RS Series User Manual

Industrial Redundant Ring Switch

Version 1.2

This document applied to models of
RS-405/405F/405A/405AF/408/408A, RSM-405/405F/405-R/405AF/408/408A



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Revision History

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Disclaimer

Limited Warranty

All products manufactured by ICP DAS are warranted against defective materials for a period of one year from the date of delivery to the original purchaser. During this period, if a customer is unable to resolve a product problem with ICP DAS Technical Support, a Return Material Authorization (RMA) will be issued. If the product is not under warranty, the customer may have ICP DAS repair the unit on a fee basis or return it.

This warranty is voided if the customer uses the product in an unauthorized or improper way, or in an environment for which it was not designed.

Standards

The Ring Switch meets the following standards:

EMCimmunity - IEC61326-1, IEEE C37.90
EMI emissions - FCC part 15, ICES 003, EN55022; Class B
Electrical safety - UL 508, CSA C22/14; EN61010-1 (IEC1010)

Warning

ICP DAS assume no liability for damages consequent to the use of this product. ICP DAS reserves the right to change this manual at any time without notice. The information furnished by ICP DAS is believed to be accurate and reliable. However, no responsibility is assumed by ICP DAS for its use, nor for any infringements of patents or other rights of third parties resulting from its use.

Safety

Install the Real Time Ring Switch in accordance with local and national electrical codes.

Lightning Danger: Do not work on equipment during periods of lightning activity.

Do not connect a telephone line into one of the Ethernet RJ45 connectors.

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Preface

The advent of Ethernet brings the whole world a new territory. So it does in industrial application. More and more industrial devices and equipment now support Ethernet. To make all these devices and equipment integrated and worked, the Ethernet switch is a key character.

For commercial using, the Ethernet switch is very easy to choose, and also cheap. But, in industrial field application, user must take the environment conditions and field requirement into concern.

Harsh environ, such as extreme high or low temperature, moisture, ground differentials and electrical noise … etc
Requirement of fault-tolerant solution.
For automation and control engineers who have been forced into this IT domain, they really don't want to get too involved with the idiosyncrasies and maintenance of Ethernet networks.

To satisfy these, the *RS Series Switch* provides you a rugged, fault-tolerant, plug and play solution.

ICP DAS industrial Switch Series

ICP DAS industrial Ethernet switch has the following series:

NS Series: Network Switch Series is a standard switch with industrial class of quality.
RS Series: Ring Switch Series is a redundant ring switch with industrial class of quality.
MS series：Management Series is a management switch with industrial class of quality.

How to Use this manual

This manual is intended to help user quickly understanding and easily making use of RS-405 (and other supported products), and the arrangement of chapters and sections follows the steps that user need to take.

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Acronyms

ATM	Acronym for Asynchronous Transfer Mode, a high performance networking technology based on the switching of fixed length, 53 byte cells. ATM switching supports the switching of voice, video, and data; also supports isochronous communication.
BPV	Acronym for Bi-Polar Violation.
B-ISDN	Broadband ISDN. A network standard from the CCITT and ANSI committee. It supports voice, data and video in the same network.
CCITT	Acronym for Consultative Committee, International Telephone and Telegraph. An international standards body responsible for setting international communications standards that allow interoperability among telephony and data communications equipment.
CD (DCD)	Acronym for Carrier Detect (Detect Carrier Detect).
CDDI	The use of unshielded or shielded twisted pair cable to transmit the FDDI signal.
CO	Acronym for Central Office. The local telephone company switch that terminates subscribers' lines for switching and connecting to the public network.
CSMA/CD	Acronym for Carrier Sense Multiple Access with Collision Detection. Access protocol for Ethernet.
CSU	Acronym for Channel Service Unit, a device furnished as an integral part of a digital access line where a user wishes to supply the bipolar signals. It provides the network with protection against user side electrical anomalies such as surges, and provides the user with network clocking.
CTS	Acronym for Clear To Send.
DCE	Acronym for Data Communication Equipment, aka. Data Circuit-Terminating Equipment.
DCR	Acronym for Data Communication Ready.
DS1	Digital Signal, Level 1 is the North American data rate used for T1 carriers. It operates at 1.544Mbps and supports 24 phone lines.
DS2	Digital Signal, Level 2 is the North American data rate used for T2 carriers. It operates at 6.312 Mbps and supports four T1 lines or 96 phone calls
DS3	Digital signal, Level 3 is the North American data rate used for T3 carriers. It operates at 44.736 Mbps and supports 28 T1 lines.
DSU	Acronym for Data Service Unit, a DCE used with digital communications circuits to provide digital data services interface. Located on the users premises, the DSU interfaces directly with the DTE, and provides loop equalization, remote and local test

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	capabilities, and the logic and timing necessary to provide a standard EIA/TIA or CCITT interface. Converts signals between those used at the DTE's serial interface and bipolar signals used on the digital network. Also Network Terminal Unit (NTU).
DTE	Acronym for Data Terminating or Data Terminal Equipment.
DTR	Acronym for Data Terminal Ready.
E1	The European standard for high speed, point to point transmission operating at 2.048 Mbps and defines 64 Kbps sub-channels.
EIA	Acronym for Electronic Industries Association. EIA, a standards body, has a set of standards which includes data communications and interface standards among others.
EMI	Acronym for Electro-Magnetic Interference.
FEP	Stands for Front End Processor. It is an IBM communication controller that routes traffic to and from cluster controllers.
FDDI	Acronym for Fiber Distributed Data Interface, is a shared medium, ring topology LAN that operates at 100 Mbps. It is ANSI standard X3T9.5, using fiber optic cable as the medium.
FPGA	Acronym for Field Programmable Gate Array.
LAN	A local area network is a group of PCs connected over a common medium within a building.
MAC	Acronym for Medium Access Control. A designated hardware address for each device on a LAN or MAN. This address is burnt into The network interface card (NIC) by its manufacturer.
MAN	A metropolitan area network is a group of PCs connected over a common medium within a campus environment or the same city.
NA	Acronym for Numerical Aperture.
OC1	Optical Carrier Signal Level 1 refers to SONET data transmission at 51.840Mbps.
OC3	Acronym for Optical Carrier 3, a transmission rate standard for fiber optic telephony or data communications circuits. OC3 operates at 155 Mbps speed and is part of the SONET hierarchy.
OC12	Optical Carrier Signal Level 12 refers to SONET data transmission at 622.080Mbps.
OSI	(Open Data Interconnection Reference Model) - This is the International Standards Organization (ISO) model of how data communications systems can be interconnected. Communication is partitioned into seven function layers. Each layer builds on the services provided by those under it.
PBX	Acronym for Private Branch Exchange, is a small private version of a phone company's larger central switching office.

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PCM	Acronym for Pulse-Coded Modulation, a means of converting analog to digital form.
RING	Path or channel; usually electrical, where devices along the path receive transmissions sequentially from one device to the next along the ring.
RS-232	An interface used between DTE and DCE employing serial binary data interchange, defined by EIA, aka. EIA-232. Similar to standard V.24 of CCITT.
RS-422	Standard defined by EIA, aka. EIA-422. Deals with the electrical characteristics of balanced voltage digital interface circuits. Similar to standard V.11 of CCITT.
RS-423	Standard defined by EIA, aka. EIA 423. Deals with electrical characteristics of unbalanced voltage digital interface circuits. Similar to standard V.10 of CCITT.
RS-449	Standard defined by EIA, aka. EIA-449. Deals with general-purpose 37- and 9-position interface for data terminal equipment and data circuit-terminating equipment employing serial binary data interchange.
RS-485	Standard defined by EIA, aka. EIA-485. Standard for electrical characteristics of generators and receivers for use in balanced multipoint systems.
RTS	Acronym for Request To Send.
SCADA	Acronym for Supervisory Control and Data Acquisition.
SNMP	Acronym for Simple Network Management Protocol. A standard management protocol used to provide a common means of managing network devices.
SONET	Acronym for Synchronous Optical NETwork, is a hierarchical standard for a high speed (45 Mbps to 2.4 Gbps) transport network.
T1	Transmission rate standard for telephony or data communications circuits. T1 operates at 1.544 Mbps speed. Usually this circuit is subdivided into many 64 Kb channels.
TCP/IP	Acronym for Transmission Control Protocol/Internet Protocol.
WAN	Acronym for Wide Area Network, a computer network interconnected over distances beyond a city or metropolitan area.
802.3	Commonly referred to as Ethernet. It is a local area network protocol that operates at 10Mbps.
802.5	Commonly referred to as Token Ring. Operates at either 4 or 16Mbps.

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Introduction

Ethernet Switch
Industrial Ethernet
Industrial Fiber Optic
RS Series Key Features
Package Contents

Welcome to **ICP DAS Industrial Redundant Ring Switch - *RS Series***, one of the world's best Industrial Ethernet Switch designed for connecting Ethernet-enabled devices in industrial field applications. This manual is for the ICP DAS *RS Series,* Ethernet network switch.

Overview

The *RS Series* Industrial Redundant Ring Switch is designed upon concepts of reliability, quick recovery, easy configuration, self-healing and SCADA for status monitoring. Besides, all models in *RS Series* mechanism is also designed to meet IP30[1] above for working under harsh environment.

Unlike other existing ring switch or managed Ethernet switch on the market, the *RS Series* is much more easy to use and absolutely free of software setting. After unpacking from the shipping case, it just takes one or two dip or rotary switch to make it work.

[1] Ingress Protection, see **"Appendix B"** for detail information.

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Ethernet Switch

Ethernet is an ideal medium to transport large volumes of data, at speed, across great distances. Previously, multiple networks carrying specific protocols were installed side by side to carry out unique tasks. This inevitably led to project costs increasing as additional fiber optic or copper cables were installed to deal with the increasing volume of data. Using Ethernet a single fiber optic cable can carry multiple protocols. Furthermore, manufacturers are exporting their legacy protocols onto Ethernet, designing new IP based communication protocols and providing embedded Web-Pages within devices that offer real-time information using simple tools like Internet Explorer and Netscape Navigator.

Unfortunately, although network hardware has dramatically increased in speed and technology over the past decade the poor perception of Ethernet has remained; namely as being difficult to fault-find and critically being a non-deterministic network. A key development that overcame some of these issues was the advent of the Ethernet Switch.

Early Ethernet networks were based on a hub or repeater. These units have no intelligence and therefore are unable to identify any information contained within the Header frame of an Ethernet packet. This means that it is not capable of determining which port to send the frame to. Therefore, every frame is sent to every port. A network of repeaters and hubs is called a ‘Shared Ethernet’ or ‘Collision Domain’. Various devices will all compete with each other before sending data using ‘Carrier Sense Multiple Access / Collision Detect’ (CSMA/CD) protocol. This means that only one system is allowed to proceed with a transmission of a frame within a Collision Domain at any one time. This is a major disadvantage when using Hubs and Repeaters within a network.

A switch, like a hub, has to forward and receive packets from one network or device to another. The switch could forward all packets, but if this was the case it would have similar behaviour to a hub. It would be more intelligent if the switch only forwarded packets which needed to travel from one network or device to another. To do this, the switch must learn which devices or networks are connected to each port. In simplistic terms; it needs to learn the destination and source ports of each and every packet received on each individual Switch port. Once learnt, any identically addressed packet will be automatically be forwarded. With today’s enhanced processing power the introduction of a Switch has significantly increase network bandwidth.

Industrial Ethernet

Industrial rated Switches are intended to be installed in both harsh climatic environments and noisy electrical installations. Such Switches are an excellent example of true industrial design principles –

very high operating temperatures (down to -30°C an d up to 75°C)
dual input power supplies
wide DC operating voltages

In Roadside and tunnel applications distances between cabinets with a suitable power supply can be challenging. Naturally, fiber optic cable is the preferred solution. Using single mode fiber, runs of up to 85km are possible. Even using standard CAT5e copper cable the Industrial Switch supports the long cable specification and distances of up to 185m are viable. However, the domain of Ethernet has always been controlled by the IT department who normally configured office networks with an iron fist and dictated to the organisation how the network would be designed. Complex network recovery protocols

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like spanning tree, and SNMP to help with fault finding and system analysis were often employed to enhance network resilience. If a network failure occurred the IT department would casually look at repairing the equipment; there was no real rush as it was an office network.

However, with industrial Ethernet you need very fast repair time and with an IT department not readily available on the roadside, maintenance personnel need to be made aware of the fault, find the error and repair it - quickly. To aid this, unique network recovery features are employed to significantly enhance network recovery times. When an IT department requires a level of redundancy a common method is to employ the spanning tree protocol. However, spanning tree can be complex to program and critically can take over 30 seconds to detect and recover from the fault – far to long for critical applications!

ICP DAS RS Series incorporate propriety protocols that enable multiple Switches to be placed into a redundant ring. A single Switch, configured as the network focal point will monitor, detect and recover from a fiber or copper link failure within approximately 50mS – for the majority of applications a seamless process. The configuration process of the network focal point is simple as it must be remembered that as the switches are to be installed on the roadside the first to be called to rectify a fault will more than likely be Maintenance personnel.

Module / Feature	ICPDAS Ring Switch	General Managed Switch
Communication Protocol	Modbus/TCP Modbus/RTU	SNMP IGMP
Managed Interface	Serial Console, Utility DIP Jumpers Rotary Jumper	Serial Console Utility Web telnet
Service	N/A	QoS, CoS, VPN, FTP, HTTP, HTTPS, SSH, VLAN
Redundancy	Cyber Ring (Variable recovery time from 100 ms to 1.5s)	Trunking, Spanning Tree, Rapid Spanning Tree
Amount of Rings	2	1
Single Coupling	Yes	No
Redundant Coupling	Yes	No
Router/IP sharing	No	Yes
IEEE standards	802.3 802.3x 802.3u 802.1D	802.3 802.3x 802.3u 802.1D/w 802.1p 802.1Q
Alarm	Relay Output Modbus	SNMP
Convenience	Easy to use/configure	N/A

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It is likely that these people will not be fully trained on Ethernet and the protocols that are in operation, nor will they fully understand the principles of SNMP etc. However, with a fault contact, fault LED's and graphical interface implemented they have a multi-level approach to fault finding:

The fault contact is hard-wired to an alarm on a control panel or as an input to a DCS. If a link failure occurs (between two switches or an Ethernet Device) or a network failure occurs the fault contact on the Switches will be energized. The Maintenance Engineer can easily locate the fault.

With the increased use of Ethernet in the field to pass critical data the greater the reliability in network infrastructure. Where multiple rings are configured in a system it is also critical that the links between the rings are also duplicated to provide enhanced redundancy. This can be achieved using Multi-ring Redundancy

Industrial Fiber Optic

Why Fiber Optics?

The utilization of fiber optic data transmission for industrial automation and process control has become increasingly popular over the past decade.

A basic fiber optic system, using an optical transceiver circuit and fiber optic media, offers a wide array of benefits that are not available with traditional copper conductors.

Advantages of Fiber Optic Data Transmission Technology

High data rate and wide bandwidth
Immunity to EMI/RFI and lightning damage
No ground loops
Low attenuation (data loss)
Longer distance – up to 1.8 miles (3 km) with Muliti Mode fiber and over 15 miles (25 km) with Single Mode fiber
Small cable diameter fits almost anywhere - requires less duct space
Light weight
No sparks if cut – ideal for Hazardous Area applications
No electric shock hazard
Secure communications
Flexible networking topologies
Corrosion resistant
Longer life expectancy than copper or coaxial cable
Economical total system cost

Disadvantages of Electronic Cabling (Twisted Pair (TP), Coax, Twinax)

In selecting the signal/data transmission technology for your Industrial Automation and Process Control networking, the following limitations of electronic cabling should be considered:

Cabling hassles: weight, routing, size, attenuation and cross-talk
Distance between terminals and hosts is severely limited
Large diameter cable fills plenums and conduits
Needs to be routed away from power cabling
Poor security
Limited topologies

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Cost can be high relative to Fiber

Industrial vs. Commercial

Most process plants and factories have unique requirements for communications networks that differ from those of commercial grade networks. Industrial network components must withstand much harsher environmental conditions that can include extreme temperatures, lightning strikes, electromagnetic interference and, in many instances, installation in hazardous area locations.

Mounting and space requirements can also be an issue since industrial networking components are often installed in the same control panel or cabinet with other measurement and control equipment. At ICP DAS, our goal is to meet the demanding requirements of industrial communication networks. Our industry standard, *RS Series* of industrially hardened fiber optic communication products addresses these issues and provides you with optimal solutions for your factory automation and process control needs.

RS Series Key Features

Connectors locate in front panel, reducing wiring complexity and easy maintenance.
Dual input power supply for non-stop connectivity
Patent pending Cyber Ring Protocol
Versatile DIN-rail, surface, and wall-mountable design
Rugged aluminium case with IP30 rated protection
Provides redundant dual DC power inputs with reverse polarity protection and alarm
Non-blocking, store-and-forward switching architecture
Watch dog
Support SCADA via Modbus/TCP or Serial Console for status monitoring
Support 2 rings
Support multiple single coupling and redundant coupling
Provides easy-to-use GUI configuration utility
Supports email warning via Simple Mail Transfer Protocol (by GUI configuration utility)

Package Contents

One Industrial Ethernet Switch
Quick Installation Guide
User Manual
RJ-45 Covers

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Appearance

Dimensions
Front Panel
On Case Quick Guide
DIP Switch(SW1)
Rotary Switch (SW2)

RS Series come with three form factors. One is stand alone with industrial plastic case. The second one is stand alone with aluminum case. And the other is modulized for ICPDAS PAC Series controllers with industrial plastic case.

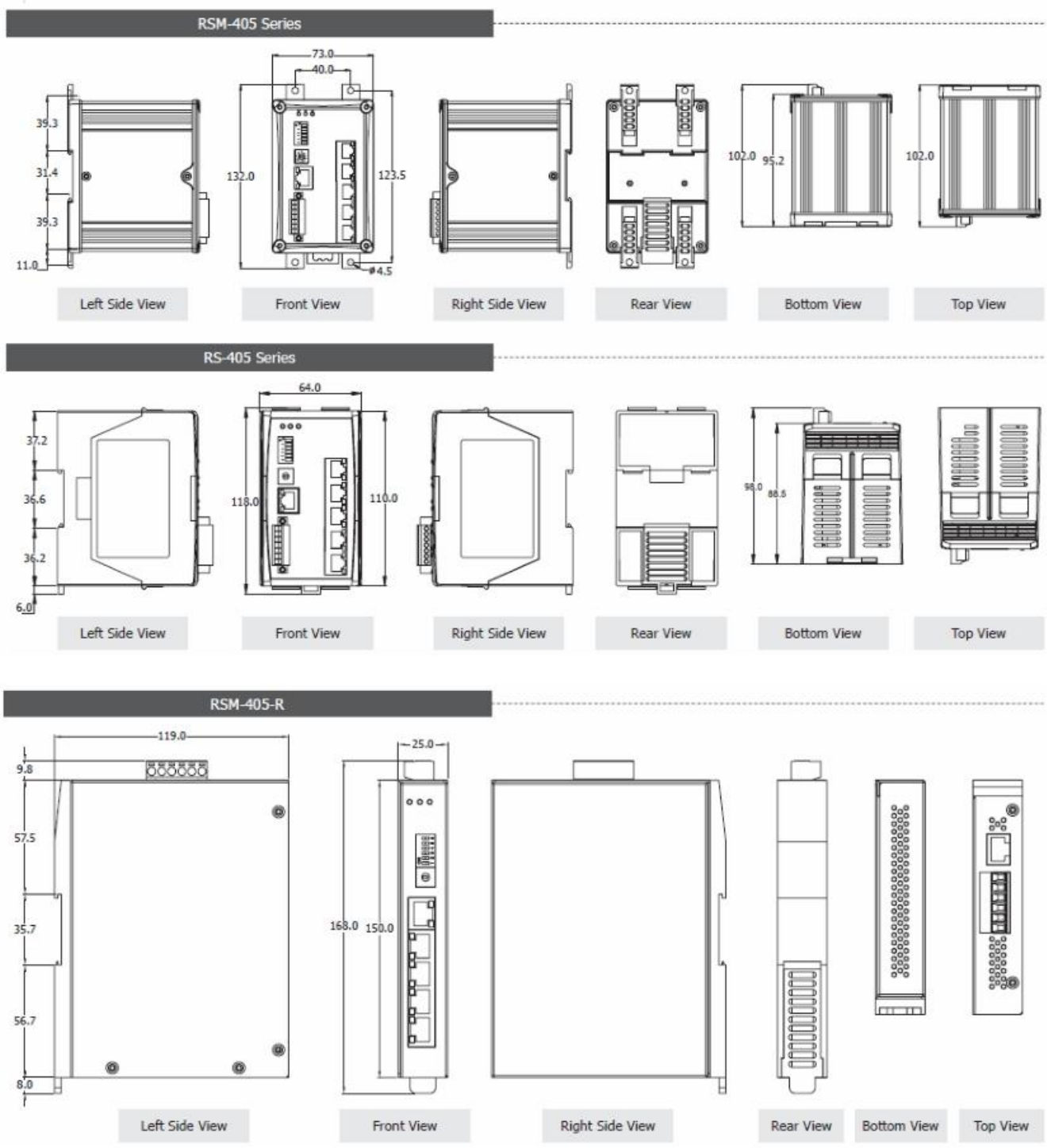
Overview

The RS Series is designed for easy installation, configuration and maintenance. For hardware installation, we provide both easy DIN rail mounting and wall mounting modes. To establish a simple redundant ring, only 2 jumpers on the front panel to set to form a ring. It does not depend on web configuration interface, neither a management server.

All of connectors are well arranged on the front panel, so it is easier to stack with other devices and to maintain in a small installation space.

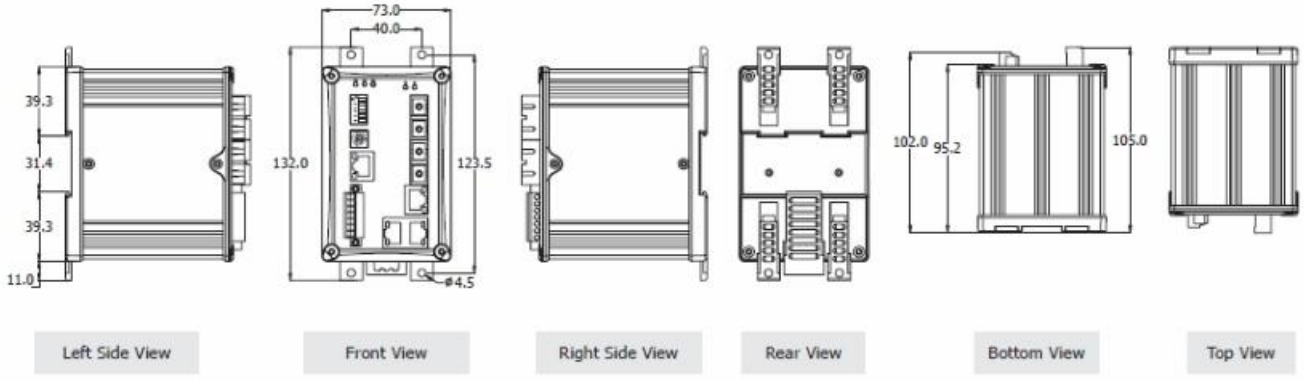
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Dimensions(Units:mm)

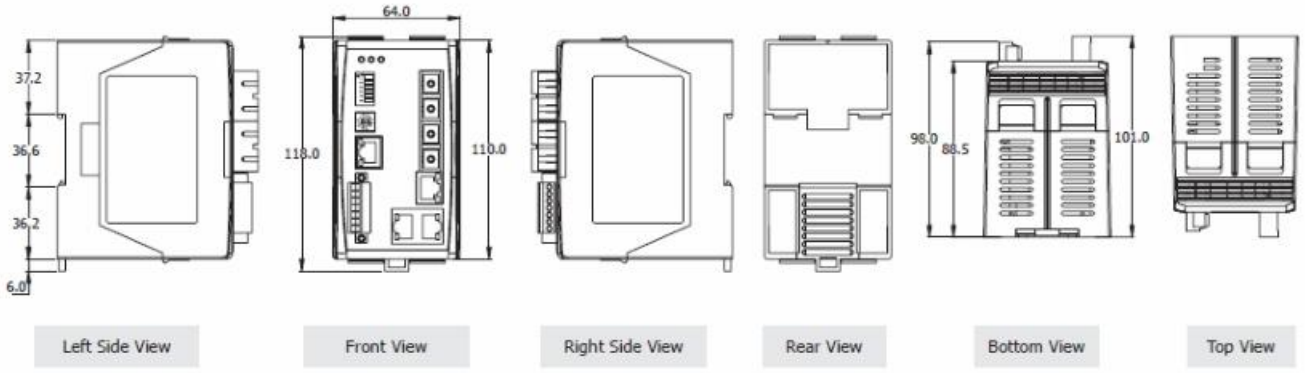


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RSM-405F Series



RS-405F Series



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Front Panel RS(M)-405/408 series

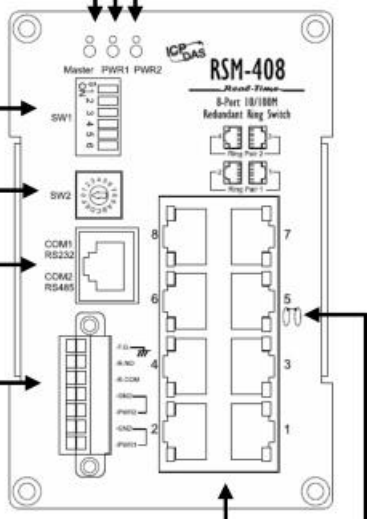
Master switch LED indicator
Power 1 LED indicator
Power 2 LED indicator
Switch jumper block

1. Ring / Normal Switch selecting jumper
2. Reset to default jumper
3. Primary/Secondary Switch setting jumper
4. Ring protocol selecting jumper
5. Enabling Ring 2 jumper
6. Enabling Ring 1 jumper

Rotate jumper block
Serial port
Terminal block

1. Frame Ground(F.G.)
2. Relay (R.NO)
3. Relay (R.COM)
4. Power 2 Grounding (GND)
5. Power 2 (PWR2)
6. Power 1 Grounding (GND)
7. Power 1 (PWR1)

Interconnection port for 2 phase recovering coupling
RJ-45 Ethernet ports



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RS(M)-405F series

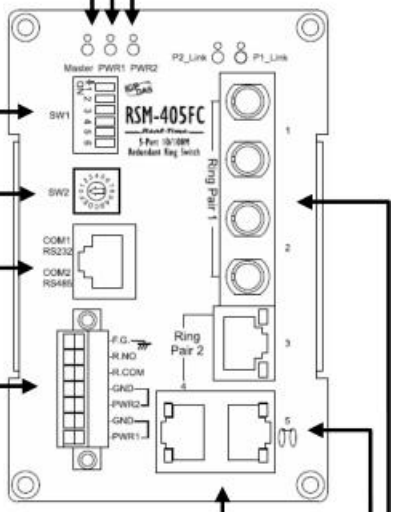
Master switch LED indicator
Power 1 LED indicator
Power 2 LED indicator
Switch jumper block

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6. Enabling Ring 1 jumper

Rotate jumper block
Serial port
Terminal block

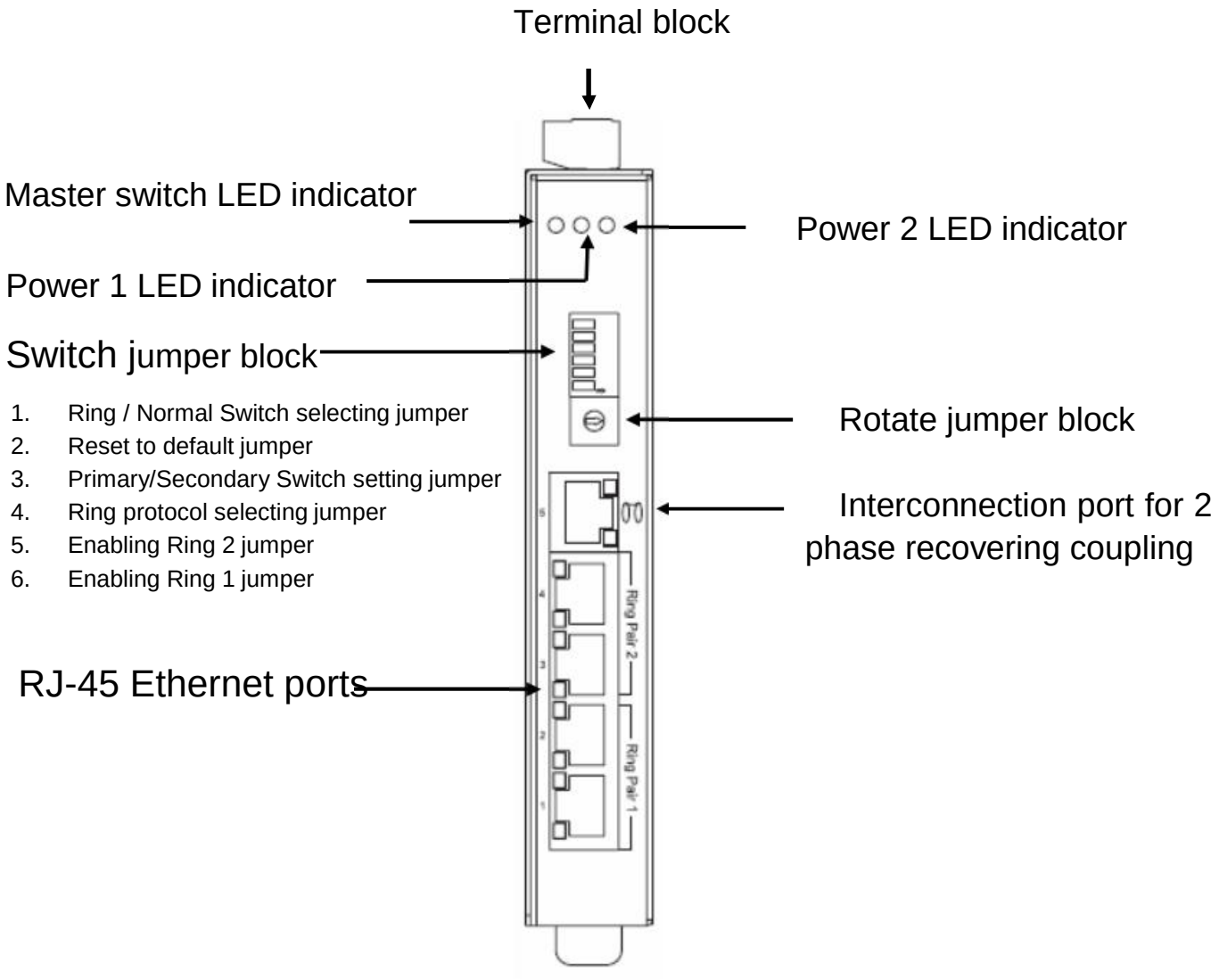
1. Frame Ground(F.G.)
2. Relay (R.NO)
3. Relay (R.COM)
4. Power 2 Grounding (GND)
5. Power 2 (PWR2)
6. Power 1 Grounding (GND)
7. Power 1 (PWR1)

Interconnection port for 2 phase recovering coupling
RJ-45 Ethernet ports
Fiber Ports

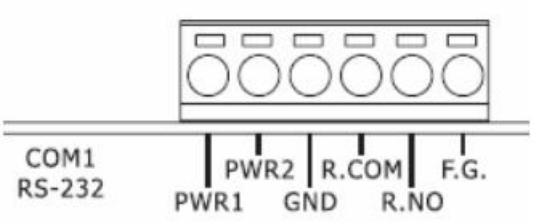


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RSM-405-R series



Terminal block

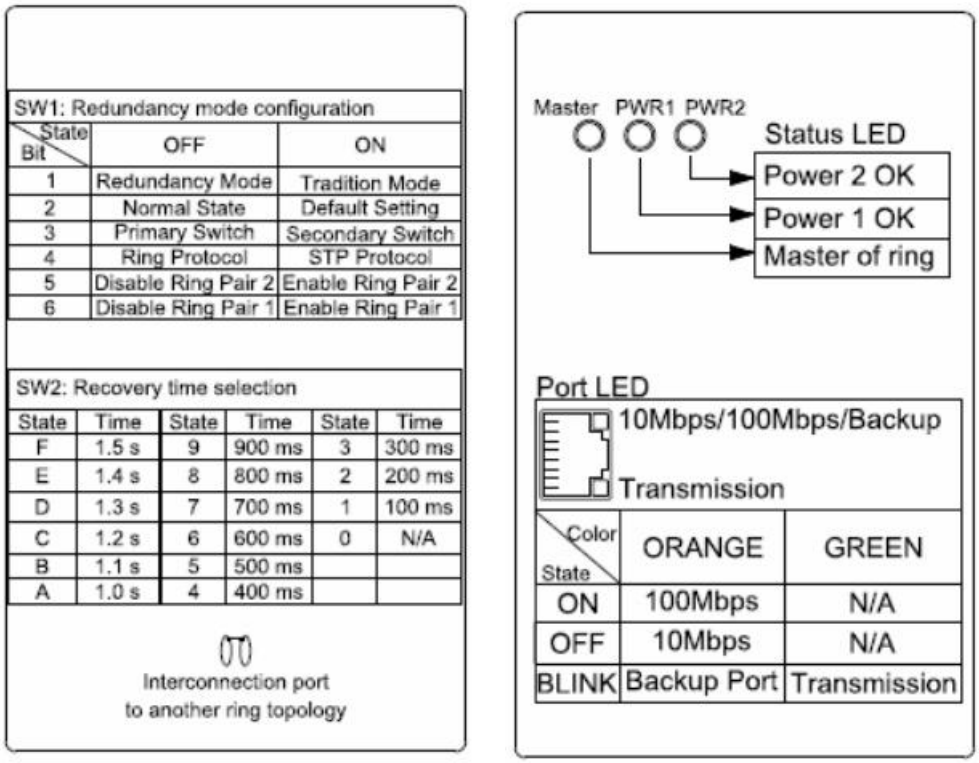


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On Case Quick Guide

The simple description of DIP and Rotate jumpers setting value, Quick Config Guide, has been printed on both right and left hand side of front panel. After acquainted with *RS Series* features, field engineers could deploy switches quickly by referencing Quick Config Guide.

RS(M) -405 / 408 series



SW1: Redundancy mode configuration

State / Bit	OFF	ON
1	Redundancy Mode	Tradition Mode
2	Normal State	Default Setting
3	Primary Switch	Secondary Switch
4	Ring Protocol	STP Protocol
5	Disable Ring Pair 2	Enable Ring Pair 2
6	Disable Ring Pair 1	Enable Ring Pair 1

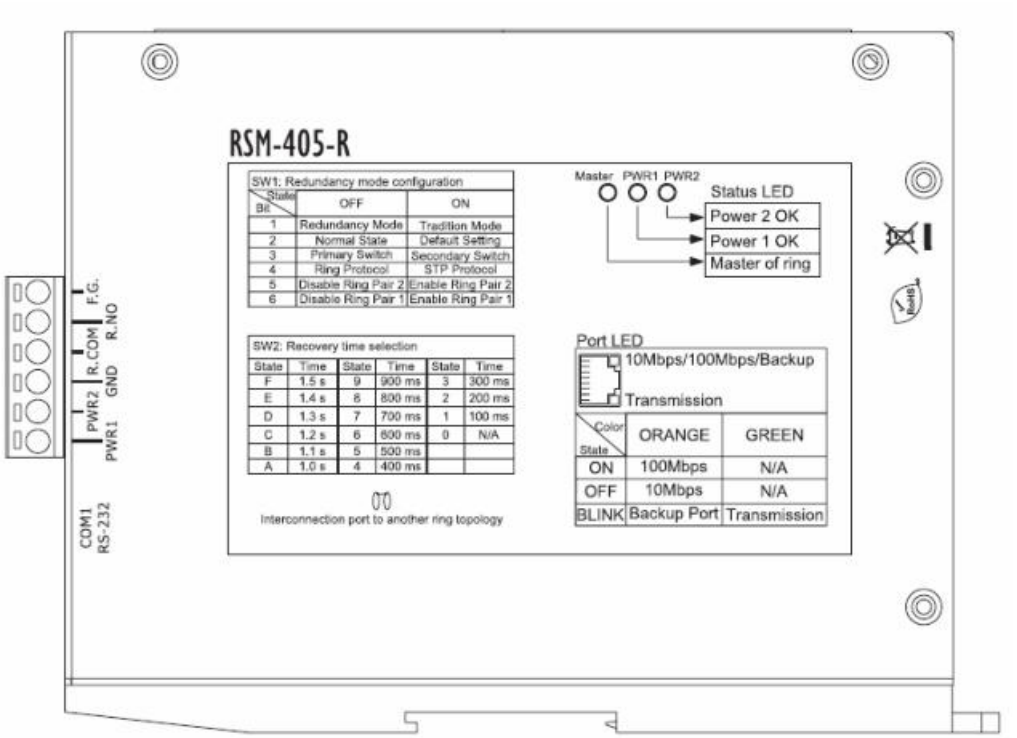
SW2: Recovery time selection

State	Time	State	Time	State	Time
F	1.5 s	9	900 ms	3	300 ms
E	1.4 s	8	800 ms	2	200 ms
D	1.3 s	7	700 ms	1	100 ms
C	1.2 s	6	600 ms	0	N/A
B	1.1 s	5	500 ms		
A	1.0 s	4	400 ms		

Interconnection port
to another ring topology

Color / State	ORANGE	GREEN
ON	100Mbps	N/A
OFF	10Mbps	N/A
BLINK	Backup Port	Transmission

RSM-405-R series



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DIP Switch (SW1)



SW1 : DIP Switch Configuration		
State Jumper	OFF	ON
1	Redundancy mode	Tradition mode
2	Normal State	Default Setting
3	Primary Switch	Secondary Switch
4	Ring Protocol	STP Protocol
5	Disable Ring Pair 2	Enable Ring Pair 2
6	Disable Ring Pair 1	Enable Ring Pair 1

Rotary Switch (SW2)

Rotary SW position	F	E	D	C	B	A	9	8
Recovery Time	1.5s	1.4s	1.3s	1.2s	1.1s	1.0s	900 ms	800 ms
Forwarding Delay	30s	28s	26s	24s	22s	20s	18s	16s
Hello Time	10s	10s	10s	10s	10s	10s	10s	10s
Max Age	40s	40s	40s	40s	40s	38s	34s	30s

Rotary SW position	7	6	5	4	3	2	1	0
Recovery Time	700 ms	600 ms	500 ms	400 ms	300 ms	200 ms	100 ms	N/A
Forwarding Delay	14s	12s	10s	8s	6s	4s	4s	N/A
Hello Time	10s	10s	8s	6s	4s	2s	1s	N/A
Max Age	26s	22s	18s	14s	10s	6s	6s	N/A

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Hardware Installation

DIN-Rail Mounting Installation
Wall-Mounting Installation
Connecting Input Power
Connecting Output Relay
Connecting Ethernet Ports
Connecting Fiber Ports

For hardware installation, we provide both easy DIN rail mounting and wall mounting modes.

Overview

RS Series support redundant power, output relay and enhanced isolation to make device much robust. With ICP DAS patent DIN-Clip® design, the installation is just as easy as plugging power cord into outlet.

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DIN-Rail Mounting Installation

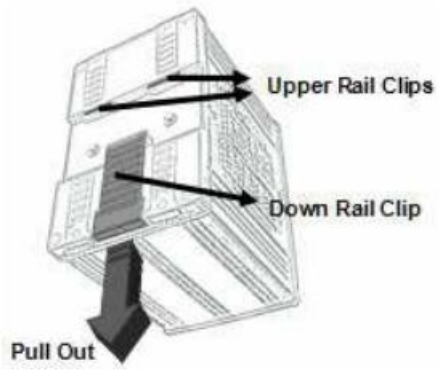




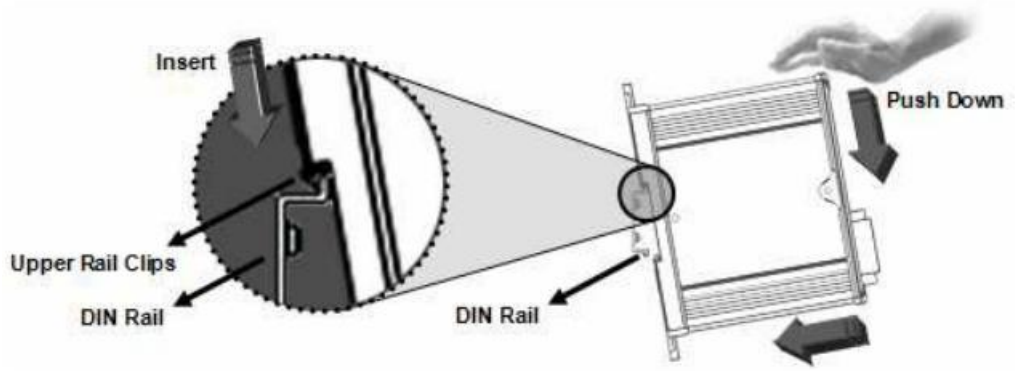


With ICPDAS patent DIN-Clip® design, DIN-Rail mounting installation becomes very easy. Following 3 steps completes installation.

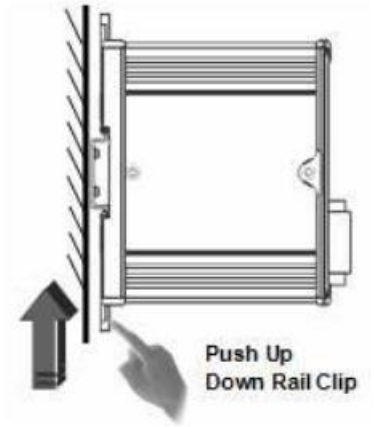
1 Pull the **down rail clip** out.



2 Obliquing the switch and insert the **upper rail clips** onto the upper lip of the DIN-rail track. Then push down the switch to fit into DIN rail as shown below.



3 Push up **down rail clip** to lock the switch on the DIN rail.



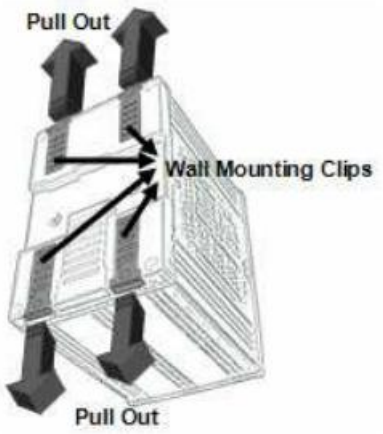
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Wall-Mounting Installation

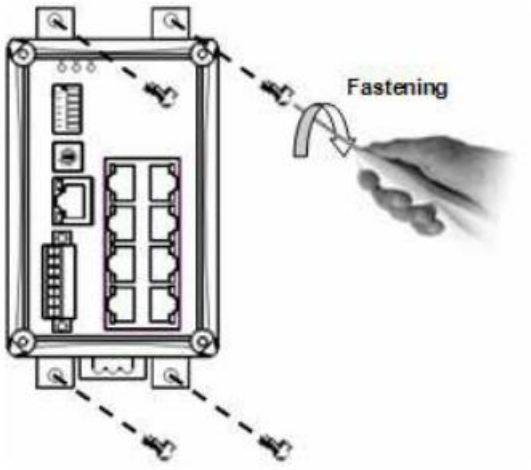


With ICP DAS patent DIN-Clip® design, Wall-Mounting installation becomes very easy. Following 2 steps completes installation.

1. Pull all wall mounting **clip** out.



2. Use the slotted holes at each corner of the wall-mounting clip to attach the unit to the wall or other flat surface. Then fasten it on the wall with screw.

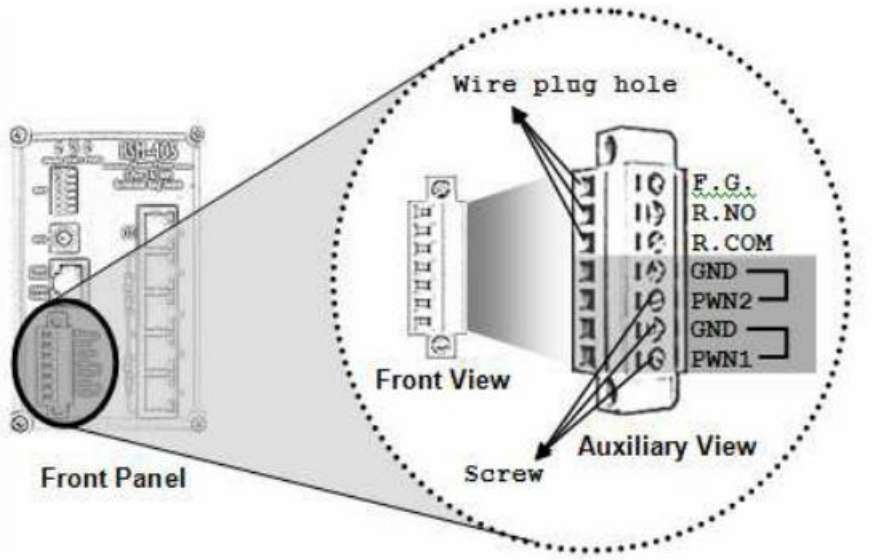


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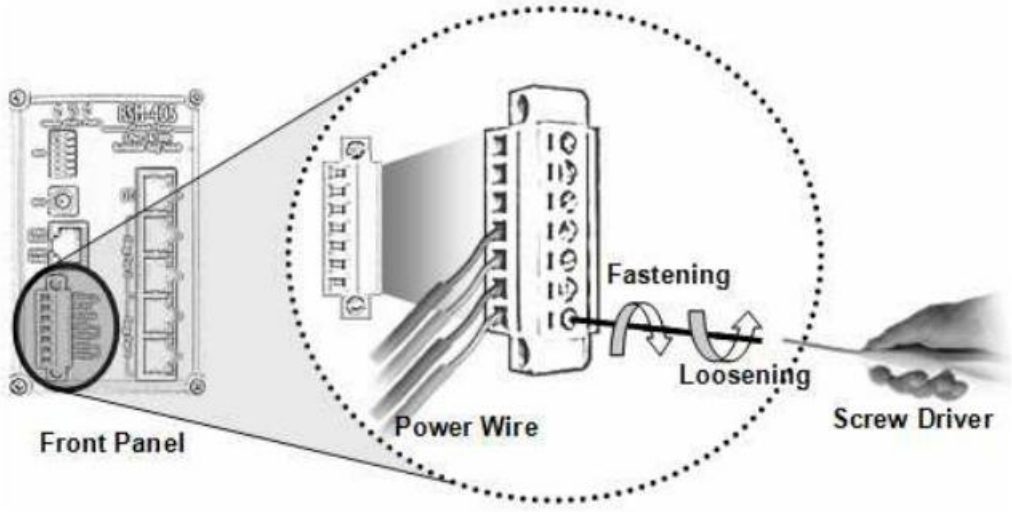
Connecting Input Power

IMPORTANT: *It is good practice to turn off input and load power, and unplug the power terminal block before making wire connections. Otherwise, your screwdriver blade can inadvertently short your terminal connections to the grounded enclosure.*

1. Identify PWR1, GND, PWR2, GND contacts on terminal block. Then identify power wire and ground wire.



2. Insert the wire of your DC supply or Battery supply into the PWN1 and/or PWN2 contacts of the terminal block connector, and fastening the terminal screws to prevent the wires from coming loose.

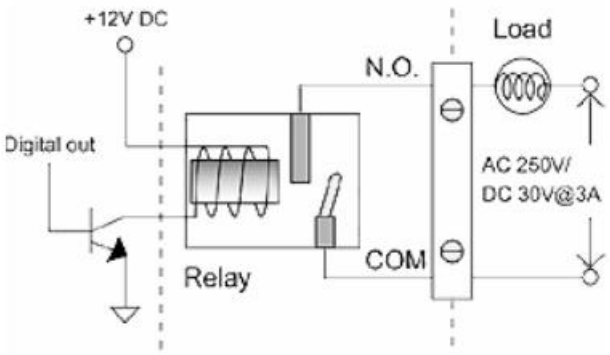


NOTE: *For best reliability, please install both of PWN1 and PWN2 for power redundant.*

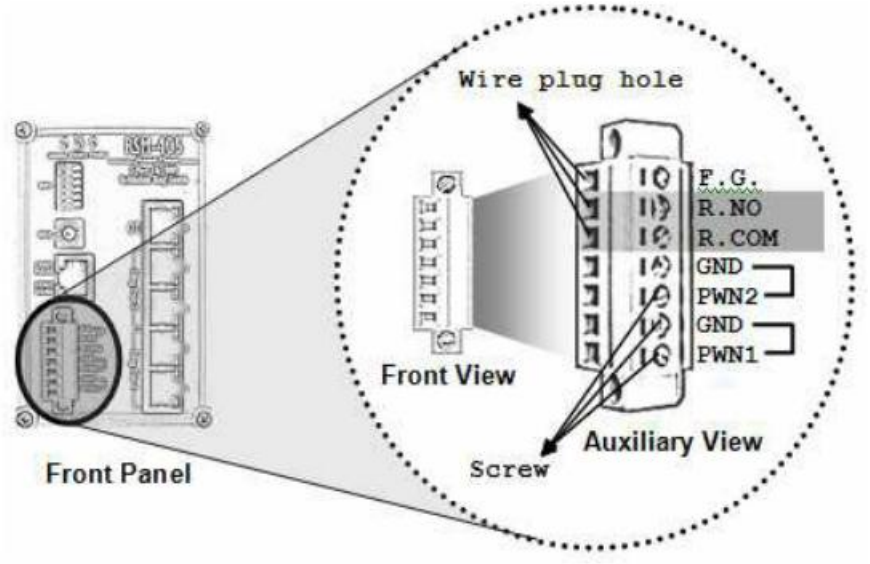
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Connecting Output Relay

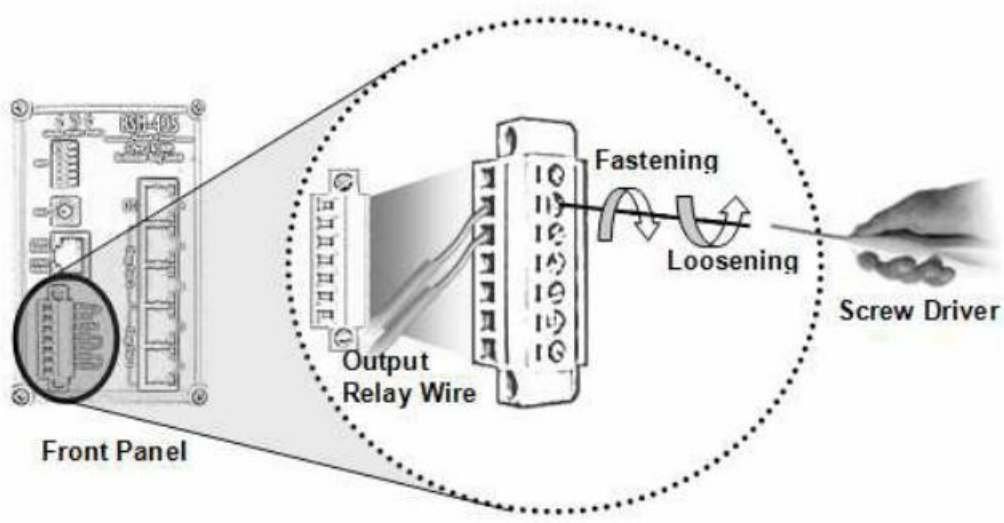
The diagram of output relay:



1. Identify R.NO and R.COM contacts on terminal block.



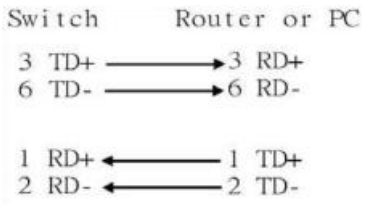
2. Insert the relayed device such as a light bulb or a buzzer pair of wire, and fastening the terminal screws to prevent the wires from coming loose.

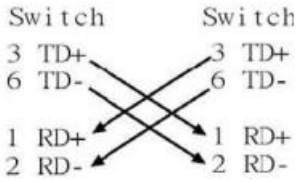


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Connecting Ethernet Ports

RS Series includes all RJ-45 ports with automatic MDI/MDI-X crossover, and automatic 10/100Mbps data rate sensing for 10Base-T or 100Base-TX connections. Automatic MDI/MDI-X crossover allows you to connect to other switches, hubs, or workstations, without regard to using straight-through or crossover cabling. The following figures depict the schematic diagram of straight-through and crossover cabling. Note that crossover cables simply cross-connect the transmit lines at each end to the receive lines at the opposite end.





Straight-through Cabling Schematic Crossover Cabling Schematic

Note that Ethernet cables use pins 1, 2, 3, and 6 of an 8-pin RJ45 connector. The signals of these pins are converted by the automatic MDI-X function, as shown in the table below:

Pin MDI-X	Signals	MDI Signals
1	RD+	TD+
2	RD-	TD-
3	TD+	RD+
6	TD-	RD-

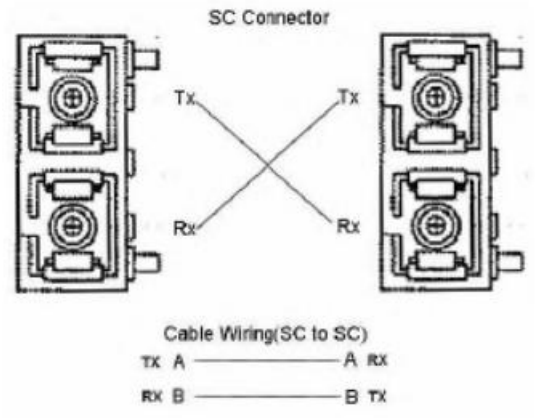
Connect one side of an Ethernet cable into any switch port and connect the other side to your attached device. The green LNK LED will light up when the cable is correctly connected. Always make sure that the cables between the switches and attached devices (e.g. switch, hub, or workstation) are less than 100 meters (328 feet).

Two switches are now up-linked together. If we change the up-link port manually at this time, the MAC address table will change as well. After the MAC address table changes, then the data can be transmitted between these two switches. This period of time is called the MAC address table aging time. The switch's default aging time is 5 minutes, which means that if you manually change the up-link port, you will need to wait up to 5 minutes before the data can be sent. If the aging time is too short, the MAC address table will constantly refresh, resulting in excess consumption of switch computing resources. For this reason, a longer aging time is recommended.

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Connecting Fiber Ports (only for models with fiber port)

The automatic MDI/MDI-X crossover function does not apply to fiber connections, as these must be crossed over manually. To connect the fiber port on one switch to the fiber port of another switch, simply cross-connect the transmit channel at each end to the receive channel at the opposite end as illustrated in the figure below.



These models have two 100Base-FX ports with SC type connectors (in multi-mode and single mode versions).

The following table describes the Fiber Ports LEDs

State / Color	ON	OFF	BLINK
P1_Link	Link	Not Link	Transmission
P2_Link	Link	Not Link	Transmission

RS Switch offer a relay contact output on Terminal Block of the Switch equipment (refer page 18) . It is able to connect to a light, buzzer …etc. warning device and notify system failures immediately configure the relay warnings of Power, Link Lose and Communication Lose (refer page K , lmask).

Link Lose

Set relay active if port disconnected, such as, no cable connected; cable break; opposing device fail.

Communication Lose

Set relay active if port of the ring pair disconnected.

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Configuration

One Ring Topology
Two Rings Coupling
Two Rings Coupling with Two Phase Recovering

This chapter provide basic techniques to form a redundant ring on your demand.

Overview

To successfully form a robust industrial Ethernet network, the designing of network pattern is the most important stage. A well-designed network pattern could dramatically reduce the risk network failure in critical situation.

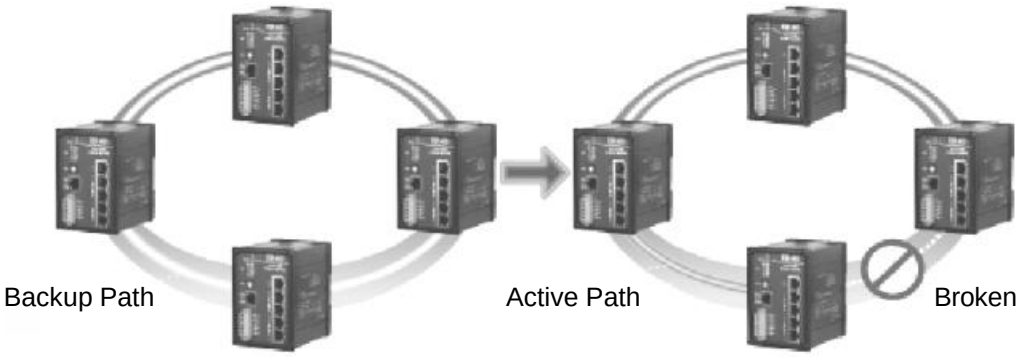
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One Ring Topology

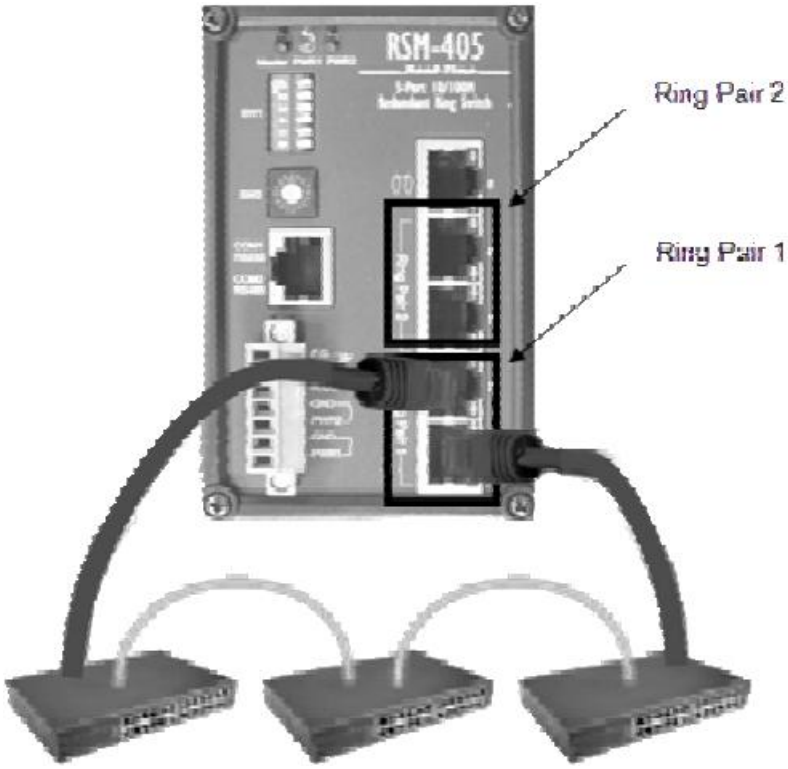


A ring topology ensures the network having **one more chance** to keep connection alive when any connection between 2 switches (nodes) has been broken inside the ring.

When we have formed a ring network, the focal point (master) will choose any one and only one path as **Redundant Path**. It is actually inactive when the ring network works properly. At the moment of any connection failure, the focal point will activates the **Redundant Path** and fire alarm to output relay.



RS Series come with 2 ring pair by default. A ring pair can form a ring with other network devices as below:



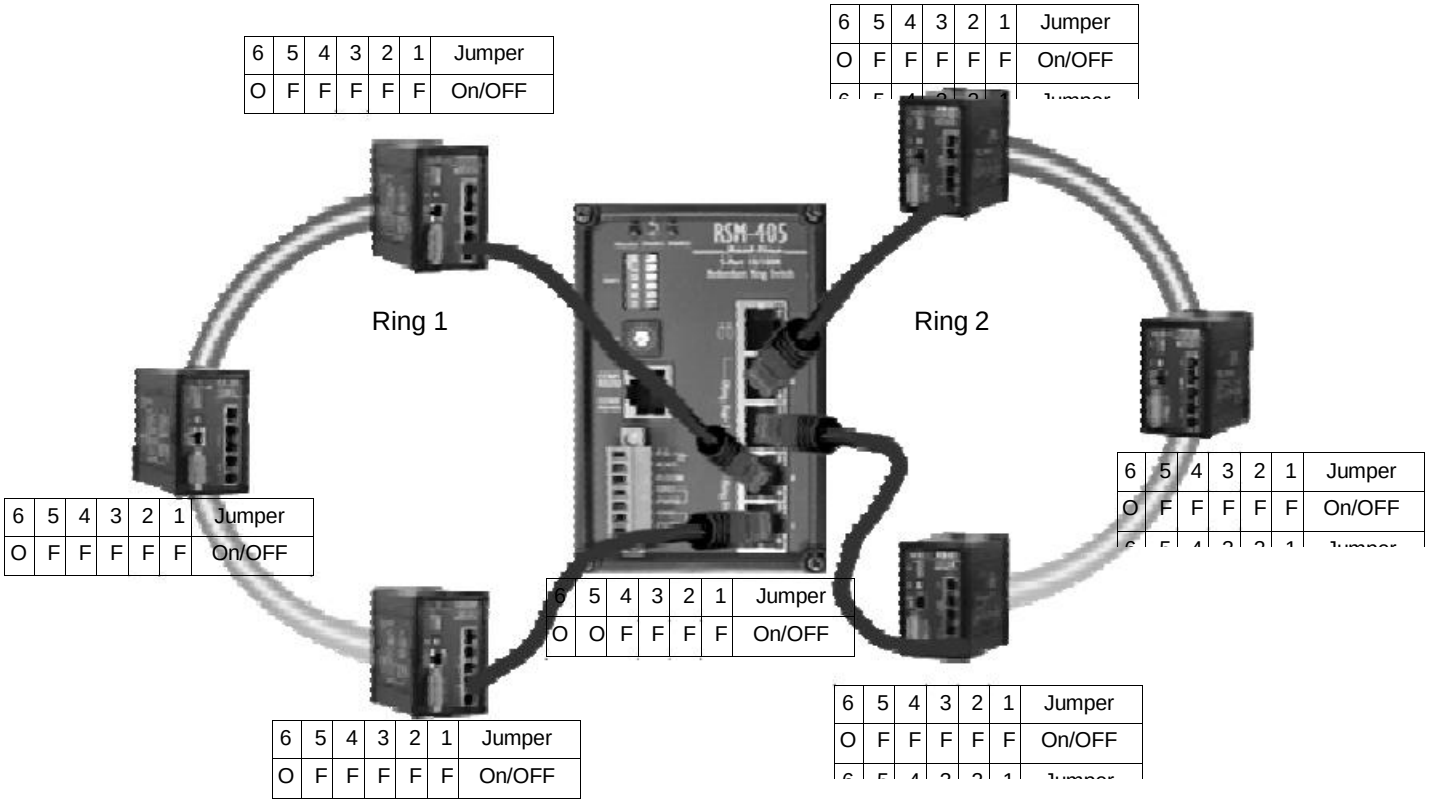
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Two Rings Coupling



As a ring network is a small group of switches by geography, functionalities, or subsystem, 2 or more rings could be coupled together to form a whole picture of industrial network for an integrated system.

Single coupling point uses a switch to bridge 2 rings. Each ring still keeps original ring topology features.



6	5	4	3	2	1	Jumper
O	F	F	F	F	F	On/OFF

6	5	4	3	2	1	Jumper
O	F	F	F	F	F	On/OFF

6	5	4	3	2	1	Jumper
O	F	F	F	F	F	On/OFF

6	5	4	3	2	1	Jumper
O	O	F	F	F	F	On/OFF

6	5	4	3	2	1	Jumper
O	F	F	F	F	F	On/OFF

6	5	4	3	2	1	Jumper
O	F	F	F	F	F	On/OFF

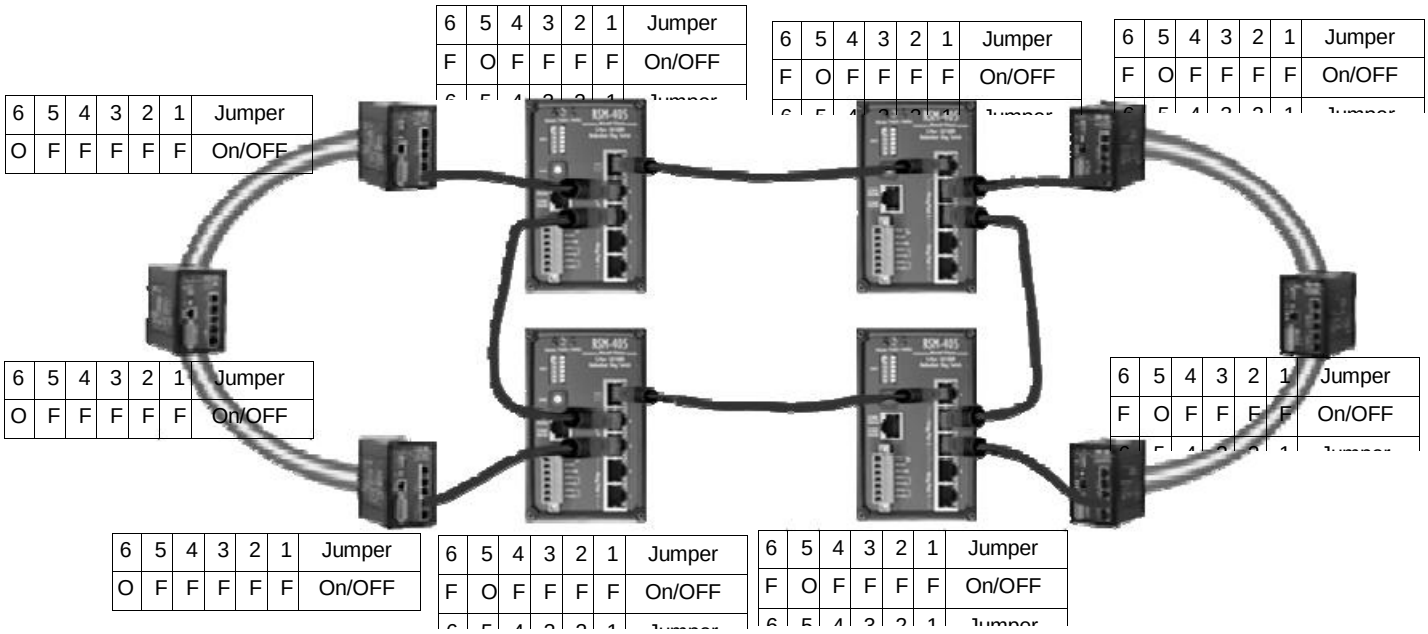
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Two Rings Coupling with Two Phase Recovering



Redundant coupling gives **one more chance** to keep connection alive when any connection between 2 rings has been broken. It is much safe than Single Coupling, but it takes 3 more switches to form Redundant Coupling.

Be sure to use port 5 (interconnection port) to form two phase recovering coupling and only ring pair 2 can be used in this topology.



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Troubleshooting

No Power to the Switch
No Link Light on a Switch Port
Master LED Keep on Flashing

Overview

This chapter includes some information for general troubleshooting as follows:

No Power to the Switch

No Link Light on a Switch Port

Master LED Keep on Flashing

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No power to the switch.

· Check for faulty power cord.

· Check for loose or broken power connections.

· Check connections to ensure the power and ground are attached to the correct terminals.

· Check for power loss or power surges at the AC power outlet.

· Check Voltage of power coming into PWR1 or PWR2 to ensure it is within +10 - +30V DC.

· Ensure there are no shorts between power and ground.

If the above fails, contact support.

No link light on a switch port.

· Check for faulty or loose Cables(both ends). Visually inspect for loose or faulty connections at all connectors and cables. If that does not correct the problem, try replacing the cable.

· Check the other device to see if it is powered up and operating correctly.

· Try moving the Ethernet cable that has the possible faulty connection to another port in the switch and check for link light.

If the above fails, contact support.

Master LED keep on Flashing

· Check if Jumper 1 (on SW1) is switched to Tradition mode (ON), if you intend to use tradition mode, keep this setting (Do not restart). If you would like to use redundancy mode, switch Jumper 1 to "OFF", and restart the switch.

· Check if the topology is accurate.

· Check if network is functioning properly.

· Check if power supply is connected properly.

· Check if there is devices failure exit (including ring switch or other devices connected to the switch)

· Check if MAC address is duplicated or illegal.

· Check if the length of recovery time (rtime) is adequate; if the recovery time is too short, set a longer time interval.

· Check if the firmware is the newest version , please go to http://www.icpdas.com/download/download-list.htm for downloading newest firmware version.

· Check if the firmware upgrading process is completed. If not, redo the upgrading sequence to complete firmware upgrading process.

· If the problem is not solved, try the following steps to return to default settings: switch Jumper 2(on SW1) to "ON" position → reset → switch Jumper 2 to "OFF" position → reset

If the above fails, contact support.

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Service Information

We sincerely hope that you never experience a problem with any ICP DAS product. If you do need service, call ICP DAS at 886-3-5973366 and ask for Applications Engineering. Our well-trained specialist will help you to quickly determine the source of the problem. Many problems are easily resolved with a single phone call.

On-line support

HTTP ://WWW .ICPDAS .COM.TW /SEVICES /SUPPORT .HTM

E- MAIL : SUPPORT @ICPDAS .COM

Contact Worldwide



		TELEPHONE	FAX
Taiwan	Hsinchu Headquarter	886-3-5973366	886-3-5973733
	Banchiao Office	886-2-29500655	886-2-29500807
	Hsintien Office	886-2-89192220	886-2-89192221
	Taichung Office	886-4-23582815	886-4-23589114
	Kaoshiung Office	886-7-2157688	886-7-2162602
USA	USA Office	1-310-517-9888 x101	1-310-517-0998
Europe	Europe Office	0049-711-9 97 37 75	0049-711- 9 97 37 84
Shanghai	Shanghai Office	8621-6247-1722	8621-6247-1725
Beijing	Beijing Office	8610-6298-0933	8610-6296-2890

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Appendix A

Glossaries

ANSI X3T9	Commonly referred to as FDDI. A local area network protocol that operates at 100Mbps.
Asynchronous	Having a variable time interval between successive data or information in the form of characters, operations, events. Transmission in which the data or information is individually synchronized or timed usually by start and stop bits (S/S).
Attenuation	A general term describing the loss of power between two points, measured in decibels per kilometer (dB/km) at a specified wavelength (nm).
Backbone Network	A main or high speed transmission facility or medium usually designed to connect lower speed channels or clusters of terminals. May describe common carrier main transmission path.
Bandwidth	A range of frequencies available for signaling; the differences between the highest and lowest frequencies of a band are expressed in (Hz).
Bridge	A device used to connect two separate LANs or used to divide a large LAN into smaller LANs. Each LAN acts as its own LAN, but uses a bridge device to communicate from one LAN to another.
Bus	Path or channel, usually electrical, with one or more conductors, where all devices are able to receive all transmissions at the same time.
Counter-Rotating Ring	Aka. Self-Healing Ring; has two physical transmission lines or rings with transmitting and receiving signals in each ring travelling in opposite directions. If the line or a device along the ring fails, the ring re-anneals by bypassing the device and or line and forms with the other ring to form a new single ring.
Crosstalk	The unwanted transfer of energy from the disturbing circuit to another called the disturbed circuit. Usually from an adjacent analog channel.
Dispersion	The spreading of light pulses that takes place in multimode fiber optic transmission. Dispersion limits the potential transmission distance because the spread out light pulses reach the destination at different times making the signal unreadable.
Ethernet	Product name for one of the first popular LAN technologies, later standardized as IEEE 802.3.
Fiber Optic Cable	Thin filaments of glass or other transparent material sheathed in an insulator through which a light beam may be transmitted for long distances by means of multiple internal reflections. A waveguide used to transmit digital information.
Flow Control	A method for a receiver to control the information flow from a transmitter. It eliminates data overflow at the receiver.

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Full Duplex	A communication method where both ends can transmit and receive simultaneously.
Half Duplex	A communication method where one end transmits while the other end receives, then reverses the process.
Hub	A device for local area networks (LANs) that is used to interconnect multiple devices over an internal bus.
Jitter	Aka. phase jitter, caused by power line harmonics and perceived in the form of minor phase changes.
Multi-Drop Line	Aka. Multipoint Line, a data link supporting multiple DTE connections, usually with one DTE controlling the link by polling the other DTEs for input and addressing output to the other DTEs. Utilizing frequency division or statistical MUX, a multipoint line can support multiple independent point-to-point channels.
Multimode fiber	An optical fiber that supports more than one propagating mode of light propagation.
Multiplexer	Aka. or Multiplexor or Mux,. A device using several communications channels at the same time, transmits and receives messages and controls communications lines, may be a microprocessor.
Node	A network-connected device, such as a server or PC.
Order Wire	Voice channel used to communicate between two locations.
Packet	A grouping of data, usually consisting of data and an address header prior to being sent over a network.
Point-of Presence (POP)	The physical access location within a specific location of the long distance or common carrier.
Polling	The method used for terminal to controller communications. The controller systematically asks for each terminal if it needs to transmit to the controller.
Protocol	A set of rules for data communication. All devices communicating together must adhere to the same rules.
Router	Similar to a bridge but provides more complex and flexible networking support. It usually also supports WANs.
Single mode fiber	An optical fiber that supports only one mode of light propagation above the cutoff wavelength.
Star	Network in which all terminals are connected through a single point or node, such as a star coupler.
Synchronous Transmission	Having a constant time interval between successive bits of data or information.
Time Division Multiplexing	A type of multiplexer that allocates a defined amount of backbone bandwidth for each connected device.
Time Slot	Unit of backbone bandwidth allocated for each port.

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Token Ring	A LAN topology where a control packet or token is passed from station to station in sequential order. The stations wishing to access must wait for the token before transmitting data, in the token ring the next logical station is also the next physical station.
Virtual Path	A software-controlled point-to-point connection between two devices or segments.

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Appendix B

Specifications

Models	RS-405	RSM-405	RS-405A	RSM-405A	RSM-405-R
Technology					
Standards	IEEE 802.3, IEEE 802.3u, IEEE802.3x				
Processing Type	Store & forward wire speed switching				
MAC Addresses	2048				1024
Memory Bandwidth	3.2 Gbps				
Frame Buffer Memory	1 Mbit				
Flow Control	IEEE 802.3x flow control, back pressure flow control				
Interface					
RJ-45 Ports	5 x 10/100 Base-TX auto negotiation speed, F/H duplex mode, and auto MDI/MDI-X connection				
LED Indicators	Power, 10/100M, Link/Act, Master				
Ethernet Isolation	1500 Vrms 1 minute				
COM1	RS-232 (TxD, RxD and GND); Non-isolation				
COM2	RS-485 (D2+, D2-; self-tuner ASIC inside); Non-isolation				–
Connection	Yes				
Power Input					
Input Voltage Range	+10 ~ +30 VDC (Isolation redundant input)		+12 ~ +48 VDC (Non- Isolation,redundant input)		
Power Consumption	0.22 A @ 24 VDC, +/-5% arrowed with 100M Full duplex				
Protection	Power reverse polarity protection				
Frame Ground for EMS Protection	Yes				
Connection	7-Pin Removable Terminal Block				5-Pin Removable Terminal Block
Mechanical					
Casing	Plastic	Metal	Plastic	Metal	Metal
Environmental Rating	UL 94V-0	IP30 Protection	UL 94V-0	IP30 Protection	IP30 Protection
Dimensions (W x L x H)	64 mm x 97.5 mm x 110 mm	73 mm x 102 mm x 132 mm	64 mm x 97.5 mm x 110 mm	73 mm x 102 mm x 132 mm	25 mm x 168 mm x 119 mm
Installation	DIN-Rail Mounting	DIN-Rail or Wall Mounting	DIN-Rail Mounting	DIN-Rail or Wall Mounting	DIN-Rail Mounting
Environmental					
Operating Temperature	-40 °C ~ + 75 °C				
Storage Temperature	-40 °C ~ + 85 °C				
Ambient Relative Humidity	10 ~ 95% RH, non-condensing				
Optional Accessories					
CA-090510	DB9 Female to RJ-45 Cable, 1M				

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Models	RS-408	RSM-408	RS-408A	RSM-408A
Technology				
Standards	IEEE 802.3, IEEE 802.3u, IEEE802.3x			
Processing Type	I Store & forward, wire speed switching			
MAC Addresses	2048			
Memory Bandwidth	3.2 Gbps			
Frame Buffer Memory	1 Mbit			
Flow Control	IEEE 802.3x flow control, back pressure flow control			
Interface				
RJ-45 Ports	10/100 Base-TX auto negotiation speed, F/H duplex mode, and auto MDI/MDI-X connection			
LED Indicators	Power, 10/100M, Link/Act, Master			
Ethernet Isolation	1500 Vrms 1 minute			
COM1	RS-232 (TxD, RxD and GND); Non-isolation			
COM2	RS-485 (D2+, D2-; self-tuner ASIC inside); Non-isolation			
Connection	Yes			
Power Input				
Input Voltage Range	+10 ~ +30 VDC (Isolation redundant input)		+12 ~ +48 VDC (Non- Isolation)	
Power Consumption	0.3 A @ 24 VDC, +/-5% arrowed with 100M Full duplex			
Protection	Power reverse polarity protection			
Frame Ground for EMS Protection	Yes			
Connection	7-Pin Removable Terminal Block			
Mechanical				
Casing	Plastic	Metal	Plastic	Metal
Environmental Rating	UL 94V-0			
Dimensions (W x L x H)	64 mm x 97.5 mm x 110 mm	73 mm x 102 mm x 132 mm	64 mm x 97.5 mm x 110 mm	73 mm x 102 mm x 132 mm
Installation	DIN-Rail Mounting	DIN-Rail or Wall Mounting	DIN-Rail Mounting	DIN-Rail or Wall Mounting
Environmental				
Operating Temperature	-40 ℃ ~ + 75 ℃			
Storage Temperature	-40 ℃ ~ + 85 ℃			
Ambient Relative Humidity	10 ~ 95% RH, non-condensing			
Option Accessories				
CA-090510	DB9 Female to RJ-45 Cable, 1M			

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Models		RS-405F series	RSM-405F series	RS-405AF series	RSM-405AF series
Technology					
Standards		IEEE 802.3, IEEE 802.3u, IEEE802.3x			
Processing Type		Store & forward wire speed switching			
MAC Addresses		1024			
Memory Bandwidth		3.2 Gbps			
Flow Control		IEEE 802.3x flow control, back pressure flow control			
Redundant strategy		STP, Ring (ICP DAS)			
Protocol		Modbus/RTU, Modbus/TCP, OPC, STP, Cyber Ring			
Interface					
RJ-45 Ports		3 x 10/100BaseT(X) auto negotiation speed, F/H duplex mode, and auto MDI/MDIX connection			
Fiber Optics Port		2 x 100 Base-FX			
LED Indicators		10/100M, Link/Act/Backup, Full duplex/Half duplex (Fiber Port)			
Ethernet Isolation		1500 Vrms 1 minute			
Frame Ground for EMS Protection		Yes			
Ethernet Transmission distance		Ethernet : 2-pair UTP/STP Cat.3,4,5, EIA/TIA-568 100-ohm Fast Ethernet : 2-pair UTP/STP Cat. 5, EIA/TIA-568 100-ohm			
Multi Mode	Multi Mode Fiber Cables	50/125, 62.5/125 or 100/140 µm			
	Distance	2 km, (62.5/125 µm recommended) for full duplex			
	Wavelength	1300 or 1310 nm			
	Min. TX Output	-20 dBm			
	Max. TX Output	-14 dBm			
	Max. RX Sensitivity	-32 dBm			
	Max. RX Overload	-8 dBm			
	Budget	12 dBm			
Single Mode (Standard)	Single-mode fiber cables	8.3/125, 8.7/125, 9/125 or 10/125 µm			
	Distance	30 km, (9/125 µm recommended) for full duplex			
	Wavelength	1300 or 1310nm			
	Min. TX Output	-15 dBm			
	Max. TX Output	-8 dBm			
	Max. RX Sensitivity	-34 dBm			
	Max. RX Overload	-5 dBm			
	Budget	19 dBm			
Single Mode (60T)	Single-mode fiber cables	8.3/125, 8.7/125, 9/125 or 10/125 µm			
	Distance	60 km, (9/125 µm recommended) for full duplex			
	Wavelength	1300 or 1310nm			
	Min. TX Output	-5 dBm			
	Max. TX Output	0 dBm			
	Max. RX	-35 dBm			

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	Sensitivity				
	Max. RX Overload	-5 dBm			
	Budget	30dBm			
Ethernet Cables		10 Base-T (Cat.3, 4, 5 UTP cable; 100m Max.) 100 Base-TX (Cat.5 UTP cable; 100m Max.)			
Management interface		Console, DIP/Rotary Switch			
Alarm output		Relay			
Power Input					
Input Voltage Range		+10 ~ +30 VDC (Isolation,redundant input)		+12 ~ +48 VDC (Non-Isolation, redundant input)	
Alarm Contact		One relay output with current carrying capacity of 2 A @ 30 VDC			
Power Consumption		0.3 A @ 24 VDC, +/-5% arrowed			
Protection		Power reverse polarity protection			
Frame Ground for EMS Protection		Yes			
Connection		7-Pin Removable Terminal Block			
Mechanical					
Casing		Plastic	Metal	Plastic	Metal
Environmental Rating		UL 94V-0	IP30 Protection	UL 94V-0	IP30 Protection
Dimensions (W x L x H)		64 mm x 98 mm x 110 mm	72.5 mm x 102 mm x 110 mm	64 mm x 98 mm x 110 mm	72.5 mm x 102 mm x 110 mm
Installation		DIN-Rail Mounting	DIN-Rail or Wall Mounting	DIN-Rail Mounting	DIN-Rail or Wall Mounting
Environmental					
Operating Temperature		0 °C~ +70°C		-30 °C~ +75°C	
Storage Temperature		-20 °C ~ + 85 °C			
Ambient Relative Humidity		10 ~ 90% RH, non-condensing			
Optional Accessories					
CA-090510		DB9 Female to RJ-45 Cable, 1M			

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Appendix C

Modbus Table

Switch Status

Address	Status	Address	
10000	Ring Pair 1 Enable	10004	Power 1 Fail
10001	Ring Pair 2 Enable	10005	Power 2 Fail
10002	0 : Ring Protocol 1 : Spanning Tree Protocol	10006	Relay output
10003	Secondary switch	10007	Master

Link Status

Address	Status	Address	
10008	Link on port 1	10016	Link on port 9
10009	Link on port 2	10017	Link on port 10
10010	Link on port 3	10018	Link on port 11
10011	Link on port 4	10019	Link on port 12
10012	Link on port 5	10020	Link on port 13
10013	Link on port 6	10021	Link on port 14
10014	Link on port 7	10022	Link on port 15
10015	Link on port 8	10023	Link on port 16

Forwarding Status

Address	Status	Address	
10024	Port 1 is forwarding	10032	Port 9 is forwarding
10025	Port 2 is forwarding	10033	Port 10 is forwarding
10026	Port 3 is forwarding	10034	Port 11 is forwarding
10027	Port 4 is forwarding	10035	Port 12 is forwarding
10028	Port 5 is forwarding	10036	Port 13 is forwarding
10029	Port 6 is forwarding	10037	Port 14 is forwarding
10030	Port 7 is forwarding	10038	Port 15 is forwarding
10031	Port 8 is forwarding	10039	Port 16 is forwarding

Communication Status

Address	Status	Address	
10040	Port 1 lose pair port	10048	Port 9 lose pair port
10041	Port 2 lose pair port	10049	Port 10 lose pair port
10042	Port 3 lose pair port	10050	Port 11 lose pair port
10043	Port 4 lose pair port	10051	Port 12 lose pair port
10044	Port 5 lose pair port	10052	Port 13 lose pair port
10045	Port 6 lose pair port	10053	Port 14 lose pair port
10046	Port 7 lose pair port	10054	Port 15 lose pair port
10047	Port 8 lose pair port	10055	Port 16 lose pair port

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Appendix D

Console Command Reference

?,help [command]: Help
reset
default
ip,setip
mask,setmask
gateway,setgateway
mac,seteid
netid [id number]
lmask [mask value]
cmask [mask value]
smask [mask value]
lvalue
cvalue
svalue
hmivalue
rtime [time]
ftime [time]
mtime [time]
htime [time]
com1 [baudrate][databit][parity][stopbit]
com2 [baudrate][databit][parity][stopbit]

?,help [command]

Description

Both “help” and “?” display a list of available commands, if parameter is not specified. The [command] parameter is used to see detail information for a specific command.

Parameters

Parameter	Description
command	Please provide the name of the command that you want detail information about.

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Example:

```
RS-405>help


?,help [command]: Help
reset
default
ip,setip
mask,setmask
gateway,setgateway
mac,seteid
netid [id number]
lmask [mask value]
cmask [mask value]
smask [mask value]
lvalue
cvalue
svalue
hmivalue
rtime [time]
ftime [time]
mtime [time]
htime [time]
com1 [baudrate][databit][parity][stopbit]
com2 [baudrate][databit][parity][stopbit]


RS-405>help lmask

Set Relay mask for link lose
lmask [mask value]
Examples :
   lmask 0x3
Set Relay active if link lose on Port 1 or Port 2

RS-405>
```

reset

Description

The reset command will initiate Ring Switch a self-restart. All current setting values remain intact.

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Example:

```
RS-405>reset
   OM1 ===> Debug      Baudrate=115200
COM2 ===> UpLink     Baudrate=115200

Redundant Ring Switch
build Sep 11 2006 11:37:55


?,help [command]: Help
reset
default
ip,setip
mask,setmask
gateway,setgateway
mac,seteid
netid [id number]
lmask [mask value]
cmask [mask value]
smask [mask value]
lvalue
cvalue
svalue
hmivalue
rtime [time]
ftime [time]
mtime [time]
htime [time]
com1 [baudrate][databit][parity][stopbit]
com2 [baudrate][databit][parity][stopbit]

RS-405>
```

default

Description

The default command will restore all settings to factory default values.

Current factory default values are as follow:

```
COM1:baudrate 115200,8bit,none patity check, 1 stopbit
COM2:baudrate 115200,8bit,none patity check, 1 stopbit
link mask:0
communication mask:0x1f
status mask:0x3
netid:1
mac: factory-set unique MAC address
ip:192.168.255.1
mask:255.255.255.0
```

Example:

```
RS-405>default
Enter default setting mode ...
RS-405>
```


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ip,setip

Description

If no IP address is specified, the “ip” or “setip” command will display current IP address. To assign an IP address for TCP/IP, please input IP address in the form of “ip1.ip2.ip3.ip4”(each field contains a value in the range 0 – 255).

Example:

```
RS-405>ip
IP=192.168.255.1
RS-405>ip 10.0.8.199
IP=10.0.8.199
RS-405>setip
IP=10.0.8.199
RS-405>setip 140.113.23.3
IP=140.113.23.3
RS-405>
```

mask,setmask

Description

If no mask address is specified, the “mask” or “setmask” command will display current mask address. To assign a mask address for TCP/IP, please input mask address in the form of “m1.m2.m3.m4”(each field contains a value in the range 0 – 255).

Example:

```
RS-405>mask
MASK=255.255.255.0
RS-405>mask 255.255.255.192
MASK=255.255.255.192
RS-405>setmask
MASK=255.255.255.192
RS-405>setmask 255.255.255.255
MASK=255.255.255.255
RS-405>
```

gateway,setgateway

Description

If no gateway IP address is specified, the “gateway” or “setgateway” command will display current gateway address. Note that if there exits a check sum error, an error message will alert. To assign a gateway address for TCP/IP, please input gateway IP address in the form of “ip1.ip2.ip3.ip4” (each field contains a value in the range 0 – 255).

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Example:

```
RS-405>gateway
Gateway=255.255.255.255
RS-405>gateway 192.168.1.0
Gateway=192.168.1.0
RS-405>setgateway
Gateway=192.168.1.0
RS-405>setgateway 140.116.1.26
Gateway=140.116.1.26
RS-405>
```

mac,seteid

Description

If no MAC address is specified, the “mac” or “seteid” command will display current MAC address. To assign a MAC address for Ethernet, please input MAC address in the form of “e1:e2:e3:e4:e5:e6”.

Example:

```
RS-405>mac
Ethernet Address=00:e0:18:0e:b2:21
RS-405>mac 00:80:c8:e9:8b:01
Ethernet Address=00:80:c8:e9:8b:01
RS-405>seteid
Ethernet Address=00:80:c8:e9:8b:01
RS-405>seteid 0e:b0:1d:51:ab:92
Ethernet Address=0e:b0:1d:51:ab:92
RS-405>
```

Note: Each RS is shipped from the factory with a unique MAC address. DO NOT change this address unless you have a good reason to do so. If you do change the address, remember to make a note of this factory-set MAC address and keep it in a safe place.

netid [id number]

Description

If Net ID of Modbus is not specified, the “netid” command will display current ID number of Modbus. The command parameter [id number] is used to assign a specific ID number for Modbus Net ID.

Parameters

Parameter	Description
id number	Provides the ID number that you want to set up for Modbus Net ID.

Example:

```
RS-405>netid
Modbus Net ID = 1
RS-405>netid 2
Modbus Net ID = 2
```


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lmask [mask value]

Description

This command enables you to configure relay output activation status when there is link loss occurring on port(s). The ports are corresponding to the 8 mask bits, bit 0 corresponds to port 1, etc. (Please refer to Appendix G, Table – 1.) If the mask bit of that port(s) is specified by being set up as 1, when there is a link loss occurring on that port(s), relay output will be activated. The mask value is in hexadecimal format that represents the 8 bits corresponding binary numbers, it can be either in the form of initiating “0X” plus a suffix of the hexadecimal number or eliminating “0X”; simply the hexadecimal number itself. If a mask value is not specified, the “lmask” command will display previous assigned mask value.

To assign a mask value for activating relay output when there is link loss occurring on the port(s), please refer to Appendix G, Table – 2.

Parameters

Parameter	Description
mask value	Provides the mask value that you want to specify to configure status of relay when link loss occurs

Example:

```
RS-405>lmask 2d
Relay mask for link lose 2D
RS-405>lmask 0X2c
Relay mask for link lose 2C
RS-405>lmask
Relay mask for link lose 2C
RS-405>
```

cmask [mask value]

Description

This command enables you to configure relay output activation status when there is communication loss occurring on port(s). The ports are corresponding to the 8 mask bits, bit 0 corresponds to port 1, etc. (Please refer to Appendix G, Table – 3.) If the mask bit of that port(s) is specified by being set up as 1, when there is a communication loss occurring on that port(s), relay output will be activated. The mask value is in hexadecimal format that represents the 8 bits corresponding binary numbers, it can be either in the form of initiating “0X” plus a suffix of the hexadecimal number or eliminating “0X”; simply the hexadecimal number itself. If a mask value is not specified, the “cmask” command will display previous assigned mask value.

To assign a mask value for activating relay output when there is communication loss occurring on the port(s), please refer to Appendix G, Table – 4.

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Example:

```
RS-405>cmask
Relay mask for communciation lose 09
RS-405>cmask 0X1c
Relay mask for communciation lose 1C
RS-405>cmask 1d
Relay mask for communciation lose 1D
RS-405>
```

smask [mask value]

Description

This command enables you to configure relay output activation status when there is power fail occurring on power 1 or power 2, or when the switch is being selected as the master switch.

Bit 0 corresponds to Power1, bit 1 corresponds to Power 2 and bit 3 corresponds to master switch indicator. If the mask bit of that power(s)(bit 0 and bit 1) or master switch indicator (bit 2) is specified by being set up as 1, when there is a power fail occurring on Power(s), or when the switch is selected as master switch, the corresponding relay output will be activated.

The mask value is in hexadecimal format that represents the 8 bits corresponding binary numbers, it can be either in the form of initiating “0X” plus a suffix of the hexadecimal number or eliminating “0X”; simply the hexadecimal number itself. If a mask value is not specified, the “smask” command will display previous assigned mask value.

To assign a mask value for activating relay output when there is communication loss occurring on the port(s), please refer to Appendix G, Table – 5.

Parameters

Parameter	Description
mask value	Provides the mask value that you want to specify for the communication loss relay output

Example:

```
RS-405>smask 1
Relay mask for system status 01
RS-405>smask 0X2
Relay mask for system status 02
RS-405>smask
Relay mask for system status 02
RS-405>
```


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lvalue

Description

This command enables you to read link status showing by a hexadecimal number that represents the 8 bits corresponding binary numbers. Bit 0 corresponds to port 1, etc. (Please refer to Appendix G, Table – 6). If there is link loss occurring on port(s), the corresponding bit(s) will be set up as 1. You would be able to clarify current link status by this returned lvalue in hexadecimal format, please refer to Appendix G, Table – 7.

Example:

```
RS-405>lvalue
link lose status 1F
RS-405>
```

cvalue

Description

This command enables you to read communication status showing by a hexadecimal number that represents the 8 bits corresponding binary numbers. Bit 0 corresponds to port 1, etc. (Please refer to Appendix G, Table – 8). If there is a communication loss occurring on port(s),the corresponding bit(s) will be set up as 1. You would be able to clarify current communication status by this returned cvalue in hexadecimal format, please refer to Appendix G, Table – 9.

Example:

```
RS-405>cvalue
communciation lose status 00
```

svalue

Description

This command enables you to read system status showing by a hexadecimal number that represents the 8 bits corresponding binary numbers, please refer to Appendix G, Table – 10.

You would be able to clarify current system status by this returned svalue in hexadecimal format, please refer to Appendix G, Table – 11 .

Example:

```
RS-405>svalue
System status 0C
RS-405>
```


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hmivalue

Description

This command enables you to read Switch 1 (SW1) and Switch 2 (SW2) settings on HMI by returning a message in the form of “HMI setting (state) DIPSW,RotarySW “. You would be able to clarify current HMI setting status by this returning message.

SW1 contains 6 jumpers, each jumper (Jumper 3 to Jumper 6) corresponds to one bit. (Please refer to Appendix G, Table – 12.) It is a DIP toggle switch with two possible positions -- on or off. Each position indicates one configuration state. (Please refer to Appendix G, Table – 13.) The returned DIPSW value is a hexadecimal number corresponding to the states of the Jumpers. (Please refer to Appendix G, Table – 14.)

The returned tag “state” indicates current state of Jumper 2, if it’s on “on” position, current configuration will be set as default state and a “default” message will be displayed, if it’s on “off” position - current configuration will be set as normal state and a “normal” message will be displayed.

SW2 is a 16 position rotary switch. When the arm of SW2 is switched to position “0”, you would be able to set up specific values for recovery time(rtime), forward delay(ftime) , maximum age(mtime), and hello time(htime) manually. If the position is on positions other than “0” (“1” to “F”), a set of preset values will be applied. The returned RotarySW value indicates the current position of SW2. Please refer to Appendix G, Table – 15, and sections of rtime, ftime, mtime and htime for more detail information.

Example:

```
RS-405>hmivalue
HMI setting (default) A,0
RS-405>
```

rtime [time]

Description

Recovery time is the length of time it takes to return back to normal operation after an error or other failure has occurred. This command enables you to set up the recovery time in millisecond (ms).

To setup the recovery time manually, you are required to switch the SW1 Jumper 4 to “off” position (applying Ring protocol), and SW2 to position ‘0’ (if the SW2 position is not on ‘0’, a preset value will be applied according to its corresponding position, please refer to Appendix G, Table – 15. If SW1 jumper 4 is not on “off” position; that is, not applying ring protocol, rtime is not applicable)

After each new rtime setting, you would need to reset the switch to make new setting effective.

Note: rtime command returns the following message: “recovery time x(y) ms.” “x” (switch value) indicates the rtime value set by console command, “y” (operating

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value) indicates the actual operating value. When applying redundancy mode, the actual rtime value can be only set up by modifying master switch rtime value.

Parameters

Parameter	Description
time	Provides the time interval(ms) that you want to set up as the recovery time

Example:

```
RS-405>rtime
recovery time 300 (300) ms
RS-405>
```

Use the following function to calculate an adequate rtime:
rtime = [Round(0.3*(N+1))]*100 ms
N: number of switches

Example:
If there are 5 switches(including master switch), the adequate rtime will be:
[Round(0.3*(5+1))]*100 = Round(1.8) *100 =2*100 =200 ms

ftime [time]

Description

This command enables you to set up the spanning tree bridge forward delay in milliseconds(ms) . Forward delay is the time interval spent waiting to change a port from its spanning tree pre-forwarding state to a forwarding state. This is necessary because every bridge on the network should ensure no loop is formed before allowing the port to forward packets.

To setup the forward time manually, you are required to switch the SW1 Jumper 4 to “on” position (applying STP protocol), and SW2 to position ‘0’ (if the SW2 position is not on ‘0’, a preset value will be applied according to its corresponding position, please refer to Appendix G, Table – 15. If SW1 jumper 4 is not on “on” position; that is, not applying STP protocol, ftime is not applicable)

Parameters

Parameter	Description
time	Provides the time interval(ms) that you want to set up as the forward time

Example:

```
RS-405>ftime
forward delay 6000 (6000) ms
RS-405>
```


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mtime [time]

Description

This command enables you to setup the spanning tree bridge maximum age in milliseconds(ms) . Max age is the maximum time a bridge waits without receiving spanning tree configuration messages before attempting a reconfiguration.

To setup the maximum time manually, you are required to switch the SW1 Jumper 4 to “on” position (applying STP protocol), and SW2 to position ‘0’ (if the SW2 position is not on ‘0’, a preset value will be applied according to its corresponding position, please refer to Appendix G, Table – 15. If SW1 jumper 4 is not on “on” position; that is, not applying STP protocol, mtime is not applicable)

Parameters

Parameter	Description
time	Provides the time interval(ms) that you want to set up as the maximum time

Example:

```
RS-405>mtime
max age time 10000 (10000) ms
RS-405>
```

htime [time]

Description

This command enables you to set the spanning tree bridge hello time in millisecond (ms). Hello time is the interval between transmission of spanning tree configuration messages. All bridges send configuration messages during reconfiguration to select the designated root bridge (in this case, the switch port).

To setup the hello time manually, you are required to switch the SW1 Jumper 4 to “on” position (applying STP protocol), and SW2 to position ‘0’ (if the SW2 position is not on ‘0’, a preset value will be applied according to its corresponding position, please refer to Appendix G, Table – 15. If SW1 jumper 4 is not on “on” position; that is, not applying STP protocol, htime is not applicable)

Parameters

Parameter	Description
time	Provides the time interval(ms) that you want to set up as the hello time

Example:

```
RS-405>htime
hello time 4000 (4000) ms
RS-405>
```


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Note: if you intend to set up any one of the recovery time, forward time, max age, or hello time manually by using console commands, you are required to set up these values all together by using the corresponding console commands, too. If you do not assign specific values for these settings, they will become preset values (or default values if no values were previously assigned)

com1 [baudrate][databit][parity][stopbit]

Description

The first serial port Com1 is assigned for RS232. This command enables you to set up the transmission speed(baudrate),data bit(databit), parity check type (parity) and stop bit(stopbit).

The transmission speed parameter [baudrate] allows the following settings: 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200. The port speed and device speed must match.

The number of data bits can be 7 (for true ASCII) or 8 (for any kind of data, as this matches the size of a byte),

The parity check code can be set to none (0), even (1), or odd (2). None(0) means that no parity bit is sent at all. Even (1) means applying even parity check, each set of transmitted bits must have an even number of set bits. Odd (2) means applying odd parity check, each set of transmitted bits must have an odd number of set bits.

Stop bit is used in asynchronous communications to indicate the end of a piece of data.

Parameters

Parameter	Description
baudrate	Provides the baud rate (300 or 600 or 1200 or 2400 or 4800 or 9600 or 19200 or 38400 or 57600 or 115200)for your usage, default value is 115200
databit	Provides the data bit value(7 or 8), default value is 8
parity	Provides the parity check type, none k(0) , even (1), odd (2):, default value is 0.
stopbit	Provides the stop bit(1 or 2), default value is 1.

Example:

```
RS-405>com1
COM1 baudrate 115200 format 801
RS-405>com1 600 7 2 2
COM1 baudrate 600 format 722
RS-405>_
```


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com2 [baudrate][databit][parity][stopbit]

Description

The second serial port Com2 is assigned for RS485. This command enables you to set up the transmission speed(baudrate),data bit(databit), parity check type (parity) and stop bit(stopbit).

The transmission speed parameter [baudrate] allows the following settings: 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200. The port speed and device speed must match.

The number of data bits can be 7 (for true ASCII) or 8 (for any kind of data, as this matches the size of a byte),

The parity check code can be set to none (0), even (1), or odd (2). None(0) means that no parity bit is sent at all. Even (1) means applying even parity check, each set of transmitted bits must have an even number of set bits. Odd (2) means applying odd parity check, each set of transmitted bits must have an odd number of set bits.

Stop bit is used in asynchronous communications to indicate the end of a piece of data.

Parameters

Parameter	Description
baudrate	Provides the baud rate (300 or 600 or 1200 or 2400 or 4800 or 9600 or 19200 or 38400 or 57600 or 115200)for your usage, default value is 115200
databit	Provides the data bit value(7 or 8), default value is 8
parity	Provides the parity check type, none k(0) , even (1), odd (2):, default value is 0.
stopbit	Provides the stop bit(1 or 2), default value is 1.

Example:

```
RS-405>com2
COM2 baudrate 115200 format 801
RS-405>com2 9600 7 1 1
COM2 baudrate 9600 format 711
RS-405>
```


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Appendix E

Ingress Protection (IP)

An IP number is used to specify the environmental protection of enclosures around electronic equipment. These ratings are determined by specific tests.

The IP number is composed of two numbers, the first referring to the protection against solid objects and the second against liquids. The higher the number is, the better the protection.

Note: All ICP DAS *RS Series* devices are manufactured and tested to IEC IP51 standards.

First Number

0	No protection (Sometimes X)
1	Protected against solid objects up to 50mm³
2	Protected against solid objects up to 12mm³
3	Protected against solid objects up to 2.5mm³
4	Protected against solid objects up to 1mm³
5	Protected against dust, limited ingress (no harmful deposit)
6	Totally protected against dust

Second Number

0	No protection (Sometimes X)
1	Protection against vertically falling drops of water (e.g. condensation)
2	Protection against direct sprays of water up to 15 degrees from vertical
3	Protection against direct sprays of water up to 60 degrees from vertical
4	Protection against water sprayed from all directions - limited ingress permitted
5	Protected against low pressure jets of water from all directions - limited ingress permitted
6	Protected against low pressure jets of water, limited ingress permitted (e.g. ship deck)
7	Protected against the effect of immersion between 15cm and 1m
8	Protected against long periods of immersion under pressure

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Appendix F

Accessories

Power Supply (KA-52F/DIN-KA52F)

Features & Specifications

- Input Range : 100~250AC
- Input Frequency : 50Hz to 60 Hz
- Output : 24Vdc/1Amp max.
- Output Power : 25Watts
- Operating Temperature:0 to 70℃
- Storage Temperature : -40 to 85℃
- Demension :
  65 x 105 x 36mm (KA-52F)
  68 x 107 x 50mm (DIN-KA52F)

Part No. Information

KA-52F	24V/1A output power supply
DIN-KA52F	24V/1A output power supply with DIN-Rail Mount

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Appendix G

Tables

Table – 1 Corresponding bits and ports (for lmask command)

Bit 7		Bit 6		Bit 5		Bit 4		Bit 3		Bit 2		Bit 1		Bit 0	
Port 8		Port 7		Port 6		Port 5		Port 4		Port 3		Port 2		Port 1	
1	on	1	on	1	on	1	on	1	on	1	on	1	on	1	on
0	off	0	off	0	off	0	off	0	off	0	off	0	off	0	off

Table – 2 Assign mask value for activating relay output when there is link loss occurring on the port(s)

Activate relay output when there is a link loss occurring on port(s):	Corresponding 8 bits binary numbers	Mask value
N/A	00000000	0X0 or 0
1	00000001	0X1 or 1
2	00000010	0X2 or 2
1 or 2	00000011	0X3 or 3
3	00000100	0X4 or 4
1 or 3	00000101	0X5 or 5
2 or 3	00000110	0X6 or 6
1 or 2 or 3	00000111	0X7 or 7
4	00001000	0X8 or 8
1 or 4	00001001	0X9 or 9
2 or 4	00001010	0Xa or a
1 or 2 or 4	00001011	0Xb or b
3 or 4	00001100	0Xc or c
1 or 3 or 4	00001101	0Xd or d
2 or 3 or 4	00001110	0Xe or e
1 or 2 or 3 or 4	00001111	0Xf or f
5	00010000	0X10 or 10
1 or 5	00010001	0X11 or 11
2 or 5	00010010	0X12 or 12
1 or 2 or 5	00010011	0X13 or 13
3 or 5	00010100	0X14 or 14
1 or 3 or 5	00010101	0X15 or 15
2 or 3 or 5	00010110	0X16 or 16
1 or 2 or 3 or 5	00010111	0X17 or 17
4 or 5	00011000	0X18 or 18
1 or 4 or 5	00011001	0X19 or 19
2 or 4 or 5	00011010	0X1a or 1a
1 or 2 or 4 or 5	00011011	0X1b or 1b
3 or 4 or 5	00011100	0X1c or 1c
1 or 3 or 4 or 5	00011101	0X1d or 1d
2 or 3 or 4 or 5	00011110	0X1e or 1e
1 or 2 or 3 or 4 or 5	00011111	0X1f or 1f
6	00100000	0X20 or 20
1 or 6	00100001	0X21 or 21
2 or 6	00100010	0X22 or 22
1 or 2 or 6	00100011	0X23 or 23
3 or 6	00100100	0X24 or 24
1 or 3 or 6	00100101	0X25 or 25
2 or 3 or 6	00100110	0X26 or 26
1 or 2 or 3 or 6	00100111	0X27 or 27

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4 or 6	00101000	0X28 or 28
1 or 4 or 6	00101001	0X29 or 29
2 or 4 or 6	00101010	0X2a or 2a
1 or 2 or 4 or 6	00101011	0X2b or 2b
3 or 4 or 6	00101100	0X2c or 2c
1 or 3 or 4 or 6	00101101	0X2d or 2d
2 or 3 or 4 or 6	00101110	0X2e or 2e
1 or 2 or 3 or 4 or 6	00101111	0X2f or 2f
5 or 6	00110000	0X30 or 30
1 or 5 or 6	00110001	0X31 or 31
2 or 5 or 6	00110010	0X32 or 32
1 or 2 or 5 or 6	00110011	0X33 or 33
3 or 5 or 6	00110100	0X34 or 34
1 or 3 or 5 or 6	00110101	0X35 or 35
2 or 3 or 5 or 6	00110110	0X36 or 36
1 or 2 or 3 or 5 or 6	00110111	0X37 or 37
4 or 5 or 6	00111000	0X38 or 38
1 or 4 or 5 or 6	00111001	0X39 or 39
2 or 4 or 5 or 6	00111010	0X3a or 3a
1 or 2 or 4 or 5 or 6	00111011	0X3b or 3b
3 or 4 or 5 or 6	00111100	0X3c or 3c
1 or 3 or 4 or 5 or 6	00111101	0X3d or 3d
2 or 3 or 4 or 5 or 6	00111110	0X3e or 3e
1 or 2 or 3 or 4 or 5 or 6	00111111	0X3f or 3f
7	01000000	0X40 or 40
1 or 7	01000001	0X41 or 41
2 or 7	01000010	0X42 or 42
1 or 2 or 7	01000011	0X43 or 43
3 or 7	01000100	0X44 or 44
1 or 3 or 7	01000101	0X45 or 45
2 or 3 or 7	01000110	0X46 or 46
1 or 2 or 3 or 7	01000111	0X47 or 47
4 or 7	01001000	0X48 or 48
1 or 4 or 7	01001001	0X49 or 49
2 or 4 or 7	01001010	0X4a or 4a
1 or 2 or 4 or 7	01001011	0X4b or 4b
3 or 4 or 7	01001100	0X4c or 4c
1 or 3 or 4 or 7	01001101	0X4d or 4d
2 or 3 or 4 or 7	01001110	0X4e or 4e
1 or 2 or 3 or 4 or 7	01001111	0X4f or 4f
5 or 7	01010000	0X50 or 50
1 or 5 or 7	01010001	0X51 or 51
2 or 5 or 7	01010010	0X52 or 52
1 or 2 or 5 or 7	01010011	0X53 or 53
3 or 5 or 7	01010100	0X54 or 54
1 or 3 or 5 or 7	01010101	0X55 or 55
2 or 3 or 5 or 7	01010110	0X56 or 56
1 or 2 or 3 or 5 or 7	01010111	0X57 or 57
4 or 5 or 7	01011000	0X58 or 58
1 or 4 or 5 or 7	01011001	0X59 or 59
2 or 4 or 5 or 7	01011010	0X5a or 5a
1 or 2 or 4 or 5 or 7	01011011	0X5b or 5b
3 or 4 or 5 or 7	01011100	0X5c or 5c
1 or 3 or 4 or 5 or 7	01011101	0X5d or 5d
2 or 3 or 4 or 5 or 7	01011110	0X5e or 5e
1 or 2 or 3 or 4 or 5 or 7	01011111	0X5f or 5f
6 or 7	01100000	0X60 or 60
1 or 6 or 7	01100001	0X61 or 61
2 or 6 or 7	01100010	0X62 or 62

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1 or 2 or 6 or 7	01100011	0X63 or 63
3 or 6 or 7	01100100	0X64 or 64
1 or 3 or 6 or 7	01100101	0X65 or 65
2 or 3 or 6 or 7	01100110	0X66 or 66
1 or 2 or 3 or 6 or 7	01100111	0X67 or 67
4 or 6 or 7	01101000	0X68 or 68
1 or 4 or 6 or 7	01101001	0X69 or 69
2 or 4 or 6 or 7	01101010	0X6a or 6a
1 or 2 or 4 or 6 or 7	01101011	0X6b or 6b
3 or 4 or 6 or 7	01101100	0X6c or 6c
1 or 3 or 4 or 6 or 7	01101101	0X6d or 6d
2 or 3 or 4 or 6 or 7	01101110	0X6e or 6e
1 or 2 or 3 or 4 or 6 or 7	01101111	0X6f or 6f
5 or 6 or 7	01110000	0X70 or 70
1 or 5 or 6 or 7	01110001	0X71 or 71
2or 5 or 6 or 7	01110010	0X72 or 72
1 or 2or 5 or 6 or 7	01110010	0X73 or 73
3 or 5 or 6 or 7	01110100	0X74 or 74
1 or 3 or 5 or 6 or 7	01110101	0X75 or 75
2 or 3 or 5 or 6 or 7	01110110	0X76 or 76
1 or 2 or 3 or 5 or 6 or 7	01110111	0X77 or 77
4 or 5 or 6 or 7	01111000	0X78 or 78
1 or 4 or 5 or 6 or 7	01111001	0X79 or 79
2 or 4 or 5 or 6 or 7	01111010	0X7a or 7a
1 or 2 or 4 or 5 or 6 or 7	01111011	0X7b or 7b
3 or 4 or 5 or 6 or 7	01111100	0X7c or 7c
1 or 3 or 4 or 5 or 6 or 7	01111101	0X7d or 7d
2 or 3 or 4 or 5 or 6 or 7	01111110	0X7e or 7e
1 or 2 or 3 or 4 or 5 or 6 or 7	01111111	0X7f or 7f
8	10000000	0X80 or 80
1 or 8	10000001	0X81 or 81
2 or 8	10000010	0X82 or 82
1 or 2 or 8	10000011	0X83 or 83
3 or 8	10000100	0X84 or 84
1 or 3 or 8	10000101	0X85 or 85
2 or 3 or 8	10000110	0X86 or 86
1 or 2 or 3 or 8	10000111	0X87 or 87
4 or 8	10001000	0X88 or 88
1 or 4 or 8	10001001	0X89 or 89
2 or 4 or 8	10001010	0X8a or 8a
1 or 2 or 4 or 8	10001011	0X8b or 8b
3 or 4 or 8	10001100	0X8c or 8c
1 or 3 or 4 or 8	10001101	0X8d or 8d
2 or 3 or 4 or 8	10001110	0X8e or 8e
1 or 2 or 3 or 4 or 8	10001111	0X8f or 8f
5 or 8	10010000	0X90 or 90
1 or 5 or 8	10010001	0X91 or 91
2 or 5 or 8	10010010	0X92 or 92
1 or 2 or 5 or 8	10010011	0X93 or 93
3 or 5 or 8	10010100	0X94 or 94
1 or 3 or 5 or 8	10010101	0X95 or 95
2 or 3 or 5 or 8	10010110	0X96 or 96
1 or 2 or 3 or 5 or 8	10010111	0X97 or 97
4 or 5 or 8	10011000	0X98 or 98
1 or 4 or 5 or 8	10011001	0X99 or 99
2 or 4 or 5 or 8	10011010	0X9a or 9a
1 or 2 or 4 or 5 or 8	10011011	0X9b or 9b
3 or 4 or 5 or 8	10011100	0X9c or 9c
1 or 3 or 4 or 5 or 8	10011101	0X9d or 9d

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2 or 3 or 4 or 5 or 8	10011110	0X9e or 9e
1 or 2 or 3 or 4 or 5 or 8	10011111	0X9f or 9f
6 or 8	10100000	0Xa0 or a0
1 or 6 or 8	10100001	0Xa1 or a1
2 or 6 or 8	10100010	0Xa2 or a2
1 or 2 or 6 or 8	10100011	0Xa3 or a3
3 or 6 or 8	10100100	0Xa4 or a4
1 or 3 or 6 or 8	10100101	0Xa5 or a5
2 or 3 or 6 or 8	10100110	0Xa6 or a6
1 or 2 or 3 or 6 or 8	10100111	0Xa7 or a7
4 or 6 or 8	10101000	0Xa8 or a8
1 or 4 or 6 or 8	10101001	0Xa9 or a9
2 or 4 or 6 or 8	10101010	0Xaa or aa
1 or 2 or 4 or 6 or 8	10101011	0Xab or ab
3 or 4 or 6 or 8	10101100	0Xac or ac
1 or 3 or 4 or 6 or 8	10101101	0Xad or ad
2 or 3 or 4 or 6 or 8	10101110	0Xae or ae
1 or 2 or 3 or 4 or 6 or 8	10101111	0Xaf or af
5 or 6 or 8	10110000	0Xb0 or b0
1 or 5 or 6 or 8	10110001	0Xb1 or b1
2 or 5 or 6 or 8	10110010	0Xb2 or b2
1 or 2 or 5 or 6 or 8	10110011	0Xb3 or b3
3 or 5 or 6 or 8	10110100	0Xb4 or b4
1 or 3 or 5 or 6 or 8	10110101	0Xb5 or b5
2 or 3 or 5 or 6 or 8	10110110	0Xb6 or b6
1 or 2 or 3 or 5 or 6 or 8	10110111	0Xb7 or b7
4 or 5 or 6 or 8	10111000	0Xb8 or b8
1 or 4 or 5 or 6 or 8	10111001	0Xb9 or b9
2 or 4 or 5 or 6 or 8	10111010	0Xba or ba
1 or 2 or 4 or 5 or 6 or 8	10111011	0Xbb or bb
3 or 4 or 5 or 6 or 8	10111100	0Xbc or bc
1 or 3 or 4 or 5 or 6 or 8	10111101	0Xbd or bd
2 or 3 or 4 or 5 or 6 or 8	10111110	0Xbe or be
1 or 2 or 3 or 4 or 5 or 6 or 8	10111111	0Xbf or bf
7 or 8	11000000	0Xc0 or c0
1 or 7 or 8	11000001	0Xc1 or c1
2 or 7 or 8	11000010	0Xc2 or c2
1 or 2 or 7 or 8	11000011	0Xc3 or c3
3 or 7 or 8	11000100	0Xc4 or c4
1 or 3 or 7 or 8	11000101	0Xc5 or c5
2 or 3 or 7 or 8	11000110	0Xc6 or c6
1 or 2 or 3 or 7 or 8	11000111	0Xc7 or c7
4 or 7 or 8	11001000	0Xc8 or c8
1 or 4 or 7 or 8	11001001	0Xc9 or c9
2 or 4 or 7 or 8	11001010	0Xca or ca
1 or 2 or 4 or 7 or 8	11001011	0Xcb or cb
3 or 4 or 7 or 8	11001100	0Xcc or cc
1 or 3 or 4 or 7 or 8	11001101	0Xcd or cd
2 or 3 or 4 or 7 or 8	11001110	0Xce or ce
1 or 2 or 3 or 4 or 7 or 8	11001111	0Xcf or cf
5 or 7 or 8	11010000	0Xd0 or d0
1 or 5 or 7 or 8	11010001	0Xd1 or d1
2 or 5 or 7 or 8	11010010	0Xd2 or d2
1 or 2 or 5 or 7 or 8	11010011	0Xd3 or d3
3 or 5 or 7 or 8	11010100	0Xd4 or d4
1 or 3 or 5 or 7 or 8	11010101	0Xd5 or d5
2 or 3 or 5 or 7 or 8	11010110	0Xd6 or d6
1 or 2 or 3 or 5 or 7 or 8	11010111	0Xd7 or d7
4 or 5 or 7 or 8	11011000	0Xd8 or d8

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1 or 4 or 5 or 7 or 8	11011001	0Xd9 or d9
2 or 4 or 5 or 7 or 8	11011010	0Xda or da
1 or 2 or 4 or 5 or 7 or 8	11011011	0Xdb or db
3 or 4 or 5 or 7 or 8	11011100	0Xdc or dc
1 or 3 or 4 or 5 or 7 or 8	11011101	0Xdd or dd
2 or 3 or 4 or 5 or 7 or 8	11011110	0Xde or de
1 or 2 or 3 or 4 or 5 or 7 or 8	11011111	0Xdf or df
6 or 7 or 8	11100000	0Xe0 or e0
1 or 6 or 7 or 8	11100001	0Xe1 or e1
2 or 6 or 7 or 8	11100010	0Xe2 or e2
1 or 2 or 6 or 7 or 8	11100011	0Xe3 or e3
3 or 6 or 7 or 8	11100100	0Xe4 or e4
1 or 3 or 6 or 7 or 8	11100101	0Xe5 or e5
2 or 3 or 6 or 7 or 8	11100110	0Xe6 or e6
1 or 2 or 3 or 6 or 7 or 8	11100111	0Xe7 or e7
4 or 6 or 7 or 8	11101000	0Xe8 or e8
1 or 4 or 6 or 7 or 8	11101001	0Xe9 or e9
2 or 4 or 6 or 7 or 8	11101010	0Xea or ea
1 or 2 or 4 or 6 or 7 or 8	11101011	0Xeb or eb
3 or 4 or 6 or 7 or 8	11101100	0Xec or ec
1 or 3 or 4 or 6 or 7 or 8	11101101	0Xed or ed
2 or 3 or 4 or 6 or 7 or 8	11101110	0Xee or ee
1 or 2 or 3 or 4 or 6 or 7 or 8	11101111	0Xef or ef
5 or 6 or 7 or 8	11110000	0Xf0 or f0
1 or 5 or 6 or 7 or 8	11110001	0Xf1 or f1
2 or 5 or 6 or 7 or 8	11110010	0Xf2 or f2
1 or 2 or 5 or 6 or 7 or 8	11110011	0Xf3 or f3
3 or 5 or 6 or 7 or 8	11110100	0Xf4 or f4
1 or 3 or 5 or 6 or 7 or 8	11110101	0Xf5 or f5
2 or 3 or 5 or 6 or 7 or 8	11110110	0Xf6 or f6
1 or 2 or 3 or 5 or 6 or 7 or 8	11110111	0Xf7 or f7
4 or 5 or 6 or 7 or 8	11111000	0Xf8 or f8
1 or 4 or 5 or 6 or 7 or 8	11111001	0Xf9 or f9
2 or 4 or 5 or 6 or 7 or 8	11111010	0Xfa or fa
1 or 2 or 4 or 5 or 6 or 7 or 8	11111011	0Xfb or fb
3 or 4 or 5 or 6 or 7 or 8	11111100	0Xfc or fc
1 or 3 or 4 or 5 or 6 or 7 or 8	11111101	0Xfd or fd
2 or 3 or 4 or 5 or 6 or 7 or 8	11111110	0Xfe or fe
1 or 2 or 3 or 4 or 5 or 6 or 7 or 8	11111111	0Xff or ff

Table –3 Corresponding bits and ports (for cmask command)

Bit 7		Bit 6		Bit 5		Bit 4		Bit 3		Bit 2		Bit 1		Bit 0	
Port 8		Port 7		Port 6		Port 5		Port 4		Port 3		Port 2		Port 1	
1	on	1	on	1	on	1	on	1	on	1	on	1	on	1	on
0	off	0	off	0	off	0	off	0	off	0	off	0	off	0	off

Table – 4 Assign mask value for activating relay output when there is communication loss occurring on the port(s)

Activate relay output when there is a communication loss occurring on port(s):	Corresponding 8 bits binary numbers	Mask value
N/A	00000000	0X0 or 0
1	00000001	0X1 or 1
2	00000010	0X2 or 2
1 or 2	00000011	0X3 or 3

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3	00000100	0X4 or 4
1 or 3	00000101	0X5 or 5
2 or 3	00000110	0X6 or 6
1 or 2 or 3	00000111	0X7 or 7
4	00001000	0X8 or 8
1 or 4	00001001	0X9 or 9
2 or 4	00001010	0Xa or a
1 or 2 or 4	00001011	0Xb or b
3 or 4	00001100	0Xc or c
1 or 3 or 4	00001101	0Xd or d
2 or 3 or 4	00001110	0Xe or e
1 or 2 or 3 or 4	00001111	0Xf or f
5	00010000	0X10 or 10
1 or 5	00010001	0X11 or 11
2 or 5	00010010	0X12 or 12
1 or 2 or 5	00010011	0X13 or 13
3 or 5	00010100	0X14 or 14
1 or 3 or 5	00010101	0X15 or 15
2 or 3 or 5	00010110	0X16 or 16
1 or 2 or 3 or 5	00010111	0X17 or 17
4 or 5	00011000	0X18 or 18
1 or 4 or 5	00011001	0X19 or 19
2 or 4 or 5	00011010	0X1a or 1a
1 or 2 or 4 or 5	00011011	0X1b or 1b
3 or 4 or 5	00011100	0X1c or 1c
1 or 3 or 4 or 5	00011101	0X1d or 1d
2 or 3 or 4 or 5	00011110	0X1e or 1e
1 or 2 or 3 or 4 or 5	00011111	0X1f or 1f
6	00100000	0X20 or 20
1 or 6	00100001	0X21 or 21
2 or 6	00100010	0X22 or 22
1 or 2 or 6	00100011	0X23 or 23
3 or 6	00100100	0X24 or 24
1 or 3 or 6	00100101	0X25 or 25
2 or 3 or 6	00100110	0X26 or 26
1 or 2 or 3 or 6	00100111	0X27 or 27
4 or 6	00101000	0X28 or 28
1 or 4 or 6	00101001	0X29 or 29
2 or 4 or 6	00101010	0X2a or 2a
1 or 2 or 4 or 6	00101011	0X2b or 2b
3 or 4 or 6	00101100	0X2c or 2c
1 or 3 or 4 or 6	00101101	0X2d or 2d
2 or 3 or 4 or 6	00101110	0X2e or 2e
1 or 2 or 3 or 4 or 6	00101111	0X2f or 2f
5 or 6	00110000	0X30 or 30
1 or 5 or 6	00110001	0X31 or 31
2 or 5 or 6	00110010	0X32 or 32
1 or 2 or 5 or 6	00110011	0X33 or 33
3 or 5 or 6	00110100	0X34 or 34
1 or 3 or 5 or 6	00110101	0X35 or 35
2 or 3 or 5 or 6	00110110	0X36 or 36
1 or 2 or 3 or 5 or 6	00110111	0X37 or 37
4 or 5 or 6	00111000	0X38 or 38
1 or 4 or 5 or 6	00111001	0X39 or 39
2 or 4 or 5 or 6	00111010	0X3a or 3a
1 or 2 or 4 or 5 or 6	00111011	0X3b or 3b
3 or 4 or 5 or 6	00111100	0X3c or 3c
1 or 3 or 4 or 5 or 6	00111101	0X3d or 3d
2 or 3 or 4 or 5 or 6	00111110	0X3e or 3e

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1 or 2 or 3 or 4 or 5 or 6	00111111	0X3f or 3f
7	01000000	0X40 or 40
1 or 7	01000001	0X41 or 41
2 or 7	01000010	0X42 or 42
1 or 2 or 7	01000011	0X43 or 43
3 or 7	01000100	0X44 or 44
1 or 3 or 7	01000101	0X45 or 45
2 or 3 or 7	01000110	0X46 or 46
1 or 2 or 3 or 7	01000111	0X47 or 47
4 or 7	01001000	0X48 or 48
1 or 4 or 7	01001001	0X49 or 49
2 or 4 or 7	01001010	0X4a or 4a
1 or 2 or 4 or 7	01001011	0X4b or 4b
3 or 4 or 7	01001100	0X4c or 4c
1 or 3 or 4 or 7	01001101	0X4d or 4d
2 or 3 or 4 or 7	01001110	0X4e or 4e
1 or 2 or 3 or 4 or 7	01001111	0X4f or 4f
5 or 7	01010000	0X50 or 50
1 or 5 or 7	01010001	0X51 or 51
2 or 5 or 7	01010010	0X52 or 52
1 or 2 or 5 or 7	01010011	0X53 or 53
3 or 5 or 7	01010100	0X54 or 54
1 or 3 or 5 or 7	01010101	0X55 or 55
2 or 3 or 5 or 7	01010110	0X56 or 56
1 or 2 or 3 or 5 or 7	01010111	0X57 or 57
4 or 5 or 7	01011000	0X58 or 58
1 or 4 or 5 or 7	01011001	0X59 or 59
2 or 4 or 5 or 7	01011010	0X5a or 5a
1 or 2 or 4 or 5 or 7	01011011	0X5b or 5b
3 or 4 or 5 or 7	01011100	0X5c or 5c
1 or 3 or 4 or 5 or 7	01011101	0X5d or 5d
2 or 3 or 4 or 5 or 7	01011110	0X5e or 5e
1 or 2 or 3 or 4 or 5 or 7	01011111	0X5f or 5f
6 or 7	01100000	0X60 or 60
1 or 6 or 7	01100001	0X61 or 61
2 or 6 or 7	01100010	0X62 or 62
1 or 2 or 6 or 7	01100011	0X63 or 63
3 or 6 or 7	01100100	0X64 or 64
1 or 3 or 6 or 7	01100101	0X65 or 65
2 or 3 or 6 or 7	01100110	0X66 or 66
1 or 2 or 3 or 6 or 7	01100111	0X67 or 67
4 or 6 or 7	01101000	0X68 or 68
1 or 4 or 6 or 7	01101001	0X69 or 69
2 or 4 or 6 or 7	01101010	0X6a or 6a
1 or 2 or 4 or 6 or 7	01101011	0X6b or 6b
3 or 4 or 6 or 7	01101100	0X6c or 6c
1 or 3 or 4 or 6 or 7	01101101	0X6d or 6d
2 or 3 or 4 or 6 or 7	01101110	0X6e or 6e
1 or 2 or 3 or 4 or 6 or 7	01101111	0X6f or 6f
5 or 6 or 7	01110000	0X70 or 70
1 or 5 or 6 or 7	01110001	0X71 or 71
2or 5 or 6 or 7	01110010	0X72 or 72
1 or 2or 5 or 6 or 7	01110010	0X73 or 73
3 or 5 or 6 or 7	01110100	0X74 or 74
1 or 3 or 5 or 6 or 7	01110101	0X75 or 75
2 or 3 or 5 or 6 or 7	01110110	0X76 or 76
1 or 2 or 3 or 5 or 6 or 7	01110111	0X77 or 77
4 or 5 or 6 or 7	01111000	0X78 or 78
1 or 4 or 5 or 6 or 7	01111001	0X79 or 79

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2 or 4 or 5 or 6 or 7	01111010	0X7a or 7a
1 or 2 or 4 or 5 or 6 or 7	01111011	0X7b or 7b
3 or 4 or 5 or 6 or 7	01111100	0X7c or 7c
1 or 3 or 4 or 5 or 6 or 7	01111101	0X7d or 7d
2 or 3 or 4 or 5 or 6 or 7	01111110	0X7e or 7e
1 or 2 or 3 or 4 or 5 or 6 or 7	01111111	0X7f or 7f
8	10000000	0X80 or 80
1 or 8	10000001	0X81 or 81
2 or 8	10000010	0X82 or 82
1 or 2 or 8	10000011	0X83 or 83
3 or 8	10000100	0X84 or 84
1 or 3 or 8	10000101	0X85 or 85
2 or 3 or 8	10000110	0X86 or 86
1 or 2 or 3 or 8	10000111	0X87 or 87
4 or 8	10001000	0X88 or 88
1 or 4 or 8	10001001	0X89 or 89
2 or 4 or 8	10001010	0X8a or 8a
1 or 2 or 4 or 8	10001011	0X8b or 8b
3 or 4 or 8	10001100	0X8c or 8c
1 or 3 or 4 or 8	10001101	0X8d or 8d
2 or 3 or 4 or 8	10001110	0X8e or 8e
1 or 2 or 3 or 4 or 8	10001111	0X8f or 8f
5 or 8	10010000	0X90 or 90
1 or 5 or 8	10010001	0X91 or 91
2 or 5 or 8	10010010	0X92 or 92
1 or 2 or 5 or 8	10010011	0X93 or 93
3 or 5 or 8	10010100	0X94 or 94
1 or 3 or 5 or 8	10010101	0X95 or 95
2 or 3 or 5 or 8	10010110	0X96 or 96
1 or 2 or 3 or 5 or 8	10010111	0X97 or 97
4 or 5 or 8	10011000	0X98 or 98
1 or 4 or 5 or 8	10011001	0X99 or 99
2 or 4 or 5 or 8	10011010	0X9a or 9a
1 or 2 or 4 or 5 or 8	10011011	0X9b or 9b
3 or 4 or 5 or 8	10011100	0X9c or 9c
1 or 3 or 4 or 5 or 8	10011101	0X9d or 9d
2 or 3 or 4 or 5 or 8	10011110	0X9e or 9e
1 or 2 or 3 or 4 or 5 or 8	10011111	0X9f or 9f
6 or 8	10100000	0Xa0 or a0
1 or 6 or 8	10100001	0Xa1 or a1
2 or 6 or 8	10100010	0Xa2 or a2
1 or 2 or 6 or 8	10100011	0Xa3 or a3
3 or 6 or 8	10100100	0Xa4 or a4
1 or 3 or 6 or 8	10100101	0Xa5 or a5
2 or 3 or 6 or 8	10100110	0Xa6 or a6
1 or 2 or 3 or 6 or 8	10100111	0Xa7 or a7
4 or 6 or 8	10101000	0Xa8 or a8
1 or 4 or 6 or 8	10101001	0Xa9 or a9
2 or 4 or 6 or 8	10101010	0Xaa or aa
1 or 2 or 4 or 6 or 8	10101011	0Xab or ab
3 or 4 or 6 or 8	10101100	0Xac or ac
1 or 3 or 4 or 6 or 8	10101101	0Xad or ad
2 or 3 or 4 or 6 or 8	10101110	0Xae or ae
1 or 2 or 3 or 4 or 6 or 8	10101111	0Xaf or af
5 or 6 or 8	10110000	0Xb0 or b0
1 or 5 or 6 or 8	10110001	0Xb1 or b1
2 or 5 or 6 or 8	10110010	0Xb2 or b2
1 or 2 or 5 or 6 or 8	10110011	0Xb3 or b3
3 or 5 or 6 or 8	10110100	0Xb4 or b4

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1 or 3 or 5 or 6 or 8	10110101	0Xb5 or b5
2 or 3 or 5 or 6 or 8	10110110	0Xb6 or b6
1 or 2 or 3 or 5 or 6 or 8	10110111	0Xb7 or b7
4 or 5 or 6 or 8	10111000	0Xb8 or b8
1 or 4 or 5 or 6 or 8	10111001	0Xb9 or b9
2 or 4 or 5 or 6 or 8	10111010	0Xba or ba
1 or 2 or 4 or 5 or 6 or 8	10111011	0Xbb or bb
3 or 4 or 5 or 6 or 8	10111100	0Xbc or bc
1 or 3 or 4 or 5 or 6 or 8	10111101	0Xbd or bd
2 or 3 or 4 or 5 or 6 or 8	10111110	0Xbe or be
1 or 2 or 3 or 4 or 5 or 6 or 8	10111111	0Xbf or bf
7 or 8	11000000	0Xc0 or c0
1 or 7 or 8	11000001	0Xc1 or c1
2 or 7 or 8	11000010	0Xc2 or c2
1 or 2 or 7 or 8	11000011	0Xc3 or c3
3 or 7 or 8	11000100	0Xc4 or c4
1 or 3 or 7 or 8	11000101	0Xc5 or c5
2 or 3 or 7 or 8	11000110	0Xc6 or c6
1 or 2 or 3 or 7 or 8	11000111	0Xc7 or c7
4 or 7 or 8	11001000	0Xc8 or c8
1 or 4 or 7 or 8	11001001	0Xc9 or c9
2 or 4 or 7 or 8	11001010	0Xca or ca
1 or 2 or 4 or 7 or 8	11001011	0Xcb or cb
3 or 4 or 7 or 8	11001100	0Xcc or cc
1 or 3 or 4 or 7 or 8	11001101	0Xcd or cd
2 or 3 or 4 or 7 or 8	11001110	0Xce or ce
1 or 2 or 3 or 4 or 7 or 8	11001111	0Xcf or cf
5 or 7 or 8	11010000	0Xd0 or d0
1 or 5 or 7 or 8	11010001	0Xd1 or d1
2 or 5 or 7 or 8	11010010	0Xd2 or d2
1 or 2 or 5 or 7 or 8	11010011	0Xd3 or d3
3 or 5 or 7 or 8	11010100	0Xd4 or d4
1 or 3 or 5 or 7 or 8	11010101	0Xd5 or d5
2 or 3 or 5 or 7 or 8	11010110	0Xd6 or d6
1 or 2 or 3 or 5 or 7 or 8	11010111	0Xd7 or d7
4 or 5 or 7 or 8	11011000	0Xd8 or d8
1 or 4 or 5 or 7 or 8	11011001	0Xd9 or d9
2 or 4 or 5 or 7 or 8	11011010	0Xda or da
1 or 2 or 4 or 5 or 7 or 8	11011011	0Xdb or db
3 or 4 or 5 or 7 or 8	11011100	0Xdc or dc
1 or 3 or 4 or 5 or 7 or 8	11011101	0Xdd or dd
2 or 3 or 4 or 5 or 7 or 8	11011110	0Xde or de
1 or 2 or 3 or 4 or 5 or 7 or 8	11011111	0Xdf or df
6 or 7 or 8	11100000	0Xe0 or e0
1 or 6 or 7 or 8	11100001	0Xe1 or e1
2 or 6 or 7 or 8	11100010	0Xe2 or e2
1 or 2 or 6 or 7 or 8	11100011	0Xe3 or e3
3 or 6 or 7 or 8	11100100	0Xe4 or e4
1 or 3 or 6 or 7 or 8	11100101	0Xe5 or e5
2 or 3 or 6 or 7 or 8	11100110	0Xe6 or e6
1 or 2 or 3 or 6 or 7 or 8	11100111	0Xe7 or e7
4 or 6 or 7 or 8	11101000	0Xe8 or e8
1 or 4 or 6 or 7 or 8	11101001	0Xe9 or e9
2 or 4 or 6 or 7 or 8	11101010	0Xea or ea
1 or 2 or 4 or 6 or 7 or 8	11101011	0Xeb or eb
3 or 4 or 6 or 7 or 8	11101100	0Xec or ec
1 or 3 or 4 or 6 or 7 or 8	11101101	0Xed or ed
2 or 3 or 4 or 6 or 7 or 8	11101110	0Xee or ee
1 or 2 or 3 or 4 or 6 or 7 or 8	11101111	0Xef or ef

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5 or 6 or 7 or 8	11110000	0Xf0 or f0
1 or 5 or 6 or 7 or 8	11110001	0Xf1 or f1
2 or 5 or 6 or 7 or 8	11110010	0Xf2 or f2
1 or 2 or 5 or 6 or 7 or 8	11110011	0Xf3 or f3
3 or 5 or 6 or 7 or 8	11110100	0Xf4 or f4
1 or 3 or 5 or 6 or 7 or 8	11110101	0Xf5 or f5
2 or 3 or 5 or 6 or 7 or 8	11110110	0Xf6 or f6
1 or 2 or 3 or 5 or 6 or 7 or 8	11110111	0Xf7 or f7
4 or 5 or 6 or 7 or 8	11111000	0Xf8 or f8
1 or 4 or 5 or 6 or 7 or 8	11111001	0Xf9 or f9
2 or 4 or 5 or 6 or 7 or 8	11111010	0Xfa or fa
1 or 2 or 4 or 5 or 6 or 7 or 8	11111011	0Xfb or fb
3 or 4 or 5 or 6 or 7 or 8	11111100	0Xfc or fc
1 or 3 or 4 or 5 or 6 or 7 or 8	11111101	0Xfd or fd
2 or 3 or 4 or 5 or 6 or 7 or 8	11111110	0Xfe or fe
1 or 2 or 3 or 4 or 5 or 6 or 7 or 8	11111111	0Xff or ff

Table – 5 Assign mask value for system status relay output

Activate relay output when:	Corresponding 8 bits binary numbers	Mask value
N/A	00000000	0X0 or 0
Power fail on Power 1	00000001	0X1 or 1
Power fail on Power 2	00000010	0X2 or 2
Power fail on Power 1 or Power 2	00000011	0X3 or 3
Switch is selected as master switch	00000100	0X4 or 4
Power fail on Power 1 or switch is selected as master switch	00000101	0X5 or 5
Power fail on Power 2 or switch is selected as master switch	00000110	0X6 or 6
Power fail on Power 1 or 2, or switch is selected as master switch	00000111	0X7 or 7

Table – 6 Corresponding bits and ports (for Ivalue)

Bit 7		Bit 6		Bit 5		Bit 4		Bit 3		Bit 2		Bit 1		Bit 0	
Port 8		Port 7		Port 6		Port 5		Port 4		Port 3		Port 2		Port 1	
1	on	1	on	1	on	1	on	1	on	1	on	1	on	1	on
0	off	0	off	0	off	0	off	0	off	0	off	0	off	0	off

Table – 7 Clarify current link status by returned Ivalue

Returned Ivalue in hexadecimal format	Corresponding 8 bits binary numbers	Indicating there is link loss occurring on port(s):
0	00000000	N/A
1	00000001	1
2	00000010	2
3	00000011	1 or 2
4	00000100	3

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5	00000101	1 or 3
6	00000110	2 or 3
7	00000111	1 or 2 or 3
8	00001000	4
9	00001001	1 or 4
a	00001010	2 or 4
b	00001011	1 or 2 or 4
c	00001100	3 or 4
d	00001101	1 or 3 or 4
e	00001110	2 or 3 or 4
f	00001111	1 or 2 or 3 or 4
10	00010000	5
11	00010001	1 or 5
12	00010010	2 or 5
13	00010011	1 or 2 or 5
14	00010100	3 or 5
15	00010101	1 or 3 or 5
16	00010110	2 or 3 or 5
17	00010111	1 or 2 or 3 or 5
18	00011000	4 or 5
19	00011001	1 or 4 or 5
1a	00011010	2 or 4 or 5
1b	00011011	1 or 2 or 4 or 5
1c	00011100	3 or 4 or 5
1d	00011101	1 or 3 or 4 or 5
1e	00011110	2 or 3 or 4 or 5
1f	00011111	1 or 2 or 3 or 4 or 5
20	00100000	6
21	00100001	1 or 6
22	00100010	2 or 6
23	00100011	1 or 2 or 6
24	00100100	3 or 6
25	00100101	1 or 3 or 6
26	00100110	2 or 3 or 6
27	00100111	1 or 2 or 3 or 6
28	00101000	4 or 6
29	00101001	1 or 4 or 6
2a	00101010	2 or 4 or 6
2b	00101011	1 or 2 or 4 or 6
2c	00101100	3 or 4 or 6
2d	00101101	1 or 3 or 4 or 6
2e	00101110	2 or 3 or 4 or 6
2f	00101111	1 or 2 or 3 or 4 or 6
30	00110000	5 or 6
31	00110001	1 or 5 or 6
32	00110010	2 or 5 or 6
33	00110011	1 or 2 or 5 or 6
34	00110100	3 or 5 or 6
35	00110101	1 or 3 or 5 or 6
36	00110110	2 or 3 or 5 or 6
37	00110111	1 or 2 or 3 or 5 or 6
38	00111000	4 or 5 or 6
39	00111001	1 or 4 or 5 or 6
3a	00111010	2 or 4 or 5 or 6
3b	00111011	1 or 2 or 4 or 5 or 6
3c	00111100	3 or 4 or 5 or 6
3d	00111101	1 or 3 or 4 or 5 or 6
3e	00111110	2 or 3 or 4 or 5 or 6
3f	00111111	1 or 2 or 3 or 4 or 5 or 6

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40	01000000	7
41	01000001	1 or 7
42	01000010	2 or 7
43	01000011	1 or 2 or 7
44	01000100	3 or 7
45	01000101	1 or 3 or 7
46	01000110	2 or 3 or 7
47	01000111	1 or 2 or 3 or 7
48	01001000	4 or 7
49	01001001	1 or 4 or 7
4a	01001010	2 or 4 or 7
4b	01001011	1 or 2 or 4 or 7
4c	01001100	3 or 4 or 7
4d	01001101	1 or 3 or 4 or 7
4e	01001110	2 or 3 or 4 or 7
4f	01001111	1 or 2 or 3 or 4 or 7
50	01010000	5 or 7
51	01010001	1 or 5 or 7
52	01010010	2 or 5 or 7
53	01010011	1 or 2 or 5 or 7
54	01010100	3 or 5 or 7
55	01010101	1 or 3 or 5 or 7
56	01010110	2 or 3 or 5 or 7
57	01010111	1 or 2 or 3 or 5 or 7
58	01011000	4 or 5 or 7
59	01011001	1 or 4 or 5 or 7
5a	01011010	2 or 4 or 5 or 7
5b	01011011	1 or 2 or 4 or 5 or 7
5c	01011100	3 or 4 or 5 or 7
5d	01011101	1 or 3 or 4 or 5 or 7
5e	01011110	2 or 3 or 4 or 5 or 7
5f	01011111	1 or 2 or 3 or 4 or 5 or 7
60	01100000	6 or 7
61	01100001	1 or 6 or 7
62	01100010	2 or 6 or 7
63	01100011	1 or 2 or 6 or 7
64	01100100	3 or 6 or 7
65	01100101	1 or 3 or 6 or 7
66	01100110	2 or 3 or 6 or 7
67	01100111	1 or 2 or 3 or 6 or 7
68	01101000	4 or 6 or 7
69	01101001	1 or 4 or 6 or 7
6a	01101010	2 or 4 or 6 or 7
6b	01101011	1 or 2 or 4 or 6 or 7
6c	01101100	3 or 4 or 6 or 7
6d	01101101	1 or 3 or 4 or 6 or 7
6e	01101110	2 or 3 or 4 or 6 or 7
6f	01101111	1 or 2 or 3 or 4 or 6 or 7
70	01110000	5 or 6 or 7
71	01110001	1 or 5 or 6 or 7
72	01110010	2or 5 or 6 or 7
73	01110010	1 or 2or 5 or 6 or 7
74	01110100	3 or 5 or 6 or 7
75	01110101	1 or 3 or 5 or 6 or 7
76	01110110	2 or 3 or 5 or 6 or 7
77	01110111	1 or 2 or 3 or 5 or 6 or 7
78	01111000	4 or 5 or 6 or 7
79	01111001	1 or 4 or 5 or 6 or 7
7a	01111010	2 or 4 or 5 or 6 or 7

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7b	01111011	1 or 2 or 4 or 5 or 6 or 7
7c	01111100	3 or 4 or 5 or 6 or 7
7d	01111101	1 or 3 or 4 or 5 or 6 or 7
7e	01111110	2 or 3 or 4 or 5 or 6 or 7
7f	01111111	1 or 2 or 3 or 4 or 5 or 6 or 7
80	10000000	8
81	10000001	1 or 8
82	10000010	2 or 8
83	10000011	1 or 2 or 8
84	10000100	3 or 8
85	10000101	1 or 3 or 8
86	10000110	2 or 3 or 8
87	10000111	1 or 2 or 3 or 8
88	10001000	4 or 8
89	10001001	1 or 4 or 8
8a	10001010	2 or 4 or 8
8b	10001011	1 or 2 or 4 or 8
8c	10001100	3 or 4 or 8
8d	10001101	1 or 3 or 4 or 8
8e	10001110	2 or 3 or 4 or 8
8f	10001111	1 or 2 or 3 or 4 or 8
90	10010000	5 or 8
91	10010001	1 or 5 or 8
92	10010010	2 or 5 or 8
93	10010011	1 or 2 or 5 or 8
94	10010100	3 or 5 or 8
95	10010101	1 or 3 or 5 or 8
96	10010110	2 or 3 or 5 or 8
97	10010111	1 or 2 or 3 or 5 or 8
98	10011000	4 or 5 or 8
99	10011001	1 or 4 or 5 or 8
9a	10011010	2 or 4 or 5 or 8
9b	10011011	1 or 2 or 4 or 5 or 8
9c	10011100	3 or 4 or 5 or 8
9d	10011101	1 or 3 or 4 or 5 or 8
9e	10011110	2 or 3 or 4 or 5 or 8
9f	10011111	1 or 2 or 3 or 4 or 5 or 8
a0	10100000	6 or 8
a1	10100001	1 or 6 or 8
a2	10100010	2 or 6 or 8
a3	10100011	1 or 2 or 6 or 8
a4	10100100	3 or 6 or 8
a5	10100101	1 or 3 or 6 or 8
a6	10100110	2 or 3 or 6 or 8
a7	10100111	1 or 2 or 3 or 6 or 8
a8	10101000	4 or 6 or 8
a9	10101001	1 or 4 or 6 or 8
aa	10101010	2 or 4 or 6 or 8
ab	10101011	1 or 2 or 4 or 6 or 8
ac	10101100	3 or 4 or 6 or 8
ad	10101101	1 or 3 or 4 or 6 or 8
ae	10101110	2 or 3 or 4 or 6 or 8
af	10101111	1 or 2 or 3 or 4 or 6 or 8
b0	10110000	5 or 6 or 8
b1	10110001	1 or 5 or 6 or 8
b2	10110010	2 or 5 or 6 or 8
b3	10110011	1 or 2 or 5 or 6 or 8
b4	10110100	3 or 5 or 6 or 8
b5	10110101	1 or 3 or 5 or 6 or 8

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b6	10110110	2 or 3 or 5 or 6 or 8
b7	10110111	1 or 2 or 3 or 5 or 6 or 8
b8	10111000	4 or 5 or 6 or 8
b9	10111001	1 or 4 or 5 or 6 or 8
ba	10111010	2 or 4 or 5 or 6 or 8
bb	10111011	1 or 2 or 4 or 5 or 6 or 8
bc	10111100	3 or 4 or 5 or 6 or 8
bd	10111101	1 or 3 or 4 or 5 or 6 or 8
be	10111110	2 or 3 or 4 or 5 or 6 or 8
bf	10111111	1 or 2 or 3 or 4 or 5 or 6 or 8
c0	11000000	7 or 8
c1	11000001	1 or 7 or 8
c2	11000010	2 or 7 or 8
c3	11000011	1 or 2 or 7 or 8
c4	11000100	3 or 7 or 8
c5	11000101	1 or 3 or 7 or 8
c6	11000110	2 or 3 or 7 or 8
c7	11000111	1 or 2 or 3 or 7 or 8
c8	11001000	4 or 7 or 8
c9	11001001	1 or 4 or 7 or 8
ca	11001010	2 or 4 or 7 or 8
cb	11001011	1 or 2 or 4 or 7 or 8
cc	11001100	3 or 4 or 7 or 8
cd	11001101	1 or 3 or 4 or 7 or 8
ce	11001110	2 or 3 or 4 or 7 or 8
cf	11001111	1 or 2 or 3 or 4 or 7 or 8
d0	11010000	5 or 7 or 8
d1	11010001	1 or 5 or 7 or 8
d2	11010010	2 or 5 or 7 or 8
d3	11010011	1 or 2 or 5 or 7 or 8
d4	11010100	3 or 5 or 7 or 8
d5	11010101	1 or 3 or 5 or 7 or 8
d6	11010110	2 or 3 or 5 or 7 or 8
d7	11010111	1 or 2 or 3 or 5 or 7 or 8
d8	11011000	4 or 5 or 7 or 8
d9	11011001	1 or 4 or 5 or 7 or 8
da	11011010	2 or 4 or 5 or 7 or 8
db	11011011	1 or 2 or 4 or 5 or 7 or 8
dc	11011100	3 or 4 or 5 or 7 or 8
dd	11011101	1 or 3 or 4 or 5 or 7 or 8
de	11011110	2 or 3 or 4 or 5 or 7 or 8
df	11011111	1 or 2 or 3 or 4 or 5 or 7 or 8
e0	11100000	6 or 7 or 8
e1	11100001	1 or 6 or 7 or 8
e2	11100010	2 or 6 or 7 or 8
e3	11100011	1 or 2 or 6 or 7 or 8
e4	11100100	3 or 6 or 7 or 8
e5	11100101	1 or 3 or 6 or 7 or 8
e6	11100110	2 or 3 or 6 or 7 or 8
e7	11100111	1 or 2 or 3 or 6 or 7 or 8
e8	11101000	4 or 6 or 7 or 8
e9	11101001	1 or 4 or 6 or 7 or 8
ea	11101010	2 or 4 or 6 or 7 or 8
eb	11101011	1 or 2 or 4 or 6 or 7 or 8
ec	11101100	3 or 4 or 6 or 7 or 8
ed	11101101	1 or 3 or 4 or 6 or 7 or 8
ee	11101110	2 or 3 or 4 or 6 or 7 or 8
ef	11101111	1 or 2 or 3 or 4 or 6 or 7 or 8
f0	11110000	5 or 6 or 7 or 8

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f1	11110001	1 or 5 or 6 or 7 or 8
f2	11110010	2 or 5 or 6 or 7 or 8
f3	11110011	1 or 2 or 5 or 6 or 7 or 8
f4	11110100	3 or 5 or 6 or 7 or 8
f5	11110101	1 or 3 or 5 or 6 or 7 or 8
f6	11110110	2 or 3 or 5 or 6 or 7 or 8
f7	11110111	1 or 2 or 3 or 5 or 6 or 7 or 8
f8	11111000	4 or 5 or 6 or 7 or 8
f9	11111001	1 or 4 or 5 or 6 or 7 or 8
fa	11111010	2 or 4 or 5 or 6 or 7 or 8
fb	11111011	1 or 2 or 4 or 5 or 6 or 7 or 8
fc	11111100	3 or 4 or 5 or 6 or 7 or 8
fd	11111101	1 or 3 or 4 or 5 or 6 or 7 or 8
fe	11111110	2 or 3 or 4 or 5 or 6 or 7 or 8
ff	11111111	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8

Table – 8 Corresponding bits and ports (for cvalue)

Bit 7		Bit 6		Bit 5		Bit 4		Bit 3		Bit 2		Bit 1		Bit 0	
Port 8		Port 7		Port 6		Port 5		Port 4		Port 3		Port 2		Port 1	
1	on	1	on	1	on	1	on	1	on	1	on	1	on	1	on
0	off	0	off	0	off	0	off	0	off	0	off	0	off	0	off

Table – 9 Clarify current link status by returned cvalue

Returned cvalue in hexadecimal format	Corresponding 8 bits binary numbers	Indicating there is link loss occurring on port(s):
0	00000000	N/A
1	00000001	1
2	00000010	2
3	00000011	1 or 2
4	00000100	3
5	00000101	1 or 3
6	00000110	2 or 3
7	00000111	1 or 2 or 3
8	00001000	4
9	00001001	1 or 4
a	00001010	2 or 4
b	00001011	1 or 2 or 4
c	00001100	3 or 4
d	00001101	1 or 3 or 4
e	00001110	2 or 3 or 4
f	00001111	1 or 2 or 3 or 4
10	00010000	5
11	00010001	1 or 5
12	00010010	2 or 5
13	00010011	1 or 2 or 5
14	00010100	3 or 5
15	00010101	1 or 3 or 5
16	00010110	2 or 3 or 5
17	00010111	1 or 2 or 3 or 5
18	00011000	4 or 5
19	00011001	1 or 4 or 5
1a	00011010	2 or 4 or 5

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1b	00011011	1 or 2 or 4 or 5
1c	00011100	3 or 4 or 5
1d	00011101	1 or 3 or 4 or 5
1e	00011110	2 or 3 or 4 or 5
1f	00011111	1 or 2 or 3 or 4 or 5
20	00100000	6
21	00100001	1 or 6
22	00100010	2 or 6
23	00100011	1 or 2 or 6
24	00100100	3 or 6
25	00100101	1 or 3 or 6
26	00100110	2 or 3 or 6
27	00100111	1 or 2 or 3 or 6
28	00101000	4 or 6
29	00101001	1 or 4 or 6
2a	00101010	2 or 4 or 6
2b	00101011	1 or 2 or 4 or 6
2c	00101100	3 or 4 or 6
2d	00101101	1 or 3 or 4 or 6
2e	00101110	2 or 3 or 4 or 6
2f	00101111	1 or 2 or 3 or 4 or 6
30	00110000	5 or 6
31	00110001	1 or 5 or 6
32	00110010	2 or 5 or 6
33	00110011	1 or 2 or 5 or 6
34	00110100	3 or 5 or 6
35	00110101	1 or 3 or 5 or 6
36	00110110	2 or 3 or 5 or 6
37	00110111	1 or 2 or 3 or 5 or 6
38	00111000	4 or 5 or 6
39	00111001	1 or 4 or 5 or 6
3a	00111010	2 or 4 or 5 or 6
3b	00111011	1 or 2 or 4 or 5 or 6
3c	00111100	3 or 4 or 5 or 6
3d	00111101	1 or 3 or 4 or 5 or 6
3e	00111110	2 or 3 or 4 or 5 or 6
3f	00111111	1 or 2 or 3 or 4 or 5 or 6
40	01000000	7
41	01000001	1 or 7
42	01000010	2 or 7
43	01000011	1 or 2 or 7
44	01000100	3 or 7
45	01000101	1 or 3 or 7
46	01000110	2 or 3 or 7
47	01000111	1 or 2 or 3 or 7
48	01001000	4 or 7
49	01001001	1 or 4 or 7
4a	01001010	2 or 4 or 7
4b	01001011	1 or 2 or 4 or 7
4c	01001100	3 or 4 or 7
4d	01001101	1 or 3 or 4 or 7
4e	01001110	2 or 3 or 4 or 7
4f	01001111	1 or 2 or 3 or 4 or 7
50	01010000	5 or 7
51	01010001	1 or 5 or 7
52	01010010	2 or 5 or 7
53	01010011	1 or 2 or 5 or 7
54	01010100	3 or 5 or 7
55	01010101	1 or 3 or 5 or 7

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56	01010110	2 or 3 or 5 or 7
57	01010111	1 or 2 or 3 or 5 or 7
58	01011000	4 or 5 or 7
59	01011001	1 or 4 or 5 or 7
5a	01011010	2 or 4 or 5 or 7
5b	01011011	1 or 2 or 4 or 5 or 7
5c	01011100	3 or 4 or 5 or 7
5d	01011101	1 or 3 or 4 or 5 or 7
5e	01011110	2 or 3 or 4 or 5 or 7
5f	01011111	1 or 2 or 3 or 4 or 5 or 7
60	01100000	6 or 7
61	01100001	1 or 6 or 7
62	01100010	2 or 6 or 7
63	01100011	1 or 2 or 6 or 7
64	01100100	3 or 6 or 7
65	01100101	1 or 3 or 6 or 7
66	01100110	2 or 3 or 6 or 7
67	01100111	1 or 2 or 3 or 6 or 7
68	01101000	4 or 6 or 7
69	01101001	1 or 4 or 6 or 7
6a	01101010	2 or 4 or 6 or 7
6b	01101011	1 or 2 or 4 or 6 or 7
6c	01101100	3 or 4 or 6 or 7
6d	01101101	1 or 3 or 4 or 6 or 7
6e	01101110	2 or 3 or 4 or 6 or 7
6f	01101111	1 or 2 or 3 or 4 or 6 or 7
70	01110000	5 or 6 or 7
71	01110001	1 or 5 or 6 or 7
72	01110010	2or 5 or 6 or 7
73	01110010	1 or 2or 5 or 6 or 7
74	01110100	3 or 5 or 6 or 7
75	01110101	1 or 3 or 5 or 6 or 7
76	01110110	2 or 3 or 5 or 6 or 7
77	01110111	1 or 2 or 3 or 5 or 6 or 7
78	01111000	4 or 5 or 6 or 7
79	01111001	1 or 4 or 5 or 6 or 7
7a	01111010	2 or 4 or 5 or 6 or 7
7b	01111011	1 or 2 or 4 or 5 or 6 or 7
7c	01111100	3 or 4 or 5 or 6 or 7
7d	01111101	1 or 3 or 4 or 5 or 6 or 7
7e	01111110	2 or 3 or 4 or 5 or 6 or 7
7f	01111111	1 or 2 or 3 or 4 or 5 or 6 or 7
80	10000000	8
81	10000001	1 or 8
82	10000010	2 or 8
83	10000011	1 or 2 or 8
84	10000100	3 or 8
85	10000101	1 or 3 or 8
86	10000110	2 or 3 or 8
87	10000111	1 or 2 or 3 or 8
88	10001000	4 or 8
89	10001001	1 or 4 or 8
8a	10001010	2 or 4 or 8
8b	10001011	1 or 2 or 4 or 8
8c	10001100	3 or 4 or 8
8d	10001101	1 or 3 or 4 or 8
8e	10001110	2 or 3 or 4 or 8
8f	10001111	1 or 2 or 3 or 4 or 8
90	10010000	5 or 8

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91	10010001	1 or 5 or 8
92	10010010	2 or 5 or 8
93	10010011	1 or 2 or 5 or 8
94	10010100	3 or 5 or 8
95	10010101	1 or 3 or 5 or 8
96	10010110	2 or 3 or 5 or 8
97	10010111	1 or 2 or 3 or 5 or 8
98	10011000	4 or 5 or 8
99	10011001	1 or 4 or 5 or 8
9a	10011010	2 or 4 or 5 or 8
9b	10011011	1 or 2 or 4 or 5 or 8
9c	10011100	3 or 4 or 5 or 8
9d	10011101	1 or 3 or 4 or 5 or 8
9e	10011110	2 or 3 or 4 or 5 or 8
9f	10011111	1 or 2 or 3 or 4 or 5 or 8
a0	10100000	6 or 8
a1	10100001	1 or 6 or 8
a2	10100010	2 or 6 or 8
a3	10100011	1 or 2 or 6 or 8
a4	10100100	3 or 6 or 8
a5	10100101	1 or 3 or 6 or 8
a6	10100110	2 or 3 or 6 or 8
a7	10100111	1 or 2 or 3 or 6 or 8
a8	10101000	4 or 6 or 8
a9	10101001	1 or 4 or 6 or 8
aa	10101010	2 or 4 or 6 or 8
ab	10101011	1 or 2 or 4 or 6 or 8
ac	10101100	3 or 4 or 6 or 8
ad	10101101	1 or 3 or 4 or 6 or 8
ae	10101110	2 or 3 or 4 or 6 or 8
af	10101111	1 or 2 or 3 or 4 or 6 or 8
b0	10110000	5 or 6 or 8
b1	10110001	1 or 5 or 6 or 8
b2	10110010	2 or 5 or 6 or 8
b3	10110011	1 or 2 or 5 or 6 or 8
b4	10110100	3 or 5 or 6 or 8
b5	10110101	1 or 3 or 5 or 6 or 8
b6	10110110	2 or 3 or 5 or 6 or 8
b7	10110111	1 or 2 or 3 or 5 or 6 or 8
b8	10111000	4 or 5 or 6 or 8
b9	10111001	1 or 4 or 5 or 6 or 8
ba	10111010	2 or 4 or 5 or 6 or 8
bb	10111011	1 or 2 or 4 or 5 or 6 or 8
bc	10111100	3 or 4 or 5 or 6 or 8
bd	10111101	1 or 3 or 4 or 5 or 6 or 8
be	10111110	2 or 3 or 4 or 5 or 6 or 8
bf	10111111	1 or 2 or 3 or 4 or 5 or 6 or 8
c0	11000000	7 or 8
c1	11000001	1 or 7 or 8
c2	11000010	2 or 7 or 8
c3	11000011	1 or 2 or 7 or 8
c4	11000100	3 or 7 or 8
c5	11000101	1 or 3 or 7 or 8
c6	11000110	2 or 3 or 7 or 8
c7	11000111	1 or 2 or 3 or 7 or 8
c8	11001000	4 or 7 or 8
c9	11001001	1 or 4 or 7 or 8
ca	11001010	2 or 4 or 7 or 8
cb	11001011	1 or 2 or 4 or 7 or 8

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cc	11001100	3 or 4 or 7 or 8
cd	11001101	1 or 3 or 4 or 7 or 8
ce	11001110	2 or 3 or 4 or 7 or 8
cf	11001111	1 or 2 or 3 or 4 or 7 or 8
d0	11010000	5 or 7 or 8
d1	11010001	1 or 5 or 7 or 8
d2	11010010	2 or 5 or 7 or 8
d3	11010011	1 or 2 or 5 or 7 or 8
d4	11010100	3 or 5 or 7 or 8
d5	11010101	1 or 3 or 5 or 7 or 8
d6	11010110	2 or 3 or 5 or 7 or 8
d7	11010111	1 or 2 or 3 or 5 or 7 or 8
d8	11011000	4 or 5 or 7 or 8
d9	11011001	1 or 4 or 5 or 7 or 8
da	11011010	2 or 4 or 5 or 7 or 8
db	11011011	1 or 2 or 4 or 5 or 7 or 8
dc	11011100	3 or 4 or 5 or 7 or 8
dd	11011101	1 or 3 or 4 or 5 or 7 or 8
de	11011110	2 or 3 or 4 or 5 or 7 or 8
df	11011111	1 or 2 or 3 or 4 or 5 or 7 or 8
e0	11100000	6 or 7 or 8
e1	11100001	1 or 6 or 7 or 8
e2	11100010	2 or 6 or 7 or 8
e3	11100011	1 or 2 or 6 or 7 or 8
e4	11100100	3 or 6 or 7 or 8
e5	11100101	1 or 3 or 6 or 7 or 8
e6	11100110	2 or 3 or 6 or 7 or 8
e7	11100111	1 or 2 or 3 or 6 or 7 or 8
e8	11101000	4 or 6 or 7 or 8
e9	11101001	1 or 4 or 6 or 7 or 8
ea	11101010	2 or 4 or 6 or 7 or 8
eb	11101011	1 or 2 or 4 or 6 or 7 or 8
ec	11101100	3 or 4 or 6 or 7 or 8
ed	11101101	1 or 3 or 4 or 6 or 7 or 8
ee	11101110	2 or 3 or 4 or 6 or 7 or 8
ef	11101111	1 or 2 or 3 or 4 or 6 or 7 or 8
f0	11110000	5 or 6 or 7 or 8
f1	11110001	1 or 5 or 6 or 7 or 8
f2	11110010	2 or 5 or 6 or 7 or 8
f3	11110011	1 or 2 or 5 or 6 or 7 or 8
f4	11110100	3 or 5 or 6 or 7 or 8
f5	11110101	1 or 3 or 5 or 6 or 7 or 8
f6	11110110	2 or 3 or 5 or 6 or 7 or 8
f7	11110111	1 or 2 or 3 or 5 or 6 or 7 or 8
f8	11111000	4 or 5 or 6 or 7 or 8
f9	11111001	1 or 4 or 5 or 6 or 7 or 8
fa	11111010	2 or 4 or 5 or 6 or 7 or 8
fb	11111011	1 or 2 or 4 or 5 or 6 or 7 or 8
fc	11111100	3 or 4 or 5 or 6 or 7 or 8
fd	11111101	1 or 3 or 4 or 5 or 6 or 7 or 8
fe	11111110	2 or 3 or 4 or 5 or 6 or 7 or 8
ff	11111111	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8

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Table – 10 Corresponding bits and system status (for svalue)

bit	Corresponding to:	Condition	Description
0	Power 1	a	If there is a power fail occurring on Power 1, bit 0 will be set as 1.
1	Power 2	b	If there is a power fail occurring on Power 2, bit 1 will be set as 1.
2	Master Ring Switch indicator	c	If his Switch is the master Ring Switch(the Master LED indicator will be “on”) bit 2 will be set as 1.
3	Relay output status	d	If the relay output is activated, bit 3 will be set as 1.

Table – 11 Displayed hexadecimal number and current system status conditions

Returned svalue in hexadecimal format	Corresponding 8 bits binary numbers	Showing current system status condition(s):
0	00000000	a
1	00000001	b
2	00000010	c
3	00000011	a or b
4	00000100	c
5	00000101	a or c
6	00000110	b or c
7	00000111	a or b or c
8	00001000	d
9	00001001	a or d
0A	00001010	b or d
0B	00001011	a or b or d
0C	00001100	c or d
0D	00001101	a or c or d
0E	00001110	b or c or d
0F	00001111	a or b or c or d

Table – 12 Corresponding bits and jumpers

Bit 3		Bit 2		Bit 1		Bit 0	
Jumper 3		Jumper 4		Jumper 5		Jumper 6	
1	on	1	on	1	on	1	on
0	off	0	off	0	off	0	off

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Table – 13 DIP Switch(SW1) configuration

SW1 : DIP Switch Configuration		
State Jumper	OFF	ON
1	Redundancy mode	Tradition mode
2	Normal State	Default Setting
3	Primary Switch	Secondary Switch
4	Ring Protocol	STP Protocol
5	Disable Ring Pair 2	Enable Ring Pair 2
6	Disable Ring Pair 1	Enable Ring Pair 1

Table – 14 DIPSW values and corresponding Jumpers states

Jumpers on “ON” state	Corresponding 8 bits binary numbers	DIPSW value(in hexadecimal format)
N/A	00000000	0
Jumper 6	00000001	1
Jumper 5	00000010	2
Jumper 5 & 6	00000011	3
Jumper 4	00000100	4
Jumper 4 & 6	00000101	5
Jumper 4 & 5	00000110	6
Jumper 4 &5 & 6	00000111	7
Jumper 3	00001000	8
Jumper 3& 6	00001001	9
Jumper 3& 5	00001010	A
Jumper 3& 5& 6	00001011	B
Jumper 3& 4	00001100	C
Jumper 3& 4& 6	00001101	D
Jumper 3& 4 & 5	00001110	E
Jumper 3& 4 & 5 & 6	00001111	F

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Table – 15 Rotary Switch (SW2) configuration

Roteray SW position	F	E	D	C	B	A	9	8
Recovery Time	1.5s	1.4s	1.3s	1.2s	1.1s	1.0s	900 ms	800 ms
Forwarding Delay	30s	28s	26s	24s	22s	20s	18s	16s
Hello Time	10s	10s	10s	10s	10s	10s	10s	10s
Max Age	40s	40s	40s	40s	40s	38s	34s	30s

Roteray SW position	7	6	5	4	3	2	1	0
Recovery Time	700 ms	600 ms	500 ms	400 ms	300 ms	200 ms	100 ms	N/A
Forwarding Delay	14s	12s	10s	8s	6s	4s	4s	N/A
Hello Time	10s	10s	8s	6s	4s	2s	1s	N/A
Max Age	26s	22s	18s	14s	10s	6s	6s	N/A

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