KEYENCE

655GB

655GB-2

Full-Spectrum Sensor

LR-W Series

IO-Link Instruction Manual

This instruction manual explains the IO-Link specifications for the full-spectrum sensor LR-W Series (hereinafter abbreviated as LR-W). Details about the LR-W functions and how to use the unit can be found in the "LR-W Series Instruction Manual". A copy of the "LR-W 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

Model	LR-W500 / LR-W500C LR-W70 / LR-W70C LR-WF10 / LR-WF10C
IO-Link approved standard	v.1.1
Baud rate	COM2 (38.4kbps)
Min. cycle time	2.3 ms
Process data length	2 Byte
Process data format	UInt (unsigned integer)

2. Wiring

M12 connector

Pin No.	Symbol	Color	Name
1	L+	Brown	DC10 - 30V
2[*1]	Other/Other	White	External input[*2]/Selectable[*3]
3	L-	Blue	0V
4[*1]	Q/C	Black	Output[*2]/IO-Link

*1 Assignment changes according to the settings on the IO-Link master.
*2 When IO-Link is not connected, pin number 2 is assigned as the external input and pin number 4 is assigned as the output.
*3 When IO-Link is connected the output can be activated using index 100 "White Wire Output Setting".

3. Process Data

Process data is a function that communicates specific data in a constant cycle.
The format in which the process data is output, can be selected from the 3 types below.
Refer to "Index 146" in "Device Parameter" on page 3, or "5-15 Process Data Output Format" in "5-2 Settings" on page 5 for information on how to select the format type.

● **Process Data Structure : 0 = Current Value (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[*1]															

● **Process Data Structure : 1 = Current Value + Stability Level + OUT**

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
0	0	Stability Level[*2]			Output	Value displayed on the sensor[*1]									

● **Process Data Structure : 2 = OUT + Stability Level + Current Value**

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[*1]										0	0	Stability Level[*2]			Output

*1 If the sensor displays something other than a value, one of the following will be output.

Sensor display	Output
ErC	Normal
ErE	Normal
∩∩∩	1000
⊔⊔⊔	1001
- - -	1003
- - -	1004

*2 The stability of detection is indicated in five levels from 0 to 4. The higher the strength of the received light signal, the more stable detection is.

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.
    If the sensor is replaced, it is necessary recalibrate the unit.

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	–	–	0	0 = Unlock 1 = Lock	–
16 (0x10)	Vendor Name	String	64 Byte	R	–		Keyence	–
17 (0x11)	Vendor Text	String	64 Byte	R	–		www.keyence.com	–
18 (0x12)	Product Name	String	64 Byte	R	–		(Differs for each model)[*2]	–
19 (0x13)	Product ID	String	64 Byte	R	–		(Differs for each model)[*2]	–
20 (0x14)	Product Text	String	64 Byte	R	–		Full-Spectrum Sensors	–
22 (0x16)	Hardware Version	String	64 Byte	R	–	–	–	–
23 (0x17)	Firmware Version	String	64 Byte	R	–	–	–	–
37 (0x25)	Detailed Device Status	Record	16 Byte	R	–	0	0xFF91 = Data Storage Upload Request 0x5000 = Device hardware fault - Device Exchange 0x7710 = Short circuit - Check installation	'Refer to "6. Events"
40 (0x28)	Process Data Input	UInt	2 Byte	R	–	–	–	–

*1 Back-up and restoring in the data storage function can be locked.
*2 The following models are applicable: LR-W500/LR-W500C/LR-W70/LR-W70C/LR-WF10/LR-WF10C

Device Parameter

Index	Name	Reference item	Format	Length	Access	Data storage	Default value	Range	Remark
100 (0x64)	Ch2 Output	White Wire Output Setting[3] (refer to 5-2)	UInt	1 Byte	R/W	○	0	0 = OFF 1 = OUT	–
101 (0x65)	NPN/PNP	NPN/PNP Selection (refer to 5-1)	UInt	1 Byte	R/W	○	0	0 = NPN 1 = PNP	–
102 (0x66)	Response Time	Response Time (refer to 5-5)	UInt	1 Byte	R/W	○	2	[When using 1-spot mode] 0 = 250 µs (LR-WF10(C)) / 200 µs (LR-W500(C)/LR-W70(C)) 1 = 1 ms 2 = 10 ms 3 = 100 ms 4 = 500 ms [When using A-1 (2-spot difference monitoring)] 0 = 500 µs 1 = 2.5 ms 2 = 20 ms 3 = 200 ms 4 = 999 ms [When using A-2 (2-spot matching mode)] 0 = 400 µs 1 = 2 ms 2 = 20 ms 3 = 200 ms 4 = 999 ms	–
104 (0x68)	Tuning	Calibration	UInt	2 Byte	C	–	–	0 = 1-point calibration Start[4] 1 = 1-point calibration End[4] 2 = Maximum sensitivity calibration Start[5] 3 = Maximum sensitivity calibration End[5] 4 = Full auto calibration Start[5] 5 = Full auto calibration End[5] 6 = 2-point calibration 1st 7 = 2-point calibration 2nd 8 = Master addition calibration Start[4] 9 = Master addition calibration End[4] 10 = Master calibration Start[4] 11 = Master calibration End[4] 12 = Light intensity adjustment[6] 13 = 2-Point Matching calibration (LR-W70(C) only)[7] 14 = (Reserved) 15 = Fiber Status Initialization (LR-WF10(C) only)	–
110 (0x6E)	Output Logic Selection	Output Logic Selection	UInt	1 Byte	R/W	○	0	0 = N.O. 1 = N.C.	–
112 (0x70)	Setting Value	Setting Value/ Matching Mode Setting Value	UInt	2 Byte	R/W	–	999	0 to 999	–
113 (0x71)	Master Calibration Set Value	Master Calibration Set Value[4] (refer to 5-12)	UInt	2 Byte	R/W	○	950	0 to 999	–
114 (0x72)	Difference Monitoring Set Value (LR-W70 only)	Difference Monitoring Setting Value (LR-W70(C) only)[8]	UInt	2 Byte	R/W	○	100	0 to 999	–
115 (0x73)	Timer	Timer (refer to 5-6)	UInt	1 Byte	R/W	○	0	0 = OFF 1 = ON delay 2 = OFF delay 3 = One shot	Linked to Index 116
116 (0x74)	Timer Duration	Timer Duration (refer to 5-7)	UInt	2 Byte	R/W	○	10	1 to 999	Linked to Index 115. Units; ms
129 (0x81)	External Input Selection	External Input (refer to 5-8)	UInt	1 Byte	R/W	○	0	0 = OFF 1 = Tuning[9] 2 = LED OFF	–
138 (0x8A)	Display Selection	Display Selection (refer to 5-9)	UInt	1 Byte	R/W	○	0	0 = ON 1 = OFF	–
139 (0x8B)	Key Lock	Key Lock	UInt	1 Byte	R/W	○	0	0 = Unlock 1 = Lock	Linked to Index 141
141 (0x8D)	Password	Password (refer to 5-14)	UInt	2 Byte	R/W	○	0	0 to 999	Linked to Index 139
143 (0x8F)	Mutual Interference	Mutual Interference Reduction Function (refer to 5-10)	UInt	1 Byte	R/W	○	0	0 = A (standard) 1 = B (alternate frequency)	–
144 (0x90)	User Tag1	User Tag[10]	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 (refer to 5-15)	UInt	1 Byte	R/W	○	0	0 = Current Value 1 = Current Value + Stability Level + OUT 2 = OUT + Stability Level + Current Value	–
147 (0x93)	LED On/Off	LED On/Off	UInt	1 Byte	R/W	–	1	0 = OFF 1 = ON	–
148 (0x94)	Current Value	Value Displayed on the Sensor	UInt	2 Byte	R	–	–	0 to 999	–
149 (0x95)	Stability Level	Strength of Received Light Signal[11]	UInt	2 Byte	R	–	–	0 to 4	–
199 (0x8E)	Detection Mode	Detection Mode[12] (refer to 5-4)	UInt	1 Byte	R/W	○	0	0 = Auto 1 = C+I 2 = C 3 = Super I	–

200 (0xC8)	Spot/Mode Selection (LR-W70 only)	Spot/Mode Selection (LR-W70(C) only) (refer to 5-3)	UInt	1 Byte	R/W	○	0	0 = 1-Spot 1 = A-1 [2-Spot Difference Monitoring] [13] 2 = A-2 [2-Spot 2-Point Matching]	–
201 (0xC9)	Light Emission Blinking Function (LR-WF10 only)	Light Emission Blinking Function (LR-WF10(C) only) (refer to 5-13)	UInt	1 Byte	R/W	–	0	0 = OFF 1 = ON	–
202 (0xCA)	Detection Light Source	Detection Light Source[5] (refer to 5-11)	UInt	1 Byte	R/W	○	0	0 = Auto 1 = RGB 2 = R 3 = G 4 = B	–

*3 An output can be assigned to white wire.
*4 Valid only when "Auto", "C+I mode", or "C mode" is selected in index 199 "Detection Mode".
*5 Valid only when "Super I mode" is selected in index 199 "Detection Mode".
*6 Valid only when "Super I mode" is selected in index 199 "Detection Mode" and "200 μs/250 μs" or "1 ms" is selected in index 102 "Response Time".
*7 Valid only when "A-2 (2-spot matching mode)" is selected in index 200 "Spot/Mode Selection".
*8 Valid only when "A-1 (2-spot difference monitoring)" is selected in index 200 "Spot/Mode Selection".
*9 Invalid when "A-1 (2-spot difference monitoring)" is selected in index 200 "Spot/Mode Selection".
*10 Sensor specific numbers can be allocated.
*11 The stability of detection is indicated in five levels from 0 to 4. The higher the strength of the received light signal, the more stable detection is.
*12 Valid only when "1-Spot" is selected in index 200 "Spot/Mode Selection".
*13 When "A-1 (2-spot difference monitoring)" is selected in index 200 "Spot/Mode Selection" this is output based on the setting value in index 114 "Difference Monitoring Set Value".

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	–

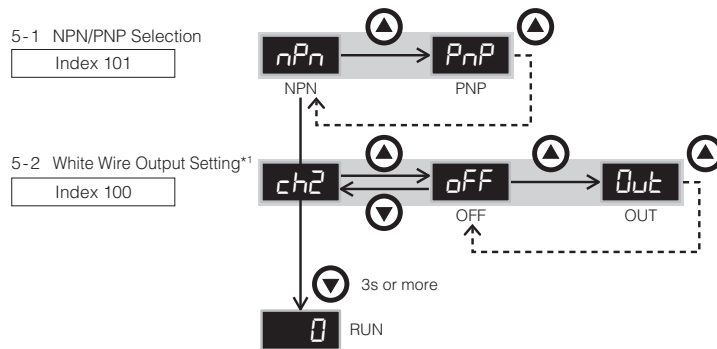# 5. Settings

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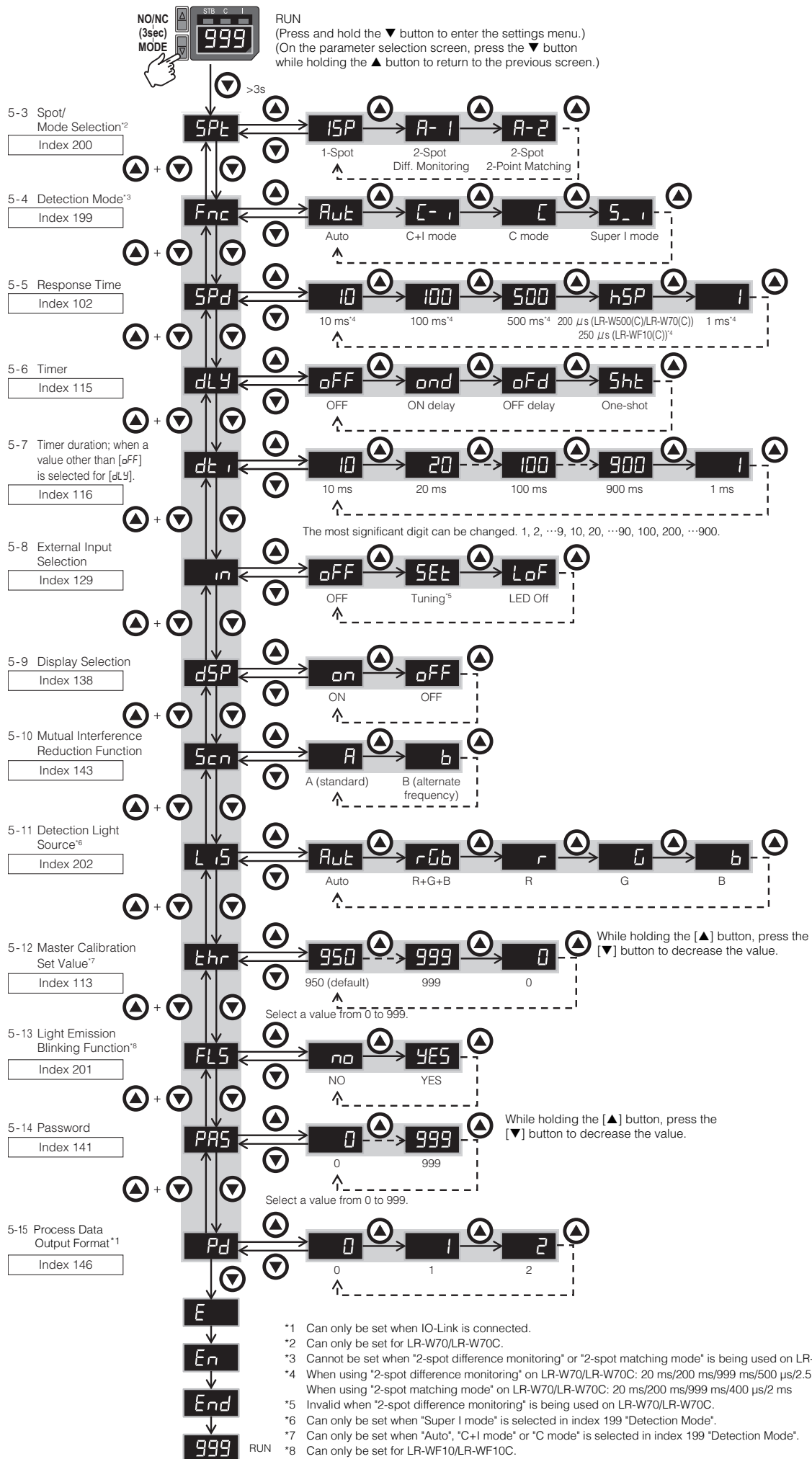This section shows how to configure certain settings using the sensor.
Refer to "Basic Settings" or "Settings" of the LR-W Series Instruction Manual for more details.

5-1 Initial Settings

5-1 NPN/PNP Selection
Index 101

5-2 White Wire Output Setting[1]
Index 100

- 4 -

NO/NC
(3sec)
MODE

STB C I

999 RUN
(Press and hold the ▼ button to enter the settings menu.)
(On the parameter selection screen, press the ▼ button while holding the ▲ button to return to the previous screen.)

>3s

5-3 Spot/ Mode Selection*2
Index 200

SPt → 1SP → A-1 → A-2
1-Spot | 2-Spot Diff. Monitoring | 2-Spot 2-Point Matching

5-4 Detection Mode*3
Index 199

Fnc → Aut → C-i → C → S_i
Auto | C+I mode | C mode | Super I mode

5-5 Response Time
Index 102

SPd → 10 → 100 → 500 → hSP → 1
10 ms*4 | 100 ms*4 | 500 ms*4 | 200 μs (LR-W500(C)/LR-W70(C)) 250 μs (LR-WF10(C))*4 | 1 ms*4

5-6 Timer
Index 115

dLY → oFF → ond → oFd → Sht
OFF | ON delay | OFF delay | One-shot

5-7 Timer duration; when a value other than [oFF] is selected for [dLY].
Index 116

dt i → 10 → 20 → 100 → 900 → 1
10 ms | 20 ms | 100 ms | 900 ms | 1 ms

The most significant digit can be changed. 1, 2, ···9, 10, 20, ···90, 100, 200, ···900.

5-8 External Input Selection
Index 129

in → oFF → SEt → LoF
OFF | Tuning*5 | LED Off

5-9 Display Selection
Index 138

dSP → on → oFF
ON | OFF

5-10 Mutual Interference Reduction Function
Index 143

Scn → A → b
A (standard) | B (alternate frequency)

5-11 Detection Light Source*6
Index 202

L iS → Aut → rGb → r → G → b
Auto | R+G+B | R | G | B

5-12 Master Calibration Set Value*7
Index 113

thr → 950 → 999 → 0
950 (default) | 999 | 0

While holding the [▲] button, press the [▼] button to decrease the value.

Select a value from 0 to 999.

5-13 Light Emission Blinking Function*8
Index 201

FLS → no → YES
NO | YES

5-14 Password
Index 141

PAS → 0 → 999
0 | 999

While holding the [▲] button, press the [▼] button to decrease the value.

Select a value from 0 to 999.

5-15 Process Data Output Format*1
Index 146

Pd → 0 → 1 → 2
0 | 1 | 2

E

En

End

999 RUN

*1 Can only be set when IO-Link is connected.
*2 Can only be set for LR-W70/LR-W70C.
*3 Cannot be set when "2-spot difference monitoring" or "2-spot matching mode" is being used on LR-W70/LR-W70C.
*4 When using "2-spot difference monitoring" on LR-W70/LR-W70C: 20 ms/200 ms/999 ms/500 μs/2.5 ms
When using "2-spot matching mode" on LR-W70/LR-W70C: 20 ms/200 ms/999 ms/400 μs/2 ms
*5 Invalid when "2-spot difference monitoring" is being used on LR-W70/LR-W70C.
*6 Can only be set when "Super I mode" is selected in index 199 "Detection Mode".
*7 Can only be set when "Auto", "C+I mode" or "C mode" is selected in index 199 "Detection Mode".
*8 Can only be set for LR-WF10/LR-WF10C.

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 (ErE) has occurred on the sensor.
0x7710	Short circuit - Check installation	An overcurrent error (ErC) has occurred.

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