
Hybrid-PIO Specification (RF, IR)

CTS-HCOM-AA01 (EQ-PIO)
CTS-HCOM-AB01 (OHT-PIO)

* This device may have the possibility of radio interference during operation.

2016. 01. 08.(Ver1.2)



FCC STATEMENT

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

FCC ID: RMNCTS-HCOM

WARNING! Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

RF EXPOSURE WARNING! This equipment must be installed and operated in accordance with provided instructions and the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. End-users and installers must be provided with antenna installation instructions and transmitter operating conditions for satisfying RF exposure compliance.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

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1. Product Overview

The CTS-HCOM Series is an integrated device that uses both RF communication in 2.4GHz and 5GHz and IR (Infrared light, optical) communication. It is capable of choosing the stable communication media depending on the surrounding conditions.

This product is a communication device to transmit and receive 8-bit data contactlessly according to the SEMI-E84 protocol regulation.

It is possible to set many comfortable additional functions by the serial port or the wireless communication. Also it is possible to change the communication media from IR to RF and vice versa, depending on the noise level of surrounding.

Moreover, it provides various functions that find causes and solutions promptly when there are abnormalities in transmitted/received data during the communication.

This device is mainly for the exchange of the control signals between the vehicle (Master or Active devices such as AGV/OHT) and the equipment (Slave or Passive devices).

2. Product Feature

- The integration of RF (2.4GHz, 5GHz) and IR (Infrared light, optical) communication in one device.
- The contactless exchange of the 8-bit input/output signals.
- The ability to choose the optimal communication media depending on the surrounding condition.
- Wireless communication in 2.5GHz and 5GHz: Additional functions such as data transmission/reception and F/W downloading.
- The maximum operational distance is 5m. (Only when there is no obstacles to electromagnetic wave in the middle.)
- Designation of Wireless communication ID (address): 6 digits (ASCII code)
- Storage of various data using a large-capacity SRAM: Up to about 130 operations including data and errors, standard time, signal intensity, etc. (The SRAM is cleared when the power is off.)
- Additional functions using a serial port: Changing the settings, receiving real-time communication data, F/W downloading, etc.

3. Product Code Configuration

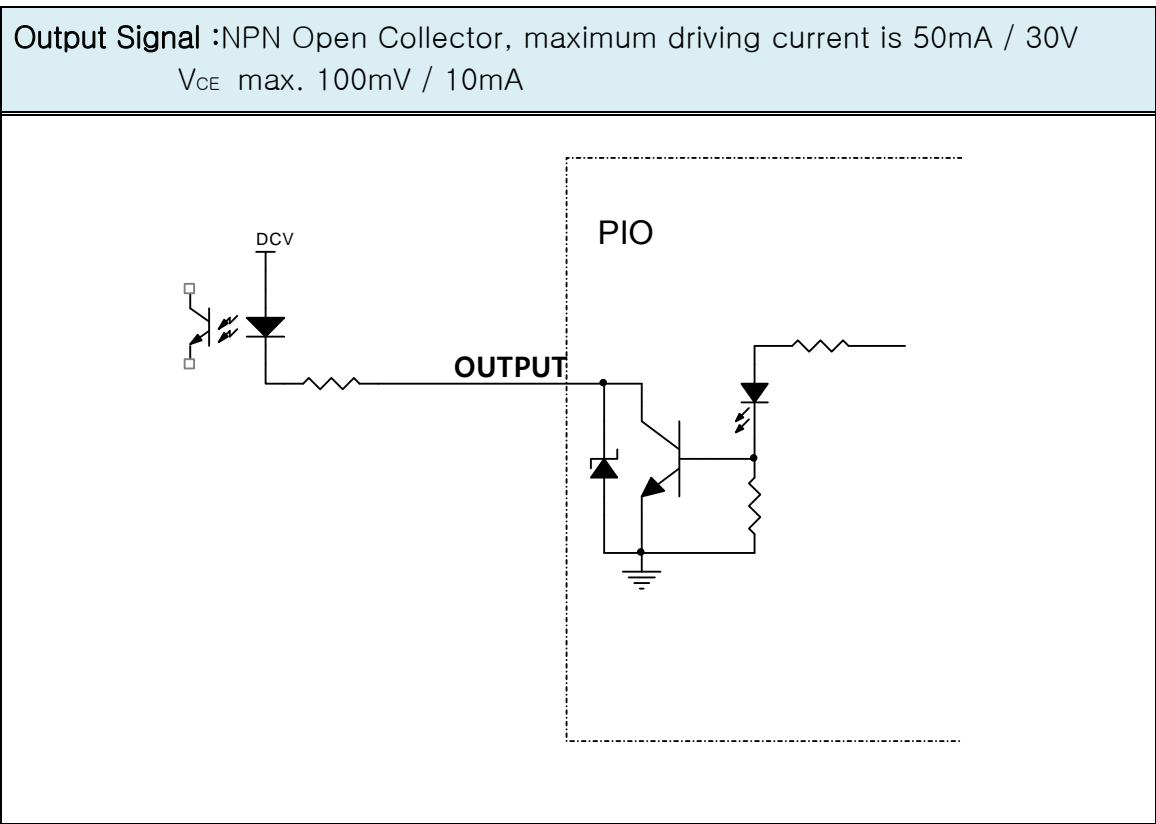
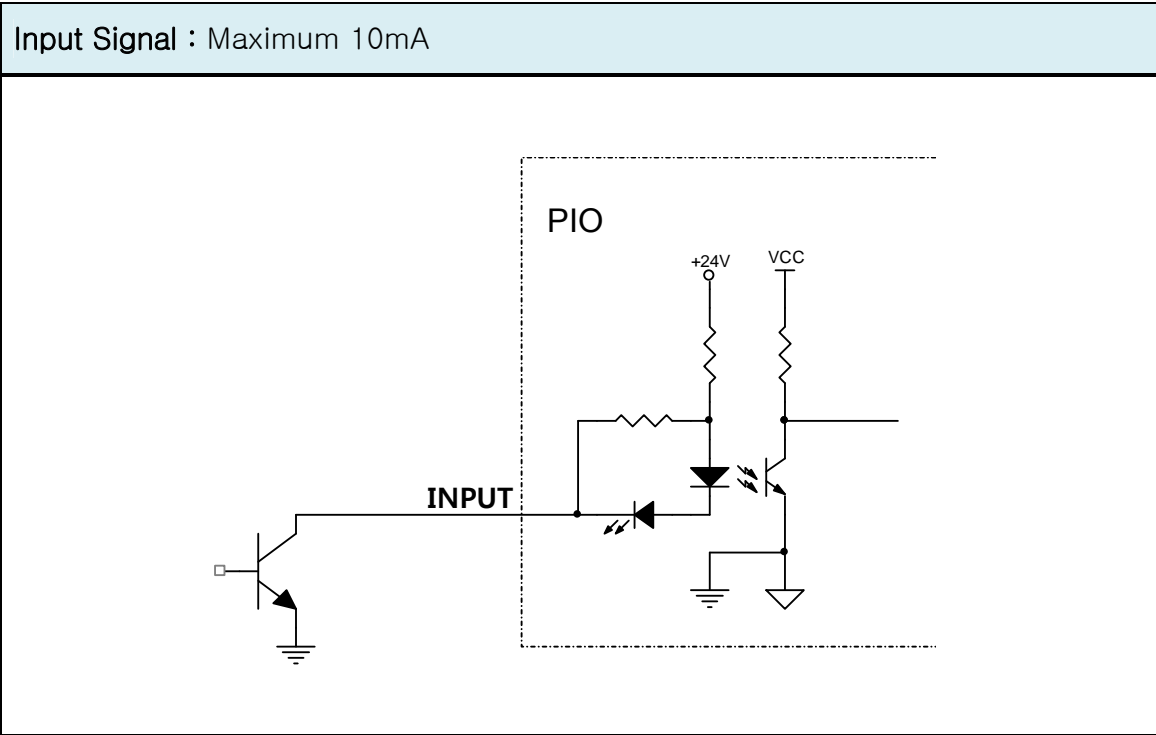
Usage	Product Code Configuration																																																						
Equipment (EQ)	<p>CTS-HCOM-AA<u>uw</u>¹⁾-<u>xx</u>²⁾-<u>y</u>³⁾-<u>zzz</u>⁴⁾-<u>rrr</u>⁵⁾</p> <table border="1" data-bbox="862 422 1216 527"> <thead> <tr> <th>rrr</th> <th>Serial Cable Length(mm)</th> </tr> </thead> <tbody> <tr><td>000</td><td>No Cable</td></tr> <tr><td>30</td><td>300</td></tr> <tr><td>150</td><td>1500</td></tr> </tbody> </table> <table border="1" data-bbox="862 533 1216 638"> <thead> <tr> <th>zzz</th> <th>I/O Cable Length</th> </tr> </thead> <tbody> <tr><td>150</td><td>1500</td></tr> <tr><td>250</td><td>2500</td></tr> <tr><td>300</td><td>3000</td></tr> </tbody> </table> <table border="1" data-bbox="862 644 1216 728"> <thead> <tr> <th>y</th> <th>Optical(Tx, Rx) Axis Direction</th> </tr> </thead> <tbody> <tr><td>T</td><td>Top View</td></tr> <tr><td>F</td><td>Front View</td></tr> </tbody> </table> <table border="1" data-bbox="862 735 1216 840"> <thead> <tr> <th>xx</th> <th>IR Communication Distance(mm)</th> </tr> </thead> <tbody> <tr><td>03</td><td>300</td></tr> <tr><td>05</td><td>500 (Standard)</td></tr> <tr><td>10</td><td>1000</td></tr> </tbody> </table> <table border="1" data-bbox="862 846 1370 930"> <thead> <tr> <th>u</th> <th>Serial Connector</th> <th>w</th> <th>I/O Connector</th> </tr> </thead> <tbody> <tr><td>0</td><td>No Connector</td><td>0</td><td>No Connector</td></tr> <tr><td>1</td><td>9P DSUB, Female Type</td><td>1</td><td>25P DSUB, Male Type</td></tr> </tbody> </table>	rrr	Serial Cable Length(mm)	000	No Cable	30	300	150	1500	zzz	I/O Cable Length	150	1500	250	2500	300	3000	y	Optical(Tx, Rx) Axis Direction	T	Top View	F	Front View	xx	IR Communication Distance(mm)	03	300	05	500 (Standard)	10	1000	u	Serial Connector	w	I/O Connector	0	No Connector	0	No Connector	1	9P DSUB, Female Type	1	25P DSUB, Male Type												
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OHT (VHL)	<p>CTS-HCOM-AB<u>uw</u>¹⁾-<u>xx</u>²⁾-<u>y</u>³⁾-<u>zzz</u>⁴⁾-<u>rrr</u>⁵⁾</p> <table border="1" data-bbox="850 1058 1255 1163"> <thead> <tr> <th>rrr</th> <th>Serial Cable Length(mm)</th> </tr> </thead> <tbody> <tr><td>000</td><td>No Cable</td></tr> <tr><td>050</td><td>500</td></tr> <tr><td>150</td><td>1200</td></tr> </tbody> </table> <table border="1" data-bbox="850 1169 1255 1274"> <thead> <tr> <th>zzz</th> <th>I/O Cable Length(mm)</th> </tr> </thead> <tbody> <tr><td>080</td><td>800</td></tr> <tr><td>120</td><td>1200</td></tr> <tr><td>150</td><td>1500</td></tr> </tbody> </table> <table border="1" data-bbox="850 1281 1255 1365"> <thead> <tr> <th>y</th> <th>Optical(Tx, Rx) Axis Direction</th> </tr> </thead> <tbody> <tr><td>T</td><td>Top View</td></tr> <tr><td>F</td><td>Front View</td></tr> </tbody> </table> <table border="1" data-bbox="850 1371 1255 1476"> <thead> <tr> <th>xx</th> <th>IR Communication Distance(mm)</th> </tr> </thead> <tbody> <tr><td>03</td><td>300</td></tr> <tr><td>05</td><td>500 (Standard)</td></tr> <tr><td>10</td><td>1000</td></tr> </tbody> </table> <table border="1" data-bbox="850 1482 1365 1682"> <thead> <tr> <th>u</th> <th>Serial Connector</th> <th>w</th> <th>I/O Connector</th> </tr> </thead> <tbody> <tr><td>0</td><td>No Connector</td><td>0</td><td>No Connector</td></tr> <tr><td>1</td><td>9P DSUB, Female Type</td><td>1</td><td>Hirose (HIF6-26D-1.27R)</td></tr> <tr><td>2</td><td>Molex 4P(S1103-0410)</td><td>2</td><td>JST</td></tr> <tr><td>3</td><td>Molex 3P(S1103-0310)</td><td>3</td><td>Molex</td></tr> <tr><td>4</td><td>JST (SMR-09V-N)</td><td>4</td><td>AMP(172170)</td></tr> </tbody> </table>	rrr	Serial Cable Length(mm)	000	No Cable	050	500	150	1200	zzz	I/O Cable Length(mm)	080	800	120	1200	150	1500	y	Optical(Tx, Rx) Axis Direction	T	Top View	F	Front View	xx	IR Communication Distance(mm)	03	300	05	500 (Standard)	10	1000	u	Serial Connector	w	I/O Connector	0	No Connector	0	No Connector	1	9P DSUB, Female Type	1	Hirose (HIF6-26D-1.27R)	2	Molex 4P(S1103-0410)	2	JST	3	Molex 3P(S1103-0310)	3	Molex	4	JST (SMR-09V-N)	4	AMP(172170)
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➤ Example of Product Code

Usage	Product Code	Optical Axis Direction	Serial Cable		Data Cable	
			Connector Type	Length (mm)	Connector Type	Length (mm)
Equipment (EQ)	CTS-HCOM-AA10- 05-T-250-050	Top	DSUB9P	500	None	2500
	CTS-HCOM-AA11- 05-F-250-050	Front	DSUB9P	500	DSUB 25P (#4-40UNC)	2500
	CTS-HCOM-AA11- 05-T-150-050	Top	DSUB9P	500	DSUB 25P (#4-40UNC)	1500
OHT (VHL)	CTS-HCOM-AB10- 05-T-250-050	Top	DSUB9P	500	None	2500
	CTS-HCOM-AB21- 05-F-080-050	Front	Molex 4P (53375-0410)	500	Hirose (HIF6-26D-1.27R)	800
	CTS-HCOM-AB44- 05-T-120-120	Top	JST	1200	AMP	1200

4. Input/Output Circuit



5. Product Specification

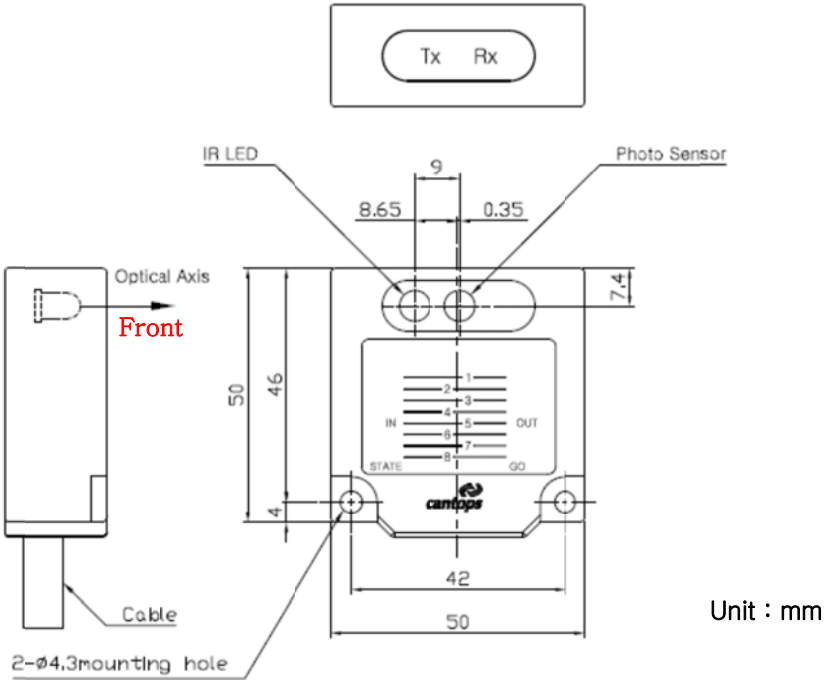
Division	Specifics	Content	
Display	GO	ON when the RF or IR communication between a master (OHT, AGV) PIO and a slave (EQ) PIO begins.	
	STATE	FLASHS as watchdog signals showing operation status.	
	IN	Displays the operation status of 8-bit input port	
	OUT	Displays the operation status of 8-bit input port	
External Equipment Connection	Connector (Optional)	AA01 Model(Slave) : 25-pin DSUB, No Connector.	
		AB01 Model(Master) : Hirose 26-pin, JST, Molex, No Connector	
	Cable	26AWG x 22C + 24AWG x 3C, Foil Shield	
	Input	8 Bit, Photo-Coupler, 24V On : 10mA, Off : 0.1mA or less	
Output	8Bit, Open Collector, NPN, 30V Maximum operating current: 50mA		
IR Communication	Major Function	8-bit I/O Communication	
	Communication Media	870nm, Infrared	
	Transmission Distance	0.5m (0°), 0.25m (+15°, -15°)	
	Directional Angle	30° (±15°)	
	Transmission Method	1:1 Transmission, Half Duplex	
	Optical Axis Direction	T Type : Pointing TOP F Type : Pointing FRONT	
	Optical Modulation Type	Pulse Modulation	
	Transmission Error Check	Parity	
	Transmission Period	About 24ms when linked, about 85ms when disconnected.	
RF Communication	Major Function	8-bit I/O communication, downloading F/W and communication data, changing the settings, etc.	
	Communication Media	2.4GHz, 5GHz ISM Band, bandwidth 1MHz	
	Frequency Band	2.4GHz	2.403~2.480GHz, 78 channels* ¹⁾
		5GHz	5.728~5.825GHz, 95 channels* ¹⁾
	Safety Function	Serial number confirmation function, CRC-16	
	Transmission Method	1:1 transmission, Half Duplex	
ID Setting	PIO serial number to avoid an interference with neighboring PIOs, which is composed of 6 digits (ASCII)		

	Channel Setting	Transmission frequency to avoid an interference with neighboring PIOs, which is composed of 3 digits (ASCII).
	ID Setting Method	Serial communication command (Set as default when released)
	Operational Distance	5m@0dBm (Only when there is no obstacles to electromagnetic wave in the middle.)
Environment	Storage Environment	Temperature: -25 ~ 70°C Humidity: 5 ~ 95%RH (There shall be no dew condensation.)
	Operating Environment	Ambient brightness(When using IR) : 4000lx or less (Incandescent lamp, fluorescent lamp) *) Install it such that no external light may enter the receiver. Temperature : 0 ~ 40°C Humidity : 35~85%RH (There shall be no dew condensation.) Vibration : 4~150 Hz, 4.9m/s ² or less
Power	Input Voltage	DC 24V±10%
	Supply Current	130mA or less @ 24V
Case Material		Polycarbonate
Dimension (W×H×D)		50×53×20mm (Excluding the cable overhang)
Weight		About 300g (CTS-HCOM-AA01-05-T-150)

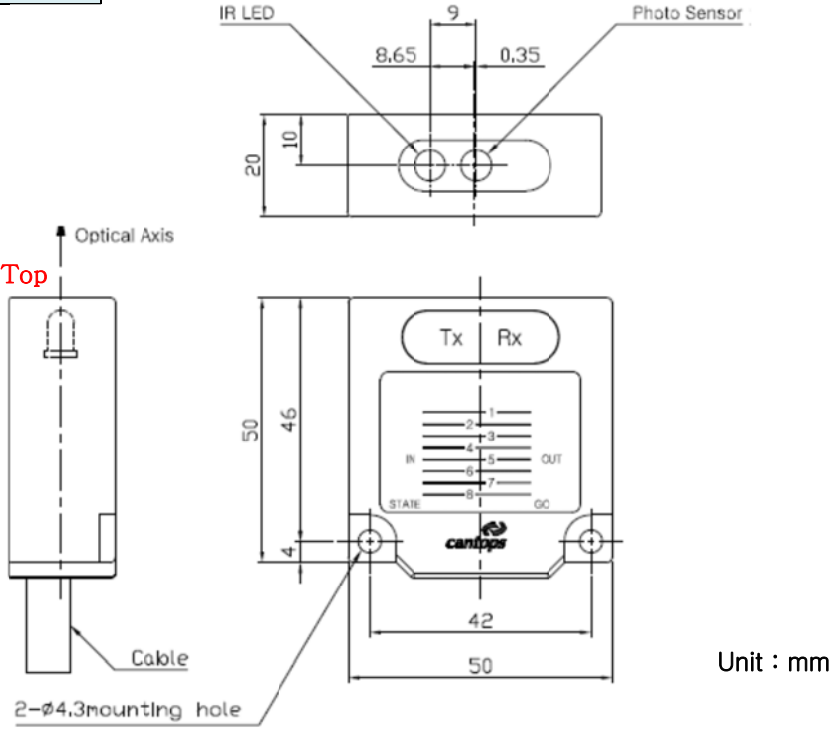
*1) Can be used in an environment without frequency interference with other wireless devices such as wireless LAN, Bluetooth, etc.

6. Device Specification

F Type : Pointing FRONT



T Type : Pointing TOP

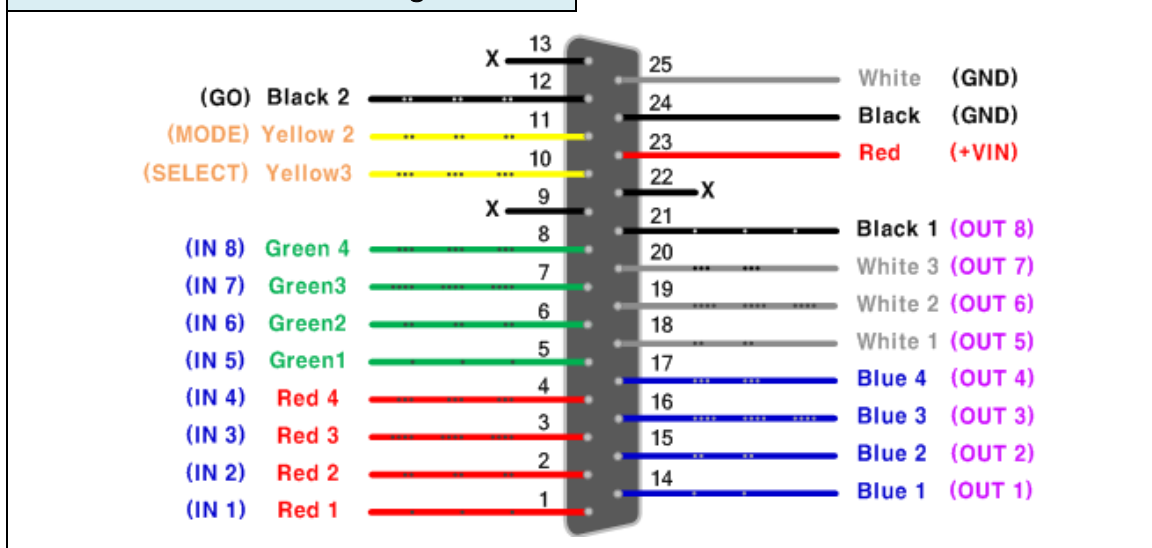


7. Connector Specification

1) For Equipment (CTS-HCOM-AA01) : Slave, DSUB 25-pin, Pin Type, Maximum cable length is 10m.

Function	Pin No.	Color	Function	Pin No.	Color
IN 1	1	Red 1	OUT 1	14	Blue 1
IN 2	2	Red 2	OUT 2	15	Blue 2
IN 3	3	Red 3	OUT 3	16	Blue 3
IN 4	4	Red 4	OUT 4	17	Blue 4
IN 5	5	Green 1	OUT 5	18	White 1
IN 6	6	Green 2	OUT 6	19	White 2
IN 7	7	Green 3	OUT 7	20	White 3
IN 8	8	Green 4	OUT 8	21	Black 1
Not Connected	9	X	Not Connected	22	X
SELECT	10	Yellow 3	+VIN	23	Red
MODE ¹⁾	11 (GND)	Yellow 2	GND	24	Black
Go (Ready)	12	Black 2	GND	25	White
Not Connected	13	X	x	x	
Serial Port (DSUB 9-pin, Female)			TxD	2	Black
			RxD	3	Brown
			GND	5	Red

Cable Connection Diagram



1) Mode pin(11) is connected to GND inside so no additional connection is needed.

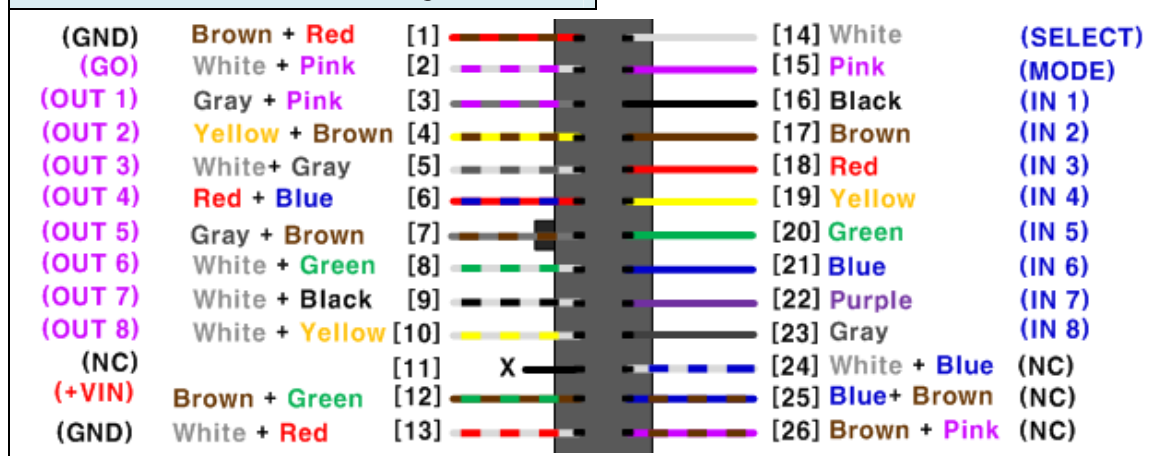


2) For OHT (CTS-HCOM-AB01), Master

➤ Hirose 26-pin, 1.27mm IDE Connector

Function	Pin No.	Color	Function	Pin No.	Color
IN 1	16	Black	OUT 1	3	Gray + Pink
IN 2	17	Brown	OUT 2	4	Yellow + Brown
IN 3	18	Red	OUT 3	5	White + Gray
IN 4	19	Yellow	OUT 4	6	Red + Blue
IN 5	20	Green	OUT 5	7	Gray + Brown
IN 6	21	Blue	OUT 6	8	White + Green
IN 7	22	Purple	OUT 7	9	White + Black
IN 8	23	Gray	OUT 8	10	White + Yellow
SELECT	14	White	Ready (Go)	2	White + Pink
MODE	15	Pink	+VIN	12	Brown + Green
X	11, 24	X	GND	1	Brown + Red
X	25, 26	X	GND	13	White + Red
Serial Port	DSUB 9-pin, female		TxD	2	Black
			RxD	3	Brown
			GND	5	Red
	Molex 4P (5557-04R)		TxD	1	Black
			RxD	2	Brown
			GND	3	Red
	Molex 3P (51103-0300)		TxD	1	Black
			RxD	2	Brown
			GND	3	Red

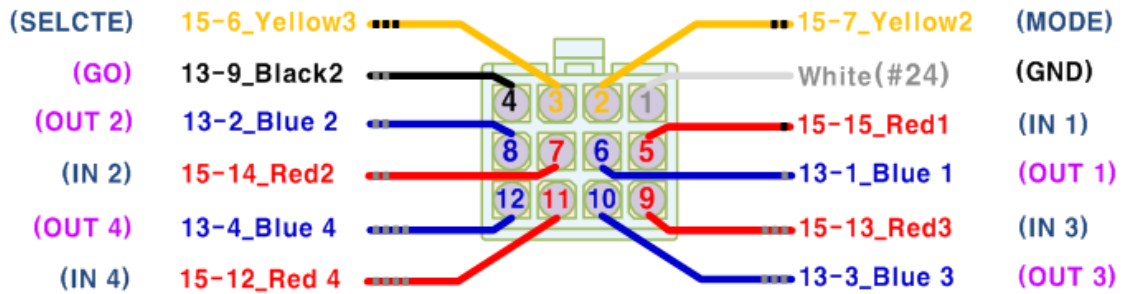
Cable Connection Diagram



➤ AMP 12-pin, 172170

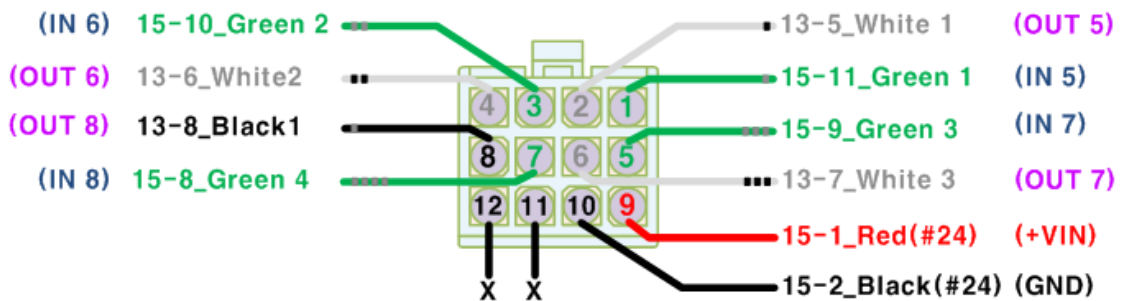
A Connector					
Function	Pin No.	Color	Function	Pin No.	Color
IN 1	5	Red 1	OUT 1	6	Blue 1
IN 2	7	Red 2	OUT 2	8	Blue 2
IN 3	9	Red 3	OUT 3	10	Blue 3
IN 4	11	Red 4	OUT 4	12	Blue 4
SELECT	3	Yellow 3	Ready (Go)	4	Black 2
MODE	2	Yellow 2	GND	1	White

Cable Connection Diagram



B Connector					
Function	Pin No.	Color	Function	Pin No.	Color
IN 5	1	Green 1	OUT 5	2	White 1
IN 6	3	Green 2	OUT 6	4	White 2
IN 7	5	Green 3	OUT 7	6	White 3
IN 8	7	Green 4	OUT 8	8	Black 1
X	11	X	+VIN	9	Red
X	12	X	GND	10	Black

Cable Connection Diagram



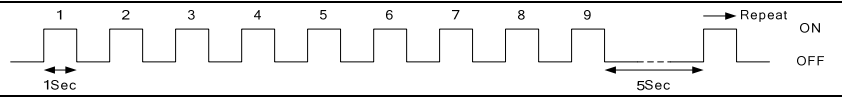
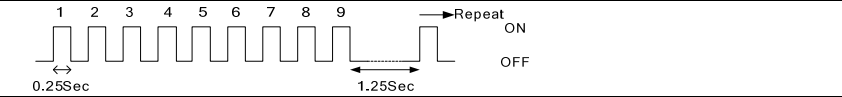
8. LED Display

LED Name		Display Content
1~8	IN	Indicates the operation status of input circuit inside of PIO, which is ON when the input is LOW.
	OUT	Indicates the output status inside of PIO, which is ON when TR is ON.
GO		Turns ON when there is data transmission/reception between a master and a slave PIOs. The maximum time that GO LED and output remain OFF after the wireless communication is disconnected is 775ms. This can be adjusted by user through <R> command.
STATE ¹⁾		Used as watchdog signal to check whether there is an abnormality in the product. <ul style="list-style-type: none"> ▪ RF mode: Blinks with periods of Master mode (0.25 sec), Slave mode (1 sec), standby mode (0.1 sec). ▪ IR mode : Similar to that of RF mode, but has different blinking periods. ※ Operation modes are distinguishable. See the diagram below.
*) LED Diagram		<p>The diagram shows a PIO module with 8 pins. Pin 1 is IN (PIO Input Signal), Pin 2 is OUT (PIO Output Signal), Pin 3 is STATE (PIO Operating Status), Pin 4 is GO (PIO Communication Signal), and Pin 5 is a Fixed Hole 2EA. Pins 6, 7, and 8 are also shown but not labeled with functions.</p>

1) STATE LED Operation Timing

Mode		Period Graph
IR	Slave	<p>Period Graph for IR Slave mode: The graph shows a sequence of 5 pulses (labeled 1-5) with a 1Sec ON period and a 5Sec OFF period. The sequence repeats.</p>
	Master	<p>Period Graph for IR Master mode: The graph shows a sequence of 5 pulses (labeled 1-5) with a 0.25Sec ON period and a 1.25Sec OFF period. The sequence repeats.</p>
2.4G	Slave	<p>Period Graph for 2.4G Slave mode: The graph shows a sequence of 7 pulses (labeled 1-7) with a 1Sec ON period and a 5Sec OFF period. The sequence repeats.</p>
	Master	<p>Period Graph for 2.4G Master mode: The graph shows a sequence of 7 pulses (labeled 1-7) with a 0.25Sec ON period and a 1.25Sec OFF period. The sequence repeats.</p>



5G	Slave	
	Master	

9. Major Pin Function

Signal Name	Usage
Mode (Input)	Input to select a mode of PIO <ul style="list-style-type: none"> ▪ GND : Slave Mode (EQ, Connected to GND inside of PIO so no additional connection is necessary.) ▪ OPEN : Master Mode (OHT)
Select (Input)	Input to operate the PIO <ul style="list-style-type: none"> ▪ GND : Stops a wireless communication of PIOs. ▪ OPEN : Operates a wireless communication of PIOs.
GO (Output)	Turns ON if there is a normal communication between a master and a slave PIOs.

➤ Modes

Master Mode	Transmits data from input port wirelessly if PIO is operated by OPENING the Select signal. This mode is used by OHT or AGV.
Slave Mode	Even though PIO is operated by OPENING the Select signal, does not transmit but only receives optical signals. Transmits data from input port wirelessly when receives optical signals from the master. This mode is used by equipment.

10. Communication Medium Selecting Method

This product has two contactless communication media: the optical (infrared light) and the wireless communication (2.4GHz, 5GHz RF). There can be a communication interference in the semiconductor factories because of surrounding equipment or sensors. If this happens, this product provides a stable communication by selecting the other medium without an interference.

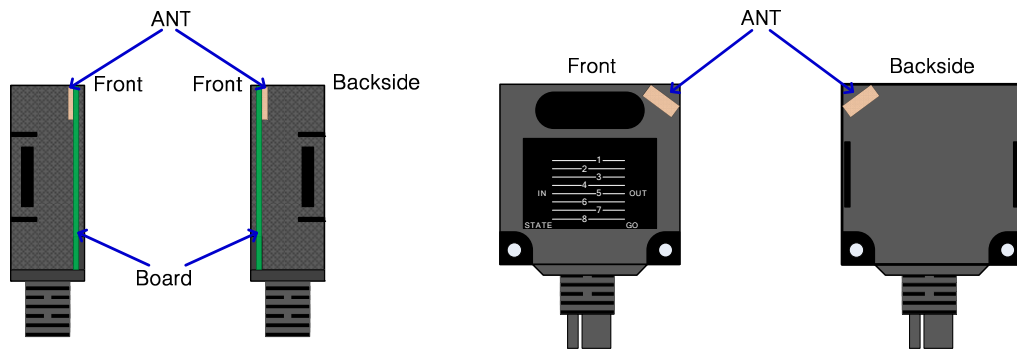
A communication medium can be selected by the serial communication command (M command). In case of wireless communication (RF), the distinct channel ID and other variables must be set.

11. RF Function

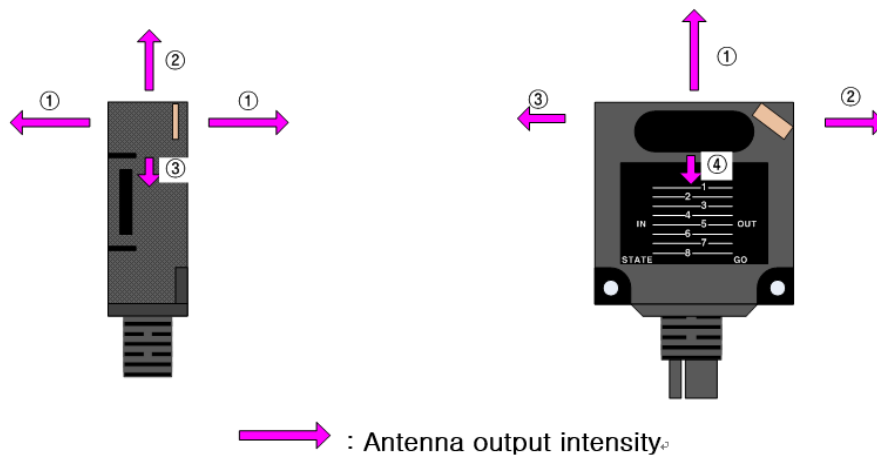
RF Communication Characteristics

- RF communication using ISM (Industrial Scientific and Medical) Band of 2.4GHz and 5GHz that can be used without an authorization.
- High-speed data communication – 1Mbps per channel.
- GFSK modulation, 1MHz bandwidth.
- A great expandability provided by the function selecting the serial numbers of 6 bytes and frequencies of 3 bytes.
- Channel occupation time is about 1ms (Communication period: 25ms). Minimizes the interference between other wireless devices.
- Setting the channel without conflict is necessary because of the frequency interference with 2.4GHz and 5GHz wireless LEN and other wireless devices.
- Maximum RF output power: 0dBm
- Sensitivity of the receiver : -90dBm

Antenna Configuration

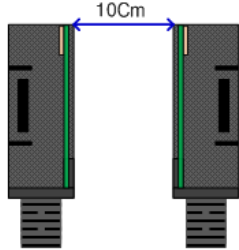
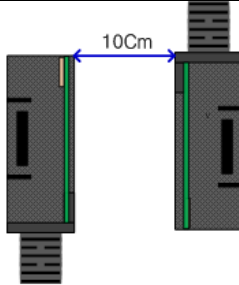
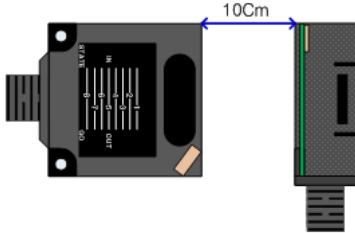
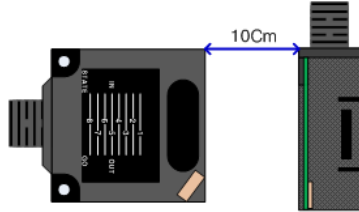
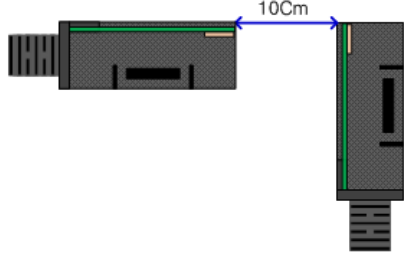
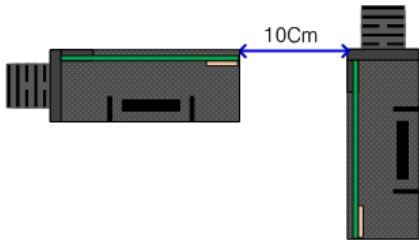
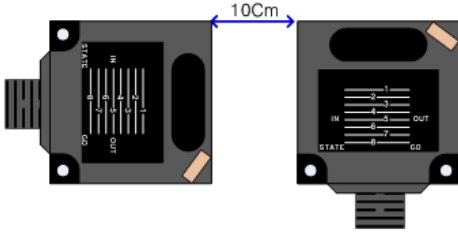


Emission Pattern

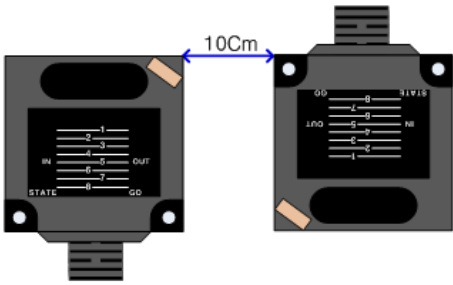
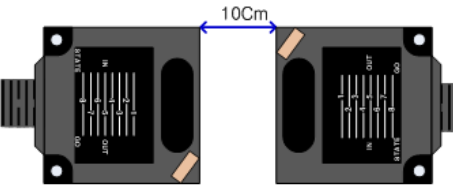
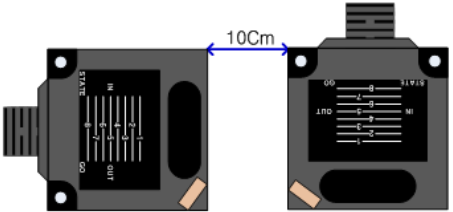
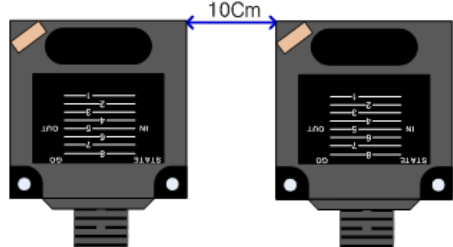
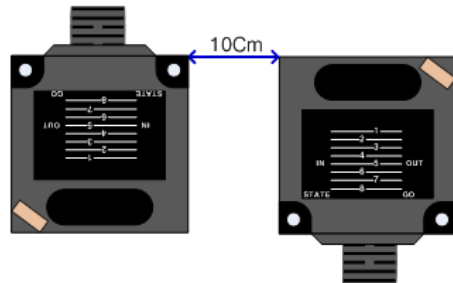


How to install

- These are the examples of the damping ratios depending on directions of the master and slave PIOs in 10cm. See the values as the relative values with error of measurement. Like the diagrams below, the reception sensitivity can be vary depending on the directions, even in such a short distance. This can influence the performance of RF communication. Therefore, check the optimal conditions for RF communication before the installation of PIOs.

Damping Ratio	Installation Direction	
-25dB		
		
-30dB		
		-



Damping Ratio	Installation Direction	
-33dB	 <p>Diagram showing two units facing each other. A blue double-headed arrow between them is labeled "10Cm". The left unit has "STATE" and "GO" at the bottom and "IN" and "OUT" on the sides. The right unit has "STATE" and "GO" at the top and "IN" and "OUT" on the sides.</p>	-
-35dB	 <p>Diagram showing two units facing each other. A blue double-headed arrow between them is labeled "10Cm". The left unit has "STATE" and "GO" on the left side and "IN" and "OUT" on the right side. The right unit has "STATE" and "GO" on the right side and "IN" and "OUT" on the left side.</p>	 <p>Diagram showing two units facing each other. A blue double-headed arrow between them is labeled "10Cm". The left unit has "STATE" and "GO" on the left side and "IN" and "OUT" on the right side. The right unit has "STATE" and "GO" on the right side and "IN" and "OUT" on the left side.</p>
-37dB	 <p>Diagram showing two units facing each other. A blue double-headed arrow between them is labeled "10Cm". The left unit has "STATE" and "GO" on the left side and "IN" and "OUT" on the right side. The right unit has "STATE" and "GO" on the right side and "IN" and "OUT" on the left side.</p>	-
-37dB	 <p>Diagram showing two units facing each other. A blue double-headed arrow between them is labeled "10Cm". The left unit has "STATE" and "GO" on the left side and "IN" and "OUT" on the right side. The right unit has "STATE" and "GO" on the right side and "IN" and "OUT" on the left side.</p>	-



Precautions for Installation

- 1) Metals, mirrors and other objects existing in a space at the straight-line distance between two sensors reduce the communication performance. Remove the obstacles on the path if possible.
- 2) You can use it stably without communication errors when there is no interference with other wireless devices in an open space.
- 3) There may be no metals or other obstacles within a 60mm radius around this antenna.
- 4) There may happen frequency interference due to other RF devices around. Use this in an environment without frequency interference for stable operation.
- 5) Especially, when using this together with a device using a 5GHz band, allocate a channel by avoiding overlaps.
- 6) Maintain a 20cm or more interval between PIOs for equipment.

Wireless Environment Setting

The wireless communication (RF) function of CTS-HCOM Series can be simultaneously connected to many devices due to its characteristics. In order to communicate with one device (equipment), the ID and CH(channel) of the communication counterparty (For equipment, Slave PIO) shall be set before starting communication with the vehicle (OHT, Master PIO). The ID and CH setting is possible using serial communication commands.

PIO	Setting Method
Slave	<ul style="list-style-type: none">▪ Connect to PIO serial port => Set by a communication commands (ID and CH, transmission power etc.)▪ The set data is stored in the memory, so it doesn't need to be set again even though power is turned OFF.
Master	<ul style="list-style-type: none">▪ Connect to PIO serial port => Set by a communication commands (No. of VHL/Communication Medium/ID/CH/PORT)▪ In case of Select OFF(Communication Permitted) → ON (Communication Prohibited), the IC and CH are changed to defaults. The No. of VHL, communication medium, ID, CH, PORT must be reset before Select OFF.※ If it is not ready for data transmission, it does not transmit data even though it becomes Select OFF.

※ For more information, see the Serial Communication Specification.

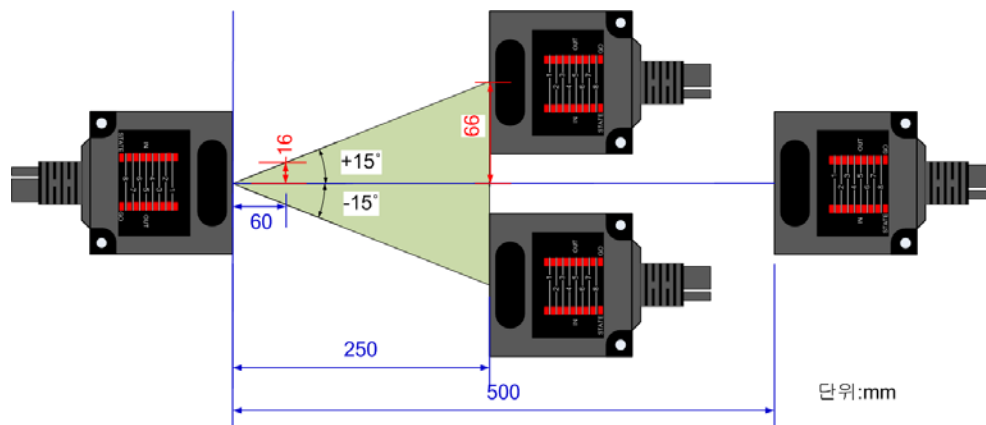
12. IR Function

IR Communication Characteristics

- Wavelength : 870nm (Infrared light, Optical)
- Ambient brightness : 4000lx or less of incandescent light and fluorescent light, the place without direct light
- Transmission/reception method : Half Duplex
- Modulation : Pulse Modulation
- Operational distance and angle : 0.5m at 0°, 0.25m at $\pm 15^\circ$
- Adjustment of communication distance : Serial/RF communication command
- Adjustment of reception level : Serial/RF communication command
(To eliminate surrounding noises if any.)
- Input signals and GO output filtering : Is possible to set the time by the serial command.

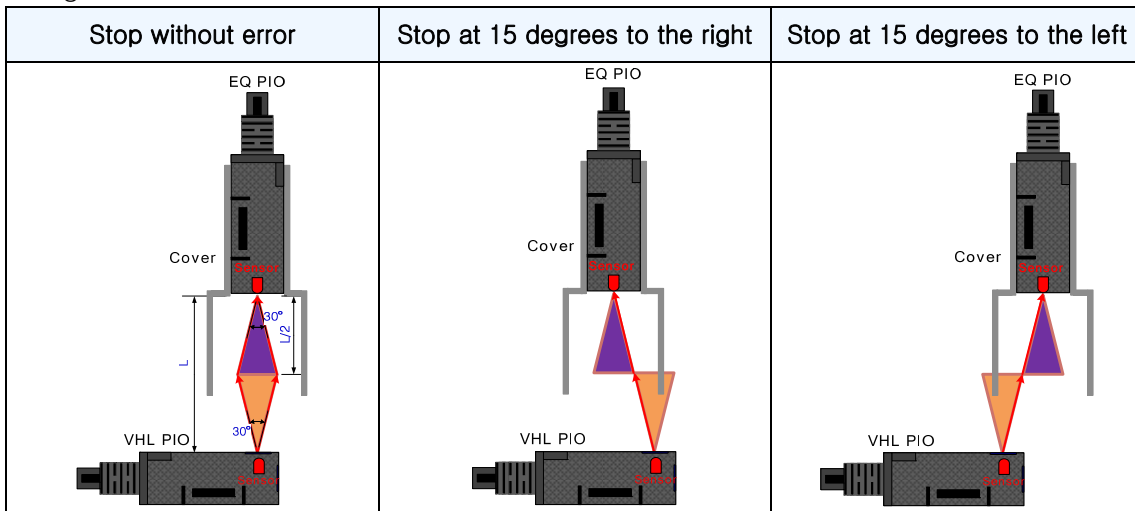
IR Radiation Characteristics

As shown in the figure below, the communicable angle is 30°, and communication is possible from a 0.25m away distance at $\pm 15^\circ$ and from a 0.5m away distance at 0°. If light, sunshine, IR remote controller, optical sensor, etc. applies light directly to the transmission/reception window, loss of communication may happen. In this case, block the external light and then use it.

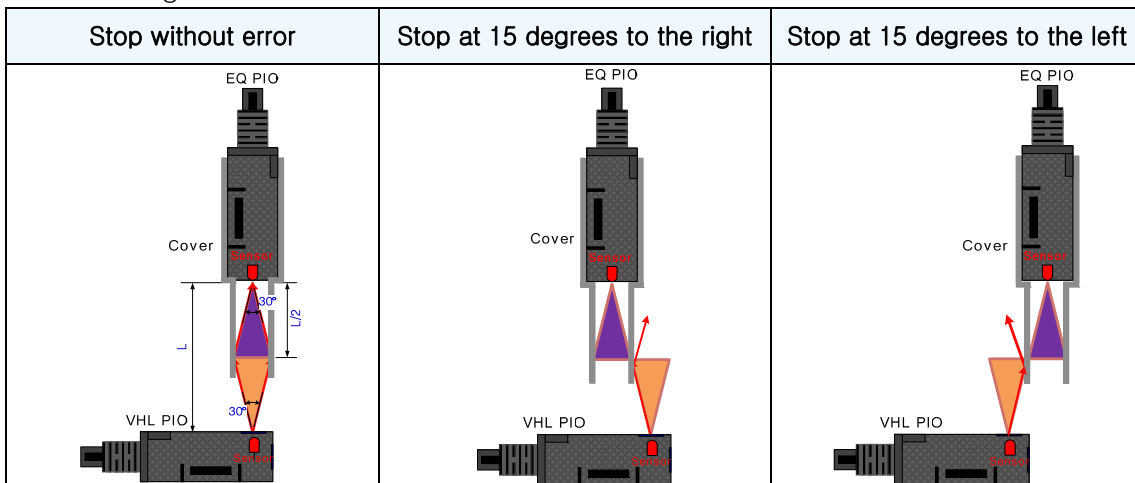


Considerations for installation

This product uses both IR and RF communication. In case of IR (optical and infrared light) communication, the performance declines if light is blocked by fixed brackets or parts since it uses invisible infrared light. As shown in the figure below, when PIOs of VHL stop without error or within the range of $\pm 15^\circ$, surrounding objects shall not block the light of PIOs.



The cases of the light of PIO is blocked by the surrounding objects are shown in diagrams below. In these cases, there is high possibility of PIO communication error depending on where VHL stops. If a VHL stops without error, the PIO communication will operate normally. However, if it stops with error, communication error can happen because light is blocked. Therefore, be careful when install the fixed equipment and surrounding devices.



Also, if there is optical noise, it is necessary to block the noise using the fixed objects.



13. List of Serial Communication Commands

How to set commands				
<ul style="list-style-type: none"> • Serial Communication Setting Value: 38400,8,n,1, No flow control • The first letter of every commands is “<” and the last letter is “>”. • The first letter of responds for commands is “[” and the last letter is “]”. 				
Command	Function	Medium ¹⁾	Master ²⁾	Slave ²⁾
M	Set the communication medium	IR/RF	Maintain	Maintain
R	The number of trials for stable connection	IR/RF	Maintain	Maintain
T	Set the current time	IR/RF	Reset	Reset
Y	Check whether it is ready to communicate	IR/RF	–	–
G	Check the GO status	IR/RF	–	–
L	Download the communication data	IR/RF	– (Function N/A)	– (Available)
S	Download the status of the communication data	IR/RF	– (Function N/A)	– (Available)
V	Check the version	IR/RF	–	–
C	Set the channel	RF	Reset	Maintain
A	Set the ID	RF	Reset	Maintain
N	Set the PORT number	RF	Reset	Unused
P	Intensity of RF radiation	RF	Maintain	Maintain
W	Time to check whether there are other devices.	RF	Maintain	Unused
O	The number of OHT	RF	Maintain	Unused
<p>1) Whether to use the set values is dependent on media (optical or wireless)</p> <p>2) Whether to save the set values (If the set value is saved, it maintains this value even though the power is off.) is dependent on the mode (Master/Slave), so be careful when use serial commands.</p> <p>※ Use the serial communication program provided by CanTops to enter the commands.</p>				

➤ About A Serial Command Setting for Different Modes

Master Mode	Setting the No. of OHT, communication medium, ID, CH, and No. of PORT is only possible when SELECT is ON (Communication prohibited). Other commands can be used at any time through the serial communication.
Slave Mode	Serial commands can be used at any time, regardless of SELECT status.

※ See “Serial communication specification” for more detailed information.

***) The specification of this product may change without notice to improve performance of the product.**

* Rev Information

Document Ver.	Date	Modified content
V 1.0	2015.8.6	<ul style="list-style-type: none"> ▪ Maximum value of Go signal: 375ms => 775ms (p.11) ▪ Period of standby mode of STATE LED: 0.05 => 0.1초 ▪ Display the number of blinks of STATE LED depending on media <ul style="list-style-type: none"> - Only for IR : 3 times - RF Mode, when IR operates : 5 times - RF Mode, when 2.4GHz operates : 7 times - RF Mode, when 5GHz operates : 9 times ▪ Modification in part of formats ▪ Addition of cable (Master) AMP for OHT
V1.1	2015.9.7	<ul style="list-style-type: none"> ▪ Addition of the item number code format
V1.2	2016.1.8	<ul style="list-style-type: none"> ▪ Addition of the RF patterns and installation method depending on the damping ratios. (p. 16, 17, 18 are added.)