Communicating Area Sensor Operating Manual V3.0

Table of Contents

Chapter 1

Product Summary

1.1 Product Information

◎ **The guideline of product selection**

Size of detection object: The detection object need to be bigger than Minimal Detection Object

Detection height: beam numbers * beam spacing

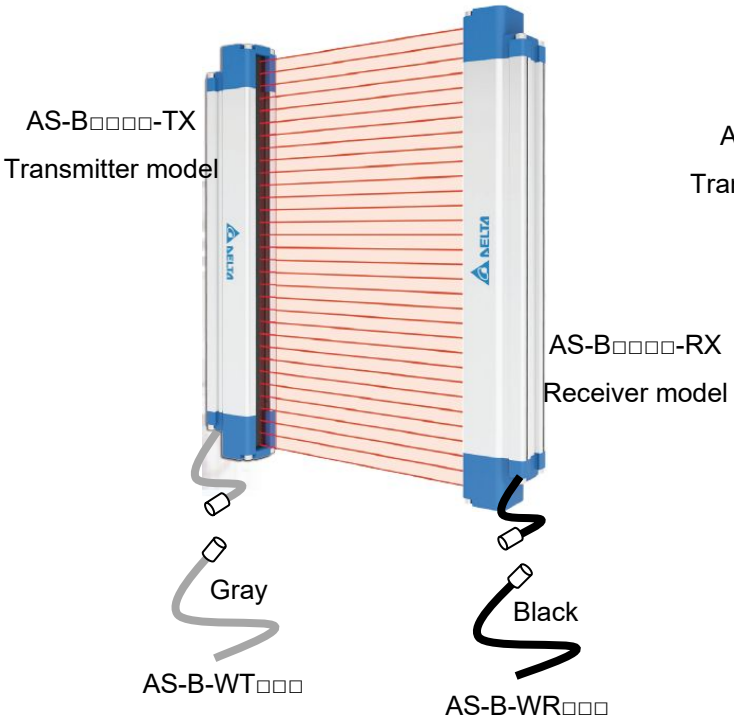
Output: Object absence detection ➔ RX model, switching output that has 2 output NPN and PNP

Object size detection ➔ CX model, switching output and communication output

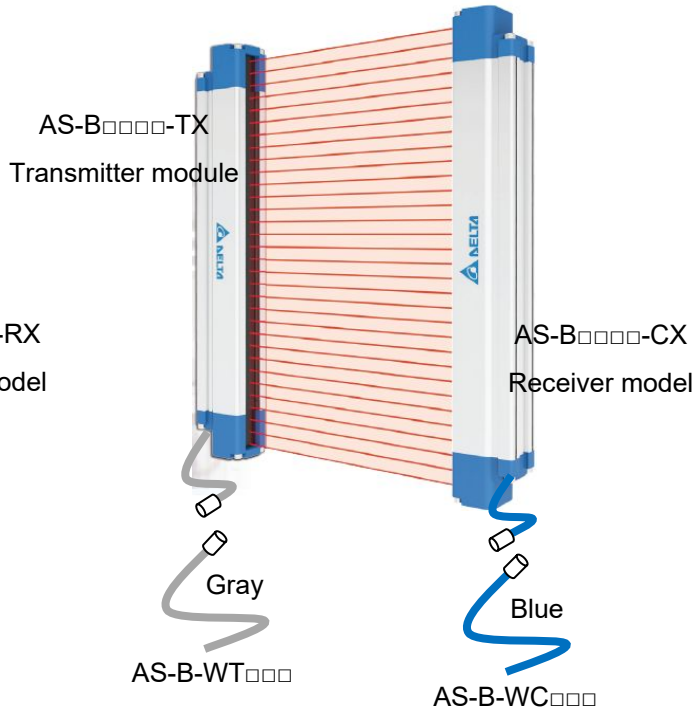
Model	AS-BF series	AS-BH series	AS-BA series
Minimal Detection Object	16.5mm	26.5mm	46.5mm
Beam Spacing	10mm	20mm	40mm
Beam Numbers	16~128	8~96	4~36
Detection height	160 ~ 1280mm	160 ~ 1920mm	160 ~ 1440mm
Detection distance	0.1 ~ 10m		

◎ **Model description**

AS-B Standard Type



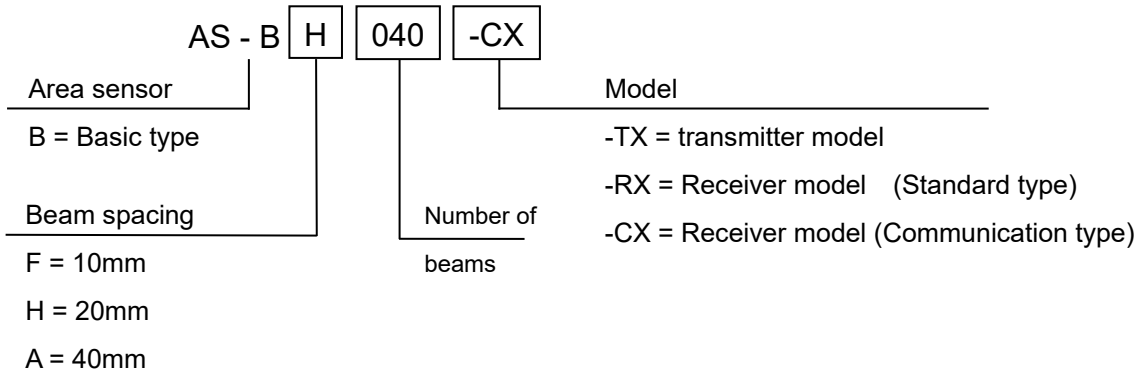
AS-B-C Communication Type



1.2 Order Information

The Transmitter, Receiver, Wire and Bracket need to be ordered separately

◎ **Transmitter/receiver model**



◎ **List of model**

AS-BF Series	AS-BH Series	AS-BA Series
AS-BF016	AS-BH008	AS-BA004
AS-BF024	AS-BH012	AS-BA006
AS-BF032	AS-BH016	AS-BA008
AS-BF040	AS-BH020	AS-BA010
AS-BF048	AS-BH024	AS-BA012
AS-BF056	AS-BH028	AS-BA014
AS-BF064	AS-BH032	AS-BA016
AS-BF072	AS-BH036	AS-BA018
AS-BF080	AS-BH040	AS-BA020
AS-BF088	AS-BH044	AS-BA022
AS-BF096	AS-BH048	AS-BA024
AS-BF104	AS-BH052	AS-BA026
AS-BF112	AS-BH056	AS-BA028
AS-BF120	AS-BH060	AS-BA030
AS-BF128	AS-BH064	AS-BA032
	AS-BH068	AS-BA034
	AS-BH072	AS-BA036
	AS-BH076	
	AS-BH080	
	AS-BH084	
	AS-BH088	
	AS-BH092	
	AS-BH096	

◎ **Cable information**

AS - B - W | T | 025

Cable for Area Sensor

Module

T = Transmitter model

R = Receiver model (Standard type)

C = Receiver model (Communication type)

Cable length

025 = 2.5m

035 = 3.5m

050 = 5m

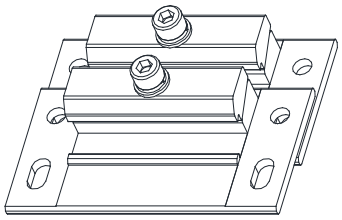
100 = 10m

◎ **List of cables**

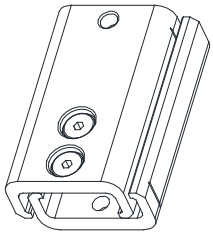
Cable length (m)	AS-B-WT (gray wire)	AS-B-WR (black wire)	AS-B-WC (blue wire)
2.5	AS-B-WT025	AS-B-WR025	AS-B-WC025
3.5	AS-B-WT035	AS-B-WR035	AS-B-WC035
5	AS-B-WT050	AS-B-WR050	AS-B-WC050
10	AS-B-WT100	AS-B-WR100	AS-B-WC100

◎ **Bracket information**

AS-B-BK01 *



AS-B-BK02



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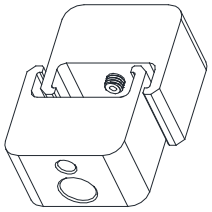
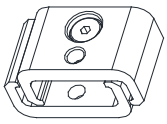


AS-B-BK04



A Bracket package include 2pcs

The bracket installation depend on the detection height, the number of bracket as the list.

Detection Height	160~320mm	400～1680mm	1760～1920mm
The number in the transmitter model / receiver model	1	2	3

Chapter 2

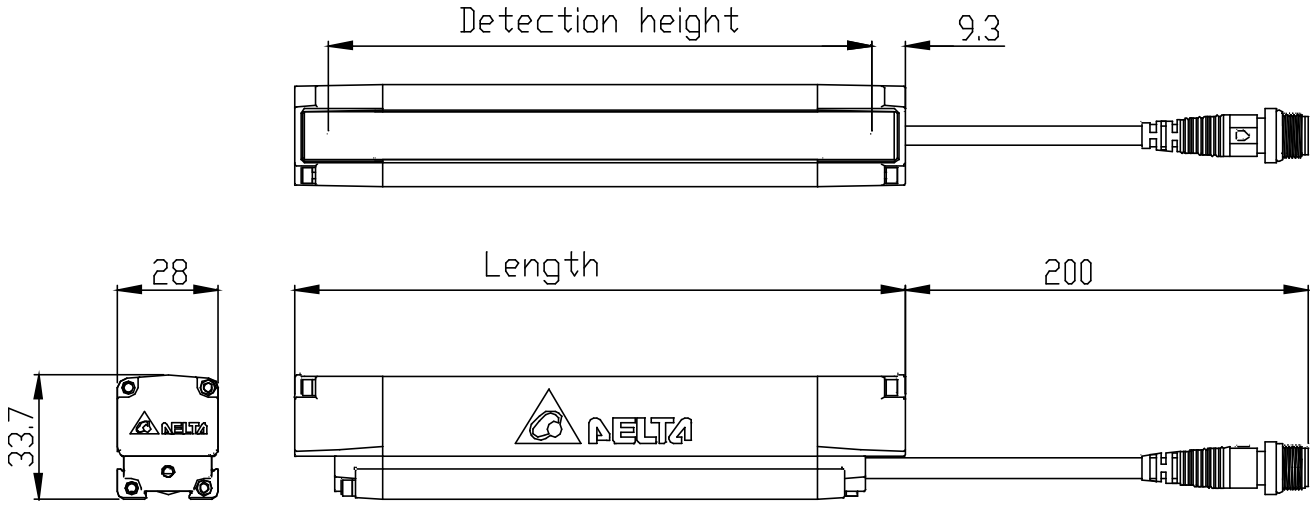
Product Specifications

2.1 Product Specification

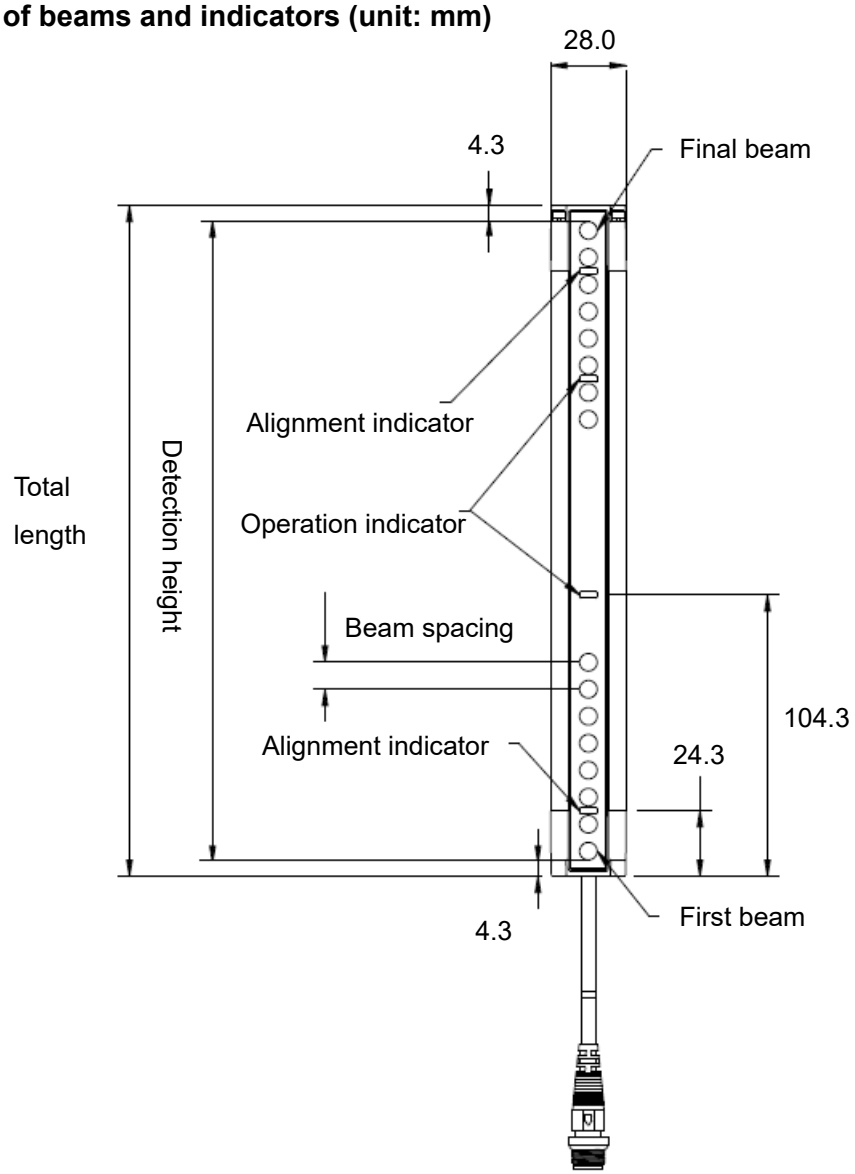
◎ **AS-B Series specification**

Model	AS-BF	AS-BH	AS-BA
Beam spacing	10mm	20mm	40mm
Detection capability	16.5mm	26.5mm	46.5mm
Detecting distance	0.1 ~ 10m		
Light source	Infrared(850nm)		
Effective aperture angle	Max +/- 5°		
Response time	Please refer to Table 2-2		
Power voltage	24VDC ± 10%		
Current consumption	Please refer to Table 2-3		
Protection mechanisms	Reverse voltage protection, output over-current protection, input surge protection, output surge protection		
Operating temperature	-10°C— 55°C (No freezing)		
Storage temperature	-25°C— 60°C (No freezing)		
Operating relative humidity	30 - 85% RH (No condensation)		
Enclosure rating	IP 67		
Ambient light	20,000 Lux or less		
Vibration resistance	10~55 Hz, 1.5mm, 3 axes for 2 hours		
Shock resistance	Max. 100 m/s², 3 axes, 6 directions and 3 times in each.		
Insulation impedance	20 MΩ or more(500VDC)		
Dielectric withstanding voltage	1000 VAC 50/60 Hz 1min		
Material	Case: Aluminum alloy; Protection cover: PMMA, End Terminal: Zinc alloy		
Cable	M12 waterproof connector, 200mm PVC cable		
Certification	CE		

◎ **Product exterior and dimensions (Unit: mm)**



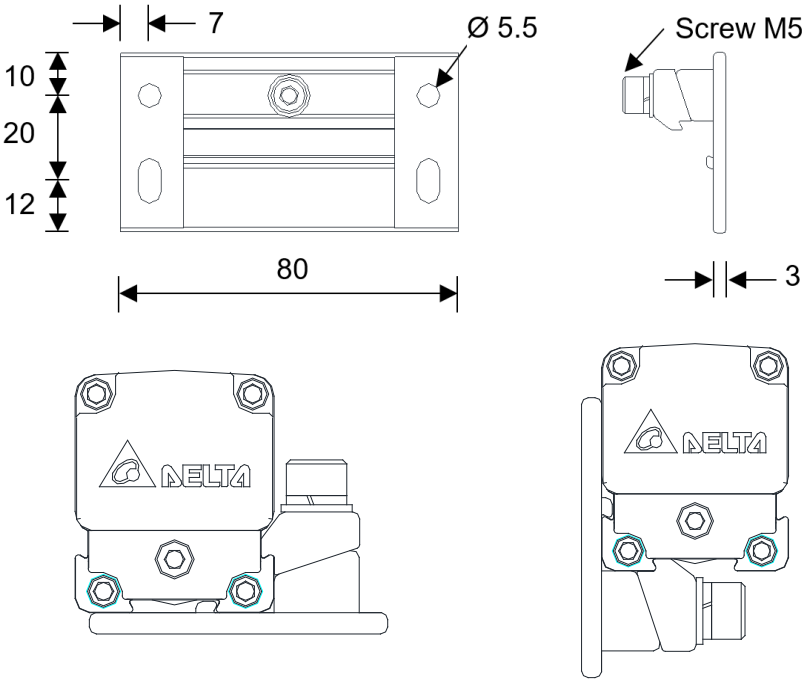
◎ **Positions of beams and indicators (unit: mm)**



2.2 Bracket Installation

◎ **Bracket dimension and installation**

AS-B-BK01 dimensions (unit: mm)



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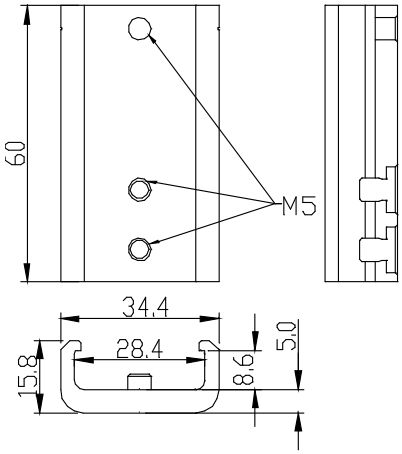

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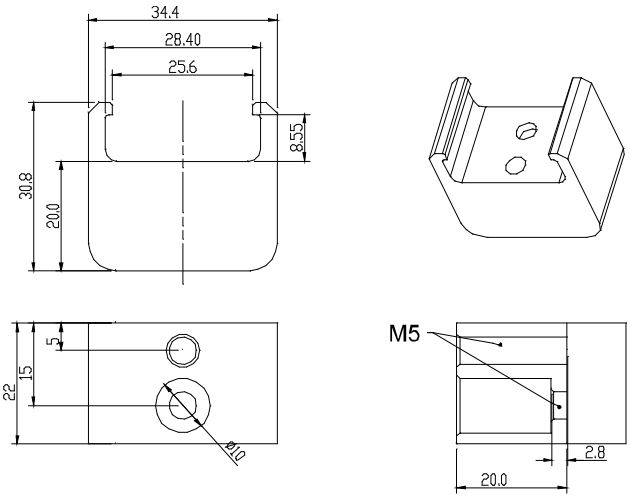

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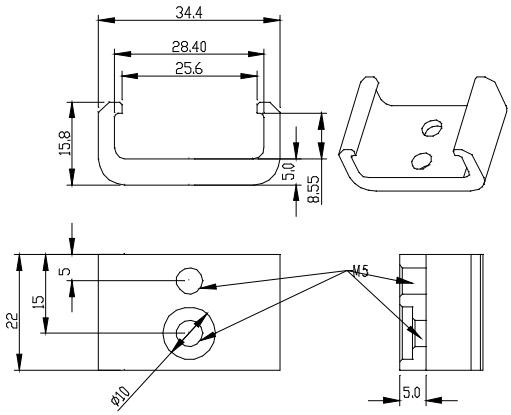
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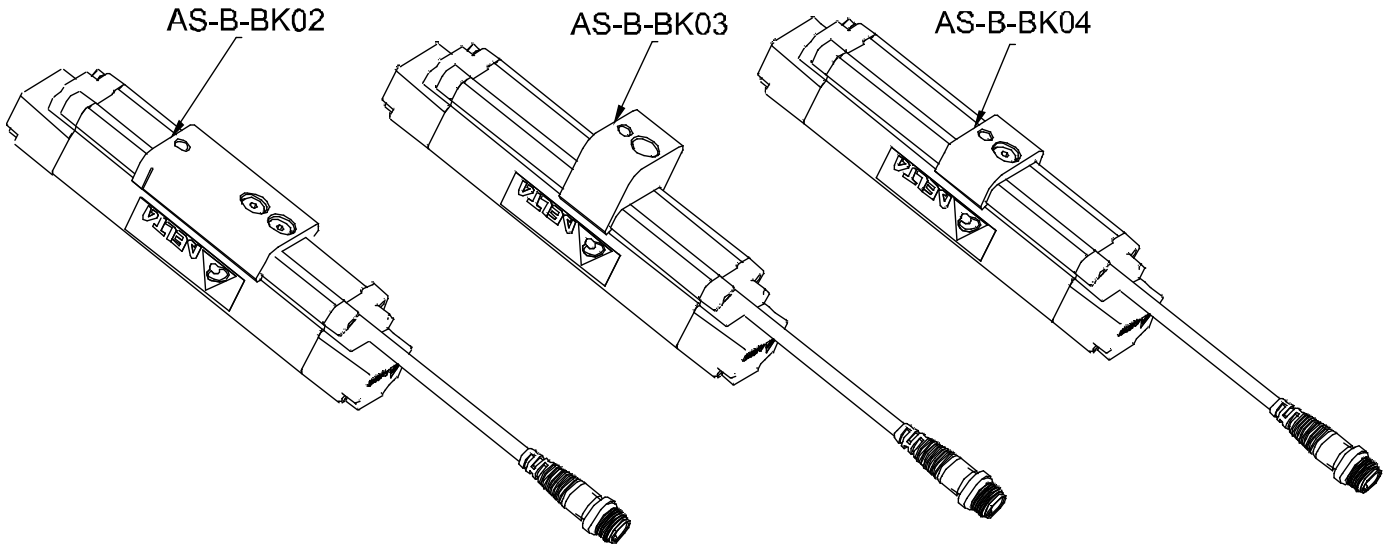

AS-B-BK02
AS-B-BK03
AS-B-BK04

2.3 Description of Optical Detection Capability

◎ **Description of optical detection capability**

Unit: mm	AS-BF	AS-BH	AS-BA
Beam spacing	10	20	40
Beam diameter	6.5	6.5	6.5
Detection capability	Ø 16.5 non-transparent object	Ø 26.5 non-transparent object	Ø 46.5 non-transparent object

Transmitter: IR LED light emitting channel array.

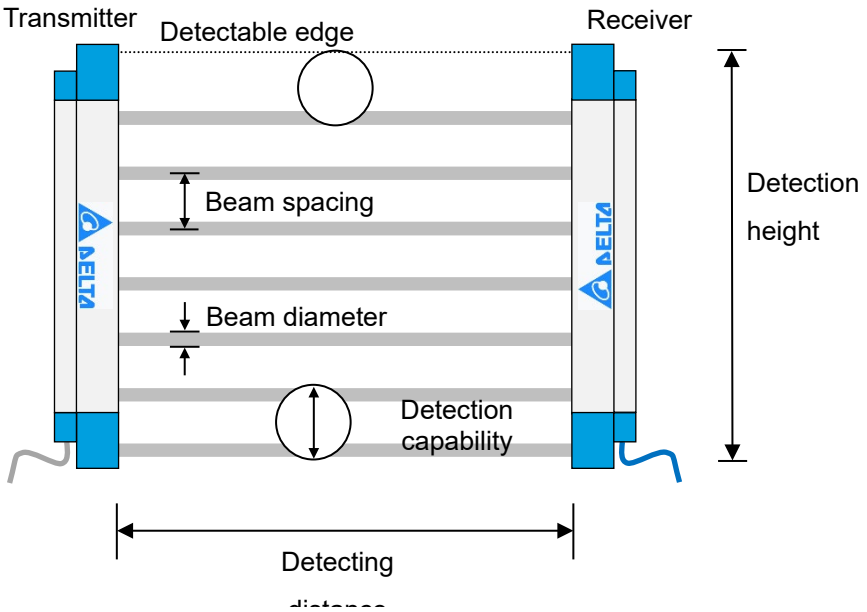
Receiver: Photodiode light receiving channel array.

Beam spacing: Distance between two beams

Beam diameter: Diameter of lenses transmitting and receiving beams.

Detection height: The distance between the highest point and the lowest point within the limit of object detection capability.

Detecting distance: The distance between transmitter and receiver.



◎ **Table 2-1 Detection Height and Total Length**

Unit: mm

AS-BF	Detection Height	Total Length	AS-BH	Detection Height	Total Length	AS-BA	Detection Height	Total Length
AS-BF016	150	168.6	AS-BH008	140	168.6	AS-BA004	120	168.6
AS-BF024	230	248.6	AS-BH012	220	248.6	AS-BA006	200	248.6
AS-BF032	310	328.6	AS-BH016	300	328.6	AS-BA008	280	328.6
AS-BF040	390	408.6	AS-BH020	380	408.6	AS-BA010	360	408.6
AS-BF048	470	488.6	AS-BH024	460	488.6	AS-BA012	440	488.6
AS-BF056	550	568.6	AS-BH028	540	568.6	AS-BA014	520	568.6
AS-BF064	630	648.6	AS-BH032	620	648.6	AS-BA016	600	648.6
AS-BF072	710	728.6	AS-BH036	700	728.6	AS-BA018	680	728.6
AS-BF080	790	808.6	AS-BH040	780	808.6	AS-BA020	760	808.6
AS-BF088	870	888.6	AS-BH044	860	888.6	AS-BA022	840	888.6
AS-BF096	950	968.6	AS-BH048	940	968.6	AS-BA024	920	968.6
AS-BF104	1030	1048.6	AS-BH052	1020	1048.6	AS-BA026	1000	1048.6
AS-BF112	1110	1128.6	AS-BH056	1100	1128.6	AS-BA028	1080	1128.6
AS-BF120	1190	1208.6	AS-BH060	1180	1208.6	AS-BA030	1160	1208.6
AS-BF128	1270	1288.6	AS-BH064	1260	1288.6	AS-BA032	1240	1288.6
			AS-BH068	1340	1368.6	AS-BA034	1320	1368.6
			AS-BH072	1420	1448.6	AS-BA036	1400	1448.6
			AS-BH076	1500	1528.6			
			AS-BH080	1580	1608.6			
			AS-BH084	1660	1688.6			
			AS-BH088	1740	1768.6			
			AS-BH092	1820	1848.6			
			AS-BH096	1900	1928.6			

◎ **Table 2-2 Response Times**

Unit：ms

AS-BF Series	Response Time ON -> OFF	Response Time OFF -> ON	AS-BH Series	Response Time ON -> OFF	Response Time OFF -> ON	AS-BA Series	Response Time ON -> OFF	Response Time OFF -> ON
AS-BF016	5.2	15.6	AS-BH008	3.4	10.2	AS-BA004	2.6	7.8
AS-BF024	7.0	21	AS-BH012	4.4	13.2	AS-BA006	3.0	9
AS-BF032	8.8	26.4	AS-BH016	5.2	15.6	AS-BA008	3.4	10.2
AS-BF040	10.8	32.4	AS-BH020	6.2	18.6	AS-BA010	3.8	11.4
AS-BF048	12.6	37.8	AS-BH024	7.0	21	AS-BA012	4.4	13.2
AS-BF056	14.0	42	AS-BH028	8.0	24	AS-BA014	4.8	14.4
AS-BF064	16.2	48.6	AS-BH032	8.8	26.4	AS-BA016	5.2	15.6
AS-BF072	18.0	54	AS-BH036	9.8	29.4	AS-BA018	5.8	17.4
AS-BF080	20.0	60	AS-BH040	10.8	32.4	AS-BA020	6.2	18.6
AS-BF088	21.8	65.4	AS-BH044	11.6	34.8	AS-BA022	6.6	19.8
AS-BF096	23.4	70.2	AS-BH048	12.6	37.8	AS-BA024	7.0	21
AS-BF104	25.2	75.6	AS-BH052	13.4	40.2	AS-BA026	7.6	22.8
AS-BF112	26.8	80.4	AS-BH056	14.0	42	AS-BA028	8.0	24
AS-BF120	28.8	86.4	AS-BH060	15.2	45.6	AS-BA030	8.4	25.2
AS-BF128	30.8	92.4	AS-BH064	16.2	48.6	AS-BA032	8.8	26.4
			AS-BH068	17.2	51.6	AS-BA034	9.4	28.2
			AS-BH072	18.0	54	AS-BA036	9.8	29.4
			AS-BH076	19.0	57			
			AS-BH080	20.0	60			
			AS-BH084	20.8	62.4			
			AS-BH088	21.8	65.4			
			AS-BH092	22.6	67.8			
			AS-BH096	23.4	70.2			

◎ **Table 2-3 Current consumption @24V**

Unit: mA

AS-BF series	-TX	-RX	-CX	AS-BH series	-TX	-RX	-CX	AS-BA series	-TX	-RX	-CX
AS-BF016	30	45	45	AS-BH008	15	20	20	AS-BA004	20	20	20
AS-BF024	30	45	45	AS-BH012	20	25	25	AS-BA006	25	25	25
AS-BF032	35	50	50	AS-BH016	25	30	30	AS-BA008	30	30	30
AS-BF040	40	55	55	AS-BH020	30	35	35	AS-BA010	35	35	35
AS-BF048	45	60	60	AS-BH024	35	40	40	AS-BA012	35	35	35
AS-BF056	50	70	70	AS-BH028	40	45	45	AS-BA014	40	40	40
AS-BF064	55	70	70	AS-BH032	40	45	45	AS-BA016	45	45	45
AS-BF072	60	80	80	AS-BH036	45	50	50	AS-BA018	50	50	50
AS-BF080	65	85	85	AS-BH040	50	55	55	AS-BA020	50	50	50
AS-BF088	70	90	90	AS-BH044	50	60	60	AS-BA022	55	55	55
AS-BF096	75	95	95	AS-BH048	55	60	60	AS-BA024	60	60	60
AS-BF104	80	105	105	AS-BH052	60	65	65	AS-BA026	65	65	65
AS-BF112	85	110	110	AS-BH056	65	70	70	AS-BA028	65	70	70
AS-BF120	90	115	115	AS-BH060	70	75	75	AS-BA030	70	75	75
AS-BF128	95	120	120	AS-BH064	70	80	80	AS-BA032	75	75	75
				AS-BH068	75	85	85	AS-BA034	80	80	80
				AS-BH072	80	90	90	AS-BA036	80	85	85
				AS-BH076	85	90	90				
				AS-BH080	90	95	95				
				AS-BH084	95	100	100				
				AS-BH088	95	105	105				
				AS-BH092	100	110	110				
				AS-BH096	105	110	110				

* Not including controlled output current

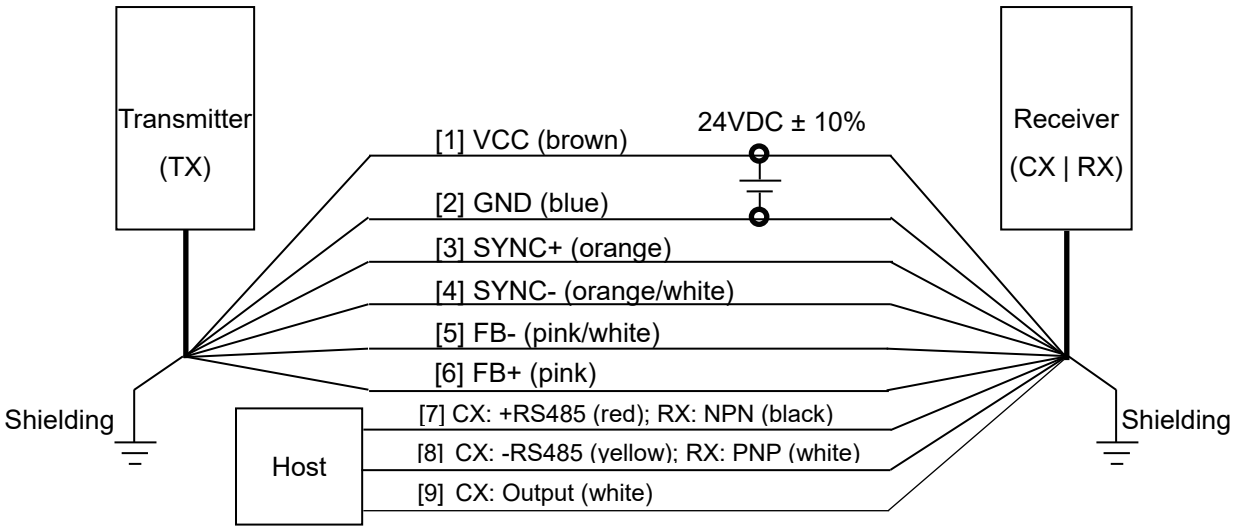
Chapter 3

Installation and Operation

※ **Note: Before using this product, please read Chapter 6 Safety Precautions and then perform the following operations.**

3.1 Wiring Instructions

◎ **AS-B □□□□ (-C) Wiring instructions**



(CX: communication model; RX: standard model)

◎ **Terminology**

VCC: Supply voltage 24V

GND: 0V

SYNC+ / SYNC-: Synchronized signal to the transmitter

FB+ / FB-: Feedback signal from the transmitter

RX_NPN: NPN output

RX_PNP: PNP output

CX_RS485+/RS485-: MODBUS ASCII/RTU

CX_Output: Can be set to NPN, PNP or Push-Pull via communication setting

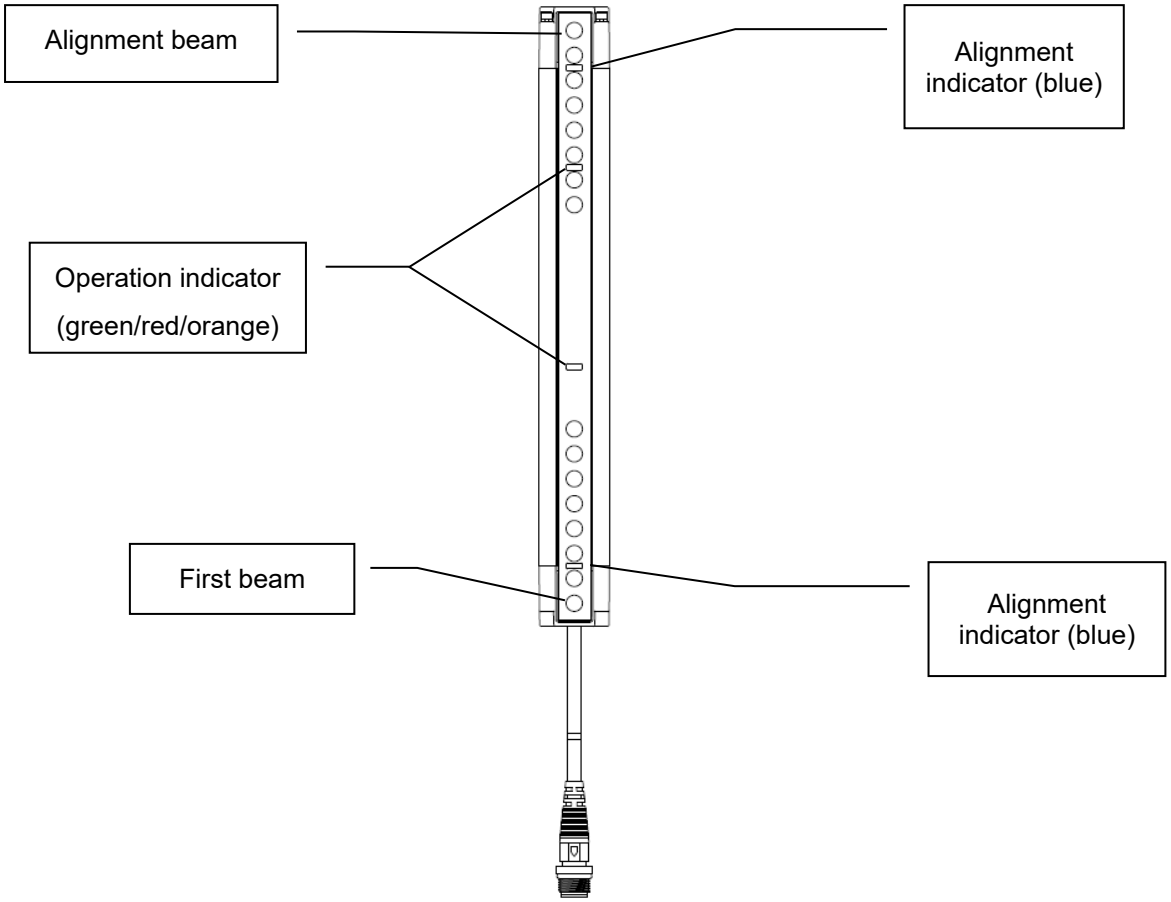
Shielding: Must be connected to a clean ground for guiding the external interference signal away and shield from interference

◎ **Power-on sequence**

1. Power on the transmitter
2. Power on the receiver

3.2 Indicators

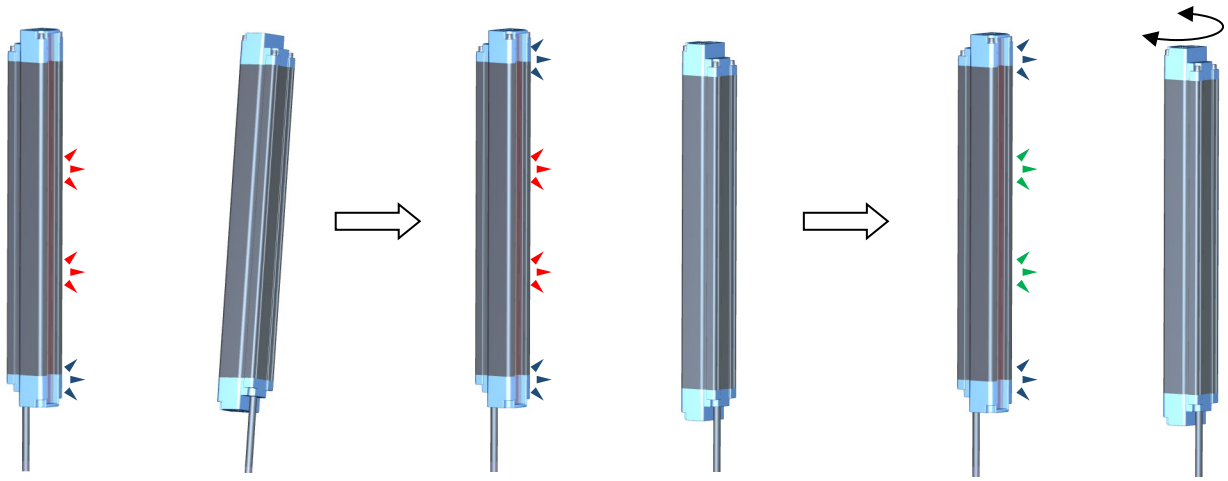
◎ **Description of positions of indicators**



3.3 Installation

◎ **Three steps for easy alignment**

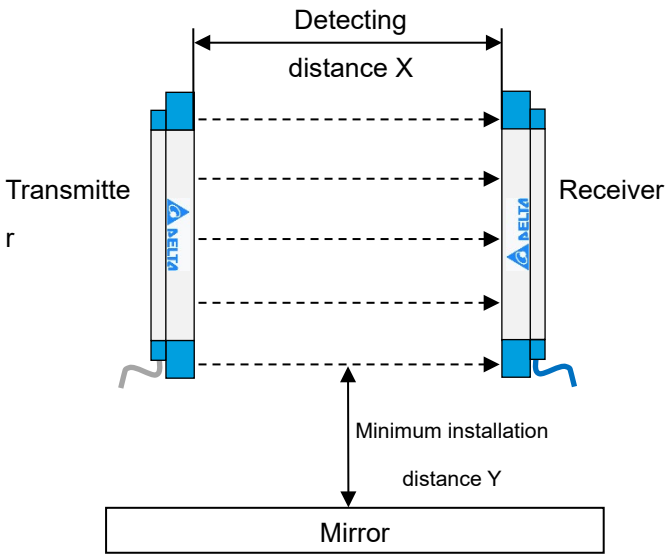
1. Align one beam first, so that the corresponding indicator (blue) lights up.
2. Then align the other beam so that the alignment indicators (blue) on both sides are lit at the same time.
3. Rotate area sensor to change the operation indicator from red to green.

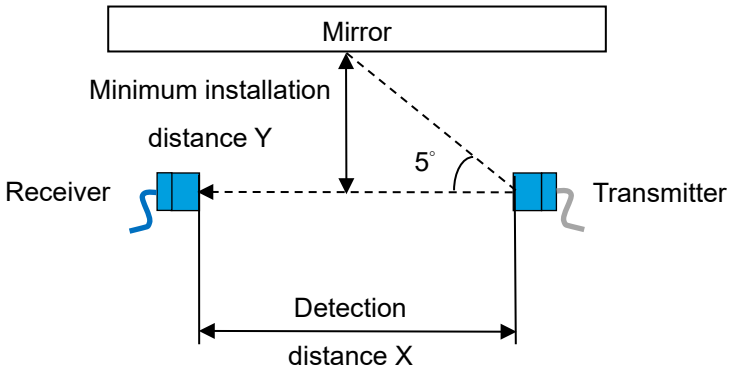


◎ **Installation instructions not affected by the mirror**

Safe installation distance

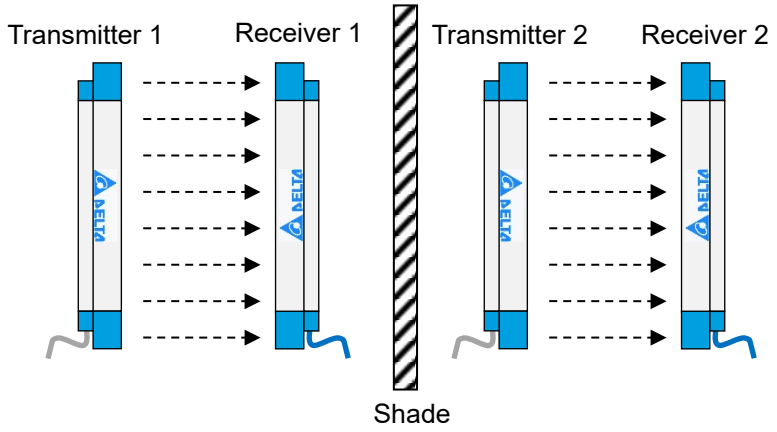
Detection distance X	Minimum installation distance Y
< 3m	0.262 m
> 3m	X * tan5˚



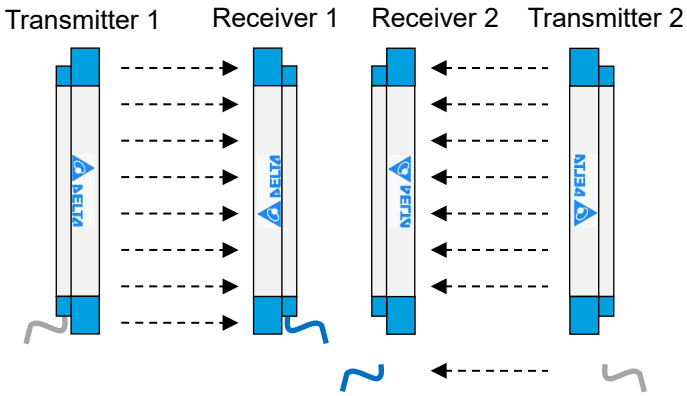


◎ **Installation instructions for multiple adjacent sets**

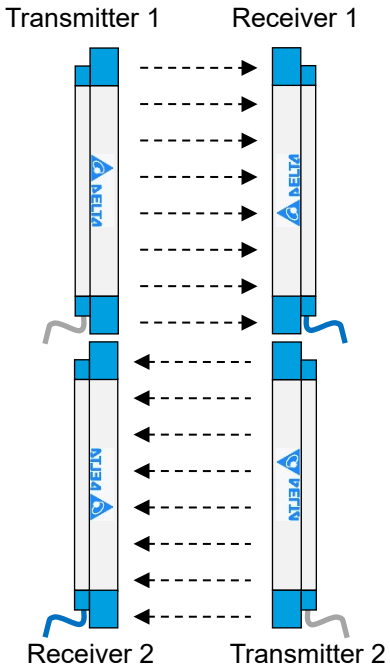
➤ Set the shade to avoid interference from adjacent light sources.



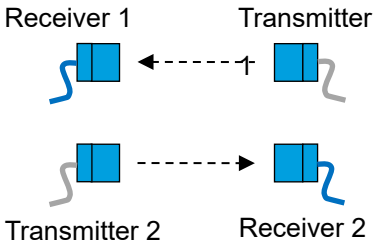
➤ Staggered left/right installation to avoid interference from adjacent light sources.



➤ Staggered up/down installation to avoid interference from adjacent light sources.



➤ Staggered front/rear installation to avoid interference from adjacent light sources.



3.4 Operation Mode

◎ **Standard model (RX)**

0	Stop Mode	There will not be any scan, the orange light is displayed, and the output is fixed at OFF state.
1	ON/OFF Mode	Check if there is any object shading in the detection area and excuse self-diagnosis. When the product is in normal use, the output is OFF(Red Light) after shading any light beam, and the output is ON(Green Light) when it is non-shading. In the OFF state, sensor do FB diagnosis, voltage diagnosis and light beam diagnosis cyclically. Output to ON state when all the diagnosis pass. When FB, internal voltage diagnosis be judged into fail, output would stand in OFF state and change into Stop Mode(Orange Light)

◎ **Communication model (CX)**

0	Stop Mode	There will not be any scan, the orange light is displayed, and the output is fixed at OFF state.
1	ON/OFF Mode	Check if there is any object shading in the detection area and excuse self-diagnosis. When the product is in normal use, the output is OFF(Red Light) after shading any light beam, and the output is ON(Green Light) when it is non-shading. In the OFF state, sensor do FB diagnosis, voltage diagnosis and light beam diagnosis cyclically. Output to ON state when all the diagnosis pass. When FB, voltage diagnosis be judged into fail, output would stand in OFF state and change into Stop Mode(Orange Light). In the mode, the fixed/floating blanking and interlock function can be used together.
2	Measurement mode (default)	When full beams are non-shading, output action ON (green light flashing once per second), any beam is shading or abnormal happened, output OFF (red light flashing once per second). Simultaneously detect Voltage, FB and light beam diagnosis in the same of scan cycle.
3	FB diagnosis mode	Detects whether or not each beam's feedback signal is normal. When diagnosis is normal, green light will flash three times every two seconds. When diagnosis is abnormal, red light will flash three times every two seconds, and output will be fixed as OFF.
4	Voltage diagnosis mode	Detects whether or not the internal/external voltage signal is normal. When diagnosis is normal, green light will flash four times every two seconds. When diagnosis is abnormal, red light will flash four times every two seconds, and output will be fixed as OFF.

5	Scan / diagnosis mode	1. Sequentially FB diagnosis, Voltage diagnosis and light beam diagnosis. The scan times is three times Measurement Mode. The output is diagnosis result, not only the shading/non-shading 2. When FB diagnosis, Voltage diagnosis are pass, and non-shading state, the output is ON and Green Light is on. 3. When FB diagnosis, Voltage diagnosis are pass, and shading state, the output is ON and Red Light is flash per second. 4. When FB diagnosis or Voltage diagnosis is fail, Stop Mode will starts And Output in off state. The failure issue should be removed then function normally. **5.** When output is over current, the output turn into off state. In non-shading, Green LED and Red LED are on. In shading, Green LED and Red LED are flash per second. Precaution: When switching operation mode, please remove OUTPUT from the host for preventing malfunction

◎ **Description of indicator display and output status**

Operation mode	Status description	Output status	Alignment indicator	Operation indicator			*Indicates Flashing state
			Blue light	Orange light	Green light *	Red light *	
0 Stop	Abnormality diagnosed or stop	OFF		V			Fixed
1 ON/OFF (Default)	Full non-shading	ON	V		V		Fixed
	Full non-shading (power saving)	ON	V				
	Full non-shading (over-current)	OFF	V		V	V	
	Shading	OFF	O			V	
	Abnormal number of beams	OFF			V	V	
2 Measurement	Full non-shading	ON	V		V		Once per second
	Full non-shading (power saving)	ON	V				
	Full non-shading (over-current)	OFF	V		V	V	
	Shading	OFF	O			V	
2 Measurement (Active upload)	Full non-shading	ON	V		V		Once every two scans
	Shading	OFF	O			V	
3 Feedback diagnosis	Normal	OFF			V		Three times every two seconds
	Abnormal	OFF				V	
4 Voltage diagnosis	Normal	OFF			V		Four times every two seconds
	Abnormal	OFF				V	
5 Scan and diagnosis	Full non-shading	ON	V		V		Fixed
	Full non-shading (over-current)	OFF	V		V	V	
	Shading	ON	O			V	Once per

	Shading (over-current)	OFF	O		V	V	second
	Abnormal number of beams	OFF			V	V	Fixed
	Feedback/Voltage abnormal and switch to Stop mode	OFF		V			

O : Indicates lit or not; * : Indicates flashing state

※ **Note: In mode 3, 4, 5 , the output status only change by the result of diagnosis. NOT shading or not. DON'T be as the basis for starting the machine.**

◎ **Description of output mode**

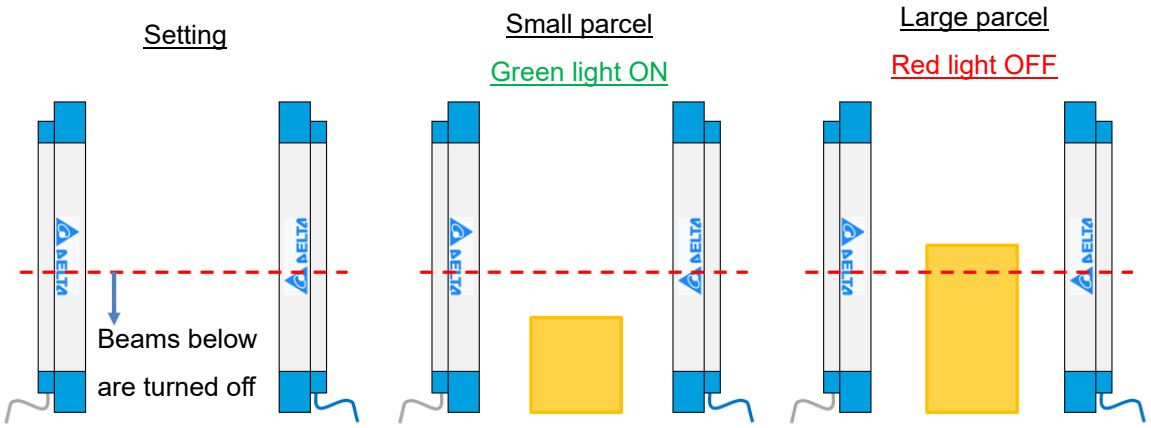
Mode1. ON/OFF Mode 2 measurement mode	Full non-shading ON	Shading OFF / Diagnosis of abnormality
NPN (Default)	Ground	Vcc
PNP	Vcc	Ground
Push-Pull	Vcc	Ground

Mode 5 Scan and diagnosis	Normal operation (Shading or non-shading)	Diagnosis of abnormality / Over Current
NPN (Default)	Ground	Vcc
PNP	Vcc	Ground
Push-Pull	Vcc	Ground

3.5 Operation Mode of Communication mode (CX)

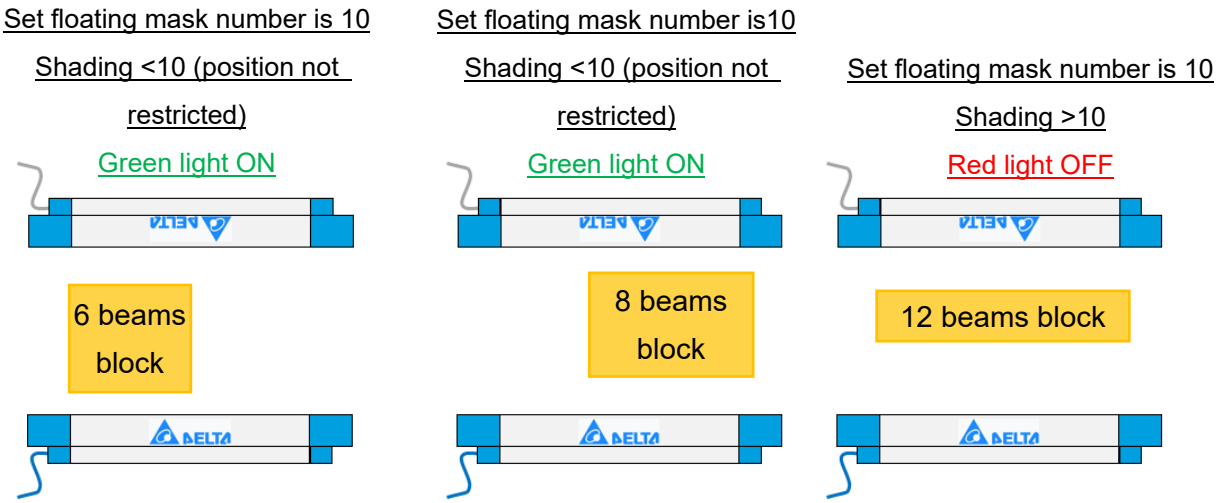
◎ **Fixed mask function**

When the optical axis blocks a fixed optical beam during device installation, these specific beams can be turned off via the settings, so that other beams can be used normally. It can also be used to detect whether or not parcel height is exceeded. Beams below the detection height can be closed, so that other beams can be used normally, and the object will be detected when it exceeds the detection height. The default setting is full beam enabled.



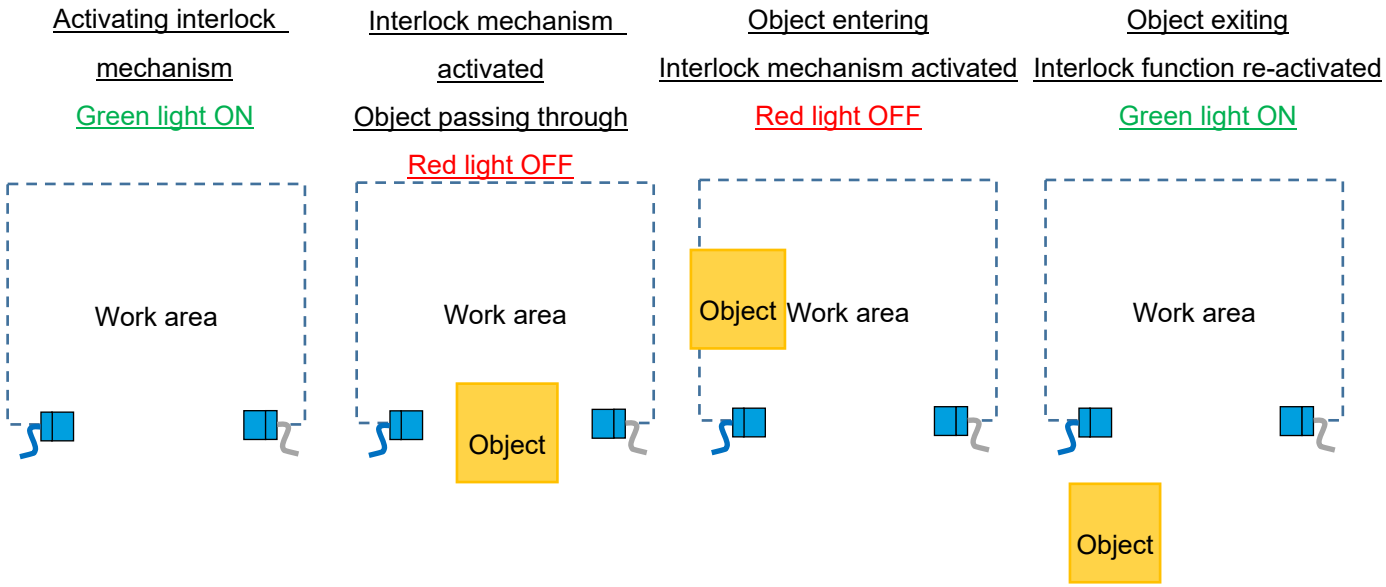
◎ **Floating mask function**

It is applied to the detection of obstacles in an unfixed position, such as detecting whether object length is exceeded, but the object may fall anywhere within the range. (The set value must be less than half of the total number of beams)



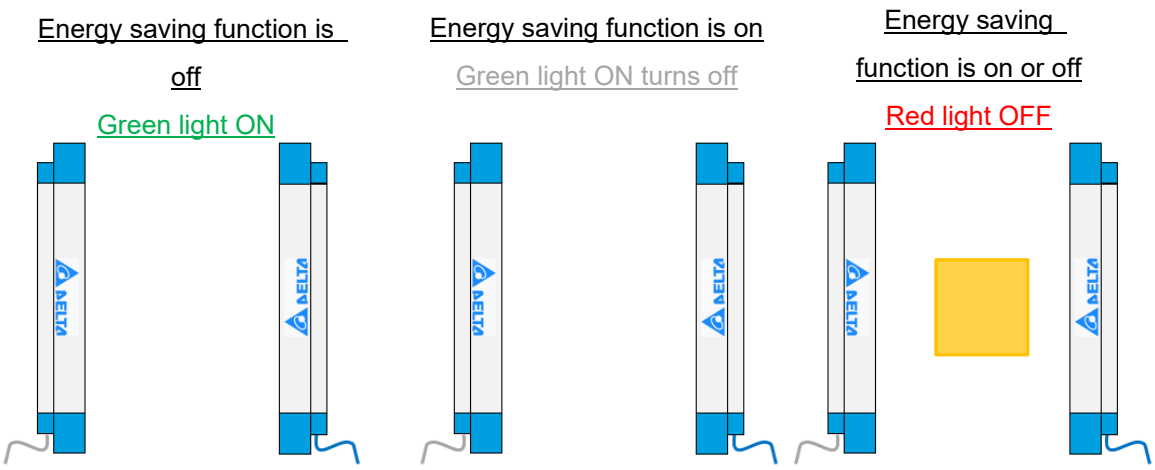
◎ **Interlocking function**

Once shading occurs, the output remains in the OFF state; once full non-shading occurs, the reset interlock function is executed, and only then is the ON state restored.



◎ **Energy-saving function**

Cancels green light indicator; when object is blocked, red light will still be lit.



Chapter 4

Communication Protocol

4.1 List of Communication Parameters

◎ **Communication via RS485**

- Supported Baud Rates:9600, 14400, 19200, 38400 (default), 57600 bps
- Supported Modbus communication formats:
  ASCII: 8,N,1, 8,O,1, 8,E,1, 8,N,2, 8,O,2, 8,E,2
  RTU: 8,N,1(default), 8,O,1, 8,E,1, 8,N,2, 8,O,2, 8,E,2
- Supported communication addresses:1 (default) - 247
- Supported function codes:03H, 06H

Before setting, the product output must be disconnected from the host; after setting, to avoid danger, it must be actually tested to see if it meets requirement before the product output can be connected to the host.

Function	Position	Read /write	Name	Description of numerical value
Basic	0000H ~ 0001H	R	Firmware version	Address 0000H (High) and 0001H (Low) Read back value 00XXH (High) and 00YYH (Low) Version is XXYYH
	002BH	W	Entering firmware upgrade procedure	1: Entering firmware upgrade
	0080H	R	Reading model	2 : AS-B
Communication format setting (Example 1)	0081H	R/W	Modbus communication address	Default setting is 1; setting range is 1 - 247
	0082H	R/W	Modbus Baud Rate (bps)	1: 9600 2: 14400 3: 19200 4: 38400 (Default) 5: 57600
	0083H	R/W	Modbus communication format	1: ASCII, 8, N, 1 2: ASCII, 8, O, 1 3: ASCII, 8, E, 1 4: ASCII, 8, N, 2 5: ASCII, 8, O, 2

				6: ASCII, 8, E, 2 11. RTU, 8, N, 1 (Default) 12. RTU, 8, O, 1 13. RTU, 8, E, 1 14. RTU, 8, N, 2 15. RTU, 8, O, 2 16. RTU, 8, E, 2 *delete 7bit supporting
	0084H	W	Execution of Modbus communication write	1: Execution of communication write Previous setting of communication don't be activated before executing this command.
Floating blanking (Example 2)	0085H	R/W	Setting the number of floating blanking beams (Limited to ON/OFF operation mode)	0 (default) - number of beams/2 Takes effect immediately after setting
Interlock (Example 4)	0086H	R/W	Interlock function (Limited to ON/OFF operation mode)	0: Off (Default) 1: Activated Takes effect immediately after setting
	0087H	W	Restart interlock function (Limited to ON/OFF operation mode; can only be carried out when green light is on)	1: Restart
Energy saving function	0088H	R/W	Activate energy saving function (Limited to ON/OFF and measurement operation mode)	0: Turn off (default) 1: Activate energy saving function (The indicator of green LED are disable)
Output (Example 5)	0089H	R/W	Output setting	0: NPN (Default) 1: PNP 2: Push-Pull Does not change after setting; only takes effect after it is powered on again.
Operation mode (Example 6)	008AH	R/W	Operation mode	0: Stop mode (orange light) 1: ON/OFF mode (constant light) 2: Measurement mode (default) (flashes once per second) 3: FB signal diagnosis mode (flashes three times every two seconds) 4: Voltage diagnosis mode (flashes four

				times every two seconds) 5: Scan / diagnosis mode (constant light in non-shading status, flashes once per second in shading status)
activate upload (Example 8)	008BH	W	Activate automatic upload function (Limited to measurement operation mode)	0: Off 1: Activated and disable when restart After every scan, the scan result will auto-upload according to the setting data content; scan time and content of upload must be set before use; once activated, product cannot receive any commands. After entering active upload procedure, indicator will flash once every two scans. Note: After re-start, this function is in OFF state. 2: Activated and keep when restart After re-start, the product will scan and diagnosis at first then active the function. It will enter stop mode in this re-start period when abnormal happened. The function can be disable in stop mode. (after firmware V1030)
	008CH	R/W	Setting automatic upload data content (Limited to measurement operation mode)	0: The status of each beam Data length = ((the number of beams-1)/8 + 1) Every bit in the data represents the corresponding beam. 1 represents shading 0 represents non-shading 1: Content is composed by the following package: First shading beam; final shading beam; total shading number; and total shading length (cm)
	008DH	R/W	Setting delay time 1 (0.1msec) (Limited to automatic upload application in measurement operation mode)	After scanning and data upload, delay the time of time1. Maximum value is 255; can be used in coordination with delay time 2.

				Set value*0.1=delay time 1 (msec)
	008EH	R/W	Setting delay time 2 (1msec) (Limited to automatic upload application in measurement operation mode)	After scanning and data upload, delay the time of time2 Maximum value is 255; can be used in coordination with delay time 1. Set value*1=delay time 2 (msec)
Number of shading beams	0090H	R	Number of shading beams (Limited to measurement operation mode)	Total number of current shading beams. If fixed blanking is set, the beam will not be counted.
Shading length	0091H	R	Shading length (Limited to measurement operation mode)	Total number of shading beams multiplied by beam pitch Unit cm
ON/OFF Delay	0092H	R/W	Output ON Delay (Limited to measurement operation mode) (Includes version v1005 and later)	When detection is changed from OFF to ON, the number of consecutive ON must exceed the number of this setting then the result will output ON. Unit is the cycle of one scan (time). Default value is 0, which means this function is turned off. Maximum value is 255.
	0093H	R/W	Output OFF Delay (Limited to measurement operation mode) (Includes version v1005 and later)	When detection is changed from ON to OFF, the number of consecutive OFF must exceed the number of this setting then the result will output OFF. Unit is the cycle of one scan (time). Default value is 0, which means this function is turned off. Maximum value is 255.
Invert light beam state	0094H	R/W	Invert light beam state (Limited to measurement operation mode) (Includes version v1031 and later)	0060H ~ 006FH light beam state Definition of light beam state 0 (default)： 0060H ~ 006FH bit = 1, mean no-shading bit = 0, mean shading 1：0060H ~ 006FH bit = 1, mean shading bit = 0, mean non-shading
Inverter light beam state in activate upload	0095H	R/W	Inverter each light beam state in activate upload, data state definition(008CH=0)	The definition of light beam state when 008CH=0 0 (default)：bit = 1, mean shading

			(Limited to measurement operation mode) (Includes version v1031 and later)	bit = 0, mean non-shading 1：bit = 1, mean no-shading bit = 0, mean shading *Note：The definition is reverse with 0094H
activate upload mechanism	0096H	R/W	The activate upload in 2 mechanism (Limited to measurement operation mode and activate upload) (Includes version v1031 and later)	0 (default)：activate upload data continuously 1: activate upload when any one light beam status chage
Rapid Light beams enable	0098H	W	Enable/disable light beams in measurement rapidly	0: Enable all beams 1: Enable no-shading beams 2: Enable the interval beams between start beam(0099H) and end beam(009AH), include start beam and end beam. 3: Enable the out of interval beams between start beam(0099H) and end beam(009AH), not include start beam and end beam. Note: 1. make sure all beams on the enable status before setting 2. before execute 2,3, should execute start beam and end beam.
	0099H	R/W	Set start beam in rapid light beams enable	1 ~ 128
	009AH	R/W	Set endbeam in rapid light beams enable	1 ~ 128
Hole detection (Example 9)	00A0H	R	First shading beam (Limited to mode 2 and 5) (Includes version v1021 and later)	FirstOFFCh position of first shading beam Cannot be used simultaneously with fixed blanking
	00A1H	R	Final shading beam (limited to mode 2 and 5) (Includes version v1021 and	LastOFFCh position of final shading beam Cannot be used simultaneously with fixed

			later)	blanking
	00A2H	R	The number from the first shading beam to the final one. (Ignore the hole between the first shading beam and the final one) (Limited to mode 2 and 5) (Includes version v1021 and later)	LastOFFCh – FirstOFFCh + 1 Cannot be used simultaneously with fixed blanking
	00A3H	R	Total length from the first shading beam to the final one. (Ignore the hole between the first shading beam and the final one) (Limited to mode 2 and 5) (Includes version v1021 and later)	(LastOFFCh – FirstOFFCh + 1)* (Beam pitch) Unit is cm Cannot be used simultaneously with fixed blanking
	00A4H	R	The last hole (Limited to mode 2 and 5) (Includes version v1021 and later)	Cannot be used simultaneously with fixed blanking
	00A5H	R	The last shading (Limited to mode 2 and 5) (Includes version v1021 and later)	Cannot be used simultaneously with fixed blanking
	00A6H	R	The second last hole (Limited to mode 2 and 5) (Includes version v1021 and later)	Cannot be used simultaneously with fixed blanking
	00A7H	R	The second last shading (Limited to mode 2 and 5) (Includes version v1021 and later)	Cannot be used simultaneously with fixed blanking
	00A8H	R	The third last hole (Limited to mode 2 and 5) (Includes version v1021 and later)	Cannot be used simultaneously with fixed blanking
	00A9H	R	The third last shading (Limited to mode 2 and 5)	Cannot be used simultaneously with fixed blanking

			(Includes version v1021 and later)	
	00AAH	R	The fourth last hole (Limited to mode 2 and 5) (Includes version v1021 and later)	Cannot be used simultaneously with fixed blanking
	00ABH	R	The fourth last shading (Limited to mode 2 and 5) (Includes version v1021 and later)	Cannot be used simultaneously with fixed blanking
	00ACH	R	The fifth last hole (Limited to mode 2 and 5) (Includes version v1021 and later)	Cannot be used simultaneously with fixed blanking
	00ADH	R	The fifth last shading (Limited to mode 2 and 5) (Includes version v1021 and later)	Cannot be used simultaneously with fixed blanking
	00AEH	R	The sixth last hole (Limited to mode 2 and 5) (Includes version v1021 and later)	Cannot be used simultaneously with fixed blanking
Fixed blanking (Example 3)	0030H ~ 003FH	R/W	Fixed blanking Channel (Limited to ON/OFF and measurement operation mode)	Low Byte, from high to low bit, represents the set values of 8 beams respectively 1: Enabled (default) 0: Ignore 0030H corresponds to beams 8~1 0031H corresponds to beams 16~9 0032H corresponds to beams 24~17 0033H corresponds to beams 32~25 0034H corresponds to beams 40~33 0035H corresponds to beams 48~41 0036H corresponds to beams 56~49 0037H corresponds to beams 64~57 0038H corresponds to beams 72~65 0039H corresponds to beams 80~73 003AH corresponds to beams 88~81 003BH corresponds to beams 96~89 003CH corresponds to beam 104~97

				003DH corresponds to beam 112~105 003EH corresponds to beams 120~113 003FH corresponds to beams 128~121
The status of channel in transmitter module	0040H ~ 004FH	R	The status of TX beam (Limited to measurement/FB/voltage diagnosis operation mode)	High Byte represents mode 2: Measurement mode 3: FB diagnosis mode 4: Voltage diagnosis mode Low Byte, from high to low bit, represents the state values of 8 beams 1: PASS 0: FAIL 0040H corresponds to beams 8~1 0041H corresponds to beams 16~9 0042H corresponds to beams 24~17 0043H corresponds to beams 32~25 0044H corresponds to beams 40~33 0045H corresponds to beams 48~41 0046H corresponds to beams 56~49 0047H corresponds to beams 64~57 0048H corresponds to beams 72~65 0049H corresponds to beams 80~73 004AH corresponds to beams 88~81 004BH corresponds to beams 96~89 004CH corresponds to beams 104~97 004DH corresponds to beams 112~105 004EH corresponds to beams 120~113 004FH corresponds to beams 128~121
The status of channel in receiver module (Example 7)	0050H ~ 005FH	R	The status of RX beam (Limited to measurement/FB/voltage diagnosis operation mode)	High Byte represents mode 2: Measurement mode 3: FB diagnosis mode 4: Voltage diagnosis mode Low Byte, from high to low bit, represents the state values of 8 beams 1: PASS or Non-shading 0: FAIL or Shading 0050H corresponds to beams 8~1 0051H corresponds to beams 16~9 0052H corresponds to beams 24~17 0053H corresponds to beams 32~25

				0054H corresponds to beams 40~33 0055H corresponds to beams 48~41 0056H corresponds to beams 56~49 0057H corresponds to beams 64~57 0058H corresponds to beams 72~65 0059H corresponds to beams 80~73 005AH corresponds to beams 88~81 005BH corresponds to beams 96~89 005CH corresponds to beams 104~97 005DH corresponds to beams 112~105 005EH corresponds to beams 120~113 005FH corresponds to beams 128~121
The light status of channel in receiver module (Includes version v1021 and later)	0060H ~ 006FH	R	The light status of RX beam (Limited to ON/OFF, measurement and scan diagnosis operation mode)	High Byte represents mode 1: ON/OFF mode 2: Measurement mode 5: Scan/diagnosis mode Low Byte, from high to low bit, represents the state values of 8 beams 1: PASS 0: FAIL 0050H corresponds to beams 8—1 0051H corresponds to beams 16—9 0052H corresponds to beams 24—17 0053H corresponds to beams 32—25 0054H corresponds to beams 40—33 0055H corresponds to beams 48—41 0056H corresponds to beams 56—49 0057H corresponds to beams 64—57 0058H corresponds to beams 72—65 0059H corresponds to beams 80—73 005AH corresponds to beams 88—81 005BH corresponds to beams 96—89 005CH corresponds to beams 104—97 005DH corresponds to beams 112—105 005EH corresponds to beams 120—113 005FH corresponds to beams 128—121

4.2 Description of Communication Function

◎ **Example 1. Change the format of Modbus communication**

➢ Change the communication format to address 2, Baud Rate to 19200, and format to 8,E,1; the procedure is as shown below

Sequence of executed action	ASCII	RTU
Change address to 2	:01060081000276	01 06 00 81 00 02 58 23
Change Baud Rate to 19200	:01060082000374	01 06 00 82 00 03 69 E3
Change format to 8,E,1	:01060083000373	01 06 00 83 00 03 38 23
Execute communication confirmation action	:01060084000174	01 06 00 84 00 01 08 23

◎ **Example 2. Floating blanking function (limited to ON/OFF operation mode)**

➢ Note: Takes effect immediately after setting. Disconnect product output contact from the host before setting, in order to prevent malfunction and damage.

➢ Description: Only when the number of shielded beams exceeds the set value will the output be ON.

➢ Setting: Default value 0 indicates turn off floating blanking function; maximum value cannot exceed half the product's number of beams.

Executed action	ASCII	RTU
Set floating blanking number to 3	:01060085000371	01 6 00 85 00 03 D8 22

◎ **Example 3. Fixed blanking function (Limited to ON/OFF and measurement operation mode)**

➢ Note: Takes effect immediately after setting. Disconnect product output contact from the host before setting, in order to prevent malfunction and damage.

➢ Description: Turn off designated beam detection. Non-shading/shading status of this beam will not affect the output action.

➢ Setting: Default 1 indicates that beam detection is turned on; 0 indicates that beam detection is turned off.

Executed action	ASCII	RTU
Turns off detection for beams 1-4.	:0106003000F0D9	01 06 00 30 00 F0 89 81

◎ **Example 4. Interlock/restart interlock function (limited to ON/OFF operation mode)**

➢ Note: Takes effect immediately after setting. Disconnect product output contact from the host before setting, in order to prevent malfunction and damage.

➢ Description: Once shading occurs, output remains in OFF state; after full non-shading takes place again, reset interlock function is executed, and only then is ON state restored at output.

➢ Setting: Default 0 indicates that interlock function is turned off; 1 indicates that interlock function is turned on.

Executed action	ASCII	RTU
Turn on interlock function	:01060086000172	01 06 00 86 00 01 A9 E3

Executed action	ASCII	RTU
Interlock function is turned on again when full non-shading occurs.	:01060087000171	01 06 00 87 00 01 F8 23

◎ **Example 5. Output setting**

- Note: Does not change immediately after setting; only takes effect after it is powered on again. Before power on again, disconnect product output contact from the host and confirm that output action is normal; output can then be connected to the host, in order to prevent output malfunction and damage.
- Description: For normal operation states, refer to table below. Any abnormal diagnosis output will fix shading OFF state.

ON/OFF; measurement mode	External resistance 4.7Kohm	Full non-shading ON	Shading OFF
NPN	Pull up	Low	High
PNP	Pull down	High	Low
Push-Pull	Not connected	High	Low

- Setting: Default 0 represents NPN, 1 represents PNP, 2 represents Push-Pull

Executed action	ASCII	RTU
Set to PNP	:0106008900016F	01 06 00 89 00 01 99 E0

◎ **Example 6. Operation mode**

- Note: Before mode switching, disconnect product output contact from the host, in order to prevent output malfunction and damage.
  - After switching from 0 or 1 to other modes, will enter stop mode, and must be powered on again to complete switching.
  - After switching from 2,3,4 to 1, will enter the stop mode, and must be powered on again to complete switching.
  - 2,3,4 can be directly switched without necessity of being powered on again.
- Example

Executed action	ASCII	RTU
Switch to measurement mode	:0106008A00026D	01 06 00 8A 00 02 29 E1

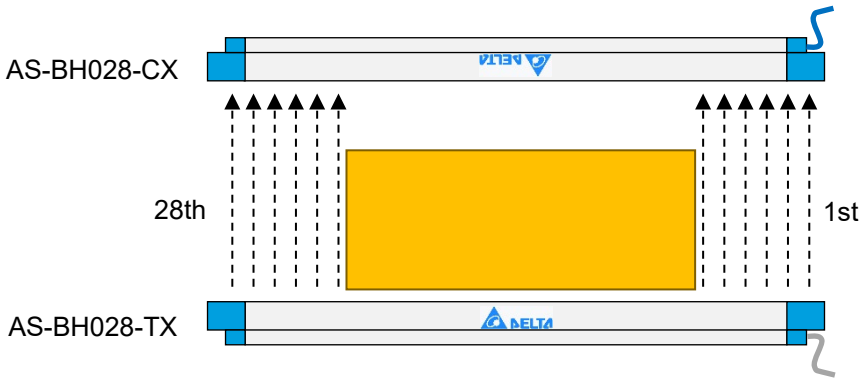
◎ **Example 7. Beam detection result**

- Description: The TX/RX beam detection result can be read in measurement/FB/voltage mode.
- Reading: 1 represents diagnosis PASS or measurement mode RX beam non-shading;
  0 represents diagnosis FAIL or measurement mode RX beam shading.
- Example Reading RX beam non-shading/shading state in measurement mode. Assume beams 7 - 22 are shaded by objects.

Executed action	ASCII	RTU
Reading RX beam state	:010300500004A8	01 03 00 50 00 04 44 18
Response	:010308023F020002C0 021FCE	01 03 08 02 3F 02 00 02 C0 02 1F 9B C3

Numerical value response is as shown below: Where high byte 02H represents measurement mode, low byte represents beam state

Channel	32—25	24—17	16—9	8—1
Register address(Hex)	0053	0052	0051	0050
Data(Hex)	021F	02C0	0200	023F
Beam state(bit)	0 0 0 1 1 1 1 1	1 1 0 0 0 0 0 0	0 0 0 0 0 0 0 0	0 0 1 1 1 1 1 1

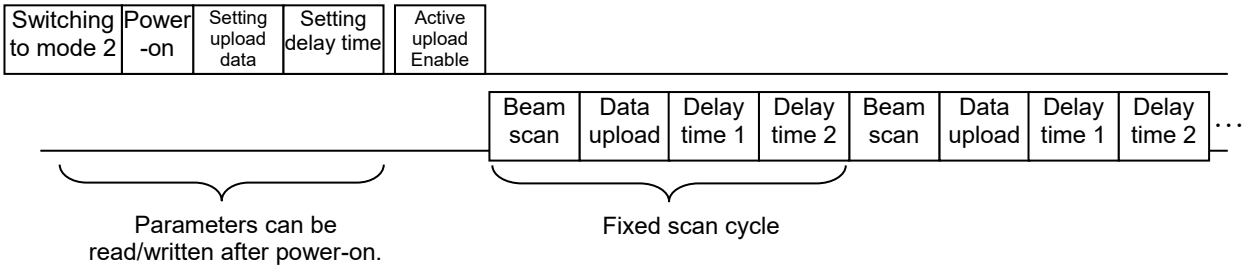


- Note: The transmitter/receiver module beam close to the outlet end is the first beam; except for models with total beam number 128, if model's total number of beams is N, normal reading of beam N+1 should be 1. For beams beyond N+1, normal reading should be 0. In the example above, beam 29 is 1, indicating it is correct that no beam is detected.

◎ **Example 8. Active upload**

➢ Application: Suited for the logistics industry to measure the information about the exterior of a passing object. The overall area and placement of an object can be calculated based on the fixed scan cycle and scan result of each cycle. The overall volume can be calculated from the two groups of products. It can also be used for correction applications in the printing and textile industries.

➢ Description of automatic upload operation procedure:



1. After product is set in measurement mode, power is turned off and then turned on again. After success, it will flash once every 2 seconds. (Product only needs to be set once.)

Executed action	ASCII	RTU
Switch to measurement mode	:0106008A00026D	01 06 00 8A 00 02 29 E1

2. Setting upload data content

Executed action	ASCII	RTU
Non-shading/shading state of each beam	:0106008C00006D	01 06 00 8C 00 00 48 21

3. Set scan cycle to scan time (Note 1) + data upload time (Note 2) + delay time setting (default value is 0).

Executed action (ex)	ASCII	RTU
Delay time 1 (0.1msec) = 32	:0106008D00204C	01 06 00 8D 00 20 18 39
Delay time 2 (1msec) = 10	:0106008E000A61	01 06 00 8E 00 0A 69 E6

4. Active upload function

Executed action	ASCII	RTU
Active upload function	:0106008B00016D	01 06 00 8B 00 01 38 20

➢ Description of setting automatic scan cycle:

Scan cycle = beam scan time + data upload time + delay time 1 + delay time 2.

- For beam scan time, refer to Table 4-1.
- Data upload time depends on total bytes of uploaded data and communication format. Refer to Table 4-2 and Table 4-3.
- Delay time 1: Unit is 0.1msec multiplied by set value.
- Delay time 2: Unit is 1msec multiplied by set value.

Example : The product to be used is AS-BH028-C with communication format of 38,400bps, RTU is 8, N, 1, and data is selected to be every beam's shading state, in order to obtain a fixed scan of 100Hz.

1) Beam scan time Equals 4.5msec, according to Table 4-1.
2) Data upload time: Total uploaded Bytes (Table 4-2) multiplied by upload time of every byte (Table 4-3).
   Equals 9 x 260.4usec, or around 2.3msec.
3) Delay time: 100Hz equals 10msec, minus 4.5msec, minus 2.3msec, and still requires delay of 3.2msec.
   Delay time 1 can be set at 32, and delay time 2 is 0.
   Alternately, delay time 1 can be set at 12, and delay time 2 at 2.

➢ Description of automatic upload data content

1. The uploaded data is set to be (008CH) = 0, indicating the non-shading/shading state of every beam; length will depend on the number of beams. The state of every beam is expressed by 1 bit. 1 represents shading/0 represents non-shading. Take RTU as an example:

Data ID	1	2	3	4	5	…	N + 3	N + 4	N + 5
Item	Device address	Function code	Returned data and byte count N	Beams 1-8	Beams 9-16	…	-8xN beam	CRC low byte	CRC high byte
	0x01	0x03	0x04	Data 1	Data 2		Data N	0xFA	0x33

	Returned data and byte count							
Bit	7	6	5	4	3	2	1	0
	Returned data(008CH) = 0				Byte count = N			

	Data 1-N							
Bit	7	6	5	4	3	2	1	0
Corresponding beam	Low beam → High beam							
Full non-shading state	0	0	0	0	0	0	0	0
Full shading state	1	1	1	1	1	1	1	1

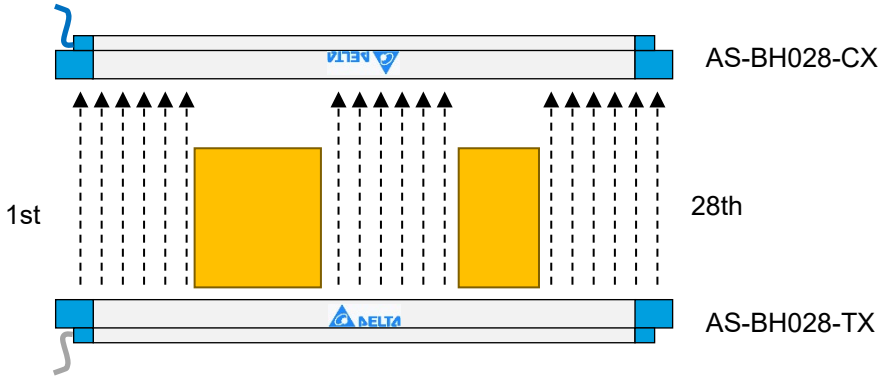
2. The uploaded data is set at (008CH) = 1, indicating that the content is composed of the following 4 pieces of data: First shading beam; final shading beam; total shading number; and total shading length (cm). Take RTU as an example:

Data ID	1	2	3	4	5	6	7	8	9
Item	Device address	Function code	Returned data and byte count	First shading beam	Final shading beam	Total shading number	Total shading length (cm)	CRC low byte	CRC high byte
	0x01	0x03	0x14	0x00	0x00	0x00	0x00	0xFA	0x33

	Returned data and byte count							
Bit	7	6	5	4	3	2	1	0
	Returned data(008CH) = 1				Byte count = 4			

Example: The product being used is AS-BH028-C with pitch 20mm, and two objects shaded in the middle. The returned data is as shown below:

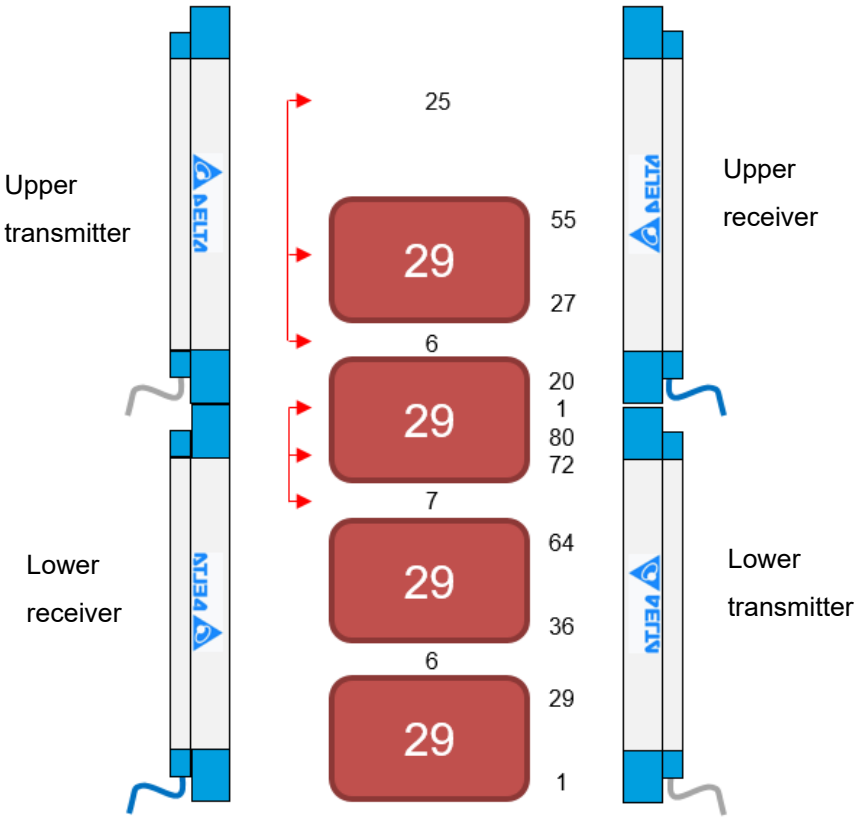
Channel	1 — 8	9 — 16	17 — 24	25 — 32
008CH = 0	Data 1	Data 2	Data 3	Data 4
Data(Hex)	03	F0	3C	00
Beam state(bit)	0 0 0 0 0 0 1 1	1 1 1 1 0 0 0 0	0 0 1 1 1 1 0 0	0 0 0 0 0 0 0 0



	Data 1	Data 2	Data 3	Data 4
008CH = 1	First shading beam = 7	Final shading beam = 22	Total shading beams =10	Total shading length (cm) = 20
Data (Hex)	07	16	0A	14

◎ **Example 9. Description of hole detection example**

Up and Low installation of two sets of AS-BH080-C, requiring staggered installation of transmitter and receiver.



Register address	Description	Lower grating	Upper grating
00A0H	First shading beam	1	1
00A1H	Final shading beam	80	55
00A2H	The number from the first shading beam to the final one.	80	55
00A3H	Total length from the first shading beam to the final one.	160	110
00A4H	The last hole	0	25
00A5H	The last shading	8	29
00A6H	The second last hole	7	6
00A7H	The second last shading	29	20
00A8H	The third last hole	6	0
00A9H	The third last shading	29	0
00AAH	The fourth last hole	0	0
00ABH	The fourth last shading	0	0
00ACH	The fifth last hole	0	0
00ADH	The fifth last shading	0	0
00AEH	The sixth last hole	0	0

Table 4-1 Scan time

Unit: ms

AS-BF series	Time	AS-BH series	Time	AS-BA series	Time
AS-BF016-C	3.2	AS-BH008-C	2.2	AS-BA004-C	1.8
AS-BF024-C	4.1	AS-BH012-C	2.7	AS-BA006-C	2.0
AS-BF032-C	5.0	AS-BH016-C	3.2	AS-BA008-C	2.2
AS-BF040-C	5.9	AS-BH020-C	3.6	AS-BA010-C	2.5
AS-BF048-C	6.8	AS-BH024-C	4.1	AS-BA012-C	2.7
AS-BF056-C	7.6	**AS-BH028-C**	**4.5**	AS-BA014-C	2.9
AS-BF064-C	8.7	AS-BH032-C	5.0	AS-BA016-C	3.2
AS-BF072-C	9.6	AS-BH036-C	5.5	AS-BA018-C	3.4
AS-BF080-C	10.5	AS-BH040-C	5.9	AS-BA020-C	3.6
AS-BF088-C	11.4	AS-BH044-C	6.4	AS-BA022-C	3.8
AS-BF096-C	12.2	AS-BH048-C	6.8	AS-BA024-C	4.1
AS-BF104-C	13.1	AS-BH052-C	7.3	AS-BA026-C	4.3
AS-BF112-C	13.9	AS-BH056-C	7.6	AS-BA028-C	4.5
AS-BF120-C	14.9	AS-BH060-C	8.2	AS-BA030-C	4.8
AS-BF128-C	15.9	AS-BH064-C	8.7	AS-BA032-C	5.0
		AS-BH068-C	9.1	AS-BA034-C	5.2
		AS-BH072-C	9.6	AS-BA036-C	5.5
		AS-BH076-C	10.1		
		AS-BH080-C	10.5		
		AS-BH084-C	10.9		
		AS-BH088-C	11.4		
		AS-BH092-C	11.8		
		AS-BH096-C	12.2		

Table 4-2 Total Byte count of uploaded data (model vs. communication format)

Data amount	RTU		ASCII		Data amount	RTU		ASCII		Data amount	RTU		ASCII	
008CH	0	1	0	1	008CH	0	1	0	1	008CH	0	1	0	1
					AS-BH008-C	6		13		AS-BA004-C	6		13	
AS-BF024-C	8		17		AS-BH012-C	7		15		AS-BA006-C	6		13	
AS-BF032-C	9		19		AS-BH016-C	7		15		AS-BA008-C	6		13	
AS-BF040-C	10		21		AS-BH020-C	8		17		AS-BA010-C	7		15	
AS-BF048-C	11		23		AS-BH024-C	8		17		AS-BA012-C	7		15	
AS-BF056-C	12		25		**AS-BH028-C**	**9**		19		AS-BA014-C	7		15	
AS-BF064-C	13		27		AS-BH032-C	9		19		AS-BA016-C	7		15	
AS-BF072-C	14	9	29	19	AS-BH036-C	10		21		AS-BA018-C	8		17	
AS-BF080-C	15		31		AS-BH040-C	10		21		AS-BA020-C	8	9	17	19
AS-BF088-C	16		33		AS-BH044-C	11		23		AS-BA022-C	8		17	
AS-BF096-C	17		35		AS-BH048-C	11		23		AS-BA024-C	8		17	
AS-BF104-C	18		37		AS-BH052-C	12	9	25	19	AS-BA026-C	9		19	
AS-BF112-C	19		39		AS-BH056-C	12		25		AS-BA028-C	9		19	
AS-BF120-C	20		41		AS-BH060-C	13		27		AS-BA030-C	9		19	
AS-BF128-C	21		43		AS-BH064-C	13		27		AS-BA032-C	9		19	
					AS-BH068-C	14		29		AS-BA034-C	10		21	
					AS-BH072-C	14		29		AS-BA036-C	10		21	
					AS-BH076-C	15		31						
					AS-BH080-C	15		31						
					AS-BH084-C	16		33						
					AS-BH088-C	16		33						
					AS-BH092-C	17		35						
					AS-BH096-C	17		35						

Table 4-3: Transmission time per byte (communication format vs. baud rate)

Unit: us

			Baudrate (0082H)				
			5	4	3	2	1
Communication format		(0083H)	57600	**38400**	19200	14400	9600
ASCII	8, N, 1	1	173.6	260.4	520.8	694.4	1041.7
	8, O, 1	2	191.0	286.5	572.9	763.9	1145.8
	8, E, 1	3	191.0	286.5	572.9	763.9	1145.8
	8, N, 2	4	191.0	286.5	572.9	763.9	1145.8
	8, O, 2	5	208.3	312.5	625.0	833.3	1250.0
	8, E, 2	6	208.3	312.5	625.0	833.3	1250.0
	7, O, 1	7	173.6	260.4	520.8	694.4	1041.7
	7, E, 1	8	173.6	260.4	520.8	694.4	1041.7
	7, O, 2	9	191.0	286.5	572.9	763.9	1145.8
	7, E, 2	10	191.0	286.5	572.9	763.9	1145.8
RTU	**8, N, 1**	11	173.6	**260.4**	520.8	694.4	1041.7
	8, O, 1	12	191.0	286.5	572.9	763.9	1145.8
	8, E, 1	13	191.0	286.5	572.9	763.9	1145.8
	8, N, 2	14	191.0	286.5	572.9	763.9	1145.8
	8, O, 2	15	208.3	312.5	625.0	833.3	1250.0
	8, E, 2	16	208.3	312.5	625.0	833.3	1250.0

Chapter 5

Troubleshooting and Others

◎ **Troubleshooting**

Indicator	Cause	Inspection method
Light is off	Poor power contact	✓ Check the power connection and whether or not the connector pin is bent
Irregular flashing of red/green light	Poor beam alignment	✓ Whether it be switched to green light with near-distance alignment ✓ Check the module and bracket installed flat ✓ Check whether mounting method is susceptible to vibration
	Electrical interference	✓ Check if the shield is connected to a clean ground. ✓ Has external high power machine shutdown been improved?
	Light source interference	✓ Is there any external glare affecting device? ✓ Installation of multiple light curtains should use transmitter/receiver staggered format
Blue/green/red lights are lit simultaneously	Over-current	✓ Check load at output end ✓ Check output mode setting
Only blue light is lit, and green light is not lit; red light is lit when shielded	Power saving setting	✓ Turn off power saving setting
Orange light	Wiring error, or input voltage exceeds specifications	✓ Check if wire connection is normal ✓ Check if input voltage is within range
	Abnormal internal signal/voltage	✓ Contact DELTA service center
Red/green lights are lit, and blue lit is not lit	Abnormal number of beams	✓ Beam number setting error, or abnormal number of internal beams Contact DELTA service center

◎ **Factory default setting (automatic upload)**

Model	Firmware Version	Default setting	
AS-BXXXX-CX	V1.03.10	Activate automatic upload after powering on	Data format: first shading beam, last shading beam, total shading beams, total shading length(cm); 4 data in total.
AS-BXXXX-CS			Data format: the beam state in shading/non-shading, data length=((beam numbers in model -1)/8+1)

◎ **Cancel automatic upload**

Take off the connection of Transmitter model, power on receiver model individually and get the stop mode. Write 0 into 008BH can cancel Activate upload function. It works when power on Transmitter and Receiver models simultaneously.

◎ **V1.03.10 software version update**

1. Rapid Light Beams Enable, 4modes for ALL ON/NOW/IN/OUT

Rapid Light beams enable	0098H	W	Enable/disable light beams in measurement rapidly	0: Enable all beams 1: Enable no-shading beams 2: Enable the interval beams between start beam(0099H) and end beam(009AH), include start beam and end beam. 3: Enable the out of interval beams between start beam(0099H) and end beam(009AH), not include start beam and end beam. Note: 1. make sure all beams on the enable status before setting 2. before execute 2,3, should execute start beam and end beam.
	0099H	R/W	Set start beam in rapid light beams enable	1 ~ 128
	009AH	R/W	Set endbeam in rapid light beams enable	1 ~ 128

2. non-shading/shading state can be inverter, active upload can be inverter

Invert light beam state	0094H	R/W	Invert light beam state (Limited to measurement operation mode) (Includes version v1031 and later)	0060H ~ 006FH light beam state Definition of light beam state 0 (default)： 0060H ~ 006FH bit = 1, mean no-shading bit = 0, mean shading 1：0060H ~ 006FH bit = 1, mean shading bit = 0, mean non-shading
Inverter light beam state in activate upload	0095H	R/W	Inverter each light beam state in activate upload, data state definition(008CH=0) (Limited to measurement operation mode) (Includes version v1031 and later)	The definition of light beam state when 008CH=0 0 (default)：bit = 1, mean shading bit = 0, mean non-shading 1：bit = 1, mean no-shading bit = 0, mean shading *Note：The definition is reverse with 0094H

3. When data change then upload active

activate upload mechanism	0096H	R/W	The activate upload in 2 mechanism (Limited to measurement operation mode and activate upload) (Includes version v1031 and later)	0 (default)：activate upload data continuously 1: activate upload when any one light beam status chage

4. Revert communication mode to default RTU 38400 8 N 1
   After setting non-active upload, put the cable of Communication Receiver model Sync+ and FB+ together, Sync- and FB- together. Power on the Receiver mode, can communicate by RTU 38400 8 N 1
5. Delete Modbus 7bits supporting.

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Chapter 6

Safety Precautions

⚠Warning

↗This product is only suited the applications without any safety requirements and without special safety requirement range, under IEC 61508-5

↗Do not connect AC power to any contact of the sensor, because AC power will cause severe damage to the sensor. Check all wiring before powering on the machine to ensure all wiring is properly done.

⚠Caution

- Keep high-current wires and motor connecting wires away from the sensor, to prevent noise from interfering with sensor operation.
- Do not disassemble the sensor by yourself.

◎ Before using this area sensor product, machine to be used must be evaluated. Safety light curtain must be used for the following machinery equipment specified by the competent authority.

1. Power punching/shearing machine.
2. Hand-feed planer.
3. Circular saw for woodworking.
4. Power stacker.
5. Grinder.
6. Grinding wheel.
7. Explosion-proof electrical equipment.
8. Photoelectric safety device for power punching/shearing machine.
9. Blade contact prevention device for hand-feed planer.
10. Repulsion prevention device and saw teeth contact prevention device for circular saw for woodworking.
11. Other equipment specified and announced by central competent authorities.

◎ For those not listed among aforementioned machinery equipment specified by the competent authorities, risk assessment must be implemented according to rule GB/T 20438 (IEC 61508).

This product can only be used by those without any safety requirements and without any special safety requirements.

Chapter 7

Warranty

All DELTA products have been checked in detail before shipment. If there is any malfunction, contact one of our branches or distributors and describe the malfunction situation in detail.

◎ **Warranty period**

➢ The warranty period is 18 months starting from product delivery to the buyer.

◎ **Warranty coverage**

➢ If a malfunction takes place within the aforementioned warranty period and can be attributed to DELTA itself, our company will offer a new product for free replacement. However, the following conditions are not covered by this warranty:

1) Any malfunction caused by improper conditions, environment, operation, or failure to follow the operation methods introduced in the operation manual, user manual, and all product instructions.
2) Any malfunction not caused by product defect, such as equipment and software used by the customer.
3) Malfunction caused by renovation or repair of the product not conducted by DELTA specialist.
4) Damage caused by maintenance or replacement of consumable parts not in accordance with the correct methods listed in the operation manual and user manual.
5) Malfunction due to any natural disaster, such as fire, earthquake, flood, or any other external factor (such as abnormal voltage, for which DELTA shall not bear the responsibility).

➢ The product warranty coverage is limited only to the aforementioned content. It is not responsible for any other secondary loss of property (such as equipment damage or business opportunity) or any other damage caused by product malfunction.