KEYENCE

96M14746

Digital Fiberoptic Sensor
FS-N40 Series
Instruction Manual

Read this manual before using the product in order to achieve maximum performance. Keep this manual in a safe place after reading it so that it can be used at any time.

For detailed FS-N40 Series setting methods and for details on the functions of the FS-N40 Series, see the "FS-N40 Series User's Manual".

■ Symbols

The following symbols are used in this instruction manual to enable the recognition of important information at a glance. Be sure to read these messages carefully.

⚠ DANGER	It indicates a hazardous situation which, if not avoided, will result in death or serious injury.
⚠ WARNING	It indicates a hazardous situation which, if not avoided, could result in death or serious injury.
⚠ CAUTION	It indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
NOTICE	It indicates a situation which, if not avoided, could result in product damage as well as property damage.

1　Before Operation

Safety Precautions

⚠ DANGER	• This product is only intended to detect objects. Do not use this product for the purpose of protecting a human body or a part of a human body. • This product is not intended for use as an explosion-proof product. Do not use this product in a hazardous location and/or potentially explosive atmosphere.
⚠ WARNING	• This is a direct current (DC) power supply type sensor. Application of an alternating current may result in explosion or fire.
NOTICE	• Use separate conduits for power lines and high-voltage lines. Use of a common conduit may result in device malfunction due to noise or damage to the sensor. • Always ground the frame ground terminal when using an off-the-shelf switching regulator. • Do not use this product outdoors.

Precautions on Regulations and Standards

■ CE Marking

KEYENCE Corporation has confirmed, on the basis of the following specifications, that this product complies with the essential requirements of the applicable EU Directive(s). Be sure to consider the following specifications when using this product in the member states of the European Union.

● **EMC Directive, applicable standard: EN60947-5-2, Class A**
Ensure that the cable length is 30 meters or less.
These specifications do not give any guarantee that the end-product with this product incorporated complies with the essential requirements of the EMC Directive. The manufacturer of the end-product is solely responsible for confirming the compliance of the end-product itself according to the EMC Directive.

■ UL Certificate

This product is a UL/c-UL certified product.
• UL File No.: E301717
• Category: NRKH/NRKH7(NRKH2/NRKH8: FS-N42N(P))
• Enclosure Type 1 (based on UL50)
Be sure to consider the following specifications when using this product as a UL/c-UL certified product.
• Use a power supply with Class 2 output defined in NFPA70 (NEC: National Electrical Code).
• Connect the power supply, external input, and control output to a single power supply with Class 2 output.
• Use OP-73864, OP-73865 or OP-85498 cable with FS-N41C when the field wiring is required.

■ FCC Regulations

This product complies with the following regulations specified by the FCC.
• Applicable regulation FCC Part 15 Subpart B Class A
• 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 interface, and (2) this device must accept any interference received, including interference that may cause undesired operation.
• FCC Caution
Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Package Contents

• Main unit　　• Instruction manual

2　Installation and Wiring

Mounting the Main Unit

■ Mounting the Main Unit on a DIN rail

1 Align the claw at the bottom of the main unit with the DIN rail, as shown in the figure. While pushing the main body in the direction of arrow 1, push down in the direction of arrow 2.

2 To remove the sensor, raise the main body in the direction of arrow 3 while pushing the main body in the direction of arrow 1.
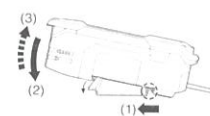
■ Installation on a wall (main unit only)

1 Attach the main unit to the optional mounting adapter (OP-88245), and then insert M3 screws into the two locations shown in the figure to secure the main unit in place.

OP-88245

Connecting Multiple Amplifiers

Up to 16 expansion units can be connected to 1 main unit. However, each dual output type will be treated as 2 expansion units.

⚠ CAUTION	When connecting to multiple amplifiers or when mounting main units together, mount the units on a DIN rail installed on a metal surface.
NOTICE	• Be sure to turn the power off before connecting multiple expansion units. • Do not touch the expansion connector.

1 Remove the protection covers from the main unit and expansion unit(s).

**2** Install the amplifiers on the DIN rail one at a time.
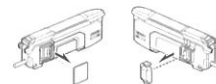
3 Slide the main unit and expansion unit(s) together. Mate the two claws of the expansion unit with the recesses on the main unit side until a click is heard/felt.
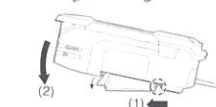
4 Attach the end units (optional, sold separately: OP-26751) to the DIN rail on both sides of the amplifiers in the same way as step (2).

5 Secure the amplifiers between the end units. Tighten the screws from the top (two screws × two units) with a Phillips screwdriver to fix the end units in place.
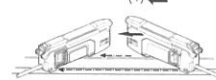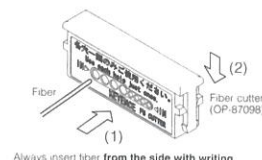
OP-26751 (a set of two)

Fiber Unit Installation

■ Using a fiber cutter

1 Insert the fiber into the cutter hole.

2 Bring down the blade in a single, swift motion to cut the fiber.
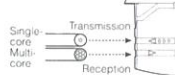(Do not use a hole that has already been used.)

Fiber　　Fiber cutter (OP-87098)

Always insert fiber from the side with writing

■ Connecting to the amplifier unit

1 Open the cover (1), and then lower the lever in the direction indicated by (2).

2 Insert the fiber unit into the installation holes (approximately 14 mm). (3)

3 Move the lever back in the direction indicated by (4).
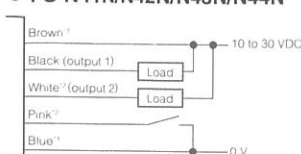
Fiber insertion sign
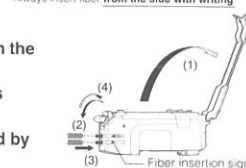
NOTICE	When installing a coaxial reflective fiber in the main unit, install the single-core fiber in the transmission installation hole and the multi-core fiber in the reception installation hole.

Single-core　Transmission
Multi-core　Reception

Wiring (Cable Type)

● FS-N41N/N42N/N43N/N44N

Brown [1]
Black (output 1)　Load
White [2] (output 2)　Load
Pink [2]
Blue [1]
10 to 30 VDC
0 V

*1 FS-N41N/N43N only
*2 FS-N43N/N44N only

● FS-N41P/N42P/N43P/N44P

Brown [1]
Black (output 1)　Load
White [2] (output 2)　Load
Pink [2]
Blue [1]
10 to 30 VDC
0 V
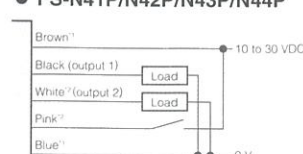
*1 FS-N41P/N43P only
*2 FS-N43P/N44P only

E FS-N40 IM

Wiring (M8 Connector Type: FS-N41C)

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

Sensor pin layout

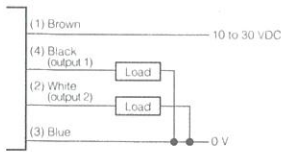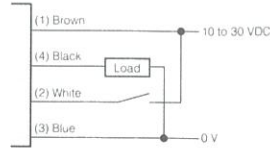> FS-N41C supports "IO-Link: Specification V.1.1/COM2 (38.4 kbps)".
> The setting file (IODD) can be downloaded from Keyence's web site
> (http://www.keyence.com).

● When using the sensor in PNP mode

OUT1 + OUT2

- (1) Brown — 10 to 30 VDC
- (4) Black (output 1) — Load
- (2) White (output 2) — Load
- (3) Blue — 0 V

OUT1 + INPUT

- (1) Brown — 10 to 30 VDC
- (4) Black — Load
- (2) White
- (3) Blue — 0 V

● When using the sensor in NPN mode

OUT1 + OUT2

- (1) Brown — 10 to 30 VDC
- (4) Black (output 1) — Load
- (2) White (output 2) — Load
- (3) Blue — 0 V

OUT1 + INPUT

- (1) Brown — 10 to 30 VDC
- (4) Black — Load
- (2) White
- (3) Blue — 0 V
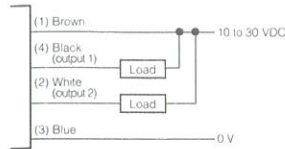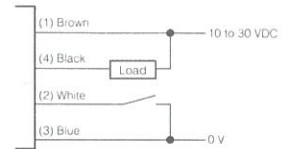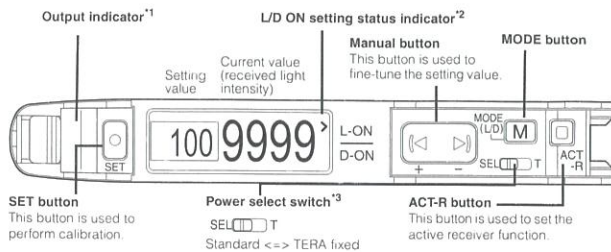
The wire colors indicate the colors when using an OP-73864/73865 M8 connector cable (sold separately).

3 Basic Settings

■ Names and functions

Output indicator[*1]
L/D ON setting status indicator[*2]
Manual button — This button is used to fine-tune the setting value.
MODE button
Setting value
Current value (received light intensity)

SET button — This button is used to perform calibration.
Power select switch[*3] — SEL ◻ T — Standard <=> TERA fixed
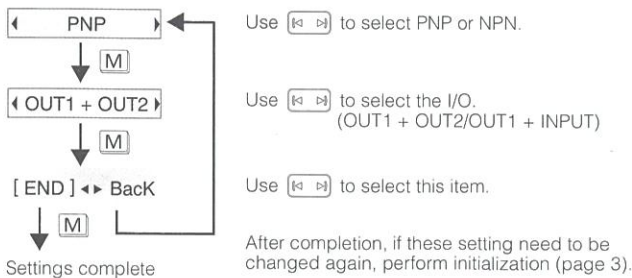ACT-R button — This button is used to set the active receiver function.

[*1] On dual output types (including the FS-N41C), the indicator operates according to the output channel selected with the output channel selection switch.

[*2] On dual output types (including the FS-N41C), this becomes the output indicator. It displays the current output status of channels 1 and 2.

[*3] On dual output types (including the FS-N41C), this becomes the output channel selection switch. It is not present on zero line types (FS-N40).

■ Initial settings (FS-N41C only)

When turning on the sensor for the first time, or when the sensor has been initialized, select the initial settings shown below.

◀ PNP ▶
[M]
◀ OUT1 + OUT2 ▶
[M]
[END] ◀▶ BacK
[M]
Settings complete

Use ◀ ▶ to select PNP or NPN.

Use ◀ ▶ to select the I/O. (OUT1 + OUT2/OUT1 + INPUT)

Use ◀ ▶ to select this item.

After completion, if these setting need to be changed again, perform initialization (page 3).

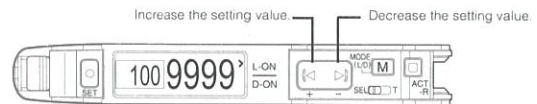## ■ Basic settings

● Switching the output style (Light ON/Dark ON)

1 Press [M] once.   Switch L-On/D-On
2 Use ◀ ▶ to switch the output style.
3 Press [M] three times.

● Switching the display language

1 Press [M] twice.   Language / 语言
2 Use ◀ ▶ to select the language.
3 Press [M] twice.

● Fine-tuning the setting value (threshold)

Use ◀ ▶ to adjust the value. Hold down the button to make adjustments more quickly.

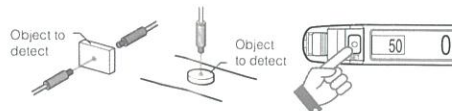Increase the setting value.   Decrease the setting value.

■ Basic calibration methods

● 2-point calibration (the most basic setting method)
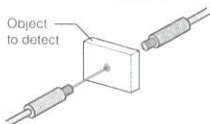
1 Press ◻ with no object to detect present.

2 Press ◻ with an object to detect present.

This sets the setting value to the midpoint between the received light intensities of points 1 and 2. If "---" blinks for 2 seconds on the display, the difference between the received light intensities is small, and detection may be unstable.
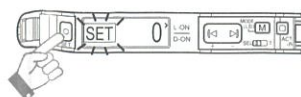
● Maximum sensitivity calibration

Thrubeam model: With an object to detect present

Reflective model: With no object to detect present

1 With the items arranged as shown in the figures on the left, hold down ◻ for 3 seconds or more. When SET blinks, release this button.

The setting value is set slightly higher than the received light intensity when the setting was configured.

● Initialization

Initialize all the settings and return the sensor to its factory default state.

1 Hold down ⊙/SET and □/ACT-R for 3 seconds or more.　◄ Initialize ►

2 Press M once.　◄ Back ►

3 Press [◄ ►] once.　◄ Execute ►

4 Press M once.

● Key lock

Disable button operations.

1 Hold down M and [◄ ►] for 3 seconds or more.

Cancel: Use the same procedure.

● Active receiver (ACT-R)

This function makes the fiber unit's receiver blink in green.

Operation when the sensor is shipped from the factory

When the sensor output is ON, the fiber unit's receiver lights in green. (This is linked to the output.)

To change the normal lighting status of the receiver (change the settings)

1 Press □/ACT-R three times.　Active Rec. Set

2 Use [◄ ►] to select the status from those shown below.

Output Link: The receiver will light when the output is ON.
Reversed Op: The receiver will light when the output is OFF.
Always On: The receiver will be lit always.
Disable: The receiver will be off always.

3 Press □/ACT-R twice to return to the normal status.

To force the receiver to blink in green (pairing mode)

1 Press □/ACT-R once.　ACT-R Blinking

2 Press [◄ ►].

3 The light-receiving side blinks in green.

4 Press □/ACT-R four times to return to the normal status.

● Saturation avoidance function

Use this function when the received light intensity does not change from the maximum displayed value.

1 Press M and ⊙/SET simultaneously.

Cancel: Use the same procedure.

● Zero shift function

Use this function to change the received light intensity display to zero.

1 Press □/ACT-R and [◄ ►] simultaneously.

Cancel: Hold down □/ACT-R and [◄ ►] for 3 seconds or more.

● To make it easy to perform optical-axis alignment (optical-axis alignment assist mode)

1 Press □/ACT-R twice.　Opt Axis Assist

2 Press [◄ ►] to make the light-receiving side blink in green.

3 Move the tip of the fiber unit within the movable range.

The light-receiving side lights in green near the peak light intensity within the range in which the tip moved.
Align the optical axis within the middle of the range in which the light-receiving side lights.
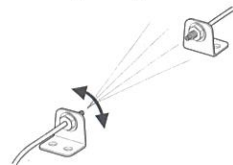
4 When you finish the alignment, press □/ACT-R three times.

The sensor returns to the normal status.

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)					
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 (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[*5]					
Unit expansion (excluding the FS-N41C)			Up to 16 units (17 units connected in total including the main unit). However, each two 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[*6]					
	Power consumption[*7]	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	One 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)					
			Two 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 to +55°C (no freezing)[*8]					
Vibration resistance			10 to 55 Hz; double amplitude 1.5 mm; 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 V1.1/COM2 (38.4 kbps) is supported.
*2 Ensure the cable length is 30 m or less for the M8 connector type. In case of connecting with IO-Link, set it to 20 m or less.
*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 The input time becomes 25 ms (ON)/25 ms (OFF) when external calibration input is selected.

*6 When expanding the system to 9 or more units, use a power supply voltage of 12 V or higher.
*7 The load current is excluded. The power consumption including the load when the maximum number of units are connected is 38 W max.
*8 When expanded by 1 to 2 units: -20°C to +55°C. When expanded by 3 to 10 units: -20°C to +50°C. When expanded by 11 to 16 units: -20°C to +45°C. When using 2 outputs, 1 unit is counted as 2 units. Note that all the temperature prescriptions assume that the sensor has been mounted on a DIN rail installed on a metal surface. Exercise special care when installing the product in an airtight space.

WARRANTIES AND DISCLAIMERS

E FS-N40 IM

6 Detailed Settings

Hold down [M] for 3 seconds or more to enter the settings menu. Then, press [M] to change the item and press [◄ ►] to switch the setting value.
Press [M] + [◄ ►] when an item is being set to return to the previous item.

A Power Modes — Press [◄ ►] to select the value.

[M] Select from eight power modes. The initial setting is FINE.

Mode	S-HSPD[1]	HSPD	FINE	TURBO
Response time	23 µs	50 µs	250 µs	500 µs
Maximum displayable light intensity			9999	

Mode	SUPER	ULTRA	MEGA	TERA
Response time	1 ms	4 ms	16 ms	64 ms
Maximum displayable light intensity	9999		99999[2]	

B Switch L-on/D-on — Press [◄ ►] to select the value.
• Light ON • Dark ON

C Display Bar — Press [◄ ►] to select the value.
• OFF • ON

[END] ◄► ADVANCE — Press [◄ ►] to select the value.
End [M] ADVANCE
Settings complete

D Detection Mode [3] — Press [◄ ►] to select the value.
[M] Select from the following operation modes.
• Standard • Preset • Percent
• Zeroshift • Area detection • Area % Mode
• DATUM • Rising edge • Falling edge

E Output timer [4] — Press [◄ ►] to select the value.

F Ext. Input — Press [◄ ►] to select the value.
[M] This can only be used on types that support an external input. It is possible to select from the following values.
• OFF • External Set • Zero shift
• Reset • LED OFF • Pause
• Sleep
When connected to the multi-output unit FS-MC8N/P or the communication unit NU Series, this setting can be configured on types that do not support an external input.

G Saturate Cancel — Press [◄ ►] to select the value.

H Attenuation — Press [◄ ►] to select the value.

I Zero Shift — Press [◄ ►] to select the value.

J Limit Detection [4] — Press [◄ ►] to select the value.
[M] If Limit Detection is set to ON, a notification of a drop in light intensity is shown on the display when the light intensity drops due to factors such as dirt.
With dual output types, it is also possible to output alarms to an external device.
When connected to the multi-output unit FS-MC8N/P, it is possible to output alarms from the "common output" of the FS-MC8N/P even for types that do not support the alarm output.

K Auto Power — Press [◄ ►] to select the value.

L Hysteresis — Press [◄ ►] to select the value.

M Language — Press [◄ ►] to select the value.
[M] Select from English (initial setting), Japanese, Chinese, and German.

N Flip Display — Press [◄ ►] to select the value.
O Sub Display — Press [◄ ►] to select the value.
P ACT-R — Press [◄ ►] to select the value.
Q Brightness — Press [◄ ►] to select the value.
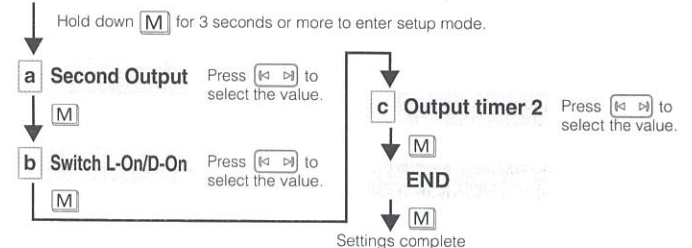## R ECO [6] — Press [◄ ►] to select the value.
S Initialize — Press [◄ ►] to select the value.
T Custom Setting — Press [◄ ►] to select the value.

U Interference [5][7] — Press [◄ ►] to select the value.
V Key Lock Method — Press [◄ ►] to select the value.
W Display Gain [5] — Press [◄ ►] to select the value.
X IO-Link Mode [8] — Press [◄ ►] to select the value.
Y IO Data Format [8] — Press [◄ ►] to select the value.
Z I/O Selection [8] — Press [◄ ►] to select the value.

END
Settings complete

■ Output 2 setting

1 [☐☐☐] 2 When using a dual output type, if the output channel selection switch is set to the "2" side, output 2 can be set.

Hold down [M] for 3 seconds or more to enter setup mode.

a Second Output — Press [◄ ►] to select the value.
b Switch L-On/D-On — Press [◄ ►] to select the value.
c Output timer 2 — Press [◄ ►] to select the value.
END
Settings complete

[1] When S-HSPD is selected for Power Modes
Output 2 of dual output types is fixed to OFF.
IO-Link communication cannot be used (FS-N41C).
[2] This is 65535 when connected to an NU Series unit.
[3] When S-HSPD is selected for Power Modes
Area detection, Area % Mode, DATUM, Rising edge, or Falling edge cannot be selected.
[4] This cannot be used when S-HSPD is selected for Power Modes.
[5] This cannot be used when S-HSPD or HSPD is selected for Power Modes.
[6] When S-HSPD is selected for Power Modes, FULL cannot be selected for the ECO function.
The IO-Link communication cannot be used when FULL is selected for ECO (FS-N41C).
[7] This item is not displayed on the FS-N41C.
[8] This item is only displayed on the FS-N41C.

KEYENCE CORPORATION

1-3-14, Higashi-Nakajima, Higashi-Yodogawa-ku,
Osaka, 533-8555, Japan
PHONE: +81-6-6379-2211
www.keyence.com

AUSTRIA Ph: +43 22 36-3782 66-0	**HONG KONG** Ph: +852-3104-1010	**NETHERLANDS** Ph: +31 40 20 66 100	**TAIWAN** Ph: +886-2-2721-8080
BELGIUM Ph: +32 1 528 1222	**HUNGARY** Ph: +36 1 802 73 60	**PHILIPPINES** Ph: +63-(0)2-981-5000	**THAILAND** Ph: +66-2-369-2777
BRAZIL Ph: +55-11-3045-4011	**INDIA** Ph: +91-124-465-5060	**POLAND** Ph: +48 71 36861 60	**UK & IRELAND** Ph: +44-1908-696900
CANADA Ph: +1-905-366-7655	**INDONESIA** Ph: +62-21-2966-0120	**ROMANIA** Ph: +40 269-232-808	**USA** Ph: +1-201-930-0100
CHINA Ph: +86-21-3357-1001	**ITALY** Ph: +39-02-6688220	**SINGAPORE** Ph: +65-6392-1011	**VIETNAM** Ph: +84-24-3772-5555
CZECH REPUBLIC Ph: +420 222 191 483	**KOREA** Ph: +82-31-789-4300	**SLOVAKIA** Ph: +421 2 5939 6461	
FRANCE Ph: +33 1 56 37 78 00	**MALAYSIA** Ph: +60-3-7883-2211	**SLOVENIA** Ph: +386 1-4701-666	
GERMANY Ph: +49 6102 36 89-0	**MEXICO** Ph: +52-55-8850-0100	**SWITZERLAND** Ph: +41 43-45577 30	

Specifications are subject to change without notice.

A6WW1-MAN-1127

E FS-N40 IM

4

96M14746-2