

Gigabit Ethernet Switch for Industrial Fiber Ring Application

MICROSENS

General

Ethernet has been used in the controlling level of industrial applications for many years. Ethernet is continuing to beat the field bus technologies used to date in coupling equipment controls, sensors and actors. Process error-tolerant network components are absolutely essential because the network availability has a direct effect on production.

It is precisely to prevent this that MICROSENS has developed a mechanism for which a patent is pending that enables the Ethernet network to be reconfigured within milliseconds if an error occurs.

The switches can be configured and monitored either by SNMP or a PC-based management tool (Device Manager). In addition to the Device Manager all statuses are displayed web based using an integrated HTTP server.

In addition to the two 1000Base-SX/LX fiber connections for chain linking several industrial switches, the MICROSENS industrial switches also offer seven 10/100Base-TX connections for linking such Ethernet terminals as machine controls, network uplinks, consoles and other network participants and one 10/100/1000Base-T port for a central uplink connection.

In an extended version this switch is available with a third optical fiber port (1000Base-X). This port can be used alternative to the 10/100/1000Base-T port.

For particularly demanding uses, the industrial switches are designed in a suitably robust construction with an integrated clamping device for direct assembly on 35 mm DIN rails. The devices meet the requirements for IP protection class 30 and are also designed for a larger temperature range.

The power supply of the devices is done by an external, central power supply unit. With the second power input the device can be supplied with redundant power. All electrical ports are either galvanic isolated or equipped with an effective over voltage protection.

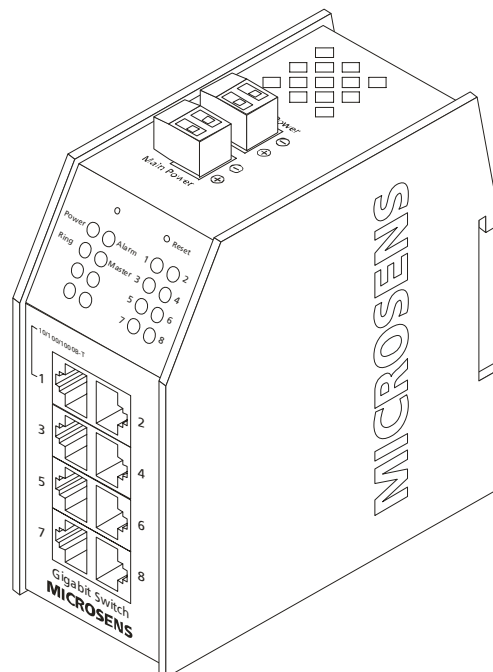


Fig. 1: Gigabit Ethernet switch for fault tolerant fiber rings

Technical specifications

Type	Manageable Gigabit Ethernet switch with 1x 10/100/1000Base-T, 7 x 10/100Base-TX and 2 x 1000Base-SX/LX uplink for industrial fiber ring	
Fiber type	Multimode 62,5/125 or 50/125µm (1000Base-SX), Single mode 9/125µm, duplex (1000Base-LX)	
Cable type	Shielded Twisted Pair cable, 100 Ohm, Category 5, Pinout RJ45-ports auto crossing	
Data rate	10, 100 or 1000 Mbps	
LED displays	<i>Port 1-8</i> <i>G1</i>	Link (on) and activity (flashing) of the TP ports Green: Copper port 1 with Gigabit Ethernet speed Orange: Third optical fiber port active, copper port 1 without function (optional)
	<i>Port 9-10</i> <i>P1</i>	Link (on) and activity (flashing) of the fiber ports Green: Main Power Supply active Orange: Main Power Supply missing
	<i>P2</i>	Green: Backup Power Supply active Orange: Backup Power Supply missing
	<i>Ring</i>	Switch configured for ring mode
	<i>RM</i>	Ring Master (only in ring mode)
	<i>Alarm</i>	Fiber link interrupted or Power Supply problem
Mounting	35 mm hat rail, according DIN EN 50 022	
Power supply	18 - 36 V DC (optional 48 V DC)/ max. 250 mA by external power supply connections with screw terminals, redundant ports	
Dimensions	50 x 108 x 116 mm (w x d x h)	
Operating temperature	-20°C to 60°C	
Storage temperature	-20°C to 80°C	
Rel. humidity	5% to 90% non condensing	
Management	- Status information via web based management (http-Server) or support of SNMPv1 - Configuration via PC based management tool (Device Manager)	

Optical parameter

Multimode	<i>min. distance:</i>	550 m (full duplex, 50/125µm)
	<i>Output power:</i>	-10 dBm
	<i>Sensitivity:</i>	-20 dBm
	<i>Wavelength:</i>	850 nm
Single mode	<i>min. distance:</i>	10 km (full duplex)
	<i>Output power:</i>	- 8 dBm
	<i>Sensitivity:</i>	- 22 dBm
	<i>Wavelength:</i>	1300 nm

Mounting

The switch is housed in a solid metal box with an integrated fixture for the installation on standard 35 mm DIN EN 50 022 rails.

The fixation of the MICROSENS switch on the rail is done with a locking pin that can be opened from the bottom side. If multiple devices are mounted in line, a minimum space of 20 mm should be kept between the devices, to ensure a sufficient heat dissipation.

Switch Features

The integrated switch has a store-and-forward architecture and can transmit all packets non-blocking between the five ports at full wire speed. For data buffering the switch incorporates 1MBit of memory.

Up to 4096 different MAC addresses can be stored simultaneously in the internal switch address tables. An automatic aging mechanism updates the tables max. 5 min. after the last reception of data.

Twisted Pair Connections

The integrated auto-crossing function of all Twisted-Pair ports makes the use of crossed patch cables unnecessary. The switch automatically detects the pinout of the connected cable and adapts the port accordingly. For all connections standard 1:1 Twisted Pair cables can be used.

The Autonegotiation mechanism detects automatically the speed and transmission mode (full or half duplex) between connected ports. A manual configuration is not required.

Power supply

The power supply is done by an external power supply with an output voltage of 24 V DC. This power supply is not included at delivery, but can be ordered separately (MS700405). The connection is done by the pluggable screw terminals on the top of the device. The connection of a redundant power supply can be done by the second screw terminal.

Management

The integrated http server offers to show status information by using a standard internet browser. A special configuration is not necessary. Additional to the web based management the switch offers a MIB to be used in all standardized Network Management Systems (NMS) supporting SNMPv1 protocol.

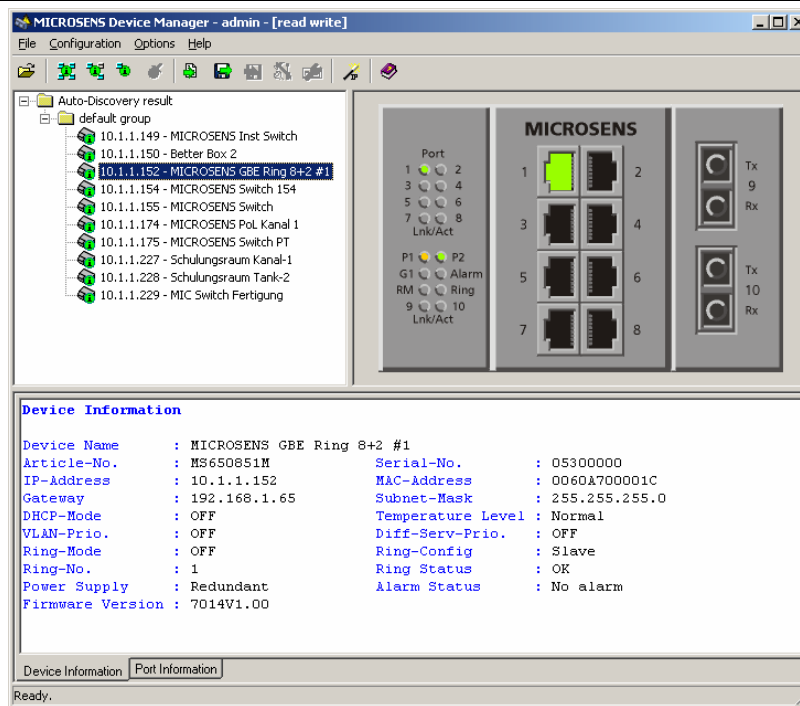
With the PC based management tool Device Manager it is possible to configure all ports of the switch manually. Please refer to the online manual for the Device manager on the disk.

With this tool it is also possible to do the initial TCP/IP setting (IP address, Gateway etc.). This configuration can be changed afterwards using the TCP/IP protocol.

Attention: The description for the initial settings can be found in the online manual!

The management information are available inside of the network (inband management). A special connection is not necessary. Due to this all four twisted pair ports are available to connect other devices.

With the deactivation of the autonegotiation function of the twisted pair ports the configuration of the speed to 10 or 100 Mbit/s and full or half duplex mode is done manually.

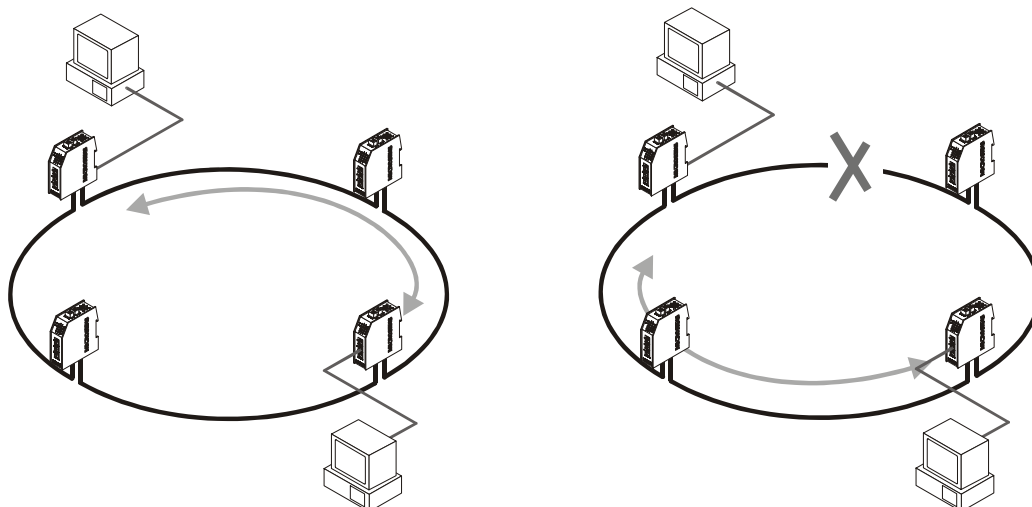


Ring Function

The two fiber ports of the device can be used to build up a ring structure. Ring structures are commonly used in industrial and telecommunication environments as they give redundant protection against failures at minimum cabling expense.

In normal operation the ring connection is logically interrupted by monitoring device (switch configured for Ring Master mode). In case of failure (broken connection or switch damage) the logically interrupted connection is activated by Ring Master.

A big advantage of this solution is, that no additional central device is necessary for the redundancy feature. Even if the ring master itself fails, the interruption of the ring stays at this location.



Normal operation status

Data transmission in failure status

Ring Mechanism

The from MICROSENS patented protection mechanism supports the fast reconfiguration of the data transmission in case of failure of one fiber segment. This function is a fixed feature of the industrial switch. During this operation one switch is having the manager function, all other switches are normal ring switches.

Each switch is monitoring the status of the connected fiber segment. In case of failure the connected switch forwards this information to the ring manager. The ring manager terminates the interruption of the ring immediately. The data is transmitted in all directions then. This fast signaling a fast failure detection within a few milliseconds (depending on the ring size).

Ring Configuration

The configuration of the operating mode for the ring application is done with the network management.

The screenshot shows the 'Hardware Settings' dialog box. It has a title bar with 'Hardware Settings' and a close button. The dialog is organized into several sections:

- TX 1:** Status: Enable; Autoneg: Enable; Speed: 10MBit, 100MBit; Duplex: FDX, HDX; Priority: high, low; Auto MDI/MDIX: Enable, mdi, mdix.
- TX 2:** Status: Enable; Autoneg: Enable; Speed: 10MBit, 100MBit; Duplex: FDX, HDX; Priority: high, low; Auto MDI/MDIX: Enable, mdi, mdix.
- TX 3:** Status: Enable; Autoneg: Enable; Speed: 10MBit, 100MBit; Duplex: FDX, HDX; Priority: high, low; Auto MDI/MDIX: Enable, mdi, mdix.
- TX 4:** Status: Enable; Autoneg: Enable; Speed: 10MBit, 100MBit; Duplex: FDX, HDX; Priority: high, low; Auto MDI/MDIX: Enable, mdi, mdix.
- FX 1:** Status: Enable; Speed: 10MBit, 100MBit; Duplex: FDX, HDX; Priority: high, low; Auto MDI/MDIX: Enable, mdi, mdix.
- FX 2:** Status: Enable; Speed: 10MBit, 100MBit; Duplex: FDX, HDX; Priority: high, low; Auto MDI/MDIX: Enable, mdi, mdix.
- Global Priority Scheme:** always deliver high priority packets first; deliver high/low packets at ratio 10/1; deliver high/low packets at ratio 5/1; deliver high/low packets at ratio 2/1.
- Description String:** Industrie Ring Switch
- Ring Mode:** Enable; Master, Slave; Ring No.: 0

At the bottom, there are 'Ok' and 'Cancel' buttons. A red circle highlights the 'Ring Mode' section.

At the menu point Hardware Setting it is possible to select the two modes master or slave. The switch which is configured in master mode is doing the ring manager functions to avoid the multiplication of the data.

If one connection or one device fails this information is forwarded to the ring manager (master) by a special protocol. The ring manager keeps the operation of the complete segment up.

Advantage of this solution is that the ring manager itself has not to be redundant, because if the manager fails the data can not be multiplied. The segments stays under operation.

To avoid that the signaling in case of failure has no affect on other rings, it is possible to define different rings with numbers from 0 to 255 by the network management.

All switches with ring functionality are having the management features included and are offering the detection and signaling of any failure.

With this concept a limitation in regards to the maximum ring length is not given.

Safety Notes

WARNING: Infrared radiation as used for data transmission within the fiber optic, although invisible to the human eye, can nevertheless cause damage.

To avoid damage to the eyes:

- never look straight into the output of fiber optic components – danger of blinding!
- cover all unused optical connections with caps.
- commission the transmission link only after completing all connections.

The active laser components used with this product comply with the provisions of **Laser Class 1**.

DANGER: Conductive components of power and telecommunications networks can carry dangerously high voltage.

To avoid electric shock:

- Do not carry out installation or maintenance work during lightning storms.
- All electric installations must be carried out in accordance with local regulations.

Order Information

Art.-No.	Description	Connectors
MS650850M	Gigabit Ethernet Switch with ring function 1x 10/100/1000Base-T, 7x 10/100Base-TX, 2x 1000Base-SX, ST multimode 850 nm	4x ST 8x RJ-45 2x Power, 1x Alarm
MS650851M	Gigabit Ethernet Switch with ring function 1x 10/100/1000Base-T, 7x 10/100Base-TX, 2x 1000Base-SX, SC multimode 850 nm	4x SC 8x RJ-45 2x Power, 1x Alarm
MS650852M	Gigabit Ethernet Switch with ring function 1x 10/100/1000Base-T, 7x 10/100Base-TX, 2x 1000Base-LX, SC single mode 1310nm, 10 km	4x SC 8x RJ-45 2x Power, 1x Alarm
MS650861M	Gigabit Ethernet Switch with ring function 1x 10/100/1000Base-T, 7x 10/100Base-TX, 3x 1000Base-SX, SC multimode 850 nm	6x SC 8x RJ-45 2x Power, 1x Alarm
MS650862M	Gigabit Ethernet Switch with ring function 1x 10/100/1000Base-T, 7x 10/100Base-TX, 3x 1000Base-LX, SC single mode 1310nm, 10 km	6x SC 8x RJ-45 2x Power, 1x Alarm

Accessories

Art.-Nr.	Description	Connectors
MS200150	Device Manager PC-Software V3.x MICROSENS Switch-Management (neccessary for Ring Configuration)	
MS200220	Firmware SNMP-Management	
MS700420	Hat-rail power supply 24 Watt 24 V / 1,0 A,wide range input 85-264 VAC	In: 3-pin Out: 2-pin
MS700421	Hat-rail power supply 60 Watt 24 V / 2,5 A,wide range input 85-264 VAC	In: 3-pin Out: 5-pin
MS700422	Hat-rail power supply 120 Watt 24 V / 5 A,wide range input 85-264 VAC	In: 3-pin Out: 5-pin
MS700430	Hat-rail power supply 60 Watt 48 V / 1,25 A, wide range input 85-264 VAC	In: 3-pin Out: 5-pin
MS700434	DC/DC hat-rail power supply 24 Watt 24 V / 1,0 A, wide range input 18-75 V DC	In: 3-pin Out: 2-pin

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