

Gigabit Ethernet Switch 4x 10/100 TX + 2x 1000 SX for Fault Tolerant Fiber Rings

MICROSENS

Introduction

Ethernet has been used for controlling of industrial applications since many years. Nowadays 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 efficiency.

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 (failure) 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 four 10/100Base-TX connections for linking such Ethernet terminals as machine controls, network uplinks, consoles and other network participants.

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 20 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.

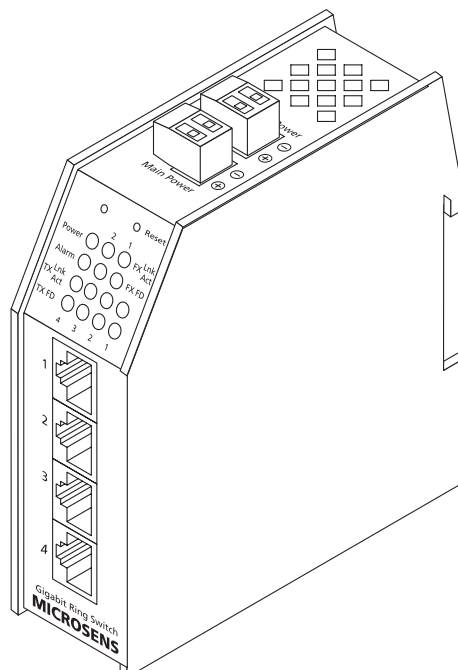


Fig. 1: Gigabit Ethernet Switch for fault tolerant fiber rings

Technical Specifications

Type	Manageable Gigabit Ethernet Switch with 4 x 10/100Base-TX and 2 x 1000Base-SX/LX ports for fault tolerant fiber ring	
Fiber type	Multimode 62,5/125 or 50/125µm, Single mode 9/125µm, duplex (optional)	
Cable type	Shielded Twisted Pair cable, 100 Ohm, Category 5, Pinout RJ45-port auto crossover	
Data rate	10, 100 or 1000 Mbps	
LED displays	<i>Power</i>	Ready for operation
	<i>Link</i>	Link status each port
	<i>Act</i>	Data traffic each port
	<i>FDX/HDX</i>	Half or full duplex transmission each port
	<i>Alarm</i>	Fiber link interrupted
Mounting	35 mm hat rail, according DIN EN 50 022	
Power supply	18 – 36 V or 48 V DC / max. 500 mA by external power supply connections with screw terminals, redundant ports	
Dimensions	38 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	<ul style="list-style-type: none"> - Status information via web based Management (http-Server, Standard) - Configuration via PC based management tool (Device Manager), must be ordered separately - Support of SNMPv1 (Firmware option) - Support of Telnet (Firmware option) 	
Ring functionality	Suitable for Master and Slave operation, no limitation in the number of ring node, no max. delay time	

Dimensions

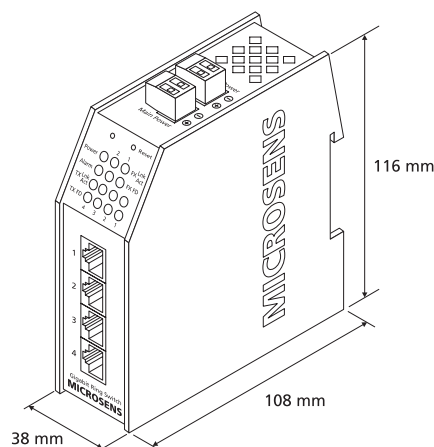


Fig. 2: Dimensions

Optical parameter

Multimode	<i>min. distance:</i>	550 m (full duplex, 50/125 μ m)
	<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.

Connectors

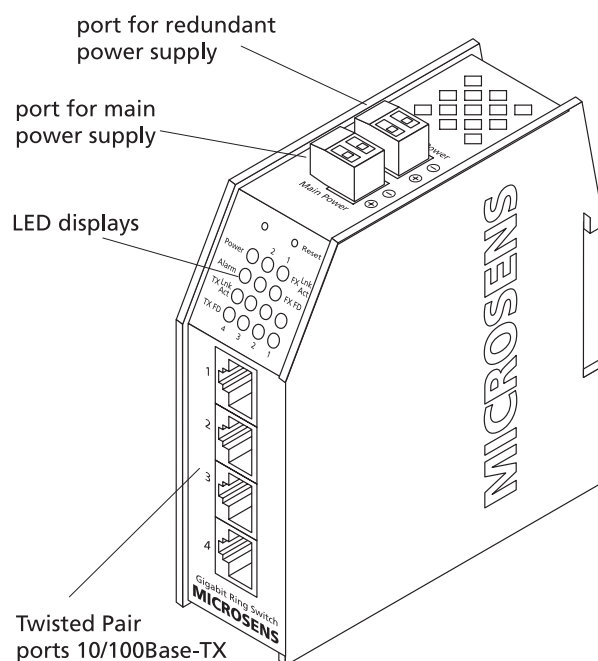


Fig. 3: Top view

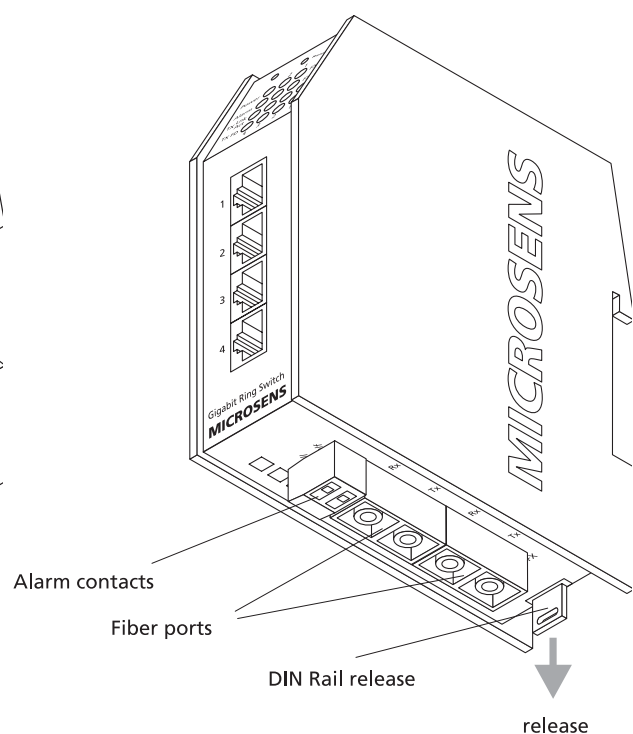


Fig. 4: Bottom view

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.

Transmission Speed

The twisted pair ports of the switch are adapting automatically to the highest possible speed using the autonegotiation protocol. The LED displays are showing the selected speed. If necessary this configuration can be also done by the network management.

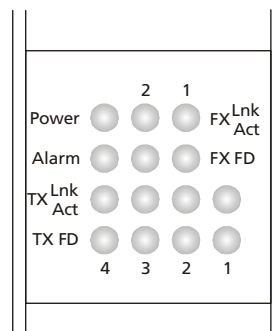


Fig. 5: LED displays

The transmission in full duplex mode is indicated by the related LED (on). If the connection is working in half duplex mode, this LED indicates collisions for the connected segment (flashing).

The transmission mode of the fiber uplinks are selected by the network management. Important is that distances longer than 412 m can be realized only in full duplex mode. The duplex settings are independent from the mode of the ring feature.

Alarm Relay Contacts

The converter has relay contacts for connection of external alarm systems. The connection type is a 3-pin screw connector at the bottom of the device. In this connection, an open (NO) or closed (NC) pin-out can be selected. The connector is switched in case of losing a connection (twisted pair and fibre) or a general failure of the device.

Power supply

The power supply is done by an external power supply with an output voltage from 18 to 48 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.

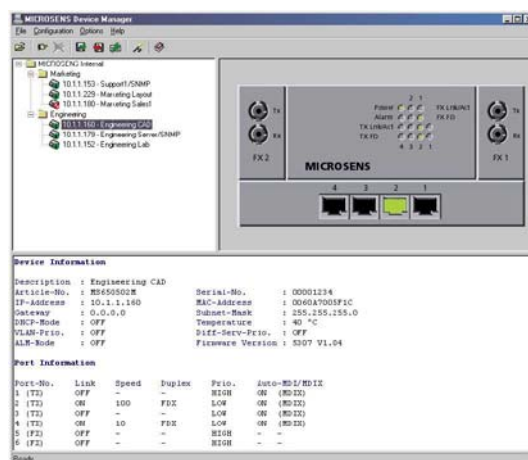


Fig. 6: MICROSENS Device Manager 3.x

Topology (Ring Function and Daisy Chain)

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.

Ring Function

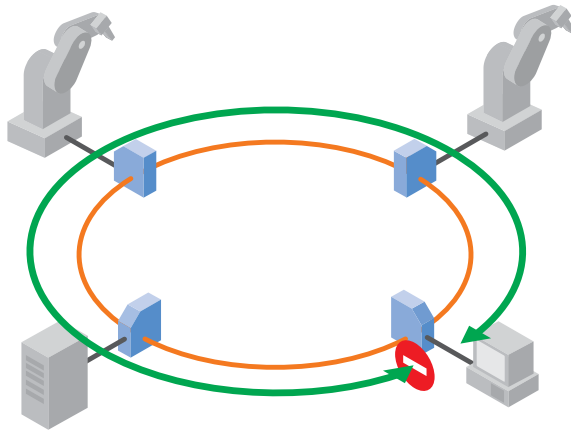


Fig. 7: Data transfer in normal operation (logical interruption of the ring by the Ring Master)

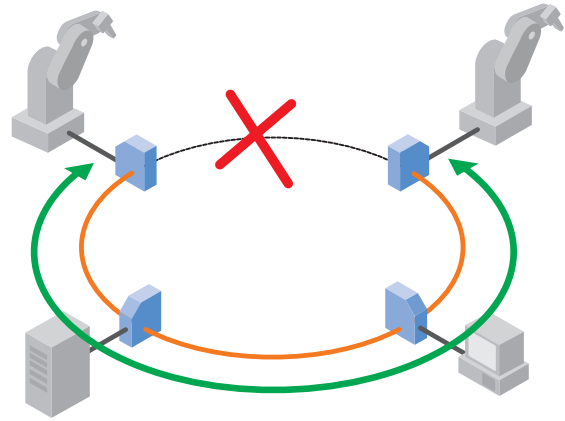
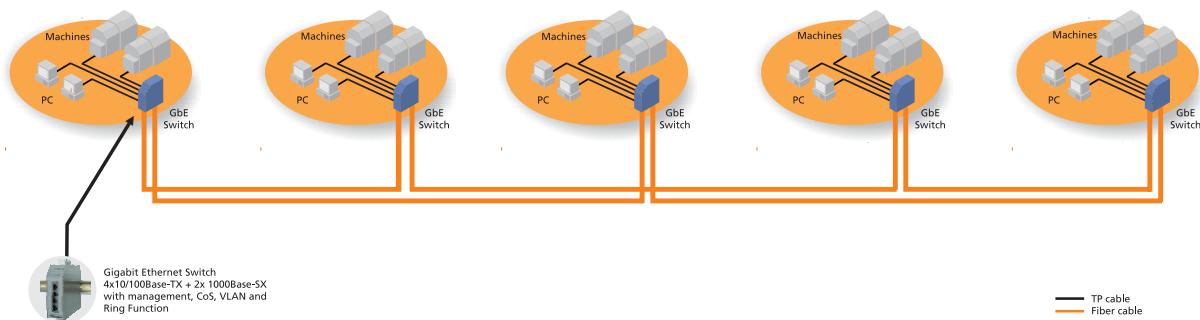


Fig. 8: Data transfer in failure (the Ring Master also enables the second fiber port)

Daisy Chain



Benefits of the MICROSENS patent

This solution of the fast redundancy offers a multiplicity of advantages:

- Fast redundancy without retarding mechanisms such as Spanning Tree or Rapid Spanning Tree (reconfiguration in less than 100 ms)
- No central component for the redundancy circuit, each switch can take over control functions of the Ring Master (manager)
- No redundancy of the Ring Master necessary, failed the switch with the master function, then are errors and logical separation of the ring in the same place
- No load of the network in normal operation, the signaling to the Ring Master takes place only in the event of an error
- No limitations regarding the running time and accordingly the maximum ring expansion (fiber distances)
- No technical restriction and/or limit of the number of switches with ring function

Ring Mechanism

The patented by MICROSENS 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 managing function (Master), all other switches are normal ring switches (Slaves).

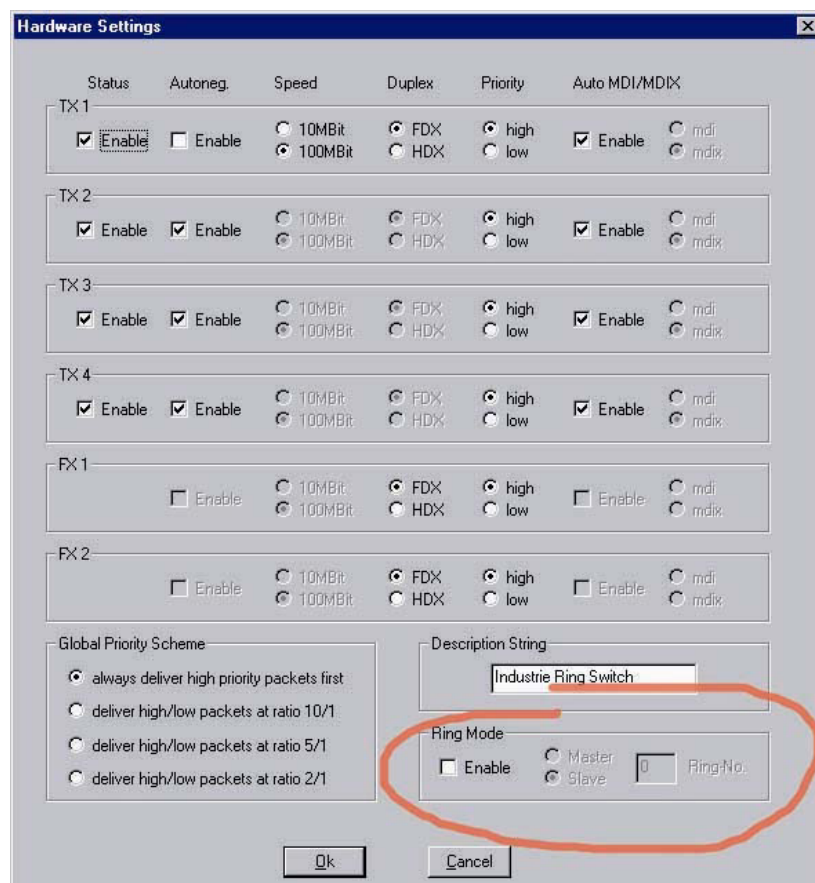
Each switch is monitoring the status of the connected fiber segment. In case of failure the connected switch forwards this information to the ring manager. The Ring Master terminates the interruption of the ring immediately. The data is transmitted in all directions then. This fast signaling a fast failure 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 via the network management (Device Manager).

At the menu point "Hardware Setting" it is possible to select one of the two modes master or slave. The switch which is configured in master mode is taking over the ring manager functions in order to avoid a data crash.

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
MS650830M	Gigabit Ethernet Industrial Switch 4x10/100TX+2x1000 SX MM ST Redundant Uplink with Ring function, 850nm Multimode	4x ST 4x RJ-45 2x Power, 1x Alarm
MS650831M	Gigabit Ethernet Industrial Switch 4x10/100TX+2x1000 SX MM SC Redundant Uplink with Ring function, 850nm Multimode	4x SC 4x RJ-45 2x Power, 1x Alarm
MS650832M	Gigabit Ethernet Industrial Switch 4x10/100TX+2x1000 LX SM SC Redundant-Uplink SC 1310nm Single mode	4x SC 4x RJ-45 2x Power, 1x Alarm

Accessories

Art.-Nr.	Description	Connectors
MS200150	Device Manager PC-Software V3.x MICROSENS Switch-Management (necessary for Ring Configuration)	
MS200220	Firmware SNMP-Management	
MS700405	Industrial power supply 50 Watt 24V*/2,1A, input voltage 85-264 VAC	In: 3-pin Out: 5-pin

*This Power Supply is also available with 48 V. Please inquire.

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