SICOM3170
Industrial Ethernet Switch

User's Manual

KYLAND Technology Co., Ltd.

SICOM3170 Industrial Ethernet Switch
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Preface

SICOM3170 is a high-performance managed industrial Ethernet switch specially designed by KYLAND Technology CO., LTD. for traffic control system equipments. Its high-performance switch engine, and excellent EMC protection of RJ45 port make SICOM3170 applicable in harsh and dangerous industrial environments. Fiber network redundancy function and powerful network management system provide multiplex guarantee for reliable operation of the system.

The user's manual for SICOM3170 Industrial Ethernet Switch mainly introduces the technical principles, performance indexes, installation and commissioning, etc. It is a reference for users in system startup, expansion and routine maintenance. It is also a practical teaching material for user training and technician study.

This manual mainly includes the following contents:

Chapter 1 Overview and system features of SICOM3170;

Chapter 2 Performance indexes of SIOCM3170;

Chapter 3 Hardware structure of SICOM3170;

Chapter 4 Installation of SICOM3170;

Chapter 5 Field test methods for SICOM3170;

Chapter 6 Network topology and system configuration of SICOM3170;

Appendix A Introduces twisted pair and pin distribution rules of SICOM3170;

Appendix B Introduces cable types and specifications of SICOM3170;

Appendix C Introduces abbreviations used in this manual.

Statement: As product and technology upgrades and improves constantly, the contents of this document may not completely accord with the actual product. For product upgrading information, please visit our company's website or directly contact with our business representative.

Notice for Safety Operation

This product performs reliably as long as it is used according to the guidance. Artificial damage or destruction of the equipment should be avoided.

● Read this manual carefully and keep it for future reference;

● Do not place the equipments near water sources or humid places;

● Do not place anything on power cable and put the cable in unreachable places;

● Do not tie or wrap the cable to prevent fire.

● Power connectors and other equipment connectors should be firmly interconnected and frequently checked.

 In the following cases, please immediately cut off the power supply and contact our company:

1. Water gets into the equipments;

2. Equipment damage or shell breakage;

3. Abnormal operation conditions of equipment or the demonstrated performances have changed;

4. The equipment emits odor, smoke or makes noise.

● Please keep optical fiber plugs and sockets clean. During the operation of equipments, do not look directly at the cross section of optical fiber;

● Please keep the equipment clean; if necessary, wipe the equipment with soft cotton cloth;

● Do not repair the equipment by yourself, unless it is clearly specified in the manual.

Explanation of Warning Marks:

This manual uses two kinds of noticeable warning signs to arouse special attention of users during operation. The implications of these signs are as follows:

Warning: pay special attention to the notes behind the mark, improper operation will lead to serious damage of the switch or injury of the operating personnel.

Caution, attention, danger: remind the operators places that need to pay attention to.

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Chapter 1: System Overview

1.1 Product Overview

SICOM3170 is a high-performance managed industrial Ethernet switch specially designed by KYLAND Technology CO., LTD. for traffic control system equipments. Its high-performance switch engine, solid and sealed case, over current, overvoltage and EMC protection at power input terminal, and excellent EMC protection of RJ45 port make SICOM3170 applicable in harsh and dangerous industrial environments. Fiber network redundancy function and dual redundant power inputs provide multiplex guarantee for reliable operation of the system.

SICOM3170 series industrial Ethernet switch have strong network management function which supports CLI, Telnet, WEB, SNMP and OPC-based network management.

SICOM3170 series has 2 uplinked redundant pluggable 1000M SFP slots in the front panel which can form 1000Mbit fiber redundant ring network with the recovery time less than 50ms. It also provides 1 10/100/1000Base-T(X) RJ45 port and 7 10/100Base-T(X) RJ45 ports and each of RJ45 port has self-adaptive function, making it automatically configured to 10Base-T/100Base-TX/1000Base-TX, full/half duplex mode and MDI/MDI-X auto-connection.

1.2 Product Features

1.   **High performance industrial Ethernet switch**

Pluggable 1000M SFP slots, be used as fiber ports or RJ45 copper ports

Supports various management methods for user's easy management, such as WEB, CLI, TELNET, SNMP, OPC

The fiber ring network redundancy technology with recovery time less than 50ms, raising the reliability of system communication

IEEE802.3/802.U/802.3X, store and forward switching mode

Supports IGMP Snooping, port mirroring, Trunk, broadcast storm control, VLAN, SNMP

Supports DT-Ring, DT-Ring+, RSTP, etc

Supports TACACS+, Radius authentication mechanism, SSL/SSH encryption and authentication to improve network security

Alarm function for port and ring

FTP-based online software update, easy for user's device management and renewal

2. **Industrial Power Design**

Supports industrial power input: 24VDC (9~36VDC)

Power input with over-current, over-voltage and EMC protection

1.3 Packing list and unpacking check

1. **Packing list**

The packing list includes the following items:

SICOM3170   1 unit

User's Manual for SICOM3170 Industrial Ethernet Switch   1 copy

CD for SICOM3170 Network Management   1 piece

Customer Service Guideline   1 copy

Network cable   1 piece

2. **Unpacking check**

Before opening the case, place it stably, pay attention to the direction of the packing case and ensure its right side is facing upward, so as to prevent SICOM3170 falling from the case after opening it. If using a hard object to open the case, do not over extend the hard object into the case to avoid damage of the equipments inside it.

After opening the case, please check the amount of SICOM3170 equipments according to the packing list and check the appearance quality of SICOM3170.

Warning:

For the built-in precise parts of the equipment, please handle with care and avoid strenuous vibration to avoid affecting the performances of equipments.

Chapter 2: Performance Specifications

2.1 System Specifications

The system performance specifications of SICOM3170 industrial Ethernet switch are shown in Table 2-1.

Table 2-1 System Specifications

Specifications	SICOM3170
Quantity of RJ45 port	7×10 /100Base-T(X), RJ45
Quantity of redundant Gigabit fiber or copper ports	2×1000Base SFP slots; 1×10/100/1000Base-T(X), RJ45
System performance	Standards: IEEE802.3, IEEE 802.3x, IEEE 802.3u, IEEE 802.1w, IEEE802.1d, IEEE802.1p, IEEE802.1q, IEEE802.3z, IEEE 802.3ab, IEEE802.3ad Store-and-Forward speed: 100M: 148810pps; 1000M: 1488100pps Max. filtering speed: 1488100pps Switching mode: Store-and-Forward System switching bandwidth: 9.6G Complies with: FCC Part 15 Class A; EN61000-4-2 (ESD), Level 4; EN61000-4-3 (RS), Level 3; EN61000-4-4 (EFT), Level 4; EN61000-4-5 (Surge), Level 4; EN61000-4-6 (CS), Level 3; EN61000-4-8; IEC 61000-4-9; EN61000-4-11; EN61000-4-12; NEMATS2 (Traffic control equipment); IEC61000-6-2 (Industrial Standards); IEC61850-3 (Substations), IEEE1613 (Electric Power Substations), EN50121-4 (Railway Applications) Certifications: UL60950, UL508 (undetermined)
Console Interface	Physical port: shielded RJ45 Port Standard: in line with RS232 standard
TP port parameters	Physical port: shielded RJ45 RJ45 port: 10/100Base-T(X), 10/100/1000Base-T(X), supporting auto-negotiation Port standard: in line with IEEE802.3, IEEE802.3u, IEEE802.3ab standards Transmission distance: <100m
Fiber port parameters	Optical power: >-13dbm (SM)　>-20dbm (MM) Receiving sensitivity: <-28dbm (SM)　<-35dbm (MM)

	Wave length: 1310nm (SM)　1550nm (SM)　850nm (MM) 1310 nm (MM)
	Transmission distance: 10~80km (SM), 500m~2km (MM)
	Connector type: LC
	Transmission speed: 1.25Gbps
Power supply	Input voltage: 24VDC (9~36VDC)
	Input power consumption: <8W (full load)
Mechanical parameters	Physical dimensions (width×height×depth): 41.45 ㎜×114 ㎜ ×167.5 ㎜ (the width of front panel is 58mm and the depth of handle is 27.5mm)
	Mounting mode: Rail installation in Caltrans TEES (170/332)
	Heat removal method: Ribbed aluminum case (fanless)
	Shell protection class: IP40
	Weight: 0.8kg
Ambient conditions	Operating temperature: -40℃～85℃
	Storage temperature: -40℃～85℃
	Humidity: 0～95% (non-condensing）

2.2 Service Interface

1. 7 10/100Base-T(X) RJ45 and 1 10/100/1000Base-T(X) RJ45 ports. Each RJ45 port has self-adaptive function, capable of automatically configuring between 10Base-T, 100Base-TX and 1000Base-TX, between full duplex and half duplex mode, supporting MDI/MDI-X auto-connection. The max transmission distance is 100m. Support line redundancy technology and can form twisted pair redundant ring network with the recovery time less than 50ms.

2. 2 uplinked redundant Gigabit pluggable SFP slots for 1000Base-LX SM/MM interface modules or 10/100/1000Base-T(X) RJ45 interface modules and the maximum throughput of each pair is 1000Mbps; 1000M full duplex working mode is compulsory for fiber ports. Support line redundancy technology with recovery time less than 50ms.

3. Complies with IEEE802.3, IEEE802.3x, IEEE802.3u, IEEE802.1w, IEEE802.1d, IEEE802.1p, IEEE802.1q, IEEE802.3z, IEEE802.3ab, IEEE802.3ad, etc

Chapter 3: Hardware Structure

3.1 System Structure

The hardware structure of SICOM3170 is as Figure 3-1:
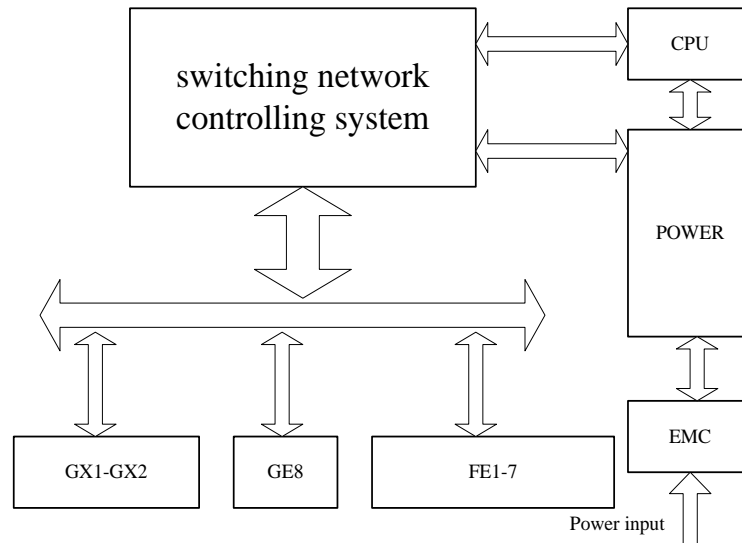

Figure 3-1 Hardware Structure

The system hardware includes:

1．High performance ASIC chip technology is applied in the switching network controlling system, providing layer two wire-speed forwarding of data packets

2．Fiber ports use optical transceiving modules with stable performance

3．Industrial power supply with over-current, over-voltage and EMC protection

4．All TP ports with EMC protection

3.2 Device Structure

3.2.1　Case

SICOM3000 case is plug-in structure. The entire unit adopts six-side-enclosed design with protection class up to IP40. The case is made of ribbed aluminum. The figuration of SICOM3170 case is shown in Figure 3-2.

Its contour dimension (excluding the dimensions of DIN-Rail and wall mounting components) is 41.45 ㎜× 114 ㎜×167.5 ㎜, (width ×height× depth) and the width of front panel is 58mm and the depth of handle is 27.5mm.
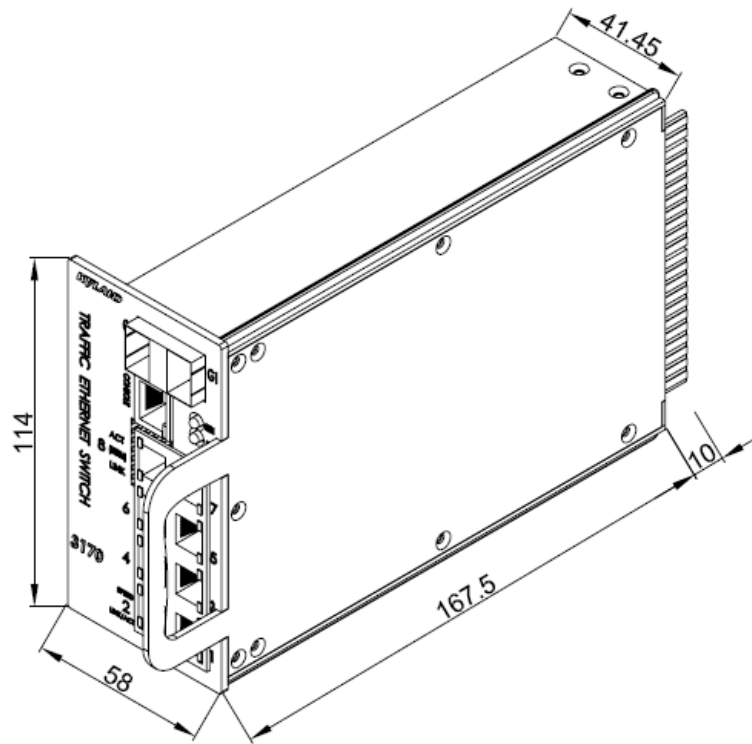
Figure 3-2 Case dimensions of SICOM3170 series

Warning: The chip at the back of main board get hot during working, so never touch the chip when the equipment is working to avoid burning, and appropriate treatment for heat dissipation is needed to prevent the switch failure due to overheating.

3.2.2 Front Panel

SICOM3170 Industrial Ethernet switch's front panel has 2 uplinked redundant Gigabit SFP slots, 1 10/100/1000Base-T(X) RJ45 port, 7 10/100Base-T(X) RJ45 ports and indicators showing power, system and port operation status. Its structure is shown as Figure 3-3：
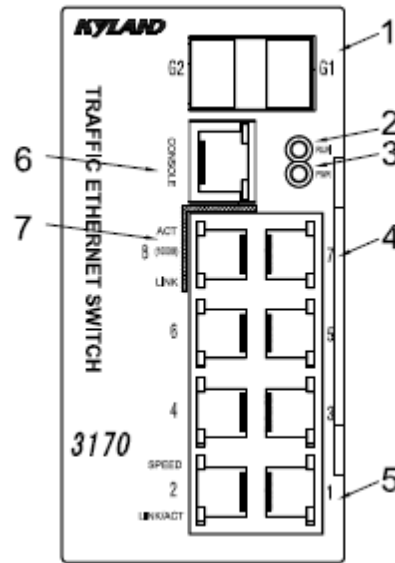
Note: 1 (G1, G2): Gigabit SFP slots; 2 (RUN): indicator for system operation; 3 (PWR): indicator for power connection; 4: handle; 5 (Port 1-7): 10/100Base-T(X) RJ45 ports; 6: CONSOLE interface; 7(Port 8): 10/100/1000Base-T(X) RJ45 port

Figure 3-3 SICOM3170's front panel

Gigabit SFP slots

SICOM3170 series has 2 redundant Gigabit SFP slots (G1 and G2), supporting 2 pairs of redundant 1000Base-LX full duplex SM/MM ports or 2 1000Base-TX RJ45 ports. The SFP slots adopt SFP interface modules (LC connector for fiber port, RJ45 connector for TP port). Fiber ports should be used in pairs (TX and RX are a pair). TX port is for transmission, connected to receiving port RX in another remote switch; RX port is for receiving, connected to the transmitting port TX in its pair in the same switch. The 2 pairs of redundant 1000Base-LX fiber ports can form a redundant fiber ring network with the recovery time less than 50ms, which effectively increase the reliability of network operation.

Ethernet RJ45 ports

SICOM3170 series has 7 10/100Base-T(X) RJ45 ports with port numbers 1 to 7 and 1 10/100/1000Base-T(X) port with port number 8. Each RJ45 port has self-adaptive function. They can be connected to terminal equipments, severs, hubs or other switches by straight-through or cross-over cables. Each port supports IEEE802.3x self adaptation, so the most suitable transmitting mode (full/half duplex) and data transmitting rate (10Mbps/100Mbps) can be automatically selected (the connected devices must support this characteristic). If the devices connected to these RJ45 ports do not support self-adaptation, these ports will transmit data at

suitable rate and the transmitting mode is default as half duplex. The redundant 10/100Base-T(X) RJ45 ports can form twisted pair redundant ring network with the recovery time less than 50ms to improve the network reliability.

LED indicators

The LED indicators in the front panel of SICOM3170 can indicate system operation status and port status in order to find and settle faults. Table 3-1 shows the meanings of LEDs in the front panel.

Table 3-1 LED indicators

| LED	State	Description
system status LEDs		
RUN	Blinking	Switch operates normally
	OFF	Switch does not operate or operate abnormally.
PWR	ON	Power is connected and operates normally.
	OFF	Power is not connected or operates abnormally.
Gigabit fiber port status LEDs (G1 and G2)		
LINK/ACT	On	Effective network connection in the port
	Blinking	Network activities in the port
	Off	No effective network connection in the port
Gigabit copper port status LEDs (G8)		
LINK (Green)	On	Effective network connection in the port
	Off	No effective network connection in the port
ACT (Yellow)	On	Network activities in the port
	Off	No network activities in the port
Ethernet RJ45 port status LEDs (1-7)		
Each RJ45 Ethernet port has two indicators, a yellow lamp and a green lamp. The yellow lamp indicates port rate, and the green lamp indicates port connection state.		
10M/100M (Yellow)	On	100M working state（i.e. 100Base-TX）
	Off	10M working state (i.e. 10Base-T）
LINK/ACT （Green）	On	Effective network connection in the port
	Blinking	Network activities in the port
	Off	No effective network connection in the port

RS232 Network management interface（CONSOLE）

The network management interface of SICOM3170 is a shielded RJ45 connector and its interface communication standard is 3-wire RS232. Users can use a network management cable with one end bearing RJ45 plug and the other end USB plug to connect the network management interface with the serial port of the control computer. Operate the hyper terminal in the control computer to configure SICOM3170 by CLI command. The cable connection is shown in the following table.

RJ45 Connector	The name of signal
2	TXD
3	RXD
5	GND

3.2.3 Rear panel

The rear panel of SICOM3170 industrial Ethernet switch has a Gold Finger connector for power connection. Its structure is as figure 3-4.
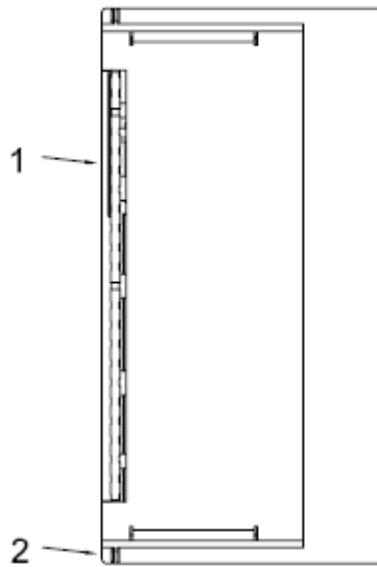
Note: 1: Gold Finger connector; 2: The rail in the top and bottom panels

Figure 3-4 Rear panel

Gold Finger

SICOM3170 uses Gold Finger to connect the power source in the back panel for power supply, supporting 24VDC (9~36VDC).

Table 3-3 The Pin definition of Gold Finger

A	B	H
GND	+24VDC	PGND

Chapter 4 Hardware Installation

4.1 Installation requirement

SICOM3170 series industrial Ethernet switch is a single unit, which can be directly inserting into the rack along with the DIN-Rail slot.

Before installation, make sure all conditions match the installation requirements below.

1．Power supply: SICOM3170 supports 24VDC (9VDC~36VDC) power input

2．Environment: operating temperature: -40℃～85℃; Relative humidity (non-condensing) 0%～95%

3．Earthing resistance: <5Ω

4．Make sure all fiber units are ready for use

5．Avoid direct sunshine, heating device and strong EMC area

6．Check whether there are cables and connectors needed.

4.2 Mainframe installation

Taking SICOM3170 out of the packing box and mounting it on the rack. Before mounting, make sure the following is ready.

1．Make sure there is enough space for SICOM3170 on the rack.

2．Ensure you are using a proper power voltage for SICOM3170

3．After selecting the location for installation, mounting SICOM3170 on the rack as the following steps: Insert the rail into the slot on the rack and push the whole switch into the rack with the handle until the Gold Finger connecting with the power socket in the back panel as Figure 4-2.
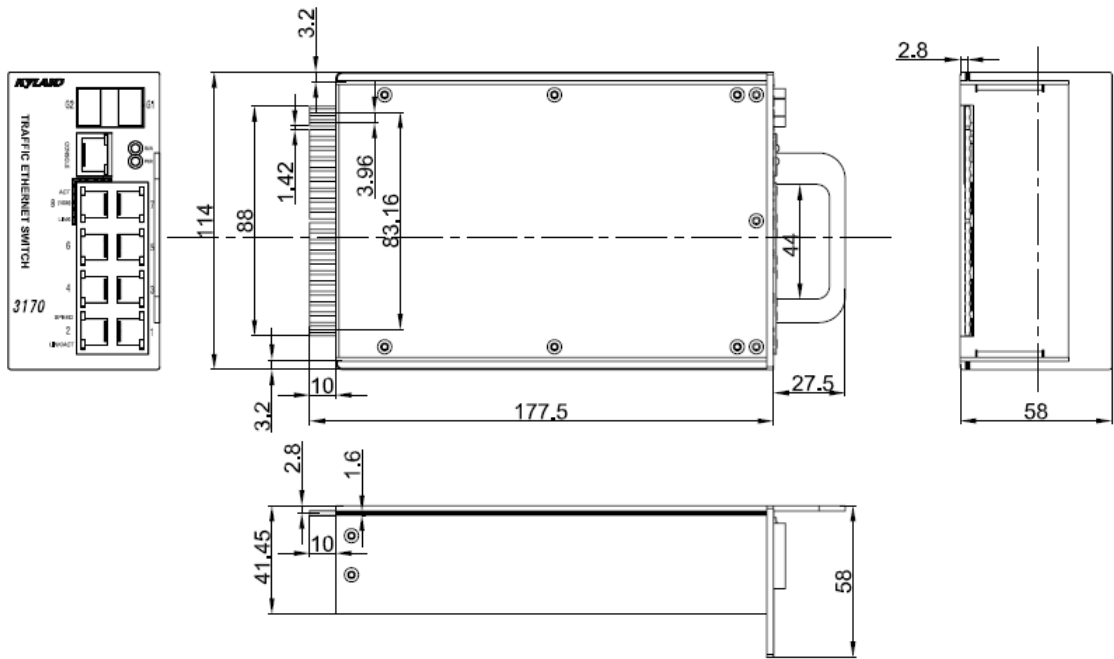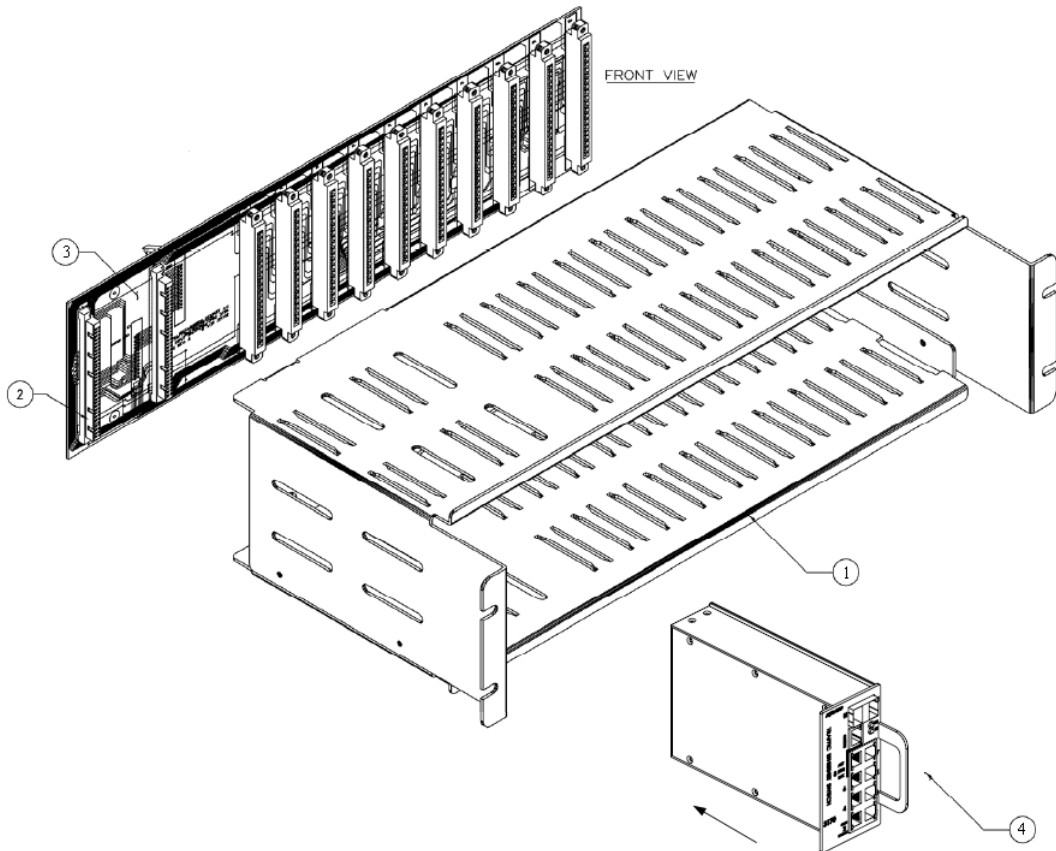
Figure 4-1 Mechanical Drawing of SICOM3170

Note: 1: Rack for mounting; 2: Power socket; 3: Back panel; 4: SICOM3170

Figure 4-2 SICOM3170 installation

4.3　Cable connection

After the installation of SICOM3170, the next step is to connect the cables.

1．Connecting service interface

SICOM3170 offers 10/100Base-TX RJ45 ports to connect with terminal equipments by straight-through cables, and to connect with network devices by cross-over cables.

2．Connecting power

Use the proper power voltage listed on the product label. After finishing other cables connection, connect the power.

⚠ Attention: In order to prevent the equipment damage, please use the power voltage listed on the switch label and do not exceed 36VDC.

4.4　Optical Fiber Connection

SICOM3170 provides 2 uplinked redundant Gigabit pluggable SFP slots which can form Gigabit fiber redundant ring network. When the failure occurs in the network, the recovery time is within 50ms. The fiber ports support LC connector.

⚠ CAUTION：

Laser is used to transmit signals in fiber cables. Routine operation do not harm to eyes, but do not directly look at the fiber port when the switch is powered on.

The connecting steps are as follows

1．Remove the rubber caps of the fiber ports and keep them for protecting the ports when they are not used.

2．Check whether the ports are clean. Dirty ports might affect the transmitting quality. Use wet handkerchiefs or cotton balls to sweep the cable connectors.

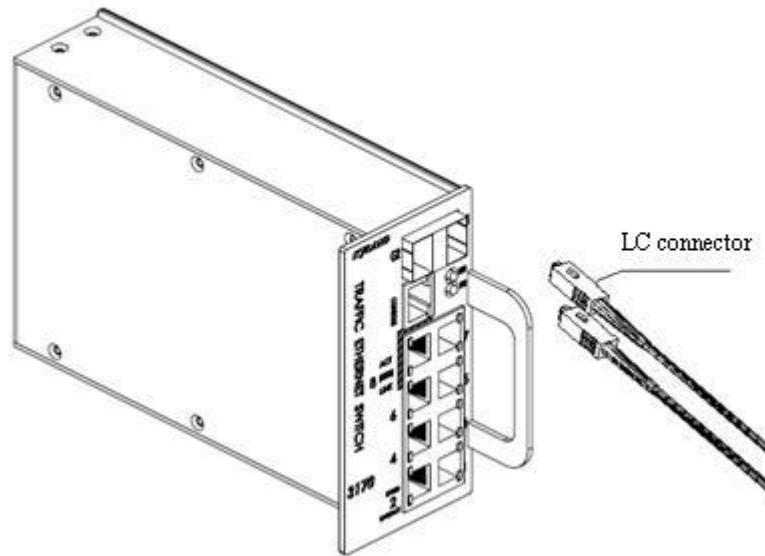3．Connect the fiber cables to fiber ports, shown as picture 4-3

Figure 4-3 : Fiber cable connection

4．After connection, check the corresponding LINK/ACT indicator in the front panel of switch. If the indicator goes on, it means an effective connection.

4.5 Cable Wiring

Cable wiring should meet the following requirements:

1．Before cable wiring, check whether the specifications, models and quantities of all cables comply with the construction drawing design and contract requirements.

2．Before cable wiring, it is necessary to check whether there are damaged cables and whether the cables are accompanied by ex-factory records and vouchers attesting their quality such as quality assurance certificate etc.

3．The specifications, quantities, route directions and laying position of the cables to be laid should meet the design requirements of construction drawings. The laying length of each cable should be determined according to its actual position.

4．No intermediate break or joint is allowed for the cables to be laid.

5．User's cables and power cable should be laid separately.

6．Inside walkways, the cables should be properly arranged in good order, with uniform, smooth and flat turnings.

7．Cables should be straightly laid in cable channels. Extruding of cable from cable channels to

block other outlet or inlet holes is not allowed. The cables at the outlet part of cable channel or at turnings should be bundled and fixed.

8. If cables, power line and grounding conductor are laid in the same channel, cables, power line and grounding conductor should be not folded or blended together. If a cable line is overly long, coil and place it in the middle of the cabling rack, do not let it cover on other cables.

9. When laying the pigtail, avoid knotting of optical fiber cable, minimize the amount of turnings and avoid turnings with overly small radius. Bundle pigtails in proper tightness and avoid too tightly bundling. If laid on a cabling rack, it should be placed separately from other cables.

10. There must be the relevant marks at both ends of cable and the information on the marks should be explicit to facilitate maintenance.

⚠ Attention:

When laying pigtails, prevent optical fiber cable from knotting, minimize the amount of turnings and avoid turnings with too small radius, because turning with too small radius will result in serious consumption of optical signal of links, affecting communication quality.

Chapter 5: Test Methods

5.1 Self inspection

After the equipment is powered on, PWE indicator will keep on and after 2 seconds, all service indicators in the front panel will blink one time. After 30 seconds, the devices is started up and RUN indicator is blinking.

5.2 TP Port Test

As shown in Figure 5-1, after SICOM3170 is powered on, respectively connect two TP ports in the switch to two test computers by straight-through cables, and send the "ping" command to each other. If both of them receive complete command without packet loss and the corresponding yellow light of the port keep on (PC work on 100M) or keep off (PC work on 10M) and the corresponding green light blink, they mean that these two TP ports are in good conditions. Test other TP ports as the same way. The PING command example is as follows.
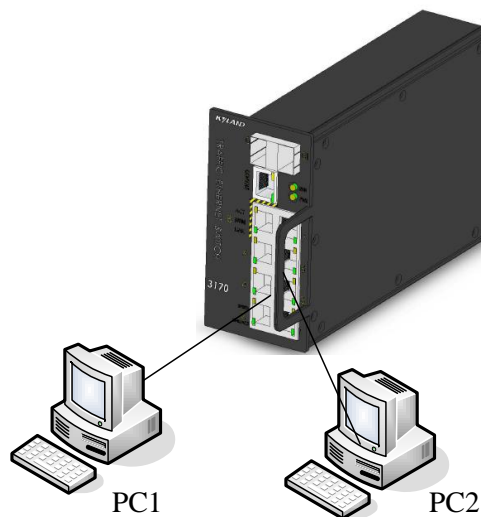

Figure 5-1 TP port test

5. 3 Fiber Port Test

As shown in Figure 5-2, firstly two units of SICOM3170 are connected to a fiber chain network. Then connect any RJ45 port in each switch with test computers by straight-through cables and

send Ping command to each other. They can both get command without packet loss and the corresponding LINK/ACT indicators of the fiber ports go on, showing the testing fiber ports work well. In the same way, test other pairs of fiber ports. The PING command example is as follows.
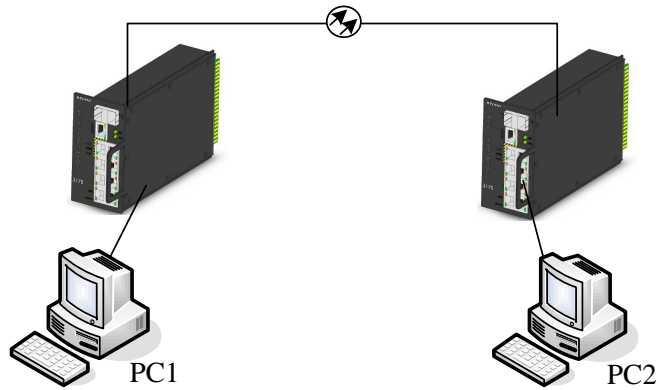

Figure 5-2 Fiber port test

PING command example：

Suppose the IP address of test computer 1 is 192.168.100.10 and the test computer 2 is 192.168.100.11. Click the "Begin" menu on the test computer 1, select the "Operation" item, input "cmd" (WIN2000) or "command" (WIN98/95), and send ping 192.168.100.11 –l 1000 –t; (-1 means the number of bytes of sending packets, -t means keep sending the data);

Operate the "Begin" menu on the test computer 2, select the "Operation" item. input "cmd" (WIN2000) or "command" (WIN98/95), and send ping 192.168.100.10 –l 1000 –t.

Test computer 1 returns "Reply from 192.168.100.11：bytes=1000 time<10ms TTL=128", Test computer 2 returns "Reply from 192.168.100.10：bytes=1000 time<10ms TTL=128". Ten minutes later, use CTL+C command to get the packet loss rate. If the rate is "0", it shows that the equipment are running well.

Chapter 6：Networking and Configurations

6.1 Networking

SICOM3170 industrial Ethernet switch provides 7 10/100Base-T(X) RJ45 ports, each of which can provide direct links to the terminal devices, or be connected to another industrial Ethernet switch/hub before terminal devices as shared links. SICOM3170 has 2 redundant 1000M pluggable SFP slots which can be used to form 1000Mbit fiber or twisted pair redundant ring network with the recovery time less than 50ms. Two Gigabit ports forming a ring network and one Gigabit port uplinked can be widely used in the fields of power, transportation, energy, water treatment, factory automation, etc.

The most typical networking topology of SICOM3170 is redundant ring network. As Figure 6-1, SICOM3170 form a redundant fiber ring network, in which one device is set as master and the rest are slaves. The recovery time of re-communication is less than 50ms.
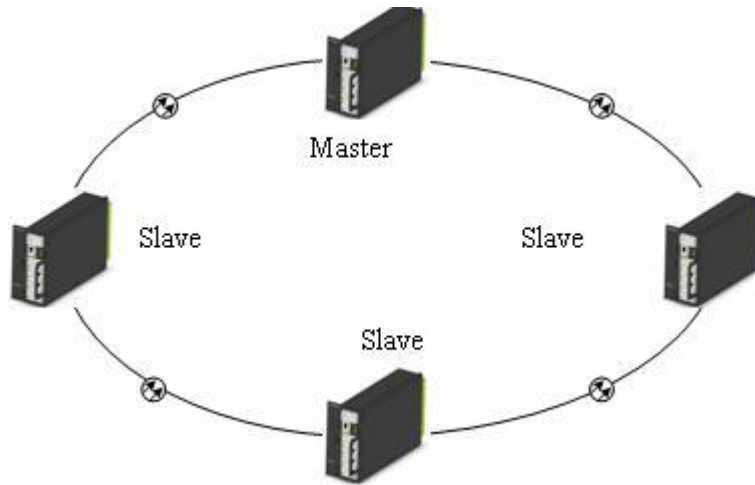

Figure 6-1 the redundant fiber/twisted pair ring network of SICOM3170

6.2 System configuration

SICOM3170 industrial Ethernet switch is an integrative structure and supports 24VDC (9~36VDC) power supply. Detailed configuration and models are shown in Table 6-1 and the optional Gigabit SFP modules are described in the Table 6-2.

Table 6-1 Configuration table of SICOM3170

Models	Description	Power supply

SICOM3170-2GX-GE-7T	2 Gigabit SFP slots, 1×10/100/1000Base-T(X), RJ45 port, 7×10/100Base-T(X) RJ45 ports	12VDC, 24VDC
SICOM3170-2GX-8GE	2 Gigabit SFP slots, 8×10/100/1000Base-T(X) RJ45 ports	

Table 6-2 Gigabit SFP Modules

Models	Description
SM-GSFP-LX/LC-550	SFP module with 1 x 1000M multimode port, LC, 1310nm, 550m
SM-GSFP-LX/LC-10	SFP module with 1 x 1000M single mode port, LC, 1310nm, 10km
SM-GSFP-LH/LC-40	SFP module with 1 x 1000M single mode port, LC, 1310nm, 40km
SM-GSFP-ZX/LC-60	SFP module with 1 x 1000M single mode port, LC, 1550nm, 60km
SM-GSFP-ZX/LC-80	SFP module with 1 x 1000M single mode port, LC, 1550nm, 80km

Appendix A: Twisted-pair and Pin Distribution

For the connection of 10Base-T/100Base-TX, the twisted-pair must have two pair cable. Each pair is distinguished with two different colors. For example, one strand is green, and the other is the alternate of green and white stripes. RJ-45 connector should be equipped at both ends of the cable.

⚠ Warning:

Don't insert a telephone plug into any RJ-45 port. Only use twisted-pair with RJ45 connectors at both ends conforming to FCC standard.

Fig. A-1 Shows how the connector of RJ-45 is numbered please make sure that the inserting direction is correct.
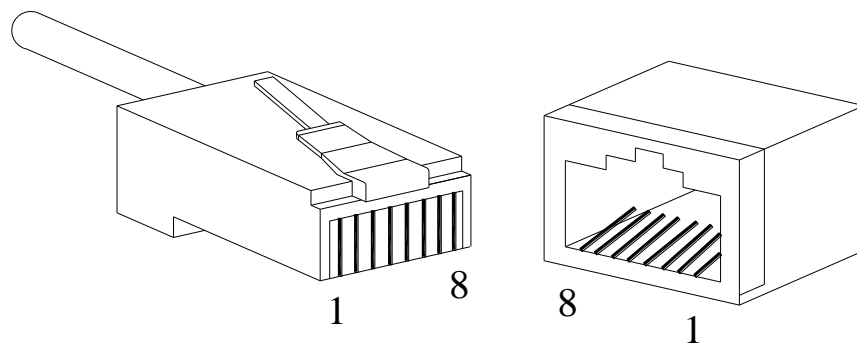

Figure A-1 Connector of RJ-45

Pin distribution of 10Base-T/100Base-TX

Unshielded twisted- pair (UTP) or shielded twisted-pair (STP) will be used for the connection of RJ-45: for the connection of 10Mbps, category 3, 4 and 5 of 100 ohm will be used, and cat.5 of 100 ohm will be used for 100Mbps. Additionally, do make sure that the connecting length of any twisted-pair shall not exceed 100 meter.

Port of RJ-45 supports automatic MDI/MDI-X operation, PC or server may be connected by straight-through cable, or connect with other switch or hub. In straight-through cable, pin 1, 2, 3 and 6 at one end of the cable are connected to pin 1, 2, 3 and 6 at the other end of the straight-through cable respectively. Cross-over cable must be used for switch or hub with MDI-X port. The pin distribution of 10Base-T/100Base-TX is listed in the table A-1.

Table A-1 Pin distribution of 10Base-T/100Base-TX

| Pin	MDI-X signal name	MDI signal name
1	Receiving data ＋ （RD+）	Output data＋ （TD+）
2	Receiving data － （RD-）	Output data － （TD-）
3	Output data ＋（TD+）	Receiving data＋（RD+）
6	Output data－ （TD-）	Receiving data －（RD-）
4，5，7，8	Unused	Unused

Note: "+""-"denoting cable polarity.

Table A-2 Pin distribution of 10/100/1000Base-T(X)

Pin	MDI/MDI-X signal name
1	TD0+
2	TD0-
3	TD1+
4	TD2+
5	TD2-
6	TD1-
7	TD3+
8	TD3-

Note: "+""-"denoting cable polarity.

Definition of straight-through cable from RJ45 (8-pin) to RJ45 (8-pin)
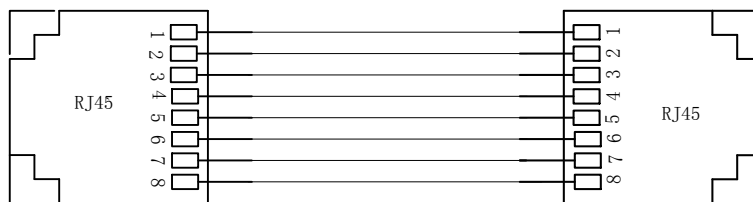
The connection sequence is in turn: Orange-white, Orange, Green-white, Blue, Blue-white, Green, Brown-white and Brown

Figure A-2   Cable sequence of straight-through cable

Definition of Cross-over cable from RJ45 (8-pin) to RJ45 (8-pin)

The connection sequence is in turn: Orange-white, Orange, Green-white, Blue, Blue-white, Green, Brown-white and Brown
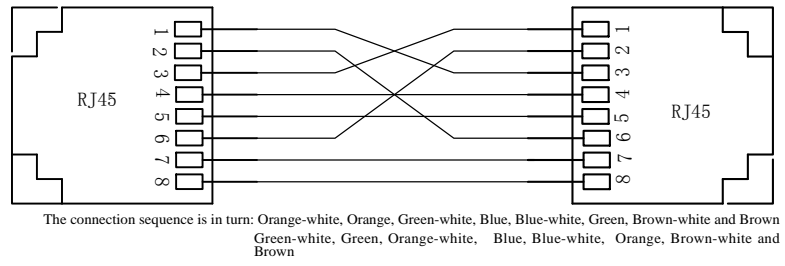Green-white, Green, Orange-white, Blue, Blue-white, Orange, Brown-white and Brown

Figure A-3 Cable sequence of cross-over cable

Appendix B: Cable Type and Specifications

The cable type and specifications are shown as table B-1:

Table B-1 Cable type and specification

Cable	Type	Max. length	Connector
10Base-T	Cat 3,4 and 5 100ohm UTP	100m	RJ45
100Base-TX	Cat 5 -100ohmUTP	100m	RJ45
100Base-FX	50/125 or 62.5/125μm core multi-mode fiber（MMF）	5km（1310nm MM）	SC/FC/ST
100Base-FX	9/125μm core single-mode fiber（SMF）	40km（1310nm SM） 80km (1550nm SM)	SC/FC/ST
1000Base-TX	Cat 5-100 ohm UTP	100m	RJ45
1000Base-SX	50/125μm multi-mode fiber (850nm)	500m	LC
1000Base-SX	62.5/125μm multi-mode fiber (850nm)	275m	LC
1000Base-LX	50/125μm multi-mode fiber (1310nm)	1100nm	LC
1000Base-LX	62.5/125μm multi-mode fiber (1310nm)	550m	LC
1000Base-LX	9/125μm single mode fiber (1310nm)	10km	LC
1000Base-LH	9/125μm single mode fiber (1310nm)	40km	LC
1000Base-ZX	9/125μm single mode fiber (1550nm)	60, 80km	LC

Appendix C: Glossary

Terminology	Explanation
10Base-T	Twisted-pair standard of Cat3, Cat4 and Cat5 in IEEE specification for 10Mbps Ethernet
100Base-TX	Twisted-pair standard of Cat5 or above in IEEE specification for 100Mbps Fast Ethernet
100Base-ＦX	Fast Ethernet which uses one pair of multi-mode or single mode optical fiber to transmit.
1000Base-T	Gigabit Ethernet which using Cat.5 UTP as transmission medium, max effective transmission distance is up to 100m. U
1000Base-LX	Gigabit Ethernet which uses one pair of multi-mode or single mode optical fiber to transmit.
Adaptive	A characteristic that is automatically configured to adaptive mode for the speed, duplex and traffic control port.
Bandwidth	The information capacity that the channel can transmit. For instance, the bandwidth of the Fast Ethernet is 100Mbps（bit per second）.
Baud Rate	It expresses the signaling rate which is defined as the change times of the status for the electric or optical transmission medium within 1 second.
Bridge	One of network equipments which run on the layer2 in the OSI layer7 model, and it can be connected to the LAN or network segment which uses the same protocol. It presents the automatic network address learning and network configuration function.
Broadcast	One data packet is sent to all equipments on the network.
Broadcast storm	Restless forward broadcast frame or multicast frame on bridge caused by the bridge ring.

Full Duplex	Use switches to set up the point to point connection among nodes in the LAN and allow them to receive and send data packet at the same time.
Half Duplex	The communication for two nodes can only move toward one direction at the same time, but cannot move toward both directions.
MDI	It is the Medium Dependent Interface, in which, one Ethernet port is taken as the receiving terminal to connect to the port of other equipment.
MDI-X	Medium Dependent Interface Cross-over