*opto*LAN 10GBASE-T1 BCM89890

2.5G / 5G / 10G BASE-T1

Operating Instructions

Digital optical transmitter
for automotive Ethernet
2.5G/5G/10G BASE-T1 signals

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Template Version 2.63.

Disclaimer: The operation and structure of older versions of our devices may differ from the ones described in this manual.

Version 1.01

*opto*LAN 10GBASE-T1
BCM89890

mk messtechnik
EMC Test and Measuring Systems

Operating Instructions

Contents

1 Legend

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

CAUTION, used with the safety alert symbol, indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to personal injury.

2 Scope of Delivery

Quantity	Content
2	*opto*LAN 10GBASE-T1 BCM89890 2.5G / 5G / 10G BASE-T1 transceiver with built-in batteries
2	chargers for built-in batteries
1	optical fiber, duplex 62.5 / 125 µm, cable length customized (20 m standard)
X	accessories like cables, external battery packs, external power supplies etc. depending on order

NOTICE

The components from mk-messtechnik GmbH are matched to each other and may not be modified and not be applied otherwise

3 Fields of Application

The *opto*LAN 10GBASE-T1 BCM89890 2.5G / 5G / 10G BASE-T1 system is a digital bidirectional optical transmission device for automotive Ethernet LAN 10GBASE-T1 BCM89890 signals.

There is no radio or RF transmitter or else integrated in this equipment. It uses optical transmission on a fiber to avoid emissions and susceptibility of electric, magnetic, or electromagnetic fields. The system is used for the transmission and supervision of signals during EMC (= Electro Magnetic Compatibility) functional tests.

4 Properties

The system is suited for the undisturbed isolated transmission of data in surroundings with high demands on electromagnetic compatibility.

Applying an optical fiber between both devices, the system can be used to connect a device under test (DUT) and source or sink of the Ethernet signal with the built-in chipset.

The optical transmission and the independent power supply, free of potential, separates the DUT from the controller. With all this and the integrated batteries, the system is optimized for low RF emission and high RF immunity.

5 Intended Use

- Transmission of automotive Ethernet 2.5G / 5G / 10G BASE-T1 signals via fiber over long distances without signal losses
- Use of the optimized components from mk-messtechnik GmbH only (correct optical fiber, charger, batteries)
- Charging of the batteries with provided chargers from mk-messtechnik GmbH only
- Non-OEM parts, e.g. power supplies influence the EMC performance and may cause damages to the system

6 Disclaimer of Warranty/Exclusion of Liability

NOTICE

Under the Following Circumstances the Warranty and Liability is Excluded:

- Usage not according to the intended purpose and misapplication
- Non-observance of the safety instructions
- Manipulation and modification of the devices

7 Special Regulations and Notes

The following regulations have to be respected for all devices. Additionally, all the specific notes for each device have to be respected (see the following chapters).

7.1 Safety

Problems and errors that are not described in chapter 11, and any damage of the devices (e. g. damaged housing or damaged cables at the charger) have to be reported to the responsible expert immediately.

The affected device has to be decommissioned by the responsible expert and must be protected against incorrect usage until all damages have been repaired.

7.2 Product Care and Maintenance

- Battery packs of the devices have to be maintained on a regular basis (see chapter 9)
- Charging the battery packs has to be done according to the instructions described in chapter 9.3
- Other components of the devices are maintenance free.
- Repairs must only be done by the manufacturer.

⚠ DANGER

Risk of Fire, Injury and Damage to the Electronics

There are no user serviceable parts in the devices. Opening the devices can lead to short circuits if powered components touch the housing of the device. Therefore NEVER open the housings, because there is a risk of fire or injury!

In case of errors consider the notes in chapter 11. If an an error cannot be solved by considering these notes, please send the device in for repair. In this case please contact mk-messtechnik GmbH BEFORE you send in the device.

7.3 Cleaning

- Cleaning of the housings is only allowed with solvent free cleaning supplies and a soft cloth.
- Do not use aggressive cleaning supplies like alcohol, acetone or abrasive materials.
- To remove dirt in the optical connections, an optical fiber cleaning kit can be supplied by mk-messtechnik GmbH

NOTICE

The rubber caps should always be placed on the FSMA connectors of the devices when they are not used. The optical fibers also have protectors which always should be applied when the fibers are not in use.

7.4 Installation Instructions

⚠ DANGER

Risk of Fire or Damage

Do not open the devices. Opening the devices is only allowed with the necessary guidance and previous authorization from mk-messtechnik GmbH. Non-observance can lead to fire or damage of the device. Warranty will be void!

⚠ WARNING

Possible Risk of Injury and Damage When not Observing this Manual.

The devices described in this manual are very complex. This manual must be read and respected compellingly before installation and initial operation. Safety instructions must be respected compellingly.

Disregard can lead to considerable damage of the devices and serious risk of injury for the user.

- Use the devices only on skid-proof surfaces, respect the specific installation references for each device.
- Electrical connections are only allowed to be done by authorized EMC trained specialist staff.
- Consider electrical parameters and correct pinout assignment.
- Incorrect electrical connections can damage the components of the devices.
- Expert only installation of the connections, provide strain reliefs if necessary.
- Do not mechanically work on devices and cases!
- Do not modify or short circuit plugs and do not shorten or extend included cables without our approval!

8 Installation and Initial Operation

8.1 Mechanical Assembly

Place one device inside and the other outside your EMC chamber, as required by your test setup.

Follow the instructions below for electrical assembly.

8.2 Electrical Assembly

⚠ DANGER

- Establish all connections only in voltage-free state.
- Turn off all devices before establishing the connections.

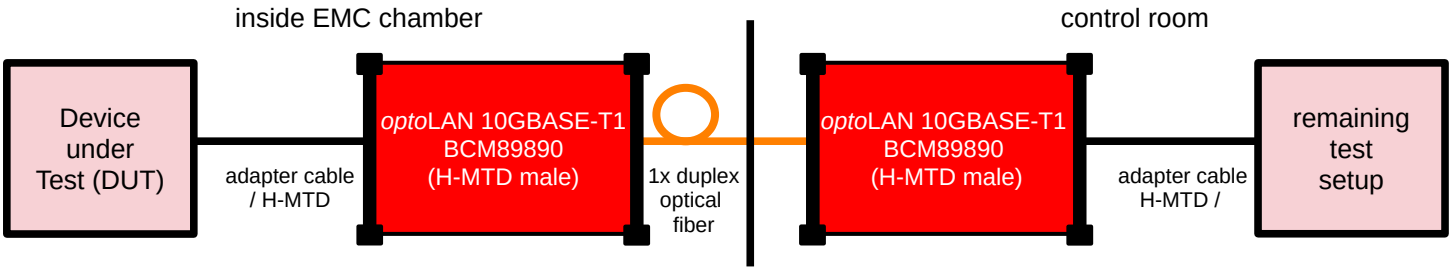
For battery packs please also refer to chapter 9.

Place one transceiver in the EMC chamber at your DUT and one outside the EMC chamber at your remaining test setup.

Connect the DUT located inside the EMC chamber with the transceiver in the EMC chamber and the remaining setup with the transceiver outside the EMC chamber.

Ensure the correct pinout of the devices and the connecting cables. The pinout of the transceivers LAN 10GBASE-T1 BCM89890 connector is printed on the housing of both transceivers (see figure 8.3.2)

Figure 8-1: Block diagrams and setups



It might be helpful to connect [GND] to your ground plane. Consider possible ground loops, short circuits, and parasitic effects to the ground plane. Use short ground connections.

Now use the delivered fiber optic cables to connect both devices. Please make sure that [Optical In] is connected to [Optical Out] and vice versa on the back side of the devices.

The devices are powered by the integrated batteries. Optional external powering has to be done according to chapter 8.5. Figure 8-2 shows the pinout of the charge/buffer connector.

NOTICE

It is not allowed to use a charger as external Power Supply while the device is powered on.

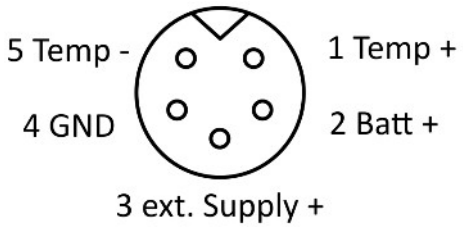


Figure 8-2: Pinout of the charge/buffer connector (front view)

Pin-No.	Short-Description	Long Description
1	Temp+	Temperature sensor (integrated into battery)
2	Batt+	Charge (+)
3	ext. Supply+	External Power Supply (+)
4	GND	Charge and External Power Supply (-)
5	Temp-	Temperature sensor (integrated into battery)

8.3 Operating Elements

8.3.1 Front Side

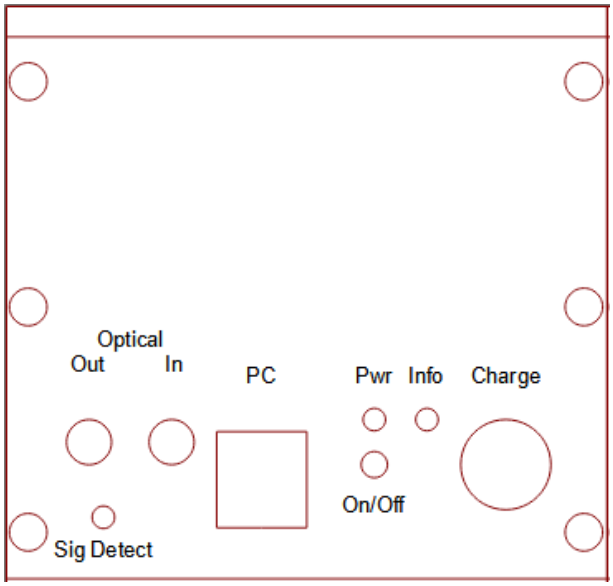


Figure 8-3: Front side of transceiver with connectors and push button

Designation	Usage	Elements
On/Off	Power push-button	Push button
Pwr	On, if device is switched on. Otherwise off	LED (red)
Info	On, if integrated batteries are low. Otherwise off. Blinking: see table 11-1	LED (yellow)
Charge	Charge/buffer connector. Pinout see Figure 8-2.	5-pole female jack, screw connector
Sig Detect	On, after device has detected an optical signal.	LED (green)
PC	USB- connection to internal micro controller (mk-messtechnik GmbH - use only)	USB socket

Table 8-1: front side control elements

8.3.2 Back Side

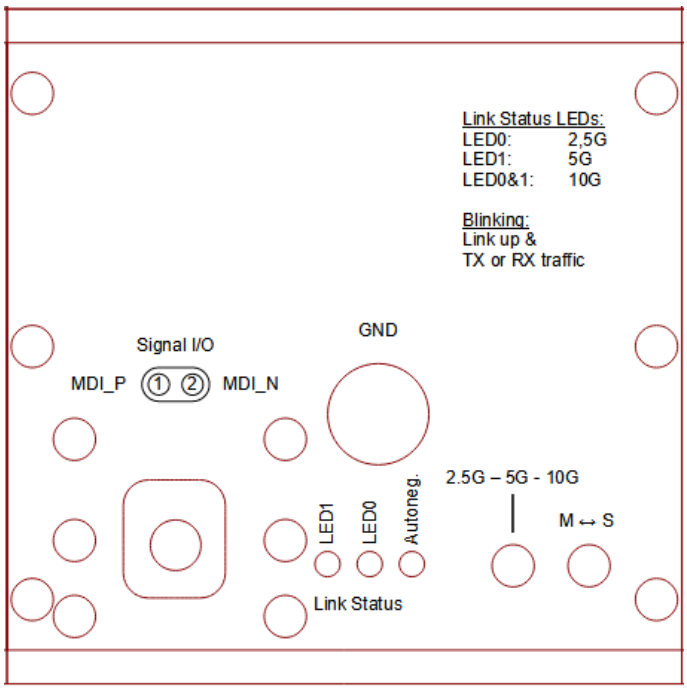


Figure 8-4: Back side of transceiver

Designation	Usage	Elements
GND	Connected to the device housing and internal ground.	4 mm female jack
Signal I/O	Signal I/O	Rosenberger H-MTD male plug
2.5G-5G-10G	Switch to configure Signal I/O interface to EITHER 2.5G BASE-T1 OR 5G BASE-T1 OR 10G BASE-T1	Switch
M<->S	Switch to configure Signal I/O interface to EITHER Master OR Secondary Mode	Switch
LED1 LED0	Active, if the transceiver is correctly linked via the Signal I/O connector, otherwise off. Blinking LEDs show TX- OR RX- traffic. Link Speed according to following list: LED0: 2.5G LED1: 5G LED0&1: 10G	LEDs (green)
Autoneg	Indicating active auto negotiation Mode. Switch for 2.5G-5G-10G is not active when auto negotiation Mode is on.	LED (green)

Table 8-2: back side control elements

8.4 Initial Operation

After all necessary electrical and optical connections have been implemented properly, the devices are switched on with the push buttons [On/Off]. After a short internal initialization of approx. 2 seconds, the data transfer starts, Link Status LEDs (LED0/LED1) are active/blinking, if the device has successfully fulfilled the link process to the DUT/ remaining setup.

There is no power up sequence to be considered. However, this might not apply if your hardware needs a special sequence for powering up. If so, please consult your hardware documentation.

If all optical connections are connected correctly, the [SD] LEDs will turn on (signal detect).Operation

8.5 Extended Operating Period / Buffering

To extend the operating time of the device inside the EMC chamber, a shielded external battery pack together with a shielded supply cable (only those approved by mk-messtechnik GmbH) can be used.

The battery pack for the *opto*LAN 10GBASE-T1 BCM89890 2.5G / 5G / 10G BASE-T1 is listed in chapter 13.

The operating time of the device located outside the EMC chamber can be extended either with another external battery pack or with a power supply from mk-messtechnik GmbH (see chapter 13).

NOTICE

You may not use the charger for extended operating time. The device must be switched off when connected to the charger.

Table 8-3 shows how the buffering methods battery pack or power supply are realized.

Buffering	Realization
External additional shielded battery pack, optional, for the device inside the EMC chamber or in the control room.	Shielded battery pack BP-xx (see chapter 13) on request from mk-messtechnik GmbH, with shielded connection cable, 0.3 m
External power supply, optional, for the device in the control room, i.e. outside of EMC chamber. **MUST NOT be used inside the EMC chamber!**	Power supply (see chapter 13), on request from mk-messtechnik GmbH, connection cable, approx. 1 m

Table 8-3: buffering methods

9 Battery and Charger

9.1 Properties

Batteries are either integrated into the devices from mk-messtechnik GmbH or delivered separately as external battery packs.

The number of cells varies and depends on the required voltages.

NOTICE

The number of cells of the battery pack and connected *optoLAN 10GBASE-T1 BCM89890 2.5G / 5G / 10G BASE-T1* device **always must be identical!**
Otherwise there is a risk that the battery will be damaged.

The related charger has the following properties:

- Power supply with power plug (Standard EU (type C or F) unless ordered otherwise, optional US (type A), UK (type G), AU (type I))
- Integrated LEDs to display the charging level of the connected devices respectively the connected battery packs.
- Short-circuit-proof, reverse polarity protected
- Suitable for batteries with 5 … 10 cells and a capacity of 1.0 … 10.0 Ah
- Charging process ΔU

After reaching the end of charging voltage, the device switches to trickle charging. This way a selfdischarge is avoided.

9.2 Regulations and References

Protect the batteries from heat (e.g. long exposure to direct sunlight) and fire. Do not immerse the batteries into fluids. Otherwise there is a risk of explosions.

⚠ DANGER

Risk of Damage and Explosion Because of Incorrect Treatment

Unintentional or incorrect treatment can damage the batteries, which can even lead to explosion of the batteries!

Batteries that are integrated into the devices of mk-messtechnik GmbH or are delivered with them, may only be charged with the intended chargers from mk-messtechnik GmbH.

These components are compatible to each other, other chargers may damage the system or may reduce the capacity or life span of the batteries significantly.

Respect the following references when operating the chargers:

- **Use chargers only for charging devices and batteries.**
- Do not leave chargers or batteries unattended when in operation.
- Switch devices off before connecting the charger.
- Do NOT switch on the device during the charging process.
- Maximum charging current 1.2 A.
- Disconnect charger before turning on the device.
- Prior to first use, charge the batteries completely.
- Charge the batteries before use if you have not used them for a longer period (self discharge of the NiMH batteries) and after use.
- To avoid capacity loss due to the memory effect, discharge the batteries completely every 5 charging cycles. To do this, leave the device on, until it turns off by itself. Then start the charging process as described above.
- The devices should be charged before storage or before a long period of non-use (and also regularly during storage) in order to avoid a deep discharge of the batteries (self discharge of the NiMH batteries).

⚠ DANGER

Risk Through High Voltage at the Charging Device

- The charger works with mains voltage.
- Security references for work with mains voltage must be followed.

NOTICE

Warning of Reduced Capacity and Life Span of the Batteries due to Maloperation

Use only the intended chargers from mk-messtechnik GmbH.

Powered devices must never be used with a connected charger, e.g. for buffering an empty battery.

Disregard can lead to a loss of capacity and a shortened life span of the battery in a short time.

9.3 Charging the Batteries (Battery Pack or Integrated into the Device)

Start of the Charging Process

- Place the battery pack or the device to charge onto a stable and skid-proof surface.
- Turn off the device (see appropriate chapter for operation and operating controls).
- Connect the charger with the battery pack or the device using the designated screw connector (see appropriate chapter for operating elements).
- Plug the power cord of the charger into the power socket.
- Do not power on the device during charging, this can damage the device.
- Check the status of the charging LED periodically (the meaning of the states are printed onto the housing of the charger).

End of the Charging Process, after the Charging LED Displays the Status “Full”

- Make sure that the device to charge is still turned off.
- Remove the connection between the charger and the screw connectors of the battery pack or the device to charge.
- Remove the power plug of the charger from the socket.
- The device or battery pack is now ready for operation. Environmentally Friendly Disposal

10 Disposal of Devices

All devices must be disposed according to the environmental regulations in force.

Important Notice for Disposal of Devices

- Used equipment must be collected separately and disposed in an environmentally friendly manner
- Electrical and electronic devices must NEVER be disposed of in the household waste.
- You can return old electrical and electronic devices to mk-messtechnik GmbH at no cost.

10.1 Disposal of Batteries

Due to their natural capacity loss batteries must be replaced after their lifespan.

NEVER open devices or housings by yourself. Replacement of batteries must be done by mk-messtechnik GmbH. Please contact mk-messtechnik GmbH for further details.

Important Notice for the Disposal of Batteries

- Disposing of batteries in the household waste is prohibited by law!
- Battery packs and devices containing batteries or environmental pollutants are marked by a symbol showing a crossed out garbage container (see picture on the left).

11 Troubleshooting

The following list is intended to support the troubleshooting to keep downtime as low as possible.

NOTICE

- If problems occur that you can not solve yourself, please contact mk-messtechnik GmbH for further help.
- Please only send in devices after contacting a staff member of mk-messtechnik GmbH and receiving an RMA number.

Error	Possible Cause	Solution
System cannot be switched on or automatically switches off (Pwr-LED off)	Batteries discharged (device automatically switches off)	Charge batteries
	Batteries exhaustively discharged	Charge batteries if possible **otherwise** Send device to manufacturer
	Batteries damaged	Send device to manufacturer
10G/5G/2.5GBase-T1 link not established (Link Status LEDs off)	Speed setting of signal chain is not consistent	Set speed setting of device according to the setting of the DUT/remaining test setup
	Master/ Secondary setting of signal chain is not consistent	Set Master/ Secondary setting of device contrary to the setting of DUT/remaining test setup
Info-LED on	Batteries have low voltage	Charge batteries as soon as possible. Device will still work, but may occasionally have transmission errors and switch of soon.
Info-LED blinking (slow ~1Hz)	Battery voltage OK, but no optical link is established	Check optical fibers and light emission on both devices.

Error	Possible Cause	Solution
Info LED blinking (fast ~3 Hz)	Device in bootloader mode for firmware update	Only possible during mk firmware update process. Automatically switches to normal mode after firmware update
No transmission	Fault related to electrical connections	Check and test connection cables and connections
	Device does not receive optical signal	• Check optical fibers and light emission on both devices. • Ensure wiring IN to OUT. • Charge batteries, if necessary.
	Batteries discharged	Charge batteries
	System turned off	Switch on both devices (Pwr LED on)
Faulty or no output signal	Link not configured correctly	Adjust register settings with configuration software
Transfer interrupts	Batteries discharged Batteries have low voltage	• Check charging state on both transceivers • Charge the batteries if necessary
	Signal source bad or deactivated	Check signal quality of DUT
	Dirt in the optical connection	See chapter 7.3 for cleaning instructions
Charging of batteries not possible	Blown fuse (inside device)	Send device(s) to manufacturer
	Batteries damaged	Send device(s) to manufacturer
	Charger damaged	• Check chargers • Exchange failed chargers
	Charging cable damaged	• Check charging cables • Exchange damaged charging cables
	Batteries exhaustively discharged	Charge the batteries when possible **otherwise** Send device(s) to manufacturer
Common problems	Optical fiber damaged	• Check cables • Exchange defective cables • Turn device(s) off and on again
	Electrical leads damaged	
	Connector damaged	

Table 11-1: troubleshooting measures

12 Technical Data

12.1 optoLAN 10GBASE-T1 BCM89890 2.5G / 5G / 10G BASE-T1

12.1.1 Mechanical

Dimensions (W x H x D):	137 mm x 86 mm x 86 mm
Weight, approx.:	1200 g
Housing:	aluminum with rubber protectors
Operating position:	any

12.1.2 Electrical

power supply:	built-in batteries 4 Ah, consisting of 5 NiMH cells operating time with fully charged batteries: approx. 8-10 h
Optical connector:	1x duplex FSMA multimode optical fiber 62.5/125 µm, OM1, 850 nm, standard length 20 m,
LAN-2.5G / 5G / 10G BASE-T1 connector:	H-MTD male plug
Transmission rate:	see datasheet of built-in chipset
Built-in chipset:	BCM89890
EMC standards:	2004/108/EG
Conformity:	CE EU conformity declaration delivered with devices

12.1.3 Ambient

Operating temperature:	0 … 40 °C
Storage temperature, < 1 year:	-20 °C … 35 °C
Storage temperature, < 3 months:	-20 °C … 45 °C
Protection class:	IP 40
Relative humidity:	5 % … 95 % non-condensing

12.2 Charger

Input voltage:	AC 100 … 240 V, 50...60 Hz
Input current:	0.25 … 0.3 A
Output voltage:	DC 4.8 … 12 V, depending on the number of detected cells
Output current, max.:	0.8 A
Internal fuse:	T 0.8 A
Weight:	0.14 kg
Type:	Power supply with different power connector (standard EU type C, if not stated otherwise)
Connections:	Cable 1.8 m with 5-pole screw connector (Binder 712 series), suitable for systems from mk-messtechnik GmbH
Temperature of operation:	0 … 40 °C at maximum load
Temperature of storage:	-40 … 70 °C
Protection class:	IP 40
Insulation class:	T40/F
Relative humidity:	5 % … 95 % non-condensing
Safety standard:	Standards IEC 60335, IEC 60601-1, IEC 61000, class II SELV

12.3 Battery Pack

Nominal voltage:	6 V, 5 cells
Capacity:	4 Ah or 10 Ah depending on order
Type:	Nickel-metal hydrid (NiMH) battery
Environmentally friendly disposal note:	See chapter 10.1

13 Accessories, Spare Parts

Part	Note
Charger with connection cable	Standard type, one channel, wall plug charger
External batteries	12 V / 4 Ah; shielded case to be used inside EMC chamber
Connection cable for BP-120	Length approx. 0.3 m
Optical fiber	Duplex multimode optical fiber 62.5 / 125 µm, ready-made with FSMA connectors, customer length (standard 20 m), ST connectors and others on request
Fiber optic cleaning set for FSMA	The cleaning set contains 5 lint free cleaning tissues, to clean the fiber cable connectors and a package of 10 clean sticks, to clean the FSMA fiber outlets
Power supply unit	Buffering supply unit DC 12 ... 16 V / 0.5 A, on request
Protector	Customer specific; Please contact mk-messtechnik GmbH for more detailed information
Operating Instructions	English