

**SYGOLE**

# UHF Integrated RFID Reader Manual





# *Technical Manual*

*Integrated RFID reader*

The purpose of the practical manual is to provide complete hardware appearance parameter, electric parameter, necessary schematic circuit diagram of the high frequency integrated reader and relevant notices for installation and operation. If needed, the reader hardware may be correspondingly modified according to the information provided in the manual in order to adapt to the application conditions of different industrial fields.

The manual mainly includes the following contents:

- Notice for reader application
- Functional description of the reader
- Reader installation guide
- Reader interface definition, appearance and electric parameter
- Supporting tag of the reader

If you have any unclear information in the manual or any inconsistency with practical situations, please contact with us.

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## *Specification for Marks in the Manual*

### **Caution Mark**



If there is a “Caution Mark” in the manual, it indicates that the user needs to pay attention during use. If the user fails to follow or ignores such information during use, the equipment may be directly or indirectly caused to have abnormal operation. Please be careful to read the content with such mark.

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## 1. Brief Introduction

### 1.1 Brief introduction to the reader

Sygole SG-UR-I84/I85/I86 Series Reader is integrated UHF RFID reader that supports multi-channel expansion. It operates from 860MHz to 928MHz and is compliant with the EPC Global Class I Gen2/ISO 18000-6C standard. It supports the expansion of multi-channel RF output with a maximum output power of 27dBm. Supporting RS (485), RS232, TCP (POE), bluetooth and other (configurable) communication methods. Providing multiple isolated I/O ports. The housing is made of sturdy aluminum case. The series of readers have the characteristics of fast batch recognition, high accuracy, long recognition distance and convenient networking. They are widely applied in home appliances, automobiles, 3C, new energy, aerospace, rail traffic, equipment and engineering machinery, etc..

### 1.2 Effective range of the manual

The manual is effective for all SG-UR-I84/I85/I86 series readers described in the manual and delivered after August 2018.

### 1.3 Revision history

Table 1.1 Manual Version Information

Version	Revision Date	Revision Reason
V1.0	2017.10.20	The first version
V1.1	2018.7.15	Add product system planing

## 2. Safety Instruction

The product conforms to EMC significant safety specification. If you have any query upon the installation environment, please contact with our service representative



Modification and disassembly of the product are not allowed. If the user violates the requirement, the wireless equipment approval, the CE approval and the manufacturer certification will be canceled.



The product can be only maintained by the personnel of our company. Unauthorized unpacking operation or improper product maintenance may cause significant equipment damage or personal injury to users.

## 3. UHF RFID Reader Application Specification

### 3.1 UHF RFID application system introduction

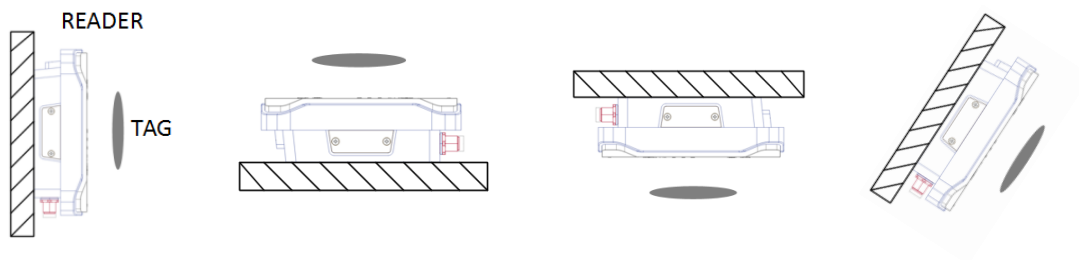
I84/I85/I86 series of readers should accord with the following implementation specification in the application system.

- (1) The installation conditions of UHF Reader ;
- (2) The installation conditions of Tag ;
- (3) The electromagnetic response in UHF band ;
- (4) Electro Magnetic Compatibility.

### 3.2 The installation conditions of UHF reader

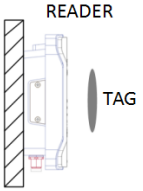
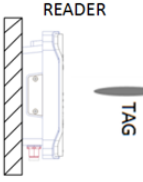
#### 3.2.1 Installation examples of UHF reader

There are some installation examples of the I84/I85/I86 series integrated reader. Antenna plane of reader should be in the right orientation with the tag to be identified, and there is no other media between them.



#### 3.2.2 Tag's direction in the application system

It will affect the reading range and performance if the tag is at a different angle from the reader antenna. In order to achieve an optimal reading effect, the tag should be aligned with the reader antenna.

	<p><b>Tag Antenna orientation:</b> Right at the reader;  <b>Reading distance:</b>Farthest;  <b>Reading performance:</b>Optimum.</p>
	<p><b>Tag Antenna orientation:</b> Vertical with the reader;  <b>Reading distance:</b>Shortest;  <b>Reading performance:</b>Worst.</p>

### 3.2.3 Crosstalk between readers in the application system

When multiple RFID readers are working in the application system at the same time, the unreasonable installation method will result in the risk of the tag being read by other readers. For example, the installation direction between the reader antennas is not standardized, and the distance between adjacent readers is too close.

To avoid crosstalk, adjacent readers operating in the same frequency band should maintain a minimum safe distance. This distance mainly depends on the maximum effective radiated power (ERP) of the reader and the directional relationship between the reader antennas.

The following shows three common multiple reader installations:

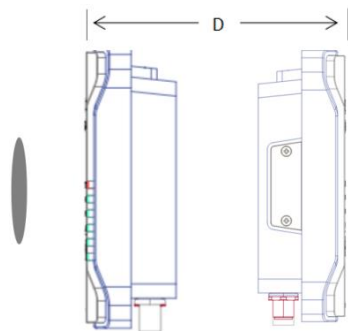


Fig 3.2.1 Back to back

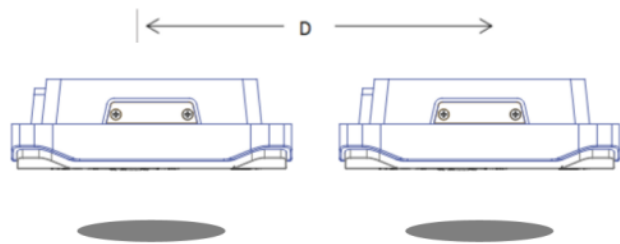


Fig 3.2.2 Side by side

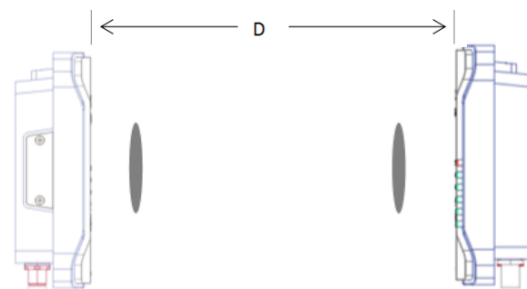


Fig 3.2.3 Face to face

Installation method	I84/I85 minimum safety clearance D	I86 minimum safety clearance D
Back to Back	1.5m	2.0m
Side by Side	3m	3.5m
Face to Face	8.0m	10.0m



**Note:** This table is only used as a reference for testing specific tags in an ideal environment. More specific requirements depend on the field application environment.

### 3.2.4 Reading distance in the application system

The effective distance which a reader reads a tag is related to many factors. Including but not limited to the following conditions:

- Reader power. In theory, the greater the power, the farther the effective distance of reading the tag.
- Tag. Tags of different types, sizes, and production qualities have different reading distance.
- Reader or tag installation environment. When the reader is in an electromagnetic wave reflective environment or the tag is mounted on a different material surface, the read distance of the reader varies.
- Read and write operations. The write operation of the reader requires more power than the read operation, so the write operation distance is much closer than the read operation distance. The following figure shows the read/write distance comparison of the tags in the reader antenna field.

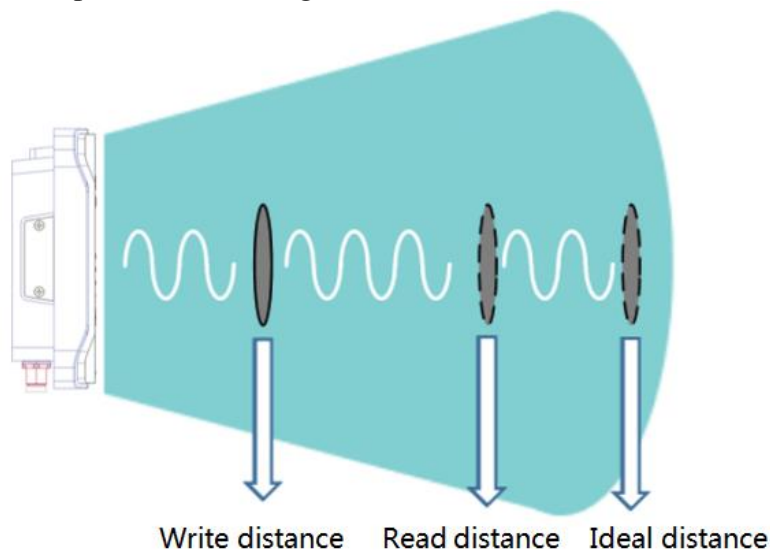


Fig 3.2.4 Distance comparison

Therefore, the installation environment of the reader is as close as possible to the implementation specification, so as to improve the reliability and effectiveness of the reader reading the tag. On the other hand, adjacent readers should be kept above the minimum safe distance and properly adjust the reader transmit power to reduce mutual interference between readers.



### 3.3 Tag installation environment specification

Tags with different attributes have different installation environments. For example, when the reader parameters are the same, the anti-metal tag is mounted on the metal surface much farther than the distance mounted on a non-metallic surface. The tags are divided into two categories: anti-metal tags and non-metal tags. Non-anti-metal tags are recommended to be installed in non-metallic environments. If there is no legal environment to avoid metal, please refer to the following implementation rules:

**Mounting on metal surface** —— Non-anti-metal tags require a buffer to be reserved, and anti-metal tags can be directly mounted to metal surfaces;

**Buffer** —— Refers to the distance from the tag to the metal surface

1、 Non-anti-metal tags are mounted on metal surfaces, buffer  $\geq 20\text{mm}$ , and tag performance can be retained above 80% ;

2、 When the anti-metal tags is directly mounted on the metal surface, it can still retain more than 90% of the original performance;

**Embedded metal mounting** —— anti-metal tags can be directly embedded in metal applications, non-anti-metal tags are not recommended for embedded metal applications.

**Free zone** —— Refers to the blank area around the tag when the tag is embedded in the metal.

1、 When the anti-metal tags are embedded in the metal installation without leaving a free area, the tag performance can still be maintained above 90%;

2、 If the non-anti-metal tags are embedded in the metal mounting surface, the free area  $a \geq 2X$ ,  $b \geq 2Y$ ,  $c \geq 20\text{mm}$  must be reserved. At this time, the tag can retain more than 80% of the original performance;

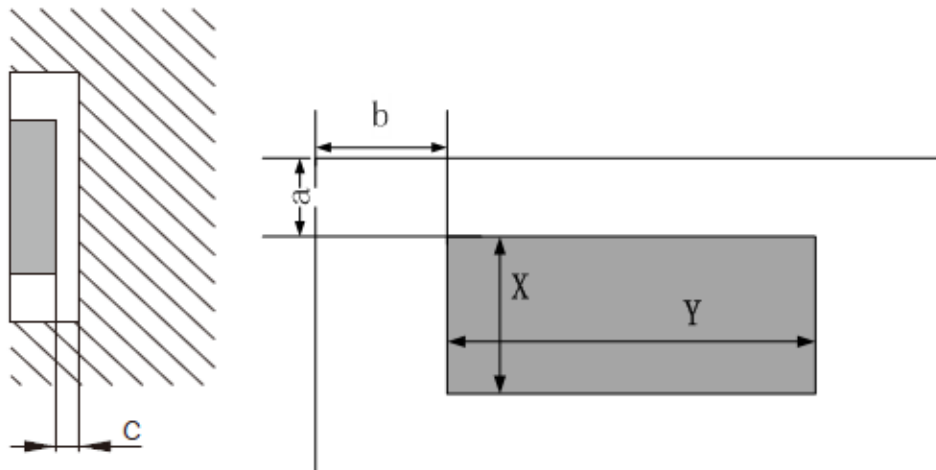


Figure 3.3.1 Tag Installation Environment Specification

### 3.4 Electromagnetic wave response in the UHF band

When electromagnetic waves propagate in the UHF band, they are constrained by some environments (such as metals, walls, liquids, other signal transmitters, etc.), resulting in reflection and mutual interference. This phenomenon may be manifested by the fact that the electromagnetic wave signal expands the reading

range of the reader through metal reflection; it may also be that the electromagnetic wave signal is interfered by other signals in the same frequency band to reduce the reading range of the reader.

Due to these electromagnetic characteristics, it is extremely difficult to determine the propagation path of the signal and its field strength when the reader is in a multiple reflection environment.

In order to reduce the influence of reflection and interference on the identification tag, it is recommended to appropriately reduce the transmit power of the reader so that it can properly identify the tag.

In addition, when the ground is poor and the reader is installed on the metal, it may affect the performance of the reader. Therefore, pay attention to the following points when installing the reader in the metal environment:

**Embedded metal mounting**——Reserved buffer (buffer can add non-anti-metal media)

**Buffer**——Refers to the distance from the reader to the metal surface

1. The buffer is 0cm, that is, when directly mounted on the metal surface, the read/write distance of the reader will be reduced by at least 10%; the specific data is related to the metal material, size, thickness, etc.;

2. When the buffer is  $\geq 20\text{mm}$ , the performance of the reader is close to that of the non-metal plane; **It is recommended to design the buffer to be larger than 20mm during installation.**

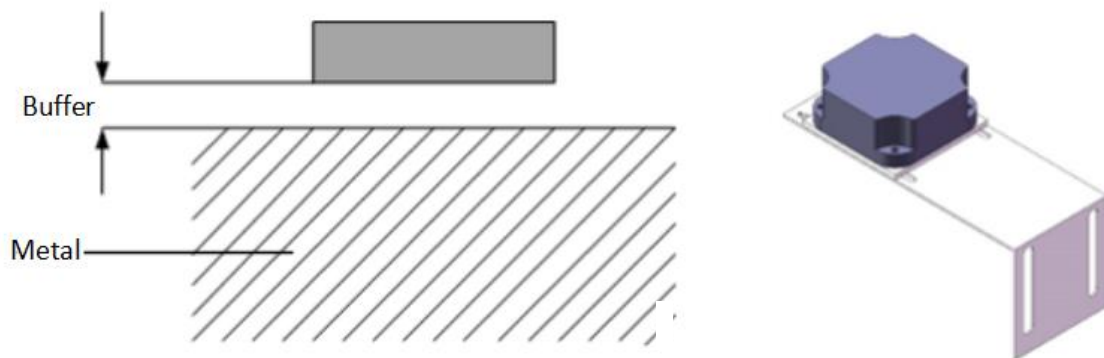


Fig 3.4.1 Nut type reader metal environment installation

If the reader housing is made of metal, it is recommended to use a plastic bracket when the ground is not good.

**Embedded metal mounting**——Reserve a free area that is large enough.

**Free zone**——Refers to the metal blank area around the reader when the reader is embedded in the metal installation.

1. When  $A = 0\text{cm}$ , that is, when the reader is installed without a reserved free area, the read/write distance of the reader will be seriously reduced. This installation method is not recommended;

2. When  $A = 10\text{cm}$ , the actual reading and writing distance will be reduced by 10%; the specific data is subject to the actual application test;

In order to meet the requirements of reading and writing distance, it is necessary to reserve enough free zone in the actual application (**the recommended value of A is not less than half of the length and width of the reader**);

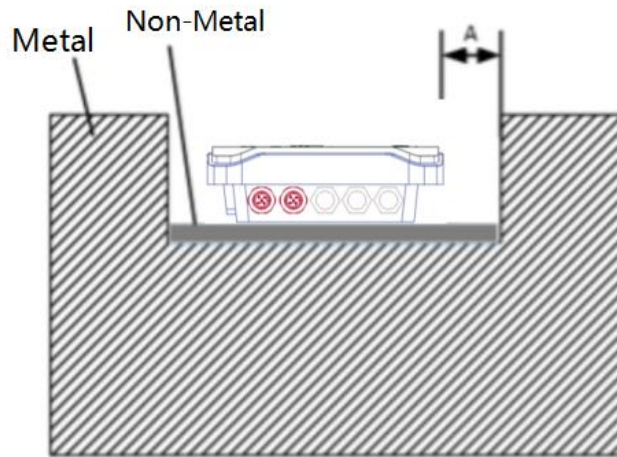


Fig 3.4.2 Embedded metal environment

**Installing the reader in the metal frame - avoiding the conductor loop**

Metal

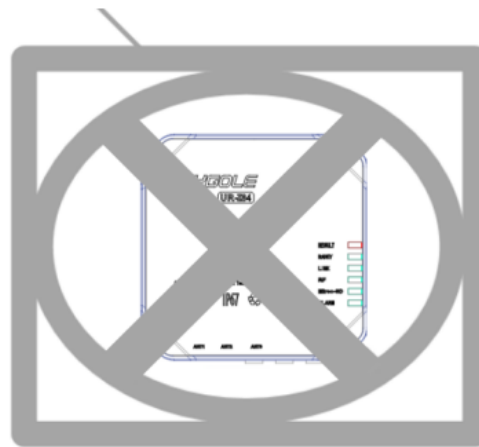


Fig 3.4.3 Round metal frame installation



If the reader is in a closed metal frame, the metal frame will reflect and disturb the electromagnetic wave signal. At this time, the antenna field and the transmitting field overlap each other, and the reader cannot receive the valid signal normally, resulting in abnormal reading. The closer the metal frame is to the reader, the greater the interference, and the installation should be avoided in practical applications.

## 3.5 Electromagnetic compatibility

### 3.5.1 Electromagnetic compatibility guidelines

Electromagnetic compatibility refers to the ability of an electronic device to function properly in an electromagnetic environment. Electromagnetic interference is an electromagnetic phenomenon that is detrimental to the

performance of electronic equipment. Electromagnetic interference not only affects the normal operation of electronic equipment, but even causes damage to certain components in electronic equipment. With the increase in automation, the arrangement of electrical and electronic equipment becomes more complicated, and the risk of interaction between devices is increased. Electromagnetic interference mainly consists of three parts: interference source, coupling path and interference receiver. When applying the implementation plan in the field, it is necessary to identify the most frequent sources of interference and the possible coupling paths that exist, so as to take corresponding measures to reduce the risk of electromagnetic interference and ensure the normal operation of the equipment.

In order to ensure electromagnetic compatibility enough, the following rules must be observed:

1、 The device is shielded by the outer casing. The reader-related equipment is installed in the cabinet and grounded through the rack to shield the external magnetic field.

2、 The equipment is well grounded. Good grounding can ensure the clean power supply of the equipment, and on the other hand, it can prevent the excessive impact voltage from being damaged when the equipment fails, and damage the reader.

3、 Cable shielding. For sites with complex electromagnetic environments, shielded communication cables must be used to avoid interference signals being coupled to the cables.

4、 Signal and line filtering. Install the filter in the power inlet or cabinet inlet direction to avoid interference from the power source into the device.

### 3.5.2 Power supply and wiring requirements

In an industrial environment, a major source of interference in equipment circuits is caused by unreasonable ground lines. Therefore, proper grounding is an important method to suppress noise and prevent interference, and is the key to ensure the normal operation and read/write success rate of the reader.

Under normal circumstances, the reader device power supply voltage is 24V, which is a weak current. When wiring, connect the power supply line of the reader and the 485 power supply line from the weak current slot, and the cable slot must be connected to the standard earth ("0"Level) .



**Note: If the grounding of the slot and shield is not guaranteed to be the standard "0" potential, you need to provide independent power for the RFID or add a filter to the power supply.**

### 3.5.3 Common electromagnetic interference causes and solutions

The following provides a reference to some common electromagnetic interference solutions :

- The switching power supply interferes from the current conduction to the device. It can be solved by replacing the independent power supply or adding a filter at the power supply.
- Cable couple Electromagnetic interference in the space. Insufficient cable shielding or the reader is not well grounded, which can be solved by improving the shielding performance of the cable and making the reader well grounded.
- Antenna interference between readers. It can be solved by increasing the safety spacing of adjacent readers and reducing the transmit power of the reader.
- Control cabinet or chassis interference. The electrical planning of the control cabinet or the casing is unreasonable, the grounding is missing or bad, and the“0”potential imbalance causes interference,which can be solved by rationally designing the control cabinet or the casing.

## 4. Reader

### 4.1 The product features of reader

The SG-UR-I84/I85/I86 series readers are compatible with multi-protocol (EPC Global Class I Gen2/ISO 18000-6C) and support RS485, RS232, TCP (POE), bluetooth and other (configurable) communication methods. It is convenient for large-scale batch networking applications and provides isolated I/O to detect external sensing input and output control signals.

It has the following advantages:

- Support anti-collision algorithm: Bulk tag identification speed is greater than 400 / s, a high recognition accuracy;
- Support for Received Signal Strength Detection (RSSI);
- Supports four-channel polling: It can be used for multi-node data acquisition to improve the coverage area of device data acquisition; or single-node multi-antenna deployment to improve the reliability of label recognition within the coverage;
- Different antennas can be connected via feeders: with appropriate labels to satisfy different identification distance requirements;
- Die-cast aluminum alloy casing: good heat dissipation.。

#### 4.1.1 Reader specifications parameter

The specifications of the SG-UR-I84/I85/I86 reader are shown in Table 4.1.1:

Tab 4.1.1 SG-UR-I84 / I85 / I86 reader specifications

Reader Specification	SG-UR-I84	SG-UR-I85	SG-UR-I86
Wireless protocol	EPC Global Class 1 Gen 2/ISO 18000-6C		
Frequency band	860MHz~928MHz		
Carrier frequency	SRRC CN 920MHz~925MHz NA 902MHz~928MHz EU 865MHz~868MHz		
Output power	5~27dBm	5~27dBm	5~30dBm
Step power	1dBm	1dBm	1dBm
Receiving sensitivity	< -83dBm	< -83dBm	< -83dBm
Read-write distance	0~5m(Related to tag)	0~5m(Related to tag)	0~12m(Related to tag)
Communication interface	RS-485 or POE	RS232 or Bluetooth	RS485 or POE
Multi-tag identification	> 400pcs/s	> 400 pcs/s	> 400 pcs/s
Tag buffer	1000pcs tag	1000pcs tag	1000pcs tag
Tag RSSI	Sup	Sup	Sup
Antenna connection protection	Sup	Sup	Sup
Serial communication rate	460.8kbit/s	115.2kbit/s	460.8kbit/s
Ethernet communication rate	10/100M Adaptive	1Mbit/s	10/100M Adaptive
vVoltage	24VDC/48V POE	24VDC	24VDC/48V POE
Input Output	4-way isolated IO	4-way isolated IO	4-way isolated IO
Cloning function	Sup (Need to buy and install Micro SD card)		
Pilot lamp	6 LED indicators	6 LED indicators	6 LED indicators

## 4.1.2 Reader physical parameters

SG-UR-I84 / I85 / I86 series of physical parameters such as the reader shown in Table 4.1.2:

Tab 4.1.2 SG-UR-I84/I85/I86 series reader physical parameters

Reader Physical Parameters	SG-UR-I84	SG-UR-I85	SG-UR-I86
Dimensions	150*150*42	150*150*42mm	246*246*63mm

Weight	1Kg	1Kg	2.5Kg
Fixed type	4 fixed feet with M6 nut	4 fixed feet with M6 nut	4 fixed feet with M6 nut
Shell material	PC and Die-cast aluminum alloy	PC and Die-cast aluminum alloy	PC and Die-cast aluminum alloy
Shell color	Blue black	Blue black	Blue black

### 4.1.3 Reader application environment

The application environment of SG-UR-I84/I85/I86 series readers is shown in Table 4.1.3:

Tab 4.1.3 SG-UR-I84/I85/I86 Series Reader Application Environment

Reader	SG-UR-I84	SG-UR-I85	SG-UR-I86
Application Environment			
Working temperature	-40°C~+70°C	-40°C~+70°C	-40°C~+70°C
storage temperature	-40°C~+85°C	-40°C~+85°C	-40°C~+85°C
Working humidity	5%~95%RH (Non-condensing)	5%~95%RH (Non-condensing)	5%~95%RH (Non-condensing)
Enclosure rating	IP67	IP67	IP67
Anti-drop test	GB/T2423.8-1995	GB/T2423.8-1995	GB/T2423.8-1995
Vibration resistant	GB/T2423.10-2008	GB/T2423.10-2008	GB/T2423.10-2008
Certification	SRRC	SRRC	SRRC

## 4.2 Definition of communication interface

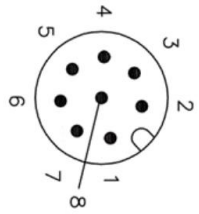
SG-UR-I84/I85/I86 series products support RS485, RS232, POE, BT and other (configurable) interfaces. The interfaces are defined as follows:

Tab 4.2.1 RS485Interface (M12 Acoding 5pin male) Pin Definition

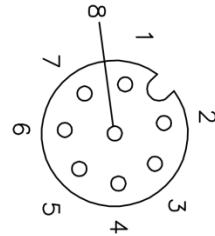
No.	Definition	Precast Cable Color	Self-provided Cable Requirement	Schematic Diagram (M12 Acoding 5pin male)
1	24V	Brown	4-core cable or 4-core shielded cable, with cable core at least 24AWG	
2	RS485_A	White		
3	0V	Blue		
4	RS485_B	Black		
5	PE	Shielding layer		

Tab 4.2.2 RS232 Interface (M12 Acoding 8pin Male) Pin Definition

No.	Definition	Precast Cable Color	Self-provided Cable Requirement	Schematic Diagram (M12 Acoding 8pin male)
1	24V (24V +)	Brown		

2	RX	White	6-core shielded cable, with cable core at least 24 AWG	
3	0V (24V -)	Blue		
4	TX	Pink		
5	PE	Gray		
6	COM	Yellow		
7	NC	Green		
8	NC	Red		

Tab 4.2.3 POE Interface (M12 Acoding 8pin Female) Pin Definition

No.	Definition	Precast Cable Color	Self-provided Cable Requirement	Schematic Diagram(M12 Acoding 8pin female)
1	TD+	Orange white	UTP above 8-core network cable	
2	TD-	Orange		
3	RD+	Green white		
4	RD-	Green		
5	POE-	Blue white		
6	POE-	Blue		
7	POE+	Brown white		
8	POE+	Brown		

### 4.3 Reader SG-UR-I84

#### 4.3.1 SG-UR-I84 schematic diagram

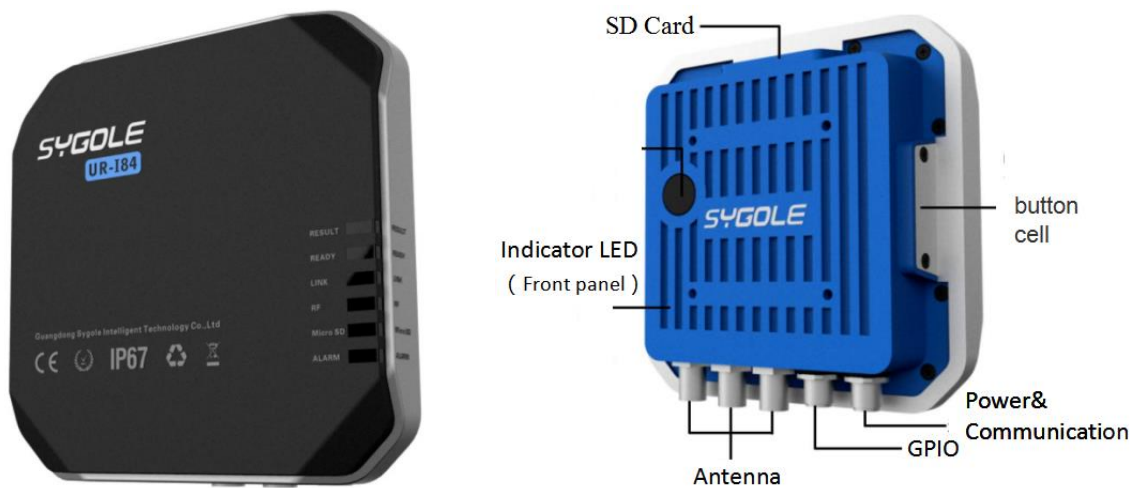


Fig 4.3.1 SG-UR-I84 Physical schematic



### 4.3.2 SG-UR-I84 Mechanical dimension drawing

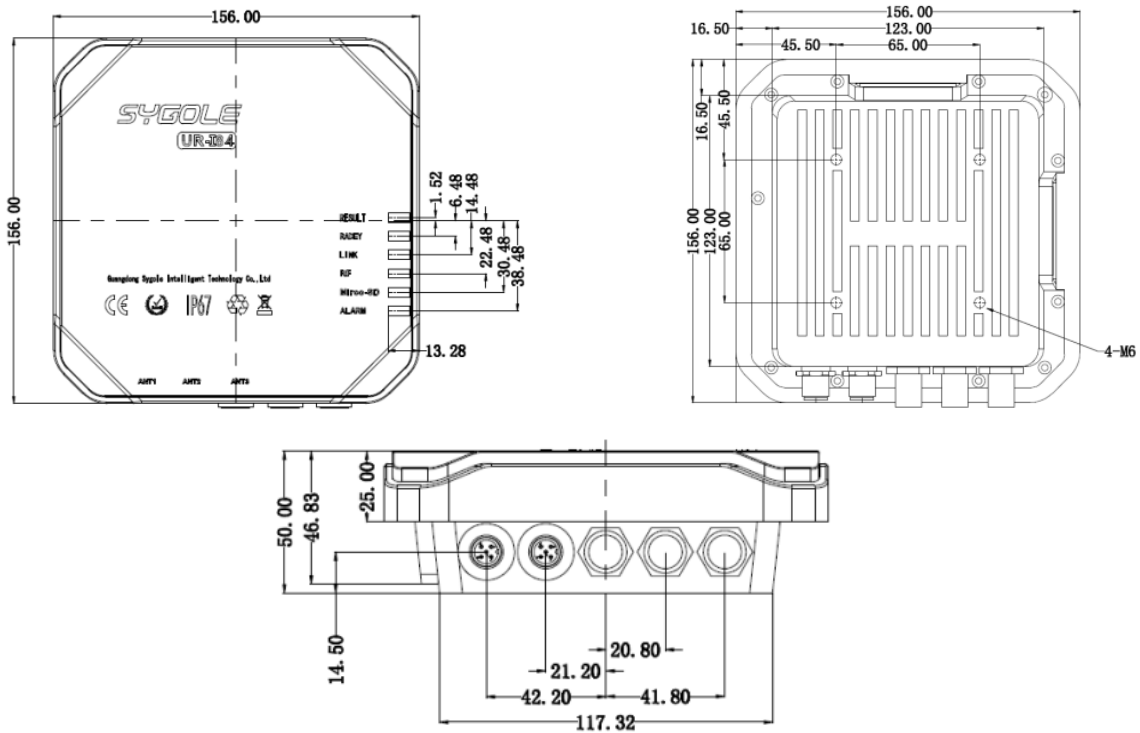


Fig 4.3.2 SG-UR-I84 Mechanical Dimensios (Unit mm)

### 4.3.3 SG-UR-I84 LED status definitions

The SG-UR-I84 has six LED indicators, which are defined as follows:

Tab 4.3.1 SG-UR-I84 reader lamp name and function description

Indicator name	Description
RESULT	Off: No read and write operations Flashing Blue: tag read and write operations in progress
READY	Steady blue: Various states are normal, the device is ready for reading and writing operations.
LINK	Steady blue: The data port is connected properly. Flashing blue: Data communication is in progress
RF	Steady blue: The device amplifier is on and the amplifier is activated.
Micro SD	Steady blue: Insert an external expansion card
ALARM	Steady red: device alarm

## 4.4 Reader SG-UR-I85

### 4.4.1 SG-UR-I85 schematic diagram

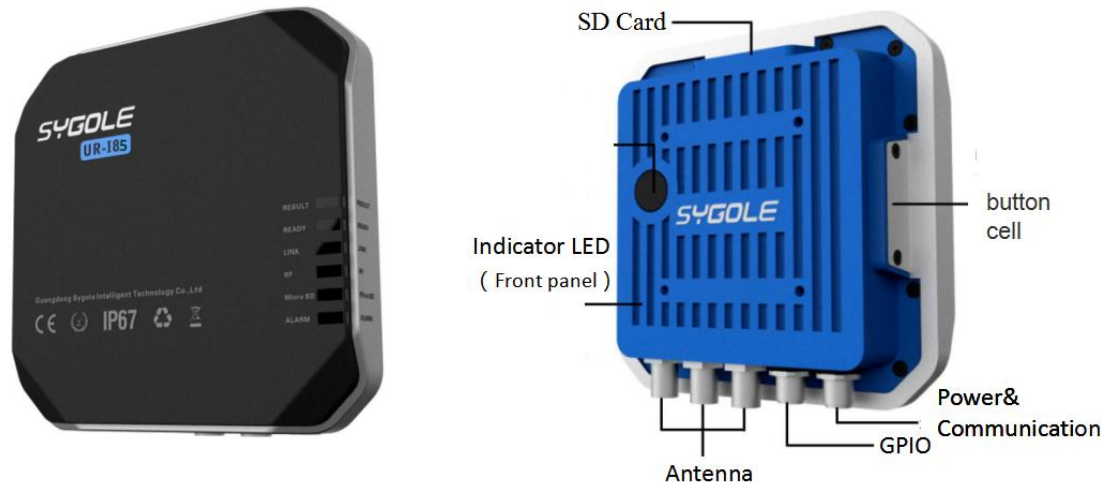


Fig 4.4.1 SG-UR-I85 physical schematic

### 4.4.2 SG-UR-I85 mechanical dimension drawing

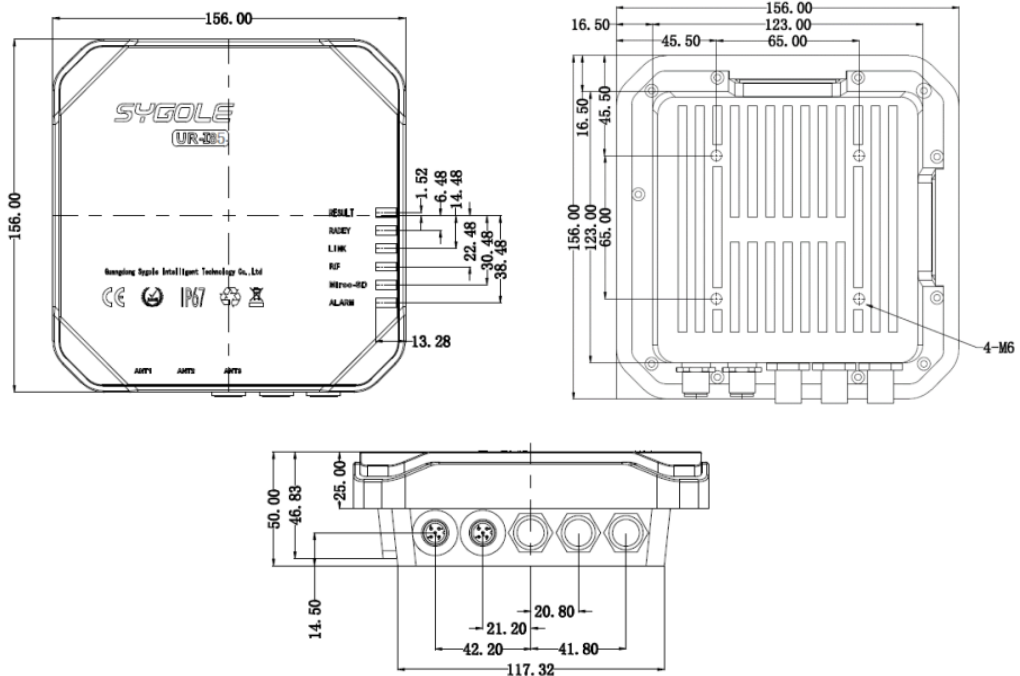


Fig 4.4.2 SG-UR-I85 Mechanical Dimensions (Unit mm)

### 4.4.3 SG-UR-I85 LED status definitions

The SG-UR-I85 has six LED indicators, which are defined as follows:

Tab 4.4.1 SG-UR-I85 reader lamp name and function description

Indicator name	Description
RESULT	Off: No read and write operations Flashing Blue: tag read and write operations in progress
READY	Steady blue: Various states are normal, the device is ready for reading and writing operations.
LINK	Steady blue: The data port is connected properly. Flashing blue: Data communication is in progress
RF	Steady blue: The device amplifier is on and the amplifier is activated.
Micro SD	Steady blue: Insert an external expansion card (This product does not support, is off)
ALARM	Steady red: device alarm

## 4.5 Reader SG-UR-I86

### 4.5.1 SG-UR-I86 schematic diagram

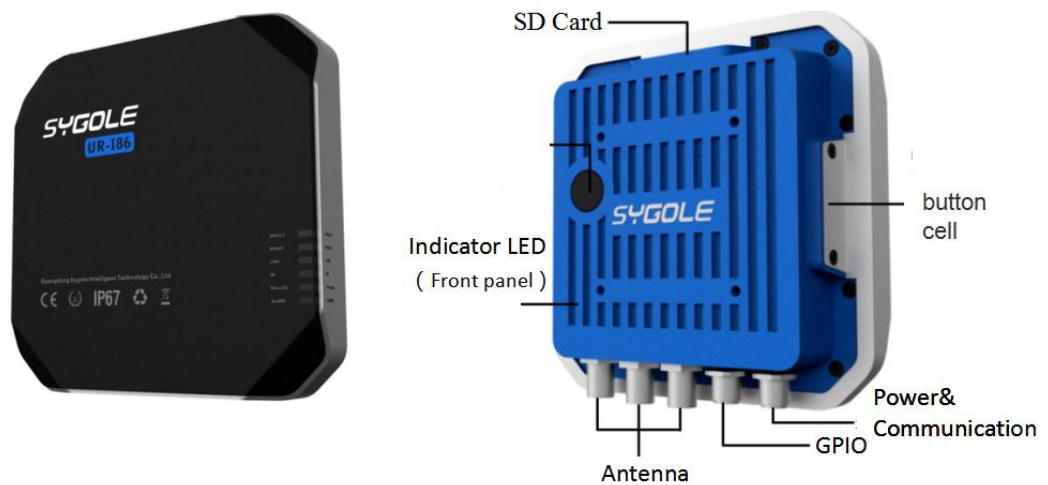


Fig 4.5.1 SG-UR-I86 Physical schematic

### 4.5.2 SG-UR-I86 mechanical dimension drawing

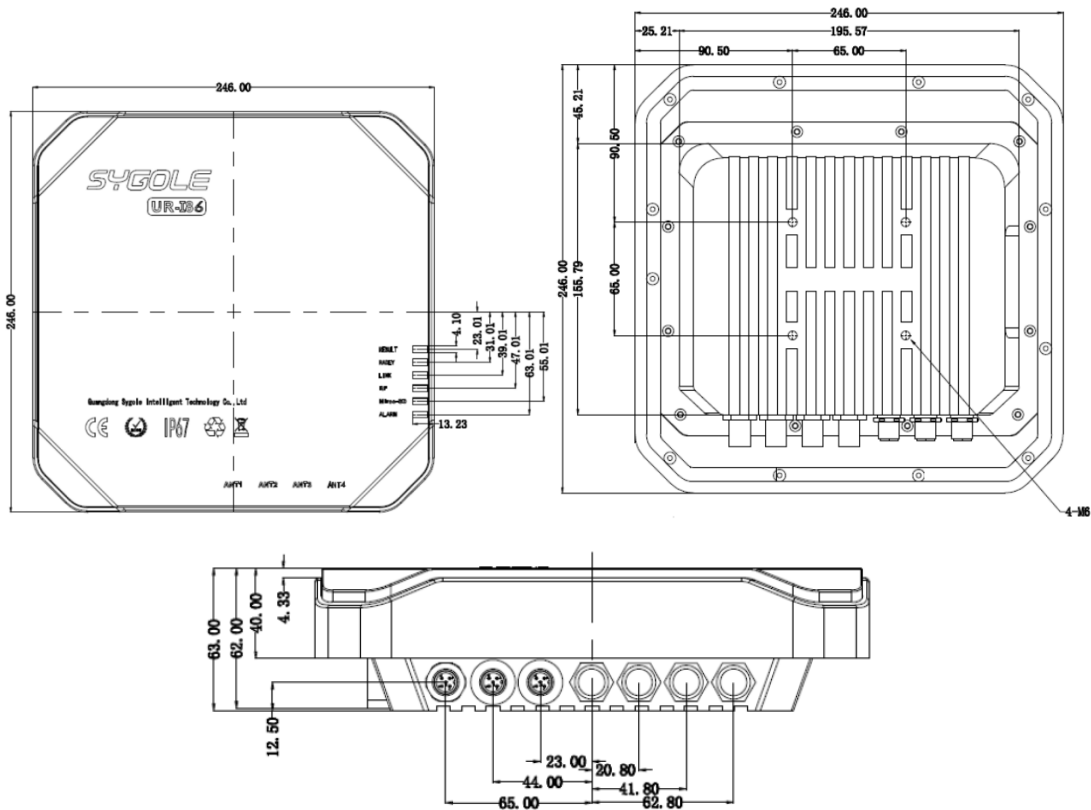


Fig 4.5.2 SG-UR-I86 Mechanical Dimensios (Unit mm)

### 4.5.3 SG-UR-I86 LED status definitions

The SG-UR-I86 has six LED indicators, which are defined as follows:

Tab 4.5.1 SG-UR-I86 reader lamp name and function description

Indicator name	Description
RESULT	Off: No read and write operations Flashing Blue: tag read and write operations in progress
READY	Steady blue: Various states are normal, the device is ready for reading and writing operations.
LINK	Steady blue: The data port is connected properly. Flashing blue: Data communication is in progress
RF	Steady blue: The device amplifier is on and the amplifier is activated.
Micro SD	Steady blue: Insert an external expansion card (This product does not support, is off)
ALARM	Steady red: device alarm

## 4.6 GPIO interface

The general-purpose input and output port (GPIO) enables the reader to add the input

and output functions of the binary signal to the upper monitor. The upper monitor can use the GPO port to control external devices such as solenoid valves and warning lights. At the same time, the upper monitor can also capture the signals of devices such as light sensors and buttons through the GPI port. The GPIO interface will be routed through the GPIO patch cable and then connected to various GPIO ports.

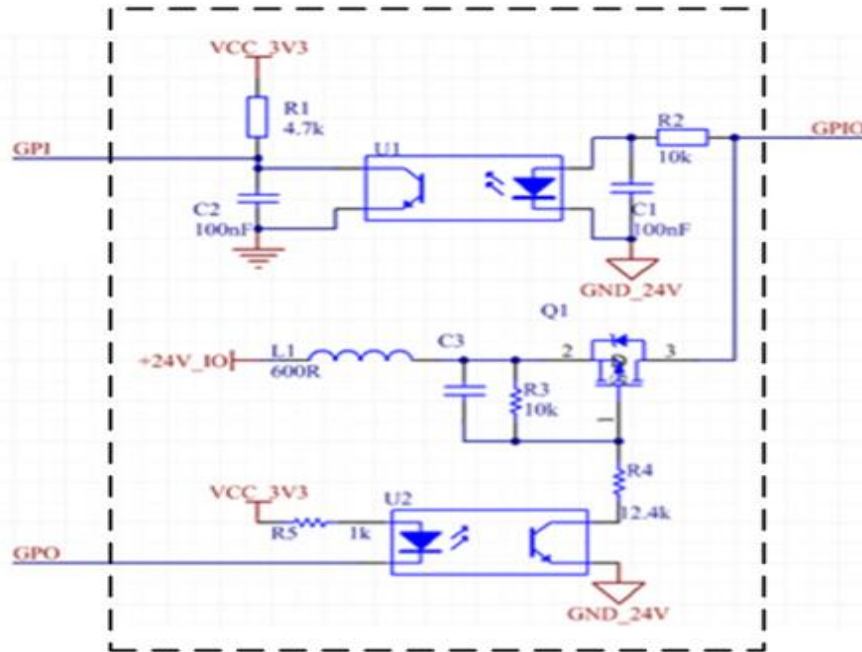


Fig 4.6.1 GPIO Circuit

The electrical parameters related to GPIO are as follows:

Tab 4.6.1 GPIO electrical parameters

<b>IO external supply voltage</b>	24V +/-15%
<b>GPO current</b>	≤200mA/ each way, the voltage is determined by external power supply
<b>GPI current</b>	≤10mA/each way, Voltage 14V~30V

The GPIO is derived from an 8-core aerospace connector (male), which is defined as follows:

Tab 4.6.2 IO interface (M12 Acoding 8pin male) pin definition

No.	Definition	Precast Cable Color	Schematic Diagram (M12 Acoding 8pin male)
1	24V	Brown	
2	NC	White	
3	0V	Blue	
4	IO_1	Pink	
5	IO_2	Gray	
6	IO_3	Yellow	
7	IO_4	Green	
8	NC	Red	

## 4.7 Ordering Information

Tab 4.7.1 I84/I85/I86 Series Reader Ordering Model Information

Model Communication Interface	SG-UR-I84	SG-UR-I85	SG-UR-I86
RS485	SG-UR-I84-RS485	SG-UR-I85-RS232	SG-UR-I86-RS485
POE	SG-UR-I84-POE	SG-UR-I85-BT(Bluetooth)	SG-UR-I86-POE

## 5. Antenna

The I84/I85/I86 series readers integrate 5dBi, 5dBi and 8dBi right-hand circularly polarized antennas with voltage standing wave ratio less than 1.3, and support the expansion of three-way RF channels (Bluetooth version supports extended two channels) output. It is convenient for enterprise distributed deployment and batch networking to satisfy different read distance requirements. The following briefly describes the electromagnetic field distribution of the antenna and the effect of the field on the tag.

As shown in the figure below, the radiation field of the antenna is divided into three parts: the main lobe, the side lobe and the back lobe.

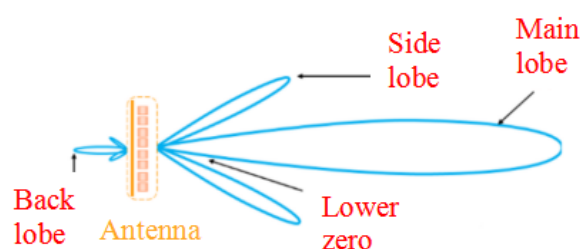


Fig 5.1 Antenna radiation field distribution

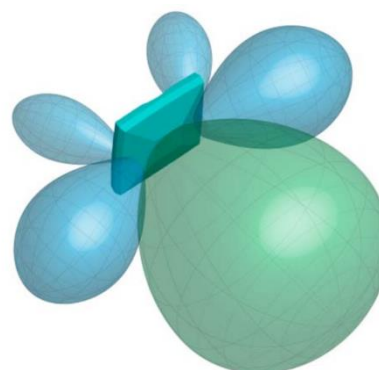


Fig 5.2 3D antenna radiation field distribution

The radiant energy of the antenna is mainly concentrated in the main lobe area. In practical applications, the tag should be read as far as possible in the main lobe field of the antenna to achieve a better recognition effect. The upper side lobes have a higher angle and a longer influence distance, which easily causes cross-region interference. That is, if adjacent tags are too close, the antenna will read other tags. Between the main lobe and the lower side lobes, there is a lower zero trap, which will cause a signal dead zone at this position. The "lower zero depth" vacancy can be filled by means of beam shaping.

It is also worth noting that when the reader is installed down, the amplitudes of the vertical and horizontal components of the antenna are constant, so the antenna pattern will be deformed. At this time, the tag antenna and the reader antenna are not flush, the read/write range is affected to some extent.

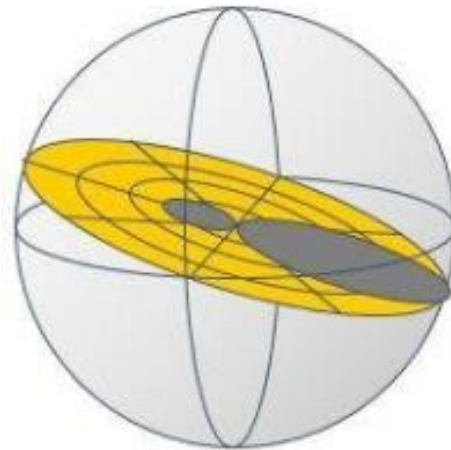
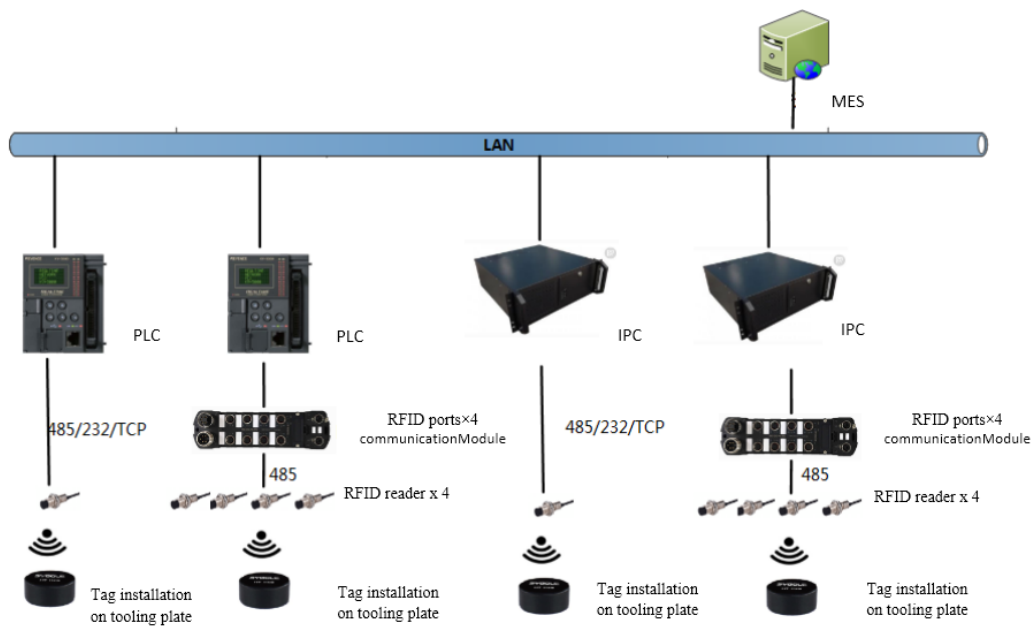


Fig 5.3 Antenna down-radiation field distribution map

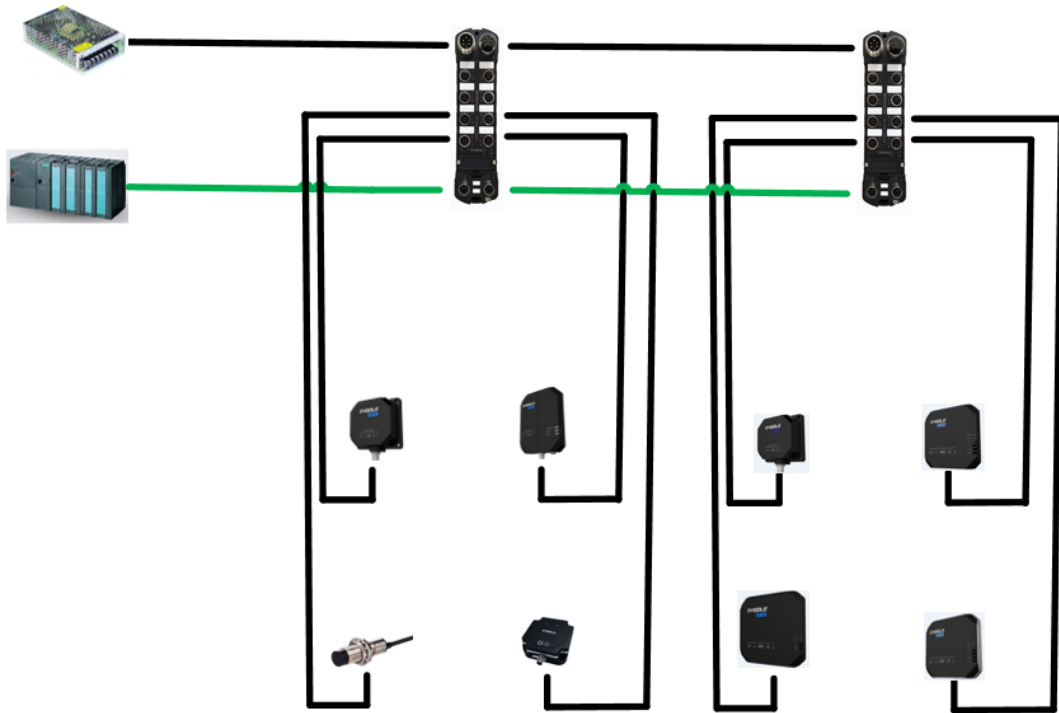
## 6. Networking Application

Sygole I84/I85/I86 series products support multiple communication modes. During networking application, the user may select a suitable communication mode according to the practical application conditions. Generally speaking, the hardware topology graph for application is as shown in the following figure:



### 6.1 Field bus communication mode

In some cases, the field bus communication mode should be adopted to meet such application requirements for large amount of RFID reader heads and high data timeliness. Sygole I84/I85/I86 series products can support the field bus through gateway controller, and support such protocols as ProfiNet, EtherCAT, Ethernet/IP, DeviceNet, CCLINK and MODBUS TCP. Specifically, readers are connected to the gateways which are mutually connected in series. In this way, all readers can be connected to the same network. Specifically, the networking mode is as follows:



## 6.2 POE communication mode

When RFID system is directly connected to MES system or the field cannot be used due to economic problem, it is also a good choice to connect all RFID equipment together through TCP/IP. Specifically, the networking mode is as follows:



## 6.3 Serial communication mode

All products of Sygole support RS232 or RS485 communication modes. MODBUS RTU communication protocol can be used in serial communication. RS485 communication mode can be used for networking application, and in networking application, various readers need to work at different time. The networking mode of RS485 is as follows:



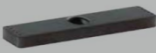


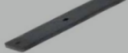



## 7. Tag

Sygole provides customers with multiple UHF data carrier selection to satisfy the application requirements of different scenarios, including FR anti-metal data carriers, high-performance anti-metal data carriers, special environmental tolerance data carriers, product tracking application data carriers and the like.

### 7.1 FR anti-metal data carriers

FR anti-metal data carriers is a series of UHF anti-metal PCB tags widely used in materials management, totes, metal asset equipment, vehicle and tool management.

					
Tag model	SG-UT-140M	SG-UT-282M	SG-UT-287M	SG-UT-295M	SG-UT-125M
Parameter					
Wireless protocol	EPC Global Class 1 Gen 2/ISO 18000-6C				
Frequency band	920~925MHz	902~928MHz	902~928MHz	920~925MHz	920~925MHz
Read-write distance	0~2.5m	0~3.5m	0~6m		0~2m
Chip	Impinj Monza R6	Impinj Monza R6		Alien H3	Impinj Monza R6
Memory	EPC 96Bits	EPC 96Bits	EPC 96Bits	EPC 96Bits	EPC 96Bits

capacity	TID 96Bits	TID 96Bits	TID 64Bits	TID 64Bits	TID 96Bits
	No USER	No USER	USER 512Bits	USER 512Bits	No USER
Working mode	Passive, read- write	Passive, read- write	Passive, read- write	Passive, read- write	Passive, read- write
Data retention time	More than 10 years	More than 10 years	More than 10 years	More than 10 years	More than 10 years
Repeatable erasing times	More than 100,000 times	More than 100,000 times	More than 100,000 times	More than 100,000 times	More than 100,000 times
Metal resistance	Anti-metal	Anti-metal	Anti-metal	Anti-metal	Anti-metal
Dimensions (mm)	40*10*3	53*10.5*1.5	80*20*3	95*25*3	25*10*3
Fixed type	Adhesive paste	Adhesive paste	Adhesive paste Screw fixing	Adhesive paste Screw fixing	Adhesive paste
Working temperature	-20°C~+70°C, 20%~90%RH				
Storage temperature	-40°C~+85°C, 20%~90%RH				
Enclosure rating	IP65	IP65	IP67	IP65	IP65

## 7.2 High performance anti-metal date carriers







High-performance anti-metal date carriers are a series of UHF anti-metal ceramic tags which are widely used in materials management, totes, metal asset equipment, vehicle and tool management, etc..

				
Tag model	SG-UT-113M	SG-UT-112M	SG-UT-116M	SG-UT-118M
Parameter				
Frequency band	920~925MHz	920~925MHz	920~925MHz	920~925MHz
Read-write distance	0~2m	0~1m	0~2.5m	0~3m
Chip	Alien H3	Impinj Monza R6	Alien H3	Alien H3
Memory capacity	EPC 96Bits	EPC 96Bits	EPC 96Bits	EPC 96Bits
	TID 64Bits	TID 96Bits	TID 64Bits	TID 64Bits
	USER 512Bits	NO USER	USER 512Bits	USER 512Bits
Working mode	Passive, read- write	Passive, read- write	Passive, read- write	Passive, read- write
Data retention time	More than 10 years	More than 10 years	More than 10 years	More than 10 years
Repeatable erasing times	More than 100,000 times	More than 100,000 times	More than 100,000 times	More than 100,000 times

Metal resistance	Anti-metal	Anti-metal	Anti-metal	Anti-metal
Dimensions (mm)	13*9*3	13*4.5*2	23*9*3	39*10*3
Fixed type	Adhesive paste	Adhesive paste	Adhesive paste	Adhesive paste
Enclosure rating	IP67	IP67	IP67	IP67

### 7.3 Special environment tolerance date carriers




Sygole industrial grade high-strength shell UHF date carriers are a series of high-strength engineering plastic shell labels, which are widely used in asset management (mold, material truck, metal frame, etc.), turnover box management and other fields.

						
Tag model	SG-UT-246M	SG-UT-264	SG-UT-272M	SG-UT-274M	SG-UT-305M	SG-UT-403MT
Parameter						
Wireless protocol	EPC Global Class 1 Gen 2/ISO 18000-6C					
Frequency band	920~925MHz		902~928MHz			
Read-write distance	0~4m	0~4m	0~8m	0~8m	0~10m	0~4m
Memory capacity	EPC 96Bits					
	TID 64Bits					
	USER 512Bits					
Working mode	Writable and readable					
Data retention time	More than 10 years					
Repeatable erasing times	More than 100,000 times					
Metal resistance	Anti-metal Thermostability	Non-anti-metal	Anti-metal Resistance to rolling	Anti-metal	Anti-metal	Anti-metal High temperature resistance
Dimensions (mm)	47*35*5	85*54*4	95*28*5	50*15*5.5	245*27*16	13*38*7
Fixed type	M3 screw fixing	Adhesive /screw fixing	Adhesive/screw fixing	Adhesive	magnet /screw fixing	M3 screw fixing
Working temperature (°C)	-30~+85	-30 ~+65	-20~+70	-20~+85	-25~+65	-30~+85
Storage temperature (°C)	-40~+180	-40~+80	-40~+80	-30~+80	-40~+85	-40~+180

Enclosure rating	IP67	IP65	IP65	IP54	IP67	IP69K
Typical application	Mold management Vehicle identification		Landmark AGV guidance	Vehicle management	Body recognition	Mold management Body recognition

## 7.4 Product tracking application date carriers

Sygole product tracking application UHF date carriers are a series of electronic tags that can be applied to the whole process of vehicle manufacturing (welding, final assembly, spraying), engine manufacturing process, asset management, etc..

				
Tag model parameter	SG-UT-525M	SG-UT-416T	SG-UT-386M	SG-UT-283M
Frequency band	902~928MHz	902~928MHz	902~928MHz	860~960MHz
Read-write distance	0~1m	0~6m	0~6m	0~11m
Memory capacity	EPC 96Bits	EPC 96Bits	EPC 96Bits	EPC 96Bits
	TID 64Bits	TID 64Bits	TID 64Bits	TID 64Bits
	USER 61、440Bits	USER 512Bits	USER 512Bits	USER 无
Working mode	Passive, read- write	Passive, read- write	Passive, read- write	Passive, read- write
Data retention time	More than 10 years	More than 10 years	More than 10 years	More than 10 years
Repeatable erasing times	10 <sup>12</sup>	More than 100,000 times	More than 100,000 times	More than 100,000 times
Metal resistance	Anti-metal	Anti-metal	Medium independent	Non-anti-metal
Dimensions (mm)	22*21.2	76*50*0.5	138*66	80*27*1
Fixed type	Embedded metal, read surface flush or exposed metal	Adhesive paste、Screw	Cable tie installation	Adhesive paste
Tag protection material	304 stainless steel	PPS	ABS	PVC
Working temperature (°C)	-40~+85	-20~+85	-20~+60	-40~+70
Storage temperature (°C)	-40~+105	-40~+220	-40~+75	-40~+70

Enclosure rating	IP67	IP67	IP67	IP67
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**Note: The reading distance of the tag is related to the reader configuration and the on-site environment. The specific values are subject to the actual field test.**

#### **FCC NOTICE:**

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.

To assure continued operation, follow the attached installation instructions and use only shield cables when connecting to other devices. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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.

The equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. The equipment should be installed and operated with minimum distance 20cm between the radiator & your body.