

### iPin-DRC222

*Miniature iTOF Laser Distance Sensor*

## Description

iPin-DRC222 series are miniaturized, long range, precise, easy to use, single point laser distance sensors. It utilizes i-TOF laser light phase shift detection technology for obtaining the distance, which is featured in long distance accurate measurement.

Specially designed short focal length optics allows the sensor to have the thinnest structure as its kind. Visible red laser light is convenient for installing the sensor.

## Features

1. Max range up to 20m
2. Max operable ambient light up to 3kLux
3. Sensor height less than 13mm
4. Typical accuracy tolerance  $\pm 3\text{mm}$
5. Class II laser eye safety rating
6. UART+USB dual ports



## Applications

1. Distance measurement
2. Robotics
3. Automation and control
4. Security surveillance
5. Displacement sensing

## Technical Specifications

### 1. Absolute Maximum Ratings

Description	Symbol	Min.	Typ.	Max.	Unit	Notes
Supply voltage (UART type)	VDD	−0.3	5	5.5	V	
Supply voltage (microUSB type)	VDDU	—	5	—	V	
Storage temperature range	T <sub>stor</sub>	−25	—	60	°C	
Operating temperature range	T <sub>op</sub>	−20	—	50	°C	a
Ambient light illumination	Ev	—	—	3000	Lux	

(a) Operating the product outside the max rated ambient temperature range may compromise its reliability.

### 2. Recommended Operating Conditions

Description	Symbol	Min.	Typ.	Max.	Unit	Notes
Supply power voltage (UART type)	VDD	3.8	5	5.5	V	
Supply power voltage (microUSB type)	VDDU	—	5	—	V	
UART signal level	V <sub>s</sub>	—	3.3	—	V	
Storage temperature range	T <sub>stor</sub>	−20	—	50	°C	
Operating temperature range	T <sub>op</sub>	0	25	40	°C	
Ambient light illumination	Ev	—	—	500	Lux	
Target remission	Rm	18	90	—	%	

### 3. Electrical and Optical Characteristics (T<sub>c</sub> = 25°C)

Description	Meas. Mode	Sym.	Min.	Typ.	Max.	Unit	Notes
Average power consumption (UART type)		P <sub>aw</sub>	—	0.26	—	W	a
Average power consumption (USB type)			—	0.38	—	W	
Standby power consumption (UART type)		P <sub>sb</sub>	—	0.20	—	W	b
Standby power consumption (USB type)			—	0.32	—	W	
Laser emission wavelength		λ	650	655	660	nm	
Laser beam FOV angle			—	0.12	0.15	deg	
Detector FOV angle			—	2.64	—	deg	
Measurement range	C0, D	d <sub>m0</sub>	0.1	—	3	m	c
	C1	d <sub>m1</sub>	0.1	—	10	m	
	A, B, C2	d <sub>m2</sub>	0.1	—	20	m	
Distance resolution		d <sub>res</sub>	—	1	—	mm	
Distance tolerance <sup>(d)</sup>	C0	Δd <sub>m0</sub>	—	5	—	mm	
	C1	Δd <sub>m1</sub>	—	5	—	mm	
	A, B, C2	Δd <sub>m2</sub>	—	3	—	mm	
	D	Δd <sub>m4</sub>	—	12	—	mm	
Measurement time	A, B, C2	t <sub>m</sub>	—	1.5	—	sec	e
Measurement frequency	C0	f <sub>m0</sub>	20	30	—	Hz	f
	C1	f <sub>m1</sub>	—	8	—	Hz	
	D	f <sub>m4</sub>	—	110	—	Hz	

(a) Under measurement mode C0.

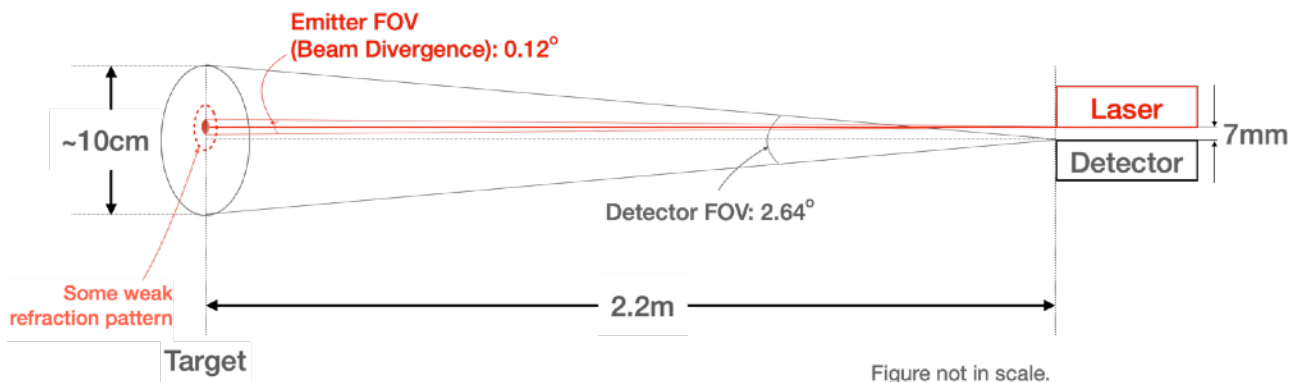
(b) Laser is off in standby status.

(c) Under typical recommended operating conditions. d<sub>m0</sub>, d<sub>m1</sub> and d<sub>m2</sub> are preset by measurement mode commands.

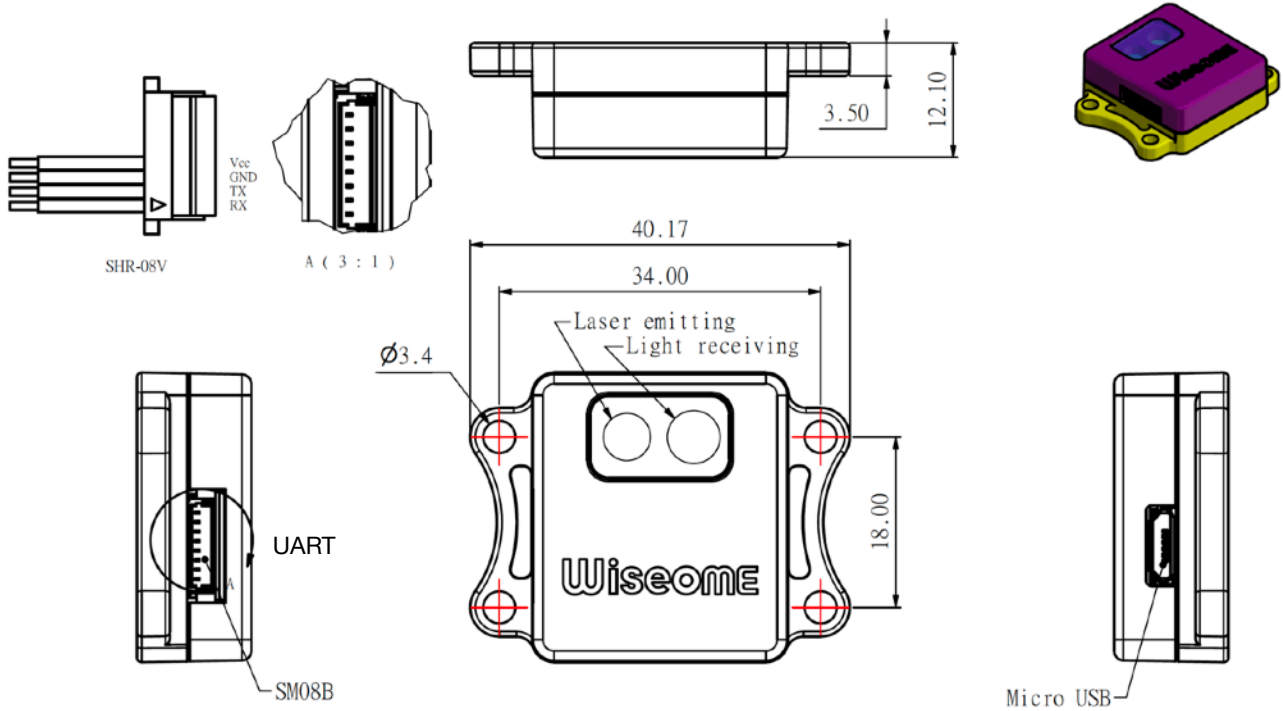
(d) This is a 95% confidence level (2σ) tolerance at a distance less than 5m. For distance over 5m, an extra tolerance deterioration need to be added on the typical value, assuming under the stationary, recommended operating conditions.

(e) This is a typical time needed for a single shot measurement under the measurement mode A and B.

(f) The frequency of continuous measurements is defined under mode C0 in the typical recommended operating conditions and the target moving speed under 250cm/s.



### 4. Outline Drawing



\* SHR-08V connector wire is included in this product.

## 5. Serial Port Communication Protocols

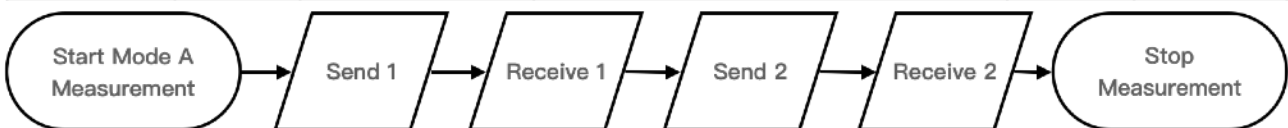
### 5.1. Data Communication Protocol

Default baud rate	115200
Data bit	8
Stop bit	1
Parity check	None

### 5.2. Command Sending (to module) and Data Receiving (from module) in the Normal Condition

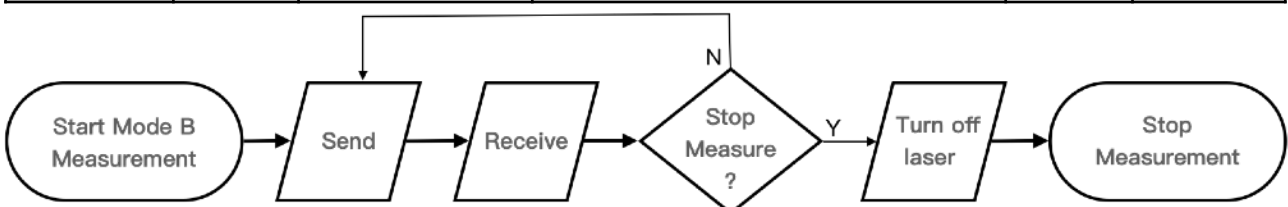
#### 5.2.1. Measurement mode A (Single-shot, max range = $d_{m2}$ )

CMD Sequence	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Note
Send 1	0xCD	0x01	0x03	0x04	Turn on laser				
Receive 1	0xFA	0x00	0x01	0x01	Acknowledgement packet				
Send 2	0xCD	0x01	0x05	0x06	Start mode A measurement				
Receive 2	0xFA	0x00	0x05	0xZZ	0xYY	0x00	0x00	Cksum	Data O/P
Note	Header	Data length from Byte 3~ Cksum		Measurement result = 0x0000YYZZ (mm) (little-endian)				Sum of Byte1~6	Auto Laser Off



#### 5.2.2. Measurement mode B (Retained, max range = $d_{m2}$ )

CMD Sequence	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Note
Send	0xCD	0x01	0x06	0x07	Start mode B measurement				
Receive	0xFA	0x00	0x05	0xZZ	0xYY	0x00	0x00	Cksum	Data O/P
Note	Header	Data length from Byte 3~ Cksum		Measurement result = 0x0000YYZZ (mm) (little-endian)				Sum of Byte1~6	



## 5.2.3. Measurement mode C0~C2<sup>a</sup> (Synchronized)

CMD Seq.	Byte #															
	0	1	2 <sup>a</sup>	3	4	5	6	7	8	9	10	11	12	13	14	15
Send	0xCD	0x04	0xFF <sup>a</sup>	T <sub>S</sub> : (big-endian) Epoch time on sending command In milliseconds represented as uint64								Cksum 1~10	Start mode CX measurement			
Receive 1	0xFA	0x00	0x01	0x01	( Acknowledgement Packet, appears only once, followed by Receive 2)											
Receive 2	0xFA	0x00	0x0D	0xFF	0xYY	0x00	0x00									Cksum
Note	Header	Data length from Byte 3~ Cksum		(little-endian) Normal meas. result = 0x0000YYFF (mm)  Failed meas. result = 0x7FFFFFFF				T <sub>R</sub> : (little-endian) Epoch time on receiving the distance result. In milliseconds. Represented as uint64								Byte 1~14

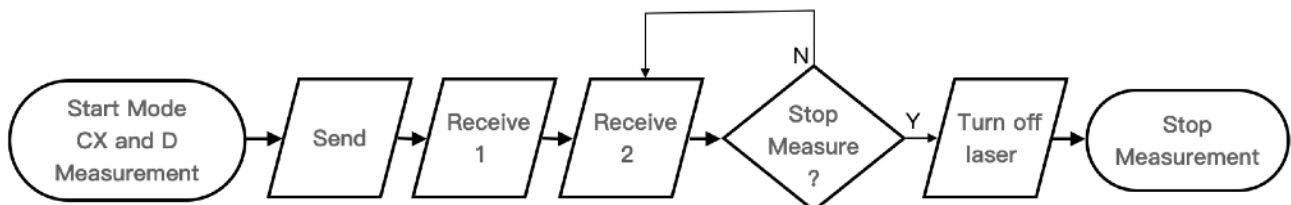
Note (a):

Byte 2 in "Send" command:

Measurement mode	Byte 2	Measurement Range	Measurement Frequency
<b>C0</b>	0x00	d <sub>m0</sub>	f <sub>m0</sub>
<b>C1</b>	0x01	d <sub>m1</sub>	f <sub>m1</sub>
<b>C2</b>	0x02	d <sub>m2</sub>	f <sub>m2</sub>

## 5.2.4. Measurement mode D (Burst, max range = d<sub>m0</sub>)

CMD Sequence	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Note
<b>Send</b>	0xCD	0x01	0x0A	0x0B	Start mode D measurement				
<b>Receive 1</b>	0xFA	0x00	0x01	0x01	( Acknowledgement Packet, appears only once, followed by Receive 2)				
<b>Receive 2</b>	0xFA	0x00	0x05	0xZZ	0xYY	0x00	0x00	Cksum	Data O/P
<b>Note</b>	Header	Data length from Byte 3~ Cksum		Measurement result = 0x0000YYZZ (mm) (little-endian)				Sum of Byte1~6	



### 5.2.5. Turn off laser

	Byte 0	Byte 1	Byte 2	Byte 3
<b>Send</b>	0xCD	0x01	<b>0x04</b>	0x05
<b>Receive</b>	0xFA	0x00	0x01	0x01

### 5.2.6. Request firmware version

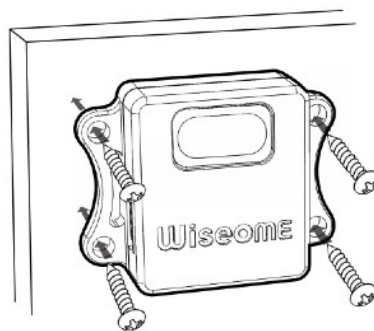
	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8	Byte 9
<b>Send</b>	0xCD	0x01	<b>0x02</b>	0x03						
<b>Receive</b>	0xFA	0x00	0x07	0xPP	0xQQ	0xRR	0xXX	0xYY	0xZZ	Cksum
<b>Note</b>	Header	Data length from Byte 3~ Cksum		Firmware Version= 0xPPQRRXXYYZZ						Sum of Byte1~8

### 5.3. Error Codes Received From the Sensor in Abnormal Conditions

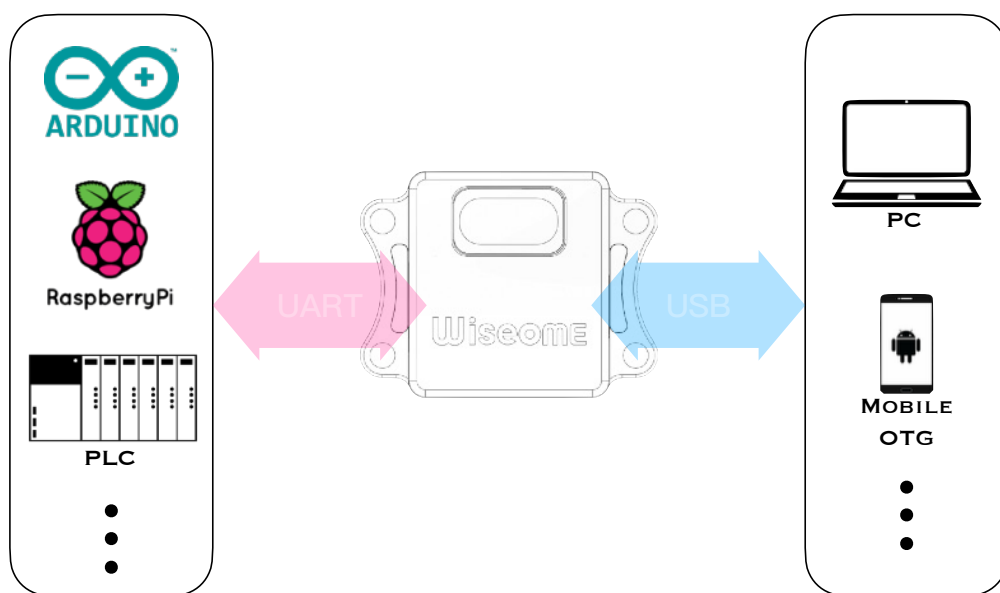
Format	Byte 0	Byte 1	Definitions
<b>Explanation</b>	<b>0x0E</b> Header	0x81	Checksum error
		0x82	Command not found
		0x83	The measured distance is out of max range.
		0x84	The parameters following command is out of permitted range
		0x85	Laser not turned on before measurement.
		0x89	Low SNR
		0x8B	Wrong command header, or header with wrong address

### Install the Sensor

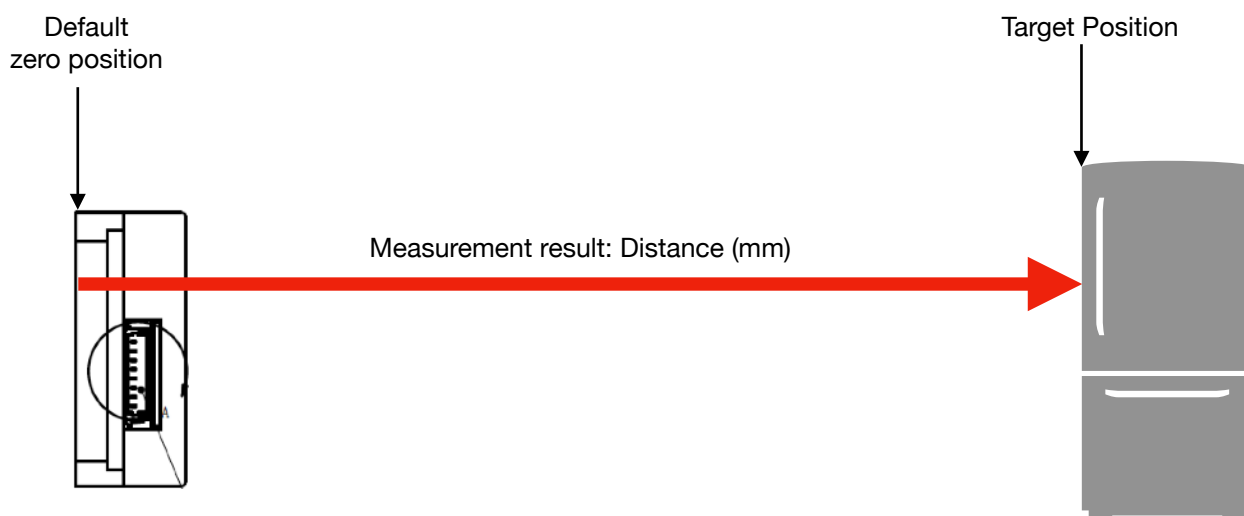
1. Fix the sensor to a firm surface.



2. Connecting the interface wires to either UART port or microUSB port (iPin-DRC222 only).
3. OTG USB is required if connected to an Android mobile device's USB port.



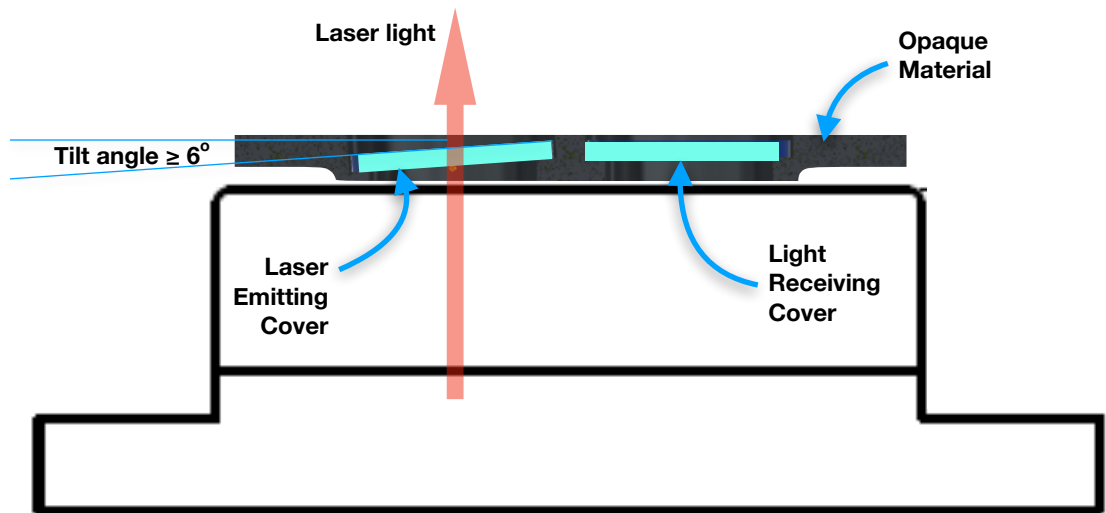
4. Definition of zero position and distance:





### 5. Design guide for external covers

- 5.1. Select high transmittance ( $T > 96\%$  preferred) and hard-coated covers for both emitting and receiving sides, in case the dust/water-proof protection needed.
- 5.2. Place the emitting side cover in a tilt angle  $\geq 6^\circ$  to preventing dual laser spots due to multiple reflections.
- 5.3. Emitting cover and receiving cover should be separated by opaque material to avoid the laser light leakage to the receiver side.



## Precautions

1. Do not stare directly into the laser beam by human eye since it may cause eye damage.
2. The transparent cover on laser measure is an optical element. Do not contaminate the optical cover by soil, oil or chemicals.
3. Avoid any mechanical impact to prevent from malfunction or measurement deviations.

## Revision History

No.	Date	Changes	Page	FW ver.
1	Dec. 31, 2021	Original version v.1.0		FW-v2
2	Jan. 4, 2022	Update to ver. 1.1 Add test software user guide	7-9	FW-v2
3	Jan. 5, 2022	Update to ver. 1.1.x 1. Fix wrong command receive formats at get FW version and measure mode. 2. Fix wrong page number.	5 1-10	FW-v2
4	Jun. 8, 2022	Update to ver. 1.5 1. Update 5. Serial Port Communication Protocols	4	FW-v2.9c
5	Jun. 13 2022	Update to ver. 1.5.1 1. Add Note (e) explanation. 2. Modify the default zero position. 3. Add 4. Design guide for external covers for “Install the Sensor”. 4. Remove “Windows System” in “Serial Port Testing Program”	2 6 9 10	FW-v2.9c
6	Jun. 17, 2022	Update to ver. 1.5.2 1. Add Measurement range $d_{m0} \sim d_{m2}$ 2. Add Measurement freq.: $f_m$ max 30Hz and Note (f) explanation. 3. Modify 5.2.6 Measurement mode C $\rightarrow$ C0	2 2 5	FW-v2.9d
7	Jun. 20, 2022	Update to ver. 1.5.3 1. Remark VDD instead of Vcc in the outline drawing 2. Measurement mode A (Single-shot, max range = $d_{m2}$ ) 3. Measurement mode B (Retained, max range = $d_{m2}$ ) 4. Remove the link of testing software.	3 5 5 10	FW-v2.9d
8	Jun. 24, 2023	Update to ver. 1.5.4 1. Add UART signal level $V_s = 3.3V$ 2. Measurement freq. / sync. mode (C0): min $f_m = 20Hz$ @ target speed < 250 cm/s 3. Add 5.2.7 and 5.2.8 Measurement mode C1, C2	2 6	FW-v2.9d
9	Nov. 2, 2022	Update to ver. 1.6.1 1. Update power consumptions. 2. Correct the mode A, B and C0~2 receiving byte 3~6 format as “little-endian”. 3. Combine commands “5.2.6~8” 4. Remove commands “5.2.9 and 5.2.10”.	2 5 6	FW-v2.9d

No.	Date	Changes	Page	FW ver.
10	Dec. 14, 2022	Update to ver. 1.7.0 1. Define new measurement mode “D” and its related spec 2. Modified optical I/O window design 3. Add 5.2.6 command note: Failed meas. result = 0x7FFFFFFF 4. Remove the section “Design guide for external covers”	3, 7 4 7 9	
11	Feb. 22, 2003	Update to ver. 1.7.1 1. Change typical tolerance of mode D to 12 mm 2. Change typical frequency of mode D to 88 Hz. 3. Remove the output of Failed meas. result in 5.2.7	3 3 7	
12	Mar. 20, 2023	Update to ver. 1.7.2 1. Change the Datasheet solely for iPin-DRC222		
13	May 25, 2023	Update to ver. 1.7.3 1. Change the Measurement Range minimum to 0.1m 2. Add the typical Measurement Freq. $f_{m1}$ to be 8 Hz 3. Change the typical Measurement Freq. $f_{m4}$ to be 110Hz	3 3 3	
14	Jun. 16, 2023	Update to ver. 1.7.4 1. Add 5.1. Data Communication Protocol	5	
15	Jul. 14, 2023	Update to ver. 1.7.5 1. Modify 5.2.6 $T_s$ : (big-endian) 2. Add 5.2.6 “Receive 1: Acknowledgement packet 3. Add 5.2.7 “Receive 1: Acknowledgement packet	1 7 7 7	
16	Jul. 20, 2023	Update to ver. 1.7.6 1. Add typical Detector FOV angle 2. Add figure for FOV explanation 3. Move “Turn on Laser” command to mode A exclusively. 4. Add flow chart for measurement commands.	3 3 5 5, 6	

\* Wiseome reserves the right to make the document change without prior notice.