![lumberg automation — A BELDEN BRAND]

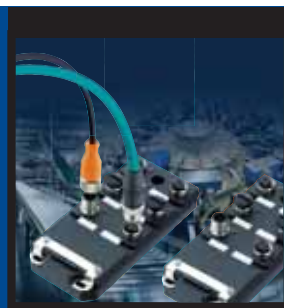# PROFINET®, EtherNet/IP, and Ethernet Connectivity Solutions

Connectors and Components for PROFINET, EtherNet/IP and Ethernet Applications

lumbergautomation

A **BELDEN** BRAND

Lumberg Automation™ Provides
Reliable PROFINET®, EtherNet/IP and
Ethernet Connectivity Solutions for
Automation Applications Worldwide.

Belden® Industrial Solutions — More Convenience and Solutions for Networks in Harsh Environments and Large-scale Infrastructures

Belden Industrial Solutions

For mission-critical applications, Belden is the signal transmission partner that delivers confidence in signal availability, integrity and performance because only Belden can offer solutions that satisfy any requirement.

A majority of system failures occur within the signal transmission space, and trouble-shooting can be very difficult and time-consuming. We want everyone to "**Be Certain**" that when choosing Belden you receive **Signal Availability** — always there, **Signal Integrity** — always trusted and secure, and **Signal Performance** — always when and where you need it.

Belden has brought together a comprehensive line of industrial cabling, connectivity and networking devices, offering the most reliable communications solutions for your application. Whether you are networking your devices to the controllers, connecting the controllers to the control room, relaying data between the control room, the engineering department, and remote manufacturing sites — or all of the above — Belden has the products you need to seamlessly connect your communications.

From the petrochemical, automotive, pharmaceutical, power generation, pulp and paper, metals, food and beverage, or general manufacturing plant to the corporate headquarters — and everywhere in between — Belden has your signal transmission solution. Belden offers the most dependable network and communications system performance in tough and mission-critical environments.

Our Synergy Ensures Continuous Performance

With the Hirschmann™ and Lumberg Automation™ product line additions to the Belden offering, our line of Complete Industrial Solutions is uniquely positioned to provide the best network and communications infrastructure possible. Belden products and systems expertise means that you can maintain ongoing operations without interruption and costly downtime — in any environment.

Here are a few more good reasons why Belden is your best choice for industrial networking, communications and control:

- We have the expertise to integrate your industrial and commercial networks.
- Our products are engineered to perform in tough and difficult environments.
- We offer the broadest selection of products, for a complete, end-to-end Ethernet solution.
- Our sales and engineering professionals can audit, recommend/design, configure and assemble the products and systems to your specific requirements.
- Our global manufacturing and distribution network make our products available to you globally.

Offering Comprehensive Service & Support

Belden recognizes that comprehensive know-how is necessary to ensure an optimized, homogenous solution. We also know that consultation, support and training requires more than just a general understanding of the products, technologies and market trends. It requires a solid understanding of the application and the ability to provide the type of support that is needed — when and where it is needed. It requires the four key service and support areas that are critical to success:

- Network Design
- Training
- Technical Support
- System Performance

Network Design

Belden eliminates your design challenges because we understand the issues surrounding the design and operation of networks in industrial and mission-critical environments. Our engineers are available to work with you to deliver high-availability networks that meet your enterprise-wide IT needs. Whether it's designing systems for Greenfield facilities, or integrating into existing industrial IT environments, our highly-trained staff lifts the design burden from your shoulders to ours.

We'll consult with you to develop a strategy — or we'll develop and implement your full design — either way our staff is available to you.

Training

Backed by years of meeting and exceeding the needs of a broad range of end-user applications, Belden is ideally suited to offer beginners and networking experts alike the opportunity to expand their understanding of mission-critical industrial networks. Belden has developed a series of training programs that are given by Belden-certified individuals — all experts in industrial networking and cabling.

Technical Support

At Belden, our personnel are poised to assist our customers — ensuring maximum uptime and reliability. And with offices in North America, Asia and Europe, Belden can respond globally.

System Performance

If Belden designs it, we guarantee performance — period. We are committed to ensuring world-class signal connectivity and to significantly improve your operational up-time. All Belden components are "designed" to deliver optimum performance: from connectors, to cable, to routers and switches. Based on this comprehensive product portfolio, we have the necessary industrial solutions DNA to deliver reliability.

For more information on our service and support offering, including our warranties, please go to the Belden web site at **www.belden.com/industrial** to locate a Belden sales representative near you.

The Lumberg Automation™ Brand Sets the Standard for Quality, Reliability and Service.

About Our Solutions

Today, more than ever, manufacturing productivity depends upon seamless data communication and automation systems. Lumberg Automation has assembled one of the most diversified portfolios for industrial connectivity and distributed I/O systems for control applications.

With the advancements in technology and improved machine designs, industrial controls, such as sensors, actuators, safety light curtains, pushbutton switches and the like are moving closer to the application.

Our Enclosure~less™ Concept

The Enclosure~less concept from Lumberg Automation addresses these applications with an entire suite of industrial hardened connectivity and distributed I/O products.

Enhanced environmental characteristics, modular designs, plug-and-play electronics with quick-disconnect designs are all integrated to increase speed of installation, decrease troubleshooting and maintenance while reducing the overall complexity of the control application. These products provide the optimal solution in machine and equipment design and offer excellent opportunities and benefits to OEMs, system integrators, and end users alike.

Easing the Design Process

Our system approach leads to decreased time and money to develop complete integrated connectivity solutions. Using our Enclosure~less concept is one of the most effective ways to dramatically reduce the design time.

Re-Useable Solutions

OEM's now have access to a set of standard products designed around the concept that everything is pluggable and interchangeable.

Having the flexibility to re-configure or expand an existing system without worrying about customization is made possible with our Enclosure~less concept. Most importantly, our products are re-usable and can be adapted to future designs or merely put back on the shelf for future use.

Improved Installation Time with Less Mistakes

A recent study by a group of European manufacturers concluded that Enclosure~less assembly costs save as much as 30 percent over conventional installation methods.

These savings are realized through not only the Enclosure~less concept, but by the technology that is being employed. With a modular design approach and plug-and-play electronic features, less time will be spent running down errors or replacing parts from incorrect wiring.

Trouble-Shooting is Simplified

Troubleshooting circuits can be a long process, especially when one is dealing with several hundred termination points.

Many of our products have integrated LED function indicators which provide a visual notification that a circuit is functioning properly.

By using products that have integrated LED functions, mechanics and engineers alike can quickly isolate and resolve the problem.

Testing Made Simple

OEMs can cost-effectively build and pre-test a machine at their facility, disassemble and transport it to an end user's plant knowing that everything has been tested. This is primarily made possible through the reduction of wiring terminations throughout the system, which makes testing a much simpler and quicker process.

Reliability is Maximized

Enclosure~less™ solutions can minimize wiring errors because wiring is pre-manufactured with quick-disconnect features. With less manual wiring involved, there are fewer points of failure.

Some studies suggest that a large portion of system failures come from installation rather than part failures. The decrease in errors associated with pre-manufactured wiring leads to an increase in the overall reliability of the control system.

In the end, this helps speed installation and commissioning, maintenance, troubleshooting, and ultimately boosts a plant's production.

Maintenance/Repair Time is Reduced

Maintenance technicians and operators no longer need to access the control panel since much of the maintenance and troubleshooting can be done outside.

With the simplicity of wiring layout and connections, end users can efficiently isolate problems and replace a starter or I/O locally, rather than sorting through a complex panel. The result is significantly easier troubleshooting and shorter Mean-Time-To-Repair (MTTR).

Floor Space at a Premium

Control cabinets can occupy a substantial amount of the production floor. The Enclosure~less™ concept dramatically reduces the need for that real estate, allowing companies to leverage more of their facility.

Industries like semiconductor and pharmaceutical manufacturing have realized the benefits of the On-Machine approach for years, as their clean-room space is at a premium.

Table of Contents

Introduction to PROFINET, EtherNet/IP and Ethernet

Industrial Ethernet Media Cordsets, Connectors and Switches with Plug-N-Play Features Reduce Overall Installation and Maintenance Costs.

About Industrial Ethernet

The use of Ethernet in IT for connecting various terminals is widespread, especially in local area networks (LAN). Since 1985, the Institute of Electrical and Electronics Engineers (IEEE) has used the Ethernet technology developed by Dr. Metcalfe as its official standard (802.3). This standard remains the basic technology used in an effective data transfer system that continues to be developed (Fast Ethernet, 10-Gigabit Ethernet, switching, full duplex data transfer, wireless LAN).

One Standard, Many Protocols.

Generally speaking, Ethernet is also suitable for automation applications. Nevertheless, the requirements of industrial communication are more rigorous with regard to the mechanical and electrical characteristics of the devices and media used.

Two examples that can be named here are ambient conditions and real-time behavior. In addition, no uniform application protocol exists that is tailored to meet the needs of automation technology. A host of different organizations have defined higher application protocols that can be embedded in the standard Ethernet data package. As a result, different protocols and specifications are currently in use. Neither protocols are compatible with one another:

TCP/IP ("Office" Ethernet Protocol)
EtherNet/IP (ODVA)
PROFINET (Profibus user organization)
Modbus/TCP (Modbus-IDA Group)

In addition, other manufacturer-specific approaches exist such as EtherCat, Ethernet-Powerlink, and JetSync. Lumberg Industrial Ethernet products have been designed for use with TCP/IP, EtherNet/IP, PROFINET, and Modbus/TCP systems.

Data Transfer Technology

While there are different approaches to real-time communication, all of them have a common core, which comprise the established standards of Layers 1-2 as well as the Ethernet data transfer technology and bus access procedure (CSMA/CD, Layer 2). All systems support industrial IT functions such as Web servers, file transferring, and e-mail. For IT functions such as these, the Internet protocol (Layer 3) as well as TCP and UDP protocol (Layer 4) are used. In addition, other IT standards can be used such as Hypertext Transfer Protocol (http) and File Transfer Protocol (FTP).

Carrier Sense Multiple Access with Collision Detection (CSMA/CD)

MA-Multiple Access All devices in an Ethernet network are equal and can exchange data with other devices at any time. Devices access media together. Ethernet does not rely on a master/slave procedure of the type used with field busses, where communication is controlled by a central device.

CS-Carrier Sense

If a device wants to send a data package, it first checks to see whether the medium is available or communication is already in progress. If the medium is busy, the device will wait for completion of the current data transfer and will only send data when the medium is no longer busy.

CD-Collision Detection

While sending data, the device monitors the medium to detect collisions with data packages sent by other devices. If a collision has been detected, the devices involved stop sending data and wait for a specific amount of time to elapse before restarting the sending procedure.

The system assumes that a data package has been sent successfully if no collisions occur. In this process, the transfer time depends greatly on the power supply load and cannot be predetermined. For this reason, this data transfer procedure is only suitable for certain types of industrial automation.

The performance of an Ethernet network can be improved through the use of switches and Ethernet interfaces with full duplex operation. The CSMA/CD procedure is deactivated during full duplex device operation (simultaneous data package sending and receiving).

Ethernet Connectors

RJ45 connectors are widely used for connecting devices to Ethernet networks for office communication. For these types of applications, an IP 20 protection rating is required. For applications in tough industrial environments M12 connectors with IP 67 protection are widely used. M12 connectors have proven to be a reliable connecting method for sensors and actuators as well as for use in transferring data.

Ethernet Data Lines
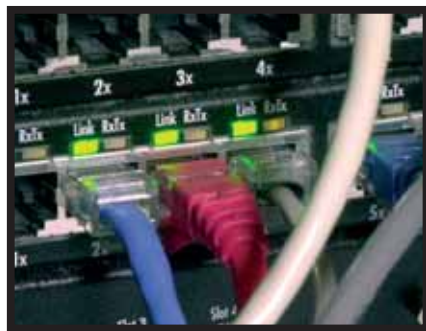
Originally, the Ethernet specification provided for the use of coaxial cables as the transfer medium. A distinction was made between thick coax (10BASE-5) and thin coax (10BASE-2), depending on the cable structure. Because of its low cost, thin coax was commonly referred to as "Cheaper net".

Today, the use of twisted-pair cable (10BASE-T, 100 BASE-TX) is more common. This type of cable represents a divergence from the original mechanisms in a number of ways. In twisted-pair cables, sending and receiving channels are separated. The channels are then transferred over a wire pair. The lines are organized according to categories.

Within the industry, use of Fast Ethernet with a data transfer rate of 100 Mbit/s is widespread. The required cable must meet Category-5 standards. To improve network expansion capability and increase data transfer rates, fiber-optic cables are also used as transfer medium (10BASE-F, 100BASE-FX, and 1000BASEX).

Use of Hubs/Switches

If only two devices are used, the sending channel of one device must be connected to the receiving channel of the other device for twisted-pair wiring. If more than two devices are to communicate with one another, hubs or switches are used as the central station. Usually, hubs and switches have multiple ports to which terminals or other hubs or switches can be connected to allow network cascading. The difference between a hub and a switch lies in the method used to forward data packages. A hub sends a data package it has received at one port to all other ports.

A switch, on the other hand, evaluates the target address of the data package and only forwards the data package to the port leading to the device that was intended as the recipient. By forwarding data packages only to targeted recipients, switches reduce the load on the network and increase communication speed.

Topology
Using a switch or hub as the central element produces wiring in the shape of a star, which, in turn, serves as the basis for the network topology. By using several switches it is possible to build a tree-like structure.

Wire Length
The permitted wire length between one hub or switch and a terminal or between two terminals (channel) according to specifications is 100 m for twisted-pair wiring. Nevertheless, the network expansion capability is greatly determined by the wires and connectors that are used.

Data Transfer Rate
The data transfer rate for standard Ethernet (10BASE-T) is 10 MBit/s. For Fast Ethernet (100BASETX) it is 100 MBit/s.

Auto Negotiation
Today's Ethernet devices support both standard and Fast Ethernet data transfer. This ensures the downward compatibility of the devices, so that older devices can still be used to exchange data. On the basis of the "auto negotiation" procedure defined in Fast Ethernet, two devices agree upon a common method of data transfer before the exchange of data actually takes place (10 or 100 MBit/s, half or full duplex).

Auto Crossing
Implementing this function enables Ethernet device interfaces to cross sending and receiving wires automatically for twisted-pair wiring. This makes it possible to use 1-to-1 wired lines instead of crossed data lines when wiring the system.

Auto Polarity
Today's Ethernet interfaces for 10BASE-T and 100BASE-TX are able to change the polarity of both of the sending or receiving lines to correct wiring errors.

Shielded (STP) and Un-Shielded (UTP) Cables
The use of shielded cables is recommended for environments with increased EMI levels. It is important to ensure the proper grounding of the shield to avoid ground loops that may lead to interference of the data communication.

Today's commonly used Ethernet cables for office applications use a 4-pair construction. For standard applications with transmission speeds up to a 100 Mbit/s (100baseT) however only two of the four pairs are used (one transmit and one receive pair). The additional wires were intended for future additions (e.g. higher transmission speeds such as Gigabit Ethernet). 100 Mbit/s are sufficient for the real-time demands on the factory floor. Therefore many of the automation specific protocols utilize the 2-pair technology.

M12 Circular Connectors, 8-Pole
The M12 8-pole connector is mostly used in applications where standard Ethernet is brought from the office to the factory floor (e.g. via TCP/IP).

The cordsets meet the requirements for Category 5e according to the TIA/EIA 568B standard. The continuous use of 4-pair cables makes it possible to use all standard Ethernet cable testers that might already be available in the IT department (not all cable testers support 2-pair cables).

The unused wires can also be used for additional functionalities like power over Ethernet or the transmission of video signals.

M12 Circular Connectors, 4-Pole
Since this connector type uses only 2- pair cables it is mostly used in automation specific applications. It is standardized for EtherNet/IP and PROFInet and is part of the IAONA specification.

The specified connector type utilizes the Dcoding. This newly developed keyway helps avoid incorrect connections (e.g. connecting an Ethernet cable to a power supply) and possibly destroying network equipment.
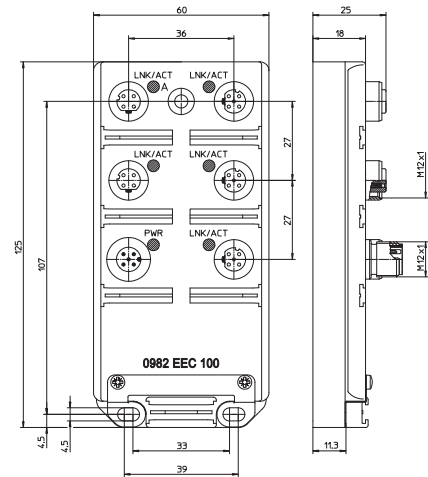
Industrial Ethernet Switches for PROFINET or Ethernet/IP Applications

0982 EEC 100

5 Port (unmanaged switch)

Ethernet-Switch, IP 67, 5-port switch for 10 and 100 Mbaud transmission rates, M12 socket 4 poles D coding, M12 power supply 5 poles standard coding.

LNK/ACT   LNK/ACT
A

LNK/ACT   LNK/ACT

PWR   LNK/ACT

0982 EEC 100

60
36
25
18
M12x1
M12x1
125
107
27
27
4,5
4,5
33
39
11,3

Pin Assignment

M12 Socket		Power supply M12	
	1 = TD+		1 = 24 V
	2 = RD+		2 = n.c
	3 = TD-		3 = GND (0 V)
	4 = RD-		4 = n.c.
	5 = shield		5 = earth

Industrial Ethernet Switches for PROFINET or Ethernet/IP Applications
0982 EEC 100

Technical Data

Environmental
Degree of protection	IP 67
Operating temperature range	0°C (32°F) to +60°C (+140°F)

Mechanical
Weight	210 g
Housing material	PUR

Switch Functionality
Mode of operation	Store and forward
Number of storable addresses	1000
Aging time	300 s
Tagging	EtherNet telegrams with VLAN tag field are transmitted unchanged

Ethernet Ports — **10BASE-T / 100BASE-TX**
Data transmission rate	10 Mbit/s and 100 Mbit/s
Cable type	Twisted Pair (TP/TX) or star quad, CAT 5, shielded
Number of ports	5
Length of a TP segment	100 m
Link control	yes
Autopolarity	yes
Autonegotiation	yes
Autocrossing	yes
Channel status indicator	LED green per port

Electronics Power Supply — **PWR**
Rated voltage	24 V DC
Voltage range	18–30 V DC
Power consumption	2.4 W
Reverse polarity protection	yes
Indication	LED green

Included in delivery/accessories
Dust covers M12	2 pieces
Attachable labels	10 pieces

Part Number
0982 EEC 100

The application of these products in harsh environments should always be checked before use.
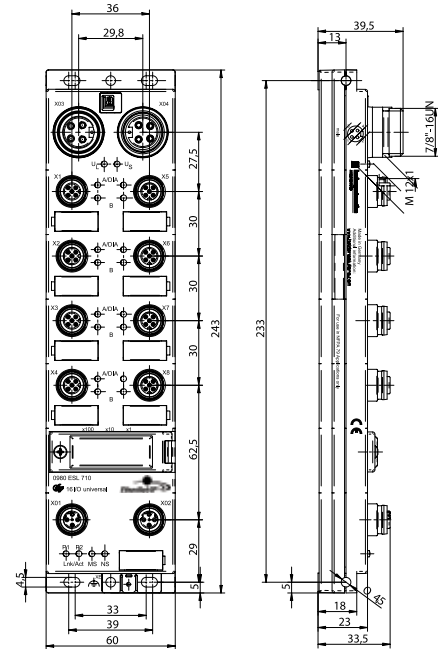Specifications subject to alteration.

EtherNet/IP I/O Modules with 16 Digital Inputs and 16 Digital Outputs

0980 ESL 710

16 IN / 16 OUT (universal)

EtherNet/IP Device with 16 digital I/O channels, channels can be used universally as inputs or outputs, M12 socket, rotary address switches for addressing, M12 LAN-Ports, D-coded, 7/8" power supply.
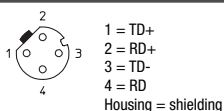
Diagnostic Indication

LED	Indication	Condition
1...8 A	yellow	channel status 1
1...8 DIA A	red	periphery fault
1... 8 B	yellow	channel status 2
1... 8 DIA B	red	periphery fault
U_S	green	sensor power supply applied
	off	sensor power supply missing
U_L	green	actuator power supply applied
	off	actuator power supply missing
P1 Lnk/Act	green	connected to an Ethernet device
	yellow flashing	I/O device exchanging data
P2 Lnk/Act	green	connected to an Ethernet device
	yellow flashing	I/O device exchanging data
MS (Module status)	green	device is ready for operating
	green flashing	wrong configuration
	red/green flashing	self test is running
	red flashing	firmware update
	off	device is off
NS (Network status)	green	connection to master exists
	green flashing	IP address exists, but no connection to the master
	red	IP address is used by a different device
	red flashing	connection has timed out
	off	device is off

Bit Assignment

Bit	7	6	5	4	3	2	1	0
M12 Input								
Byte 0	4B	4A	3B	3A	2B	2A	1B	1A
Byte 1	8B	8A	7B	7A	6B	6A	5B	5A
M12 Output								
Byte 0	4B	4A	3B	3A	2B	2A	1B	1A
Byte 1	8B	8A	7B	7A	6B	6A	5B	5A

Pin Assignment

LAN connection M12, D-Coded	Power supply 7/8"	Input/Output M12
1 = TD+ 2 = RD+ 3 = TD- 4 = RD Housing = shielding	1 = +24 V Actuators 2 = +24 V Logic / Sensors 3 = GND (0 V) Logic / Sensors 4 = GND (0 V) Actuators Housing = FE	1 = +24 V 2 = IN/OUT B 3 = GND (0 V) 4 = IN/OUT A 5 = earth Housing = FE
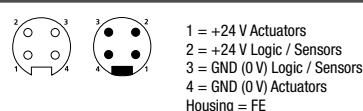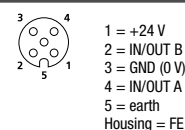
EtherNet/IP I/O Modules with 16 Digital Inputs and 16 Digital Outputs
0980 ESL 710

Technical Data

Environmental
Degree of protection	IP 67
Operating temperature range	-10°C (+14°F) to +60°C (+140°F)

Mechanical
Weight	380 g
Housing material	PBT

Bus system — **Ethernet/IP**
Vendor ID	21
Device ID	710
EDS-File	EDS-v3.9 - LumbergAutomation-0980ESL710-20110420.eds (or later)
Download	www.beldensolutions.com
Transmission rate	10/100 Mbs
Address range	0-255
Rotary address switches	0-255
Default address	1

System/Sensors power supply — **System power supply**
Rated voltage	24 V DC
Voltage range	11–30 V DC
Power consumption	typ. 90 mA
Reverse polarity protection	yes

Input power supply — **Us**
Voltage range	19–30 V DC
Sensor current	200 mA (at T_{amb} 30°C)
Short-circuit proof	yes
Indication	LED green

Inputs — **Type 3 acc. to IEC 61131-3**
Rated input voltage	24 V DC
Channel type N.O.	p-switching
Number of digital channels	max. 16
Channel status indicator	LED yellow per channel
Diagnostic indication	LED red per socket

Output power supply — **U_L**
Rated voltage	24 V DC
Voltage range	19–30 V DC
Reverse polarity protection	yes/antiparallel diode
Indication	LED green

Outputs
Rated output current	1.6 A per channel
Short-circuit proof	yes
Max. output current	9 A (12 A*) per module

*Test proven and approved under the following conditions:
· looped through System/ Sensorpower supply max. 2,5 A
· Power supply cable STL 204 (5x1.00 mm^2)
· Operating temperature range max. 40°C

Overload-proof — **yes**
Number of digital channels	max. 16
Channel type N.O.	p-switching
Channel status indicator	LED yellow per channel
Diagnostic indication	LED red per socket

Included in delivery/accessories
Dust covers M12	2 pieces
Attachable labels	10 pieces

Part Number
0980 ESL 710

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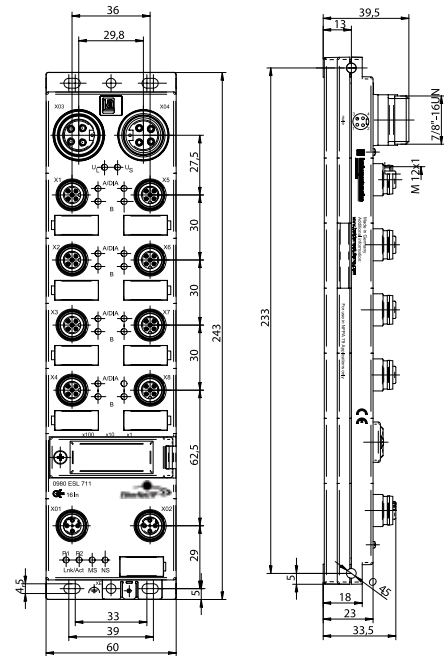Specifications subject to alteration.

EtherNet/IP I/O Modules with16 Digital Inputs

0980 ESL 711

16 IN

EtherNet/IP Device with 16 digital inputs, M12 socket, rotary address switches for addressing, M12 LAN–Ports, D-coded, 7/8" power supply.
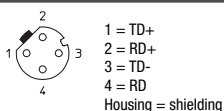
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Bit Assignment

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				M12 Input				
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Pin Assignment

LAN connection M12, D-Coded	Power supply 7/8"	Input M12
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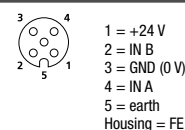
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Operating temperature range	-10°C (+14°F) to +60°C (+140°F)

Mechanical

Weight	380 g
Housing material	PBT

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Device ID	711
EDS-File	EDS-v3.9 - LumbergAutomation-0980ESL711-20110420.eds (or later)
Download	www.beldensolutions.com
Transmission rate	10/100 Mbs
Address range	0-255
Rotary address switches	0-255
Default address	1

System/Sensors power supply — **System power supply**

Rated voltage	24 V DC
Voltage range	11–30 V DC
Power consumption	typ. 90 mA
Reverse polarity protection	yes

Input power supply — **Us**

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Sensor current	200 mA (at T_{amb} 30°C)
Short-circuit proof	yes
Indication	LED green

Inputs — **Type 3 acc. to IEC 61131-3**

Rated input voltage	24 V DC
Channel type N.O.	p-switching
Number of digital channels	max. 16
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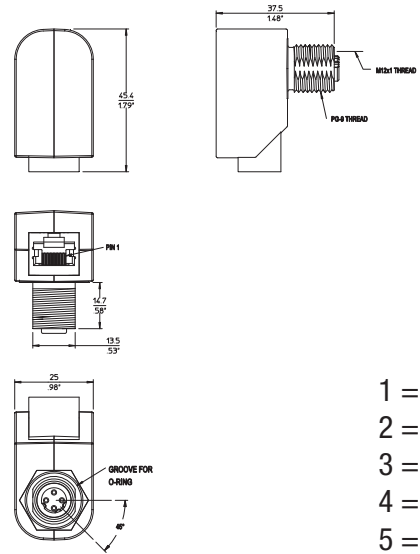Specifications subject to alteration.

PROFINET

EtherNet/IP

Industrial Ethernet Panel-Mount Adaptors for PROFINET or Ethernet/IP Applications

0981 ENC 100

M12 / RJ45 (panel-mount adaptor)

RJ45/M12 adaptor, female receptacle connector M12, D coding, chassis side thread PG 9, RJ45 female connector, 90 degree.

37.5
1.48"

45.4
1.79"

M12x1 THREAD

PG-9 THREAD

PIN 1

14.7
58"

13.5
53"

25
.98"

GROOVE FOR O-RING

45°

1 = TD+
2 = RD+
3 = TD-
4 = RD
5 = RX+
6 = TX+
7 = n.c.
8 = RXhousing shield

Pin Assignment

M12 Socket		RJ45 Socket	
1 = TD+		1 = TD+	5 = n.c.
2 = RD+		2 = TD-	6 = RD-
3 = TD-		3 = RD+	7 = n.c.
4 = RD-		4 = n.c.	8 = n.c.
5 = shield			

Industrial Ethernet Panel-Mount Adaptors for PROFINET or Ethernet/IP Applications
0981 ENC 100

Technical Data

Environmental

Degree of protection	IP 20 / IP 67
Operating temperature range	0°C (32°F) to +70°C (+158°F)

Materials

Housing	PA

	M12
Contacts	CuZn, pre-nickeled and gold-plated
Housing	CuZn, nickel-plated
Insert	PUR, selfextinguishing
O-ring	FKM

	RJ45
Contacts	CuSn, pre-nickeled and gold-plated
Housing	CuZn, tin-plated
Insert	PA GF

Electrical

Nominal current	1.5 A
Nominal voltage	max. 60 V

Part Number	
0981 ENC 100	UL

The application of these products in harsh environments should always be checked before use.
Specifications subject to alteration.

Industrial Ethernet Field Attachable Connectors for PROFINET or Ethernet/IP Applications

0986 EMC 102

Male, 4-Pole, D-coding

Field attachable connector, M12 male connector, 3- and 4-pole with threaded joint, shieldable, assembling with spring-type terminals.

– 0986 EMC 102: 4 poles, D coding, especially suitable for Industrial EtherNet data cable 0985 342 000/... M –

M12 x1
ø 1 *
* 8-polig: ⊘ 0,8
ca. 65

20
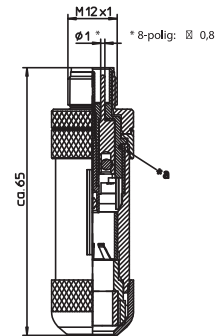
*a O-Ring

Pin Assignments

M12, Male

4 pole D-coding

Industrial Ethernet Field Attachable Connectors for PROFINET or Ethernet/IP Applications
0986 EMC 102

Technical Data

Environmental

Degree of protection	IP 67 / NEMA 6P
Operating temperature range	-25°C (-13°F) / +90°C (+194°F)

Mechanical

Housing / Molded body	GD-ZnAl, pre-coppered and nickel-plated
Insert	PBT
Contact	Stainless steel, silver-plated, gold-plated
Receptacle shell	CuZn, nickel-plated
Shield sleeve	CuBe, tin-plated
O-ring	FKM
Mode of connection	Spring-type terminals
Connectable conductor	0.14–0.50 mm^2, 0.14 mm^2 with terminal pin sleeve

Electrical

Contact resistance	≤ 5 mΩ
Nominal current at 40°C	4 A
Nominal voltage	120 V
Rated voltage	125 V
Test voltage	1.5 kV eff. / 60 s
Insulation resistance	> 10^9 Ω
Pollution degree	3

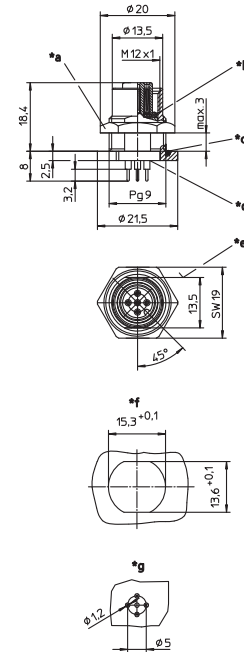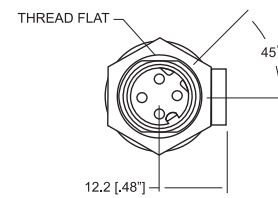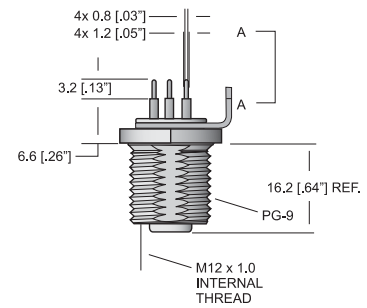| Part Number	Pins	Cable Diameter Range	Characteristics
0986 EMC 102	**4D**	Ø 4.0-9.0 mm	

Industrial Ethernet Receptacle Connectors for PROFINET or Ethernet/IP Applications

0986 EFC 152

4-Pole, Female (D-coding)

Receptacle connector, M12 female connector for rear mounting, 4-pole, D-coding, printed contacts, chassis side thread PG 9 (panel nut RSKF 9).

*a nut
*b O-Ring
*c solder contacts potted with epoxy
*d anti-rotation protection
*e cut out for anti-rotation
*f hole pattern in printed circuit board
*v center contact leading

Pin Assignments

Face Views / M12

4 poles D-Coding

Industrial Ethernet Receptacle Connectors for PROFINET or Ethernet/IP Applications
0986 EFC 152

Technical Data

Environmental

Degree of protection	IP 67 / NEMA 6P
Operating temperature range	-25°C (-13°F) / +80°C (+176°F)

Mechanical

Housing / Molded body	CuZn, nickel-plated
Insert	PA
Contact	CuZn, pre-nickeled and 0.8 microns gold-plated
O-ring	FKM2

Electrical

Contact resistance	≤ 5 mΩ
Nominal current at 40°C	4 A
Nominal voltage	240 V
Rated voltage	250 V
Test voltage	2.0 kV eff. / 60 s
Insulation resistance	$> 10^9$ Ω
Pollution degree	3

Part Number	Pins	Characteristics	
0986 EFC 152	**4D**		UL

Industrial Ethernet Receptacle Connectors for PROFINET or Ethernet/IP Applications

0986 EFC 101

4-Pole, Female (D-coding)

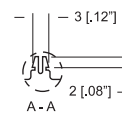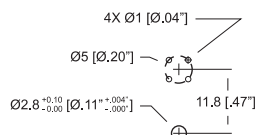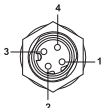Receptacle connector, M12 female connector, 4-pole, D-coding, PCB contacts with board lock, chassis side thread PG 9.

4x 0.8 [.03"]
4x 1.2 [.05"]
A
3.2 [.13"]
A
6.6 [.26"]
16.2 [.64"] REF.
PG-9
M12 x 1.0 INTERNAL THREAD

THREAD FLAT
45°
12.2 [.48"]

Pin Assignments

Face Views / M12	Recommended PCB Pattern

4 poles D-Coding

4
3   1
2

4X Ø1 [Ø.04"]
Ø5 [Ø.20"]
Ø2.8 +0.10 -0.00 [Ø.11" +.004" -.000"]
11.8 [.47"]
3 [.12"]
2 [.08"]
A - A

Industrial Ethernet Receptacle Connectors for PROFINET or Ethernet/IP Applications
0986 EFC 101

Technical Data

Environmental

Degree of protection	IP 67 / NEMA 6P
Operating temperature range	-25°C (-13°F) / +90°C (+194°F)

Mechanical

Housing / Molded body	CuZn, nickel-plated
Insert	PUR, black
Contact	CuZn, gold over nickel plated
O-ring	Viton
Board lock	Phosphor bronze, tin-lead plated

Electrical

Current rating	4 A
Voltage rating	250 V

Part Number	Pins	Characteristics	
0986 EFC 101	4D		

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Industrial Ethernet Receptacle Connectors for PROFINET or Ethernet/IP Applications
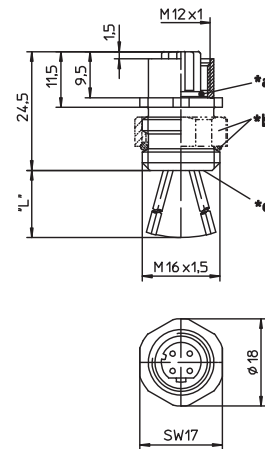
0986 EFC 151 A

Male, 4-Pole, D-Coding

Receptacle connector, M12 female connector for front mounting, 4 poles, D coding, adjustable, assembled stranded wire, solder contacts potted with epoxy, chassis side thread M16 x 1.5.

– especially suitable for Industrial Ethernet –
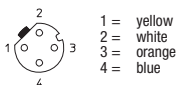
*a O-Ring
*b adjustable nut and o-ring enclosed separately
*c solder contacts potted with epoxy
"L" 0,5 m

Pin Assignments

Face Views / M12

Female: 4 poles D Coding

1 = yellow
2 = white
3 = orange
4 = blue

Industrial Ethernet Receptacle Connectors for PROFINET or Ethernet/IP Applications
0986 EFC 152

Technical Data

Environmental

Degree of protection	IP 67 / NEMA 6P
Operating temperature range	-25°C (-13°F) / +80°C (+176°F)

Mechanical

Housing / Molded body	CuZn, nickel-plated
Insert	TPU, self-extinguishing
Contact	CuSn, pre-nickeled and 0.3 microns gold-plated
O-ring	FKM
Adjustable nut	CuZn, nickel-plated

Electrical

Contact resistance	$\leq 5\ m\Omega$
Nominal current at 40°C	4 A
Nominal voltage	240 V
Test voltage	2.0 kV eff. / 60 s
Insulation resistance	$> 10^9\ \Omega$
Pollution degree	3

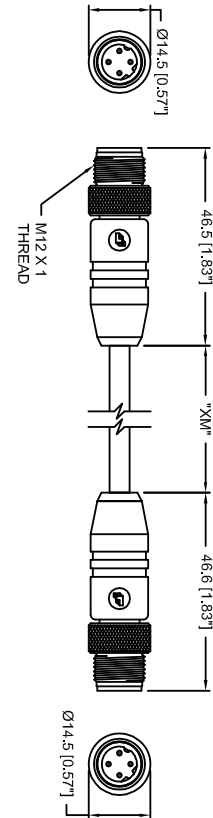| Part Number	Pins	Lead (mm²)	Characteristics	
0986 EFC 151 A	**4D**	AWG 22		

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PROFINET Double-Ended Cordsets

0985 342 100

M12 / M12

PROFINET data cable according to type C,
molded on both sides with M12 male connector,
D coding, stranded/shielded with green jacket.

Ø14.5 [0.57"]

M12 X 1
THREAD

46.5 [1.83"]

"XM"

46.6 [1.83"]

Ø14.5 [0.57"]

Wiring Diagram

M12 / M12		
M12	**Color**	**M12**
1	Yellow	1
2	White	2
3	Orange	3
4	Blue	4
NUT	**SHIELD**	**NUT**

Pin Assignment

M12 Socket

1 = TD+   yellow
2 = RD+   white
3 = TD-   orange
4 = RD-   blue

PROFINET Double-Ended Cordsets
0985 342 100

Technical Data

Environmental

Degree of protection	IP 67
Operating temperature range	-20°C (-4°F) to +75°C (+167°F)

Materials

Molded body	PUR, black
Coupling nut	Brass, nickel plated
Contacts	Brass, gold over nickel plated
Insert	PUR, self extingusing

Cable Specifications

Cable jacket	PUR, halogen-free
Color	Green
Overall diameter	6.2mm, nominal
Conductor	22AWG, 7 stranded bare copper
Insulation	Polyethylene foam skin
Foil shield	Aluminum/polyester tape, 100% coverage
Braided Shield	Tinned copper, 85% coverage
Agency Approval	AWM 20236
Cable Type	High Flex, High Noise, PROFINET cable

Part Number	Cable Length Options
0985 342 100/...M	1 M / 2 M / 3 M / 4 M / 5 M / 10 M / 15 M / 20 M

The application of these products in harsh environments should always be checked before use.
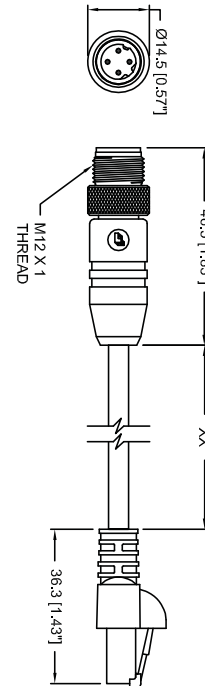Specifications subject to alteration.

PROFINET Double-Ended Cordsets

0985 342 104

M12 / RJ45

PROFINET data cable according type C, molded M12 male connector, D coding to RJ45 connector, stranded/shielded with green jacket.

Ø14.5 [0.57"]

M12 X 1
THREAD

46.5 [1.83"]

"XX"

36.3 [1.43"]

Wiring Diagram

M12	Color	RJ45
1	Yellow	1
2	White	3
3	Orange	2
4	Blue	6
NUT	SHIELD	SHELL

Pin Assignment

M12 Socket	RJ45 Socket

1 2 3 4 5 6 7 8

PROFINET Double-Ended Cordsets
0985 342 104

Technical Data

Environmental

Degree of protection	M12: IP 67 / RJ45: IP 20
Operating temperature range	-25°C (-13°F) to +60°C (+140°F)

Materials

	M12
Molded body	PUR, black
Coupling nut	Brass, nickel plated
Contacts	Brass, gold over nickel plated
Insert	PUR, black
	RJ45
Plug	Polycarbonate
Contacts	Phosphor bronze, gold plated
Boot	Elastomer polyolefin

Electrical

Current rating	1.5 A
Voltage rating	30 V AC / 42 V DC
Performance	CAT5e

Cable Specifications

Cable jacket	PUR, halogen-free
Color	Green
Overall diameter	6.2mm, nominal
Conductor	22AWG, 7 stranded bare copper
Insulation	Polyethylene foam skin
Foil shield	Aluminum/Polyester tape, 100% coverage
Braided Shield	Tinned copper, 85% coverage
Agency Approval	AWM 20236
Cable Type	High Flex, High Noise, PROFINET cable

Part Number	Cable Length Options
0985 342 104/...M	0.5 M / 1 M / 2 M / 5 M / 10 M / 15 M / 20 M / 25 M / 30 M / 40 M / 50 M

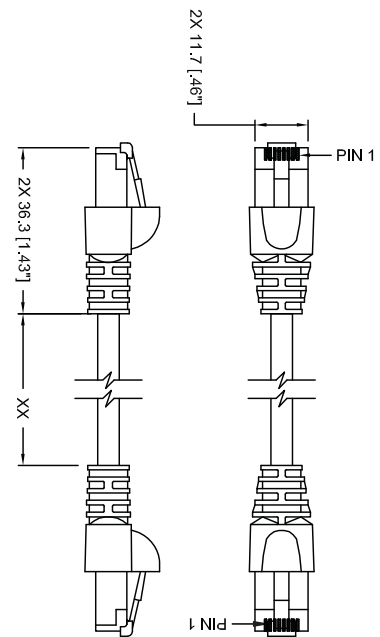NOTE: Vibration & Oil Resistant applies to M12 side only.

![lumberg automation - A BELDEN BRAND]

0985 342 500

PROFINET Double-Ended Cordsets

RJ45 / RJ45

PROFINET data cable according to type C with RJ45 to RJ45 connectors, stranded/shielded with green jacket.

2X 11.7 [.46"]

PIN 1

2X 36.3 [1.43"]

XX

PIN 1

Wiring Diagram

RJ45 / RJ45		
RJ45	**Color**	**RJ45**
1	Yellow	1
3	White	3
2	Orange	2
6	Blue	6
SHELL	**SHIELD**	**SHELL**

Pin Assignment

RJ45 Socket

1 2 3 4 5 6 7 8

PROFINET Double-Ended Cordsets
0985 342 500

Technical Data

Environmental

Degree of protection	IP 20
Operating temperature range	-25°C (-13°F) to +60°C (+140°F)

Material

Plug	Polycarbonate
Contacts	Phosphor bronze, gold plated
Boot	Elastomer polyolefin

Electrical

Current rating	1.5 A
Voltage rating	30 V AC / 42 V DC
Performance	CAT5e

Cable Specifications

Cable jacket	PUR, halogen-free
Color	Green
Overall diameter	6.2mm, nominal
Conductor	22AWG, 7 stranded bare copper
Insulation	Polyethylene foam skin
Foil shield	Aluminum/Polyester tape, 100% coverage
Braided Shield	Tinned copper, 85% coverage
Agency Approval	AWM 20236
Cable Type	High Flex, High Noise, PROFINET cable

Part Number	Cable Length Options
0985 342 500/...M	0.5 M / 1 M / 2 M / 5 M / 10 M / 15 M / 20 M / 30 M

Industrial Ethernet Double-Ended Cordsets for Ethernet/IP
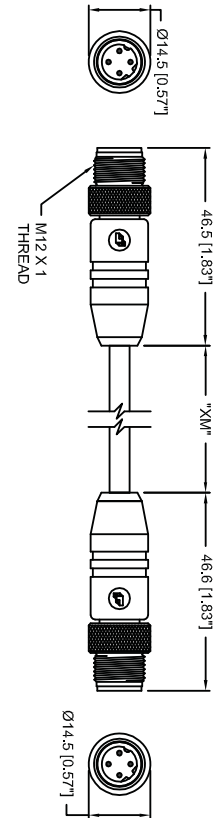
EtherNet/IP

0985 706 100

M12 / M12 (High-Flex, Unshielded, TPE)

EtherNet/IP, high-flex, double-ended cord set, M12 male to male straight, 4-pin, D-coding, 24 AWG TPE cable, stranded/unshielded, 2 twisted pair with teal jacket.

Ø14.5 [0.57"]

M12 X 1 THREAD

46.5 [1.83"]

"XM"

46.6 [1.83"]

Ø14.5 [0.57"]

Wiring Diagram

M12	Color	M12
1	White/Orange	1
2	White/Green	2
3	Orange	3
4	Green	4

M12 / M12

Pin Assignment

M12 Socket

Industrial Ethernet Double-Ended Cordsets for Ethernet/IP
0985 706 100

Technical Data

Environmental

Degree of protection	IP 68, NEMA 6P
Temperature rating	-20°C(-4°F) to +75°C(+167°F)

Mechanical

Molded body	Polyurethane, black
Coupling nut	Brass, nickel plated
Contacts	Brass, gold over nickel plated
Insert	Polyurethane, black

Cable Specifications

Cable jacket	TPE
Color	Teal
Overall diameter	.210"
Conductor	24 AWG stranded tinned copper
Insulation	High density polyethylene
Continuous Flex	2 million cycles @ 10X, 10 million cycles @ 20X bend radius

Part Number	Cable Length Options
0985 706 100/...M	0.5 M / 1 M / 2 M / 5 M / 10 M / 15 M / 20 M / 25 M / 30 M / 35 M / 40 M / 45 M / 50 M / 60 M / 70 M / 80 M / 90 M

The application of these products in harsh environments should always be checked before use.
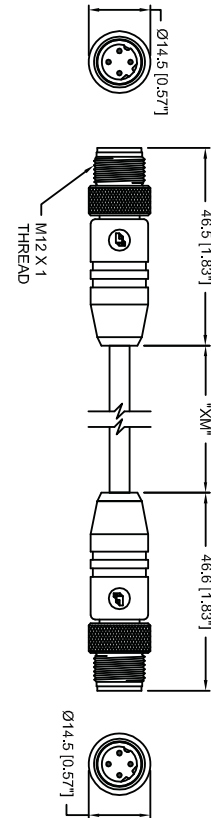Specifications subject to alteration.

Industrial Ethernet Double-Ended Cordsets for Ethernet/IP

0985 706 101

M12 / M12 (Crossover Wiring)

Ethernet I/P, high-flex, double-ended cord set, M12 male to M12 male, teal TPE jacket, 4 pin, 24 AWG, stranded/unshielded cross-over cable with 2 twisted pairs.

Ø14.5 [0.57"]

M12 X 1 THREAD

46.5 [1.83"]

"XM"

46.6 [1.83"]

Ø14.5 [0.57"]

Wiring Diagram

M12 / M12		
M12	**Color**	**M12**
		Crossover Wiring
1	White/Orange	2
3	Orange	4
2	White/Green	1
4	Green	3

Pin Assignment

M12 Socket

Industrial Ethernet Double-Ended Cordsets for Ethernet/IP
0985 706 101

Technical Data

Environmental

Degree of protection   IP 68, NEMA 6P
Temperature rating   -20°C(-4°F) to +75°C(+167°F)

Mechanical

Molded Body   PUR, black
Coupling Nut   Brass, bickel plated
Contacts   Brass, Gold over Nickel plated
Insert   PUR, self extingusing

Cable Specifications

Cable jacket   TPE
Color   Teal
Overall diameter   .210"
Conductor   24 AWG stranded tinned copper
Insulation   High density polyethylene
Continuous Flex   2 million cycles @ 10X,
     10 million cycles @ 20X bend radius

Part Number	Cable Length Options
0985 706 101/...M	0.5 M / 1 M / 2 M / 5 M / 10 M

The application of these products in harsh environments should always be checked before use.
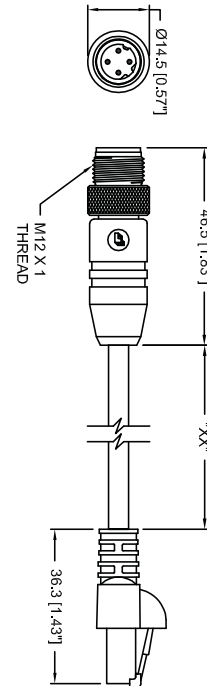Specifications subject to alteration.

EtherNet/IP

Industrial Ethernet Double-Ended Cordsets for Ethernet/IP

0985 706 103

M12 / RJ45 (High-Flex, Unshielded, TPE)

Ethernet I/P, high-flex, double-ended cord set, M12 male to RJ45 male, 4 pin, D-coded, 24 AWG, teal TPE jacket, stranded/unshielded cable with 2 twisted pairs.

Ø14.5 [0.57"]

M12 X 1
THREAD

46.5 [1.83"]

"XX"

36.3 [1.43"]

Wiring Diagram

M12 / RJ45		
M12	**Color**	**RJ45**
1	White/Orange	1
3	Orange	2
2	White/Green	3
4	Green	6

Pin Assignment

M12 Socket	RJ45 Socket
	1 2 3 4 5 6 7 8

Industrial Ethernet Double-Ended Cordsets for Ethernet/IP
0985 706 103

Technical Data

Environmental
Degree of protection	M12: IP 68, NEMA 6P / RJ45: IP 20
Temperature rating	-20°C(-4°F) to +75°C(+167°F)

Mechanical — **M12**
Molded Body	PUR, Black
Coupling Nut	Brass, Nickel plated
Contacts	Brass, Gold over Nickel plated
Insert	PUR, Self extingusing

RJ45
Housing	Pre-tinned copper alloy
Insert	Clear polycarbonate
Contacts	50 μ" gold in contact area over nickel plating

Cable Specifications
Cable jacket	TPE
Color	Teal
Overall diameter	.210"
Conductor	24 AWG stranded tinned copper
Insulation	High density polyethylene
Continuous Flex	2 million cycles @ 10X, 10 million cycles @ 20X bend radius

Part Number	Cable Length Options
0985 706 103/...M	0.5 M / 1 M / 2 M / 5 M / 10 M / 15 M / 20 M / 25 M / 30 M / 35 M / 40 M / 45 M / 50 M / 60 M / 70 M / 80 M / 90 M

The application of these products in harsh environments should always be checked before use.
Specifications subject to alteration.

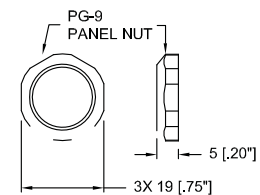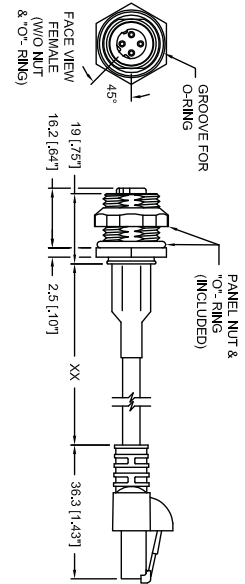NOTE: Vibration & Oil Resistant applies to M12 side only.

Industrial Ethernet Double-Ended Cordsets for Ethernet/IP

0985 706 104

M12 / RJ45 (High-Flex, Unshielded, TPE)

EtherNet/IP, high-flex, double-ended cord set, M12 female 4 pin, D-coded receptacle to male RJ45, 24 AWG, teal TPE jacket, stranded/unshielded with 2 twisted pairs.

Wiring Diagram

M12	Color	RJ45
1	White/Orange	1
3	Orange	2
2	White/Green	3
4	Green	6

Pin Assignment

M12 Socket	RJ45 Socket	Recommended Panel Cut Out
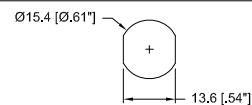
Industrial Ethernet Double-Ended Cordsets for Ethernet/IP
0985 706 104

Technical Data

Environmental
Degree of protection	M12: IP 68 / RJ45: IP 20
Temperature rating	-20°C(-4°F) to +75°C(+167°F)

Materials — **M12**
Molded Body	PUR, black
Shell	Brass, nickel plated
Contacts	Brass, gold over nickel plated
Insert	PUR, self extingusing
O-Ring	Viton™

RJ45
Housing	Pre-tinned copper alloy
Insert	Clear polycarbonate
Contacts	50 µ" gold in contact area over nickel plating

Cable Specifications
Cable jacket	TPE
Color	Teal
Overall diameter	.210"
Conductor	24 AWG stranded tinned copper
Insulation	High density polyethylene
Continuous Flex	2 million cycles @ 10X, 10 million cycles @ 20X bend radius

Part Number	Cable Length Options	
0985 706 104	0.5 M / 1 M / 2 M / 5 M / 10 M / 15 M / 20 M / 25 M / 30 M / 35 M	

The application of these products in harsh environments should always be checked before use.
Specifications subject to alteration.

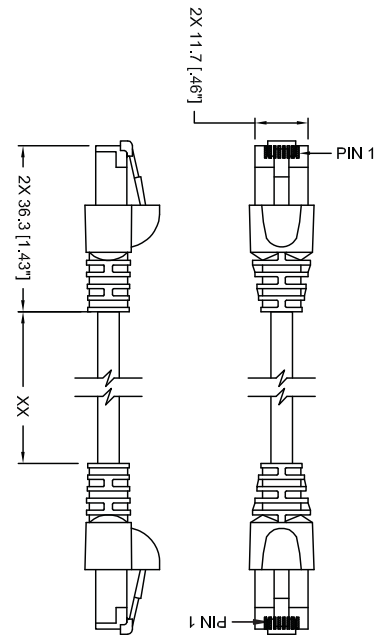NOTE: Vibration & Oil Resistant applies to M12 side only.

EtherNet/IP

Industrial Ethernet Double-Ended Cordsets for Ethernet/IP

0985 706 500

RJ45 / RJ45 (High-Flex, Unshielded, TPE)

Ethernet I/P, high-flex, double-ended cord set, RJ45 male to RJ45 male, 24 AWG, teal TPE jacket, stranded/unshielded cable with 2 twisted pairs.

2X 11.7 [.46"]

PIN 1

2X 36.3 [1.43"]

XX

PIN 1

Wiring Diagram

RJ45 / RJ45

RJ45	Color	RJ45
1	White/Orange	1
2	Orange	2
3	White/Green	3
6	Green	6

Pin Assignment

RJ45 Socket

1 2 3 4 5 6 7 8

Industrial Ethernet Double-Ended Cordsets for Ethernet/IP
0985 706 500

Technical Data

Environmental
Degree of protection	IP 20
Temperature rating	-20°C(-4°F) to +75°C(+167°F)

Mechanical
Housing	Pre-tinned copper alloy
Insert	Clear polycarbonate
Contacts	50 µ" gold in contact area over nickel plating

Cable Specifications
Cable jacket	TPE
Color	Teal
Overall diameter	.210"
Conductor	24 AWG stranded tinned copper
Insulation	High density polyethylene
Continuous Flex	2 million cycles @ 10X, 10 million cycles @ 20X bend radius

Part Number	Cable Length Options
0985 706 500/...M	0.5 M / 1 M / 2 M / 5 M / 10 M / 15 M / 20 M / 25 M / 30 M / 35 M / 40 M / 45 M / 50 M / 60 M / 70 M / 80 M / 90 M

The application of these products in harsh environments should always be checked before use.
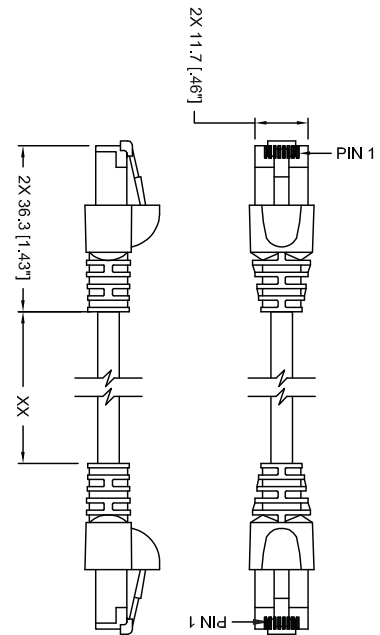Specifications subject to alteration.

Industrial Ethernet Double-Ended Cordsets for Ethernet/IP

EtherNet/IP

0985 705 500

RJ45 / RJ45 (Mod-Flex, Unshielded, PVC)

Ethernet I/P, moderate-flex, double-ended cord set, RJ45 male to RJ45 male, 24 AWG, teal TPE jacket, solid/unshielded cable with 2 twisted pairs.

2X 11.7 [.46"]

PIN 1

2X 36.3 [1.43"]

XX

PIN 1

Wiring Diagram

RJ45	Color	RJ45
1	White/Orange	1
2	Orange	2
3	White/Green	3
6	Green	6

Pin Assignment

RJ45 Socket

1 2 3 4 5 6 7 8

Industrial Ethernet Double-Ended Cordsets for Ethernet/IP
0985 705 500

Technical Data

Environmental

Degree of protection	IP 20
Temperature rating	-20°C(-4°F) to +75°C(+167°F)

Mechanical

Molded body	Polyurethane, black
Coupling nut	Brass, nickel plated
Contacts	Brass, gold over nickel plated
Insert	Polyurethane, black

Cable Specifications

Cable jacket	PVC, (sun and oil resistant)
Color	Teal
Overall diameter	5.62 mm, nominal
Conductor	24AWG, solid bare copper
Insulation	Polyolefin
Agency Approval	UL rated CMR
Cable Type	Moderate Noise, Cat5e Industrial Ethernet Cable

Part Number	Cable Length Options
0985 705 500/...M	0.5 M / 1 M / 2 M / 5 M / 10 M / 15 M

The application of these products in harsh environments should always be checked before use.
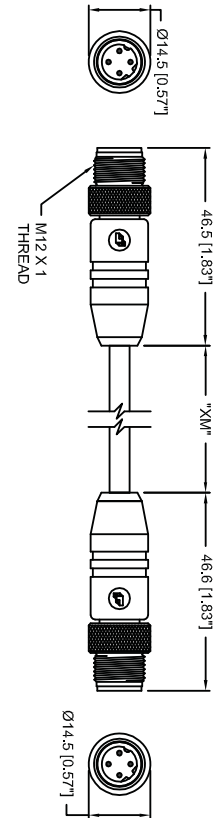Specifications subject to alteration.

Industrial Ethernet Double-Ended Cordsets for Ethernet/IP

EtherNet/IP

0985 707 100

M12 / M12 (Mod-Flex, Shielded, PVC)

EtherNet/IP, moderate-flex, double-ended cord set, M12 male to male straight, 4-pin, D-coding, 24 AWG PVC cable, solid/shielded, 2 twisted pairs with teal jacket.

Ø14.5 [0.57"]

M12 X 1 THREAD

46.5 [1.83"]

"XM"

46.6 [1.83"]

Ø14.5 [0.57"]

Wiring Diagram

M12 / M12

M12	Color	M12
1	White/Orange	1
3	Orange	3
2	White/Green	2
4	Green	4
Nut	Shield	Nut

Pin Assignment

M12 Socket

Industrial Ethernet Double-Ended Cordsets for Ethernet/IP
0985 707 100

Technical Data

Environmental

Degree of protection	IP 68, NEMA 6P
Temperature rating	-20°C(-4°F) to +75°C(+167°F)

Mechanical

Molded body	Polyurethane, black
Coupling nut	Brass, nickel plated
Contacts	Brass, gold over nickel plated
Insert	Polyurethane, black

Cable Specifications

Cable jacket	PVC, (sun and oil Resistant)
Color	Teal
Overall diameter	7.6mm, nominal
Conductor	24AWG, solid bare copper
Insulation	Polyolefin
Inner jacket	PVC
Foil shield	Aluminum/polyester tape, 100% coverage
Braided shield	Tinned copper, 70% coverage
Agency approval	UL rated CMR
Cable type	Moderate Flex, High Noise, Cat5e Industrial Ethernet Cable

Part Number	Cable Length Options	
0985 707 100/...M	2 M / 5 M / 10 M / 20 M / 30 M / 40 M / 50 M / 60 M / 70 M / 80 M / 90 M	

The application of these products in harsh environments should always be checked before use.
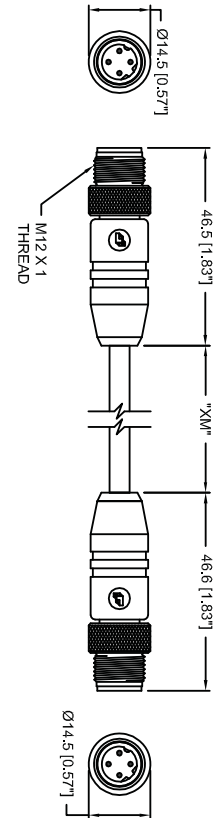Specifications subject to alteration.

![lumbergautomation - A BELDEN BRAND]

Industrial Ethernet Double-Ended Cordsets for Ethernet/IP
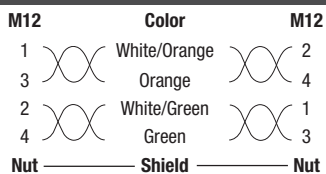
0985 707 101

M12 / M12 (Mod-Flex, Shielded, PVC)

EtherNet/IP, moderate-flex, double-ended cord set, M12 male to male straight, 4-pin, D-coding, 24 AWG PVC cable, solid/shielded, cross-over cable, 2 twisted pairs with teal jacket.

Ø14.5 [0.57"]

M12 X 1 THREAD

46.5 [1.83"]

"XM"

46.6 [1.83"]

Ø14.5 [0.57"]

Wiring Diagram

M12	Color	M12
1	White/Orange	2
3	Orange	4
2	White/Green	1
4	Green	3
Nut	Shield	Nut

Pin Assignment

M12 Socket

Industrial Ethernet Double-Ended Cordsets for Ethernet/IP
0985 707 101

Technical Data

Environmental
Degree of protection	IP 68, NEMA 6P
Temperature rating	-20°C(-4°F) to +75°C(+167°F)

Mechanical
Molded body	Polyurethane, black
Coupling nut	Brass, nickel plated
Contacts	Brass, gold over nickel plated
Insert	Polyurethane, black

Cable Specifications
Cable jacket	PVC, (sun and oil resistant)
Color	Teal
Overall diameter	7.6mm, nominal
Conductor	24AWG, solid bare copper
Insulation	Polyolefin
Inner jacket	PVC
Foil shield	Aluminum/polyester tape, 100% coverage
Braided shield	Tinned copper, 70% coverage
Agency approval	UL rated CMR
Cable type	Moderate Flex, High Noise, Cat5e Industrial Ethernet Cable

Part Number	Cable Length Options	
0985 707 101/...M	2 M / 5 M / 10 M / 20 M / 30 M / 40 M / 50 M / 60 M / 70 M / 80 M / 90 M	

The application of these products in harsh environments should always be checked before use.
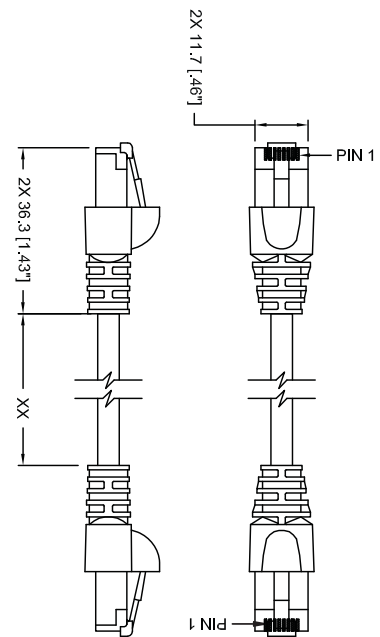Specifications subject to alteration.

EtherNet/IP

Industrial Ethernet Double-Ended Cordsets for Ethernet/IP

0985 707 500

RJ45 / RJ45 (Mod-Flex, Shielded, PVC)

Ethernet I/P, moderate-flex, double-ended cord set, RJ45 male to RJ45 male, 24 AWG, PVC cable, solid/shielded cable, 2 twisted pairs with teal jacket.

2X 11.7 [.46"]
PIN 1

2X 36.3 [1.43"]

XX

PIN 1

Wiring Diagram

RJ45 / RJ45

RJ45	Color	RJ45
1	White/Orange	1
2	Orange	2
3	White/Green	3
6	Green	6
Shell	Shield	Shell

Pin Assignment

RJ45 Socket

1 2 3 4 5 6 7 8

Industrial Ethernet Double-Ended Cordsets for Ethernet/IP
0985 707 500

Technical Data

Environmental

Degree of protection	IP 20
Temperature rating	-20°C(-4°F) to +75°C(+167°F)

Mechanical

Housing	Pre-tinned copper alloy
Insert	Clear polycarbonate
Contacts	50 µ" gold in contact area over nickel plating

Cable Specifications

Cable jacket	PVC, (Sun and Oil Resistant)
Color	Teal
Overall diameter	7.6mm, nominal
Conductor	24AWG, solid bare copper
Insulation	Polyolefin
Inner jacket	PVC
Foil shield	Aluminum/Polyester Tape, 100% coverage
Braided shield	Tinned copper, 70% coverage
Agency approval	UL rated CMR
Cable type	Moderate Flex, High Noise, Cat5e Industrial Ethernet Cable

Part Number	Cable Length Options
0985 707 500/...M	0.5 M / 1 M / 2 M / 5 M / 10 M / 15 M / 20 M / 25 M / 30 M / 40 M / 50 M

The application of these products in harsh environments should always be checked before use.
Specifications subject to alteration.

lumbergautomation
A BELDEN BRAND

Industrial Ethernet Double-Ended Cordsets for Ethernet/IP

0985 S4549 100

M12 / M12 (Shielded, PUR Halogen-Free)

EtherNet/IP, double-ended cord set, M12 male to male straight, 4-pin, D-coding, 26 AWG PUR halogen-free cable, stranded/shielded, 2 twisted pairs with water blue jacket.

Ø14.5 [0.57"]

M12 X 1 THREAD

46.5 [1.83"]

"XM"

46.6 [1.83"]

Ø14.5 [0.57"]
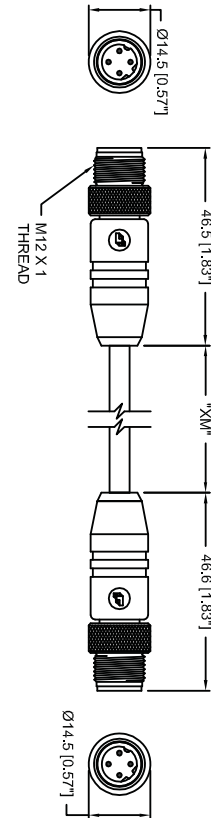
Wiring Diagram

M12 / M12

M12	Color	M12
1	White/Orange	1
3	Orange	3
2	White/Green	2
4	Green	4
Nut	Shield	Nut

Pin Assignment

M12 Socket

Industrial Ethernet Double-Ended Cordsets for Ethernet/IP
0985 S4549 100

Technical Data

Environmental

Degree of protection	IP 68, NEMA 6P
Temperature rating	-40°C(-40°F) to +80°C(+176°F)

Mechanical

Molded body	Polyurethane, black
Coupling nut	Brass, nickel plated
Contacts	Brass, gold plated
Insert	Polyurethane, black

Cable Specifications

Cable jacket	PUR, halogen-free
Color	Water blue
Overall diameter	5.8 mm
Conductor	26AWG, stranded
Number of pairs	2
Foil shield	Aluminum laminated plastic foil
Braid	Tinned copper, 85% coverage
Cable type	CAT5e Industrial Ethernet Cable

Part Number	Cable Length Options	
0985 S4549 100/...M	0.5 M / 1 M / 2 M / 5 M / 10 M / 15 M / 20 M / 30 M / 40 M / 45 M	

The application of these products in harsh environments should always be checked before use.
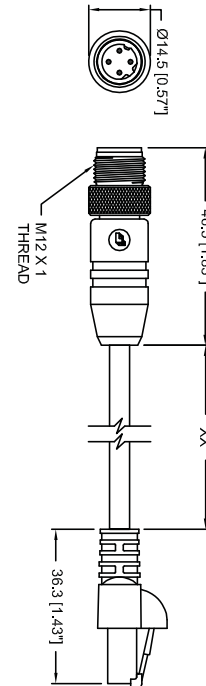Specifications subject to alteration.

Industrial Ethernet Double-Ended Cordsets for Ethernet/IP

EtherNet/IP

0985 S4549 103

M12 / RJ45 (Shielded, PUR Halogen-Free)

EtherNet/IP, double-ended cord set, M12 male to RJ45 male, 4-pin, D-coding, 26 AWG PUR halogen-free cable, stranded/shielded, 2 twisted pairs with water blue jacket.

Ø14.5 [0.57"]

M12 X 1 THREAD

46.5 [1.83"]

"XX"

36.3 [1.43"]

Wiring Diagram

M12	Color	RJ45
1	White/Orange	1
3	Orange	2
2	White/Green	3
4	Green	6
Nut	Shield	Shell

Pin Assignment

M12 Socket	RJ45 Socket
2 3 1 4	1 2 3 4 5 6 7 8

Industrial Ethernet Double-Ended Cordsets for Ethernet/IP
0985 S4549 103

Technical Data

Environmental

Degree of protection	M12: IP 68 / RJ45: IP 20
Temperature rating	-40°C(-40°F) to +75°C(+167°F)

Mechanical — **M12**

Molded Body	PUR, Black
Coupling Nut	Brass, Nickel plated
Contacts	Brass, Gold over Nickel plated
Insert	PUR, Self extingusing

RJ45

Housing	Pre-tinned copper alloy
Insert	Clear polycarbonate
Contacts	50 µ" gold in contact area over nickel plating

Cable Specifications

Cable jacket	PUR, halogen-free
Color	Water blue
Overall diameter	5.8 mm
Conductor	26AWG, stranded
Number of pairs	2
Foil shield	Aluminum laminated plastic foil
Braid	Tinned copper, 85% coverage
Cable type	CAT5e Industrial Ethernet Cable

Part Number	Cable Length Options	
0985 S4549 103/...M	0.5 M / 1 M / 2 M / 5 M / 10 M / 15 M / 20 M / 30 M	

The application of these products in harsh environments should always be checked before use.
Specifications subject to alteration.

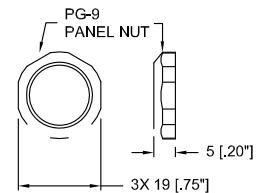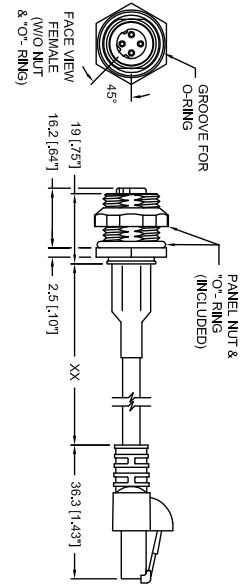NOTE: Vibration & Oil Resistant applies to M12 side only.

Industrial Ethernet Double-Ended Cordsets for Ethernet/IP

0985 S4549 104

M12 / RJ45 (Shielded, PUR Halogen-Free)

EtherNet/IP, double-ended cord set, M12 female receptacle to RJ45 male, 4-pin, D-coding, 26 AWG PUR halogen-free cable, stranded/shielded, 2 twisted pairs with water blue jacket.

FACE VIEW
FEMALE
(W/O NUT
& "O"-RING)

45°

GROOVE FOR
O-RING

19 [.75"]
16.2 [.64"]

2.5 [.10"]

XX

PANEL NUT &
"O"-RING
(INCLUDED)

36.3 [1.43"]

PG-9
PANEL NUT

5 [.20"]
3X 19 [.75"]

Wiring Diagram

M12 / RJ45

M12	Color	RJ45
1	White/Orange	1
3	Orange	2
2	White/Green	3
4	Green	6
Shell	Shield	Shell

Pin Assignment

M12 Socket	RJ45 Socket	Recommended Panel Cut Out
		Ø15.4 [Ø.61"]
	1 2 3 4 5 6 7 8	13.6 [.54"]
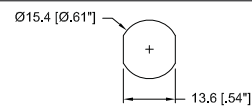
Industrial Ethernet Double-Ended Cordsets for Ethernet/IP
0985 S4549 104

Technical Data

Environmental

Degree of protection	M12: IP 68 / RJ45: IP 20
Temperature rating	-20°C(-4°F) to +75°C(+167°F)

Mechanical — **M12**

Housing	Brass, nickel plated
Insert	PUR, black
Contacts	Brass, gold plated
Insert	PUR, black

RJ45

Plug	Polycarbonate
Contacts	Phosphor bronze, gold plated
Boot	Elastomer polyolefin
Shell	Copper alloy, nickel plated

Cable Specifications

Cable jacket	PUR, halogen-free
Color	Water blue
Overall diameter	5.8 mm
Conductor	26AWG, stranded
Number of pairs	2
Foil shield	Aluminum laminated plastic foil
Braid	Tinned copper, 85% coverage
Cable type	CAT5e Industrial Ethernet Cable

Part Number	Cable Length Options
0985 S4549 104/...M	0.5 M / 1 M / 2 M / 5 M / 10 M / 15 M / 20 M / 25 M / 30 M / 35 M

The application of these products in harsh environments should always be checked before use.
Specifications subject to alteration.

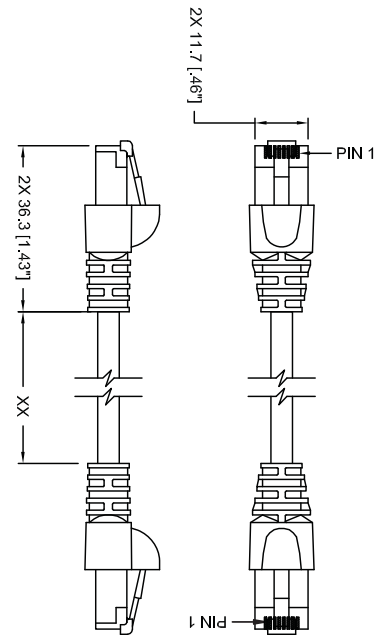NOTE: Vibration & Oil Resistant applies to M12 side only.

EtherNet/IP

Industrial Ethernet Double-Ended Cordsets for Ethernet/IP

0985 S4549 500

RJ45 / RJ45 (Shielded, PUR Halogen-Free)

EtherNet/IP, double-ended cord set, RJ45 male to RJ45 male, 4-pin, 26 AWG PUR halogen-free cable, stranded/shielded, 2 twisted pairs with water blue jacket.

Wiring Diagram

RJ45 / RJ45

RJ45	Color	RJ45
1	White/Orange	1
2	Orange	2
3	White/Green	3
6	Green	6
Shell	**Shield**	**Shell**

Pin Assignment

RJ45 Socket

1 2 3 4 5 6 7 8

Industrial Ethernet Double-Ended Cordsets for Ethernet/IP
0985 S4549 500

Technical Data

Environmental

Degree of protection	M12: IP 68 / RJ45: IP 20
Temperature rating	-20°C(-4°F) to +75°C(+167°F)

Mechanical

Plug	Polycarbonate
Contacts	Phosphor bronze, gold plated
Boot	Elastomer Polyolefin
Shell	Copper alloy, nickel platedk

Cable Specifications

Cable jacket	PUR, halogen-free
Color	Water blue
Overall diameter	5.8 mm
Conductor	26AWG, stranded
Number of pairs	2
Foil shield	Aluminum laminated plastic foil
Braid	Tinned copper, 85% coverage
Cable type	CAT5e Industrial Ethernet Cable

Part Number	Cable Length Options		
0985 S4549 500/...M	0.3 M / 0.5 M / 1 M / 2 M / 3 M / 4 M / 5 M / 10 M / 15 M		

The application of these products in harsh environments should always be checked before use.
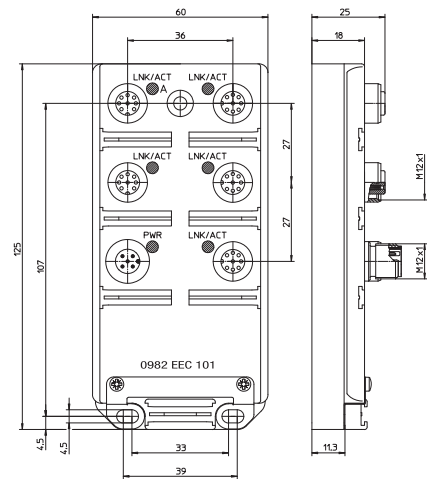Specifications subject to alteration.

EtherMATE™ Industrial Ethernet Switches

0982 EEC 101

5 Port (unmanaged switch)

Ethernet-Switch, IP 67, 5-port switch for 10 and 100 Mbaud transmission rates, M12 socket 8 poles, M12 power supply 5 poles standard coding.

0982 EEC 101

Pin Assignment

M12 Socket			Power supply M12	
1 = TD+	5 = RX+		1 = 24 V	
2 = RD+	6 = TX+		2 = n.c	
3 = TD-	7 = n.c.		3 = GND (0 V)	
4 = RD	8 = RX-		4 = n.c.	
	housing shield		5 = earth	

EtherMATE™ Industrial Ethernet Switches
0982 EEC 101

Technical Data

Environmental
Degree of protection	IP 67
Operating temperature range	0°C (32°F) to +60°C (+140°F)

Mechanical
Weight	210 g
Housing material	PUR

Switch Functionality
Mode of operation	Store and forward
Number of storable addresses	1000
Aging time	300 s
Tagging	EtherNet telegrams with VLAN tag field are transmitted unchanged

Ethernet Ports — **10BASE-T / 100BASE-TX**
Data transmission rate	10 Mbit/s and 100 Mbit/s
Cable type	Twisted Pair (TP/TX) or star quad, CAT 5, shielded
Number of ports	5
Conductors/pins	8
Length of a TP segment	100 m
Link control	yes
Autopolarity	yes
Autonegotiation	yes
Autocrossing	yes
Channel status indicator	LED green per port

Electronics Power Supply — **PWR**
Rated voltage	24 V DC
Voltage range	18–30 V DC
Power consumption	2.4 W
Reverse polarity protection	yes
Indication	LED green

Included in delivery/accessories
Dust covers M12	2 pieces
Attachable labels	10 pieces

Part Number
0982 EEC 101

The application of these products in harsh environments should always be checked before use.
Specifications subject to alteration.

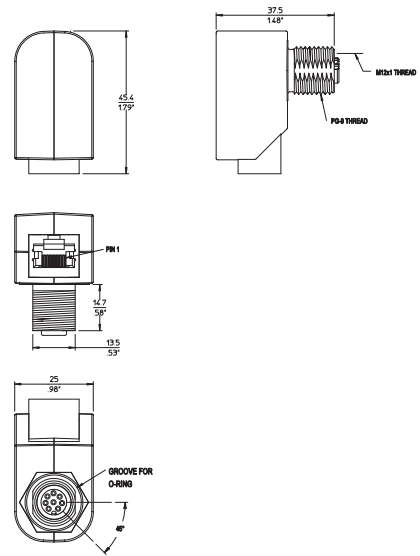## EtherMATE™ Industrial Ethernet Panel-Mount Adaptor

0981 ENC 102

M12 / RJ45 (panel-mount adaptor)

RJ45/M12 adaptor, female receptacle connector, 8 pin, M12, standard coding, chassis side thread PG 9, RJ45 female connector, 90 degree.

Wiring Diagram

M12 / RJ45

M12		RJ45
6	Tx+	1
4	Tx-	2
5	Rx+	3
7		4
1		5
8	Rx+	6
2		7
3		8

Pin Assignment

M12 Socket	RJ45 Socket
	1 2 3 4 5 6 7 8

EtherMATE™ Industrial Ethernet Panel-Mount Adaptor
0981 ENC 102

Technical Data

Environmental

Degree of protection	M12: IP 67 / RJ45: IP 20
Operating temperature range	0°C (32°F) to +70°C (+158°F)

Materials

Housing	PA

	M12
Contacts	CuZn, pre-nickeled and gold-plated
Housing	CuZn, nickel-plated
Insert	PUR, self extinguishing
O-ring	FKM

	RJ45
Contacts	CuSn, pre-nickeled and gold-plated
Housing	CuZn, tin-plated
Insert	PA GF

Electrical

Nominal current	1.5 A
Nominal voltage	max. 60 V

Part Number
0981 ENC 102

The application of these products in harsh environments should always be checked before use.
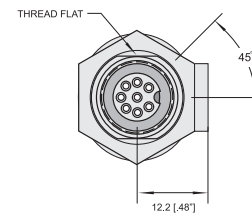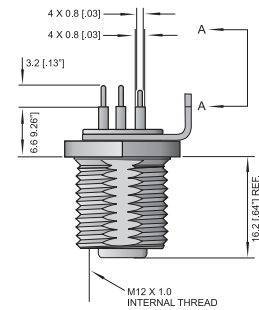Specifications subject to alteration.

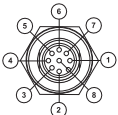## EtherMATE™ Industrial Ethernet PCB Receptacle

0986 EFC 100

8-Pole, Female

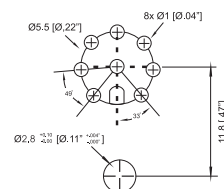Receptacle connector, M12 female connector, 8-pole, PCB contacts with board lock.

4 X 0.8 [.03]

4 X 0.8 [.03]

3.2 [.13"]

6.6 9.26"]

16.2 [.64"] REF.

A

A

M12 X 1.0
INTERNAL THREAD

THREAD FLAT

45°

12.2 [.48"]

Pin Assignments

Face Views / M12	Recommended PCB Pattern

4 poles D-Coding

Ø5.5 [Ø.22"]

8x Ø1 [Ø.04"]

Ø2,8 ⁺⁰·¹⁰ [Ø.11" ⁺·⁰⁰⁶"]

11.8 [.47"]

EtherMATE™ Industrial Ethernet PCB Receptacle
0986 EFC 100

Technical Data

Environmental

Degree of protection	IP 67 / NEMA 6P
Operating temperature range	-25°C (-13°F) / +90°C (+194°F)

Mechanical

Housing / Molded body	CuZn, nickel-plated
Insert	PUR, black
Contact	CuZn, gold over nickel plated
O-ring	Viton
Board lock	Phosphor bronze, tin-lead plated

Electrical

Current rating	4 A
Voltage rating	250 V

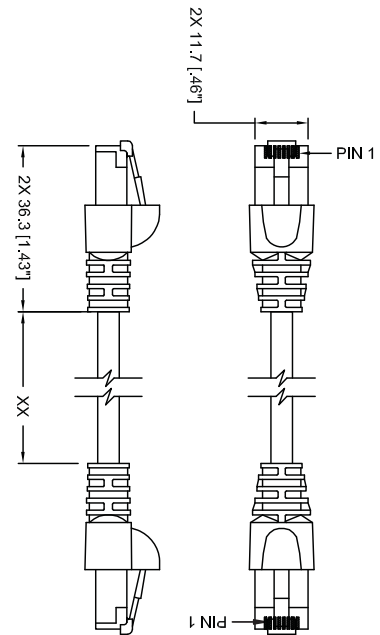| Part Number	Pins	Characteristics
0986 EFC 100	**8**	

etherMATE

EtherMATE™ Industrial Ethernet Double-Ended Cordsets

0985 606 500

RJ45 / RJ45 (Unshielded, PVC)

Industrial Ethernet double-ended cord set, **moderate–flex**, male, RJ45 to RJ45 straight, 4-pair, 24 AWG, PVC cable, **solid/unshielded** with teal jacket.

2X 11.7 [.46"]

2X 36.3 [1.43"]

XX

PIN 1

PIN 1

Wiring Diagram

RJ45 / RJ45

RJ45	Color	RJ45
1	White/Orange	1
2	Orange	2
5	White/Blue	5
4	Blue	4
3	White/Green	3
6	Green	6
7	White/Brown	7
8	Brown	8

Pin Assignment

RJ45 Socket

1 2 3 4 5 6 7 8

EtherMATE™ Industrial Ethernet Double-Ended Cordsets
0985 606 500

Technical Data

Environmental

Degree of protection	IP 20
Temperature rating	-20°C(-4°F) to +75°C(+167°F)

Mechanical

Plug	Polycarbonate
Contacts	Phosphor bronze, gold plated
Boot	Elastomer polyolefin
Shell	Copper alloy, nickel plated

Cable Specifications

Cable jacket	PVC (sun and oil resistant)
Color	Teal
Overall diameter	5.87 mm
Conductor	24AWG, solid
Number of pairs	4
Cable type	CAT5e, moderate flex / moderate noise

Part Number	Cable Length Options
0985 606 500/...M	0.3 M / 0.5 M / 1 M / 2 M / 3 M / 4 M / 5 M / 10 M / 15 M / 20 M / 25 M/ 30 M / 35 M / 40 M / 45 M / 50 M / 55 M / 60 M / 65 M / 70 M / 75 M / 80 M / 85 M / 90 M

The application of these products in harsh environments should always be checked before use.
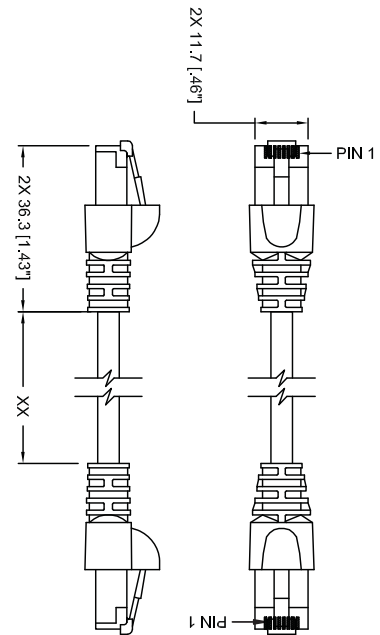Specifications subject to alteration.

etherMATE

EtherMATE™ Industrial Ethernet Double-Ended Cordset

0985 607 500

RJ45 / RJ45 (Unshielded, PVC)

Industrial Ethernet double-ended cord set, **high–flex**, male, RJ45 to RJ45 straight, 4–pair, 24 AWG, PVC cable, **stranded/unshielded** with teal jacket.

2X 11.7 [.46"]

2X 36.3 [1.43"]

XX

PIN 1

PIN 1

Wiring Diagram

RJ45 / RJ45

RJ45	Color	RJ45
1	White/Orange	1
2	Orange	2
5	White/Blue	5
4	Blue	4
3	White/Green	3
6	Green	6
7	White/Brown	7
8	Brown	8

Pin Assignment

RJ45 Socket

1 2 3 4 5 6 7 8

EtherMATE™ Industrial Ethernet Double-Ended Cordset
0985 607 500

Technical Data

Environmental

Degree of protection	IP 20
Temperature rating	-20°C(-4°F) to +75°C(+167°F)

Mechanical

Plug	Polycarbonate
Contacts	Phosphor bronze, gold plated
Boot	Elastomer polyolefin
Shell	Copper alloy, nickel plated

Cable Specifications

Cable jacket	PVC (sun and oil resistant)
Color	Teal
Overall diameter	6.50 mm
Conductor	24AWG, stranded (tin copper)
Number of pairs	4
Cable type	CAT5e, high flex / moderate noise

Part Number	Cable Length Options
0985 607 500/...M	0.3 M / 0.5 M / 1 M / 2 M / 3 M / 4 M / 5 M / 10 M / 15 M / 20 M / 25 M/ 30 M / 35 M / 40 M / 45 M / 50 M / 55 M / 60 M / 65 M / 70 M / 75 M / 80 M / 85 M / 90 M

The application of these products in harsh environments should always be checked before use.
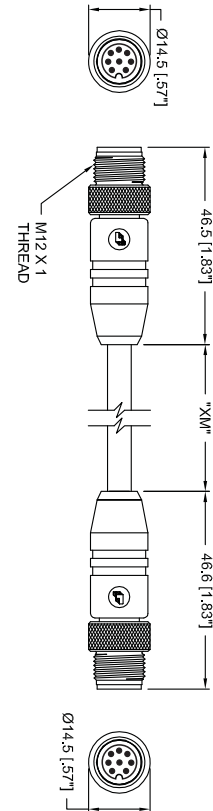Specifications subject to alteration.

etherMATE

0985 609 100

EtherMATE™ Industrial Ethernet Double-Ended Cordset

M12 / M12 (Shielded, PVC)

Industrial Ethernet double-ended cord set, **moderate-flex**, male, RJ45 to RJ45 straight, 4-pair, 24 AWG, PVC cable, **solid/shielded** with teal jacket and orange inserts.

Ø14.5 [.57"]

M12 X 1 THREAD

46.5 [1.83"]

"XM"

46.6 [1.83"]

Ø14.5 [.57"]

Wiring Diagram

M12 / M12		
M12	**Color**	**M12**
6	White/Orange	6
4	Orange	4
1	White/Blue	1
7	Blue	7
5	White/Green	5
8	Green	8
2	White/Brown	2
3	Brown	3
Nut	**Shield**	**Nut**

Pin Assignment

M12 Socket

EtherMATE™ Industrial Ethernet Double-Ended Cordset
0985 609 100

Technical Data

Environmental

Degree of protection	IP 20
Temperature rating	-20°C(-4°F) to +75°C(+167°F)

Mechanical

Molded Body	PUR, black
Coupling nut	Brass, nickel plated
Contacts	Brass, gold over nickel plated
Insert	PUR, self extingusing

Cable Specifications

Cable Jacket	PVC, (sun and oil resistant)
Color:	Teal
Overall diameter	7.26mm, nominal
Conductor	24AWG, solid
Insulation	Polyethylene
Foil shield	Aluminum/polypropylene tape, 100% coverage
Braided shield	Tinned copper, 65% coverage
EMI protection	50 dB @ 0.772 MHz - 1000 MHz
Agency approval	ETL rated CMR
Cable Type	CAT5e, moderate flex / high noise

Part Number	Cable Length Options
0985 609 100/...M	0.3 M / 0.5 M / 1 M / 2 M / 3 M / 4 M / 5 M / 10 M / 15 M / 20 M / 25 M/ 30 M / 35 M / 40 M / 45 M / 50 M / 55 M / 60 M / 65 M / 70 M / 75 M / 80 M / 85 M / 90 M

The application of these products in harsh environments should always be checked before use.
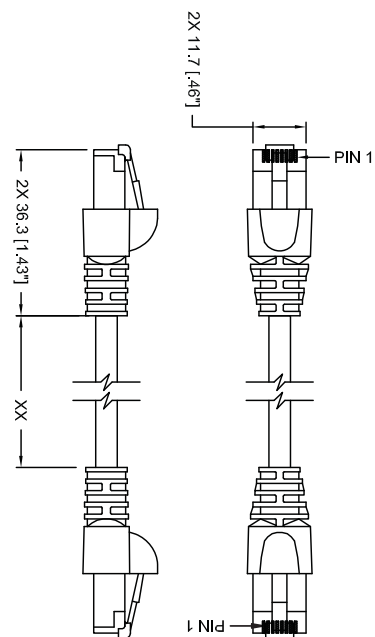Specifications subject to alteration.

EtherMATE™ Industrial Ethernet Double-Ended Cordset

0985 609 101

M12 / M12 (Shielded, PVC)

Industrial Ethernet double-ended cord set, **moderate-flex**, male, RJ45 to RJ45 straight, 4-pair, 24 AWG, PVC cable, **solid/shielded**, crossover with teal jacket and orange inserts.

Ø14.5 [.57"]

M12 X 1 THREAD

46.5 [1.83"]

"XM"

46.6 [1.83"]

Ø14.5 [.57"]
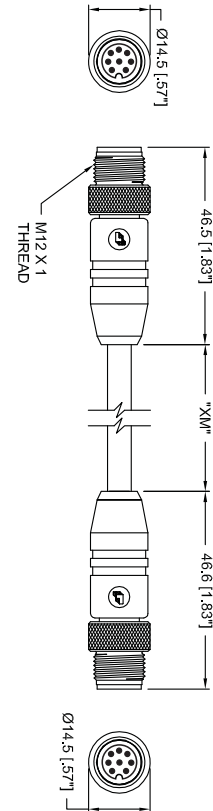
Wiring Diagram

M12	Color	M12 Crossover Wire
6	White/Orange	5
4	Orange	8
1	White/Blue	1
7	Blue	7
5	White/Green	6
8	Green	4
2	White/Brown	2
3	Brown	3
Nut	**Shield**	**Nut**

M12 / M12

Pin Assignment

M12 Socket

EtherMATE™ Industrial Ethernet Double-Ended Cordset
0985 609 101

Technical Data

Environmental

Degree of protection	IP 20
Temperature rating	-20°C(-4°F) to +75°C(+167°F)

Mechanical

Molded Body	PUR, black
Coupling nut	Brass, nickel plated
Contacts	Brass, gold over nickel plated
Insert	PUR, self extingusing

Cable Specifications

Cable Jacket	PVC, (sun and oil resistant)
Color:	Teal
Overall diameter	7.26mm, nominal
Conductor	24AWG, solid
Insulation	Polyethylene
Foil shield	Aluminum/polypropylene tape, 100% coverage
Braided shield	Tinned copper, 65% coverage
EMI protection	50 dB @ 0.772 MHz - 1000 MHz
Agency approval	ETL rated CMR
Cable Type	CAT5e, moderate flex / high noise

Part Number	Cable Length Options	
0985 609 101/...M	0.3 M / 0.5 M / 1 M / 2 M / 3 M / 4 M / 5 M / 10 M / 15 M / 20 M / 25 M/ 30 M / 35 M / 40 M / 45 M / 50 M / 55 M / 60 M / 65 M / 70 M / 75 M / 80 M / 85 M / 90 M	

The application of these products in harsh environments should always be checked before use.
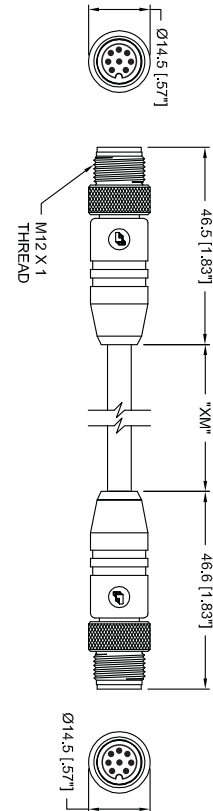Specifications subject to alteration.

![lumberg automation - A BELDEN BRAND]

EtherMATE™ Industrial Ethernet Double-Ended Cordset

RJ45 / RJ45 (Shielded, PVC)

Industrial Ethernet double-ended cord set, **moderate-flex**, male, RJ45 to RJ45 straight, 4-pair, 24 AWG, PVC cable, **solid/shielded** with teal jacket.

2X 11.7 [.46"]
PIN 1
2X 36.3 [1.43"]
XX
PIN 1

Wiring Diagram

RJ45 / RJ45		
RJ45	**Color**	**RJ45**
1	White/Orange	1
2	Orange	2
5	White/Blue	5
4	Blue	4
3	White/Green	3
6	Green	6
7	White/Brown	7
8	Brown	8

Pin Assignment

RJ45 Socket

1 2 3 4 5 6 7 8

EtherMATE™ Industrial Ethernet Double-Ended Cordset
0985 609 500

Technical Data

Environmental

Degree of protection	IP 20
Temperature rating	-20°C(-4°F) to +75°C(+167°F)

Mechanical

Plug	Polycarbonate
Contacts	Phosphor bronze, gold plated
Boot	Elastomer polyolefin
Shell	Copper alloy, nickel plated

Cable Specifications

Cable Jacket	PVC, (sun and oil resistant)
Color:	Teal
Overall diameter	7.26mm, nominal
Conductor	24AWG, solid
Insulation	Polyethylene
Foil shield	Aluminum/polypropylene tape, 100% coverage
Braided shield	Tinned copper, 65% coverage
EMI protection	50 dB @ 0.772 MHz - 1000 MHz
Agency approval	ETL rated CMR
Cable Type	CAT5e, moderate flex / high noise

Part Number	Cable Length Options	
0985 609 500/...M	0.3 M / 0.5 M / 1 M / 2 M / 3 M / 4 M / 5 M / 10 M / 15 M / 20 M / 25 M/ 30 M / 35 M / 40 M / 45 M / 50 M / 55 M / 60 M / 65 M / 70 M / 75 M / 80 M / 85 M / 90 M	

The application of these products in harsh environments should always be checked before use.
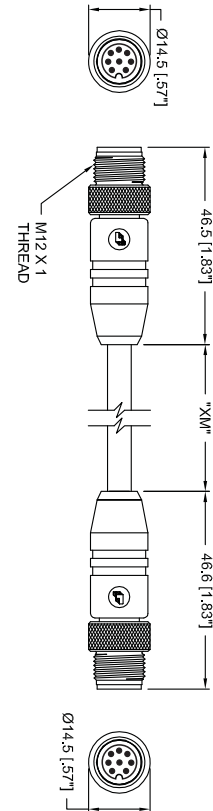Specifications subject to alteration.

etherMATE®

EtherMATE™ Industrial Ethernet Double-Ended Cordset

0985 656 100

M12 / M12 (Shielded, PVC)

Industrial Ethernet double-ended cord set, **high-flex**, male, RJ45 to RJ45 straight, 4-pair, 24 AWG, PVC cable, **stranded/shielded** with teal jacket and orange inserts.

Ø14.5 [.57"]

M12 X 1 THREAD

46.5 [1.83"]

"XM"

46.6 [1.83"]

Ø14.5 [.57"]

Wiring Diagram

M12	Color	M12
6	White/Orange	6
4	Orange	4
1	White/Blue	1
7	Blue	7
5	White/Green	5
8	Green	8
2	White/Brown	2
3	Brown	3
Nut	**Shield**	**Nut**

Pin Assignment

M12 Socket

EtherMATE™ Industrial Ethernet Double-Ended Cordset
0985 656 100

Technical Data

Environmental
Degree of protection   IP 20
Temperature rating   -20°C(-4°F) to +75°C(+167°F)

Mechanical
Molded Body   PUR, black
Coupling nut   Brass, nickel plated
Contacts   Brass, gold over nickel plated
Insert   PUR, self extingusing

Cable Specifications
Cable Jacket   PVC, (sun and oil resistant)
Color: Teal
Overall diameter   7.77mm, nominal
Conductor   24AWG, 7 strands tinned copper
Insulation   Polyethylene
Foil shield   Aluminum/polypropylene tape, 100% coverage
Braided shield   Tinned copper, 65% coverage
EMI protection   50 dB @ 0.772 MHz - 1000 MHz
Agency approval   ETL rated CMR
Cable Type   CAT5e, high flex / high noise

Part Number	Cable Length Options
0985 656 100/...M	0.3 M / 0.5 M / 1 M / 2 M / 3 M / 4 M / 5 M / 10 M / 15 M / 20 M / 25 M/ 30 M / 35 M / 40 M / 45 M / 50 M / 55 M / 60 M / 65 M / 70 M / 75 M / 80 M / 85 M / 90 M

The application of these products in harsh environments should always be checked before use.
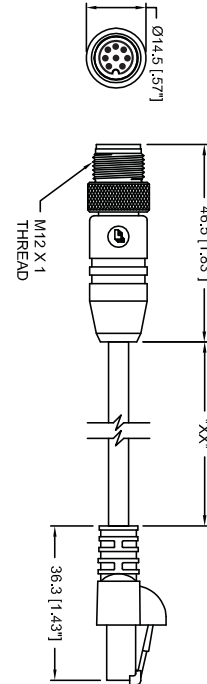Specifications subject to alteration.

EtherMATE™ Industrial Ethernet Double-Ended Cordset

0985 656 101

M12 / M12 (Shielded, PVC)

Industrial Ethernet double-ended cord set, **high-flex**, male, RJ45 to RJ45 straight, 4-pair, 24 AWG, PVC cable, **stranded/shielded**, crossover with teal jacket and orange inserts.

Ø14.5 [.57"]

M12 X 1 THREAD

46.5 [1.83"]

"XM"

46.6 [1.83"]

Ø14.5 [.57"]

Wiring Diagram

M12 / M12

M12	Color	M12 Crossover Wire
6	White/Orange	5
4	Orange	8
1	White/Blue	1
7	Blue	7
5	White/Green	6
8	Green	4
2	White/Brown	2
3	Brown	3
Nut	Shield	**Nut**

Pin Assignment

M12 Socket

EtherMATE™ Industrial Ethernet Double-Ended Cordset
0985 656 101

Technical Data

Environmental

Degree of protection	IP 20
Temperature rating	-20°C(-4°F) to +75°C(+167°F)

Mechanical

Molded Body	PUR, black
Coupling nut	Brass, nickel plated
Contacts	Brass, gold over nickel plated
Insert	PUR, self extingusing

Cable Specifications

Cable Jacket	PVC, (sun and oil resistant)
Color:	Teal
Overall diameter	7.77mm, nominal
Conductor	24AWG, 7 strands tinned copper
Insulation	Polyethylene
Foil shield	Aluminum/polypropylene tape, 100% coverage
Braided shield	Tinned copper, 65% coverage
EMI protection	50 dB @ 0.772 MHz - 1000 MHz
Agency approval	ETL rated CMR
Cable Type	CAT5e, high flex / high noise

Part Number	Cable Length Options	
0985 656 101/...M	0.3 M / 0.5 M / 1 M / 2 M / 3 M / 4 M / 5 M / 10 M / 15 M / 20 M / 25 M/ 30 M / 35 M / 40 M / 45 M / 50 M / 55 M / 60 M / 65 M / 70 M / 75 M / 80 M / 85 M / 90 M	

The application of these products in harsh environments should always be checked before use.
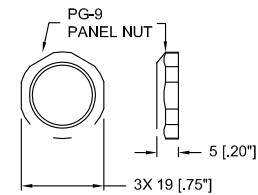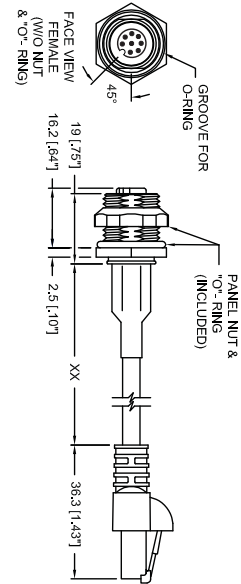Specifications subject to alteration.

EtherMATE™ Industrial Ethernet Double-Ended Cordset

etherMATE®

0985 656 103

M12 / RJ45 (Shielded, PVC)

Industrial Ethernet double-ended cord set, **high-flex**, male, M12 to RJ45 straight, 4-pair, 24 AWG, PVC cable, **stranded/shielded** with teal jacket and orange inserts.

Ø14.5 [.57"]

M12 X 1 THREAD

46.5 [1.83"]

"XX"

36.3 [1.43"]

Wiring Diagram

M12 / RJ45		
M12	**Color**	**RJ45**
6	White/Orange	1
4	Orange	2
1	White/Blue	5
7	Blue	4
5	White/Green	3
8	Green	6
2	White/Brown	7
3	Brown	8
Nut	**Shield**	**Shell**

Pin Assignment

M12 Socket	RJ45 Socket
	1 2 3 4 5 6 7 8

EtherMATE™ Industrial Ethernet Double-Ended Cordset
0985 656 103

Technical Data

Environmental

Degree of protection	M12: IP 67 / RJ45: IP 20
Temperature rating	-20°C(-4°F) to +75°C(+167°F)

Mechanical	**M12**
Molded Body	PUR, Black
Coupling Nut	Brass, Nickel plated
Contacts	Brass, Gold over Nickel plated
Insert	PUR, Self extingusing

	RJ45
Housing	Pre-tinned copper alloy
Insert	Clear polycarbonate
Contacts	50 µ" gold in contact area over nickel plating

Cable Specifications

Cable Jacket	PVC, (sun and oil resistant)
Color:	Teal
Overall diameter	7.77mm, nominal
Conductor	24AWG, 7 strands tinned copper
Insulation	Polyethylene
Foil shield	Aluminum/polypropylene tape, 100% coverage
Braided shield	Tinned copper, 65% coverage
EMI protection	50 dB @ 0.772 MHz - 1000 MHz
Agency approval	ETL rated CMR
Cable Type	CAT5e, high flex / high noise

Part Number	Cable Length Options
0985 656 103/...M	0.3 M / 0.5 M / 1 M / 2 M / 3 M / 4 M / 5 M / 10 M / 15 M / 20 M

The application of these products in harsh environments should always be checked before use.
Specifications subject to alteration.

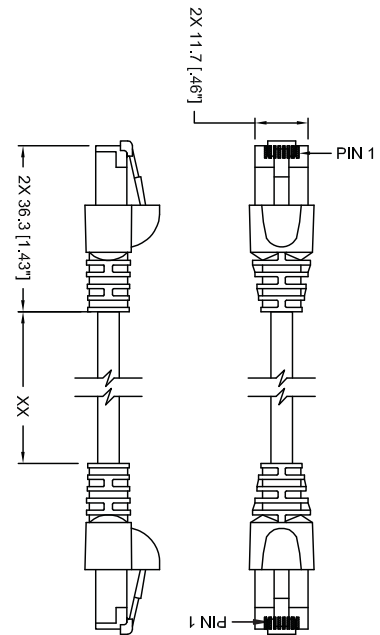NOTE: Vibration & Oil Resistant applies to M12 side only.

etherMATE

EtherMATE™ Industrial Ethernet Double-Ended Ethernet Cordset

0985 656 104

M12 Receptacle / RJ45 (Shielded, PVC)

Industrial Ethernet, double-ended cord set, **high-flex**, M12 female receptacle to RJ45 male, 4-pair, 24 AWG, PVC cable, **stranded/shielded**, with teal jacket.

FACE VIEW FEMALE (W/O NUT & "O"-RING)

GROOVE FOR O-RING

45°

19 [.75"]
16.2 [.64"]

2.5 [.10"]

XX

36.3 [1.43"]

PANEL NUT & "O"-RING (INCLUDED)

PG-9 PANEL NUT

5 [.20"]

3X 19 [.75"]

Wiring Diagram

M12 / RJ45		
M12	**Color**	**RJ45**
6	White/Orange	1
4	Orange	2
1	White/Blue	5
7	Blue	4
5	White/Green	3
8	Green	6
2	White/Brown	7
3	Brown	8
Nut	**Shield**	**Shell**

Pin Assignment

M12 Socket	RJ45 Socket	Recommended Panel Installation

RECOMMENDED PANEL CUT-OUT

Ø17.3 [Ø.68"]

15.5 [.61"]

FOR INSULATED APPLICATIONS

RECOMMENDED PANEL CUT-OUT

Ø15.4 [Ø.61"]

13.6 [.54"]

FOR NON-INSULATED APPLICATIONS

INSULATING WASHER

INSULATING COLLAR

1 2 3 4 5 6 7 8
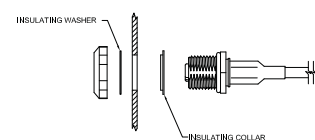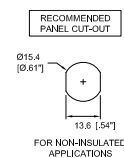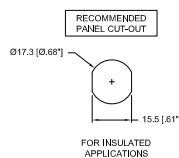
EtherMATE™ Industrial Ethernet Double-Ended Ethernet Cordset
0985 656 104

Technical Data

Environmental

Degree of protection	M12: IP 68 / RJ45: IP 20
Temperature rating	-20°C(-4°F) to +75°C(+167°F)

Mechanical — **M12**

Housing	Brass, nickel plated
Insert	PUR, black
Contacts	Brass, gold plated
Insert	PUR, black

RJ45

Plug	Polycarbonate
Contacts	Phosphor bronze, gold plated
Boot	Elastomer polyolefin
Shell	Copper alloy, nickel plated

Cable Specifications

Cable Jacket	PVC, (sun and oil resistant)
Color:	Teal
Overall diameter	7.77mm, nominal
Conductor	24AWG, 7 strands tinned copper
Insulation	Polyethylene
Foil shield	Aluminum/polypropylene tape, 100% coverage
Braided shield	Tinned copper, 65% coverage
EMI protection	50 dB @ 0.772 MHz - 1000 MHz
Agency approval	ETL rated CMR
Cable Type	CAT5e, high flex / high noise

Part Number	Cable Length Options
0985 656 104/...M	0.5 M / 1 M / 2 M / 5 M / 10 M / 15 M / 20 M

The application of these products in harsh environments should always be checked before use.
Specifications subject to alteration.

NOTE: Vibration & Oil Resistant applies to M12 side only.

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EtherMATE™ Industrial Ethernet Double-Ended Cordset

0985 656 500

RJ45 / RJ45 (Shielded, PVC)

Industrial Ethernet double-ended cord set, **moderate–flex**, male, RJ45 to RJ45 straight, 4-pair, 24 AWG, PVC cable, **stranded/shielded** with teal jacket.

Wiring Diagram

RJ45 / RJ45		
RJ45	Color	RJ45
1	White/Orange	1
2	Orange	2
5	White/Blue	5
4	Blue	4
3	White/Green	3
6	Green	6
7	White/Brown	7
8	Brown	8
Shell	Shield	Shell

Pin Assignment

RJ45 Socket

1 2 3 4 5 6 7 8

EtherMATE™ Industrial Ethernet Double-Ended Cordset
0985 656 500

Technical Data

Environmental

Degree of protection	IP 20
Temperature rating	-20°C(-4°F) to +75°C(+167°F)

Mechanical

Plug	Polycarbonate
Contacts	Phosphor bronze, gold plated
Boot	Elastomer polyolefin
Shell	Copper alloy, nickel plated

Cable Specifications

Cable Jacket	PVC, (sun and oil resistant)
Color:	Teal
Overall diameter	7.77mm, nominal
Conductor	24AWG, 7 strands tinned copper
Insulation	Polyethylene
Foil shield	Aluminum/polypropylene tape, 100% coverage
Braided shield	Tinned copper, 65% coverage
EMI protection	50 dB @ 0.772 MHz - 1000 MHz
Agency approval	ETL rated CMR
Cable Type	CAT5e, high flex / high noise

Part Number	Cable Length Options
0985 656 500/...M	0.3 M / 0.5 M / 1 M / 2 M / 3 M / 4 M / 5 M / 10 M / 15 M / 20 M / 25 M/ 30 M / 35 M / 40 M / 45 M / 50 M / 55 M / 60 M / 65 M / 70 M / 75 M / 80 M / 85 M / 90 M

The application of these products in harsh environments should always be checked before use.
Specifications subject to alteration.

lumbergautomation

A **BELDEN** BRAND

etherMATE

EtherMATE™ Industrial Ethernet Double-Ended Cordset

0985 S3667 100

M12 / M12 (Shielded, PUR, halogen-free)

Industrial Ethernet double-ended cord set, male,
M12 to M12 straight, 4-twisted pair, 26 AWG,
PUR halogen-free cable, **stranded/shielded**
with blue jacket, orange inserts.
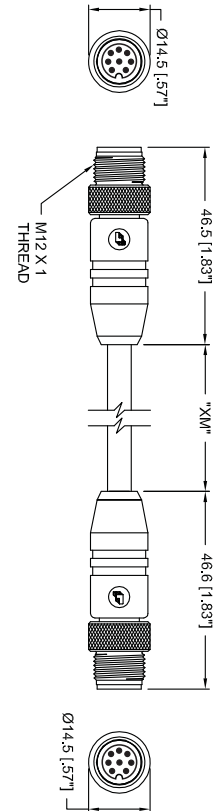
Ø14.5 [.57"]

M12 X 1
THREAD

46.5 [1.83"]

"XM"

46.6 [1.83"]

Ø14.5 [.57"]

Wiring Diagram

M12	Color	M12
6	White/Orange	6
4	Orange	4
1	White/Blue	1
7	Blue	7
5	White/Green	5
8	Green	8
2	White/Brown	2
3	Brown	3
Nut	Shield	Nut

Pin Assignment

M12 Socket

Be Certain with Belden

EtherMATE™ Industrial Ethernet Double-Ended Cordset
0985 S3667 100

Technical Data

Environmental
Degree of protection	IP 68, NEMA 6P
Temperature rating	-40°C(-40°F) to +80°C(+176°F)

Mechanical
Molded Body	PUR, black
Coupling nut	Brass, nickel plated
Contacts	Brass, gold over nickel plated
Insert	PUR, self extingusing

Electrical
Current rating	1.5 A
Voltage rating	60 V

Cable Specifications
Cable jacket	PUR, halogen free
Jacket color	Blue
Overall diameter	6.1 mm
Conductor	26 AWG stranded
Insulation	Foam-skin
Foil shield	Aluminium foil
Braided shield	Tinned copper, 85% coverage

Part Number	Cable Length Options	
0985 S3667 100/...M	0.3 M / 0.5 M / 1 M / 2 M / 3 M / 4 M / 5 M / 10 M / 15 M / 20 M / 25 M/ 30 M / 35 M / 40 M / 45 M / 50 M	

The application of these products in harsh environments should always be checked before use.
Specifications subject to alteration.

EtherMATE™ Industrial Ethernet Double-Ended Cordset

etherMATE®

0985 S3667 101

M12 / M12 (Shielded, PUR, halogen-free)

Industrial Ethernet double-ended cord set, male, M12 to M12 straight, 4-twisted pair, 26 AWG, PUR halogen-free cable, **stranded/shielded**, crossover with blue jacket, orange inserts.
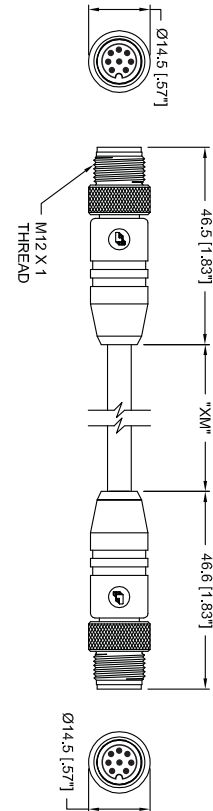
Ø14.5 [.57"]

M12 X 1 THREAD

46.5 [1.83"]

"XM"

46.6 [1.83"]

Ø14.5 [.57"]

Wiring Diagram

M12 / M12		
M12	**Color**	**M12** Crossover Wire
6	White/Orange	5
4	Orange	8
1	White/Blue	1
7	Blue	7
5	White/Green	6
8	Green	4
2	White/Brown	2
3	Brown	3
Nut	**Shield**	**Nut**

Pin Assignment

M12 Socket

EtherMATE™ Industrial Ethernet Double-Ended Cordset
0985 S3667 101

Technical Data

Environmental

Degree of protection	IP 68, NEMA 6P
Temperature rating	-40°C(-40°F) to +80°C(+176°F)

Mechanical

Molded Body	PUR, black
Coupling nut	Brass, nickel plated
Contacts	Brass, gold over nickel plated
Insert	PUR, self extingusing

Electrical

Current rating	1.5 A
Voltage rating	60 V

Cable Specifications

Cable jacket	PUR, halogen free
Jacket color	Blue
Overall diameter	6.1 mm
Conductor	26 AWG stranded
Insulation	Foam-skin
Foil shield	Aluminium foil
Braided shield	Tinned copper, 85% coverage

Part Number	Cable Length Options
0985 S3667 101	0.3 M / 0.5 M / 1 M / 2 M / 3 M / 4 M / 5 M / 10 M / 15 M / 20 M / 25 M/ 30 M / 35 M / 40 M / 45 M / 50 M

The application of these products in harsh environments should always be checked before use.
Specifications subject to alteration.

Ethernet Accessories

0986 EMC 500 I 501 I 502 I 503

RJ45 Plug

RJ45 connectors, category 5 high performance 8-pin, modular plugs for solid or stranded, shielded or unshielded, 24AWG cables.

Technical Data

Materials

Plug	Polycarbonate
Contacts	Phosphor bronze, gold plated
Shell	Copper alloy, nickel plated
Boot	Elastomer polyolefin

Mechanical

Temperature   -20°C to 70°C

Packaging Specifications

Items come packaged 25 plugs and 25 boots per bag.

2X 11.7 [.46"]

2X 36.3 [1.43"]

PIN 1

Pin Assignment

M12 Socket

1 2 3 4 5 6 7 8
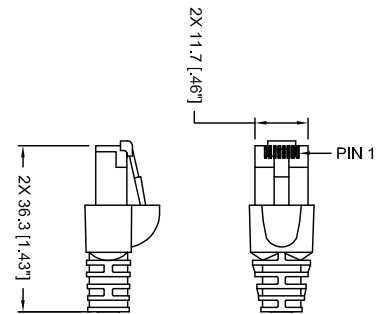
Part Number	Pins	Guage	Stranding	Shielding	Cable	Packaging	
0986 EMC 500	8	24	Solid	Shielded	0985 707 000	25 piece bag	〰
0986 EMC 501	8	24	Stranded	Shielded	0985 708 000	25 piece bag	〰
0986 EMC 502	8	24	Solid	Unshielded	0985 705 000	25 piece bag	
0986 EMC 503	8	24	Stranded	Unshielded	0985 706 000	25 piece bag	

0989 EAC 500

Professional Grade Crimping Tool

Professional RJ45 premium grade hand tool for terminating modular RJ45 plug connectors on to stranded/solid or shielded or unshielded round cable.

Part Number

0989 EAC 500

International Protection Classes According to DIN EN 60529 (IEC 529/VDE 047 T1)

The International Electrotechnical Commission (IEC) is the international standards and conformity assessment body for all fields of electro technology.

IEC International Standard 60529 (Edition 2.1: 2001–02) is a classification of degrees of protection provided by enclosures as a system for specifying the enclosures of electrical equipment on the basis of the degree of protection provided by the enclosure.

Ingress Protection as it relates to sealing against the entry of solid and liquid objects. Complete details of this standard can be obtained from the IEC. This uniform and widely acknowledged classification system provides equipment designers and specifying agents with a convenient and reliable method of comparing relative levels of sealing between competing (connector) products. In its simplest form, the classification system consists of the letters "IP" followed by two separate digits, which denoteincreasingly greater sealing from solid objects and from water.

For example, a product rated as being sealed to IP55 will provide some degree of protection from penetration by dust and a jet spray of water, but it would not be expected to completely seal against all dust or being immersed in water.

With an IP67 rating a product will be "dust tight" and remain completely sealed when immersed in water for 30 minutes. The chart below clearly defines levels of IP ratings and should be used as a guide during the specification and design process.

Protection Against Solid Foreign Objects Penetrating the Product.	**IP** Ingress Protection	**6** First Index Figure Protection Against Foreign Objects	**7** Second Index Figure **Protection Against Water**

1st Index Number	Icon	Brief Description	Definition
0		No protection	Not applicable
1		Protected against solid foreign objects of 50 mm Ø and >	The object probe, sphere of 50 mm Ø, shall not fully penetrate**
2		Protected against solid foreign objects of 12.5 mm Ø and >	The object probe, sphere of 12.5 mm Ø, shall not fully penetrate**
3		Protected against solid foreign objects of 2.5 mm Ø and >	The object probe, sphere of 2.5 mm Ø, shall not fully penetrate**
4		Protected against solid foreign objects of 1.0 mm Ø and >	The object probe, sphere of 1.0 mm Ø, shall not fully penetrate**
5		Dust protected	Ingress of dust is not totally prevented, but dust shall not penetrate in a quantity to interfere with satisfactory operation of the apparatus or to impair safety.
6		Dust tight	No ingress of dust

International Protection Classes According to DIN EN 60529 (IEC 529/VDE 047 T1)

| Protection Class - Protection Against Ingress of Water with Adverse Effects.	IP Ingress Protection	6 First Index Figure Protection Against Foreign Objects	7 Second Index Figure **Protection Against Water**

1st Index Number	Icon	Brief Description	Definition
0		No protection.	Not applicable.
1		Protected against vertically falling water drops.	Vertically falling drops shall have no harmful effects.
2		Protected against vertically falling water drops when the enclosure is tilted up 15°.	Vertically falling drops shall have no harmful effects when the enclosure is tilted at an angle up to 15° on either side of the vertical.
3		Protected against spraying water.	Water sprayed at an angle up to 60° on either side of the vertical shall have no harmful effects.
4		Protected against splashing water.	Water splashed against the enclosure from any direction shall have no harmful effect.
5		Protected against water jets.	Water projected in jets against the enclosure from any direction shall have no harmful effects.
6		Protected against powerful water jets	Water projected in powerful jets against the enclosure shall have no harmful effects.
7		Protected against the effects of temporary immersion in water.	Ingress of water in quantities causing harmful effects shall not be possible when the enclosure is temporarily immersed in water under standardized conditions of pressure and time.
8		Protected against the effects of continuous immersion in water.	Ingress of water in quantities causing harmful effects shall not be possible when the enclosure is continuously immersed in water under the conditions which shall be agreed between the manufacturer and user, but which are more severe than for numeral 7, above.
9K		Protected against water from high-pressure / steam jet cleaners.	Water directed against the enclosure from any direction under extemely high pressure and must have no adverse effects.

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Product Characteristics

Product Characteristics

Especially suitable for robotic applications (resistance to torsion).

Very good resistance to oils, coolants and lubricants as well as emulsions.

Suitable for use in C-Tracks.

Very good resistance to flying weld slag (e.g.) unfinished constructions).

Very good resistance to acids, lye and chemical cleaning agents.

Very good electromagnetic resistance (EMC) and shieldedsystems.

Very good vibration and shock resistance.

UL approved.

UL/CSA approved.

Other Literature From Lumberg Automation

Connectivity Solutions
Connectors and Components for Industrial Automation
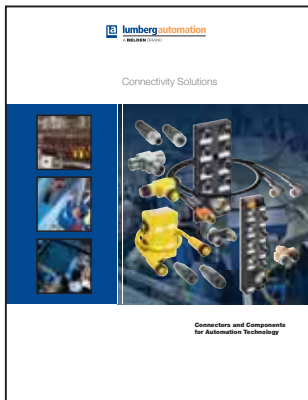
This 384-page catalog features connectivity passive products with complete technical specifications, wiring configurations, and technical illustrations for machinery or on-machine wiring applications for connector sizes M8-Pico, M12- and ½"-20-Micro, and 7/8", 1", and 1 1/8"-Mini. Connector types include: distribution boxes, single- and double-ended cordsets, Y and T splitters, receptacles, field attachable connectors, and accessories. In addition, the catalog is complete with an in-depth reference section with a part number configuration guide, glossary of terms, and detailed part number index.

DeviceNet Fieldbus Solutions for
On-Machine Systems Design

This 96-page catalog features DeviceNet active products with complete technical specifications, wiring configurations, and technical illustrations for typical on-machine DeviceNet applications. Products include input/output modules, single- and double-ended cord sets (thick, thin, and mid cables) terminating resistors, receptacles, and field attachable connectors.

Profibus Fieldbus Solutions for
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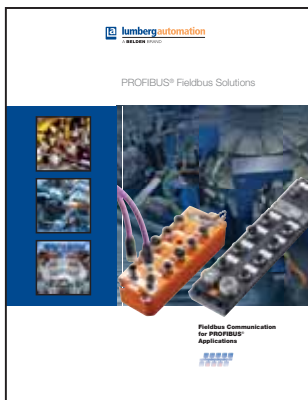
This 92-page catalog features Profibus active products with complete technical specifications, wiring configurations, and technical illustrations for typical on-machine Profibus applications. Products include input/output modules, single- and double-ended cord sets (thick, thin, and mid cables) terminating resistors, taps/splitters, receptacles, and field attachable connectors.

LioN-Link Fieldbus Solutions
for On-Machine Systems Design
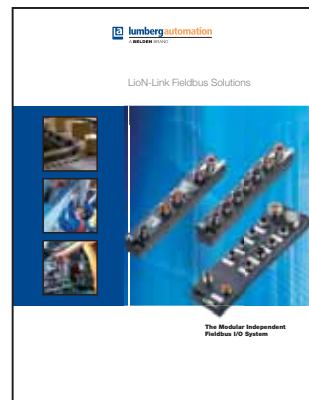
This 68 page catalog features the new LioN-Link fieldbus system, bringing flexibility to machine design and automated fieldbus systems with independent input/output devices and bus couplers for DeviceNet, Profibus, and CANopen fieldbus systems. A complete overview of the LioN-Link concept is illustrated with complete technical specifications, wiring diagrams, and schematics.

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