

# CTS-HPIO Specification

## (IR+RF)

**\* This radio equipment may be subject to radio interference during operation.**

Model Name: CTS-HPIO-25

Revision 1.0  
June18, 2018

Updated By: **KM.JO**

|                                 |                                                 |                                                 |                                                 |
|---------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|
| <b>Approval<br/>Signatures:</b> | <input type="checkbox"/> Name<br>(Job Position) | <input type="checkbox"/> Name<br>(Job Position) | <input type="checkbox"/> Name<br>(Job Position) |
|                                 | Date:                                           | Date:                                           | Date:                                           |
|                                 |                                                 |                                                 |                                                 |
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|                                 |                                                 |                                                 |                                                 |
|                                 |                                                 |                                                 |                                                 |

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**Revision History:**

| Rev<br>. | Date/Initials        | Location | Description of Change |
|----------|----------------------|----------|-----------------------|
| 1.0      | 2018. 06.18./ KM. JO | All      | - First edition       |
|          |                      |          |                       |
|          |                      |          |                       |
|          |                      |          |                       |

## 1. PRODUCT OVERVIEW

The CTS-HPIO 2<sup>nd</sup> (E84 Sensor, PIO) is a communication device used to give and receive 8-bit data without contact according to the semiconductor SEMI-E84, E23 protocol.

In addition, this is a combined product of RF communication and IR (infrared, optical) communication media of 2.4GHz, 5GHz, so it is possible to select and use communication media working stably according to the site situations.

This product is a product, realizing the best operation state without radio disconnection even at sites with severe electromagnetic interference due to electromagnetic noises and diffuse reflections, that can be set with various and convenient additional functions via serial ports and wirelessly and can be used by converting communication media into IR or RF depending on uses.

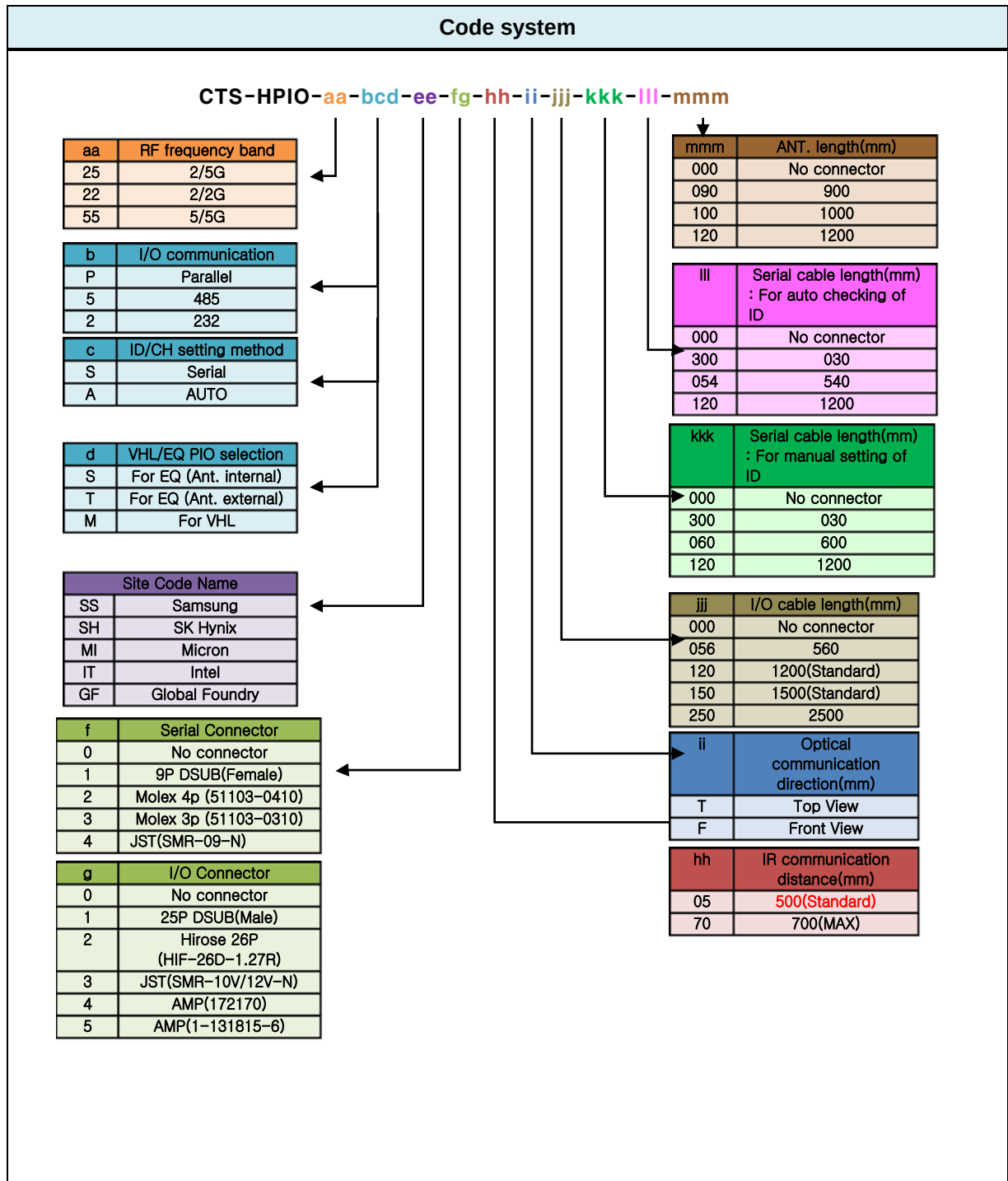
In addition, this product provides various functions to facilitate the prompt grasping of causes and the establishment of countermeasures in case of abnormalities in transmission/reception data during communication.

This device is mainly used for an interchange of control signals between vehicle (master or active device such as AGV/OHT) and equipment (slave or passive device).

## 2. PRODUCT FEATURE

- RF (2.4GHz, 5GHz) and IR (infrared, optical) communication media combined in a product
- Exchange of 8-bit input/output signals without contact
- Possible to select optimal communication media according to the ambient communication interference environment
- 2.4/5GHz radio communication: Additional function such as data transmission/reception and F/W downloading
- Radio communication working distance used within at most 2m (There shall be no obstacle or electromagnetic noise interference)
  - 2M distance criterion : A distance for stable communication without radio disconnection at the site environment
- Radio communication ID (address) designation: 6 digits (Hexa code)
- Storage of various information using large-capacity SRAM: About 100 sets of work such as communication data and error contents, absolute time, signal intensity, etc. (Cancelled when power OFF)
- Various additional functions using serial communication functions: Setup change, communication data information receiving, F/W downloading, etc.

### 3. PRODUCT CODE CONFIGURATION



## PRODUCT CODE EXAMPLE)

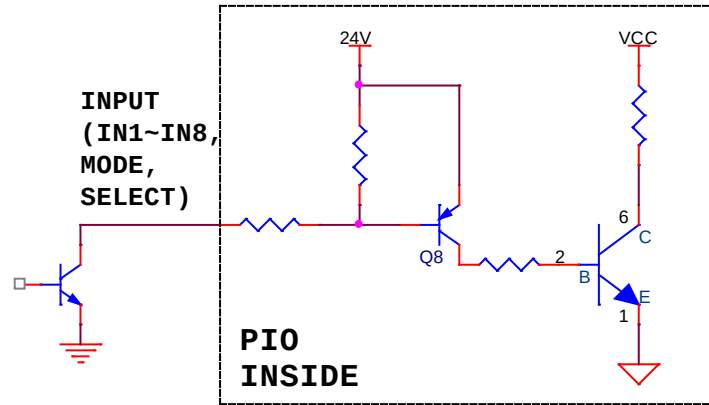
| Product classification     | Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-------------------|----|------|---|-------------------|---|----------|---|----------------------|---|--------|---|----------------------|---|-----------------------|----------------|--|----|---------|---|------------------|---|-----------------------|---|---------------|---|-------------------------------|-----|-----------------|-----|-----|-----|------------------------------------------------------|-----|--------------|-----|-------------------------------------------------------|-----|-----|-----|----------------------|-----|---------------|----|-------------------------------------|---|------------|----|-------------------------------|----|---------------|
| EQ<br>( Slave,<br>Passive) | <div>CTS-HPIO-25-PSS-SS-11-05-T-125-030-000-090</div> <div><table><tr><td>aa</td><td>RF frequency band</td></tr><tr><td>25</td><td>2/5G</td></tr></table><table><tr><td>b</td><td>I/O communication</td></tr><tr><td>P</td><td>Parallel</td></tr></table><table><tr><td>c</td><td>ID/CH setting method</td></tr><tr><td>S</td><td>Serial</td></tr></table><table><tr><td>d</td><td>VHL/EQ PIO selection</td></tr><tr><td>S</td><td>For EQ(Ant. internal)</td></tr></table><table><tr><td colspan="2">Site Code Name</td></tr><tr><td>SS</td><td>Samsung</td></tr></table><table><tr><td>f</td><td>Serial Connector</td></tr><tr><td>1</td><td>9P DSUB(Female)</td></tr></table><table><tr><td>g</td><td>I/O Connector</td></tr><tr><td>1</td><td>25P DSUB(Male)</td></tr></table><table><tr><td>mmm</td><td>ANT. length(mm)</td></tr><tr><td>090</td><td>900</td></tr></table><table><tr><td>III</td><td>Serial cable length(mm)<br/>: For auto checking of ID</td></tr><tr><td>000</td><td>No connector</td></tr></table><table><tr><td>kkk</td><td>Serial cable length(mm)<br/>: For manual setting of ID</td></tr><tr><td>300</td><td>030</td></tr></table><table><tr><td>jjj</td><td>I/O cable length(mm)</td></tr><tr><td>125</td><td>125(Standard)</td></tr></table><table><tr><td>ii</td><td>Optical communication direction(mm)</td></tr><tr><td>T</td><td>Top View</td></tr></table><table><tr><td>hh</td><td>IR communication distance(mm)</td></tr><tr><td>05</td><td>500(Standard)</td></tr></table></div> | aa | RF frequency band | 25 | 2/5G | b | I/O communication | P | Parallel | c | ID/CH setting method | S | Serial | d | VHL/EQ PIO selection | S | For EQ(Ant. internal) | Site Code Name |  | SS | Samsung | f | Serial Connector | 1 | 9P DSUB(Female)       | g | I/O Connector | 1 | 25P DSUB(Male)                | mmm | ANT. length(mm) | 090 | 900 | III | Serial cable length(mm)<br>: For auto checking of ID | 000 | No connector | kkk | Serial cable length(mm)<br>: For manual setting of ID | 300 | 030 | jjj | I/O cable length(mm) | 125 | 125(Standard) | ii | Optical communication direction(mm) | T | Top View   | hh | IR communication distance(mm) | 05 | 500(Standard) |
| aa                         | RF frequency band                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| 25                         | 2/5G                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| b                          | I/O communication                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| P                          | Parallel                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| c                          | ID/CH setting method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| S                          | Serial                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| d                          | VHL/EQ PIO selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| S                          | For EQ(Ant. internal)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| Site Code Name             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| SS                         | Samsung                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| f                          | Serial Connector                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| 1                          | 9P DSUB(Female)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| g                          | I/O Connector                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| 1                          | 25P DSUB(Male)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| mmm                        | ANT. length(mm)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| 090                        | 900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| III                        | Serial cable length(mm)<br>: For auto checking of ID                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| 000                        | No connector                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| kkk                        | Serial cable length(mm)<br>: For manual setting of ID                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| 300                        | 030                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| jjj                        | I/O cable length(mm)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| 125                        | 125(Standard)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| ii                         | Optical communication direction(mm)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| T                          | Top View                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| hh                         | IR communication distance(mm)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| 05                         | 500(Standard)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| EQ<br>( Slave,<br>Passive) | <div>CTS-HPIO-25-PSS-SS-32-05-F-056-060-000-000</div> <div><table><tr><td>aa</td><td>RF frequency band</td></tr><tr><td>25</td><td>2/5G</td></tr></table><table><tr><td>b</td><td>I/O communication</td></tr><tr><td>P</td><td>Parallel</td></tr></table><table><tr><td>c</td><td>ID/CH setting method</td></tr><tr><td>S</td><td>Serial</td></tr></table><table><tr><td>d</td><td>VHL/EQ PIO selection</td></tr><tr><td>M</td><td>For VHL</td></tr></table><table><tr><td colspan="2">Site Code Name</td></tr><tr><td>SS</td><td>Samsung</td></tr></table><table><tr><td>f</td><td>Serial Connector</td></tr><tr><td>3</td><td>Molex 3p (51103-0310)</td></tr></table><table><tr><td>g</td><td>I/O Connector</td></tr><tr><td>2</td><td>Hirose 26P<br/>(HIF-26D-1.27R)</td></tr></table><table><tr><td>mmm</td><td>ANT. length(mm)</td></tr><tr><td>000</td><td>000</td></tr></table><table><tr><td>III</td><td>Serial cable length(mm)<br/>: For option setting</td></tr><tr><td>000</td><td>No connector</td></tr></table><table><tr><td>kkk</td><td>Serial cable length(mm)<br/>: For ID checking</td></tr><tr><td>060</td><td>600</td></tr></table><table><tr><td>jjj</td><td>I/O cable length(mm)</td></tr><tr><td>056</td><td>560</td></tr></table><table><tr><td>ii</td><td>Optical communication direction(mm)</td></tr><tr><td>F</td><td>Front View</td></tr></table><table><tr><td>hh</td><td>IR communication distance(mm)</td></tr><tr><td>05</td><td>500(Standard)</td></tr></table></div>               | aa | RF frequency band | 25 | 2/5G | b | I/O communication | P | Parallel | c | ID/CH setting method | S | Serial | d | VHL/EQ PIO selection | M | For VHL               | Site Code Name |  | SS | Samsung | f | Serial Connector | 3 | Molex 3p (51103-0310) | g | I/O Connector | 2 | Hirose 26P<br>(HIF-26D-1.27R) | mmm | ANT. length(mm) | 000 | 000 | III | Serial cable length(mm)<br>: For option setting      | 000 | No connector | kkk | Serial cable length(mm)<br>: For ID checking          | 060 | 600 | jjj | I/O cable length(mm) | 056 | 560           | ii | Optical communication direction(mm) | F | Front View | hh | IR communication distance(mm) | 05 | 500(Standard) |
| aa                         | RF frequency band                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| 25                         | 2/5G                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| b                          | I/O communication                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| P                          | Parallel                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| c                          | ID/CH setting method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| S                          | Serial                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| d                          | VHL/EQ PIO selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| M                          | For VHL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| Site Code Name             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| SS                         | Samsung                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| f                          | Serial Connector                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| 3                          | Molex 3p (51103-0310)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| g                          | I/O Connector                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| 2                          | Hirose 26P<br>(HIF-26D-1.27R)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| mmm                        | ANT. length(mm)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| 000                        | 000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| III                        | Serial cable length(mm)<br>: For option setting                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| 000                        | No connector                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| kkk                        | Serial cable length(mm)<br>: For ID checking                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| 060                        | 600                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| jjj                        | I/O cable length(mm)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| 056                        | 560                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| ii                         | Optical communication direction(mm)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| F                          | Front View                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| hh                         | IR communication distance(mm)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |
| 05                         | 500(Standard)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |    |                   |    |      |   |                   |   |          |   |                      |   |        |   |                      |   |                       |                |  |    |         |   |                  |   |                       |   |               |   |                               |     |                 |     |     |     |                                                      |     |              |     |                                                       |     |     |     |                      |     |               |    |                                     |   |            |    |                               |    |               |

## ➤ Hybrid-PIO fixed cover code(For Slave)

| Product code     | PIO optical communication direction |
|------------------|-------------------------------------|
| CTS-HPIO-COVER-F | Front View                          |
| CTS-HPIO-COVER-T | Top View                            |

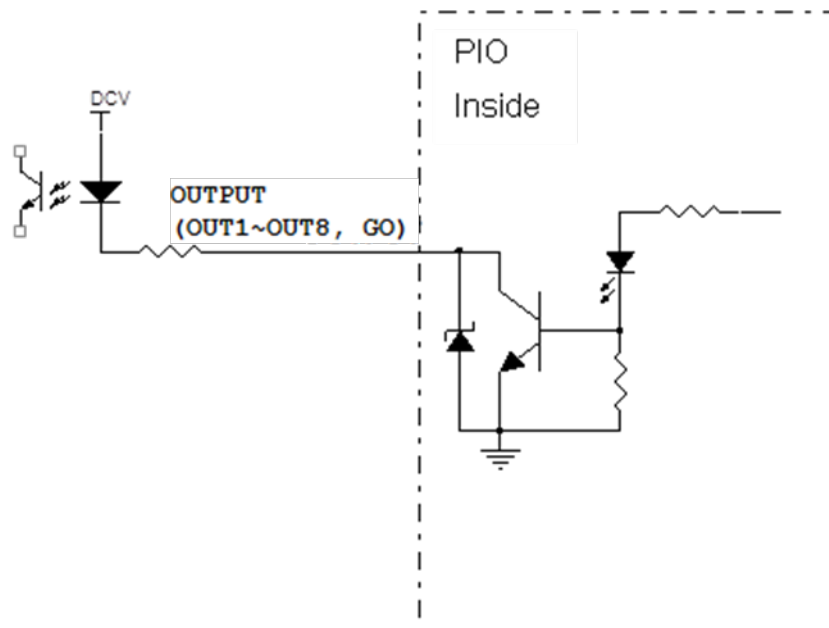
#### 4. INPUT/OUTPUT CIRCUIT

**Input circuit : Maximum 10mA, connected with the equipment or OHT output circuits**



**Output circuit : NPN type Open Collector, maximum operation current 50mA / 30V**

**V<sub>CEmax</sub> 100mV / 10mA, connected with the equipment or OHT input circuit**



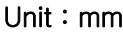
## 5. MAJOR SPECIFICATION OF THE PRODUCT

| Division                           | Specific item                            |                                                              | Content                                                                                            |
|------------------------------------|------------------------------------------|--------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| Display part                       | GO                                       |                                                              | Turned ON if RF and IR communication starts between the master(OHT, AGV) PIO and the slave(EQ) PIO |
|                                    | STATE                                    |                                                              | Flashing as watchdog signals to display the working state                                          |
|                                    | IN                                       |                                                              | Display of the working state of the input port(8Bit)                                               |
|                                    | OUT                                      |                                                              | Display of the working state of the output port(8Bit)                                              |
| External device connection         | Connector (Optional)                     | Master(OHT, AGV) PIO: DSUB 25 pins, without connector        |                                                                                                    |
|                                    |                                          | Slave(EQ) PIO: Hirose 26 pins, JST, Molex, without connector |                                                                                                    |
|                                    | Cable                                    |                                                              | 26AWG x 25C, Shield                                                                                |
|                                    | Input                                    |                                                              | 8 Bit, Transistor IN, 24V<br>On : 10mA, Off : Less than 0.1mA                                      |
|                                    | Output                                   |                                                              | 8Bit, Open Collector, NPN, 30V<br>Maximum working current 50mA                                     |
| IR(optical) communication function | Major function                           |                                                              | 8 bit I/O communication                                                                            |
|                                    | Communication media                      |                                                              | 870nm, Infrared                                                                                    |
|                                    | Communication distance                   |                                                              | 0.5m (0°), 0.25m (+15°, -15°)                                                                      |
|                                    | Communication angle                      |                                                              | 30° (±15°)                                                                                         |
|                                    | Communication method                     |                                                              | 1:1 communication, Half Duplex                                                                     |
|                                    | Communication window position (Optional) |                                                              | T Type : Top View<br>F Type : Front View                                                           |
|                                    | Optical modulation method                |                                                              | Pulse Modulation                                                                                   |
|                                    | Communication error check                |                                                              | Parity                                                                                             |
|                                    | Communication cycle                      |                                                              | About 23ms                                                                                         |
| RF Communication function          | Major function                           |                                                              | 8 bit I/O communication, F/W and communication data download, set value change, etc.               |
|                                    | Communication media                      |                                                              | 2.4GHz, 5GHzISM Band, bandwidth 1MHz                                                               |
|                                    | Frequency band                           | 2.4G                                                         | 2.401~2.480 GHz, 80 channels <sup>*1)</sup>                                                        |
|                                    |                                          | 5G                                                           | 5.727~5.850GHz, 124 channels <sup>*1)</sup>                                                        |
|                                    | Maximum RF                               |                                                              | 10mW                                                                                               |

|                      |                             |                                                                                                                                                                                                                                                                                                                                              |
|----------------------|-----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                      | <b>Output Power</b>         |                                                                                                                                                                                                                                                                                                                                              |
|                      | <b>Safety function</b>      | Identification number(ID) checking function, CRC-16                                                                                                                                                                                                                                                                                          |
|                      | <b>Communication method</b> | 1:1 communication, Half Duplex                                                                                                                                                                                                                                                                                                               |
|                      | <b>ID setting</b>           | PIO identification number(ID) to avoid interference with the neighbor PIO, composed of 6-digit ASCII codes : 000001~FFFFFF                                                                                                                                                                                                                   |
|                      | <b>Channel(CH) setting</b>  | Communication frequency to be used in radio communication needing frequency management to avoid radio interference with the neighbor PIO, composed of 3-digit ASCII codes                                                                                                                                                                    |
|                      | <b>ID setting method</b>    | Serial communication command : Set as a release default value(56B9-xxxxxx)                                                                                                                                                                                                                                                                   |
|                      | <b>Working distance</b>     | Within 2m<br>However, a distance for stable communication without radio disconnection at the site environment, without radio interference in the middle                                                                                                                                                                                      |
| <b>Environment</b>   | <b>Storage environment</b>  | Storage temperature: -25 ~ 70°C<br>Storage humidity: 5 ~ 95%RH<br>(However, there shall be no dew condensation)                                                                                                                                                                                                                              |
|                      | <b>Working environment</b>  | Ambient brightness(Condition when IR is used) : 4000lx or less(Incandescent lamp, fluorescent lamp)<br>*) Installed to prevent external light from entering the receptor<br>Working temperature : 0 ~ 40°C<br>Working humidity : 35~85%RH (However, there shall be no dew condensation)<br>Vibration : 4~150 Hz, 4.9m/s <sup>2</sup> or less |
| <b>Power</b>         | <b>Input voltage</b>        | DC 24V±10%                                                                                                                                                                                                                                                                                                                                   |
|                      | <b>Consumed current</b>     | 100mA or less @ 24V                                                                                                                                                                                                                                                                                                                          |
| <b>Case material</b> |                             | Polycarbonate                                                                                                                                                                                                                                                                                                                                |
| <b>Size(W×H×D)</b>   |                             | 50×66×20mm (Except the connector protrusion)                                                                                                                                                                                                                                                                                                 |
| <b>Weight</b>        |                             | About 300g (For EQ, IO cable length 1.5m)                                                                                                                                                                                                                                                                                                    |

**\*1) Usable in an environment without frequency interference with other radio equipment(wireless LAN, Bluetooth, etc.)**

### F Type : Front View



## Unit : mm

## 7. CONNECTOR CONNECTION SPECIFICATION

### 1) For equipment (Slave, Passive, EQ)

| Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        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| Cable wiring diagram                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                |         | DSUB 25P, Male |                |         |
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|                |         |                |                |         |

Note 1) SELECT : For an always used mode, it is not necessary to control this signal from the outside.

Note 2) MODE signal(No.11) : It is not necessary to control this signal from the outside.

\*) For input/output signal criteria, the E84 Sensor(PIO) was used as a criterion.

## 2) OHT (Master, Active, Vehicle)

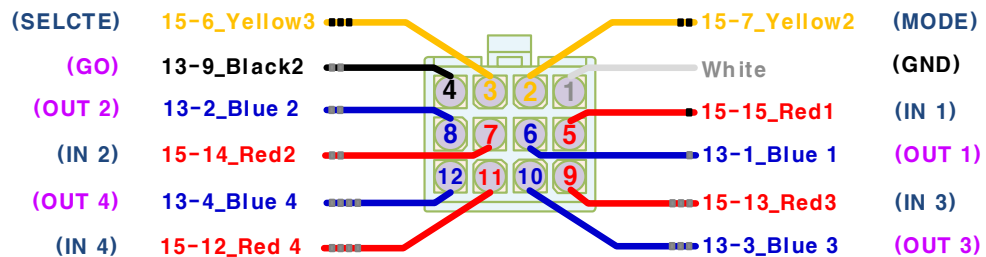
## ➤ HIF6-26D-1.27R Connector

| Function             | HIF6-26D pin No.      | Color    | Function               | HIF6-26D pin No. | Color   |
|----------------------|-----------------------|----------|------------------------|------------------|---------|
| IN 1                 | 16                    | Red 1    | Out1                   | 3                | Blue 1  |
| IN 2                 | 17                    | Red 2    | Out2                   | 4                | Blue 2  |
| IN 3                 | 18                    | Red 3    | Out3                   | 5                | Blue 3  |
| IN 4                 | 19                    | Red 4    | Out4                   | 6                | Blue 4  |
| IN 5                 | 20                    | Green 1  | Out5                   | 7                | White 1 |
| IN 6                 | 21                    | Green2   | Out6                   | 8                | White2  |
| IN 7                 | 22                    | Green3   | Out7                   | 9                | White3  |
| IN 8                 | 23                    | Green4   | Out8                   | 10               | Black 1 |
| SELECT               | 14                    | Yellow 3 | Ready (Go)             | 2                | Black 2 |
| MODE                 | 15                    | Yellow 2 | +VIN                   | 12               | Red     |
| NC                   | 11, 24                | -        | GND                    | 1                | White   |
| NC                   | 25, 26                | -        | GND                    | 13               | Black   |
| Serial Connector     | DSUB 9p, 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 wiring diagram |                       |          | HIF6-26D-1.27R         |                  |         |
| (GND) White [1]      |                       |          | [14] Yellow 3 (SELECT) |                  |         |
| (GO) Black 2 [2]     |                       |          | [15] Yellow 2 (MODE)   |                  |         |
| (OUT 1) Blue 1 [3]   |                       |          | [16] Red 1 (IN 1)      |                  |         |
| (OUT 2) Blue 2 [4]   |                       |          | [17] Red 2 (IN 2)      |                  |         |
| (OUT 3) Blue 3 [5]   |                       |          | [18] Red 3 (IN 3)      |                  |         |
| (OUT 4) Blue 4 [6]   |                       |          | [19] Red 4 (IN 4)      |                  |         |
| (OUT 5) White 1 [7]  |                       |          | [20] Green 1 (IN 5)    |                  |         |
| (OUT 6) White 2 [8]  |                       |          | [21] Green 2 (IN 6)    |                  |         |
| (OUT 7) White 3 [9]  |                       |          | [22] Green 3 (IN 7)    |                  |         |
| (OUT 8) Black 1 [10] |                       |          | [23] Green 4 (IN 8)    |                  |         |
| (NC) X [11]          |                       |          | [24] White 4 (NC)      |                  |         |
| (+VIN) Red [12]      |                       |          | [25] Yellow 4 (NC)     |                  |         |
| (GND) Black [13]     |                       |          | [26] Yellow 1 (NC)     |                  |         |

## ➤ AMP 12 pin, 172170

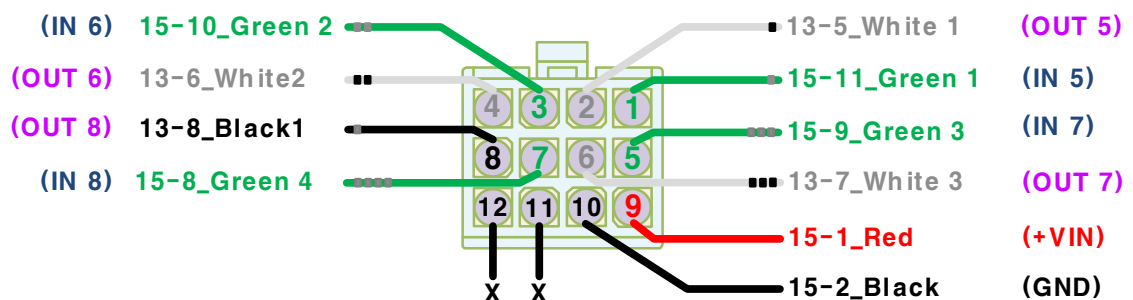
| A Connector |         |          |            |         |         |
|-------------|---------|----------|------------|---------|---------|
| Function    | Pin No. | Color    | Function   | Pin No. | Color   |
| IN 1        | 5       | Red 1    | Out1       | 6       | Blue 1  |
| IN 2        | 7       | Red 2    | Out2       | 8       | Blue 2  |
| IN 3        | 9       | Red 3    | Out3       | 10      | Blue 3  |
| IN 4        | 11      | Red 4    | Out4       | 12      | Blue 4  |
| SELECT      | 3       | Yellow 3 | Ready (Go) | 4       | Black 2 |
| MODE        | 2       | Yellow 2 | GND        | 1       | White   |

## Cable wiring diagram



| B Connector                     |         |         | AMP 12 pin, 172170 |         |          |
|---------------------------------|---------|---------|--------------------|---------|----------|
| Function                        | Pin No. | Color   | Function           | Pin No. | Color    |
| IN 5                            | 1       | Green 1 | Out5               | 2       | White 1  |
| IN 6                            | 3       | Green2  | Out6               | 4       | White2   |
| IN 7                            | 5       | Green3  | Out7               | 6       | White3   |
| IN 8                            | 7       | Green4  | Out8               | 8       | Black 1  |
| X                               | 11      | -       | +VIN               | 9       | Red      |
| X                               | 12      | -       | GND                | 10      | Black    |
| Serial Connector<br>(SMR-09V-N) |         |         | TxD                | 2       | Yellow 1 |
|                                 |         |         | RxD                | 1       | Yellow 4 |
|                                 |         |         | GND                | 5       | White 4  |

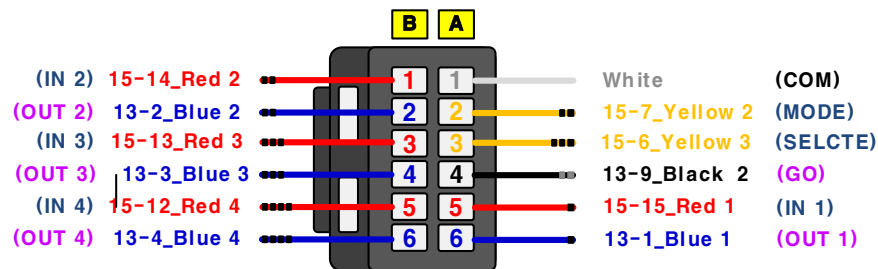
## Cable wiring diagram



## ➤ AMP 12 pin, 1-1318115

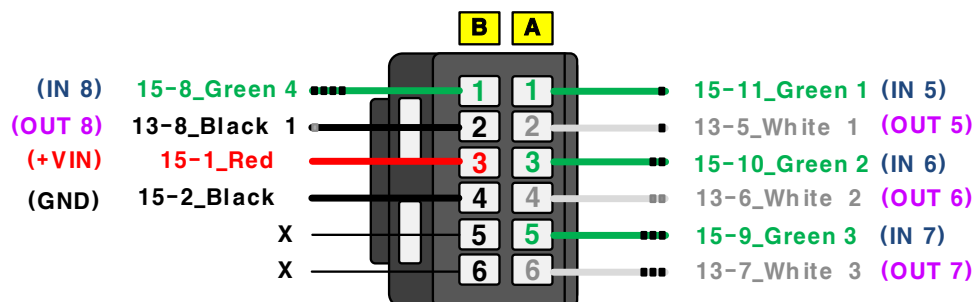
| A Connector |         |          |            |         |         |
|-------------|---------|----------|------------|---------|---------|
| Function    | Pin No. | Color    | Function   | Pin No. | Color   |
| IN 1        | A-5     | Red 1    | Out1       | A-6     | Blue 1  |
| IN 2        | B-1     | Red 2    | Out2       | B-2     | Blue 2  |
| IN 3        | B-3     | Red 3    | Out3       | B-4     | Blue 3  |
| IN 4        | B-5     | Red 4    | Out4       | B-6     | Blue 4  |
| SELECT      | A-3     | Yellow 3 | Ready (Go) | A-4     | Black 2 |
| MODE        | A-2     | Yellow 2 | GND        | A-1     | White   |

## Cable wiring diagram



| B Connector                     |         |         | AMP 12 Pin, 1-1318115 |         |          |
|---------------------------------|---------|---------|-----------------------|---------|----------|
| Function                        | Pin No. | Color   | Function              | Pin No. | Color    |
| IN 5                            | A-1     | Green 1 | Out5                  | A-2     | White 1  |
| IN 6                            | A-3     | Green2  | Out6                  | A-4     | White2   |
| IN 7                            | A-5     | Green3  | Out7                  | A-6     | White3   |
| IN 8                            | B-1     | Green4  | Out8                  | B-2     | Black 1  |
| X                               | 11      | -       | +VIN                  | B-3     | Red      |
| X                               | 12      | -       | GND                   | B-4     | Black    |
| Serial Connector<br>(SMR-09V-N) |         |         | TxD                   | 2       | Yellow 1 |
|                                 |         |         | RxD                   | 1       | Yellow 4 |
|                                 |         |         | GND                   | 5       | White 4  |

## Cable wiring diagram



## 8. LED DISPLAY CONTENT

| LED name                     |     | Display content                                                                                                                                                                                                                                                                                                                                                                                                        |
|------------------------------|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1~8                          | IN  | Display of the working state of the input circuit in the PIO, turned ON when a low is inputted                                                                                                                                                                                                                                                                                                                         |
|                              | OUT | Display of the output state in the PIO, turned ON when TR On                                                                                                                                                                                                                                                                                                                                                           |
| GO                           |     | Turned ON when transmission/reception of data between the master PIO and the slave PIO is realized, the GO LED and output OFF time after disconnection of radio communications is maximum 3 seconds, which can be set up to 0.023 sec~5.5 sec using the <R> command                                                                                                                                                    |
| STATE <sup>Note 1)</sup>     |     | <p>Used as a watchdog signal to check the internal state of this product</p> <ul style="list-style-type: none"> <li>When working in an IR/RF mode :<br/> “2 times ON -&gt; 2 times OFF -&gt; 1 time ON -&gt; 2 times OFF -&gt; 5 times ON -&gt; 2 times OFF -&gt; 1 time ON -&gt; 2 times OFF” cycle, repeated flashing</li> <li>※ The product working mode can be identified, so see the following diagram</li> </ul> |
| *) LED configuration diagram |     |                                                                                                                                                                                                                                                                                                                                                                                                                        |

### Note 1) STATE LED working timing

| Mode             |        | Cycle graph |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|------------------|--------|-------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| IR<br>2.4G<br>5G | Slave  |             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                  | Master |             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

## 9. MAJOR PIN FUNCTION

| Signal name    | Usage                                                                                                                                                                                                                                                    |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mode (Input)   | Input to select a PIO mode <ul style="list-style-type: none"> <li>▪ GND connection: Slave Mode (Connected to the GND from the inside of EQ, PIO, so there is no need to connect anything from the outside)</li> <li>▪ Open: Master Mode (OHT)</li> </ul> |
| Select (Input) | Input to operate the radio/optical communication of PIO <ul style="list-style-type: none"> <li>▪ GND connection: Pause of the radio communication function of PIO</li> <li>▪ Open: Working of the radio communication function of PIO</li> </ul>         |
| GO (Output)    | Turned ON if the radio/optical communication between the Master PIO and the Slave PIO is normally realized                                                                                                                                               |

### ➤ Mode description

|             |                                                                                                                                                                                                                                                                                                                                   |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Master Mode | Operating the PIO by opening the Select signals transmits the data entering the input port to the radio/optical. This is a mode installed and used at the OHT or AGV.                                                                                                                                                             |
| Slave Mode  | Operating the PIO by opening the Select signal only receives the radio/optical, and if the radio/optical signals are received from the master, the received data are outputted to the output port, and the signals entering the input port are transmitted to the master PIO. This is a mode installed and used at the equipment. |

## **10. COMMUNICATION MEDIA SELECTION METHOD**

This product has optical (infrared) and radio (2.4GHz, 5GHz RF) communication media that can communicate without contact. Using radio communication at semiconductor factories can affect the media used by this product due to ambient equipment or sensors to generate communication interference.

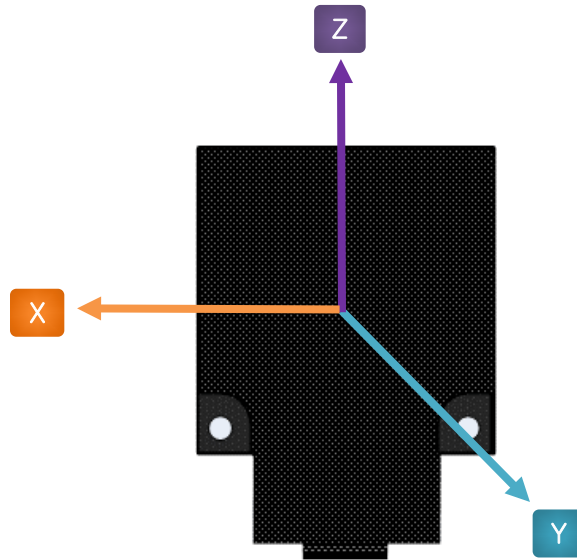
In this case, selecting and using other media without interference can enable more stable radio communications.

The method of selecting communication media is enabled by using serial communication commands (M command), and when radio (RF) is used, various variables such as channel, unique ID, etc. shall be set together.

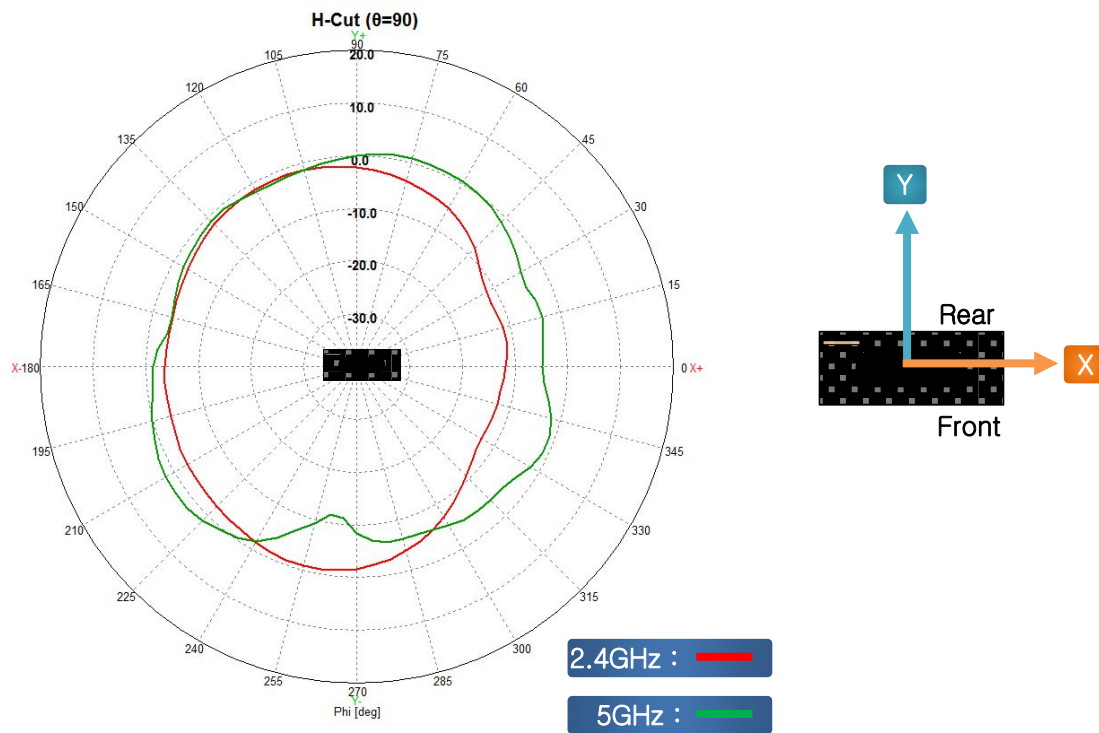
For the command list, see the 14. Serial command list.

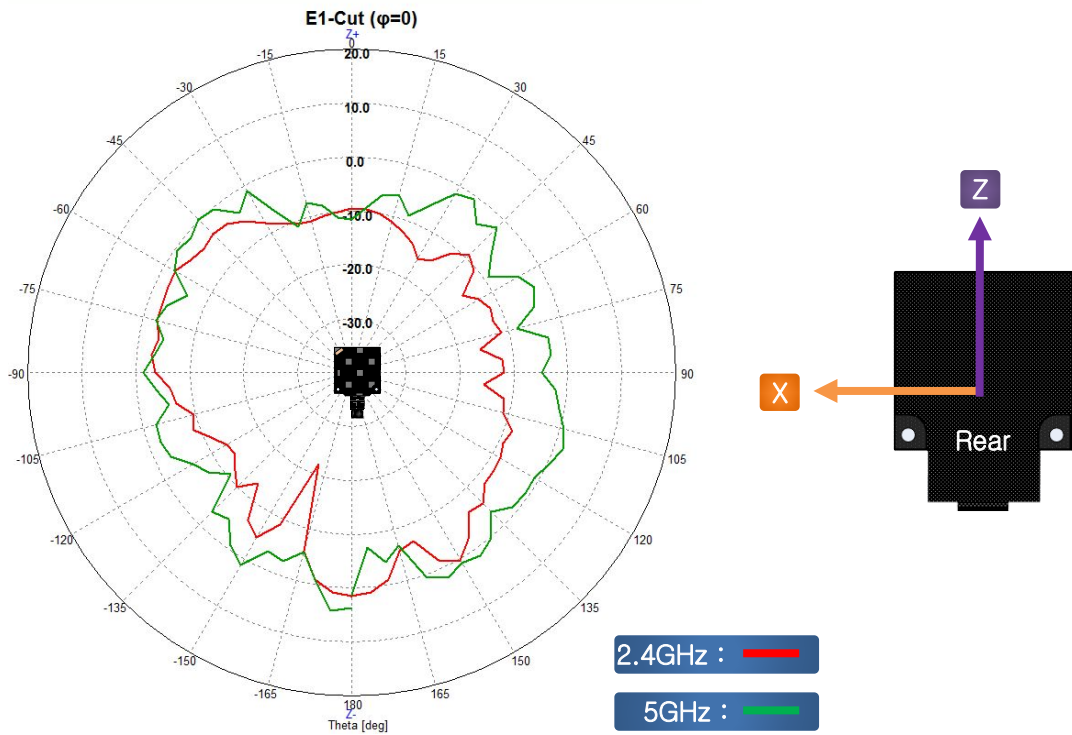
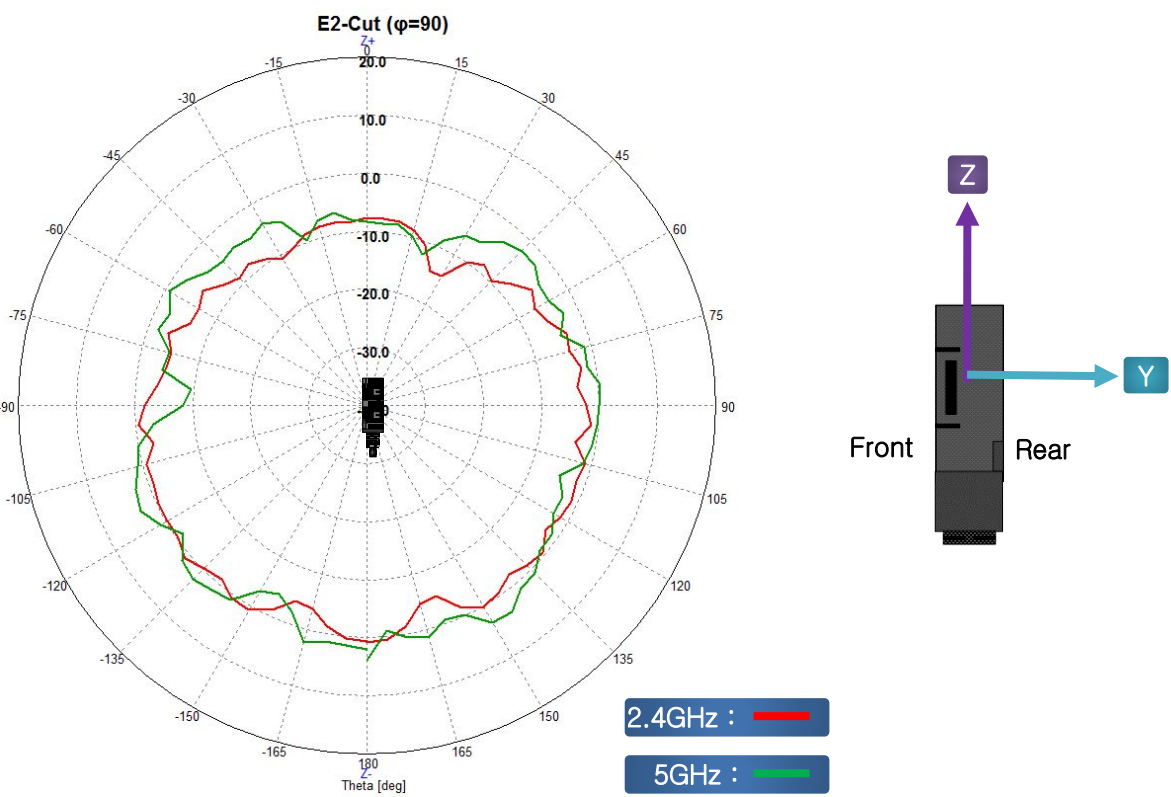
## 11. ANTENNA RADIATION PATTERN

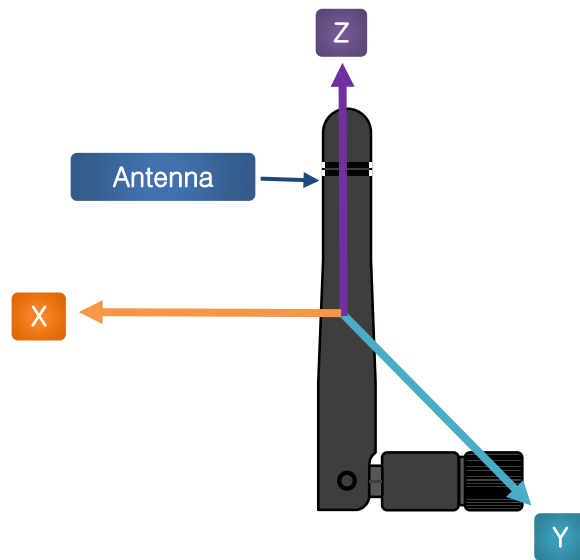
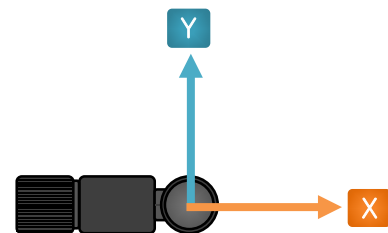
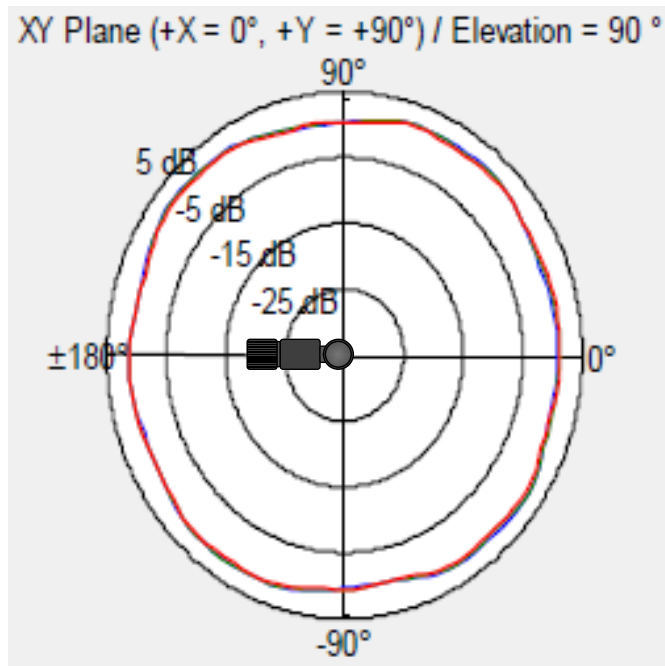
### Internal Antenna



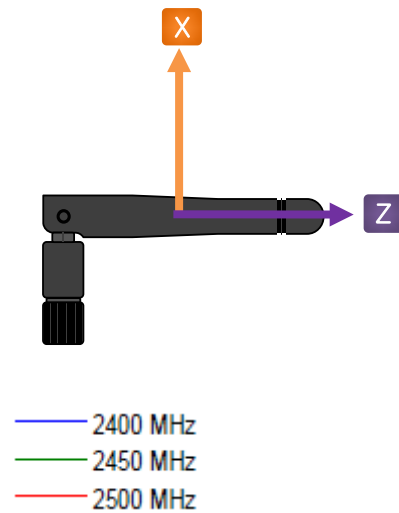
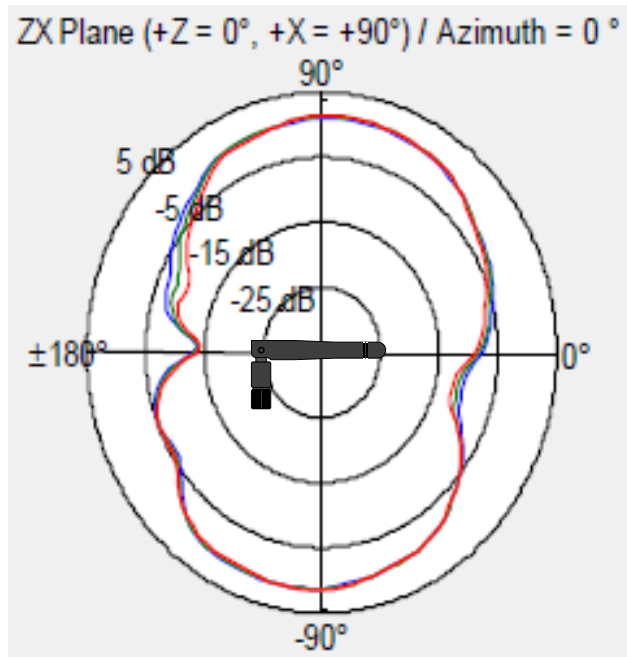
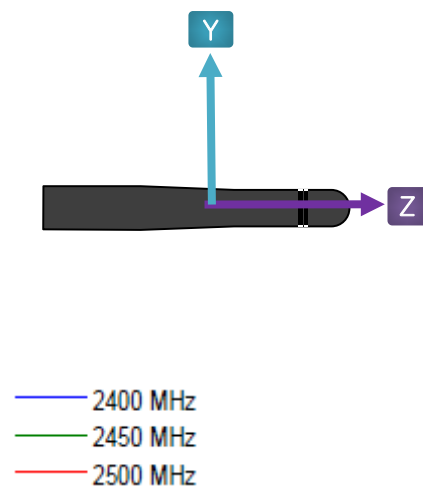
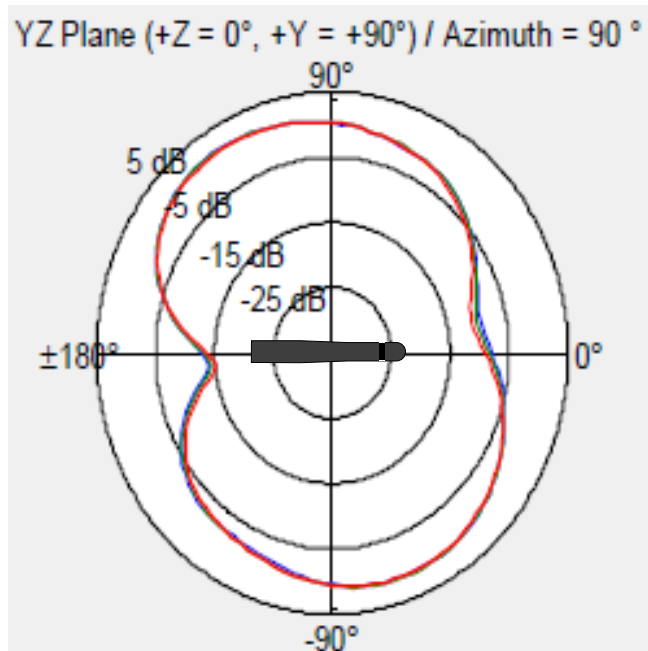
### X – Y Plane

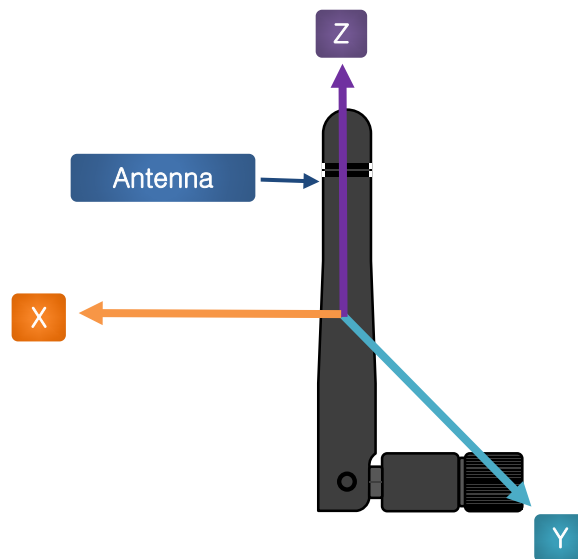
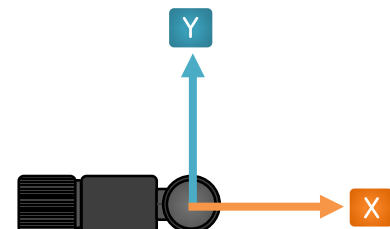
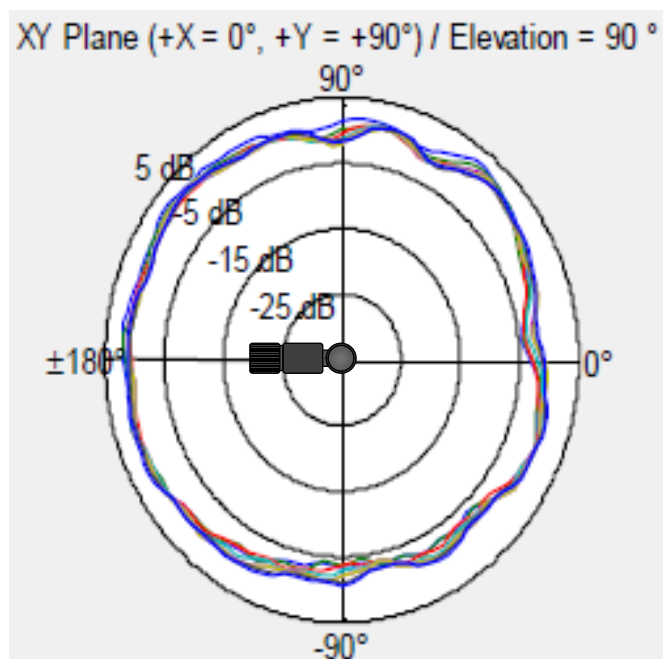


**X – Z Plane****Y – Z Plane**

**External Antenna  
(2.4GHz)****X – Y Plane**

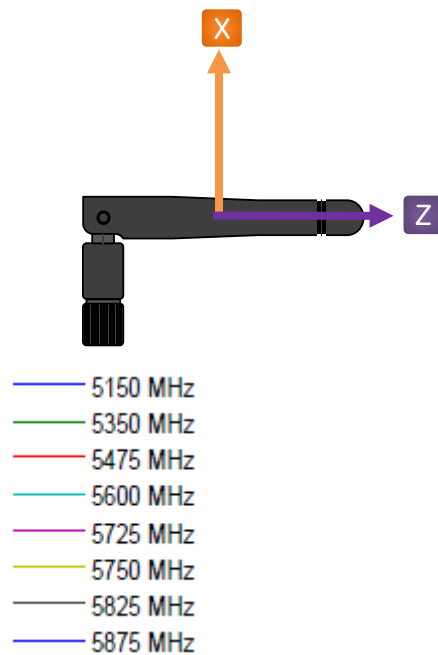
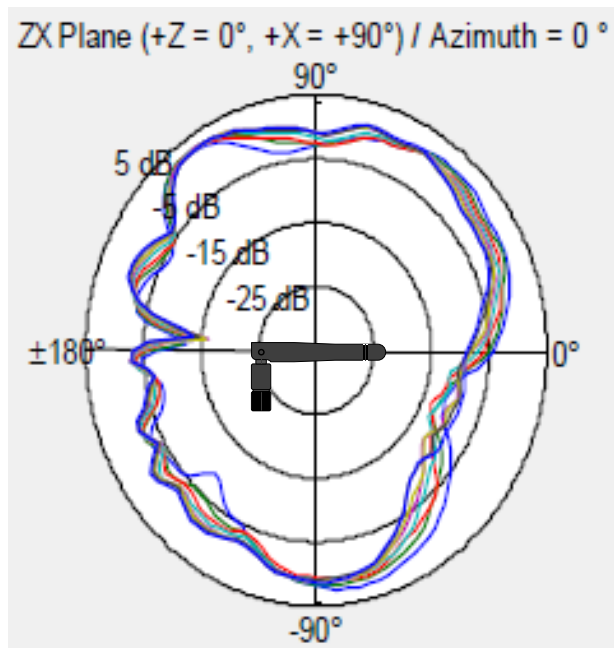
— 2400 MHz  
— 2450 MHz  
— 2500 MHz

**Z – X Plane****Y – Z Plane**

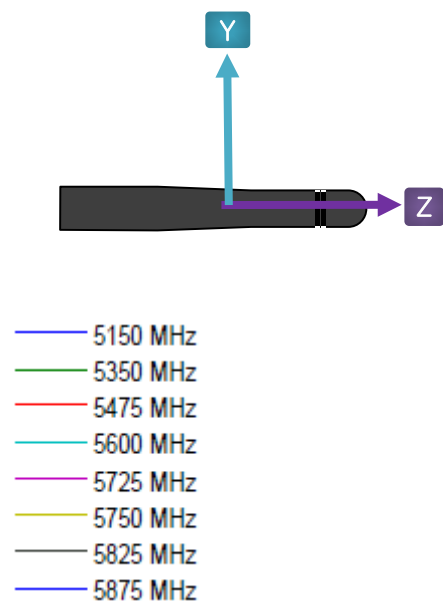
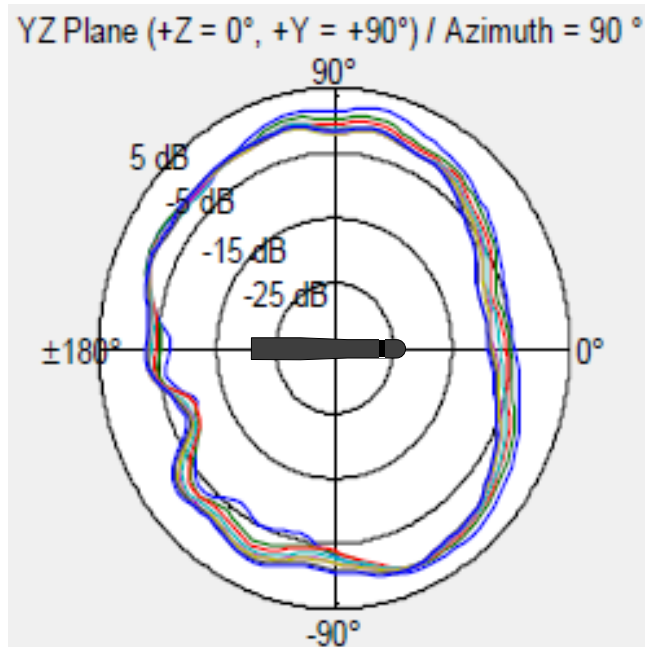
**External Antenna  
(5GHz)****X – Y Plane**

- 5150 MHz
- 5350 MHz
- 5475 MHz
- 5600 MHz
- 5725 MHz
- 5750 MHz
- 5825 MHz
- 5875 MHz

## Z – X Plane



## Y – Z Plane



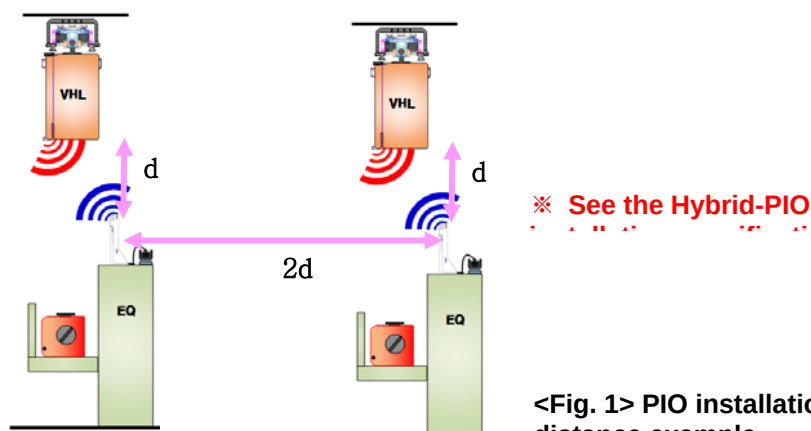
## 12. RF FUNCTION

### RF communication characteristics

- RF communication using 2.4GHz/5GHz of ISM(Industrial Scientific and Medical)Band that can be used without permission
- High speed data communication of 1Mbps per channel
- GFSK modulation type, 1MHz bandwidth
- Excellent expandability with 6 bytes of ID and 3 bytes of frequency selection function
- Communication cycle : About 23ms
- There can happen frequency interference with 2.4GHz/5GHz of radio LAN and other radio communication devices, so it is necessary to set a channel without collision
- RF maximum output power : +10dBm
- Receiving part sensitivity : -90dBm

### Caution in installation

- 1) Radio performance drops when there are metals or objects causing electromagnetic troubles in the space of linear distance between two PIOs. Remove obstacles from the radio paths before use.
- 2) There shall be no interference with other radio equipment in an open space for stable use without communication errors.
- 3) Take care so that there may not be metals or other obstacles within 60mm radius around the antenna.
- 4) There can happen frequency interference due to other RF equipment around. Use this product in an environment without frequency interference for stable operation.
- 5) Especially, when using a 2.4GHz/5GHz band in the same space, allot a channel such that the channels(frequencies) are not overlapped.
- 6) If there is equipment emitting electromagnetic noises such as magnetron in the same space, then shield the electromagnetic waves from the corresponding equipment before use by all means.
- 7) Keep the spacing at 30cm when simultaneous work is not done between PIOs for equipment installed at the equipment, and keep the spacing at 50cm when simultaneous work is done.
- 8) Leave 2 times or more distance between PIOs for installation when simultaneous work is done at the VHL(OHT) as shown in the figure.



<Fig. 1> PIO installation distance example

※ This product uses 2.4GHz/5GHz of radio Wi-Fi band, so there can happen interference when the same frequency band as other radio devices is used. Therefore, to use this product, at least 40MHz of frequency band without interference with other radio equipment is needed.

### Radio environment setting method

The CTS-HPIO Series of radio(RF) function is connected with many devices simultaneously due to its characteristics to cause interference, so to communicate with a device(equipment), set the ID and CH(channel) port number of the counter side(slave PIO for equipment) first before starting communication at the Vehicle(OHT, Master PIO). This ID and CH can be set using a serial communication command.

| PIO division | Setting method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Slave        | <ul style="list-style-type: none"> <li>▪Connection with the PIO serial port =&gt; Setting with a communication command (ID and CH, transmission power, etc.)</li> <li>▪The set data is stored in the internal memory, so once it is set, it doesn't need to be set again even though the power is OFF.</li> </ul>                                                                                                                                                                                                                                                                                                                             |
| Master       | <ul style="list-style-type: none"> <li>▪ Connection with the PIO serial port =&gt; Setting with a communication command (VHL device/communication media/ID/CH/PORT, etc.)</li> <li>▪Select Off(communication permitted)→ On(communication prohibited), then the ID and CH are automatically changed to the initial value, and before the Select Off(communication permitted), be sure to reset the VHL device number, communication media, ID, CH, port number.</li> <li>※ If data transmission is not prepared for (checked by &lt;Y&gt; command), then data is not transmitted even though Select Off (communication permitted).</li> </ul> |

※ For details, see the serial communication specification.

### 13. IR FUNCTION

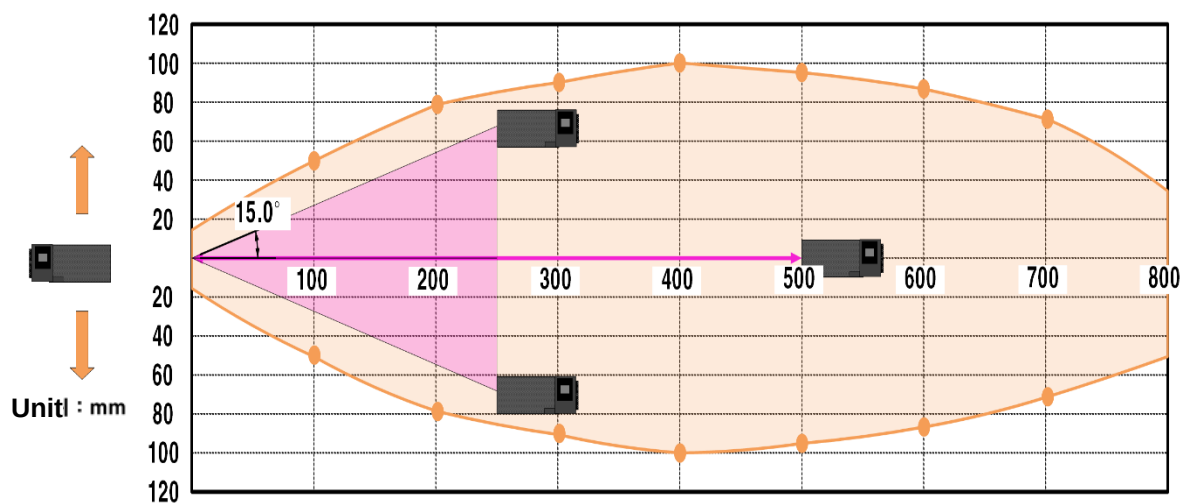
#### IR communication characteristics

- Wavelength : 870nm (Infrared, optical)
- Ambient brightness : 4000lx or less incandescent lamp and fluorescent lamp, where there is no direct sunlight
- Transmission and reception method : Half Duplex
- Modulation type : Pulse Modulation
- Working distance and angle : 0.5m at 0°, 0.25m at  $\pm 15^\circ$
- Communication distance adjustment : Serial/RF communication command
- Reception level adjustment : Serial/RF communication command  
(Raising the reception level when ambient noises are introduced can reduce noise interference.)
- Input signal and GO output filtering : Time can be set by a serial command

#### IR communication range

The IR communication range is  $30^\circ(\pm 15^\circ)$ , so communication is possible at 25cm distance at  $\pm 15^\circ$  and at 50cm distance at  $0^\circ$ . (The figure below shows the data of measuring the actual IR communication distance)

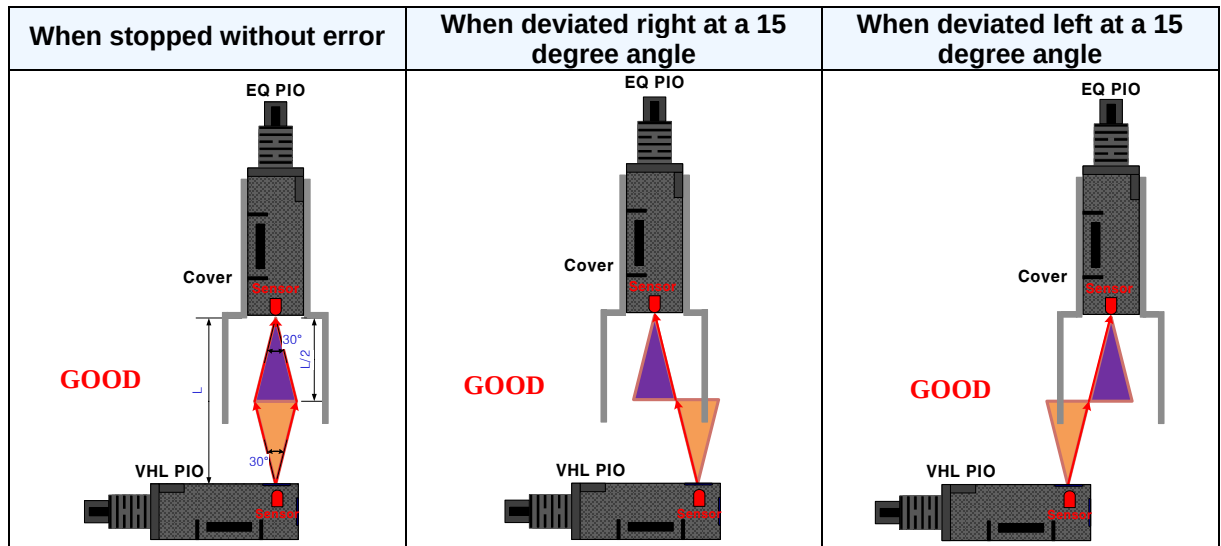
However) loss of communication can happen when the lighting, sunlight, IR remote control, optical sensor, etc. faces the transmission and reception window. In this case, shield the external light before use.



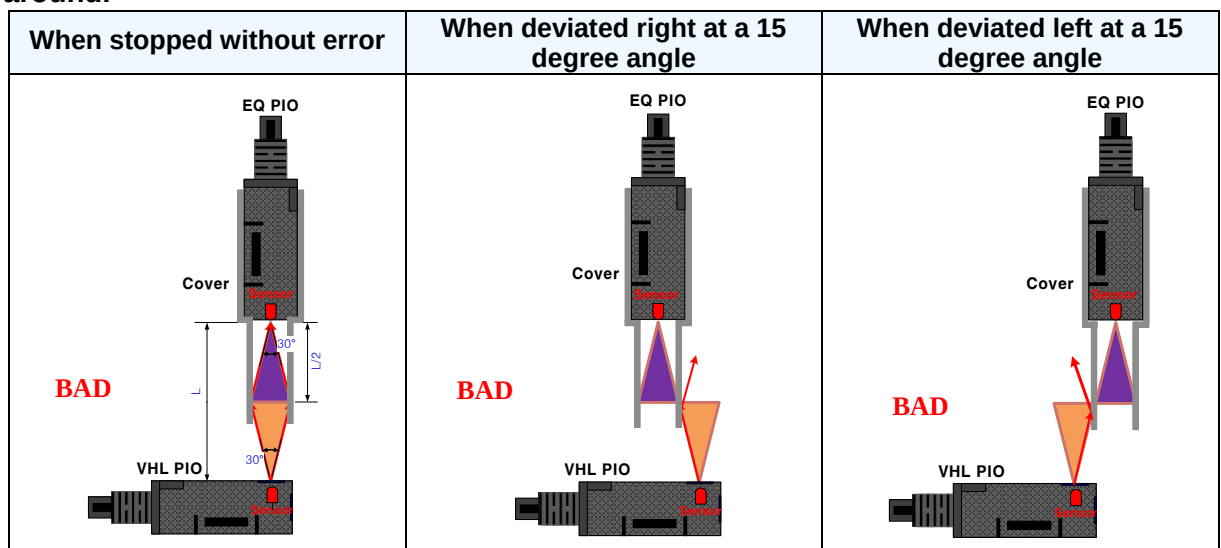
### Consideration in installation

Both IR and RF communication methods are used as the communication media of this product. In case of IR (optical, infrared) type, since it uses the invisible infrared rays, when PIO fixing bracket or fixing part intercept the light, the original specification performance will not be used properly.

When stopping without error or stopping within  $\pm 15^\circ$  as shown in the figure below, make sure that peripheral equipment does not block PIO light (red arrow).



The following figures show cases that objects around the PIO intercept light, so there is high possibility that PIO communication errors can happen depending on the VHL stop degrees. When stopped without error, PIO communication is normally realized, but when errors become large, light is intercepted by objects to cause abnormal communication. Therefore, take care when designing fixed objects and mechanisms around.



In addition, if there are many optical noises around, then a function of intercepting external interference light through fixed objects is needed.

## 14. SERIAL COMMAND LIST

| Serial command setting method                                                                                                                                                                                                                                                                                                                                                   |                                          |                             |                |               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|-----------------------------|----------------|---------------|
| <ul style="list-style-type: none"> <li>Serial communication set value : 38400,8,n,1, without flow control</li> <li>The starting letter of all commands is "&lt;", and the ending letter is "&gt;".</li> <li>The starting letter of response to a command is "[", and the ending letter is "]"</li> </ul>                                                                        |                                          |                             |                |               |
| Command                                                                                                                                                                                                                                                                                                                                                                         | Function                                 | Communication media Note 1) | Master Note 2) | Slave Note 2) |
| M                                                                                                                                                                                                                                                                                                                                                                               | Communication media setting              | IR/RF                       | Keep           | Keep          |
| R                                                                                                                                                                                                                                                                                                                                                                               | Communication retrial numbers            | IR/RF                       | Keep           | Keep          |
| T                                                                                                                                                                                                                                                                                                                                                                               | Current time setting                     | IR/RF                       | Reset          | Reset         |
| Y                                                                                                                                                                                                                                                                                                                                                                               | Communication preparation state check    | IR/RF                       | -              | -             |
| G                                                                                                                                                                                                                                                                                                                                                                               | GO state check                           | IR/RF                       | -              | -             |
| L                                                                                                                                                                                                                                                                                                                                                                               | Communication data download              | IR/RF                       | -(No function) | -(Function)   |
| S                                                                                                                                                                                                                                                                                                                                                                               | Communication data state download        | IR/RF                       | -(No function) | -(Function)   |
| V                                                                                                                                                                                                                                                                                                                                                                               | Version check                            | IR/RF                       | -              | -             |
| C                                                                                                                                                                                                                                                                                                                                                                               | Channel setting                          | RF                          | Reset          | Keep          |
| A                                                                                                                                                                                                                                                                                                                                                                               | ID setting                               | RF                          | Reset          | Keep          |
| N                                                                                                                                                                                                                                                                                                                                                                               | Port number setting                      | RF                          | Reset          | Not used      |
| P                                                                                                                                                                                                                                                                                                                                                                               | RF output intensity                      | RF                          | Keep           | Keep          |
| W                                                                                                                                                                                                                                                                                                                                                                               | Time to check if there are other devices | RF                          | Keep           | Not used      |
| O                                                                                                                                                                                                                                                                                                                                                                               | OHT device                               | RF                          | Keep           | Not used      |
| DI                                                                                                                                                                                                                                                                                                                                                                              | Building/floor division                  | RF                          | Keep           | Keep          |
| <p>Note 1) The use of setting value is determined depending on the communication media (optical or radio).</p> <p>Note 2) Cares shall be taken for using the serial command as setting value storage status (If the setting value is stored, the previous setting value is maintained even if power is applied again) is classified according to the mode (Master / Slave).</p> |                                          |                             |                |               |

### ➤ Major contents of serial command setting by mode

|             |                                                                                                                                                                                                      |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Master Mode | The OHT device number, communication media, ID, CHANNEL, PORT numbers can be set at the Select On(communication prohibited) state only, and for other commands, serial commands can be used anytime. |
| Slave Mode  | Serial commands can be used anytime regardless of the Select state.                                                                                                                                  |

※ For details, see the "Serial communication specification".

## 15. BUILDING/FLOOR DIVISION CODE SETTING

- For radio, signals can be received from more than several meters depending on ambient situations.
- If the same ID and CH are used in the neighbor buildings or on other floors, there may happen interference.
- To avoid this interference, it is possible to use a different code by building and floor.

### ➤ Application scope

- ✓ Building : 0~8(number only), floor : 0~9(number only)

Ex) Building 3 floor 4 :DI=3-4

※ For the detailed description method, see the user manual for the ID/CH setting

### ➤ Caution

- ✓ Be sure to use this at the place where the building/floor code set value is equal.  
(Communication disabled when the set value is confused)
- ✓ When installing at other places after removal of PIO, be sure to reset it to a set value used at the installation place.
- ✓ Management history for code setting is needed.

## 16. Channel and frequency relationship (5GHz band)

| CH<br>(Channel)                                                                                                                                                                                                                                                                              | Frequenc<br>y<br>(MHz) | WLAN<br>Channe<br>l |      | CH<br>(Channel<br>) | Frequenc<br>y<br>(MHz) | WLAN<br>Channe<br>l |      | CH<br>(Channel<br>) | Frequenc<br>y<br>(MHz) | WLAN<br>Channe<br>l |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|---------------------|------|---------------------|------------------------|---------------------|------|---------------------|------------------------|---------------------|
| 128                                                                                                                                                                                                                                                                                          | 5725                   |                     |      | 168                 | 5765                   | 153                 |      | 208                 | 5805                   | 161                 |
| 129                                                                                                                                                                                                                                                                                          | 5726                   |                     |      | 169                 | 5766                   |                     |      | 209                 | 5806                   |                     |
| 130                                                                                                                                                                                                                                                                                          | 5727                   |                     |      | 170                 | 5767                   |                     |      | 210                 | 5807                   |                     |
| 131                                                                                                                                                                                                                                                                                          | 5728                   |                     |      | 171                 | 5768                   |                     |      | 211                 | 5808                   |                     |
| 132                                                                                                                                                                                                                                                                                          | 5729                   |                     |      | 172                 | 5769                   |                     |      | 212                 | 5809                   |                     |
| 133                                                                                                                                                                                                                                                                                          | 5730                   |                     |      | 173                 | 5770                   |                     |      | 213                 | 5810                   |                     |
| 134                                                                                                                                                                                                                                                                                          | 5731                   |                     |      | 174                 | 5771                   |                     |      | 214                 | 5811                   |                     |
| 135                                                                                                                                                                                                                                                                                          | 5732                   |                     |      | 175                 | 5772                   |                     |      | 215                 | 5812                   |                     |
| 136                                                                                                                                                                                                                                                                                          | 5733                   |                     |      | 176                 | 5773                   |                     |      | 216                 | 5813                   |                     |
| 137                                                                                                                                                                                                                                                                                          | 5734                   |                     |      | 177                 | 5774                   |                     |      | 217                 | 5814                   |                     |
| 138                                                                                                                                                                                                                                                                                          | 5735                   | 149                 |      | 178                 | 5775                   | 157                 |      | 218                 | 5815                   | 165                 |
| 139                                                                                                                                                                                                                                                                                          | 5736                   |                     |      | 179                 | 5776                   |                     |      | 219                 | 5816                   |                     |
| 140                                                                                                                                                                                                                                                                                          | 5737                   |                     |      | 180                 | 5777                   |                     |      | 220                 | 5817                   |                     |
| 141                                                                                                                                                                                                                                                                                          | 5738                   |                     |      | 181                 | 5778                   |                     |      | 221                 | 5818                   |                     |
| 142                                                                                                                                                                                                                                                                                          | 5739                   |                     |      | 182                 | 5779                   |                     |      | 222                 | 5819                   |                     |
| 143                                                                                                                                                                                                                                                                                          | 5740                   |                     |      | 183                 | 5780                   |                     |      | 223                 | 5820                   |                     |
| 144                                                                                                                                                                                                                                                                                          | 5741                   |                     |      | 184                 | 5781                   |                     |      | 224                 | 5821                   |                     |
| 145                                                                                                                                                                                                                                                                                          | 5742                   |                     |      | 185                 | 5782                   |                     |      | 225                 | 5822                   |                     |
| 146                                                                                                                                                                                                                                                                                          | 5743                   |                     |      | 186                 | 5783                   |                     |      | 226                 | 5823                   |                     |
| 147                                                                                                                                                                                                                                                                                          | 5744                   |                     |      | 187                 | 5784                   |                     |      | 227                 | 5824                   |                     |
| 148                                                                                                                                                                                                                                                                                          | 5745                   |                     |      | 188                 | 5785                   |                     |      | 228                 | 5825                   |                     |
| 149                                                                                                                                                                                                                                                                                          | 5746                   |                     |      | 189                 | 5786                   |                     |      | 229                 | 5826                   |                     |
| 150                                                                                                                                                                                                                                                                                          | 5747                   |                     |      | 190                 | 5787                   |                     |      | 230                 | 5827                   |                     |
| 151                                                                                                                                                                                                                                                                                          | 5748                   |                     |      | 191                 | 5788                   |                     |      | 231                 | 5828                   |                     |
| 152                                                                                                                                                                                                                                                                                          | 5749                   |                     |      | 192                 | 5789                   |                     |      | 232                 | 5829                   |                     |
| 153                                                                                                                                                                                                                                                                                          | 5750                   |                     |      | 193                 | 5790                   |                     |      | 233                 | 5930                   |                     |
| 154                                                                                                                                                                                                                                                                                          | 5751                   |                     |      | 194                 | 5791                   |                     |      | 234                 | 5831                   |                     |
| 155                                                                                                                                                                                                                                                                                          | 5752                   |                     |      | 195                 | 5792                   |                     |      | 235                 | 5832                   |                     |
| 156                                                                                                                                                                                                                                                                                          | 5753                   | 196                 | 5793 | 236                 | 5833                   |                     |      |                     |                        |                     |
| 157                                                                                                                                                                                                                                                                                          | 5754                   | 197                 | 5794 | 237                 | 5834                   |                     |      |                     |                        |                     |
| 158                                                                                                                                                                                                                                                                                          | 5755                   | 153                 |      | 198                 | 5795                   |                     | 238  | 5835                |                        |                     |
| 159                                                                                                                                                                                                                                                                                          | 5756                   |                     |      | 199                 | 5796                   |                     | 239  | 5836                |                        |                     |
| 160                                                                                                                                                                                                                                                                                          | 5757                   |                     |      | 200                 | 5797                   |                     | 240  | 5837                |                        |                     |
| 161                                                                                                                                                                                                                                                                                          | 5758                   |                     |      | 201                 | 5798                   |                     | 241  | 5838                |                        |                     |
| 162                                                                                                                                                                                                                                                                                          | 5759                   |                     |      | 202                 | 5799                   |                     | 242  | 5839                |                        |                     |
| 163                                                                                                                                                                                                                                                                                          | 5760                   |                     |      | 203                 | 5800                   |                     | 243  | 5840                |                        |                     |
| 164                                                                                                                                                                                                                                                                                          | 5761                   |                     |      | 204                 | 5801                   |                     | 244  | 5841                |                        |                     |
| 165                                                                                                                                                                                                                                                                                          | 5762                   |                     |      | 205                 | 5802                   |                     | 245  | 5842                |                        |                     |
| 166                                                                                                                                                                                                                                                                                          | 5763                   |                     |      | 206                 | 5803                   |                     | 246  | 5843                |                        |                     |
| 167                                                                                                                                                                                                                                                                                          | 5764                   |                     |      | 207                 | 5804                   | 247                 | 5844 |                     |                        |                     |
| *) The shaded area shall be checked for the availability by country.<br>If this band has to be used, please contact us.<br>*) In order to use this product stably, set the channel so that there is no frequency interference with other wireless devices such as wireless LAN or Bluetooth. |                        |                     |      |                     |                        |                     |      | 248                 | 5845                   |                     |
|                                                                                                                                                                                                                                                                                              |                        |                     |      |                     |                        |                     |      | 249                 | 5846                   |                     |
|                                                                                                                                                                                                                                                                                              |                        |                     |      |                     |                        |                     |      | 250                 | 5847                   |                     |
|                                                                                                                                                                                                                                                                                              |                        |                     |      |                     |                        |                     |      | 251                 | 5848                   |                     |
|                                                                                                                                                                                                                                                                                              |                        |                     |      |                     |                        |                     |      | 252                 | 5849                   |                     |
|                                                                                                                                                                                                                                                                                              |                        |                     |      |                     |                        |                     |      | 253                 | 5850                   |                     |
|                                                                                                                                                                                                                                                                                              |                        |                     |      |                     |                        |                     |      | 254                 | 5851                   |                     |
|                                                                                                                                                                                                                                                                                              |                        |                     |      |                     |                        |                     |      | 255                 | 5852                   |                     |

## 17. CHANNEL AND FREQUENCY RELATIONSHIP(2.4GHz BAND)

| CH<br>(Channel) | Frequency<br>(MHz) | WLAN<br>Channel | CH<br>(Channel) | Frequency<br>(MHz) | WLAN<br>Channel |
|-----------------|--------------------|-----------------|-----------------|--------------------|-----------------|
| 0               | 2400               |                 | 44              | 2444               |                 |
| 1               | 2401               |                 | 45              | 2445               |                 |
| 2               | 2402               |                 | 46              | 2446               |                 |
| 3               | 2403               |                 | 47              | 2447               | 8               |
| 4               | 2404               |                 | 48              | 2448               |                 |
| 5               | 2405               |                 | 49              | 2449               |                 |
| 6               | 2406               |                 | 50              | 2450               |                 |
| 7               | 2407               |                 | 51              | 2451               |                 |
| 8               | 2408               |                 | 52              | 2452               | 9               |
| 9               | 2409               |                 | 53              | 2453               |                 |
| 10              | 2410               |                 | 54              | 2454               |                 |
| 11              | 2411               |                 | 55              | 2455               |                 |
| 12              | 2412               | 1               | 56              | 2456               |                 |
| 13              | 2413               |                 | 57              | 2457               | 10              |
| 14              | 2414               |                 | 58              | 2458               |                 |
| 15              | 2415               |                 | 59              | 2459               |                 |
| 16              | 2416               |                 | 60              | 2460               |                 |
| 17              | 2417               | 2               | 61              | 2461               |                 |
| 18              | 2418               |                 | 62              | 2462               | 11              |
| 19              | 2419               |                 | 63              | 2463               |                 |
| 20              | 2420               |                 | 64              | 2464               |                 |
| 21              | 2421               |                 | 65              | 2465               |                 |
| 22              | 2422               | 3               | 66              | 2466               |                 |
| 23              | 2423               |                 | 67              | 2467               | 12              |
| 24              | 2424               |                 | 68              | 2468               |                 |
| 25              | 2425               |                 | 69              | 2469               |                 |
| 26              | 2426               |                 | 70              | 2470               |                 |
| 27              | 2427               | 4               | 71              | 2471               |                 |
| 28              | 2428               |                 | 72              | 2472               | 13              |
| 29              | 2429               |                 | 73              | 2473               |                 |
| 30              | 2430               |                 | 74              | 2474               |                 |
| 31              | 2431               |                 | 75              | 2475               |                 |
| 32              | 2432               | 5               | 76              | 2476               |                 |
| 33              | 2433               |                 | 77              | 2477               |                 |
| 34              | 2434               |                 | 78              | 2478               |                 |
| 35              | 2435               |                 | 79              | 2479               |                 |
| 36              | 2436               |                 | 80              | 2480               |                 |
| 37              | 2437               | 6               |                 |                    |                 |
| 38              | 2438               |                 |                 |                    |                 |
| 39              | 2439               |                 | 83              | 2483               |                 |
| 40              | 2440               |                 | 84              | 2484               | 14              |
| 41              | 2441               |                 |                 |                    |                 |
| 42              | 2442               | 7               |                 |                    |                 |
| 43              | 2443               |                 | 125             | 2525               |                 |

\*) The specification of this product is subject to changes without prior notice for improvement of performance.

**FCC Warning Statement**

FCC Part 15.19

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 Part 15.21

Any changes or modifications (including the antennas) to this device that are not expressly approved by the manufacturer may void the user's authority to operate the equipment.

**FCC RF Radiation Exposure Statement**

his equipment complies with FCC RF Radiation exposure limits set forth for an uncontrolled environment.

This device and its antenna must not be co-located or operating in conjunction with any other antenna or transmitter.

This equipment should be installed and operated with a minimum distance of 30 cm between the radiator and your body.

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.

Modifications not expressly approved by the manufacturer could void your authority to operate the equipment under FCC rules.