

FQ-M Series

# Vision sensor

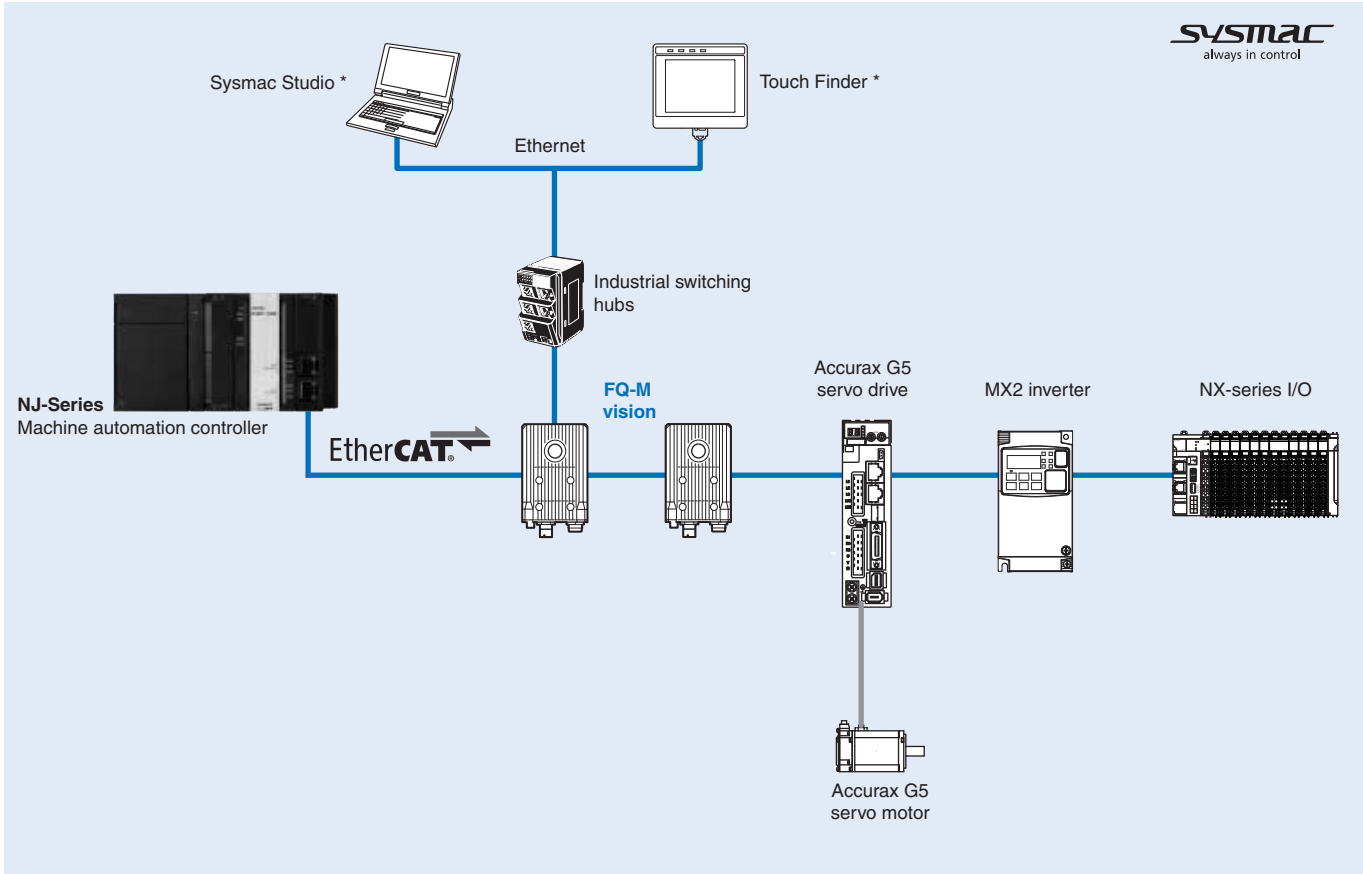
### Designed for object tracking

The new FQ-M Series is a vision sensor designed specifically for pick and place applications.

- Camera, image processing and connectivity in one
- Shape based object detection
- Connectivity with EtherCAT/Ethernet
- Encoder input for object tracking and easy calibration
- Up to 5000 pieces per minute with 360 degree rotation
- Flexible data output depending on the output devices



## System configuration



\* Sysmac Studio and Touch Finder can not be used together. When both are connected, Sysmac Studio will have a priority. When you use the Sysmac Studio Standard Edition and connect the FQ-M Series and the Machine Automation Controller NJ-Series, connect them with a general-purpose Ethernet cable or a USB cable.

1. EtherCAT and Ethernet (PLC Link) can not be used simultaneously.
2. It is not possible to configure and adjust the FQ-M via an NJ-Series controller, when they are connected via an EtherCAT network. For configuration and adjustment of FQ-M, connect the FQ-M and a computer or a Touch Finder via an Ethernet network.

Specifications

Sensor specifications

Item	Type	EtherCAT communication function provided	
		Color	Monochrome
Model	NPN	FQ-MS120-ECT	FQ-MS120-M-ECT
	PNP	FQ-MS125-ECT	FQ-MS125-M-ECT
Field of vision, installation distance		Selecting a lens according to the field of vision and installation distance. Refer to "Optical Chart" page	
Main functions	Inspection items	Shape search, Search, Labeling, Edge position	
	Number of simultaneous inspections	32	
	Number of registered scenes	32	
Image input	Image processing method	Real color	Monochrome
	Image elements	1/3-inch color CMOS	1/3-inch monochrome CMOS
	Image filter	High dynamic range (HDR) and white balance	High dynamic range (HDR)
	Shutter	Electronic shutter; select shutter speeds from 1/10 to 1/30000 (sec)	
	Processing resolution	752 (H) × 480 (V)	
	Pixel size	6.0 (μm) × 6.0 (μm)	
	Frame rate (image read time)	60 fps (16.7 ms)	
External Lightings	Connecting method	Connection via a strobe light controller	
	Connectable lighting	FL Series	
Data logging	Measurement data	In Sensor: Max. 32000 items <sup>*1</sup>	
	Images	In Sensor: 20 images <sup>*1</sup>	
Measurement trigger		I/O trigger, Encoder trigger, Communications trigger (Ethernet No-protocol, PLC Link or EtherCAT)	
I/O specifications	Input signals	9 signals <ul style="list-style-type: none"> <li>• Single measurement input (TRIG)</li> <li>• Error clear input (INO)</li> <li>• Error counter reset input (IN1)</li> <li>• Encoder input (A±, B±, Z±)<sup>*2</sup></li> </ul>	
	Output signals	5 signals <sup>*3</sup> <ul style="list-style-type: none"> <li>• OUT0 Overall judgement output (OR)</li> <li>• OUT1 Control output (BUSY)</li> <li>• OUT2 Error output (ERROR)</li> <li>• OUT3 Shutter output (SHTOUT)</li> <li>• OUT4 Strobe trigger output (STGOUT)</li> </ul>	
	Ethernet specifications	100BASE-TX/10BASE-TX	
	EtherCAT specifications	Dedicated protocol for EtherCAT 100BASE-TX	
	Connection method	Special connector cables <ul style="list-style-type: none"> <li>• Power supply and I/O: 1 special connector I/O cable</li> <li>• Touch Finder, Computer and Ethernet: 1 Ethernet cable</li> <li>• EtherCAT: 2 EtherCAT cable</li> </ul>	
LED display	LED display	<ul style="list-style-type: none"> <li>• OR: Judgment result indicator</li> <li>• ERR: Error indicator</li> <li>• BUSY: BUSY indicator</li> <li>• ETN: Ethernet communications indicator</li> </ul>	
	EtherCAT display	<ul style="list-style-type: none"> <li>• L/A IN (Link/Activity IN) × 1</li> <li>• L/A OUT (Link/Activity OUT) × 1</li> <li>• RUN × 1</li> <li>• ERR × 1</li> </ul>	
Ratings	Power supply voltage	21.6 to 26.4 VDC (including ripple)	
	Insulation resistance	Between all lead wires and case: 0.5 MΩ (at 250 V)	
	Current consumption	450 mA max. (When the FL-Series Strobe controller and lighting are used) 250 mA max. (When external lighting is not used)	
Environmental immunity	Ambient temperature range	Operating: 0 to 50°C, Storage: -20 to 65°C (with no icing or condensation)	
	Ambient humidity range	Operating and storage: 35% to 85% (with no condensation)	
	Ambient atmosphere	No corrosive gas	
	Vibration resistance (destruction)	10 to 150 Hz, single amplitude: 0.35 mm, X/Y/Z directions, 8 min each, 10 times	
	Shock resistance (destruction)	150 m/s <sup>2</sup> 3 times each in 6 direction (up, down, right, left, forward and backward)	
Degree of protection		IEC60529 IP40	
Materials		Case: aluminium die casting, Rear cover: aluminium plate	
Weight		Approx. 480 g (Sensor only)	
Accessories		Instruction Manual	

\*1 If a Touch Finder is used, results can be saved up to the capacity of an SD card.

\*2 Encoder input specifications

\*3 The five output signals can be allocated for the judgements of individual inspection items.

Pulse input specifications (when an open collector type encoder is used)

Item	Specifications		
	24 VDC ±10%	12 VDC ±10%	5 VDC ±5%
Input voltage	24 VDC ±10%	12 VDC ±10%	5 VDC ±5%
Input current	4.8 mA (at 24 VDC, typical value)	2.4 mA (at 12 VDC, typical value)	1.0 mA (at 5 VDC, typical value)
NPN	ON voltage <sup>*1</sup>	4.8 V max.	1.0 V max.
	OFF voltage <sup>*2</sup>	19.2 V min.	4.0 V min.
PNP	ON voltage <sup>*1</sup>	19.2 V min.	4.0 V min.
	OFF voltage <sup>*2</sup>	4.8 V max.	1.0 V max.

Item	Specifications
Maximum response frequency <sup>*3</sup>	50 kHz (I/O cable: when the FQ-MWD005 or FQ-MWDL005 cables is used) 20 kHz (I/O cable: when the FQ-MWD010 or FQ-MWDL010 cables is used)
Input impedance	5.1 kΩ

<sup>\*1</sup> ON voltage: Voltage to change from OFF to ON state. The ON voltage is the difference of voltages between the GND terminal of the encoder power terminals and each input terminal.

<sup>\*2</sup> OFF voltage: Voltage to change from ON to OFF state. The ON voltage is the difference of voltages between the GND terminal of the encoder power terminals and each input terminal.

<sup>\*3</sup> Select maximum response frequency depending on length of the encoder cable and response frequency of the encoder.

**Pulse input specifications (when a line-driver output type encoder is used)**

Item	Specifications
Input voltage	EIA standard RS-422-A line driver level
Input impedance <sup>*1</sup>	120 Ω ±5%
Differential input voltage	0.2 V min.
Hysteresis voltage	50 mV
Maximum response frequency <sup>*2</sup>	200 kHz (I/O cable: when the FQ-MWD005, FQ-MWDL005, FQ-MWD010 or FQ-MWDL010 cable is used)

<sup>\*1</sup> When terminating resistance function is used.

<sup>\*2</sup> Select maximum response frequency depending on length of the encoder cable and response frequency of the encoder.

**Touch Finder specifications**

Item	Type	Model with DC power supply		Model with AC/DC/battery power supply
		FQ-MD30		FQ-MD31
Number of connectable sensors		2 max.		
Main functions	Types of measurement displays	Last result display, last NG display, trend monitor, histograms		
	Types of display images	Through, frozen, zoom-in and zoom-out images		
	Data logging	Measurement results, measured images		
	Menu language	English, Japanese		
Indications	LCD	Display device	3.5-inch TFT color LCD	
		Pixels	320 × 240	
		Display colors	16,777,216	
	Backlight	Life expectancy <sup>*1</sup>	50,000 hours at 25°C	
		Brightness adjustment	Provided	
		Screen saver	Provided	
	Indicators	Power indicator (color: green)	POWER	
		Error indicator (color: red)	ERROR	
		SD card access indicator (color: yellow)	SD ACCESS	
		Charge indicator (color: orange)	–	CHARGE
Operation interface	Touch screen	Method	Resistance film	
		Life expectancy <sup>*2</sup>	1,000,000 operations	
External interface	Ethernet	100 BASE-TX/10 BASE-T		
	SD card	Omron SD card (Model: HMC-SD291) or a SDHC card of Class4 or higher rating is recommended		
Ratings	Power supply voltage	DC power connection	20.4 to 26.4 VDC (including ripple)	
		AC adapter connection	–	100 to 240 VAC, 50/60 Hz
		Battery connection	–	FQ-BAT1 Battery (1 cell, 3.7 V)
	Continuous operation on Battery <sup>*3</sup>	–	1.5 h	
	Current consumption	DC power connection: 0.2 A		
Insulation resistance	Between all lead wires and case: 0.5 MΩ (at 250 V)			
Environmental immunity	Ambient temperature range	Operating: 0 to 50°C Storage: –25 to 65°C (with no icing or condensation)	Operating: 0 to 50°C when mounted to DIN Track or panel 0 to 40°C when operated on a Battery Storage: –25 to 65°C (with no icing or condensation)	
	Ambient humidity range	Operating and storage: 35% to 85% (with no condensation)		
	Ambient atmosphere	No corrosive gas		
	Vibration resistance (destruction)	10 to 150 Hz, single amplitude: 0.35 mm, X/Y/Z directions 8 min each, 10 times		
	Shock resistance (destruction)	150 m/s <sup>2</sup> 3 times each in 6 direction (up, down, right, left, forward and backward)		
	Degree of protection	IEC 60529 IP20		
Dimensions	95 × 85 × 33 mm			
Materials	Case: ABS			
Weight	Approx. 270 g (without Battery and hand strap)			
Accessories	Touch Pen (FQ-XT), Instruction Manual			

<sup>\*1</sup> This is a guideline for the time required for the brightness to diminish to half the initial brightness at room temperature and humidity. No guarantee is implied. The life of the backlight is greatly affected by the ambient temperature and humidity. It will be shorter at lower or higher temperature.

<sup>\*2</sup> This value is only a guideline. No guarantee is implied. The value will be affected by operating conditions.

<sup>\*3</sup> This value is only a guideline. No guarantee is implied. The value will be affected by the operating environment and operating conditions.

## Battery Specifications

Item	Model	FQ-BAT1
Battery type		Secondary lithium ion battery
Nominal capacity		1800 mAh
Rated voltage		3.7 V
Dimensions		35.3 × 53.1 × 11.4 mm
Ambient temperature range		Operating: 0 to 40°C Storage: -25 to 65°C (with no icing or condensation)
Ambient humidity range		Operating and storage: 35% to 85% (with no condensation)
Charging method		Charged in Touch Finder (FQ-MD31) AC adapter (FQ-AC□) is required
Charging time <sup>*1</sup>		2.0 h
Battery backup life <sup>*2</sup>		300 charging cycles
Weight		50 g max.

<sup>\*1</sup> This value is only a guideline. No guarantee is implied. The value will be affected by operating conditions.

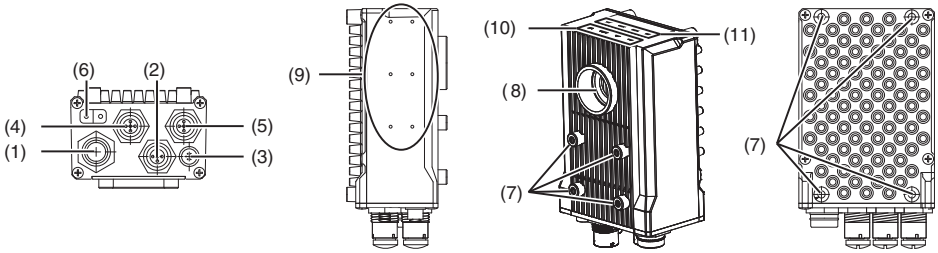
<sup>\*2</sup> This is a guideline for the time required for the capacity of the Battery to be reduced to 60% of the initial capacity. No guarantee is implied. The value will be affected by the operating environment and operating conditions.

## FQ-M Series EtherCAT communications specifications

Item	Specifications
Communication standard	IEC 61158 Type 12
Physical layer	100BASE-TX (IEEE802.3)
Connector	M12 × 2 E-CAT IN: EtherCAT (IN) E-CAT OUT: EtherCAT (OUT)
Communications media	Use the cables for FQ-MWN□□ or FQ-WN□□ series
Communications distance	Use the communication cable within the length of FQ-MWN□□ or FQ-WN□□ series cables
Process data	Variable PDO Mapping
Mailbox (CoE)	Emergency messages, SDO requests, SDO responses and SDO information
Distributed clock	Synchronization with DC mode 1
LED display	L/A IN (Link/Activity IN) × 1 L/A OUT (Link/Activity OUT) × 1 RUN × 1 ERR × 1

Nomenclature

Sensor

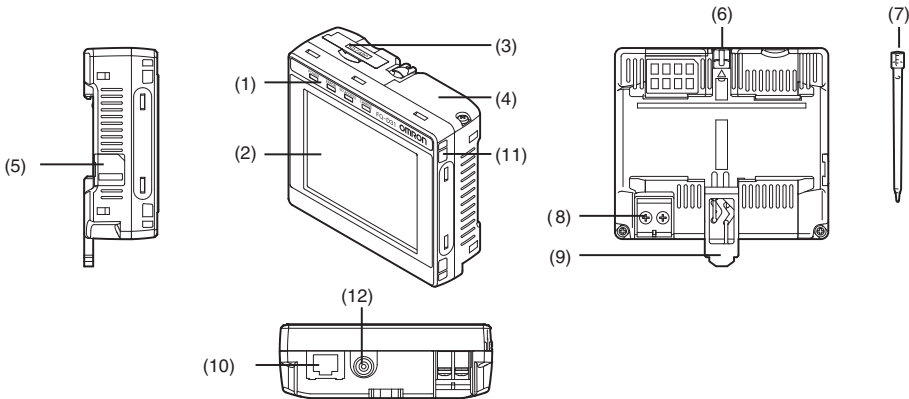


No.	Name	Description
(1)	I/O Cable connector	An I/O Cable is used to connect the sensor to the power supply and external I/O.
(2)	Ethernet connector	An Ethernet cable is used to connect the sensor to external devices such as PLCs, the Touch Finder or computers.
(3)	Lighting connector	Connect an external lighting (strobe controller).
(4)	EtherCAT connector (IN)*	Connect an EtherCAT compatible device.
(5)	EtherCAT connector (OUT)*	Connect an EtherCAT compatible device.
(6)	Node address switch*	Set the node address for EtherCAT communications.
(7)	Installation holes	Holes to install and secure the camera.
(8)	C-mount lens connection part	Install the C-Mount lens in this part. Determine the field of view depending on the measurement target and select a suitable CCTV lens (C-mounting lens).

No.	Name	Description	
(9)	Strobe controller connection holes	Install the strobe controller in this part. FL-TCC1 can be mounted.	
(10)	Measurement process Operation Indicators	OR	Lit in orange while OR signal is ON.
		ETN	Lit in orange while in Ethernet communications.
		ERROR	Lit in red when an error occurs.
		BUSY	Lit in green while the sensor is processing.
(11)	EtherCAT Operation indicators	L/A IN	Lit in green when Link with EtherCAT device is established and flickers in green when communicating (data IN).
		L/A OUT	Lit in green when Link with EtherCAT device is established and flickers in green when communicating (data OUT).
		ECAT RUN	Lit in green when EtherCAT communications is available.
		ECAT ERROR	Lit in red when an EtherCAT communications error occurs.

\* FQ-MS □□□-ECT and FQ-MS □□□-M-ECT only.

Touch Finder



No.	Name	Description	
(1)	Operation indicators	POWER	Lights green when the Touch Finder is turned ON.
		ERROR	Lights red when an error occurs.
		SD ACCESS	Lights yellow when an SD card is inserted. Flashes yellow when the SD card is being accessed.
		CHARGE*	Lights orange when the Battery is charging.
(2)	LCD/touch panel	Displays the setting menu, measurement results and images input by the camera	
(3)	SD card slot	An SD card can be inserted.	
(4)	Battery cover*	The Battery is inserted behind this cover. Remove the cover when mounting or removing the Battery.	
(5)	Power supply switch	Turns on the Touch Finder.	

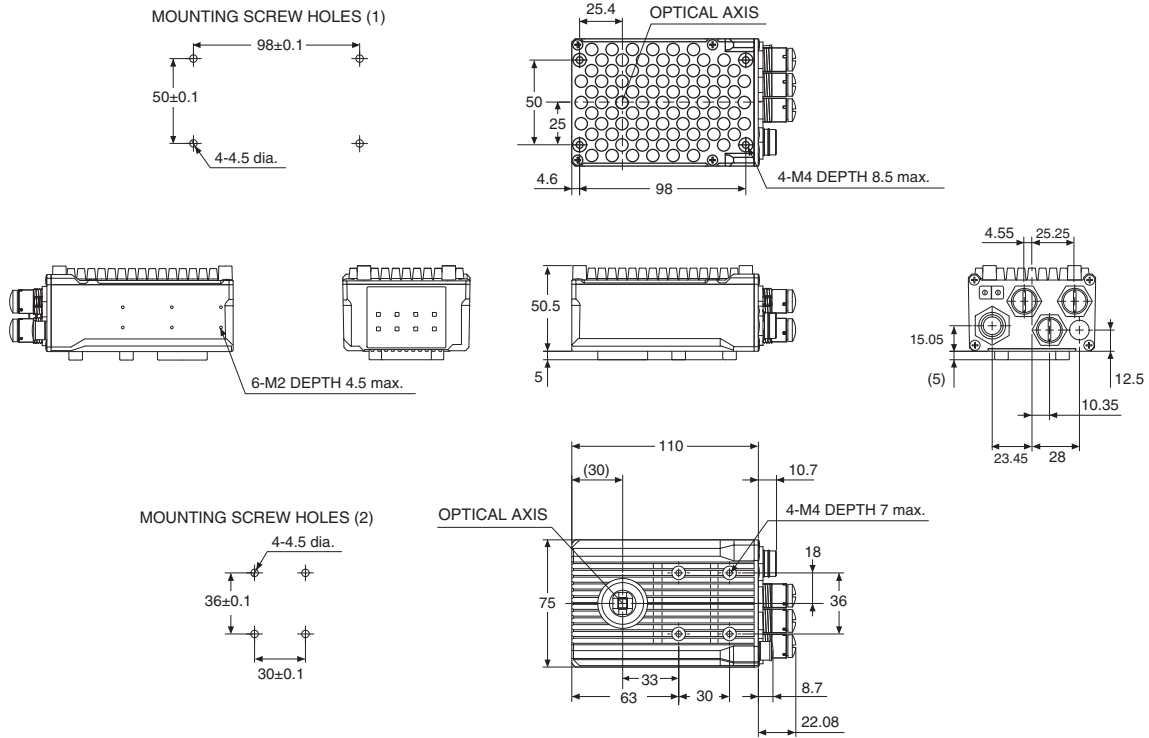
No.	Name	Description
(6)	Touch pen holder	The touch pen can be stored here when it is not being used.
(7)	Touch pen	Used to operate the touch panel.
(8)	DC power supply connector	Used to connect a DC power supply.
(9)	Slider	Used to mount the Touch Finder to a DIN Track.
(10)	Ethernet port	Used when connecting the Touch Finder to the sensor with an Ethernet cable. Insert the connector until it locks in place.
(11)	Strap holder	This is a holder for attaching the strap.
(12)	AC power supply connector*	Use to connect the AC adapter.

\* Applicable to the FQ-MD31 only.

Dimensions

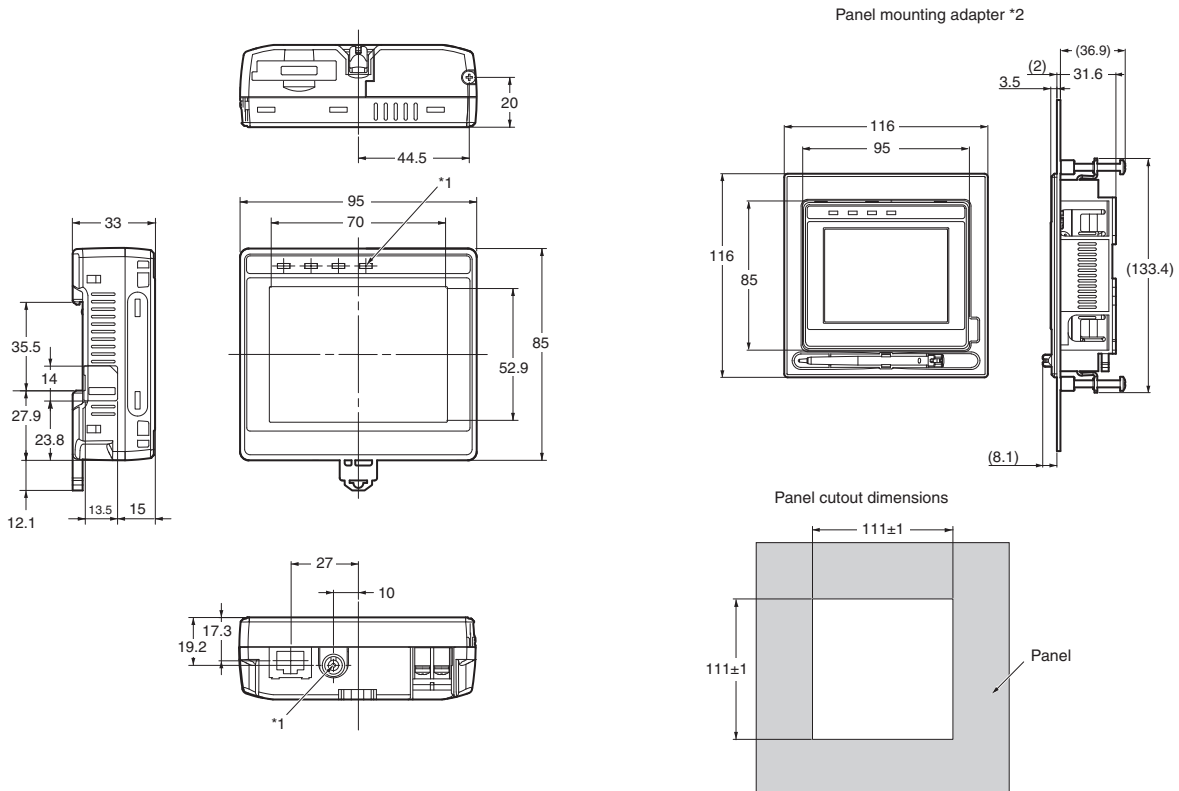
Sensor

FQ-MS12□-ECT/MS12□-M-ECT



Touch Finder

FQ-MD30/MD31



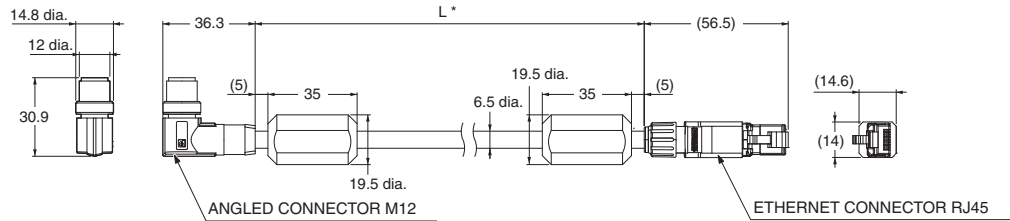
\*1. Provided with FQ-MD31 only.

\*2. The dimension of the panel mounting adapter does not include that of a FQ-MD□□.

Cables

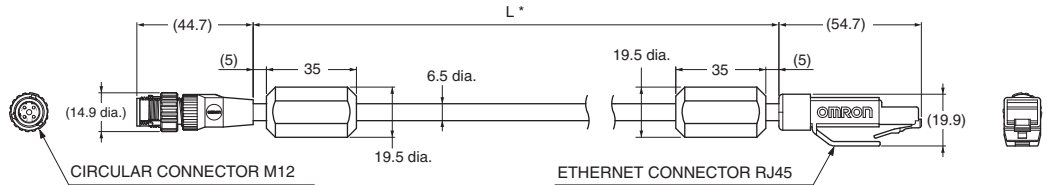
For EtherCAT and Ethernet cable

Angle: M12 / Straight: RJ45  
FQ-MWNL005/010



\* Cable is available in 5 m/10 m

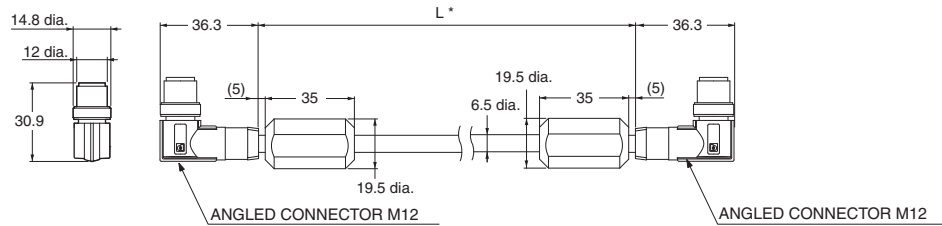
Straight type (M12/RJ45)  
FQ-WN005/010



\* Cable is available in 5 m/10 m

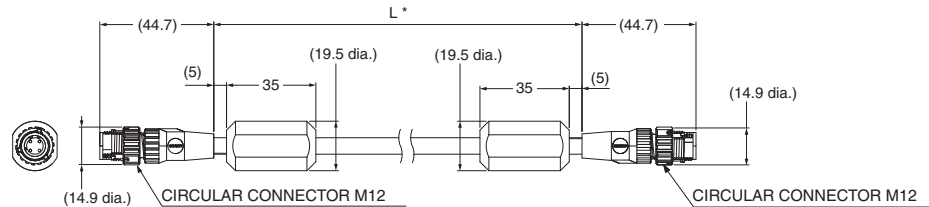
For EtherCAT cable

Angle type (M12/M12)  
FQ-MWNE005/010



\* Cable is available in 5 m/10 m

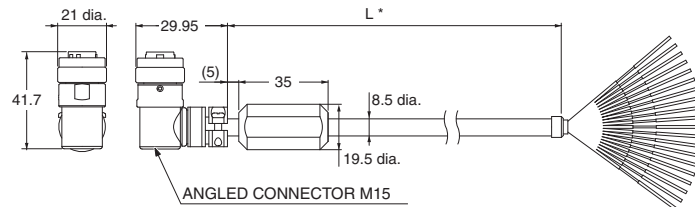
Straight type (M12/M12)  
FQ-MWNE005/010



\* Cable is available in 5 m/10 m

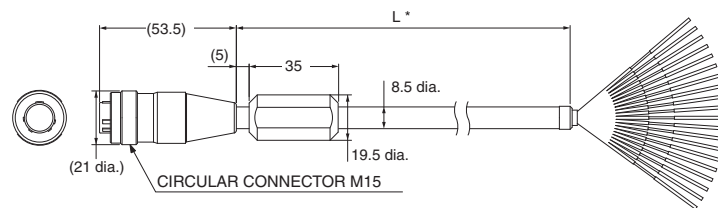
I/O cables

Angle type  
FQ-MWDL005/010



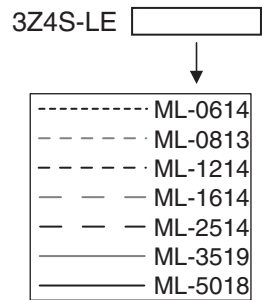
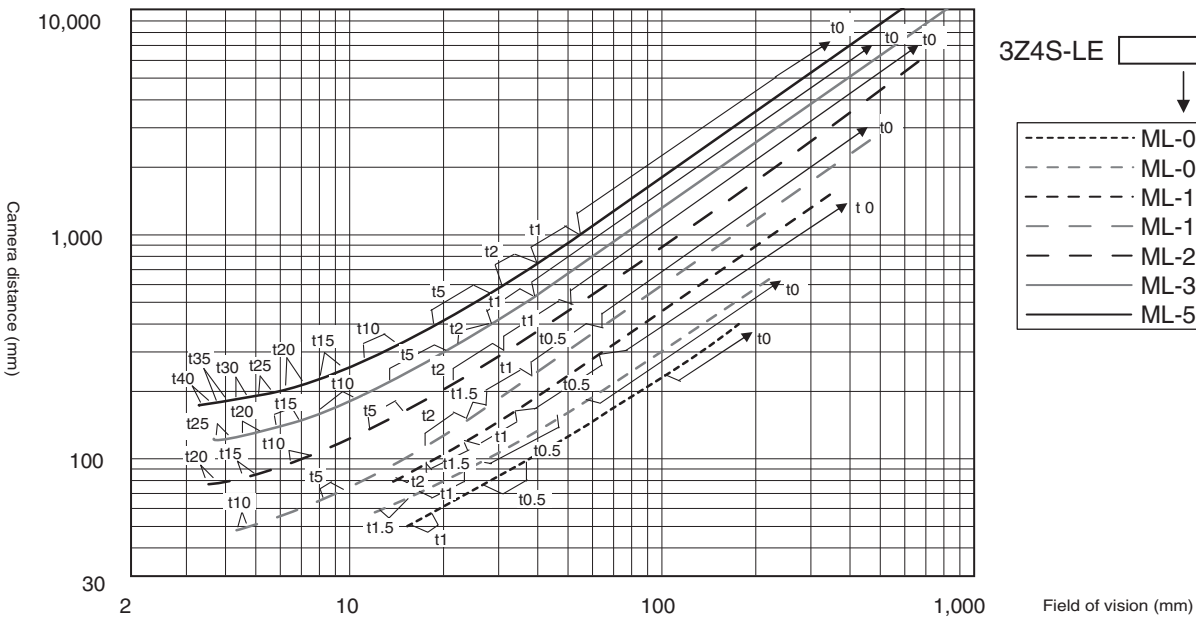
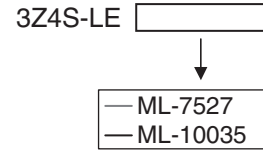
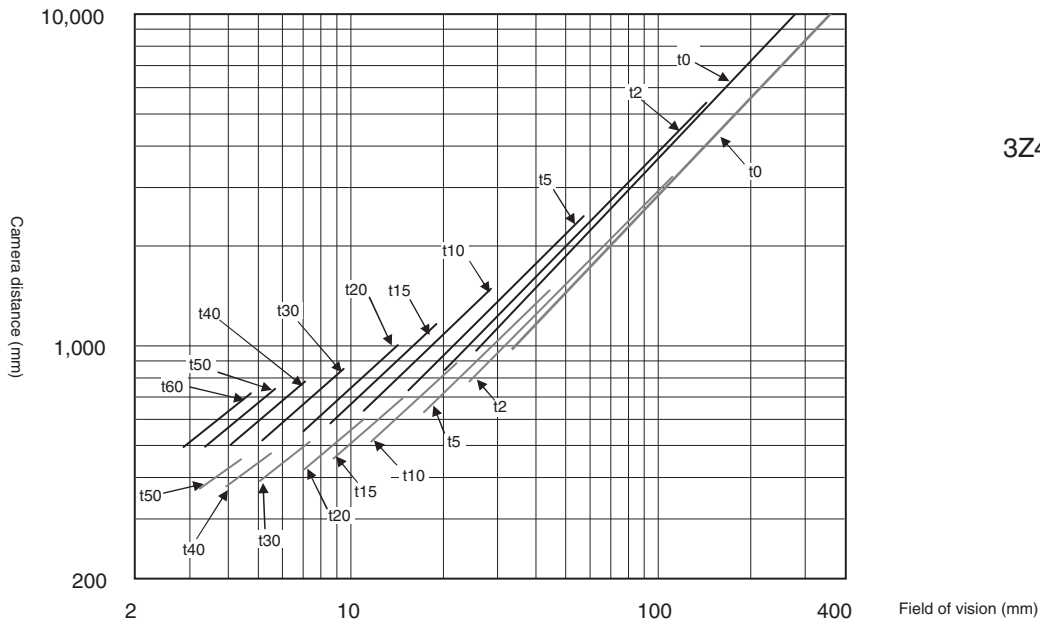
\* Cable is available in 5 m/10 m

Straight type  
FQ-MWD005/010



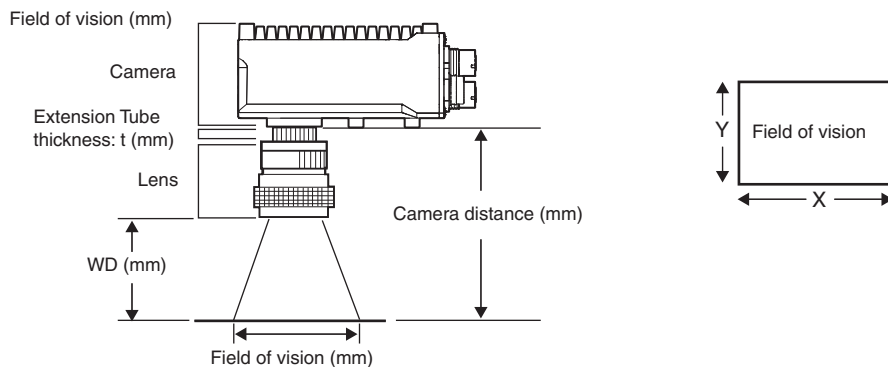
\* Cable is available in 5 m/10 m

Optical Chart



Meaning of Optical Chart

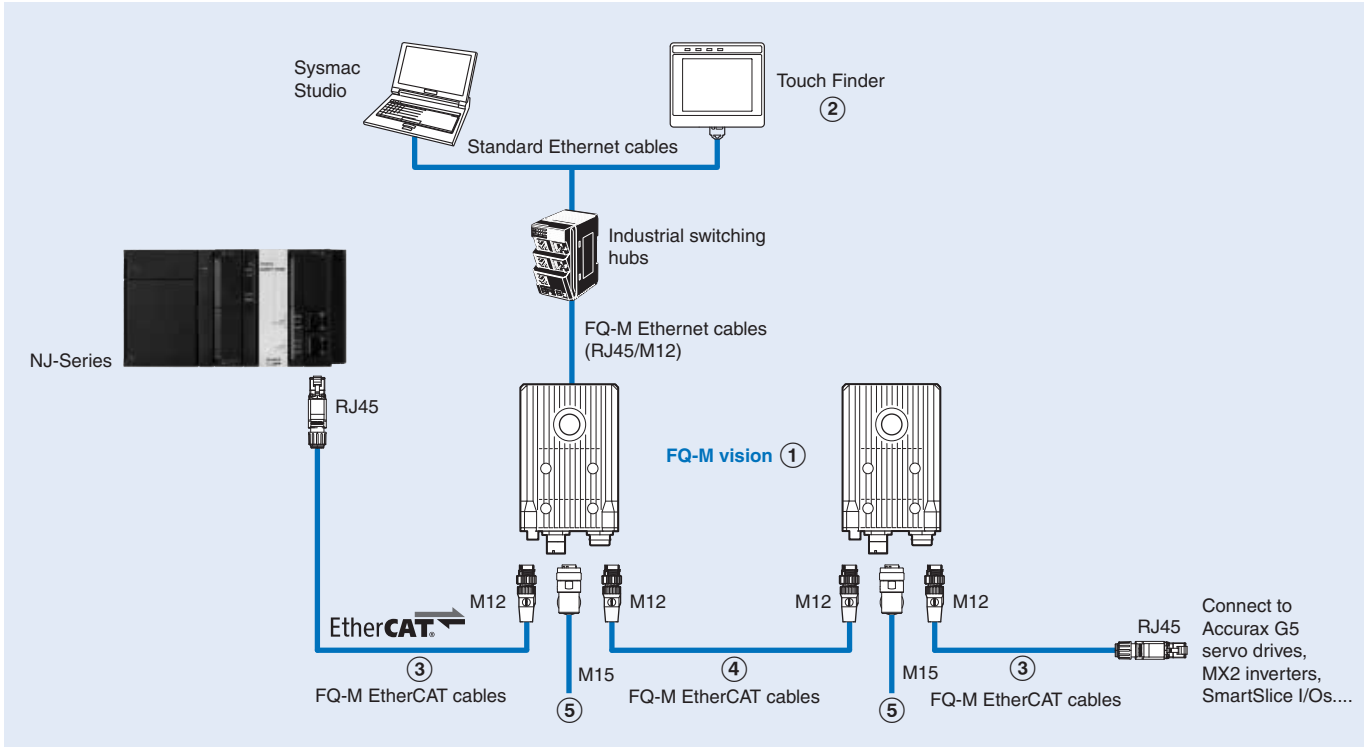
The X axis of the optical chart shows the field of vision (mm)<sup>\*1</sup>, and the Y axis of the optical chart shows the camera installation distance (mm).<sup>\*2</sup>



\*1. The lengths of the fields of vision given in the optical charts are the lengths of the Y axis.  
\*2. The vertical axis represents WD for small cameras.



Ordering information



Sensors

Symbol	Type		Model	Appearance	
①	Color	NPN	EtherCAT communication function provided	FQ-MS120-ECT	
		PNP		FQ-MS125-ECT	
	Monochrome	NPN		FQ-MS120-M-ECT	
		PNP		FQ-MS125-M-ECT	

Touch Finder






Symbol	Type	Model	Appearance
②	DC power supply	FQ-MD30	
	AC/DC/battery <sup>*1</sup>	FQ-MD31	

\*1 AC Adapter and Battery are sold separately.

Bend Resistant Cables for FQ-M Series

Symbol	Type	Model	Appearance		
③	For EtherCAT and Ethernet cable Angle: M12/Straight: RJ45	Cable length: 5 m	FQ-MWNL005		
		Cable length: 10m	FQ-MWNL010		
	For EtherCAT and Ethernet cable Straight type (M12/RJ45)	Cable length: 5 m	FQ-WN005-E		
		Cable length: 10m	FQ-WN010-E		
④	For EtherCAT cable Angle type (M12/M12)	Cable length: 5 m	FQ-MWNE005		
		Cable length: 10 m	FQ-MWNE010		
	For EtherCAT cable Straight type (M12/M12)	Cable length: 5 m	FQ-MWNE005		
		Cable length: 10 m	FQ-MWNE010		
⑤	I/O Cables	Angle type	Cable length: 5 m	FQ-MWDL005	
			Cable length: 10 m	FQ-MWDL010	
	Straight type	Cable length: 5 m	FQ-MWD005		
		Cable length: 10 m	FQ-MWD010		

## Accessories for Touch Finder

Type	Model	Appearance
Panel Mounting Adapter	FQ-XPM	
AC Adapter (for models for DC/AC/Battery)	Plug type A, 125 V max. (PSE standard)	FQ-AC1
	Plug type A, 125 V max. (UL/CSA standard)	FQ-AC2
	Plug type A, 250 V max. (CCC mark standard)	FQ-AC3
	Plug type C, 250 V max.	FQ-AC4
	Plug type BF, 250 V max.	FQ-AC5
	Plug type O, 250 V max.	FQ-AC6
Battery (for models for DC/AC/Battery)	FQ-BAT1	
Touch Pen (enclosed with Touch Finder)	FQ-XT	
Strap	FQ-XH	
SD Card (2 GB)	HMC-SD291	

## Cameras Peripheral Devices

Type	Specifications	Model
Cameras peripheral devices (CCTV Lens)	Focal distance: 6 mm, Focus: F1.4~close, Diameter: 30 mm	3Z4S-LE ML-0614
	Focal distance: 8 mm, Focus: F1.3~close, Diameter: 30 mm	3Z4S-LE ML-0813
	Focal distance: 12 mm, Focus: F1.4~close, Diameter: 30 mm	3Z4S-LE ML-1214
	Focal distance: 16 mm, Focus: F1.4~close, Diameter: 30 mm	3Z4S-LE ML-1614
	Focal distance: 25 mm, Focus: F1.4~close, Diameter: 30 mm	3Z4S-LE ML-2514
	Focal distance: 35 mm, Focus: F1.9~close, Diameter: 30 mm	3Z4S-LE ML-3519
	Focal distance: 50 mm, Focus: F1.8~close, Diameter: 32 mm	3Z4S-LE ML-5018
	Focal distance: 75 mm, Focus: F2.7~close, Diameter: 32 mm	3Z4S-LE ML-7527
	Focal distance: 100 mm, Focus: F3.5~close, Diameter: 32 mm	3Z4S-LE ML-10035
Extension tube <sup>*1</sup>	Length: 0.5 mm	3Z4S-LE ML-EXR0.5
	Length: 1 mm	3Z4S-LE ML-EXR1
	Length: 2 mm	3Z4S-LE ML-EXR2
	Length: 5 mm	3Z4S-LE ML-EXR5
	Length: 10 mm	3Z4S-LE ML-EXR10
	Length: 20 mm	3Z4S-LE ML-EXR20
Length: 40 mm	3Z4S-LE ML-EXR40	
External Lightings		FL Series
Lighting Controllers	For FL Series	FL-TCC1

\*1 To achieve 50 and 60 mm, please combine two extension tubes.

## Computer software

Specifications	Model
Sysmac Studio version 1.01 or higher	SYSMAC-SE2□□□

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.  
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.