       |
| <b>Failure to follow these instructions can result in death, serious injury, or equipment damage.</b> |

Refer to %SW97 to verify the status of the card.

Procedure for inserting a memory card into a BMXP34•••• controller:

| Step | Action  |
|------|---|
| 1    | <p>Open the protective cover by pulling the cover towards you.</p>   |
| 2    | <p>Insert the memory card into its slot by pushing it in.</p> <p><b>NOTE:</b> Insertion of the memory card does not force an application restore.</p>  |
| 3    | <p>Close the memory card protective cover.</p>  |

## Memory Card Removal Procedure

Before removing a memory card, a rising edge on bit %S65 must be generated to maintain the information consistency. When the CARDAC LED is off, then it is possible to extract the card. There is a risk of inconsistency or loss of data if the extraction is done without the management of bit %S65.

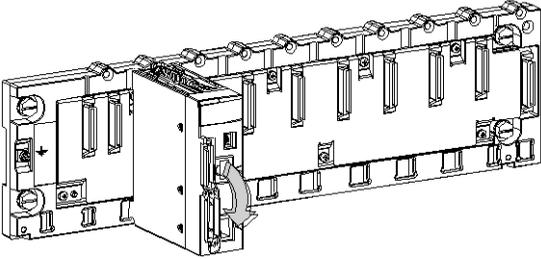
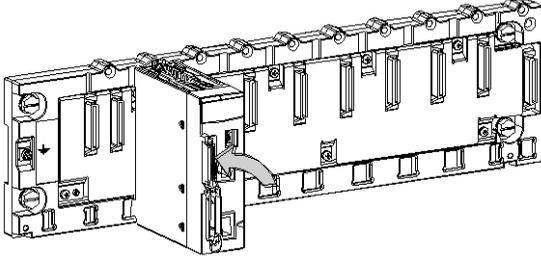
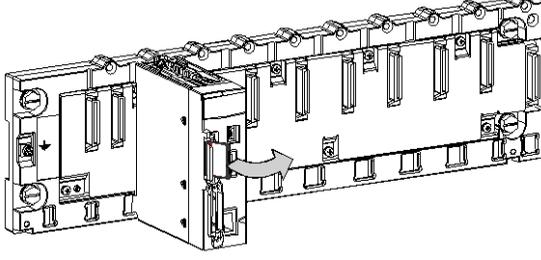
### **▲ WARNING**

#### **LOSS OF DATA**

Do not remove the card before applying a rising edge (0>1) on bit %65.

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

Procedure for removing a memory card from a BMXP34•••• controller:

| Step | Action   |
|------|--|
| 1    | <p>Open the protective cover by pulling the cover towards you.</p>    |
| 2    | <p>Push the memory card in its slot.</p> <p><b>Result:</b> The card should unclip from its slot.</p>                                    |
| 3    | <p>Remove the card from its slot.</p> <p><b>NOTE:</b> The CARDERR LED is on when the memory card is removed from the controller.</p>  |
| 4    | <p>Close the protective cover.</p>   |

## Update an Application

The following table presents the procedure for updating an application in a controller using a memory card.

| Step | Action  |
|------|---|
| 1    | Put the controller in STOP.   |
| 2    | Set bit %S65 to 1 and verify that the CARDAC LED is OFF.  |
| 3    | Remove the memory card, which contains the outdated application.  |
| 4    | Insert the memory card containing the updated application.  |
| 5    | Press the RESET button on the power supply.<br><b>Result:</b> The new application is transferred to the internal RAM. |
| 6    | Remove the memory card.   |
| 7    | Insert the memory card with the outdated application in the controller.   |
| 8    | Run a backup command.   |
| 9    | Put the controller in RUN mode.   |

## Protect an Application

The %SW146–147 system words contain the 32-bit serial number of the SD card. If no SD card is present or if an unrecognized SD card is detected, the value of these two system words is set to 0. This information can be used to help protect an application against unauthorized duplication. By comparing the serial number value to the initial value, the application can take appropriate action, such as entering a halt state, or allowing the application to run on the original SD card.

With EcoStruxure Control Expert™, the application must be read-protected. To do this, clear the **Upload** information in the project settings.

**NOTE:** To enforce the protection, you can encrypt the value of the serial number used in the comparison.

**NOTE:** The complete SD card identification comprises several parameters including the product serial number (32 bits).

## Preparation

To maintain functionality of the memory card, follow these measures:

- Avoid removing the memory card from its slot when the controller accesses the card (green access LED is ON or flashing).
- Avoid touching the memory card connectors.
- Keep the memory card away from electrostatic and electromagnetic sources, as well as heat, sunlight, water, and moisture.
- Avoid impact to the memory card.
- Before mailing a memory card, review the postal service security policy for both the sending and receiving countries. In some countries, the postal service exposes mail to high levels of radiation as a security measure. These high levels of radiation can erase the contents of the memory card and render it unusable.
- If a card is extracted without generating a rising edge on bit %S65 and without verifying that the CARDAC LED is OFF, the data (including files and applications) may be lost or become unreliable.

Use the CLOSE\_FILE function to:

- Close a file if an error is detected.
- Delete a file with an FTP client.

---

# BMXP34xxxx Controller Diagnostics

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## Overview

This section presents BMXP34... controller diagnostics.

## Display

### Introduction

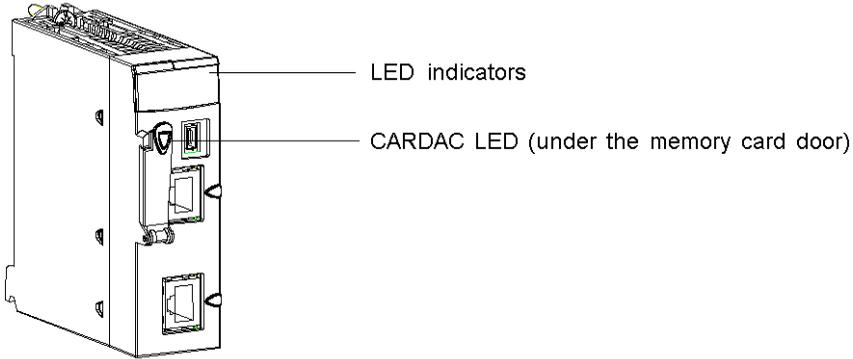
There are several LEDs available on the front panel of each controller, enabling rapid diagnosis of the controller status.

These LEDs provide information on:

- controller functioning
- the memory card
- communication with the modules
- serial communication
- communication on the CANopen network
- communication on the Ethernet network

## Illustration

The following illustration presents the physical location of the LEDs on the front panel of a BMXP34..... controller:



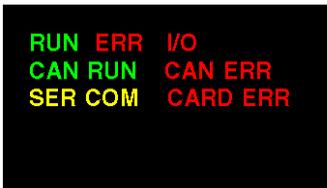
## BMXP341000 / BMXP342000 Controller LEDs

The following example presents the diagnostic LEDs on the BMXP341000/2000 controllers:



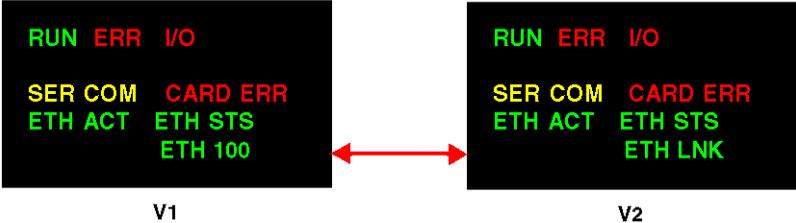
## BMXP342010 Controller LEDs

The following example presents the diagnostic LEDs on the BMXP342010 controller:



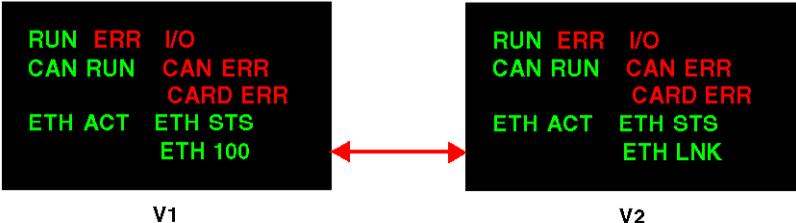
# BMXP342020 Controller LEDs

The following example presents the diagnostic LEDs on the BMXP342020 controller. Note that two displays exist, depending on whether you are using V1 or V2 (or later) of the controller.



# BMXP342030 Controller LEDs

The following example presents the diagnostic LEDs on the BMXP342030 controller. Note that two displays exist, depending on whether you are using V1 or V2 (or later) of the controller.



# Memory Card Access LED

There is a memory card access LED, page 70 on each BMXP34•••• controller.

# Description

The LEDs on the front panel of the BMXP34xxxx appear as follows:

| Label   | LED  | Description   |
|---|--|---|
| RUN (green): operational state  | ON   | Controller functioning normally, program running  |
|   | Flashing   | Controller in STOP mode or blocked by a software detected error   |
|   | OFF  | Controller not configured (absent, incorrect, or incompatible application)  |
| ERR (red): detected error   | ON   | Controller or system detected error   |
|   | Flashing   | <ul style="list-style-type: none"> <li>Controller not configured (absent, incorrect, or incompatible application)</li> <li>Controller blocked by a software detected error</li> </ul> |
|   | OFF  | No errors detected  |
| I/O (red): input/output status  | ON   | <ul style="list-style-type: none"> <li>Input/output detected error originating from a module or channel</li> <li>Configuration detected error</li> </ul>                              |
|   | OFF  | No errors detected  |
| SER COM (yellow): serial data status  | Flashing   | Data exchange on the serial connection in progress (receiving or sending)   |
|   | OFF  | No data exchange on the serial connection   |
| CARDERR (red): memory card detected error<br><br>For further information, see project backup management for Modicon M340 controllers (see EcoStruxure™ Control Expert, Operating Modes) | ON   | <ul style="list-style-type: none"> <li>Memory card absent</li> <li>Memory card not recognized</li> </ul>  |
|   | OFF  | <ul style="list-style-type: none"> <li>Memory card recognized</li> <li>Memory card content identical to the application saved in the controller</li> </ul>                            |
|   | Flashing   | Memory card content differs from the application saved in the controller  |
| CAN RUN (green): CANopen operations   | ON   | CANopen network operational   |
|   | Rapid flashing (ON for 50 ms, OFF for 50 ms, repeating)  | Automatic detection of data flow or LSS services in progress (alternates with CAN ERR)  |
|   | Slow flashing (ON for 200 ms, OFF for 200 ms, repeating) | CANopen network pre-operational   |
|   | 1 flash  | CANopen network stopped   |
|   | 3 flashes  | Downloading CANopen firmware  |

| Label  | LED   | Description  |
|--|---|--|
| CAN ERR (red): CANopen detected errors   | ON  | CANopen bus stopped  |
|  | Rapid flashing (ON for 50 ms, OFF for 50 ms, repeating)                       | Automatic detection of data flow or LSS services in progress (alternates with CAN RUN)   |
|  | Slow flashing (ON for 200 ms, OFF for 200 ms, repeating)                      | CANopen configuration not valid  |
|  | 1 flash   | At least one of the detected error counters has reached or exceeded the alert level  |
|  | 2 flashes   | A guard event (NMT-slave or NMT-master) or a heartbeat event has taken place   |
|  | 3 flashes   | The SYNC message was not received before the end of the communication cycle period   |
|  | OFF   | No CANopen detected error  |
| ETH STS (green): Ethernet communication status   | ON  | Communication successful   |
|  | OFF   | No communication activity  |
|  | 2 flashes   | Inaccurate MAC address   |
|  | 3 flashes   | Ethernet link not connected  |
|  | 4 flashes   | Duplicate IP address   |
|  | 5 flashes   | Waiting for a server IP address  |
|  | 6 flashes   | Secure and safe mode (with default IP address)   |
| 7 flashes  | Configuration incongruence between rotary switches and internal configuration |  |
| CARDAC (green): memory card access<br><br><b>Note:</b> This LED is located under the memory card door. | ON  | Access to the card is enabled  |
|  | Flashing  | Activity on the card; during each access, the card LED is set to OFF, then back to ON  |
|  | OFF   | Access to the card is disabled. It is possible to extract the card after the access to the card has been disabled by generating a rising edge on bit %S65. |

The following table describes the meaning of the ETH ACT and ETH 100 LED on the front panel for V1.

| Label  | LED      | Description  |
|--|----------|--|
| ETH ACT (green):<br>Ethernet communication<br>(transmission/reception)<br>activity | ON       | Ethernet link detected: no communications activity.                |
|  | OFF      | No Ethernet link detected.   |
|  | Flashing | Ethernet link and communications activity detected.                |
| ETH 100 (green): Ethernet<br>transmission speed                                    | ON       | Ethernet transmission at 100 Mbit/s (Fast Ethernet).               |
|  | OFF      | Ethernet transmission at 10 Mbit/s (Ethernet) or no link detected. |

The following table describes the meaning of the ETH ACT and ETH LNK LED on the front panel for V2.

| Label  | LED | Description                         |
|--|-----|-------------------------------------|
| ETH ACT (green):<br>Ethernet communication<br>(transmission/reception)<br>activity | ON  | Communication activity detected.    |
|  | OFF | No communication activity detected. |
| ETH LNK (green):<br>Ethernet link status   | ON  | Ethernet link detected.             |
|  | OFF | No Ethernet link detected.          |
|  | OFF | No communication activity           |

**NOTE:** Rapid flashing is defined as ON for 50 ms and OFF for 50 ms.

**NOTE:** Slow flashing is defined as ON for 200 ms and OFF for 200 ms.

## Searching for Errors Using the Controller Status LEDs

### Overview

The status LEDs located on the controller inform the user of the operating mode and any possible errors.

The errors detected by the controller concern:

- circuits that constitute the controller and/or its modules: internal errors
- the process driven by the controller or the process wiring: external errors
- functioning of the application executed by the controller: internal or external errors

## Error Detection

Error detection is performed at startup (autotest) or during operation (which is the case for most equipment errors), during exchanges with the modules, or during execution of a program instruction.

Certain *serious* errors require the controller to be restarted while others are left to the user to decide how to proceed depending on the level of application required.

There are three types of error:

- non-blocking
- blocking
- controller or system

## Blocking Errors

### Overview

Blocking errors caused by the application program do not cause system errors but prohibit execution of the program. When such an error occurs, the controller stops immediately and goes into HALT mode (all tasks are stopped on the ongoing instruction). The ERR LED flashes.

## Restarting the Application After a Blocking Error

To end this status, it is necessary to initialize the controller or to set the %S0 bit to 1.

The application is then in an initial state:

- The data resumes its initial value.
- Tasks are stopped at end of cycle.
- The input image is refreshed.
- Outputs are controlled in fallback position.

The RUN command then allows the application to be restarted.

## Blocking Error Diagnosis

Indication of a blocking error is signaled by the ERR and RUN LEDs flashing on the controller front panel.

The %SW126

and %SW127 system words indicate the address of the instruction which caused the blocking error.

The nature of the error is indicated by the %SW125 system word.

The following table presents the errors signaled by the values of the %SW125 system word.

| Hexadecimal Value of %SW125 | Corresponding Error  |
|-----------------------------|--|
| 23...                       | Execution of a CALL function towards an undefined subroutine |
| 0...                        | Execution of an undefined function                           |
| 2258                        | Execution of the HALT instruction                            |
| 9690                        | Application CRC check (checksum) error                       |
| DEB0                        | Watchdog overrun   |
| DE87                        | Calculation error on numbers with decimal points             |
| DEF0                        | Division by 0  |
| DEF1                        | Character string transfer error                              |
| DEF2                        | Capacity exceeded  |
| DEF3                        | Index overrun  |
| DEF7                        | SFC execution error  |
| DEFE                        | SFC steps undefined  |
| 81F4                        | SFC node incorrect   |
| 82F4                        | SFC code inaccessible  |
| 83F4                        | SFC workspace inaccessible                                   |
| 84F4                        | Too many initial SFC steps                                   |
| 85F4                        | Too many active SFC steps                                    |
| 86F4                        | SFC sequence code incorrect                                  |
| 87F4                        | SFC code description incorrect                               |
| 88F4                        | SFC reference table incorrect                                |
| 89F4                        | SFC internal index calculation error                         |
| 8AF4                        | SFC step status not available                                |

| Hexadecimal Value of %sw125 | Corresponding Error   |
|-----------------------------|---|
| 8BF4                        | SFC memory too small after a change due to a download                   |
| 8CF4                        | Transition/action section inaccessible                                  |
| 8DF4                        | SFC workspace too small   |
| 8EF4                        | Version of the SFC code older than the interpreter                      |
| 8FF4                        | Version of the SFC code more recent than the interpreter                |
| 90F4                        | Inadequate description of an SFC object: NULL pointer                   |
| 91F4                        | Action identifier not valid   |
| 92F4                        | Inadequate definition of the time for an action identifier              |
| 93F4                        | Macro step cannot be found in the list of active steps for deactivation |
| 94F4                        | Overflow in the action table  |
| 95F4                        | Overflow in the step activation/deactivation table                      |

## Non-Blocking Errors

### Introduction

A non-blocking error is caused by an input/output error on the bus or through execution of an instruction. It can be processed by the user program and does not modify the controller status.

### Non-Blocking Errors Linked to Inputs/Outputs

Indication of a non-blocking error linked to the inputs/outputs is signaled by:

- The I/O status LED of the controller is ON.
- The I/O status LED of the module is ON.
- The error bits and words combined with the channel:
  - Bit %Ir.m.c.ERR at 1 indicates the channel at error (implicit exchanges).
  - Words %MWr.m.c.2 indicates the channel's type of error (implicit exchanges).

- System bits:
  - %S10: input/output error on one of the modules on the backplane
  - %S16: input/output error in the task in progress
  - %S118: input/output error on the CANopen bus
  - %S40 - %S47: input/output error on address backplane 0-7

The following table presents the diagnosis of non-blocking errors from the status LEDs and the system bits.

| RUN status LED | ERR status LED | I/O status LED | System bit       | Error  |
|----------------|----------------|----------------|------------------|--|
| Undetermined   | Undetermined   | ON             | %S10 at 0        | Input/Output error: channel power supply error, broken channel, module not compliant with the configuration, inoperative or module power supply error. |
| Undetermined   | Undetermined   | ON             | %S16 at 0        | Input/output error in a task.  |
| Undetermined   | Undetermined   | ON             | %S118 at 0       | Input/output error on the CANopen bus (the errors are the same as those of bit %S10).  |
| Undetermined   | Undetermined   | ON             | %S40 - %S47 at 0 | Input/output error in at backplane level.<br><br>(%S40: backplane 0 - %S47: backplane 7).  |

## Non-Blocking Errors Linked to the Execution of the Program

Indication of a non-blocking error linked to the execution of the program is signaled by one or more system bits %S15, %S18, and %S20 being set to 1. The nature of the error is indicated in the system word %SW125 (always updated).

The following table presents the diagnosis of non-blocking errors linked to the execution of the program.

| System bit | Error  |
|------------|--|
| %S15 at 1  | Character string manipulation error                          |
| %S18 at 1  | Capacity overrun, error on a floating point or division by 0 |
| %S20 at 1  | Index overrun  |

There are two ways to change non-blocking errors linked to the execution of the program to blocking errors:

- Diagnostic program function, accessible through the EcoStruxure™ Control Expert programming software
- Bit %S78 (HALTIFERROR) when it is set to 1.

The HALT status of the controller is determined by observing the flashing ERR and I/O LEDs.

Testing and setting these system bits to 0 is the user's responsibility.

## Controller or System Errors

### Introduction

Controller or system errors are serious errors related either to the controller (equipment or software) or to the backplane bus wiring. The system can no longer operate correctly when these errors occur. They cause the controller to stop in ERROR status, which requires a cold restart. The next cold restart will be forced in STOP status to prevent the controller from returning to error.

### Diagnosis of Controller and System Errors

The following table presents the status of controller and system errors:

| RUN status LED | ERR status LED | I/O status LED | Hexadecimal value of the system word % SW124 | Error   |
|----------------|----------------|----------------|--|---|
| Undetermined   | ON             | ON             | 80   | System watchdog error or backplane bus wiring error |
| Undetermined   | ON             | ON             | 81   | Backplane bus wiring error                          |
| Undetermined   | ON             | ON             | 90   | Unforeseen interruption<br>System task pile overrun |

# Controller Performance

## What's in This Chapter

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| MAST Task Cycle Time: Program Processing .....                     | 92 |
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## Execution of Tasks

### Introduction

BMXP34... controllers can execute single-task and multi-task applications. Unlike a single-task application, which only executes master tasks, a multi-task application defines the task execution priorities.

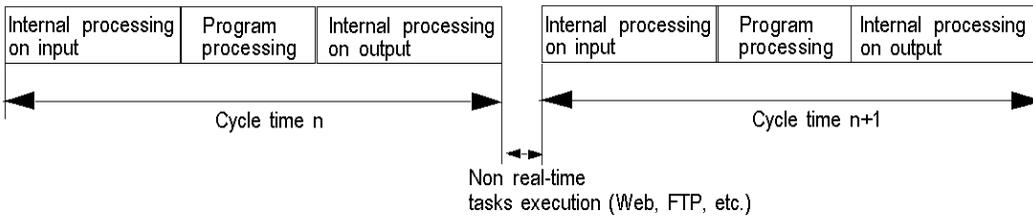
### Master Task

The master task represents the application program's main task. You can choose from the following MAST task execution modes:

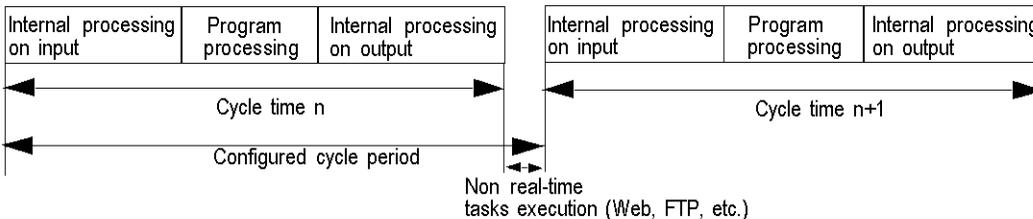
- Cyclical (default setup): Execution cycles are performed in sequence, one after the other.
- Periodical: A new cycle is started periodically, according to a user-defined time period (1 - 255 ms).

If the execution time is longer than the period configured by the user, the %S19 bit is set to 1 and a new cycle is launched.

The following illustration presents the cyclical execution of the MAST task:



The following illustration presents the periodical execution of the MAST task:



Both MAST task cycle modes are controlled by a watchdog.

The watchdog is triggered if the MAST task execution time exceeds the maximum period defined in the configuration, which results in a software error. The application then goes into HALT status, and bit %S11 is set to 1 (the user must reset it to 0).

The watchdog value (%SW11) can be configured between 10 ms and 1,500 ms (default value: 250 ms).

**NOTE:** Configuring the watchdog to a value that is less than the period is not allowed.

In periodical operating mode, an additional verification detects when a period has been exceeded. The controller will not switch off if the period overrun remains less than the watchdog value.

Bit %S19 signals a period overrun. It is set to 1 by the system when the cycle time becomes longer than the task period. Cyclical execution then replaces periodical execution.

The MAST task can be checked with the following system bits and system words:

| System object | Description                   |
|---------------|-------------------------------|
| %SW0          | MAST task period              |
| %S30          | Activation of the master task |
| %S11          | Watchdog default              |

| System object | Description                           |
|---------------|---------------------------------------|
| %S19          | Period exceeded                       |
| %SW27         | Last cycle overhead time (in ms)      |
| %SW28         | Longest overhead time (in ms)         |
| %SW29         | Shortest overhead time (in ms)        |
| %SW30         | Last cycle execution time (in ms)     |
| %SW31         | Longest cycle execution time (in ms)  |
| %SW32         | Shortest cycle execution time (in ms) |

## Fast Task

The FAST task is for periodical processing and processing over short durations.

FAST task execution is periodical and must be efficient so that no lower priority tasks overrun. The FAST task period can be configured (1 - 255 ms). The FAST task execution principle is the same as for periodical execution of the master task.

The FAST task can be checked with the following system bits and system words:

| System object | Description                           |
|---------------|---------------------------------------|
| %SW1          | FAST task period                      |
| %S31          | Activation of the fast task           |
| %S11          | Watchdog default                      |
| %S19          | Period exceeded                       |
| %SW33         | Last cycle execution time (in ms)     |
| %SW34         | Longest cycle execution time (in ms)  |
| %SW35         | Shortest cycle execution time (in ms) |

## Event Tasks

With event processing, the reaction time of the application program can be reduced for events originating from:

- input/output modules (EVTi blocks)
- events timers (TIMERi blocks)

Event processing is asynchronous. The occurrence of an event reroutes the application program towards the process associated with the input/output channel, or to the event timer that caused the event.

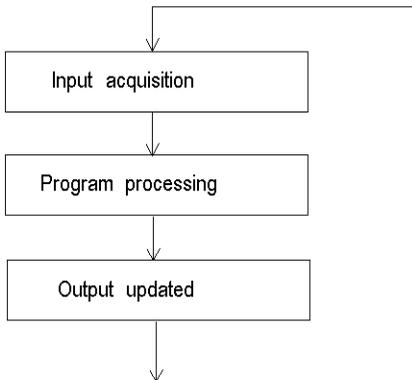
Event tasks can be verified with the following system bits and system words:

| System object | Description  |
|---------------|--|
| %S38          | Activation of events processing  |
| %S39          | Saturation of the event signal management stack.   |
| %SW48         | Number of I/O events and telegram processes executed<br><b>NOTE:</b> TELEGRAM is available only for Premium controllers (not on Quantum or M340 controllers) |

## Single-Task Execution

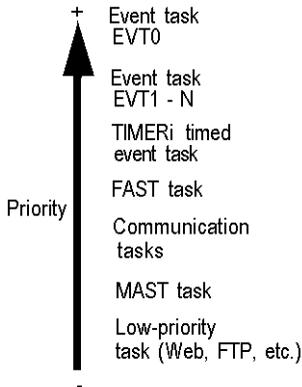
A single-task application program is associated with the MAST task.

The following diagram presents the operation cycle of a single-task application:

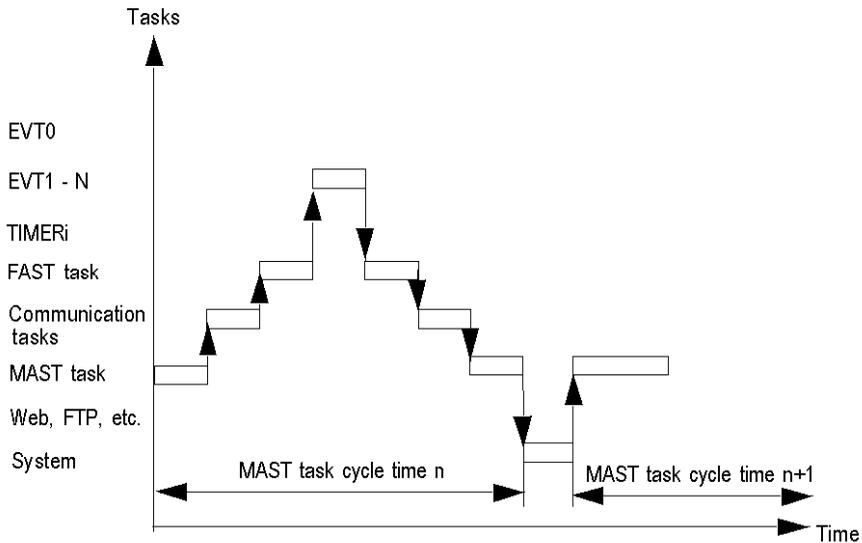


# Multi-Task Execution

The following diagram presents the level of priority of the tasks in a multi-task structure:



The following diagram presents the execution of tasks in a multi-task structure:



# MAST Task Cycle Time: Introduction

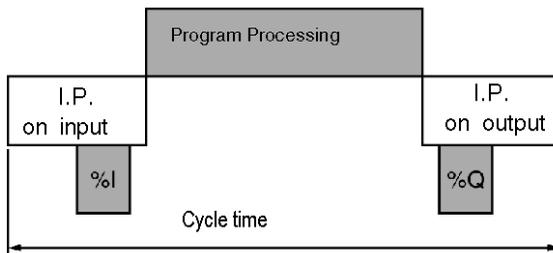
## Introduction

The MAST task cycle time is the sum of the following:

- internal processing time on input
- master task program processing time
- internal processing time on output

## Illustration

The following diagram defines the MAST task cycle time:



**I.P.** internal processing

# MAST Task Cycle Time: Program Processing

## Definition of Program Processing Time

Program processing time is equivalent to the time needed to execute application code.

## Application Code Execution Time

The application code execution time is the sum of the times needed for the application program to execute each instruction, at each controller cycle.

The following table provides the execution time for 1 K of instructions (i.e. 1024 instructions).

| Controllers  | Application code execution time <sup>(1)</sup> |                                     |
|--|--|-------------------------------------|
|  | 100 % Boolean program                          | 65 % Boolean + 35 % digital program |
| BMXP341000   | 0.18 ms  | 0.23 ms                             |
| BMXP342000   | 0.12 ms  | 0.15 ms                             |
| BMXP342010   |  |                                     |
| BMXP3420102  |  |                                     |
| BMXP342020   |  |                                     |
| BMXP342030   |  |                                     |
| BMXP3420302  |  |                                     |
| <sup>(1)</sup> All instructions are executed at each controller cycle. |  |                                     |

## MAST Task Cycle Time: Internal Processing on Input and Output

### Introduction

The internal processing time for inputs and outputs is the sum of the following:

- MAST task system overhead time
- maximum communication system reception time and input management time for implicit inputs/outputs
- maximum communication system transmission time and output management time for implicit inputs/outputs

### MAST Task System Overhead Time

For BMXP34xxxx controllers, the MAST task system overhead time is 700 µs.

**NOTE:** Three system words give information on the MAST task system overhead times:

- %SW27: last cycle overhead time
- %SW28: longest overhead time
- %SW29: shortest overhead time

## Implicit Input/Output Management Time

The implicit input management time is the sum of the following:

- Fixed base of 25  $\mu$ s
- Sum of the input management times for each module (in the following table, IN)

The implicit output management time is the sum of the following:

- Fixed base of 25  $\mu$ s (FAST), 73  $\mu$ s (MAST)
- Sum of the output management times for each module (in the following table, OUT)

The following table presents the input (IN) and output (OUT) management times for each module.

| Type of module   | Input management time (IN) | Output management time (OUT) | Total management time (IN+OUT) |
|--|----------------------------|------------------------------|--------------------------------|
| BMXDDI1602, 16 discrete inputs module                          | 60 $\mu$ s                 | 40 $\mu$ s                   | 100 $\mu$ s                    |
| BMXDDI1603, 16 discrete inputs module                          | 60 $\mu$ s                 | 40 $\mu$ s                   | 100 $\mu$ s                    |
| BMXDDI1604, 16 discrete inputs module                          | 60 $\mu$ s                 | 40 $\mu$ s                   | 100 $\mu$ s                    |
| BMXDDI3202K, 32 discrete inputs module                         | 67 $\mu$ s                 | 44 $\mu$ s                   | 111 $\mu$ s                    |
| BMXDDI6402K, 64 discrete inputs module                         | 87 $\mu$ s                 | 63 $\mu$ s                   | 150 $\mu$ s                    |
| BMXDDO1602, 16 discrete outputs module                         | 60 $\mu$ s                 | 45 $\mu$ s                   | 105 $\mu$ s                    |
| BMXDDO1612, 16 discrete outputs module                         | 60 $\mu$ s                 | 45 $\mu$ s                   | 105 $\mu$ s                    |
| BMXDDO3202K, 32 discrete outputs module                        | 67 $\mu$ s                 | 51 $\mu$ s                   | 118 $\mu$ s                    |
| BMXDDO6402K, 64 discrete outputs module                        | 87 $\mu$ s                 | 75 $\mu$ s                   | 162 $\mu$ s                    |
| BMXDDM16022, 8 discrete inputs and 8 discrete outputs module   | 68 $\mu$ s                 | 59 $\mu$ s                   | 127 $\mu$ s                    |
| BMXDDM3202K, 16 discrete inputs and 16 discrete outputs module | 75 $\mu$ s                 | 63 $\mu$ s                   | 138 $\mu$ s                    |
| BMXDDM16025, 8 discrete inputs and 8 discrete outputs module   | 68 $\mu$ s                 | 59 $\mu$ s                   | 127 $\mu$ s                    |
| BMXDAI0805, 8 discrete inputs module                           | 60 $\mu$ s                 | 40 $\mu$ s                   | 100 $\mu$ s                    |
| BMXDAI1602, 16 discrete inputs module                          | 60 $\mu$ s                 | 40 $\mu$ s                   | 100 $\mu$ s                    |
| BMXDAI1603, 16 discrete inputs module                          | 60 $\mu$ s                 | 40 $\mu$ s                   | 100 $\mu$ s                    |
| BMXDAI1604, 16 discrete inputs module                          | 60 $\mu$ s                 | 40 $\mu$ s                   | 100 $\mu$ s                    |
| BMXDAO1605, 16 discrete outputs module                         | 60 $\mu$ s                 | 45 $\mu$ s                   | 105 $\mu$ s                    |
| BMXAMI0410 analog module                                       | 103 $\mu$ s                | 69 $\mu$ s                   | 172 $\mu$ s                    |

| Type of module                           | Input management time (IN) | Output management time (OUT) | Total management time (IN+OUT) |
|--|----------------------------|------------------------------|--------------------------------|
| BMXAMI0800 analog module                 | 103 µs                     | 69 µs                        | 172 µs                         |
| BMXAMI0810 analog module                 | 103 µs                     | 69 µs                        | 172 µs                         |
| BMXAMO0210 analog module                 | 65 µs                      | 47 µs                        | 112 µs                         |
| BMXAMO0410 analog module                 | 65 µs                      | 47 µs                        | 112 µs                         |
| BMXAMO0802 analog module                 | 110 µs                     | 110 µs                       | 220 µs                         |
| BMXAMM0600 analog module                 | 115 µs                     | 88 µs                        | 203 µs                         |
| BMXART0414 analog module                 | 103 µs                     | 69 µs                        | 172 µs                         |
| BMXART0814 analog module                 | 138 µs                     | 104 µs                       | 242 µs                         |
| BMXDRA1605, 16 discrete outputs module   | 60 µs                      | 45 µs                        | 105 µs                         |
| BMXDRA0804, 8 discrete outputs module    | 56 µs                      | 43 µs                        | 99 µs                          |
| BMXDRA0805, 8 discrete outputs module    | 56 µs                      | 43 µs                        | 99 µs                          |
| BMXEHC0200 dual-channel counting module  | 102 µs                     | 93 µs                        | 195 µs                         |
| BMXEHC0800 eight-channel counting module | 228 µs                     | 282 µs                       | 510 µs                         |

## Communication System Time

Communication (excluding telegrams) is managed during the MAST task internal processing phases:

- on input for receiving messages
- on output for sending messages

The MAST task cycle time is, therefore, affected by the communication traffic. The communication time spent per cycle varies considerably, based on the following elements:

- traffic generated by the controller: number of communication EFs active simultaneously
- traffic generated by other devices to the controller, or for which the controller ensures the routing function as the master

This time is only spent in the cycles where there is a new message to be managed.

**NOTE:** These times may not all occur in the same cycle. Messages are sent in the same controller cycle as instruction execution when communication traffic is low. However, responses are never received in the same cycle as instruction execution.

# MAST Task Cycle Time Calculation

## Introduction

The MAST task cycle time can be calculated before the implementation phase if the desired controller configuration is already known. The cycle time can also be determined during the implementation phase, using the system words %SW30 - %SW32.

## Calculation Method

The following table presents how to calculate the MAST task cycle time.

| Step | Action   |
|------|--|
| 1    | Calculate the input and output internal processing time by adding the following times: <ul style="list-style-type: none"> <li>• MAST task system overhead time, page 93</li> <li>• maximum communication system reception time and input management time for implicit inputs/outputs, page 94</li> <li>• maximum communication system transmission time and output management time for implicit inputs/outputs, page 94</li> </ul> |
| 2    | Calculate the program processing time, page 92 according to the number of instructions and the type (Boolean, digital) of program.   |
| 3    | Add together the program processing time, and the input and output internal processing time.   |

# FAST Task Cycle Time

## Introduction

The FAST task cycle time is the sum of the following:

- program processing time
- internal processing time on input and output

## Definition of Internal Processing Time on Input and Output

The internal processing time on input and output is the sum of the following:

- FAST task system overhead time
- implicit input/output management time on input/output, page 94

For the BMXP3420x0x controllers, the FAST task system overhead time is 130  $\mu$ s.

## Event Response Time

### Introduction

The response time is the time between an edge on an event input and the corresponding edge on an output positioned by the program in an event task.

### Response Time

The following table gives the response time for the BMXP3420x0x controllers with an application program of 100 Boolean instructions and the module.

| Controllers | Minimum      | Typical      | Maximum      |
|-------------|--------------|--------------|--------------|
| BMXP3420x0x | 1625 $\mu$ s | 2575 $\mu$ s | 3675 $\mu$ s |



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