# A Return To Simplified Sensing

A Genuine All-Purpose Solution

Easier and More Stable Than Ever Before

A SIMPLE and RELIABLE Solution for Any Application

Fiber optic sensors provide a variety of solutions that are unmatched by any other type of sensor. The high-powered, yet precise, amplifier combines with a variety of flexible and compact fiber heads to tackle all sensing needs.
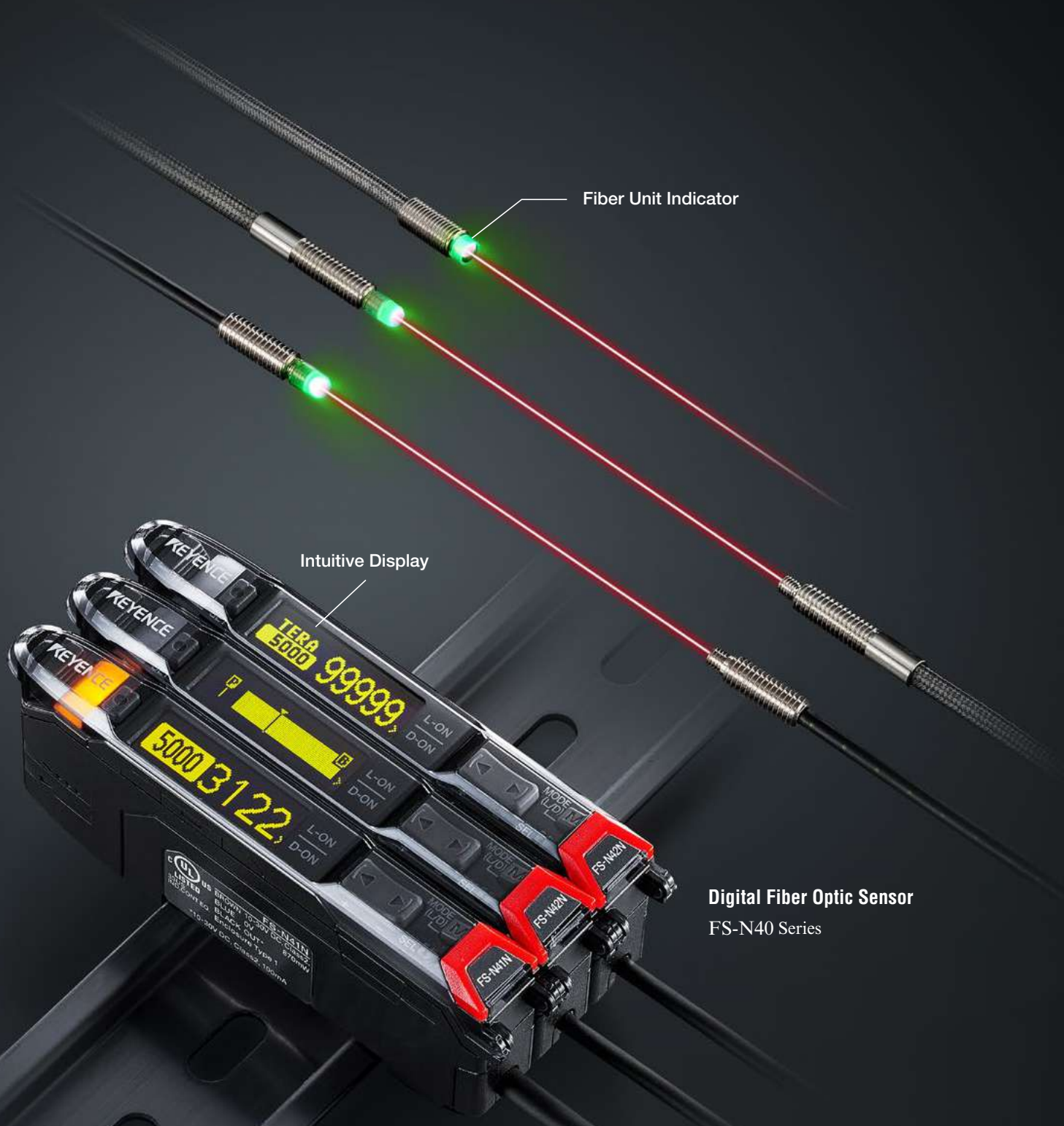
Fiber Unit Indicator

Intuitive Display

Digital Fiber Optic Sensor
FS-N40 Series

THE POWER OF
FIBER OPTIC SENSING

FLEXIBLE

Handle any and all applications with one high-powered amplifier and a variety of head options.

• **Detect Anything**
• **Detect Anywhere**

SIMPLE

Setup is handled quickly and easily with this intuitive amplifier.

• **Easy to Read Display**
• **Innovative Fiber Units**

RELIABLE

Detection remains stable in any situation or environment.

• **Built-In Preventive Maintenance**
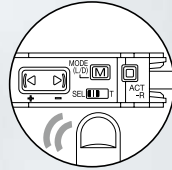• **Clear Status Indication**

3

Flexible

Enhanced power makes the FS-N40 Series more capable than ever before.

Power Select Switch

TERA Switch

Go from standard to high-power with the flick of a switch
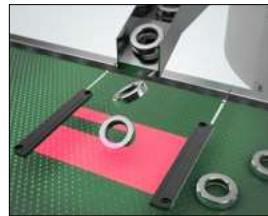
NEO Parabolic LED

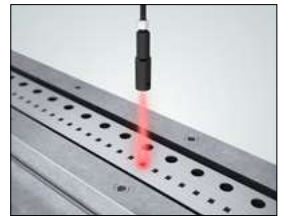## Detect Anything

**Contrasts/
Surface Finishes**

**Distant
Targets**

**Transparent
Targets**

**Targets in
Varying Positions**

**Small
Targets**

Detect Anywhere

**Tight
Spaces**

**Oily/Wet
Environments**

**High Temperature
Enviroments**

**Environments with
Chemicals**

**On Robotic
Arms**

Long Range and Stable Detection with Any Head

With industry leading high-power, the FS-N40 Series enables long range detection with even the thinnest of fiber heads. This also ensures detection remains stable in environment where build-up occurs.

		Previous (FINE)	FS-N40 (TERA)	
Thrubeam	[1 mm 0.04" Cylindrical]	**140 mm** 5.51"	▶	**800 mm** 31.50"
Reflective	[M3 Threaded]	**72 mm** 2.83"	▶	**590 mm** 23.23"

Increased Detection Capabilities

The FS-N40 Series has not only increased its power, but has also greatly improved its signal to noise ratio. This allows for consistent and reliable detection of changes in contrast, surface finish, and position.

Contrast changes
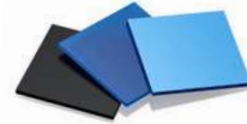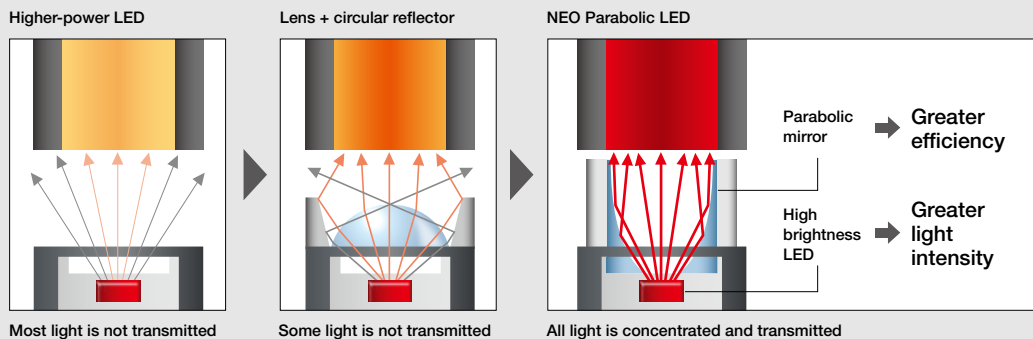
Surface finish changes

Simple position changes

Deeper Understanding

New LED Module - "NEO Parabolic LED"

The high-power of the FS-N40 Series is derived from the use of a new LED module. This module boasts a high brightness LED and efficient circuit design, along with a parabolic mirror that ensures the majority of the light is transmitted into the fiber optic cable.

❚**Evolution of LED Modules**

Higher-power LED	Lens + circular reflector	NEO Parabolic LED

Parabolic mirror ➡ **Greater efficiency**

High brightness LED ➡ **Greater light intensity**

Most light is not transmitted

Some light is not transmitted

All light is concentrated and transmitted

Simple

Easy to Read Display

No manuals required with this easy to understand interface.

■Conventional Display

■FS-N40 Display

A Power Modes

B Light ON

Innovative OLED Display

The introduction of an OLED display places the FS-N40 Series leaps-and-bounds ahead of conventional fiber amplifiers. The ability to see clear and detailed information on a single screen dramatically reduces setup time.

D Detection Mode

S Initialize

Bar Graph Display

Simplify the display even further by representing the light intensity as a bar graph. This comes complete with a threshold point indicator and peak/bottom value flags.

Peak value   ON/OFF point   Bottom value

## Easily Understandable Messages

No need to decipher cryptic display messages. Identify any issues or scenarios that the sensor may be experiencing by simply reading the display.

System Error	Keys Locked
Low Intensity	Check Dip Switch
Saturate Cancel	PIN Code

Fiber Units with Built-In Indicators

Quickly and easily recognize
the sensor status by simply looking at
the fiber head
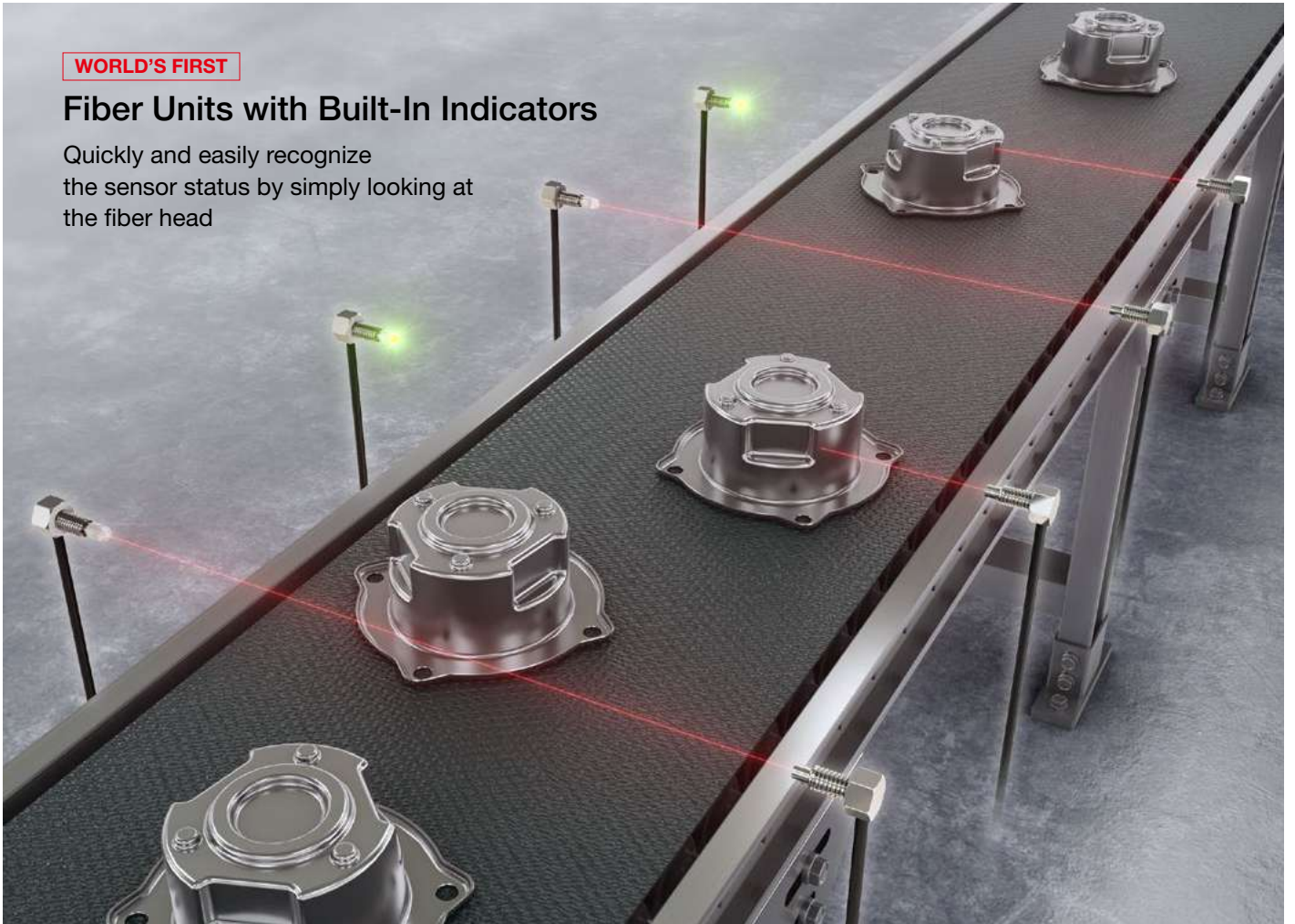
Integrated ON/OFF Status Indicators

It is no longer necessary to look inside of a control box and locate the proper amplifier to determine the detection status of a specific sensor. These innovative fiber heads, will light in Green when the output is ON for immediate recognition of the sensor status.

Alignment Assistance

Alignment has never been simpler with Optical Axis Assistance. The fiber unit illuminates when the two heads are aligned, eliminating the guesswork and time associated with alignment.
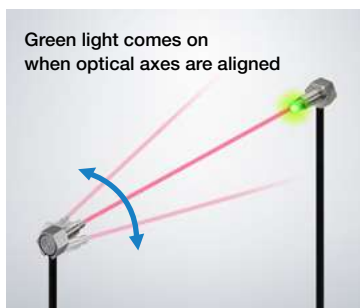
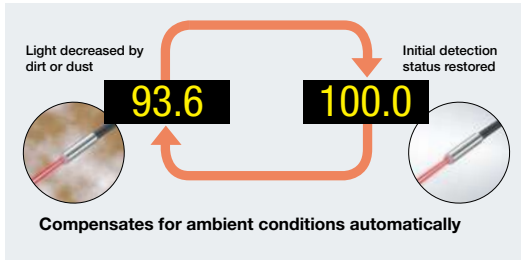**Green light comes on when optical axes are aligned**

Easy Head Identification

Quickly recognize which head is being programmed by lighting the fiber head in green. This prevents any unnecessary confusion during setup.

7

Reliable

Built-In Preventive Maintenance Features

Harsh Environment Adjustment

Datum mode automatically adjusts the live and set values to compensate for build-up and maintain stable detection.

Light decreased by dirt or dust

93.6

100.0

Initial detection status restored

**Compensates for ambient conditions automatically**

Automatic Power Control

When high precision detection is of the utmost concern, the light intensity can be automatically regulated to ignore the effects of power fluctuations.

Interference Prevention

Prevent interference between up to 16 units that are connected together (KEYENCE 1-Line System), or 2 units that are not connected together.

1 Detects ambient light

**2** Shifts emission periods

Ambient light
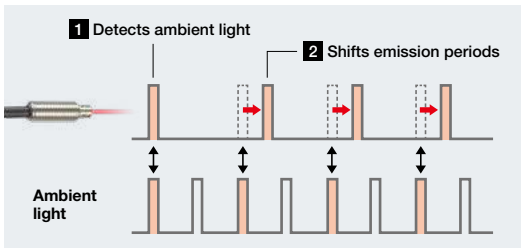
Heat Sink

Concerns about heat generation, and temperature induced strain on internal component, are eliminated with the built-in heat sink.

Customizable Interface for Clear Status Indications

Uniform Calibration and Display

With the push of a button, the set value and current value can be automatically calibrated to 50.0% and 100.0% respectively. This enables easy identification of detection statuses and maintenance needs at a glance.

Maintenance required

Low intensity
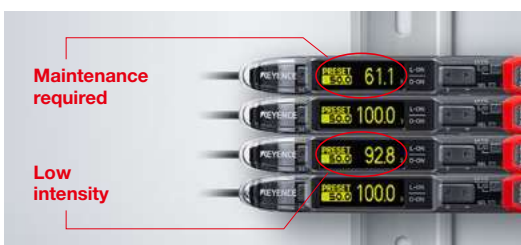
Various Display Option

The FS-N40 Series offers countless display and sub-display options. This allows users to view the data how they see fit and ensures clear understanding.

Additional Features

Highly Visible Indicator

The highly visible indicator, with an area 8.7x larger than conventional models, ensure that the ON/OFF status of the sensor can be seen from a distance.

Saturation Canceling

A simple button combination is all that is needed to eliminate saturation and ensure stable detection of transparent, tiny, or highly reflective targets.

Network Compatibility

Industrial network integration is possible with the use of the KEYENCE NU Series. Multiple network options are available!

EtherNet/IP™
DeviceNet™
CC-Link V2
EtherCAT.

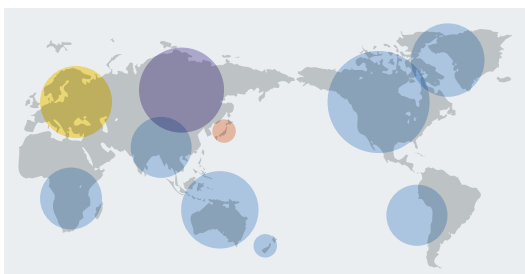## IO-Link Compatibility

(FS-N41C Only)

The FS-N41C amplifier can communicate a large variety of information over IO-Link. This includes the live value, set value, settings, and much more.
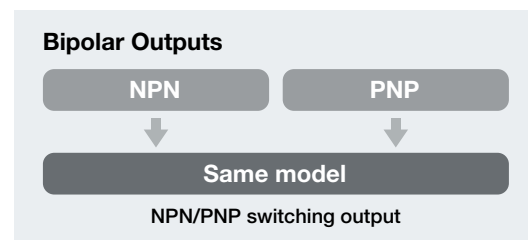

IO-Link

Selectable Language Options

Language selection options for English, Japanese, Chinese, and Germen have been added to guarantee global ease-of-use.

Bipolar Outputs

(FS-N41C Only)

Regardless of NPN or PNP output needs, only one part number is required. The FS-N41C offers a bipolar selectable output.

Bipolar Outputs

NPN	PNP

Same model

NPN/PNP switching output

Multi-Output Unit

Dramatic Reductions in Cost and Time

Reduce Startup, Operation, and Maintenance Workloads

Multi-Output Unit
FS-MC8N/P

Fibers and cables on one side ONLY

Reduced Cables

The Multi-Output Unit provides a clean cable layout with just one power supply/output cable coming from the device. Replacing or adding sensors has also never been easier; since now there is no longer a need to reroute cables.

Conventional Units

Terminal block

Multi-Output Unit

Terminal block
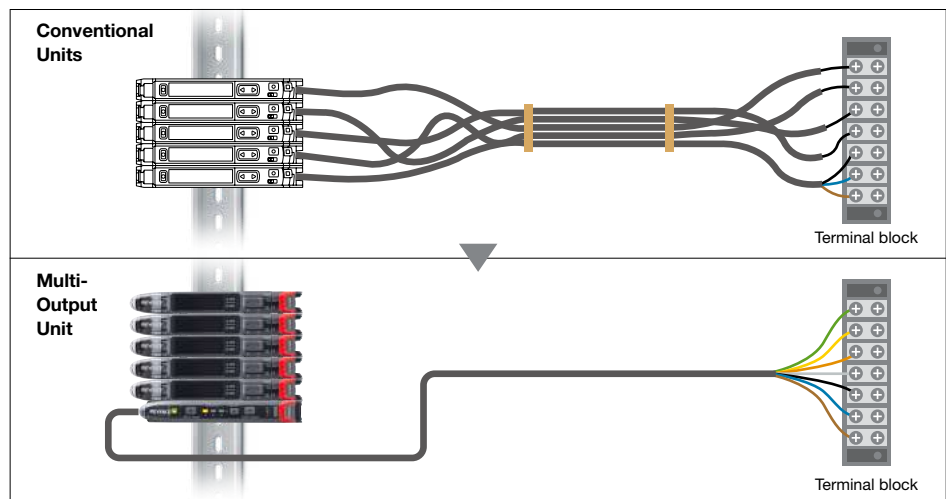
Memory Function

The settings for up to 8 connected amplifiers can be saved on the Multi-Output Unit. If any of the amplifiers need to be replaced, the settings can be batch written to the new amplifiers, eliminating the need for any manual recalibration. Up to 3 memory banks can be configured to provide easy changeover between different runs on a machine.

Benefits During Every Stage of Use

Setup	Changeover	Troubleshooting	Maintenance
Duplicate settings for fiber amplifiers installed on standard machines.	Quickly switch between 3 bank of settings when running different parts.	Return the sensors to their correct settings with the push of a button.	When replacing a unit, transfer necessary settings in seconds.

# Easily Add Amplifiers without Extra Wiring

Adding amplifiers is a breeze with only one cable needing to be routed for the entire setup. Route this multi-core cable once and simply connect amplifiers as they become necessary.

Versatile Wiring and Expansion Options
Options for Any Situation

When Network Compatibility is Necessary

Network Communication Unit
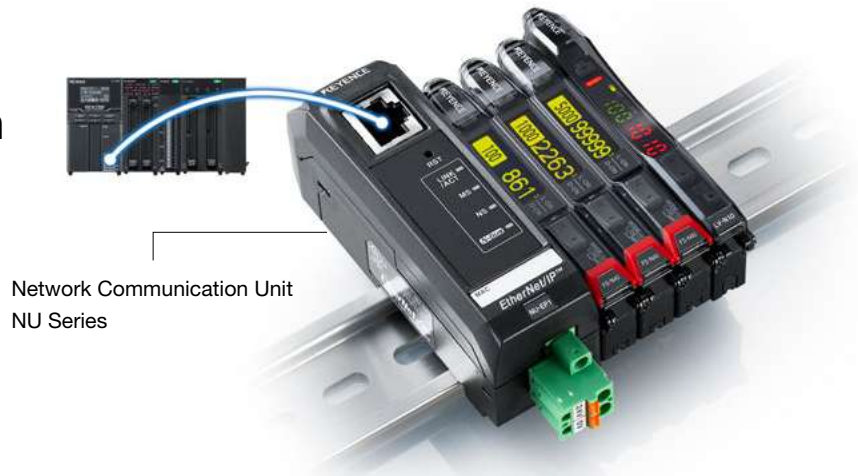
Network Communication Unit
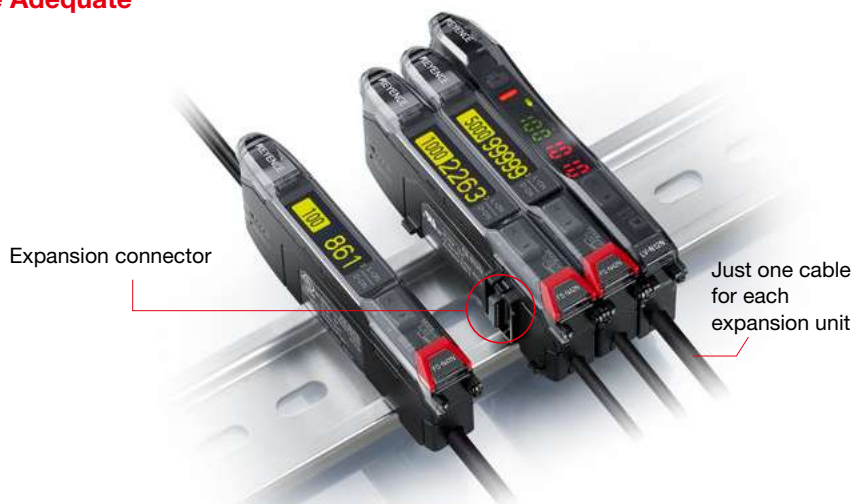NU Series

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When Saving Space is Important

Multi-Output Unit

Multi-Output Unit
FS-MC8N/P

Simplified wiring

When Standard Connections are Adequate

Main Unit + Expansion Units

Expansion connector

Just one cable for each expansion unit

Compatible with a range of open industrial networks

▎Control multiple sensors at once via network communication

EtherNet/IP™   **DeviceNet™**   **CC-Link V2**   **EtherCAT®**

*EtherCAT® is registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

Increase Efficiency During Startup, Operation, and Maintenance

▎Memory function enables speedy settings recovery and easy changeover

▎Drastically decreases the number of necessary cables

Simplified Wiring	Easy Program Changeover	Effortless Maintenance

Best-Selling and Reliable Simplified Wiring

▎Connect up to 17 amplifiers, featuring stable interference prevention

Lineup

Amplifier Units

Cable type

Main unit

Expansion unit

Type		Model		Control outputs	External input
		NPN output	PNP output		
Standard	Main unit	**FS-N41N**	**FS-N41P**	1	0
	Expansion unit	**FS-N42N**	**FS-N42P**		
2-Output	Main unit	**FS-N43N**	**FS-N43P**	2	1
	Expansion unit	**FS-N44N**	**FS-N44P**		

M8 Connector type

IO-Link

Type	Model	Control outputs	External input
	Switchable between NPN/PNP output		
Main unit	**FS-N41C**	2*	1*

*Switchable between 2 control outputs or 1 control output + 1 external input.
The system is not compatible with expansion units.

Zero line type

Type	Model	Control output
Expansion unit	**FS-N40**	None*

*Counted as 1 output if expanded with Multi-Output Unit FS-MC8N/P or the NU Series communication unit.

Multi-Output Units

Type		Model		Separate control outputs	Common output	Common input
		NPN output	PNP output			
Main unit		**FS-MC8N**	**FS-MC8P**	8	1	1

Optional Parts (sold separately*1)

	Description	Model
Amplifier securing bracket (for main unit)	OP-88245	**OP-88245**
End units*1 (when using expansion units)	OP-26751 (Set of 2)	**OP-26751**
M8 connector cable 2 m 6.6'/10 m 32.8'	2 m 6.6' type **OP-73864**	
	10 m 32.8' type **OP-73865**	
Expansion converter unit	This adapter allows the FS-N40 series to connect to non-NEO type expansion units using the KEYENCE 1-Line System.	**OP-87199**

*1 Multi-output units come with end units.

Network Units

Type	Appearance	Network	Model
Communication unit		EtherNet/IP™	**NU-EP1**
		DeviceNet™	**NU-DN1**
		EtherCAT®	**NU-EC1**
		CC-Link	**NU-CL1**

Network Unit Optional Parts (sold separately)

Model	Type
OP-79426	Version 1.10 supported CC-Link dedicated cable 20 m 65.6'
OP-79427	Version 1.10 supported CC-Link dedicated cable 100 m 328.1'
OP-51504	STP (Shielded twisted-pair) cable 0.2 m 0.7'
OP-51505	STP (Shielded twisted-pair) cable 0.5 m 1.6'
OP-51506	STP (Shielded twisted-pair) cable 1 m 3.3'
OP-51507	STP (Shielded twisted-pair) cable 3 m 9.8'
OP-51508	STP (Shielded twisted-pair) cable 5 m 16.4'
OP-51509	STP (Shielded twisted-pair) cable 10 m 32.8'
OP-84338*1	e-CON connector (2 pieces included)

*1 Use a cable with sheath outer diameter of 1.15 to 1.35 mm 0.045" to 0.053" and wire range of 0.1 to 0.5 mm² 0.000155 to 0.000775"². To connect a device using a cable other than as specified above, prepare an e-CON connector that conforms with its wire diameter.

Fiber Unit Index

Solve Any and All Applications

Fiber Units
FU Series
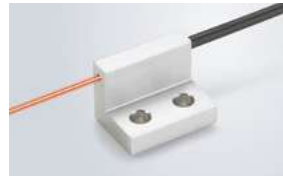
Mounting/Space Constraints

Integrated Bracket Fibers

The fiber is already integrated into a L-shaped bracket for quick and painless installation.

Thrubeam Models
P20

Reflective Models
P27

Threaded and Hex-shaped Fibers

Threaded models can be easily mounted to a machine with one or two nuts. Hex-shaped model provide easy cable routing and prevent snagging.

Thrubeam Models
P20

Reflective Models
P26

Difficult Detection Targets

Long Distance Targets

By focusing the light being emitted, these fibers can see targets at distances that are too far for conventional fibers.
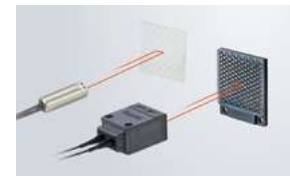
Thrubeam Models
P21

Reflective Models
P28

Transparent Targets

The use of a reflector allows these fibers to stably detect transparent targets with ease.

Retro-Reflective Models
P34

Demanding Environments

High Traffic/Guarded

Perfect for high traffic environments, these guarded fibers will not be damaged by crushing, pinching, or snagging.

Thrubeam Models
P19

Reflective Models
P19

Oil/Chemical Exposure

The fluorocarbon resin coating allows these fiber units to be used in locations where oil or chemical exposure is constant.

Thrubeam Models
P23

Reflective Models
P32

Flat Bracket Fibers

These low profile fibers provide a compact design and integrated mounting holes for easy installation in tight spaces.
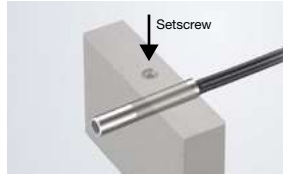
Thrubeam Models

P22

Reflective Models

P30

Cylindrical Fibers

These fibers can fit in nearly any location and are held in place with a set screw.

Setscrew

Thrubeam Models

P21

Reflective Models

P27

Sleeve Type Fibers

These fibers feature a thin sleeve that can be routed into the necessary detection location, while being secured somewhere else.

Thrubeam Models

P22

Reflective Models

P30

Varied Position/Falling Targets

By looking over an area, instead of a fixed point, it is possible to detect falling targets or targets that are not in repeatable positions.

Thrubeam Models

P24

Reflective Models

P33

Small Targets

With the use of built-in or attachable lenses, the light is focused to a fine point for consistent small target detection.

Reflective Models

P28

Liquid Levels

It is possible to reliably detect liquid levels using fibers. This can be done through immersion or by attaching them to a transparent tube.

Reflective Models

P33

Robotic Arms/Constant Motion

With bend ratings of up to 50 million bends (typical value), these fibers are ideal for robotic integration or anywhere consistent bending occurs.

Thrubeam Models

P23

Reflective Models

P31

Vacuum Chambers

These specially designed fibers can be used in vacuum environments and still provide stable detection.

Thrubeam Models

P35

High Temperature Locations

Detect targets in high temperature environments with fibers that can withstand temperatures of up to 350°C 662°F.

Thrubeam Models

P24

Reflective Models

P32

Specifications

▌ Amplifier Units

Model	NPN output	FS-N41N	FS-N42N	FS-N43N	FS-N44N	FS-N41C*1 (Selectable output)	FS-N40
	PNP output	FS-N41P	FS-N42P	FS-N43P	FS-N44P		
Cable/connector		Cable				M8 Connector*2	–
Main unit/expansion unit		Main unit	Expansion unit	Main unit	Expansion unit	Main unit	Expansion unit
Number of control outputs		1	1	2	2	2*3	None*4
Number of external inputs		–	–	1	1	1*3	–
Light source LED		Transmitter side: Red, four-element LED (wavelength: 660 nm)					
Response time		23 µs (S-HSPD*5)/50 µs (HSPD*6)/250 µs (FINE)/500 µs (TURBO)/ 1 ms (SUPER)/4 ms (ULTRA)/16 ms (MEGA)/64 ms (TERA)					
Control output		Open-collector, 30 V or less 100 mA or less per output, 100 mA or less total for 2 outputs (when used as a solitary unit) / 20 mA or less (when used as an expansion unit)					–
	Residual voltage	NPN 1.4 V or less (output current: 10 mA or less) / 2 V or less (output current: 10 to 100 mA) PNP 1.6 V or less (output current: 10 mA or less) / 2.2 V or less (output current: 10 to 100 mA)					–
External input		Input time: 2 ms (ON) / 20 ms (OFF) or longer*7					
Unit expansion (excluding the FS-N41C)		Up to 16 units (17 units connected in total including the main unit). However, each dual output type will be treated as two expansion units.					
Protection circuit		Protection against reverse power connection, output overcurrent, output surge, and reverse output connection					
Mutual interference prevention		S-HSPD / HSPD: 0 units, FINE: 4 units, TURBO / SUPER / ULTRA / MEGA / TERA: 8 units (The mutual interference prevention values are twice those shown here when Double is set.)					
Power supply	Power supply voltage		10 to 30 VDC (including 10% ripple (P-P) or less), class 2 or LPS*8				
	Power consumption*9	NPN FS-N40	During normal operation: 870 mW or less (34 mA or less at 24 V / 62 mA or less at 12 V) ECO ON: 800 mW or less (31 mA or less at 24 V / 56 mA or less at 12 V) ECO FULL: 710 mW or less (28 mA or less at 24 V / 49 mA or less at 12 V)				
		PNP FS-N41C	Single output type (FS-N41P / N42P) and FS-N41C During normal operation: 910 mW or less (36 mA or less at 24 V / 65 mA or less at 12 V) ECO ON: 840 mW or less (33 mA or less at 24 V / 60 mA or less at 12 V) ECO FULL: 750 mW or less (30 mA or less at 24 V / 52 mA or less at 12 V)				
			Dual output type (FS-N43P / N44P) During normal operation: 990 mW or less (39 mA or less at 24 V / 72 mA or less at 12 V) ECO ON: 920 mW or less (36 mA or less at 24 V / 66 mA or less at 12 V) ECO FULL: 830 mW or less (33 mA or less at 24 V / 59 mA or less at 12 V)				
Ambient light		Incandescent lamp: 20,000 lx or less, sunlight: 30,000 lx or less					
Ambient temperature		-20°C -4°F to +55°C +131°F (no freezing)*10					
Vibration resistance		10 to 55 Hz; double amplitude 1.5 mm 0.06"; 2 hours each for X, Y, and Z axes					
Shock resistance		500 m / s²; 3 times each for X, Y, and Z axes					
Case material		Main unit and cover: polycarbonate					
Weight		Approx. 78 g	Approx. 48 g	Approx. 83 g	Approx. 73 g	Approx. 25 g	Approx. 23 g

*1 IO-Link Specification V.1.1/COM2 (38.4 kbps) is supported.
*2 Ensure the cable length is 30 m 98.4' or less for the M8 connector type. Ensure the cable length is 20 meters 65.6' or less when connecting by way of IO-Link.
*3 Output 2 and the external input are selectable.
*4 This counts as 1 output when connecting multiple units to the FS-MC8N/P, NU Series.
*5 Restrictions when S-HSPD is selected
  • Output 2 of dual output types (FS-N43N / N43P / N44N / N44P / N41C) is fixed to OFF.
  • IO-Link communication (FS-N41C) cannot be used.
  • Area detection, Area % Mode, DATUM, Rising edge, and Falling edge cannot be selected for Detection Mode.
  • Output timer, Limit Detection, and Display Gain cannot be used.
  • FULL cannot be selected for the ECO function.
*6 Restrictions when HSPD is selected
  • Display Gain cannot be used.
*7 The input time becomes 25 ms (ON)/25 ms (OFF) when external calibration input is selected.
*8 When expanding the system to 9 or more units, use a power supply voltage of 12 V or higher.
*9 The load current is excluded. The power consumption including the load when the maximum number of units are connected is 38 W max.
*10 When expanded by 1 to 2 units: -20°C -4°F to +55°C +131°F. When expanded by 3 to 10 units: -20°C -4°F to +50°C +122°F.
   When expanded by 11 to 16 units: -20°C -4°F to +45°C +113°F. When using 2 outputs, 1 unit is counted as 2 units.
   The prescribed values for the ambient temperature assume that the sensor amplifier has been mounted on a DIN rail installed on a metal surface.
   Exercise special care when installing the product in an airtight space.

Multi-Output Unit

| Model	NPN output	FS-MC8N	
	PNP output	FS-MC8P	
Number of inputs and outputs		Separate control outputs: 8, common output: 1, common input: 1	
Response time		Depends on the response time settings of the connected expansion units	
Unit expansion		Up to 8 expansion units can be connected. (However, each dual output type will be treated as 2 expansion units.) Allowable passing current: 1200 mA or less	
Indicators		STATUS indicator (green and red two-color display) MEMORY indicator (orange) LOCK indicator (orange)	
Separate control output, common output	NPN output	NPN open-collector, 30 V or less, 20 mA or less per output, residual voltage: 1.4 V or less	
	PNP output	PNP open-collector, 30 V or less, 20 mA or less per output, residual voltage: 1.6 V or less	
External input time		Input time of the connected expansion units +11 ms	
Protection circuit		Protection against reverse power connection, reverse output connection, output overcurrent, and output surge	
Power supply	Power supply voltage[*1]	10 to 30 VDC (including 10% ripple (P-P) or less), class 2 or LPS	
	Power consumption[*2]	690 mW or less (when used as a solitary unit) (26 mA or less at 24 V/38 mA or less at 12 V [excluding the load current])	
Environmental resistance	Ambient temperature	-20°C -4°F to +55°C +131°F (no freezing)	
	Vibration resistance	10 to 55 Hz; double amplitude 1.5 mm 0.06"; 2 hours each for X, Y, and Z axes	
	Shock resistance	500 m/s²; 3 times each for X, Y, and Z axes	
Case material		Main unit and cover: polycarbonate	
Weight		Approx. 110 g	

*1 Match the rated power supply voltage of the expansion units to be connected to the system.
*2 The power consumption including the load when the maximum number of units are connected is 38 W max.
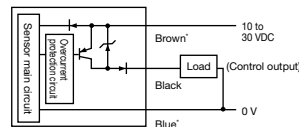
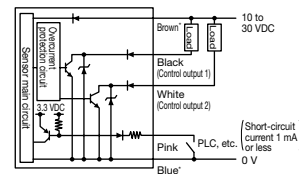# I/O Circuit Diagrams

▐ Amplifier Units (Cable Type)

FS-N41N/N42N
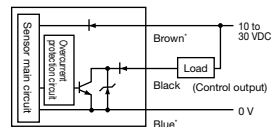
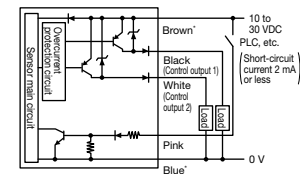
*FS-N41N only

FS-N41P/N42P

*FS-N41P only

FS-N43N/N44N
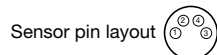

*FS-N43N only

FS-N43P/N44P

*FS-N43P only

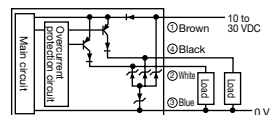## ▐ Amplifier Unit (M8 Connector Type FS-N41C)

Select PNP or NPN and the function of I/O pin (2) during the initial settings.
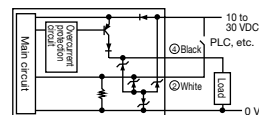
Sensor pin layout

When using the sensor in PNP mode
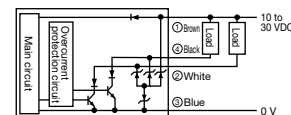
[OUT1 + OUT2 selected]

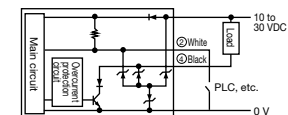

[OUT1 + INPUT selected]

When using the sensor in NPN mode
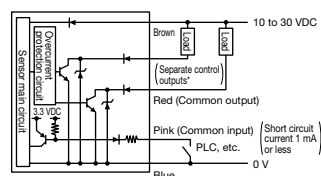
[OUT1 + OUT2 selected]
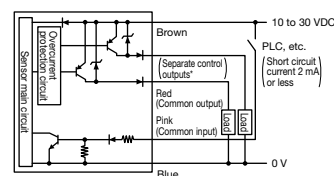

[OUT1 + INPUT selected]

The wire colors indicate the colors when using an OP-73864/73865 M8 connector cable (sold separately).

▐ Multi-Output Unit

FS-MC8N

FS-MC8P

* Black, white, orange, yellow, green, purple, gray, pink / purple