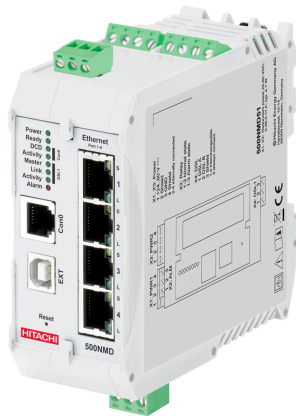


Managed Ethernet switch 500NMD51

EDS500 series - Ethernet & DSL switches



- Industrial managed layer-2 switch
- 24 ... 60 V DC supply voltage
- 4x 10 / 100 / 1000 Mbps Ethernet (RJ45)
- 1x SHDSL for copper wire
- Supports redundant topologies (STP / RSTP / MSTP / ERPS)
- Supports IEEE 1588v2 PTP
- 1x RS-232 interface suitable for tunneling of serial protocols

Application

The DIN rail mountable 500NMD51 is a managed plug and play layer-2-switch providing:

- 4x Gigabit Ethernet auto-negotiating RJ45 ports with auto MDI/X (Automatic Crossover Detection and Correction).
- 1x 2-wire SHDSL-port for use with private copper cables.
- 1x RS-232 interface suitable for tunneling of serial protocols.

The switch is able to provide redundant topologies by the Spanning Tree Protocol (STP / RSTP / MSTP). A connection to PVST+ networks is also possible. Alternatively, the Ethernet Ring Protection Switching protocol (ITU-T G.8032 ERPS) can be used. VLAN segments and serial data tunneling are supported. Ethernet may be distributed within a station through the four RJ45 ports of the switch.

The SHDSL port can be used for interconnecting stations with a maximum distance of 25 km (copper cable with diameter of 0.8 mm). The SHDSL interface can be connected to any EDS500 SHDSL compatible device including 560NMS24, 560NMS34 and any EFM based SHDSL device.

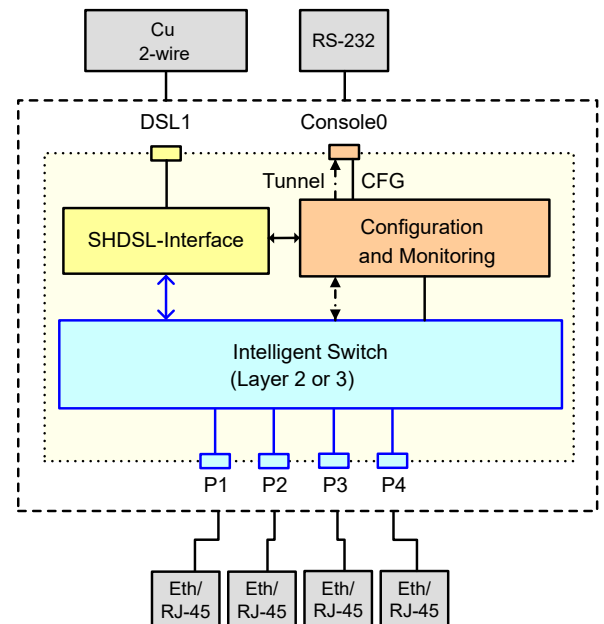


Figure 1: Block diagram of 500NMD51

Characteristics

For documentation purposes, the Ethernet ports are labeled from 1 to 4. There is no specific uplink port. All ports are equal in function. The SHDSL port is connected through a pluggable screw connector. Link and speed status of each Ethernet connection and the SHDSL port are displayed by status indicators.

The switch learns Ethernet addresses by analyzing received frames and stores them in a lookup-table (max. 8192 entries), which is used to forward frames only to the correct port. If it is broad- or multicast or if the target address is not found in the lookup-table, a received frame is forwarded to all ports except the receiving one. If an entry in the lookup-table is not refreshed by an incoming frame with the specific source address, it is aged out within a maximum of 304 seconds (by default, value is configurable).

Regarding IEEE 802.1Q VLAN frames, the switch can be configured to VLAN or transparent mode. In transparent mode the switch will never change any frame or tag of a frame; in VLAN mode it can be configured to support several applications like trunk or access ports.

Quality-of-Service is supported by the switch if an IEEE 802.1p compliant frame format is used. The switch can separate frames into up to four queues, which can be configured for priority based or weighted-fair queuing.

The 500NMD51 uses a wide range power supply and works with a voltage from 24 to 60 V.

The component itself, the Ethernet ports as well as the SHDSL connection, the RS-232 interface and the extension bus interface (Ext) are hot-plug capable.

Topology

The 500NMD51 provides different ports for use with end devices, switches, bridges, hubs and routers. Star, ring or line topologies can easily be built by this family of switches.

Redundant topologies are automatically detected and handled by the Rapid Spanning Tree Protocol (RSTP) or the Multiple Spanning Tree Protocol (MSTP). This is fully backward compatible with the widespread Spanning Tree Protocol (STP).

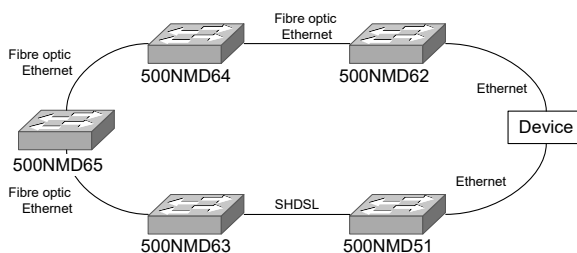


Figure 2: Typical topology for use with 500NMD51

Management and Configuration

Management and configuration of the 500NMD51 can be done by Telnet, Secure Shell (SSH), SNMP or Web-interface. All methods can be used to either read or write parameters of the device.

Additionally the interface and alarm state of the device can be monitored by IEC 60870-5-101 or -104.

An existing configuration can be saved as well as restored. The configuration can also be stored to an external configuration stick (500NMA01), which supports the simple exchange of a device without trained personnel.

By default, the IP address for the configuration of a 500NMD51 switch is 10.0.0.2 with a subnet mask of 255.0.0.0 and a gateway of 10.0.0.1. Connections for configuration purposes may be accepted through any interface. All Ethernet ports are administratively active in default state.

The preconfiguration for the RS-232 interface is baudrate 57600, 8 databits, no parity, 1 stopbit (57600, 8N1). The command-line interpreter for configuration via this interface can be accessed by any terminal software (e.g. Hyperterminal, PuTTY).

Ports

All ports of the device can be disabled or enabled by configuration. Furthermore, the speed and duplex mode of any port can be set according to its capabilities. This is 10, 100 or 1000 Mbps, full or half duplex for the RJ45 Ethernet ports and 100 or 1000 Mbps, full or half duplex for SFP Ethernet ports. For SHDSL ports this is 192 kbps up to 15 Mbps in steps of 8 kbps. It is also possible to use an auto-detect setting.

For the SHDSL port it is recommended to set the 500NMD51 device closer to the control center to a fixed speed setting, while setting the communication partner at the other side to auto-detect.

The switch supports multiple additional features, like port mirroring, bandwidth control, or quality of service.

Alerts, Notifications and Logging

The 500NMD51 provides Syslog and SNMP capabilities to send alerts and notifications to one or more predefined destinations. There is also a relay for configurable out-of-band alerts.

For each Syslog server entry a severity can be entered to filter outgoing messages.

A system log stores critical messages. The log includes a timestamp either by system uptime, or date and time if a time server is configured.

Time synchronization

A SNTP (Simple Network Time Protocol) time server can be configured as time source in the 500NMD51. In this case the device time will be synchronized with the server.

Furthermore, the synchronization of the device time can be done via PTP (Precision Time Protocol, IEEE 1588v2). PTP offers a significantly higher accuracy compared to SNTP. The 500NMD51 can be used as Transparent Clock (PTP TC) in the network. For this, at least one PTP time source is required in the network.

The device time can be used for internal device log entries and time stamp generation for syslog messages.

If IEC 60870-5-10x conversion is configured, the device time can be used to supplement information during conversion of CP24 to CP56 timestamps.

Redundancy Support

The redundancy protocols Spanning Tree Protocol (STP), Rapid Spanning Tree Protocol (RSTP) and Multiple Spanning Tree Protocol (MSTP) are fully supported. Without configuration RSTP is enabled for all ports. Switching from RSTP to STP is done automatically to ensure the compatibility to existing STP installations.

For every port, the parameters can be adjusted separately. This includes port priority for root bridge control as well as point-to-point and edge connection settings. A global bridge priority is also settable.

The protocol Ethernet Ring Protection Switching (ERPS) is supported as well.

Security

Access to the configuration interfaces of the 500NMD51 is controlled by a two-level password protection. The first level enables the user to access parameters in read-only mode and has to be entered as soon as a connection is established. To read and write parameters, the device has to be put in a configuration mode that requires an additional password. Any password can be disabled. Some security sensitive information, such as the configuration file, are not available in read-only mode.

Besides the two-level password protection, users may be authenticated by a standard RADIUS server.

Devices can be authenticated via optional IEEE 802.1X support using a central authentication server (RADIUS).

Access control lists provide packet filtering and class-of-service rewriting on a per port basis.

Compatible SFPs

The 500NMD51 is designed for operation with following SFPs. Further information about the SFPs can be found in the SFP Selection Guide.

Ordering Nr. / Name	Fiber type	Range	Data rate
1KGT038901R0001 500SMM02 R0001	multimode	2 km	100 Mbps
1KGT038922R0001 500SMM92 R0001	multimode	2 km	100 / 1000 Mbps
1KGT038917R0001 500SSM11 R0001	singlemode	10 km	100 / 1000 Mbps
1KGT038902R0001 500SSM15 R0001	singlemode	15 km	100 Mbps
1KGT038914R0001 500SSM40 R0001	singlemode	40 km	100 Mbps
1KGT038918R0001 500SSM41 R0001	singlemode	40 km	100 / 1000 Mbps
1KGT038919R0001 500SSM71 R0001	singlemode	70 km	100 / 1000 Mbps

Ordering Nr. / Name	Fiber type	Range	Data rate
1KGT038907R0001 500SSM80 R0001	singlemode	80 km	100 Mbps
1KGT038921R0001 500SSM91 R0001	singlemode	120 km	100 Mbps
1KGT038920R0001 500SSM90 R0001	singlemode	200 km	100 / 1000 Mbps
1KGT038903R0001 500SDM20 R0001	BiDi singlemode	20 km	100 Mbps
1KGT038904R0001 500SUM20 R0001	BiDi singlemode	20 km	100 Mbps
1KGT038905R0001 500SDM40 R0001	BiDi singlemode	40 km	100 Mbps
1KGT038906R0001 500SUM40 R0001	BiDi singlemode	40 km	100 Mbps
1KGT038930R0001 500SDM41 R0001	BiDi singlemode	40 km	100 / 1000 Mbps
1KGT038931R0001 500SUM41 R0001	BiDi singlemode	40 km	100 / 1000 Mbps
1KGT038932R0001 500SDM81 R0001	BiDi singlemode	80 km	100 / 1000 Mbps
1KGT038933R0001 500SUM81 R0001	BiDi singlemode	80 km	100 / 1000 Mbps
1KGT038923R0001 500SGM32 R0001	SFP Module G.703	- km	2048 kbps

Technical data

In addition to the EDS500 series general technical data, the following applies:

General standards	
Safety tested according to	<ul style="list-style-type: none">IEC 62368-1
Environmental conditions tested according to	<ul style="list-style-type: none">ETSI EN 300 019-1-3 class 3.4ETSI EN 300 019-2-8 test condition T8.1IEC 61850-3IEC 60255-21-1 class 2IEC 60255-21-2 class 1IEC 60721-3-3 class 3M5EN 50125-3 class T1 and T2
Electromagnetic compatibility (EMC) tested according to	<ul style="list-style-type: none">IEC 61000-6-2IEC 61000-6-4IEC 61000-6-5ETSI EN 300 386EN 50121-4IEC 61850-3EN 55022 CISPR 22EN 55024 CISPR 24
Insulation classification according to	IEC 60664-1 <ul style="list-style-type: none">Pollution degree 2Overtoltage category IIAltitude: ≤ 3,000 m

Environmental conditions - climatic	
Operating temperature EN 60068-2-1, EN 60068-2-2, EN 60068-2-14	-40 °C ... 80 °C
Relative humidity EN 60068-2-30, EN 60086-2-78	5 ... 95 % (non condensing)
Railway applications EN 50125-3	climatic class T1 and T2

Environmental conditions - mechanical

Vibration sinusoidal, Test Fc, IEC 60068-2-6	1.2 mm (5 ... 9 Hz) 4 m/s ² (9 ... 200 Hz) 1 octave/min, 5 cycles per axis EN 300 019-2-8 class 1
	3.5 mm (1 ... 9 Hz) 10 m/s ² (9 ... 35 Hz) 1 octave/min, 1 cycle per axis IEC 60255-21-3 class 1
	3 mm (2 ... 9 Hz) 10 m/s ² (9 ... 200 Hz) 15 m/s ² (200 ... 500 Hz) 1 octave/min, 10 cycles per axis IEC 60870-2-2 class Bm
	0.075 mm (10 ... 60 Hz) 9.8 m/s ² (60 ... 150 Hz) 1 octave/min, 1 cycle per axis IEC 60255-21-1 class 2
Shock and Bump, Test Ea, IEC 60068-2-27	50 m/s ² , 30 ms 3 shocks per direction
	250 m/s ² , 10 ms 4 shocks per direction IEC 60721-3-3 class 3M5
	150 m/s ² , 11 ms 3 shocks per direction IEC 60255-21-2 class 1 IEC 60870-2-2 class Bm
	50 m/s ² , 11 ms 100 shocks per direction EN 300 019-2-8 class 1
	100 m/s ² , 16 ms 1000 shocks per direction IEC 60255-21-2 class 1
Vibration broad-band random, Test Fh, IEC 60068-2-64	+12 dB/oct. (5 ... 10 Hz) 0.04 m ² /s ³ (10 ... 50 Hz) -12 dB/oct. (50 ... 100 Hz) 30 min per axes EN 300 019-2-8 class 1

Emission test

Radiated emissions - enclosure ports (30 Mhz to 1 GHz), CISPR 16-2-3/ EN 55016-2-3	EN 55022/ CISPR 22 class A
Radiated emissions - enclosure ports (1 to 6 GHz), CISPR 16-2-3/ EN 55016-2-3	EN 55022/ CISPR 22 class A

Immunity test

Electrostatic discharge, IEC 61000-4-2	8 kV air / 6 kV contact (level 3), criterion A
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Immunity test	
Radiated radio-frequency electromagnetic field, IEC 61000-4-3	80 MHz to 800 MHz: 10 V/m (level 3), criterion A
	800 MHz to 1 GHz: 20 V/m (level x), criterion A
	1 GHz to 2 GHz: 10 V/m (level 3), criterion A
	2 GHz to 6 GHz: 5 V/m (level 2), criterion A
Power frequency magnetic field, IEC 61000-4-8	100 A/m (level 5), criterion A 1000 A/m for 1 sec (level 5)
Impulse magnetic field, IEC 61000-4-9	300 A/m (level 4), criterion A

Mean time between failure (MTBF)

Calculation according to Telcordia II 40°C	384 years @ 40 °C
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Mechanical layout

Dimensions	99 x 45 x 115 mm (H x W x D)
Housing type	Plastic housing
Mounting	DIN rail mounting (EN 50022 TS35: 35 mm x 15 mm or 35 mm x 7.5 mm)
Cooling	thermal convection (no moving parts)
Enclosure protection class	IP20 (IP30 when mounted on DIN-rail)
Weight	280 g

Power supply input (X1, X3)

Operating voltage	24 ... 60 V DC
Input tolerance range	-20% ... +20%
Power consumption (typical)	5 W
Current demand (peak)	280 mA @ 24 V / 120 mA @ 60V
Plug type	Phoenix Contact MSTBT 2.5/4-ST
Reverse polarity protection	yes
Circuit classification	ES2 (acc. IEC 62368-1)
External circuit breaker	8 A trip current
Galvanic isolation	1.5 kV isolation voltage
Overvoltage protection	4 kV line to earth, 2 kV line to line
Electrical fast transient / Burst, IEC 61000-4-4	4 kV line to earth (level 4), criterion A
Surge 1.2/50 µs, IEC 61000-4-5	4 kV line to earth, 2 kV line to line (level 4), criterion B
Conducted disturbances, induced by radio-frequency fields, IEC 61000-4-6	10 V (level 3), criterion A
Ring wave, IEC 61000-4-12	2.5 kV line to earth, 1 kV line to line (level 3), criterion B

Power supply input (X1, X3)

Conducted, common mode disturbances in the frequency range 0 Hz to 150 kHz, IEC 61000-4-16	30 V continuous disturbance/ 300 V short duration disturbance (level 4), criterion A
Ripple on DC power supply, IEC 61000-4-17	10% Un, criterion A
Damped oscillatory wave, IEC 61000-4-18	2.5 kV line to earth, 1 kV line to line @ 1 MHz (level 3), criterion A 2 kV line to earth @ 10 MHz (level 3), criterion A
Voltage dips, short interruptions and voltage variations, IEC 61000-4-11	70% Un: 20 ms; 40% Un: 1000 ms; 0% Un: 1000 ms, criterion A, powered by CP-E 48/5.0
Conducted emissions - asymmetrical DC ports, common mode (0.15 MHz to 30 MHz), CISPR 16-2-1/ EN 55016-2-1	EN 55011/ CISPR 11 class A

Gigabit Ethernet interfaces (Port1 - Port4)

Electrical specification	IEEE 802.3
Protocol	Gigabit Ethernet, Fast Ethernet, Auto negotiation, Auto sense
Data rate	10 Mbps, 100 Mbps, 1 Gbps or auto
Duplex	Full duplex, Half duplex, auto
Cable	shielded CAT5e cable (or better), maximum length: 100m
Plug type	RJ-45 (8P8C)
Circuit classification	ES1 (acc. IEC 62368-1)
Galvanic isolation	1.5 kV isolation voltage
Overvoltage protection	shield to earth 4 kV
Electrical fast transient / Burst, IEC 61000-4-4	4 kV (level 4), criterion A
Surge 1.2/50 µs, IEC 61000-4-5	4 kV (level 4), criterion A
Conducted disturbances, induced by radio-frequency fields, IEC 61000-4-6	10 V (level 3), criterion A
Ring wave, IEC 61000-4-12	2.5 kV (level 3), criterion A
Conducted, common mode disturbances in the frequency range 0 Hz to 150 kHz, IEC 61000-4-16	30 V continuous disturbance / 300 V short duration disturbance (level 4), criterion A
Damped oscillatory wave, IEC 61000-4-18	2.5 kV (level 3), criterion A
Conducted emissions - symmetrical network ports (0.15 MHz to 30 MHz), CISPR 16-2-1/ EN 55016-2-1	EN 55032 / CISPR 32 class A

Serial interface (Con0)

Electrical specification	ITU-T V.24, EIA RS-232
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Serial interface (Con0)	
Data rate	50 bps ... 230.4 kbps
Plug type	RJ-12 (6P6C)
Cable	shielded RS-232 cable, up to 3 m
Adapter cable	500CAB06 1KGT038912R0001: RJ12 to SubD9F (DTE-PC)
Circuit classification	ES1 (acc. IEC 62368-1)
Galvanic isolation	no
Overvoltage protection	shield to earth 4 kV
Electrical fast transient / Burst, IEC 61000-4-4	4 kV (level 4), criterion A
Surge 1.2/50 μ s, IEC 61000-4-5	4 kV (level 4), criterion B
Conducted disturbances, induced by radio-frequency fields, IEC 61000-4-6	10 V (level 3), criterion A
Ring wave, IEC 61000-4-12	2.5 kV (level 3), criterion A
Conducted, common mode disturbances in the frequency range 0 Hz to 150 kHz, IEC 61000-4-16	30 V continuous disturbance/ 300 V short duration disturbance (level 4), criterion A
Damped oscillatory wave, IEC 61000-4-18	2.5 kV (level 3), criterion A

DSL interface (X4)

Electrical specification	ETSI TS 101 524, ITU-T G.991.2, IEEE 802.3-2008 Cl. 63
Protocol	ETSI SDSL (ETSI TS 101 524 V 1.2.1) ETSI SDSL.bis (ETSI TS 101 524 V 1.2.2) ITU-T G.shdsl (ITU-T G.991.2) ITU-T G.shdsl.bis (ITU-T G.991.2) ITU-T G.hs (ITU-T G.994.1) IEEE EFM (IEEE 802.3)
Data rate	up to 15 Mbps
Plug type	Phoenix Contact MSTBT 2.5/3-ST (item no. 1779848)
Cable	shielded, twisted telecommunications cable, up to 25 km with cable diameter 0.8 mm
Circuit classification	ES2 (acc. IEC 62368-1)
Auto crossover detection	yes
Galvanic isolation	3 kV isolation voltage
Overvoltage protection	Shield to earth \pm 6 kV, line to earth \pm 6 kV, line-line \pm 6 kV
Electrical fast transient / Burst, IEC 61000-4-4	4 kV (level 4), criterion A
Surge 1.2/50 μ s, IEC 61000-4-5	6 kV line to earth, 6 kV line to line (level x), criterion B
Surge 10/700 μ s, IEC 61000-4-5	6 kV line to earth, 6 kV line to line (level x), criterion B
Conducted disturbances, induced by radio-frequency fields, IEC 61000-4-6	10 V (level 3), criterion A

DSL interface (X4)

Ring wave, IEC 61000-4-12	2.5 kV, criterion A
Conducted, common mode disturbances in the frequency range 0 Hz to 150 kHz, IEC 61000-4-16	30 V continuous disturbance/ 300 V short duration disturbance (level 4), criterion A
Damped oscillatory wave, IEC 61000-4-18	2.5 kV (level 3), criterion A

Extension connector (EXT)

Connector	proprietary
For usage of the configuration stick 500NMA01 to save the configuration to an external media.	

Alarm output (X2)

Type of switch	toggle (potential free)
Switching voltage	60 VDC / 25 VAC
Switching current	500 mA
Plug type	Phoenix Contact MSTBT 2.5/3-ST (item no. 1779848)
Circuit classification	ES1 (acc. IEC 62368-1)
Overvoltage protection	line to earth \pm 4 kV, line to line \pm 2 kV
Electrical fast transient / Burst, IEC 61000-4-4	4 kV (level 4), criterion A
Surge 1.2/50 μ s, IEC 61000-4-5	4 kV (level 4), criterion A
Conducted disturbances, induced by radio-frequency fields, IEC 61000-4-6	10 V (level 3), criterion A
Ring wave, IEC 61000-4-12	2.5 kV line to earth, 1 kV line to line, criterion A
Damped oscillatory wave, IEC 61000-4-18	2.5 kV / 1 kV (level 3), criterion A
Conducted, common mode disturbances in the frequency range 0 Hz to 150 kHz, IEC 61000-4-16	30 V continuous disturbance/ 300 V short duration disturbance (level 4), criterion A

Switching

Flow Control	full duplex flow control according to IEEE 802.32005 An. 31B and IEEE 802.3x-1997
	half duplex back pressure
Max. Frame size	10240 Bytes
Quality of Service	IEEE 802.1p tag based priority
MAC Lookup Table	max. 8192 entries
	max. 304 s hold time
Switching Mode	store and forward

Supported Protocols

Telecontrol Comm.	IEC 60870-5-101 IEC 60870-5-104
LLDP	IEEE 802.1AB-2009

Supported Protocols	
Spanning Tree (STP / RSTP / MSTP)	IEEE 802.1D-2004 IEEE 802.1Q-2018
Class of Service	IEEE 802.1p
VLAN Tagging	IEEE 802.1Q-2005
Network Access Ctrl.	IEEE 802.1X-2001
PTP	IEEE 1588-2019
ERPS	ITU-T G.8032/Y.1344
UDP	RFC-768
IP	RFC-791
ICMP	RFC-792
TCP	RFC-793
ARP	RFC-826
Telnet	RFC-854
SNMP	RFC-1155 to RFC-1157 RFC-1901 to RFC-1908
SNMP MIB-II	RFC-1213
TFTP	RFC-1350
CIDR	RFC-1519
RIP	RFC-2453
HTTP	RFC-2616
L2TP	RFC-2661
RADIUS	RFC-2865
Syslog	RFC-3164
SSHv2	RFC-4254 and RFC-5251
SNTP	RFC-5905
DHCP	RFC-2131, RFC-2132, RFC-2563, RFC-3046

Ordering information	
500NMD51 R0001	1KGT050251R0001

Accessories ordering information 500NMA01 configuration adapter	
500NMA01 R0001	1KHW027870R0001

Accessories ordering information 500CAB03 RS-232 adapter cable 250 cm RJ12 to SubD9F (DTE-PC)	
500CAB03 R0001	1KGT038909R0001

Accessories ordering information 500CAB06 RS-232 adapter cable 120 cm RJ12 to SubD9F (DTE-PC)	
500CAB06 R0001	1KGT038912R0001

Accessories ordering information 500CAB07 Serial adapter cable RJ12 to RJ-45 (500FSD analog modem)	
500CAB07 R0001	1KGT038913R0001

Accessories ordering information 500CAB10 Serial adapter cable RJ12 to RJ-45 (RTU500)	
500CAB10 R0001	1KGT038924R0001

Accessories ordering information 500CAB11 Serial adapter cable RJ12 to RJ-45 (500RMD32 RS-232 Monitor)	
500CAB11 R0001	1KGT038925R0001

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