Panasonic® **INSTRUCTION MANUAL**

Ultra High-Speed, High-Accuracy Laser Displacement Sensor
Sensor Head
HL-C211F(E), HL-C211F(E)-MK

MJE-HLC211F No.0084-12V

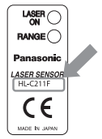
Thank you very much for purchasing Panasonic products. Read this Instruction Manual carefully and thoroughly for the correct and optimum use of this product. Kindly keep this manual in a convenient place for quick reference.

⚠ WARNING

- This product is intended to detect the objects and does not have the control function to ensure safety such as accident prevention.
  Do not use the product as a sensing device to protect human body.
- Be careful not to directly watch or touch the direct laser beam or reflected laser beam.
- The product was developed and manufactured for industrial use.

BEFORE USE

- Before using the product, check the sensor head model and contents of packing.



- **Sensor head model**
  Check the model name of product at the top of sensor head.
- **Packing**
  Check that all of the following components are included in the package.
  - 1 sensor head unit
  - 1 Instruction manual
  - Laser warning labels
    [JIS/IEC/KS: 1 set, GB: 1 set (E type only), FDA: 1 set]

- This product complies with CE Marking when used together with a controller and programmable display unit that are in compliance with CE Marking. Likewise, the product complies with UKCA Marking when used together with a controller and programmable display unit that are in compliance with UKCA Marking.

1 DESCRIPTION

- **HL-C211F(E)**, **HL-C211F(E)-MK** displacement sensor head achieves ultra high-speed and high-accurate measurement using linear image sensor as light receiving element to be used on equipment that require high-speed operation with high-accuracy.
- The product is used at diffuse or specular reflection sensor head by installing and setting.

2 CAUTIONS ON HANDLING LASER LIGHT

- In order to prevent the accidents by laser product and protect the users, IEC, JIS, GB, KS and FDA establish the following standards respectively.
  IEC : IEC 60825-1-2014
  JIS : JIS C 6802-2014
  GB : GB 7247.1-2012
  KS : KS C IEC 60825-1-2013
  FDA : PART 1040(PERFORMANCE STANDARDS FOR LIGHTEMITTING PRODUCTS)

  These standards classifies laser products according to the level of hazard and provide the safety measures for respective classes (Refer to the “FDA Standard” table).

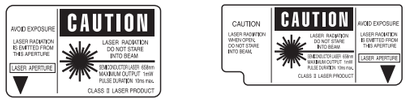
- **FDA standard**

Requirements	Class *1					
	I	IIa	II	IIIa	IIIb	IV
Performance (all laser products)						
Protective housing [1040.10 (f) (1)]	R *2	R *2	R *2	R *2	R *2	R *2
Safety interlock [1040.10 (f) (2)]	R *3,4	R *3,4	R *3,4	R *3,4	R *3,4	R *3,4
Location of controls [1040.10 (f) (7)]	N/A	R	R	R	R	R
Viewing optics [1040.10 (f) (8)]	R	R	R	R	R	R
Scanning safeguard [1040.10 (f) (9)]	R	R	R	R	R	R
Performance (laser system)						
Remote control connector [1040.10 (f) (3)]	N/A	N/A	N/A	N/A	R	R
Key control [1040.10 (f) (4)]	N/A	N/A	N/A	N/A	R	R
Emission indicator [1040.10 (f) (5)]	N/A	N/A	R	R	R *10	R *10
Beam attenuator [1040.10 (f) (6)]	N/A	N/A	R	R	R	R
Reset [1040.10 (f) (10)]	N/A	N/A	N/A	N/A	N/A	R *13
Performance (specific-purpose products)						
Medical [1040.11 (a)]	S	S	S	S *8	S *8	S *8
Measurement, leveling, alignment [1040.11 (b)]	S	S	S	S	NP	NP
Demonstration [1040.11 (c)]	S	S	S	S	S *11	S *11
Labeling (all laser products)						
Certification/identification [1010.2,3]	R	R	R	R	R	R
Protective housing [1040.10 (g) (6),(7)]	D *5	R *5	R *5	R *5	R *5	R *5
Aperture [1040.10 (g) (4)]	N/A	N/A	N/A	N/A	N/A	N/A
Class warning [1040.10 (g) (1),(2),(3)]	N/A	R *6	R *7	R *9	R *12	R *12
Information (all laser products)						
User information [1040.10 (h) (1)]	R	R	R	R	R	R
Product literature [1040.10 (h) (2) (i)]	N/A	R	R	R	R	R
Service information [1040.10 (h) (2) (ii)]	R	R	R	R	R	R

R : Required
N/A: Not applicable
S : Same as for other products of that Class. Also see footnotes.
NP : Not permitted
D : Depends on level of inner radiation

*1 : Class is based on the maximum level of laser exposure during operation.
*2 : Required wherever and whenever human access to laser radiation above Class I limits is not needed for product to perform its functions.
*3 : Required for protective housings opened during operation or maintenance, if human access thus gained is not always necessary when housing is opened.
*4 : The requirements for interlock differ depending on the class of inner radiation.
*5 : The contents of label differ depending on the level and wavelength of laser radiation inside the protective housing.
*6 : Warning statement label
*7 : CAUTION logotype
*8 : The method to measure the level of laser radiation to human body is required.
*9 : CAUTION if 2.5mWcm^{-2} or less, DANGER is greater than 2.5mWcm^{-2}.
*10 : Time difference is needed between instruction and emission.
*12 : DANGER logotype
*13 : Required after August 20, 1986.

- **Warning / Aperture label**



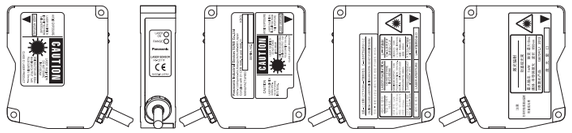
- **Certification / Identification label**

- **WARNING label**

In Japanese / English / Korean

In Chinese (E type only)

<Label position>



- Install the product so the laser beam comes higher or lower than eye level in order not to watch the beam directly during operation.
  Laser safety distance (Nominal Ocular Hazard Distance: NOHD) is approx. 0.5m. The laser beam must be terminated at the end of its path by a diffuse reflector or an absorber.
- Please contact our company if the system breaks down. It is not equipped with a function that stops laser radiation automatically during disassembling the sensor head. The users therefore may be exposed to laser beam in disassembling the sensor head.
- Do not use the system in the manner other than specified in this Instruction Manual.

3 EXPORT REGULATIONS BY JAPANESE GOVERNMENT

- **HL-C211F** and **HL-C211F-MK** are subject to export control regulation by the Foreign Exchange and Foreign Trade Law. Export admission by Japanese government is required before the product is to be exported or brought out of the country. These products are also subject to Article 1.B.3.b.1 of Nuclear Suppliers Group in international export control regime and 2.B.6.b.1 of Wassenaar Arrangement.
- Please follow the export control regulations required.
  HL-C211FE and **HL-C211FE-MK** (E type) are not subject to export control regulations under the condition that they are used combined with the non-pertinent controller to export control specified by Foreign Exchange and Foreign Trade Law.
  When they are combined with the pertinent controller to export control, they are subject to the Law. In this case export admission by Japanese government is required before the product is to be exported or brought out of the country.

4 SPECIFICATIONS

Model No.		HL-C211F(E)		HL-C211F(E)-MK	
		Diffuse Reflection	Specular Reflection	Diffuse Reflection	Specular Reflection
Meas. method (Note 2)		Diffuse reflection / Specular reflection			
Measurement center distance		110mm	106.7mm	110mm	106.7mm
Measurement range (Note 3)		±15mm	±14.5mm	±15mm	±14.5mm
Beam source		Red semiconductor laser Class II (FDA), Class 2 (JIS/IEC/GB/KS) Max output: 1mW, Emission Peak wavelength: 658nm			
Beam diameter (Note 4)		Approx. ø80μm		Approx. 80 × 1,700μm	
Beam receiving element		Linear image sensor			
Resolution		0.4μm / average times: 256, 0.1μm /average times: 4,096 [E type (Note 5) 0.25μm / average times 256]			
Linearity		±0.03%F.S.			
Temperature characteristics		0.01%F.S./°C			
Indicator	Laser emission	Green LED: Lights up during laser emission.			
	Meas. range	Yellow LED: Near measurement center:ON, within measurement range:Blink, beyond the range:OFF			
Protective structure		IP67 (except connector)			
Pollution degree		2			
Insulation resistance		20M ohms or more by 500V DC megger (between all the terminals and enclosure.)			
Dielectric withstand	Commercial Frequency	AC 500V for 1min. (between all the terminals and enclosure.)			
	Impulse	±1,000V 1.2/50μs (between all the terminals and enclosure.)			
Vibration resistance		Endurance: 10 to 55Hz (cycle: 1minute), Resistant amplitude of vibration: 1.5mm, in X, Y, and Z directions for 2 hours			
Shock resistance		196m/ s^2 in X, Y, and Z directions for 3 times			
Ambient illuminance (Note 6)		3,000lx or less (illuminance at beam receiving surface using incandescent lamp)			
Ambient temperature		0 to +45°C (No dew condensation or icing allowed), At storage: -20 to +70°C			
Ambient humidity		35 to 85%RH At storage: 35 to 85%RH			
Ambient Height		2,000m or less			
Material		Main unit case / cover: Die-cast aluminum, Front cover: Glass			
Cable length		0.5m			
Cable extension		Extendible to 30m long maximum using the optional extension cable.			
Weight		Approx. 300g including cable weight			
Applicable regulations		Compliant with EU Law: EMC Directive / British Legislation: EMC Regulation			

Notes: 1) Measuring conditions are as follows unless otherwise specified; connection with controller, power voltage: 24V DC, ambient temperature: 20°C, sampling cycle: 40μs, average times:256, at measurement center distance, object substance: white ceramic,, and digital measurement value.
2) Use the external ND filter (optional) in case the amount of reflected beam is too large on Specular Reflection installation.
3) The measurement range is limites between +0.5 and +15.0mm (in case the sampling cycle is 20μs at diffuse reflection), between +0.5 and +14.5mm (in case the sampling cycle is 20μs at specular reflection), between +12.5 and +15.0mm (in case the sampling cycle is 10μs at diffuse reflection), or between +12.5 and +14.5mm (in case the sampling cycle is 10μs at specular reflection).
4) The figure shows the value at measurement center distance. It is determined by 1/e^2 (approximately 13.5%) of center beam intensity. Due to leak light outside the specified area, the reflectance around the detecting point may be higher than at the point and this may affect the measurement value.
5) The minimum resolution of 0.25μm can be achieved if the sensor head is connected to the controller that is not subject to “Foreign Exchange and Foreign Trade Law”.
6) The variation in ambient illuminance is ±0.03%F.S. or less.

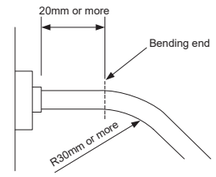
5 CAUTIONS

Connection

- Turn off the power of controller before connecting or disconnecting the connectors.
- When connecting or disconnecting the connectors, be sure to hold the connector area not to apply extra force to the cable.
- Be careful not to touch terminals or to let foreign matter get in the connector after disconnecting connectors.
- Be careful not to apply force to around the connector of standard cable and extension cable. Do not bend the cables near connectors. Failure to do so causes causes disconnection of the cable.

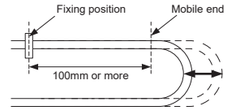
Wiring

- Do not run the sensor cable along (bundled in parallel) with other wirings. Keep it at least 100mm away from other wires. Run the cable so it is separate from high voltage and power circuit lines. If it is necessary to run the cable in parallel with them, shield it by running through a grounded electrical conduit.
- Install the product as far away as possible from noise source such as high-voltage lines, high-voltage device, power lines, power device, machines which generate a large starting and stopping surge, welding machines and inverter motor.
- Do not pull the cable using a force more than 29.4N when routing the cable with the sensor head and controller fixed. At least 20 mm is required from the cable connection to the bend. The bending radius must be 30 mm or more.
- When the sensor head is moved around while in use, the cable in the moving part may be damaged. Therefore, use an extension cable for the moving part and, when the extension cable is damaged, immediately replace it. Otherwise, it may result in failure.



Cable Extension

- Use only one extension cable for connection between one sensor head and a controller.
- When the sensor head part is moved around while in use, fix the extension cable at a position 100 mm away from the mobile end.



Warming up time

- Allow at least 30 minutes of warming up after turning on the power to ensure the performance of the product.

Environment

- The life of the semiconductor laser depends on the ambient temperature during use. When using the product near a heat source, take measures to lower the ambient temperature of the sensor head as possible. Mount the sensor on a device having good heat radiation because the sensor itself emits heat.

Notes: 1) When installing 2 sensor heads in parallel at a 20mm or less interval, mount each sensor head on an aluminum or iron plate having a 200cm^2 surface area.

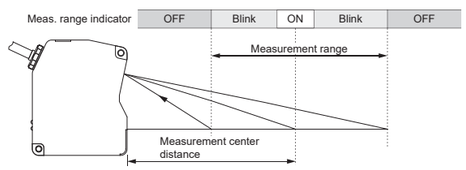
- Water, oil, or fingerprints on the emitter surface and receiver surface of sensor head reflects light. Dust and dirt on them block light. Keep them clean at all times. When cleaning these parts, wipe them off using a soft lint-free cloth or lens cleaning paper.
- Install the sensor head so ambient light such as sunlight or light with the same wavelength as laser beam should not enter the light receiver. If high accuracy is required, install a light shielding plate or the like on the sensor head.
- The controller and connectors are not structurally dustproof, waterproof, or corrosion-resistant. Do not use the product underwater or in the rain.
- Do not use the product in dusty places or that exposed to flammable or corrosive gases, droplet, direct sunlight, severe vibration or impact.

Setting

- The initial values of “Analog Scaling” after initialization is set to the following values when the sensor head is connected to the controller of Version 1.1* or earlier.
  Measurement Value A +15.000000[mm], Correction Value a +15.000[V]
  Measurement Value B -15.000000[mm], Correction Value b -15.000[V]
  The initial values of “Analog Scaling” at initialization is +5.000[V] for Correction Value a and -5.000[V] for Correction Value b when the sensor head is connected to the controller of Version 1.2* or later.

6 MEASUREMENT RANGE / INDICATOR

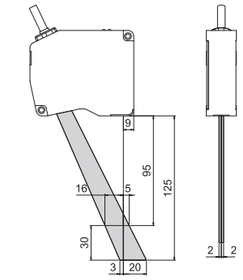
- **Installation Mode: Diffuse**



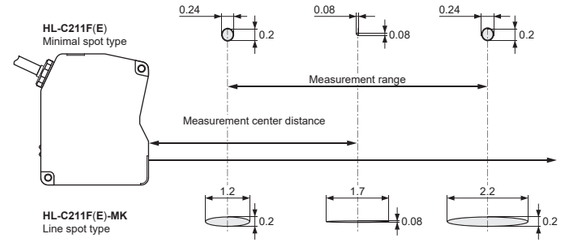
- The measurement range indicator at sampling cycle of 20μs or 10μs lights up at the center of limited measurement range.

7 MUTUAL INTERFERENCE AREA (Unit: mm)

- When installing 2 or more sensor heads side by side, mutual interference occurs if the laser spots from other sensor heads fall within the shaded areas in the right figure. Install sensor heads so the laser spots from other sensor heads fall outside the shaded areas.

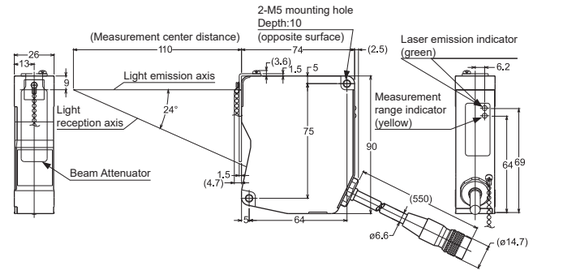


8 BEAM DIAMETER (Unit: mm)

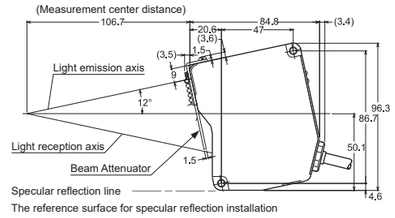


9 DIMENSIONS (Unit: mm)

- **Installation Mode: Diffuse**



- **Installation Mode: Specular**



10 OPTION

- ND filter (product code: **HL-C2F01**) is optionally available to adjust the excessive received light intensity to an optimum level. This is useful when mounting the sensor head for specular reflection.

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Panasonic Industrial Devices SUNX Co., Ltd. 2022
September, 2022
PRINTED IN JAPAN