SIEMENS

# SIMATIC NET PROFIBUS
# Optical Link Module
# OLM / P11 V4.0
# OLM / P12 V4.0
# OLM / P11 V4.0
# OLM / G12 V4.0
# OLM / G12-EEC V4.0
# OLM / G11-1300 V4.0
# OLM / G12-1300 V4.0

Operating Instructions


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# 1 Preface



## 1.1 Preface

### Purpose of the operating instructions

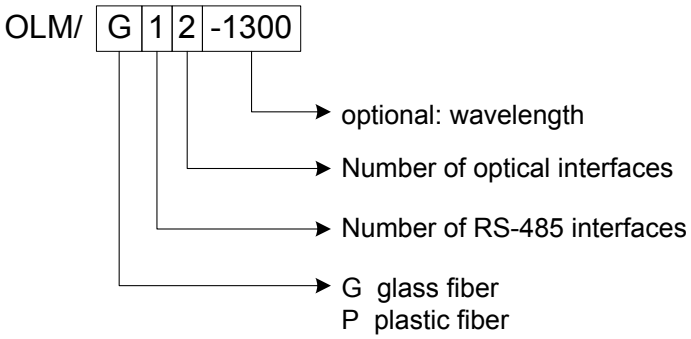
These operating instructions support you when commissioning PROFIBUS OLM devices (Optical Link Module)

### Validity of these operating instructions

These operating instructions are valid for the following devices:

| | |
|---|---|
| SIMATIC NET OLM/P11 V4.0 | 6GK1 503-2CA00 |
| SIMATIC NET OLM/P12 V4.0 | 6GK1 503-3CA00 |
| SIMATIC NET OLM/G11 V4.0 | 6GK1 503-2CB00 |
| SIMATIC NET OLM/G12 V4.0 | 6GK1 503-3CB00 |
| SIMATIC NET OLM/G12-EEC V4.0 | 6GK1 503-3CD00 |
| SIMATIC NET OLM/G11-1300 V4.0 | 6GK1 503-2CC00 |
| SIMATIC NET OLM/G12-1300 V4.0 | 6GK1 503-3CC00 |

### Convention



# 3 Network Topologies

3

## Which network topologies can be implemented?

The following network topologies can be implemented with the PROFIBUS OLM:

- Point-to-point connection
- Bus (linear) topology
- Star topology
- Redundant optical ring

Combinations of these basic types are also possible. To set up the fiber-optic links of these network topologies, cables with two optical fibers are used.

If a high degree of availability is required of the fieldbus network, this can be increased by using a redundant network configuration, for example to allow continued communication if a cable is broken.

**Please note the following:**

- Single DTEs or complete PROFIBUS segments with a maximum of 31 nodes can be connected to the electrical interface of the PROFIBUS OLM.
- Use only fiber-optic cables in areas subject to heavy noise to avoid EMC problems affecting the entire network.
- **Only OLMs of the same wavelength** may be connected to each other optically:
  - OLM/P11 and OLM/P12 with each other
  - OLM/G11 and OLM/G12 as well as OLM/G12 EEC with each other
  - OLM/G11-1300 and OLM/G12-1300 with each other
- Optical channels connected via fiber-optic cables must be set to the same mode.
- Transitions between different OLM types are only possible via the RS-485 interface.
- In the network topologies described below, the OLM/G12-EEC can be used everywhere where an OLM/G12 can be used.

## 3.1 Linear (bus) Topology

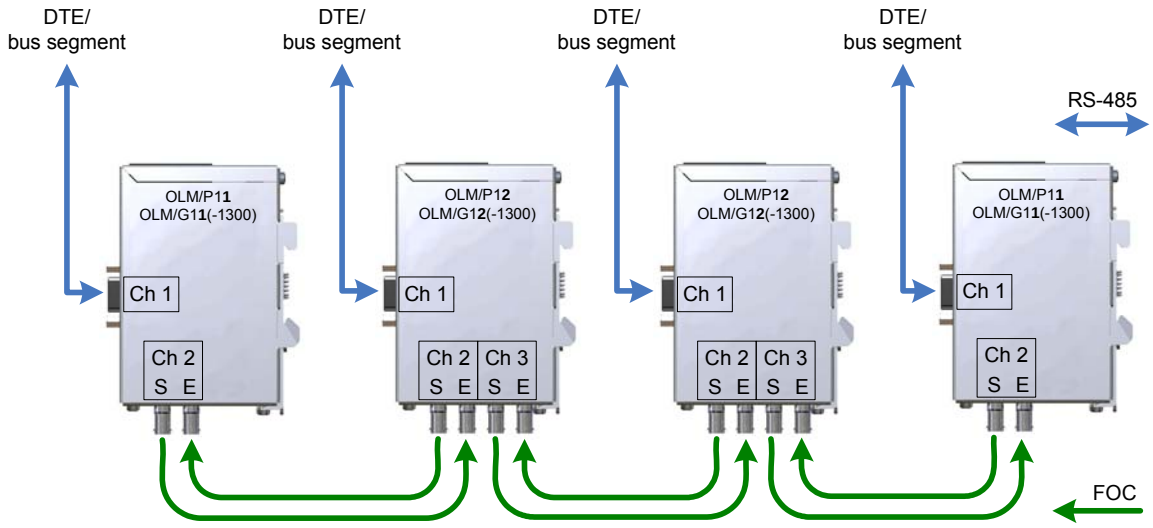



Figure 3-1 Network structure in a linear (bus) optical topology

In a linear or bus structure, the single PROFIBUS OLMs are connected by two-fiber cables.
At the beginning and at the end of a line, modules with one optical channel are adequate, in-between modules with two optical channels are necessary.

If single point-to-point connections are required, they can be implemented with modules with one optical channel each.

The bus topology can be implemented with and without fiber-optic link monitoring. Fiber-optic link monitoring is recommended in homogeneous OLM networks (factory default).

Please note that to ensure correct operation, the following conditions must be kept to when configuring the network:

- The parameter MIN TSDR, described in the PROFIBUS standard EN 50170 /2/, must be set to a value ≥ 11 on all DTEs. This is usually the case but should be checked if permanent communication problems occur.
- Choose bus node addresses as low as possible when configuring your network, to reduce master timeouts that may occur due to disruptions.

You will find information on changing the setting in the documentation supplied by the manufacturer of your DTE.

## 3.2 Star Topology

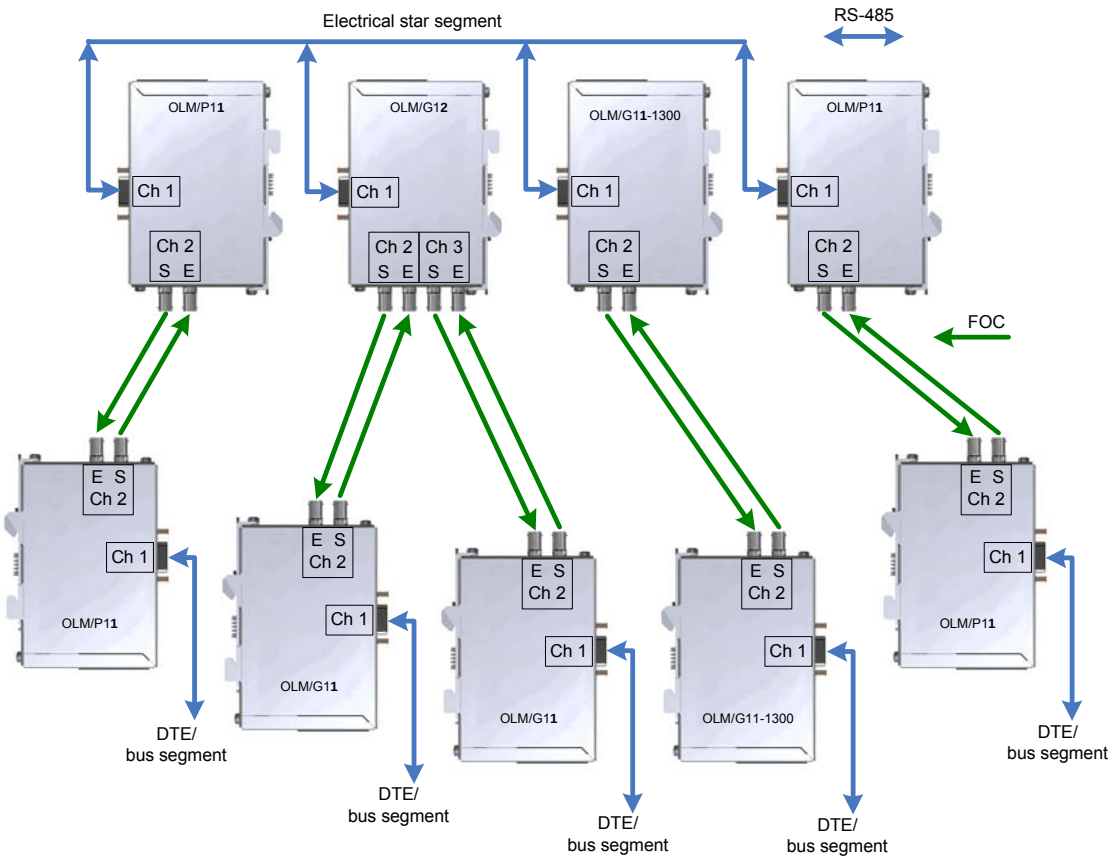



Figure 3-2 Network structure with an optical star topology

Several modules are grouped together to form an active PROFIBUS star coupler. Further modules are connected to this via two-core fiber-optic cables. The modules of the star coupler are interconnected via the electrical channel (electrical star segment). All OLM types for different fiber-optic cables (plastic, PCF, glass) can be combined via the electrical star segment.

**Please note the following:**

- CH1 must be set to “Monitor off” (S0 = 1) on all OLMs connected to the electrical star segment. This disables segmentation function of the RS-485 channel of this OLM to achieve high availability of the electrical star.
- Make sure that the electrical star segment is carefully wired. Keep its span as small as possible to avoid interference in the electrical star segment that can spread to the whole network. You can achieve this by positioning the OLMs directly next to each other on a DIN rail.
- Switch on the terminating resistors (see section 5.3) in the bus connectors at the two ends of the electrical star segments.
- If possible do not connect any bus nodes to the electrical star segment.

To set up an active PROFIBUS star coupler, modules with one or two optical channels can be used. To connect a DTE or an RS-485 bus segment to an active star coupler, modules with one optical channel are adequate.

When the monitoring on the optical channels is active, the fiber-optic links are monitored by the connected OLMs.

**Note:**

Unused optical channels you intend to use later to expand the network cause a broken fiber-optic cable signal if the monitoring is active. You can avoid this error message by setting unused channels to the mode ‘‘bus without fiber-optic link monitoring”. Remember that the optical channels that are not connected must be protected against external light and pollution by protective caps.

**Please note the following:**

For correct operation, the following conditions must be met:

- Only use this mode, if you only connect PROFIBUS OLMs with at least version V3 with each other. Both optical channels must be set to the "redundant optical ring" mode on all PROFIBUS OLMs. All modules within a ring must be connected to each other over fiber-optic cables. There must be no RS-485 bus cable within the ring.
- The MIN TSDR parameter described in the PROFIBUS standard EN 50170 /2/ must be set to a value ≥ 11 on all DTEs. This is usually the case but should be checked if permanent communication problems occur.
- Choose bus node addresses as low as possible when configuring your network, to reduce master timeouts that may occur due to disruptions.
- If there is a failover (for example due to a cable break), there is failover time during which correct data transmission is not possible. To ensure bumpless bridging for the application, it is advisable to set the frame retry number on the PROFIBUS master to at least 3. To ensure a bumpless return from the optical bus to the optical ring once a problem has been eliminated, there must be no frame on the network at this time. This status occurs when the master sends a GAP query to an address lower than HSA. The master tries to address the device cyclically and waits for a reply at the longest until the configured slot time has elapsed ("GAP query"). The OLM recognizes this status and closes the optical bus to form an optical ring in the middle of this query sequence. This results in the **following two important configuration requirements** for the redundant optical ring:
  - The value of the parameter HSA (Highest Station Address) must be set on all DTEs so that there is at least one address between bus address 0 and the value HSA that is not occupied by a bus node, in other words there is at least one address gap. You can create this address gap simply by setting the HSA value one higher than the highest existing bus node address.

**Notice**

If this requirement is not or no longer met, the optical bus will no longer close to form a redundant optical ring after segmentation. In this case the error message (LED and signaling contact) of the two affected OLMs will not be cleared after eliminating the problem.

  - The slot time must be set to about twice the value compared with a redundant network. See section 5.10 for further information. You will find information on changing the setting in the documentation supplied with your DTE or with the configuration software.

**Notice**

**No** glass fiber-optic cable may be connected to an OLM that uses plastic fiber-optic cable and vice versa.

### 3.3.1 Redundant Optical Ring with two OLMs

Setting up a redundant optical ring with two PROFIBUS OLMs can be seen as special case of the redundant optical ring and can be implemented with the following two configurations.

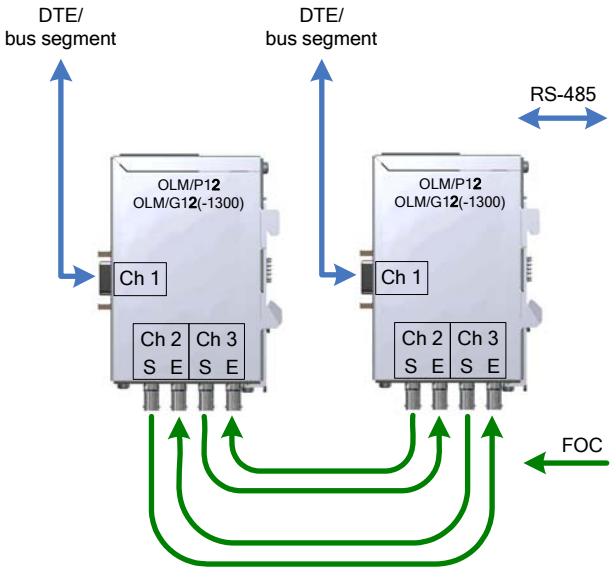



Figure 3-2 Configuration 1

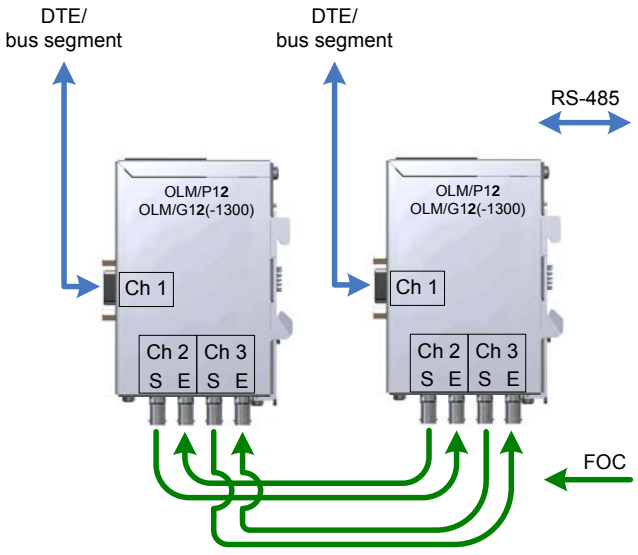



Figure 3-1 Configuration 2

**How the LEDs react in the redundant optical ring:**
A frame received by any channel is passed on to all other channels. If the frame was received at an optical channel, it will also be sent back to the sender on the same channel as an echo and therefore serves as a monitoring frame to test the fiber-optic links between the OLMs.
The OLM recognizes whether a received frame is an echo or a frame that was forwarded. In the case of an echo frame, the channel LED stays off whereas in the case of a forwarded frame it will light up yellow. In networks with more than two OLMs, echo frames and forwarded frames will alternate quickly. Due to the extended display-time of at least 300 ms, all channel LEDs seem to be lit yellow continuously.
The channel LEDs may react differently in the redundant optical ring only if the following conditions are met:

**1. The redundant optical ring consists of exactly two OLMs and the two fiber-optic links are of different length (difference > approx. 2 m).**
Under these conditions, the receiving OLM will always receive a sent frame first on the channel with the shorter fiber-optic link. The channel signals this with a lit yellow LED. The frame on the other optical channel is interpreted as an “echo frame”, the channel LED stays unlit. Since the fiber-optic cable lengths represent static variables, the display reaction is also static.

# 4 Product Characteristics

## 4.1 Technical Specifications

| Characteristics | Device type | | |
|---|---|---|---|
| | OLM P11 V4.0<br>OLM P12 V4.0 | OLM G11 V4.0<br>OLM G12 V4.0<br>OLM G12-EEC V4.0 | OLM G11-1300 V4.0<br>OLM G12-1300 V4.0 |
| **Power supply** | | | |
| Operating voltage | 24 V DC safety extra low voltage<br>permitted voltage range 18..32 V DC NEC Class 2 | | |
| Current consumption | max. 200 mA | | |
| Output voltage for bus termination<br>RS-485 (D-sub jack, pin 6) | 5 V DC+5/-10%, | | |
| **Signaling Contact** | | | |
| Function | floating contact, opens in case of error | | |
| Voltage | CE: max. 50 V DC/30 V AC safety extra low voltage<br>cULus: max. 30 V DC/30 V AC safety extra low voltage | | |
| Current | max 1.0 A | | |
| **Signal transmission** | | | |
| Transmission rate | 9.6; 19.2; 45.45; 93.75; 187.5; 500 Kbps<br>1.5; 3; 6; 12 Mbps | | |
| Transmission rate setting | automatic | | |
| Bit error rate | $<10^{-9}$ | | |
| Signal delay time (any input/output) | $\leq 6.5\ t_{Bit}$ | | |
| **Retimer** | | | |
| Input (all channels)<br>Signal distortion<br>Bit length | <br>± 30%<br>± 0.12% | | |
| Output (all channels)<br>Average bit length | <br>± 0.01% | | |
| **Status signaling** | | | |
| Device | LED “system”, red/green together with signaling contact | | |
| Electrical channel | LED yellow/red | | |
| Optical channels | LED yellow/red | | |
| Optical level | level display with green/yellow/red LED | | |
| **Safety** | | | |
| IEC regulation | IEC 60950 (corresponds to EN 60950 and VDE 0805) | | |
| UL-approval | according to type plate | | |
| CSA-approval | according to type plate | | |

| **Characteristics** | **Device type** | | |
|---|---|---|---|
| C-Tick approval | according to type plate | | |
| FM approval | according to type plate | | |
| Ex (hazardous area) approval | according to type plate | | |
| **Electrical channel** | | | |
| Type | RS-485 | | |
| Input voltage stability | -7 V..+12 V | | |
| **Optical channels** | OLM P11 V4.0<br>OLM P12 V4.0 | OLM G11 V4.0<br>OLM G12 V4.0<br>OLM G12-EEC V4.0 | OLM G11-1300 V4.0<br>OLM G12-1300 V4.0 |
| Wavelength | 660 nm | 860 nm | 1310 nm |
| Optical power that can be injected | | | |
| in glass fiber **E 10/125 (9/125)** | - | - | -19 dBm |
| in glass fiber **G 50/125** | - | -16 dBm | -17 dBm |
| in glass fiber **G 62.5/125** | - | -13 dBm | -17 dBm |
| in PCF **S 200/230** | | | |
| Optical transmit power "reduced" | - | - | - |
| Optical transmit power "default" | -17 dBm | - | - |
| in plastic fiber **S 980/1000** | | | |
| Optical transmit power "reduced" | -9.5 dBm | - | - |
| Optical transmit power "default" | -5 dBm | - | - |
| Sensitivity of receiver | -25 dBm | -28 dBm | -29 dBm |
| Overdrive limit receiver | -3 dBm | -3 dBm | -3 dBm |
| **Range** [3] | | | |
| with glass fiber **E 10/125** (0.5dB/km) | - | - | 0..15 km |
| with glass fiber **G 50/125**<br>(3dB/km @860nm, 1dB/km @1310nm) | - | 0..3 km | 0..10 km |
| with glass fiber **G 62.5/125**<br>(3.5dB/km @860nm, 1dB/km @1310nm) | - | 0..3 km | 0..10 km |
| with PCF **S 200/230** | | | |
| Transmit power "reduced" | - | - | - |
| Transmit power "default" | 0..400 m | - | - |
| with plastic fiber **S 980/1000** (0.2dB/m) | | | |
| Transmit power "reduced" | 0..50 m | - | - |
| Transmit power "default" | 30..80 m | - | - |
| Connector | BFOC/2.5 | | |
| **Electromagnetic compatibility** | | | |
| Radiated emission | EN55022, limit value class A | | |
| Conducted emission | EN55022, limit value class A | | |
| Electrostatic discharge (ESD) | EN61000-4-2, ± 6 kV contact discharge | | |
| Radiated RF | EN61000-4-3, 10 V/m 80 MHz..1 GHz | | |
| Conducted RF | EN61000-4-6, 10 V 10 kHz..80 MHz | | |
| Burst | EN61000-4-4, ± 2 kV on power supply, signaling contact and RS-485 | | |
| Surge<br>(with Blitzductor) | EN61000-4-5,<br>on power supply lines ± 1 kV balanced<br>± 2 kV unbalanced<br>on RS-485 bus lines ± 2 kV unbalanced | | |

[3] The distances between two OLMs may not be exceeded, regardless of the optical power budget.

| Characteristics | Device type | | |
|---|---|---|---|
| Voltage interruption<br>Voltage dips | EN61000-4-11,<br>voltage reduction by >95% for 5 s<br>voltage reduction by 30% for 10 ms<br>voltage reduction by 60% for 100 ms and 1000 ms | | |
| **Climatic ambient conditions** | | | |
| Ambient temperature during operation | -25 °C..+60 °C for OLMG12-EEC<br>0 °C..+60 °C for all other OLMs | | |
| Storage and transport temperature | -40 °C..+70 °C | | |
| Relative humidity | 100%, condensing for OLMG1x-EEC<br><95%, non condensing for all other OLMs | | |
| **Mechanical ambient conditions** | | | |
| Oscillation in operation | 10..58 Hz, 0.075 mm deflection<br>58..150 Hz, 1 g acceleration | | |
| Oscillation during transportation | 5 Hz..9 Hz, 3.5 mm deflection<br>9 Hz..500 Hz, 1 g acceleration | | |
| Vibration in operation | 40 m/s² | | |
| Shock in operation | 150 m/s², 10 ms | | |
| Shock packed | 250 m/s², 6 ms | | |
| Free fall unpacked | 10 cm | | |
| Free fall packed | 30 cm in product packaging<br>1 m in shipping packaging | | |
| **Miscellaneous information** | | | |
| Degree of protection | IP40 | | |
| Dimensions | 39.5 x 110 x 72.2 mm | | |
| Housing material | stainless steel, 1.4016 | | |
| Weight | approx. 320 g | | |
| Silicone | the device is free of silicone | | |
| MTBF at 40 °C | 76405 h | 89831 h | 80115 h |
| MTBF at 85 °C | 59442 h | 67326 h | 61717 h |

Table 4-1 Overview of the product characteristics

### 4.2.2 General information on commissioning

Unpack the OLM V4.0 and its accessories and check that the consignment is complete and that there has been no damage during transportation. After unpacking, the device should be acclimatized for some time to avoid condensation after to storage in cold surroundings.

First choose the network topology suitable for your requirements. Commissioning of the modules then involves the following steps:

- Checking and, if necessary, setting of the DIL switches.
- Installation of the modules.
- Connection of the power supply and, if required, connection of the signaling contacts.
- Connection of the RS-485 bus line with installed bus connectors (if you use a bus topology, remember that the terminating resistors in the connectors at both ends of the line must be activated).
- Connection of the optical bus lines.

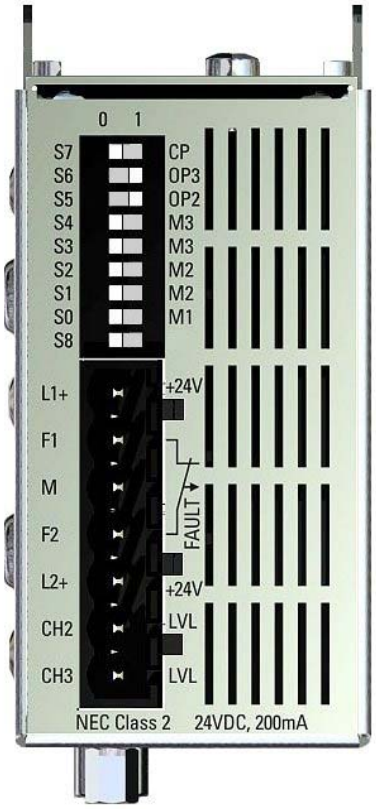



Figure 4-1 View of the OLM module from the top

Position of the DIL switches and of the terminal block for the power supply/signaling contacts/level measurement. The figure shows the factory default setting of the DIL switches (switches S0, S1, S2, S3, S4, S7 and S8 in position "0", switches S5 and S6 in position "1").

**Notes:**

For a valid measurement, that the partner OLM at the other end of the fiber-optic cable must send normal PROFIBUS frames. This can be recognized by the LED display of the partner OLM (see section 5.7.1).

The output voltages at the measurement sockets are influenced by many factors:

- strength of the optical transmit power of the partner OLM
- ambient temperature of the optical transmitter and receiver
- attenuation of the transmission line
- transmission rate used

The measurement sockets are therefore not intended as a substitute for a calibrated level measuring device with a calibrated light source. The value obtained only serves to classify the received optical signals in 3 classes:

- good (normal operation, green) 5V > U > 240 mV
- critical (optical link margin reduced, yellow) 120 mV ≤ U ≤ 240 mV
- bad (functionality not guaranteed, red) U < 120 mV

The measurement must be performed with a standard ungrounded and high-resistance voltmeter. The internal resistance of the measurement sockets is approx. 30 kΩ. A connection from the measurement sockets or of reference potential to the OLM housing is not permitted.

**When an OLM of the SINEC L2FO range is connected, the OLM V4 LED level indicator has no meaning. The measurement sockets cannot be used.**

# 5.7 LED Displays and Troubleshooting

## 5.7.1 LED displays




Figure 5-13 LED displays on the front panel

**Note:**

The LED between “SYSTEM” and “CH 1” is unused and does not light up.

| LED display | | Possible causes | Signaling contact |
|---|---|---|---|
| | ☐ not lit | Transmission rate not detected yet – LED "System" flashes red<br>- There is no transmitting bus node<br>- Transmit and receive fiber-optic cables swapped over<br>-No partner module connected or partner module is not turned on<br>- Connected partner module is defective<br><br>Transmission rate is detected – LED "System" is lit green<br>- When the mode "redundant optical ring" is set, the optical channel operates as standby channel. There is no problem in the OLM or on the fiber-optic cable.<br>- If one of the modes "bus with fiber-optic link monitoring..." is set, no frames are received on the optical PROFIBUS channel. There is no error in the OLM or on the fiber-optic cable. | does not signal |
| | ☐ flashes yellow | Transmission rate is detected – LED "System" is lit green or flashes red/green<br>- There is no transmitting bus node (fiber-optic cable connection is ok) | does not signal |
| | ■ lit red | - Transmit and receive fiber-optic cables are swapped over<br>- No partner module connected or partner module is not turned on<br>- Connected partner module is defective<br>- Transmission time exceeded by the connected partner module<br>- Interruption of a fiber-optic cable<br>- Fiber optic cable to the partner module longer than permitted<br>- Loose contact at a fiber-optic cable connector<br>- Fiber in the fiber-optic cable is loose<br>- When the channel LED of the two concerned OLMs continues to be lit red after clearing a fiber-optic cable fault in the redundant optical ring check that the setting of the parameter HSA described in section 3.3 is correct | signals |
| | ■ ☐ flashes red/yellow | - Periodically occurring error (see above) loose contact at a fiber-optic cable connector<br>- Fiber in the fiber-optic cable is loose<br>- Only one single bus node is connected, which only sends token to itself. After the activation of a second participant the LED display should stop | signals |
| | | **Mode "bus without fiber-optic link monitoring"** | |
| | ■ lit yellow | PROFIBUS frames are received on the optical channel | does not signal |
| | ☐ Not lit | - There is no transmitting bus node<br>- Transmit and receive fiber-optic cables are swapped over<br>- No partner module connected or partner module is not active<br>- Connected partner module is defective | does not signal |
| **CH2, CH3 Level** | ■ Lit green | Receiving level adequate, normal operation | not relevant |
| | ■ lit yellow | Receiving level critical, link power margin reduced | |
| | ■ Lit red | Receiving level inadequate, function not guaranteed | |

Table 5-1 Meaning of the LED displays and indication by the signaling contact

## 5.7.2 Troubleshooting

This section will help you to localize the problem after an error message (LED or signaling contact). Refer to the description of the LED displays in section 5.7.1.

### 5.7.2.1 Error display of the System LED

See description of the LED displays in section 5.7.

### 5.7.2.2 Error display on CH1

Check whether

- the DIL switch S0 is in position 1, when the OLM is in the electrical star segment of a star topology (see section 3.2)
- the problem remains after removing the RS-485 connector.

  Still there: Device defective[4]. Change the OLM.

  Gone: The error is in the RS-485 bus segment.

  Check:
  – all RS-485 connectors as described in section 5.3
  – the setup and the shielding of the RS-485 bus segment.
  – the RS-485 bus segment using the PROFIBUS bus monitor
  – the configuration of all bus nodes.

### 5.7.2.3 Error display on CH2 / CH3

**1. Check whether**

- only modules of the same type are connected to each other optically (see chapter 3),
- the optical fiber is permitted for the module type being used and does not exceed the permitted length (see Table 2-1).
- the optical channels connected via fiber-optic cables are set to the same mode. (see section 4.2.3)
- the ends of the fiber-optic cables and the optical transmission and receiving components are clean
- the fiber-optic cable connectors are connected completely and correctly,
- the requirements of section 5.1.2 were met when connecting and laying the optical bus cables.

**2. Detect the optical receive level (section 5.6):**

- Check the fiber-optic cable attenuation with an optical level meter if the level is in the range ‘‘function not guaranteed’’ or ‘‘optical link power margin reduced". If the attenuation is too high, replace the fiber-optic cable. If the attenuation is within the valid range, one of the two OLMs of the disturbed segment is defective. First, replace the OLM which supplies the signal for the measurement mentioned above. If the problem remains, replace the other OLM instead. If there is no optical level meter at hand, you can still get an idea of where the problem lies simply by swapping over **both** fiber-optic cables at **both** OLMs: if the problem moves along with the cables, the cable is almost certainly faulty, if it does not, the problem is in one of the OLMs.
- If the level is in the range ‘‘normal operation’’, first check the transmitting OLM, as described above, and then the receiving OLM, if necessary.

[4] Does not apply if the monomaster of a PROFIBUS network is connected to the RS-485 bus segment to be tested. In this case, swap the suspect OLM with another OLM from the network and then carry out the test mentioned above.
If the error moves with the OLM, the device is defective. Replace the OLM.
If the error does not move with the OLM, the disturbance originates in the RS-485 bus segment. Take measures as described above.