Motion controller Modicon LMC058
Flexible modular system

Motion controller Modicon LMC058

The Motion controller Modicon LMC058 is the optimum solution for axis control and positioning, including automation functions. Part of Schneider Electric's “Flexible Machine Control” concept, it meets the needs of a wide range of applications in all business sectors.

This motion controller is designed for machine manufacturers (OEMs) who require synchronized axes, focusing on applications such as packaging, conveying and storage machines, metal and wood working machines, etc. and offers high-performance solutions for velocity control, counting, axis control and communication functions.
To this end, the LMC058 master motion controller includes as standard:
- A CANopen master
- A CANmotion master dedicated to control of up to 8 synchronized axes, with a performance of 2 ms for 4 axes

With Motion controllers Modicon LMC058, Lexium 32 and Lexium SD3 drives, and BSH and BDH servo motors, Schneider Electric offers a complete, high-performance and cost-effective solution.

Applications

The motion controller Modicon LMC058 performs axis synchronization and coordination, via a fieldbus, for applications requiring control of up to 8 synchronized axes.

It integrates the standard motion control functions:
- Velocity control and torque control
- Relative or absolute positioning
- Cam profiles for slave axes and control of programmable cam switches
- Virtual axes
- Electronic gearing function for velocity and position, linear and circular interpolations (2½D)
- Master axis using an external encoder
- Distance measurement and position capture on high-speed (30 µs) digital input

This is specifically designed for applications such as:
- Material handling machines (conveyors, palletizers, storage and retrieval systems, etc.) and transfer machines (cranes, etc.)
- Assembly machines (tool fixing, clamping, etc.)
- Inspection and quality control machines
- Packaging machines working “on the fly” (flying shear, printing, marking, etc.)
- Wood and metal working machines

Performance

In terms of performance, the motion controller Modicon LMC058 has a Dual-Core processor:
- Core 1 is dedicated exclusively to managing program tasks and offers the maximum resources for real-time execution of synchronized axis control and the application code.
- Core 2 is dedicated to executing communication tasks, which then have no further impact on the application execution performance.

Execution of the Motion task is synchronized with the CANmotion bus cycle time. This task calculates the position of the synchronized axes and is programmed with SoMachine software, which offers six IEC 61131-3 programming languages:
- Instruction List (IL)
- Ladder (LD)
- Function Block Diagram (FBD)
- Grafcet (SFC)
- Structured Text (ST)
- Continuous Function Chart (CFC)

The ease of use of PLCopen function blocks significantly reduces the time taken to program motion control and control independent and synchronized axes on machines.
The ability to combine motion functions with standard automation functions offers both maximum flexibility and a high level of performance. The LMC058 master motion controller is able to control synchronization of real, remote and virtual axes.

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Performance (continued)

To improve the performance and reliability of your machines, the LMC058 motion controller has a 15-way SUB-D connection for a master encoder (incremental or SSI).
With an execution speed of **22 ns** for a Boolean instruction i.e. more than **45,000 Boolean instructions** per ms, the capacity to manage up to **2400 I/O**, a **64 MB** RAM that can store data and programs as well as a **128 MB** Flash memory for application and data backup, the motion controller Modicon LMC058 eliminates any doubts about the machine's capabilities.
In developing the motion controller Modicon LMC058, the cost aspect was taken into account, and the CPUs are equipped as standard with:
- 42 digital I/O
- Embedded serial link and Ethernet port
- 4 analog inputs (reference LMC058 LF424)
- A CANopen master
- A CANmotion master

Development and technology

In all its characteristics, the motion controller Modicon LMC058 has been developed to minimize the costs of assembly, cabling, commissioning and maintenance.
To this end:
- All the modules have removable terminals.
- All the electrical connections are made on spring terminals, speeding up the wiring process and also avoiding the need for periodic retightening. In addition, each terminal has a test point for a voltage sensing device.
- The embedded serial link and Ethernet port on the motion controller Modicon LMC058 have an RJ45 connection at 45° for quick visible connection of the communication channels.
- The modularity of the various bases and expansion modules has been optimized in order to significantly reduce the number of references to be ordered and assembled, while ensuring the minimum investment in your configuration is necessary, thanks to a capacity of between 2 and 42 channels per expansion module.
- Mechanical assembly of the various parts has been designed to save a considerable amount of time during assembly.

Software configuration

Configuration and programming of all motion controller Modicon LMC058s and equipment in Schneider Electric's “Flexible Machine Control” concept are both designed to cut costs and optimize machine performance, using SoMachine.

To reduce the configuration time of device, a selection of function blocks is available in the “Motion Library”:
- Library for ATV on CANopen
- Lexium library for Lexium 32 and Lexium SD3 on CANopen and CANmotion
- Lexium library for the whole ILx range on CANopen

This PLCopen-compliant library consists of administrative function blocks (read/write parameters, states, etc.) and single-axis and multi-axis function blocks.
The main functions are as follows:
- Power On, stop, reset
- Relative, absolute or additional positioning
- Continuous positioning (reaching a position at a predefined speed)
- Velocity control
- Velocity profile
- Position profile
- Cam profile
- Electronic gearing
- Phasing
- Programmable cam switch
- Linear or circular interpolation

User library
With SoMachine software, it is very easy to create your own function blocks (user library) to reduce programming times. Creating a user library simplifies the standardization and reuse of programs and also allows you to protect your know-how.

SoMachine software platform

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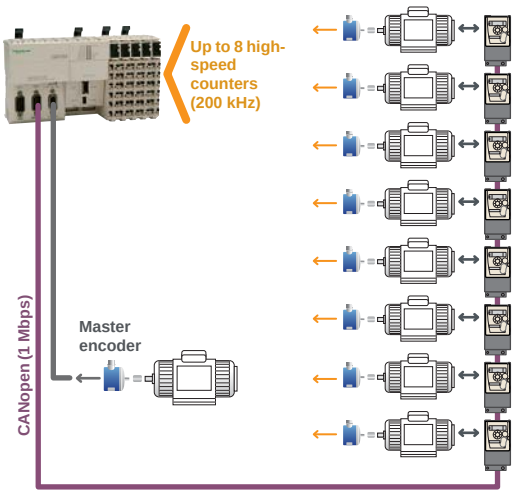
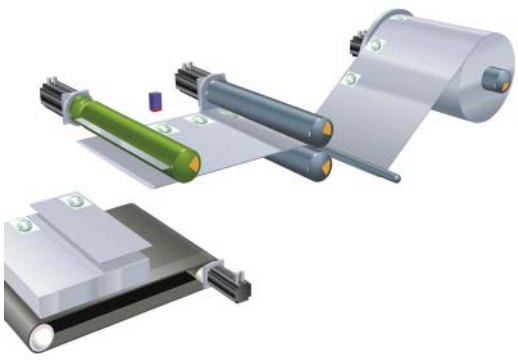


High-speed counter function (one-phase or two-phase)



Lexium 32 servo drives: monitoring cutting to length

Application function blocks (AFB)

This is a library of functions developed specifically by Schneider Electric. It contains application functions currently encountered in applications in the fields of assembly, material handling and cutting to length. Each function block has a large number of mechanical and application variants.
The use of function blocks:
- Saves programming time
- Saves setup time
- Simplifies reading

The function blocks available in the library are:
- Flying shear
- Rotary knife
- Grouping/ungrouping
- Clamping with torque control
- Etc.

*Nota: AFB are available only on the type S motion controllers : **LMC058●●●S0** with SoMachine extension. See page 36300/5.*

Functions

Analog functions

For machines that require functions to process data issued by analog sensors/ actuators (voltage or current), temperature sensors or PID control sensors, a complete range of expansion modules (compact blocks or “slice”) as well as advanced programming functions are included in the motion controller Modicon LMC058 offer.

In order to minimize the number of machine product references, optimize assembly time and cut costs, the LMC058 LF424 motion controller includes 4 voltage or current analog inputs with 12-bit resolution as standard.

The different expansion modules are available in 2, 4 or 6-channel versions and with either 12 or 16-bit resolution.
The powerful performance of the LMC058 motion controller enables up to 200 analog I/O and/or temperature modules to be connected, thus extending the limits of machine requirements.

High-speed counter function (HSC)

In order to meet requirements for machine productivity, the LMC058 motion controller has 8 embedded high-speed counters with a counting frequency of 200 kHz for each channel and 4 reflex outputs.
These embedded counters, together with the CANopen master link, make it quick and easy to create cost-effective, high-performance multi-axis functions to suit the machines' limitations.

With the availability of PLCopen function blocks specific to the motion control functions in the SoMachine software, you can be sure that developing your applications will be quick and reliable.
Moreover, a complete range of high-speed counter modules is available so you can adapt your configuration to your machine's specific requirements.

Position control function

Several options are offered in terms of position control:
□ Creating a sequence in Lexium 32 servo drives, with communication with the LMC058 motion controller achieved by the use of digital I/O
□ Creating an application in the LMC058 motion controller and controlling Lexium 32 drives and servo drives and/or Lexium SD3 stepper drives via the integrated CANopen master link available on LMC058 motion controllers (in this case the Motion tasks are independent axis Motion tasks)
□ Creating an application in the LMC058 motion controller and controlling the Lexium 32 drives and servo drives and/or Lexium SD3 stepper drives via the integrated CANmotion master link available on all LMC058 motion controllers (in this case the Motion tasks are independent and/or synchronized axis Motion tasks - cam profiles, electronic gearing, interpolation)

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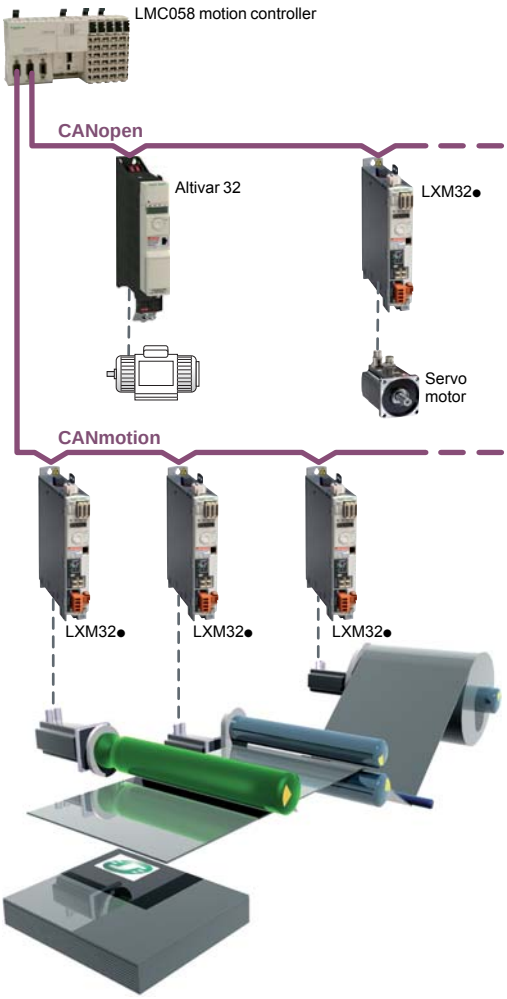


Ethernet communication

All motion controller Modicon LMC058 references have an embedded RJ45 Ethernet port (10/100 Mbps, MDI/MDIX) with Ethernet TCP Modbus, Ethernet IP Device, SoMachine on Ethernet, UDP, TCP and SNMP protocols.

In addition, all the LMC058 motion controllers have an embedded Web Server and FTP Server. As well as the default address based on the MAC address, it is possible to assign a motion controller IP address via a DHCP server or BOOTP server.

CANmotion/CANopen communication

The CANopen machine bus is now very widely used in industry because of its high performance. In accordance with international standard ISO 11898 promoted by the CAN in Automation association of users and manufacturers, it offers a high level of openness and interoperability thanks to its standardized communication and equipment profiles.
CANmotion and CANopen buses use a double shielded twisted pair. Each end of the bus must be equipped with a line terminator.
A staged CANmotion and CANopen connectivity solution reduces costs and optimizes your architecture, thanks to:
- Reduced cabling time
- Greater reliability of the cabling
- Flexibility should you need to add or remove a device

CANmotion

All motion controller Modicon LMC058 references have an embedded CANmotion master.
This bus is dedicated to synchronizing the drives (conforming to standard CiA DSP 402, the Device Profile for Drives & Motion Control).
This CANmotion link can be configured between 250 kbps and 1 Mbps, and offers the option of configuring and controlling up to 8 Lexium 32 servo drives and/or Lexium SD3 stepper drives.
The CANmotion bus cycle time ensures that the axis positions will be refreshed.
To ensure maximum performance on the motion bus, we recommend using a daisy chain cabling architecture.

CANopen

All motion controller Modicon LMC058 references have an embedded CANopen master.
This bus is dedicated to expansion of the automation capabilities, such as the I/O, drives, encoders, etc.
The link can be configured between 125 kbps and 1 Mbps and supports up to 32 slaves. Architectures based on CANopen can be used to distribute I/O modules as close to the sensors and actuators as possible, thus reducing wiring costs and times, and to communicate with different devices such as variable speed drives, servo drives, etc.
The CANopen configurator is integrated in the SoMachine software and can also be used to import standard description files in EDS format.

Modbus communication

All motion controllers Modicon LMC058 have a serial link as standard that can be configured as either RS232 or RS485 and incorporates the two most commonly used protocols on the market:
- Modbus ASCII/RTU Master or Slave
- Character string (ASCII)

Integration in the Schneider Electric product offer

Combined with other products dedicated to machine manufacturers in the Schneider Electric offer, such as ATV variable speed drives, Lexium servo drives, Magelis HMI terminals, TeSys motor starters and contactors, the motion controller Modicon LMC058 is now a must-have element in machine architectures, with hitherto unrivalled ease and speed of installation.

Motion controller Modicon LMC058
Compact bases

LMC058 LF42 motion controller

LMC058 LF424 motion controller

TM5 PC●● communication modules

TM5 C compact block ▲, digital and/or analog I/O

TM5 SD slice digital I/O module

TM5 SA slice analog I/O module

TM5 SE slice counter module

TM5 SPD slice common distribution module

TM5 SPS slice power distribution modules

TM5 SBET1 slice expansion bus module (transmitter)

TM5 SBER2 slice expansion bus module (receiver)

Presentation

Range

The LMC058 motion controller range is divided into two sizes:
□ The LMC058 LF42 motion controller is 177 mm wide.
□ The LMC058 LF424 motion controller is 237.5 mm wide as it has two free PCI slots for optional communication modules (serial link or Profibus DP).

This range is completed by an extensive expansion module offer:
□ Digital/analog I/O compact blocks ▲
□ Slice digital I/O expansion modules
□ Slice analog I/O expansion modules
□ Slice counter modules
□ Slice common distribution modules
□ Slice power distribution modules
□ Slice bus expansion modules

Functions

The main component in a system is the motion controller: two LMC058 motion controller models are offered to cover different control requirements (pressure, temperature, counting, velocity, positioning, motion, etc.).
LMC058 motion controllers and I/O modules are programmed using SoMachine software.

Reference	Embedded functions
LMC058 LF42	■ 42 digital I/O including 8 high-speed counters (200 kHz) ■ CANopen master ■ CANmotion master
LMC058 LF424	■ 42 digital I/O including 8 high-speed counters (200 kHz) ■ 4 voltage/current analog inputs ■ CANopen master ■ CANmotion master

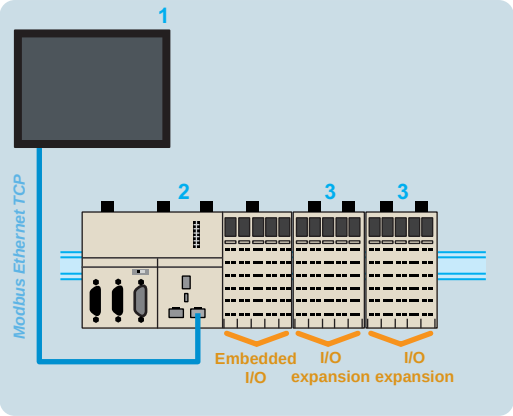
All LMC058 motion controllers have two groups of high-speed I/O with, for each group:
□ Four sink type high-speed inputs (up to 200 kHz), 2 standard inputs and 2 source type high-speed outputs (up to 100 kHz) dedicated to HSC or PWM functions
□ A high-speed input which can be used as an “Encoder capture input”
□ Two commons for the inputs
□ One common for the outputs
□ A power supply (24 V ⎓) consisting of 3 units:
- One for the CPU
- One for the high-speed I/O modules
- One for other modules (internal I/O Bus).

Conformity to standards

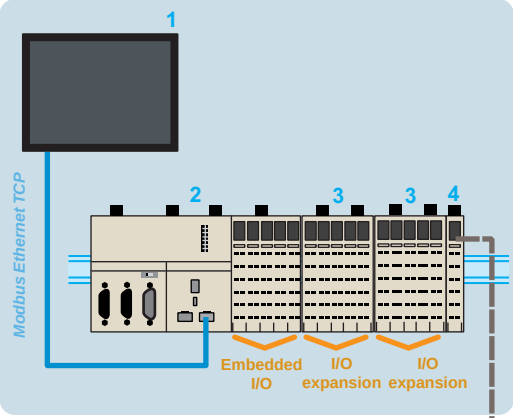
Type		Performance
Surge immunity 24 VDC circuit	EN/IEC 61000-4-5	1 kV in common mode
		0.5 kV in differential mode
Surge immunity 230 VAC circuit	EN/IEC 61000-4-5	2 kV in common mode
		1 kV in differential mode
Induced electromagnetic field	EN/IEC 61000-4-6	10 Veff (0.15...80 MHz)
Conducted emission	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

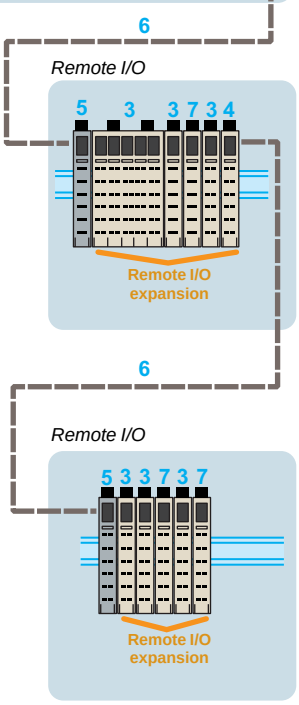
▲ *Available: second quarter 2011.*

Motion controller Modicon LMC058
Compact bases



Local I/O





Assembly and mounting

The components of this system have been designed for simple interlocking mechanical assembly.
An 8-way expansion bus connection (2 for the power supply, 2 for the bus and 4 for the data) is used to distribute data and the power supply when assembling the components: the LMC058 motion controller with compact blocks and slice expansion modules (I/O, counting, common distribution, power distribution, bus expansion).
All the elements which make up the system are mounted on a symmetrical rail using the locking levers located on top of each device.

Wiring and maintenance of devices is simplified by the use of removable spring terminals. The spring terminals are undone by pressing a locking tab.

The system is integrated into communication networks: all connectors (RJ45, USB, mini-USB and SUB-D type) are accessible, as they are located on the motion controller front panels.

Local or remote architecture

Local I/O

A PLC configuration can be local or remote. It consists of an LMC058 motion controller with its embedded input and output channels, used in conjunction with compact blocks and/or slice I/O expansion modules which are used to increase the number of channels and/or application-specific functions.

■ Compact blocks represent a way of adding a large number of I/O with a single component, and thus only a single product reference.
■ Slice I/O expansion modules (combination of a bus base, an electronic module and a terminal block) complete this configuration and, being modular with between 2 and 12 channels, make it possible to adjust the number of channels to exactly that required. The addition of slice digital or analog I/O expansion modules, temperature or high-speed counter modules increases the processing capabilities of applications.

Local I/O configuration
1 XBT GT supervisory graphic touch screen terminal
2 LMC058 motion controller
3 Compact blocks or slice I/O expansion modules

Remote I/O

Because of its backplane bus management, the TM5 system can be used to control I/O remotely.
The same modules can be used in either a local and/or remote configuration, linked together with bus expansion cables.
The maximum distance between two remote islands is 100 m and the maximum number of islands is 25, i.e. a total distance of up to 2500 m.

This function ensures a high level of flexibility, while retaining **synchronization of all data acquisition**, since all the expansion modules are on the same backplane bus.

Remote I/O configuration
1 XBT GT supervisory graphic touch screen terminal
2 LMC058 motion controller
3 Compact blocks or slice I/O expansion modules
4 Slice bus transmitter expansion modules
5 Slice bus receiver expansion modules
6 TM5 expansion bus cables
7 Slice common distribution modules

Motion controller Modicon LMC058
Compact bases

Communication

LMC058 motion controllers have the following built-in communication ports:

References	Communication ports	Use
LMC058LF42	RJ45 Configurable as RS232 or RS485	ASCII or RTU exchange with Modbus communication protocol
	1 x RJ45 (MDI/MDIX port)	□ FTP server □ Web server □ Modbus TCP server □ Modbus TCP client □ SoMachine Manager □ SNMP □ Ethernet IP device □ Modbus device
	1 x USB-A	Connection of a USB memory stick for transferring (uploading/ downloading) programs, data and/ or firmware
	1 x mini-USB	Programming port (480 Mbps)
	1 x 9-way male SUB-D	CANopen master connection
	1 x 9-way male SUB-D	CANmotion master connection
	1 x 15-way female SUB-D	Master encoder
LMC058LF424	1 x RJ45 Configurable as RS232 or RS485	ASCII or RTU exchange with Modbus communication protocol
	1 x RJ45 (MDI/MDIX port)	□ FTP server □ Web server □ Modbus TCP server □ Modbus TCP client □ SoMachine Manager □ SNMP □ Ethernet IP device □ Modbus device
	1 x USB-A	Connection of a USB memory stick for transferring (uploading/ downloading) programs, data and/ or firmware
	1 x mini-USB	Programming port (480 Mbps)
	1 x 9-way male SUB-D	CANopen master connection
	1 x 9-way male SUB-D	CANmotion master connection
	1 x 15-way female SUB-D	Master encoder
	2 PCI slots for communication modules = 2 x 9-way male SUB-D	Optional addition of communication modules for a serial link or Profibus DP

Embedded Ethernet

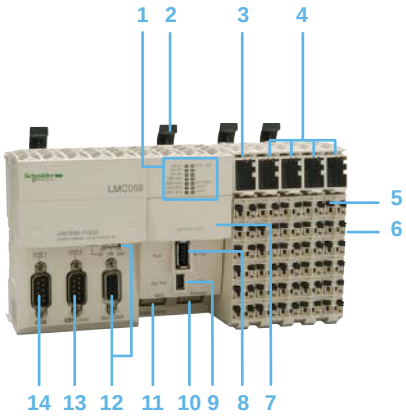
LMC058 motion controllers have an embedded Ethernet link via a direct connection to their RJ45 port.

□ Speed: “10 BaseT” and “100 BaseTX” with auto-negotiation

□ RJ45 port (MDI/MDIX): automatic adaptation to a straight or crossed cable

References	Protocols	Number of connections
LMC058LF42	Modbus server	8
LMC058LF424	Modbus device	2
	Ethernet IP device	16
	FTP server	4
	Web server	10

Motion controller Modicon LMC058
Compact bases

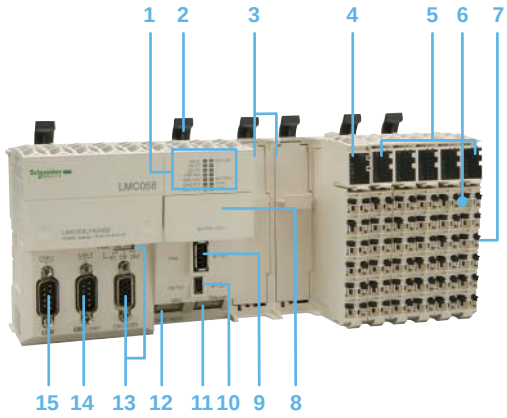


Description

The LMC058LF42 motion controller comprises:

1 A display block with:
- 4 motion controller status LEDs (RUN/MS, BATTERY, APP0 and APP1)
- 7 built-in communication port status LEDs (*Eth* LA, *Eth* ST, *Eth* NS, USB Host, MBS COM, CAN 0 STS, CAN 1 STS)

2 Locking lever for mounting/dismounting on ⊐ symmetrical rail
3 A 24 V ⎓ power supply module with removable terminal block and locking lever, display block and slot for a label
4 I/O modules, each one with a removable terminal block with locking lever, a display block showing the I/O states and a slot for a label-holder
5 Removable terminal block with locking lever for locking/unlocking
6 On the side, an expansion bus connector for connecting to the next module
7 A slot for the RTC (Real Time Clock) battery
8 A USB-A connector (marked Host) for connecting a USB memory stick for transferring programs, data or firmware updates
9 A USB-B mini-connector (marked Pgr Port) for connecting to the programming PC
10 An RJ45 connector (marked Ethernet) for connecting to the Ethernet network and/or Magelis XBT GT graphic terminal
11 An RJ45 connector (marked MBS) for the RS232 or RS485 serial link
12 A 15-way female SUB-D connector, marked ENCODER, for connecting the master encoder and a selector switch for the 3 encoder supply voltage states (5 V, Off, 24 V)
13 A 9-way male SUB-D connector, marked CAN0, for connecting to the CANopen bus
14 A 9-way male SUB-D connector, marked CAN1, for connecting to the CANmotion bus



The LMC058LF424 motion controller comprises:

1 A display block with:
- 4 motion controller status LEDs (RUN/MS, BATTERY, APP0 and APP1)
- 7 built-in communication port status LEDs (*Eth* LA, *Eth* ST, *Eth* NS, USB Host, MBS COM, CAN 0 STS, CAN 1 STS)

2 Locking lever for mounting/dismounting on ⊐ symmetrical rail
3 Two free PCI slots for the communication modules
4 A 24 V ⎓ power supply module with removable terminal block and locking lever, display block and slot for a label
5 I/O modules, each one with a removable terminal block with locking lever, a display block showing the I/O states and a slot for a label-holder
6 Removable terminal block with locking lever for locking/unlocking
7 On the side, an expansion bus connection for the link with the next module
8 A slot for the RTC (Real Time Clock) battery
9 A USB-A connector (marked Host) for connecting a USB memory stick for transferring programs, data or firmware updates
10 A USB-B mini-connector (marked Pgr Port) for connecting to the programming PC
11 An RJ45 connector (marked Ethernet) for connecting to the Ethernet network and/or Magelis XBT GT graphic terminal
12 An RJ45 connector (marked MBS) for the RS232 or RS485 serial link
13 A 15-way female SUB-D connector, marked ENCODER, for connecting the master encoder and a selector switch for the 3 encoder supply voltage states (5 V, Off, 24 V)
14 A 9-way male SUB-D connector, marked CAN0, for connecting to the CANopen bus
15 A 9-way male SUB-D connector, marked CAN1, for connecting to the CANmotion bus

Motion controller Modicon LMC058
Compact bases

LMC058LF42

LMC058LF424

References

LMC058 motion controllers, 24 V ⎓ power supply *(1)*

No. of I/O	Inputs	Outputs	Built-in communication ports	Reference	Weight (kg)
42 I/O	■ 26 x 24 V ⎓ digital inputs including 8 counter inputs (200 kHz)	■ 16 digital transistor outputs (0.5 A) including 4 reflex outputs	□ 1 RJ45 port: Ethernet □ 1 SUB-D port (9-way male): CANopen master □ 1 SUB-D port (9-way male): CANmotion master □ 1 SUB-D port (15-way female): master encoder □ 1 USB-A port: program transfer □ 1 USB-B mini-port: software programming □ 1 RJ45 port: RS232/RS485 serial link	**LMC058LF42**	0.550
42 + 4 I/O	■ 26 x 24 V ⎓ digital inputs including 8 counter inputs (200 kHz) ■ 4 analog inputs 10 V/- 10 V, 4-20 mA/ 0-20 mA, 12-bit resolution	■ 16 digital transistor outputs (0.5 A) including 4 reflex outputs	□ 1 RJ45 port: Ethernet □ 1 SUB-D port (9-way male): CANopen master □ 1 SUB-D port (9-way male): CANmotion master □ 1 SUB-D port (15-way female): master encoder □ 1 USB-A port: program transfer □ 1 USB-B mini-port: software programming □ 1 RJ45 port: RS232/RS485 serial link □ + 2 free PCI slots for optional communication modules *(2)*: RS232/ RS485 serial link and Profibus DP	**LMC058LF424**	0.770

(1) The motion controllers Modicon LMC058 require a power supply with a nominal voltage of 24 V ⎓.
The 24 V ⎓ power supply must be rated Separated Extra Low Voltage (SELV-rated) according to IEC 61140.
The SELV-rating means that SELV isolation is provided between the electrical input and output of the power supply.
(2) To be ordered separately

Motion controller Modicon LMC058
Compact bases
Accessories, connection cables, USB memory stick

TM5 ACTLC100

TM5 ACTCH100

TM5 ACLITW1

TM5 ACLT1

References

Accessories

Designation	Used for	Colour	Sold in lots of	Unit reference	Weight kg
Plain text cover holder (label-holder)	Labelling the terminal blocks on the I/O channels	Transparent	100	**TM5 ACTCH100**	0.002
Terminal block shield locking clip *(Order with plain text cover holder TM5 ACTCH100)*	Locking plain text cover holder TM5 ACTCH100	Transparent	100	**TM5 ACTLC100**	0.001
Sheet of 92 precut paper labels	Plain text cover holder TM5 ACTCH100	White	100	**TM5 ACTLS100**	0.001
Coloured plastic markers	Labelling 16 connection channel terminals	White	1	**TM5 ACLITW1**	0.015
		Red	1	**TM5 ACLITR1**	0.015
		Blue	1	**TM5 ACLITB1**	0.015
Metal tool	Inserting/removing TM5 ACLIT●1 markers	Black	1	**TM5 ACLT1**	0.030

Connection cables

Designation	Used from	to	Length	Reference	Weight kg
Software programming cable Baud rate: 480 Mbps max. Protocol: Modbus, HTTP, FTP, Codesys or virtual, non-isolated	PC USB port	USB mini-port on LMC058 motion controllers, the ATV-IMC card or XBT GT graphic touch screen terminals	3 m	**TCS XCN AM UM3P**	0.065
Programming cable	PC USB port	USB-B mini-port on LMC058 motion controllers	1.8 m	**BMX XCA USB H018**	0.230
RS485 serial link cables Modbus protocol	SUB-D port (25-way) on Small Panels: XBT N401, XBT N410, XBT R410, XBT R411, XBT GT2... GT7	RJ45 port on LMC058 motion controllers	1.8 m	**XBT Z938**	0.230
	RJ45 port on XBT GT graphic touch screen terminals	RJ45 port on LMC058 motion controllers	2.5 m	**XBT 9980**	0.230
RS232 serial link cables Character mode	SUB-D port (9-way female) on DTE *(1)*: printer, hand-held bar code reader, etc.	RJ45 port on LMC058 motion controllers	3 m	**TCS MCN 3M4F3C2**	0.150
	SUB-D port (9-way female) on DCE *(2)*: GSM modem	RJ45 port on LMC058 motion controllers	3 m	**TCS MCN 3M4M3S2**	0.150
Cable for master encoder input	Incremental encoders or SSI serial absolute encoders (1 stripped end)	15-way female SUB-D port on LMC058 motion controllers (1 High Density 15-way male SUB-D connector)	1 m	**VW3 M4 701**	–

(1) DTE: Data Terminal Equipment
(2) DCE: Data Communication Equipment