



## Self-contained CMOS Laser Sensor LR-ZH Series



## IO-Link Instruction Manual

This instruction manual explains the IO-Link specifications for the built-in amplifier CMOS laser sensor LR-ZH Series (hereinafter abbreviated as LR-ZH). Details about the LR-ZH functions and how to use the unit can be found in the "LR-ZH Series Instruction Manual". A copy of the "LR-ZH Series Instruction Manual" can be downloaded off of the KEYENCE website. Alternatively, contact a local KEYENCE representative.

The settings file can also be downloaded off of the KEYENCE website. If it is not possible to gain access to the internet to download the file, contact your KEYENCE representative.

**Keyence Website:** <http://www.keyence.com>

### 1. Specifications

<b>Model</b>	LR-ZH500P LR-ZH500CP LR-ZH500C3P LR-ZH490CB <sup>*1</sup>
<b>IO-Link approved standard</b>	v.1.1
<b>Baud rate</b>	COM2 (38.4kbps)
<b>Min. cycle time</b>	2.3 ms
<b>Process data length</b>	2 Byte
<b>Process data format</b>	UInt (unsigned integer)

<sup>\*1</sup> Can only be used when PNP output is selected. When initialization is performed, select PNP for the initial setting using the sensor.

### 2. Wiring

M12 connector

M8 connector (4 pin)

M8 connector (3 pin)



Pin No.	Symbol	Color	Name
1	L+	Brown	DC10 - 30V
2 <sup>*1</sup>	other/-	White	External input <sup>*2</sup> /-
3	L-	Blue	0V
4 <sup>*1</sup>	Q/C	Black	Output <sup>*2</sup> /IO-Link

<sup>\*1</sup> Assignment changes according to the settings on the IO-Link master.

<sup>\*2</sup> When IO-Link is not connected these are assigned to external input and output.

### 3. Process Data

Process data is a function that communicates specific data in a constant cycle. Cycles can be executed at 2.3 ms intervals.

The format in which the process data is output, can be selected from the 4 types below.

Refer to "Index 146" in "Device Parameter" on page 3, or "Index 146" in "5-10 Process Data Output Format" in "5. Settings" on page 4 for information on how to select the format type.

#### ● Process Data Structure : 0 = CurrentValue and Output (default)

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value displayed on the sensor <sup>*1, *2</sup>												0	0	0	Output 1

#### ● Process Data Structure : 1 = CurrentValue

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Value displayed on the sensor <sup>*1, *2</sup>															

#### ● Process Data Structure : 2 = Distance and Output

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Distance from the sensor to the work piece <sup>*1, *3</sup>												0	0	0	Output 1

#### ● Process Data Structure : 3 = Distance

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Distance from the sensor to the work piece <sup>*1, *3</sup>															

<sup>\*1</sup> If the sensor displays something other than a value, one of the following will be output.

Sensor display	Output
---	1000
uuu	1001
ErC	Normal
Er5	1000
ErL	1000
ErE	Normal

<sup>\*2</sup> If the sensor display shows a negative value or "FF", 0 will be output as the sensor display value in the process data.

<sup>\*3</sup> When Universal Change Detection is being executed the sensor display value will be output.

## 4. Service Data

Service data is a function that refreshes information between the IO-Link master and slave only when there is a send request. Reading/writing of the sensor settings and status, and execution of operation commands (tuning, etc.) can be carried out.

Meaning of each item

Item	Value	Meaning
Reference item	–	Shows the notation in the instruction manual
Format	Record	Data structure
	Bit (x)	Bit No. x in Record
	String	Text string
	UInt	Unsigned integer
Access	R	Read possible
	R/W	Read/write possible
	W	Write possible
	C	Operation command
Data storage	○	Compatible with the data storage function*1
	–	Not compatible with the data storage function

\*1 Sensor settings are backed up with the IO-Link master. This allows settings to be restored if the sensor is replaced.

### 4-1 Parameter List

#### Predefined parameter

Index	Name	Format	Length	Access	Data storage	Default value	Range	Remark
12 (0x0C)	Device Access Locks	Record	2 Byte	R/W	–	–	–	–
2 (0x02)	Data Storage Lock*1	Bit (1)	1 Bit	R	–	0	0 = Unlock 1 = Lock	–
16 (0x10)	Vendor Name	String	8 Byte	R	–	Keyence		–
17 (0x11)	Vendor Text	String	8 Byte	R	–	www.keyence.com		–
18 (0x12)	Product Name	String	8 Byte	R	–	(Differs for each model)*2		–
19 (0x13)	Product ID	String	8 Byte	R	–	(Differs for each model)*2		–
20 (0x14)	Product Text	String	8 Byte	R	–	CMOS Laser Sensor		–
22 (0x16)	Hardware Version	String	64 Byte	R	–	–		–
23 (0x17)	Firmware Version	String	64 Byte	R	–	–		–
24 (0x18)	Application Specific Tag	String	16 Byte	R/W	–	***	–	–
37 (0x25)	Detailed Device Status	Record	16 Byte	R	–	0	0xFF91 = Data Storage Upload Request 0x5000 = Device hardware fault - Device Exchange	'Refer to *6. Events'
40 (0x28)	Process Data Input	UInt	2 Byte	R	–	–	–	–

\*1 Uploading and downloading in the data storage function can be locked.

\*2 The following models are applicable: LR-ZH500P/LR-ZH500CP/LR-ZH500C3P/LR-ZH490CB

#### Reserved for Profile

Index	Name	Reference item	Format	Length	Access	Data storage	Default value	Range	Remark
60 (0x3C)	BDC1 Switchpoint	–	Record	2 Byte	R/W	–	–	–	–
1 (0x01)	Switchpoint SP1	Setting value	UInt	2 Byte	R	○	100	0 to 999	Linked to Index 104*3
61 (0x3D)	BDC1 Configuration	–	Record	2 Byte	R/W	–	–	–	–
1 (0x01)	Switchpoint Logic	Switch output	UInt	1 Byte	R	○	1	0 = D-On 1 = L-On	–

\*3 When "Universal Change Detection" is executed in index 104 "Tuning", this is output based on the setting value in index 113 "Universal Change Detection Setting Value".

**Device Parameter**

Index	Name	Reference item	Format	Length	Access	Data storage	Default value	Range	Remark
102 (0x66)	Response Time	Response time (refer to 5-1)	UInt	1 Byte	R/W	○	2	0 = hSP 1 = 10ms 2 = 50ms	–
104 (0x68)	Tuning	Sensitivity setting	UInt	1 Byte	C	–	–	0 = 2-Point 1st 1 = 2-Point 2nd 2 = FullAuto/MaximumSensitivity Start 3 = FullAuto/MaximumSensitivity End 4 = DATUM Start 5 = DATUM End 6 = UniversalChangeDetection Start 7 = UniversalChangeDetection End	–
113 (0x71)	Universal Change Detection Setting Value	Setting value during background tuning	UInt	1 Byte	R/W	○	90	0 to 100	Linked to Index 104 <sup>*4</sup>
115 (0x73)	Timer Mode	Delay timer (refer to 5-2)	UInt	1 Byte	R/W	○	0	0 = OFF 1 = ON delay 2 = OFF delay 3 = One-shot	–
116 (0x74)	Timer Setting	Timer time <sup>*5</sup> (refer to 5-3)	UInt	2 Byte	R/W	○	10	1/2/... <sup>*6</sup> /10/20/.../100/200/.../900	Linked to Index 115/102 [ms]
129 (0x81)	External Input Function	External input (refer to 5-4)	UInt	1 Byte	R/W	○	0	0 = OFF 1 = Tuning 2 = Stop applying laser 3 = Adjust	–
137 (0x89)	Shift Function	Shift function (refer to 5-7)	UInt	1 Byte	R/W	○	1	0 = OFF 1 = ON	Linked to Index 104 <sup>*7</sup> <sup>*8</sup>
138 (0x8A)	Hold Function	Hold function (refer to 5-6)	UInt	1 Byte	R/W	○	0	0 = OFF 1 = Peak hold 2 = Bottom hold	–
139 (0x8B)	Clamp Function	Clamp Function (refer to 5-8)	UInt	1 Byte	R/W	○	0	0 = OFF 1 = ON	Linked to Index 104 <sup>*7</sup>
140 (0x8C)	Display	Display (refer to 5-9)	UInt	1 Byte	R/W	○	1	0 = Bar display <sup>*9</sup> 1 = ON 2 = OFF	–
141 (0x8D)	Key Lock	Key Lock	UInt	1 Byte	R/W	○	0	0 = Release key lock 1 = Key lock	–
142 (0x8E)	DSC Function	DSC Function (refer to 5-5)	UInt	1 Byte	R/W	○	2	0 = OFF 1 = 0.25s 2 = 1s 3 = 3min	Linked to Index 104 <sup>*10</sup>
143 (0x8F)	Intensity	Amount of light received <sup>*11</sup>	UInt	2 Byte	R	–	–	0 to 999	–
144 (0x90)	User Tag1	User tag <sup>*12</sup>	UInt	4 Byte	R/W	○	0	0 to 4294967295	–
145 (0x91)	User Tag2		UInt	2 Byte	R/W	○	0	0 to 65535	–
146 (0x92)	Process Data Structure	Process data output format	UInt	1 Byte	R/W	○	0	0 = Current Value and Output 1 = Current Value 2 = Distance and Output 3 = Distance	–

<sup>\*4</sup> When anything other than "background tuning" is executed in index 104 "Tuning", this is output based on the setting value in index 60 "BDC1 Switchpoint".

<sup>\*5</sup> If the input value does not match a number in the setting range (see "LR-ZH Series Instruction Manual"), the value will be rounded down to the nearest number in the setting range.

<sup>\*6</sup> These can be set only when "hSP" is selected in index 102 "Response Time".

<sup>\*7</sup> This is disabled when "Universal Change Detection" is executed in index 104 "Tuning".

<sup>\*8</sup> This is ON regardless of the settings when "DATUM tuning" is executed in index 104 "Tuning".

<sup>\*9</sup> This cannot be set when "Universal Change Detection" is executed in index 104 "Tuning".

<sup>\*10</sup> This is enabled only when "Universal Change Detection" is executed in index 104 "Tuning".

<sup>\*11</sup> This value represents the amount of light currently being received. The larger the amount of light received the more stable detection becomes.

<sup>\*12</sup> This can be used to assign individual sensor numbers.

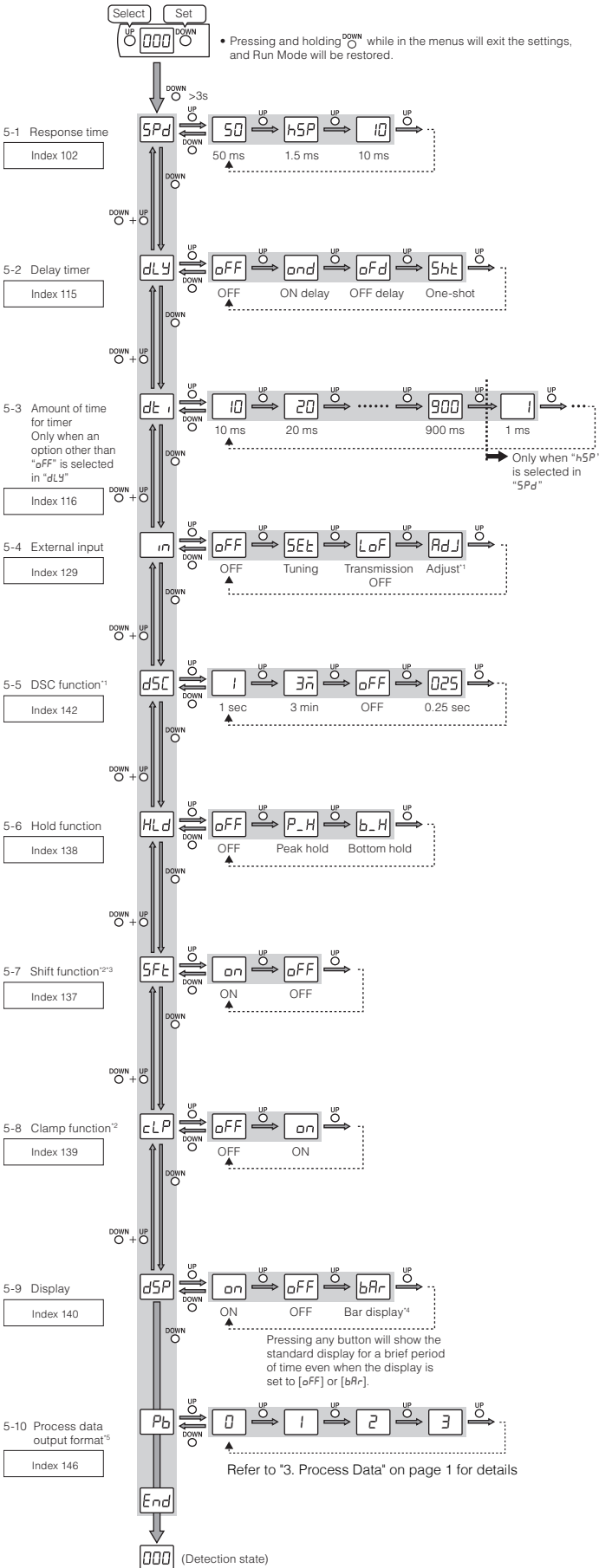
**Standard Command**

Index	Name	Reference item	Format	Length	Access	Data storage	Default value	Range	Remark
2 (0x02)	System Command	Initialization	UInt	1 Byte	W	–	130	Initialization <sup>*13</sup>	–

<sup>\*13</sup> When initialization is performed on the LR-ZH490CB, select PNP in the initial settings using the sensor.

5. Settings

Some of the items that can be set in "4-1 Parameter List" on page 2 can also be set using the sensor itself.  
This section shows how to configure certain settings using the sensor.  
Refer to "3. Settings" or "4. Advanced Settings" of the LR-ZH Series Instruction Manual for more details.



\*1 Enabled only when "Universal Change Detection" is performed.  
\*2 Disabled when "Universal Change Detection" is performed.  
\*3 Utilized when "Datum calibration" is performed, regardless of setting.  
\*4 Cannot be set when "Universal Change Detection" is performed.  
\*5 Can only be set when IO-Link is connected.

6. Events

When an event occurs the event flag in the process data telegram turns ON.  
The master detects the event flag and reads the value that corresponds to the event that has occurred.  
This allows the status of the sensor to be forwarded to a PLC or monitor through the IO-Link master.  
Service data exchange is not carried out while an event is being read.

Value	Name	Meaning
0xFF91	Data Storage Upload Request	Settings were changed on the sensor.
0x5000	Device hardware fault - Device Exchange	An error (ErS/ErE/ErL) has occurred on the sensor.

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