FASTUS
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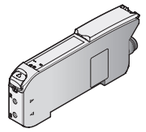
Instruction Manual

Digital Fiber Amplifier with IO-Link Interface

D4RF Series



Download the index list, the IO-Link setting file (IODD file), and the user's manual from the OPTEX FA website.
https://www.optex-fa.com

IO-Link

OPTEX FA CO., LTD.

0813142

- Thank you for purchasing this Digital Fiber Amplifier D4RF.
- Before using this product, please read this manual carefully to ensure proper use.
- Read this manual thoroughly, and then keep this manual at hand so that it can be used whenever necessary.

Safety Precautions

Safety precautions for ensuring safe operation of this product are displayed as follows with the following symbols.
Precautions listed here describe important information about safety. Make sure to follow them accordingly.

Safety Symbols

⚠WARNING	Indicates that any improper operation or handling may result in moderate or minor injury, and in rare cases, serious injury or death. Also indicates a risk of serious property damage.
⚠CAUTION	Indicates that any improper operation or handling may result in minor injury or property damage.

⚠WARNING

	Do not disassemble, repair, modify, deform under pressure, or incinerate this product. Doing so may cause injury or fire.
	This product is not explosion-proof and should not be used around flammable or explosive gases or liquids. Doing so may cause ignition resulting in an explosion or fire.
	Do not use air dusters or any spray that uses flammable gas around the product or on the inside of the product. Doing so may cause ignition resulting in an explosion or fire.
	Do not install this product in any of the following locations. Doing so may cause a fire, damage, or a malfunction. 1. Locations where dust, salt, iron powders, or vapor (steam) is present. 2. Locations subjected to corrosive gases or flammable gases. 3. Locations where oil or chemical splashes may occur. 4. Locations where heavy vibrations or impacts may occur. 5. Locations where the ambient temperature exceeds the rated range. 6. Locations subject to rapid temperature changes (or where condensation occurs). 7. Locations with strong electric or magnetic fields. 8. Outdoor locations or locations subject to direct sunlight.
	This is a class A product. In a domestic environment this product may cause radio interference, in which case the user may be required to take adequate measures.
	This product is not intended for use with nuclear power, railways, aviation, vehicles, medical equipment, food-handling equipment, or any application where particular safety measures are required. Absolutely do not use this product for any of these fields.
	This product cannot be used in applications that directly or indirectly detect human bodies for the purpose of ensuring safety. Do not use this product as a detection device for protecting the human body.
	What to do in the event of a malfunction such as smoke being emitted from the product If you detect any malfunction including emission of smoke, abnormal smells or sounds, or the product enclosure becoming very hot, immediately stop operating the product and turn off the sensor power. Failure to do so may cause a fire. Repairing the product is dangerous and should in no way be performed by the customer. Contact an OPTEX FA sales representative for repairs.

⚠CAUTION

- Make sure to turn the power off before wiring the cable or connecting/disconnecting the connector. Connecting or disconnecting while energized may damage the product or cause electric shock.
- Avoid using the transient state while the power is on (300 ms). Output could become unstable, causing unexpected operation.
- Do not place wires with this product near a high voltage cable or power line. Doing so may cause malfunction or damage by induction.
- Do not bend the cable when below the freezing point. This may cause the cable to break.
- Do not drop the product or subject the product to strong impacts. Doing so may damage the product.
- Follow the instructions in this manual or the specified instruction manual when wiring the product or the dedicated controller for the correct wiring method. Incorrect wiring can damage the product or the controller, or cause a malfunction.
- When disconnecting the connector, be careful not to touch the terminals inside the connector, and do not allow foreign objects to enter the connector.
- Install this product as far away as possible from high-voltage equipment, power equipment, equipment that generates large switching surges, inverter motors, welders, or any equipment that can be a source of noise.
- When connecting or disconnecting the cable, make sure to hold it by the connector portion, and do not apply excessive force to the cable.

NOTICE

- After carefully considering the intended use, required specifications, and usage conditions, install and use the product within the specified ranges.
- All specifications may be changed without notice.
- When using this product, it is the responsibility of the customer to ensure necessary safety designs in hardware, software, and systems in order to prevent any threat to life, physical health, and property due to product malfunction or failure.
- Do not use this product for the development of weapons of mass destruction, for military use, or for any other military application. Moreover, if this product is to be exported, comply with all applicable export laws and regulations, including the "Foreign Exchange and Foreign Trade Act" and the "Export Administration Regulations," and carry out the necessary procedures pursuant to the provisions therein.
- Before using this product, fully examine the applicable environmental laws and regulations, and operate the product in conformity to such laws and regulations. OPTEX FA does not assume any responsibility for damages or losses occurring as a result of noncompliance with applicable laws and regulations.
- Detection characteristics and digital display values may vary depending on the state of the target object and variations among individual products.

1. Included Items

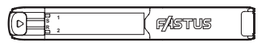
- This instruction manual
- Mounting bracket

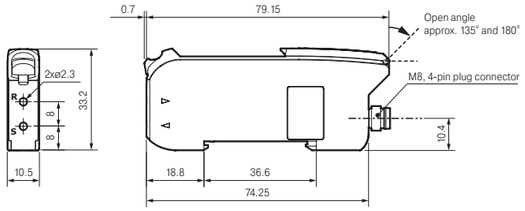
2. Dimensions

Amplifier

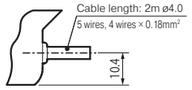
Unit (mm)

Connector models

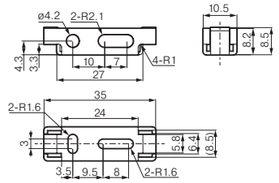




Cable models



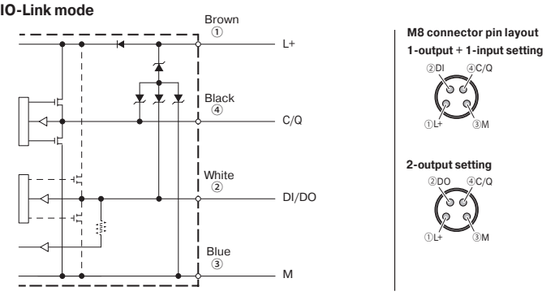
Mounting bracket



3. I/O Circuit Diagram

1-output and 1-switchable-output/input models

IO-Link mode

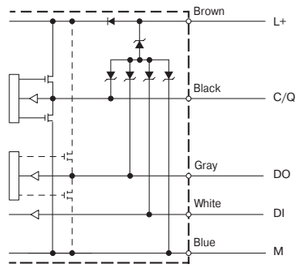


M8 connector pin layout
1-output + 1-input setting

2-output setting

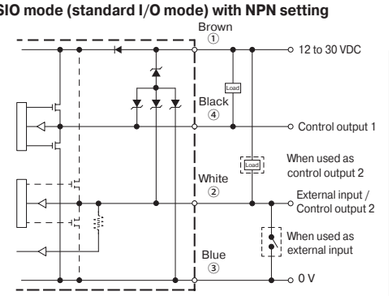
2-output and 1-input models

IO-Link mode

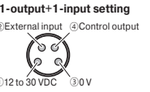


1-output and 1-switchable-output/input models

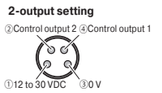
SIO mode (standard I/O mode) with NPN setting



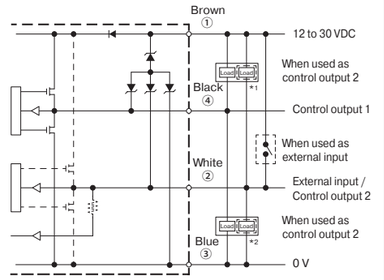
M8 connector pin layout
1-output+1-input setting



2-output setting

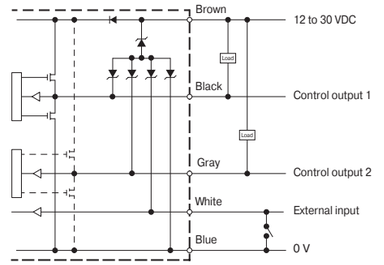


SIO mode (standard I/O mode) with PNP setting or Push-pull

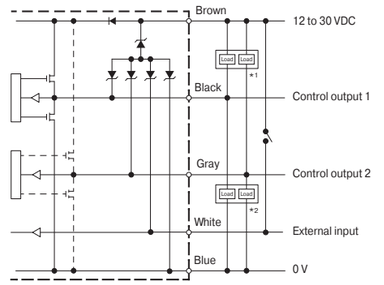


2-outputs and 1-input models

SIO mode (standard I/O mode) with NPN setting



SIO mode (standard I/O mode) with PNP setting or Push-pull

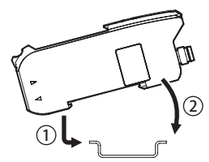


*1 When I/O polarity is set to Push-pull and the sensor is connected with plus common circuits.
*2 When I/O polarity is set to Push-pull or PNP and the sensor is connected with minus common circuits.

4. Installation

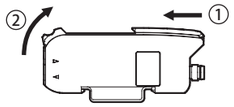
Installing the amplifier

① Place the groove on the side of fiber unit holes to the DIN-rail.
② Press down until the hook locks.



Removing the amplifier

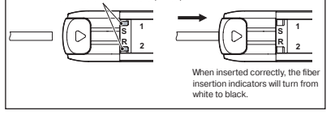
① Push the amplifier toward the side of fiber unit holes.
② Lift up the side of fiber unit holes and remove it.

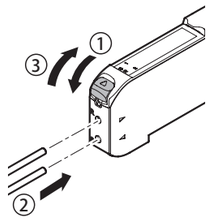


Mounting the fiber unit

① Slide the lock lever down.
② Insert the fiber wires in the holes to the end.

Check the fibers are inserted correctly with the fiber insertion indicators.

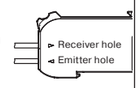




③ Raise the lock lever to the stop position.

CAUTION

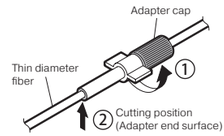
When using a coaxial reflective fiber unit, insert a single-core fiber or fiber sheath with a white line on the emitter hole, and multi-core fiber on the receiver hole.



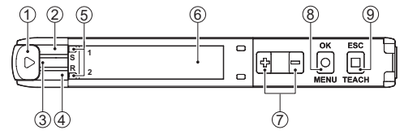
How to use the fiber adapter

(Included with the thin fiber units)

① Turn the adapter cap fully counterclockwise to unlock, and then align the ends of adapter pipe and fiber. Turn the cap fully clockwise to lock the adapter.
② Cut the fiber at a desired length, using the fiber cutter included in a free-cut fiber unit.



5. Part Names



No.	Name	Description
①	Lock lever	Locks and releases the fiber unit.
②	Output 1 indicator (orange)	Illuminates in orange when output 1 is ON.
③	Power indicator (green)	Illuminates in green when the power is turned on, and blinks during IO-Link communication.
④	Output 2 indicator (orange)	Illuminates in orange when output 2 is ON.
⑤	Fiber insertion indicator	Indicates the insertion status of the fiber unit.
⑥	OLED display	Displays the present receiving light level and threshold, and the parameters during setting.
⑦	Selection keys (+/- keys)	Manually adjusts the threshold, and select menu during setting.
⑧	OK/MENU key	Selects and sets the parameters.
⑨	ESC/TEACH key	Performs teaching, and exit menu during setting.

Contact Ramco Innovations today for technical support or application questions

Ramco Innovations www.optex-ramco.com
(800) 280-6933 nsales@ramcoi.com

6. Menu List

In case “English” is selected in “Language”.

Initial menu		Setting value	Default value
1/3	Language	English, 日本語, 简体中文, Espanol, 한국어	English
2/3	I/O polarity	NPN, Push-pull, PNP	NPN
3/3	Display	Std. display, Hold display	Std. display

Main menu		Sub menu		Setting value / description	Default value
S1	Output mode (N.O./ N.C.)*1	-		Light on, Dark on, (N.O./ N.C.)	Light on
S3	Response time			16 µs, 70 µs, 250 µs, 500 µs, 1 ms, 2 ms, 8 ms	250 µs
S4	Timer			Not used, On delay, Off delay, On/off delay, Pulse output, On delay pulse, 1 to 30,000 ms	Not used
S6	Display	P1	Display mode	Value, Percentage, Bar graph, Counter*2, Edge*3	Value
		P2	Hold display	Off, Peak/bottom, Peak, Bottom, Time, On*4	Off
		P3	Brightness	10 to 100 % (10% increments)	100 %
		P4	Rotate display	Off, On	Off
		P5	Invert display	Off, On	Off
		P6	Alarm display	Off, On	Off
		P7	Zeroing	Not used, Execute	Not used
		P8	Eco mode	Off, On	Off
		P9	Stretch mode*5	Off, On - x10, On - x50	Off
		PA	Language	English, 日本語, 简体中文, Espanol, 한국어	English
		PB	To main menu		
S7	Detection	D1	Hysteresis	1 to 90 %	5%
		D2	Threshold mode	Standard, Edge height, Not used	Standard
		D3	APC	On, Off	On
		D4	ASC	Off, On - standard, On - fast, On - max	Off
		D5	Emitter power	Max, Mid, Min, Auto	Max
		D6	Counter	Off, On	Off
		D7	Set count*2	1 to 16383	10
		D8	Edge direction*3	Both, Positive, Negative	Both
		D9	Edge offset*3	16 µs: 16 µs to 4080 µs, 70 µs: 70 µs to 17850 µs, 250 µs: 250 µs to 63750 µs, 500 µs: 0.5 ms to 127.5 ms 1 ms: 1 ms to 255 ms, 2 ms: 2 ms to 510 ms, 8 ms: 8 ms to 2040 ms	2500 µs
		DA	Edge hys.*3	1 to 9999	5
		DB	To main menu		
S8	I/O	O1	I/O polarity	NPN, Push-pull, PNP	NPN
		O2	Pin 2 setting*6	Output 2, Alarm output, Teach input, Emitter off, Counter reset*2, Not used	Output 2
		O3	Pin 5 setting*7	Output 2, Alarm output, Input ack., Not used	Output 2
		O4	Pin 2 setting*7	Teach input, Emitter off, Counter reset*2, Load preset, Not used	Teach input
		O5	Lock mode	Lock all, Lock keys	Lock all
		O6	Preset setting	Preset 1 to Preset 5	-
		O7	Load preset	Preset 1 to Preset 5	-
		O8	To main menu		
S9	Information	I1	Serial number	Manufacturing time.	
		I2	Firmware ver.	Firmware version.	
		I3	Hardware ver.	Hardware version.	
		I4	Temperature	Internal temperature in Celsius.	
		I5	Operation time	Operating time after reset.	
		I6	Total time	Total operating time.	
		I7	Counter value	Counter value in Counter mode.	
		I8	Received light	Value of the light received level diagnosis.	
		IB	Edge peak*3	Displays the edge peak value in Edge peak mode.	
		IC	To main manu		
SC	Reset	SB	No		
		SB	Setting reset		
		SB	Factory reset		
SD	To run mode				

*1: “N.O./N.C.” is displayed when “Edge” is selected in “D2 Threshold mode” or when “1-point Zone” or “2-point Zone” is selected during teaching.
*2: Displayed when “On” is selected in “D6 Counter”.
*3: Displayed when “Edge height” is selected in “D2 Threshold mode”.
*4: Only “Off” or “On” can be selected when “Edge height” is selected in “D2 Threshold mode”.
*5: Displayed when “Standard” or “Not used” is selected in “D2 Threshold mode”.
*6: Displayed on 1-output and 1-switchable-output/input models.
*7: Displayed on 2-output and 1-input models.

Contact Ramco Innovations today for technical support or application questions

7. Specifications

Type			Stand-alone unit (IO-Link device)
Model	1 output and 1 switchable output/input	Cable type	D4RF-T
		Connector type	D4RF-TC4
	2 outputs and 1 input	Cable type	D4RF-TD
	2 outputs and 1 input, short-range/high accuracy	Cable type	D4RF-TD-Y
Light source			4-element Red LED (Wavelength: 660nm)
Response time			16 µs, 70 µs, 250 µs, 500 µs, 1 ms, 2 ms, 8 ms
Teach Mode			1 point, 2 points, Auto, Through, 1-point Zone, 2-point Zone, Manual
Display	Digital display		OLED display 128 x 22 pixel Menu languages : English, Japanese, Korean, Simplified Chinese, Spanish
	Indicators		2 x Output indicator (orange) Power indicator (green): Lights up when power is on (Blinks during IO-Link communication for standalone unit)
Interface	Control output		NPN/PNP, open collector or Push-pull selecable by setting 1 output : Max. 100mA, 2 outputs : Max. 50mA /30 VDC residual voltage1.8V or less
	External input		Teach, Counter-reset, Emitter off or Preset loading*1
	IO-Link		Control output 1 is switchable to IO-Link
IO-Link	Revision		1.1
	Baud rate		COM 3 (230.4kbps)
	Number of process input data bytes		4 bytes
	Minimum cycle time		0.5 ms
Timer function			On delay, Off delay, On/off delay, Pulse output, On delay pulse Adjustable 1 to 30,000 ms
Output mode			Light ON/Dark ON, selectable by setting
Connection type			Cable type: 2m, 5 wires with 2-output and 1-input models, 4 wires with 1-output and 1-swichable-output/input models, Minimum bending radius: 4 x Cable diameter Connector type: M8 4-pin plug connector
Insulation resistance			20 Megohm or more (with 500 VDC)
Rating	Supply voltage	SIO mode	12 to 30 VDC ± 10 % including 10 % ripple (p-p)
		IO-Link mode	18 to 30 VDC ±10 % including 10 % ripple (p-p)
	Current consumption	Eco mode: Off	870 mW max. (29 mA or less at 30 VDC, 33 mA or less at 24 VDC, 52 mA or less at 12 VDC)
		Eco mode: On	780 mW max. (26 mA or less at 30 VDC, 29 mA or less at 24 VDC, 43 mA or less at 12 VDC)
Warm-up time			300 ms
Applicable regulations		EMC	EU EMC directive (2014/30/EU) UK directive EMC (The Electromagnetic Compatibility Regulations 2016)
		Environment	EU RoHS directive (2011/65/EU) UK RoHS (The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012) China RoHS (MIIT Order No.32)
Applicable standards			EN 60947-5-2
NRTL certification			UL Listed or Recognized Components Proximity Switch Certified for US and Canada.
Company standards			Noise resistance Feilen Level 4 cleared
Protection circuit			Reverse connection protection, Overcurrent protection
Environmental resistance	Ambient temperature/humidity		-25 to 55 °C/35 to 85 % RH (no freezing or condensation)
	Ambient illuminance		Sunlight: 10000 lx or less, Incandecent light: 3000 lx or less
	Vibration resistance		10 to 55 Hz, Double amplitude 1.5 mm; 2 hours in each of the X,Y and Z directions
	Shock resistance		Approx. 50 G (500 m/s²) 3 times in each of the X,Y and Z directions
	Degree of protection		IP54
Material			Housing, cover: PC
Weight			Cable model: approx. 71 g (including cable), Connector model: approx. 25 g
Included items			Mounting bracket, Instruction manual

*1: Preset loading selectable only on 2-output and 1-output models.

This device complies with part 15 of the FCC Rules.
Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

*This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

- Support for the China RoHS directive

For details on the support for the China RoHS (the Administrative Measure on the Control of Pollution Caused by Electronic Information Products), see the following website.
https://www.optex-fa.com/rohs_cn/

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