Modicon LMC058 Motion C ontroller

Hardware Guide

10/2010

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

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

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

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

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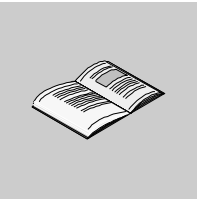

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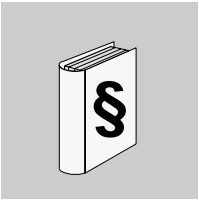
Safety Information



Important Information

NOTICE

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

The addition of this symbol to a Danger 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 an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

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

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

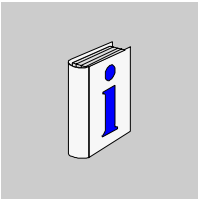
CAUTION
CAUTION, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result in** equipment damage.

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 the installation, and has received safety training to recognize and avoid the hazards involved.

About the Book



At a Glance

Document Scope

The purpose of this document is to:

- show you how to install and operate your Modicon LMC058 Motion Controller,
- show you how to connect the Modicon LMC058 Motion Controller to a programming device equipped with SoMachine software,
- help you understand how to interface the Modicon LMC058 Motion Controller with I/O modules, HMI and other devices,
- help you become familiar with the Modicon LMC058 Motion Controller features.

NOTE: Read and understand this document and all related documents *(see page 8)* before installing, operating, or maintaining your Modicon LMC058 Motion Controller.

Modicon LMC058 Motion Controller users should read through the entire document to understand all of its features.

Validity Note

This document has been updated with the release of SoMachine V2.0.

The technical characteristics of the device(s) described in this manual also appear online. To access this information online:

Step	Action
1	Go to *www.schneider-electric.com*
2	In the **Search** box on the home page, type a model number. Do not type any blank spaces in the model number. To get information on a grouping similar modules, you can use the characters ****; do not use dots or *xx*'s.
3	Under **All**, click **Products** →**Product Datasheets** and select the model number that interests you.
4	To save or print a data sheet as a .pdf file, click **Export to PDF**.

The characteristics presented in this manual should be the same as those that appear online. In line with our policy of constant improvement we may revise content over time to improve clarity and accuracy. In the event that you see a difference between the manual and online information, use the online information as your reference.

Related Documents

Title of Documentation	Reference Number
Modicon LMC058 Logic Controller Programming Guide	EIO0000000408 (Eng), EIO0000000409 (Fre), EIO0000000410 (Ger), EIO0000000411 (Spa), EIO0000000412 (Ita), EIO0000000413 (Chs)
Modicon TM5 Flexible System - System Planning and Installation Guide	EIO0000000426 (ENG); EIO0000000427 (FRE); EIO0000000428 (GER); EIO0000000429 (SPA); EIO0000000430 (ITA); EIO0000000431 (CHS)
Modicon TM5 Digital I/O Modules Hardware Guide	EIO0000000450 (ENG); EIO0000000451 (FRE); EIO0000000452 (GER); EIO0000000453 (SPA); EIO0000000454 (ITA); EIO0000000455 (CHS)
Modicon TM5 Analog I/O Modules Hardware Guide	EIO0000000444 (ENG); EIO0000000445 (FRE); EIO0000000446 (GER); EIO0000000447 (SPA); EIO0000000448 (ITA); EIO0000000449 (CHS)
Modicon TM5 Expert (High Speed Counter) Modules Hardware Guide	EIO0000000462 (ENG); EIO0000000463 (FRE); EIO0000000464 (GER); EIO0000000465 (SPA); EIO0000000466 (ITA); EIO0000000467 (CHS)

Modicon TM5 Transmitter and Receiver Modules Hardware Guide	EIO0000000468 (ENG); EIO0000000469 (FRE); EIO0000000470 (GER); EIO0000000471 (SPA); EIO0000000472 (ITA); EIO0000000473 (CHS)
Modicon TM5 PCI Modules Hardware Guide	EIO0000000474 (ENG); EIO0000000475 (FRE); EIO0000000476 (GER); EIO0000000477 (SPA); EIO0000000478 (ITA); EIO0000000479 (CHS)

You can download these technical publications and other technical information from our website at www.schneider-electric.com.

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 unit.
- Use only the specified voltage when operating this equipment and any associated products.

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

This equipment has been designed to operate outside of any hazardous location. Only install this equipment in zones known to be free of a hazardous atmosphere.

⚠ DANGER

EXPLOSION HAZARD

This equipment is suitable for use in non-hazardous locations only.

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

⚠ WARNING

LOSS OF CONTROL

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

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

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

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

User Comments

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

TM5 System General Rules for Implementing

1

What's in this Chapter?

This chapter contains the following topics:

Topic	Page
Installation Requirements	12
Wiring Rules and Recommendations	14
Environmental Characteristics	20

Installation Requirements

Before Starting

Read and understand this chapter before beginning the installation of your TM5 System.

⚠ 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 unit.
- Use only the specified voltage when operating this equipment and any associated products.

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

CAUTION

ELECTROSTATIC DISCHARGE

- Store all components in their protective packaging until immediately before assembly.
- Never touch exposed conductive parts such as contacts or terminals.

Failure to follow these instructions can result in equipment damage.

Programming Considerations

⚠ 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.

Operating Environment

This equipment has been designed to operate outside of any hazardous location. Only install this equipment in zones known to be free of a hazardous atmosphere.

⚠ DANGER

EXPLOSION HAZARD

This equipment is suitable for use in non-hazardous locations only.

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

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Install and operate this equipment according to the environmental conditions described in the operating limits.

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

Installation Considerations

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Use appropriate safety interlocks where personnel and/or equipment hazards exist.
- Install and operate this equipment in an enclosure appropriately rated for its intended environment.
- Use the sensor and actuator power supplies only for supplying power to the sensors or actuators connected to the module.
- Power line and output circuits must be wired and fused in compliance with local and national regulatory requirements for the rated current and voltage of the particular equipment.
- Do not use this equipment in safety critical machine functions.
- Do not disassemble, repair, or modify this equipment.
- Do not connect any wiring to unused connections, or to connections designated as Not Connected (N.C.).

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

Wiring Rules and Recommendations

Introduction

There are several rules that must be followed when wiring the TM5 System.

Wiring Rules

⚠ 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 unit.
- Use only the specified voltage when operating this equipment and any associated products.

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

The following rules must be applied when wiring the TM5 System:

- I/O and communication wiring must be kept separate from the power wiring. Route these 2 types of wiring in separate cable ducting.
- Verify that the operating conditions and environment are within the specification values.
- Use proper wire sizes to meet voltage and current requirements.
- Use copper conductors only.
- Use twisted-pair, shielded cables for analog, expert or fast I/O and TM5 bus signals.
- Use twisted-pair, shielded cables for encoder, networks and field bus (CAN, serial, Ethernet).

⚠ WARNING

IMPROPER GROUNDING CAN CAUSE UNINTENDED EQUIPMENT OPERATION

- Use cables with insulated shielded jackets for analog I/O, fast I/O and communication signals.
- Ground shielded cables for analog I/O, fast I/O and communication signals at a single point [1]
- Always comply with local wiring requirements regarding grounding of cable a shields.

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

NOTE: [1]Multipoint grounding is permissible if connections are made to an equipotential ground plane dimensioned to help avoid cable shield damage in the event of power system short circuit currents.

Refer to the section Grounding the TM5 System *(see Modicon Flexible TM5 System, System Planning and Installation Guide)* to ground the shielded cables.

The table below provides the wire sizes to use with the removable spring terminal blocks:

mm / in. 9 / 0.35				
mm²	0,08…2,5	0,25…2,5	0,25…1,5	2 x 0,25...2 x 0,75
AWG	28…14	24…14	24…16	2 x 24…2 x 18

⚠ DANGER

FIRE HAZARD

Use only the recommended wire sizes for I/O channels and power supplies.

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

The spring clamp connectors of the terminal block are designed for only one wire or one cable end. Two wires to the same connector must be installed with a double wire cable end to help prevent loosening.

⚠ DANGER

LOOSE WIRING CAUSES ELECTRIC SHOCK

Do not insert more than one wire per connector of the terminal block without a double wire cable end.

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

Terminal Block

Plugging a terminal block into the incorrect electronic module can cause unintended operation of the application and/or damage the electronic module.

⚠ DANGER

UNINTENDED EQUIPMENT OPERATION OR ELECTRIC SHOCK

Be sure to connect the terminal blocks to their designated location.

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

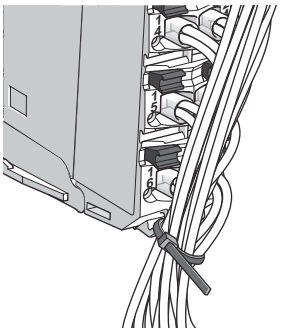
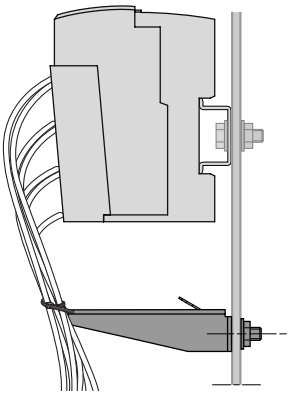
NOTE: To help prevent a terminal block from being inserted incorrectly, clearly and uniquely code each terminal block and electronic module according to the instructions in Coding the TM5 System *(see Modicon Flexible TM5 System, System Planning and Installation Guide)*.

Stress Relief Using Cable Tie

There are two methods to reduce the stress on cables:

- The terminal blocks *(see Modicon Flexible TM5 System, System Planning and Installation Guide)* have slots to attach cable ties. A cable tie can be fed through this slot to secure cables and wires to reduce stress between them and the terminal block connections.
- After grounding the TM5 System via the TM2XMTGB grounding plate *(see Modicon Flexible TM5 System, System Planning and Installation Guide)*, wires can be bundled and fixed to the grounding plate tabs using wire ties to reduce stress on the cables.

The table below provides the size of the cable tie and shows the two methods to reduce the stress on the cables:

Cable Tie Size	**Terminal block**	**TM2XMTGB Grounding plate**
Thickness	1.2 mm (0.05 in.) maximum	1.2 mm (0.05 in.)
Width	4 mm (0.16 in.) maximum	2.5...3 mm (0.1...0.12 in.)
Mounting figure		

Protecting Outputs from Inductive Load Damage

Depending on the load, a protection circuit may be needed for the outputs on the controllers and certain modules. Inductive loads using DC voltages may create voltage reflections resulting in overshoot that will damage or shorten the life of output devices.

⚠ CAUTION

OUTPUT CIRCUIT DAMAGE DUE TO INDUCTIVE LOADS

Use an appropriate external protective circuit or device to reduce the risk of inductive direct current load damage.

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

Relay outputs can support up to 240 Vac. Inductive damage to these types of outputs can result in welded contacts and loss of control. Each inductive load must be equipped with a protection device such as a peak limiter, RC circuit or flyback diode. Capacitive loads are not supported by these relays.

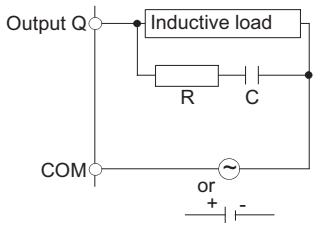
⚠ WARNING

RELAY OUTPUTS WELDED CLOSED

- Always protect relay outputs from inductive alternating current load damage using an appropriate external protective circuit or device.
- Do not connect relay outputs to capacitive loads.

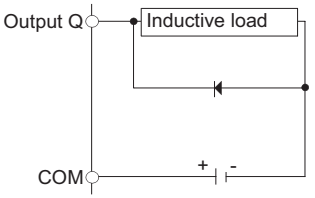
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Protective circuit A: this protection circuit can be used for both AC and DC load power circuits.



- C represents a value from 0.1 to 1 µF.
- R represents a resistor of approximately the same resistance value as the load.

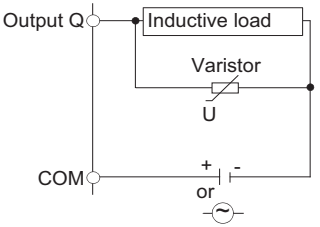
Protective circuit B: this protection circuit can be used for DC load power circuits.



Use a diode with the following ratings:

- Reverse withstand voltage: power voltage of the load circuit x 10.
- Forward current: more than the load current.

Protective circuit C: this protection circuit can be used for both AC and DC load power circuits.



- In applications where the inductive load is switched on and off frequently and/or rapidly, ensure that the continuous energy rating (J) of the varistor exceeds the peak load energy by 20 % or more.

Environmental Characteristics

Introduction

The following information describes the system-wide environmental requirements and characteristics for the TM5 System.

The general environmental characteristics are common to all components of the TM5 System.

Enclosure Requirements

TM5 components are designed as Zone B, Class A industrial equipment according to IEC/CISPR Publication 11. If they are used in environments other than those described in the standard, or in environments that do not meet the specifications in this manual, your ability to meet electromagnetic compatibility requirements in the presence of conducted and/or radiated interference may be reduced.

All TM5 components meet European Community (CE) requirements for open equipment as defined by EN61131-2. You must install them in an enclosure designed for the specific environmental conditions and to minimize the possibility of unintended contact with hazardous voltages. Your enclosure should be constructed of metal to improve the electromagnetic immunity of your TM5 System. Your enclosure should have a keyed locking mechanism to minimize unauthorized access.

Environmental Characteristics

This equipment meets cULus, CSA, GOST-R and c-Tick certifications and CE requirements as indicated in the table below. This equipment is intended for use in a Pollution Degree 2 industrial environment.

The table below provides the general environmental characteristics:

Characteristic	Specification	
This product is compliant with Europe RoHS recommendations and China RoHS regulations.		
Agency	IEC61131-2	UL508, CSA 22.2 n° 142
Ambient operating temperature	Horizontal installation	- 10...60 °C (14...140 °F)[1]
	Vertical installation	- 10...50 °C (14...122 °F)
Storage temperature		- 40...70 °C (- 40...158 °F)[2]
Relative humidity		5...95% (non-condensing)
Degree of pollution	IEC60664	2

Characteristic	Specification	
Degree of protection	IEC61131-2	IP20
Corrosion immunity		No
Operating altitude		0...2,000 m (0...6,560 ft.)
Storage altitude		0...3,000 m (0...9,842 ft.)
Vibration resistance	Mounted on a DIN rail	3.5 mm (0.138 in.) fixed amplitude from 5...8.4 Hz 9.8 m/s^2 (1 g_n) fixed acceleration from 8.4...150 Hz
Mechanical shock resistance		147 m/s^2 (15 g_n) for a duration of 11 ms
Connection type		Removable spring terminal block
Connector insertion/removal cycles		50
Controller RTC Battery Type (not applicable for TM5 field bus interface)		BBCV2, Renata Type CR2477 (replaceable)
Note: **1** Some devices have temperature operating restrictions that require de-rating between 55 °C and 60 °C (131 °F and 140 °F), and may be subject to other possible restrictions. See the specific characteristics for your electronic module. **2** All controllers with a battery installed must be stored in the following temperature range: -30...70 °C (- 22...158 °F).		

NOTE: Replacement of the battery in the controllers other than with the type specified in this documentation may present a risk of fire or explosion.

⚠ WARNING

IMPROPER BATTERY CAN PROVOKE FIRE OR EXPLOSION

Replace battery only with identical type: Renata Type CR2477M.

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

Electromagnetic Susceptibility

The table below provides the TM5 System electromagnetic susceptibility specifications:

Characteristic	Specification	Range
Electrostatic discharge	IEC/EN 61000-4-2	8 kV (air discharge) 4 kV (contact discharge)
Electromagnetic fields	IEC/EN 61000-4-3	10 V/m (80 MHz...2 GHz) 1 V/m (2...2.7 GHz)
Fast transients burst	IEC/EN 61000-4-4	Power lines: 2 kV I/O: 1 kV Shielded cable: 1 kV Repetition rate: 5 and 100 KHz
Surge immunity 24 Vdc circuit	IEC/EN 61000-4-5	1 kV in common mode 0.5 kV in differential mode
Surge immunity 230 Vac circuit		2 kV in common mode 1 kV in differential mode
Induced electromagnetic field	IEC/EN 61000-4-6	10 V_{eff} (0.15...80 MHz)
Conducted emission	EN 55011 (IEC/CISPR11)	150...500 kHz, quasi peak 79 dBµV
		500 kHz...30 MHz, quasi peak 73 dBµV
Radiated emission	EN 55011 (IEC/CISPR11)	30...230 MHz, 10 m@40 dBµV/m
		230 MHz...1 GHz, 10 m@47 dBµV/m

Modicon LMC058 Motion Controller Features

2

Introduction

This chapter describes the features of the Modicon LMC058 Motion Controller.

What's in this Chapter?

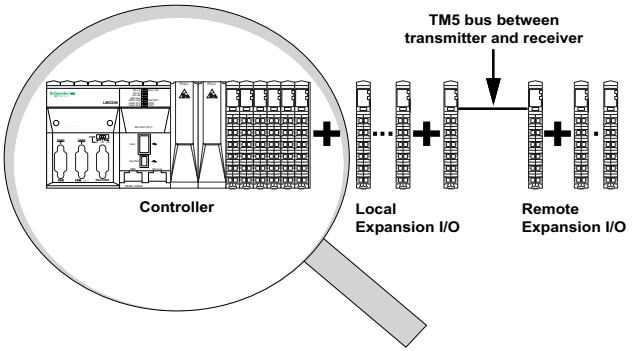
This chapter contains the following topics:

Topic	Page
About the Modicon LMC058 Motion Controller	24
Controller Description	26
Controller Common Characteristics	27
Real Time Clock (RTC)	30

About the Modicon LMC058 Motion Controller

Overview

The Schneider Electric Modicon LMC058 Motion Controller is a controller with a variety of powerful features. This controller is the optimized solution for axis positioning thanks to the SoMachine software platform, which includes embedded automation functions and an ergonomic interface for axis configuration. It can control a wide range of applications. Combined with Lexium servo drives or Lexium SD3 Stepper drives, this lets you easily design and commission your applications.



The Software configuration is described in the SoMachine Programming Guide *(see Modicon LMC058 Motion Controller, Programming Guide)*.

Key Features

The SoMachine software supports the following IEC61131-3 programming languages for use with these controllers:

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

All controllers support the following fieldbuses and network capabilities:

- CANmotion Master dedicated to motion device synchronization
- CANopen Master
- Ethernet
- Serial Line

All controllers support the following functions and I/O types:

- Encoder Master
- Expert functions (counting, reflex outputs...)
- Embedded I/Os

All controllers support up to 21 application program tasks with the following limits:

- 4 cyclic tasks: one is configured by default (MAST)
- 1 freewheeling task
- 8 software event driven tasks
- 9 hardware event driven tasks: 1 is the motion task synchronized with the CANmotion Master

Controller Range

	PCI	CAN	USB A	USB Pgr	Ethernet	Serial Line	Encoder
LMC058LF42•• *(see page 35)*	0	2	1	1	1	1	1
LMC058LF424•• *(see page 43)*	2	2	1	1	1	1	1

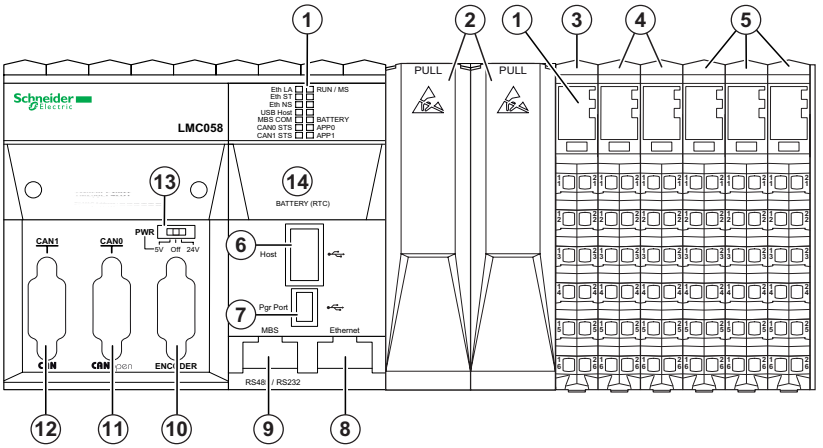
	Embedded Expert I/O				Embedded Regular I/O			
		Fast Inputs	Fast Outputs	Regular Inputs		Digital Inputs	Digital Outputs	Analog Inputs
LMC058LF42•• *(see page 35)*	2x	5	2	2	1x	12	12	0
LMC058LF424•• *(see page 43)*	2x	5	2	2	1x	12	12	4

Controller Description

Overview

The Modicon LMC058 Motion Controller and its range are described below.

Physical Description



1 LED status
2 PCI slots (depending on the controller reference)
3 Controller Power Distribution Module (CPDM)
4 Expert I/O (Embedded)
5 Regular I/O (Embedded)
6 USB A port (Host)
7 USB programming port (Pgr Port)
8 Ethernet port (Ethernet)
9 Serial Line port
10 Encoder Interface
11 CANopen port (CAN0)
12 CANopen or CANmotion port (CAN1)
13 Switch for encoder power distribution selection (PWR)
14 Real Time Clock battery (Battery (RTC))

Controller Common Characteristics

Overview

The common characteristics for all the Modicon LMC058 Motion Controllers are described below.

Programming

Use the SoMachine software to program the controller.

⚠ 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.

SoMachine is a professional, efficient and open OEM software solution that helps you develop, configure and commission the entire machine in a single environment (including logic, motor control, HMI and related network automation functions).

SoMachine allows you to program and commission the entire range of elements in Schneider Electric's Flexible Machine Control (FMC) platform and helps you optimize the control solution for each machine's requirements.

All information about SoMachine is included in the global SoMachine software help system.

Memory

The following table describes the different kinds of memory:

Memory type	Size	Used
RAM	64 Mbytes	To execute the application.
Flash	128 Mbytes	To save program and data in case of a power outage.

Embedded Communication features

The four kinds of ports on the controller front panel are:

- Ethernet port
- CAN ports

- USB ports
- Serial Line Port

For more details, refer to the chapter Integrated Communication Ports *(see page 53)*.

Encoder Interface General Description

The encoder interface *(see page 75)* consists of a 15-pin Sub-D HD connector and a voltage supply selector.

The encoder interface supports the following two types of connections:
- incremental
- absolute synchronous serial interface (SSI)

PCI

The communication electronic module range includes:
- RS232 connection electronic modules
- RS485/RS422 connection electronic modules

Controller Power Distribution Module (CPDM)

The controller power distribution module is divided into 3 power circuits:
- 24 Vdc Embedded expert modules power
- 24 Vdc Main power (for controller, fieldbus and TM5 power bus)
- 24 Vdc I/O power segment

There is no configuration necessary for this module.

Embedded Expert Input/Output

The controller base provides:
- 1 encoder
- 2 Embedded Expert I/O modules (DM72F0 and DM72F1) each with:
  - 5 fast inputs
  - 2 regular inputs
  - 2 fast outputs

Embedded Regular Input/Output

The Embedded Regular I/O may include, depending on the controller range:
- digital input electronic modules
- digital output electronic modules
- analog input electronic modules

Every digital and analog electronic module channel has a status LED.

Expansion Modules

You can expand the number of I/O for your controller by adding expansion I/O slices. The following table lists the different types of electronic modules available to create expansion I/O slices:

Reference	Description
TM5SD••	Digital modules *(see Modicon TM5, Digital I/O Modules, Hardware Guide)*
TM5SA••	Analog modules *(see Modicon TM5, Analog I/O Modules, Hardware Guide)*
TM5SPS••	Power distribution modules *(see Modicon Flexible TM5 System, System Planning and Installation Guide)*
TM5SE••	Specialized expansion modules *(see Modicon TM5, Expert (High Speed Counter) Modules, Hardware Guide)*
TM5SBE••	Transmitter and receiver modules *(see Modicon TM5, Transmitter and Receiver Modules, Hardware Guide)*
TM5SPD••	Common Distribution Module *(see Modicon Flexible TM5 System, System Planning and Installation Guide)*
TM5SD000	Dummy module *(see Modicon Flexible TM5 System, System Planning and Installation Guide)*

Real Time Clock (RTC)

Overview

These controllers include an RTC to provide system date and time information, and to support related functions requiring a real-time clock. To continue to keep time when power is off, a non-rechargeable but replaceable battery is delivered with the controller. A battery LED indicates if the battery charge is low or the battery absent. For further details, please refer to Status LEDs *(see page 37)*.

The following table shows how RTC drift is managed:

RTC characteristics	Description
RTC drift	Less than 30 seconds per month without any user calibration at 25° C (77° F)
RTC drift with user logic assistance	Less than or equal to 6 seconds per month with user calibration *(see Modicon LMC058 Motion Controller, System Functions and Variables, LMC058 PLCSystem Library Guide)* through application software when the controller is in RUN mode.

RTC Battery

The controller has one RTC battery.

In the event of a power outage, the backup battery will retain the time of the controller.

The table below shows the characteristics of the RTC battery:

Use	In the event of a transient power outage, the battery will power the RTC
Backup Time	At least 1.5 years at 45° C max (113° F). At higher temperatures, the time is reduced
Battery Monitoring Features	Yes
Replaceable	Yes
Controller RTC Battery Type	Type BBCV2, Renata Type CR2477M

Installing and Replacing the RTC battery

While lithium batteries are preferred due to their slow discharge and long life, they can present hazards to personnel, equipment and the environment, and must be handled properly.

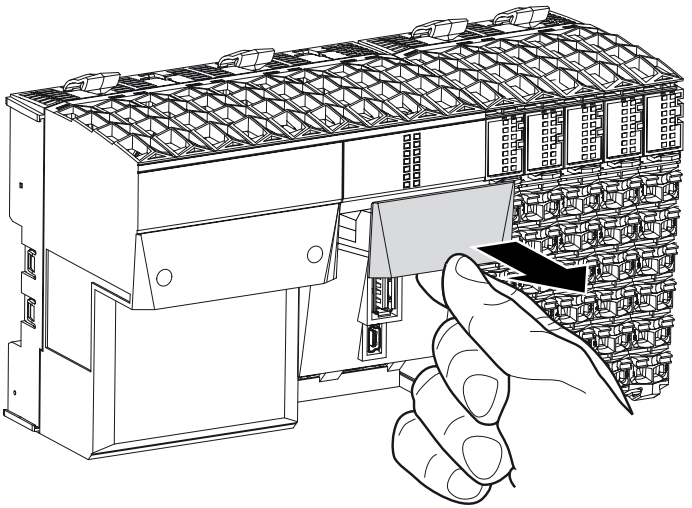
⚠ DANGER

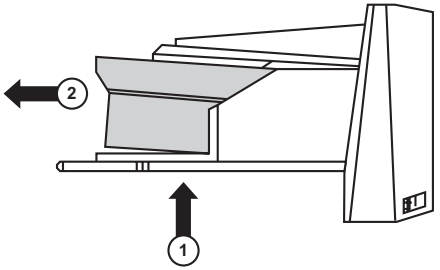
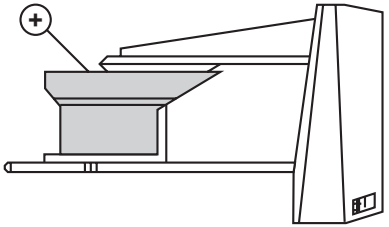
EXPLOSION, FIRE, OR CHEMICAL HAZARD

Follow these instructions for the lithium batteries:
- Replace with identical type.
- Follow all battery manufacturer's instructions.
- Remove all replaceable batteries before discarding unit.
- Recycle or properly dispose of used batteries.
- Protect battery from any potential short circuit.
- Do not recharge, disassemble, heat above 100 °C (212 °F), or incinerate.
- Use your hands or insulated tools to remove or replace the battery.
- Maintain proper polarity when inserting and connecting a new battery.

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

To install or replace the RTC battery, follow these steps:

Step	Action
1	Power off your controller.
2	Slide out the battery holder of the controller: 

Step	Action
3	Remove the battery from the battery holder: 
4	Insert the new battery into the battery holder in accordance with the polarity markings on the battery: 
5	Replace the battery holder on the controller and verify that the latch clicks into place.
6	Power up your Modicon LMC058 Motion Controller.
7	Set the internal clock. For further details on the internal clock, please refer to RTC Library *(see Modicon LMC058 Motion Controller, System Functions and Variables, LMC058 PLCSystem Library Guide)*.

NOTE: Replacement of the battery in the controllers other than with the type specified in this documentation may present a risk of fire or explosion.

⚠ WARNING

IMPROPER BATTERY CAN PROVOKE FIRE OR EXPLOSION

Replace battery only with identical type: Renata Type CR2477M.

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

Modicon LMC058 Motion Controller Installation

3

First Startup

Overview

This procedure helps you through the installation and startup of your controller.

Startup Procedure

Step	Action	Comment
1	Unpack your controller and check the contents of the package.	Contents of package: Instruction Sheet, Controller, Terminal blocks to be mounted on the controller, RTC battery in a separate bag
2	Choose an appropriate cabinet and DIN rail and install them.	Refer to the Modicon Flexible TM5 System - System Planning and Installation Guide *(see Modicon Flexible TM5 System, System Planning and Installation Guide)*.
3	Install your controller on the DIN rail.	
4	Connect your PCI expansion modules to the controller (optional).	Refer to the PCI Slots *(see page 71)* chapter.
5	Connect the expansion I/O slices (optional).	Refer to the Modicon Flexible TM5 System - System Planning and Installation Guide *(see Modicon Flexible TM5 System, System Planning and Installation Guide)*.
6	Connect the communication field buses and networks: ● Ethernet ● CAN ● Serial Line	Refer to chapters ● Ethernet Port *(see page 54)* ● CAN Ports *(see page 57)* ● Serial Line Port *(see page 66)*

Step	Action	Comment
7	Connect your devices to the inputs and outputs.	Refer to Modicon TM5 Analog I/O Modules Hardware Guide *(see Modicon TM5, Analog I/O Modules, Hardware Guide)* and Modicon TM5 Digital I/O Modules Hardware Guide *(see Modicon TM5, Digital I/O Modules, Hardware Guide)*.
8	Connect the external 24 Vdc power source(s) to the Controller Power Distribution Module (CPDM) and any optional Power Distribution Modules (PDM).	Refer to CPDM Wiring Diagram *(see page 51)*.
9	Verify all connections.	—
10	Turn on power.	—
11	Login to your controller.	—
12	Create an application.	—
13	Load your application into the controller.	—
14	Create your boot application.	—
15	Run the application.	—

LMC058LF42••

4

Introduction

This chapter describes the LMC058LF42•• controller.

What's in this Chapter?

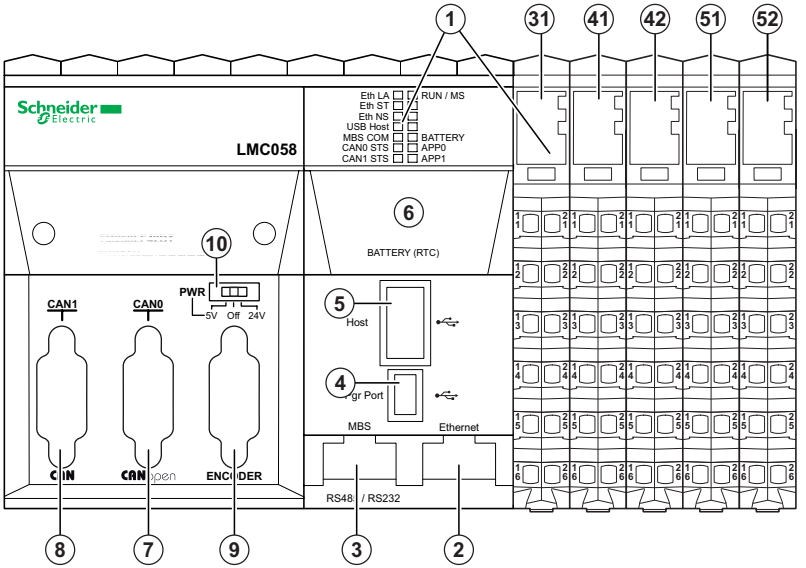
This chapter contains the following topics:

Topic	Page
General Description	36
Characteristics of the Controller Power Distribution Module	40

General Description

Overview

The following figure shows the different components of the LMC058LF42••:

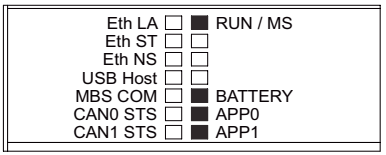


N°	Designation / Description	Refer to
1	LED status	Status LEDs *(see page 37)*
2	Ethernet port / Type RJ45	Ethernet Port *(see page 54)*
3	Serial line / Type RJ45 (RS232 or RS485)	Serial Line Port *(see page 66)*
4	USB programming port / For terminal connection to a programming PC (SoMachine)	USB Programming Port *(see page 62)*
5	USB host / For memory key management	USB Host Port *(see page 64)*
6	Battery	RTC Battery *(see page 30)*
7	CAN 0 port / Male Sub-D 9 CANopen master	CAN Ports *(see page 57)*
8	CAN 1 port / Male Sub-D 9 for CANmotion bus master or CANopen master	CAN Ports *(see page 57)*
9	Encoder interface connector / Female Sub-D HD 15-pin	Encoder Interface *(see page 75)*
10	Encoder interface switch / 3 positions (+5 V, OFF, +24V)	
31	Controller Power Distribution Module / For connecting external power supplies	Controller Power Distribution Module *(see page 28)*

N°	Designation / Description	Refer to
41	Embedded Expert I/O modules / 5 fast inputs, 2 regular inputs, 2 fast outputs	Embedded Expert I/O *(see page 81)*
42		
51	Embedded Regular input module / 12 digital inputs	Digital DI12DE *(see page 95)*
52	Embedded Regular output module / 12 digital outputs	Digital DO12TE *(see page 95)*

Status LEDs

The following figure shows the LEDs on the front panel display:



The following table describes the controller status LEDs:

Marking	Description	LED	
		Color	Description
RUN/MS	Module status	Green / Red	See RUN/MS status LED below
BATTERY	Battery status	Red	On when RTC battery needs to be replaced
APP0	Application LEDs	Green / Red	Managed by user application
APP1			

For further details on the following LEDs:

- Eth LA, Eth ST and Eth NS, please refer to Ethernet Port - Status LEDs *(see page 55)*.
- USB Host, please refer to USB Host Port - Status LED *(see page 65)*.
- MBS COM, please refer to Serial Line Port - Status LED *(see page 69)*.
- CAN0 STS and CAN1 STS, please refer to CAN Ports - Status LEDs *(see page 60)*.

The following table describes the RUN/MS status LED:

Status LED	Controller State	Pgr Port Communication	Application Execution
Flashing green / red	BOOTING	No	No
Flashing red	INVALID OS	Restricted	No
Single flash green	EMPTY	Yes	No
Green ON	RUNNING	Yes	Yes
3 flash green	RUNNING with Breakpoint	Yes	Restricted

Status LED	Controller State	Pgr Port Communication	Application Execution
Flashing green	STOPPED	Restricted	No
Single flash red	HALT	Yes	No
Rapid flashing red	REBOOT after a hardware error has been detected	Yes	No (Empty)
Red ON	HALT after system error detected	No	No
OFF	No power	No	No
Green ON / with single flash red	RUNNING with external error detected Or different Boot Project Or no Boot Project	Yes	Yes
Flashing green / with single flash red	STOPPED with external error detected	Restricted	No

NOTE: For further details on controller states, refer to the Operating Mode discussion in the Programming Guide for your particular controller.

Controller states

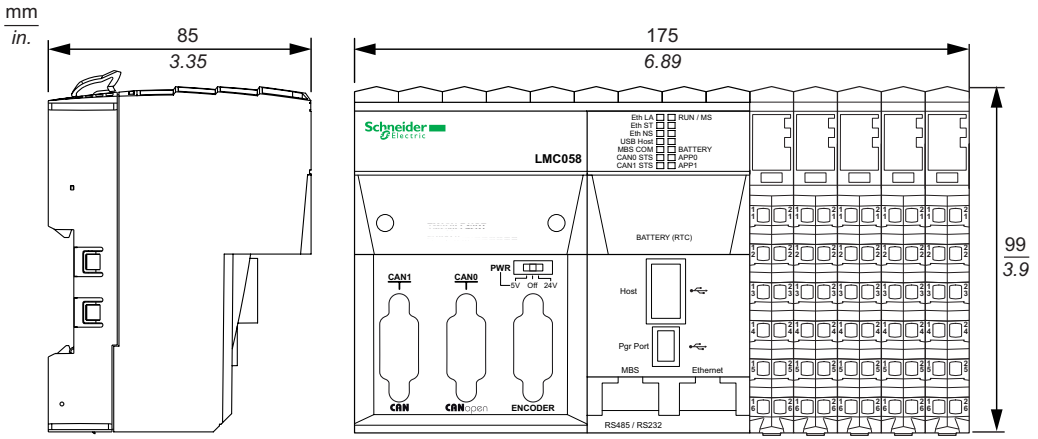
The following table describes the controller states:

State	Description
BOOTING	The controller executes the boot firrmware and its own internal self tests. It does not execute the application nor does it communicate. It then checks the checksum of the firmware and user application.
INVALID_OS	The Operating System is not valid. The controller can not execute an application. Communications are restricted.
EMPTY	The user application is not valid or a hardware error has been detected. The controller does not execute the application but it can communicate.
RUNNING	The controller executes the application.
STOPPED	The controller has a valid application that is stopped.
HALT	The controller has detected an application or system error and has ceased application execution.

NOTE: For further details on controller states, refer to the Operating Mode discussion in the Programming Guide for your particular controller.

Dimensions

The following figure shows the external dimensions of the controller:



The following table describes the weight of the LMC058LF42••:

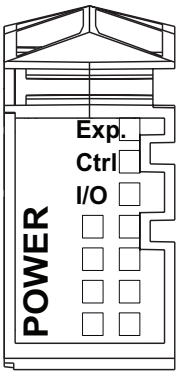
Weight	
LMC058LF42••	550 g (19.4 oz)

Characteristics of the Controller Power Distribution Module

The Controller Power Distribution Module (CPDM) has three 24 Vdc power connections:

- Main power (**Ctrl**)
- Expert I/O power (**Exp.**)
- 24 Vdc I/O Power Segment power (**I/O**)

The state of these three power connections is indicated by a set of LEDs on the CPDM:



The following table describes the CPDM LED display:

LEDs	Color	Status	Description
Exp. (Expert I/O power)	Green	On	24 Vdc applied
Ctrl (Main power)	Green	On	24 Vdc applied
I/O (24 Vdc I/O Power Segment power)	Green	On	24 Vdc applied

The Main power serves the TM5 power bus, the Serial Line port, the USB port, any PCI modules that may be installed, and power for the controller electronics.

The Expert I/O power serves the Expert I/O module inputs and outputs, the power for the embedded Encoder port, and power for the Expert I/O module electronics.

The 24 Vdc I/O power segment power serves the Regular I/O modules inputs and outputs, as well as providing power to the first segment of the 24 Vdc I/O Power segment for any optional I/O slices of the local configuration.

CDPM Power Consumption Overview

The following table shows the power characteristics of the LMC058LF42••:

Rated voltage CPDM			24 Vdc	
Voltage range CPDM			20.4...28.8 Vdc	
Main power	Minimum current (no external loads)		0.28 A	
	Maximum current including the following loads:		0.6 A	
		Current for TM5 bus power when adding expansion modules	0...0.1 A	
		Current for serial line when connected devices consume power	0...0.05 A	
		Current for USB Host when connected devices consume power	0...0.1 A	
	Inrush current	Time < 70 µs	100 A max.	
		70 ... 2000 µs	3 A max.	
	Internal protection	No	see note 1	
Embedded Expert modules power and encoder power	Minimum current (no external loads)		0.04 A	
	Maximum current including the following loads:		1.15 A	
		Current for Expert Inputs	0...0.1 A	
		Current for Expert Outputs	0...0.8 A	
		Current for Encoder on Sub-D when connected devices consume power	5 Vdc switch position	0...0.1 A
			24 Vdc switch position	0...0.25 A
	Inrush current	Time < 150 µs	50 A max.	
	Internal protection	No	see note 1	
24 Vdc I/O power segment	Maximum current (depending on the modules on the segment)		6.3 A max.	
	Inrush current (depending on the modules on the segment)	Time < 500 µs	25 A max.	
	Internal protection	No	see note 1	

[1] Add external fuse as specified in the wiring diagrams.

Refer to the chapter Example 1: Current Consumed by a Local Configuration *(see Modicon Flexible TM5 System, System Planning and Installation Guide)* for further details on power consumption.

LMC058LF424••

5

Introduction

This chapter describes the LMC058LF424•• controller.

What's in this Chapter?

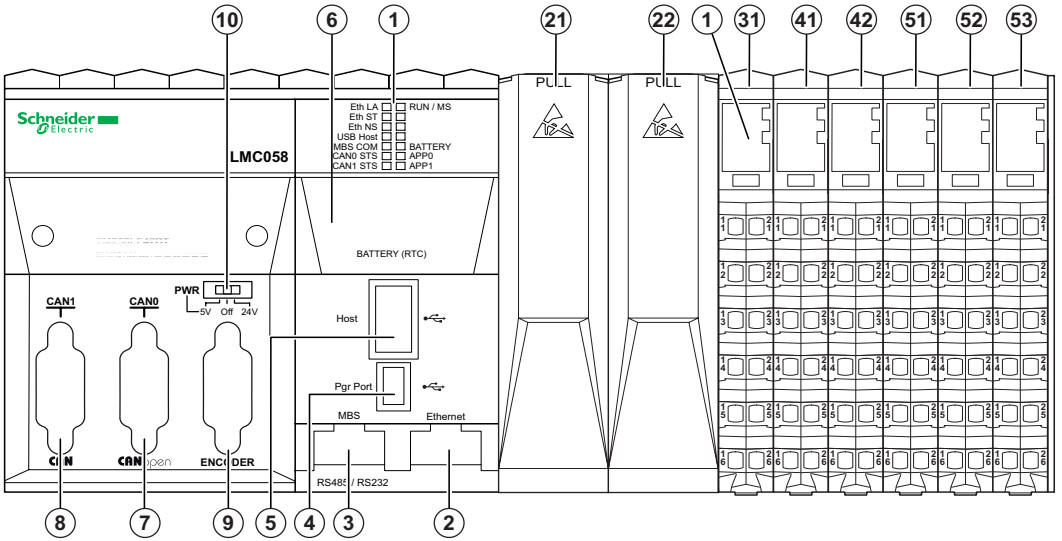
This chapter contains the following topics:

Topic	Page
General Description	44
Characteristics of the Controller Power Distribution Module	48

General Description

Overview

The following figure shows the different components of the LMC058LF424••:

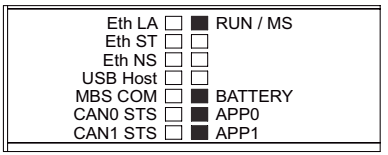


N°	Designation / Description	Refer
1	LED status	Status LEDs *(see page 45)*
2	Ethernet port / Type RJ45	Ethernet Port *(see page 54)*
3	Serial line / Type RJ45 (RS232 or RS485)	Serial Line Port *(see page 66)*
4	USB programming port / For terminal connection to a programming PC (SoMachine)	USB Programming Port *(see page 62)*
5	USB host / For memory key management	USB Host Port *(see page 64)*
6	Battery	RTC Battery *(see page 30)*
7	CAN 0 port / Male Sub-D 9 CANopen master	CAN Ports *(see page 57)*
8	CAN 1 port / Male Sub-D 9 for CANmotion bus master or CANopen master	CAN Ports *(see page 57)*
9	Encoder interface connector / Female Sub-D HD 15-pin	Encoder Interface *(see page 75)*
10	Encoder interface switch / 3 positions (+5 V, OFF, +24V)	
21	PCI slot	PCI Slots *(see page 71)*
22		
31	Controller Power Distribution Module / For connecting external power supplies	Controller Power Distribution Module *(see page 28)*

N°	Designation / Description	Refer
41	Embedded Expert I/O modules / 5 fast inputs, 2 regular inputs, 2 fast outputs	Embedded Expert I/O *(see page 81)*
42		
51	Embedded Regular input modules / 12 Digital inputs	Digital DI12DE *(see page 96)*
52	Embedded Regular output modules / 12 Digital outputs	Digital DO12TE *(see page 100)*
53	Embedded Regular input module / 4 Analog inputs (12-bit)	Analog AI4LE *(see page 105)*

Status LEDs

The following figure shows the LEDs on the front panel display:



The following table describes the controller status LEDs:

Marking	Description	LED	
		Color	Description
RUN/MS	Module status	Green / Red	See RUN/MS status LED below
BATTERY	Battery status	Red	On when RTC battery needs to be replaced
APP0	Application LEDs	Green / Red	Managed by user application
APP1			

For further details on the following LEDs:

- Eth LA, Eth ST and Eth NS, please refer to Ethernet Port - Status LEDs *(see page 55)*.
- USB Host, please refer to USB Host Port - Status LED *(see page 65)*.
- MBS COM, please refer to Serial Line Port - Status LED *(see page 69)*.
- CAN0 STS and CAN1 STS, please refer to CAN Ports - Status LEDs *(see page 60)*.

The following table describes the RUN/MS status LED:

Status LED	Controller State	Prg Port Communication	Application Execution
Flashing green / red	BOOTING	No	No
Flashing red	INVALID OS	Restricted	No
Single flash green	EMPTY	Yes	No
Green ON	RUNNING	Yes	Yes

Status LED	Controller State	Prg Port Communication	Application Execution
3 flash green	RUNNING with Breakpoint	Yes	Restricted
Flashing green	STOPPED	Restricted	No
Single flash red	HALT	Yes	No
Rapid flashing red	REBOOT after a hardware error has been detected	Yes	No (Empty)
Red ON	HALT after system error detected	No	No
OFF	No power	No	No
Green / with single flash red	RUNNING with external error detected Or different Boot Project Or no Boot Project	Yes	Yes
Flashing green / with single flash red	STOPPED with external error detected	Restricted	No

NOTE: For further details on controller states, refer to the *Operating Mode* discussion in the Programming Guide for your particular controller.

Controller states

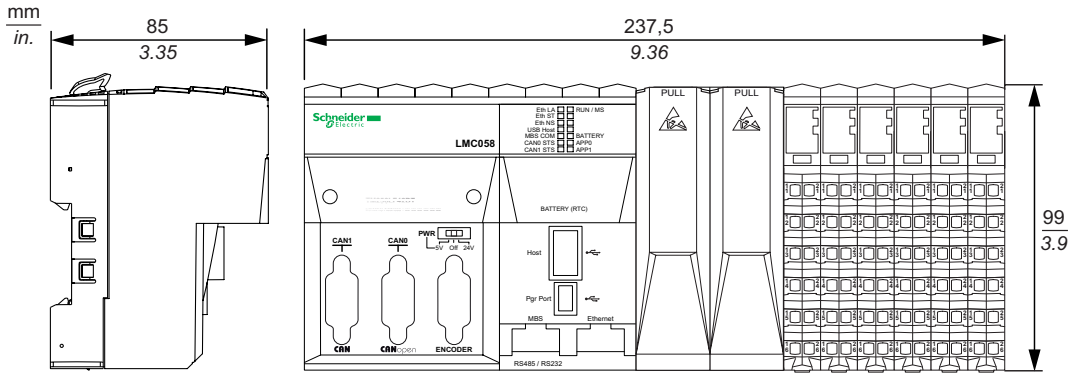
The following table describes the controller states:

State	Description
BOOTING	The controller executes the boot firmware and its own internal self tests. It does not execute the application nor does it communicate. It then checks the checksum of the firmware and user application.
INVALID_OS	The Operating System is not valid. The controller can not execute an application. Communications are restricted.
EMPTY	The user application is not valid or a hardware error has been detected. The controller does not execute the application but it can communicate.
RUNNING	The controller executes the application.
STOPPED	The controller has a valid application that is stopped.
HALT	The controller has detected an application or system error and has ceased application execution.

NOTE: For further details on controller states, refer to the *Operating Mode* discussion in the Programming Guide for your particular controller.

Dimensions

The figure below shows the external dimensions of the controller:



The following table describes the weight of the LMC058LF424••:

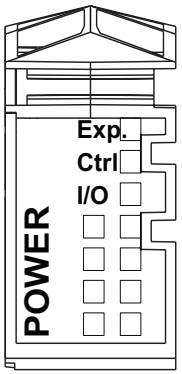
Weight	
LMC058LF424••	770 g (24.7 oz)

Characteristics of the Controller Power Distribution Module

The Controller Power Distribution Module (CPDM) has three 24 Vdc power connections:

- Main power (**Ctrl**)
- Expert I/O power (**Exp.**)
- 24 Vdc I/O Power Segment power (**I/O**)

The state of these three power connections is indicated by a set of LEDs on the CPDM:



The following table describes the CPDM LED display:

LEDs	Color	Status	Description
Exp. (Expert I/O power)	Green	On	24 Vdc applied
Ctrl (Main power)	Green	On	24 Vdc applied
I/O (24 Vdc I/O Power Segment power)	Green	On	24 Vdc applied

The Main power serves the TM5 power bus, the Serial Line port, the USB port, any PCI modules that may be installed, and power for the controller electronics.

The Expert I/O power serves the Expert I/O module inputs and outputs, the power for the embedded Encoder port, and power for the Expert I/O module electronics.

The 24 Vdc I/O power segment power serves the Regular I/O modules inputs and outputs, as well as providing power to the first segment of the 24 Vdc I/O Power segment for any optional I/O slices of the local configuration.

CDPM Power Consumption Overview

The following table shows the power characteristics of the LMC058LF424••:

Rated voltage CPDM			24 Vdc	
Voltage range CPDM			20.4...28.8 Vdc	
Main power	Minimum current (no external loads)		0.28 A	
	Maximum current including the following loads:		0.7 A	
		Current for TM5 bus power when adding expansion modules	0...0.1 A	
		Current for serial line when connected devices consume power	0...0.05 A	
		Current for USB Host when connected devices consume power	0...0.1 A	
		Current for optional PCI modules when connected devices consume power	Refer to your specific PCI module *(see Modicon TM5, PCI Modules, Hardware Guide)*	
	Inrush current	Time < 70 µs	100 A max.	
		70 ... 2000 µs	3 A max.	
	Internal protection	No	see note 1	
Embedded Expert modules power and encoder power	Minimum current (no external loads)		0.04 A	
	Maximum current including the following loads:		1.15 A	
		Current for Expert Inputs	0...0.1 A	
		Current for Expert Outputs	0...0.8 A	
		Current for Encoder on Sub-D when connected devices consume power	5 Vdc switch position	0...0.1 A
			24 Vdc switch position	0...0.25 A
	Inrush current	Time < 150 µs	50 A max.	
	Internal protection	No	see note 1	

24 Vdc I/O power segment	Maximum current (depending on the modules on the segment)		6.3 A max.
	Inrush current (depending on the modules on the segment)	Time < 500 µs	25 A max.
	Internal protection	No	see note 1

[1] Add external fuse as specified in the wiring diagrams.

Refer to the chapter Example 1: Current Consumed by a Local Configuration *(see Modicon Flexible TM5 System, System Planning and Installation Guide)* for further details on power consumption.

Power Distribution Wiring Diagram

6

Wiring Diagram for External Power Supplies

Wiring Diagram

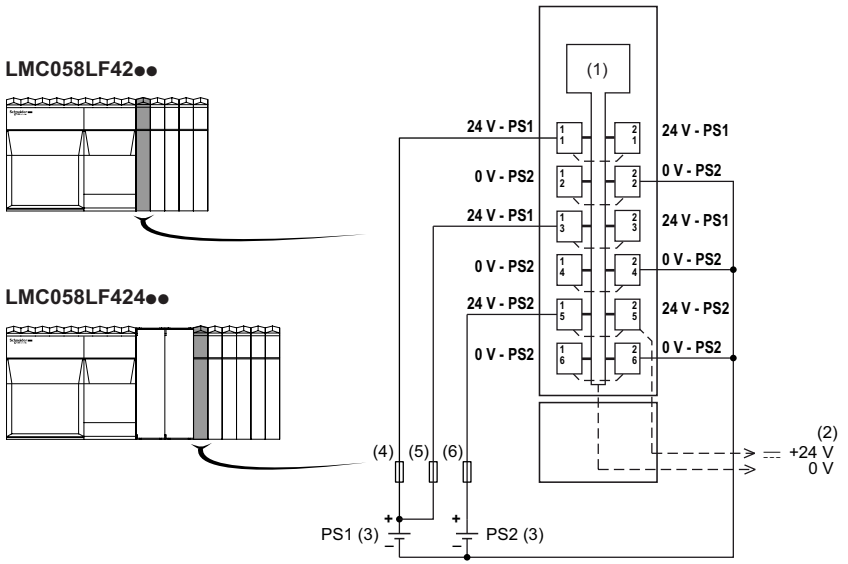
⚠ WARNING

POTENTIAL OF OVERHEATING AND FIRE

- Do not connect the modules directly to line voltage.
- Use only isolating SELV power supplies to supply power to the modules.
- For UL and CSA conformance, use only SELV power supplies with limited energy capacity; see wiring schematics in this document for approved limits.

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

The following figure shows the wiring diagram of the Controller Power Distribution Module (CPDM):



1 Internal electronics
2 24 Vdc I/O power segment integrated into the bus bases
3 PS1/PS2: External isolated SELV power supply 24 Vdc limited to 200 VA for UL508 conformance, or limited to 150 VA for CSA 22.2, N° 142 conformance
4 External fuse, Type T slow-blow, 3 A 250 V
5 External fuse, Type T slow-blow, 1 A 250 V
6 External fuse, Type T slow-blow, 6.3 A max., 250 V

⚠ DANGER

FIRE HAZARD

Use only the recommended wire sizes for I/O channels and power supplies.

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

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Do not exceed any of the rated values specified in the following tables.

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

Integrated Communication Ports

7

What's in this Chapter?

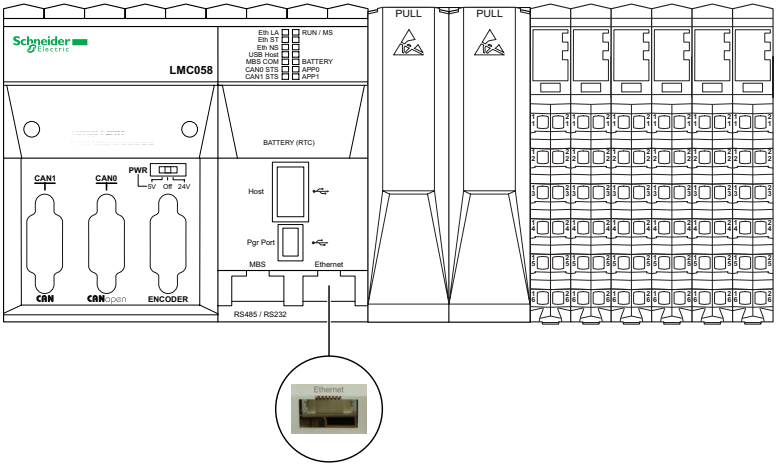
This chapter contains the following topics:

Topic	Page
Ethernet Port	54
CAN Ports	57
USB Programming Port	62
USB Host Port	64
Serial Line Port	66

Ethernet Port

Overview

The following figure shows the location of the Ethernet port of the controller:



For more information, please refer to *Transparent Ready User Guide (see Transparent Ready, User Guide)*

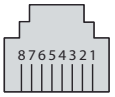
Characteristics

The following table describes the different Ethernet characteristics:

Characteristic	Description
Standard	Ethernet
Connector type	RJ45
Baud rate	Supports Ethernet "10BaseT" and "100BaseTX" with auto-negotiation
Auto-crossover	MDI / MDIX
Protocol supported	• SoMachine Protocol • Modbus Client/server • Ethernet IP device • FTP server • HTTP server • SNMP
IP address negotiation type supported	• DHCP • BOOTP • Configured IP
Supplied current	No

Pin Assignment

The following figure shows the Ethernet connector pins:



The following table describes the Ethernet connector pins:

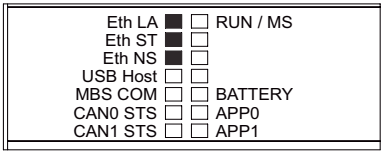
Pin N°	Signal
1	TD+
2	TD-
3	RD+
4	-
5	-
6	RD-
7	-
8	-

For more information, please refer to *Ethernet User Guide.*

NOTE: The controller supports the MDI/MDIX auto-crossover cable function. It is not necessary to use special Ethernet crossover cables to connect devices directly to this port (connections without an Ethernet hub or switch).

Status LEDs

The following figure shows the LEDs on the front panel display:



The following table describes the Ethernet status LEDs:

Marking	Description	LED	
		Color	Description
Eth LA	Ethernet Activity	Green / Yellow	See Ethernet status LED below
Eth ST	Ethernet Status	Green / Red	
Eth NS	Ethernet Network Status	Green / Red	

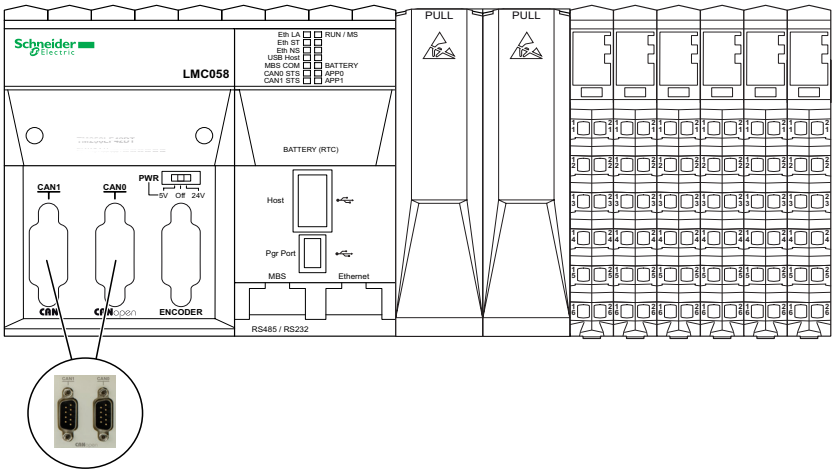
The following table describes the Ethernet status LED:

LED	Status	Description
Eth LA	Off	No link
	Flashing green / yellow	Power up testing. 3 flashes
	Solid green	Link at 100 Mbit/s
	Solid yellow	Link at 10 Mbit/s
	Flashing green	Activity at 100 Mbit/s
	Flashing yellow	Activity at 10 Mbit/s
Eth ST	Off	No cable connected, no IP address obtained
	Flashing green / red	Power up testing. 3 flashes
	Solid green	Port is connected and an IP address obtained
	3 flashes green	No cable connected, but the card has an IP address
	4 flashes green	Duplicated IP address detected
	5 flashes green	The card is performing a BOOTP or DHCP sequence
	6 flashes green	The configured IP is invalid. The default IP is used instead.
Eth NS	Off	The device does not have an IP address or is powered off
	Flashing green / red	Power up testing. 3 flashes
	Solid green	The device has at least one established connection
	Rapid flashing green	The device has not established connections but has obtained an IP address
	Rapid flashing red	One or more of the connections in which this device is the target has timed out.
	Solid red	The device has detected that its IP address is already in use. The controller Ethernet port can not communicate using this IP address.

CAN Ports

Overview

The following figure shows the location CAN ports of the controller:



For more information, please refer to CANopen Hardware Setup Manual.

Capabilities

The protocols and functions supported by the CAN ports are CANmotion and CANopen.

Characteristics

The following table describes the CAN characteristics:

Characteristic	Description
Standard	CAN-CiA (ISO 11898-2:2002 Part 2)[1]
Connector type	Sub-D9, 9 pins male
Protocol supported	CANmotion and CANopen
CAN power distribution	No
Maximal cable length	See Transmission Speed and Cable - CANopen Hardware Setup Manual
Isolation	See note[2]
Bit rate	See table below[4]
Line termination	No. See note[3]

NOTE:

[1] Part 1 and Part 2 of ISO 11898:2002 are equivalent to ISO 11898:1993.

[2] The isolation of the electronic module is 500 Vac RMS between the electronics powered by TM5 power bus and the part powered by 24 Vdc I/O power segment connected to the module. In practice, the TM5 electronic module is installed in the bus base, and there is a bridge between TM5 power bus and 24 Vdc I/O power segment. The two power circuits reference the same functional ground (FE) through specific components designed to reduce effects of electromagnetic interference. These components are rated at 30 Vdc or 60 Vdc. This effectively reduces isolation of the entire system from the 500 Vac RMS.

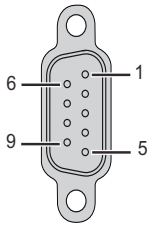
[3] A resistor (R) is needed on each end of the CAN field bus.

[4] Maximum cable length is described in the following table:

Baud rate		1 Mbit/s	800 Kbit/s	500 Kbit/s	250 Kbit/s	125 Kbit/s	50 Kbit/s	20 Kbit/s	10 Kbit/s
Maximum cable length	m	4	25	100	250	500	1000	2500	5000
	ft.	13.12	82.02	328.08	820.20	1640.41	3280.83	8202.07	16404.15

Pin Assignment

The following graphic describes the pins of the CAN port:



The following table describes the pins of the CAN port:

PIN N°	Signal	Description
1	N.C.	Reserved
2	CAN_L	CAN_L bus Line (Low)
3	CAN_GND	CAN 0 Vdc
4	N.C.	Reserved
5	CAN_SHLD	N.C.
6	GND	0 Vdc
7	CAN_H	CAN_H bus Line (High)
8	N.C.	Reserved
9	N.C.	Reserved

N.C.: Not Connected.

The shield is connected to pin 6, the 0 Vdc pin.

NOTE: Pin 9 is not connected internally. The controller does not provide power on CAN_V+.

⚠ WARNING

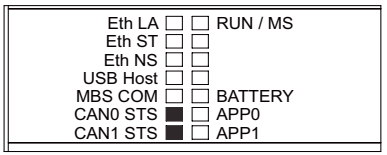
UNINTENDED EQUIPMENT OPERATION

Do not connect wires to unused terminals or terminals marked “Not Connected (N.C.)”.

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

Status LEDs

The following figure shows the LED on the front panel display:



The following table describes the CAN status LED:

Marking	Description	LED	
		Color	Description
CAN0 STS	CAN 0 port status	Green / Red	See CAN0 / CAN1 STS LED below for CANopen status
CAN1 STS	CAN 1 port status	Green / Red	See CAN0 / CAN1 STS LED below for CANopen status See CAN1 STS LED below for CANmotion status

The following table describes the CAN0 STS and/or CAN1 STS status LED when the CAN 0 and/or CAN 1 ports are used as CANopen master:

CAN0/CAN1 STS LED	CANopen Status	Description
OFF	No CANopen configured	CANopen is not active in the application
Single flash red / with green ON	Acceptable detected error limit threshold has been reached	The controller has detected that the maximum number of error frames has been reached or exceeded.
Double flash red / with green ON	Node Guarding or Heartbeat event	The controller has detected either a Node Guarding or Heartbeat exception for the CANopen master or slave device.
Red ON	Bus off	The CANopen bus is stopped
Green ON	The CANopen bus is operational	

The following table describes the CAN1 STS status LED when CAN 1 port is used as CANmotion master:

CAN1 STS LED	CANmotion Status	Description
OFF	No CANmotion configured	CANmotion is not active in the application
Single flash red / with green ON	Acceptable detected error limit has been reached	The controller has detected that the maximum number of error frames has been reached or exceeded.

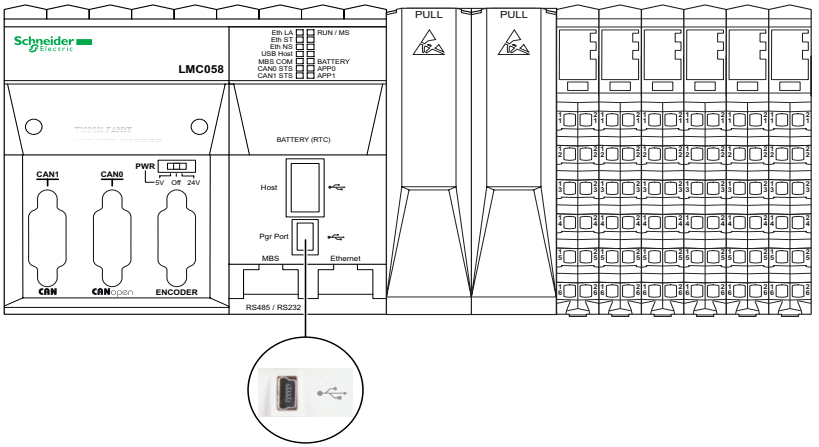
CAN1 STS LED	CANmotion Status	Description
Double flash red / with green ON	CANmotion device not present	The controller has detected that a CANmotion device is not present.
Red ON	Bus off	The CANmotion bus is stopped
Green ON	The CANmotion bus is operational	

For further details, please refer to the CANopen Hardware Setup Manual.

USB Programming Port

Overview

The following figure shows the location of the USB mini-B programming port of the controller:



The USB Mini-B Port is the programming port you can use to connect a PC with a USB host port using SoMachine software. Using a typical USB cable, this connection is suitable for quick updates of the program or short duration connections to perform maintenance and inspect data values. It is not suitable for long term connections such as commissioning or monitoring without the use of specially adapted cables to help minimize electromagnetic interference.

⚠ WARNING

INOPERABLE EQUIPMENT OR UNINTENDED EQUIPMENT OPERATION

- You must use a shielded USB cable such as a BMX XCAUSBH0•• secured to the functional ground (FE) of the system for any long term connection.
- Do not connect more than one controller at a time using USB connections.

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

Characteristics

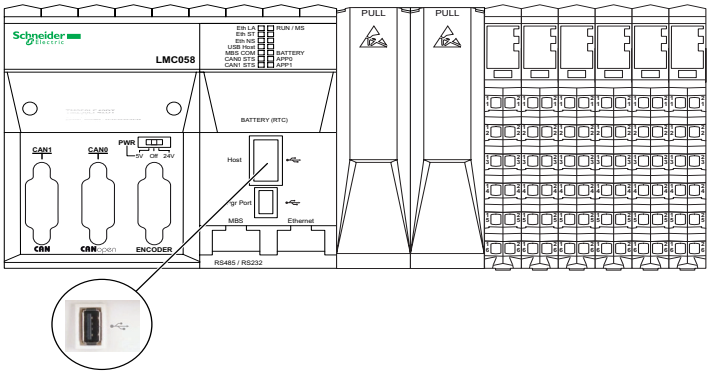
The following table describes the characteristics for the USB Programming port:

Parameter	USB Programming Port
Standard	Hi-Speed USB 2.0 Device
Connector type	Mini-B
Maximum baud rate	480 Mbit/s
Protocol supported	• SoMachine Protocol • FTP Server • HTTP Server
Supplied current	No
Maximum cable length	3 m (9.8 ft)
Isolation	None

USB Host Port

Overview

The following figure shows the location of the USB type A host port of the controller:



NOTE: The USB type A host port provides 500 mA continuous current (USB-standard) and 700 mA for short duration current spikes.

The Modicon LMC058 Motion Controller allows firmware updates and file transfers using a USB Memory Key. This makes it possible to perform device and data updates without the need for a SoMachine instance or the FTP Server.

The USB Host port can be used for upgrading the firmware and data files transfer with a USB Memory key.

For further details on firmware upgrades, please refer to Upgrading Controller Firmware *(see Modicon LMC058 Motion Controller, Programming Guide)*.

For further details on data file transfers, please refer to File Transfer with USB Memory Key *(see Modicon LMC058 Motion Controller, Programming Guide)*.

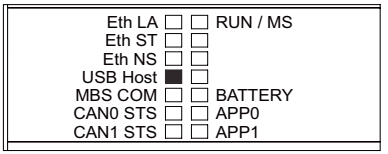
Characteristics

The following table describes the characteristics for the USB Host port:

Characteristic	Description
Standard	Hi-speed USB 2.0 Host
Connector type	A
Maximum baud rate	480 Mbit/s
Protocol supported	Mass Storage
Supplied current	5 Vdc USB Standard
Isolation	None

Status LED

The following figure shows the LEDs on the front panel display:



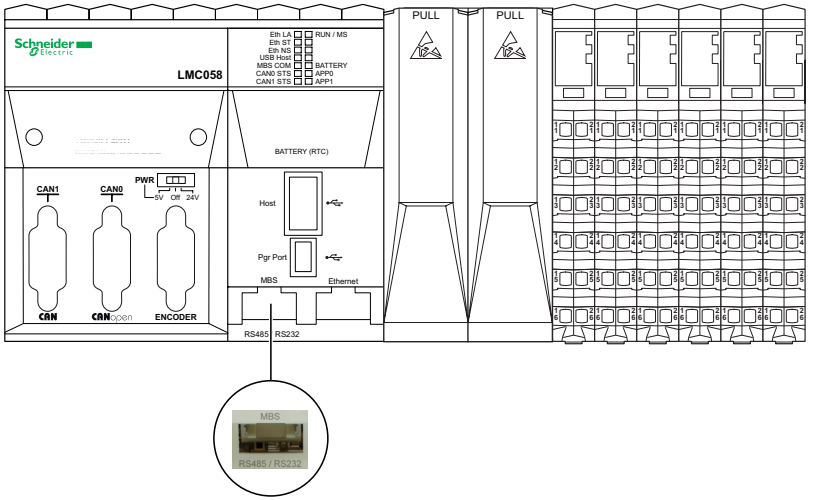
The following table describes the USB status LED:

Marking	Description	LED	
		Color	Description
USB Host	USB Host	Green / Red	• Off when nothing is connected • Rapid flashing green during exchange • Solid green when no exchange • Solid red for detected script error

Serial Line Port

Overview

The following figure shows the location of the Serial Line port of the controller:



The serial line:

- is used to communicate with devices supporting the Modbus protocol as either master or slave, ASCII protocol (printer, modem...) and SoMachine Protocol (HMI, ...).
- provides a 5 Vdc power distribution.

For further details, please refer to Serial Line - Planning and Installation.

Characteristics

Characteristic	Description
Standard	RS485 or RS232 software configured
Connector type	RJ45
Baud rate	300 up to 115 200 bps
Protocol supported	• ASCII • Modbus (RTU or ASCII) • SoMachine
Device power distribution	5 Vdc / 200 mA
5 Vdc Protection	Withstands up to 24 Vdc

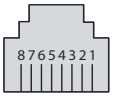
Characteristic	Description
Isolation	See note [1]
Polarization	Two 560 Ω resistors switched on or off by software configuration

NOTE:

[1] The isolation of the electronic module is 500 Vac RMS between the electronics powered by TM5 power bus and the part powered by 24 Vdc I/O power segment connected to the module. In practice, the TM5 electronic module is installed in the bus base, and there is a bridge between TM5 power bus and 24 Vdc I/O power segment. The two power circuits reference the same functional ground (FE) through specific components designed to reduce effects of electromagnetic interference. These components are rated at 30 Vdc or 60 Vdc. This effectively reduces isolation of the entire system from the 500 Vac RMS.

Pin Assignment

The following figure shows the pins for RS485 and RS232:



The following table describes the pins for RS485 and RS232:

Pin	RS485	RS232
1	N.C.	RxD
2	N.C.	TxD
3	N.C.	RTS
4	D1 (A+)	N.C.
5	D0 (B-)	N.C.
6	N.C.	CTS
7	5 Vdc / 200 mA	5 Vdc / 200 mA
8	0 Vdc	0 Vdc

CTS: Clear To Send

N.C.: Not Connected

RTS: Ready To Send

RxD: Received Data

TxD: Transmitted Data

⚠ WARNING

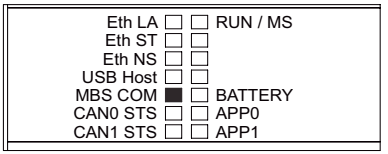
UNINTENDED EQUIPMENT OPERATION

Do not connect wires to unused terminals or terminals marked “Not Connected (N.C.)”.

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

Status LED

The following figure shows the LEDs on the front panel display:



The following table describes the Serial line status LED:

Marking	Description	LED	
		Color	Description
MBS COM	Serial line port activity	Yellow	Rapid flashing when frames are received or transmitted

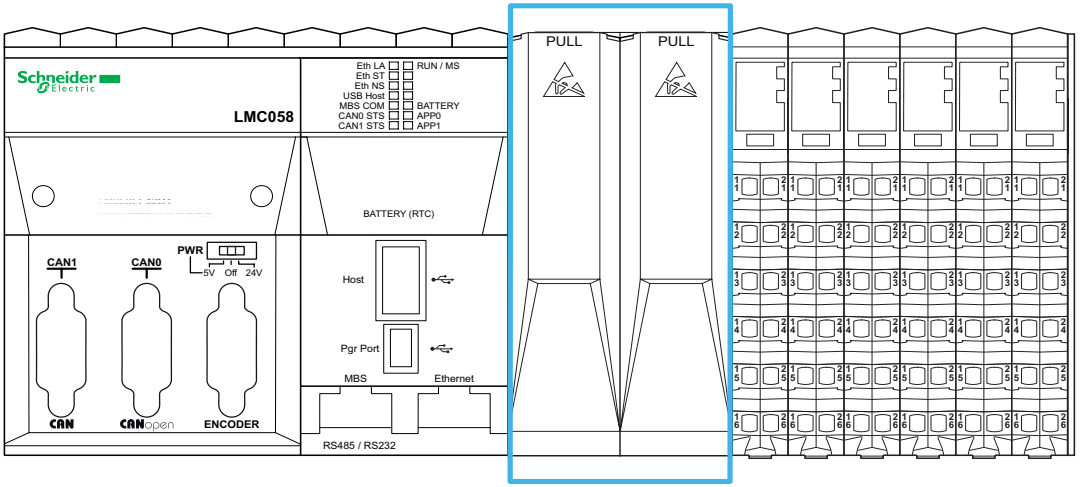
PCI Slots

8

PCI Slots

Overview

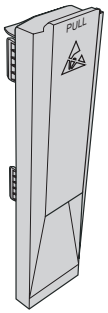
The following figure shows the location of the controller PCI slots:



For more information, please refer to TM5 System General Rules for Implementing *(see Modicon TM5, PCI Modules, Hardware Guide)*.

Description

The following figure shows the covers of the PCI slots found on the front of the controller:



Compatibilities

There are two PCI slots to connect up to two interface modules depending on the controller reference.

The PCI modules are used for specific application expansions of the controller. They are inserted in the PCI slots of the controller:

Reference	Type	Description
TM5PCRS2	Serial line	TM5 interface electronic module, 1 RS232, electrically isolated
TM5PCRS4	Serial line	TM5 interface electronic module, 1 RS485/RS422, electrically isolated

NOTE: Only one serial line PCI interface module can be connected to the controller. There are two slots available to accommodate future evolutions.

The following table describes the compatibilities between electronic modules and controllers:

Controllers	**PCI Slots**	
	TM5PCRS2	**TM5PCRS4**
LMC058LF424•• *(see page 43)*	OK	OK

For further details about installing PCI modules, please refer to PCI Electronic Modules Installation *(see Modicon TM5, PCI Modules, Hardware Guide)*

CAUTION

ELECTROSTATIC DISCHARGE

- Ensure that empty PCI slots have their covers in place before applying power to the controller.
- Never touch an exposed PCI connector.

Failure to follow these instructions can result in equipment damage.

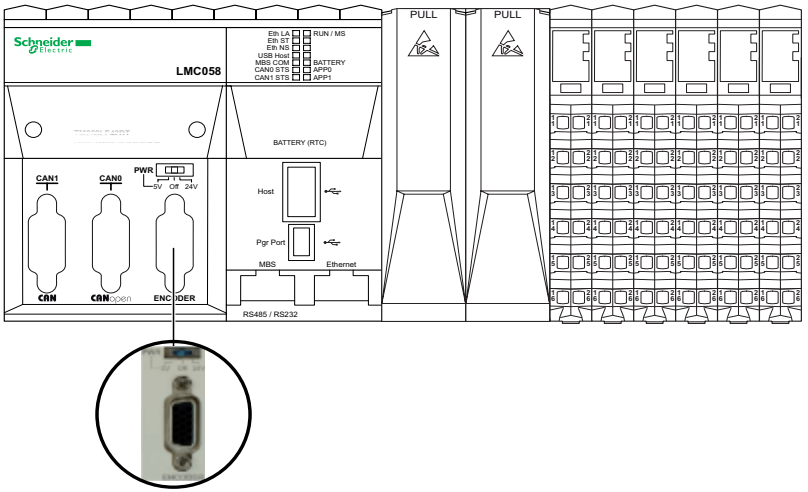
Encoder Interface

9

Encoder Interface

Overview

The following figure shows the location of the encoder interface of the controller:

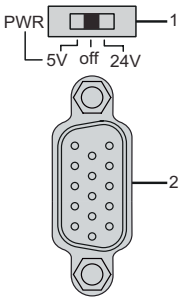


The encoder interface supports both incremental and absolute Synchronous Serial Interface (SSI) connections.

The encoder interface can provide and control the encoder power supply.

Description

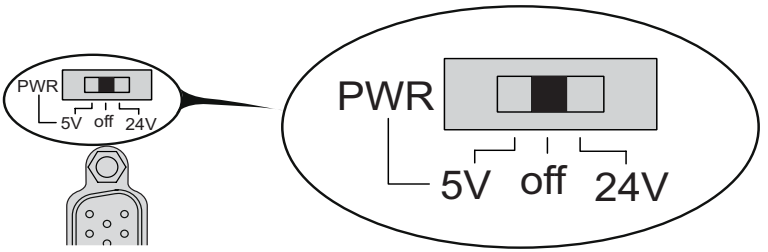
The encoder interface consists of a 15-pin Sub-D HD connector and a voltage supply selector as shown below:



1 Selection of power distribution
2 Encoder interface connector

Encoder Interface Switch

The figure below shows the 3 different positions of the switch:



The switch allows the user to select one of the following voltages:

- +5 Vdc
- No power distribution delivered
- +24 Vdc

The table below shows the voltage supplied to pins 7 and 15:

Encoder Interface Switch Position	Pin 15	Pin 7
5V	5 Vdc	0 Vdc
OFF	0 Vdc	0 Vdc
24V	0 Vdc	24 Vdc

CAUTION

LOSS OF ENCODER POWER

- Verify the position of the encoder interface switch before applying power to the controller.
- Do not change the position of the encoder interface switch when the controller is powered.

Failure to follow these instructions can result in equipment damage.

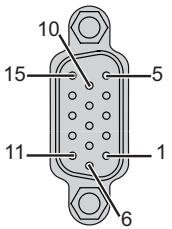
Characteristics

The table below shows the characteristics of the encoder:

Characteristics	Description	
Incremental	Type of signals	A+, A-, B+, B-, Z+, Z-
	Maximum operating frequency	250 kHz per input x 4, or 1 MHz for counting
SSI	Clock voltage	5 Vdc
	Max. clock frequency	200 KHz

Pin Assignment

The following graphic describes the pins numbering:



The following table describes the pins of the encoder:

Description	Encoder	Pin	VW3M4701 option wire colors
Incremental encoder	A+	1	red/white
	A-	2	brown
	Z+	4	orange
	Z-	5	yellow
	B+	10	white
	B-	11	purple
Absolute SSI encoder	SSI data +	1	red/white
	SSI data -	2	brown
	CLKSSI +	6	green
	CLKSSI -	14	light brown
5 V Encoder supply	+ 5 Vdc	15	light purple
	0 Vdc	8	pink
24 V Encoder supply	+ 24 Vdc	7	blue
	0 Vdc	8	pink
Encoder power distribution feedback	Supply return	13	light green
Shielding		Shell	cable braided shield

Power Supply Characteristics

The table below shows the current supplied to pins 7 and 15:

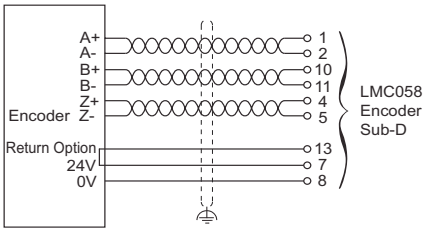
Pin	Supplied current	Voltage	Voltage range
7	170 mA	24 Vdc	11...30 Vdc
15	150 mA	5 Vdc	4...6 Vdc

NOTE: The encoder connector is supplied by the Expert I/O Power Distribution. Please refer to the chapter Embedded Expert I/O *(see page 81)*.

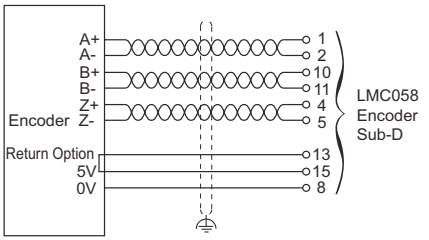
A supply return signal from the encoder enables detection of encoder disconnection and allows your application program to check if the encoder is still powered.

Wiring Diagram

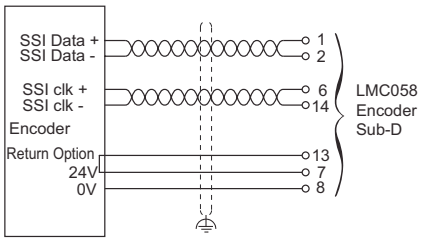
The following figure describes the wiring diagram of an encoder (RS422 / 24 Vdc) mounted on the encoder interface:



The following figure describes the wiring diagram of an encoder (RS422 / 5 Vdc or push-pull) mounted on the encoder interface:



The following figure describes the wiring diagram of an encoder (SSI) mounted on the encoder interface:



Embedded Expert I/O

10

Introduction

This chapter describes the embedded Expert I/O.

What's in this Chapter?

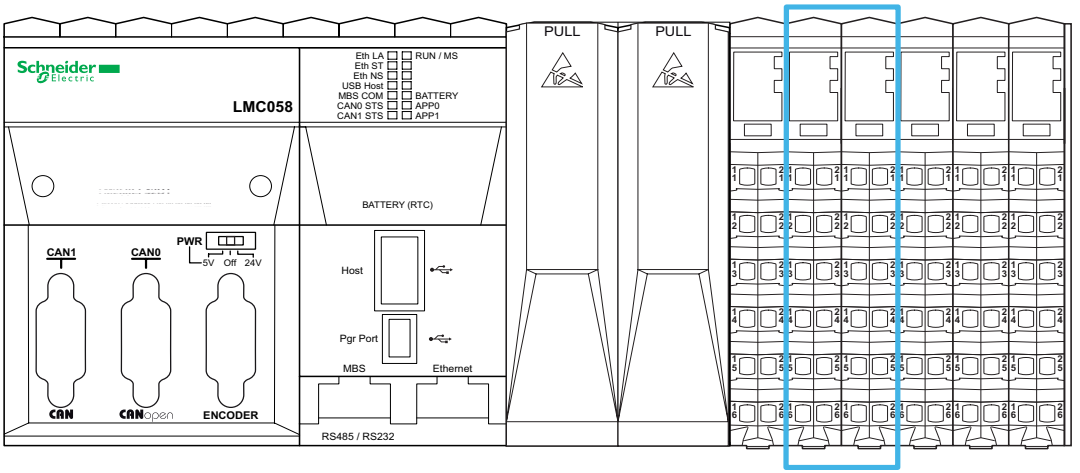
This chapter contains the following topics:

Topic	Page
Expert I/O	82
Fast Inputs Characteristics	87
Regular Inputs	90
Fast Outputs	92

Expert I/O

Overview

The following figure shows the location of the Expert I/O of the controller:



The controller has 2 modules of Embedded Expert I/O. Each module is comprised of:

- 5 fast inputs, 2 regular inputs and 2 fast outputs
- 3 commons

Advanced Functions

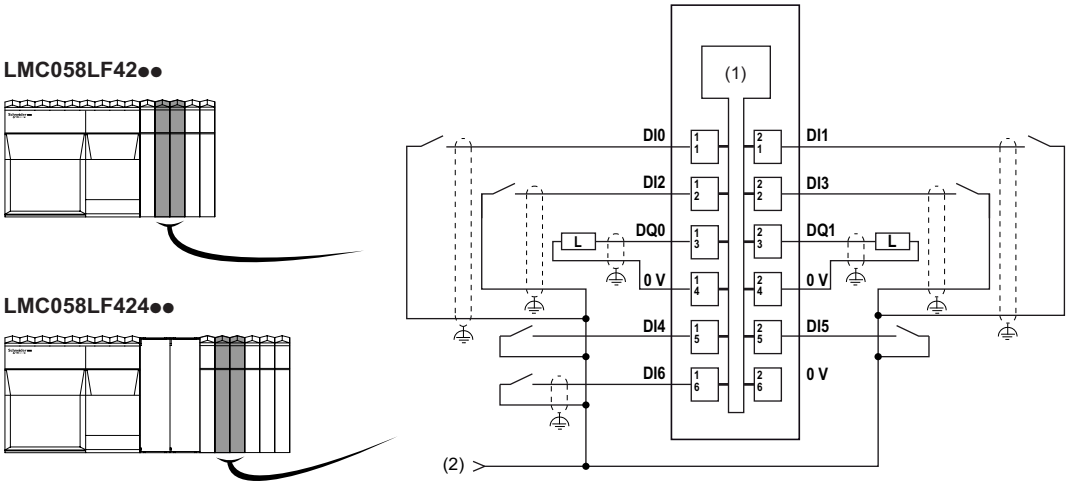
Expert I/O modules support the following advanced functions:

- High speed counter (HSC)
- Encoder (that can be used as master axes in motion application)
- Event input
- Latch input
- Run/Stop input
- Pulse width generator (PWM)
- Frequency generator
- Alarm output

For more details about encoder functions, please refer to Encoder Interface *(see page 75)*.

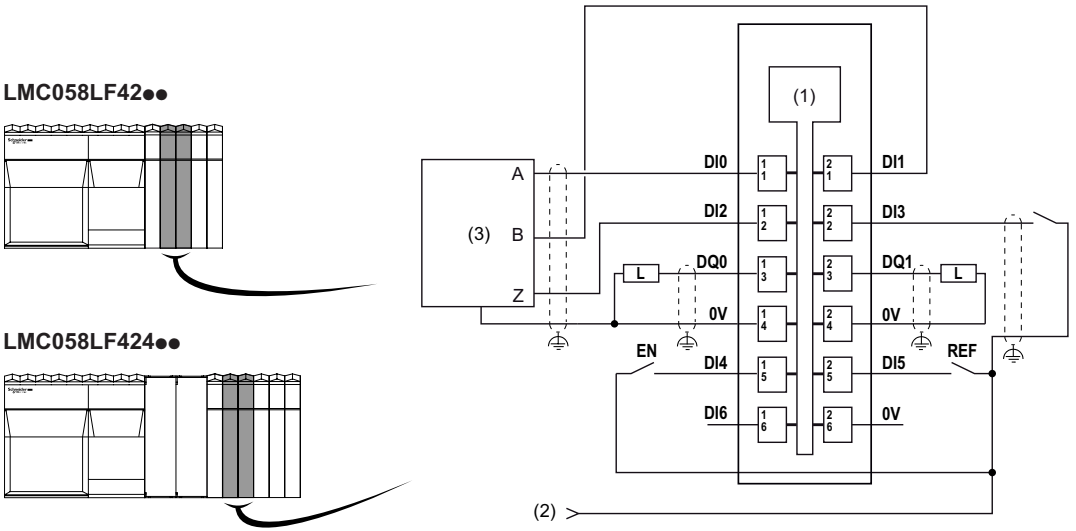
Wiring Diagram

The following figure shows the wiring diagram of the Embedded Expert I/O:



1 Internal electronics
2 24 Vdc Embedded expert modules power by external connection

The following figure shows the wiring diagram of the expert I/O with encoder:



1 Internal electronics
2 24 Vdc Embedded expert modules power by external connection
3 Encoder

⚠ WARNING

IMPROPER GROUNDING CAN CAUSE UNINTENDED EQUIPMENT OPERATION

- Use cables with insulated shielded jackets for analog I/O, fast I/O and communication signals.
- Ground shielded cables for analog I/O, fast I/O and communication signals at a single point [1]
- Always comply with local wiring requirements regarding grounding of cable a shields.

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

NOTE: [1]Multipoint grounding is permissible if connections are made to an equipotential ground plane dimensioned to help avoid cable shield damage in the event of power system short circuit currents.

For more information, refer to the TM5 System Wiring Rules and Recommendation *(see page 14)*.

⚠ WARNING

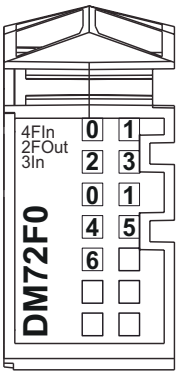
UNINTENDED EQUIPMENT OPERATION

Do not connect wires to unused terminals or terminals marked “Not Connected (N.C.)”.

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

Status LEDs

The following figure shows the LEDs for the Expert I/O:



The table below describes the Expert I/O status LEDs:

LED	Color	Status	Description
0-3	Green	On	Input status of the corresponding input 0...3
0-1	Yellow	On	Output status of the corresponding output 0...1
4-6	Green	On	Input status of the corresponding input 4...6

General Characteristics

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Do not exceed any of the rated values specified in the following tables.

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

The following table describes the general characteristics of the embedded Expert modules:

General characteristics		
Input voltage range		19.2...28.8 Vdc
Rated voltage		24 Vdc
Isolation	Between channels and internal bus	See note [1]
	Between channels	Not isolated
Number of 0 Vdc commons		3 (internally connected)
24 Vdc I/O power segment current draw		17 mA
Internal power consumption		0.4 W max.

[1] The isolation of the electronic module is 500 Vac RMS between the electronics powered by TM5 power bus and the part powered by 24 Vdc I/O power segment connected to the module. In practice, the TM5 electronic module is installed in the bus base, and there is a bridge between TM5 power bus and 24 Vdc I/O power segment. The two power circuits reference the same functional ground (FE) through specific components designed to reduce effects of electromagnetic interference. These components are rated at 30 Vdc or 60 Vdc. This effectively reduces isolation of the entire system from the 500 Vac RMS.

Fast Inputs Characteristics

Input Characteristics

⚠ DANGER

FIRE HAZARD

Use only the recommended wire sizes for I/O channels and power supplies.

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

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Do not exceed any of the rated values specified in the following tables.

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

The following table describes the inputs characteristics of the fast inputs:

Input characteristics	
Number of fast inputs	5
Input signal type	Sink (see note [2])
Rated input current	4 mA
Input impedance	6 kΩ
Input type	Type 1 (IEC 61131-2)
OFF state 0 (voltage / current)	5 Vdc max. / 1.5 mA max.
ON state 1 (voltage / current)	15 Vdc min. / 2 mA min.
Integrator filtering	0 - 1.5 - 4 or 12 ms
Anti-bounce filtering	2 µs...4 ms
Turn ON time	1 ms max.
Turn OFF time	1 ms max.

Input characteristics		
Isolation	Between channels and internal bus	See note [1]
	Between channels	Not isolated
Cable type		Shielded cable required
Cable length		5 m (16.4 ft.) max.

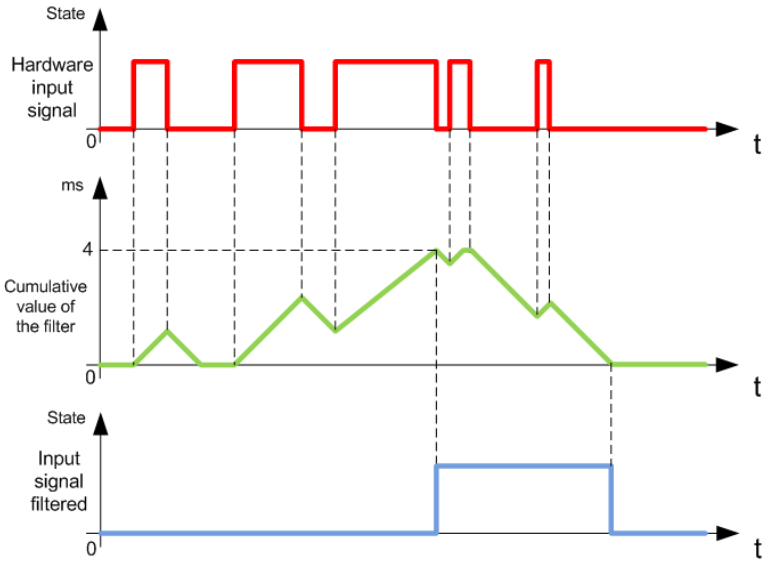
[1] The isolation of the electronic module is 500 Vac RMS between the electronics powered by TM5 power bus and the part powered by 24 Vdc I/O power segment connected to the module. In practice, the TM5 electronic module is installed in the bus base, and there is a bridge between TM5 power bus and 24 Vdc I/O power segment. The two power circuits reference the same functional ground (FE) through specific components designed to reduce effects of electromagnetic interference. These components are rated at 30 Vdc or 60 Vdc. This effectively reduces isolation of the entire system from the 500 Vac RMS.

[2] Connected to the 24 Vdc embedded Expert modules

Integrator Filter Principle

The integrator filter is designed to reduce the effect of noise. Setting a filter value allows the controller to ignore some sudden changes of input levels caused by noise.

The following timing diagram illustrates the integrator filter effects for a value of 4 ms:

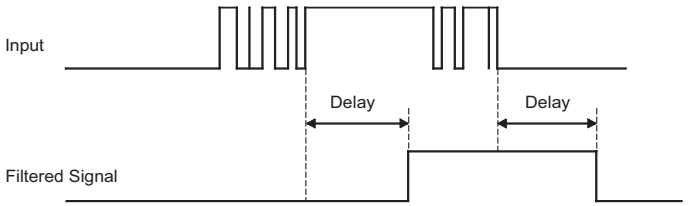


NOTE: The value selected for the filter's time parameter specifies the cumulative time in ms that must elapse before the input is recognized as logical 1, as well as specifying how long the filtered input signal remains at logical 1.

Bounce Filter Principle

The bounce filter is designed to reduce the bounce effect at the inputs. Setting a bounce filter value allows the controller to ignore some sudden changes of input levels caused by contact bounce. The bounce filter is only available on the fast inputs.

The following timing diagram illustrates the anti-bounce filter effects:



Regular Inputs

Input Characteristics

⚠ DANGER

FIRE HAZARD

Use only the recommended wire sizes for I/O channels and power supplies.

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

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Do not exceed any of the rated values specified in the following tables.

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

The following table describes the characteristics of the regular inputs:

Input characteristics		
Number of input channels		2
Input signal type		Sink (see note [2])
Rated input current		4 mA
Input impedance		6 kΩ
Input type		Type 1 (IEC 61131-2)
OFF state 0 (voltage / current)		5 Vdc max. / 1.5 mA max.
ON state 1 (voltage / current)		15 Vdc min. / 2 mA min.
Integrator filtering		0 - 1.5 - 4 or 12 ms
Isolation	Between channels and internal bus	See note [1]
	Between channels	Not isolated
Cable length		30 m (98.4 ft.) max.

[1] The isolation of the electronic module is 500 Vac RMS between the electronics powered by TM5 power bus and the part powered by 24 Vdc I/O power segment connected to the module. In practice, the TM5 electronic module is installed in the bus base, and there is a bridge between TM5 power bus and 24 Vdc I/O power segment. The two power circuits reference the same functional ground (FE) through specific components designed to reduce effects of electromagnetic interference. These components are rated at 30 Vdc or 60 Vdc. This effectively reduces isolation of the entire system from the 500 Vac RMS.

[2] Connected to the 24 Vdc embedded Expert modules

For further details on integrator filtering, please refer to Integrator Filter Principle *(see page 89)*.

For further details on anti-bounce filtering, please refer to Bounce Filter Principle *(see page 89)*.

Fast Outputs

Output Characteristics

⚠ DANGER

FIRE HAZARD

Use only the recommended wire sizes for I/O channels and power supplies.

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

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Do not exceed any of the rated values specified in the following tables.

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

For additional important information about fast output protection, refer to Protecting Outputs from Inductive Load Damage *(see page 18)*.

The following table describes the characteristics of the fast outputs:

Output characteristics		
Number of fast outputs		2
Output signal type		Sink / Source
Output type		Push / pull
Rated Output current at 24 Vdc		0.5 A max.
Maximum switching frequency		0.2 A up to 25 KHz
		0.05 A up to 100 KHz
Protection against overload / short circuit		Yes (device becomes inoperable if current exceeds 0.625 A)
Delay time	From 0 to 1	2 µs
	From 1 to 0	4 µs
Isolation	Between channels	None (referenced to 0 Vdc of the 24 Vdc embedded expert modules power)
	Between output and internal bus	See note [1]
Cable type		Shielded cable required
Cable length		5 m (16.4 ft.) max.

[1] The isolation of the electronic module is 500 Vac RMS between the electronics powered by TM5 power bus and the part powered by 24 Vdc I/O power segment connected to the module. In practice, the TM5 electronic module is installed in the bus base, and there is a bridge between TM5 power bus and 24 Vdc I/O power segment. The two power circuits reference the same functional ground (FE) through specific components designed to reduce effects of electromagnetic interference. These components are rated at 30 Vdc or 60 Vdc. This effectively reduces isolation of the entire system from the 500 Vac RMS.

For further details on integrator filtering, please refer to Integrator Filter Principle *(see page 89)*.

For further details on anti-bounce filtering, please refer to Bounce Filter Principle *(see page 89)*.

Embedded Regular I/O

11

Introduction

This chapter describes the embedded regular I/O.

What's in this Chapter?

This chapter contains the following topics:

Topic	Page
Digital DI12DE	96
Digital DO12TE	100
Analog AI4LE	105

Digital DI12DE

Overview

The digital DI12DE module is equipped with 12 sink inputs.

⚠ DANGER

FIRE HAZARD

Use only the recommended wire sizes for I/O channels and power supplies.

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

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Do not exceed any of the rated values specified in the following tables.

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

Input Characteristics

The table below shows the characteristics of the DI12DE electronic module:

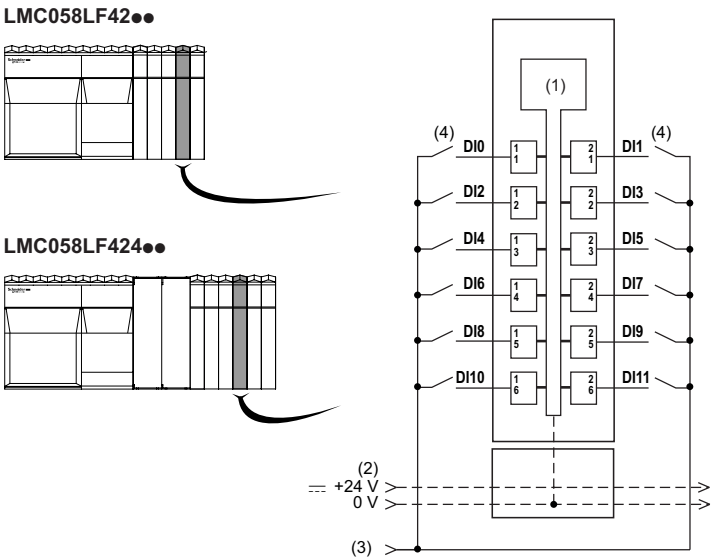
Characteristic		Value
Number of input channels		12
Wiring type		1 wire
Input type		Type 1
Signal type		Sink
Rated input voltage		24 Vdc
Input voltage range		20.4...28.8 Vdc
De-rating	55...60 °C (131...140 °F)	11 channels
Rated input current at 24 Vdc		3.75 mA
Input impedance		6.4 kΩ
OFF state		5 Vdc max.
ON state		15 Vdc min.

Characteristic		Value
Input filter	Hardware	≤100 µs
	Software	Default 1 ms, can be configured between 0 and 25 ms in 0.2 ms intervals.
Isolation	Between input and internal bus	See note [1]
	Between channels	Not isolated
24 Vdc I/O segment current draw		73 mA (all inputs On)

[1] The isolation of the electronic module is 500 Vac RMS between the electronics powered by TM5 power bus and the part powered by 24 Vdc I/O power segment connected to the module. In practice, the TM5 electronic module is installed in the bus base, and there is a bridge between TM5 power bus and 24 Vdc I/O power segment. The two power circuits reference the same functional ground (FE) through specific components designed to reduce effects of electromagnetic interference. These components are rated at 30 Vdc or 60 Vdc. This effectively reduces isolation of the entire system from the 500 Vac RMS.

Wiring Diagram

The following figure describes the wiring diagram of the DI12DE:



1 Internal electronics
2 24 Vdc I/O power segment integrated into the bus bases

3 24 Vdc I/O power segment by external connection
4 2-wire sensor

⚠ WARNING

POTENTIAL EXPLOSION OR FIRE

Connect the returns from the devices to the same power source as the 24 Vdc I/O power segment serving the module.

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

⚠ WARNING

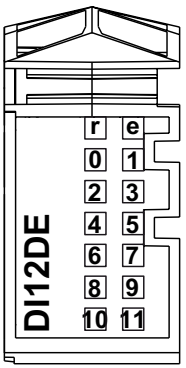
UNINTENDED EQUIPMENT OPERATION

Do not connect wires to unused terminals or terminals marked “Not Connected (N.C.)”.

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

Status LEDs

The following figure shows the LEDs for DI12DE:



The table below shows the DI12DE status LEDs:

LEDs	Color	Status	Description
r	Green	Off	No power supply
		Single Flash	Reset mode
		Flashing	Preoperational mode
		On	Normal operation
e	Red	Off	OK or no power supply
e+r	Steady red / single green flash		Invalid firmware
0-11	Green	Off	Corresponding input deactivated
		On	Corresponding input activated

Digital DO12TE

Overview

The digital DO12TE electronic module is equipped with 12 source outputs.

⚠ DANGER

FIRE HAZARD

Use only the recommended wire sizes for I/O channels and power supplies.

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

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Do not exceed any of the rated values specified in the following tables.

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

Output Characteristics

For additional important information about fast output protection, refer to Protecting Outputs from Inductive Load Damage *(see page 18)*.

The following table describes the characteristics of the DO12TE electronic module:

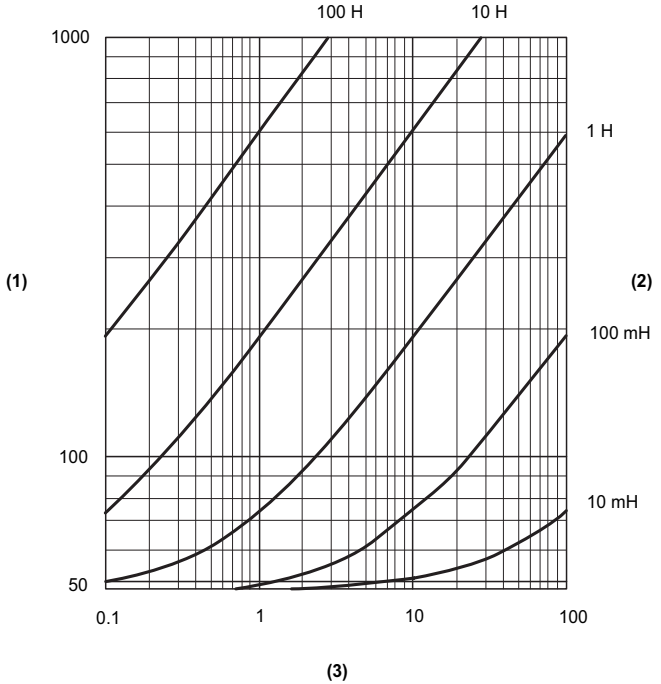
Characteristic	Value
Output channels	12
Wiring type	1 wire
Output type	Transistor
Signal type	Source
Output current	0.5 A max. per output
Total output current	6 A max.
Rated output voltage	24 Vdc
Output voltage range	20.4 ... 28.8 Vdc
De-rating at 60° C (140° F)	I=0.4 A max. by channel
Voltage drop	0.3 Vdc max. at 0.5 A rated current
Leakage current when switched off	5 µA
Turn on time	300 µs max.
Turn off time	300 µs max.

Characteristic		Value
Output protection		Against short-circuit and overload, thermal protection
Short circuit output peak current		12 A max.
Automatic rearming after short circuit or overload		Yes, 10 ms min. depending on internal temperature
Protection against reverse polarity		Yes
Clamping voltage		Typ. 50 Vdc
Switching frequency	Resistive load	500 Hz Max.
	Inductive load	See the switching inductive load characteristics *(see page 102)*
Isolation	Between input and internal bus	See note [1]
	Between channels	Not isolated
24 Vdc I/O segment current draw		48 mA

[1] The isolation of the electronic module is 500 Vac RMS between the electronics powered by TM5 power bus and the part powered by 24 Vdc I/O power segment connected to the module. In practice, the TM5 electronic module is installed in the bus base, and there is a bridge between TM5 power bus and 24 Vdc I/O power segment. The two power circuits reference the same functional ground (FE) through specific components designed to reduce effects of electromagnetic interference. These components are rated at 30 Vdc or 60 Vdc. This effectively reduces isolation of the entire system from the 500 Vac RMS.

Switching Inductive Load

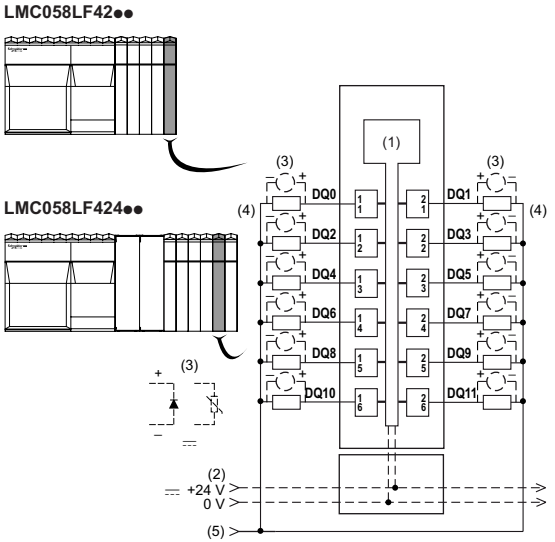
The following curves provide the switching inductive load characteristics for the DO12TE electronic module.



1 Coil resistance in Ω
2 Coil inductance
3 Max. operating cycles / second

Wiring Diagram

The following figure shows the wiring diagram of the DO12TE:



1 Internal electronics
2 24 Vdc I/O power segment integrated into the bus bases
3 Inductive load protection
4 2-wire load
5 0 Vdc I/O power segment by external connection

⚠ WARNING

POTENTIAL EXPLOSION OR FIRE

Connect the returns from the devices to the same power source as the 24 Vdc I/O power segment serving the module.

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

⚠ WARNING

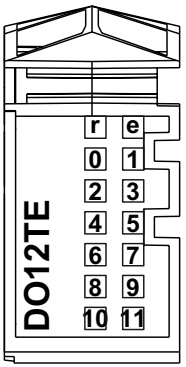
UNINTENDED EQUIPMENT OPERATION

Do not connect wires to unused terminals or terminals marked “Not Connected (N.C.)”.

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

Status LEDs

The following figure shows the LEDs for DO12TE:



The following table describes the DO12TE status LEDs:

LEDs	Color	Status	Description
r	Green	Off	No power supply
		Single Flash	Reset mode
		Flashing	Preoperational mode
		On	Normal operation
e	Red	Off	OK or no power supply
		Single flash	Detected error for an output channel
e+r	Steady Red / Single Green flash		Invalid firmware
0- 11	Yellow	Off	Corresponding output deactivated
		On	Corresponding output activated

Analog AI4LE

Overview

The analog AI4LE electronic module is equipped with 4 12-bit inputs.

Only available for the LMC058LF424••.

⚠ DANGER

FIRE HAZARD

Use only the recommended wire sizes for I/O channels and power supplies.

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

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Do not exceed any of the rated values specified in the following tables.

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

Input Characteristics

The following table describes the characteristics of theAI4LE electronic module:

Characteristic	Voltage input	Current input
Number of input channels	4	
Input range	-10... +10 Vdc	0...20 mA / 4...20 mA
Input impedance	20 MΩ min.	-
Load impedance	-	400 Ω max.
Sample duration time	400 µs for all inputs without filtering 1 ms for all inputs with filtering	
Input type	Differential	
Conversion mode	Successive Approximative Register	
Input filter	Low pass 3rd order / cut-off frequency 1 kHz	
Input tolerance - maximum deviation at ambient 25° C (77° F)	< 0.08% of the measurement	< 0.08% of the measurement
Input tolerance - temperature drift	0.006% / °C of the measurement	0.009% / °C of the measurement

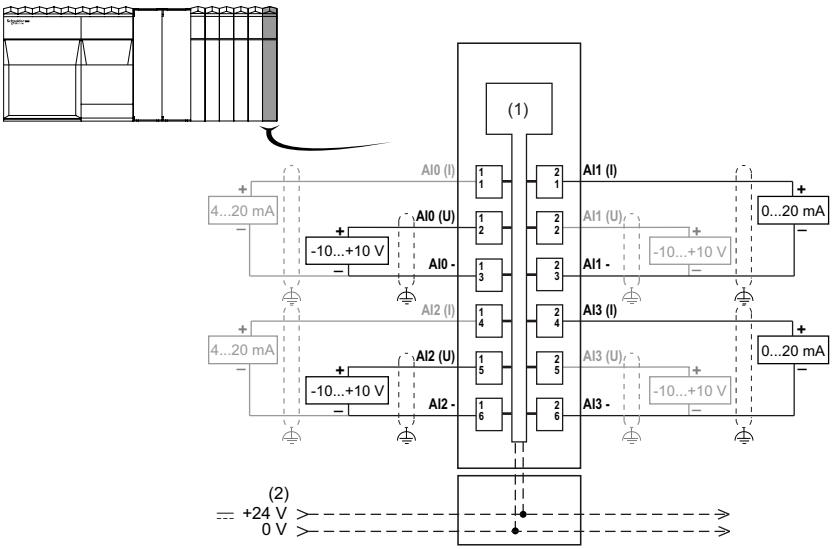
Characteristic	Voltage input	Current input
Input tolerance - non linearity	< 0.025% of the full scale (20 V)	< 0.05% of the full scale (20 mA)
Digital resolution	12 bit + sign	12 bit
Resolution value	2.441 mV	4.883 µA
Common mode rejection	DC	70 dB min.
	50 Hz	70 dB min.
Cable type	Shielded cable required	
Crosstalk rejection between channels	70 dB min.	
Isolation between channels	Not isolated	
Isolation between channels and bus	See note [1].	
Permitted input signal	±30 Vdc max.	±50 mA max.
Input protection	Protection against wiring with 24 Vdc supply voltage	
Common mode voltage allowable between channels	±12 Vdc max.	
24 Vdc I/O power segment current draw	48 mA	

[1] The isolation of the electronic module is 500 Vac RMS between the electronics powered by TM5 power bus and the part powered by 24 Vdc I/O power segment connected to the module. In practice, the TM5 electronic module is installed in the bus base, and there is a bridge between TM5 power bus and 24 Vdc I/O power segment. The two power circuits reference the same functional ground (FE) through specific components designed to reduce effects of electromagnetic interference. These components are rated at 30 Vdc or 60 Vdc. This effectively reduces isolation of the entire system from the 500 Vac RMS.

Wiring Diagram

The following figure shows the wiring diagram of theAI4LE:

LMC058LF424●●



1 Internal electronics
2 24 Vdc I/O power segment integrated into the bus bases
I Current
U Voltage

⚠ WARNING

IMPROPER GROUNDING CAN CAUSE UNINTENDED EQUIPMENT OPERATION

- Use cables with insulated shielded jackets for analog I/O, fast I/O and communication signals.
- Ground shielded cables for analog I/O, fast I/O and communication signals at a single point [1]
- Always comply with local wiring requirements regarding grounding of cable a shields.

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

NOTE: [1]Multipoint grounding is permissible if connections are made to an equipotential ground plane dimensioned to help avoid cable shield damage in the event of power system short circuit currents.

For more information, refer to the TM5 System Wiring Rules and Recommendation *(see page 14)*.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Do not connect wires to unused terminals or terminals marked “Not Connected (N.C.)”.

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

If you have physically wired, for example, your analog module channel for a voltage signal, and you configure the channel for a current signal in SoMachine, you may damage the analog module.

CAUTION

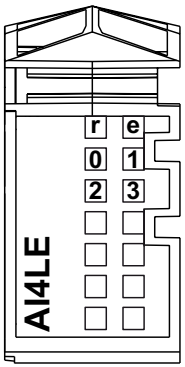
INOPERABLE EQUIPMENT

Be sure that the physical wiring of the module is compatible with the software configuration for the module.

Failure to follow these instructions can result in equipment damage.

Status LEDs

The following figure shows LEDs for AI4LE:



The following table describes the AI4LE status LEDs:

LEDs	Color	Status	Description
r	Green	Off	No power supply
		Single Flash	Reset mode
		Flashing	Preoperational mode
		On	Normal operation
e	Red	Off	OK or no power supply
		On	Detected error or reset state
		Double Flash	System detected error: ● Scan time overrun ● Synchronization detected error
0-3	Green	Off	Open connection or sensor is disconnected
		On	The analog/digital converter is running, value is available

Connecting the Modicon LMC058 Motion Controller to a PC

12

Connecting the Controller to a PC

Overview

To transfer, run and monitor the applications, connect the controller to a computer, that has SoMachine installed. Use one of the following USB cables:

TCS XCNA MUM3P : This USB cable is suitable for short duration connection like quick updates or retrieving data values.

BMX XCA USBH045 : Grounded and shielded, this USB cable is suitable for long duration connection.

NOTE: You can only connect 1 controller to the PC at the same time.

The USB Mini-B Port is the programming port you can use to connect a PC with a USB host port using SoMachine software. Using a typical USB cable, this connection is suitable for quick updates of the program or short duration connections to perform maintenance and inspect data values. It is not suitable for long term connections such as commissioning or monitoring without the use of specially adapted cables to help minimize electromagnetic interference.

⚠ WARNING

INOPERABLE EQUIPMENT OR UNINTENDED EQUIPMENT OPERATION

- You must use a shielded USB cable such as a BMX XCAUSBH0•• secured to the functional ground (FE) of the system for any long term connection.
- Do not connect more than one controller at a time using USB connections.

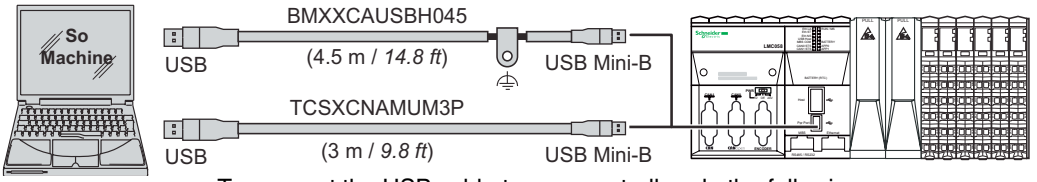
Failure to follow these instructions can result in death, serious injury, or equipment damage.

The communication cable should be connected to the PC first to minimize the possibility of electrostatic discharge affecting the controller.

CAUTION
INOPERABLE EQUIPMENT Always connect the communication cable to the PC before connecting it to the controller. **Failure to follow these instructions can result in equipment damage.**

USB Mini-B Port Connection

The following figure shows the USB connection to a PC:



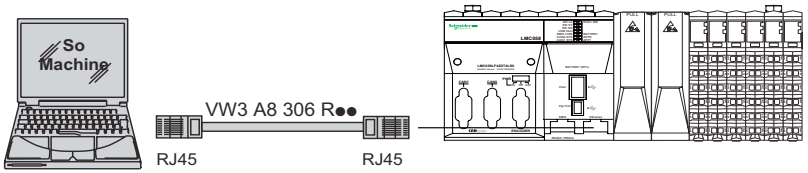
To connect the USB cable to your controller, do the following:

Step	Action
1	**1a** If making a long term connection using the cable BMX XCA USBH045, or other cable with a ground shield connection, be sure to securely connect the shield connector to the functional ground (FE) or protective ground (PE) of your system before connecting the cable to your controller and your PC. **1b** If making a short term connection using the cable TCS XCNA MUM3P or other non-grounded USB cable, proceed to step 2.
2	Connect the USB cable connector to the PC.
3	Connect the Mini connector of your USB cable to the controller USB connector.

Ethernet Port Connection

You can also connect the controller to a PC using an Ethernet cable.

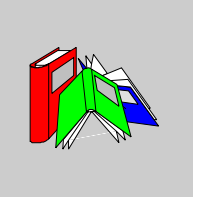
The following figure shows the Ethernet connection to a PC:



To connect the controller to the PC, do the following:

Step	Action
1	Connect your Ethernet cable to the PC.
2	Connect your Ethernet cable to the Ethernet port on the controller.

Glossary



A

analog input

An *analog input* module contains circuits that converbt an analog DC input signal to a digital value that can be manipulated by the processor. By implication, the analog input is usually direct. That means a data table value directly reflects the analog signal value.

analog output

An *analog output* module contains circuits that transmit an analog DC signal proportional to a digital value input to the module from the processor. By implication, these analog outputs are usually direct. That means a data table value directly controls the analog signal value.

AWG

The *american wire gauge* standard specifies wire gauges in North America.

B

bus base

A *bus base* is a mounting device that is designed to seat an electronic module on a DIN rail and connect it to the TM5 bus for M258 and LMC058 controllers. Each base bus extends the TM5 data and to the power buses and the 24 Vdc I/O power segment. The electronic modules are added to the TM5 system through their insertion on the base bus. The base bus also supplies the articulation point for the terminal blocks.

C

CAN

The *controller area network* protocol (ISO 11898) for serial bus networks is designed for the interconnection of smart devices (from multiple manufacturers) in smart systems for real-time industrial applications. CAN multi-master systems ensure high data integrity through the implementation of broadcast messaging and advanced diagnostic mechanisms. Originally developed for use in automobiles, CAN is now used in a variety of industrial automation control environments.

CANopen

CANopen is an open industry-standard communication protocol and device profile specification.

compact I/O module

A *compact I/O module* is an indissociable group of five analog and/or digital I/O electronic modules in a single reference.

configuration

The *configuration* includes the arrangement and interconnection of hardware components within a system and the hardware and software selections that determine the operating characteristics of the system.

controller

A *controller* (or “programmable logic controller,” or “programmable controller”) is used to automate industrial processes.

CPDM

controller power distribution module

CSA

The *canadian standards association* defines and maintains standards for industrial electronic equipment in hazardous environments.

CTS

Clear to send is a data transmission signal and acknowledges the RDS signal from the transmitting station.

D

De-rating

De-rating describes a reduction in an operating specification. For devices in general it is usually a specified reduction in nominal power to facilitate operation at increased ambient conditions like higher temperatures or higher altitudes.

DHCP

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

digital I/O

A *digital input* or *output* has an individual circuit connection at the electronic module that corresponds directly to a data table bit that holds the value of the signal at that I/O circuit. It gives the control logic digital access to I/O values.

DIN

Deutsches Institut für Normung is a German institution that sets engineering and dimensional standards.

E

electronic module

In a programmable controller system, most electronic modules directly interface to the sensors, actuators, and external devices of the machine/process. This electronic module is the component that mounts in a bus base and provides electrical connections between the controller and the field devices. Electronic modules are offered in a variety of signal levels and capacities. (Some electronic modules are not I/O interfaces, including power distribution modules and transmitter/receiver modules.)

EN

EN identifies one of many European standards maintained by CEN (*European Committee for Standardization*), CENELEC (*European Committee for Electrotechnical Standardization*), or ETSI (*European Telecommunications Standards Institute*).

encoder

An *encoder* is a device for length or angular measurement (linear or rotary encoders).

Ethernet

Ethernet is a physical and data link layer technology for LANs, also known as IEE 802.3.

expansion bus

The *expansion bus* is an electronic communication bus between expansion modules and a CPU.

expert I/O

*Expert I/O*s are dedicated modules or channels for advanced features. These features are generally embedded in the module in order to not use the resources of the PLC Controller and to allow a fast response time, depending of the feature. Regarding the function, it could be considered as a “stand alone” module, because the function is independent of the Controller processing cycle, it just exchanges some information with the Controller CPU.

F

FAST I/O

*FAST I/O*s are specific I/Os with some electrical features (response time, for example) but the treatment of these channels is done by the Controller CPU.

FE

Functional ground is the point of a system or device that must be grounded to help prevent equipment damage.

FG

frequency generator

firmware

The *firmware* represents the operating system on a controller.

H

hot swapping

Hot swapping is the replacement of a component with a like component while the system remains operational. The replacement component begins to function automatically after it is installed.

HSC

high-speed counter.

I

I/O

input/output

IEC

The *international electrotechnical commission* is a non-profit and non-governmental international standards organization that prepares and publishes international standards for all electrical, electronic, and related technologies.

input filter

An *input filter* is a special function that rejects input noises. It is useful for eliminating input noises and chatter in limit switches. All inputs provide a level of input filtering using the hardware. Additional filtering with software is also configurable through the programing or the configuration software.

IP 20

Ingress protection rating according to IEC 60529. IP20 modules are protected against ingress and contact of objects larger than 12.5 mm. The module is not protected against harmful ingress of water.

L

LED

A *light emitting diode* is an indicator that lights up when electricity passes through it.

M

Modbus

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

N

NC

A *normally closed* contact is a contact pair that is closed when the actuator is de-energized (no power is applied) and open when the actuator is energized (power is applied).

network

A network includes interconnected devices that share a common data path and protocol for communications.

P

PCI

A *peripheral component interconnect* is an industry-standard bus for attaching peripherals.

PDM

A *power distribution module* distributes either AC or DC field power to a cluster of I/O modules.

PE

Protective ground is a return line across the bus for fault currents generated at a sensor or actuator device in the control system.

Pt100/Pt1000

Platinum resistance thermometer are characterized by their nominal resistance R0 at a temperature of 0° C.

- Pt100 (R0 = 100 Ohm)
- Pt1000 (R0 = 1 kOhm)

PWM

Pulse width modulation is used for regulation processes (e.g. actuators for temperature control) where a pulse signal is modulated in its length. For these kind of signals, transistor outputs are used.

R

RS-232

RS-232 (also known as EIA RS-232C or V.24) is a standard type of serial communication bus, based on three wires.

RS-485

RS-485 (also known as EIA RS-485) is a standard type of serial communication bus, based on two wires.

RTS

Request to send is a data transmission signal and will be acknowledged by the CTS signal from the destination node.

RxD

receiving data (data transmission signal)

S

SEL-V

A system that follows IEC 61140 guidelines for *safety extra low voltage* is protected in such a way that voltage between any 2 accessible parts (or between 1 accessible part and the PE terminal for Class 1 equipment) does not exceed a specified value under normal conditions or under single-fault conditions.

sink input

A *sink input* is a wiring arrangement in which the device provides current to the input electronic module. A sink input is referenced to 0 Vdc.

SL

serial line

source output

A *source output* is a wiring arrangement in which the output electronic module provides current to the device. A source output is referenced to +24 Vdc.

T

terminal block

The *terminal block* is the component that mounts in an electronic module and provides electrical connections between the controller and the field devices.

TxD

TxD represents a transmit signal.

U

UL

Underwriters laboratories, US organization for product testing and safety certification.

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