RFID Reader
(4 channels, EtherCAT)

Operation manual

CTS-STBR-AA Series (Ver 1.1)

cantops
캔탑스

1. Outline

This product is a RFID Reader which can read the tag (Transponder) of ISO 11785 standard using 134.2KHz. This is a product which is optimized in such a way that it can stably be operated in a diversity of noise environment, and it is used for logistics of semiconductor line.

The product is constituted with reader, antenna, and sensor as shown in <Fig. 1>. <Fig. 1-b> shows the antenna which is used together with the reader, and a specialized antenna can also be developed and used in accordanced with application. <Fig. 1-c> shows the sensor detecting FOUP, and for further information, please refer to the specification of sensors.

For this product, network function is strengthened so that ID and sensor information required for overall factory logistics can be collected and managed in real time by utilizing ethernet based industrial filed bus called EtherCAT.

(a) RFID reader

(b) Antenna

(c) FOUP detecting sensor

<Fig. 1> Shape of reader and antenna

Caution	☞ During the operation of reader, a high voltage of more than 200V is generated at the antenna. Therefore, cares shall be taken as there is a danger of electric shock if the wire around the antenna is touched. In addition, there is also the danger of electric shock when any part(s) at the case inside is touched. Never touch any part(s) at the board inside. ☞ Reader and antenna are in the optimally adjusted state to suit to the product of our company. If using another product, it can be the cause of part breakdown. ☞ In accordance with the type of this company's antenna, the setup value of the reader will be different, therefore, confirm the antenna which can be connected to the reader before the use. ☞ The frequency used by this reader is 120~140KHz. In order to use this product under the optimum state, install it at the location where the electric wave of this frequency band is not generated from surrounding appliances or equipments.

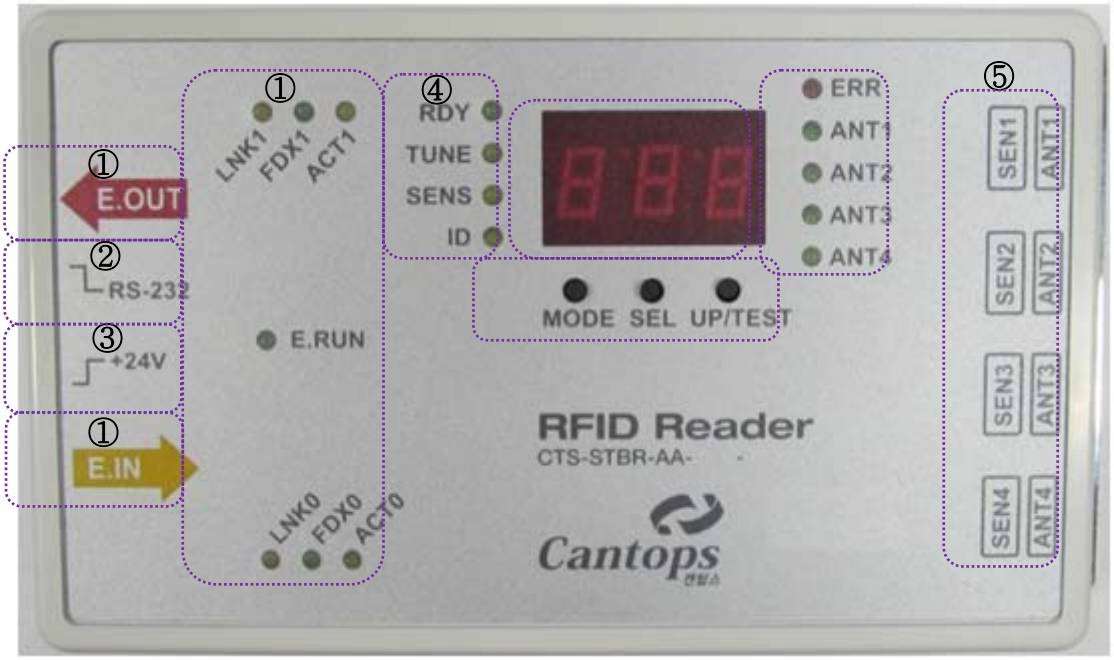
Main specification and installation environment of this product are shown in the following <Table 1>.

<Table 1> Main specification for RFID reader and antenna

Classification	Detailed item	Description
Reader	Frequency	134.2KHz
	Reading time*1)	150ms / Page
	Writing time	390ms / Page
	Maximum reading distance	80mm (There are differences in accordance with the types of antenna.)
	Maximum writing distance	35mm (There are differences in accordance with the types of antenna.)
	The number of connected antenna	Maximum 4 units
	The number of sensor input	Maximum 8 units (2 units/antenna channel), filtering function
	Firmware Upgrade	EtherCAT communication
	Additional function	Opening of antenna, detection of sensor abnormality, auto tuning, etc.
Cable of antenna	Diameter	3mm
	Bending diameter	45mm
	Length	0.1M ~ 3M (Optional item, in the unit of 10cm)
	Material	PVC
Head section of antenna	Size	43×30.5x12mm
	Material	Polycarbonate, black color
	Connector	43650-0200 (MOLEX)
Type of tag	RI-TRP-DR2B	17Page×64bit, Read/Write
Specification for communication	RS-232C	1 CH, Full Duplex, for the purpose of setting up
	Field Bus	EtherCAT, 100MHz
	Protocol	CoE, FoE, etc.
Manually operating section	LED indicating section	16 units, indicating mode and operating state
	7 Segment indicating section	3 units, ID, used for tuning
	Manually operating switch	3 units, for manually installing the reader without PC

Environment and safety	Storing environment	Temperature: -25 ~ 70°C Humidity: 5 ~ 95 %RH (However, there shall not be any condensing phenomenon.)
	Operating environment	Temperature: 0 ~ 50°C Humidity:35~85 %RH (However, there shall not be any condensing phenomenon.)
	Withstand voltage	More than 500V
Power source	Input voltage	DC 20V ~ 26V, 400mA
Size (W×H×D)		185×97×41.3mm (Excluding the protruding section of connector)
Material of case		Fixing plate:SCP1(Steel)??? Main body: Polycarbonate
Weight		Approx. 460g ???

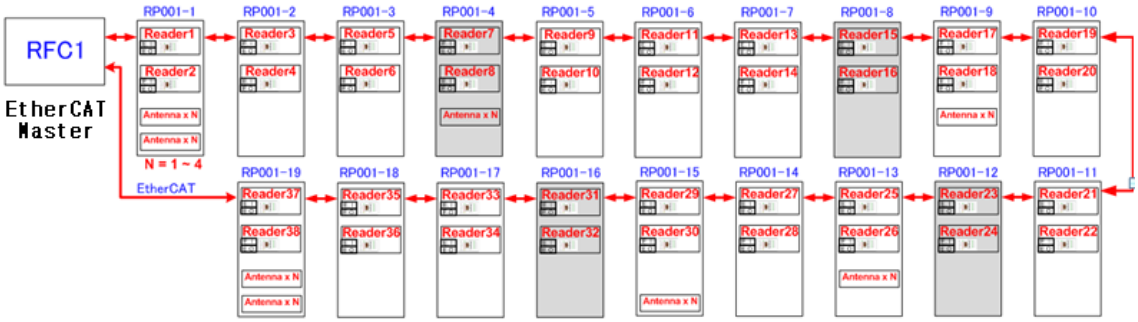
2. Function for each section



<Fig. 2> Arrangement diagram of main parts

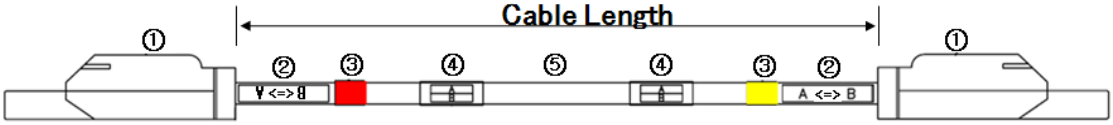
2.1 EtherCAT connector and indicating section

EtherCAT communication configuration, which connects ethernet communication line with the shape of daisy chain as shown in <Fig. 3>, is an industrial ethernet communication standard of conducting real time communication with 100MHz. In order to have this kind of daisy chain shape wiring, there are 2 communication ports in a reader, and E.IN is connected to E.OUT of the previous reader, and E.OUT is connected to E.IN of the next reader.



<Fig. 3> Basic configuration diagram of EtherCAT system

Communication line is constituted with the shape as shown in the following <Fig. 4>.



<Fig. 4> Configuration diagram of EtherCAT cable

<Table 2> Specification of cable parts

Description	Specification	Maker	Q`ty	Remark
① Plug	6GK1 901-1BB10-2AA0	Siemens	2EA	CN1 CN2
② Label 1	Starting point (A), indicating the ending point (B), thermally shrunken transparent tube, attached to the location 10mm away from the connector end			
③ Classification of input/output port	Attaching color tape at the cable end (Tape width is 10mm.)			
	Input: Yellow		1EA	
	Output: Red or orange color		1EA	
④ Label 2	Starting point (A), indicating the ending point (B), thermally shrunken transparent tube, attached to the side of ②			
⑤ Cable	AWG#22, 2Pair, SFTP, Profinet Type B	Siemens	1EA	

Wiring diagram of EtherCAT cable is as shown in the following <Table 3 >.

<Table 3> Wiring diagram of EtherCAT cable

CN1	Color	Function	CN2
1	Yellow	Tx+	1
2	Orange	Tx-	2
3	White	Rx+	3
4	N.C	-	4
5	N.C	-	5
6	Blue	Rx-	6
7	N.C	-	7
8	N.C	-	8
Shell	Shield braiding wire	Shield	Shell

The items to be careful about when connecting the communication line are that the inscription marked at the starting point (A) and ending point (B) of cable shall be corresponded to the unit number attached to the reader, and connection shall be made as shown in <Fig. 5> so that the colors (red and yellow) indicated at the cable shall be agreed with those of E.OUT(red) and E.IN(yellow) located at the case of the reader.

<Previous position: A>	<Current position: B>	<Next position: C>

<Fig. 5> Connection method of EtherCAT cable

Operation state of EtherCAT is indicated with the 7 units of state indication LEDs.

From the E.RUN LED, connecting state of EtherCAT communication port can be grasped as follows.

E.RUN	State
Off	When EtherCAT is at INIT which is the initial communication state
Slowly flickering	When curret state is at Pre-OP mode
Lighted once	When curret state is at Safe-OP mode
Continously turned on	When it is in normal operation mode after completing initialization
Rapidly flickering	When it is in bootstrap mode

LNK0(E.IN) and LNK1(E.OUT) LED indicate following state for each of the ports.

LNK0, or LNK1	State
Off	When communication line is not connected
Flickering	When EtherCAT communication is underway as communication line is connected
Continously turned on	When it is the state of connection only without communication

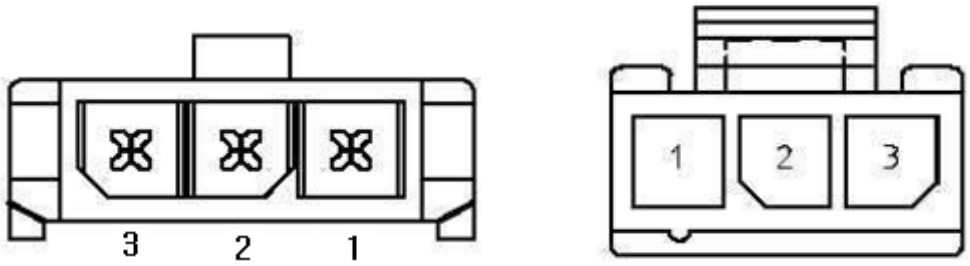
FDX0 and FDX1 are the function of indicating communication velocity, and in the case of EtherCAT, it uses the communication velocity of 100MHz as the basis, therefore, under the normal connecting state of EtherCAT communication line, the continously turned on state shall always be maintained.

ACT0(E.IN) and ACT1(E.OUT) indicate following state for each of the ports.

ACT0, or ACT1	State
Off	When communication line is not connected
Flickering	When EtherCAT communication is underway as communication line is connected
Continously turned on	When it is the state of connection only without communication

2.2 RS-232C communication connector

This is a serial communication port in which the reader is connected with PC for simple setup and state confirmation without using EtherCAT communication. The connector used in the connection is 43650-0300(Molex). For pin arrangement and function, refer to <Table 4>.



(a) Header : Reader (b) Receptacle : Cable

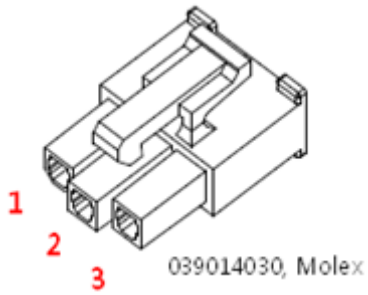
<Fig. 6> Arrangement of pin number of RS-232C communication port

<Table 4> Arrangement of RS-232 connector pin

Reader	Function		**TxD**	**RxD**		**GND**				
	Number		**2**	**1**		**3**				
Computer/high rank	Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
	Function	**x**	**RxD**	**TxD**	**x**	**GND**	**x**	**x**	**x**	**x**

2.3 Power input connector

Power source applied to reader is DC +24V, and pin numbers are as shown in the following Figure.



<Fig. 7> Power input connector

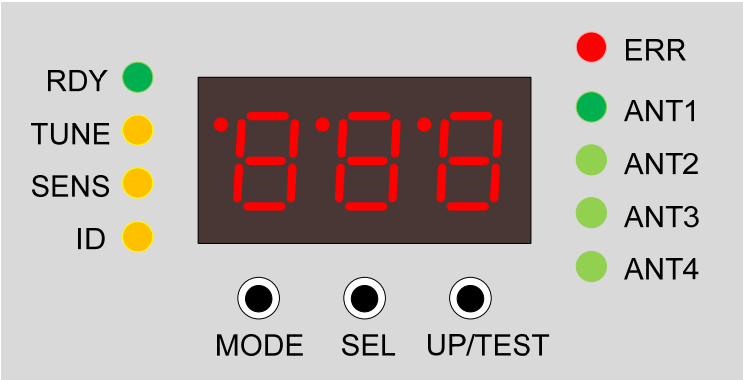
Pin number	1	2	3
Function	FG	GND	+24V
Name of connector	39303035, Molex		
Connector for cable	039014030, Molex		

2.4 Manually operating section

This is the operating section which is used when tuning the antenna for displaying the highest performance of RFID Reader and setting the noise environment analysis function and ID required for communication with host. This is a convenient function which can verify all functions with the reader itself without PC so that setup can easily be conducted at the job site.

Operation state of reader is indicated with 4 LEDs located at the left side of the manually operating section, and ID number and a variety of states are indicated with 7 sgment located at

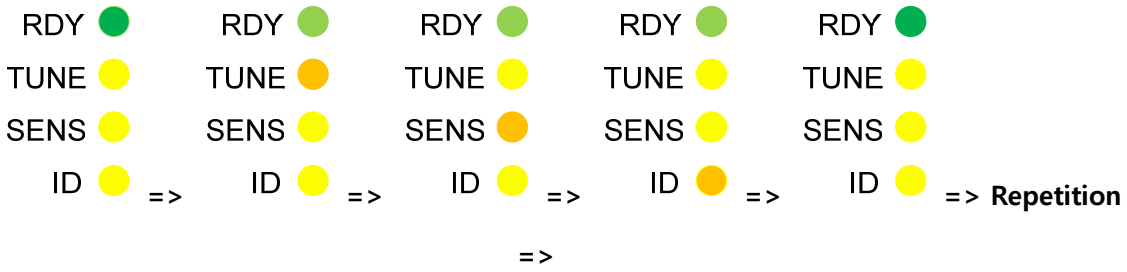
the middle, and the antenna channel under operation is indicated with 4 LEDs located at the right side, and the reader is operated with 3 switches located at lower section. ERR LED located at the top right side indicates the latest reading result.



<Fig. 8> Manually operating section

a) LED for indicating operation mode

Operation mode of reader is indicated with 4 LEDs. For selection of mode, if pressing the mode switch, the mode is changed as the LED of corresponding mode is sequentially lighted from the upper to lower section.



<Fig. 9> LED for indicating mode

<Table 5> Description of function of LED for indicating mode

Name of LED	Function	Remarks
RDY	This is the LED which is lighted under the state of being able to read or write the tag, and unless it is the state of reader setup mode, it shall always be lighted in normal situation.	Green
TUNE	This is the LED which is lighted when it is the antenna tuning mode.	Yellow
SENS	This is the LED which is lighted when it is the mode for measuring the noise deserted around the antenna under the state of installing reader and antenna in the actural operation environment	Yellow
ID	This is the LED which is lighted when setting up individual numbers to 4 antennas and reader, respectively	Yellow

b) 7 Segment section

This is used for indicating the operation state of reader and individual numbers (ID) of reader and antenna, and displaying the state of noise level, antenna output tuning value, and so forth with numerals. The segment is constituted with 3-digit, and a diversity of states are indicated for each of the modes.

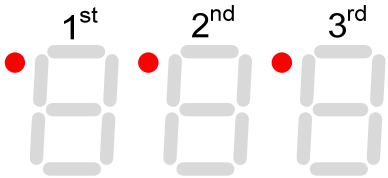
<Fig. 10> 3 Digit 7 Segment

Those numerals and characters indicated through 7 Segment are as shown in the following <Table 6>.

<Table 6> Details of numeral and character indication with 7 Segment

Indicated numeral	Indicated contents	Indicated numeral	Indicated contents	Indicated character	Indicated contents
0		5		S	
1		6		c	
2		7		E	
3		8		r	
4		9			

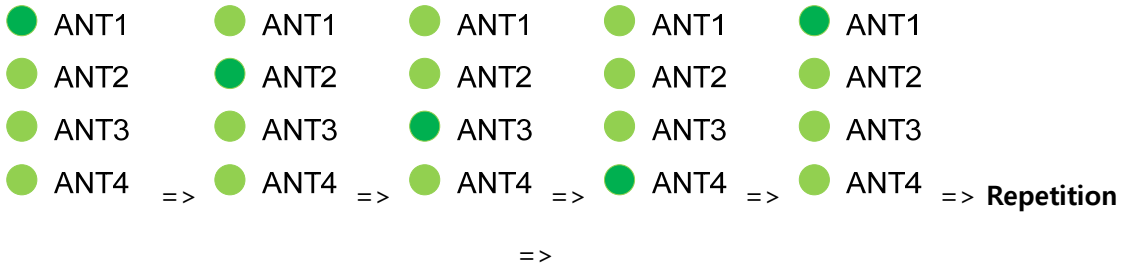
The red dot at the top left side of Segment in <Fig. 10> displays a variety of indications at each of the modes. The dot at the first segment is lighted when the command inputted through EtherCAT communication or button is performed, and the dot at the second segment is lighted when the Sensor2(HOME Sensor) input is ON, and the dot at the third segment is lighted when the Sensor1(FOUP Sensor) input is ON. In addition, from the ID setup mode, the location of digit number to be set up is indicated.



<Fig. 11> Dot indication of 7 Segment

c) LED for indicating antenna channel

The antenna under operation is indicated with 4 LEDs. For selecting antenna, if pressing SEL switch, corresponding antenna will sequentially (from No. 1 to No. 4) be selected.



<Fig. 12> LED for indicating antenna channel

d) LED for indicating error

When error is occurred under the operation of reading or writing the tag, the error LED is lighted. Error state is remembered by the reader inside for each channel, and even when the selection of antenna is changed, the latest error state is indicated at LED.

<Fig. 13> LED for indicating error

e) Switch for manual operation

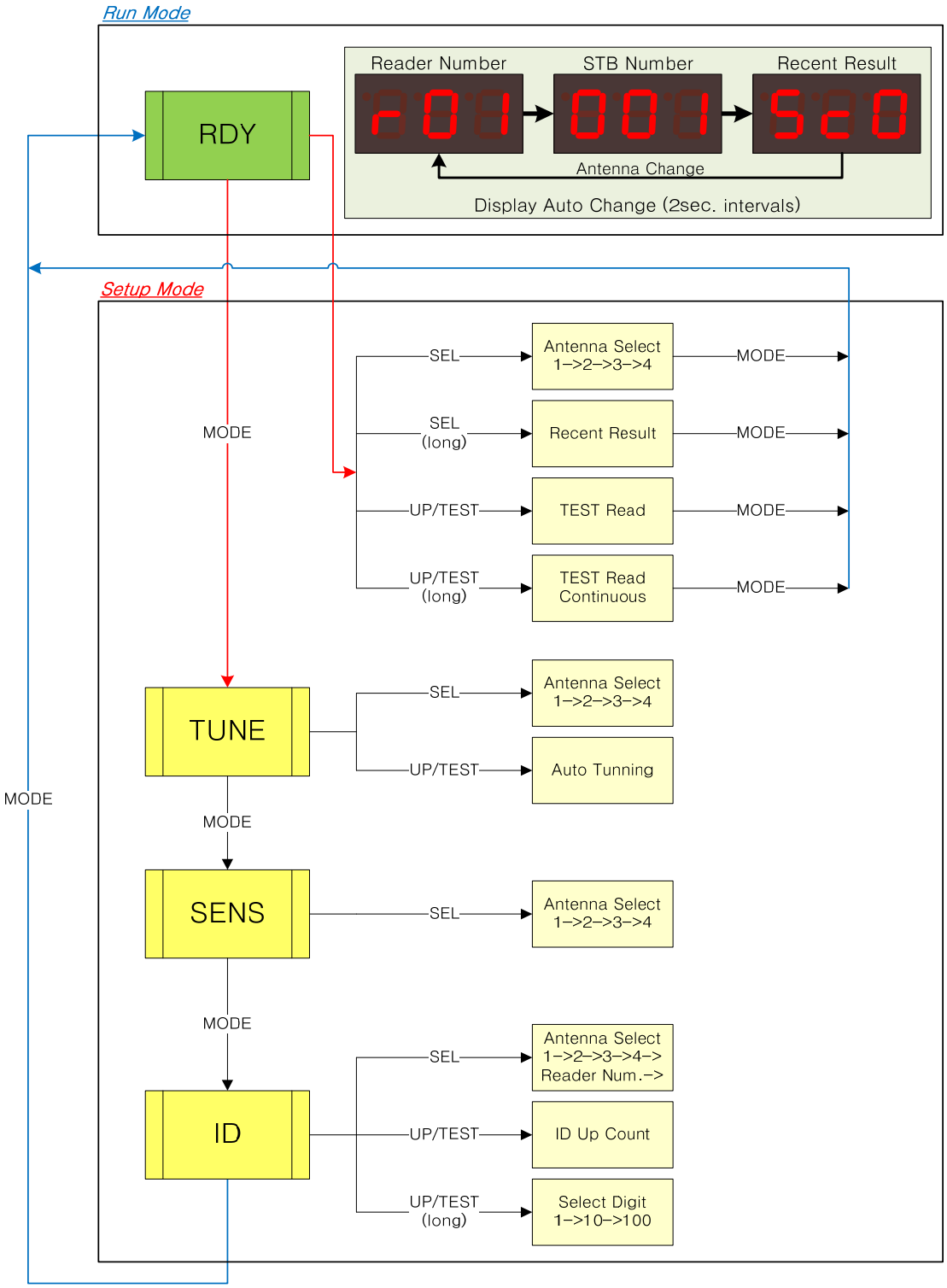
There are 3 switches for manual operation, and each of their functions is as shown in the following <Table 7>.

<Fig. 14> Manual operation switch

<Table 7> Function of switch

Name of switch	Function	Remarks
MODE	When this button is pressed, 3 types of setup modes (TUNE, SENS, ID) can sequentially be selected. If the function of reading and writing data on the tag is to be used, press the MODE switch so that RDY LED is lighted.	
SEL	This is the button of selecting antenna channel. When pressing this button, the antennas of 4 channels can sequentially be selected. Whenever pressing the button, the antenna to be used will be selected in the order of the number 1 -> 2 -> 3 -> 4.	
UP/TEST	① **RDY mode:** Whenever pressing this button with the function of manually reading the data in the tag, the tag data is read once a time. When this switch is pressed for the duration of more than 1 second, continuous reading mode is operated. If it is wanted to get out of this continuous reading mode, simply press this button once more. This action can be operated only under the turning on state of READY LED which is not a setup mode. ② **TUNE mode:** When the tuning mode is activated, this is used in the same way as that of general enter key. ③ **SENS mode:** No operation is conducted. ④ **ID setup mode**: This is used as the function of increasing the number indicated at the 7 Segment one by one. When this switch is pressed with the duration of more than 1 second, it will be used as the function of changing the digit to be set up. The digit is changed in the order of single-digit -> double-digit -> three-digit.	Read Page = 15

f) Sequence diagram of panel operation



<Fig. 15> Sequence diagram of panel operation

g) Description of panel operation

ⓐ RDY MODE

This is the function for testing the reading of the tag data by the reader independently without high rank host. It can simply be activated by pressing the UP/TEST switch under the turning on state of RDY LED after coming out of setup mode with the MODE switch. With this mode, the data in the page 15 of the tag will be read.

<Fig. 16> Indicating state of RDY MODE

When the test of manually reading the tag from the reader is conducted, Er(Reading failed) and Sc(Reading succeeded) are indicated through the indication window as shown in <Table 8>. In the third digit of the Segment, the number of re-attempted reading is indicated in the case of succeeded reading, and error code is indicated in the case of failed reading.

<Table 8> Contents of state indication during the reading operation of tag

State	Contents of indication	State	Contents of indication
Sc(No error)	Sc0	Er(Error is generated)	Er5

The error codes at the time of failed reading are as shown in the following <Table 9>.

<Table 9> Type of error code

Code	State	Remarks
'4'	When writing the data on the tag is failed	
'5'	When there is no tag	
'6'	When the type of tag is different from that of the received command	
'7'	When the check sum error is generated from the tag	
'8'	Communication error with the tag	
'9'	When there is no antenna or when problem is occurred for installing the antenna	

ⓑ TUNE MODE

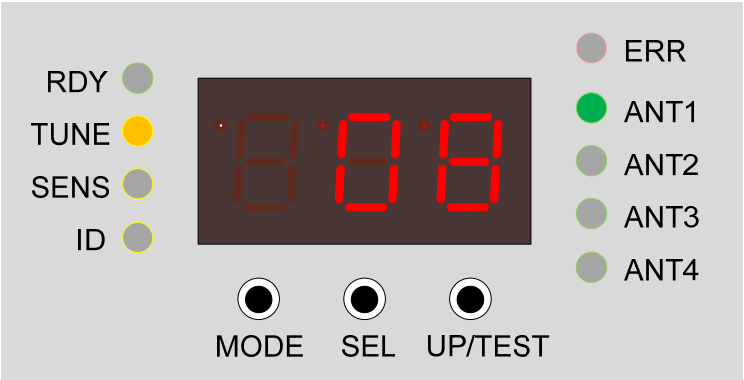
Basic principle of RFID is to transmit and receive data in accordance with mutually decided agreement after supplying power to the Tag(Transponder) by producing high voltage signal from antenna. This high voltage signal is created by the LC resonance from the oscillation circuit of antenna and reader inside, and, in general, the higher this oscillated voltage becomes, the lengthier will be the reading distance.

This TUNE(Tx Tuning) mode is the function of tuning internal circuit in such a way that transmitting voltage of antenna becomes the highest one. This is the function to be conducted in the first place in order to have a stable operation after installing the reader.

Setup value is indicated at the 7 Segment, and it will be adjusted to 16 steps from 00 to 15.

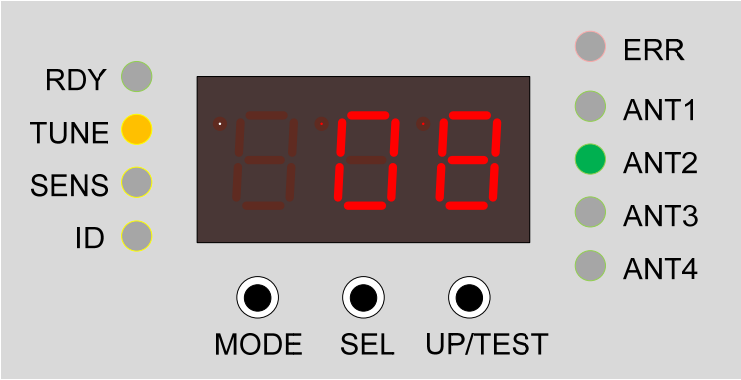
<Fig. 17> is the initial indication state under the TUNE mode. In the initial state, currently set up tuning value is displayed. When UP/TEST button is pressed, tuning is started. It takes around 1 second for the tuning, and when the tuning is finished, a new setup value is indicated at the 7 Segment. This value is automatically saved and used internally, therefore, a separate recording is not required.

If antenna is not connected or if there is problem for the wiring of antenna, measuring value of transmitting voltage may become too low during the Tx Tuning. In this case, the resultant value after the tuning is not applied, and the previous setup value will be maintained as it is. In the 7 Segment, 'Err' is indicated as shown in <Fig. 18>. In this circumstances, Tx Tuning shall be attempted again after confirming the connecting state of antenna. When SEL button is pressed to change the channel of antenna, each of the antennas can be selected in the order of ANT1 -> ANT2 -> ANT3 -> ANT4. The case of selecting No. 2 antenna is shown in <Fig. 19>.



<Fig. 17> Indicating state of TUNE MODE

<Fig. 18> Indication of tuning error state



<Fig. 19> Indication of ANT2 state

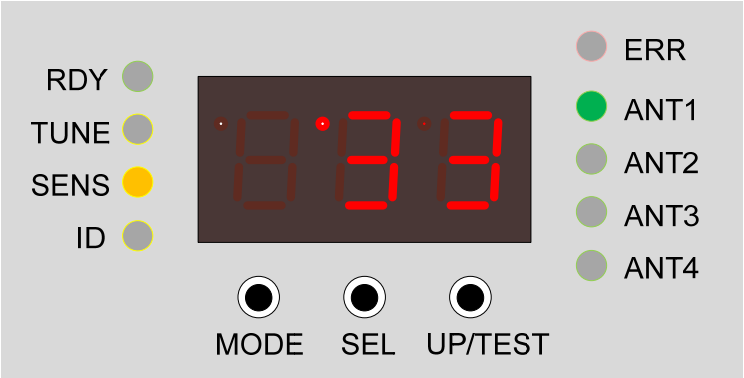
ⓒ SENS MODE

In the case of RFID, communication between Tag and antenna is conducted by using the

frequency of around 130KHz. This frequency of around 130KHz is the electromagnetic wave which can generally be created during the switching of semiconductor for motor or power. Therefore, under the deteriorated environment with this kind of switching element, normal operation of RFID is difficult to expect. This SENS(Rx Sensitivity) mode is the function of indicating the strength of noise around the frequency of 130KHz. With this function, the antenna can be installed at the location without noise, and the noise level can directly be confirmed when corrective measures are prepared for other appliances, therefore, it is a convenient function of rapidly providing the optimum measures.

<Fig. 20> is the example of indicating the operation state of this mode, and the indicated value is 00 ~ 99, and the lower value indicates the state of not having the noise. Therefore, please set up the surronding environment so that the value ouputted from the 7 Segment becomes "00" as much as possible. Especially, when this value becomes more than "70", the reading performance may be dropped by external noise, therefore, a sufficient corrective measures shall be established.

When entering to SENS mode, Rx Sensitivity action is started, and the noise level will continously be indicated at the 7 Segment as shown in <Fig. 20>.



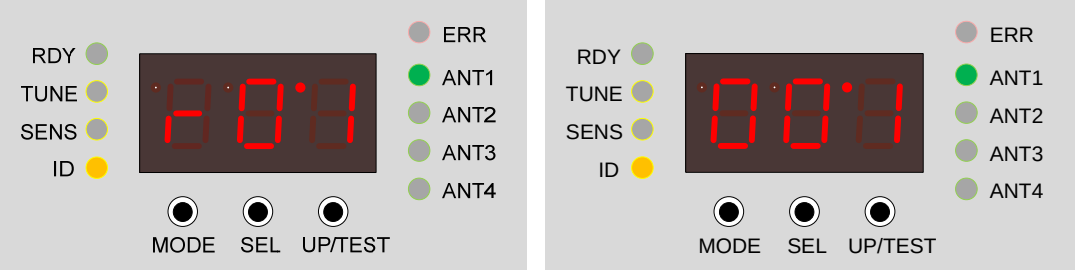
<Fig. 20> Operation result of SENS MODE

ⓓ ID MODE

This is the function of setting up the individual number of the reader, and 1 reader number and 4 STB (antenna) numbers can be set up. For the reader number, 64 numbers can be set up in the range of r01 ~ r64, and for the STB (antenna) number, 255 IDs can be set up in the range of 001 ~ 255. Basic setup value is "r00" and "000", respectively, and the reader set up as "000" becomes a disabled state in which no operation is conducted. Cares shall be taken not to have

the identical ID.

When UP/TEST button is pressed under ID setup mode, the number of selected digit will be increased one by one. When UP/TEST button is pressed with the duration of more than 1 second, it is used as the function of changing the digit to be set up. The digit is changed in the order of single-digit -> double-digit -> three-digit.



<Fig. 21> Indicating state of reader number (left) and STB number (right) of ID MODE

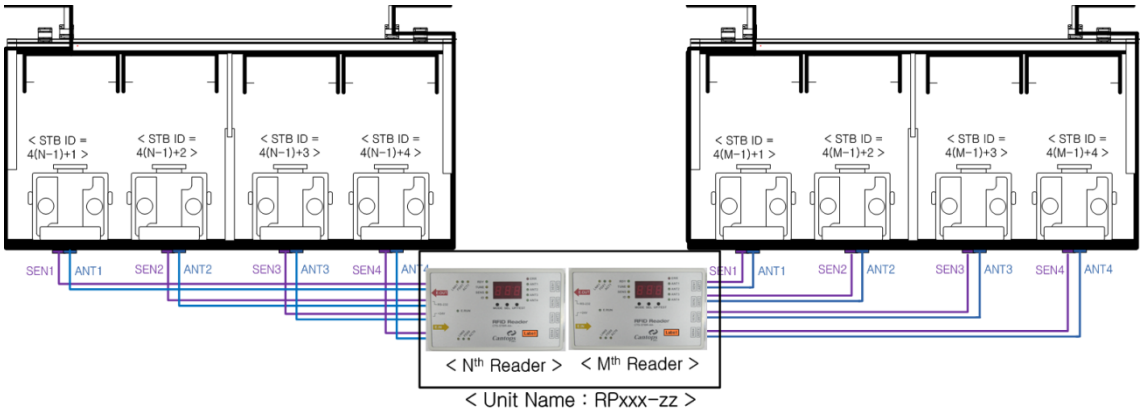
<Table 10> Indication of ID setup digit state

	Setting up the second digit of the Reader	Setting up the first digit of the Reader
Setting up the third digit of STB	Setting up the second digit of STB	Setting up the first digit of STB

2.5 Antenna and sensor linking connector

From this reader, maximum 4 antennas and sensor can be connected as shown in <Fig. 22>. The occasions that reading work is conducted by RFID reader are the unit reading command through EtherCAT communication, the Verify command which confirms the state of FOUP and tag data, the function of automatic reading at the time when the FOUP sensor becomes changed from Off to On, and the reading function under the manual operation mode. In this way, except manual mode and simple reading command, operation is always

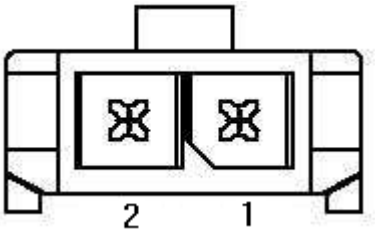
conducted in connection with FOUP sensor in actual operation environment, therefore, it shall always be operated with the same number.



<Fig. 22> Example of using antenna and sensor

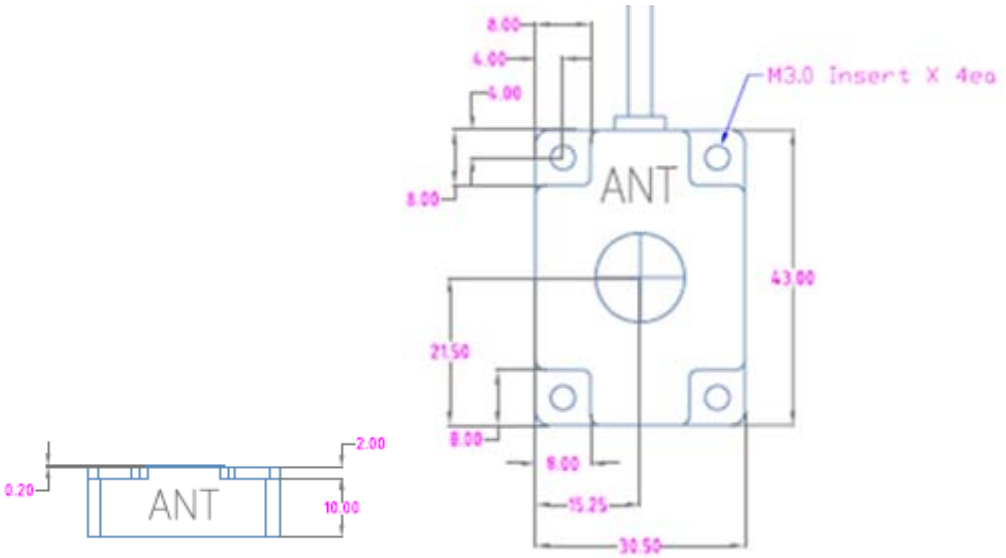
The antenna and sensor cable provided by this company are supposed to be linked to this connector, and separation and connection of antenna and sensor cable shall always be conducted under turned off or disabled state of power.

This antenna is the one made in such a way that it can have the reading by attaching to the plate such as STB which saves FOUP, or UTB, etc. When special products such as different shape or reading performance, cable length, and so forth are required, please contact with this company.

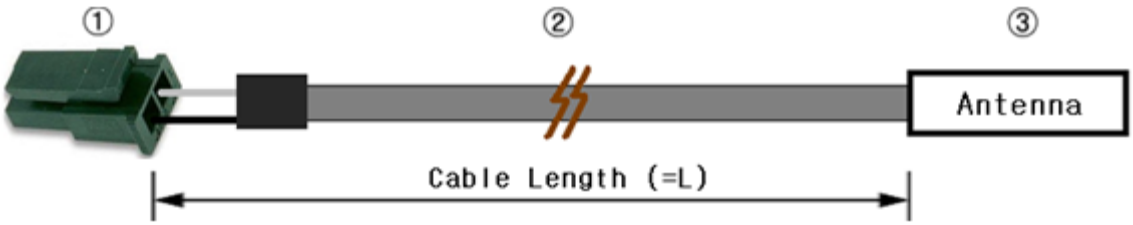


Pin number	1	2
Function	ANT+	ANT-
Name of connector	43650-0200, Molex	
Connector for cable	42645-0200, Molex	

<Fig. 23> Arrangement of antenna connector pin



<Fig. 24> Size of antenna head section



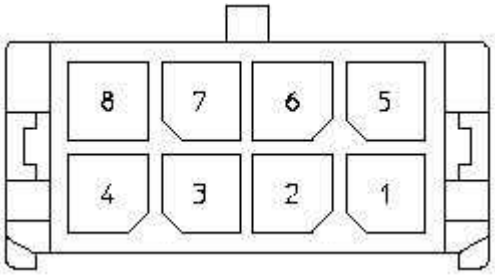
Description	Specification	Maker	Q`ty	Remark
① Connector	Housing : 42645-0200 Terminal : 43030-0002	Molex	1EA 2EA	
② Cable	AWG#22, 1 strand, Shield, UL1185, Grey	CanTops	1EA	
③ Antenna head	43x30.5x12mm, Polycarbonate, black	CanTops	1EA	

<Fig. 25> Constitution of antenna cable

⚠ Caution	☞ As high voltage is being flown in this antenna connector, do not touch it because there is the danger of electric shock when it is touched. Attaching and detaching the cable during the operation of the reader is extremely dangerous. Connecting and separating work of cable shall always be conducted under the turned off state of electric power. ☞ Only the cable manufactured by this company shall be used as the antenna cable, and when the extenstion of cable is unavoidable, taked care that all wires shall not touch external appliances,

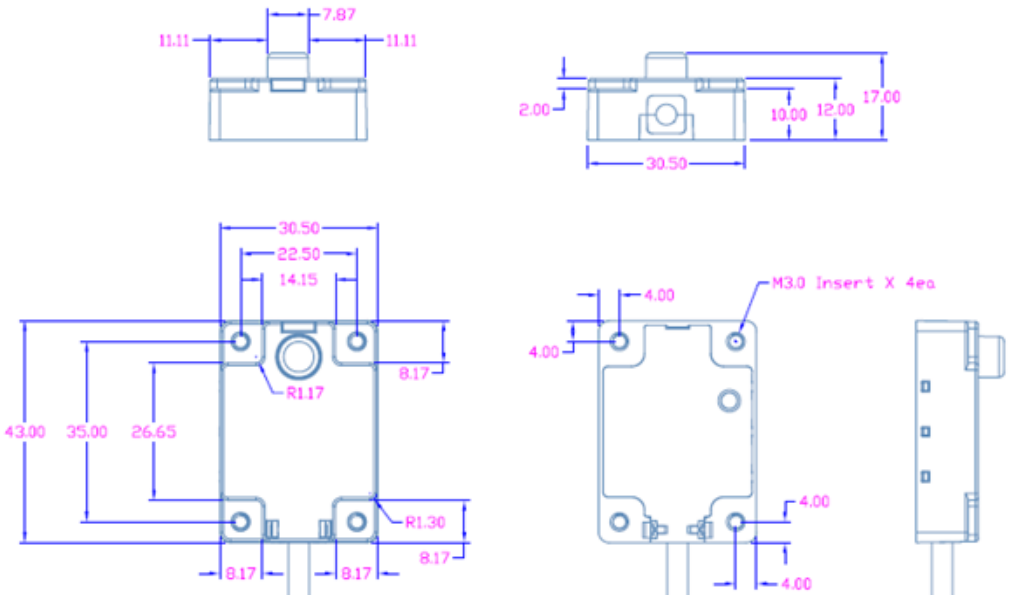
	grounding wire, etc. ☞ Conductor, cable, and so forth shall be away from the vicinity of antenna head as much as possible. Otherwise, reading performance can be deteriorated. ☞ The shapes of antenna and sensor are the same with each other, therefore, cares shall be taken to have wiring of antenna and sensor to the same number during the installation. ☞ When antenna is installed for the first time or when surrounding circumstances are changed, a new tuning shall definitely be conducted in order to have the optimum operating condition for the reader.

Connecting specification and configuration diagram of the sensors which detect the state of FOUP are as shown in the following Figure. Pin numbers are based on the view from the connector actually installed in the board. Basically, 2 sensors can be interlocked with 1 antenna, however, basic operation is conducted with 1 FOUP sensor. Additional sensor can be used by connecting with general sensor other than FOUP detecting sensor. Check IN1 & 2 are the signals outputted from the reader for checking in advance the change of sensitivity and life of sensors. With this function, abnormality of the function related with the sensitivity of sensors installed at the entire line can systematically be managed.

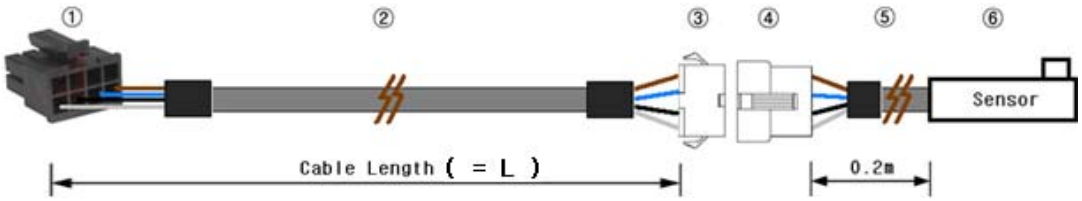


Pin number	1	2	3	4	5	6	7	8
Function	+24V	GND	Sensor OUT1 (FOUP Sensor)	Check IN1	+24V	GND	Sensor OUT2 (Home Sensor)	Check IN2
Name of connector	43045-0800, Molex							
Connector for cable	43025-0800, Molex							

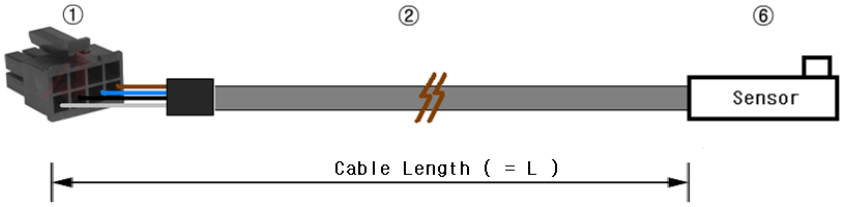
<Fig. 26> Arrangement of sensor connector pin



<Fig. 27> Size of sensor head section



(a) Head separation type



(b) Head integration type

Description	Specification	Maker	Q`ty	Remark
① Housing	Housing : 43025-0800 Terminal : 43030-0001	Molex	1EA 4EA	
② Cable	4C X 24AWG, UL2464	Gwangil Electric	L	
③ Housing	SMP-04V-NC, 4 Pin, Plug(Socket) SHF-001T-0.8BS	JST	1EA 4EA	
④ Housing	SMR-04V-N, 4 Pin, Receptacle(Pin) SYM-001T-P0.6	JST	1EA 4EA	

⑤ Cable	4C X 24AWG, UL2464	Gwangil Electric	0.2m	
⑥ Sensor Head	Main body of sensor	CanTops	1EA	

<Fig. 28> Constitution of sensor cable

When FOUP sensor is operated in actual using environment, there is an unstable period in which signal becomes On/Off in the transient state. This unstable time of signal can be set up as the time constant of filter. For detailed information, refer to the setup parameter.

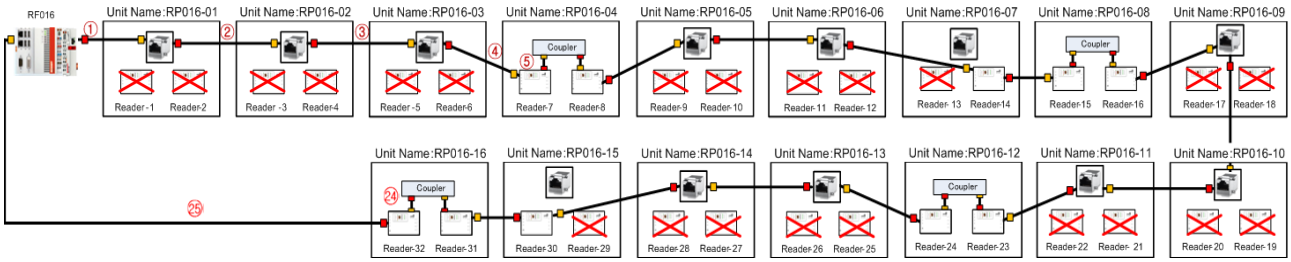
Caution	☞ Optical type sensor is used at the FOUP detecting sensor inside. Therefore, when particles are flown in from outside, abnormality of FOUP detection can be occurred because sensitivity of sensor is deteriorated. Periodic inspection of sensor state is required.

3. EtherCAT connection and communication specification

3.1 Connecting method of EtherCAT

Although it is different in accordance with the configuration of system, readers, in general, are not installed once and for all, but extension is conducted during the line expansion. However, in the case of basic infrastructure required such as overall network, power lines, and so forth, it can be efficient to install them during the initial investment. The following <Fig. 29> is the example of connecting only 10 units after constituting the network so that maximum 32 units of readers can be connected. Maximum 64 units of readers can be connected to one EtherCAT Master, and in the case of antenna, up to the total 255 units can be used.

As the number of the reader connected to EtherCAT Master, a serial number is given and this serial number is also applied to the number of the antenna connected to the reader. For the antenna which is not used, No. 0 can simply be designated. In the case of the nth reader, the ID numbers of 4(n-1)+1, 4(n-1)+2, 4(n-1)+3, and 4(n-1)+4 can be designated.



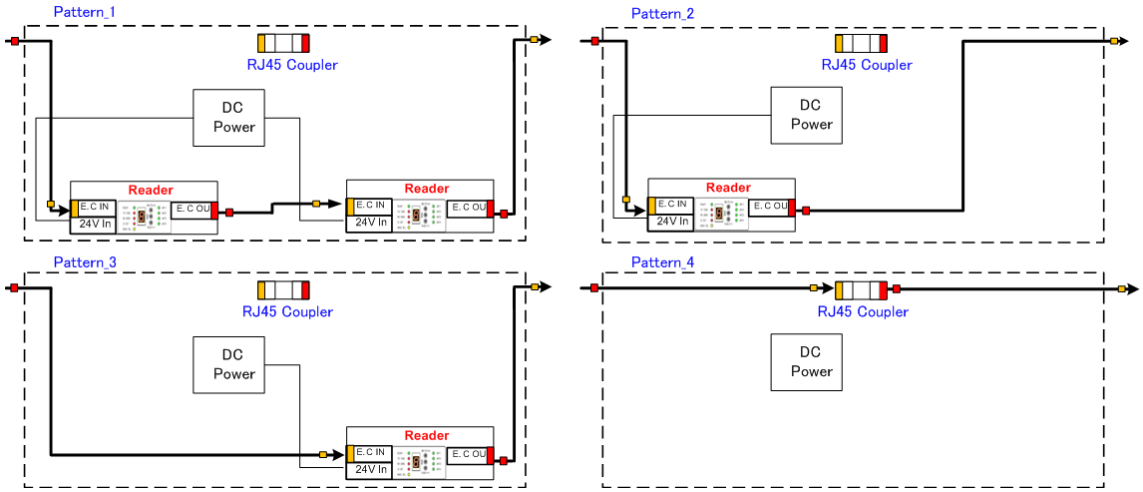
<Fig. 29> Example of EtherCAT wiring

2 readers are installed in a unit, and for the sake of this expansibility, communication line is connected with RJ45 Coupler or EtherCAT Coupler as shown in <Fig. 30>. In general, LAN line is connected with RJ45 coupler, and when more than 3 units of this coupler are to be used, EtherCAT Coupler shall always be installed. Once a coupler is installed, it shall always be remained at the fixed location.

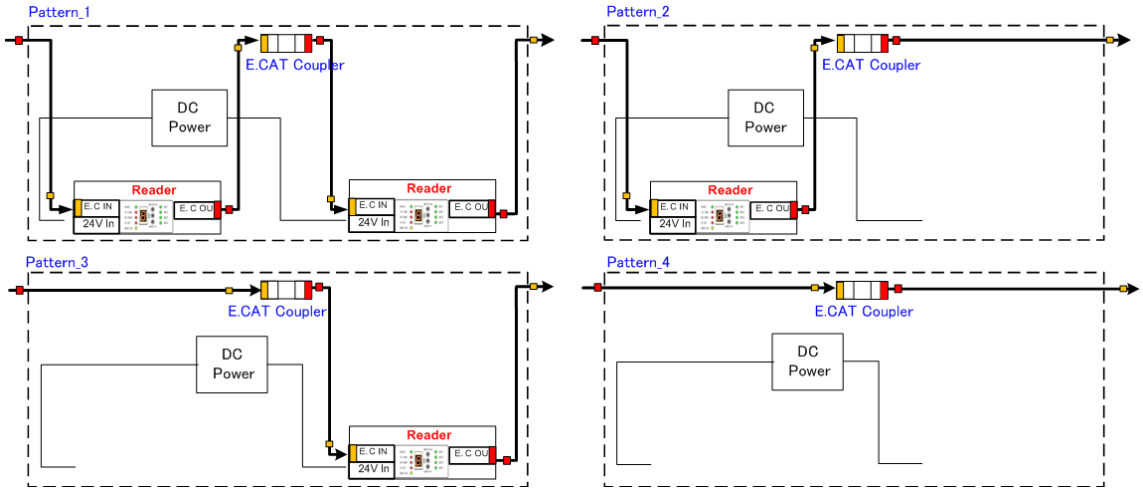
(a) RJ45 Coupler (b) EtherCAT Coupler

<Fig. 30> Type of coupler

The method of wiring the LAN line in accordance with the existence and nonexistence of reader is as shown in <Fig. 31>. When the reader is to be installed in the unit where RJ45 Coupler is used, RJ45 Coupler will not be used. In the structure where EtherCAT Coupler has been used, the wiring shall always be conducted with the structure of using EtherCAT Coupler.



(a) Internal wiring diagram of the unit constituted with RJ45 Coupler



(b) Internal wiring diagram of the unit constituted with EtherCAT Coupler

<Fig. 31> Internal wiring diagram of the unit considering expansibility in the future

3.2 Structure of EtherCAT communication

The structure of transmitting and receiving data between EtherCAT Master and Slave(Reader) is to have the communication in real time by loading the data packet for EtherCAT on the basic Ethernet communication frame as shown in <Fig. 32>. From this reader (Slave), data is renewed with the cycle of 10ms, and maximum 255 units of antenna can be used.

통신 주기	Communication cycle

<Fig. 32> EtherCAT communication flow

In order to transmit cyclical data in real time, PDO(Process Data Objects) which is a cyclic data is

to be used. PDO data format of this reader is as shown in the following <Fig. 33>.

TxPDO (96Byte) : Slave -> Master

(2Byte)	(2Byte)	(2Byte)	(2Byte)	(22Byte)	(22Byte)	(22Byte)	(22Byte)
RFID Error Code 0x2000.1	RFID Status 0x2000.2	Comm Ack. 0x3000.3	Alive Counter 0x4000.2	Antena 1 0x21XX	Antena 2 0x22XX	Antena 3 0x23XX	Antena 4 0x24XX

(2Byte)	(2Byte)	(2Byte)	(8Byte)	(8Byte)
STB Number 0x2101.1	STB Error Code 0x2100.1	STB Status 0x2100.2	PageData 1 0x2102.1	PageData 2 0x2103.2

RxPDO (18Byte) : Master -> Slave

(2Byte)	(14Byte)
Alive Counter 0x4000.1	Command 0x3000.1, 2, 4, 5, 6, 7, 8

<Fig. 33> Configuration of PDO data

3.3 PDO map list

System Parameters

Index	*Sub Index*	*Size*	*Name*	*RW*	*Range*	*Default*	*Refer*
0x1000		4	Device Type	RO		0x00001389	
0x1001		2	Error Register	RO		0x0000	
0x1008		2	Device Name	RO		0x0001	
0x1009		2	Hardware Version	RO		0x0013	*1
0x100A		2	Software Version	RO		0x0012	*1

RFID Reader Parameters

Index	*Sub Index*	*Size*	*Name*		*RW*	*Range*	*Default*	*Refer*
0x2000 RFID Error and Status	*0*	*2*	*Sub Index Number*					
	1	2	RFID Reader Error Code		RO	0x0000 ~ 0x00ff	0x0000	
			LSB	RFID Error Code	RO			*2
			MSB		RO			
	2	2	RFID Reader Status		RO	0x0000 ~	0x0000	

						0xffff		
			0	RFID Reader Ready	RO	0 ~ 1	0	Ready=1
			1	Reserved	RO	0 ~ 1	0	
			2	Reserved	RO	0 ~ 1	0	
			3	E.CAT IN Connect	RO	0 ~ 1	0	Connect=1
			4	E.CAT OUT Connect	RO	0 ~ 1	0	Connect=1
			5	Reserved	RO	0 ~ 1	0	
			6	Firmware Download Status	RO	0 ~ 1	1	*3
			7	Command Done Flag	RO	0 ~ 1	1	*4
			8	Reserved	RO	0 ~ 1	0	
			9	Reserved	RO	0 ~ 1	0	
			10	Reserved	RO	0 ~ 1	0	
			11	Reserved	RO	0 ~ 1	0	
			12	Reserved	RO	0 ~ 1	0	
			13	Reserved	RO	0 ~ 1	0	
			14	Reserved	RO	0 ~ 1	0	
			15	Reserved	RO	0 ~ 1	0	
0x2001	*0*	*2*	*Sub Index Number*					
	1	2	RFID Reader ID		RW	1 ~ 64	0	
RFID Parameter	2	2	UART Baud rate		RW	0 ~ 5	5	5=115200
	3	2	Tx Duty		RW	0 ~ 99	50	(%)
	4	2	Tx Start Duty		RW	0 ~ 99	50	(%)
	5	2	Tx Start Time		RW	0 ~ 255	100	(us)
	6	2	Charge Time		RW	20 ~ 255	60	(ms)
	7	2	Rx Sensitivity Low Voltage		RW	0 ~ 30	8	(0.1V)
	8	2	Rx Sensitivity High Voltage		RW	0 ~ 30	20	(0.1V)
	9	2	Rx Sensitivity Time Delay		RW	0 ~ 65535	200	(ms)
	10	2	Read Retry Count		RW	1 ~ 10	3	(time)
	11	2	Read Retry Interval		RW	0 ~ 255	100	(ms)
	12	2	Read Start Delay		RO	0 ~ 65535		*5
	13	2	Test Read Page		RW	1 ~ 17	15	(page)
	14	2	Test Read Interval		RW	0 ~ 65535	1000	(ms)
	15	2	HRE Clear Time		RW	0 ~ 999	30	(s)
	16	2	Reserved					
	17	2	Reserved					
	18	2	Reserved					
	19	2	Reserved					
	20	2	Reserved					
0x2002	*0*	*2*	*Sub Index Number*					
	1	2	Index Of PageData1		RW	1~17	1	0xFF=auto
Index Of Page Data	2	2	Index Of PageData2		RW	1~17	2	0xFF=auto
	3	2	Index Of PageData3		RW	1~17	0	
	4	2	Index Of PageData4		RW	1~17	0	
	5	2	Index Of PageData5		RW	1~17	0	
	6	2	Index Of PageData6		RW	1~17	0	
	7	2	Index Of PageData7		RW	1~17	0	
	8	2	Index Of PageData8		RW	1~17	0	

Antenna1 (STB) Parameters

Index	*Sub Index*	*Size*	*Name*		*RW*	*Range*	*Default*	*Refer*
0x2100	*0*	*2*	*Sub Index Number*					
	1	2	STB Error Code		RO			
ANT1 Error and Status			LSB	STBC Error Code	RO	0x0000 ~ 0x00ff	0x0000	*6
			MSB	ANT Error Code	RO	0x0000 ~ 0xff00	0x0000	*7
	2	2	STB Status		RO			
			0	STB Ready	RO	0 ~ 1	0	Ready=1
			1	Carrier Sensor State (Foup)	RO	0 ~ 1	0	ON=1
			2	Home Sensor State (HP)	RO	0 ~ 1	0	ON=1

			3	E.CAT IN Connect	RO	0 ~ 1	0	Connect=1
			4	E.CAT OUT Connect	RO	0 ~ 1	0	Connect=1
			5	Tag Read Complete	RO	0 ~ 1	0	Detect=1
			6	Home Rising Edge	RO	0 ~ 1	1	Detect=1
			7	Reserved				
			8	STB Enable	RO	0 ~ 1	0	Enable=1
			9	Carrier Sensor Diagnosis	RO	0 ~ 1	1	Normal=1
			10	Home Sensor Diagnosis	RO	0 ~ 1	1	Normal=1
			11	Tx Power Diagnosis	RO	0 ~ 1	1	Normal=1
			12	Noise Sens Diagnosis	RO	0 ~ 1	1	Normal=1
			13	Sensor1 Enabled	RO	0 ~ 1	0	Enable=1
			14	Page Data Info.	RO	0 ~ 1	0	*8
			15	Sensor2 Enabled	RO	0 ~ 1	0	Enable=1
0x2101	*0*	*2*	*Sub Index Number*					
	1	2	STB Number		RW	0 ~ 255	0	*9
ANT1 Parameter	2	2	Tx Tuning Level		RW	0 ~ 15	8	
	3	2	Tx Power		RO	0 ~ 65535	0	(V)
	4	2	Tx Power Diag Threshold		RW	0 ~ 65535	100	(V)
	5	2	Noise Sensitivity		RO	0 ~ 99	0	(%)
	6	2	Noise Sens Diag Threshold		RW	0 ~ 99	90	(%)
	7	2	Sensor1 Enable (Foup/Carrier)		RW	0 ~ 1	1	
	8	2	Sensor1 Polarity (Foup/Carrier)		RW	0 ~ 1	1	
	9	2	Sensor1 Filter Order (Foup/Carrier)		RW	1 ~ 31	10(200ms)	(20ms)
	10	2	Sensor2 Enable (Home/HP)		RW	0 ~ 1	0	
	11	2	Sensor2 Polarity (Home/HP)		RW	0 ~ 1	1	
	12	2	Sensor2 Filter Order (Home/HP)		RW	1 ~ 31	10(200ms)	(20ms)
	13	2	Reserved					
	14	2	Reserved					
	15	2	Reserved					
	16	2	Reserved					
0x2102	*0*	*2*	*Sub Index Number*					
	1	8	PageData1		RO			
ANT1 Page Data	2	8	PageData2		RO			
	3	8	PageData3		RO			
	4	8	PageData4		RO			
	5	8	PageData5		RO			
	6	8	PageData6		RO			
	7	8	PageData7		RO			
	8	8	PageData8		RO			

Antenna2 (STB) Parameters

Index	***Sub Index***	***Size***	***Name***		***RW***	***Range***	***Default***	***Refer***
0x2200	*0*	*2*	*Sub Index Number*					
	1	2	STB Error Code		RO			
ANT2 Error and Status			LSB	STBC Error Code	RO	0x0000 ~ 0x00ff	0x0000	*6
			MSB	ANT Error Code	RO	0x0000 ~ 0xff00	0x0000	*7
	2	2	STB Status		RO			
			0	STB Ready	RO	0 ~ 1	0	Ready=1
			1	Carrier Sensor State (Foup)	RO	0 ~ 1	0	ON=1
			2	Home Sensor State (HP)	RO	0 ~ 1	0	ON=1
			3	E.CAT IN Connect	RO	0 ~ 1	0	Connect=1
			4	E.CAT OUT Connect	RO	0 ~ 1	0	Connect=1
			5	Tag Read Complete	RO	0 ~ 1	0	Detect=1
			6	Home Rising Edge	RO	0 ~ 1	1	Detect=1
			7	Reserved				

			8	STB Enable	RO	0 ~ 1	0	Enable=1
			9	Carrier Sensor Diagnosis	RO	0 ~ 1	1	Normal=1
			10	Home Sensor Diagnosis	RO	0 ~ 1	1	Normal=1
			11	Tx Power Diagnosis	RO	0 ~ 1	1	Normal=1
			12	Noise Sens Diagnosis	RO	0 ~ 1	1	Normal=1
			13	Sensor1 Enabled	RO	0 ~ 1	0	Enable=1
			14	Page Data Info.	RO	0 ~ 1	0	*8
			15	Sensor2 Enabled	RO	0 ~ 1	0	Enable=1
0x2201	*0*	*2*	*Sub Index Number*					
	1	2	STB Number		RW	0 ~ 255	0	*9
ANT2 Parameter	2	2	Tx Tuning Level		RW	0 ~ 15	8	
	3	2	Tx Power		RO	0 ~ 65535	0	(V)
	4	2	Tx Power Diag Threshold		RW	0 ~ 65535	100	(V)
	5	2	Noise Sensitivity		RO	0 ~ 99	0	(%)
	6	2	Noise Sens Diag Threshold		RW	0 ~ 99	90	(%)
	7	2	Sensor1 Enable (Foup/Carrier)		RW	0 ~ 1	1	
	8	2	Sensor1 Polarity (Foup/Carrier)		RW	0 ~ 1	1	
	9	2	Sensor1 Filter Order (Foup/Carrier)		RW	1 ~ 31	10(200ms)	(20ms)
	10	2	Sensor2 Enable (Home/HP)		RW	0 ~ 1	0	
	11	2	Sensor2 Polarity (Home/HP)		RW	0 ~ 1	1	
	12	2	Sensor2 Filter Order (Home/HP)		RW	1 ~ 31	10(200ms)	(20ms)
	13	2	Reserved					
	14	2	Reserved					
	15	2	Reserved					
	16	2	Reserved					
0x2202	*0*	*2*	*Sub Index Number*					
	1	8	PageData1		RO			
ANT2 Page Data	2	8	PageData2		RO			
	3	8	PageData3		RO			
	4	8	PageData4		RO			
	5	8	PageData5		RO			
	6	8	PageData6		RO			
	7	8	PageData7		RO			
	8	8	PageData8		RO			

Antenna3 (STB) Parameters

Index	***Sub Index***	***Size***	***Name***		***RW***	***Range***	***Default***	***Refer***
0x2300	*0*	*2*	*Sub Index Number*					
	1	2	STB Error Code		RO			
ANT3 Error and Status			LSB	STBC Error Code	RO	0x0000 ~ 0x00ff	0x0000	*6
			MSB	ANT Error Code	RO	0x0000 ~ 0xff00	0x0000	*7
	2	2	STB Status		RO			
			0	STB Ready	RO	0 ~ 1	0	Ready=1
			1	Carrier Sensor State (Foup)	RO	0 ~ 1	0	ON=1
			2	Home Sensor State (HP)	RO	0 ~ 1	0	ON=1
			3	E.CAT IN Connect	RO	0 ~ 1	0	Connect=1
			4	E.CAT OUT Connect	RO	0 ~ 1	0	Connect=1
			5	Tag Read Complete	RO	0 ~ 1	0	Detect=1
			6	Home Rising Edge	RO	0 ~ 1	1	Detect=1
			7	Reserved				
			8	STB Enable	RO	0 ~ 1	0	Enable=1
			9	Carrier Sensor Diagnosis	RO	0 ~ 1	1	Normal=1
			10	Home Sensor Diagnosis	RO	0 ~ 1	1	Normal=1
			11	Tx Power Diagnosis	RO	0 ~ 1	1	Normal=1
			12	Noise Sens Diagnosis	RO	0 ~ 1	1	Normal=1
			13	Sensor1 Enabled	RO	0 ~ 1	0	Enable=1
			14	Page Data Info.	RO	0 ~ 1	0	*8

			15	Sensor2 Enabled	RO	0 ~ 1	0	Enable=1
0x2301	*0*	*2*	*Sub Index Number*					
	1	2	STB Number		RW	0 ~ 255	0	*9
ANT3 Parameter	2	2	Tx Tuning Level		RW	0 ~ 15	8	
	3	2	Tx Power		RO	0 ~ 65535	0	(V)
	4	2	Tx Power Diag Threshold		RW	0 ~ 65535	100	(V)
	5	2	Noise Sensitivity		RO	0 ~ 99	0	(%)
	6	2	Noise Sens Diag Threshold		RW	0 ~ 99	90	(%)
	7	2	Sensor1 Enable (Foup/Carrier)		RW	0 ~ 1	1	
	8	2	Sensor1 Polarity (Foup/Carrier)		RW	0 ~ 1	1	
	9	2	Sensor1 Filter Order (Foup/Carrier)		RW	1 ~ 31	10(200ms)	(20ms)
	10	2	Sensor2 Enable (Home/HP)		RW	0 ~ 1	0	
	11	2	Sensor2 Polarity (Home/HP)		RW	0 ~ 1	1	
	12	2	Sensor2 Filter Order (Home/HP)		RW	1 ~ 31	10(200ms)	(20ms)
	13	2	Reserved					
	14	2	Reserved					
	15	2	Reserved					
	16	2	Reserved					
0x2302	*0*	*2*	*Sub Index Number*					
	1	8	PageData1		RO			
ANT3 Page Data	2	8	PageData2		RO			
	3	8	PageData3		RO			
	4	8	PageData4		RO			
	5	8	PageData5		RO			
	6	8	PageData6		RO			
	7	8	PageData7		RO			
	8	8	PageData8		RO			

Antenna4 (STB) Parameters

Index	***Sub Index***	***Size***	***Name***		***RW***	***Range***	***Default***	***Refer***
0x2400	*0*	*2*	*Sub Index Number*					
	1	2	STB Error Code		RO			
ANT4 Error and Status			LSB	STBC Error Code	RO	0x0000 ~ 0x00ff	0x0000	*6
			MSB	ANT Error Code	RO	0x0000 ~ 0xff00	0x0000	*7
	2	2	STB Status		RO			
			0	STB Ready	RO	0 ~ 1	0	Ready=1
			1	Carrier Sensor State (Foup)	RO	0 ~ 1	0	ON=1
			2	Home Sensor State (HP)	RO	0 ~ 1	0	ON=1
			3	E.CAT IN Connect	RO	0 ~ 1	0	Connect=1
			4	E.CAT OUT Connect	RO	0 ~ 1	0	Connect=1
			5	Tag Read Complete	RO	0 ~ 1	0	Detect=1
			6	Home Rising Edge	RO	0 ~ 1	1	Detect=1
			7	Reserved				
			8	STB Enable	RO	0 ~ 1	0	Enable=1
			9	Carrier Sensor Diagnosis	RO	0 ~ 1	1	Normal=1
			10	Home Sensor Diagnosis	RO	0 ~ 1	1	Normal=1
			11	Tx Power Diagnosis	RO	0 ~ 1	1	Normal=1
			12	Noise Sens Diagnosis	RO	0 ~ 1	1	Normal=1
			13	Sensor1 Enabled	RO	0 ~ 1	0	Enable=1
			14	Page Data Info.	RO	0 ~ 1	0	*8
			15	Sensor2 Enabled	RO	0 ~ 1	0	Enable=1
0x2401	*0*	*2*	*Sub Index Number*					
	1	2	STB Number		RW	0 ~ 255	0	*9
ANT4 Parameter	2	2	Tx Tuning Level		RW	0 ~ 15	8	
	3	2	Tx Power		RO	0 ~ 65535	0	(V)
	4	2	Tx Power Diag Threshold		RW	0 ~ 65535	100	(V)
	5	2	Noise Sensitivity		RO	0 ~ 99	0	(%)
	6	2	Noise Sens Diag Threshold		RW	0 ~ 99	90	(%)

	7	2	Sensor1 Enable (Foup/Carrier)	RW	0 ~ 1	1	
	8	2	Sensor1 Polarity (Foup/Carrier)	RW	0 ~ 1	1	
	9	2	Sensor1 Filter Order (Foup/Carrier)	RW	1 ~ 31	10(200ms)	(20ms)
	10	2	Sensor2 Enable (Home/HP)	RW	0 ~ 1	0	
	11	2	Sensor2 Polarity (Home/HP)	RW	0 ~ 1	1	
	12	2	Sensor2 Filter Order (Home/HP)	RW	1 ~ 31	10(200ms)	(20ms)
	13	2	Reserved				
	14	2	Reserved				
	15	2	Reserved				
	16	2	Reserved				
0x2402	*0*	*2*	*Sub Index Number*				
	1	8	PageData1	RO			
ANT4	2	8	PageData2	RO			
Page Data	3	8	PageData3	RO			
	4	8	PageData4	RO			
	5	8	PageData5	RO			
	6	8	PageData6	RO			
	7	8	PageData7	RO			
	8	8	PageData8	RO			

3.4 PDO function list

Index	Sub Index	Size	Name		Function
0x1000		4	Device Type		Product group of device is indicated with the form of code. 0x00001389 => RFID Reader
0x1001		2	Error Register		Error state of reader inside is indicated. 0x0000
0x1008		2	Device Name		Name of device is indicated with the form of code. 0x0001 => Cantops RFID 4CH Reader
0x1009		2	Hardware Version		Hardware version of reader is described. 0x0013 => Version 1.3
0x100A		2	Software Version		Software version of reader inside is described. 0x0020 => Version 2.0
0x2000	*0*	*2*	*Sub Index Number*		
RFID Error and Status	1	2	RFID Reader Error Code		Communication of RFID inside and the state for reading result are informed, and for further information, refer to <Table 11>.
	2	2	RFID Reader Status		16 bit state register for indicating the state of RFID Reader
			1bit	RFID Reader Ready	A normal state without error
			1bit	Reserved	X
			1bit	Reserved	X
			1bit	E.CAT IN Connect	Connecting state of EtherCAT input port connector: 1= Normal connection, 0= Abnormality
			1bit	E.CAT OUT Connect	Connecting state of EtherCAT output port connector: 1= Normal connection, 0= Abnormality
			1bit	Reserved	X
			1bit	Reserved	X
			1bit	Command Done Flag RFID	The flag which informs that disposal has been conducted in accordance with the

					command from high rank through EtherCAT
			1bit	Reserved	X
			1bit	Reserved	X
			1bit	Reserved	X
			1bit	Reserved	X
			1bit	Reserved	X
			1bit	Reserved	X
			1bit	Reserved	X
			1bit	Reserved	X
0x2001 **RFID Parameter**	*0*	*2*	*Sub Index Number*		Changing is not allowed except specialist because a great influence is exerted to performance.
	1	2	RFID Reader ID		Individual number of reader
	2	2	UART Baud rate		Setting up the communication velocity of RS-232 communication port
	3	2	Tx Duty		Variable 1 which adjusts transmission output of antenna
	4	2	Tx Start Duty		Variable 2 which adjusts transmission output of antenna
	5	2	Tx Start Time		Variable 3 which adjusts transmission output of antenna
	6	2	Charge Time		Setting up the charging time in which electric power is supplied to the tag
	7	2	Rx Sensitivity Low Voltage		Setting up the level and measuring time in order to measure peripheral noise
	8	2	Rx Sensitivity High Voltage		
	9	2	Rx Sensitivity Time Delay		
	10	2	Read Retry Count		This is the number of re-attempt to be performed when reading error is generated, and the initial value is 3 times. Namely, if error is occurred, re-attempt is automatically conducted up to 3 times.
	11	2	Read Retry Interval		Cycle of re-attempt
	12	2	Read Start Delay		Setting up reading delay time to avoid interference with peripheral readers
	13	2	Test Read Page		Setting up the page to be read with read button
	14	2	Test Read Interval		Cycle of manual reading
	15	2	Reserved		X
	16	2	Reserved		X
	17	2	Reserved		X
	18	2	Reserved		X
	19	2	Reserved		X
	20	2	Reserved		X
0x2002 **Index Of Page Data**	*0*	*2*	*Sub Index Number*		
	1	2	Index Of Page Data1		Setting up the page to be read
	2	2	Index Of Page Data2		
	3	2	Index Of Page Data3		
	4	2	Index Of Page Data4		
	5	2	Index Of Page Data5		
	6	2	Index Of Page Data6		
	7	2	Index Of Page Data7		
	8	2	Index Of Page Data8		
0x2100 **ANT1 Error and Status**	*0*	*2*	*Sub Index Number*		The state for the first antenna
	1	2	STB Error Code		
			1Byte	STBC Error Code	This is the error code for the STB where the first antenna is installed, and for detailed information, refer to <Table 12>.
			1Byte	ANT Error Code	These are the error code indicating the reading result of the antennas for each STB, and for further information, refer to <Table 11>.
	2	2	STB Status		The state of the STB where the first antenna is installed

			1bit	STB Ready	1: Normal state without error
			1bit	Carrier Sensor State	1: With carrier
			1bit	Home Sensor State	1: Mobile type STB is located at home position.
			1bit	E.CAT IN Connect	1: Normal connection of EtherCAT input port connector
			1bit	E.CAT OUT Connect	1: Normal connection of EtherCAT output port connector
			1bit	Reserved	X
			1bit	Reserved	X
			1bit	Reserved	X
			1bit	STB Enable	1:STB Enable
			1bit	Carrier Sensor Diagnosis	0: Abnormality of carrier detection sensor
			1bit	Home Sensor Diagnosis	0: Abnormality of home sensor
			1bit	Tx Power Diagnosis	0: Abnormality of antenna transmission output
			1bit	Noise Sens Diagnosis	0: Standard value is exceeded by peripheral noise.
			1bit	Reserved	X
			1bit	Page Data Info.	0: The data read with sensor input 1: The data read with communication command
			1bit	Command Busy	1: Disposal of received command is underway.
0x2101 **ANT1 Parameter**	*0*	*2*	*Sub Index Number*		
	1	2	STB Number		ID number manually set up at reader. 0 means Disable. Take care not to have duplication with other number.
	2	2	Tx Tuning Level		Tuning level of antenna
	3	2	Tx Power		Tuning voltage of antenna
	4	2	Tx Power Diag Threshold		The boundary value with which abnormality of antenna is checked
	5	2	Noise Sensitivity		The noise level currently measured with antenna
	6	2	Noise Sens Diag Threshold		The level with which the size of noise is judged
	7	2	Sensor1 Enable		Setting up the using or not using of the sensor which detects FOUP
	8	2	Sensor1 Polarity		Selection of sensor operation voltage level. Initial setup value is 1.
	9	2	Sensor1 Filter Order		The filter for removing the chattering which is generated when sensor is in operation
	10	2	Sensor2 Enable		Setting up the using or not using of the sensor which detects Home
	11	2	Sensor2 Polarity		Selection of sensor operation voltage level. Initial setup value is 1.
	12	2	Sensor2 Filter Order		The filter for removing the chattering which is generated when sensor is in operation
	13	2	Reserved		X
	14	2	Reserved		X
	15	2	Reserved		X
	16	2	Reserved		X
0x2102 **ANT1 Page Data**	*0*	*2*	*Sub Index Number*		
	1	8	Page Data1		The data of the first page read from the Tag
	2	8	Page Data2		The data of the second page read from the Tag
	3	8	Page Data3		Null for every page
	4	8	Page Data4		Null for every page
	5	8	Page Data5		Null for every page
	6	8	Page Data6		Null for every page
	7	8	Page Data7		Null for every page
	8	8	Page Data8		Null for every page

0x2200 **ANT2 Error and Status**	*0*	*2*	*Sub Index Number*		The state for the second antenna
	1	2	STB Error Code		
			1Byte	STBC Error Code	This is the error code for the STB where the second antenna is installed, and for further information, refer to <Table 12>.
			1Byte	ANT Error Code	These are the error code indicating the reading result of the antennas for each STB, and for further information, refer to <Table 11>.
	2	2	STB Status		The state of the STB where the second antenna is installed
			1bit	STB Ready	1: Normal state without error
			1bit	Carrier Sensor State	1: With carrier
			1bit	Home Sensor State	1: Mobile type STB is located at home position.
			1bit	E.CAT IN Connect	1: Normal connection of EtherCAT input port connector
			1bit	E.CAT OUT Connect	1: Normal connection of EtherCAT output port connector
			1bit	Reserved	X
			1bit	Reserved	X
			1bit	Reserved	X
			1bit	STB Enable	1:STB Enable
			1bit	Carrier Sensor Diagnosis	0: Abnormality of carrier detection sensor
			1bit	Home Sensor Diagnosis	0: Abnormality of home sensor
			1bit	Tx Power Diagnosis	0: Abnormality of antenna transmission output
			1bit	Noise Sens Diagnosis	0: Standard value is exceeded by peripheral noise.
			1bit	Reserved	X
			1bit	Page Data Info.	0: The data read with sensor input 1: The data read with communication command
			1bit	Command Busy	1: Disposal of received command is underway.
0x2201 **ANT2 Parameter**	*0*	*2*	*Sub Index Number*		
	1	2	STB Number		ID number manually set up at reader. 0 means Disable. Take care not to have duplication with other number.
	2	2	Tx Tuning Level		Tuning level of antenna
	3	2	Tx Power		Tuning voltage of antenna
	4	2	Tx Power Diag Threshold		The boundary value with which abnormality of antenna is checked
	5	2	Noise Sensitivity		The noise level currently measured with antenna
	6	2	Noise Sens Diag Threshold		The level with which the size of noise is judged
	7	2	Sensor1 Enable		Setting up the using or not using of the sensor which detects FOUP
	8	2	Sensor1 Polarity		Selection of sensor operation voltage level. Initial setup value is 1.
	9	2	Sensor1 Filter Order		The filter for removing the chattering which is generated when sensor is in operation
	10	2	Sensor2 Enable		Setting up the using or not using of the sensor which detects Home
	11	2	Sensor2 Polarity		Selection of sensor operation voltage level. Initial setup value is 1.
	12	2	Sensor2 Filter Order		The filter for removing the chattering which is generated when sensor is in operation
	13	2	Reserved		X
	14	2	Reserved		X
	15	2	Reserved		X
	16	2	Reserved		X

0x2202	*0*	*2*	*Sub Index Number*		
ANT2 Page Data	1	8	Page Data1		The data of the first page read from the Tag
	2	8	Page Data2		The data of the second page read from the Tag
	3	8	Page Data3		Null for every page
	4	8	Page Data4		Null for every page
	5	8	Page Data5		Null for every page
	6	8	Page Data6		Null for every page
	7	8	Page Data7		Null for every page
	8	8	Page Data8		Null for every page
0x2300	*0*	*2*	*Sub Index Number*		The state for the third antenna
ANT3 Error and Status	1	2	STB Error Code		
			1Byte	STBC Error Code	This is the error code for the STB where the third antenna is installed, and for detailed information, refer to <Table 12>.
			1Byte	ANT Error Code	These are the error code indicating the reading result of the antennas for each STB, and for further information, refer to <Table 11>.
	2	2	STB Status		The state of the STB where the third antenna is installed
			1bit	STB Ready	1: Normal state without error
			1bit	Carrier Sensor State	1: With carrier
			1bit	Home Sensor State	1: Mobile type STB is located at home position.
			1bit	E.CAT IN Connect	1: Normal connection of EtherCAT input port connector
			1bit	E.CAT OUT Connect	1: Normal connection of EtherCAT output port connector
			1bit	Reserved	X
			1bit	Reserved	X
			1bit	Reserved	X
			1bit	STB Enable	1:STB Enable
			1bit	Carrier Sensor Diagnosis	0: Abnormality of carrier detection sensor
			1bit	Home Sensor Diagnosis	0: Abnormality of home sensor
			1bit	Tx Power Diagnosis	0: Abnormality of antenna transmission output
			1bit	Noise Sens Diagnosis	0: Standard value is exceeded by peripheral noise.
			1bit	Reserved	X
			1bit	Page Data Info.	0: The data read with sensor input 1: The data read with communication command
			1bit	Command Busy	1: Disposal of received command is underway.
0x2301	*0*	*2*	*Sub Index Number*		
ANT3 Parameter	1	2	STB Number		ID number manually set up at reader. 0 means Disable. Take care not to have duplication with other number.
	2	2	Tx Tuning Level		Tuning level of antenna
	3	2	Tx Power		Tuning voltage of antenna
	4	2	Tx Power Diag Threshold		The boundary value with which abnormality of antenna is checked
	5	2	Noise Sensitivity		The noise level currently measured with antenna
	6	2	Noise Sens Diag Threshold		The level with which the size of noise is judged
	7	2	Sensor1 Enable		Setting up the using or not using of the sensor which detects FOUP
	8	2	Sensor1 Polarity		Selection of sensor operation voltage level. Initial setup value is 1.
	9	2	Sensor1 Filter Order		The filter for removing the chattering which is generated when sensor is in

					operation
	10	2	Sensor2 Enable		Setting up the using or not using of the sensor which detects Home
	11	2	Sensor2 Polarity		Selection of sensor operation voltage level. Initial setup value is 1.
	12	2	Sensor2 Filter Order		The filter for removing the chattering which is generated when sensor is in operation
	13	2	Reserved		X
	14	2	Reserved		X
	15	2	Reserved		X
	16	2	Reserved		X
0x2302 **ANT3 Page Data**	*0*	*2*	*Sub Index Number*		
	1	8	Page Data1		The data of the first page read from the Tag
	2	8	Page Data2		The data of the second page read from the Tag
	3	8	Page Data3		Null for every page
	4	8	Page Data4		Null for every page
	5	8	Page Data5		Null for every page
	6	8	Page Data6		Null for every page
	7	8	Page Data7		Null for every page
	8	8	Page Data8		Null for every page
0x2400 **ANT4 Error and Status**	*0*	*2*	*Sub Index Number*		The state for the fourth antenna
	1	2	STB Error Code		
			1Byte	STBC Error Code	This is the error code for the STB where the fourth antenna is installed, and for detailed information, refer to <Table 12>.
			1Byte	ANT Error Code	These are the error code indicating the reading result of the antennas for each STB, and for further information, refer to <Table 11>.
	2	2	STB Status		The state of the STB where the fourth antenna is installed
			1bit	STB Ready	1: Normal state without error
			1bit	Carrier Sensor State	1: With carrier
			1bit	Home Sensor State	1: Mobile type STB is located at home position.
			1bit	E.CAT IN Connect	1: Normal connection of EtherCAT input port connector
			1bit	E.CAT OUT Connect	1: Normal connection of EtherCAT output port connector
			1bit	Reserved	X
			1bit	Reserved	X
			1bit	Reserved	X
			1bit	STB Enable	1:STB Enable
			1bit	Carrier Sensor Diagnosis	0: Abnormality of carrier detection sensor
			1bit	Home Sensor Diagnosis	0: Abnormality of home sensor
			1bit	Tx Power Diagnosis	0: Abnormality of antenna transmission output
			1bit	Noise Sens Diagnosis	0: Standard value is exceeded by peripheral noise.
			1bit	Reserved	X
			1bit	Page Data Info.	0: The data read with sensor input 1: The data read with communication command
			1bit	Command Busy	1: Disposal of received command is underway.
0x2401 **ANT4 Parameter**	*0*	*2*	*Sub Index Number*		
	1	2	STB Number		ID number manually set up at reader. 0 means Disable. Take care not to have duplication with other number.
	2	2	Tx Tuning Level		Tuning level of antenna
	3	2	Tx Power		Tuning voltage of antenna

	4	2	Tx Power Diag Threshold	The boundary value with which abnormality of antenna is checked
	5	2	Noise Sensitivity	The noise level currently measured with antenna
	6	2	Noise Sens Diag Threshold	The level with which the size of noise is judged
	7	2	Sensor1 Enable	Setting up the using or not using of the sensor which detects FOUP
	8	2	Sensor1 Polarity	Selection of sensor operation voltage level. Initial setup value is 1.
	9	2	Sensor1 Filter Order	The filter for removing the chattering which is generated when sensor is in operation
	10	2	Sensor2 Enable	Setting up the using or not using of the sensor which detects Home
	11	2	Sensor2 Polarity	Selection of sensor operation voltage level. Initial setup value is 1.
	12	2	Sensor2 Filter Order	The filter for removing the chattering which is generated when sensor is in operation
	13	2	Reserved	X
	14	2	Reserved	X
	15	2	Reserved	X
	16	2	Reserved	X
0x2402 **ANT4 Page Data**	*0*	*2*	*Sub Index Number*	
	1	8	Page Data1	The data of the first page read from the Tag
	2	8	Page Data2	The data of the second page read from the Tag
	3	8	Page Data3	Null for every page
	4	8	Page Data4	Null for every page
	5	8	Page Data5	Null for every page
	6	8	Page Data6	Null for every page
	7	8	Page Data7	Null for every page
	8	8	Page Data8	Null for every page
0x3000 **RFID Command**	*0*	*2*	*Sub Index Number*	
	1	2	STB Number	0: Reader related command 1: Antenna related command
	2	2	Command Type	The command defined for EtherCAT which is the master and reader which is the slave
	3	2	Command Ack	Disposal state and result for the received command
	4	2	Data Length	Length of transmitted/received data
	5	2	Checksum	Data for error checking
	6	2	Reserved	X
	7	2	Command Data0	Auxiliary data 0 required for command
	8	2	Command Data1	Auxiliary data 1 required for command
0x4000 **RFID Live Check**	*0*	*2*	*Sub Index Number*	
	1	2	Master Counter	The counter for checking abnormal state between master and slave
	2	2	Slave Counter	

<Table 11> Error code of RFID reader

Code	State	Remarks
'0'	When there is no abnormality at the received data, and the command is normally executed	0x30
'1'	When there is abnormality at the Check Sum of the received data	0x31

'2'	In the case of receiving command even though there isn't any abnormality at ID and Check Sum	0x32
'3'	When received data has the value deviating the range which can be set up	0x33
'4'	When it is failed to write data on the tag	0x34
'5'	When there is no tag	0x35
'6'	When type of tag is different from that of the received command	0x36
'7'	When Check Sum error is generated at the tag	0x37
'8'	Communication error with the tag	0x38
'9'	When there is no antenna or when problem is generated regarding installation of antenna	0x39

When STB is not registered, raise to 0x00.

<Table 12> Error state of RFID Reader which is responded to STBC

Code	Description
0	OK (Read OK or Not detect Carrier)
1	Read Error
3	STB Home is OFF (AZFS only)

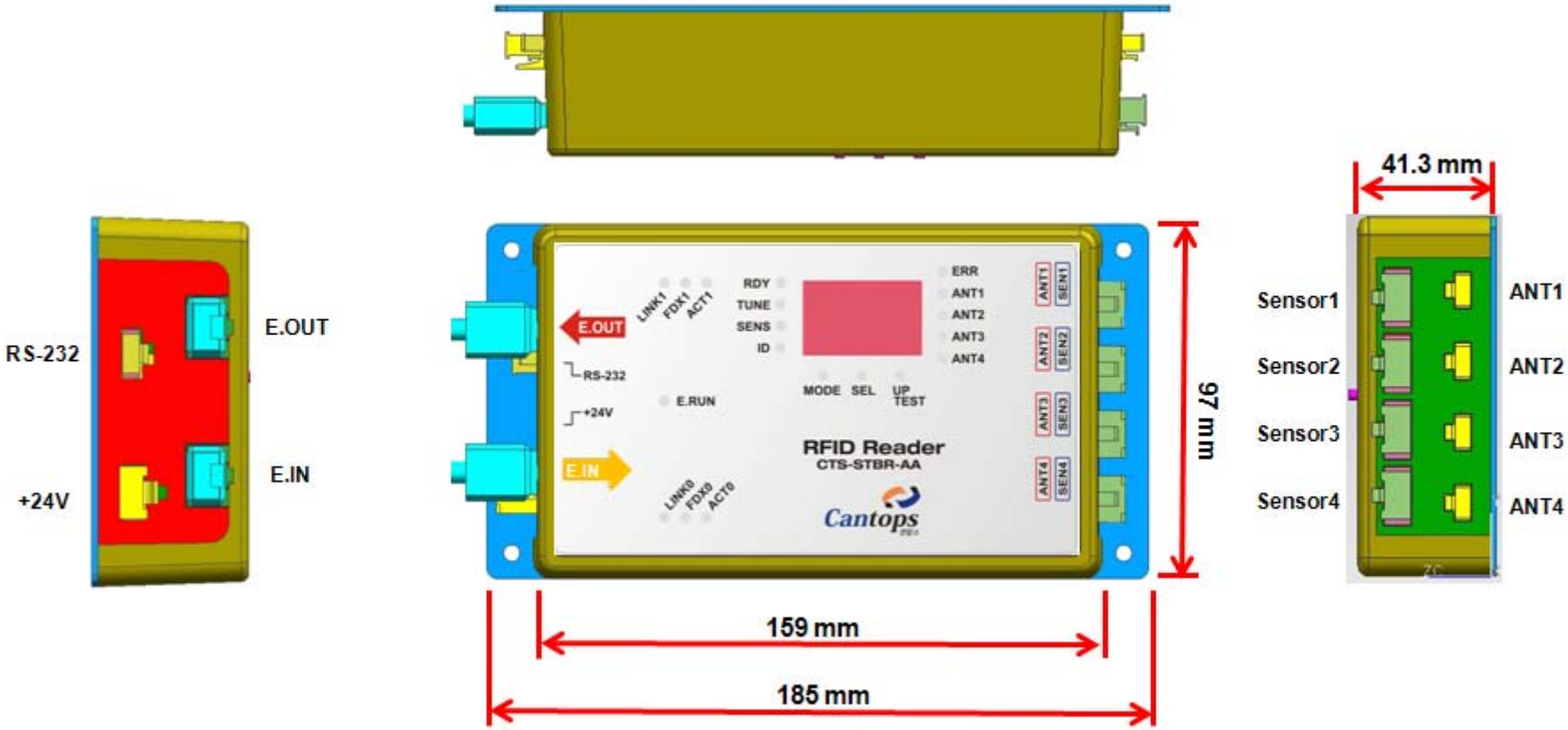
4. Type of tag

The tag currently used has the memory of 17 Pages (8Byte/Page) with which reading and writing can be conducted. Since basic unit of reading and writing at the tag is page, it is desirable to handle with 8 Byte of page unit when reading and writing the tag are conducted at high rank. Each page is constituted with the shape as shown in the following <Table 13>.

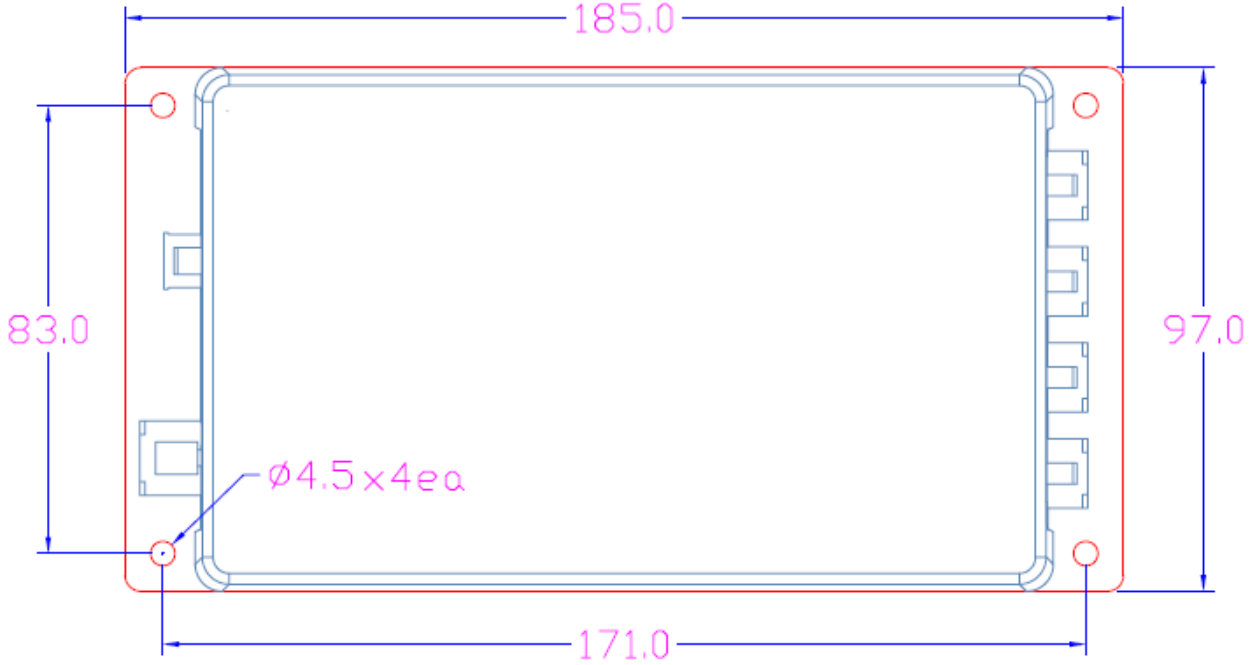
<Table 13> Type of tag

Page number	Application	Remarks
1, 2	8 Byte in low rank and 8 Byte in high rank of Material ID	MID information
2, 3	8 Byte in low rank and 8 Byte in high rank of Material ID	
4~17	The area for freely reading and writing the process information	Notepad area

< Attachment 1> Specification of RFID Reader case (Color and printed character are for reference only.)



< Attachment 2> Dimension of fixing holes for RFID Reader



Version	Date	Details of revision	Remarks
1.0	2011-08-22	Initial Revision	
1.1	2012-09-06	2.4 Contents of manually operating section are revised. 3.3 Contents of PDO Map list are revised. 3.4 Contents of PDO function list are revised.	