OMRON

N E W

CE

Faster and more powerful than anything in its class!

F160

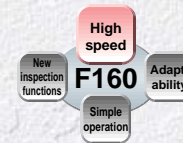## Vision Sensor

Authorized Distributor:
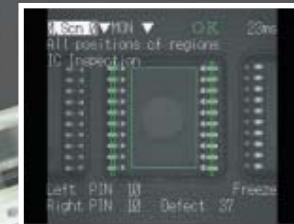
Great Performance from a Sensor with No Blind Spots

The development of the F160 represents the arrival of a remarkable vision sensor that answers the needs of today's inspection line. It has the processing speed required for ultra high-speed lines and, using memory cards, has the capacity required for multi-product lines. Choose from a comprehensive selection of cameras for just the right type of inspection, and customize screens and operations to ensure optimum on-site operability. Initial setup can be performed even by inexperienced operators thanks to user-friendly conversational menus, and inspection performance has been comprehensively improved using new algorithms.

All of OMRON's technology and know-how has come together to bring you the optimum vision sensor - the F160, a sensor you can use with confidence.

High speed

New inspection functions **F160** Adapt-ability

Simple operation

High speed

New inspection functions **F160** Adapt-ability

Simple operation

Creating New Possibilities with Incredible Speed

The F160 can be applied to ultra high-speed lines. It allows a greater range of inspections within the required tact time, contributing greatly to the improvement of inspection quality.

The newly-developed Double-speed Camera allows images to be captured up to 4 times faster than with previous cameras, and image processing can now be achieved 2 to 10 times faster than before. For example, gray search for the image shown in Picture 1 below can be performed for 5,000 items-a-minute inspection lines. Also, because each individual inspection is made at high speed, the total inspection time for complicated applications has been dramatically reduced. This creates extra time for inspections that were not possible before, leading to significant improvements in inspection quality.

Image capture time   Inspection processing time

Existing products

Up to 4 times as fast   2 to 10 times as fast
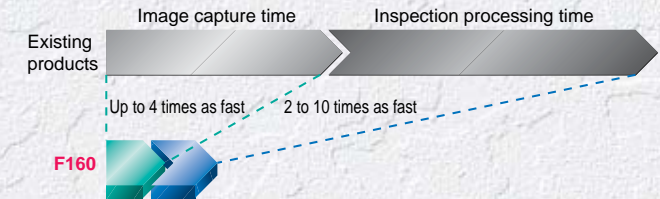
F160

• Example: Gray Search Processing (Picture 1)   • Example: More than one inspection item
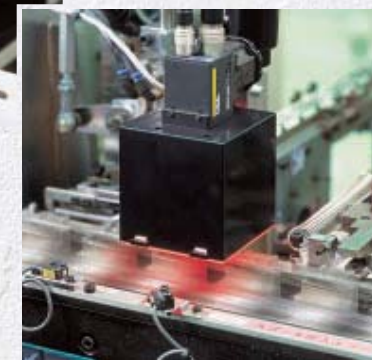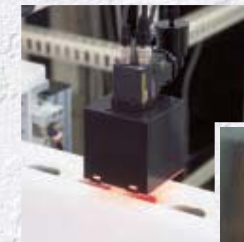
Use in a Wide Variety of Applications with a Greatly Reduced Installation Time

■ Data-handling Capacity Increased with Memory Cards

The F160 enables reductions in setup costs and allows a greater number of scenes to be used.

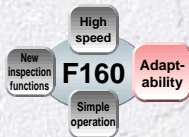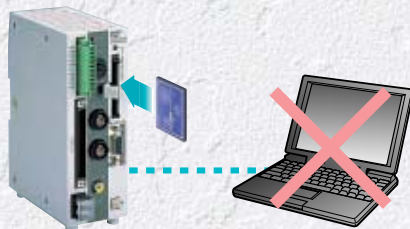The F160 is equipped with a memory card slot that allows the number of available scenes to be increased simply by inserting a card. With a 128-MByte card, for example, up to 1,000 scenes can be saved (see note). The construction of computer-based systems for exchanging scene data is no longer required.

Note: The actual number of scenes that can be saved depends on the scene settings.

■ Increased Functionality for Storing Images

Up to 35 screens of measurement images and improper images (i.e. images of improper products) can be stored. Also, because the most recent improper image can be viewed while performing measurement, problems in the inspection line can be analyzed without stopping production.

Good product image

NG0
NG1
NG34

Improper product image

■ I/O Monitor

The status of input and output terminals can be displayed on the screen. This function can be used for checking wiring when making adjustments to the system.

Parallel I/O monitor:

■ Screen Capture

Images of menu setting screens, measurement screens, and improper images can be captured and stored in the memory card. This feature is very useful for creating documentation.

Setting screen

Capture

Memory card

Documentation on computers

Setup Manual

Procedure
1.
2.
3.
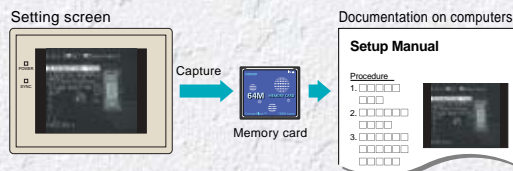
A Wide Variety of Cameras

OMRON's Double-speed Cameras, F150 Cameras, or F200/F300 Cameras can be connected. Use the Camera that meets your speed, cost, and lighting requirements.

● Double-speed Camera
F160-S1/SLC20/SLC50

The shutter speed can be set to one of 8 settings from the Controller. Cameras with intelligent lighting are also included in the lineup.

● F150 Camera
F150-S1A/SLC20/SLC50/SL20A/SL50A

Compact and cost-effective. Models with intelligent lighting or compact LED lighting are available.

● F200/F300 Camera

Existing cameras can be used by just moving them from the F200/F300 to the F160.
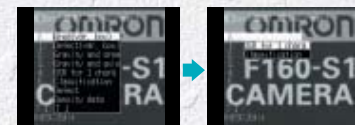

Customize Operations, Screens, and Output to Suit Your Requirements

Operations

■ Menu Masking

Incorrect operation can be prevented by masking menu items for settings that must not be changed. This function also simplifies the operations required to change menu settings and helps save time.

■ Password Setting

Passwords can be set to restrict the personnel allowed to operate the F160. This function helps to improve security and reduce incorrect operation.

■ Shortcut Keys

Frequently used operations can be allocated to specific console keys. Menus can be switched at the touch of a button.

Measurement image   Line-brightness display

Switch the display with one touch

Screens

■ Screen Messages

Screen messages can be changed to suit the on-site environment and can be displayed in any desired position on the screen.

■ Drawing Figures

Figures such as lines, boxes, circles, and cross cursors can be drawn. It is also possible to these figures at measurement positions.

■ It is possible to select the character-size and the display can be black-white inverted.
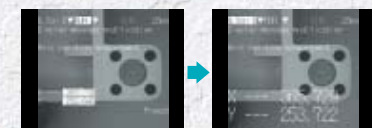
■ Color Display

Messages and figures can be made easier to view by using different colors.
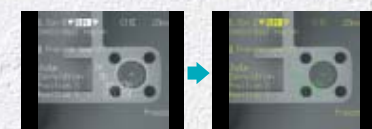
Output

■ RS-232C Format

The output format can be changed to suit system specifications.

■ Conversational Menus

The F160 also has menus designed in a conversational style so that even personnel with little experience can perform settings with ease.

Inspection revolutionized with new algorithms.

■ QUEST Character Recognition

The F160 uses OMRON's character recognition system - QUEST.

Features
• The user does not have to register characters.
• High-level of discrimination of similar characters.
• Adapts to fluctuations in shape and size.

Use for any type of character

■ "Variable Box" Measurement for Defect Inspection

The measurement region can be set to change automatically when performing inspections for objects with varying sizes, such as electronic chip components. This feature ensures that the optimum measurement regions are always used for inspection.

Setting screen

Measurement screen

Set frames for adjusting the region size.

The inspection region automatically adapts to the object. region size.
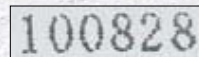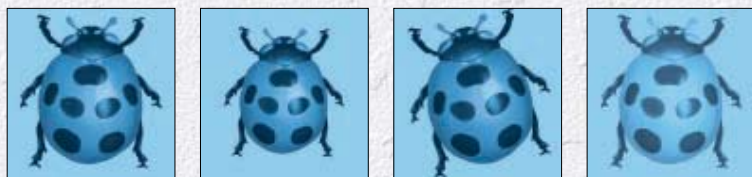
■ Flexible Search

Using this method, matching is performed using more than one reference image and so the F160 can perform inspection for objects with varying shapes. This feature helps to reduce incorrect judgements.

Matching can be performed for products with varying shapes by using more than one reference image.

A Variety of Functions Accessible with Easy-to-Use Menus

■ Rotation Search

Using this method, search is performed while the image is rotated. Processing is performed 10 times faster than with existing models. Using angle interpolation, it is possible to detect angles with a high degree of precision.

Example: Searching in a rotation range of 360° with a skipping angle of 5°.

■ Classification

A search is performed for more than one model, and the model number with the highest correlation is output. The flexible search function can be used for applications involving objects with different shapes.

Model 1   Model 2   Model 3
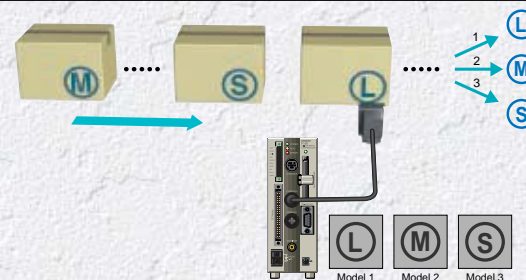
■ Edge Width

The positions of both edges of an object are detected with high accuracy, and from this the width of the object is calculated. It is not necessary to set expressions for calculating the width.

■ Labeling

The number of labels (i.e., objects) inside the measurement region is counted. After they have been sorted according to area or center of gravity, the measurement data for specified labels is output.

Counting gears

Inspecting the position and number of buttons

■ Position Displacement Compensation

With the F160, compensation using only the outline of the object, 2-stage position compensation, and setting priorities for the compensation direction are all possible.

Compensation in the X direction followed by compensation in the Y direction.

■ Expressions

Judgement and data output based on a maximum of 32 expressions is possible. Up to 32 variables (representing other expressions) can be used, enabling more complex calculations.

System Configuration

Sync sensor

Programmable Controller

Console
F160-KP   F150-KP

Double-speed Camera

Camera with Intelligent Lighting
F160-SLC20
F160-SLC50

Camera
F160-S1

Parallel Cable
F160-VP

Controller
F160-C10E
F160-C15E

Camera
Cable
F150-VS

Memory Card
F160-N64S (64 Mbytes)
QM300-N128S (128 Mbytes)
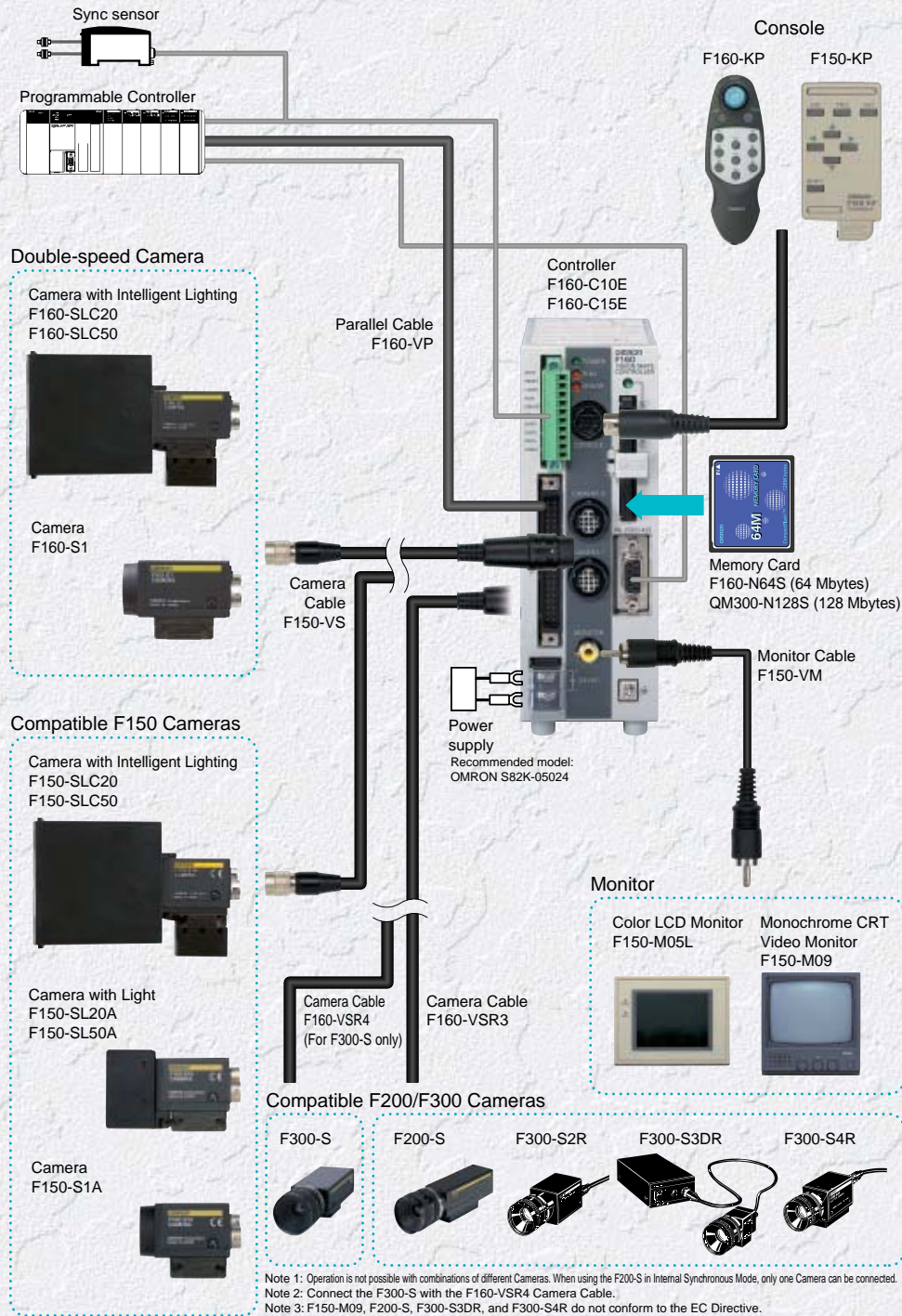
Monitor Cable
F150-VM

Power
supply
Recommended model:
OMRON S82K-05024

Compatible F150 Cameras

Camera with Intelligent Lighting
F150-SLC20
F150-SLC50

Camera with Light
F150-SL20A
F150-SL50A

Camera
F150-S1A

Camera Cable
F160-VSR4
(For F300-S only)

Camera Cable
F160-VSR3

Monitor

Color LCD Monitor
F150-M05L

Monochrome CRT
Video Monitor
F150-M09

Compatible F200/F300 Cameras

F300-S   F200-S   F300-S2R   F300-S3DR   F300-S4R

Note 1: Operation is not possible with combinations of different Cameras. When using the F200-S in Internal Synchronous Mode, only one Camera can be connected.
Note 2: Connect the F300-S with the F160-VSR4 Camera Cable.
Note 3: F150-M09, F200-S, F300-S3DR, and F300-S4R do not conform to the EC Directive.

Standard Models

Name		Model number	Comments
Controller		F160-C10E	NPN Input/Output
		F160-C15E	PNP Input/Output
Double-speed Camera	Camera with Intelligent Lighting	F160-SLC20	
		F160-SLC50	
	Camera only	F160-S1	
Compatible F150 Cameras	Camera with Intelligent Lighting	F150-SLC20	
		F150-SLC50	
	Camera with Light	F150-SL20A	
		F150-SL50A	
	Camera only	F150-S1A	
Compatible F200/F300 Cameras	Camera	F200-S	
		F300-S	
	Shutter Camera	F300-S2R	
		F300-S3DR	With separable head.
	Frame-shutter Camera	F300-S4R	
Console		F160-KP	
		F150-KP	
Color LCD Monitor		F150-M05L	
Monochrome CRT Video Monitor		F150-M09	
Memory Card		F160-N64S	Memory capacity: 64 Mbytes
Camera Cable		F150-VS	For Double-speed Camera and compatible F150 Cameras. Cable length: 3 m
		F160-VSR3	For compatible F200/F300 Cameras. Cable length: 3 m
		F160-VSR4	For F300-S only. Cable length: 3 m
Monitor Cable		F150-VM	Cable length: 2 m
Parallel Cable		F160-VP	Loose-wire cable for parallel I/O connectors Cable length: 2 m

Specifications

■ Ratings/Functions

● Controller: F160-C10E/C15E

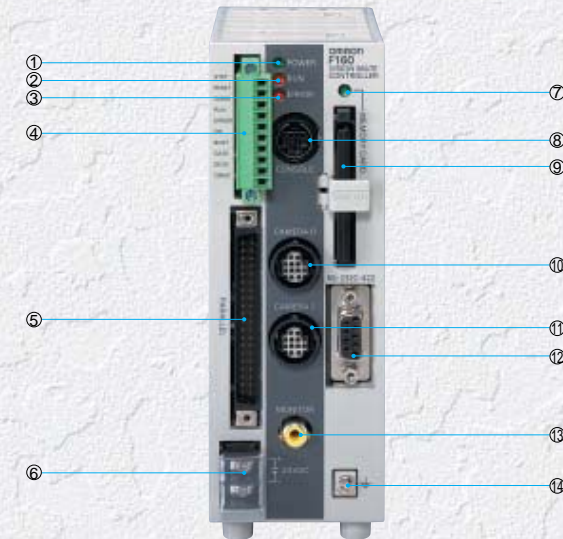| Item Specifications	Conversational Menu Mode	Expert Menu Mode
Connectable Cameras	F150-S1A/SL20A/SL50A/SLC20/SLC50, F160-S1/SLC20/SLC50, F300-S/S2R/S3DR/S4R etc.	
Number of Cameras connectable	1	2
Number of pixels	512 x 484 (H x V)	
Number of scenes	32 (Expansion possible using Memory Card.)	
Image storage function	Maximum of 35 images stored	
Filtering	――	Smoothing (strong, weak), edge enhancement, edge extraction (horizontal, vertical, both horizontal and vertical), dilation, erosion, median, background suppression
Position displacement compensation	Set either automatically or manually Compensation directions: X, Y, and θ (360°) directions	Compensation directions: X, Y, and θ (360°) directions Detection methods: Binary center of gravity, axis angle, labeling, rotation search, gray search, edge position
Number of measurement regions	32 regions per scene	
Applications	7 types available (presence, orientation, dimensions, defects, conformity, position, chips and burs)	――
Measurement data	Automatically selected according to the application.	Gravity and area, gravity and axis, gray search, precise search, rotation search, flexible search, relative search, defect, area (variable box), defect (variable box), edge position, edge pitch, edge width, density average, labeling, OCR for 1 character, classification
Data operation functions (expressions)	――	Number : 32 expressions can be set for judgements, data, and variables used in other expressions Operations : Arithmetic operations, square root, absolute value, remainder, distance, angle, maximum, minimum, SIN, COS, ATAN, AND, OR, NOT
Results output	Overall judgements, judgements for each measurement region	Overall judgements, judgements for each measurement region, expression results, measurement/expression data
Functions for customizing operations	――	Menu masking, password setting, shortcut keys
Functions for customizing screens	――	Display items : Character strings (measurement values, judgement results, times, user-specified characters, measurement region names) Figures : (lines, boxes, circles, cross cursors) Specified parameters : Display color, position, size
Number of slots for Memory Cards	1	
Monitor interface	1 channel (color, monochrome)	
Serial communications	RS-232C/422A, 1 channel	
Parallel I/O	13 inputs and 22 outputs including control I/O points	
Input/ Output type NPN	F160-C10E	
Input/ Output type PNP	F160-C15E	
Power supply voltage	20.4 to 26.4 VDC	
Current consumption	Approx. 1.6 A (with two F160-SLC50 Cameras are connected)	
Ambient temperature	Operating: 0 to 50°C Storage: -25 to 65°C (with no icing or condensation)	
Ambient humidity	Operating and storage: 35% to 85% (with no condensation)	
External dimensions	56 x 160 x 110 (W x H x D) mm (not including connectors and other protruding parts)	
Weight	Approx. 570 g (Controller only)	

● Double-speed Camera: F160-S1

Picture element	1/3" Interline CCD
Effective pixels	659 x 494 (H x V)
Scanning method	1/60-s non-interlace (frame) mode, 1/120-s 2:1 interlace (field) mode
Shutter	Electronic shutter; select from 8 shutter-speed settings (1/120 to 1/20,000 s) using menu.
Camera with Intelligent Lighting	F160-SLC20 (field of vision: 20 mm), F160-SLC50 (field of vision: 50 mm)
External dimensions	31 x 40 x 54.5 (W x H x D) mm (not including connectors and other protruding parts)
Weight	Approx. 85 g (Camera only)

● Monitor

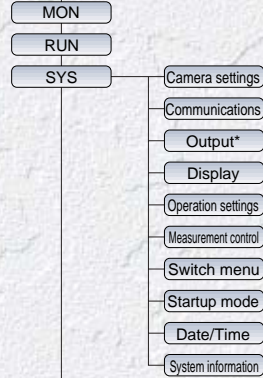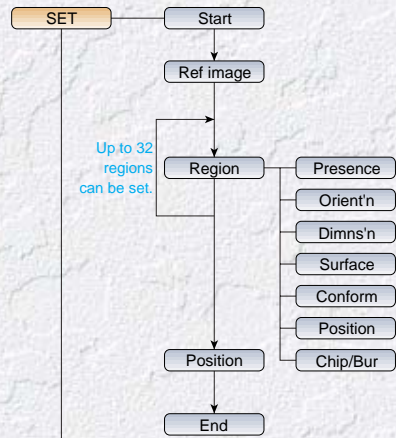| Name Model number Item	F150-M05L Color LCD Monitor	F150-M09 Monochrome CRT Video Monitor
Size	5.5 inches	9 inches
Type	Liquid crystal color TFT	CRT monochrome
Resolution	320 x 240 dots	800 TV lines min. (at center)
Input signals	NTSC composite video (1.0 V/75 Ω)	
Power supply voltage	20.4 to 26.4 VDC	100 to 240 VAC (-15%, +10%)
Current consumption	Approx. 700 mA	Approx. 200 mA
Ambient temperature	Operating: 0 to 50°C Storage: -25 to 65°C (with no icing or condensation)	Operating: -10 to 50°C Storage: -20 to 65°C (with no icing or condensation)
Ambient humidity	Operating or storage: 35% to 85% (with no condensation)	10% to 90% (with no condensation)
Weight (Monitor only)	Approx. 1 kg	Approx. 4.5 kg
Accessories	Instruction manual and 4 mounting brackets	Instruction manual

Component Names and Functions

● F160-C10E/C15E

① **Power indicator**
Lit while power is ON.

② **RUN indicator**
Lit while the F160 is in Run Mode.

③ **ERROR indicator**
Lit when an error has occurred.

④ **I/O terminals (control lines)**
Connect the F160 to external devices such as sync sensors or PLCs.

⑤ **I/O connector (data lines)**
Connects the F160 to external devices such as sync sensors or PLCs.

⑥ **Power supply terminals**
Connect the power supply.

⑦ **Memory Card indicator**
Lit while the Memory Card is accessed.

⑧ **Console connector**
Connects the F160 to the Console.

⑨ **Memory Card slot**
Inserts the Memory Card.

⑩ **Camera 0 connector**
Connects to Camera 0.

⑪ **Camera 1 connector**
Connects to Camera 1.

⑫ **RS-232C/422 connector**
Connects the F160 to an external device such as a computer or PLC.

⑬ **Monitor connector**
Connects to the Monitor.
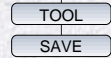
⑭ **Ground terminal**
Connects to the ground wire
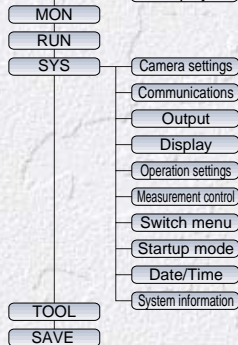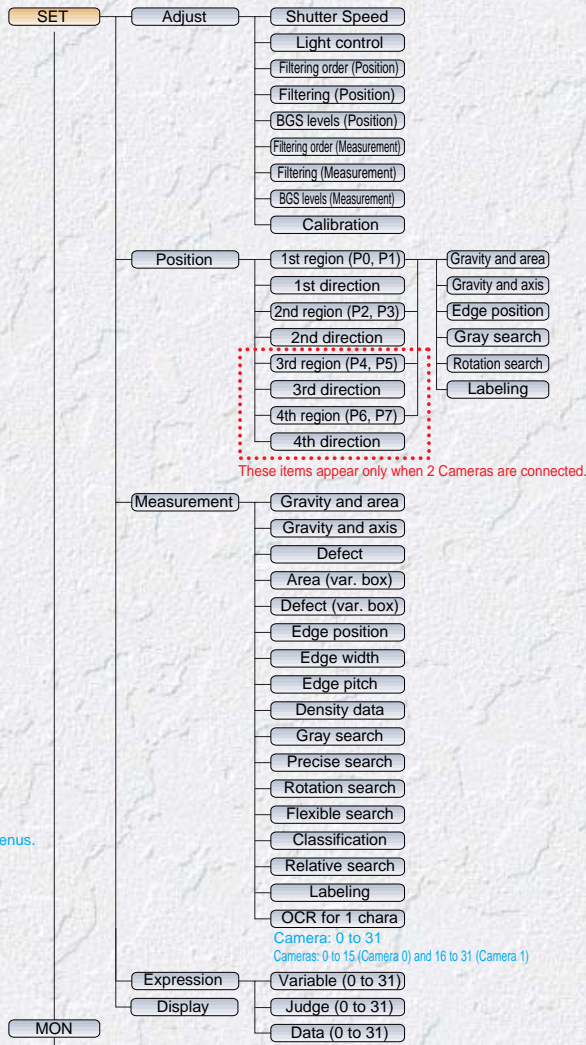
Menus

■ Menu Trees

● Conversational Menu Mode

SET → Start

Ref image

Up to 32 regions can be set.

Region → Presence / Orient'n / Dimns'n / Surface / Conform / Position / Chip/Bur

Position

End

MON
RUN
SYS → Camera settings / Communications / Output* / Display / Operation settings / Measurement control / Switch menu / Startup mode / Date/Time / System information

*Cannot be used with conversational menus.

TOOL
SAVE

● Expert Menu Mode

SET →

Adjust → Shutter Speed / Light control / Filtering order (Position) / Filtering (Position) / BGS levels (Position) / Filtering order (Measurement) / Filtering (Measurement) / BGS levels (Measurement) / Calibration

Position → 1st region (P0, P1) → Gravity and area
1st direction → Gravity and axis
2nd region (P2, P3) → Edge position
2nd direction → Gray search
3rd region (P4, P5) → Rotation search
3rd direction → Labeling
4th region (P6, P7)
4th direction

These items appear only when 2 Cameras are connected.

Measurement → Gravity and area / Gravity and axis / Defect / Area (var. box) / Defect (var. box) / Edge position / Edge width / Edge pitch / Density data / Gray search / Precise search / Rotation search / Flexible search / Classification / Relative search / Labeling / OCR for 1 chara

Camera: 0 to 31
Cameras: 0 to 15 (Camera 0) and 16 to 31 (Camera 1)

Expression
Display → Variable (0 to 31) / Judge (0 to 31) / Data (0 to 31)

MON
RUN
SYS → Camera settings / Communications / Output / Display / Operation settings / Measurement control / Switch menu / Startup mode / Date/Time / System information

TOOL
SAVE

Dimensions (Unit: mm)

Controller
● F160-C10E/C15E
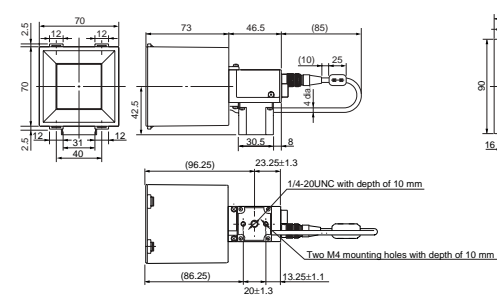

Console
● F160-KP

● F150-KP
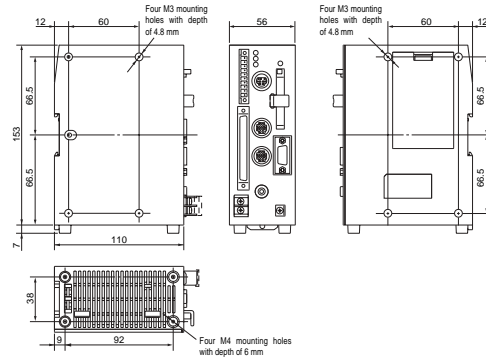
Double-speed Camera
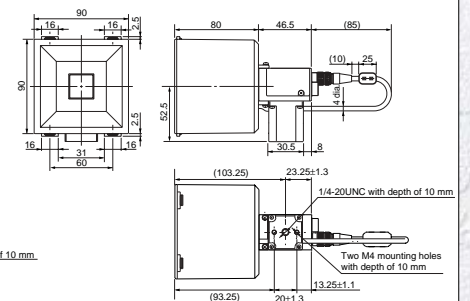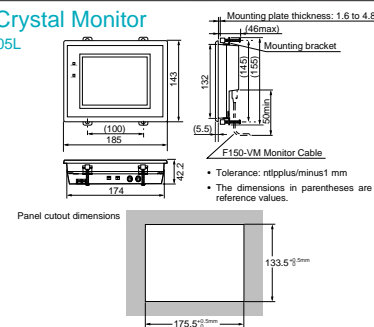● F160-S1
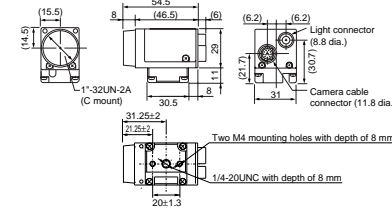
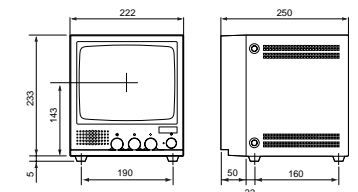● F160-SLC20

● F160-SLC50

Liquid Crystal Monitor
● F150-M05L

Video Monitor
● F150-M09

Lenses (for use with the F150-S1 and F150-S1A only)

- With reference to the optical graph below, select the lens and combination of Extension Tubes that give the required field of vision and camera distance.

■ CCTV Lenses

	CCTV Lenses					
Model	3Z4S-LE C815B	3Z4S-LE B1214D-2	3Z4S-LE C1614A	3Z4S-LE B2514D	3Z4S-LE B5014A	3Z4S-LE B7514C
Dimensions	42 dia. 40	42 dia. 50	30 dia. 33	30 dia. 37.3	48 dia. 48	62 dia. 79
Locking mechanism	Focus locking mechanism					None

■ Extension Tubes

Model	Contents
3Z4S-LE EX-C6	A set of six Extension Tubes of thicknesses 40, 20, 10, 5, 1, and 0.5 mm respectively.

■ Meaning of Optical Graph

The X axis of the graph shows the field of vision L (mm), and the Y axis shows the camera distance A (mm). The curves on the graph indicate different lenses, and the "t" values indicate the lengths of the Extension Tubes.

Camera

Extension Tube thickness, t□ (mm)

Lens

Camera distance A (mm)
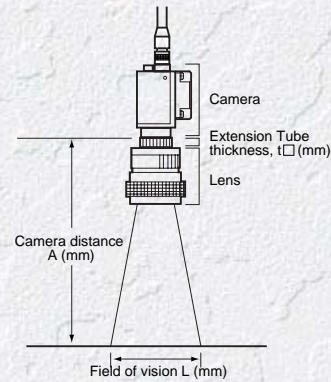
Field of vision L (mm)

■ Optical Graph

- The values given in the optical graph are only approximate values. It is recommended that the camera distance is adjusted by sliding the Camera forward or backward to get the required field of vision for actual operation.

Lens model: 3Z4S-LE □

B7514C
B5014A
B2514D
C1614A
B1214D-2
C815B

t: Extension Tube thickness

Camera distance A (mm)

Field of vision L (mm)