

Fiber Optic Amplifier Communication Converters

BFNC Series

PRODUCT MANUAL

Be sure to follow the instructions and precautions in the instruction manual, other manuals, and the Autonics website.
The specifications, dimensions, and other information in this document are subject to change without notice for product improvement.
Certain models may be discontinued without notice.

Safety Precautions

- 'Safety Precautions' are provided to ensure safe and proper use of the product and to prevent accidents or hazards. Please make sure to follow them carefully.
- ⚠ symbol indicates a caution, warning of potential hazards under certain conditions.

⚠ Warning Failure to follow instructions may result in serious injury or death.

01. **Fail-safe device must be installed when using the product in applications that may cause serious injuries or property loss. (E.g. nuclear control systems, medical equipment, ships, vehicles, railroads, aircraft, combustion devices, safety devices, security systems, disaster prevention devices, etc.)**
    Failure to do so may result in personal injury, property loss or fire.
02. **Do not use or store the product in environments containing flammable, explosive, or corrosive gases, or in places exposed to high humidity, direct sunlight, radiant heat, vibration, shock, or salt.**
    Failure to do so may result in explosion or fire.
03. **Install the device inside a device panel before use.**
    Failure to do so may result in fire.
04. **When expanding amplifiers, be sure to mount the units on a DIN rail. Securely fix the fiber optic amplifier and communication converter on the DIN rail by attaching end plates on each end. If using third-party end plates, make sure it meets the manufacturer's specification requirements.**
    Failure to do so may result in fire or product malfunction due to poor contact of the side connectors.
05. **The side connectors of the amplifiers on each end or any unused amplifiers must be covered with side connector protective caps.**
    Failure to do so may result in electric shock or product damage.
06. **Do not disassemble, repair, or modify the product without authorization.**
    Failure to do so may result in fire or injury.
07. **Wait at least 3 seconds after applying power before using the product.**
08. **Do not connect, repair, or inspect the unit while connected to a power source.**
    Failure to follow this instruction may result in fire.
09. **Check the connection diagram before wiring.**
    Failure to do so may result in fire or product damage.
10. **Installation, configuration, and integration with machine control system must be performed by a qualified supervisory user who is:**
    - fully familiar with the installation, configuration, operation, and maintenance of the product.
    - fully familiar with national and regional standards, regulations, and laws applicable to the type of machine on which the product is installed.
    Installation or configuration by personnel other than a supervisory user may result in improper operation or increase the risk of accidents.
11. **After installing the product, check that the product's functions and settings are working as intended before the machine is in operation.**
    Improper configuration of the product may result in personal injury.
12. **This product is not a safety sensor and does not comply with any domestic or international safety standards.**
    Do not use the product in applications where personal injury, loss of life, or property damage may occur.

⚠ Caution Failure to follow instructions may result in injury or product damage.

01. **When wiring the BFNC-EC / CL power connectors, use copper (Cu) wires rated for temperatures of 60 °C or higher, with sizes between AWG 28 and AWG 16. Tighten the screws with a torque of 0.34 N·m.**
    Failure to do so may result in fire or product malfunction due to contact failure.
02. **Use the product within its rated specifications and performance limits.**
    Failure to do so may result in fire or product damage.
03. **Use a dry cloth to clean the product. Do not use water or organic solvents.**
    Failure to do so may result in fire.
04. **Prevent metal, dust, wiring debris, and other foreign material from entering the product.**
    Failure to do so may result in fire, product malfunction, or product damage.

Cautions During Use

- Make sure to follow the instructions in 'Cautions During Use'. Failure to do so may result in unexpected accidents.
- Power input should be supplied from an isolated and limited voltage/current source, or from a Class 2 or SELV power supply.
- When supplying power with an SMPS, ground the F.G. terminal and connect a noise suppression capacitor between the 0 V and F.G. terminals.
- When connecting inductive loads such as DC relays, use a diode, varistor, or similar component to suppress surges.
- To prevent surges and inductive noise, separate the wiring from high-voltage and power lines, and keep wiring lengths as short as possible.
- When installing power lines and input lines close to each other, use a line filter or varistor on the power lines and shielded wires on the input lines. For stable operation, use shielded wires and ferrite cores when installing communication lines, power lines, and signal lines.
- Do not use the product near devices that generate strong magnetic fields or high-frequency noise.
- The communication section of the product is isolated, but the input section is not isolated. Please exercise caution regarding electrical safety when using the product.
- Turn off the power before connecting or disconnecting fiber optic amplifier units to the product. Failure to do so may result in product damage.
- When connecting the product with fiber optic amplifiers, connect the power supply only to the communication converter. Do not connect separate power supplies to the communication converter and the fiber optic amplifier.
- Use communication cables recommended by each communication association, and refer to the manuals published by the respective association for specific connection specifications. The communication distance must be within the rated specification range, and be sure to observe the following precautions when wiring.
  - Install communication cables with sufficient distance from power lines and high-voltage lines.
  - Avoid excessive bending or pulling of the communication cables.
  - Do not place objects on top of the communication cables.
  - Communication cables must be installed inside a duct.
- When disposing of this product, treat it as industrial waste. For detailed information, refer to the applicable national and regional standards, regulations, and laws.
- This product may be used in the following environmental conditions.
  - Indoors (in the environment condition rated in 'Specifications')
  - Altitude: up to 2,000 m
  - Pollution Degree 3
  - Installation Category II

Ordering Information

For reference only. The actual product does not support all combinations.
To check all supported models, please refer to the Autonics website.

BFNC - ❶

❶ Communication protocol
No-mark: Modbus RTU
EC: EtherCAT
CL: CC-Link

Product Components

- Product, instruction manual
- [BFNC-EC/CL] Power connector
- [BFNC-CL] Communication connector, Termination resistor ×2

Sold Separately

- Fiber optic amplifier: BFN Series
- End plate: BK-BFN-B
- Serial communication converter : SCM-US

Manuals and Software

Refer to the product manual for detailed product information and instructions, and be sure to follow the precautions in the technical documents.
Manuals and software can be downloaded from the Autonics website.

■ BFNC Series Communication Manual

Provides communication tables for each protocol for the BFN Series dual display models.

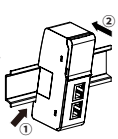
■ DAQMaster

Comprehensive device management software used to configure parameters, monitor status, and manage data of supported Autonics devices..

Installing the Communication Converter

⚠ **Turn off the power before starting installation.**

Installation
01. Hook the DIN rail holder on the bottom (①) onto the DIN rail.
02. Push the top part of the converter (②) toward the DIN rail to lock it in place.



Removal
01. Push the bottom part of the converter upward and slightly lift it off the DIN rail.
02. Tilt the converter outward to remove it from the DIN rail.

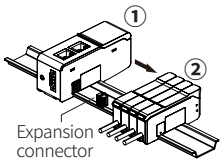
- Install end plates (BK-BFN-B, sold separately) on each end to secure the converter. When installing the screws, tighten with a torque less than 0.59 N m.

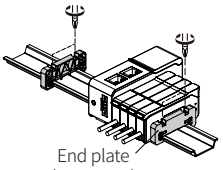
Connecting Communication Converters with Amplifiers

- This installation example is based on the BFNC-EC model. The external appearance and connector positions may differ depending on the model. Please refer to the specifications of each model before installation.

⚠
01. Turn off the power before starting installation.
02. Do not apply excessive force to the side connector.
Failure to do so may result in damaging or bending the connector pins.
03. Make sure the side connector is tightly and securely connected.
Failure to do so may result in reduced performance or product malfunction..
04. When using BFNC-EC/CL, connect the power only to the comm. converter.
05. Do not connect separate power supplies to the communication converter (BFNC-EC/CL) and the fiber optic amplifier.

01. Install the comm. converter (①) onto the DIN rail.
02. Mount the amplifiers (②) one by one onto the DIN rail in the correct order.
Check the mounting direction and order of each amplifier, and make sure to follow the amplifier installation instructions. If the expansion connector is covered with a protective cap, remove the cap before connecting the units.
03. Push the side connector on the right side of the converter toward the expansion connector of the amplifier to make the connection. Check that the connectors are securely and tightly connected.
04. Check that all devices are firmly mounted and all connectors are properly engaged.
05. If a side connector of an amplifier is exposed after installation, reattach the protective cap to cover it.
06. Install the end plates (BK-BFN-B, sold separately) on both ends of the entire unit, and tighten the screws with a torque less than 0.59 N m to fix the position.

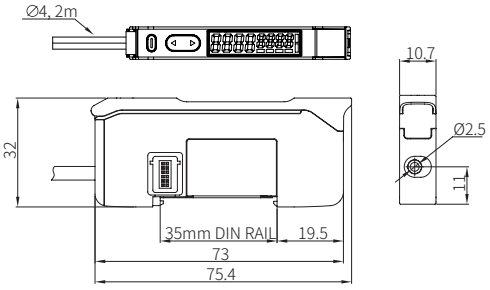




Dimensions

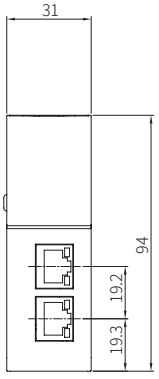
- Unit: mm (Refer to the CAD files from the Autonics website for exact dimensions)

■ BFNC

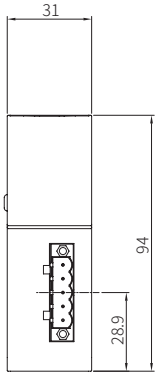


■ BFNC-EC/CL

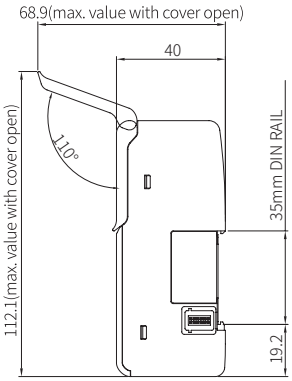
BFNC-EC

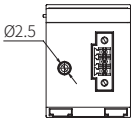


BFNC-CL

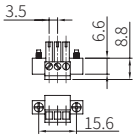


- Protective cover fully open

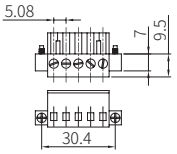




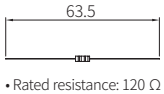
■ Power Connector (BFNC-EC/CL)



■ Comm. Connector (BFNC-CL)



■ Termination Resistor (BFNC-CL)



- Rated resistance: 120 Ω
- Tolerance: ± 1%
- Rated power: 0.25 W (1/4 W)
- Resistor type: Metal Film Resistor

Specifications

Model	BFNC	BFNC-EC	BFNC-CL
Display	FND display (green: 4-digit, white: 4-digit)	Status indicator × 5	Status indicator × 4
Communication	RS-485	EtherCAT	CC-Link
Power voltage	10 - 30 VDC⎓ (ripple P-P: ≤ 10%)		
Power supply	Side connector (amplifier)	Power connector (3-pin)	Power connector (3-pin)
No. of amplifier expansion units	≤ 30 units	≤ 16 units	≤ 16 units
Current consumption	≤ 80 mA (10 VDC⎓), ≤ 50 mA (30 VDC⎓)	≤ 300 mA (10 VDC⎓), ≤ 200 mA (30 VDC⎓)	≤ 200 mA (10 VDC⎓), ≤ 140 mA (30 VDC⎓)
Amp. allowable current	— 01)	≤ 2 A 02)	≤ 2 A 02)
Amp. connection	Via side connector		
Input	NPN / PNP non-contact input	—	—
Connection	Cable type	—	—
Cable specification	Ø 4 mm, 4-wire, 2 m	—	—
Wire specification	AWG23 (0.08 mm, 60-core), insulator outer diameter: Ø 1.25 mm	—	—
Certification	CE UKCA cULus KC	CE UKCA cULus KC	CE UKCA cULus KC
Weight (packaged)	≈ 73 g (≈ 137 g)	≈ 81 g (≈ 125 g)	≈ 75 g (≈ 128 g)

01) Power is not supplied to the amplifier.
02) The value indicates the total current supplied to connected or expanded amplifiers.
Ensure that the total current consumption of the connected amplifiers does NOT exceed the allowable limit.

Protection circuit	Reverse power protection circuit, surge protection circuit
Insulation resistance	≥ 20 MΩ (500 VDC⎓ megger)
Dielectric strength	Between charging part and case: 1,000 VAC~ 50/60 Hz for 1 min
Vibration resistance	1.5 mm double amplitude at frequency 10 to 55 Hz in each X, Y, Z direction for 2 hours
Shock resistance	500 m/s² (≈ 50 G) in each X, Y, Z direction for 3 times
Ambient temperature	-10 to 50 °C, storage: -20 to 70 °C (no freezing or condensation)
Ambient humidity	35 to 85% RH, storage: 35 to 85% RH (no freezing or condensation)
Installation	35 mm DIN rail installation
Protection rating	[BFNC] IP40 (IEC standard) [BFNC-EC/CL] IP20 (IEC standard)
Material	Case, cover: PC

Communication Interface

■ RS-485

Communication protocol	Modbus RTU
Application standard	EIA RS-485 compliant
Comm synchronization method	Asynchronous
Communication method	2-wire half duplex
Transmission speed	1,200 / 2,400 / 4,800 / 9,600 / 19,200 / 38,400 / 57,600 / 115,200 (default) bps
Transmission medium	RS-485 compliant or Modbus Association certified cable
Cable length	≤ 1 km
Address setting	FND display and button
Address range	1 to 99
Topology	Daisy Chain, Bus, Drop Line, Trunk
Start bit	1-bit
Data bit	8-bit
Parity bit	None (default), Even, Odd
Stop bit	1-bit, 2-bit (default)

■ EtherCAT

Communication protocol	EtherCAT
Association certification 01)	EtherCAT Conformance tested
Ethernet standard	100BASE-TX (IEEE802.3u)
Transmission speed	100 Mbps
Transmission medium	Category 5e STP or ETG certified cable
Cable length	≤ 100 m
Communication connector	RJ45 × 2
Node address setting	Hexadecimal rotary switch × 3
Node address range	0 to 4095
Topology	Daisy Chain
Communication function	Process Data Object Communication (PDO) / Mailbox Communication (CoE Compliant)
ESI file	Download from Autonics website

01) EtherCAT® is registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany

■ CC-Link

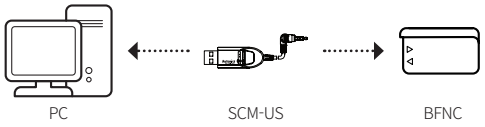
Communication protocol	CC-Link Ver. 1.1 / Ver. 2.0
Association certification	CC-Link
Remote station type	Remote device station
Transmission speed	156 kbps / 625 kbps / 2.5 Mbps / 5 Mbps / 10 Mbps
Transmission medium	CLPA certified cable
Distance between nodes	≥ 20 cm
Cable length	Varies depending on transmission speed 156 kbps ≤ 1,200 m / 625 kbps ≤ 900 m / 2.5 Mbps ≤ 400 m 5 Mbps ≤ 160 m / 10 Mbps ≤ 100 m
Communication connector	5-pin PCB × 1
Node address setting	Decimal rotary switch × 2
Node address range	1 to 64
Number of stations	Ver. 1.1: 1, 2, 3, or 4 stations Ver. 2.0: 3 stations 2 cycles
Topology	Daisy Chain, Bus, Drop Line, Trunk
CSP+ file	Download from Autonics website

Serial Communication

- Use the serial communication converter (SCM-US, sold separately) to connect the product to the DAQMaster software. (For maintenance purposes only)
- DAQMaster must be installed on the PC.
- In the parameter settings, 'Communication mode' to COM USB (serial communication mode).
- Be sure to set the same communication port and address on the product and DAQMaster software.

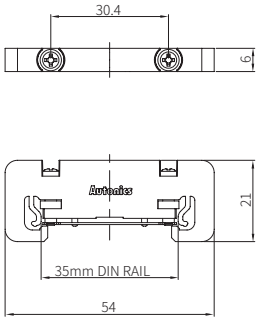
■ Connecting to the PC

01. Connect the serial communication converter (SCM-US, sold separately) to the serial communication port on the product.
02. Connect the SCM-US to the PC.
03. Proceed with settings in the DAQMaster software.
For the detailed information, refer to the 'DAQMaster Software User Manual.'



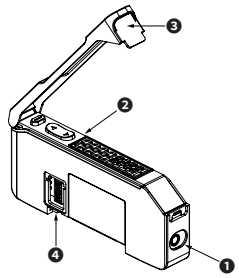
Sold Separately: End Plate (BK-BFN-B)

- Unit: mm (Refer to the CAD files from the Autonics website for exact dimensions)



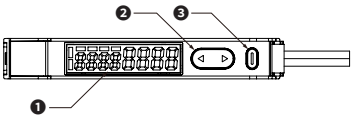
BFNC

Unit Description



❶ **SCM-US connection terminal**
❷ **Display·Operation part**
❸ **Protective cover**
❹ **Side connector**

■ Display / Operation



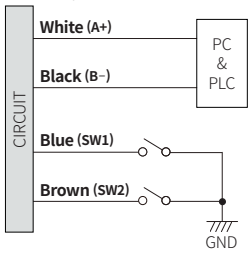
❶ **Display**
Displays the communication standby or active status.
❷ **[◀] [▶] (UP / DOWN) key**
Changes setting values in communication settings.
❸ **[MODE] key**
Enters communication settings from communication standby.

Wiring and Circuit Diagram

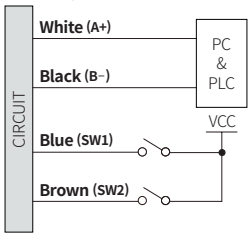
- Configure the SW input power to match the BFN power specifications. Failure to do so may result in product malfunction or damage.

Wire color	Function
White	A+
Black	B-
Blue	SW 1
Brown	SW 2

- Communication mode: SW
- Switch input method: NPN



- Communication mode: SW
- Switch input method: PNP



Alarms

Display		Alarm description
ErrA	E001	NVM error
ErrA	E004	BFN configuration error
ErrA	E007	BFN response error
ErrA	E008	BFN CRC error
Errb	NNnn	BFN error

Parameter Settings

- While in communication standby, press the [MODE] key for over 3 seconds to enter communication settings.
  Display: COM PARA will flashe twice, then automatically enter parameter settings.
- [MODE] key: save and move to next setting / [◀ / ▶] key: change setting vlaue

Parameter		Display		Setting Value	Comm. Mode
C-1	Comm. mode	Com	485	COM USB: USB communication COM 485: RS-485 communication SW BANK (0/1/2): SW input	
C-2	Comm. address	Adr5	01	01 to 99 • Same communication address not allowed in the network.	COM USB, COM 485
C-3	Comm. speed	bPS	1152	1200/2400/4800/9600/192k/384k/576k/1152	
C-4	Parity bit	PrtY	nonE	NONE, EVEN, ODD	
C-5	Stop bit	StoP	2bit	1BIT, 2BIT	
C-6	Switch input method	tYPE	nPn	NPN, PNP	SW BANK

Communication Settings

■ Communication Mode: USB / RS-485

Status	Display		Description
Comm. standby	YAIt	----	Waits for communication.
Run teaching command	tCHI	----	Runs teaching on expanded amplifier units via master command.
Run LOAD command	LoAd	bAnD	Runs LOAD on expanded amplifier units via master command.
Run SAVE command	SAvE	bAnD	Runs SAVE on expanded amplifier units via master command.
Run initialization command	Init	----	Runs initialization (reset) on expanded amplifier units via master command.

■ Communication Mode: SW

- Connect an external switch to load a BANK into the expanded amplifier units.

Display		Setting Operation
SEt	bAnD	Waits for communication.
SY0	bAnD	Selects BANK 0–2 by inputting external switch for more than 3 seconds.
LoAd	bAnD	Enters BANK LOAD.
CH01	oE	Runs LOAD command on each channel. Includes expanded amplifier units.
LoAd	End	LOAD completed. Enters communication standby status.

- BANK is selected based on C-6 switch input method setting and external switch input.

	NPN		PNP	
	SW1 (Blue)	SW2 (Brown)	SW1 (Blue)	SW2 (Brown)
Comm. standby	H	H	L	L
BANK 0	H	L	L	H
BANK 1	L	H	H	L
BANK 2	L	L	H	H

■ Communication Speed Settings

Display (setting value)	Communication Speed (bps)
1200	1200
2400	2400
4800	4800
9600	9600
192E	19200
384E	38400
576E	57600
1152	115200

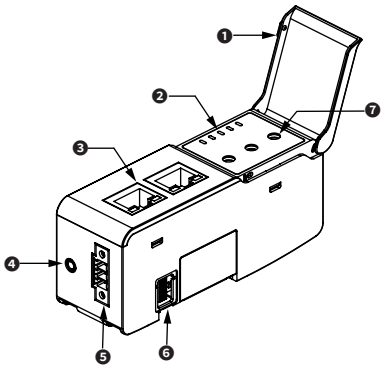
Segment Table

The actual display on the product represents the following letters and numbers on each type of segment display. The display may differ depending on the product.

7-Segment		11-Segment		12-Segment		16-Segment	
0	0	I	I	0	0	I	I
1	1	J	J	1	1	J	J
2	2	K	K	2	2	K	K
3	3	L	L	3	3	L	L
4	4	M	M	4	4	M	M
5	5	N	N	5	5	N	N
6	6	o	O	6	6	o	O
7	7	P	P	7	7	P	P
8	8	Q	Q	8	8	Q	Q
9	9	R	R	9	9	R	R
A	A	S	S	A	A	S	S
b	B	T	T	b	B	T	T
C	C	U	U	C	C	U	U
d	D	V	V	d	D	V	V
E	E	W	W	E	E	W	W
F	F	X	X	F	F	X	X
G	G	Y	Y	G	G	Y	Y
H	H	Z	Z	H	H	Z	Z

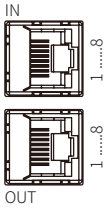
BFNC-EC

Unit Description



❶ Protective cover
❷ Indicator
❸ EtherCAT communication connector
❹ SCM-US connection terminal
❺ Power connector
❻ Side connector
❼ Address setting switch

Connector

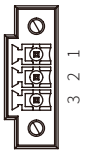


• **EtherCAT Communication Connector**

Pin	T568A wire color	Signal (Description)
1	Green / White	TD + (Transmit Data +)
2	Green	TD - (Transmit Data -)
3	Orange / White	RD + (Receive Data +)
6	Orange	RD - (Receive Data -)

• **RJ45 LED (Green)**

Status	Description
OFF	No connection
ON	CABLE connected - no communication
Flash	CABLE connected - communication exchange



• **Power Connector**

Pin	Signal (Description)
1	FG (Frame Ground)
2	- (System power: 0 VDC)
3	+ (System power: 10 to 30 VDC)

Switch







• **DEVICE ID**

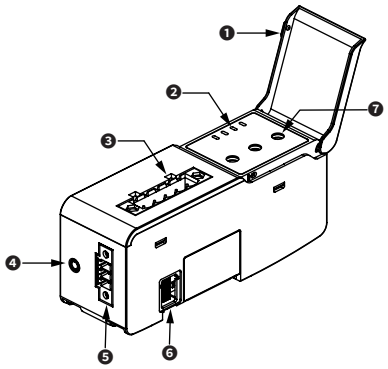
Rotary Switch (Hexadecimal)	Address
000 to FFFh	0 to 4095

Indicator

Indicator	LED Color	Status	Description
POWER	Green	ON	Input voltage
		OFF	No input voltage
SYSTEM	Green	ON	Normal operation
		OFF	Error occured
	Red	Flash ×1	Internal data error (non-recoverable)
		Flash ×2	Communication setting error
		Flash ×3	Rotary switch change during operation (recoverable)
		Flash ×4	Initial sensor configuration error
		Flash ×5	Field network initialization failed (non-recoverable)
		Flash ×6	Field network error (non-recoverable)
		Flash ×7	No response from sensor during BFN communication
		Flash ×8	CRC error occured during BFN sensor communication
SENSOR	Green	ON	BFN normal
		OFF	BFN error occured
	Red	ON	BFN error occured
		OFF	BFN normal
RUN	Green	OFF	EtherCAT INIT status
		Flash	EtherCAT PRE-OPERATIONAL status
		Flash ×1	EtherCAT SAFE-OPERATIONAL status
		ON	EtherCAT OPERATIONAL status
ERR	Red	OFF	Normal operation
		Flash	Setting error
		Flash ×1	LOCAL error
		Flash ×2	Application error

BFNC-CL

Unit Description



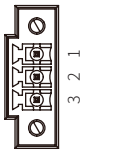
❶ Protective cover
❷ Indicator
❸ CC-Link communication connector
❹ SCM-US connection terminal
❺ Power connector
❻ Side connector
❼ Address setting switch

Connector



• CC-Link Communication Connector

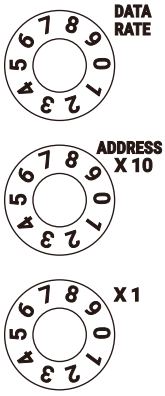
Pin	Signal	Color	Description
1	DA: Data A	Blue	RS-485 High signal
2	DB: Data B	White	RS-485 Low signal
3	DG: Data Ground	Yellow	RS-485 signal ground
4	SH: Shield	-	Shield
5	FG: Frame Ground	-	Frame ground



• Power Connector

Pin	Signal (Description)
1	FG (Frame Ground)
2	- (System power: 0 VDC)
3	+ (System power: 10 to 30 VDC)

Switch



• DATARATE

No	Baud Rate	Max. Overall Cable Distance
0	156 kbps	≤ 1200 m
1	625 kbps	≤ 900 m
2	2.5 Mbps	≤ 400 m
3	5 Mbps	≤ 160 m
4	10 Mbps	≤ 100 m

No	Operation Mode	Station Configuration	No. of Link Points	
			RX/RY	RWw/RWr
5	Small Mode	Ver. 1.1 1-station, 1x	32	4
6	Monitor Mode 1	Ver. 1.1 2-station, 1x	64	8
7	Monitor Mode 2	Ver. 1.1 3-station, 1x	96	12
8	Full Mode 1	Ver. 1.1 4-station, 1x	128	16
9	Full Mode 2	Ver. 2 3-station, 2x	160	24

• ADDRESS

Rotary Switch (Decimal)	Address
01 to 64	1 to 64

Indicator

Indicator	LED Color	Status	Description
POWER	Green	ON	Input voltage
		OFF	No input voltage
SYSTEM	Green	ON	Normal operation
		OFF	Error occured
	Red	Flash ×1	Internal data error (non-recoverable)
		Flash ×2	Communication setting error
		Flash ×3	Rotary switch change during operation (recoverable)
		Flash ×4	Initial sensor configuration error
		Flash ×5	Field network initialization failed (non-recoverable)
		Flash ×6	Field network error (non-recoverable)
		Flash ×7	No response from sensor during BFN communication
		Flash ×8	CRC error occured during BFN sensor communication
SENSOR	Green	ON	BFN normal
		OFF	BFN error occured
	Red	ON	BFN error occured
		OFF	BFN normal
L RUN/ERR	Green	ON	CC-Link network connected
		OFF	Waiting for connection, communication line not detected, communication timeout, hardware reset in progress
	Red	ON	CRC error
		OFF	Normal operation, hardware reset in progress

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