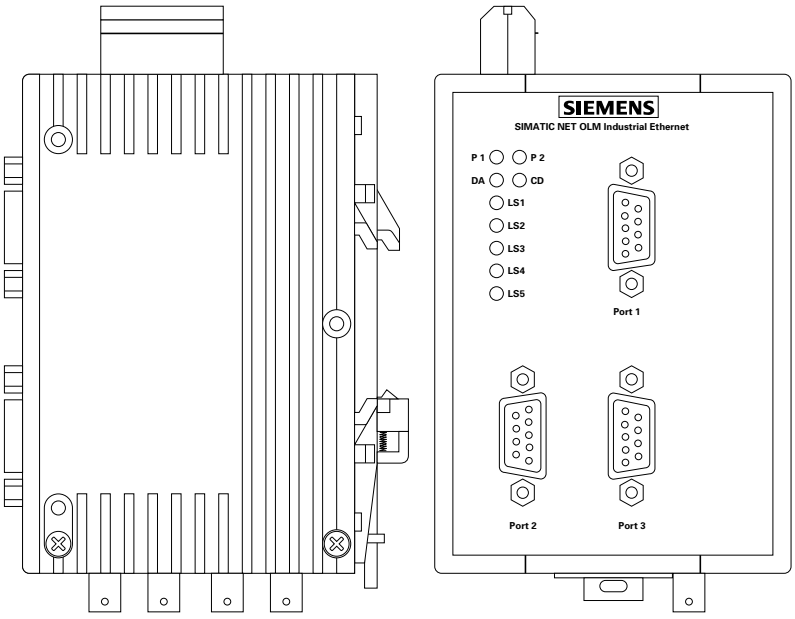
SIEMENS

SIMATIC NET Industrial Ethernet OLM V2.0 / ELM

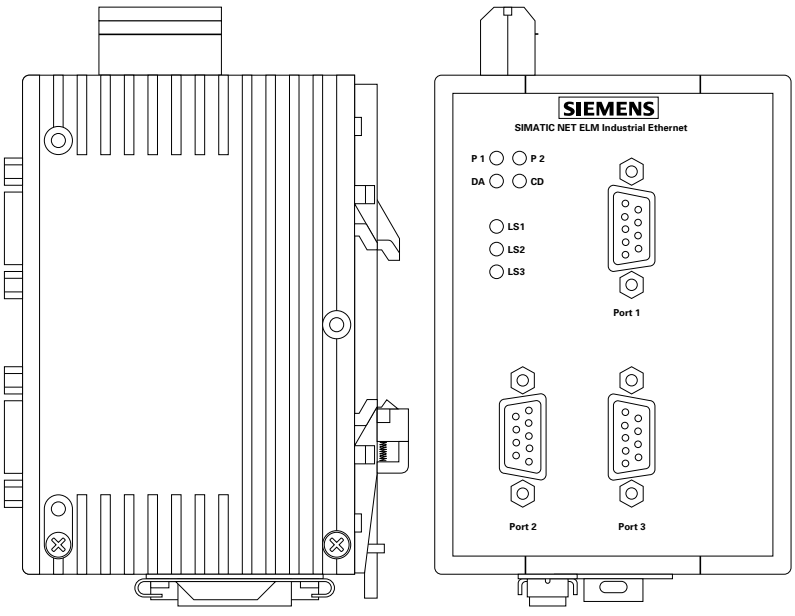
Description and operating instructions Link Modules for Industrial Ethernet

Order no.

6GK1102-4AA00/ 6GK1102-5AA00



Industrial Ethernet OLM V2.0



Industrial Ethernet ELM

The SIMATIC NET link modules for Industrial Ethernet allow Ethernet networks to be constructed flexibly in accordance with IEEE standard 802.3 using optical waveguide (F/O) and copper technology. The link modules provide several connection options in one piece of equipment and are plugged onto the standard bar.

The OLMs (optical link modules) have three industrial twisted pair (ITP) interfaces and two BFOC optical interfaces. It is possible to connect up to three pieces of terminal equipment or other ITP segments using ITPs, and F/Os can be used to connect up to two more pieces of terminal equipment or optical network components (OLM, ECFL2, Mini-OTDE, etc.).

Besides the three industrial twisted pair (ITP) interfaces, the ELMs (electrical link modules) have an AUI interface. It is possible to connect an Ethernet segment to a CSMA/CD local area network (LAN) with a transmission speed of 10 Mbit/s via the AUI interface.

Both modules conform to the specifications of ISO/IEC standard 8802-3.

You will find a detailed description of constructing a network with link modules and notes on network planning and installation in the “Industrial Twisted Pair” manual.

Safety guidelines

Warning!
The OLM/ELM units are designed for operation with safety extra-low voltage. Accordingly, only safety extra-low voltages (SELV) to IEC950/EN60950/VDE0805 may be connected to the supply voltage connections.

1. Functional description

1.1 GENERAL FUNCTIONS

Signal regeneration
The OLM/ELM processes the signal shape and amplitude of the data received.

Retiming
In order to prevent jitter increasing over several segments, the OLM/ELM retimes the data to be transmitted.

Preamble regeneration
The OLM/ELM supplements lost preamble bits from data received to 64 bits (incl. the start of frame delimiter (SFD)).

Fragment extension
Collisions can cause short fragments to occur. If the OLM/ELM receives a fragment, this is supplemented to give the minimum length of 96 bits. This ensures reliable collision detection by all network participants.

Collision handling
If the OLM/ELM detects a data collision, it interrupts the transmission. For the duration of the collision, the collided data package is replaced by a jam signal to ensure collision detection by the terminal equipments.

Auto partitioning
Network failures can be caused by permanent occupancy, interrupted lines, lack of terminating resistors, damaged cable insulation and frequent collisions due to electromagnetic interference. In order to protect the network from such failures, the OLM/ELM in this case separates the segment in the receiving direction from the rest of the network.
The OLM/ELM has this auto partitioning function individually at each port. The other ports can thus continue to be operated without interference if one of the ports has been auto partitioned. In the event of auto partitioning, transmission continues into the ITP segment or the F/O line but reception at this port is blocked.

With twisted pair, auto partitioning is activated if
– a data collision lasts longer than 105 µs or
– there are more than 64 consecutive data collisions.

With F/O, auto partitioning becomes active when
– a data collision lasts longer than 1.5 ms (normal mode) or 0.2 ms (redundant mode) or
– there are more than 64 (normal mode) or 16 (redundant mode) consecutive data collisions.

Reconnection
The segment is reconnected to the network as soon as a package with the minimum length of 51 µs is received without collision at the relevant port, i. e. when the segment is working properly again.
When the redundant mode is active, packages >51 µs sent at a F/O port without collision also lead to reconnection.

Jabber control
Due to a defective bus coupler or LAN controller, for example, the network can be continuously occupied with data. To protect against this, the OLM/ELM interrupts reception
– at the affected ITP or AUI port after 5.5 ms. 9.6 µs after the end of the error the auto partitioning will be canceled. (jabber lockup protection)
– at the relevant F/O port after 3.9 ms. 420 ms after the end of the error the auto partitioning will be canceled. (Rx jabber)

1.2 SPECIFIC FUNCTIONS OF THE ITP INTERFACE

Link control
The OLM/ELM monitors the connected ITP line segments for short-circuit or interrupt using regular link test pulses in accordance with IEEE standard 802.3 10BASE-T. The OLM/ELM does not transmit any data in an ITP segment from which it does not receive a link test pulse.

Note: A non-occupied interface is assessed as a line interrupt. The ITP line to terminal equipment which is switched off is likewise assessed as a line interrupt as the de-energised bus coupler cannot transmit link test pulses.

Auto polarity exchange
If the reception line pair is incorrectly connected (RD+ and RD- switched) polarity is automatically reversed.

1.3 SPECIFIC FUNCTIONS OF THE F/O INTERFACE

Link control
The OLM monitors the connected F/O lines for interrupts using regular link test pulses in accordance with IEEE standard 802.3 10BASE-FL. The OLM transmits no data to an F/O line from which it is receiving no link test pulse.

Redundancy
In areas where data security has top priority, it is possible with the aid of the redundancy function to bridge any failure of an F/O line or OLM. To do so, a replacement line is frequently routed in a different cable run. In the event of a fault, there is an automatic switch between the main line and the replacement. A cross-link within the bus structure creates a ring (see Fig. 6). If any OLM link or OLM fails, every other OLM can still be reached with the aid of the redundant run.

1.4 DISPLAY ELEMENTS

Equipment status
The 4 LEDs on top provide information about statuses which affect the function of the entire OLM/ELM.
P1 – Power 1 (green LED)
– lit: supply voltage 1 present
– lit not: – supply voltage 1 not present,
– hardware fault in OLM/ELM

P2 – Power 2 (green LED)
– lit: supply voltage 2 present
– lit not: – supply voltage 2 not present,
– hardware fault in OLM/ELM

DA – Data (yellow LED)
– lit: OLM/ELM receiving data at at least 1 interface
– lit not: – OLM/ELM not receiving data at any interface,
– hardware fault in OLM/ELM
Depending on network load, the illumination of the LED can vary between a brief lighting up to permanent illumination.

CD – Collision Detect (red LED)
– lit: data collision detected at OLM/ELM level
– lit not: – no data collision at OLM/ELM level

Port Status ELM
These groups of LEDs display port-related information.
LS1 to LS3 - link status of the ITP ports (3 x green LED)
– lit: ELM receiving link test pulses from ITP segment,
– the ITP segment connected is working properly
– lit not: ELM is not receiving any link test pulses from ITP segment,
– the assigned ITP port is not connected,
– the equipment connected is switched off,
– the ITP line is interrupted or short-circuited

Port Status OLMV2.0
These groups of LEDs display port-related information.
LS1 to LS3 - link status of the ITP ports (3 x green LED)
– lit: OLM receiving link test pulses from ITP segment,
– the ITP segment connected is working properly
– flashes 2 times per period: port has auto partitioned
– lit not: OLM is not receiving any link test pulses from ITP segment,
– the assigned ITP port is not connected,
– the equipment connected is switched off,
– the ITP line is interrupted or short-circuited

LS4 – link status of F/O port 4 (green LED)
– lit: OLM receiving link test pulses from F/O segment,
– the F/O segment connected is working properly

– flashes 2 times
per period: port has auto partitioned
– lit not: OLM not receiving any link test pulses from F/O segment,
– the assigned F/O port is not connected,
– the equipment connected is switched off,
– the F/O receiving fibre is interrupted

LS5 – Link status of F/O port 5
(green LED)
Normal mode switched on
– lit: OLM receiving link test pulses from F/O segment,
– the connected redundant F/O segment is working properly
– flashes 2 times
per period: port has auto partitioned
– lit not: OLM not receiving any link test pulses from F/O segment,
– the assigned F/O port is not connected,
– the equipment connected is switched off,
– the F/O receiving fibre is interrupted

LS5 – Link status of F/O port 5
(green LED)
Redundant mode switched on
– lit: OLM receiving link test pulses from F/O segment,
– the connected redundant F/O segment is working properly **and** is active,
– flashes 1 time
per period: OLM receiving link test pulses from F/O segment,
– the connected redundant F/O segment is working properly **and** is in stand-by mode,
– lit not: OLM not receiving any link test pulses from F/O segment,
– the assigned F/O port is not connected,
– the equipment connected is switched off,
– the F/O receiving fibre is interrupted

1.5 CONTROLS

6-pin DIP switch
Using the 6-pin DIP switch on the top of the OLM/ELM housing
– the message about the link statuses can be suppressed by the indicator contact on a port-by-port basis. Using switches LA1 to LA5 (LA1 to LA3 on the ELM), the message about the link status of ports 1 to 5 (1 to 3 on ELM) is suppressed. State on delivery: switch position 1 (on), i.e. message not suppressed.
- port 5 can be switched to redundant mode (on the OLM). State on delivery: switch position 0 (off), i.e. port 5 in normal mode.

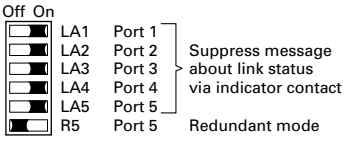


Fig. 1: 6-pin DIP switch on OLM

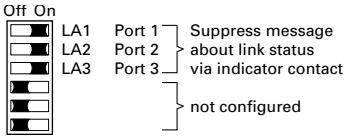


Fig. 2: 6-pin DIP switch on ELM

1.6 INTERFACES

ITP connection
Three 9-pin sub-D sockets enable three independent ITP segments to be connected. The socket casings are electrically connected to the front panel and thus connected to the housing of the OLM/ELM.

Mechanical locking is by means of a UNC 4-40 screw locking mechanism.
– **Pin configuration** of the 9-pin sub-D socket:
– TD+: pin 5, TD-: pin 9
– RD+: pin 1, RD-: pin 6
– remaining pins: not configured.

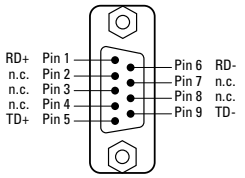


Fig. 3: Pin configuration of an ITP interface

AUI connection (ELM)
An AUI port to IEEE 802.3 enables ELM equipment to be connected to an Ethernet segment via a bus coupler. The data and CD lines of the AUI port are DC-decoupled from the supply voltages. The voltage (+ 12 V DC) to supply a bus coupler has the earth of the supply voltage as a reference potential.

Note: When connecting the ELM to a SINEC bus coupler with 2 interfaces (level 4 of issue or less), use only the left-hand interface of the coupler.

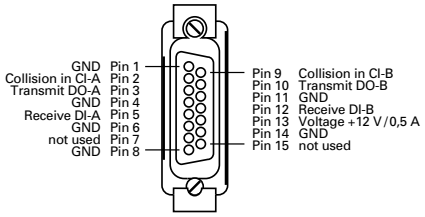


Fig. 4: Pin configuration of AUI interface

F/O connection (OLM)
2 optical ports to 10BASE-FL (BFOC/2.5 (ST) sockets) enable OLM equipment to be cascaded as well as redundant rings to be constructed using F/Os and terminal equipment to be connected.

5-pin terminal block
The supply voltage and the indicator contact are connected via a 5-pin terminal block with screw locking mechanism.

Warning!
The OLM/ELM equipment is designed for operation with SELV. Only safety extra-low voltages to IEC950/EN60950/VDE0805 may therefore be connected to the supply voltage connections and to the indicator contact.

– **Voltage supply**: The voltage supply can be connected to be redundant. Both inputs are decoupled. There is no load distribution. With redundant supply, the power pack supplies the OLM/ELM alone with the higher output voltage. The supply voltage is electrically isolated from the housing.

– **Indicator contact:** Contract interrupt indicates the following by means of a potential-free indicator contact (relay contact, closed circuit):
– the failure of at least one of the two supply voltages.
– a permanent fault in the link module (internal 5 V DC voltage, supply voltage 1 or 2 not in the permissible range).
– the faulty link status of at least one F/O (on OLM) or ITP port.
The indication of the link state might be masked on a port-by-port basis using DIP switches.
– at least one port has auto partitioned. Port 5 in redundant mode doesn't indicate the state „auto partitioning", because this function characterizes the error free state of the optical ring.

Note: In the case of the voltage supply being routed without redundancy, the OLM/ELM indicates the failure of a supply voltage. You can prevent this message by feeding in the supply voltage through both inputs.

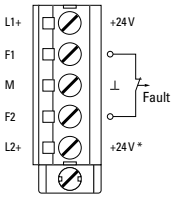


Fig. 5: Pin configuration of 5-pin terminal block

2. Configuration

2.1 LINE STRUCTURE

The OLM/ELM enables line structures to be built up. Cascading can be effected using both the ITP and F/O ports (OLM) or with a bus coupler via the AUI port (ELM).

☐ When cascading via ITP ports, use a cable which crosses the signal pairs, i.e. in each case connects output to input.

Detailed planning rules (cascade depth etc.) can be found in the "Industrial Twisted Pair Networks" manual.

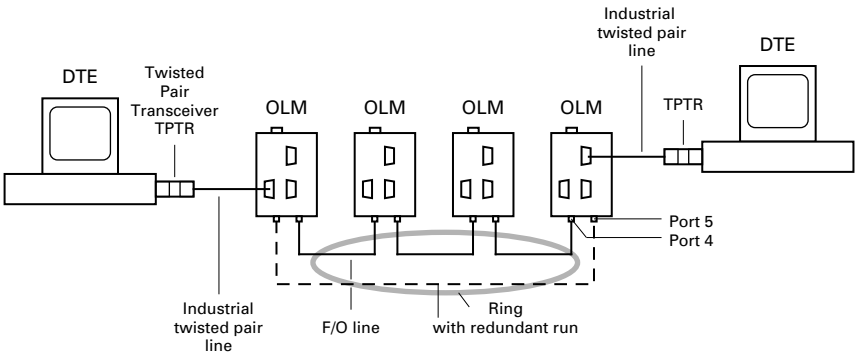


Fig. 6: Redundant ring structure via the F/O ports of the OLM equipments

2.2 REDUNDANT RING STRUCTURE (OLM)

Redundant ring structures can be built up using the F/O ports of the OLM. Figure 6 shows a redundant ring structure with OLM equipment. To do so, the first piece of equipment is connected to the last in the fiber optical line structure consisting of OLM equipment (see above) and the redundant fiber optical ring thus closed.

To do so, the redundant connection on precisely one of the two OLMs is to be connected to port 5, and port 5 switched to redundant mode. Switchover is effected at the 6-pin DIP switch on top of the equipment (see chapter entitled "Functional description - Controls".

Note: All the modules in the redundant ring may only be connected to one another via F/O runs (ECFL2, ECFL4).

2.3 COMBINATION WITH CONCENTRATORS OF THE ASGE, MC AND AMC FAMILY

The OLM/ELM can also be combined with concentrators of the ASGE, MC and AMC family. The OLM/ELMs can be cascaded for example in line structures via the ECFL2, ECFL4, ECTP3 etc. interface cards.

The number of pieces of equipment which can be cascaded depends on the overall network structure. Redundant ring structures can be implemented via the F/O ports (OLM).

Hints on calculating the maximum network expansion can be found in the Ethernet manual, Chapter 8 (see „Technical Data" for order number).

OLM

A maximum of 11 OLMs might be cascaded in a fiber optical line.
Here the total line length between the terminal equipments with the maximum distance might not exceed 1180 m.
The total line length is determined by the total sum of all F/O line sections and the two ITP lines to the terminal equipments.

ELM

A maximum of 13 OLMs/ELMs might be cascaded in an ITP line, with a maximum length of 100 m per ITP line.
A maximum of 2050 m total line length is allowed between two terminal equipments.

3. Assembly, startup procedure and dismantling

3.1 UNPACKING, CHECKING

– Check whether the package was delivered complete (see scope of delivery).
– Check the individual parts for transport damage.

Warning!
Use only undamaged parts!

3.2 ASSEMBLY

The equipment is delivered in a ready-to-operate condition. The following procedure is appropriate for assembly:
– Check whether the switch pre-setting suits your requirements.
– Pull the terminal block off the OLM/ELM and wire up the supply voltage and indicator lines.
– Fit the OLM/ELM on a 35 mm standard bar to DIN EN 50 022.
– Suspend the upper snap-in hook of the OLM/ELM in the standard bar, insert a screwdriver horizontally under the housing into the locking slide pull this downwards (cf. Fig. 8, Dismantling) and press the bottom of the module onto the standard bar until it locks in position (Fig. 7).
– Fit the signal lines.

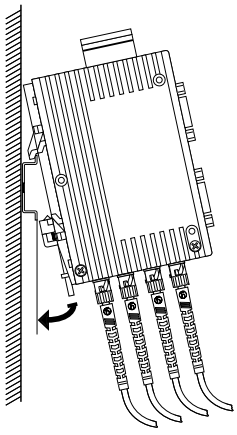


Fig. 7: Assembling the OLM/ELM

Notes:
– The housing of the OLM/ELM is grounded via the standard bar. There is no separate ground connection.
– The screws in the lateral half-shells of the housing may not be undone under any circumstances.
– The shielding ground of the industrial twisted pair lines which can be connected is electrically connected to the housing.

3.3 STARTUP PROCEDURE

You start up the OLM/ELM by connecting the supply voltage via the 5-pin terminal block. Lock the terminal block with the locking screw at the side.

3.4 DISMANTLING

To take the OLM/ELM off the standard bar, insert a screwdriver horizontally under the housing into the locking slide, pull it (without tipping the screwdriver) downwards and fold the OLM/ELM upwards (Fig. 8).

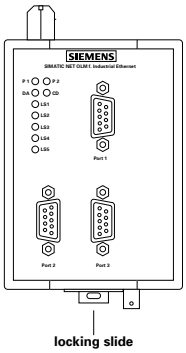


Fig. 8: Dismantling the OLM/ELM

4. Further support

In the event of technical queries, please talk to your Siemens contact in the agencies/offices responsible for looking after you. You can find the addresses
– in our IK10 catalogue
– and on the Internet (http://www.ad.siemens.de)

Our hotline is also at your disposal:
Tel: +49 911 895-7000 (Fax: -7001)

5. Technical data

General data

Operating voltage	DC 18 to 32 V safety extra-low voltage (SELV) (redundant inputs decoupled)
Current consumption	typ. 160 mA (OLM) respectively 80 mA (ELM) at 24 VDC (without AUI-load) max. 280 mA (OLM) respectively 430 mA (ELM) at 24 VDC (with AUI-load)
Overload current protection at input	non-changeable thermal fuse
Dimensions W x H x D	80 mm x 140 mm x 85 mm
Mass	OLM 900 g, ELM 850 g
Ambient temperature	0 °C to + 60 °C
Storage temperature	- 40 °C to + 80 °C
Humidity	10% to 90% (not-condensing)
Protection class	IP 30 (OLM), IP 40 (ELM)
Radio interference level Interference immunity	EN 55022 Class B EN 50082-2

Network size

Transition	ITP-Port ↔ ITP-Port (OLM, ELM)	F/O port ↔ F/O port (OLM)
Propagation equivalent	190 m	260 m
Variability Value	3 BT	3 BT
Transition	ITP-Port ↔ F/O port (OLM)	ITP-Port ↔ AUI-Port (ELM)
Propagation equivalent	360 m	190 m
Variability Value	6 BT	3 BT
F/O port (OLM ↔ OLM)		
Optical output power		
Graded-index fiber 50/125 µm (average)	min. -22,0 dBm	max. -16,2 dBm
Graded-index fiber 62,5/125 µm (average)	min. -19,0 dBm	max. -12,4 dBm
Optical input power	min. -33,0 dBm	

ITP line length (ITP-Port ↔ ITP-Port)	
Length of an industrial twisted pair segment	max. 100 m
AUI line length (AUI-Port ↔ AUI-Port)	
Length of an AUI cable	max. 50 m
F/O line length (example)	
50/125 µm fiber	max. 2.600 m
62,5/125 µm fiber	max. 3.100 m

Scope of delivery

SIMATIC NET Industrial Ethernet
OLM V2.0/ELM incl.
terminal block for supply voltage
description and operating instructions

Order number	
SIMATIC NET Industrial Ethernet OLM V2.0	6GK1102-4AA00
SIMATIC NET Industrial Ethernet ELM	6GK1102-5AA00

Accessories

"Industrial Twisted Pair Networks" manual	6GK1970-1BA00-0AA0
Ethernet manual	HIR:943 320-011

CE

Notes on CE identification
The link modules for Industrial Ethernet comply with the regulations of the following European directive:

89/336/EEC
Council Directive on the harmonisation of the legal regulations of member states on electromagnetic compatibility (amended by Directives 91/263/EEC, 92/31/EEC and 93/68/EEC).

Area used	Requirements for emitted interference	interference immunity
Residential	EN 50081-1: 1992	EN 50082-1: 1992
Industrial	EN 50081-2: 1993	EN 50082-2: 1995

The EU declaration of conformity is kept available for the responsible authorities in accordance with the above-mentioned EU directives at:

Siemens Aktiengesellschaft
Bereich Automatisierungs- und Antriebstechnik
Industrielle Kommunikation (A&D PT2)
Postfach 4848
D-90327 Nürnberg

The product can be used in the residential sphere (residential sphere, business and trade sphere and small companies) and in the industrial sphere.

The precondition for compliance with EMC limit values is strict adherence to the construction guidelines specified in this description and operating instructions and in the "Industrial Twisted Pair Networks" manual!

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