



User Manual

FX8 Range-Finding Sensor

LA9532A

Version 2.0

**MEMS Promotion Department
Visionary Business Center
Nippon Signal Co., Ltd.**

Nippon Signal Co., Ltd.

A-LA9532A-001E

Contents

1. Precautions Before Using this Product	3
2. Configuration & Specifications.....	7
2.1 Configuration & internal function blocks	7
2.2 Equipment specifications	9
2.2.1 Environmental conditions	9
2.2.2 Power supply (recommended)	9
2.2.3 External cables & connectors.....	9
2.2.4 External dimensions & weight.....	10
2.2.5 Sensor installation specifications	10
2.3 Distance measurement specifications	11
2.4 Data communication specifications	12
3. Main unit & accessories	13
4. How to use the FX8 special software.....	14
4.1 Operating environment	14
4.2 Setting the computer's IP address.....	14
4.3 How to use the sample display software	17
4.4 How to use the FX8 setup software.....	20
4.5 Format of data saved using the display software	22
Inquiries	25

Approved by

Checked by

Prepared by


110224



1. Precautions Before Using this Product

In order to use this product effectively, before using it, please be sure to read all matters relating to the products you have purchased.




This User Manual contains information that is important when using this product. Please retain it so that you can refer to it when necessary.

Safety Precautions

A number of symbols have been used in this User Manual to assist you in using this product safely and correctly, and to prevent injury to people or damage to property. The symbols and their meanings are as follows. Please familiarize yourself with them fully before reading the rest of this User Manual.

	Warning	This indicates that if this symbol is ignored and the product is handled incorrectly, there is the potential risk of someone suffering a serious injury.
	Caution	This indicates that if this symbol is ignored and the product is handled incorrectly, there is the potential risk of someone suffering a serious injury, and the potential for only property to be damaged.

Examples of symbols used

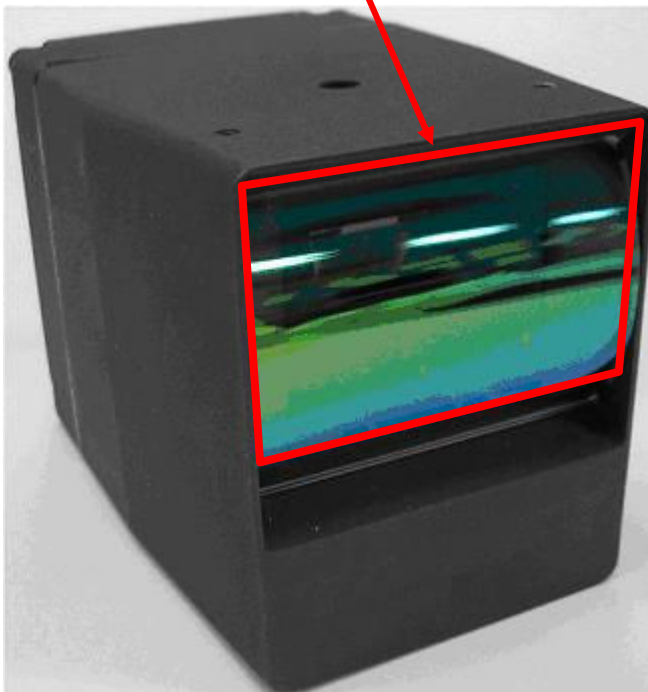
	Signifies that there is something requiring caution (including warnings). Indicates that <u>care needs to be taken</u> .
	Signifies that some action is prohibited. Indicates that something <u>must not be done</u> .
	Signifies that some action is to be compelled or instructed. Indicates that something <u>must be done</u> .



Warning



- ◆ Do not look through the glass window on the laser emission surface for a long period of time while the sensor is operating. Doing so may injure your eyes.



- ◆ Do not use the product at a supply voltage other than the voltage prescribed. Doing so may cause fire or an electric shock.



- ◆ In the unlikely event something unusual occurs, such as smoke or a foul smell coming from the product, shut off the power supply immediately.



- ◆ In the unlikely event smoke has been coming from the product, check that the smoke has stopped, and request that the product be serviced. Due to the danger, you should never attempt to repair the product yourself.



Caution



◆ Vibrations and impacts

Do not subject the product to strong vibration or shock, such as by dropping it. If this product has been dropped onto the floor, the product cannot be guaranteed.

Precise optical elements have been used in this product. Any mechanical vibration, impact or so forth may damage the product and result in performance degradation.

Take care when handling the glass window as it is particularly fragile.



◆ Environmental conditions

Take care not to leave the product in an area where there are condensation or corrosive gases.

Certain environmental conditions may cause performance degradation.



◆ Wiring

If this product has not been used correctly, such as incorrect wiring, incorrect insertion of a connector or used in excess of the rated range of use, the product may not perform properly or it may be rendered ineffective.



◆ Disassembly

If this product is taken apart, users may be injured as a result of performance degradation, broken internal components or other such reasons.

Also, the product cannot be guaranteed once it has been taken apart.



◆ Instructions for washing/cleaning

If normal properties cannot be attained due to the glass window on the laser emission surface becoming dirty, dip a cotton swab, gauze or some other clean, soft cloth into a tiny amount of reagent ethanol (ethyl alcohol) and lightly wipe away the dirt.

Do not wash any other parts besides the glass window.



◆ This User Manual and the documents, electronic data, programs and other attachments included with the product are prohibited from being reproduced, transcribed, distributed, altered, etc., either in part or in full, without

authorization from our company.



◆ Imitating this product or otherwise producing similar products is prohibited.



◆ Please note that the contents of this User Manual are subject to change without notice.

2. Configuration & Specifications

2.1 Configuration & internal function blocks

Figure 2.1 shows the configuration and internal function blocks of the sensor.

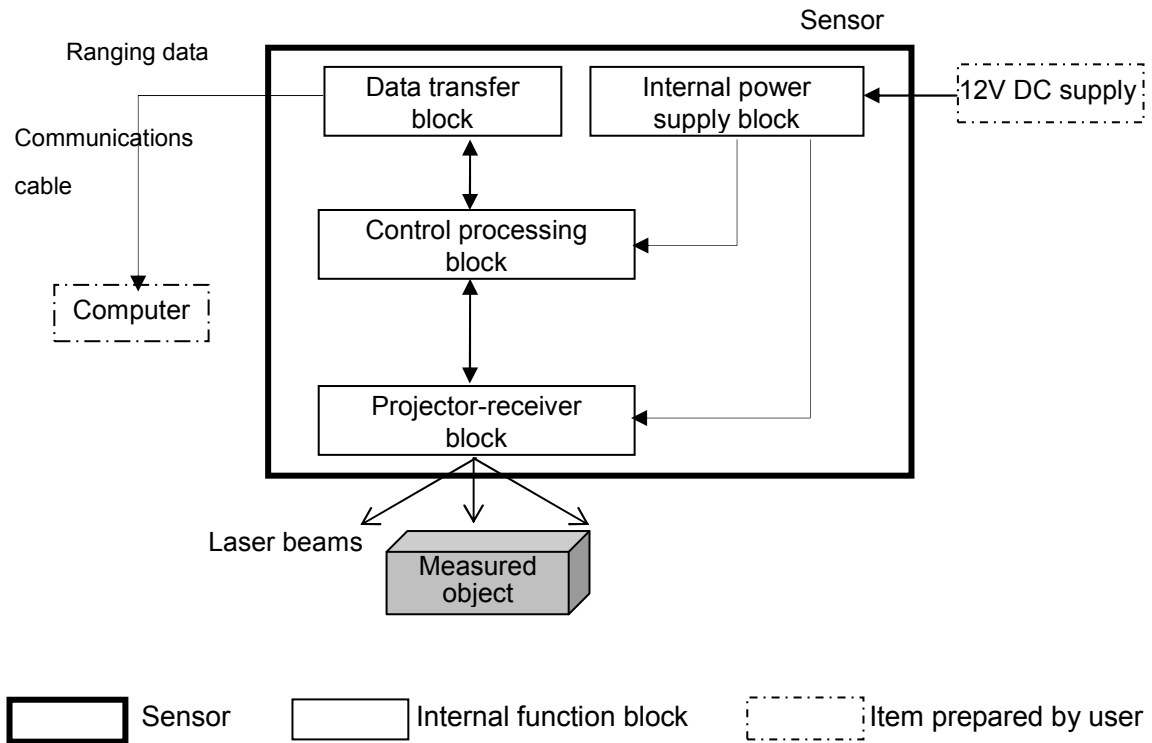


Figure 2.1 Configuration and internal function blocks

(1) Projector-receiver block

The projector-receiver block projects a laser toward the measured object via an ECO SCAN® mirror, which scans two-dimensionally at high speed. It then receives reflected/diffused light irradiated by the measured object located along the optical path.

(2) Control processing block

The control processing block measures the time lag between the timing of the laser beam being projected and the timing of the reflected/diffused light being received from the measured object, and converts this time lag into distance. This block also controls the 2D scanning and ranging by using the 2D scanning control by ECO SCAN® and generating a laser output timing signal that is synchronized with this.

(3) Data transfer block

The data transfer block transfers the ranging data and light quantity data from the control processing block to the computer.

(4) Internal power supply block

The internal power supply block produces the required voltage for each block using the externally provided input power supply.

2.2 Equipment specifications

2.2.1 Environmental conditions

[The performance of items under development is currently being assessed. This product should be used at normal temperature, normal humidity and in an indoor environment.]

(1) Operating temperature and humidity:

-10°C to +50°C, 20-85%RH (However, maximum absolute humidity of 36g/m³)

(2) Storage temperature and humidity:

-30°C to +70°C, 20-100%RH (However, maximum absolute humidity of 36g/m³)

(3) Vibrations & impacts:

In XYZ directions, 10-500Hz, 1G (double amplitude); 40Hz, 2G (double amplitude)

In XYZ directions, 30G (impact)

(4) Dustproof & waterproof: equivalent to IP55

(5) Sunlight resistance: able to find the range of a whiteboard 1m away at 100,000lx

2.2.2 Power supply (recommended)

DC +12V ±2V

Minimum 2.0A (Maximum steady current consumption of 0.5A)

2.2.3 External cables & connectors

(1) Power cable

Connector: round crimp terminal (RBV0.3-3YE)

Length: 1.5m

(2) Communications cable

Connector: RJ45 plug (male)

Length: 1.5m

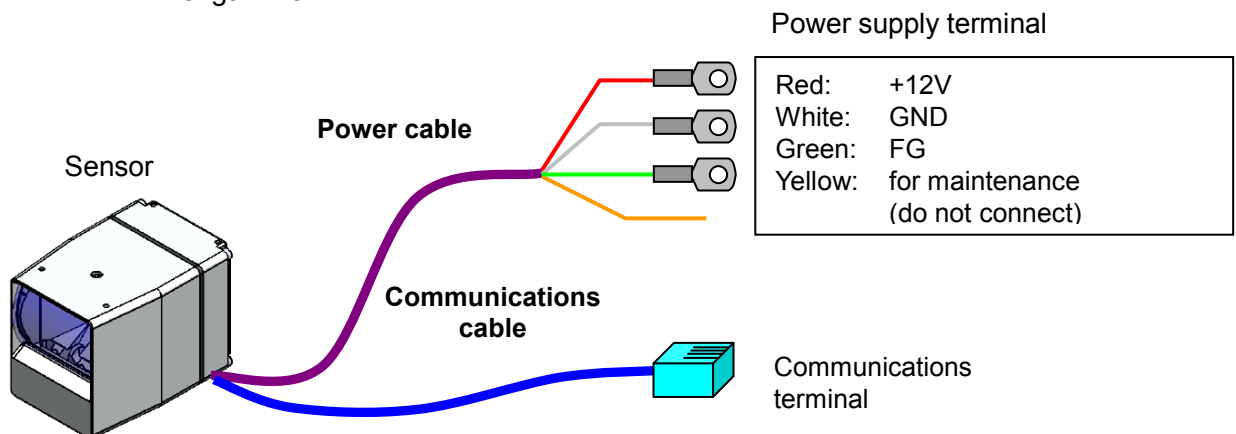


Figure 2.2 external cables

2.2.4 External dimensions & weight

(1) External dimensions

W60×D90×H65mm (see Figure 2.3)

(2) Mass

Approximately 500g

2.2.5 Sensor installation specifications

Nuts used for mounting when installing sensor:

8 × 5mm-deep M3 tap (4 each on top and bottom surface)

Install the product in a way that the vent on the underside for preventing condensation does not become blocked by a bracket, etc., and so that, wherever practicable, the product does not get splashed with water, etc.

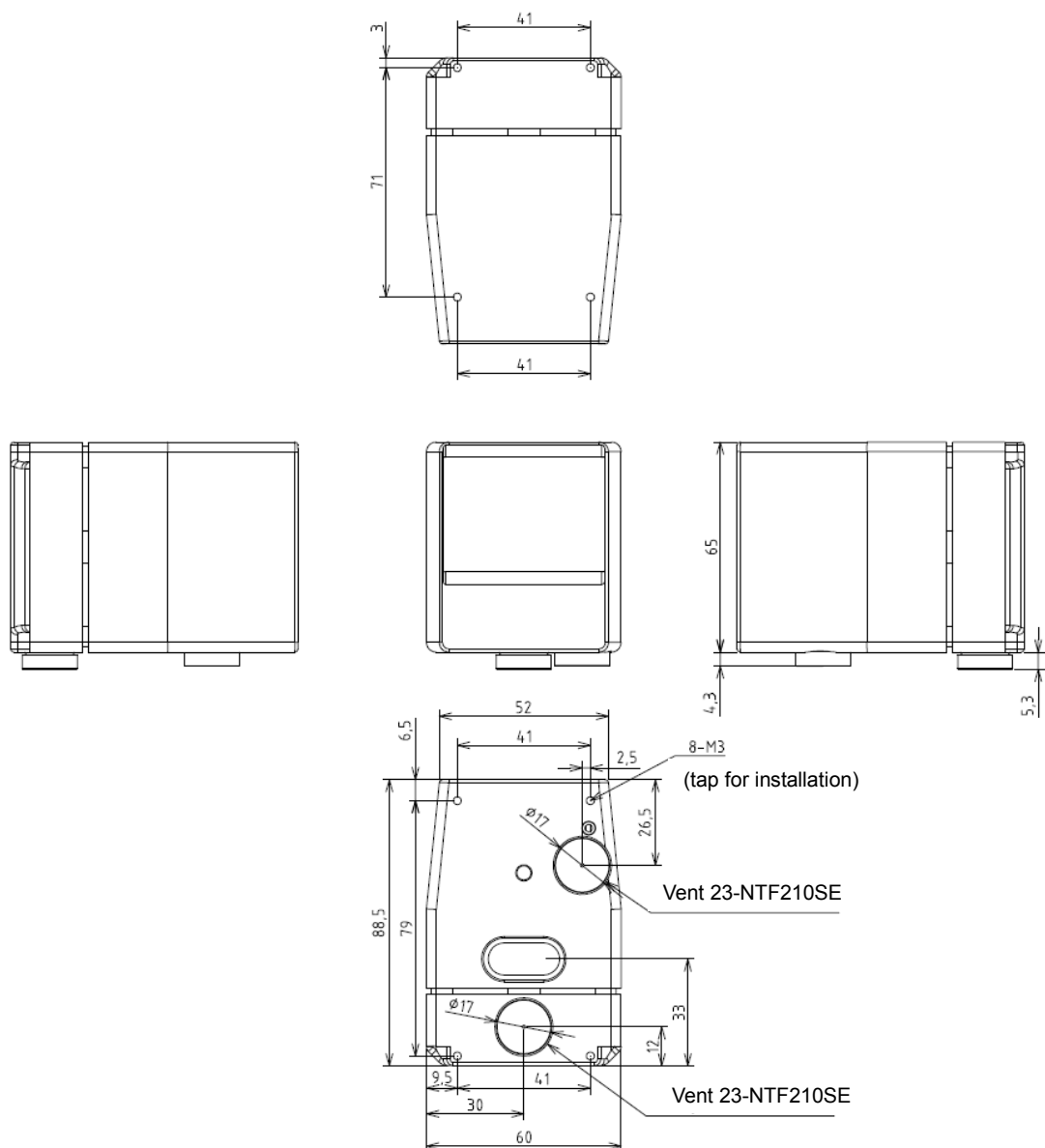


Figure 2.3 Sensor installation specifications

A-LA9532A-010E

2.3 Distance measurement specifications

Item	Specifications	
Method of measuring	Optical pulse "time of flight" (TOF)	
Frame rate / number of measuring points ^{*1}	Format label	Frame rate / pixels
	A	20fps±2fps / 1075 pixels (43 × 25)
	B	16fps±1.6fps / 1749 pixels (53 × 33)
	C	10fps±1fps / 2535 pixels (65 × 39)
D	4fps±0.4fps / 5917 pixels (97 × 61)	
Scanning viewing angle	Horizontal 60° × Vertical 50°	
Accuracy of scanning angle	Horizontal 60°±1.0°, Vertical 50°±1.0°	
Distance range ^{*2}	0.3-5.0m (Munsell scale N4.0, equivalent to reflectance of 12%) * Up to maximum of 15m is possible depending on the reflectance of the measured object	
Accuracy of distance ^{*2}	Maximum of ±5cm (@±3σ) (Munsell scale N4.0, reflectance 12%, distance 5m, Ta: repeatability at 25°C)	
Range resolution	10mm (system resolution)	
Laser safety standard	Class 1 (IEC60825-1: 2001) near-infrared pulse laser	
Status display	Displayed using indicator lamps See LX9638A Communications Interface Specifications V1.1 (P8-4.3.3)	

*1 The frame rate / number of pixels able to be used by each sensor is indicated according to the ABCD marking (○) on the format label on the rear of the main unit. Dual mode sensors have markings in two places.

*2 The distance range and accuracy may not be guaranteed depending on the conditions of the measured object (reflectance and slope) and the environmental conditions. [Specifications not yet achieved for items under development]

2.4 Data communication specifications

Item	Specifications
Communication standard (Physical / data-link layer)	Ethernet 10Base-T/100Base-TX (auto-negotiation enabled)
Communication protocol (Network / transport layer)	Control commands / ranging data: TCP/IP
IP address	Factory default IP address: 192.168.0.80 (can be changed using FX8 setup software)
MDI/MDI-X	Auto MDI/MDI-X compatible
Data output	[Ranging data] For each measuring point: distance value (12bit), light value (12bit) See LX9638A Communications Interface Specifications V1.1

3. Main unit & accessories

(1) Main sensor unit (including communications cable and power cable)

(2) Accompanying CD



The folder structure and contents for the accompanying CD are as follows:

doc	doc
dotnet	<ul style="list-style-type: none"> • User Manual • Communications Interface Specifications • User Library Specifications
fx8conftool	dotnet
fx8disp	<ul style="list-style-type: none"> • .NET Framework Runtime Package
fx8lib	fx8conftool
fx8libsampclr	<ul style="list-style-type: none"> • FX8 Setup Software
fx8libsampvb	fx8disp
	<ul style="list-style-type: none"> • Sample Display Software
	fx8lib
	<ul style="list-style-type: none"> • User Library Package
	fx8libsampclr
	<ul style="list-style-type: none"> • Project Package for C++/CLI Sample Software Compatible version: Microsoft Visual C++ 2005 or later
	fx8libsampvb
	<ul style="list-style-type: none"> • Project Package for Visual Basic .NET Sample Software Compatible version: Microsoft Visual Basic 2005 or later

4. How to use the FX8 special software

4.1 Operating environment

OS

Microsoft Windows XP or later version

Microsoft.NET Framework 2.0 SP2 is required

(included on accompanying CD)

Method of installation

Run files in the order: [NetFx20SP2_x86.exe], [NetFx20SP2_x86ja.exe].

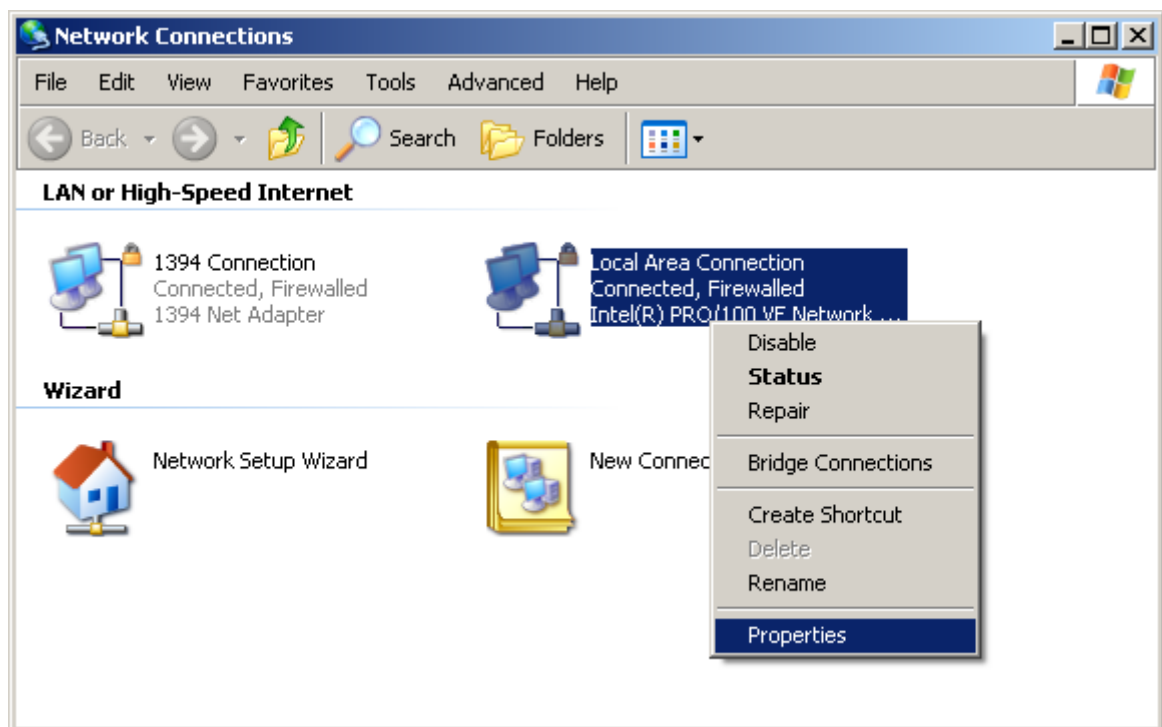
The files used in installing .NET Framework are different depending on the version of Windows you are using. For more details, please read the "Installing dotnet.txt" file contained in the "dotnet" folder of the accompanying CD.

4.2 Setting the computer's IP address

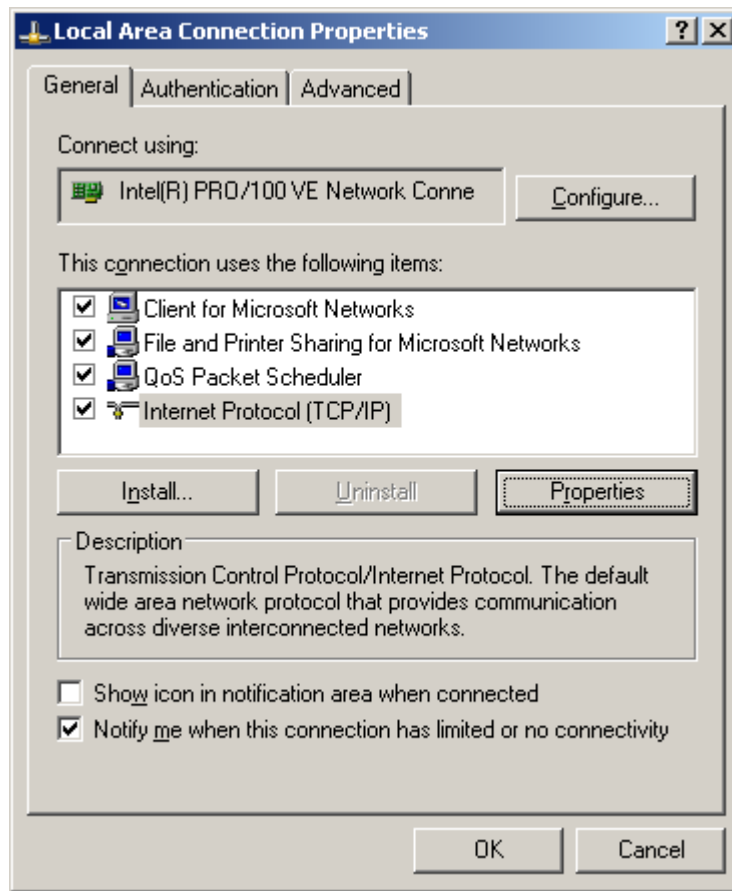
Before connecting the sensor and computer, you will need to set the computer's IP address.

(1) From the Windows Control Panel, (double) click [Network Connections].

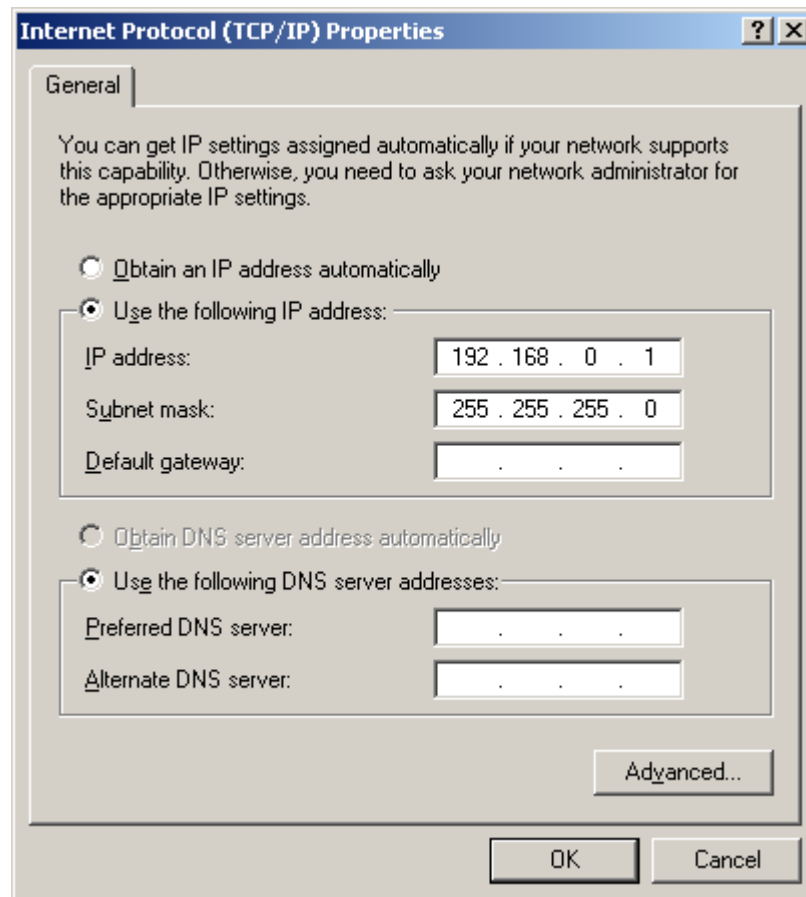
(2) Right-click [Local Area Connection] and click on [Properties].



- (3) On the [General] tab, click [Internet Protocol (TCP/IP)], and then click on the [Properties] button below that.



- (4) Select [Use the following IP address]. If you are using the sensor for the first time, or if you have not changed the sensor's IP address, enter 192.168.0.1 in the IP address box. Also, make the subnet mask 255.255.255.0. If you have already changed the sensor's IP address, enter an IP address accordingly.



(5) Click [OK] to close the window, and then click [OK] in the [Local Area Connection Properties] window to complete the setting.

Note: If you change the settings for the IP address as outlined above, and then connect the computer to a network that is different from the sensor (company LAN, internet, etc.), please change the settings according to the respective network settings.

4.3 How to use the sample display software

This software can be used to display and record ranging images and light volume images.

(1) Installation

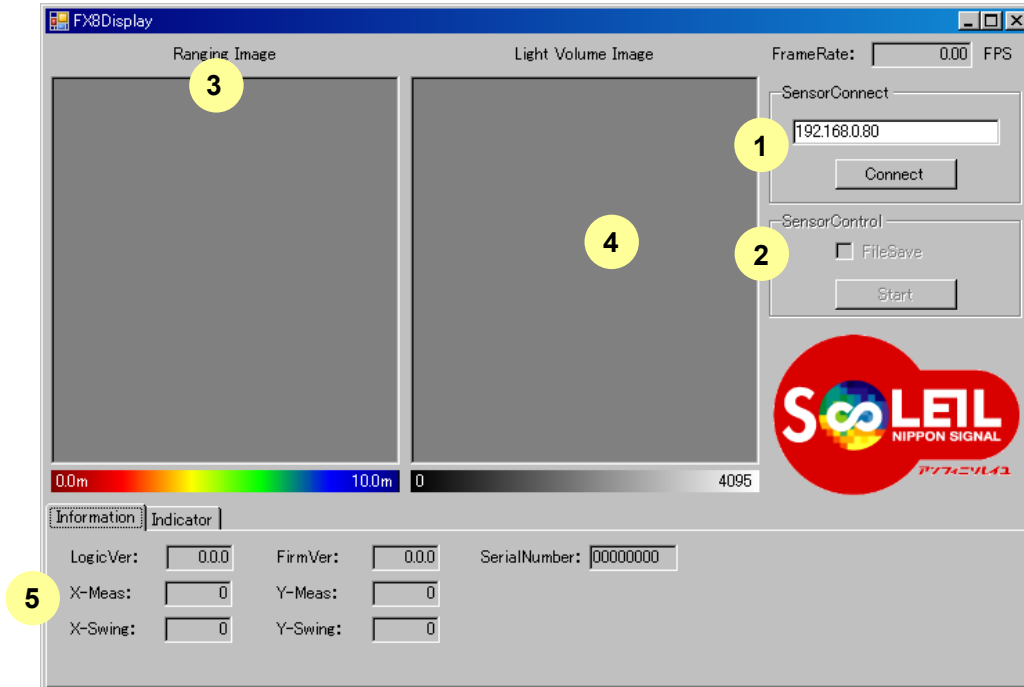
Copy the entire [/FX8_display software/] folder from the accompanying CD to your computer.

[File configuration]	bw_table.dat:	display black and white table
	Clr_scl.dat:	display color table
	fx8clientlib.dll:	communication library
	fx8userlib.dll:	library for display
	fx8disp.exe:	display software main unit
	fx8disp.exe.config:	display software setup file

(2) Directions for use

- Connect the sensor and your computer using the communications cable, and switch on the power to the sensor.
- In the folder you have copied, double-click the file [fx8disp.exe] to startup the display software.

[Startup screen]



① Sensor Connect

[Connect]: Connect to the sensor to be displayed by entering its IP address.

② Sensor Control

[Start]: Commence range-finding using the connected sensor.

Due to the scanning synchronization/adjustment, it may take a little time for the screen to display.

[File Save]: By ticking this box, the ranging data will be saved in the same folder as the program.

③ Ranging image display area:

This area displays the ranging image. You can check the distance using the color bar at the bottom of the screen.

To change the scope of the color bar, using Notepad or some other text editor, change the values of the [fx8disp.exe.config] file in the folder.

<add key="DispRange0" value="0.0" /> Value="*. *" display minimum distance (m), red

<add key="DispRange1" value="10.0" /> Value="*. *" display maximum distance (m), blue

④ Light volume image display area:

This area displays an image representing the values of the volume of light received. You can check the light value using the black-and-white bar at the bottom of the screen.

⑤ Information tab

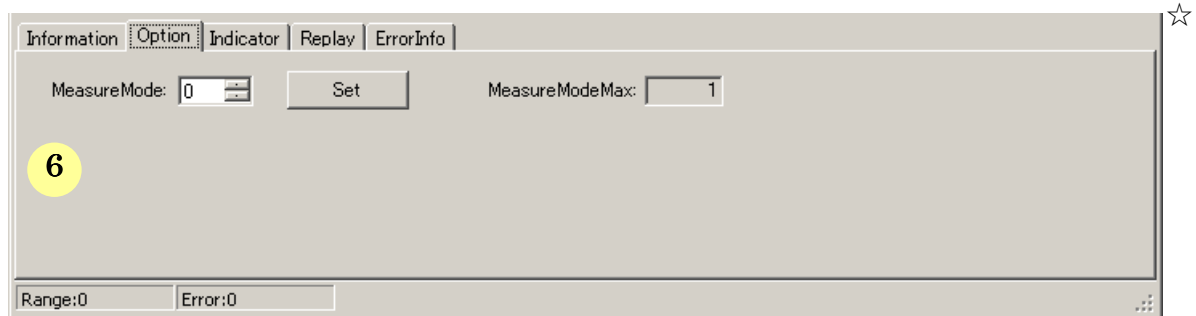
Displays various information about the connected sensor.

⑥ Option tab

Select the sensor's frame rate (ranging mode). (Dual mode sensors only)

Setting: 0 = low frame rate, 1 = high frame rate

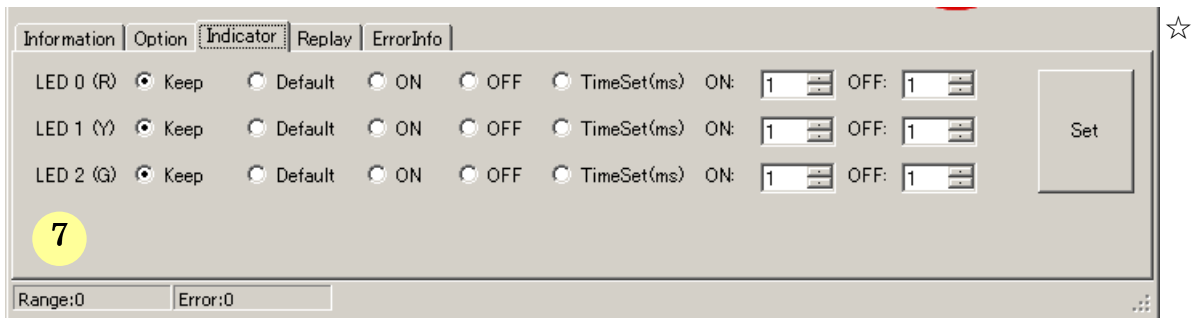
(Example: In case of 4FR and 16FR: 0 = 4FR, 1 = 16FR)



⑦ Indicator tab

Here, you can change how the status indicators on the main unit switch on or flash.

(The sample software settings will return to the factory default settings if the power to the main unit is switched off.)



[Keep]: Maintain the value set for the sensor.

[Default]: Return to the factory default setting.

[ON]: Permanently switched on

[OFF]: Permanently switched off

[TimeSet]: Set any interval between ON and OFF while flashing.

(1-100, 100msec units. Example: 1 = 0.1sec, 100 = 10sec)

⑧ Replay tab

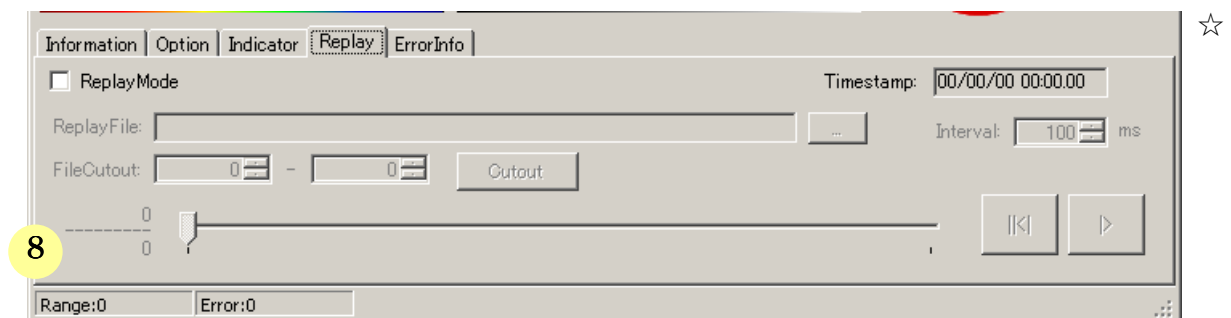
Replays the ranging data saved on the computer.

[ReplayMode]: Ticking this box switches to the replay mode for saved data. If connected to the sensor, the connection will be cut.

[ReplayFile]: Sets the path for the file to be replayed.

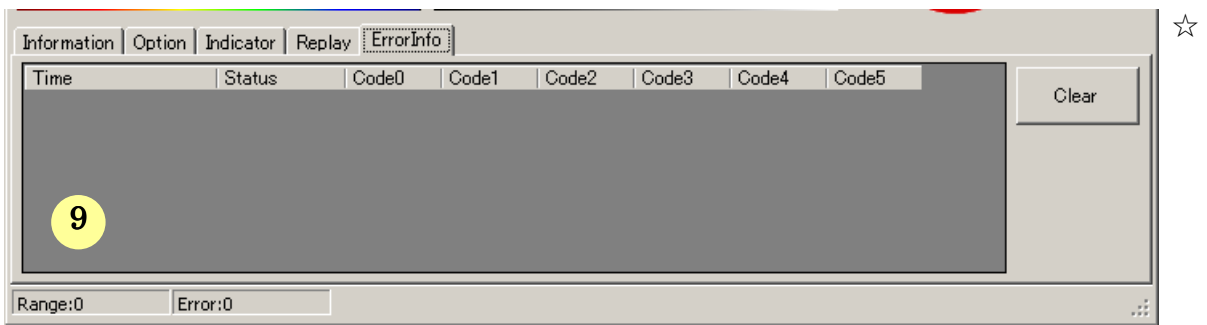
[FileCutout]: Outputs the data between the set frames to a new file.

[Interval]: Duration between frames



⑨ ErrorInfo tab

Displays information on any errors that have occurred on the sensor.



4.4 How to use the FX8 setup software

This software can be used to set the IP address of the sensor and to switch the operating mode (frame rate / number of measuring points).

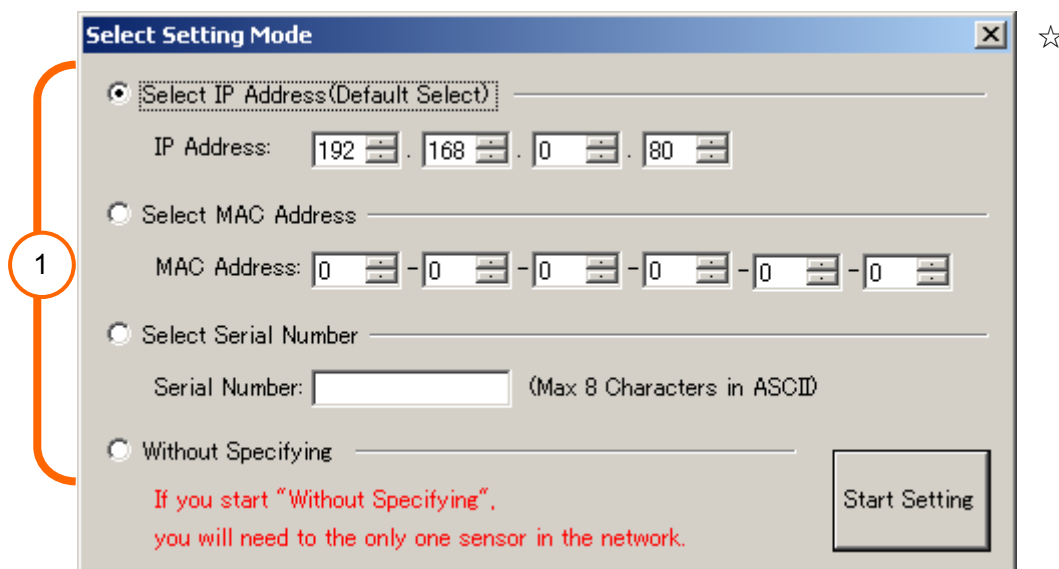
(1) Installation

Copy the [fx8conftool.exe] file from the [FX8_setup software] folder on the accompanying CD to your computer.

(2) Directions for use

- Connect the sensor and your computer using the communications cable, and switch on the power to the sensor.
- Double-click the [fx8conftool.exe] file to start it.

[Startup screen]



From (1), select the specifications for the sensor you want to change the settings for, enter the appropriate data, and click [Start setup].

* Normally, select the [IP address specification].

[Setup screen]

"IP Address" Mode Host IP: 192.168.0.81 Connect IP:192.168.0.80

Sensor Setting
Get

IP Address
IP Address: 192 . 168 . 0 . 80 Set
Subnet Mask: 255 . 255 . 255 . 0

DHCP Client
 Enable Set

Measure Mode
Mode Select: 0 Set



[Sensor Setting]: Acquires the setup information for the sensor, and displays a list.

[IP Address]: By entering an arbitrary IP address and clicking [Set], the IP address will be recorded to flash memory, and the sensor's IP address will be changed when the power is turned on again.

[DHCP Client]: By ticking the [Enable] box and clicking [Set], the sensor will switch to the mode of automatically acquiring IP addresses. (The power needs to be turned back on for an IP address to be automatically acquired.)

[Measure Mode]: Set the frame rate for when the sensor's power is turned on. (Dual mode sensors only)

The set value is recorded to flash memory, and will become the initial value when the power is turned on.

Setting: 0 = low frame rate, 1 = high frame rate

(Example: In case of 4FR and 16FR: 0 = 4FR, 1 = 16FR)

4.5 Format of data saved using the display software

Filename: Shows the time that data acquisition commenced.

last two digits of the year+month+date+_(underscore)+hour+minute+second.fx8

(Example: 100921_101135.fx8)

Data configuration: Binary data comprised of a header section, XY data section, and a ranging data section

Header section	XY data section				Ranging data section			
	Plane 0	(Plane 1)	...	(Plane N-1)	1st frame	2nd frame	...	Mth frame

[Header section]

Offset	Data content	Notes
0	X number of measuring points (upper 8bit)	
1	X number of measuring points (lower 8bit)	
2	Y number of measuring points (upper 8bit)	
3	Y number of measuring points (lower 8bit)	
4	X deflection angle (upper 8bit)	Half-angle 0.1 degree (ex. $\pm 30^\circ = 300$)
5	X deflection angle (lower 8bit)	
6	Y deflection angle (upper 8bit)	Half-angle 0.1 degree (ex. $\pm 25^\circ = 250$)
7	Y deflection angle (lower 8bit)	
8	Number of planes of XY data	N planes
9	Frame period (upper)	Millisecond units (used for reproduction interval, etc.)
10	Frame period (lower)	
11	Ranging mode	0/1
12	Upper limit of ranging mode	0 to 1
13-43	Spare	0x00 fixed
44	XY data management number (1)	
45	XY data management number (2)	
46	XY data management number (3)	
47	XY data management number (4)	
48	Logic version (major)	
49	" (minor)	
50	" (sequence)	
51	" (spare)	
52	Frame version (major)	
53	" (minor)	
54	" (sequence)	
55	" (spare)	
56	Sensor serial number (leftmost character)	ASCII code (space 0x20)
57	" (2nd character)	
58	" (3rd character)	
59	" (4th character)	
60	" (5th character)	
61	" (6th character)	
62	" (7th character)	
63	" (8th character)	

☆

64	Save software version (major)	
65	“ (minor)	
66	“ (sequence)	
67	“ (spare)	
68-255	Spare	0x00 fixed

[XY data section]

Offset	Data content		Notes
0	1st measuring point	X coordinate	0 - X number of measuring points -1
1		Y coordinate	0 - Y number of measuring points -1
2		Sx (upper)	for conversion of XYZ coordinates Binary values (Sx,Sy): values 0 – 20,000 The value calculated by subtracting 10,000 and dividing by 10,000 becomes the coefficient. (→ -1.000 – 0 – +1.000)
3		Sx (lower)	
4		Sy (upper)	
5		Sy (lower)	
...	
(P-1)*6+0	Pth measuring point	X coordinate	
(P-1)*6+1		Y coordinate	
(P-1)*6+2		Sx (upper)	
(P-1)*6+3		Sx (lower)	
(P-1)*6+4		Sy (upper)	
(P-1)*6+5		Sy (lower)	

Measuring point number: P (= 1 – X number of measuring points × Y number of measuring points)

Saves data for the number of planes of XY data (Header section offset = 12).

[Ranging data section] (in case of ranging data)

Offset	Data content		Notes
0	For verifying synchronization	0xF0	
1		0xF0	
2		0xF0	
3		0xF0	
4	Frame number	Upper	Number issued sequentially by sensor (also including error notifications)
5		Lower	
6	Data type	0x71	
7	Plane number		Plane number for referenced XY data
8	Time stamp (PC clock)	Year	Last two digits of the year (ex. 2010 = 0x0A)
9		Month	(0x01 – 0x0C)
10		Date	(0x01 – 0x1F)
11		Hour	24-hour basis (0x00 – 0x17)
12		Minute	(0x00 – 0x3B)
13		Second	(0x00 – 0x3B)
14-77	Internal sensor information		
78	1st measuring point	Light volume (upper)	
79		Light volume (lower)	
80		Range (upper)	
81		Range (lower)	
...	...		
(P-1)*4+78	Pth measuring point	Light volume (upper)	

(P-1)*4+79		Light volume (lower)	
(P-1)*4+80		Range (upper)	
(P-1)*4+81		Range (lower)	

Measuring point number: P (= 1 – X number of measuring points × Y number of measuring points)

[Ranging data section] (in case of error notification)

Offset	Data content		Notes
0	For verifying synchronization	0xF0	
1		0xF0	
2		0xF0	
3		0xF0	
4	Frame number	Upper	Number issued sequentially by sensor (also including ranging data)
5		Lower	
6	Data type	0x91	
7	Spare	0x00	
8	Time stamp (PC clock)	Year	Last two digits of the year (ex. 2010 = 0x0A)
9		Month	(0x01 – 0x0C)
10		Date	(0x01 – 0x1F)
11		Hour	24-hour basis (0x00 – 0x17)
12		Minute	(0x00 – 0x3B)
13		Second	(0x00 – 0x3B)
14-77	Internal sensor information		
78	Sensor status	Upper	
79	Sensor status	Lower	
80	Error code	(0)	
81	Error code	(1)	
82	Error code	(2)	
83	Error code	(3)	
84	Error code	(4)	
85	Error code	(5)	
86+	Fill in 0x00 so that it ends up the same size as for the ranging data		

Inquiries

MEMS Promotion Department, Visionary Business Center, Nippon Signal Co., Ltd.
13F Shin-Marunouchi Building, 1-5-1 Marunouchi, Chiyoda-ku, Tokyo 100-6513, Japan
TEL +81-3-3217-7167
FAX +81-3-3217-7377

Copyright © 2010 NIPPON SIGNAL CO., LTD. All Rights Reserved.

A-LA9532A-025E[○]