

Technical Information

Opto Box



Described product

Product name: Opto Box

Manufacturer

Endress+Hauser SICK GmbH+Co. KG
Bergener Ring 27
01458 Ottendorf-Okrilla
Germany

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Original document

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Basic Information

Product

Opto-Box:	
Optical/digital in/out	2024780
Optical analog in	2024778
Optical analog out	2024781
Optical analog in/out	2024782

Symbols Used

To easily recognize and distinguish the different warnings, any of the following symbols can be used throughout the documentation.

Corresponding symbols can also be attached to the instrument.



This symbol warns of a **general danger** that could result in personal injury to yourself or other persons or in instrument damage.



This symbol warns of the **risk of electric shock** that could result in personal injury to yourself or other persons or in death.



This symbol warns of situations that could result in serious instrument damage.

Note This symbol provides advice that facilitates the handling of the instrument.

About this Document

This document provides instructions on the installation, start-up and operation of the Opto-Box.

Authorized Personnel

To ensure the best possible and safe operation of the instrument, it may be operated exclusively by **appropriately trained and authorized** personnel. The operating personnel must know and make use of the safety and operating instructions concerning the respective field of work.



- Incorrect operation of the Opto-Box can cause **damage to the instrument** as well as **consequential damage**.
-

Before the start-up of the Opto-Box read and pay attention to the following:

- The warnings and safety information of the Manual.
- The respective chapters on the installation, start-up and operation of the Opto-Box.

Damage to the Opto-Box

Only a Endress+Hauser service engineer or a similarly trained and authorized person should be permitted to perform installations, maintenance and repairs, or adjustments.

- Do not attempt to make adjustments or replacements on the Opto-Box except as directed in this Operator's Manual.
-

Intended Use

The Opto-Box is part of the modular MODIOS I/O system and is installed in an existing I/O module box system.

This fiber optic system is used in the Endress+Hauser gas analyzers.

There is no potential danger from the instrument when used for its intended purpose.

Any warranty claim against Endress+Hauser is void when the instrument is used for any other purpose or is modified.

Compliances



The technical design of this instrument complies with the following EC directives and EN standards:

- EC Directive NSP
- EC Directive EMC

Applied EN standards:

- EN 61010-1, Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use
- EN 61326, Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements

Electrical Protection

Insulation: Class of protection 1 according to EN 61010-1.

Insulation coordination: Measuring category II according to EN 61010-1.

Contamination: The equipment operates safely in an environment up to degree of contamination 2 according to EN 61010-1 (usual, non-conductive contamination and temporary conductivity by occasional moisture condensation).

Electrical energy: The wiring system to the power source of the system must be installed and fused according to the relevant regulations.

For your Safety

Introduction

This manual contains safety information and warnings that must be followed by the user to ensure safe operation and to maintain the instrument in a safe condition.

The safety information and warnings summarized on the following pages are intended to supplement, not supersede:

- The normal safety code of behavior prevailing in the user's country
- The safety code of behavior according to the existing local conditions

Before starting to work, become familiar with the relevant information about the general regulations and standards that apply for your field of application.



Safe Handling of the Instrument:

- Do not operate the Opto-Box except for its intended use (refer to Chapter "Intended Use", page 7).
- Do not attempt to make adjustments, replacements, repairs, or modifications to the Opto-Box except as described in the documentation supplied with the Opto-Box.
- Do not operate the Opto-Box with any covers or other parts removed.
- Whenever it is likely that the Opto-Box is no longer electrically safe for use, make the Opto-Box inoperative, disconnect it from the mains and secure it against any unauthorized or unintentional operation.

Pay attention to possibly resulting consequential effects during the shutdown of the instrument.

The Opto-Box is likely to be electrically unsafe when it:

- Shows visible damage on the outside
 - No longer operates correctly
 - Has been subjected to prolonged storage or operation under unfavorable or inadmissible conditions.
-

Electrical Safety



Electrical Hazard.

Only appropriately trained and qualified specialists should be permitted to perform any maintenance or repair work or make any modifications to the electric or electronic connections of the instrument.

Do not attempt to make adjustments, replacements, repairs, or modifications to the interior of the Opto-Box except as described in the documentation supplied with the instrument.

For operation, the Opto-Box must be connected only to a safe power source with appropriate earth connection.

Use only fuses with the required current rating and of the specified type for replacement. Do not short-circuit the fuse holder.

The Opto-Box is likely to be electrically unsafe when it:

- Shows visible damage on the outside
- In case of inadequate or damaged protective conductor (earth/ground terminal)
- Fails to operate correctly
- Has been subjected to prolonged storage or operation under unfavorable or inadmissible conditions
- Has been subjected to inadmissible transport stresses.

Whenever it is likely that the Opto-Box is no longer electrically safe for use, make the Opto-Box inoperative, disconnect it from the mains and secure it against any unauthorized or unintentional operation.



Environment

Risk of Explosion.

The instrument

- is not to be operated in explosive atmospheres.
-

Operating Conditions

The Opto-Box will operate correctly under the following conditions:

- Indoors
- Ambient temperature +5 °C to +45 °C
- Ambient relative humidity max. 80%, without condensation.

Storage Conditions

The Opto-Box can be safely stored under the following conditions:

- Ambient temperature -10 °C to +80 °C
- Relative humidity max. 80%, without condensation
- Clean, dust-free environment

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1 Product Description

The Opto-Box is the transfer interface between an analyzer (host) and external equipment. It is part of the modular MODIOS I/O system and is installed in an existing I/O module box system.

The measuring system and the Opto-Boxes are connected via fiber optics (fiber optic bus). The highest possible interference protection during data transfer is thereby achieved.

The sequence of the Opto-Boxes in the fiber optic bus is optional. The Opto-Boxes are identified via an address set on the Opto-Boxes.

External equipment ("process connection") is electrically connected to the Opto-Box.

Four versions of the Opto-Box are available:

- Optical/digital in/out 11 (12) digital inputs and 8 digital outputs
- Optical analog in 8 analog inputs
- Optical analog out 8 analog outputs
- Optical analog in/out: 4 analog inputs and 4 analog outputs



Fig. 1-1: View of Opto-Box

The first Opto-Box is activated by a serial optical interface which is normally located in an analyzer (referred to as "host" in data processing).

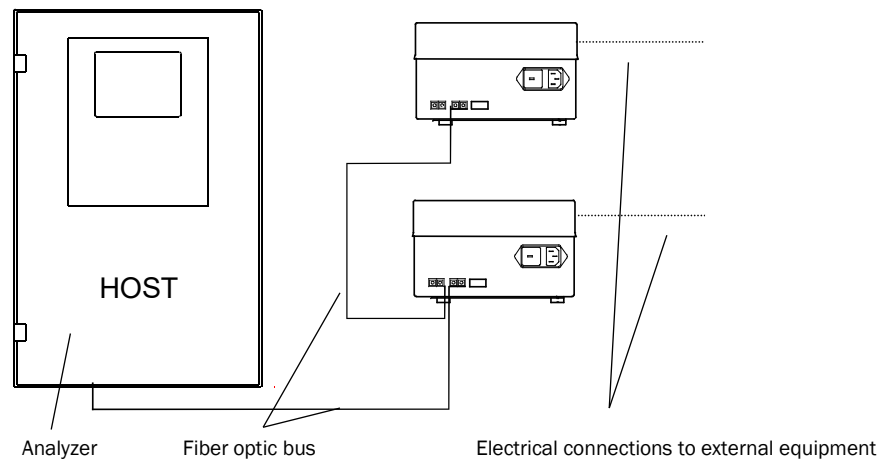


Fig. 1-2: Typical Process Connection (External Equipment) with Opto-Boxes

The maximum number of boxes depends on the types used (see Chapter 2.3.2 "Addressing", page 30).

In case of a time-out initiated by the box (no contact to analyzer (host)), the respective box switches to the following state:

- "Optical analog out" box: 0 mA
- "Optical digital out" box: Relay in "de-energized state"

The time-out is programmed in the analyzer and is typically 2 - 5 seconds.

The boxes "following" in the bus system continue to operate unless:



Caution: Interruption of the Bus System during a Voltage Failure

When a voltage failure of an Opto-Box occurs, the boxes "following" in the bus system lose communication with the analyzer (host).

When the Opto-Box is delivered in a completely configured analysis system, all required adjustments will have been made already.

These adjustments are described in the system documentation.

1.1 Description of the "Optical Digital in/out" Box

- Application: Transmission of digital signals (inputs and outputs)
- Interfaces:
 - 8 digital outputs.
 - AND (selectable)
 - 11 digital inputs and an internal, unregulated 20 V supply voltage
or
 - 12 digital inputs for external supply voltage
(For the switch-over of the digital inputs, see Chapter 2.2.4 "Modification to 12 Inputs", page 26).
- Assigned addresses: 2 (Setting of addresses, refer to Chapter 2.3.2 "Addressing", page 30)
- Terminal assignment: Refer to Chapter 2.2.3 "Terminal Assignment of the "Optical Digital in/out" Box", page 25.
- Technical Data, refer to Chapter. 9 "Technical Data", page 51.

1.1.1 Outputs

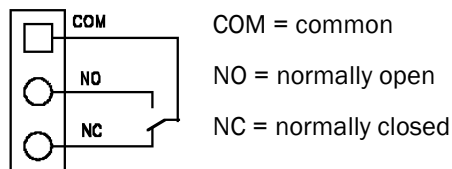
- Design: Potential-free change-over contact.
- The relay outputs are isolated from each other by basic insulation.
No protective separation function.



Destruction of Switching Contacts.

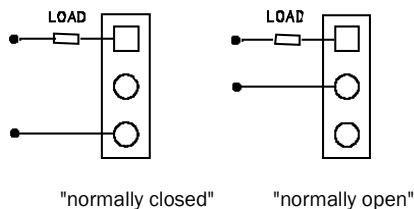
For the protection of the switching contacts, an inductive connection must be damped with a protective circuit.

1.1.1.1 Internal Circuitry



1.1.1.2 Connection Options

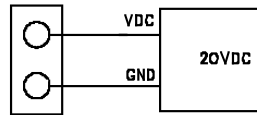
Connection of external voltage.



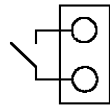
1.1.2 Inputs with Internal Supply Voltage

- Supply voltage: Internal 20 V unregulated

1.1.2.1 Internal Circuitry (Terminals 25 and 26)



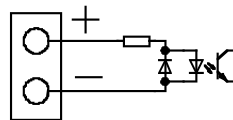
1.1.2.2 Connection Options (Terminals 27 – 48)



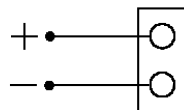
1.1.3 Inputs for External Supply Voltage

- Design: Potential-free, optically decoupled

1.1.3.1 Internal Circuitry



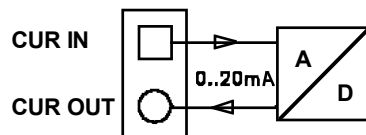
1.1.3.2 Connection Options



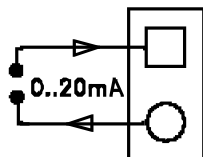
1.2 Description of the "Optical Analog in" Box

- Application: Reading of analog signals
- Number of inputs: 8
- Resolution: 12 bits
- Type: Single-pole switched inputs without mutual electrical isolation
- Galvanic isolation: In 2 groups (1..4 galvanically isolated from 5 ..8).
- Output range: 0/4 - 20 mA (scaling by evaluation software)
- Ground: The minus inputs 1-4 and 5-8 are each connected to a common, ground-free conductor.
- Assigned addresses: 8 (Setting of addresses, refer to Chapter 2.3.2 "Addressing", page 30)
- Technical Data, refer to Chapter. 9 "Technical Data", page 51.
- Terminal assignment, refer to Chapter 2.2.5 "Terminal Assignment of the "Optical Analog in" Box", page 27.

1.2.1 Internal Circuitry



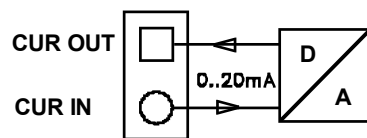
1.2.2 Connection Options



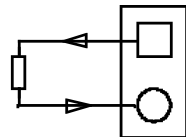
1.3 Description of the "Optical Analog out" Box

- Application: Output of analog signals
- Number of outputs: 8
- Resolution: 12 bits
- Galvanic isolation: In 2 groups (1..4 galvanically isolated from 5..8).
- Output range: 0/4 - 20 mA (scaling by evaluation software)
- Ground: The minus outputs 1-4 and 5-8 are each connected to a common, ground-free conductor.
- Assigned addresses: 8 (Setting of addresses, refer to Chapter 2.3.2 "Addressing", page 30)
- Technical Data, refer to Chapter. 9 "Technical Data", page 51.
- Terminal assignment: Refer to Chapter 2.2.6 "Terminal Assignment of the "Optical Analog out" Box", page 27.

1.3.1 Internal Circuitry



1.3.2 Connection Options



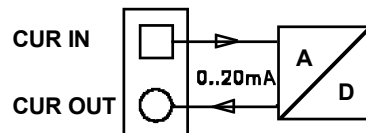
1.4 Description of the "Optical Analog in/out" Box

- Application: Reading and output of analog signals
- Number of inputs: 4
- Number of outputs: 4
- Resolution: 12 bits
- Assigned addresses: 8 (Setting of addresses, refer to Chapter 2.3.2 "Addressing", page 30)
- Technical Data, refer to Chapter. 9 "Technical Data", page 51.
- Terminal assignment: Refer to Chapter. 2.2.7 "Terminal Assignment of "Optical Analog in/out" Box"; page 28.

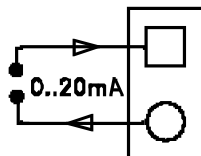
1.4.1 Power Inputs:

- Type: Single-pole switched inputs without mutual electrical isolation
- Power inputs: Current range: 0/4 - 20 mA (scaling by evaluation software)
- Ground: The minus inputs are connected to a common, ground-free conductor.

1.4.2 Internal Circuitry



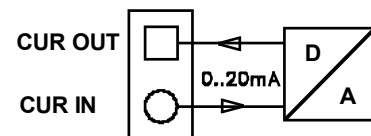
1.4.3 Connection Options



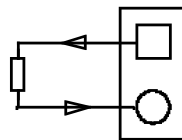
1.4.4 Power Outputs

- Output range: 0/4 - 20 mA (scaling by evaluation software)
- Resolution: 12 bits
- Ground: The minus outputs are connected to a common, ground-free conductor.

1.4.5 Internal Circuitry



1.4.6 Connection Options



2 Installation

Installation Method:

- Mechanical installation (see below)
- Electrical installation (refer to Chapter 2.2 "Electrical Installation", page 24).
- Adjustment of baud rate (if required) (refer to Chapter 2.3.1 "Setting of the Baud Rate", page 29).
- Setting of address (if required) (refer to Chapter 2.3.2 "Addressing", page 30)
- Check of supply voltage (refer to Chapter 2.4.1.1 "Check of Set Mains Voltage", page 32).

2.1 Mechanical Installation



Short-Circuit Caused by Moisture or Dust!

- Pay attention to the ambient conditions (refer to Chapter "Operating Conditions", page 11).



Risk of Explosion.

The instrument

- is not to be operated in explosive atmospheres.

2.1.1 Set-up / Installation

An installation plate is recommended for the installation of the Opto-Box.

- Attach the installation plate to a sturdy wall using the provided fastening holes

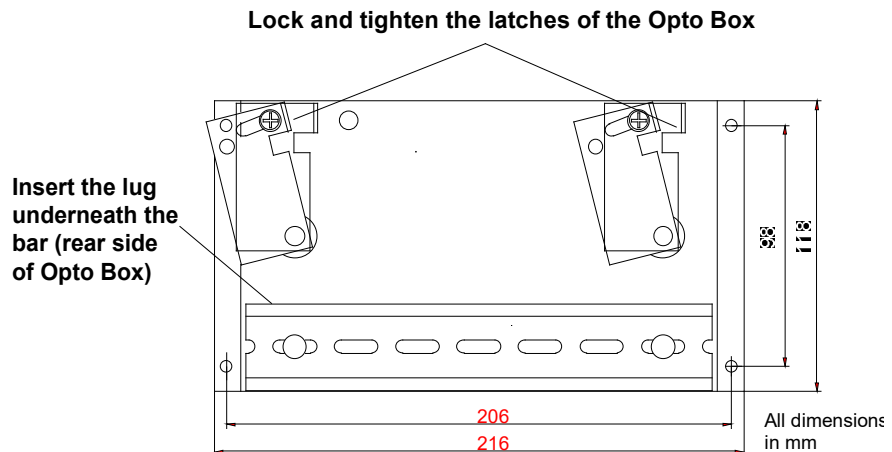


Fig. 2-1: Installation Plate for the Opto-Box

- Insert the lug of the Opto-Box in the installation rail
- Lock and screw tight the clamping tabs

2.1.2 Connection of Fiber Optic Cables



Caution: Damage to Fiber Optic Cables.

Handle the fiber optics with care.

- Do not bend or kink the fiber optics excessively.
- Do not pull out the fiber optic connectors by the cable.

MA, Master: Superordinate Opto-Box (in the first case, the analyzer (host))

SL, Slave: Subordinate Opto-Box

S: Transmitter (light output)

E: Receiver (light input)

Therefore:

Connector MA E: Input from superordinate Opto-Box connector SL S

Connector SL E: Input from subordinate Opto-Box connector MA S

Connector MA S: Output to superordinate box connector SL E

Connector SL S: Output to subordinate box connector MA E

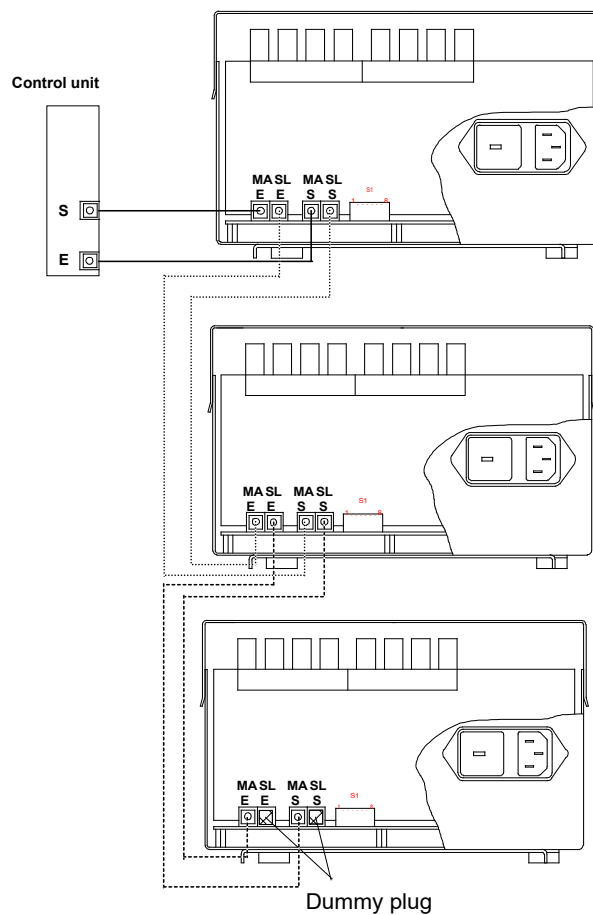


Fig. 2-2: Fiber Optic Connection of the Opto-Box

Opto-Box

The sequence of the Opto-Boxes is optional (setting of addresses, refer to Chapter 2.3.2 "Addressing", page 30).

- Maximum length of a fiber optic cable: 50 m
- The direction of the fiber optic cables is optional.
- Lay the fiber optic cables correctly, avoid kinks
Minimum bending radius: 3 cm.
- Plug in the connectors of the fiber optics so that the ribbed sides are at one level.
- Plug in the connector until it can be heard to click into place.



At the "last "Opto-Box of the bus system, close the two slave channels (SL) with dummy plugs.

2.2 Electrical Installation

Method:

- Connect the external equipment to the Opto-Box (refer to Chapter 2.2.2 "Electrical Connection of Terminals", page 25).
- Check the set supply voltage (refer to Chapter 2.4.1.1 "Check of Set Mains Voltage", page 32).
- Connect the supply voltage

2.2.1 Opening and Closing of the Opto-Box

2.2.1.1 Opening of the Opto-Box



Electrical Hazard.

Mains voltages are present at some places within the Opto-Box.

Before working in the Opto-Box:

- Verify whether the Opto-Box is voltage-free.



Caution: Loss of Communication of Boxes Following in the Bus System

When a voltage failure of an Opto-Box occurs, the boxes "following" in the bus system loose communication with the analyzer (host).

The outputs switch to the "voltage-free" state.

- When connected: Pull the mains plug
- Unscrew the two recessed-head screws on the cover
- Pull off the cover

2.2.1.2 Closing of the Opto-Box

- Route the leads through the three cable feed-throughs.
- Replace the cover
 - The drilled holes for the cover screws must be aligned with the threads
 - Do not compress the leads
- Screw tight the cover with two recessed-head screws
- When all work has been completed: Refer to Chapter 3 "Start-up / Restart", page 35.

2.2.2 Electrical Connection of Terminals

- Open the Opto-Box (refer to Chapter 2.2.1 "Opening and Closing of the Opto-Box", page 24).



Short-Circuit Caused by Frayed Wire Ends

- Provide all stranded individual wires with suitable connector sleeves before their connection.

- Connect the stranded wires to the terminal blocks (the terminal blocks can be pulled off).
- Two connections are provided between the cable feed-throughs for the connection of the cable shields.
- Close the Opto-Box.

2.2.3 Terminal Assignment of the "Optical Digital in/out" Box

For a general description of the "Optical digital in/out" box, refer to Chapter 1.1 "Description of the "Optical Digital in/out" Box", page 15.

Input	1	2	3	4	5	6	7	8	9	10	11	12* VDC
Terminal + (X8)	47	45	43	41	39	37	35	33	31	29	27	25
Terminal - (X8)	48	46	44	42	40	38	36	34	32	30	28	26
Output	1	2	3	4	5	6	7	8				
Relay No.	K1	K2	K3	K4	K5	K6	K7	K8				
Terminal C (X9)	1	4	7	10	13	16	19	22				
Terminal NO (X9)	2	5	8	11	14	17	20	23				
Terminal NC (X9)	3	6	9	12	15	18	21	24				

(X8, X9 are internal designations)

*: With "internal supply voltage (default)", the following applies:

Terminal 25: +

Terminal 26: –

of the internal voltage source.

The relay outputs are isolated from each other by basic insulation.

No protective separation function!



Caution: Protection of Relay Contacts.

- For the protection of the relay contacts, an inductive connection must be damped with a protective circuit.

2.2.4 Modification to 12 Inputs

For the modification to 12 inputs, the internal supply voltage is switched off. The terminals 25 and 26 then form the 12th input.

For modification, change two jumpers on the LPM27 printed circuit board.

Method:



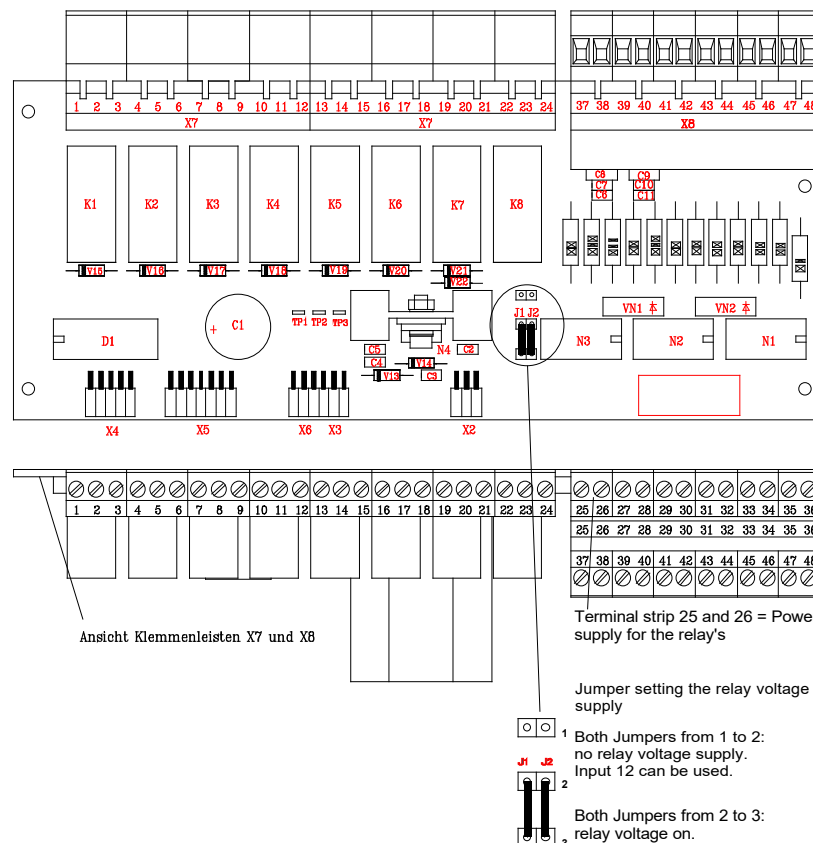
Electrical Hazard.

Mains voltages are present at some places within the Opto-Box.

Before working in the Opto-Box:

- Pull power plug.

- Open the box (refer to Chapter 2.2.1 "Opening and Closing of the Opto-Box", page 24).
- Remove the "Digital-optical interface board" (LPM 27) PCB (refer to Chapter 7.4 "Removal/Installation of the Digital-Optical Interface Board (LPM 27)", page 44).
- Using tweezers, change the two jumpers from position 2 - 3 to position 1 - 2.



- Re-install the printed circuit board.
- Close the box.

2.2.5 Terminal Assignment of the "Optical Analog in" Box

For a general description of the "Optical analog in/out" box, refer to Chapter 1.2 "Description of the "Optical Analog in" Box", page 17.

Input	1	2	3	4	5	6	7	8
Terminal + (X3)	1	4	7	10	14	17	20	23
Terminal - (X3)	2	5	8	11	15	18	21	24

(X3 is an internal designation)

The minus inputs 1-4 and 5-8 are each connected to a common, ground-free conductor.

2.2.6 Terminal Assignment of the "Optical Analog out" Box

For a general description of the "Optical analog out" box, refer to Chapter 1.3 "Description of the "Optical Analog out" Box", page 18.

Output	1	2	3	4	5	6	7	8
Terminal I+	1	4	7	10	14	17	20	23
Terminal I-	2	5	8	11	15	18	21	24

The minus outputs 1-4 and 5-8 are each connected to a common, ground-free conductor.

2.2.7 Terminal Assignment of "Optical Analog in/out" Box

For a general description of the "Optical analog in/out" box, refer to Chapter 1.4 "Description of the "Optical Analog in/out" Box", page 19.

2.2.7.1 Power Inputs

Input	1	2	3	4
Terminal + (X3)	1	4	7	10
Terminal - (X3)	2	5	8	11

(X3 is an internal designation)

The minus inputs are connected to a common, ground-free conductor.

2.2.7.2 Power Outputs

Output	1	2	3	4
Terminal + (X3)	14	17	20	23
Terminal - (X3)	15	18	21	24

(X3 is an internal designation)

The minus outputs are connected to a common, ground-free conductor.

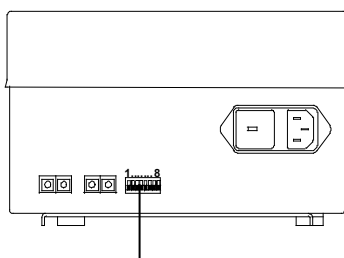
2.3 Configuration of the Opto-Box

In a Endress+Hauser measuring system, the Opto-Boxes have been configured. The work described here is then unnecessary.

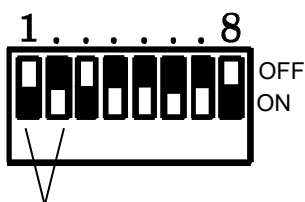
2.3.1 Setting of the Baud Rate

The baud rate depends on the baud rate setting at the analyzer (host).

Setting: 9600 baud (typical)



Switch for baud rate setting



Switches 1 and 2
for baud rate setting

Baud rate	Switch 1	Switch 2
1200	on	on
2400	on	off
4800	off	on
9600	off	off

(off = place the switch in the up position)

The baud rate change becomes effective only after the voltage at the Opto-Box has been switched off and on again.

2.3.2 Addressing

The Opto-Boxes are addressed via the addresses set at the Opto-Boxes.

Depending on the Opto-Box, the range of addresses used varies:

- Digital box: 2 addresses
- Analog input box: 8 addresses
- Analog output box: 8 addresses
- Analog input/output box: 8 addresses

The addresses of the Opto-Boxes are independent of the sequence at the bus system.

When an address is set, the respective Opto-Box uses the set address plus the higher value addresses.

Example for an analog input box:

Set address: 2

Used addresses: 2, 3, 4, 5, 6, 7, 8, 9

When several Opto-Boxes are used, the address ranges must not overlap.

Maximum number of addresses: 64 (decimal); corresponds to address 00 - address 3F (hexadecimal)

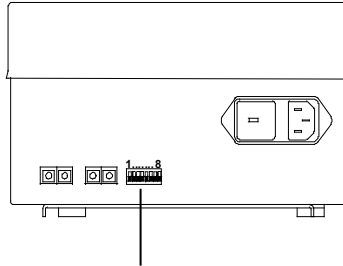
2.3.3 Setting of the Opto-Box Address



Caution: Addresses with Double Assignment

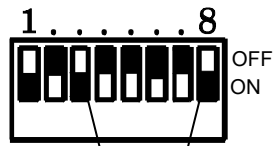
If you set an address that is being used already by another Opto-Box, errors can occur on both Opto-Boxes.

- Ensure that you assign each address only once.



Switches for address setting

The switches 3...8 are used for address setting



Switch 3 ... 8
for address setting

The settings correspond to the binary system of figures.

Switch 3 is the most significant bit (MSB),
Switch 8 is the least significant bit (LSB).

Address	S-3	S-4	S-5	S-6	S-7	S-8
00 Hex	ON	ON	ON	ON	ON	ON
01	ON	ON	ON	ON	ON	OFF
02	ON	ON	ON	ON	OFF	ON
03	ON	ON	ON	ON	OFF	OFF
04	ON	ON	ON	OFF	ON	ON
05	ON	ON	ON	OFF	ON	OFF
.
.
3f	OFF	OFF	OFF	OFF	OFF	OFF

(S = switch, off = place switch in the up position)

The baud rate change becomes effective only after the voltage at the Opto-Box has been switched off and on again.

2.4 Mains Voltage Selector and Mains Fuses



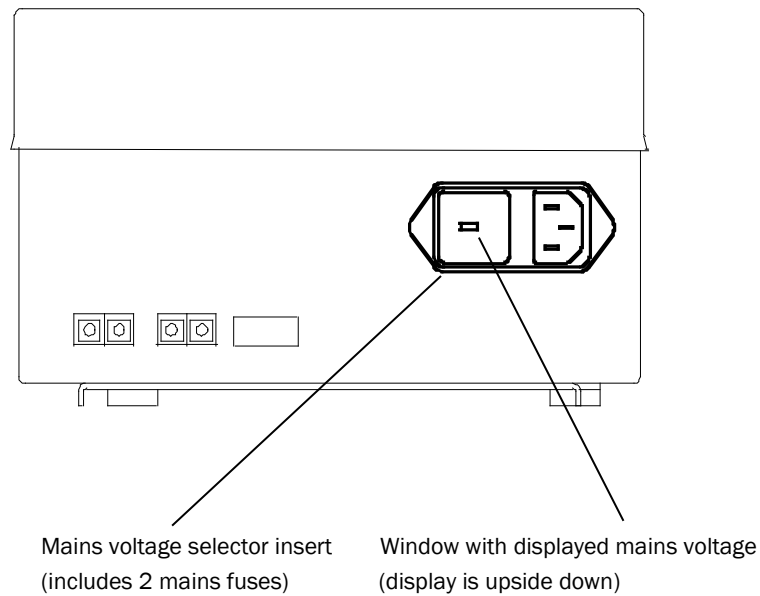
The fuse values depend on the mains voltage.

- Exchange the mains fuse when changing the mains voltage.

2.4.1.1 Check of Set Mains Voltage

The mains voltage selector and the mains fuses are in the mains voltage selector insert.

The number in the mains voltage selector insert indicates the set mains voltage.



Change of the set mains voltage: See next chapter.

2.4.1.2 Replacement of the Fuses or Change of the Mains Voltage



Electrical Hazard.

Mains voltages are present at some places within the Opto-Box.

Before working in the Opto-Box:

- Pull power plug.

- Insert a suitable screwdriver into the small recess next to the main socket.
- Press the snap lock in the direction of the arrow; the mains voltage selector insert springs out a short distance.
- Pull out the mains voltage selector insert.
- If the mains voltage is to be changed:



The Fuse Values Depend on the Mains Voltage.

- Insert the fuses that match the mains voltage.

- Carefully pry out the mains voltage selector with a small screwdriver.
- Press the mains voltage selector in so that the desired number of the mains voltage (115 for 115 V or 230 for 230 V) becomes visible.



Danger by Incorrect Fuses

- Use only fuses with the required current rating and of the specified type for replacement.
- Do not use makeshift fuses.
- Do not short-circuit the fuse holder.

- Check the fuses (two):
 - The filaments of the fuses must not have melted
 - The values of the fuses must match the available and set mains voltage.

Two fuses in the fuse holder:

For 230 V: 0.2 AT (slow)

For 115 V: 0.4 AT (slow)

- When the fuses have blown or the values do not match the mains voltage:
 - Insert matching fuses in the fuse holder
- Insert the fuse holder in the mains voltage selector insert and press it in until it audibly clicks into place.
- Check whether the number that corresponds to the mains voltage is visible in the mains voltage selector insert.

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3 Start-up / Restart

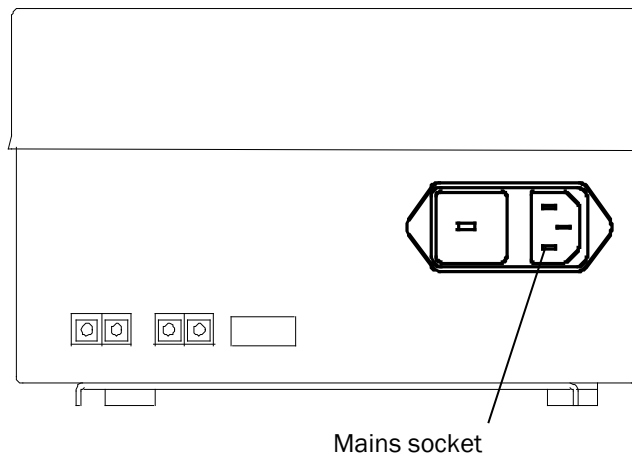
Start-up Method:

- Check the following before start-up:
 - Fiber optic cables for kinks
 - Mains voltage set (refer to Chapter 2.4 “Mains Voltage Selector and Mains Fuses“, page 32)
 - Correctness of fuses (refer to Chapter 2.4 “Mains Voltage Selector and Mains Fuses“, page 32)
- Connect the Opto-Box to the mains

3.1 Connection of the Mains Voltage



The Opto-Box **starts operation immediately** when connected to the mains voltage.
➤ Complete the installation of the Opto-Box before connecting it to the mains voltage.



- Insert the plug (not included in the delivered items) in the mains socket.

Empty page

Opto-Box

4 Operation

The Opto-Box operates independently and maintenance-free.

- Check the Opto-Box, the fiber optic cables and the electrical connections occasionally for mechanical damage.

Empty page

5 Shutdown



Caution: Loss of Communication of Boxes Following in the Bus System

When the mains plug is pulled, the boxes "following" in the bus system lose communication with the analyzer (host).

- To put the instrument out of operation, pull the mains plug.

5.1 Removal

- Unscrew the electrical connections on the terminal blocks or pull off the terminal blocks.

For opening of the Opto-Box (refer to Chapter 2.2.1 "Opening and Closing of the Opto-Box", page 24).



Caution: Damage to Fiber Optic Cables.

Handle the fiber optics with care.

- Do not bend or kink the fiber optics excessively.
 - Do not pull out the fiber optic connectors by the cable
-

- Pull off the fiber optic cables and roll them together in loose rolls
- Remove the Opto-Box from the installation plate

5.2 Storage

Store the Opto-Box and the fiber optics at a clean, dust-free place.
Position the Opto-Box so that the fiber optic outputs point downward.

5.3 Disposal

Dispose of unusable or irreparable Opto-Boxes in an environmentally compatible manner and according to the specific waste disposal regulations of your country.

The design of the Opto-Box allows for the separation into reusable secondary raw materials and special waste (electronics waste).

Empty page

Opto-Box

6 Maintenance

The Opto-Box operates maintenance-free.

Check the Opto-Box and the fiber optic cables occasionally for mechanical damage.

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7 Troubleshooting

When the data transfer to or from the Opto-Box malfunctions, the errors described in the following could have occurred.

More extensive repairs should be performed exclusively by the Endress+Hauser Service.

7.1 Fiber Optics not Inserted Correctly or Defective

- Insert the fiber optic cables correctly.
- Check the fiber optic cables for through passage of light. For this purpose, hold the fiber optic cables against a light source that is not too bright.

7.2 Fuses for Mains Voltage Supply Defective

- For checking and changing the fuses of the mains voltage supply, refer to Chapter 2.4.1.1 "Check of Set Mains Voltage" page 32.

7.3 Secondary Fuses Defective

These fuses (two) are located on the printed circuit board on the bottom of the Opto-Box.

7.3.1 Replacement of Secondary Fuses

- Put the Opto-Box out of operation (refer to Chapter 5 "Shutdown", page 39).
- Open the Opto-Box (refer to Chapter 2.2.1 "Opening and Closing of the Opto-Box", page 24).
- The fuses are located on the printed circuit board at the bottom of the box.



Danger by Incorrect Fuses

- Use only fuses with the required current rating and of the specified type for replacement.
 - Do not use makeshift fuses.
 - Do not short-circuit the fuse holder.
-

Fuse value (two fuses):

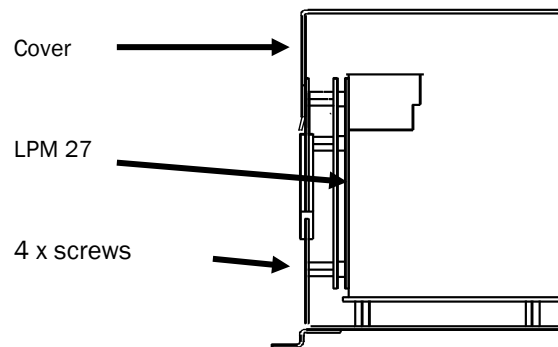
0.5 A slow fuse

- Pull out and check the fuses, replace them, if necessary.
For this purpose, the "optical digital in/out" Opto-Box must be disassembled to some extent, refer to Chapter 7.4 "Removal/Installation of the Digital-Optical Interface Board (LPM 27)", page 44.
- Close the Opto-Box
- Put the Opto-Box back into operation (refer to Chapter 3 "Start-up / Restart", page 35).

7.4 Removal/Installation of the Digital-Optical Interface Board (LPM 27)

7.4.1 Removal of the Printed Circuit Board

- Put the Opto-Box out of operation (refer to Chapter 5 "Shutdown", page 39).
- Open the Opto-Box (refer to Chapter 2.2.1 "Opening and Closing of the Opto-Box", page 24).



- Unscrew the 4 screws holding the digital-optical interface board (LPM 27) from the outside of the wall.
- Carefully pull out the printed circuit board.
- Place the printed circuit board on a grounded, antistatic surface.

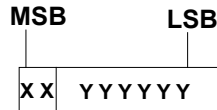
7.4.2 Installation of the Printed Circuit Board

- Carefully plug the printed circuit board into the strip and press it on. Take care not to bend pins.
- Screw the printed circuit board on with 4 screws.
- Reinsert the terminal blocks. Pay attention to the correct positions (labeling) of the terminal link.
- Close the Opto-Box.

8 Data Exchange between the Host and the Opto-Box

8.1 General Description

The communication of the analyzer (host) with the Opto-Box is performed bitwise. Each byte contains two fields, a 2-bit control field and a 6-bit data field.



**XX: Steuerfeld, 00 - Adressierung, YYYYYY = Adresse des Kanals
 01 - Schreiben in den Kanal, YYYYYY = Daten
 10 - Lesen aus dem Kanal, YYYYYY = Daten
 11 - zusätzliche Funktion, Fehler usw.**

The information exchange was set up in the conversation mode (software handshake).

The data transmission is performed via a serial interface with an 8-bit word, 1 stop bit and without parity.

An output channel can be read; the value written last to the channel is shown as the result. Writing to an input channel is possible, however, the operation is without effect.

Each Opto-Box has two "time-out" counters. The first (short time) counter measures the time that has elapsed since the last receipt of an optional byte. The second (long time) counter measures the time that elapsed after the last addressing of the Opto-Box.

When one of these counters has reached its maximum value, all outputs are reset. The maximum value can be defined with the "set time-out" command.

After switching on or a reset, all outputs have value 0 and the "time-out" (short time) has the value of 1 s.

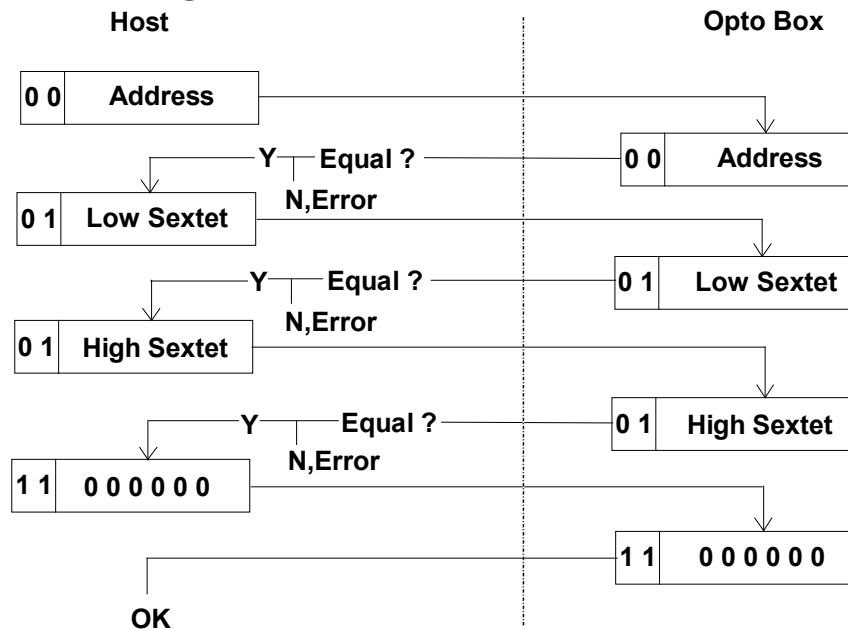
Important:

To be able to detect a crosstalk between the send and reception line, all bytes sent by the Opto-Box are inverted. For example, the address 10d is sent as byte 00001010B from the host to the Opto-Box, but as 11110101B from the Opto-Box to the host. It is thus sufficient that the software driver of the analyzer (host) inverts all received bytes directly after reading out of the "UART" register. However, for better readability, the bytes in the signal flow schemes are not displayed as inverted.

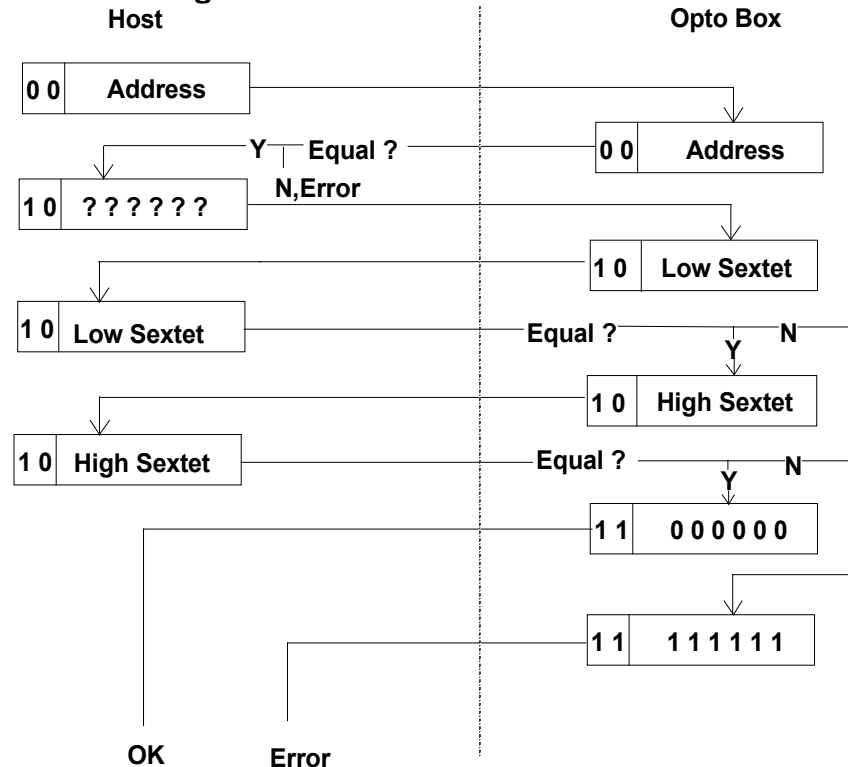
8.2 Data Exchange

The values in the frame specify the transmitted bytes. The decision whether the transmission was error-free is made either by the host or by the Opto-Box (depending on the position in the signal flow schemes). The write and read processes assume that only the used addresses (determined with the "Reset" function and checked with the "Query" function) are sent to the Opto-Box; otherwise a waiting time would also have to be integrated for writing and reading.

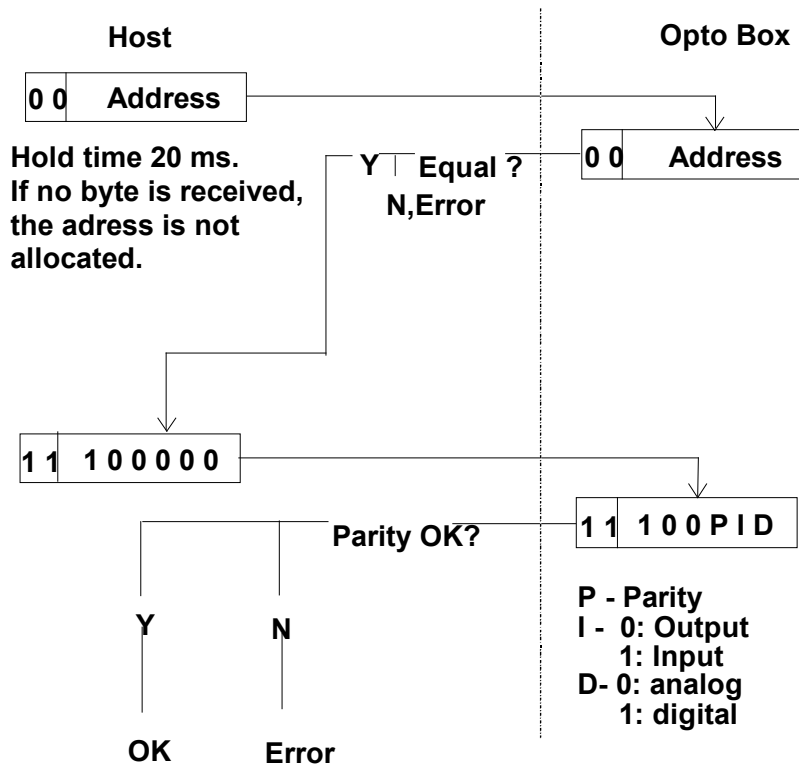
8.2.1 Writing to a Channel



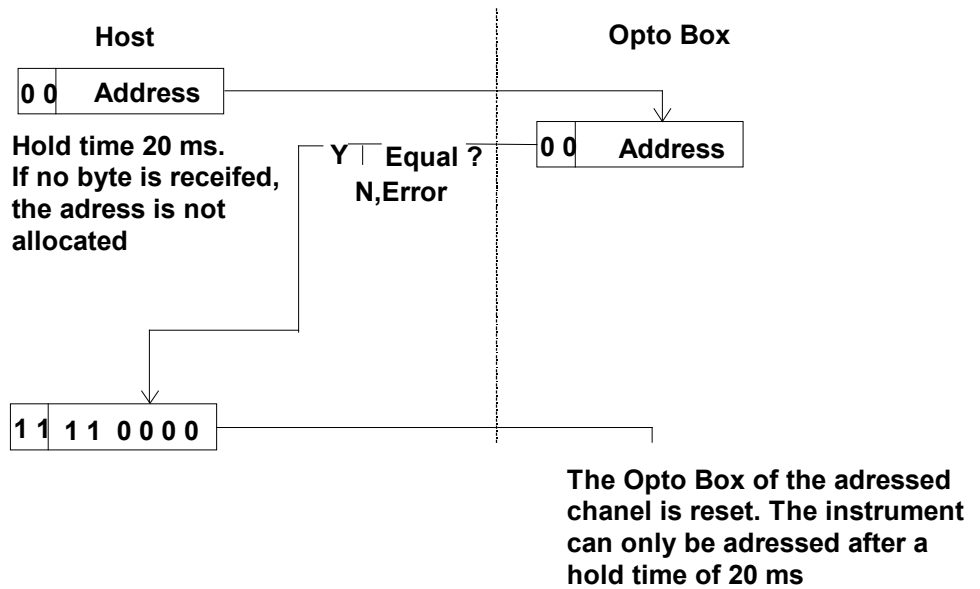
8.2.2 Reading from a Channel



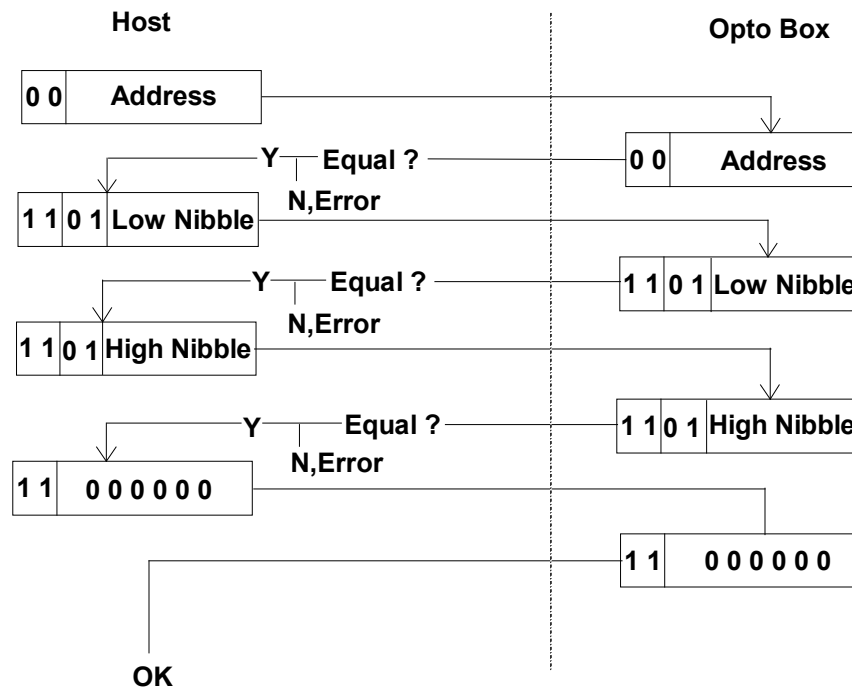
8.2.3 Query of the Function of a Channel



8.2.4 Reset of an Opto-Box



8.2.5 Setting of the "Time-Out" Value



The following values are set:

$$\text{Short time} = 16 \times (\text{high nibble}) + (\text{low nibble})$$

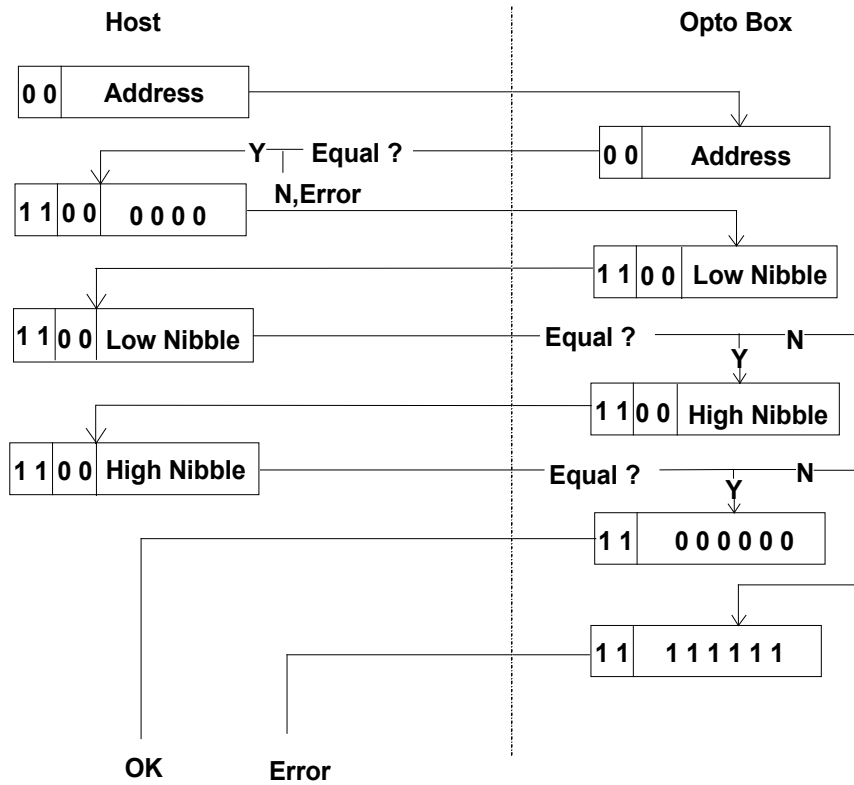
Value 0 is not allowed. When short time = 0, then short time = 256 is assigned.

$$\text{Long time} = 10 \times \text{short time}$$

For short time, the LSB is equivalent to a time of 50 ms, i.e.:

Short time min.	= 50 ms
Short time max.	= 12.8 s
Long time min.	= 0.5 s
Long time max.	= 128

8.2.6 Determination of the "Time-Out" Value



The determined values have the same significance as in Chapter 2.5

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9 Technical Data

9.1 Technical Data for all Types

Ambient temperature:	0 - 45 °C, non-condensing
Relative humidity	max. 80 % without condensation
Supply voltage:	230 V/50-60 Hz +10% - 15% 115 V/50-60 Hz +10% - 15%
Mains fusing:	For 115 V AC: 0.4 A slow fuse, 5 x 20 mm, 2 fuses For 230 V AC: 0.2 A slow fuse, 5 x 20 mm, 2 fuses
Secondary fusing:	0.5 A slow fuse, 5 x 20 mm, 2 fuses
Fiber optic cable connections:	4 sockets
Length of the fiber optic cables:	50 m, longer fiber cables on request
Cascadability:	Optional within the available address range (0..63)
Dimensions:	215 x 110 x 145 mm (w x H x D)

9.2 Opto-Box "Optical Digital in/out", (2024780)

Digital Inputs

Number:	11 or 12
Input voltage:	11 - 40 V DC => logical "1" 0 - 1 V DC => logical "0"
Input resistance:	2.2 kΩ

Relay outputs:

Number/type:	8 changeover relays
Load capability:	Up to 24 V DC, 144 W Up to 48 V DC, 60 W Up to 60 V DC, 50 W Up to 110 V DC, 50 W Up to 220 V DC, 65 W Up to 250 V AC, 1500 VA
Maximum switching voltage:	250 V
Maximum switching current:	6 A

The relay outputs are isolated from each other by basic insulation.
No protective separation function.

Electric strength

Inputs/outputs:	3.75 kV/AC
Supply voltage/inputs/outputs:	3.75 kV/AC

Internal voltage output:

Voltage:	20 V DC (unregulated)
Load capability:	11 digital inputs or 100 mA maximum

Address range:	2 addresses
----------------	-------------

9.3 Opto-Box "Optical Analog in", (2024778)

Resolution:	12 bits
Range:	0/4-20 mA (scaled evaluation software)
Accuracy:	0.5 %
Input resistance:	100 Ω
Number of inputs:	8, divided into 2 groups each with 4 inputs (inputs 1..4 and 5..8)
Galvanic isolation:	Between the two groups 1..4 and 5..8

Electric strength:

Input/protective conductor:	50 V
Group/group:	3.75 kV/AC
Supply voltage/group:	3.75 kV/AC

Address range:	8 addresses
-----------------------	-------------

9.4 Opto-Box "Optical Analog out", (2024781)

Resolution:	12 bits
Range:	0/4-20 mA (scaled evaluation software)
Accuracy:	0.5 %
Load resistance:	500 Ω maximum
Number of outputs:	8, divided in 2 groups, each with 4 outputs
Galvanic isolation:	Between the two groups outputs 1..4 and 5..8

Electric strengths

Output/protective conductor:	50 V
Group/group:	3.75 kV/AC
Supply voltage/group:	3.75 kV/AC

Address range:	8 addresses
-----------------------	-------------

9.5 Opto-Box "Optical Analog in/out", (2024781)

Power Inputs

Resolution:	12 bits
Range:	0/4-20 mA (scaled evaluation software)
Input resistance:	100 Ω
Inputs:	4 differential inputs without mutual electrical isolation

Maximum potential differences:

For 1 input:	0..2 V
For any 2 terminals:	10V
Accuracy:	0.5 %

Power Outputs

Range:	0/4-20 mA
Resolution:	12 bits
Accuracy:	0.5 %
Load resistance:	500 Ω maximum
Number of outputs:	4 with a common ground (outputs 5..8)

Electric strength

Output/protective conductor:	50 V
Group/group:	3.75 kV/AC
Supply voltage/group:	3.75 kV/AC

Address range: 8 addresses

9.6 Accessories

Installation set	2024669
Fiber optic cable 350 mm	2024738
Dummy plug	2024740

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www.addresses.endress.com
