TC EXTENDER 6004 ETH-2S

Managed Ethernet extender



Data sheet
106943_en_06

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1 Description

The Ethernet extender makes broadband Ethernet applications on existing cables possible. The Ethernet extender can be used for in-house 2 and 4-wire cables but not in the public telephone network.

Point-to-point, line or ring structures can be established, with ranges of up to 20 km.

The managed Ethernet extender can be combined with the new unmanaged Ethernet extender (Item No. 2702409). However, it can also be used in a network with old generation devices (PSI-MODEM-SHDSL/ETH from firmware version 4.xx, Item No. 2313643). This enables the central diagnostics of all users and lines via IP.

In the event of a storm, high-energy transients can occur. Without protection, they are coupled into the 2-wire line. The integrated surge protection protects the device's SHDSL interface from these transients.

Functions in firmware version 5.xx or later

- Virtually separate critical IP networks with VLAN
- Increase availability through RSTP redundancy
- Greater transparency with SNMP diagnostic extension

Features

- Distances up to 20 km
- 4-port switch, can be configured via web server
- Integrated surge protection of the SHDSL interface
- Surge protection module available as replacement part (TC EXTENDER PT-IQ-2S, Item No. 2702258)
- Easy startup, plug and play
- Robust modulation method (SHDSL)
- Automatic topology and data rate detection
- Two alarm and signal outputs
- Remote diagnostics via IP and automatic event messages via SNMP
- Protocol-transparent transmission of all standard Ethernet protocols, including EtherNet/IP™, Modbus/TCP, PROFINET, PROFIsafe, EtherCAT®, KNX, BACnet/IP
- Use in point-to-point, line, and ring topologies with managed and unmanaged Ethernet extenders

Observe these notes

WARNING: Explosion hazard when used in potentially explosive areas

The device is a category 3 item of electrical equipment. Observe the safety notes in the packing slip.

The additional information in the user manual must also be strictly observed.

Make sure you always use the latest documentation.

It can be downloaded at: phoenixcontact.com/product/2702255

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3 Ordering data

Description	Type	Item no.	Pcs./Pkt.
Managed Ethernet extender, point-to-point, line and ring structures, data rates up to 30 Mbps, distances of up to 20 km on in-house copper cables, replaceable surge protection, 2 SHDSL ports, 4-port switch, diagnostics via display and Ethernet	TC EXTENDER 6004 ETH-2S	2702255	1
Replaceable surge protection module, only for Ethernet extender TC EXTENDER 6004 ETH-2S (2702255), 2 SHDSL ports, two-wire protection for floating SHDSL cables, two-level protective circuit	TC EXTENDER PT-IQ-2S	2702258	1

Accessories	Type	Item no.	Pcs./Pkt.
Replaceable surge protection module, only for Ethernet extender TC EXTENDER 6004 ETH-2S (2702255), 2 SHDSL ports, two-wire protection for floating SHDSL cables, two-level protective circuit	TC EXTENDER PT-IQ-2S	2702258	1
Surge protection in accordance with Class E_A ($CAT6_A$), for Gigabit Ethernet (up to 10 Gbps), token ring, FDDI/ CDDI, ISDN, and DS1. Suitable for Power over Ethernet (PoE++ / 4PPoE) “Mode A” and “Mode B”. RJ45 attachment plug with separate grounding cable and ground connection snap-on foot for NS 35 DIN rails.	DT-LAN-CAT.6+	2881007	1
Security element for FL patch cable	FL PATCH SAFE CLIP	2891246	20
Patch cable, CAT5, assembled, 0.5 m	FL CAT5 PATCH 0,5	2832263	1
Patch cable, CAT5, assembled, 5 m	FL CAT5 PATCH 5,0	2832580	1
CAT5-SF/UTP cable (J-02YS(ST)C HP 2 x 2 x 24 AWG), heavy-duty installation cable, 2 x 2 x 0.22 mm², solid conductor, shielded, outer sheath: 7.8 mm diameter, inner sheath: 5.75 mm ± 0.15 mm diameter, preassembled on both sides with RJ45 plug, crossover or line	FL CAT5 HEAVY CONF/	2744827	1
Primary-switched power supply, QUINT POWER, screw connection, DIN rail mounting, supply of devices possible via the TBUS DIN rail connector, protective coating, input: single-phase, output: 24 V DC/2.5 A	QUINT4-SYS-PS/1AC/24DC/ 2.5/SC	2904614	1
Program and configuration memory, plug-in, 512 Mbyte.	SD FLASH 512MB	2988146	1

Accessories	Type	Item no.	Pcs./Pkt.
Second generation: Unmanaged Ethernet extender for point-to-point connections, line and ring structures, data rates up to 30 Mbps, distances of up to 20 km on in-house copper cables, diagnostics via USB and LEDs, 2 SHDSL ports, 1 LAN port	TC EXTENDER 2001 ETH-2S	2702409	1
RJ45 connector, design: RJ45, degree of protection: IP20, number of positions: 8, 1 Gbps, CAT5, material: Plastic, connection method: Insulation displacement connection, connection cross section: AWG 26- 23, cable outlet: straight, color: traffic gray A RAL 7042, Ethernet	VS-08-RJ45-5-Q/IP20	1656725	1
The FL DIN RA is installed in a standard, 19-inch rack (EIA-310-D, IEC 60297-3-100) to allow DIN rail mounted equipment to be rack mounted.	FL DIN RA	2891053	1

4 Technical data

Supply	
Connection method	Push-in spring connection
Supply voltage range	10 V DC … 60 V DC
Nominal supply voltage	24 V DC ±5 %
Typical current consumption	200 mA (24 V DC) 90 mA (60 V DC) 450 mA (10 V DC)
Electrical isolation	VCC // Ethernet // DSL (A) // DSL (B) // FE
Test voltage	500 V AC (In accordance with EN/IEC 60079-7, observe the limitations in the specific conditions of use.) 1.5 kV AC (50 Hz, 1 min.)

External protection of the suppressor diodes recommended in the supply voltage input: <6 AT per supply line, maximum terminal current 12 A

Available, internal device protection: 5 AT

Protection against polarity reversal via series diode

Ethernet interface, 10/100Base-T(X) in accordance with IEEE 802.3	
Number of ports	4
Connection method	RJ45 jack, shielded 4 ports 10/100BaseT(X), auto negotiation and autocrossing
Serial transmission speed	10/100 Mbps, auto negotiation
Transmission length	< 100 m (shielded twisted pair)
Protocols supported	IPv4, IPv6, TCP/IP, HTTP, HTTPS
Auxiliary protocols	ARP, DHCP (Client), PING, SNMP

SHDSL interface according to ITU-T G.991.2.bis	
Connection method	Push-in spring connection
Serial transmission speed	4-wire operation: 64 kbps ... 30 Mbps 2-wire operation: 32 kbps ... 15.3 Mbps
Transmission length	< 20 km (Depending on data rate and cable cross section)

Surge protection of the SHDSL interface	
IEC test classification	B1 C1 C2 C3 D1
Nominal pulse current I_{an} (10/1000) µs, Line-line/line-ground	100 A / 100 A (B1)
Nominal discharge current I_n (8/20) µs, Line-line/line-ground	1 kA / 1 kA (C1, 300 pulses)
	5 kA / 5 kA (C2, 10 pulses)
	100 A / 100 A (C3, 300 pulses)
Total surge current (8/20) µs, Core-ground	9 kA (C2)
Pulse discharge current I_{imp} (10/350) µs, Core-ground	500 A (D1)
Overvoltage category	II
Degree of pollution	2

Digital output	
Connection method	Push-in spring connection
Number of outputs	2
Voltage output signal	10 V DC ... 60 V DC (24 V DC, depending on the operating voltage)
Current output signal	≤ 500 mA (Short-circuit-proof)

Provide the digital switching outputs with a load between 200 Ω and 100 kΩ.

Push-in spring connection	
Stripping length	10 mm
Conductor cross-section, flexible	0.2 mm² ... 2.5 mm²
Conductor cross-section, rigid	0.2 mm² ... 1.5 mm²
Conductor cross-section, rigid [AWG]	24 ... 16

Ethernet extenders in accordance with ITU-T G.991.2	
Management	Web-based management (Access to all managed and unmanaged Ethernet extenders of the segment unit, role-based user management) SNMPv2/v3
Diagnostic functions	Web-based access to all managed and unmanaged Ethernet extenders of the segment unit SNMP traps Port mirroring
Filter functions	Extended Multicast Filtering VLAN
Redundancy	RSTP Proprietary SHDSL redundancy protocol (Managed and unmanaged Ethernet extenders)
IP parameterization	Static IP address DHCP client BootP (Delivery state: alternately BootP / DHCP)
Max. number of VLANs	64
Number of supported devices	≤ 50 (Per SHDSL segment unit)
General data	
Status and diagnostic indicators	Display for warning, status and device information
Degree of protection	IP20
Mounting type	DIN rail mounting
Assembly note	The product can be snapped onto all 35 mm DIN rails in accordance with EN 60715.
Dimensions (W/H/D)	60 mm x 130 mm x 160 mm
Material	
Housing	Aluminum
Housing	Sheet steel DC01
Vibration resistance in accordance with EN 60068-2-6/ IEC 60068-2-6	5g, 10...150 Hz, 2.5 h, in XYZ direction
Shock in accordance with EN 60068-2-27/IEC 60068-2-27	15g
Electromagnetic compatibility	Conformance with EMC Directive 2014/30/EU
MTTF (mean time to failure)	
SN 29500 standard, temperature 25°C, operating cycle 21%	506 Years
SN 29500 standard, temperature 40°C, operating cycle 34.25%	260 Years
SN 29500 standard, temperature 40°C, operating cycle 100%	110 Years

Ambient conditions	
Ambient temperature	
Operation	-25 °C ... 60 °C
	-25 °C ... 0 °C (Display inactivity can occur, image changes may take several seconds)
	55 °C ... 60 °C (Display contrast can deteriorate)
Storage/transport	-40 °C ... 85 °C
Humidity	
Operation	10 % ... 95 % (non-condensing)
	< 60 % (At an ambient operating temperature >70 °C)
Storage/transport	10 % ... 95 % (non-condensing)
Altitude	≤ 2500 m (For restrictions, see the manufacturer's declaration for altitude operation)

Conformance/Approvals	
CE	CE-compliant
ATEX	Ⓔx II 3 G Ex ec IIC T4 Gc PxCIF16ATEX2702253X Please follow the special installation instructions in the documentation!
UL, USA/Canada	508 Listed
Corrosive gas test	ISA-S71.04-1985 G3 Harsh Group A
Standards/regulations	EN 50121-4

Conformance with EMC Directive 2014/30/EU		
Immunity in accordance with EN 61000-6-2		
Electrostatic discharge	EN 61000-4-2	
	Contact discharge	± 6 kV
	Discharge in air	± 8 kV
	Indirect discharge	± 6 kV
	Comments	Criterion B
Electromagnetic HF field	EN 61000-4-3	
	Frequency range	80 MHz ... 3 GHz
	Field intensity	10 V/m
	Comments	Criterion A
Fast transients (burst)	EN 61000-4-4	
	Input	± 2 kV
	Signal	± 2 kV
	Comments	Criterion B
Surge current loads (surge)	EN 61000-4-5	
	Input	± 0.5 kV (Symmetrical, unshielded supply line) ± 1 kV (Asymmetrical, unshielded supply line)
	Output	± 1 kV (asymmetrical, unshielded)
	Signal	± 1 kV (asymmetrical, shielded Ethernet cable) ± 4 kV (asymmetrical: line to ground, unshielded SHDSL cable) ± 2 kV (symmetrical: line to line, unshielded SHDSL cable)
	Comments	Criterion B
Conducted interference	EN 61000-4-6	
	Frequency range	0.15 MHz ... 80 MHz
	Voltage	10 V
	Comments	Criterion A

Criterion A	Normal operating behavior within the specified limits.
Criterion B	Temporary impairment to operational behavior that is corrected by the device itself.

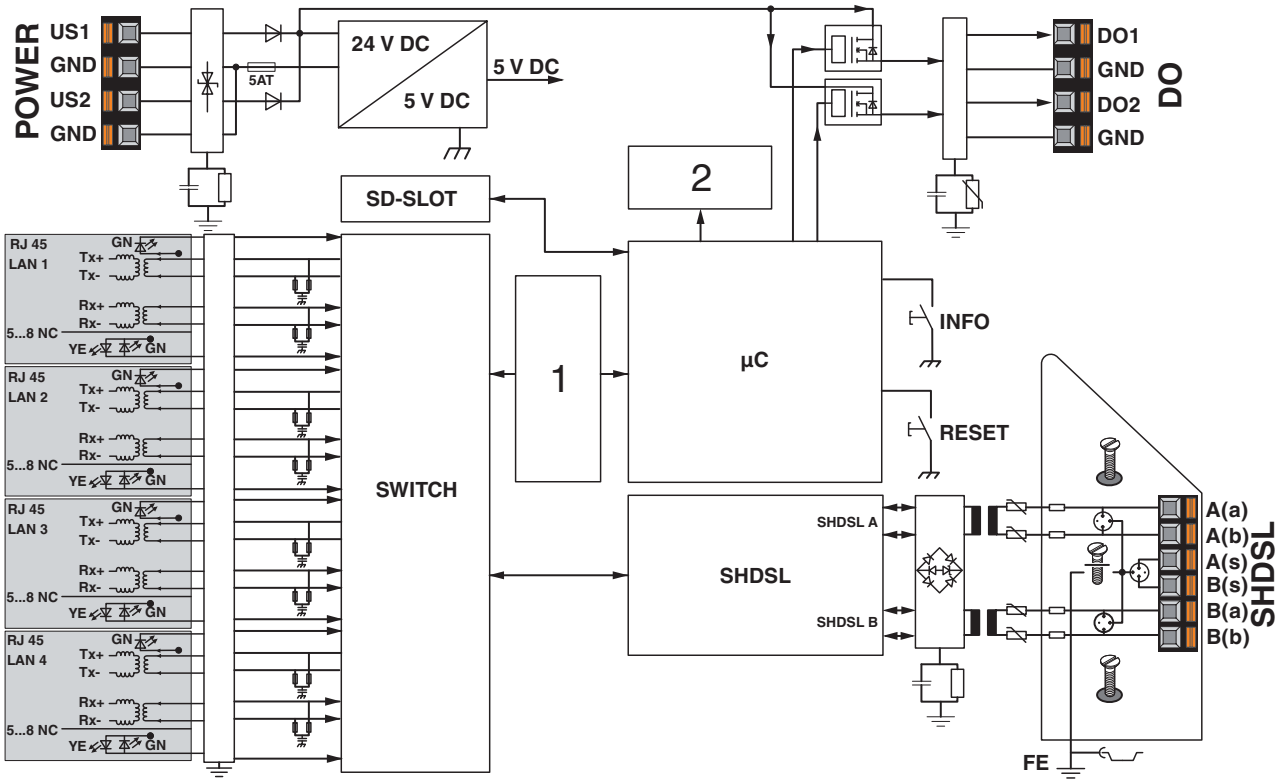
Emitted interference in acc. with EN 61000-6-4	
Interference emission	EN 55011 Class A, industrial applications

5 UL note

INDUSTRIAL CONTROL EQUIPMENT 11AE
Wire Range: 24-16 AWG
Cu Copper Wire, 60/75C
Terminal tightening torque value: 5-7 (Lbs-Ins)
Environmental designation: "Open Type Device"
"Pollution Degree 2 Installation Environment"

6 Basic circuit diagram

Figure 1 Basic circuit diagram



1 Transceiver
2 Display

7 Range

7.1 DSL technology

In contrast to an analog permanent line modem, DSL (Digital Subscriber Line) uses a greater frequency range, which enables a data rate that is several times higher.

The modulation process is applied to different carrying frequencies for DSL. Modulation is therefore significantly less sensitive to external sources of electromagnetic interference.

SHDSL is a version of this DSL technology. In contrast to other DSL technologies, a greater range can be realized with SHDSL. In addition, the bandwidth for upstream and downstream is equally large (symmetrical data transmission). For this reason, SHDSL is well suited to industrial applications.

SHDSL is standardized in the ITU-T G-991-2. Further technical information can be found there.

Ethernet extenders with SHDSL technology are ideal for retrofitting a system, because the extenders can be used with the system's existing wiring.

7.2 Determining the data rate

A precise prediction of the maximum possible data rate is difficult in practice as many parameters play a role:

– Cable type (design, diameter, capacity, shielding)
– How it is laid (number of transitions, lines laid in parallel)
– EMC influences of neighboring devices on the communication line

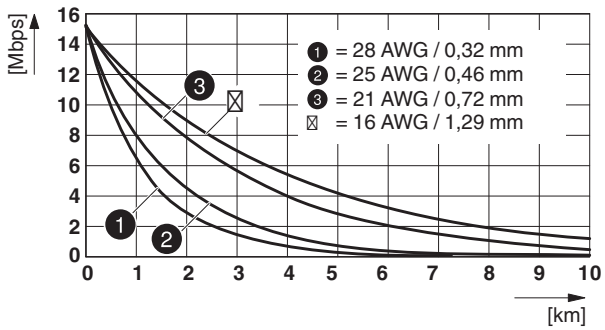
For a new installation, we recommend using shielded twisted pair cables.

To gain an initial estimation of the possible data rate, use the following diagram or the SHDSL calculator software. It can be downloaded free of charge at phoenixcontact.com/product/2702255.

The actual data rate can only be determined in a practical test. To this end, Phoenix Contact provides test kits with two Ethernet extenders. This enables you to test the paths under realistic conditions.

The maximum possible data rate is dependent on several parameters. Two important parameters are the cable length and cable cross section.

Figure 2 Data rate depending on the distance, 2-wire



The diagram illustrates the dependency of the maximum data rate on the line length with 4 cable types. Longer distances can be achieved using high-quality cables with larger diameters.

The industrial Ethernet extenders support data rates of 32 kbps to 15.3 Mbps in 2-wire operation and data rates of up to 30 Mbps in 4-wire operation.

The Ethernet extenders are suitable for in-house cables, not for public telephone networks. Establishing the connection between the devices usually takes around one minute.

8 Application examples

8.1 Point-to-point connection

Figure 3 Point-to-point connection (2-wire)

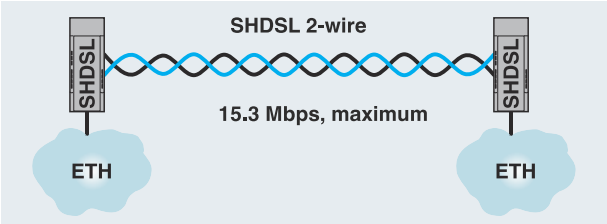
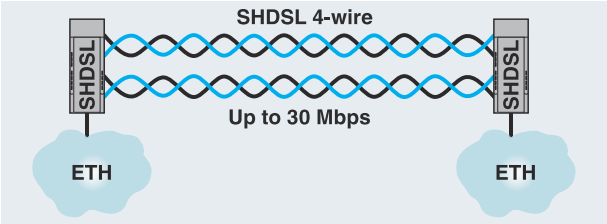


Figure 4 Point-to-point connection (4-wire)



There can be a maximum distance of 20 km between two devices. The Ethernet extender automatically recognizes if the path is constructed on a 2-wire or 4-wire path.

If the devices have detected a 4-wire line, the transmission rate is automatically increased depending on the line quality. It is usually doubled. If one of the connections fails, the data is transmitted via the remaining conductors at single transmission speed. In this way, a reliable redundancy operation is supported.

8.2 Line structure

Figure 5 Linear structure (2-wire)

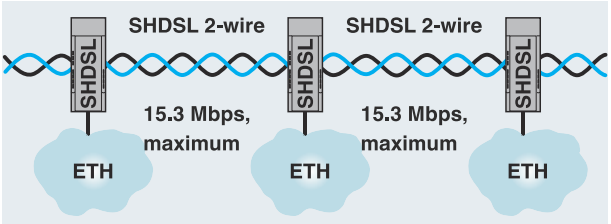
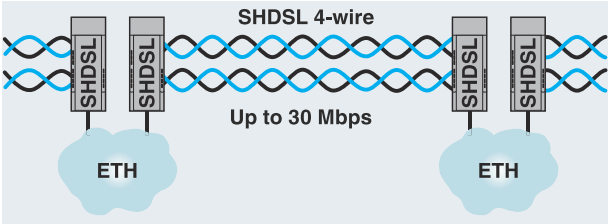


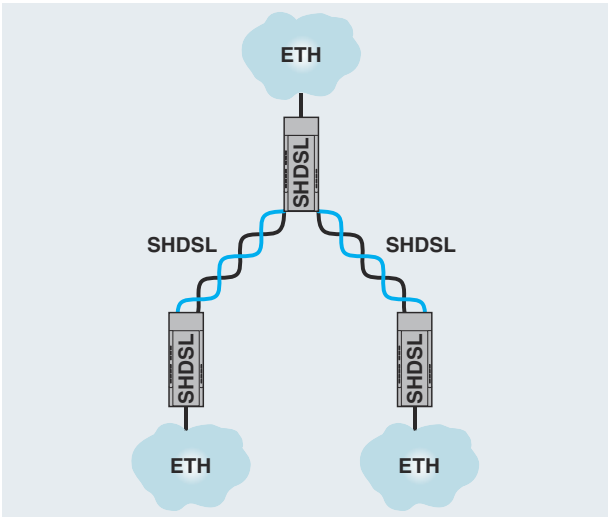
Figure 6 Linear structure (4-wire)



There can be a maximum distance of 20 km between two devices. You can switch up to 50 devices in series.

8.3 Star structure

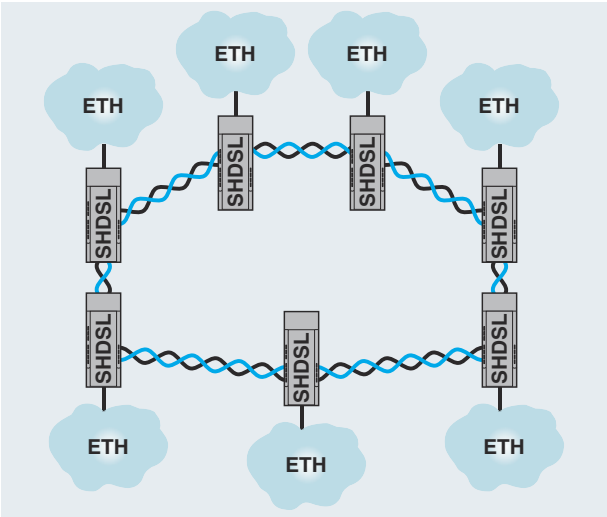
Figure 7 Star structure



Since each device features two SHDSL ports, you need only three devices.

8.4 Ring structure

Figure 8 Redundant ring structure



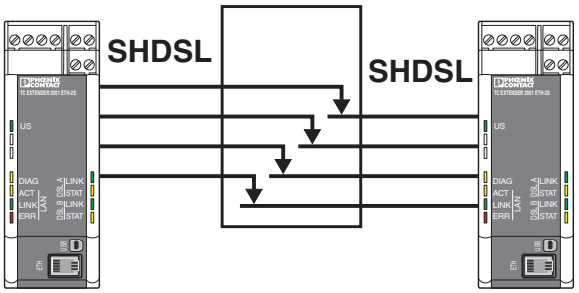
The overall availability of the system is significantly increased by a redundant ring.

There can be a maximum distance of 20 km between two devices. You can integrate up to 50 devices in a ring.

If there is a ring interruption, Ethernet communication is possible again after the following response time:
$t_{Recovery}$ = 1500 ms + number of devices x 100 ms
The paths of the SHDSL ring should show a very high connection quality during normal operation. If that is not the case, the reaction time can deviate from the value calculated above.

8.5 Redundant data communication in rotating applications

Figure 9 Slip ring communication



The Ethernet extenders are connected via a 4-wire line. The connection is therefore redundantly established.

Using the two digital outputs on the Ethernet extender, you can monitor the slip ring communication.

9 Revision history

Document revision	Hardware revision	Firmware revision	Date	Description
00	10	400	2016-05-23	First publication
01	10	400	2016-07-29	“You can switch up to 255 devices in series.” removed
02	10	410	2017-05-31	ATEX and UL approval, section “Safety regulations and installation notes” revised, block diagram corrected, section “Digital switching outputs” added, section “Load default setting” revised, section “Special application: Redundant data communication in wind turbine generators” removed
03	10	412	2020-09-17	Note added: “The use in potentially explosive areas is not permitted in China.”
04	10	510	2021-06-21	New functions from firmware version 5.xx (VLAN, RSTP), accessories added, new table “Ethernet extenders in accordance with ITU-T G.9912”
05	10	510	2022-12-15	Data sheet greatly shortened, reference to packing slip and user manual, UKEX added, ATEX re-evaluation, test voltage in accordance with EN/IEC 60079-7 added, output signal voltage added
06	10	512	2026-02-20	UKEX removed, revision history added