EXTEND ETHERNET FROM THE OFFICE TO THE FACTORY FLOOR

ROBUST RJ-45 CONNECTION SYSTEM FOR ARDUOUS INTERNAL AND EXTERNAL DATACOMS APPLICATIONS

Woodhead Connectivity

Applicom™ · Brad Harrison® · mPm™ · RJ·Lnxx™ · SST™

RJ·Lnxx™

IP67 Industrial Ethernet Connectivity

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THE CONCEPT

FEATURES

Moulded RJ-45 coupling system reduces downtime due to accidental damage or disengagement

Environmental protection to IP67. EMI protection to TIA/EIA Category 5e

Elimination of contact wear due to mechanical vibration

Supports 10 Base T, 100 Base TX, 568A and 568B systems

Compatible with standard RJ-45 components

Designed to facilitate the growing requirement to extend office communication networks to the factory floor, in order to provide access to real time process control and monitoring information, the RJ-Lnxx™ robust IP67 rated RJ-45 connectivity system has been created to provide a secure and trouble free communication link able to operate in arduous industrial environments.

The system comprises:

Male field attachable connectors designed to accept standard datacoms shielded (FTP) or unshielded (UTP) cables with either solid or stranded conductor cores.

Male moulded connectors, in either single or double-ended (jumper) configuration, with standard or custom cable lengths, manufactured using a wide range of Category 5e cables. Available in most combinations of FTP/UTP, solid/stranded conductor cores and PVC/PUR/Proplex® outer jackets to provide the exact cable type for the majority of applications.

An in-line interconnect adapter for joining male connectors.

A comprehensive range of female receptacles featuring a number of back-end termination options permitting integration into OEM devices and Ethernet/datacoms control panels.

Male and female closure caps, with or without retaining lanyard, to provide mating face protection when the connector or receptacle is not in use.

When any combination of RJ-Lnxx™ connectors, receptacles and closure caps are mated together, the result is an extremely robust interface providing ingress protection to IP67, thus maintaining data integrity at all times.

FEATURES

Secure, Robust Connection - Standard RJ-45 connectors are not designed to withstand regular and potentially damaging abuse often experienced in industrial applications. The threaded, overmoulded design completely protects both male and female RJ-45 components, making it virtually impossible for data to be interrupted by unintentional physical intervention.

Harsh Environments - The RJ-Lnxx IP67 rated industrial connector provides protection from ingress of hazards such as water, oil and dust. The PVC or PUR jacketed FTP Category 5e cable stands up to aggressive chemical environments often found in severe applications.

Vibration - While standard RJ-45 connectors can expect a long life when mounted in a communications panel, due to the inherent 'play' in the design, they cannot withstand significant levels of vibration. On industrial machinery, this may cause the gold plate on the contacts to wear leading to a potential loss of data. The additional threaded coupling on the RJ-Lnxx connector locks the male and female contacts together, thus eliminating the negative effects of contact vibration.

Electrically Noisy Conditions - Motors, inverters, transmitters and drives are all potential sources of EMI (electro-magnetic interference). The RJ-Lnxx Category 5e FTP shielded cable enhances data transmission integrity by protecting against the effects of EMI.

APPLICATIONS

Industrial applications include machine monitoring & control, data acquisition, vision based quality control systems, thermal image monitoring, visual displays, weighing, labelling and bar code scanning within the automotive, machine tool, mechanical handling, food processing, textile, ceramics, marine and petrochemical industries. In addition to industrial uses, the RJ-Lnxx connector system is ideal for a range of datacoms applications where harsh environmental conditions are a factor. Examples include railways, airport display systems wireless internet, health, stage sound & lighting, military, construction and building management.

To complement the connector products, there is a developing range of Ethernet network connectivity products, encompassing switches and I/O modules, the first of which are shown on the opposite page.

IP67 Machine Mount 8 Port Ethernet Switch
IP20 DIN Rail Mount 5 Port Ethernet Switch

Features

- Store & Forward switches with address auto learning enhances bandwidth efficiency and aids determinism for control applications.
- 10 Mbps/100 Mbps auto-negotiation enables devices that transmit at different speeds to reside on the same subnet.
- Dedicated uplink port allows linking to another switch without use of a crossover cable.

Part Number: ENHSAURR8

Part Number: ENHSDURR5

- Full Duplex capability with 1.4Gbps of total bandwith.
- High end temperature operating limit of +85° C for use in extreme temperature environments.
- No programming required means that the switches can be up and running in a matter of minutes.
- LED indicators provide status and diagnostic information at a glance.

Although Ethernet switches, rather than repeater hubs, are necessary to ensure time critical, control related data is reliably delivered, most are not designed to withstand the harsh environmental conditions found in industrial applications.

The machine mount switch ENHSAURR8 can be fitted directly onto automation equipment or building infrastructure, its unique IP67 rating and robust, vibration resistant construction eliminating the cost and space of a protective enclosure. The IP67 rating is achieved by using the RJ-Lnxx range of moulded or field attachable connectors, with unused ports being protected by closure caps 65-0300. Standard RJ-45 patch cords can also be used when the IP67 rating is not required. Power is provided to the switch via a choice of IP68 rated connectors from the 104000 or 104001 series Brad Harrison Mini-Change® range. See separate catalogue for details.

The DIN rail switch ENHSDURR5 can be mounted easily into industrial enclosures and like the machine mount switch has been designed to withstand the temperature and vibration conditions of industrial environments. Where an IP67 rated connection is required, external Ethernet enabled field devices or other enclosures can be connected to the switch by fitting one of the range of RJ-Lnxx bulkhead receptacles to the enclosure wall.

Description

Active Switches - Machine or DIN Rail Mount, Unmanaged, RJ-45 comm. ports, RJ-45 uplink port, 8 or 5 total ports

Electrical

Required Power:	10 – 30 VDC
Power Consumption:	1.9 Watts typical
Network Isolation:	1200 Volts RMS for 1 minute

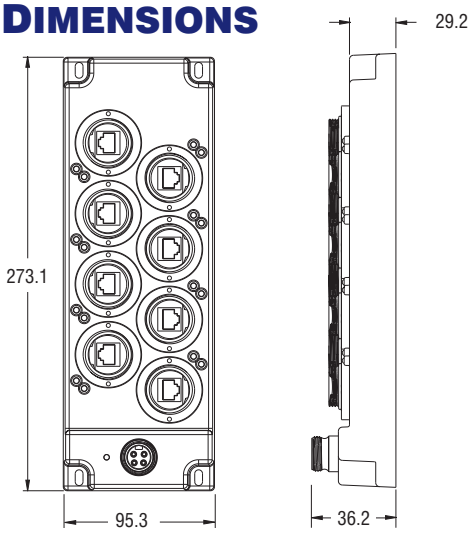
Environmental/Mechanical

Operating Temperature:	-40° C to +85° C
Humidity:	5 to 95% (non-condensing)
Screw Terminals:	0.75mm^2
Environmental Rating:	ENHSAURR8, IP67 (with RJ-Lnxx connectors) ENHSDURR5, IP20

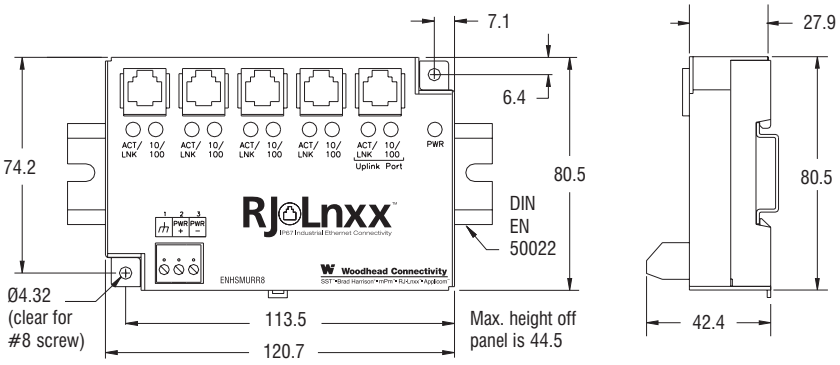
Network

Ports:	ENHSAURR8 - Eight 10/100 Base-T(x), shielded RJ-45 ENHSDURR5 - Five 10/100 Base-T(x), shielded RJ-45
Ethernet Standards:	IEEE 802.3, 802.3u, 802.3x
Ethernet Protocols:	All standard IEEE 802.3 protocols supported
Speed per Port:	10 or 100 Mbps (half duplex), 20 or 200 Mbps (full duplex)
Buffers:	1024, 128 byte buffers available
Broadcast Storm Protection:	Broadcasts limited to 25% of available bandwidth
Flow Control:	Supported for both transmit and receive
Back Pressure Function:	Will inhibit stations from transmitting for 20 ms, if buffers are full
Total Bandwidth:	1.4 Gbps

Dimensions



Part Number: ENHSAURR8



Part Number: ENHSDURR5

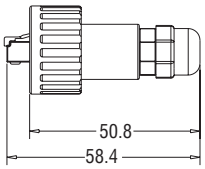
MALE CONNECTORS

Achieves an IP67 rating when mated to one of the range of RJ-Lnxx female receptacles by using a rugged outer shell that fully seals the RJ-45 connector from environmental factors like water, dirt, and oil.

The field-attachable version provides maximum flexibility by allowing the machine/system builder to affix the necessary cable length themselves, while the moulded version offers pre-wired connectors in various lengths of Category 5e cable. An in-line interconnect (Part Number RJBG16821) allows either moulded or field attachable connectors to be coupled together, thus extending overall connector length.

An IP67 rated closure cap P/N 65-0301 or 67-0301with captive lanyard provides ingress and physical protection of the contact face when not in use.

FIELD ATTACHABLE CONNECTORS



Fitted with standard shielded Cat 5e male plugs

Available for both solid core and stranded (patch) core cable

Accepts 24/26 AWG/0.50mm FTP/UTP datacoms cable with outer jacket O/D from 2.5mm – 6.5mm

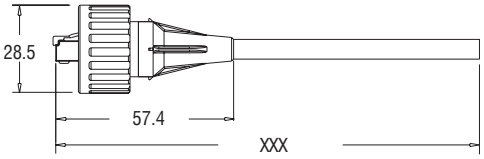
Uses standard AMP style shielded RJ-45 crimp tools

10/100 Base TX, 568A, 568B compatible

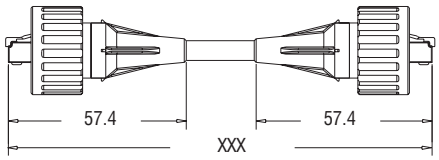
Ingress protection to IP67, Cat 5e rated

Part Number	Description
ENSAM315	Field attachable connector for solid core FTP/UTP cable
ENQAM315	Field attachable connector for stranded (patch) core FTP/UTP cable
RJ56-0200-01	*Replacement shielded male plug for ENSAM315*
RJ56-0200-02	*Replacement shielded male plug for ENQAM315*

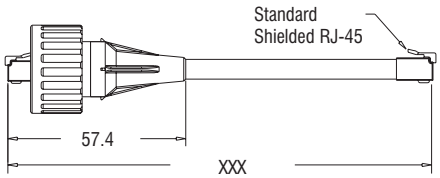
MALE MOULDED CONNECTORS



Part Number: ENV(1/2/3)105MXXX
Industrial RJ-45 Connector



Part Number: ENV(1/2/3)115MXXX
Industrial RJ-45 to Industrial RJ-45 Jumper



Part Number: ENV(1/2/3)135MXXX
Industrial RJ-45 to Standard RJ-45 Jumper

Wiring configuration (1/2/3)
1 = 10/100 Base TX
2 = 568A
3 = 568B

Available Configurations –
Industrial Connector; Industrial to Industrial Jumper; Industrial to Standard Jumper

Coupling Nut. Moulded 1"-14UNS, material ABS.

RJ-45 Connector. Standard shielded version.

Partial Sub-Mould. Injected around cable / RJ-45 assembly. Provides mechanical stability to connector geometry. Creates flanged area for O-ring nest and coupling nut.

Overmould. Injected to form an intimate bond with both cable jacket and sub-mould during injection process. Will assist in providing mechanical support and flex relief. Forms barrier against dust and liquid ingress.

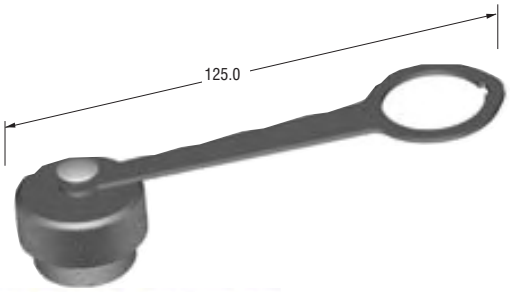
Lock Relief. Contoured mould to allow easy access to RJ-45 lock release.

Category 5e Cable. Internally constructed to TIA/EIA Cat 5e standards, solid and stranded core cables, shielded (FTP), with a range of outer jackets to suit most applications are available.

IP67 CONNECTOR CLOSURE CAPS

Part Number: 65-0301
Closure cap only (material Delrin)

Part Number: 67-0301
Captive closure cap with integral rubberised lanyard and stainless steel retaining clip for attaching to male field attachable and moulded connectors.



Male Moulded Connectors Specifications and Part Numbers

The RJ-Lnxx range of moulded connectors is available in a number of cable configurations to suit the majority of industrial and commercial applications. Solid or stranded cores, shielded (FTP) or unshielded (UTP) construction, and three choices of outer jacket, PVC, PUR or an extremely robust Urethane/Kevlar construction, Proplex.

For static applications, when the connector is not subject to excessive movement, a cable with solid conductors should be selected. In addition to being cheaper than stranded cable, solid core cable has superior attenuation properties and is suitable for connectors of up to 100m in length. The solid core cables available are RJCAB-F and RJCAB-V.

For applications where the connector will be operating under flexing conditions, a cable with stranded conductors should be used. This enables the conductor cores to withstand regular movement thus maintaining data transmission integrity under most operating conditions and are suitable for connectors of up to 30m in length. Available stranded cables are RJCAB-B, RJCAB-C, RJCAB-P and cable designed specifically for drag chain applications, RJCAB-D.

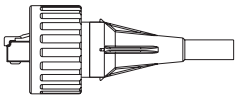
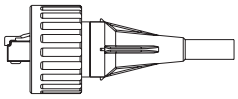
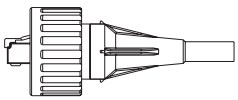
Three types of cable outer jacket are available. PVC for general purpose and washdown (food processing) applications. PUR for industrial environments where connectors may be subjected to cutting fluids, oil-based fuels or chemicals, grease and general contaminates. PUR is also water resistant and UV stable, making it suitable for external applications. Proplex is particularly suitable for the most arduous of operating conditions, its Kevlar wrapped construction providing exceptional mechanical strength combined with flexibility.

It is recommended that shielded (FTP) cables be used for industrial applications, where both local Electro-Magnetic Interference (EMI) is often present and the additional mechanical protection provided by the metal screen would be beneficial.

The following table details the part number decode per cable type:

Typical Part Number	Cable Ref.	Cable Description
EN**B**1135M020	RJCAB-**B**	FTP/Stranded Conductors/PVC Outer Jacket
EN**C**1135M020	RJCAB-**C**	FTP/Stranded Conductors/PUR Outer Jacket
EN**D**1135M020	RJCAB-**D**	FTP/Stranded Conductors/PUR Outer Jacket/Drag Chain
EN**F**1135M020	RJCAB-**F**	FTP/Solid Conductors/PVC Outer Jacket
EN**P**1135M020	RJCAB-**P**	FTP/Stranded Conductors/Proplex Outer Jacket (Cat 5 Rated)
EN**V**1135M020	RJCAB-**V**	FTP/Solid Conductors/PUR Outer Jacket

The table below details the range of connector configuration available as standard, using V cable as an example, this being the preferred cable choice for the majority of industrial applications.

First Connector (Industrial RJ-45)	Wiring Configuration	Length (m)	Second Connector: Free end, cable only Part Number	Second Connector: Industrial RJ-45 Part Number	Second Connector: Standard RJ-45 Part Number
	10/100 Base TX	1 m	ENV1105M010	ENV1115M010	ENV1135M010
		2 m	ENV1105M020	ENV1115M020	ENV1135M020
		3 m	ENV1105M030	ENV1115M030	ENV1135M030
		4 m	ENV1105M040	ENV1115M040	ENV1135M040
		5 m	ENV1105M050	ENV1115M050	ENV1135M050
	568A	1 m	ENV2105M010	ENV2115M010	ENV2135M010
		2 m	ENV2105M020	ENV2115M020	ENV2135M020
		3 m	ENV2105M030	ENV2115M030	ENV2135M030
		4 m	ENV2105M040	ENV2115M040	ENV2135M040
		5 m	ENV2105M050	ENV2115M050	ENV2135M050
	568B	1 m	ENV3105M010	ENV3115M010	ENV3135M010
		2 m	ENV3105M020	ENV3115M020	ENV3135M020
		3 m	ENV3105M030	ENV3115M030	ENV3135M030
		4 m	ENV3105M040	ENV3115M040	ENV3135M040
		5 m	ENV3105M050	ENV3115M050	ENV3135M050

Lengths above 5 metres are available in multiples of 5m. e.g. ENV1135M100 (10M), ENV1135M250 (25m)

Bare cable is also available in packed lengths of 50metres. Example RJCAB-V-500

Other connectors available on request are:

Unshielded UTP - RJCAB-A UTP/Solid Conductors/ PVC Jacket, RJCAB-R UTP/Stranded Conductors/PVC Jacket.

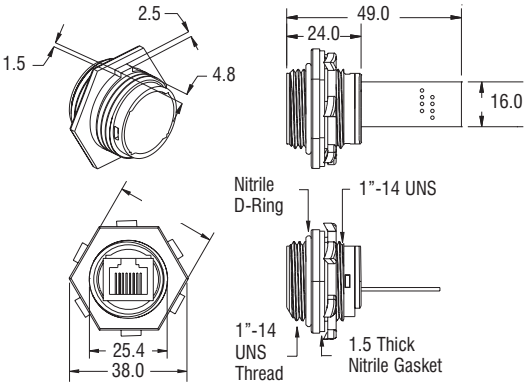
UL/CSA Rated - RJCAB-Q UTP/Stranded Conductors/PVC Jacket, RJCAB-S FTP/Solid Conductors/PUR Jacket.

Female Receptacles

The RJ-Lnxx line offers several different types of receptacles designed for a variety of applications. Suitable for OEMs wanting to incorporate a robust RJ-45 connector into an Ethernet enabled device, a datacom installer extending office networks down to the factory or for bringing robust Ethernet/datacoms cabling to an industrial enclosure, there is an appropriate RJ-Lnxx receptacle. Importantly, all receptacles are compatible with commercial RJ-45 connectors, enabling one solution for both harsh and benign environments. Receptacles come complete with sealing gasket and lock nut. They feature a hexagonal flange and location key for precise orientation onto panel or device. All are Cat 5e compliant except ENPR1FF5 (Cat 5) and are fully shielded. The receptacle line is complemented by two IP67 closure caps providing protection when the receptacle is not in use, for example in non-continuous data transfer applications.

PC Board Receptacles

Available in three back terminations to provide maximum flexibility when mounting onto panels or OEM devices. From the basic PCB version which allows the user to terminate as required, to versions pre-wired with 300cm or 1m lengths of shielded Cat 5e solid core PUR jacketed cable, either with free ends or terminated with a shielded male RJ-45 plug permitting direct connection to an Ethernet/datacoms device inside the panel. Choice of 10/100 BaseT, 568A or 568B wiring on cable versions. Please note photo shows exposed board and wiring to illustrate assembly. Cable versions have protected board and cable terminations.

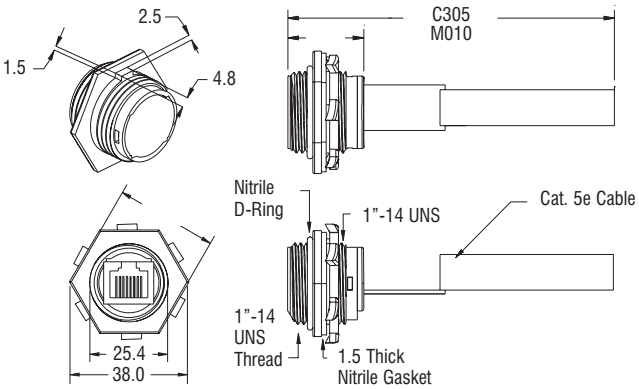


PCB Termination

Part Number	Description
ENSR1FB5	Receptacle, PC Board Terminated, 10/100 BaseT, 568A, 568B.

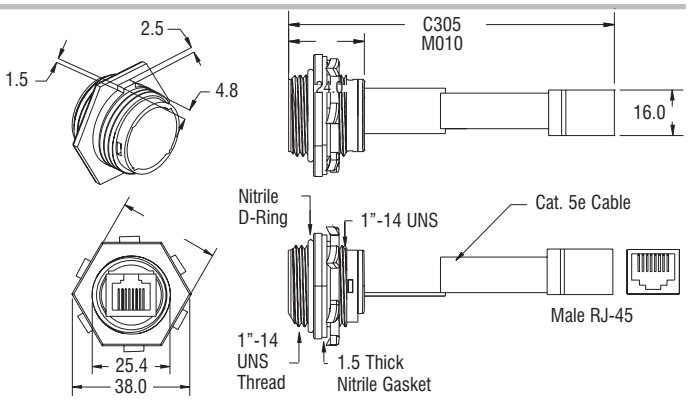
PCB + Cable Termination

Part Number	Description
ENSR1FB5C305	Receptacle, 305mm, 10/100 BaseT
ENSR2FB5C305	Receptacle, 305mm, 568A
ENSR3FB5C305	Receptacle, 305mm, 568B
ENSR1FB5M010	Receptacle, 1.0m, 10/100 BaseT
ENSR2FB5M010	Receptacle, 1.0m, 568A
ENSR3FB5M010	Receptacle, 1.0m, 568B

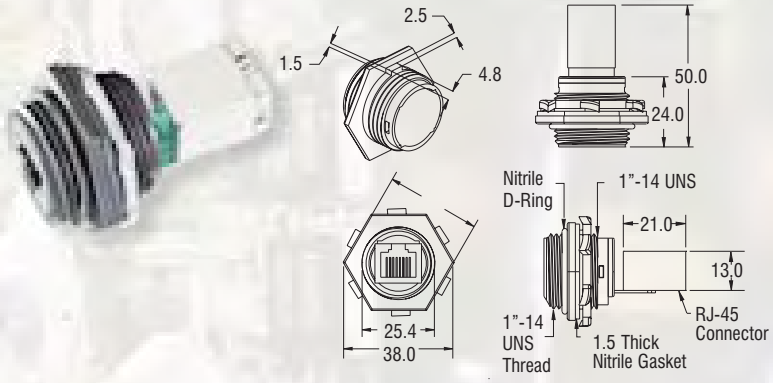


PCB + Cable + Male RJ-45 Plug Termination

Part Number	Description
ENSP1F5C305	Receptacle, 305mm, plug 10/100 BaseT
ENSP2F5C305	Receptacle, 305mm, plug 568A
ENSP3F5C305	Receptacle, 305mm, plug 568B
ENSP1F5M010	Receptacle, 1.0m, plug 10/100 BaseT
ENSP2F5M010	Receptacle, 1.0m, plug 568A
ENSP3F5M010	Receptacle, 1.0m, plug 568B



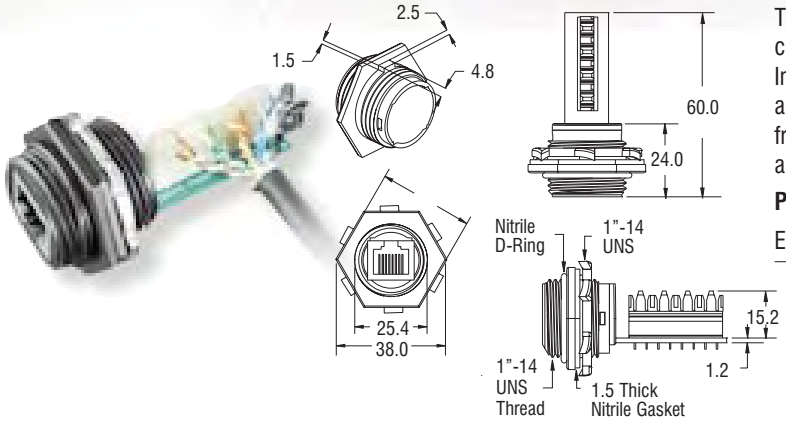
Through Panel Receptacles



These receptacles have a shielded female Category 5e jack fitted to the PCB. Connection is made to the device inside the panel with a standard male patch cord or jumper. The bulkhead passthrough receptacles are particularly useful when internal cable lengths are either unknown or varied. They are available in two versions. RJ-45 for use with the range of RJ-Lnxx field attachable and moulded male connectors. Also with 6 pole RJ-11 female jacks (both front face and fitted to PCB) for use with standard RJ-11 connectors, for applications where the front face of the receptacle is protected by IP67 closure caps when not in use.

Part Number	Description
ENSP1F5	Bulkhead Passthrough Receptacle, RJ-45
ENSP6F5	Bulkhead Passthrough Receptacle, RJ-11

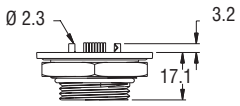
110 Punchdown Receptacle

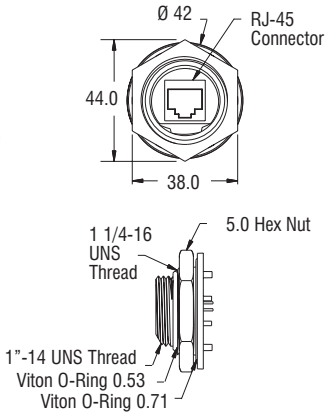


This receptacle has been designed to permit termination directly onto cable without the need for stripping and soldering conductor cores. Insulated cores are simply laid across the colour coded terminal blocks and are IDC terminated in seconds using a 110 Punchdown hand tool freely available from any datacoms distributor. The receptacle is shielded and Category 5e compliant.

Part Number	Description
ENDR2FB5	Receptacle, 110 Punchdown IDC termination.

Direct PCB Mount Receptacle





Due to the front lock nut design this receptacle is ideal for OEM applications where the receptacle needs to be terminated directly onto a PCB which is then mounted into the device housing. The short overall depth from front face to PCB pins makes the receptacle particularly suitable where internal housing space is at a premium. Features a shielded female jack and earthing clips to assure continuity of shielding to attached PCB.

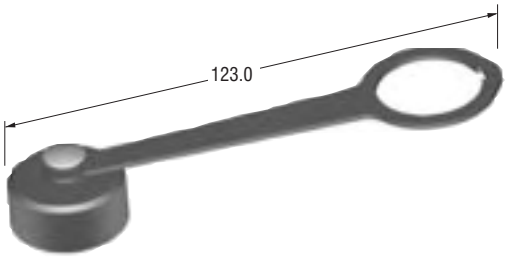
Part Number	Description
ENPR1FF5	Receptacle, Direct PCB Mount, Front Lock Nut, Category 5.

IP67 In-Line Interconnect

Allows either moulded or field attachable male connectors to be mated together, extending overall system length.

Part Number	Description
RJBG16821	In-line Interconnect

IP67 Receptacle Closure Caps



To protect the front face of receptacles when either not in use, for example in non-continuous data transfer applications or when temporarily disconnected from RJ-Lnxx male connectors such as in portable/mobile applications.

Part Number	Description
65-0300	Closure Cap only (material Delrin)
67-0300	Captive Closure Cap with integral rubberised lanyard and stainless steel retaining clip for attaching to receptacles.

SPECIFICATIONS

FTP Solid Core Cable - Physical

Conductors	#24 AWG Solid Bare Copper 0.51 mm
Insulation	0.23 mm of Cellular Polyethylene, 1.0 mm nominal diameter
Pair	2 insulated conductors twisted together, lay lengths varied between pairs to minimize cross talk
Core	4 pairs cabled together
Binder	Polyester tape, minimum 20% overlay minimum
Shield	Aluminum/Polyester tape, 20% overlay minimum
Drain Wire	#24 AWG stranded tin plated copper
Jacket	Grey PVC, Black Polyurethane 0.64 mm nominal thickness
Operating Temperature	PVC -15° C to +75° C, Polyurethane -40° C to +80° C
Diameter	6.2 mm nominal
Wiring Sequence	Choice of TIA/EIA 568A, 568B or 10/100 Base-T

Solid Core Cable - Electrical @ 20°C

Capacitance	56 pF/m
Velocity of Propagation	72% nominal
Conductor DC Resistance	82Ω /km
Impedance	100Ω ± 15Ω
Delay Skew	40 nS/100 meter at 100 Mhz
TIA/EIA Rating	Category 5e

Frequency (MHz)	Attenuation (db/100 M nominal)	NEXT (db nominal)
1	2.1	65.3
4	4.0	56.3
10	6.3	50.3
16	8.0	47.3
20	9.0	45.8
31.25	11.4	42.9
62.5	16.5	38.4
100	21.3	35.3

Connector/Receptacle

O-Ring Material	Nitrile Rubber
Insert Material	(ABS) Acrylonitrile-Butadiene-Styrene
Overmold Material	Polyurethane
Coupling Nut Material	ABS
Receptacle Shell Material	ABS
Knockout Hole for Receptacle	27 mm
Mating Thread	1" - 14UNS
Operating Temperature	-20° C to +80° C
Return Loss	5 dB @ 100 MHZ
Shock/Vibration	Per IEC 60068-2-6
Environmental Rating	IEC IP67

RJ-45 Plugs and Jacks

Contact Base Material	Copper alloy with 30 μ-inches gold alloy
Contact Underplating	2.54 microns of nickel
Body Material	Polycarbonate
Mating Cycles	250, minimum
Current Rating	1.5 Amp
Voltage Rating	125 VDC

Stranded Cable - Physical

Conductors	#26 AWG Stranded Tinned Copper, 0.41mm
Insulation	0.23 mm of Cellular Polyethylene, 1.0 mm nominal diameter
Pair	2 insulated conductors twisted together, lay lengths varied between pairs to minimize cross talk
Core	4 pairs cabled together
Binder	Polyester tape, minimum 20% overlay minimum
Shield	Aluminum/Polyester tape, 20% overlay minimum
Drain Wire	#26 AWG stranded tin plated copper
Jacket	Grey PVC, Black Polyurethane 0.64mm nominal thickness
Operating Temperature	PVC -15° C to +75° C, Polyurethane -40° C to +80° C
Diameter	6.2 mm nominal
Wiring Sequence	Choice of TIA/EIA 568A, 568B or 10/100 Base-T

Stranded Cable - Electrical @ 20 °C

Capacitance	56 pF/m
Velocity of Propagation	72% nominal
Conductor DC Resistance	122Ω /km
Impedance	100Ω ± 15Ω
Delay Skew	40 nS/100 meter at 100 Mhz
TIA/EIA Rating	Category 5e

Frequency (MHz)	Attenuation (db/100 M nominal)	NEXT (db nominal)
1	3.5	65.3
4	6.0	56.3
10	9.5	50.3
16	12.0	47.3
20	13.5	45.8
31.25	17.1	42.9
62.5	24.8	38.4
100	32.0	35.3

Proplex Kevlar Wrapped Cable - Physical

Conductors	#26 AWG Stranded Bare Copper
Insulation	Color coded HFFR, halogen free, 0.90 mm nominal diameter
Pair	Cabled with Kevlar strength member and tape wrapped
Core	4 pairs cabled together
Shield	Inner - Aluminum mylar, 100% coverage. Outer - Tinned copper braid, 80% coverage
Operating Temperature	-70° C to +105° C
Jacket	Black Urethane 1.5 mm nominal thickness
Diameter	7.3 mm nominal
Wiring Sequence	Choice of TIA/EIA 568A, 568B or 10/100 Base-T

Proplex Kevlar Wrapped Cable - Electrical @ 20 °C

Capacitance	4.6 nF/100 meters
Propagation Delay	5.2 ns/m maximum
Conductor DC Resistance	15Ω /100 meter Max
Impedance	100Ω ± 15Ω
Delay Skew	20 nS/100 meter typical, 25 nS/100 meter, maximum
TIA/EIA Rating	Category 5

Frequency (MHz)	Attenuation (db/100 M nominal)	NEXT (db nominal)
1	3.15	62
4	6.45	53
16	12.3	44
20	13.8	42
31.25	17.7	40
62.5	25.6	35
100	33.0	32

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