

LW213 – LW214 (1300 nm) & LW215 – LW216 (850 nm) Optical fiber modules for transmission of incremental encoder or sensor signals

Product features:

- Modules for data transmission of incremental encoder or sensor signals via an optical fiber
- Safe and reliably transmission of incremental signals, up to a distance of 3000 meters
- Four channels allowing a signal transmission with a sample rate of 10 MHz each
- For all incremental RS422, 5V-TTL or 10 to 30 V HTL encoders and sensors
- The optical fiber cable can be routed through explosive areas as well
- Input / Output data rate of max. 2 Mbit/s (transmitter and receiver)
- Resistant against extremely strong electromagnetic fields
- Already assembled optical fiber cables are available
- Power supply either 5 VDC or 10 to 30 VDC

Available systems (Transmitter and receiver with the same wave length are arbitrarily combinable):

| Transmitter (1300 nm) | Transmitter (850 nm) | Input levels: | Power supply |
|-----------------------|----------------------|---|---------------------|
| LW213 | LW215 | RS422 | 5 VDC ($\pm 5\%$) |
| LW213-1 | LW215-1 | RS422 | 10 ... 30 VDC |
| LW213-2 | LW215-2 | HTL (push-pull / differential signal) * | 10 ... 30 VDC |
| LW213-3 | LW215-3 | HTL (push-pull / single ended) | 10 ... 30 VDC |
| Receiver (1300 nm) | Receiver (850 nm) | Output levels: | Power supply |
| LW214 | LW216 | RS422 | 5 VDC ($\pm 5\%$) |
| LW214-1 | LW216-1 | RS422 | 10 ... 30 VDC |
| LW214-2 | LW216-2 | HTL (push-pull) | 10 ... 30 VDC |

*) differential signal transmitter variants cannot be operated with single ended signals

Die deutsche Beschreibung ist verfügbar unter:

https://www.motrona.com/fileadmin/files/bedienungsanleitungen/Lw215_d.pdf



The English description is available at:

https://www.motrona.com/fileadmin/files/bedienungsanleitungen/Lw215_e.pdf



| Version: | Description: |
|----------------------------|--|
| LW21501a/pp/01_2012 | First edition |
| LW21501b/pp/09_2012 | Enhanced by LW213-LW214; Changed dimension and color for all modules |
| LW21501c/pp/11_2012 | Small Changes |
| LW21501d/pp/02_2013 | Implementation of new product photo |
| LW21501e/mb-sk/Sept.14 | Correction Transmission |
| Lw215_01f_oi/ag/Sept.14 | “Safety Instructions” and design new, “Technical Specifications” updated Note added: dual channel variants <u>cannot</u> be operated in single channel mode |
| Lw215_01g_oi/ag/Mar-16 | Technical Specifications updated |
| Lw215_01h_oi/mbo/July 2024 | Various modifications, QR codes added, standards updated |
| Lw215_01i_oi/mbo/Feb. 2025 | Technical Specifications modified: Ambient temperature |

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Table of Contents

| | |
|--|-----------|
| 1. Safety Instructions and Responsibility | 4 |
| 1.1. General Safety Instructions | 4 |
| 1.2. Use according to the intended purpose | 4 |
| 1.3. Installation | 5 |
| 1.4. EMC Guidelines | 6 |
| 1.5. Cleaning, Maintenance and Service Notes | 6 |
| 2. Description..... | 7 |
| 3. Electrical and Optical Connections..... | 8 |
| 3.1. Terminal Assignment..... | 8 |
| 3.2. Electrical Connections | 9 |
| 3.3. Optical Connections..... | 10 |
| 4. LED-Function..... | 10 |
| 5. Dimensions | 11 |
| 6. Technical Specifications | 12 |

1. Safety Instructions and Responsibility

1.1. General Safety Instructions

This operation manual is a significant component of the unit and includes important rules and hints about the installation, function and usage. Non-observance can result in damage and/or impairment of the functions to the unit or the machine or even in injury to persons using the equipment!

Please read the following instructions carefully before operating the device and observe all safety and warning instructions! Keep the manual for later use.

A pertinent qualification of the respective staff is a fundamental requirement in order to use this manual. The unit must be installed, connected and put into operation by a qualified electrician.

Liability exclusion: The manufacturer is not liable for personal injury and/or damage to property and for consequential damage, due to incorrect handling, installation and operation. Further claims, due to errors in the operation manual as well as misinterpretations are excluded from liability.

In addition, the manufacturer reserves the right to modify the hardware, software or operation manual at any time and without prior notice. Therefore, there might be minor differences between the unit and the descriptions in operation manual.

The raiser respectively positioner is exclusively responsible for the safety of the system and equipment where the unit will be integrated.

During installation or maintenance all general and also all country- and application-specific safety rules and standards must be observed.

If the device is used in processes, where a failure or faulty operation could damage the system or injure persons, appropriate precautions to avoid such consequences must be taken.

1.2. Use according to the intended purpose

The unit is intended exclusively for use in industrial machines, constructions and systems. Non-conforming usage does not correspond to the provisions and lies within the sole responsibility of the user. The manufacturer is not liable for damages which has arisen through unsuitable and improper use.

Please note that device may only be installed in proper form and used in a technically perfect condition (in accordance to the "Technical Specifications" chapter. The device is not suitable for operation in explosion-proof areas or areas which are excluded by the EN 61010-1 standard

1.3. Installation

The device is only allowed to be installed and operated within the permissible temperature range. Please ensure an adequate ventilation and avoid all direct contact between the device and hot or aggressive gases and liquids.

Before installation or maintenance, the unit must be disconnected from all voltage-sources. Further it must be ensured that no danger can arise by touching the disconnected voltage-sources.

Devices which are supplied by AC-voltages, must be connected exclusively by switches, respectively circuit-breakers with the low voltage network. The switch or circuit-breaker must be placed as near as possible to the device and further indicated as separator.

Incoming as well as outgoing wires and wires for extra low voltages (ELV) must be separated from dangerous electrical cables (SELV circuits) by using a double resp. increased isolation.

All selected wires and isolations must be conformed to the provided voltage- and temperature-ranges. Further all country- and application-specific standards, which are relevant for structure, form and quality of the wires, must be ensured. Indications about the permissible wire cross-sections for wiring are described in the "Technical Specifications" chapter.

Before first start-up it must be ensured that all connections and wires are firmly seated and secured in the screw terminals. All (inclusively unused) terminals must be fastened by turning the relevant screws clockwise up to the stop.

Overvoltages at the connections must be limited to values in accordance to the overvoltage category II.

1.4. EMC Guidelines

All motrona devices are designed to provide high protection against electromagnetic interference. Nevertheless you must minimize the influence of electromagnetic noise to the device and all connected cables.

Therefore the following measures are mandatory for a successful installation and operation:

- **Use shielded cables for all signal and control input and output lines.**
- **Cables for digital controls (digital I/O, relay outputs) must not exceed a length of 30 m and are allowed for in building operation only**
- Use shield connection clamps to connect the cable shields properly to earth
- The wiring of the common ground lines must be star-shaped and common ground must be connected to earth at only one single point
- The device should be mounted in a metal enclosure with sufficient distance to sources of electromagnetic noise.
- Run signal and control cables apart from power lines and other cables emitting electromagnetic noise.

Please also refer to motrona manual "General Rules for Cabling, Grounding, Cabinet Assembly". You can download that manual by the link

<https://www.motrona.com/en/support/general-certificates.html>

1.5. Cleaning, Maintenance and Service Notes

To clean the front of the unit please use only a slightly damp (not wet!), soft cloth. For the rear no cleaning is necessary. For an unscheduled, individual cleaning of the rear the maintenance staff or assembler is self-responsible.

During normal operation no maintenance is necessary. In case of unexpected problems, failures or malfunctions the device must be shipped for back to the manufacturer for checking, adjustment and reparation (if necessary). Unauthorized opening and repairing can have negative effects or failures to the protection-measures of the unit.

2. Description

The optical fiber modules LW213/LW214 and LW215/LW216 form together a transmission system for data transmission of industrial signals by means of optical fibers.

Both, transmitter and receiver modules, provide four channels which are completely independent of each other, with differential inputs and outputs. All four channels allow the transmission of signals with a maximum data rate of 2 Mbit/s. With their technical features, the optical fiber modules are intended for the transmission of signals from incremental encoders and sensors. Differential signals with RS422 or Push-pull HTL levels from other sources may also be connected to these devices.

The modules are available with various wave lengths, level and supply voltage variants.

The optical fiber modules are mainly used for signal transmission in environments with strong electromagnetic interference, or when a potential separation is necessary due to high ground potential differences between signal source and signal processing equipment.

High ground potential differences generally appear in applications with long distances between the encoder/sensors and the PLC or any other processing electronics.

The optical fiber cable is failure-safe: it does not constitute any danger in case of damage. Since the light-emitting component used is not a laser, but a light-emitting diode, the transmission line is totally safe, even when looking directly into the opened connector or into the broken glass fiber.

If necessary, a level conversion can be linked with the potential separation without problem. Since all devices use the same signal transmission protocol on the optical fiber cable, any transmitter can be combined with any receiver.



The optical fiber cable can be routed through explosive areas.

With 850 nm wave length, signals can be transmitted up to 2000 meters wide, and with 1300 nm wave length up to 3000 meters wide.

3. Electrical and Optical Connections

3.1. Terminal Assignment

2-pin terminal:

| Pin | Description |
|-----|-------------------------------|
| 1 | 0 V (GND), power supply input |
| 2 | +Ub, power supply input |

11-pin terminal:

| Pin | Description |
|-----|---|
| 1 | 0 V (GND), encoder supply output (transmitter only) |
| 2 | +Ub, encoder supply output (transmitter only) |
| 3 | Channel A |
| 4 | Channel /A* |
| 5 | Channel B |
| 6 | Channel /B* |
| 7 | Channel O or C |
| 8 | Channel /O or /C* |
| 9 | Channel D |
| 10 | Channel /D* |
| 11 | Cable shield connector |



*) With dual-channel transmitter versions necessarily all inverted tracks must be connected. Unconnected inverted tracks inevitably lead to malfunctions.

If the encoder does not have a separate power supply, pins 1 and 2 of the transmitter's 11-pin terminal can be used to supply the encoder, provided that the encoder has the same voltage class as the module.

On the receiver module the power supply can be applied to either the 2-pin terminal or to pins 1 and 2 of the 11-pin terminal.



All pin assignments are identical for the transmitter and receiver modules.

3.2. Electrical Connections

As a principle, the input and output lines always must be routed pairwise, i.e. both wires of a differential signal must be routed in a twisted pair of cables. The use of bundle wires (called control cables) is not allowed, since this will not guarantee correct signal transmission nor EMC compliance.

The cable shield must be connected at both ends, at the encoder and the optical fiber transmitter, and at the optical fiber receiver and the signal processing device. The optical fiber transmitter and receiver are equipped with the additional ground pin 11 for this purpose.



For the modules with RS-422 output (LW214/LW214-1/LW216 and LW216-1), please make sure that the signal receiver provides a differential input with an input resistance of 100 – 120 ohms.

For modules LW214-2 and LW216-2, this value must be 2 kohms.

If there are no specific requirements for the output signals of the receiver modules (e.g. low transmission frequencies in the lower kHz range), the outputs may be operated as single-pole TTL or HTL outputs. However, the correct operation of this application must be checked on a case-by-case basis, and it is not supported by the manufacturer.

All modules are protected against reversed polarity, in order to avoid damage in case of wrong polarity of the power supply.

The outputs of the modules are only conditionally short-circuit proof; therefore please avoid imperatively short-circuits between modules or with the earth.

Exceeding the supply voltage of the modules LW213, LW214, LW215 and LW216 above a value of about 6 V provokes destruction of the fuse located inside of the device and must thus be avoided.

For the modules LW213-1, LW213-2, LW213-3, LW215-1, LW215-2, LW215-3, LW214-1, LW214-2, LW216-1 and LW216-2, this value is 33 V.



The fuse can only be replaced in the manufacturer's factory. Any attempt to repair the device will void the warranty.

3.3. Optical Connections

For connection of the modules a cord set of multimode optical fiber cables assembled by motrona can be used. Alternatively, any multimode optical fiber cable 50/125 μm or 62.5/125 μm will be suitable.



Single-mode optical fiber cables cannot be used.

Please keep the dust protection covers of the optical transmitters and receivers, and put them back in place when no optical fiber cable is connected to the modules, in order to avoid any soiling by dust or any other substance.



Make sure here that the connector of the optical fiber cable is correctly in place and that the bayonets catch is locked.

It must also be noted that the ST connector in use is indexed and has an orientation spigot which must engage the slots of the optical emitter and of the optical receiver. Please never force!

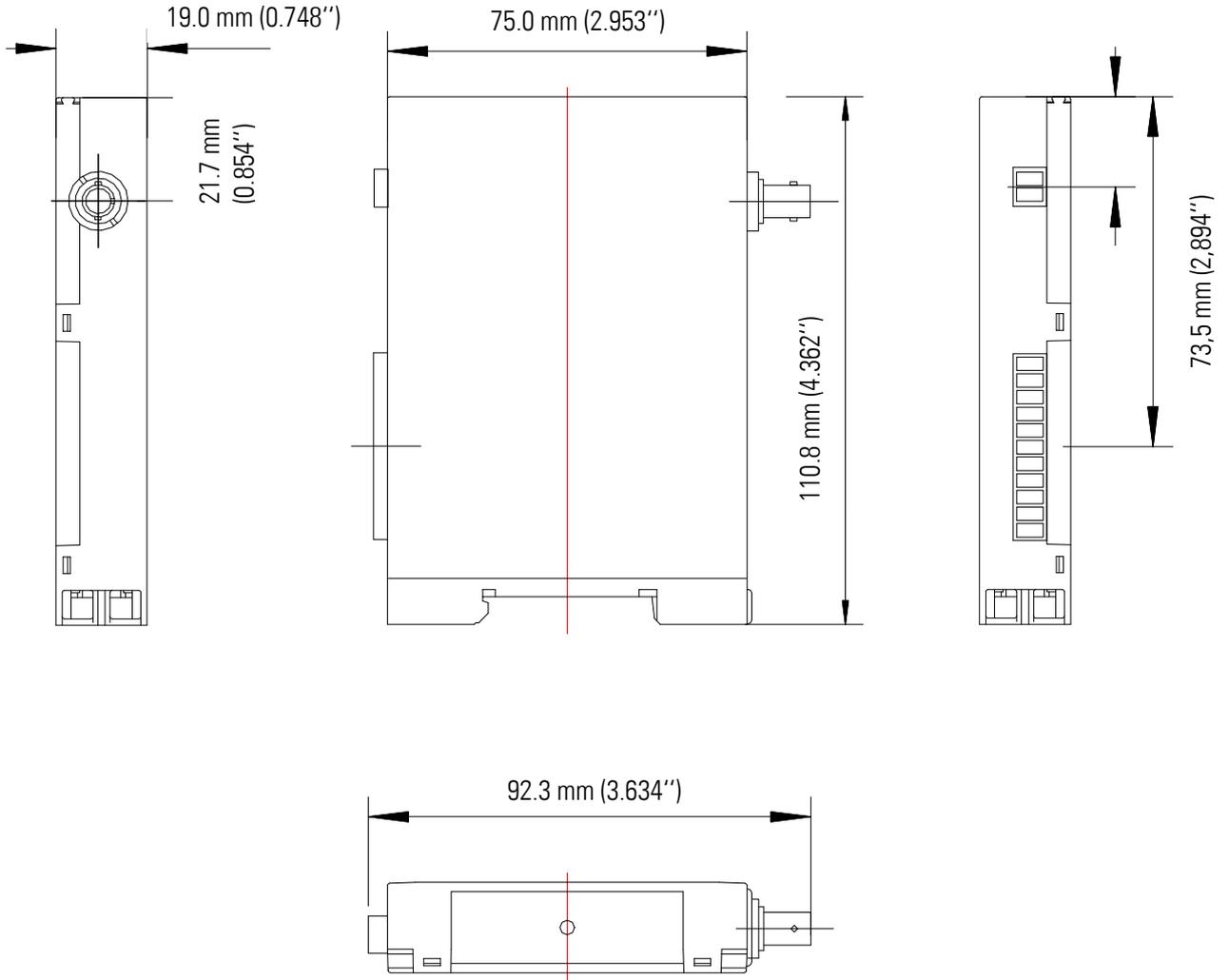
4. LED-Function

The green control LED of the transmitter must be on when the modules are connected correctly by means of a proper cable. The green LED of the receiver must also be on.

If the LED of the module is not on, make sure that the supply voltage is applied and that it is connected with the right polarity.

If the LED of the receiver module blinks, the optical fiber cable is not connected or broken.

5. Dimensions



6. Technical Specifications

| Technical specifications: | | |
|------------------------------------|---|---|
| Power supply: | Input voltage: Ripple: Protection circuit: Consumption: Connections: | available versions see table on page 1 ≤ 10 % at 24 VDC reverse polarity protection < 2 W (per module) screw terminal, 1.5 mm ² / AWG 16 |
| Encoder supply: | Output voltage: | according to the power supply voltage (is internally looped trough) |
| Optical fiber connection: | Optical wave length: Optical transmission rate: Glass fiber: Transmission distances: (transmitter and receiver) Connections: | 850 nm resp. 1300 nm (multimode) 120 Mbit/s Multimode - fiber, 50/125 μm, 62.5/125 μm with 850 nm wave length: optical fiber = max. 2000 m / approx. 6,500 feet with 1330 nm wave length: optical fiber = max. 3000 m / approx. 10,000 feet ST- plug (at the underside of the housing) |
| Electrical in- and outputs: | Number of channels: Tracks: Signal levels: Data rate (input / output): | 4 independent channels (A, B, C, D) A, /A, B, /B, C, /C, D, /D, resp. A, B, C, D with single-track versions HTL (10 ... 30 V) resp. RS422 max. 2 Mbit/s (transmitter and receiver) |
| Signal processing: | Conversion time: Sample rate (input signals): | < 300 ns per module 10 Msamples/s |
| Display elements: | Type: Functions: | 1 x LED (green) continuously on: synchronization ok flashes: synchronization error, resp. disconnected / broken optical fiber cable |
| Housing: | Material: Mounting: Dimensions (w x h x d): Protection class: Weight: | green plastic (RAL 6018) 35 mm top hat rail (according to EN 60715) 19 x 92.3 x 110 mm / 0.7480 x 3.634 x 4.331 inch IP40 / screw terminal: IP20 approx. 80 g |
| Ambient temperature: | Operation: | -10 °C ... +60 °C / +14° F ... +140° F (not condensing) Option: -40 °C ... +75 °C / -40 °F ... +167°F (not condensing) |
| Conformity & standards: | EMC 2014/30/EU: RoHS (II) 2011/65/EU RoHS (III) 2015/863: | EN 61326-1: 2021 for industrial location EN 55011: 2016 + A1: 2017 + A11: 2020 + A2: 2021 Class A EN IEC 63000: 2018 |