EtherScope™ Industrial Kit
Network Assistant

The EtherScope Industrial Kit contains everything needed to prequalify, deploy, qualify and troubleshoot Industrial Ethernet. EtherScope is the next generation of Industrial Ethernet test equipment for networks carrying control, data, voice and video. The kit also includes a unique, low cost, LinkReflector tester which lets you perform complete Ethernet transport qualification from physical layer to higher TCP/IP layers.

Features and Benefits

With EtherScope Industrial Kits you can:

- Use a single, integrated tool to cover the Industrial Ethernet deployment lifecycle.
- Solve Ethernet problems fast on copper, fiber optic and wireless networks.
- Validate security measures by testing access control and authentication, communicate securely, or event audit your network by generating malicious traffic.
- Generate comprehensive reports that provide a comprehensive baseline of network performance.
- Identify unintended traffic by traffic type, top talkers and protocol using mirror ports.
- Trend utilization by unicast, multicast and broadcast for up to 18 hours.
- Monitor VLAN utilization by VLAN ID and priority.
- Characterize redundancy fail-over performance of ring structures or trunk redundancy between switches.
- Monitor the building, plant, or remote locations for performance testing and problem segmentation.
- Analyze 802.11 a/b/g wireless networks with full suite of tests including detailed information about RF signal strength, access point and client configurations, and network utilization.

Key applications allow you to:

- Remotely monitor and troubleshoot for rapid in-service diagnostics to ensure critical network links don't bring your network down
- Characterize your network for deterministic performance instrumentation, including latency and jitter
- Detect network bottlenecks and areas for optimizing network and applications discrete process
- Switch element provisioning, management, and troubleshooting
- Evaluate vendor equipment prior to installation
- Test port-level security and Quality of Service (QoS)
- Create, distribute, and archive reports for preventative maintenance records
- Simulate multicast traffic generation and client signaling prior to new equipment installations (stress testing and worst-case loading)
- Test LAN provisioning and prioritization
- Perform wireless service turn-up and troubleshooting

Helping engineers solve network problems fast.

Technical Data

Determinism

As the move to Industrial Ethernet continues on the manufacturing floor, a key issue of concern is end-to-end performance. Determinism, the ability to ensure that a packet is sent and received in a specific period of time, is an important design goal for industrial networks. Performance tests for switched and routed networks have shown that it is possible to provide real-time communication on the network domain making use of Quality of Service. Determinism for the critical control data is achieved through the use of layer 2 VLANs per IEEE802.1p/1Q and TOS/DiffServ for layer 3.
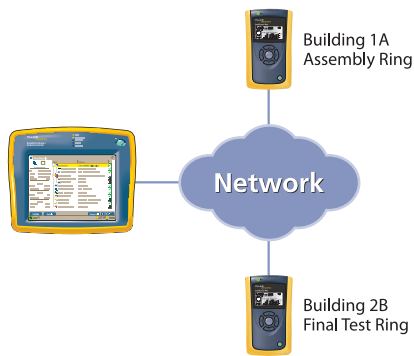

Measuring Determinism means the capability to accurately characterize the worst case time to exchange information end to end, no matter what other network traffic is occurring, such as web exchanges (HTTP, FTP) or non real-time exchanges (configuration, management). In evaluating this determinism it is important to consider not only network throughput and latency, but also delay variability or jitter. These measurements must also be made in the presence of a prescribed traffic load with precise hardware timing for transmission and reception, insuring accuracy in the presence of congestion. EtherScope Industrial Kit performance tests characterize determinism by directly measuring point-to-point network throughput, loss, latency and jitter. The characterization can take place across an individual switch during vendor evaluation, or across a wide area global network.
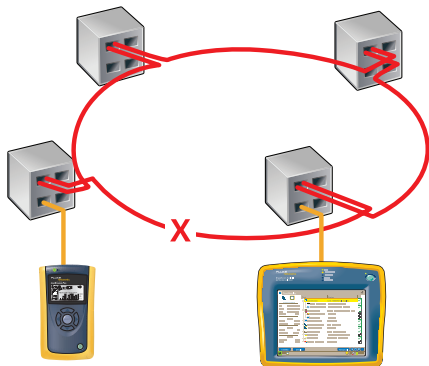
Redundancy

Industrial Ethernet networks must be highly reliable and continue to operate during harsh environmental conditions, accidental network disruptions, and equipment failures. Network downtime can be dangerous and expensive. Network reliability is largely achieved by the use of redundancy for all critical links. There are four popular redundancy schemes for Ethernet: Spanning Tree Protocol (STP), Rapid Spanning Tree Protocol (RSTP), Link Aggregation (Trunking), and proprietary ring topology.

Independent of the redundancy scheme, EtherScope coupled with a LinkReflector provides precise measurement of failover recover time with sub-millisecond accuracy. The characterization is performed at the prescribed load to ensure a worst cast measurement, up to full gigabit line rate.
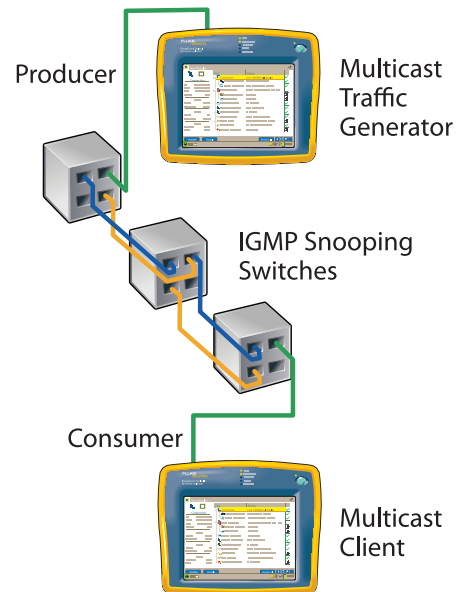
Multicasting

Many Industrial Ethernet applications depend on IP multicast technology. IP multicast allows a host, or source, to send packets to another group of hosts called receivers anywhere within the IP network using a special form of IP address called the IP multicast group address. While traditional multicast services, such as video or multimedia, tend to scale with the number of streams, Industrial Ethernet multicast applications do not.

Industrial Ethernet environments use a producer-consumer model, where devices generate data for consumption by other devices. The devices that generate the data are producers and the devices receiving the information are consumers. Multicast is more efficient than unicast, because consumers will often want the same information

from a particular producer. Each device on the network can be both a producer and a consumer of traffic. While most devices generate very little data, networks with a large number of nodes can generate a large amount of multicast traffic, which can overrun end devices in the network. Using mechanisms like QoS and IGMP snooping, organizations can control and manage multicast traffic in industrial environments.

EtherScope can operate as either a producer or consumer of multicast traffic.

Security

While the increasing integration of IT and Industrial Ethernets has the potential to deliver new levels of benefit in industrial operations, it also raises potential vulnerabilities. The act of monitoring and analyzing data from control systems at plant-device level means that the network extends in the other direction too. This greatly increases exposure of the expanded network to intrusions and threats. Internal factors offer different risks. For example when the network is overloaded due to faulty devices or operating errors, switches and routers may offer little relief. Industrial Ethernet can use many methods to help ensure network confidentiality and integrity.

These network security measures can be grouped into several categories, including access control and authentication, and secure connectivity and management.

When designing an access-control solution, network administrators can set up filtering decisions based on a variety of criteria, such as an MAC or IP address or TCP/UDP port number. Intelligent switches can provide support for this advanced filtering to limit network access to authorized users. At the same time, they can enable organizations to enforce policy decisions based on the IP or MAC address of a laptop or PLC. Even simple steps such as turning off unused ports reduce the opportunity for intrusion. EtherScope allows the user to manually configure MAC and IP addresses to validate access or denial provisioning. The included Server Response Tool allows the user to test access based on TCP/UDP port numbers by testing port response times to any IP address.

Virtual LANs (VLANs) are another access-control solution, providing the ability to create multiple IP subnets within an Ethernet switch. VLANs provide network security and isolation by virtually segmenting factory-floor data from other data and users. VLANs can also be used to enhance network performance, separating low-priority end devices from high-priority devices. Ether-Scope's extensive VLAN discover-and-monitoring features allows complete VLAN SuperVision.

Monitoring

Other mirror ports provide engineers and technicians with real-time monitoring tools for system behavior. Monitoring allows vision into live network operation for expected traffic types and amounts. Equally important is the identification of unexpected network usage to identify leakage from enterprise to factory networks. EtherScope provides the ability to monitor links for utilization, traffic types, top talkers and protocols, and VLAN usage for minutes, or days.

Using port mirroring on industrial Ethernet switches, statistics and history can be used to identify capacity trends, allowing users the ability to pinpoint problems quickly and see who the top bandwidth users are at a glance. Utilization by unicast, multicast, broadcast and errors can be trended up to 18 hours for long-term analysis.
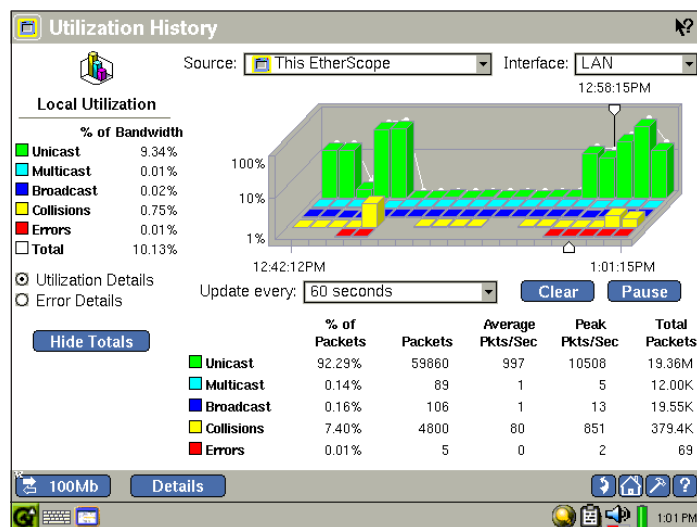
Utilization history

Fluke Networks' EtherScope Industrial Kit offers additional capabilities not found in other handhelds – capabilities that can eliminate the need to bring a laptop along. The built-in web browser, terminal emulator, or telnet can configure devices or access-shared documents. Built-in FTP capability provides the ability to easily download files. All these capabilities are controlled through a touch-sensitive keyboard on the display or an optional USB keyboard. Embedded Linux® shell programming allows the automation of standard work, data collection, and reporting.

LinkRunner Kit: LRPRO-1000-IE

EtherScope Industrial Kit: ES2-PRO-SX/I-KIT-IE

The kit includes built-in 10/100/1000BASE-T support as well as 100BASE-FX fiber support. Test at Gigabit speeds with the full-duplex 10/100/1000 twisted pair interface, 100BASE-FX, or 1000BASE-SX, LX or ZX optical fiber interface. All the cables and adapters necessary to connect to Industrial Ethernet ports are in the kit, including LC, SC, and LT fiber adapters, J12 for copper connections, and M12-to-RJ45 patch cables.

Ethernet Transport Qualification

EtherScope can be teamed with LinkRunner Pro Reflector to offer a low-cost solution for end-to-end testing. A Reflector is an intelligent IP loopback solution supporting gigabit speeds based on Fluke Networks' LinkRunner Pro Network Multimeter. This unique device can be placed anywhere, on the factory floor, a remote facility, or on the enterprise networks.
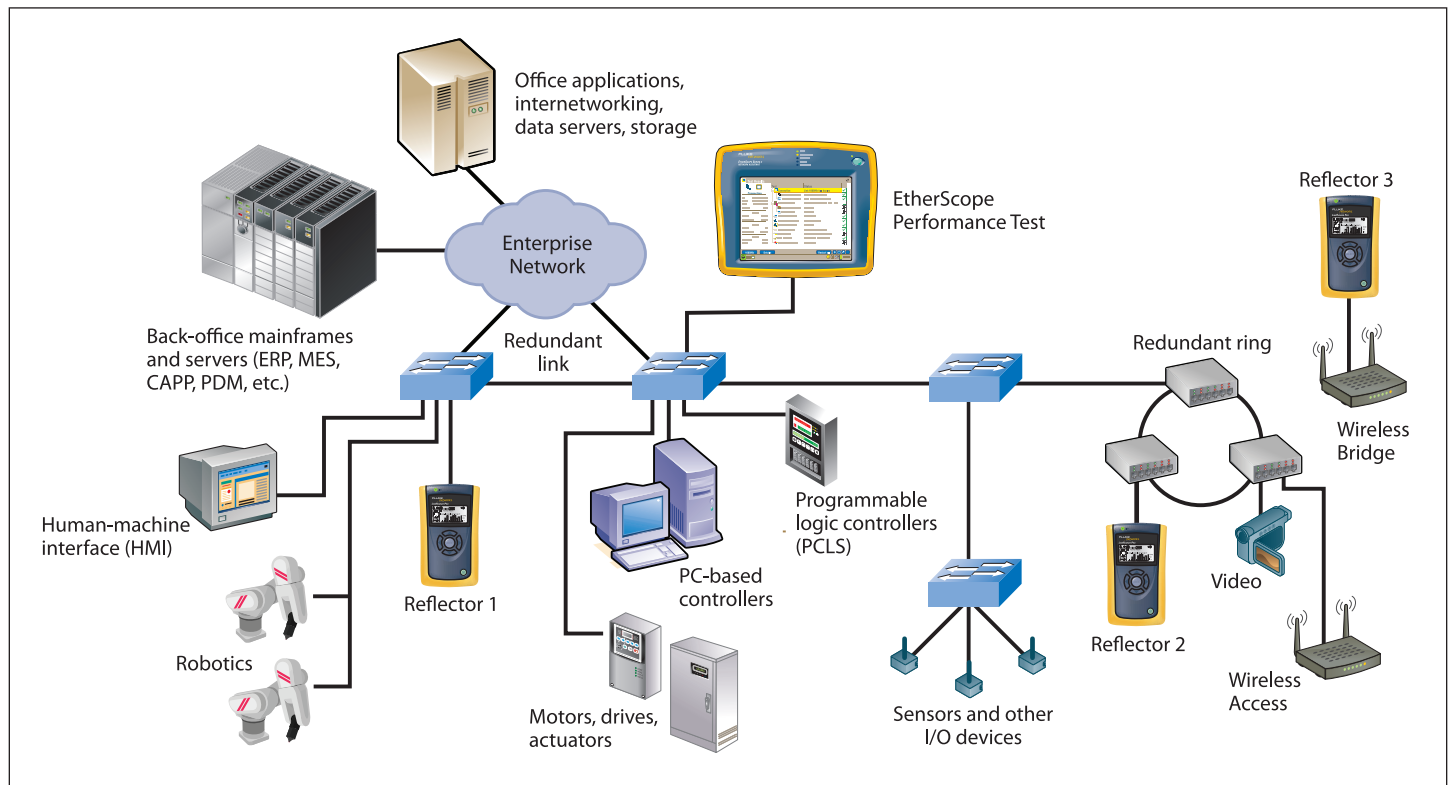
In addition to providing the end-to-end testing capability, LinkRunner Pro is a powerful troubleshooting tool on its own, with the ability to ping key devices, verify link and port status, provide basic monitoring, and test copper cabling. With the EtherScope Industrial Kit, you can qualify and document your Ethernet transport for through-put, determinism, latency, packet loss under congestion, broadcast, and multicast behavior independent of the physical media or distance.

Wireless

EtherScope has a wide variety of WLAN troubleshooting tools. Use RF measurements to determine if co-channel interference causing a problem? Is signal strength too low to support all users? EtherScope continuously scans 2.4 GHz and 5 GHz frequencies, providing visibility into wireless LAN coverage and performance. Drop-down menus includ-ing signal strength, signal-to-noise ratio, utilization, and several other useful measurements allow users to choose the measurement they wish. Users can quickly determine if access points are configured for the appropriate channels and that the RF transmit power is appropriate for the environment.

Network Discovery identifies who is using the network, and where they are. Are wireless clients congregating in one area of the build-ing, dragging down wireless network performance? Wireless EtherScope quickly identifies all wireless network access points and discovers all associated clients. Visibility into wireless network utilization helps us-ers make better decisions about access-point placement and expansion to support actual usage patterns.

Identify top talkers to see who the top bandwidth users are at a glance. Use Wireless EtherScope to identify the busiest access points and the most demanding wireless clients. Drill-in to view wireless LAN metrics such as FCS errors, crosstalk, and retries. Identify suspicious activity, then identify the source and solve the problem.

Office applications, internetworking, data servers, storage

Back-office mainframes and servers (ERP, MES, CAPP, PDM, etc.)

Enterprise Network

Redundant link

EtherScope Performance Test

Reflector 3

Redundant ring

Human-machine interface (HMI)

Robotics

Reflector 1

PC-based controllers

Motors, drives, actuators

Programmable logic controllers (PCLS)

Sensors and other I/O devices

Reflector 2

Video

Wireless Bridge

Wireless Access

EtherScope Series II Network Assistant Specifications

General specifications

Weight, with battery	0.86 kg (1.9 lb)
Dimensions	19.1 x 15.2 x 4.4 cm (7.5 x 6.0 x 1.75 in)
Display	LCD touch screen, 640 x 480 pixels, TFT (active) color panel, touch pad
LED indicators	6 (including power LED)

Power

Battery	Lithium Ion 7.2V DC (nominal), 4.2Ah, removable/rechargeable
Battery life	4 hr typical, 10 hr in standby mode
External AC adapter/ battery charger	AC input: 90 to 264 V ac, 48 to 62 Hz; 1.5 A DC output: 15 V dc, 1.2 A (isolated output)

Ports

Communication and accessory ports	1 USB, 1 PCMCIA/Cardbus (PC Card type II), 1 SFP cage, 1 Compact Flash (Card Type I/II), 1 DB-9 serial, headphone jack, microphone jack, Kensington lock receptacle
Network analysis ports	RJ-45 10/100/1000 BASE-T Ethernet, (must be enabled)

Environmental and safety

Operating temperature	0° to +50°C (32° to 122°F) with up to 95% relative humidity
Battery charging temperature	10° to +40°C (50° to 104°F) with up to 95% relative humidity
Storage temperature	-20° to +60°C (-4° to 140°F)
Shock and vibration	Meets requirements of MIL-PRF-28800F for Class 3 equipment
Safety	CSA Canada and United States, CE, FCC Part 15 Class A, C-TICK N10140; UL and CSA approvals for universal AC adapter.
EMC	Complies with EN61326, Class A, Criteria C

Copper media (LAN/Pro models)

Cable types	Unshielded twisted pair LAN cables (100 and 120 Ohm UTP), Foil-screened twisted pair LAN cables (100 and 120 Ohm ScTP)
Cable length	1 to 305 m (3 to 1000 ft), accuracy dependent upon the cable type selected
Length resolution	± [5% of reading + 1 m (3 ft)], with open, shorted, with wire map adapter, or terminated with reflection ≥ 20%
Receive level	100 to 5000 mVp-p
Datalink signal	500 to 4000 mVp-p
Power over Ethernet (PoE)	Solicit for IEEE 802.3af PoE, measure DC voltage (mV) on each pin, remove solicitation

Measuring terminated cables

The Cable Verification feature tests the individual twisted-pairs of a cable that are terminated into most equipment vendor's Ethernet ports such as on a hub, switch or NIC. All cable tests other than WireView wire map and office locator ID are operational in the presence of datalink signal.

Wiremapper/office locator compatibility

Detects combinations of shorts, opens, and connector miswires. Compatible with Fluke Networks WireView wire map adapter/office locator.

Fault tolerance

The RJ-45 Ethernet connection on the analyzer is designed to withstand a maximum of 100 volts. The RJ-45 connection is not for connection of public telephone systems and should only be connected to the public phone network through regulatory-agency-compliant modem devices.

Fiber optic power meter (LAN/Pro models)

Optical power meter compatibility

The analyzer supports the Fluke Networks DSP-FOM optical power meter. Connection to the DSP-FOM is through the RF-45 Ethernet connection.

Internetwork Throughput Option (option for LAN/Pro models)

Compatible remote device	OptiView v4 Integrated Network Analyzer, EtherScope, Series II, OneTouch Series II
Frame content	All 0s, all 1s, alternation 1s and 0s, Pseudo Random Bit Sequence (PRBS)
Frame size	64, 128, 256, 512, 1024, 1280, 1518, sweep of all sizes
Rate (bps)	672 to 1000 M (max. rate using two EtherScopes)
Duration (s)	1 to 64,800 (18hr)
Results	Frames sent, received, rate and percent loss for both upstream and downstream directions
Results format	Tabular, graphical, xml-based report

Traffic generator (included with Internetwork Throughput Option)

Traffic type	Broadcast, multicast or unicast
Frame type	Benign Ethernet, Benign LLC, NetBEUI, Benign IP, IP/ICMP Echo, IP/UDP Echo, IP/UDP Discard, IP/UDP Chargen, IP/UDP NFS, IP/UDP NetBIOS
Frame size	64, 128, 256, 512, 1024, 1280, 1518
Rate	Utilization (%): >0 - 100 Frames/second: 1 – 1488095
Duration	Seconds: 1 – continuous Frames: 1 – continuous

Wireless LAN Adapter Card (Wireless/Pro models)

Specification compliance	IEEE 802.11a, 11b, 11g
Certifications	FCC part 15, Telec, CTICK, ETSI, EN301893, EN60950
Interoperability	WECA compliant
Interface	32-bit Cardbus
Outdoor operating range	Up to 515 m (1690 ft)
Indoor operating range	Up to 85 m (279 ft)
Data rate	802.11a: up to 54 Mbps 802.11b: up to 11 Mbps 802.11g: up to 54 Mbps
Output power	18 dBm peak power
Infrastructure mode	BSS

Fiber Optic Transceiver (option for LAN/Pro models)

Ethernet rate	1000Mbps
Type	Small Form-factor Pluggable (SFP)
Connector	Duplex LC

Security

Authentication types	LAN: 802.1X, WLAN: 802.1X, 802.11i, WEP, WPA, WPA2
EAP types	TLS, GTC, MD5, MS-CHAP-V2, LEAP, PEAP-GTC, PEAP-MD5, PEAP-MS-CHAP-V2, PEAP-TLS, TTLS-PAP, TTLS-CHAP, TTLS-MS-CHAP, TTLS-MS-CHAP-V2, TTLSEAP-MD5, TTLS-EAP-GTC, TTLS-EAP-MS-CHAP-V2, TTLSEAP-TLS

EtherScope Series II Network Assistant Specifications *(continued)*

Industrial Ethernet protocols identified in local protocol stats page	
4 IE Ethertypes	Profinet, EtherCAT, Powerlink, SERCOS-III
13 UDP/TCP ports	Modbus (TCP only), Fieldbus Ann, Fieldbus Msg, Fieldbus Sys, Rockwell CSP2, Profinet RT, Profinet RTM, Profinet CM, EtherCAT Port, DeviceNet, BACnet, SNAP I/O, OptoControl
M12/ RJ45 Cable Specifications	
Cable type	Ethernet cable, Cat5e, shielded, 2 Pair AWG 26 stranded (7 wire), RAL 5021 (water blue), M12 4 pos. D- coded on RJ45 connector
Number of positions	4
Fixed cable length	2 m
Volume resistance	≤ 5 mΩ
Insulation resistance	≥ 100 MΩ
Ambient temperature	-20° to 50°C
Inflammability class acc to UL 94	V0
Surge voltage category	II
Pollution degree	3
Degree of protection	IP20/IP67
External cable diameter	6.7 mm
Transmission characteristics	Cat 5 (IEC 11801:2002), Cat 5e (TIA 568B:2001)

Ordering Information

Model Number	Name	Description
ES2-PRO-SX/I-KIT-IE	EtherScope 2 LAN WLAN FIBER ITO Kit Industrial Ethernet	EtherScope Series II Network Assistant PRO-SX/I-KIT includes mainframe with LAN option, 802.11a/b/g adapter with WLAN option, SX SFP with Fiber option, ITO/RFC2544 option, external directional antenna, rechargeable Li-Ion battery pack (installed), protective holster, carrying strap, carrying case, AC adapter/battery charger, wire map remote (ID #1), RJ45 coupler, patch cable, 128MB CompactFlash® card and resource CD, LinkRunner Pro w/ Reflector, LinkRunner Pro Li-Ion battery and AC adapter/battery charger, LinkRunner Pro carrying case and (2) M12-to-RJ45 jack patch cables
ES2-LAN-SX-IE	EtherScope 2 LAN FIBER Industrial Ethernet	EtherScope Series II Network Assistant LAN-SX includes mainframe with LAN option, SX SFP with Fiber option, rechargeable Li-Ion battery pack (installed), protective holster, carrying strap, carrying case, AC adapter/battery charger, wire map remote (ID #1), RJ45 coupler, patch cable, 128 MB CompactFlash® card and resource CD and (1) M12-to-RJ45 jack patch cables
Accessories		
M12PCJ	M12/ RJ45 Patch Cable Jack	M12-to-RJ45 jack patch cable - 2 m
M12PCP	M12/RJ45 Patch Cable Plug	M12-to-RJ45 plug patch cable - 2 m