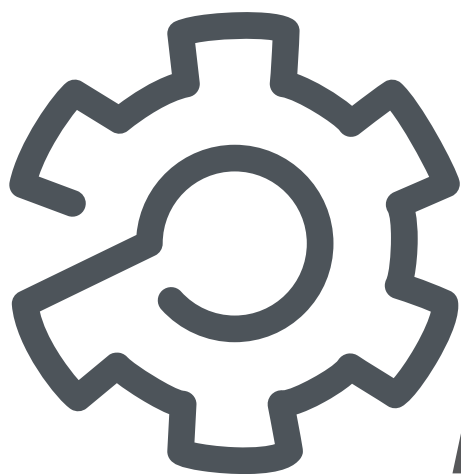


Machine  truxure™

Industrial Ethernet

Catalog

March **2016**



Ethernet
Ethernet

Schneider
 Electric

General content

Industrial Ethernet network

■ For Modicon M221, Modicon M241 and Modicon M251 logic controllers and Modicon TM4 Ethernet switch module

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Industrial Ethernet

For Modicon M221, M241 and M251 logic controllers and 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

On an Ethernet Industrial network, it is possible to connect:

- 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.

The 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).

EtherNet/IP is the result of implementing CIP protocol 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, robots, etc.

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/Target architecture for data exchanges.

The Modbus TCP 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 on 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/IP 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 for data exchanges.

Industrial Ethernet

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

Modicon M221, M241 and M251 logic controllers

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

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

- machine to devices (variable speed drives, remote I/O modules, operator dialogue terminals) with the I/O Scanner function
- machine to machine with the NGVL function
- machine to supervision with the Modbus Client/Server function and EtherNet/IP adapter

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

- 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, using the web servers embedded in Modicon M241 and M251 controllers.

Safety can be enhanced by the use of VPN modems; refer to our Partner program on our website www.schneider-electric.com > Products and Services > Automation and Control > Collaborative Automation Partner Program.

Main devices supported

Device	Protocols supported			Tools for integration in the SoMachine software (1)
	TCP/UDP	Modbus TCP	EtherNet/IP	
Altivar 32	–	✓	✓	FDR, DTM, TVDA
Altivar 71	–	✓	✓	FDR, DTM, TVDA
Lexium 32 M	–	✓	✓	FDR, DTM, TVDA
Lexium ILA	–	✓	✓	FDR, libraries, TVDA
Lexium ILE	–	✓	✓	FDR, libraries, TVDA
Lexium ILS	–	✓	✓	FDR, libraries, TVDA
OsiSense XG	–	✓	✓	TVDA
OsiSense XUW	–	–	✓	TVDA
Modicon OTB1EODM9LP	–	✓	–	Libraries
Preventa XPSMCM	–	(2)	✓	TVDA for EtherNet/IP
Harmony XB4R, XB5R	–	✓	–	DTM, libraries
Modicon M221, M241, M251	✓	✓	✓	User parameters (only for EtherNet/IP), libraries
Device supplied with EDS file (1)	–	–	✓	User parameters
Generic device	✓	✓	✓	User parameters (only for EtherNet/IP), libraries

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 the I/O states
 - Controller diagnostics, and of its expansion and communication modules
 - Communication port diagnostics
 - I/O Scanner function diagnostics
 - Maintenance and configuration functions (EtherNet/IP, firewall, etc.)
- After configuration
 - Viewing data values
 - Viewing the evolution of these data values over time (oscilloscope function)

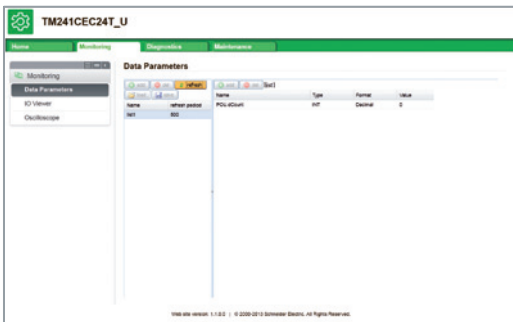
Viewer Web server

The SoMachine programming software is used to create customized pages for viewing 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 consult our catalog [DIA3ED2140110EN.pdf](#) or our website 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



Viewer Web server

Industrial Ethernet

For Modicon M221, M241 and M251 logic controllers and 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 and 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 on the Ethernet network 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.

Slave Modbus TCP

This function can be used to create a dedicated I/O table in the controller, which 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 one; 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 can be used to assign an address to a controller (client DHCP/BOOTP) automatically. 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, the SNMP protocol is used to monitor and control the Ethernet architecture components, meaning problems are 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), SNMP communication protocols but also Modbus, WEB and FTP servers can be locked individually in the SoMachine software.

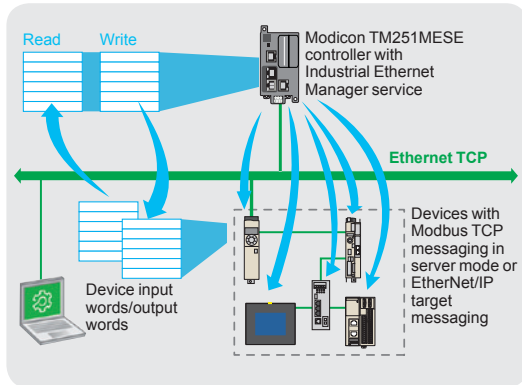
EtherNet/IP target

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 target acts 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 target function. EtherNet/IP originator acts 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)

Transparent Ready class and Functions

	Logic controllers, Ethernet switch module			
	TM221ME●●●/TM221CE●●●	TM241CE●●●, TM4ES4	TM251MESc	TM251MESE
Transparent Ready class	A10	B20		
Internet protocol version	IPV4			
Ethernet services				
Programming, downloading, monitoring				
Firmware update	–			
Modbus TCP/IP (client & server)				
Modbus TCP slave				
EtherNet/IP target				
EtherNet/IP originator	–	–	–	
Data exchange – NVGL and IEC VAR ACCESS	–			
Web server	–			
SNMP network management MIB2	–			
Scanner Manager on Modbus TCP	–	–	–	Ethernet port 2
Scanner Manager on EtherNet/IP	–	–	–	Ethernet port 2
FTP file transfer	–			
DHCP Client dynamic configuration				Ethernet port 1
DHCP Server dynamic configuration	–	–	–	Ethernet port 2
FDR faulty device replacement	–	–	–	
SMS	(1)			
Security functions				
IP address filter (Whitelisting)	–			
Locking communication protocols				
Locking IP address routing	–			

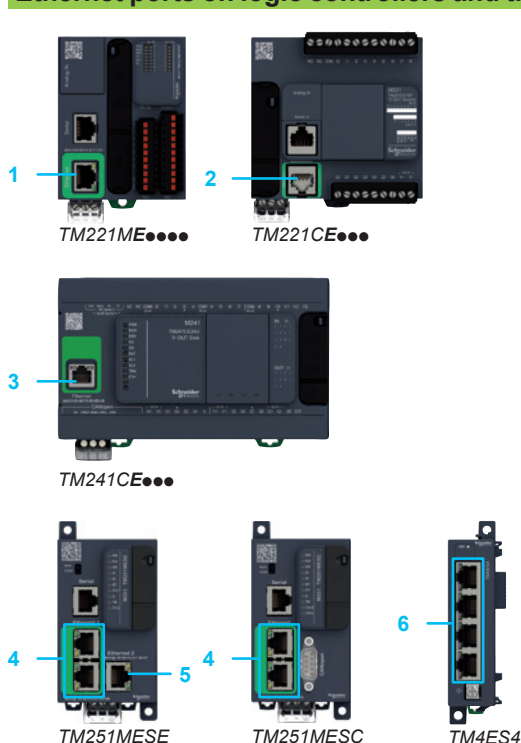
(1) With dedicated function block in the SoMachine Basic software.

Modicon 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 (Ethernet 2 connector), 16 devices maximum can be controlled (EtherNet/IP + Modbus TCP).

Ethernet ports on logic controllers and the Ethernet switch module



M221 logic controllers

- 1 On **TM221ME●●●●** controllers: RJ 45 connector for Ethernet network, with exchange speed and activity LED indicator.
- 2 On **TM221CE●●●●** controllers: RJ 45 connector for Ethernet network, with exchange speed and activity LED indicator.

M241 logic controllers

- 3 On **TM241CE●●●●** controllers: RJ 45 connector for Ethernet network, with exchange speed and activity LED indicator.

M251 logic controllers

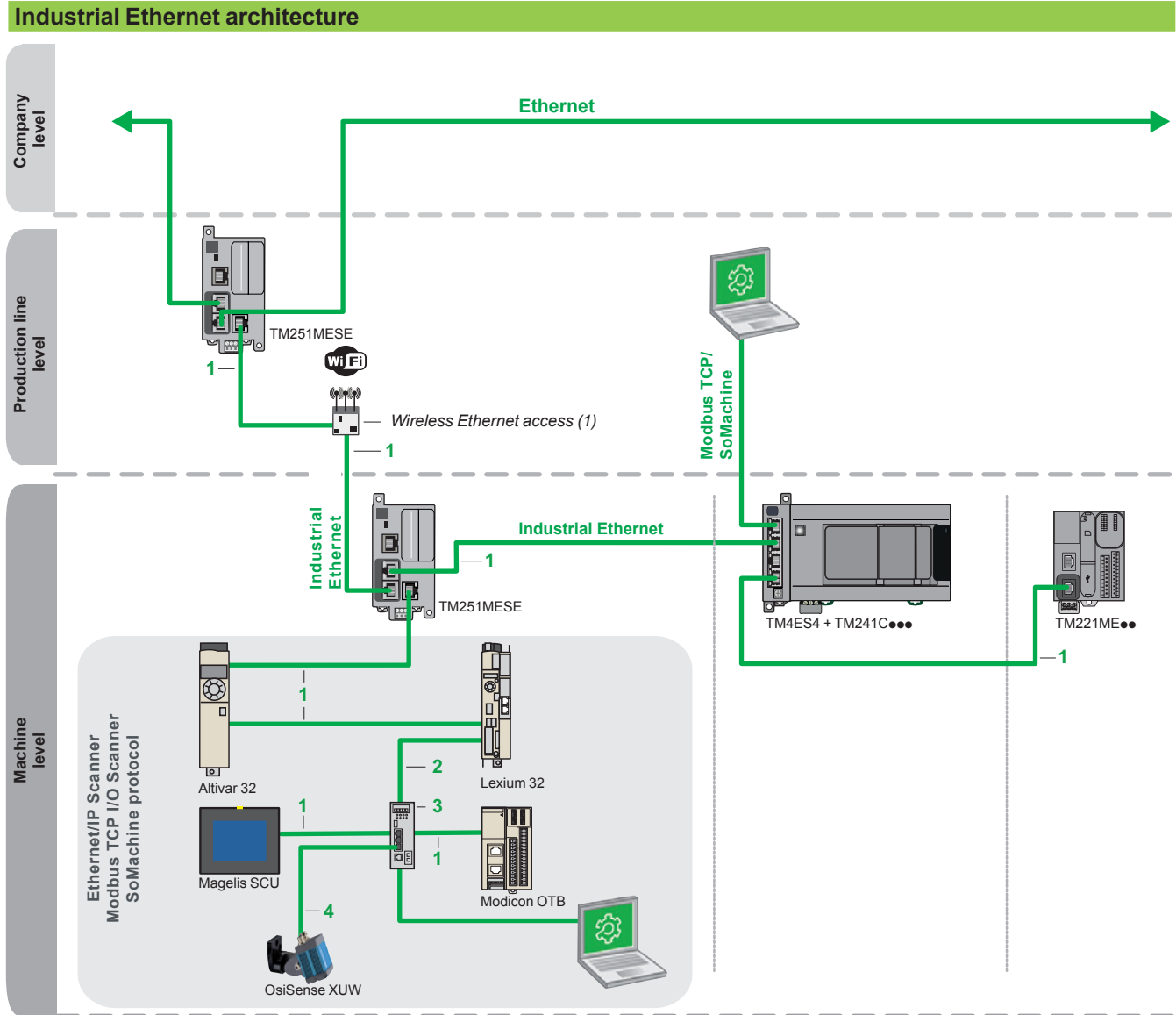
- 4 On **TM251MESE** and **TM251MESc** controllers: 2 connectors connected by an RJ 45 internal switch for “Machine or Factory” Ethernet network, with exchange speed and activity LED indicator.
- 5 On **TM251MESE** controller: RJ 45 connector for “fieldbus” Ethernet network with exchange speed and activity LED indicator. This port can be used with the Industrial Ethernet Manager function.

TM4ES4 Ethernet switch communication module

- 6 4 type RJ 45 connectors for Ethernet network with exchange speed and activity LED indicator.

Industrial Ethernet

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



NB: 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.

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

Item 4: Ethernet jumper cables XGSZ●2E45●● (M12 straight/RJ 45, shielded cable, straight cabling) for OsiSense XUW vision sensors. More information on our partner website www.tesensors.com

Shielded copper connection cables

ConneXium shielded connection cables are available in two 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 RJ 45 connectors reinforced with a metal profile.

References

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

Description	End fittings	Item	Type	Length m (ft.)	Reference	Weight kg
Straight-through copper cables, C€ compatible	2 RJ 45 connectors For connection to terminal devices (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	–	



TCSECE3M3M1S4

Shielded twisted pair cables for UL market

Description	End fittings	Item	Type	Length m (ft.)	Reference	Weight kg
Straight-through copper cables, UL compatible	2 RJ 45 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 RJ 45) 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 standards and approval listed above	2	300 (984.25)	TCSECN300R2	–
RJ 45 connector	Conforms to EIA/TIA-568-D	2	–	TCSEK3MDS	–

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

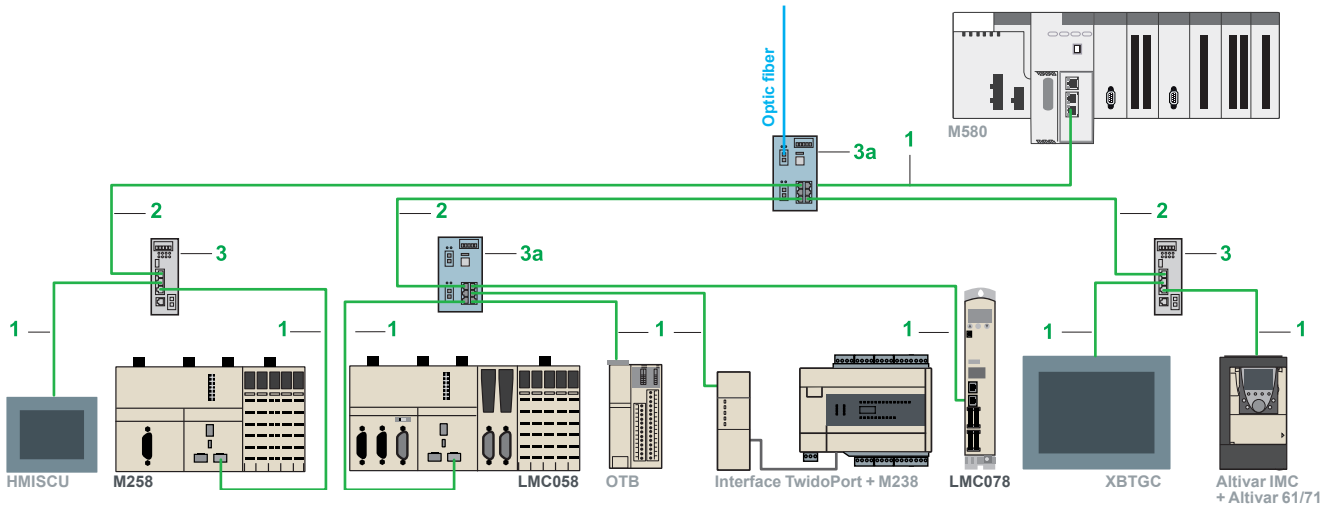
Description	Interfaces	Item	Reference	Weight kg lb
ConneXium unmanaged switches	3 x 10BASE-T/100BASE-TX ports (copper cable), RJ 45 shielded connectors	3	TCSESU033FN0	0.113 0.249
	■ 4 x 10BASE-T/100BASE-TX ports (copper cable), RJ 45 shielded connectors ■ 1 x 100BASE-FX port (multimode fiber), duplex SC connector	3	TCSESU043F1N0	0.120 0.265
	5 x 10BASE-T/100BASE-TX ports (copper cable), RJ 45 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



TCSESU053FN0

Industrial Ethernet or EtherNet/IP network architecture



Transparent Ready class and Functions

	M258 logic controllers	LMC058 motion controllers	LMC078 motion controllers
Transparent Ready class	B20		
Internet protocol version	IPv4		
Ethernet Services			
Programming, downloading, monitoring			
Firmware update			
Modbus TCP/IP (client & server)			
Modbus TCP slave			
EtherNet/IP target			
EtherNet/IP originator	-	-	-
Data exchange – NVGL and IEC VAR ACCESS			
WEB visu			
Web server			-
SNMP network management MIB2			
Scanner Manager on Modbus TCP	-	-	-
Scanner Manager on EtherNet/IP	-	-	-
FTP file transfer			
DHCP Client dynamic configuration			
DHCP Server dynamic configuration	-	-	-
FDR faulty device replacement	-	-	-
SMS			
Security functions			
IP address filter (Whitelisting)			
Locking communication protocols (fire wall)			
Locking IP address routing			

Compatible

References (1)

Shielded copper connection cables

ConneXium shielded copper connection cables are available in two versions to comply with the different standards and approvals in force:

- Shielded twisted pair copper cables to standard EIA/TIA 568**
 These cables conform to: standard EIA/TIA 568, category CAT 5E, and standard IEC 11801/EN 50173, class D.
 Their flame resistance conforms to NFC 32070# classification C2, and standards IEC 322/1, Low Smoke Zero Halogen (LSZH).
- Shielded twisted pair copper cables, UL and CSA 22.1 approved**
 These cables conform to standards UL and CSA 22.1. Their flame resistance conforms to NFPA 70.

“Do It Yourself” cable and connectors

The ConneXium “Do It Yourself” range allows the user to make up Ethernet copper cables on site and to the required length. They are designed for cabling Ethernet 10/100 Mbit/s networks. The maximum length of cables made up in this way is 80 m. They can be assembled quickly using a knife and cutting pliers (no special tools are required).

Description	Conforming to	Length m (ft.)	Reference	Weight kg/ lb
Ethernet copper cable 2 shielded twisted pairs 24 AWG	The above-mentioned standards and approvals	300 (984,25)	TCSECN300R2	-
RJ 45 connector	EIA/TIA-568-D	-	TCSEK3MDS	-
M12 connector	IEC 60176-2-101	-	TCSEK1MDRS	-

(1) Other versions (fibre optic, switches, ...): please consult the ConneXium range offer on our web site www.schneider-electric.com



490NT●000●●



TCSESU043F1N0



TCSESM043F2C●0



499NMS/NSS25102



TCSESM083F2C●0



TCSESU051F0

References (continued)

Shielded twisted pair cables to standard EIA/TIA568

Description	Pre-formed at both ends	Item	Length m (ft.)	Reference	Weight kg/lb
Straight cables	2 x RJ45 connectors For connection to terminal equipment (DTE)	1	2 (6.562)	490NTW00002	—
			5 (16.404)	490NTW00005	—
			12 (39.370)	490NTW00012	—
			40 (131.234)	490NTW00040	—
			80 (262.467)	490NTW00080	—
Crossover cables	2 x RJ45 connectors For connection between hubs, switches and transceivers	2	5 (16.404)	490NTC00005	—
			12 (39.370)	490NTC00015	—
			40 (131.234)	490NTC00040	—
			80 (262.467)	490NTC00080	—

Shielded twisted pair cables, UL and CSA 22.1 approved

Description	Pre-formed at both ends	Item	Length m (ft.)	Reference	Weight kg/lb
Straight cables	2 x RJ45 connectors For connection to terminal equipment (DTE)	1	2 (6.562)	490NTW00002U	—
			5 (16.404)	490NTW00005U	—
			12 (39.370)	490NTW00012U	—
			40 (131.234)	490NTW00040U	—
			80 (262.467)	490NTW00080U	—
Crossover cables	2 x RJ45 connectors For connection between hubs, switches and transceivers	2	5 (16.404)	490NTC00005U	—
			40 (131.234)	490NTC00040U	—
			80 (262.467)	490NTC00080U	—

Shielded twisted pair cable for IP 67 switch

Description	Pre-formed at both ends	Item	Length m (ft.)	Reference	Weight kg/lb
Straight cables	1 x IP 67 4-way M12 connector and 1 x RJ45 connector	—	1 (3.281)	TCSECL1M3M1S2	—
			3 (9.843)	TCSECL1M3M3S2	—
			5 (16.404)	TCSECL1M3M5S2	—
			10 (32.808)	TCSECL1M3M10S2	—
			25 (82.021)	TCSECL1M3M25S2	—
			40 (131.234)	TCSECL1M3M40S2	—

ConneXium hub

Description	Number of ports		Item	Reference	Weight kg/lb
	Copper cable	Fibre optic			
Twisted pair hub 10BASE-T copper ports, RJ45 shielded connectors	4	—	3	499NEH10410	0.530 1.168

ConneXium switches

Description	Number of ports		Item	Manageable	Reference	Weight kg/lb
	Copper cable	Fibre optic				
Optimized twisted pair switch 10BASE-T/100BASE-TX copper ports, RJ45 shielded connectors 100BASE-FX optic port, SC connectors	3	—	3	No	TCSESU033FN0	0.113 0.249
	4	1	3	No	TCSESU043F1N0	0.120 0.265
	5	—	3	No	TCSESU053FN0	0.113 0.249
Twisted pair switches 10BASE-T/100BASE-TX copper ports, RJ45 shielded connectors	8	—	3	No	499NES18100	0.230 0.507
	8	—	3a	Yes	TCSESM083F23F0	0.410 0.904
Twisted pair and fibre optic switches 10BASE-T/100BASE-TX copper ports, RJ45 shielded connectors. 100BASE-FX optic ports, SC connectors	3	1, multimode	3a	Yes	TCSESM043F1CU0	0.400 0.882
	2	2, multimode	3a	Yes	TCSESM043F2CU0	0.400 0.882
	3	1, single-mode	3a	Yes	TCSESM043F1CS0	0.400 0.882
	2	2, single-mode	3a	Yes	TCSESM043F2CS0	0.400 0.882
	4	1, multimode	3	No	499NMS25101	0.330 0.728
	3	2, multimode	3	No	499NMS25102	0.335 0.739
	4	1, single-mode	3	No	499NSS25101	0.330 0.728
	3	2, single-mode	3	No	499NSS25102	0.335 0.739
	7	1, multimode	3a	Yes	TCSESM083F1CU0	0.410 0.904
	6	2, multimode	3a	Yes	TCSESM083F2CU0	0.410 0.904
7	1, single-mode	3a	Yes	TCSESM083F1CS0	0.410 0.904	
6	2, single-mode	3a	Yes	TCSESM083F2CS0	0.410 0.904	
IP 67 twisted pair switch (1) 10BASE-T/100BASE-TX copper ports, shielded M12 connectors (type D)	5	—	—	No	TCSESU051F0	0.210 0.463

(1) Require special cables with M12 connectors for their --- 24 V supply: XZCP1●64L●

4		TCSESU033FN0	7
490NTC00005	9		9
490NTC00005U	9	TCSESU043F1N0	7
490NTC00015	9		9
490NTC00040	9	TCSESU051F0	9
490NTC00040U	9	TCSESU053FN0	7
490NTC00080	9		9
490NTC00080U	9		
490NTW00002	7		
	9		
490NTW00002U	7		
	9		
490NTW00005	7		
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490NTW00005U	7		
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490NTW00040	7		
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490NTW00040U	7		
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490NTW00080	7		
	9		
490NTW00080U	7		
	9		
499NEH10410	9		
499NES18100	9		
499NMS25101	9		
499NMS25102	9		
499NSS25101	9		
499NSS25102	9		

T			
TCSECE3M3M10S4	7		
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TCSECL1M3M40S2	9		
TCSECL1M3M5S2	9		
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TCSECU3M3M1S4	7		
TCSECU3M3M2S4	7		
TCSECU3M3M3S4	7		
TCSECU3M3M5S4	7		
TCSEK1MDRS	8		
TCSEK3MDS	7		
	8		
TCSESM043F1CS0	9		
TCSESM043F1CU0	9		
TCSESM043F2CS0	9		
TCSESM043F2CU0	9		
TCSESM083F1CS0	9		
TCSESM083F1CU0	9		
TCSESM083F23F0	9		
TCSESM083F2CS0	9		
TCSESM083F2CU0	9		

The Next Generation



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