

# Modicon M221 logic controllers

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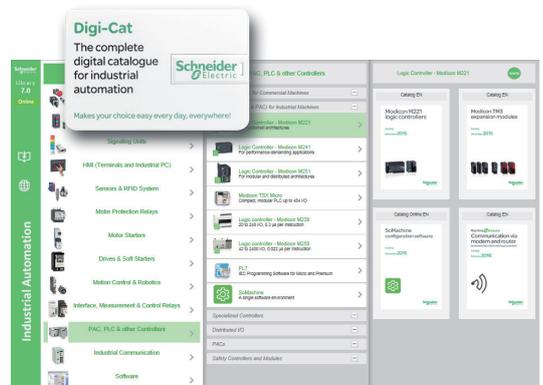
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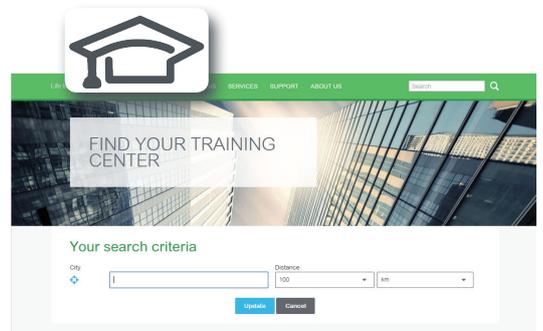
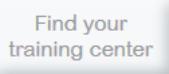


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## Communication bus

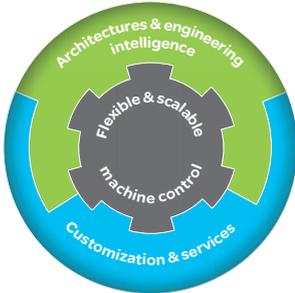
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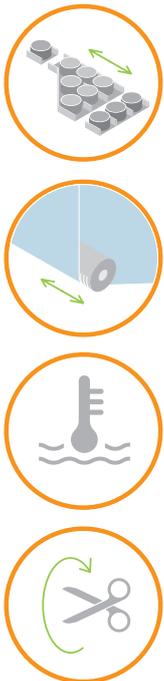


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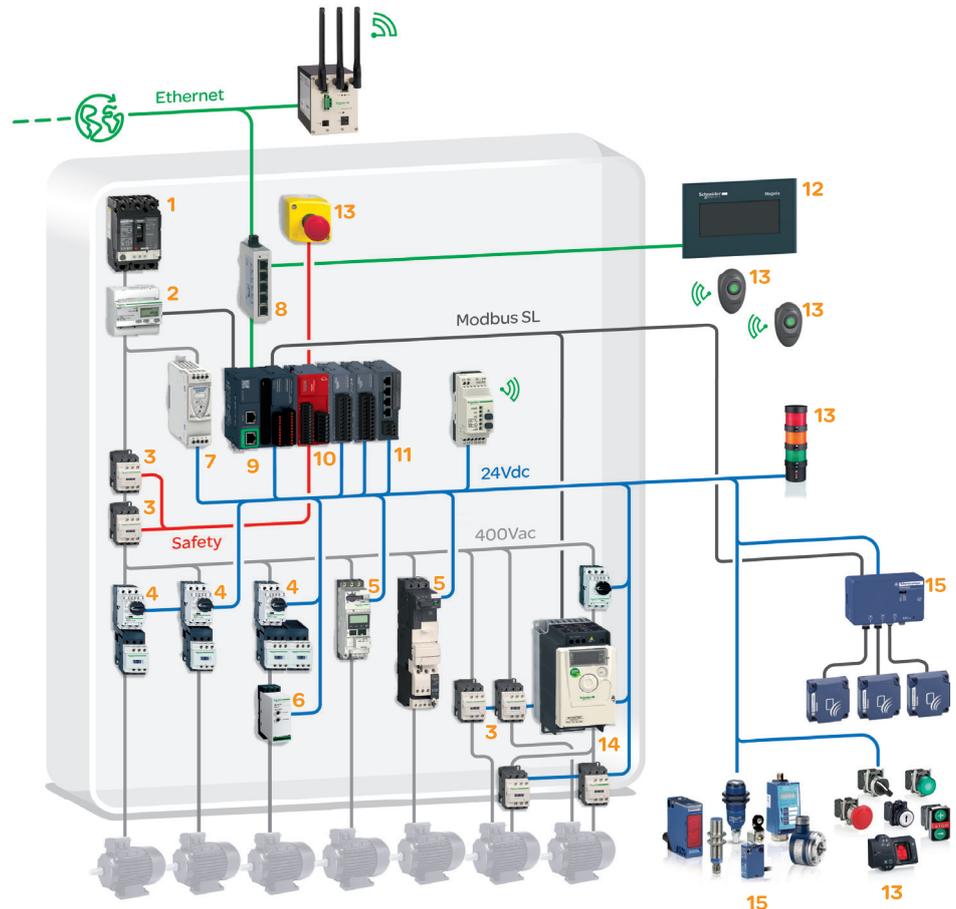
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Application Function Blocks (AFB)



- |                                               |                                                                      |
|-----------------------------------------------|----------------------------------------------------------------------|
| 1 POWERPACT circuit breaker                   | 10 Modicon TM3 safety module, Modicon TM3 digital/analog I/O modules |
| 2 Energy meter Acti9 iEM310 iEM310            | 11 Modicon TM3 TeSys motor starter module                            |
| 3 TeSys D contactor                           | 12 Magelis display                                                   |
| 4 TeSys GV2P motor circuit-breaker            | 13 Harmony signalling and control devices                            |
| 5 TeSys U starter-controller                  | 14 Altivar 312 variable speed drive                                  |
| 6 Multi9 circuit-breaker C60N                 | 15 OsiSense: limit switches and inductive sensors                    |
| 7 Phaseo power supply 24 V $\bar{\text{---}}$ |                                                                      |
| 8 Ethernet switch (unmanaged)                 |                                                                      |
| 9 <b>Modicon M221 Book</b> logic controller   |                                                                      |

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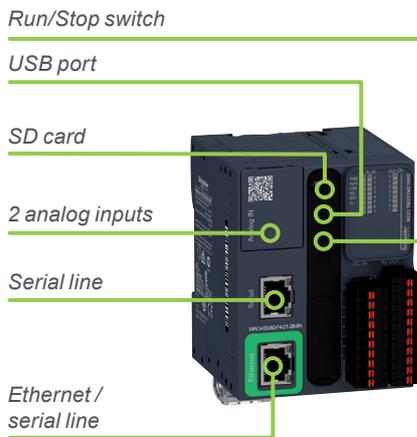
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Modicon M221: the small yet powerful logic controller for hardwired solutions

Everything you need is embedded

The Modicon M221 offers best-in-class performance. Available also in book format, the Modicon M221 requires minimal installation and offers tremendous versatility.



Modicon M221 Book and a broad choice of I/O extension modules



- > SD card, Run/Stop switch, USB port, 2 analog inputs, serial line, Ethernet and serial line, cartridge extension (on standard version): it's all **embedded**.
- > Thanks to its high degree of **flexibility**, it's very easy to add additional modules (safety modules, Tesys motor starter module, extensive line of analog and digital modules, ...) - and still keep everything in **just one configuration**

**Modicon M221: the small yet powerful logic controller for hardwired solutions**

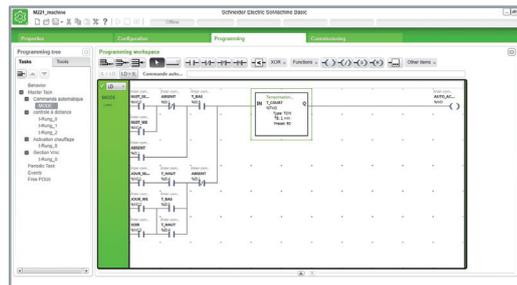
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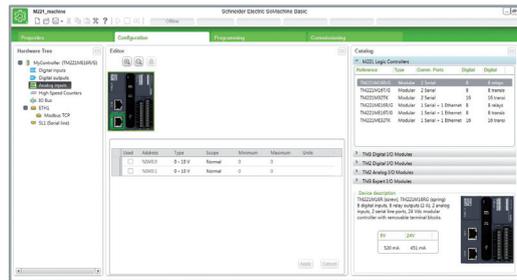
- > In order to reduce complexity we offer SoMachine Basic, a simplified engineering tool for the new controller Modicon M221.
- > All programming, visualization, and commissioning are handled in just one intuitive tool that is available as a free download.
- > No training required



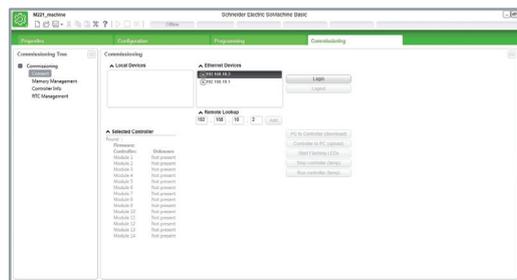
SoMachine simplifies every step in the design and commissioning of your machines



Programming



Configuration



Commissioning

### Connected everywhere

For simplified maintenance, commissioning, and uploads/downloads, simply connect anytime, anywhere.

- > Modem and router offer
- > QRcode on the front of the controller



### Customization and services

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Achieve benchmark performance  
while increasing profitability



# Modicon M221 and M221 Book logic controllers

Applications	Control of simple machines						Control of simple machines		
									
<b>Supply voltage</b>	100-240 V ~	24 V ~	24 V ~	100-240 V ~	24 V ~	24 V ~	24 V ~	24 V ~	24 V ~
<b>Inputs/outputs</b>	<b>16 logic I/O</b> 9 sink/source 24 V ~ inputs, inc. 4 high-speed inputs 9 sink/source 24 V ~ inputs, inc. 4 high-speed inputs 9 sink/source 24 V ~ inputs, inc. 4 high-speed inputs 14 sink/source 24 V ~ inputs, inc. 4 high-speed inputs 14 sink/source 24 V ~ inputs, inc. 4 high-speed inputs 14 sink/source 24 V ~ inputs, inc. 4 high-speed inputs						<b>40 logic I/O</b> 24 sink/source 24 V ~ inputs, inc. 4 high-speed inputs 24 sink/source 24 V ~ inputs, inc. 4 high-speed inputs 24 sink/source 24 V ~ inputs, inc. 4 high-speed inputs		
	<b>24 logic I/O</b> 7 relay outputs 7 source transistor outputs, inc. 2 high-speed outputs 7 sink transistor outputs, inc. 2 high-speed outputs 10 relay outputs 10 source transistor outputs, inc. 2 high-speed outputs 10 sink transistor outputs, inc. 2 high-speed outputs						<b>16 logic I/O</b> 8 sink/source 24 V ~ inputs, inc. 4 high-speed inputs 8 sink/source 24 V ~ inputs, inc. 4 high-speed inputs 8 sink/source 24 V ~ inputs, inc. 4 high-speed inputs		
	On removable screw terminal block 2 x 0...10 V analog inputs On dedicated removable connector						On removable screw terminal block or spring terminal block (1) 2 x 0...10 V analog inputs On dedicated removable connector		
	<input type="checkbox"/> No. and type of inputs <input type="checkbox"/> No. and type of outputs <input type="checkbox"/> Connection of the logic I/O <input checked="" type="checkbox"/> Analog inputs <input type="checkbox"/> Connection of analog inputs						<input type="checkbox"/> No. and type of inputs <input type="checkbox"/> No. and type of outputs <input type="checkbox"/> Connection of the logic I/O <input checked="" type="checkbox"/> Analog inputs <input type="checkbox"/> Connection of analog inputs		
<b>I/O extension</b>	Max. number of I/O expansion modules that can be connected /with bus expansion modules <input type="checkbox"/> 7 Modicon TM3 expansion modules, along with limited number of outputs. <input type="checkbox"/> 14 Modicon TM3 expansion modules with the use of bus expansion modules (transmitter and receiver), along with limited number of outputs. <input type="checkbox"/> Possible use of Modicon TM2 expansion modules with restrictions.						Max. number of I/O expansion modules that can be connected /with bus expansion modules <input type="checkbox"/> 7 Modicon TM3 expansion modules, along with limited number of outputs. <input type="checkbox"/> 14 Modicon TM3 expansion modules with the use of bus expansion modules (transmitter and receiver), along with limited number of outputs. <input type="checkbox"/> Possible use of Modicon TM2 expansion modules with restrictions.		
<b>Embedded communication</b>	Ethernet link 1 Ethernet port on TM221CE... controllers: Modbus TCP communication (client & server), slave Modbus TCP, DHCP Client dynamic configuration, programming, downloading, monitoring, EtherNet/IP adapter						Ethernet link 1 Ethernet port on TM221ME... controllers: Modbus TCP communication (client & server), slave Modbus TCP, DHCP Client dynamic configuration, programming, downloading, monitoring, EtherNet/IP adapter		
	Serial link 1 serial link port (RJ 45 connector) RS 232/RS 485 with + 5 V supply						Serial link 1 serial link port (RJ 45 connector) RS 232/RS 485 with + 5 V supply 1 additional serial link port on TM221M... controllers (RJ 45) RS 485		
<b>Embedded functions</b>	Process control Counting Position control PID Up to 4 high-speed counter inputs (HSC), 100 kHz frequency Position control (PTO), with trapezoidal profile and S curve able to control either: <input type="checkbox"/> 2 axes in "pulse direction" (P/D) mode <input type="checkbox"/> 1 axis in CW/CCW mode						Process control Counting Position control PID Up to 4 high-speed counter inputs (HSC), 100 kHz frequency Position control (PTO), with trapezoidal profile and S curve able to control either: <input type="checkbox"/> 2 axes in "pulse direction" (P/D) mode <input type="checkbox"/> 1 axis in CW/CCW mode		
	<input type="checkbox"/> 4 axes in "pulse direction" (P/D) mode <input type="checkbox"/> 2 axes in CW/CCW mode						<input type="checkbox"/> 4 axes in "pulse direction" (P/D) mode <input type="checkbox"/> 2 axes in CW/CCW mode		
<b>Format</b>	W x H x D 3 controller sizes: 95 x 90 x 70 mm 3.74 x 3.54 x 2.75 in. 110 x 90 x 70 mm 4.33 x 3.54 x 2.75 in. 163 x 90 x 70 mm 6.41 x 3.54 x 2.75 in.						1 size only: 70 x 90 x 70 mm 2.75 x 3.54 x 2.75 in.		
<b>Options</b>	<input checked="" type="checkbox"/> Cartridges <input type="checkbox"/> 3 analog I/O expansion cartridges <input type="checkbox"/> 1 additional serial link communication cartridge <input type="checkbox"/> 3 application cartridges - for control of hoisting applications - for control of packaging applications - for control of conveying applications						<input checked="" type="checkbox"/> Cartridges <input type="checkbox"/> 3 analog I/O expansion cartridges <input type="checkbox"/> 1 additional serial link communication cartridge <input type="checkbox"/> 3 application cartridges - for control of hoisting applications - for control of packaging applications - for control of conveying applications		
	Number of cartridge slots <input checked="" type="checkbox"/> Display unit						Number of cartridge slots <input checked="" type="checkbox"/> Display unit		
<b>Mounting</b>	TMH2GDB remote graphic display: visualization and monitoring Mounting on L symmetrical rail or panel with specific mounting kit TMAM2						TMH2GDB remote graphic display: visualization and monitoring Mounting on L symmetrical rail or panel with specific mounting kit TMAM2		
<b>Software programming</b>	With SoMachine Basic software						With SoMachine Basic software		
<b>Logic controller type</b>	<b>Modicon M221</b> Controllers without Ethernet port TM221C16R TM221C16T TM221C16U TM221C24R TM221C24T TM221C24U Controllers with embedded Ethernet port TM221CE16R TM221CE16T TM221CE16U TM221CE24R TM221CE24T TM221CE24U						<b>Modicon M221 Book</b> TM221M16R TM221M16T TM221M32TK TM221M16RG (1) TM221M16TG (1) TM221ME16R TM221ME16T TM221ME32TK TM221ME16RG (1) TM221ME16TG (1)		
	Pages 18						Pages 19		

(1) Spring terminal block on references ending in the letter G.

# Modicon M221 and M221 Book logic controllers

## General presentation

### Compatibility of offers

#### Modicon M221 and M221 Book logic controllers

- Modicon TM3 expansion modules
- Modicon TM2 expansion modules
- SoMachine Basic software



16 I/O channels



24 I/O channels



40 I/O channels

Modicon M221 logic controllers (standard format)



16 I/O channels



32 I/O channels

Modicon M221 Book logic controllers

### Presentation

#### Applications

Modicon **M221** and **M221 Book** logic controllers are designed for simple machines. They can optimize the size of wall-mounted and floor-standing control system enclosures due to their compact dimensions.

- The controllers are available in 2 formats:
  - Modicon **M221** controllers ( TM221C●●●● references) offer excellent connection capacity and customization options without increasing the controller size, using I/O, communication or application cartridges.
  - Modicon **M221 Book** controllers ( TM221M●●● references) offer very small dimensions and a wide choice of connections.
- M221 and M221 Book controllers have an embedded Ethernet port meaning they can easily be integrated in control system architectures, for remote control and maintenance of machines using applications for smartphones, tablets and PCs.
- The wealth of functions embedded in M221 and M221 Book controllers minimizes the cost of the machine:
  - Functions embedded in the controller: Modbus serial link, USB port dedicated to programming and simple position control functions (high-speed counters and pulse train outputs with trapezoidal profile and S curve).
  - Functions embedded in Modicon TM3 extensions: functional safety modules, motor-starter control module and remote expansion system.
  - Functions embedded in the dedicated display unit.
- The application is created quickly thanks to the intuitive nature of the SoMachine Basic programming software, which also has embedded configuration of the display unit and extensions, including the functional safety modules. This software environment makes it easy to retrieve Twido range applications, maximizing use of the investment already made. Applications can thus easily be ported to any of the Modicon logic controllers: M241, M251 and M258.

#### Main functions

Modicon TM221C●●●	Modicon TM221M●●●
<b>w x h x d (mm/in.)</b>	
<ul style="list-style-type: none"> <li>□ 16 I/O: 95 x 90 x 70 / 3.74 x 3.54 x 2.75</li> <li>□ 24 I/O: 110 x 90 x 70 / 4.33 x 3.54 x 2.75</li> <li>□ 40 I/O: 163 x 90 x 70 / 6.41 x 3.54 x 2.75</li> </ul>	<ul style="list-style-type: none"> <li>□ 16 I/O: 70 x 90 x 70 / 2.75 x 3.54 x 2.75</li> <li>□ 32 I/O: 70 x 90 x 70 / 2.75 x 3.54 x 2.75</li> </ul>
<b>Supply voltage</b>	
24 V $\overline{\text{---}}$ or 100..240 V $\sim$ 50/60 Hz	24 V $\overline{\text{---}}$
<b>Connection of the embedded I/O</b>	
On removable screw terminal blocks at intervals of 5.08 mm (0.20 in.) 24 V/0.25 A power supply provided by the controller for sensor inputs on TM221C●●R models	16 I/O: On removable screw or spring terminal blocks at intervals of 3.81 mm (0.15 in.) 32 I/O: On HE10 connectors with HE 10 cables/bare wires or Telefast ABE7 connection sub-bases (1)
<b>Analog inputs</b>	
2 embedded inputs on each TM221M●●● and TM221C●●● controller	
<b>Embedded Ethernet communication</b>	
Yes on TM221CE●●	Yes on TM221ME●●
<b>Serial link</b>	
1 embedded link	1 to 2 embedded links
<b>Cartridges</b>	
1 slot for 1 or 2 cartridges: <ul style="list-style-type: none"> <li>□ I/O cartridge (analog inputs or outputs, temperature inputs)</li> <li>□ communication cartridge (serial link) or application cartridges (hoisting, conveying and packaging)</li> </ul>	–

#### Hardware characteristics

M221 and M221 Book controllers each have an embedded:

- Run/Stop switch
- slot for an industrial SD memory card
- QR code for direct access to its technical documentation

(1) Telefast Modicon ABE7 pre-wired system to be ordered separately. Refer to the "Telefast pre-wiring system: Modicon ABE7 and Modicon ABE9" catalog or our website [www.schneider-electric.com](http://www.schneider-electric.com).



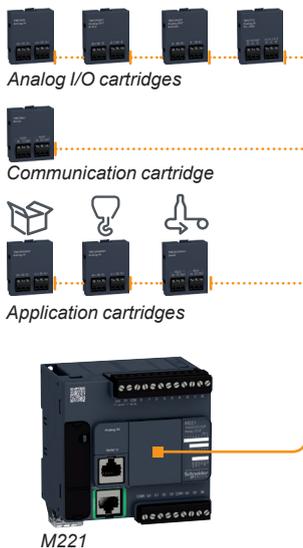
Example of a QRcode:  
QRcode for access to the TM221M16R logic controller technical documentation

# Modicon M221 and M221 Book logic controllers

General presentation, options for Modicon M221 and M221 Book logic controllers



SoMachine Basic software



## Presentation

### Embedded communication (see page 15)

M221 and M221 Book logic controllers have three types of integrated communication port:

- Ethernet
- RS 232/RS 485 serial link
- USB mini-B programming port

### Embedded functions

Each Modicon M221 and M221 Book logic controller has the following integrated functions:

- Analog (PID control)
- Counting: Up to 4 high-speed counters (HSC), 100 kHz frequency  
Controllers with transistor logic outputs (source or sink) are equipped with 2 or 4 high-speed counters (1) supporting pulse generation functions.
- Position control (PTO), with trapezoidal profile and S curve able to control either:
  - 2 or 4 axes in pulse direction (P/D) mode
  - 1 or 2 axes in CW/CCW mode
 These outputs can be associated with event-triggered inputs to feed back homing and capture information. A "Motiontask" function block (one per axis) associated with a command table can be used to program and preview intuitively all the movements of an axis in the SoMachine Basic software.
- Pulse width modulation (PWM)
- Pulse generator (PLS)
- Frequency generator (FREQGEN)

### Processing power

- Execution speed: 0.2 μs/Boolean instruction
- Program: 10 Boolean Kinstructions
- Number of words: 8,000. Number of internal bits: 1,024
- RAM: 640 K (256 K for internal variables and 256 K for application and client data)
- Flash memory: 2 MB (including 256 K for backing up the client application and data in the event of a power outage)

### Programming

Modicon M221 and M221 Book logic controllers are programmed with the SoMachine Basic software. **Please consult our website: [www.schneider-electric.com](http://www.schneider-electric.com).** SoMachine Basic is an integral component of the SoMachine software. SoMachine Basic is available on CD and also as a download from our website: [www.schneider-electric.com](http://www.schneider-electric.com).

## Options

### Memory card

The **TMASD1** industrial SD memory card, with 256 MB capacity, is available for Modicon M221 and M221 Book logic controllers. It is used for:

- backing up and transferring applications
- loading firmware
- duplicating applications between controllers

### Cartridges

One or two cartridges can be inserted on the front of TM221C●●● controllers without increasing the dimensions.

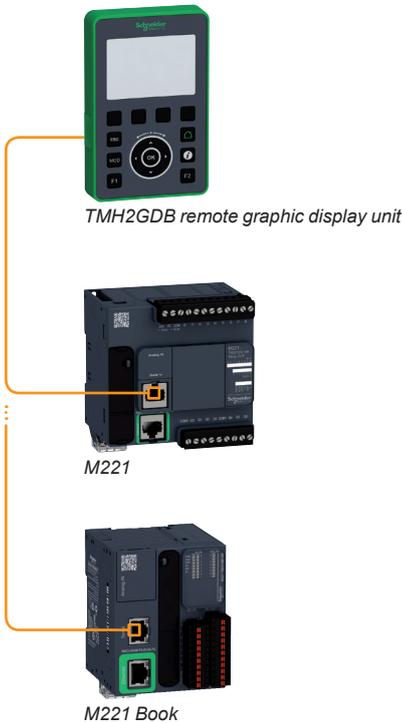
Three types of cartridge are offered:

- Analog I/O cartridges
  - TMC2AI2** for 2 analog inputs which can be configured as voltage or current
  - TMC2AQ2V** for 2 voltage analog outputs
  - TMC2AQ2C** for 2 current analog outputs
  - TMC2TI2** for 2 temperature inputs
- Communication cartridge
  - TMC2SL1** providing additional serial link port terminals for connection via a printer, barcode reader, etc.
- Application cartridges
  - TMC2HOIS01** for hoisting applications with two dedicated analog inputs for controlling a load cell
  - TMC2PACK01** for packaging applications with two dedicated analog inputs for controlling the temperature on a packaging machine
  - TMC2CONV01** for conveyor system applications with a serial link
 Using an application cartridge provides direct access to application examples via the SoMachine Basic software.

(1) 4 high-speed outputs on TM221C●40U, 2 high-speed outputs on TM221●●16T, TM221C●24T, TM221C●40T, TM221C●16U, TM221C●24U.

# Modicon M221 and M221 Book logic controllers

## Remote graphic display unit for Modicon M221 and M221 Book logic controllers



### TMH2GDB remote graphic display unit

#### Presentation

The **TMH2GDB** remote graphic display unit is an HMI dedicated to M221 and M221 Book logic controllers. It is mounted on the front panel of a wall-mounted or floor-standing enclosure (degree of protection IP 65) or, using mounting brackets, at the back of an enclosure on a panel or symmetrical rail.

The **TMH2GDB** display unit is ready to use: the main application parameters can be accessed, with no prior programming, as soon as it is connected to the logic controller. Customized dialog pages can however easily be created using predefined templates in the SoMachine Basic software dedicated to Modicon M221 and M221 Book logic controllers.

The **TMH2GDB** remote graphic display unit is a multifunction display unit which runs alongside your machine throughout its life cycle:

- During debugging: reading the states and values of variables and providing complete diagnostics of the controller configuration
- During installation: options for setting the time and configuring the communication ports
- During runtime: an operator interface created in the SoMachine Basic software can be used to (for example):
  - display information in the form of text, values, bargraphs or gauges
  - perform machine control actions
  - enter or modify data
  - customize buttons on the front panel
- During maintenance: the page displaying alarm messages is permanently accessible by pressing a single key. Alarm messages are stored and time-tagged in a page of the log. An icon, which is always visible, flags up the presence of at least one alarm message. Access to each page and modification of its values can be protected by a password.

#### Main characteristics

- Backlit monochrome STN LCD 60 x 40 mm (2.36 x 1.57 in.)
- 5 lines of 20 to 35 characters, depending on the type of page
- Title block at the top of the page
- Title block at the bottom of the page
- 8 languages available: English, French, German, Italian, Spanish, Portuguese, Chinese and Turkish
- Up to 4 customizable service keys
- 100 HMI pages maximum
- Dimensions on the front panel of the machine (w x h x d): 80 x 126 x 19.2 mm (3.15 x 4.96 x 0.75 in)

#### Conformity

- CE, cULus Listing Mark

#### Environmental characteristics

- Ambient operating temperature: -15...+ 50 °C (5...122 °F)

#### Supply characteristics

- 5 V  $\overline{\text{DC}}$  (200 mA) directly by the controller
- Max. consumption: 1 W

# Modicon M221 and M221 Book logic controllers

## Remote graphic display unit for Modicon M221 and M221 Book logic controllers

Controller Info		10/02/2012 02:57:11
Device name	TM221CE24T	
Firmware version	0.3.9.1	
LastMAST cycle	0,134 ms	
Min. MAST cycle	0,134 ms	
Max. MAST cycle	0,159 ms	
		Alarm Back

Debugging: Controller information

Ethernet		10/02/2012 02:57:47
IP Mode	0	
IP address	85.21.1.24	
Mask	255.255.255.0	
Gateway	0.0.0.0	
Device name	M221	
		Apply Edit Refresh Cancel

Debugging: Configuring communication

Monitoring		26/11/2014 10:38:24
Temperature 1	23	
Temperature 2	24	
Heating	1	
Cooling	0	
Auto/Manu	1	
		Edit Alarm menu

HMI: Monitor

Controls		26/11/2014 10:38:40
Auto mode status		
Auto mode selected		
Oven is heating		
Cooling system is OFF		
		On Off Menu Alarm

HMI: Control panel

WATER SUPPLY		14/09/2015 23:26:13
3	m	
[Progress bar from 0 to 10]		
9	m <sup>3</sup>	
[Progress bar from 0 to 10]		
		Edit1 Edit2 Alarm Home

HMI: Bargraph

Temperature		10/02/2012 02:58:14
20		
[Bargraph with needle pointing to 22]		
22	°C	
		Alarm menu set

HMI: Gauge

Alarm History		17/09/2015 07:44:18
TANK EMPTY	17/09/2015 07:43:55	
Conveyor blocked	17/09/2015 07:43:36	
LOW BATTERY	17/09/2015 07:41:37	
TANK EMPTY	17/09/2015 07:41:00	
		Alarm Delete Back

HMI: Alarm display

Examples of screens

### TMH2GDB remote graphic display unit (continued)

#### Installation and setup

The **TMH2GDB** remote graphic display unit is mounted in a 22 mm (0.87 in.) diameter hole and is connected to the SL or SL1 serial link on Modicon M221 and M221 Book logic controllers with the **XBTZ9980** and **VW3A1104R10** cable which also supplies it with power (no other Modbus slave equipment must be connected on this link) (1).

The debug screens, including those for setting the time and configuring the communication ports, are already configured and available as soon as the display unit is connected to the logic controller (2).

The HMI (runtime) pages and alarm pages are created and configured very easily in the SoMachine Basic programming software (3), from predefined pages:

- "Alarm display" template
- "Menu" template
- "Monitor"
- "Control panel" template
- "Bargraph" template (1 or 2 bars)
- "Gauge" template

These pages constitute part of the controller application. They are transferred to and stored in the M221 and M221 Book logic controller memory, no transfer is necessary between the PC and the **TMH2GDB** graphic display unit. The latter is operational as soon as it is connected to the serial port on the logic controller.

#### Upgrade envisaged from 2nd quarter 2016: addition of the Home page.

The Home page can be selected by programming. Each HMI and alarm page can be displayed by navigating the front panel using the keys or called by a program. In addition, the alarm pages can be displayed on a red background.

The HMI pages can be created in several languages, the language displayed on the graphic display unit can then be selected by the operator in the display configuration menu.

(1) Neither the serial link on the TMC2SL1 cartridge, nor the SL2 embedded serial link, can be used to connect the graphic display unit.

(2) When the controller has no application program, only the product reference and the controller firmware version are accessible. The controller firmware version must be V1.3 or later.

(3) Possible from version V1.3 of SoMachine Basic.

# Modicon M221 and M221 Book logic controllers

## Communication via modem and router

### Communication via modem and router

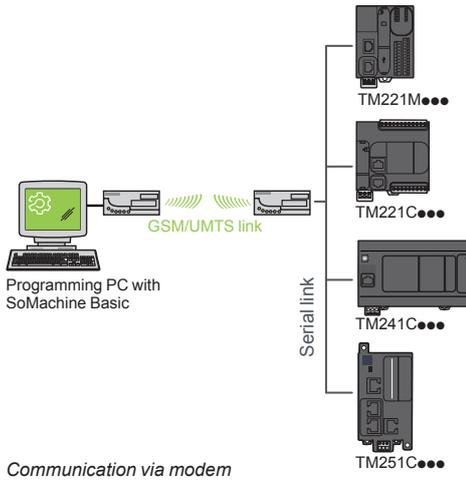
The communication via modem and router offer is dedicated to the following applications:

- Synchronization between remote machines; direct data exchange between controllers
- Remote maintenance; access to the controller via the SoMachine Basic programming software
- Remote control and monitoring of machines; receipt of information and sending commands on GSM/UMTS phone (1)

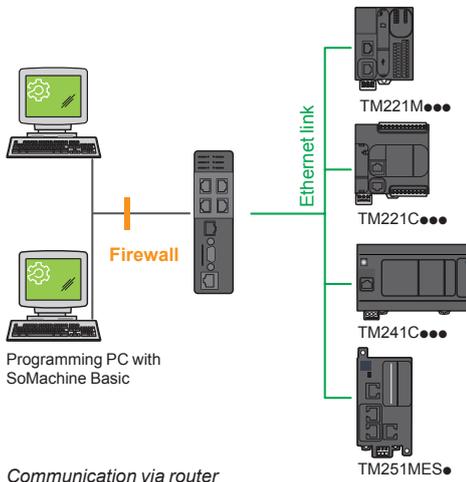
This offer comprises a **Schneider Electric** modem, a GSM/UMTS modem and an **eWon** VPN router.

For modem and router, please consult our website [www.schneider-electric.com](http://www.schneider-electric.com).

(1) Global System Mobile (2G)/Universal Mobile Telecommunications System (3G)



Communication via modem



Communication via router

# Modicon M221 and M221 Book logic controllers

## I/O extensions with Modicon TM3 expansion modules

### I/O extensions with Modicon TM3 modules

#### Modicon TM3 expansion modules

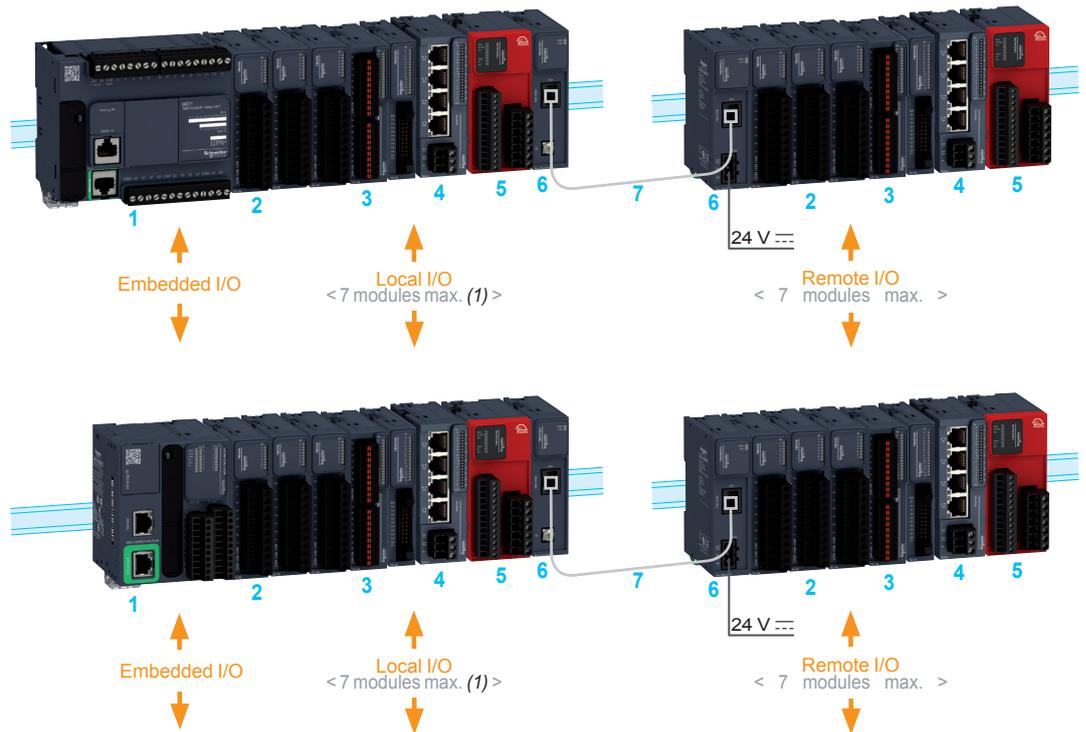
Please consult our website: [www.schneider-electric.com](http://www.schneider-electric.com)

The capacity of M221 and M221 Book logic controllers can be enhanced with the Modicon TM3 expansion module offer:

- Digital I/O modules that can be used to create configurations with up to 488 digital I/O. These modules are available with the same connections as the controllers.
- Analog I/O modules which can be used to create configurations with up to 114 analog I/O and are designed to receive, amongst other things, position, temperature, and speed sensor signals. They are also capable of controlling variable speed drives or any other device equipped with a current or voltage input.
- Expert module for control of TeSys motor-starters, connected with RJ 45 cables to simplify wiring up the control section.
- Functional safety modules which simplify wiring and can be configured in the SoMachine Basic software.

In addition, the TM3 expansion system is flexible due to the possibility of remotely locating some of the TM3 modules in the enclosure or another cabinet, up to 5 meters (16.404 ft.) away, using a bus expansion system.

The Modicon TM3 expansion system is common to the whole range of Modicon M221, M241 and M251 logic controllers, meaning that the controller model can be upgraded without changing extension.



- 1 Modicon M221/M221 Book logic controller
- 2 Modicon TM3 digital I/O modules
- 3 Modicon TM3 analog I/O modules (2)
- 4 Modicon TM3 expert module: control of TeSys motor-starters
- 5 Modicon TM3 functional safety modules
- 6 Modicon TM3 bus expansion modules (transmitter and receiver)
- 7 TM3 bus expansion cable

(1) Depending on type of TM3 module used.

(2) Compatibility of expansion module offers: the majority of Modicon TM2 expansion modules can be used with M221 and M221 Book logic controllers. Nonetheless, adding a Modicon TM2 expansion module to a configuration can increase the expansion module execution times by as much as a few milliseconds. The compatibility between Modicon TM2 expansion modules and each M221 or M221 Book logic controller is specified on page 30.

# Modicon M221 and M221 Book logic controllers

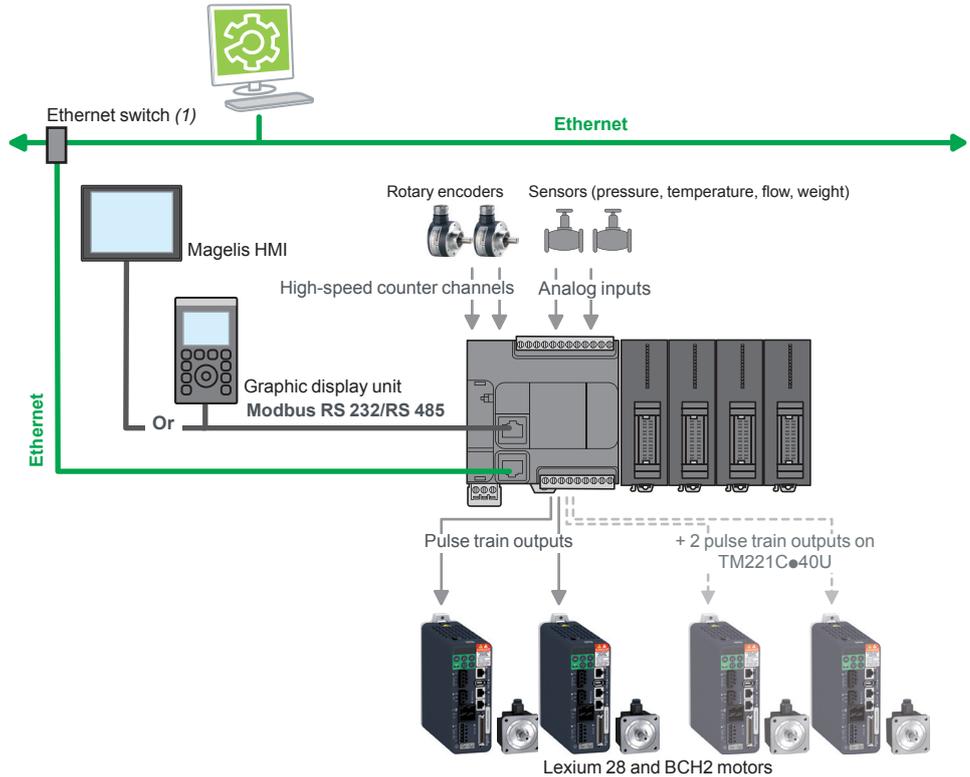
## Control architecture

### Control architecture for standalone machines

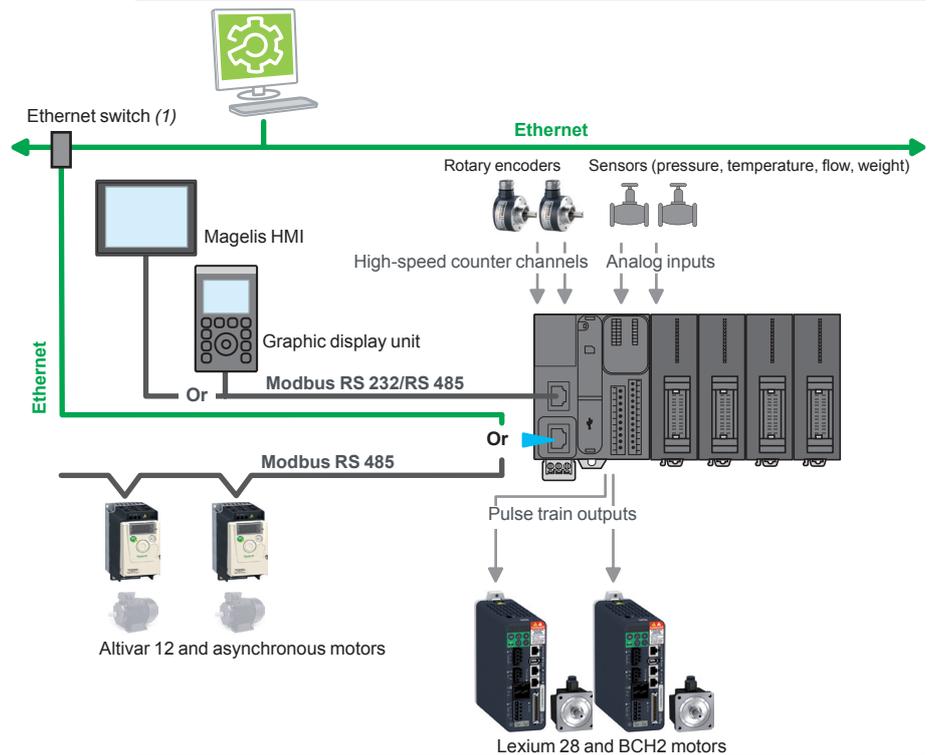
**Typical applications: repetitive machines**

- Packaging: recycling machines
- Textile-clothing machines
- Commercial equipment: automatic wash units, advertising hoardings, etc.
- Construction/service sector: access and entry control for automated systems
- Other sectors: woodworking, agriculture, fish farming, incubators, swimming pools, etc.

■ M221 (TM221C●●●●) controllers



■ M221 Book (TM221M●●●) controllers



(1) Only use one switch, as Hubs are not compatible.

# Modicon M221 and M221 Book logic controllers

## Embedded communication Characteristics

### Embedded communication

#### Communication on Ethernet network

TM221CE●●● and TM221ME●●● controllers have an embedded RJ 45 Ethernet port (10/100 Mbps, MDI/MDIX) with Modbus TCP (Client/Server), Ethernet IP (adapter), UDP, and TCP protocols.

- As well as the default address based on the MAC address, it is possible to assign the controller IP address via a DHCP server or via a BOOTP server.
- The Ethernet port also offers the same application upload/download, update and debug functions when the controller is supplied with power.
- A firewall can be used to lock each communication protocol.

**For connection cables and accessories for Industrial Ethernet network, see page 24.**

#### Serial links

■ Each TM221C●●● controller has an embedded serial link that can be configured as RS 232 or RS 485. A 5 V/200 mA power supply is available on the RJ 45 connector, which then supplies the **TMH2GDB** display unit or Magelis **XBTN** or **XBTRT** HMI.

■ Each TM221M●●● controller has one or two embedded serial links.

- The SL1 serial link, found on each M221 Book controller, can be configured as RS 232 or RS 485. A 5 V/200 mA power supply is available on the RJ 45 connector, which then supplies the **TMH2GDB** display unit, Magelis **XBTN** or **XBTRT** HMI, or other device.
- The SL2 serial link, found on TM221M16●●●, TM221M24●●● and TM221M40●●● controllers only, is configured as RS 485.

Serial links also offer application upload/download, update and debug functions when the controller is supplied with power. Embedded in both links are the two main commercially-available protocols:

- Modbus ASCII/RTU Master or Slave
- ASCII character string

**For connection cables and accessories for serial link, see page 22.**

#### Software programming with power off charging function

The programming port, equipped with a USB mini-B connector, is embedded in each M221 and M221 Book controller; it is dedicated to communication with a PC equipped with SoMachine Basic for programming, debugging, and maintenance. In addition, it offers the ability to load an application program or update the firmware without the controller being powered by another source.

### Characteristics of M221 and M221 Book logic controllers

- Certifications: CE, UL Listing Mark, CSA, RCM, EAC, LR, ABS, DNV - GL
- Standards: IEC/EN 61131-2 (Edition 2 2007), UL 508 (UL 61010-2-201), ANSI/ISA 12.12.01-2007, CSA C22.2 No. 213, No. 142, E61131-2 and IACS E10

#### Environment

- Ambient operating temperature: - 10...+ 55 °C (14...+ 131 °F)
- Storage temperature: - 25...+ 70 °C (- 13...+ 158 °F)
- Relative humidity: 10...95% (non-condensing)

Operating altitude:

- 0...2,000 m (0...6,562 ft): complete specification for temperature and insulation
- 2,000...4,000 m (6,562...13,123 ft):
  - temperature derating: + 1 °C/400 m (+ 1.8 °F/1,312 ft.)
  - insulation losses: 150 V ~~/1,000 m (150 V ~~/3,280 ft.)

- Storage altitude: 0...3,000 m (0...9,842 ft.)

Immunity to mechanical stress (vibrations):

- For 1131: 5...8.4 Hz (amplitude 3.5 mm/ 0.138 in.); 8.4...150 Hz (acceleration 1 g)
- For merchant navy: 5...13.2 Hz (amplitude 1.0 mm/0.039 in.); 13.2...100 Hz (acceleration 0.7g)

#### Power supply

Two power supply types are available depending on the M221 controller model: 24 V ~ or 100-240 V ~ 50/60 Hz

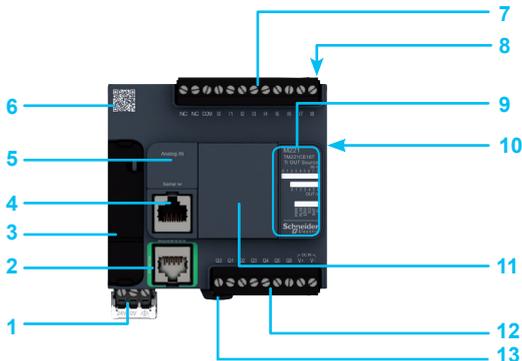
- Voltage limit (including ripple): 19.2...28.8 V ~~/85...264 V ~
- Immunity to micro-cuts (class PS-2): 10 ms

Max. consumption:

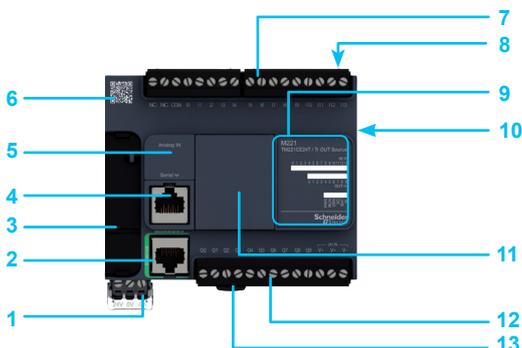
- TM221 powered with AC, depending on model: 31...41 VA without expansion modules, 46...70 VA with maximum expansion module configuration
- TM221 powered with DC, depending on model: 3.2...4.9 W without expansion modules, 10...23 W with maximum expansion module configuration

# Modicon M221 and M221 Book logic controllers

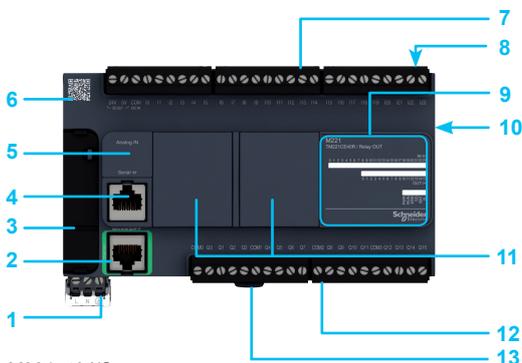
## Modicon M221 logic controllers



M221: 16 I/O



M221: 24 I/O



M221: 40 I/O



TMH2GDB

### Description

#### M221 logic controllers (TM221C●●●)

- 1 Removable screw terminal block, 3 terminals for connecting the 24 V  $\overline{\text{DC}}$  or 100-240 V  $\sim$  power supply (depending on the model)
- 2 On TM221CE●●● controllers: RJ 45 connector for Ethernet network, with activity and exchange speed LED indicator
- 3 Behind the removable cover:
  - Mini-B USB connector for connecting a PC equipped with SoMachine Basic software
  - Slot for the industrial SD memory card
  - Run/Stop switch
- 4 Serial link port (RS 232 or RS 485): RJ 45 connector
- 5 Behind a flap: dedicated removable connector for two analog inputs
- 6 QR code for access to the controller technical documentation
- 7 Connection of 24 V  $\overline{\text{DC}}$  logic inputs on removable screw terminal blocks (1)
- 8 On top of the controller: slot for backup battery
- 9 LED display block showing:
  - the status of the controller and its components (battery, industrial SD memory card)
  - the status of the serial link
  - the status of the embedded I/O
- 10 On the side of the controller: TM3 bus connector for the link with a Modicon TM3 expansion module
- 11 Slot(s) for I/O cartridge(s), communication cartridge or application cartridge(s): one on M221 controllers with 16 and 24 I/O, two on M221 controllers with 40 I/O
- 12 Connection of relay/transistor logic outputs: on removable screw terminal blocks (1)
- 13 Clip for locking on  $\overline{\text{D}}$  symmetrical rail

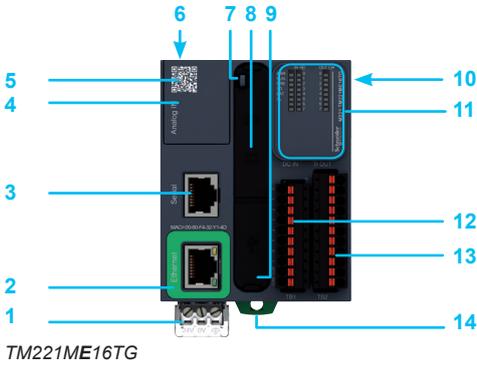
(1) Removable screw terminal blocks equipped with screw terminals, supplied with M221 controller.

#### Graphic display unit TMH2GDB

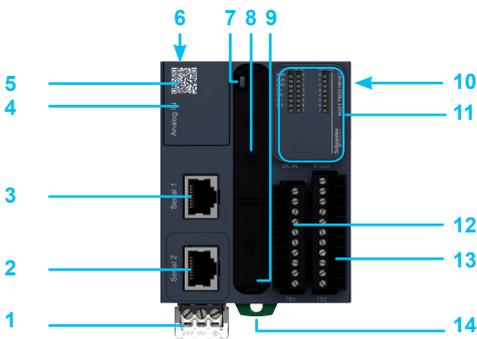
- 1 Control screen: backlit STN graphic screen, two-tone (white/red)
  - 2 Ten command buttons, two of which can be customized with the option of identifying associated functions
  - 3 Rotary navigation and control wheel
- On the back of the display unit:
- 4 Mounting system consisting of locking nut, seal and anti-rotation tee
  - 5 RJ 45 connector for the cable connecting the graphic display unit to the Modicon M221/M221 Book logic controller

# Modicon M221 and M221 Book logic controllers

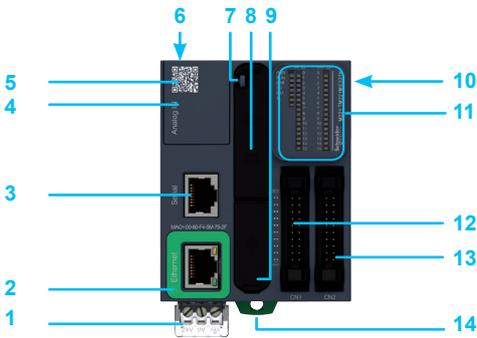
## Modicon M221 Book logic controllers



TM221ME16TG



TM221M16T



TM221ME32TK

### Description

#### M221 Book logic controllers (TM221M●●●)

- 1 Removable screw terminal block, 3 terminals for connecting the 24 V  $\sim$  supply
  - 2 On TM221ME16●● and TM221ME32●● controllers: RJ 45 connector for Ethernet network, with activity and exchange speed LED indicator  
On TM221M16●● and TM221M32●● controllers: RJ 45 connector for SL2 serial link
  - 3 SL1 serial link port (RJ 45 connector)
  - 4 Behind the removable cover: removable connector for two analog inputs
  - 5 QR identification code for the controller technical documentation
  - 6 Backup battery slot
- Behind the removable cover: 7, 8 and 9
- 7 Slot for the industrial SD memory card
  - 8 Run/Stop switch
  - 9 Mini-B USB connector for connecting a PC equipped with SoMachine Basic software
  - 10 TM3 bus connector for linking to a Modicon TM3 expansion module
  - 11 LED display block showing:
    - the status of the controller and its components (battery, industrial SD memory card)
    - the status of the serial links
    - the status of the I/O
  - 12 Connection of 24 V  $\sim$  logic inputs:
    - on 16-channel controllers: removable screw or spring terminal blocks (1)
    - on 32-channel controllers: HE10 connector
  - 13 Connection of relay/transistor logic outputs:
    - on 16-channel controllers: removable screw or spring terminal blocks (1)
    - on 32-channel controllers: HE10 connector
  - 14 Clip for locking on  $\perp$  symmetrical rail

(1) Removable terminal blocks equipped with screw or spring-type terminals depending on controller type. Terminal blocks supplied with M221 Book controller.

#### Graphic display unit TMH2GDB

Description: see page 16



TMH2GDB

# Modicon M221 and M221 Book logic controllers

## Modicon M221 logic controllers



TM221C16R, TM221C16T, TM221CE16U



TM221CE16R, M221CE16T, TM221CE16U



TM221C24R, M221C24T, TM221CE24U



TM221CE24R, TM221CE24T, TM221CE24U



TM221C40R, TM221C40T, TM221CE40U



TM221CE40R, TM221CE40T, TM221CE40U



TMC2AI2



TMC2AQ2V



TMC2AQ2C



TMC2TI2



TMC2SL1



TMC2PACK01



TMC2HOIS01



TMC2CONV01

### References

#### Modicon M221 logic controllers (1)

Number of logic I/O	Logic inputs	Logic outputs	Analog inputs	Integrated communication ports (2)		Reference	Weight kg/lb
				Ethernet (RJ 45)	Serial link (RJ 45)		
■ 100-240 V ~ power supply							
16 inputs/outputs	9 sink/source 24 V $\overline{\text{---}}$ inputs, inc. 4 high-speed inputs	7 relay outputs	2 x 0...10 V inputs	–	1	TM221C16R	0.346 0.763
				1	1	TM221CE16R	0.346 0.763
24 inputs/outputs	14 sink/source 24 V $\overline{\text{---}}$ inputs, inc. 4 high-speed inputs	10 relay outputs	2 x 0...10 V inputs	–	1	TM221C24R	0.395 0.871
				1	1	TM221CE24R	0.395 0.871
40 inputs/outputs	24 sink/source 24 V $\overline{\text{---}}$ inputs, inc. 4 high-speed inputs	16 relay outputs	2 x 0...10 V inputs	–	1	TM221C40R	0.456 1.005
				1	1	TM221CE40R	0.456 1.005
■ 24 V $\overline{\text{---}}$ power supply							
16 inputs/outputs	9 sink/source 24 V $\overline{\text{---}}$ inputs, inc. 4 high-speed inputs	7 source transistor outputs, inc. 2 high-speed outputs	2 x 0...10 V inputs	–	1	TM221C16T	0.346 0.763
				1	1	TM221CE16T	0.346 0.763
24 inputs/outputs	14 sink/source 24 V $\overline{\text{---}}$ inputs, inc. 4 high-speed inputs	10 source transistor outputs, inc. 2 high-speed outputs	2 x 0...10 V inputs	–	1	TM221C24T	0.395 0.871
				1	1	TM221CE24T	0.395 0.871
40 inputs/outputs	24 sink/source 24 V $\overline{\text{---}}$ inputs, inc. 4 high-speed inputs	16 source transistor outputs, inc. 2 high-speed outputs	2 x 0...10 V inputs	–	1	TM221C40T	0.456 1.005
				1	1	TM221CE40T	0.456 1.005
16 inputs/outputs	9 sink/source 24 V $\overline{\text{---}}$ inputs, inc. 4 high-speed inputs	7 sink transistor outputs, inc. 2 high-speed outputs	2 x 0...10 V inputs	–	1	TM221C16U	0.558 1.230
				1	1	TM221CE16U	0.626 1.380
24 inputs/outputs	14 sink/source 24 V $\overline{\text{---}}$ inputs, inc. 4 high-speed inputs	10 sink transistor outputs, inc. 2 high-speed outputs	2 x 0...10 V inputs	–	1	TM221C24U	0.770 1.698
				1	1	TM221CE24U	0.570 1.257
40 inputs/outputs	24 sink/source 24 V $\overline{\text{---}}$ inputs, inc. 4 high-speed inputs	16 sink transistor outputs, inc. 4 high-speed outputs	2 x 0...10 V inputs	–	1	TM221C40U	0.630 1.389
				1	1	TM221CE40U	0.780 1.720

#### Options for Modicon TM221C●●●● logic controllers (3)

Description	Function	Reference	Weight kg/lb
I/O cartridges	2 analog inputs (12-bit resolution) configurable as: - 0...10 V voltage - 0...20 mA/4...20 mA current	TMC2AI2	0.025 0.055
	2 analog outputs (12-bit resolution) 0...10 V voltage Screw terminal version	TMC2AQ2V	0.025 0.055
	2 analog outputs (12-bit resolution) 4...20 mA current Screw terminal version	TMC2AQ2C	0.025 0.055
	2 temperature inputs (12-bit resolution) type K, J, R, S, B, E, T, N, C, PT100, PT1000, NI100, NI1000 Screw terminal version	TMC2TI2	0.025 0.055
Communication cartridge	1 additional serial link on screw terminal block	TMC2SL1 (4)	0.025 0.055
Cartridges for specific application	Hoisting application	TMC2HOIS01	0.025 0.055
	Packaging application	TMC2PACK01	0.025 0.055
	Conveyor system application	TMC2CONV01 (4)	0.025 0.055

(1) M221 controllers are supplied with:

- removable screw terminal blocks for connecting the I/O
- a removable screw terminal block for connecting the power supply
- a button cell backup battery (BR2032)
- a cable for connecting the analog inputs

(2) Each M221 logic controller has an embedded USB mini-B programming port.

(3) One cartridge for controllers with 16 and 24 I/O. Two cartridges maximum for controllers with 40 I/O, only one of which can be a communication cartridge.

(4) Just one cartridge per controller.

# Modicon M221 and M221 Book logic controllers

## Modicon M221 Book logic controllers



TM221M16RG



TM221M16T



TM221ME16RG



TM221ME16T



TM221M16TG



TM221M32TK



TM221ME32TK

References									
Modicon M221 Book logic controllers (1)									
24 V $\bar{\text{---}}$ power supply									
No. of logic I/O	Logic inputs	Logic outputs	Analog inputs	Embedded communication ports (2)	Ethernet (RJ 45)		Terminal block for I/O conn. Interval (mm/in.)	Reference	Weight kg/lb
					SL1 (RJ 45)	SL2 (RJ 45)			
16 inputs/ outputs	8 sink/source 24 V $\bar{\text{---}}$ inputs, inc. 4 high-speed inputs	8 relay outputs	2 x 0...10 V inputs	–	1	1	Screw (3.81/0.15)	<b>TM221M16R</b>	0.264 0.582
				–	1	1	Spring (3.81/0.15)	<b>TM221M16RG</b>	0.264 0.582
16 inputs/ outputs	8 sink/source 24 V $\bar{\text{---}}$ inputs, inc. 4 high-speed inputs	8 relay outputs	2 x 0...10 V inputs	1	1	–	Screw (3.81/0.15)	<b>TM221ME16R</b>	0.264 0.582
				1	1	–	Spring (3.81/0.15)	<b>TM221ME16RG</b>	0.264 0.582
16 inputs/ outputs	8 sink/source 24 V $\bar{\text{---}}$ inputs, inc. 4 high-speed inputs	8 source transistor outputs, inc. 2 high-speed outputs	2 x 0...10 V inputs	–	1	1	Screw (3.81/0.15)	<b>TM221M16T</b>	0.264 0.582
				–	1	1	Spring (3.81/0.15)	<b>TM221M16TG</b>	0.264 0.582
16 inputs/ outputs	8 sink/source 24 V $\bar{\text{---}}$ inputs, inc. 4 high-speed inputs	8 source transistor outputs, inc. 2 high-speed outputs	2 x 0...10 V inputs	1	1	–	Screw (3.81/0.15)	<b>TM221ME16T</b>	0.264 0.582
				1	1	–	Spring (3.81/0.15)	<b>TM221ME16TG</b>	0.264 0.582
32 inputs/ outputs	16 sink/source 24 V $\bar{\text{---}}$ inputs, inc. 4 high-speed inputs	16 source transistor outputs, inc. 2 high-speed outputs	2 x 0...10 V inputs	–	1	1	HE 10 connector	<b>TM221M32TK</b>	0.270 0.595
				1	1	–	HE 10 connector	<b>TM221ME32TK</b>	0.270 0.595

(1) M221 Book controllers are supplied with:

- removable terminal blocks (screw or spring-type depending on controller model) for connecting the I/O
- a removable screw terminal block for connecting the power supply
- a button cell backup battery (BR2032)
- a cable for connecting the analog inputs

(2) Each M221 Book logic controller has an embedded USB mini-B programming port.

# Modicon M221 and M221 Book logic controllers

Options, separate parts



TMH2GDB



ZB5AZ905



A9A15151



DX1AP52



XBTZ9980



TMASD1



TMAHOL02

## References

### Remote graphic display unit, mounting accessories, cable

Designation	Description	Unit reference	Weight kg/lb
Remote graphic display unit	<input type="checkbox"/> For data display and modification (1) <input type="checkbox"/> Contains 1 bezel key ZB5AZ905	TMH2GDB	0.170 0.37
Tightening tool	For tightening the cover on Ø 22 mm unit	ZB5AZ905	0.016 0.04
Mounting plate for symmetrical rail (Sold in lots of 4)	For clipping onto 35 mm (1.378 in.) symmetrical rail (1 hole Ø 22 mm (0.87 in.))	A9A15151	0.040 0.09
Metal bracket for panel mounting, threaded (Sold in lots of 10)	1 hole Ø 22 mm (0.87 in.) Mounted using 2 screws, 7 mm (0.28 in.) diameter	DX1AP52	0.065 0.014
Connecting cables	Equipped with an RJ 45 connector at each end Length: 2.5 m (8.202 ft.)	XBTZ9980	0.230 0.51
Used between TMH2GDB remote display unit and M221/M221 Book logic controller	Equipped with an RJ 45 connector at each end Length: 1 m (3.281 ft.)	VW3A1104R10	0.050 0.110

### Option

Industrial SD memory card	Application backup and program transfer Capacity: 256 MB	TMASD1	0.004 0.009
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### Separate parts

Designation	Description	Unit reference	Weight kg/lb
Mounting kit (Sold in lots of 10)	For plate or panel mounting of M221 and M221 Book controllers	TMAM2	0.065 0.143

### Replacement parts

Designation	Description	Reference	Weight kg/lb
Set of terminal blocks for connecting the power supply on M221 and M221 Book logic controllers	8 removable screw terminal blocks	TMAT2PSET	0.127 0.280
Set of terminal blocks for connecting the I/O on M221 controllers	Removable screw terminal connectors: 8 different connectors for equipping a TM221C●●●● logic controller (8 x I/O)	TMAT2CSET	0.127 0.280
Set of terminal blocks for connecting the I/O on M221 Book controllers	4 x 10-way and 4 x 11-way removable terminal blocks with screw terminals	TMAT2MSET	0.127 0.280
	4 x 10-way and 4 x 11-way removable terminal blocks with spring terminals	TMAT2MSETG	0.127 0.280
Set of battery holders	2 spare battery holders for M221 and M221 Book controllers	TMAHOL02	0.130 0.286
Backup battery	The battery supplied with each controller is not available as a spare part in the Schneider catalog. If a replacement part is needed, use a Panasonic battery type BR2032 only.		

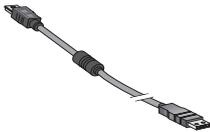
(1) Compatible only with M221 and M221 Book logic controllers whose firmware is version V1.3 or later. HMI pages can be configured with SoMachine Basic from version V1.3.

# Modicon M221 and M221 Book logic controllers

Programming software, expansion modules, connection cables



SoMachine Basic software



TCSXCNAMUM3P

## References

### Programming software

Description	For use with	Reference
SoMachine Basic	For Modicon M221 and M221 Book logic controllers	Please consult our website: <a href="http://www.schneider-electric.com">www.schneider-electric.com</a>

### Expansion modules

Description	For use with	Reference
Modicon TM3 expansion modules	For Modicon M221 and M221 Book logic controllers	Please consult our website: <a href="http://www.schneider-electric.com">www.schneider-electric.com</a>

### Connection cables

Description	Use	Length	Reference	Weight kg/lb
Programming cordsets	From the PC USB port to the USB mini-B port on M221 and M221 Book controllers	3 m (0.98 ft.)	TCSXCNAMUM3P (1)	0.065 0.143
		1.8 m (5.90 ft.)	BMXXCAUSBH018	0.065 0.143
Cable for connecting the analog inputs embedded in M221 and M221 Book controllers	Equipped with 1 dedicated removable connector at one end and bare wires at the other end	1 m (3.28 ft.)	TMACBL1	0.024 0.053

(1) Unshielded, non-grounded cable. Only for use on temporary connections. For permanent connections, use cable reference BMXXCAUSBH018.

# Modicon M221, M221 Book logic controllers

## Serial links

### Modbus protocols, character mode

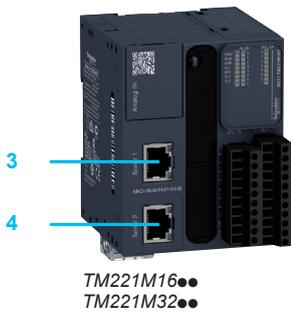
#### Presentation

RS 232/RS 485 serial links offer a simple solution to the communication needs of compact machines.

Modbus and ASCII standard communication protocols are used to connect numerous equipment items such as: HMIs, printers, energy meters, variable speed drives, motor starters, remote I/O (RIO), etc. Thanks to the I/O Scanner function, this equipment is just as easy to integrate into the application as the local I/O.

#### Description

- Modicon M221 Book logic controllers with 16, 24 or 40 I/O have the following on the front panel:
  - 1 A serial link port with an RJ 45 connector delivering a voltage of 5 V (200 mA) to supply an HMI or Bluetooth® adapter with power.
  - 2 A slot for a 2<sup>nd</sup> serial link port (with connection on screw terminals) by inserting the **TMC2SL1** communication cartridge or the **TMC2CONV01** application cartridge (1).
- Modicon M221 Book logic controllers with 16 or 32 I/O have the following on the front panel:
  - 3 A serial link port with an RJ 45 connector delivering a voltage of 5 V (200 mA) to supply an HMI or Bluetooth® adapter with power
  - 4 A 2<sup>nd</sup> serial port also equipped with an RJ 45 connector for **TM221M16●●** and **TM221M32●●** controllers (controllers without embedded Ethernet).

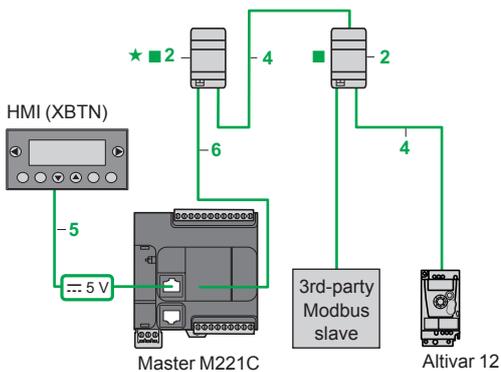


Controller Type	Embedded Ports	Optional Port (1 max. per controller)
	"Serial" or Serial 1" port, RJ 45 connector	"Serial 2" port, RJ 45 connector
		On TMC2SL1 or TMC2CONV01 option cartridges, connection on screw terminals
TM221C●●●●	RS 232/RS 485 with 5 V (200 mA) power supply for HMI or Bluetooth communication adapter (items 1/3)	RS 232/RS 485 (item 2)
TM221M●●●●		RS 485 (item 4)
TM221ME●●●●		-

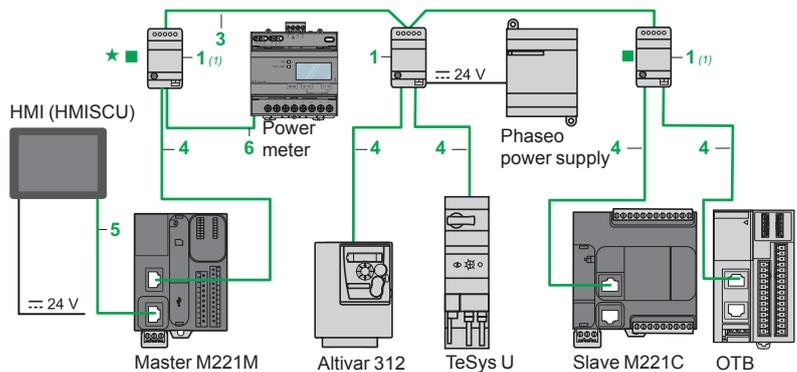
(1) TM221C40●●●● controllers have 2 slots for a cartridge; only one cartridge, TMC2SL1 or TMC2CONV01, can be used per controller. The other slot remains available for an analog I/O cartridge or an application cartridge.

#### Modbus serial link wiring system

##### Non-isolated bus



##### Isolated bus (recommended for bus > 10 m/32.808 ft)



- Total length of cables between M221 and ATV 12: ≤ 30 m (98.425 ft)  
 - Length of cable 4: ≤ 10 m (32.808 ft)  
 ★ Line polarization active. ■ Line termination

- Total length of cables between isolation boxes 1: ≤ 1,000 m (3,280.840 ft)  
 - Length of drop cables 4 or 5: ≤ 10 m (32.808 ft)  
 ★ Line polarization active. ■ Line termination  
 (1) Box powered by the logic controller.

## References

Tap-off and adapter components for RS 485 serial link						
Designation	Description	Item	Length	Unit reference	Weight kg lb	
 TWDXCAISO	<b>T-junction box with line isolation</b> Screw terminal block for trunk cable 2 x RJ 45 for tap-off	<input type="checkbox"/> Isolation of the RS 485 link (1) <input type="checkbox"/> Line termination (RC 120 Ω, 1 nF) <input type="checkbox"/> Line pre-polarization (2 R 620 Ω) <input type="checkbox"/> Power supply: 24 V $\overline{\text{---}}$ (screw terminals) or 5 V $\overline{\text{---}}$ (via RJ 45) <input type="checkbox"/> Mounting on 35 mm (1.378 in.) $\perp$	1	–	TWDXCAISO	0.100 0.220
	<b>T-junction box 1 RJ 45 for trunk cable</b> 2 x RJ 45 for tap-off	<input type="checkbox"/> Line termination (RC 120 Ω, 1 nF) <input type="checkbox"/> Line pre-polarization (2 R 620 Ω) <input type="checkbox"/> Mounting on 35 mm (1.378 in.) $\perp$	2	–	TWDXCAT3RJ	0.080 0.176
 TWDXCAT3RJ	<b>Modbus splitter box</b> Screw terminal block for trunk cable 10 x RJ 45 for tap-off	<input type="checkbox"/> Mounting on 35 mm $\perp$ , on plate or panel	–	–	LU9GC3	0.500 1.102
	<b>T-junctions</b> 2 x RJ 45 for trunk cable	1 integrated cable with RJ 45 connector for tap-off dedicated to Altivar variable speed drive	–	0.3 m 0.984 ft 1 m 3.281 ft	VW3A8306TF03 VW3A8306TF10	– –
 TSXSACA50	<b>Passive T-junction box</b>	<input type="checkbox"/> 1-channel line extension and tap-off on screw terminals <input type="checkbox"/> Line termination	–	–	TSXSACA50	0.520 1.146
	<b>RS 232C/RS 485 line converter</b>	<input type="checkbox"/> Max. data rate 19.2 Kbps. No modem signals <input type="checkbox"/> 24 V $\overline{\text{---}}$ /20 mA power supply <input type="checkbox"/> Mounting on 35 mm (1.378 in.) $\perp$	–	–	XGSZ24	0.100 0.220
<b>Cables and cordsets for RS 485 serial link</b>						
 LU9GC3	<b>RS 485 double shielded twisted pair trunk cables</b>	Modbus serial link, supplied without connector	3	100 m 328.064 ft	TSXCSA100	5.680 12.522
				200 m 656.168 ft	TSXCSA200	10.920 24.074
				500 m 1,640.420 ft	TSXCSA500	30.000 66.139
 TSXSACA50	<b>Modbus RS 485 cordsets</b>	2 x RJ 45 connectors	4	0.3 m 0.984 ft	VW3A8306R03	0.030 0.066
				1 m 3.281 ft	VW3A8306R10	0.050 0.110
				3 m 9.840 ft	VW3A8306R30	0.150 0.331
		1 x RJ 45 connector and 1 end with flying leads	6	1 m 3.281 ft	TWDXCAFJ010	0.060 0.132
				3 m 9.843 ft	VW3A8306D30	0.150 0.331
 XGSZ24	<b>Controller to Magelis HMI cordsets</b>	2 x RJ 45 connectors Compatible with: <input type="checkbox"/> Com Port 1 on XBTN200/N400/R400/RT500 (2) <input type="checkbox"/> Com Port 1 on XBTRT511/HMISTO/STU/SCU <input type="checkbox"/> Com Port 2 on XBTGT2●●0...7●●0 and HMIGTO	5	2.5 m 8.202 ft	XBZ9980	0.230 0.507
			5	10 m 32.81 ft	XBZ9982	–
		1 x RJ 45 connector and 1 x 25-way SUB-D connector Compatible with: <input type="checkbox"/> Com Port 1 on XBTN410/N410 and XBTR410/R411	–	2.5 m 8.202 ft	XBZ9938	0.210 0.463
		1 x RJ 45 connector and 1 x 9-way SUB-D connector Compatible with: <input type="checkbox"/> Com Port 1 on XBTGT2●●0...7●●0	–	2.5 m 8.202 ft	XBZ9908	–
 TWDXCAISO	<b>TMC2SL1 cartridge to Magelis HMI cordsets</b>	1 x RJ 45 connector and stripped wires Compatible with: <input type="checkbox"/> Com Port 1 on XBTRT511/HMISTO/STU/SCU <input type="checkbox"/> Com Port 2 on XBTGT2●●0...7●●0 and HMIGTO	–	3 m 9.843 ft	VW3A8306D30	0.150 0.331
 TWDXCAISO	<b>Line end adapter</b> Sold in packs of 2	For RJ 45 connector R = 120 Ω, C = 1 nF	–	–	VW3A8306RC	0.200 0.441
<b>Cordsets for RS 232 serial link</b>						
 TWDXCAISO	<b>Cordset for DTE terminal (printer) (3)</b>	Serial link for DTE (2) 1 x RJ 45 connector and 1 x 9-way female SUB-D connector	–	3 m 9.843 ft	TCSMCN3M4F3C2	0.150 0.331
 TWDXCAISO	<b>Cordset for DCE terminal (modem, converter)</b>	Serial link for point to point device (DCE) 1 x RJ 45 connector and 1 x 9-way male SUB-D connector	–	3 m 9.843 ft	TCSMCN3M4M3S2	0.150 0.331

(1) Line isolation recommended for line distances &gt; 10 m (32.808 ft).

(2) Can only be connected to the controller SL or SL1 ports in order to supply the Magelis terminal with power.

(3) If the terminal is equipped with a 25-way SUB-D connector, you will also need to order the 25-way female/9-way male SUB-D adapter TSXCTC07.

# Modicon M221 and M221 Book logic controllers

## Industrial Ethernet network

For Modicon M221, M221 Book, M241, and M251 logic controllers and Modicon TM4ES4 Ethernet switch module

### General

Industrial Ethernet is the term used to refer to industrial communication protocols using Ethernet standard physical layers such as:

- EtherNet/IP
- Modbus TCP
- TCP and UDP

The following equipment can be connected to an Industrial Ethernet network:

- industrial products (industrial communication protocols) such as controllers, variable speed drives, robots, etc.
- products using TCP/UDP-based proprietary protocols

In addition, it is possible to use different Ethernet Industrial protocols on the same network simultaneously.

### EtherNet/IP protocol

EtherNet/IP is an industrial communication protocol based on CIP (Common Industrial Protocol), owned and managed by the ODVA, an independent standards organization ([www.odva.org](http://www.odva.org)).

EtherNet/IP is the result of implementing CIP on standard Ethernet. EtherNet/IP operates on the same device and the same infrastructure as Modbus TCP, and both protocols can be activated simultaneously on the network at any time.

EtherNet/IP is a robust protocol for use with sophisticated devices, such as cameras and robots.

### Advanced services and outstanding performance

EtherNet/IP is object-oriented. In each EtherNet/IP device, the data is arranged as objects and each device can be associated with several types of object depending on its intended use. Integration of devices is made easy thanks to predefined and standard objects.

The EtherNet/IP protocol uses an Originator/Adapter architecture to exchange data.

### Modbus TCP/IP protocol

Modbus has been the industry communication standard since 1979. During the internet revolution, Modbus was combined with Ethernet to form Modbus TCP, a completely open Ethernet protocol.

### Modbus TCP, simple and open

The Modbus application layer is simple and universally familiar with its 9 million installed connections.

- Thousands of manufacturers have already implemented this protocol. Many have already developed a Modbus TCP connection and numerous products are currently available.
- The simplicity of Modbus TCP enables any fieldbus device, such as an I/O module, to communicate over Ethernet without the need for a powerful microprocessor or a lot of internal memory.

### Modbus TCP, a standard

- The application protocol is identical on Modbus serial link and Modbus TCP; messages can be routed from one network to the other without converting the protocol.
- Since Modbus operates on the TCP higher layer, users benefit from IP routing, thus enabling devices located anywhere in the world to communicate without worrying about the distance between them. Modbus and Modbus TCP are recognized as a fieldbus by the international standard IEC/EN 61158. They also comply with the “national Chinese standard” managed by ITEI.

The Modbus TCP protocol uses a Client/Server architecture to exchange data.

# Modicon M221 and M221 Book logic controllers

## Industrial Ethernet network

For Modicon M221, M221 Book, M241, and M251 logic controllers and Modicon TM4ES4 Ethernet switch module

### Modicon M221, M241, and M251 logic controllers

The embedded Ethernet communication ports in Modicon M221, M241, and M251 logic controllers and in the Modicon TM4ES4 communication module optimize the capability for integration into factory network architectures.

Modicon M221, M241, and M251 logic controllers can be easily integrated into typical architectures:

- machine-to-device (variable speed drives, remote I/O modules, operator dialog terminals) with the I/O Scanner function
- machine-to-machine with the NGVL function
- machine-to-supervisory system with the Modbus Client/Server and EtherNet/IP adapter functions

Ethernet also brings transparency to the factory, in particular - thanks to the firewall functions - making it possible to perform the following functions securely from any point on the network:

- program, monitor a controller, or download an application
- access device parameters (variable speed drives, for example)

A simple web browser can be used to access machines anytime anywhere, using a tablet or smartphone, for example, by means of the Web servers embedded in Modicon M241 and M251 controllers.

Security can be enhanced through the use of VPN modems; refer to our partner program on our website [www.schneider-electric.com](http://www.schneider-electric.com) > Products and Services > Automation and Control > Collaborative Automation Partner Program.

### Main devices supported

Device	Protocols supported			Integration tools in SoMachine (1)
	TCP/UDP	Modbus TCP	EtherNet/IP	
Altivar 32	-	✓	✓	FDR, DTM, TVDA
Altivar 320	-	✓	✓	FDR, DTM, TVDA
Altivar 340	-	✓	✓	FDR, DTM, TVDA
Altivar 71	-	✓	✓	FDR, DTM, TVDA
Lexium 32 M	-	✓	✓	FDR, DTM, TVDA
Lexium ILA	-	✓	✓	FDR, librairies, TVDA
Lexium ILE	-	✓	✓	FDR, librairies, TVDA
Lexium ILS	-	✓	✓	FDR, librairies, TVDA
OsiSense XG	-	✓	✓	TVDA
OsiSense XUW	-	-	✓	TVDA
Modicon OTB1EODM9LP	-	✓	-	Librairies
Preventa XPSMCM	-	(2)	✓	TVDA for EtherNet/IP
Harmony XB4R, XB5R	-	✓	-	DTM, librairies
Modicon M221, M241, M251	✓	✓	✓	User parameters (for EtherNet/IP only), librairies
Device supplied with EDS file (1)	-	-	✓	User parameters
Generic device	✓	✓	✓	User parameters (for EtherNet/IP only), librairies

### Web servers

#### Preconfigured Web server

Using a simple web browser available on PC, smartphone, or tablet, this server authorizes the following "ready-to-use" functions:

- With no prior programming
  - Display of I/O states
  - Diagnostics of controller, expansion modules, and communication modules
  - Communication port diagnostics
  - I/O Scanner function diagnostics
  - Maintenance and configuration functions (EtherNet/IP, firewall, etc.)
- After configuration
  - Visualization of data values
  - Visualization of how these data values evolve over time (oscilloscope function)

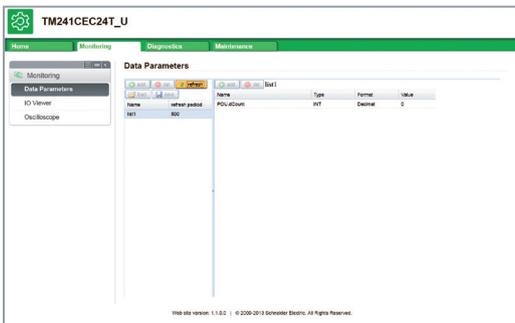
#### Web visualization server

SoMachine programming software is used to create customized pages for visualizing and monitoring devices. These pages can also be accessed on any mobile device such as a tablet or smartphone with any operating system (iOS, Android, Windows).

(1) SoMachine configuration software: please refer to catalog [DIA3ED2140110EN.pdf](#) or our website [www.schneider-electric.com](http://www.schneider-electric.com)

- FDR: Fast Device Replacement
- DTM: Device Type Manager
- TVDA: Tested, Validated, Documented Architectures

(2) Integration as a generic device



Preconfigured Web server



Web visualization server

# Modicon M221 and M221 Book logic controllers

## Industrial Ethernet network

For Modicon M221, M221 Book, M241, and M251 logic controllers and Modicon TM4ES4 Ethernet switch module

### Description of Ethernet services

#### Network Global Variable List (NGVL)

The NGVL protocol allows a controller to share data with other controllers on a local Ethernet network (LAN) or subscribe to data published by other controllers that support the NGVL protocol thus allowing, for example, synchronization between control platforms.

#### I/O scanning (Industrial Ethernet Manager)

The Industrial Ethernet Manager service is used to manage the exchange of remote I/O states over Ethernet after a simple configuration operation, with no need for special programming.

I/O scanning is performed transparently by means of read/write requests in accordance with the Modbus TCP or EtherNet/IP protocol; this is called Scanner Manager on Modbus TCP or Scanner Manager on EtherNet/IP.

#### Modbus TCP Slave

This function can be used to create a dedicated I/O table in the controller that can be accessed via the Modbus TCP protocol and by a controller with the Modbus TCP I/O Scanner function.

#### Fast Device Replacement (FDR)

This service uses standard address management technologies (BOOTP, DHCP) and the TFTP (Trivial File Transfer Protocol) file management service in order to simplify maintenance of Ethernet products.

The FDR service is used to replace a device with a new device; the device is detected, reconfigured, and automatically rebooted by the system.

#### Access to files via FTP (File Transfer Protocol)

This service provides access to the controller files from, for example, a PC (FTP client) and is used to exchange files such as application programs, data, etc.

This service can be accessed even if the controller has no application program in its memory.

#### Dynamic Host Configuration Protocol (DHCP)

This protocol is used to automatically assign an address to a controller (DHCP/BOOTP client). This address can be:

- fixed and determined either in the SoMachine software or included in a post-configuration file
- assigned by a controller with the DHCP server or BOOTP server function (such as the **TM251MESE** logic controller)

#### SNMP (Simple Network Management Protocol)

From a network management station, SNMP is used to monitor and control the Ethernet architecture components, allowing detected errors to be diagnosed quickly.

The SNMP protocol is used to access configuration and management objects that are contained in the device MIBs (management information bases).

Modicon M241 and M251 controllers support the "MIB 2 Standard" SNMP network management interface. This interface accesses a first level of network management; it enables the manager to identify the devices making up the architecture and retrieve general information about configuration and operation of the Ethernet Modbus TCP interfaces.

#### IP address filter (Whitelisting)

IP addresses that are authorized to access the controller can be loaded in the controller from either an SD card or an FTP client.

#### Locking communication protocols

Not only SoMachine, NetManage (1), and SNMP communication protocols but also Modbus, WEB, and FTP servers can be locked individually in the SoMachine software.

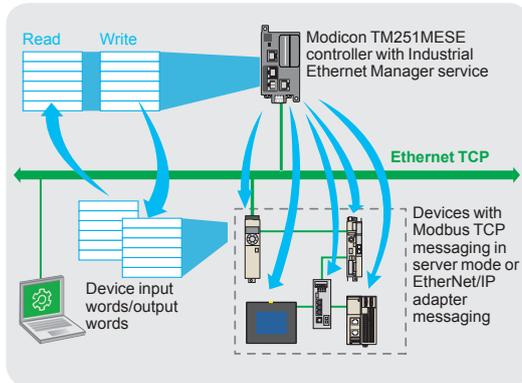
#### EtherNet/IP adapter

This function can be used to create a dedicated I/O table in the controller that can be accessed via the EtherNet/IP protocol and by a controller with the EtherNet/IP originator function. EtherNet/IP adapter is used in the same way for EtherNet/IP as a Modbus TCP slave.

#### EtherNet/IP originator

Controllers with this function trigger exchanges with devices featuring the EtherNet/IP adapter function. EtherNet/IP originator is used in the same way for EtherNet/IP as a Modbus TCP master.

(1) The NetManage function can automatically detect which controllers are present on the network. It also offers the option of straightforward connection to any controller present on the network in order to identify it physically by means of a visual or audible message and modify its parameters or manage the resident application.



I/O scanning (Industrial Ethernet Manager)

# Modicon M221 and M221 Book logic controllers

Industrial Ethernet network

For Modicon M221, M221 Book, M241, and M251 logic controllers and Modicon TM4ES4 Ethernet switch module

## Transparent Ready class and functions

	Logic controllers				TM4ES4 Ethernet switch module
	TM221ME●●●, TM221CE●●●	TM241CE●●●	TM251MESC	TM251MESE	
Transparent Ready class	A10	B20			
Internet protocol version	IPV4				
<b>Ethernet services</b>					
Programming, downloading, monitoring					
Firmware update	–				
Modbus TCP/IP (Client/Server)					
Modbus TCP Slave					
EtherNet/IP adapter					
EtherNet/IP originator	–	(1)	–		
Data exchange – NVGL and IEC VAR ACCESS	–				
WEB server	–				
SNMP.MIB2 (Client/Server) network management	–				
Scanner Manager on Modbus TCP	–	(1)	–	Ethernet port 2	
Scanner Manager on EtherNet/IP	–	(1)	–	Ethernet port 2	
FTP (Client/Server)	–				
DHCP Client				Ethernet port 1	
DHCP Server	–	(1)	–	Ethernet port 2	–
FDR	–	(1)	–		–
SMS	(2)				
SQL Client (3)	–				–
E-mail, based on TCP/UDP library	–				–
<b>Security functions</b>					
IP address filter (Whitelisting)	–				
Locking communication protocols					
Locking IP address routing	–				

(1) Except on TM241CEC24● controller.

(2) With dedicated function block in SoMachine Basic software.

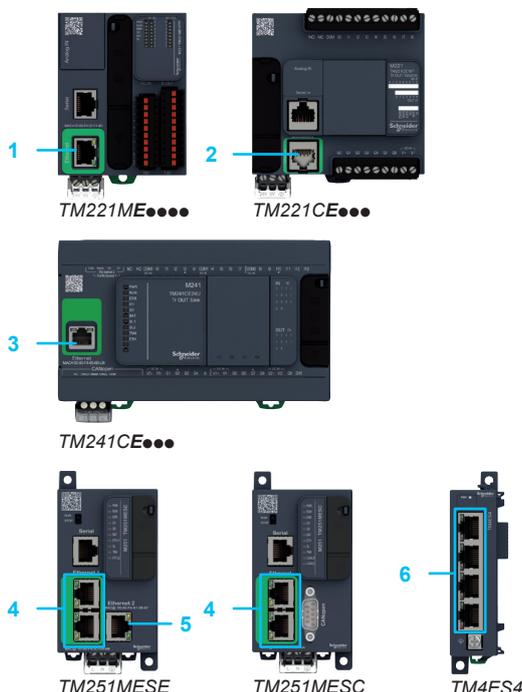
(3) For more information, refer to the “SoMachine Configuration Software” catalog on our website [www.schneider-electric.com](http://www.schneider-electric.com).

## Modicon M241 and M251 controller network characteristics

Topology	Daisy chain and star using switches
Bandwidth	10/100 Mbps
EtherNet/IP scanner performance	Up to 16 slave devices controlled by the controller in 10 ms
Ethernet Modbus TCP scanner performance	Up to 64 slave devices controlled by the controller in 64 ms

Note: When EtherNet/IP and Modbus TCP devices are controlled on the same network simultaneously, a maximum of 16 devices can be controlled (EtherNet/IP + Modbus TCP).

## Ethernet ports on logic controllers and the Ethernet switch module



### M221 logic controllers

- 1 On TM221ME●●● controllers: RJ45 connector for Ethernet network, with speed and activity LED
- 2 On TM221CE●●● controllers: RJ45 connector for Ethernet network, with speed and activity LED

### M241 logic controllers

- 3 On TM241CE●●● controllers: RJ45 connector for Ethernet network, with speed and activity LED

### M251 logic controllers

- 4 On TM251MESE and TM251MESC controllers: 2 connectors connected by an RJ45 internal switch for “Machine or Factory” Ethernet network, with speed and activity LED
- 5 On TM251MESE controller: RJ45 connector for “fieldbus” Ethernet network with speed and activity LED. This port can be used with the Industrial Ethernet Manager function.

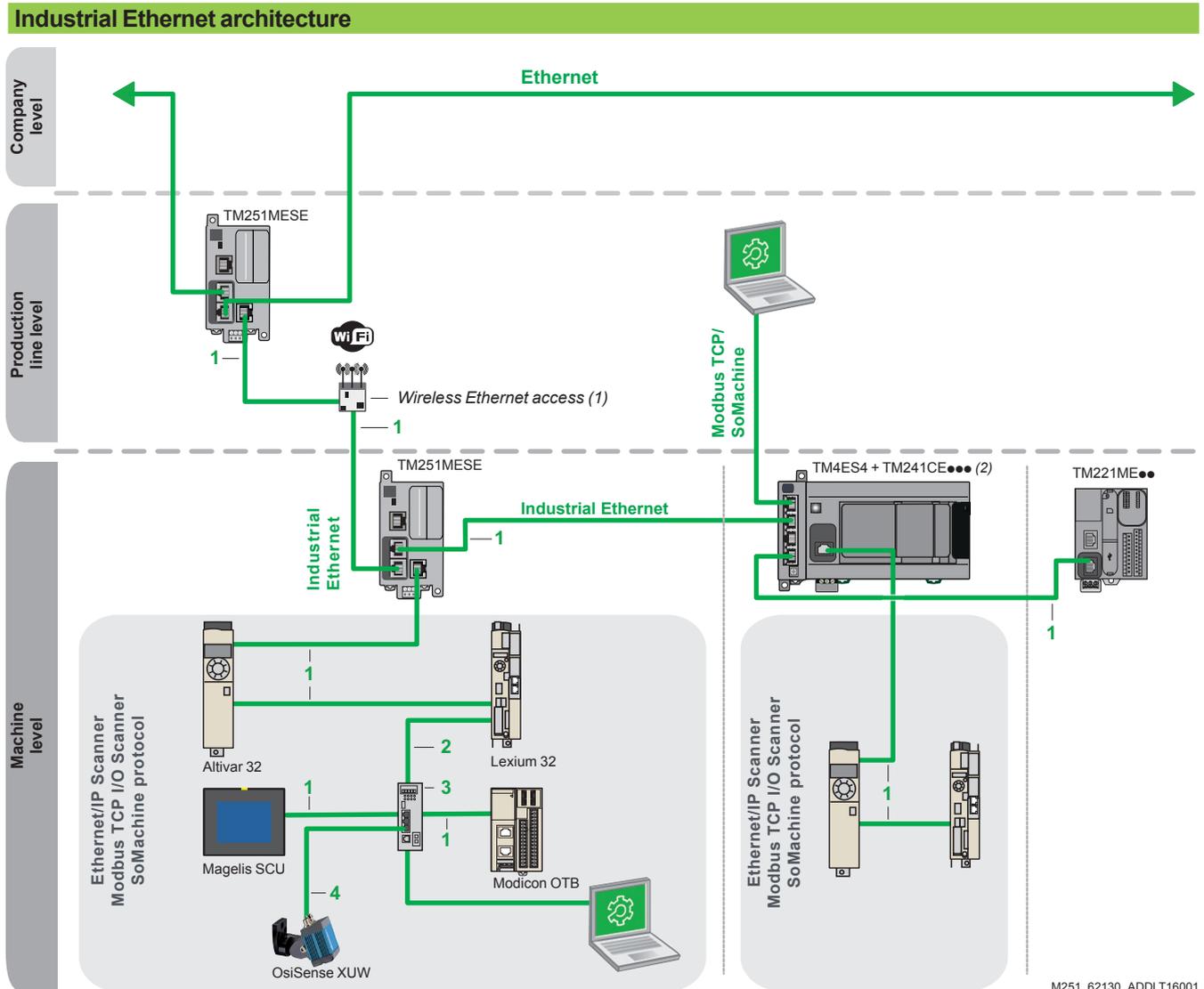
### TM4ES4 Ethernet switch communication module

- 6 4 RJ45 connectors for Ethernet network with speed and activity LED

# Modicon M221 and M221 Book logic controllers

## Industrial Ethernet network

For Modicon M221, M221 Book, M241, and M251 logic controllers and Modicon TM4ES4 Ethernet switch module



**Note:** The ports on M251 controllers and the TM4ES4 communication module cannot be used to create redundant architectures.

(1) Wireless Ethernet access, see our partner program.

(2) Excludes Modicon TM241CEC24 controller.

Items 1, 2, and 3: see references on next page.

Item 4: Ethernet jumper cables XGSZ●2E45● (M12 straight/RJ45, shielded cable, straight cabling) for OsiSense XUW vision sensors.

For more information, see our partner website [www.tesensors.com](http://www.tesensors.com)

### Shielded copper connection cables

ConneXium shielded connection cables are available in 2 versions to meet the requirements of the various current standards and approvals:

#### ■ EIA/TIA 568 shielded twisted pair cables for CE market

These cables conform to:

- EIA/TIA-568 standard, category CAT 5E
- IEC 11801/EN 50173-1 standard, class D

Their fire resistance conforms to:

- NF C32-070 standard, class C2
- IEC 322/1 standards
- Low smoke zero halogen (LSZH)

#### ■ EIA/TIA 568 shielded twisted pair cables for UL market

These cables are:

- CEC type FT-1
- NEC type CM

A new range of ConneXium fully shielded preassembled cables has been specially designed for use in harsh industrial environments. These cables combine a category 5E shielded cable and RJ45 connectors reinforced with a metal profile.

# Modicon M221 and M221 Book logic controllers

Industrial Ethernet network

For Modicon M221, M221 Book, M241, and M251 logic controllers and Modicon TM4ES4 Ethernet switch module



## References

### EIA/TIA 568 shielded twisted pair cables for C€ market

Description	Pre-formed connectors at both ends	Item	Type	Length m (ft.)	Reference	Weight kg
Straight-through copper cables C€ compatible	2 RJ45 connectors For connection to terminal equipment (DTE)	1	Standard	2 (6.56)	490NTW00002	–
				5 (16.41)	490NTW00005	–
				12 (39.37)	490NTW00012	–
				40 (131.23)	490NTW00040	–
				80 (262.467)	490NTW00080	–
		1	Ruggedized	1 (3.28)	TCSECE3M3M1S4	–
				2 (6.56)	TCSECE3M3M2S4	–
				3 (9.84)	TCSECE3M3M3S4	–
				5 (16.40)	TCSECE3M3M5S4	–
				10 (32.81)	TCSECE3M3M10S4	–

### Shielded twisted pair cables for UL market

Description	Pre-formed connectors at both ends	Item	Type	Length m (ft.)	Reference	Weight kg
Straight-through copper cables UL compatible	2 RJ45 connectors For connection to terminal devices (DTE)	1	Standard	2 (6.56)	490NTW00002U	–
				5 (16.40)	490NTW00005U	–
				12 (39.37)	490NTW00012U	–
				40 (131.23)	490NTW00040U	–
				80 (262.47)	490NTW00080U	–
		1	Ruggedized	1 (3.28)	TCSECU3M3M1S4	–
				2 (6.56)	TCSECU3M3M2S4	–
				3 (9.84)	TCSECU3M3M3S4	–
				5 (16.40)	TCSECU3M3M5S4	–
				10 (32.81)	TCSECU3M3M10S4	–

### Do it Yourself copper cable and connectors

The **ConneXium** “Do it Yourself” offer consists of 2 connector references (M12 and RJ45) and 1 cable reference - 300 m (984.25 ft) reel - enabling Ethernet 10/100 Mbps network cables to be made up in situ. The maximum length of cables made up in this way is 80 m (262,47 ft.). They are assembled using only a knife and wire cutters (no special tool is required).

Description	Characteristics	Item	Length m (ft.)	Reference	Weight kg
Ethernet copper cable 2 shielded twisted pairs 24 AWG	Conforms to the above-mentioned standards and approvals	2	300 (984.25)	TCSECN300R2	–
RJ45 connector	Conforms to EIA/TIA-568-D	2	–	TCSEK3MDS	–



### ConneXium unmanaged switches, 3, 4, and 5 ports, twisted pair, and optical fiber

Description	Interfaces	Item	Reference	Weight kg lb
ConneXium switches, unmanaged	3 x 10BASE-T/100BASE-TX ports (copper cable), RJ45 shielded connectors	3	TCSESU033FN0	0.113 0.249
	■ 4 x 10BASE-T/100BASE-TX ports (copper cable), RJ45 shielded connectors ■ 1 x 100BASE-FX port (multimode optical fiber), SC duplex connector	3	TCSESU043F1N0	0.120 0.265
	5 x 10BASE-T/100BASE-TX ports (copper cable), RJ45 shielded connectors	3	TCSESU053FN0	0.113 0.249

Other wiring components are available; please consult the **ConneXium** offer on our website [www.schneider-electric.com](http://www.schneider-electric.com)

# Modicon M221 and M221 Book logic controllers

Compatibility of Modicon TM2 expansion modules with Modicon M221, M221 Book, M241 and M251 logic controllers

Compatibility					
Modicon TM2 expansion modules		Logic controllers			
		M221	M221 Book	M241	M251
<b>Digital modules</b>	TM2DDI8DT				
	TM2DDI16DT				
	TM2DDI16DK				
	TM2DDI32DK				
	TM2DAI8DT				
	TM2DDO8UT				
	TM2DDO8TT				
	TM2DDO16UK				
	TM2DDO16TK				
	TM2DDO32UK				
	TM2DDO32TK				
	TM2DRA8RT				
	TM2DRA16RT				
	TM2DMM8DRT				
	TM2DMM24DRF				
<b>Analog modules</b>	TM2AMI2HT				
	TM2AMI2LT				
	TM2AMI4LT				
	TM2AMI8HT				
	TM2ARI8LRJ				
	TM2ARI8LT				
	TM2ARI8HT				
	TM2AMO1HT				
	TM2AVO2HT				
	TM2AMM3HT				
	TM2ALM3LT				
	TM2AMM6HT				
	<b>Expert modules (counter modules)</b>	TM200HSC206DT			
TM200HSC206DF					

Compatible

Not compatible

**Note:** The TWD●●●●● range of expansion and communication modules is not compatible with the Modicon M221/M221 Book/M241/M251 logic controller offer.

## Configuration

- Modicon TM3 expansion modules are powered by logic controllers via the bus connector on the side of the products. This connector delivers 2 voltages, 5 V and 24 V. For the Modicon M221 and M221 Book logic controllers, you should therefore calculate the total TM3 expansion module consumption and check that it is definitely compatible with the maximum current delivered by the controller. This information is available on each product data sheet or in the hardware reference guide. This can be checked very quickly in the SoMachine Basic programming software setup page.
- For Modicon M241 and M251 logic controllers, up to 7 TM2 expansion modules can be attached regardless of these module references.



The Next Generation



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