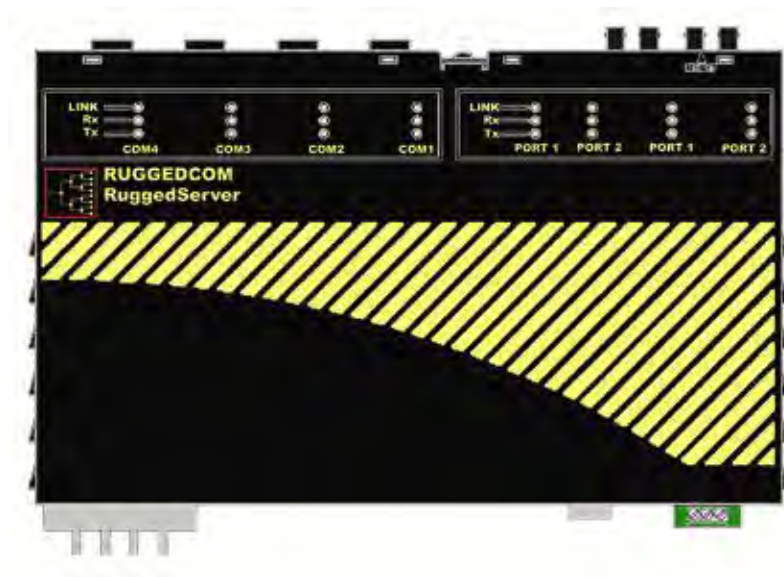




RuggedServer™ RS400 Family

4-Port Serial Device Server with Integrated 4-Port Managed Ethernet Switch



Installation Guide

July 21, 2010

www.ruggedcom.com

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Federal Communications Commission Radio Frequency Interference Statement

This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his expense.

Caution

This product contains a laser system and is classified as a “CLASS 1 LASER PRODUCT”.

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure. This product contains no user-serviceable parts. Attempted service by unauthorized personnel shall render all warranties null and void.

Should this device require service see the “Warranty” section of this installation guide.

Important

This unit should be installed in a restricted access location where access can only be gained by service personnel or users who have been instructed about the reasons for the restrictions applied to the location and about any precautions that shall be taken; and access is through the use of a tool or lock and key, or other means of security, and is controlled by the authority responsible for the location.

Table of Contents

Federal Communications Commission Radio Frequency Interference Statement	3
Table of Contents	4
1 Product Overview.....	5
1.1 Functional Overview	5
1.2 Feature Highlights	5
1.3 RS400 Series Description	7
1.1.1 RS400.....	7
1.1.2 RS401.....	9
2 Installation.....	11
2.1 Mounting.....	11
2.1.1 RS400.....	11
2.1.2 RS401.....	12
2.2 Power Supply Wiring and Grounding	13
2.2.1 Power Supply - AC Input	14
2.2.2 Power Supply – DC Inputs	14
2.3 HIPOT (Dielectric Strength) Testing.....	15
2.4 Failsafe Relay Outputs	16
2.5 RS232 Console Port Wiring	17
2.6 Serial Ports.....	18
2.6.1 4 x RS232 via DB9	19
2.6.2 4 x RS485 via Phoenix	20
2.6.3 4 x RS232/RS485/RS422 via DB9	21
2.6.4 4 x RS232/RS485/RS422 via RJ-45.....	22
2.6.5 RS485 Wiring	23
2.6.6 Serial Port Transient Protection.....	24
2.7 Ethernet Ports	25
2.7.1 RJ-45 Twisted-Pair Ports.....	26
2.7.2 Ethernet Port Transient Protection	26
2.7.3 Fiber Optic Ports.....	27
2.8 V.90 Modem Port (Optional).....	28
3 Technical Specifications	29
3.1 Operating Environment	29
3.2 Power Supply Specifications	29
3.3 Failsafe Relay Specifications	30
3.4 Data Port Specifications	30
3.5 Fiber Optical Specifications.....	31
3.6 Physical Dimensions	32
3.6.1 RS400.....	32
3.6.2 RS401.....	34
4 Type Tests	35
4.1 IEC 61850-3 Type Tests	35
4.2 IEEE 1613 Type Tests	36
4.3 IEC Environmental Type Tests.....	36
5 Agency Approvals	37
6 Warranty.....	37

1 Product Overview

1.1 Functional Overview

The **RuggedServer™** RS400 Series is an industrially hardened, serial device server with an integrated, fully managed, Ethernet switch, designed to operate reliably in electrically harsh and climatically demanding environments. The RS400 Series consists of the RS400 and RS401 which are functionally equivalent differing only mechanically in shape. Featuring an integrated 4 port serial server, a 4 port managed Ethernet switch, and an optional v.90 modem, the RS400 Series is able to interconnect multiple types of intelligent electronic devices (IEDs) that have different methods of communications. Using the RS400 Series results in fewer connectivity devices (which reduces overall system costs) and extends the useful life of existing legacy IEDs (which minimizes capital expenditure for new equipment).

The RS400 Series provides a high level of immunity to electromagnetic interference and heavy electrical surges typical of environments found in electric utility substations, factory floors or in curb side traffic control cabinets. The RS400 Series meets or exceeds a wide range of industry standards including IEC61850, IEEE1613, IEC61000-6-2, IEEE61800-3, and NEMA TS-2. The RS400 Series also features a wide operating temperature range of -40°C to +85°C allowing it to be installed in virtually any location.

1.2 Feature Highlights

Serial device server

- Fully compliant EIA/TIA RS485, RS422, RS232 serial ports
- (software selectable) - DB9, RJ-45, Phoenix style connectors
- Baud rates up to 230 kbps
- Point-to-point and multi-point modes
- Convert Modbus RTU to Modbus TCP
- Supports multiple Modbus masters
- Serial IP' port redirection software to support Personal Computer (PC) applications statistics and built-in 'sniffer' for troubleshooting

Ethernet Ports

- Integrated Ethernet Switch – up to 4 ports
- High performance and throughput Ethernet switching
- Fully IEEE 802.3, IEEE 802.3u, IEEE 802.3x compliance
- Non-blocking, store and forward switching
- 10/100BaseTX, 10BaseFL, 100BaseFX options

Remote Dial Up Access

- Integrated v.90 modem and PPP server
- Provides remote access to serial devices and Ethernet LAN

RuggedRated™ for Reliability in Harsh Environments

- Immunity to EMI and heavy electrical surges
 - Meets IEEE 1613 (electric utility substations)
 - Exceeds IEC 61850-3 (electric utility substations)
 - Exceeds IEEE 61800-3 (variable speed drive systems)

- Exceeds IEC 61000-6-2 (generic industrial)
- Exceeds NEMA TS-2 (traffic control equipment)
- Fully independent 2kV (RMS) isolated serial ports
- 40°C to +85°C operating temperature (no fans)
- 8 AWG galvanized steel enclosure

Universal Power Supply Options

- Fully integrated power supplies (no external adaptors)
- Popular low-voltage DC ranges: 12, 24 and 48 VDC
- Universal high-voltage range: 88-300 VDC or 85-264 VAC
- CSA/UL 60950 safety approved to +85°C

Rugged Operating System (ROS™) Features

- Simple plug and play operation - automatic learning, negotiation, and crossover detection
- Integrated Cyber Security features
- RSTP (802.1w) and Enhanced Rapid Spanning Tree (eRSTP™) network fault recovery (<5ms) Quality of Service (802.1p) for real-time traffic
- VLAN (802.1q) with double tagging and GVRP support
- IGMP Snooping for multicast filtering
- Port Rate Limiting and Broadcast Storm Limiting
- Port configuration, status, statistics, mirroring, security

Management Tools

- Web-based, Telnet, CLI management interfaces
- SNMP v1/v2/v3
- Remote Monitoring (RMON)
- Rich set of diagnostics with logging and alarms

1.3 RS400 Series Description

1.1.1 RS400

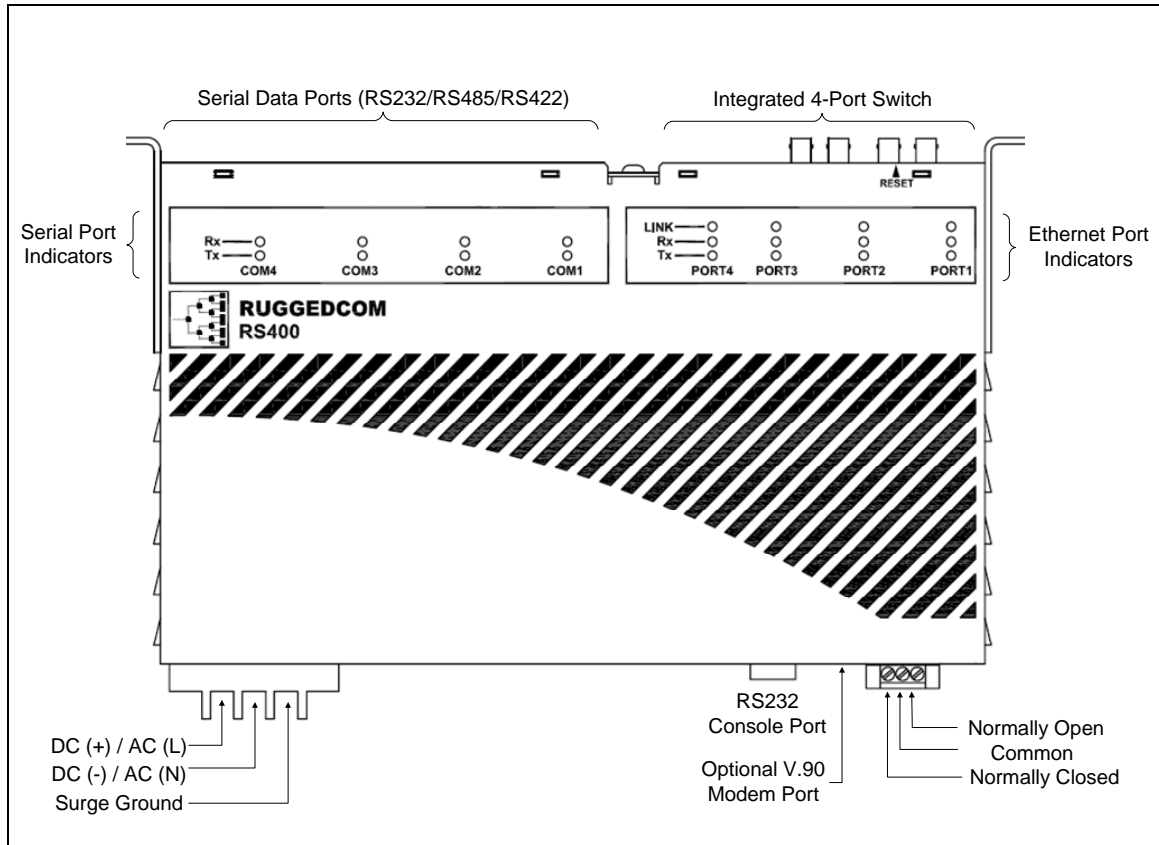


Figure 1: RS400 Top View

ITEM	Activity	Comments
LINK LED (Orange)	Solid	Link Established
	Blinking – Once per second	Tx, Rx Activity
Tx LED (Orange)	Blinking	Tx (Transmit) Activity
Rx LED (Orange)	Blinking	Rx (Receive) Activity
POWER LED (Green)	Solid	Power On
Fault LED (Red)	Solid	Fault has occurred

Table 1: RS400 LED description

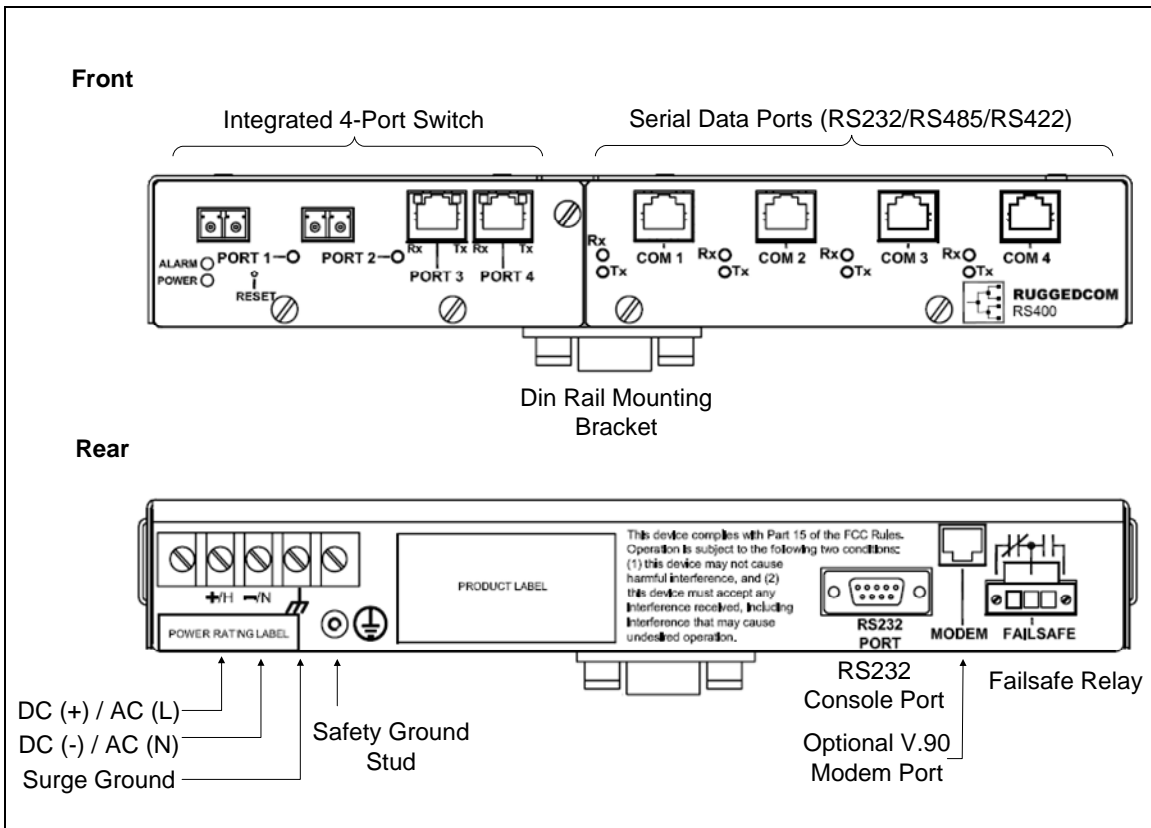


Figure 2: RS400 Front and Rear View

1.1.2 RS401

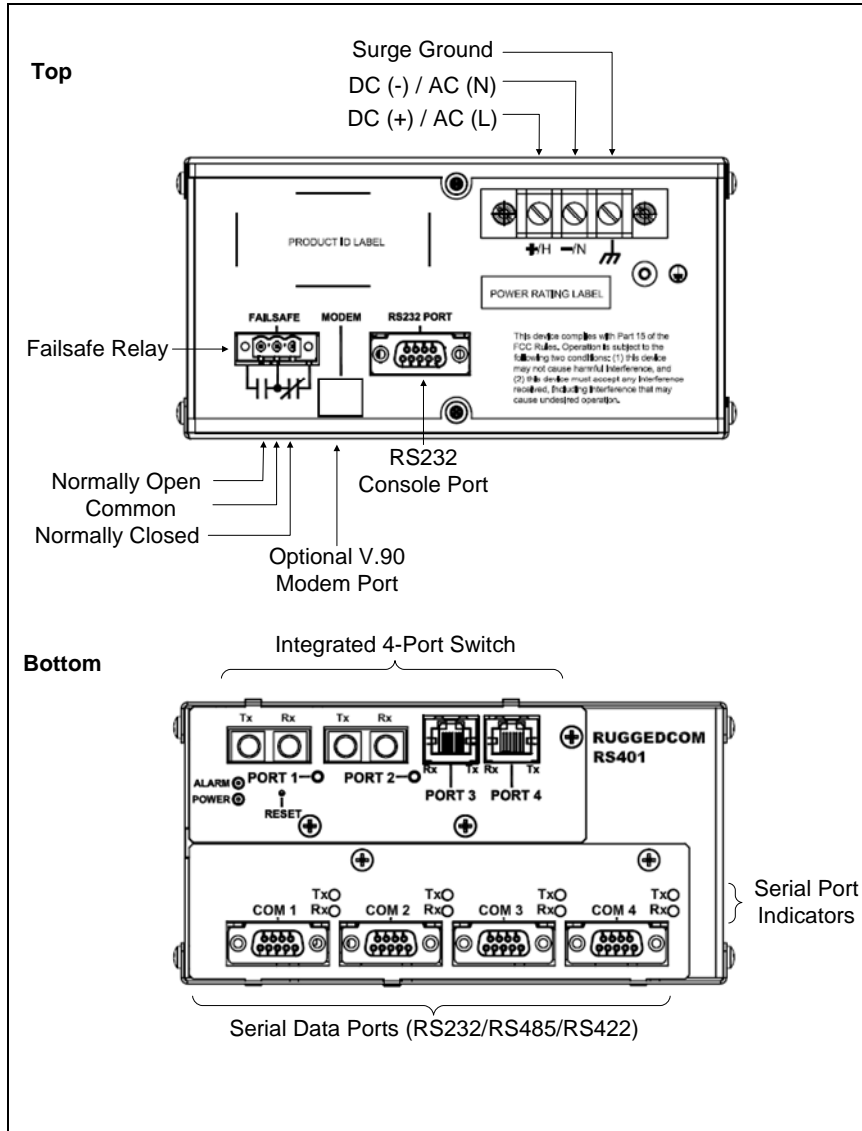


Figure 3: RS401 Top and Bottom View

ITEM	Activity	Comments
LINK LED (Orange)	Solid	Link Established
	Blinking – Once per second	Tx, Rx Activity
Tx LED (Orange)	Blinking	Tx (Transmit) Activity
Rx LED (Orange)	Blinking	Rx (Receive) Activity
POWER LED (Green)	Solid	Power On
Fault LED (Red)	Solid	Fault has occurred

Table 2: RS401 LED Description

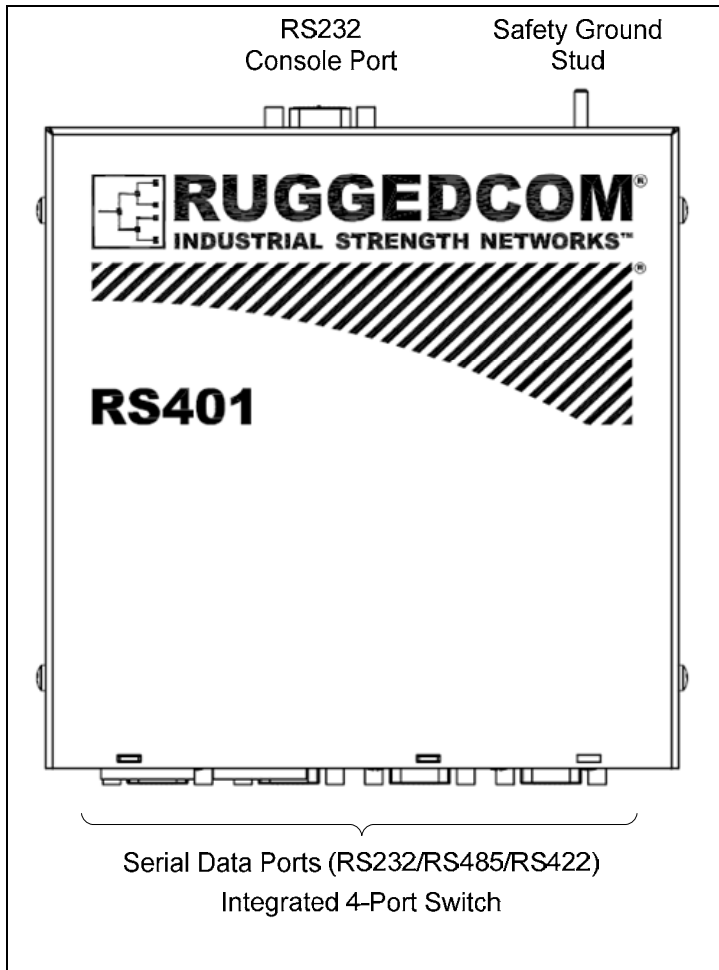


Figure 4: RS401 Front View

2 Installation

2.1 Mounting

2.1.1 RS400

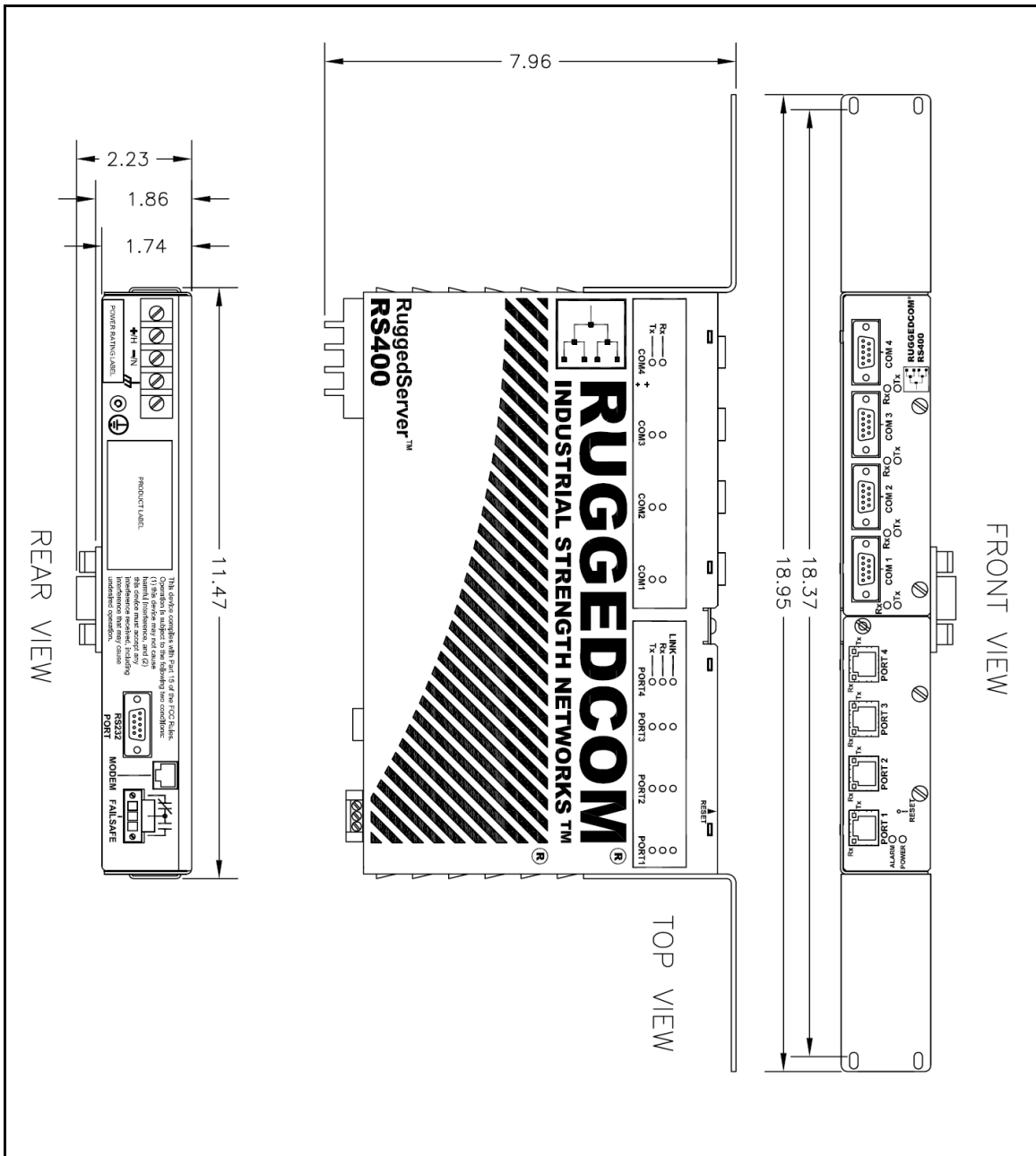


Figure 5: RS400 Front & Side Panel/DIN Mounting

2.1.2 RS401

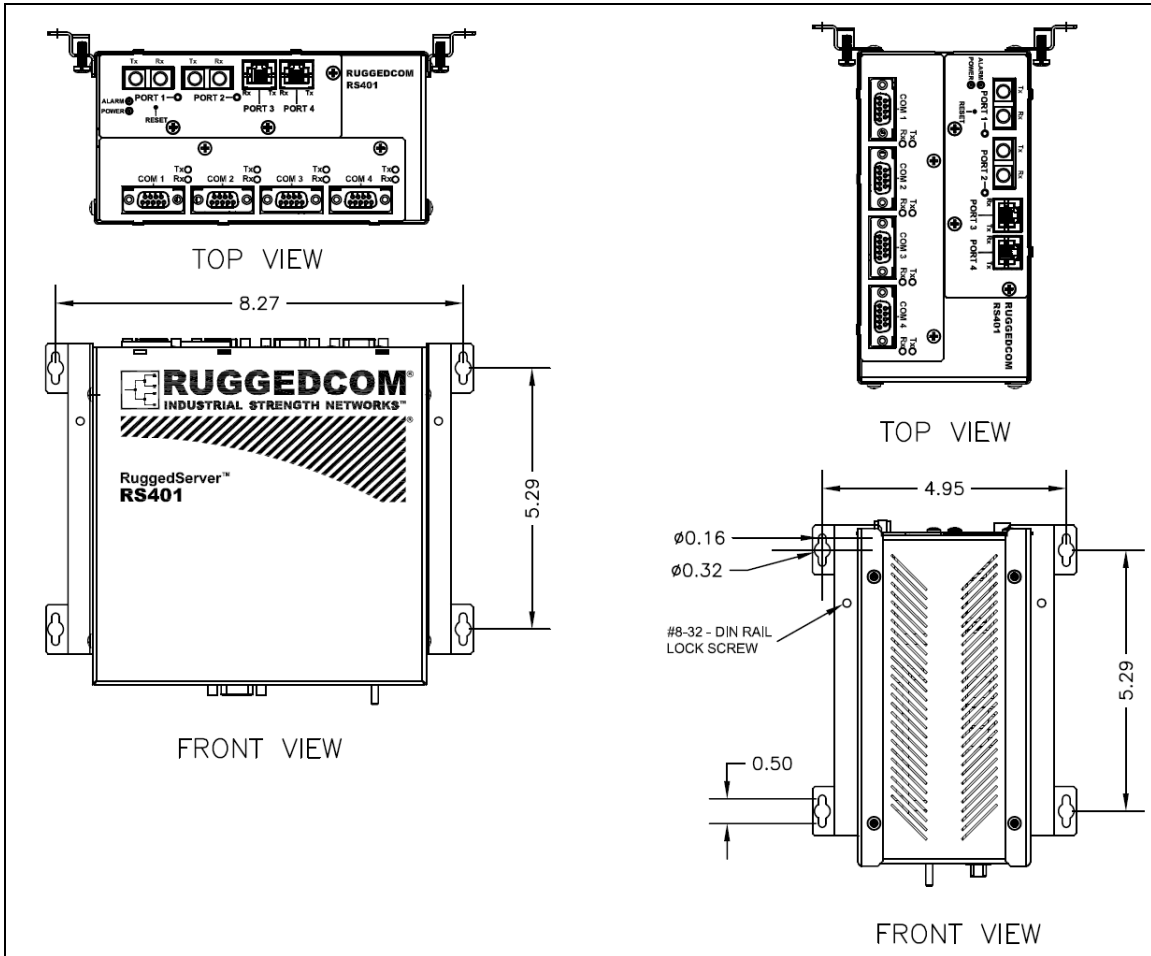


Figure 6: RS401 Front & Side Panel/DIN Mounting

2.2 Power Supply Wiring and Grounding

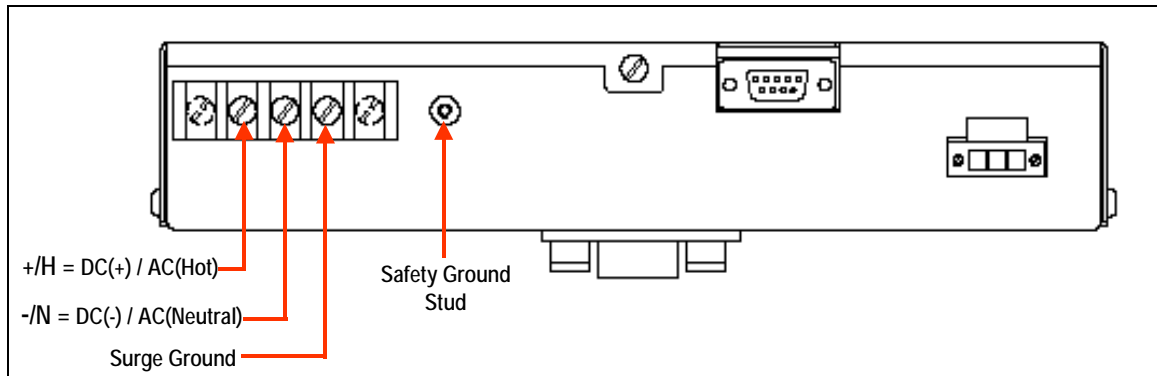


Figure 7: RS400 Series Power Supply Inputs

The RS400 Series power supply inputs are connected as follows:

1. **+/H** = DC (+) / AC (Hot) is connected to the positive (+) terminal if the power source is DC or to the (Hot) terminal if the power source is AC.
2. **-/N** = DC (-) / AC (Neutral) is connected to the negative (-) terminal if the power source is DC or to the (Neutral) terminal if the power source is AC.
3. **Surge Ground** is connected to the Chassis Ground via a braided cable or other appropriate grounding wire. Surge Ground is used as the ground conductor for all surge and transient suppression circuitry internal to the RS400 Series.
4. **Chassis Ground** is connected to the Safety Ground terminal for AC inputs or the equipment ground bus for DC inputs.

NOTES:

- 1) 88-300VDC Equipment: A 300VDC appropriately rated circuit breaker must be installed.
- 2) 100-240VAC Equipment: A 250VAC appropriately rated circuit breaker must be installed.
- 3) A circuit breaker is not required for 12, 24 or 48 VDC rated equipment
- 4) Power input terminals have reverse polarity protection for 12, 24 & 48 VDC rated equipment.
- 5) Equipment must be installed according to the applicable country wiring codes.

2.2.1 Power Supply - AC Input

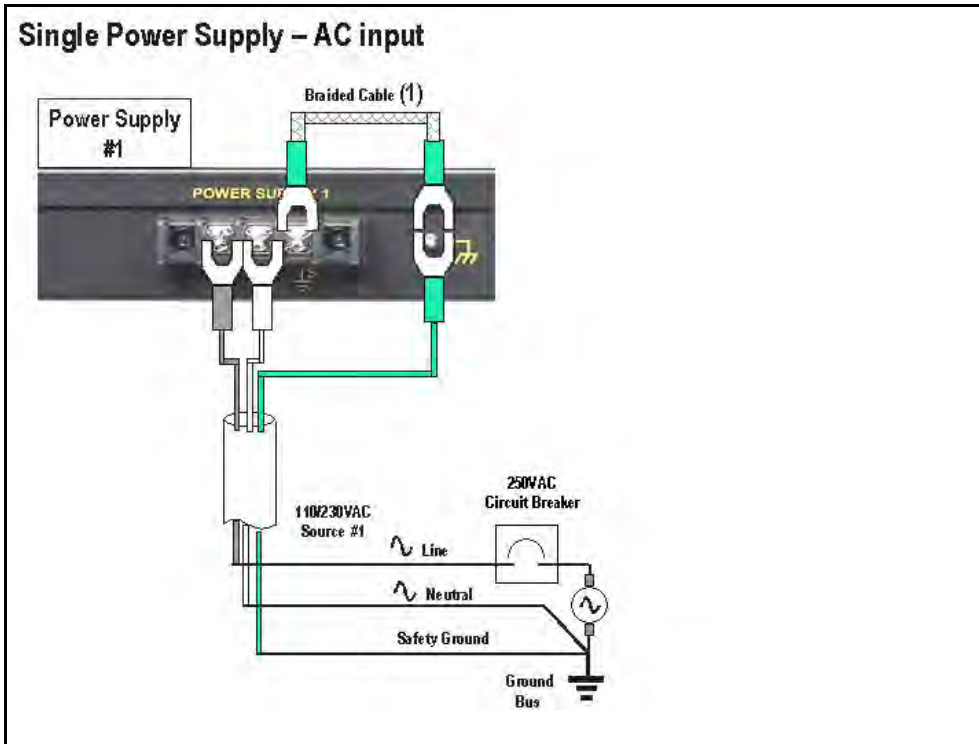


Figure 8: Power Supply – AC Input

2.2.2 Power Supply – DC Inputs

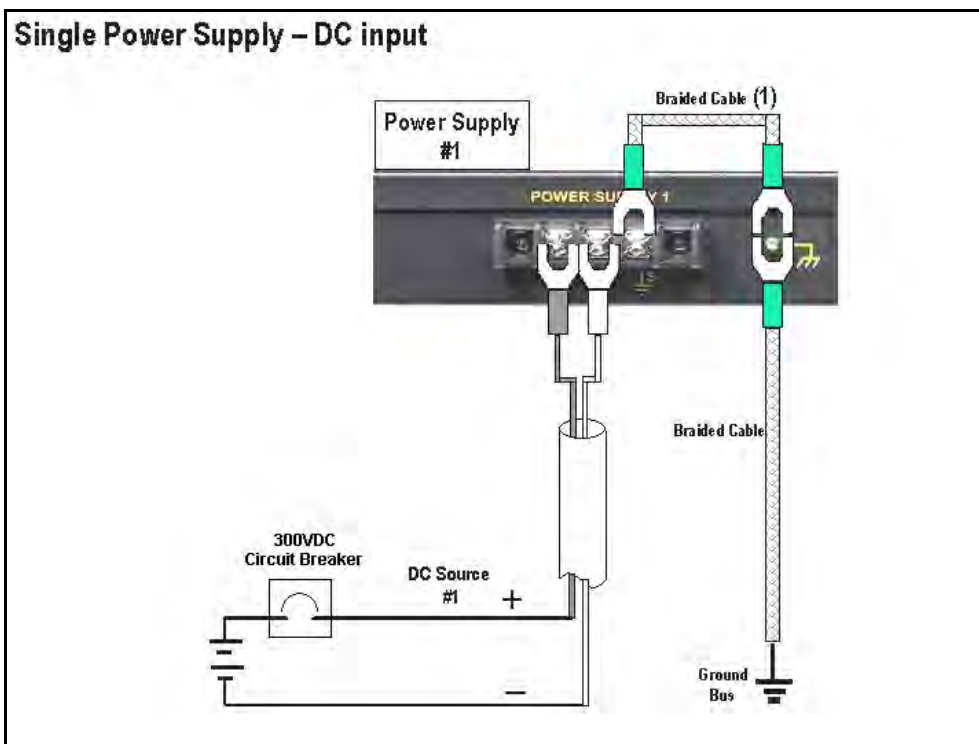


Figure 9: Power Supply – DC Inputs

2.3 HIPOT (Dielectric Strength) Testing

Units which are to be “HIPOT” tested in the field must have the braided ground cable(s) disconnected as shown in Figure 10 during the HIPOT test. This is required in order to prevent the transient/surge suppression circuitry, which is connected to Surge Ground, from being activated during the HIPOT test.

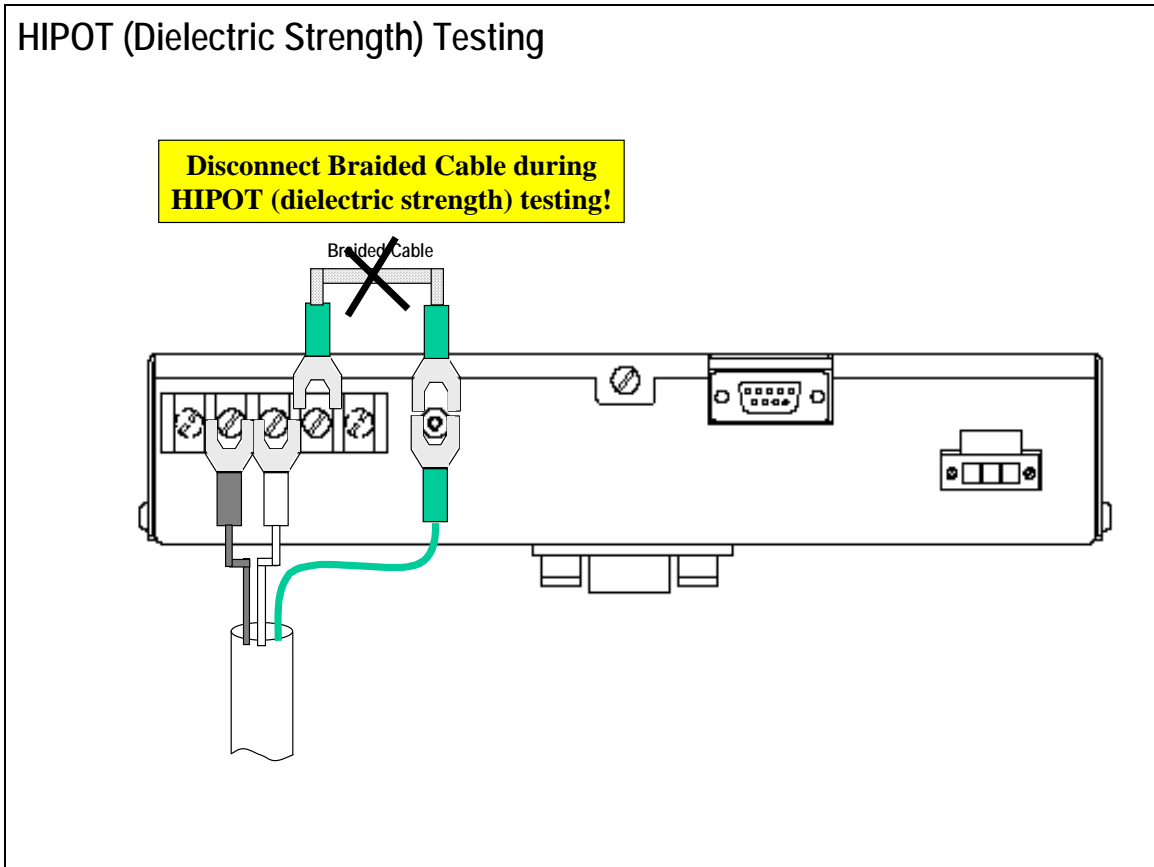


Figure 10: HIPOT (Dielectric Strength) Testing

2.4 Failsafe Relay Outputs

The “Failsafe” output relay is provided to signal critical error conditions that may occur on the RS400 Series. The contacts are energized upon power up of the unit and remain energized until a critical error occurs. One common application for this output is to signal an alarm if a power failure or removal of control power occurs.

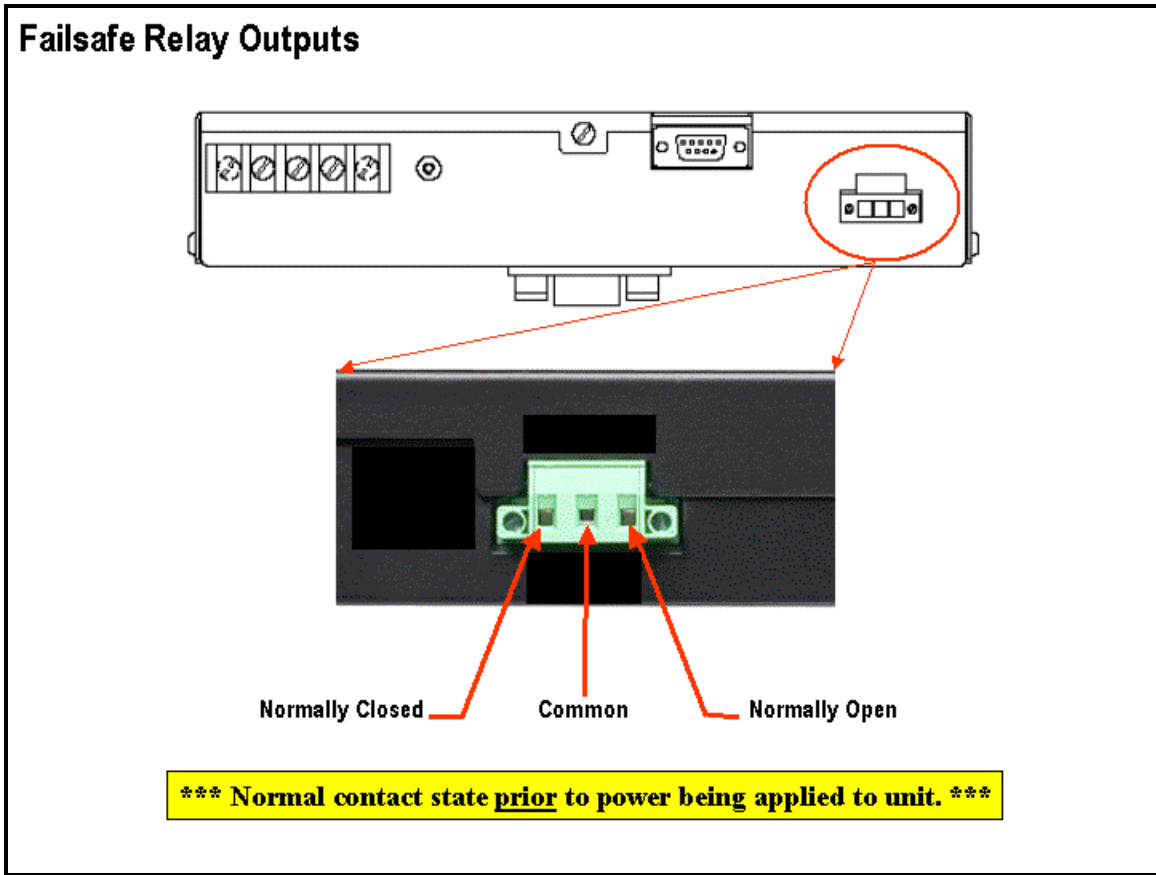


Figure 11: Failsafe Output Relay

2.5 RS232 Console Port Wiring

The RS232 port is used for configuring the RS400 Series. A straight-through serial cable with a DB-9 connector is required. There is no need to cross-over the TXD and RXD signals from the PC side since this has been done internally as is shown below.

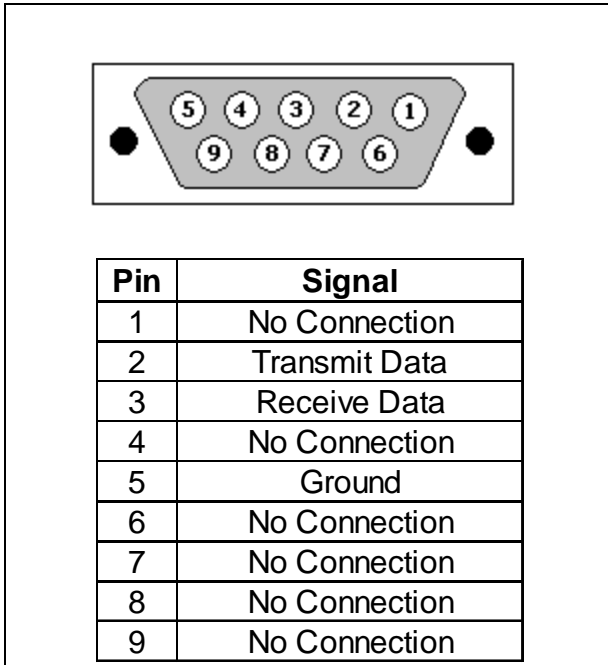


Figure 12: RS232 DB9 Female DCE pin-out

NOTE: This port is not intended to be a permanent connection and the cable shall be less than 2m (6.5 ft) in length.

2.6 Serial Ports

The RS400 Series can be equipped with four RS232 DB9 ports, four RS485 Phoenix ports, four RS232/RS485/RS422 DB9 ports or four RS232/RS485/RS422 RJ-45 ports. When the RS400 Series is equipped with four RS232 DB9 ports it is physically indistinguishable than when it is equipped with four RS232/RS485/RS422 DB9 ports. Check the product label on the back of the unit or the ROS firmware and review the table below in order to determine the type of serial ports on your RS400 Series. The italicized letters in the order code represent options specific to your order.

Ports	Order Code
4 x RS232 via DB9	<i>RS40X-PS-M-E1E2-2-MP</i>
4 x RS485 via Phoenix	<i>RS40X-PS-M-E1E2-4-MP</i>
4 x RS232/RS485/RS422 via DB9	<i>RS40X-PS-M-E1E2-3D-MP</i>
4 x RS232/RS485/RS422 via RJ-45	<i>RS40X-PS-M-E1E2-3R-MP</i>

Figure 13: Serial Port Options

2.6.1 4 x RS232 via DB9

The figure below shows the RS400 when equipped with four RS232 DB9 ports.

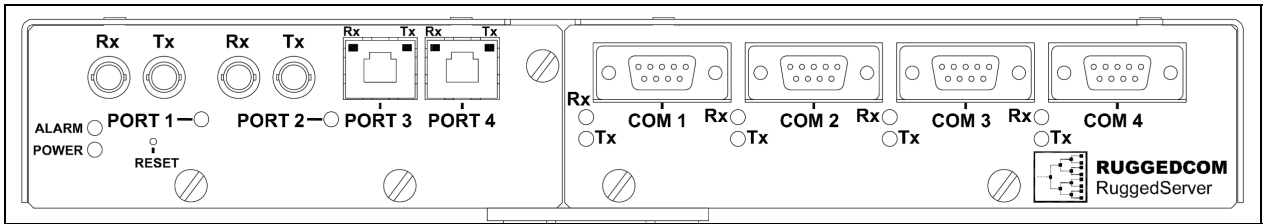


Figure 14: RS400 equipped with four RS232 DB9 ports

When equipped with four RS232 ports, the RS400 Series offers a female Data Communications Equipment (DCE) interface. When communicating with a Data Terminal Equipment (DTE) device, such as a PC, a straight-through serial cable (3 pin or 9 pin) is required. When communicating with a DCE, such as another RS400, the RX and TX must be ‘crossed-over’, for example, using a NULL modem cable. The RS232 pin-out is shown below.

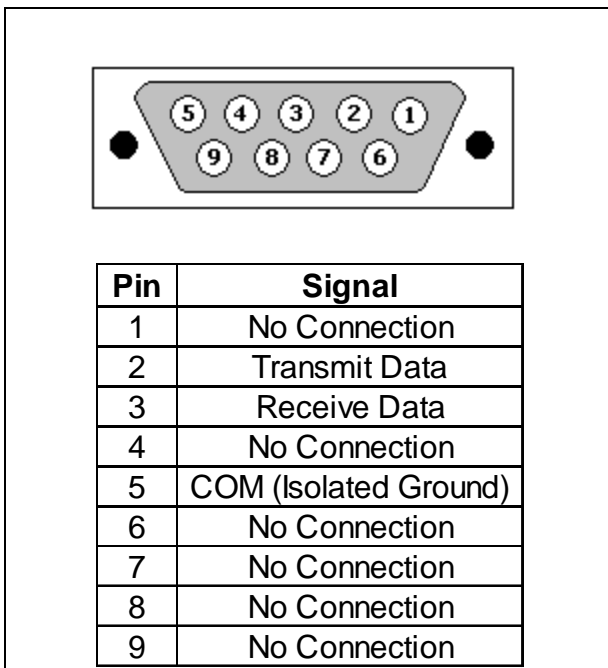


Figure 15: DB9 Female DCE pin-out

2.6.2 4 x RS485 via Phoenix

The figure below shows the RS400 when equipped with four RS485 Phoenix ports.

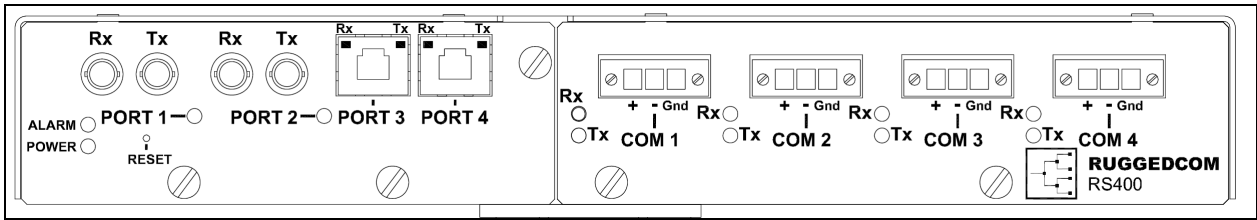


Figure 16: RS400 equipped with four RS485 Phoenix ports

The Phoenix port pin-out is shown below.

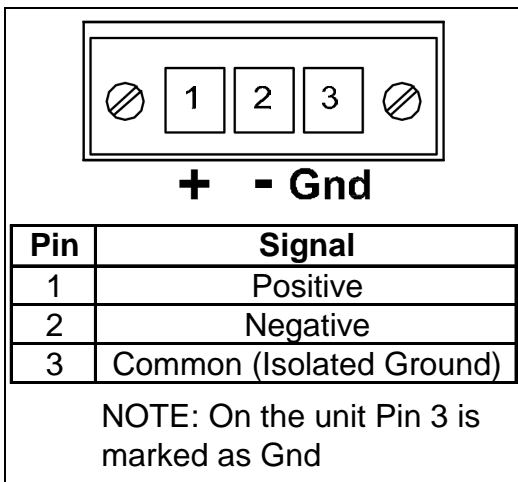


Figure 17: Phoenix port pin-out

The RS485 serial ports are terminated by default from the factory. Termination provided is AC Termination style 120 Ohm resistor in series with a 10nF capacitor. The following table details the appropriate jumper configuration for each RS485 port.

Port Number	Jumper #	Jumper Position	
		No Termination	AC Termination
1	JP5	Removed	Installed
2	JP6	Removed	Installed
3	JP7	Removed	Installed
4	JP8	Removed	Installed

Table 2.7.2.1 RS485 termination options

2.6.3 4 x RS232/RS485/RS422 via DB9

The figure below shows the RS400 when equipped with four RS232/RS485/RS422 DB9 ports.

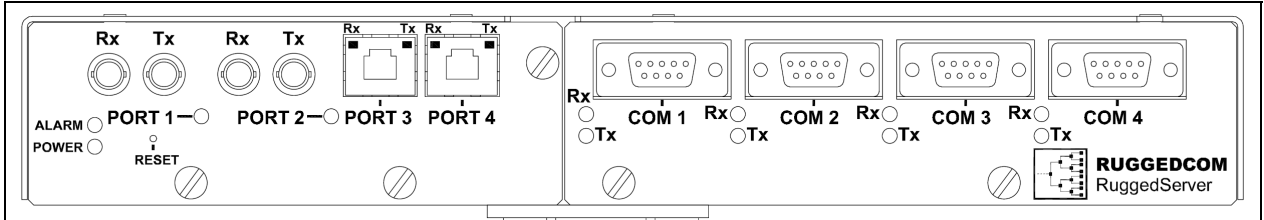


Figure 18: RS400 equipped with four RS232/RS485/RS422 DB9 ports

Each port is individually selectable via software to be RS232, RS485 or RS422. The DB9 port is below.

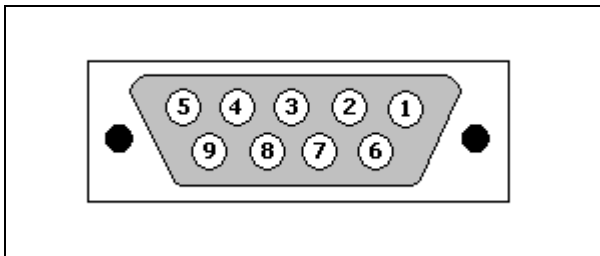


Figure 19: DB9 Female DCE Port pin-out

Pin	RS232 Mode	RS485 Mode	RS422 Mode
1	CD	-	-
2	TX	TX/RX+	TX+
3	RX	-	RX+
4	DTR	-	-
5	Common (Isolated Ground)		
6	DSR	-	RX-
7	CTS	TX/RX -	TX-
8	RTS	-	-
9	RI (No Connection)	-	-
Shield	Chassis Ground		

Table 3: DB9 Female DCE Port pin-out

NOTES:

1. No internal termination is provided.
2. Pins 1, 4, and 6 are connected internally. Pins 7 and 8 are connected internally. In RS232 mode, these pins enter a high impedance state. A DTE that asserts DTR and expects DSR or CD will operate correctly. A DTE that asserts RTS will see CTS asserted, although the RuggedServer will not perform hardware flow control.
3. The Common terminals are optically isolated; however, there is transient voltage protection circuitry between the Common terminals and chassis ground.

2.6.4 4 x RS232/RS485/RS422 via RJ-45

The figure below shows the RS400 when equipped with four RS232/RS485/RS422 RJ-45 ports.

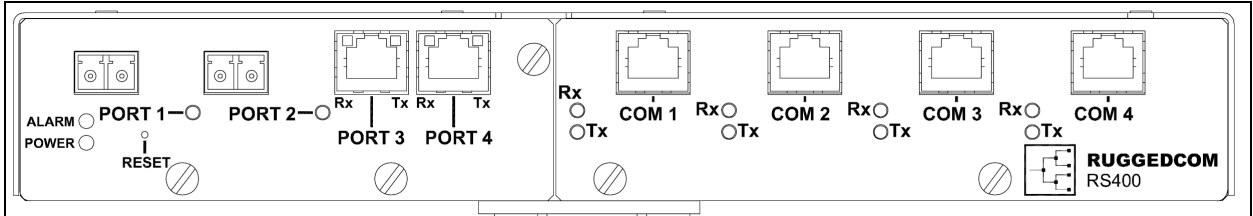


Figure 20: RS400 equipped with four RS232/RS485/RS422 RJ-45 ports

Each port is individually selectable via software to be RS232, RS485 or RS422. The RJ-45 port is shown below.

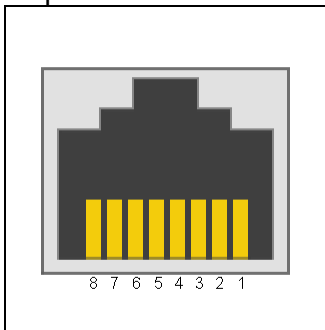


Figure 21: RJ45 Port pin-out

Pin	RS232 Mode	RS485 Mode	RS422 Mode
1	DSR	-	RX-
2	DCD	-	-
3	DTR	-	-
4	Common (Isolated Ground)		
5	RX	-	RX+
6	TX	TX/RX +	TX +
7	CTS	-	-
8	RTS	TX/RX -	TX -
Shield	Chassis Ground		

Table 4: RJ45 Port pin-out

NOTES:

- 1 No internal termination is provided.
- 2 Pins 1, 2, and 3 are connected internally. Pins 7 and 8 are connected internally. In RS232 mode, these pins enter a high impedance state. A DTE that asserts DTR and expects DSR or CD will operate correctly. A DTE that asserts RTS will see CTS asserted, although the RuggedServer will not perform hardware flow control.
- 3 The Common terminals are optically isolated; however, there is transient voltage protection circuitry between the Common terminals and chassis ground.

2.6.5 RS485 Wiring

Each RS485 port can communicate to multiple RS485 devices by daisy chaining devices over a single twisted pair with transmit and receive signals on the same two wires (half duplex). The following guidelines should be followed to ensure reliable continuous communication:

1. To minimize the effects of ambient electrical noise, shielded cabling is recommended.
2. The correct polarity must be observed throughout a single daisy chain.
3. The number of devices wired should not exceed 32, and total distance should be less than 4000 feet (at 100 kbps).
4. The Common terminals should be connected to the common wire inside the shield.
5. The shield should be connected to earth ground at a single point to avoid loop currents.
6. The twisted pair should be terminated at each end of the chain.

The figure below shows the recommended RS485 wiring.

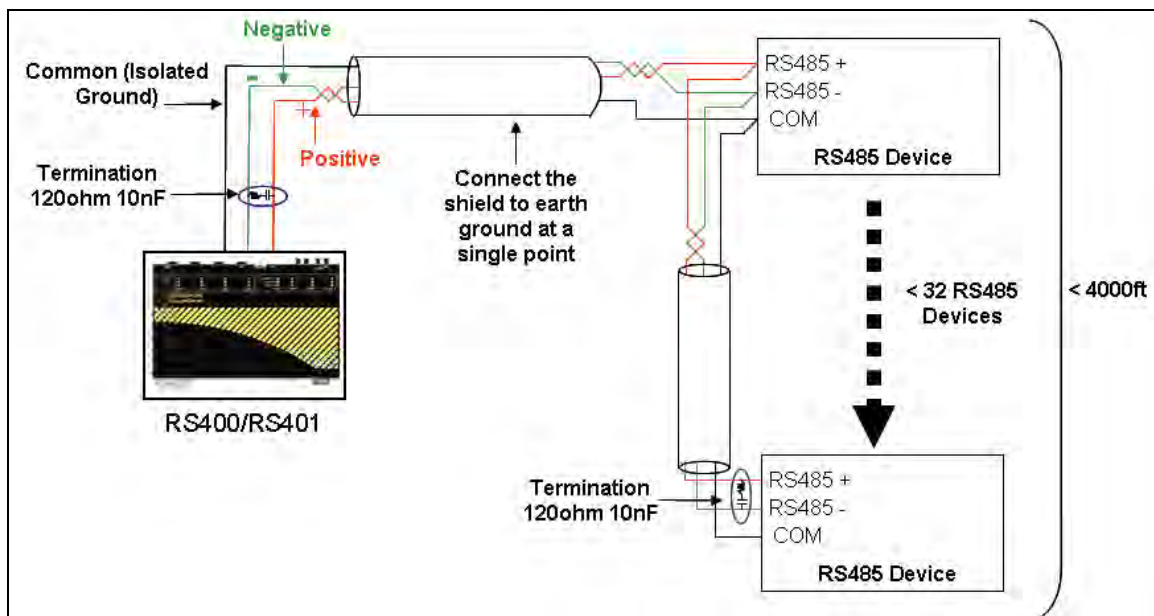


Figure 22: Conceptual recommended RS485 wiring diagram

NOTES:

1. On RS400 Series units with Phoenix ports, the Common (Isolated Ground) port is marked "Gnd". See the Phoenix ports section for details.
2. On RS400 Series units with Phoenix ports, internal termination is provided. See the Phoenix ports section for details.
3. On RS400 Series units with RS232/RS485/RS422 DB9 or RJ-45 ports then no internal termination is provided. See the DB9 & RJ-45 port sections for details.

2.6.6 Serial Port Transient Protection

RuggedCom does not recommend the use of copper cabling of any length for critical real-time substation automation applications. However, transient suppression circuitry is present on all copper ports to protect against damage from electrical transients and to ensure IEC 61850-3 and IEEE 1613 Class 1 conformance. This means that during the transient event communications errors or interruptions may occur but recovery is automatic.

RuggedCom also does not recommended to use these ports to interface to field devices across distances which could produce high levels of ground potential rise, (i.e. greater than 2500V) during line to ground fault conditions.

2.7 Ethernet Ports

Depending on the order code of the product, the RS400 Series can be equipped with several different types of Ethernet ports. In order to determine the type of Ethernet ports on your RS400 Series, review your order code (your order code is in the form RS40X-PS-M-E1E2-SP-MP) and compare it to Table 2.8.1 below.

Code (E1 & E2 in your order code)	Port
00	No Ethernet ports
TX	10/100BaseTX RJ-45
FL	10FL Multimode ST, 820nm, 2km
MJ	100FX Multimode MTRJ
MC	100FX Multimode SC
MT	100FX Multimode ST
T2	100FX Singlemode ST, Standard 20km
L2	100FX Singlemode LC, Standard 20km
L5	100FX Singlemode LC, Intermediate Reach 50km
L9	100FX Singlemode LC, Long Reach 90km
C2	100FX Singlemode SC, Standard 20km
C5	100FX Singlemode SC, Intermediate Reach 50km
C9	100FX Singlemode SC, Long Reach 90km

Table 5: Ethernet Port Options

The following two figures show examples of the RS400 equipped with different Ethernet ports.

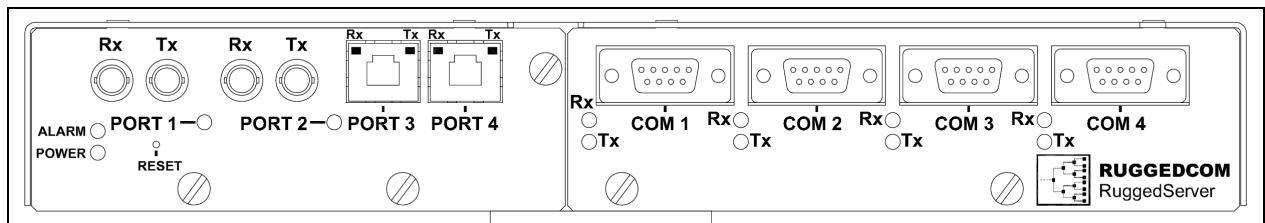


Figure 23: RS400 equipped with ST and RJ-45 Ethernet ports

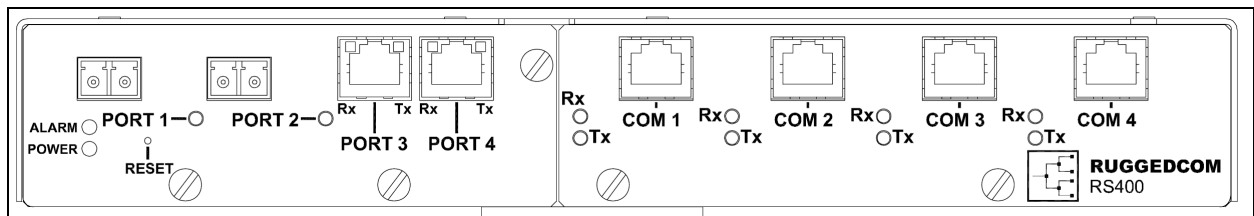


Figure 24: RS400 equipped with LC and RJ-45 Ethernet ports

2.7.1 RJ-45 Twisted-Pair Ports

The RS400 Series can be equipped with a number of 10/100BaseTX ports that allow connection to standard CAT-5 UTP cable with RJ-45 male connectors. These ports have auto-crossover, auto-negotiation, and auto-polarity features. The RJ-45 receptacles used can accept and take advantage of screened (commonly known as “shielded”) cabling. Figure 25 shows the RJ-45 port pin-out.

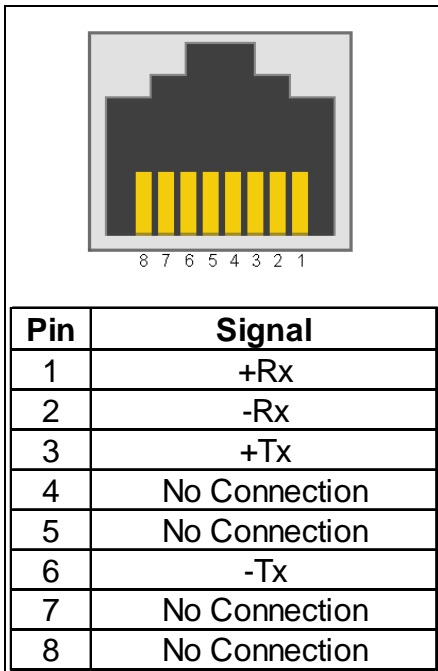


Figure 25: RJ-45 Port pin-out

2.7.2 Ethernet Port Transient Protection

RuggedCom does not recommend the use of copper cabling of any length for critical real-time substation automation applications. However, transient suppression circuitry is present on all copper ports to protect against damage from electrical transients and to ensure IEC 61850-3 and IEEE 1613 Class 1 conformance. This means that during the transient event communications errors or interruptions may occur but recovery is automatic.

RuggedCom also does not recommended to use these ports to interface to field devices across distances which could produce high levels of ground potential rise, (i.e. greater than 2500V) during line to ground fault conditions.

2.7.3 Fiber Optic Ports

The RS400 Series can be equipped with several different types of fiber optic ports. The Transmit (TX) and Receive (RX) connections of each port must be properly connected and matched for proper link and operation. The drawings in the following figures show each fiber optical connector style with a side and top view to allow the user to identify the proper cable connection orientation.

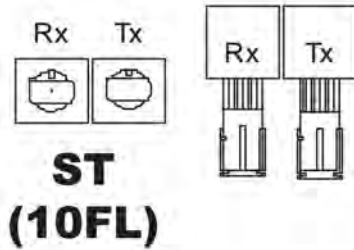


Figure 26: 10FL ST connector

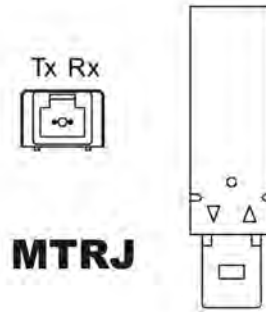


Figure 27: 100FX MTRJ connector

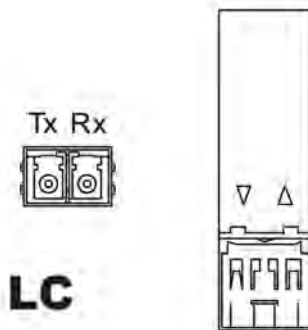


Figure 28: 100FX LC connector

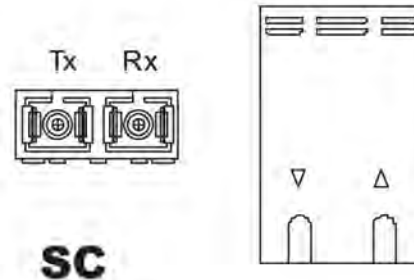


Figure 29: 100FX SC connector

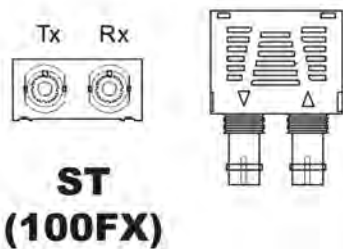


Figure 30: 100FX ST connector

2.8 V.90 Modem Port (Optional)

The RS400 Series can be equipped with one single standard V.90 modem port to allow remote dial-in access to the RS400 Series, and the Ethernet network. For instructions regarding the configuration and operation of this port please see the RuggedServer User Manual available at www.ruggedcom.com.

The modem port can be accessible via the RJ-11 port located on the rear of the unit. Figure 31 details the port pin-out, which conforms to the standard telephony pin configuration.

CAUTION – To reduce the risk of fire, use only No. 26 AWG or larger telecommunication line cord.

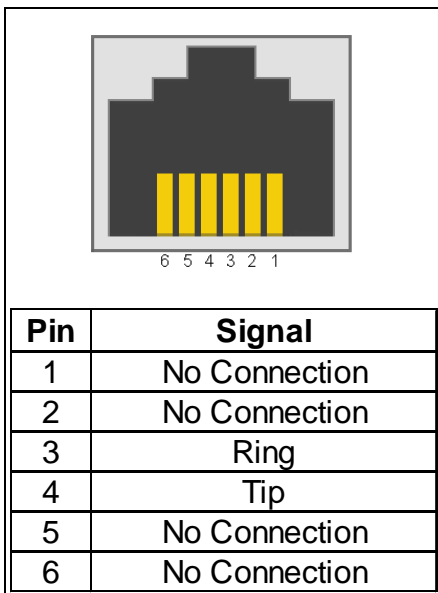


Figure 31: RJ-11 V.90 Modem Port pin-out

This product meets the applicable Industry Canada technical specifications

The Ringer Equivalence Number is an indication of the maximum number of devices allowed to be connected to a telephone interface. The termination on an interface may consist of any combination of devices subject only to the requirement that the sum of the RENs of all the devices does not exceed five.

3 Technical Specifications

3.1 Operating Environment

Parameter	Range	Comments
Ambient Operating Temperature	-40 to 85°C	Ambient Temperature as measured from a 30 cm radius surrounding the center of the RS400 Series enclosure.
Ambient Relative Humidity	5% to 95%	Non-condensing
Ambient Storage Temperature	-40 to 85°C	

3.2 Power Supply Specifications

Power Supply Type	Minimum Input	Maximum Input	Internal Fuse Rating	Maximum Power Consumption
12 -24 VDC	10 VDC	36 VDC	6.3A(F) ²	8 W
24 VDC	18 VDC	36 VDC	5A(F) ²	
48 VDC	36 VDC	59 VDC	2A(T) ²	
HI (125/250 VDC) ¹	88 VDC	300 VDC	2A(T) ^{1,2}	
HI (110/230 VAC) ¹	85 VAC	265 VAC		

NOTES:

1. This is the same power supply for both AC and DC.
2. (F) Denotes fast-acting fuse, (T) denotes time-delay fuse.

3.3 Failsafe Relay Specifications

Parameter		Value
Max Voltage	Switching	30VAC, 80VDC
Rated Current	Switching	0.3A @ 30VAC 1A @ 30VDC, 0.3A @ 80VDC

3.4 Data Port Specifications

Data Port	Media	Distance	Connector Type
10/100BaseTx	Cat 5 UTP/STP	100m	RJ-45
RS232	Standard RS232 Shielded Serial Cable	15m	DB9 Male or RJ-45
RS485	Shielded Twisted-Pair	1200m	N/A
RS422	Shielded Twisted-Pair	1200m	N/A

3.5 Fiber Optical Specifications

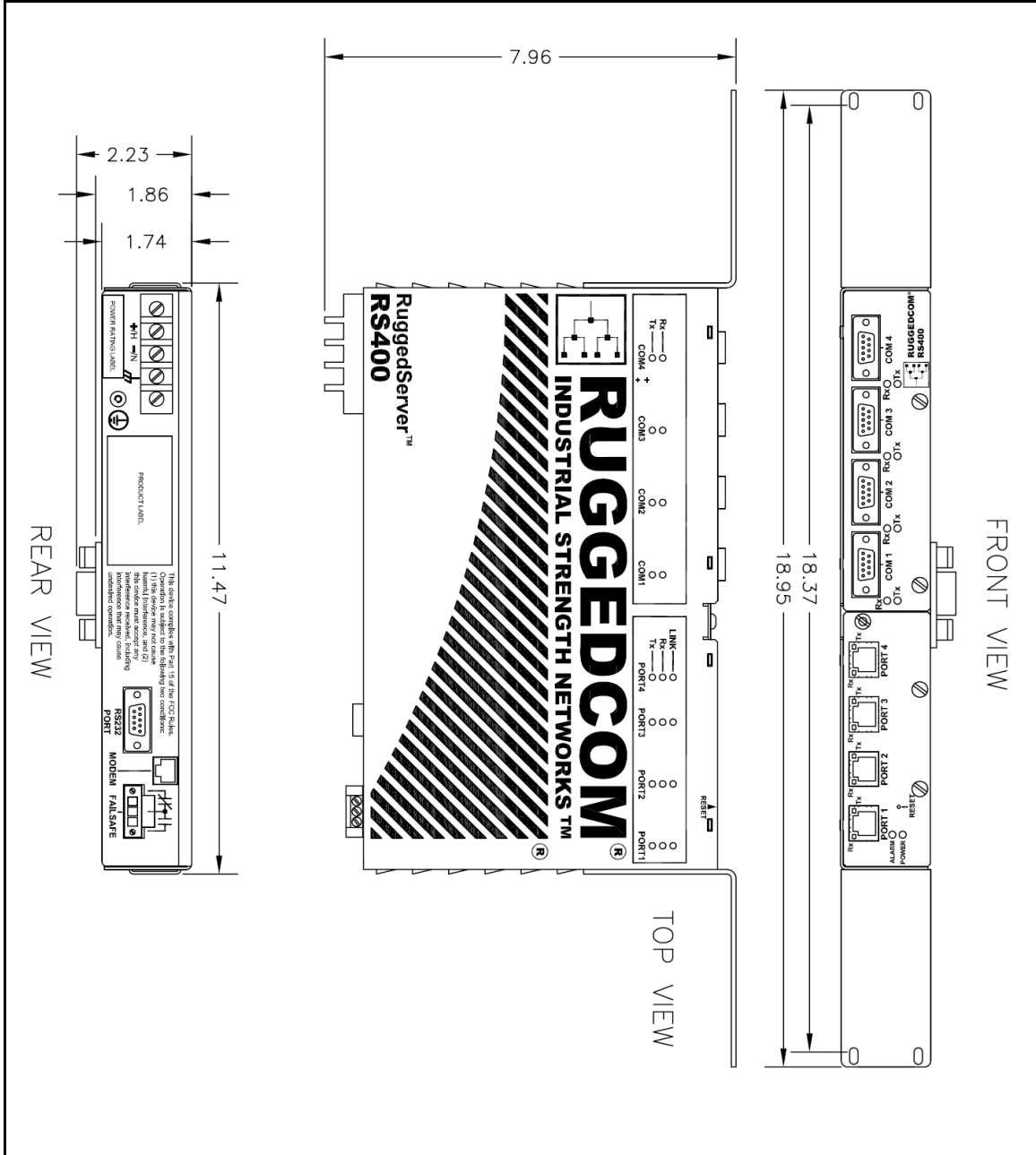
<i>Speed Standard</i>	<i>Mode / Connector</i>	<i>Tx λ (nm)</i>	<i>Cable Type² (μm)</i>	<i>Tx Pwr (dBm peak)² (Min / Max)</i>	<i>Rx Sensitivity (dBm Average)²</i>	<i>Rx Saturation (dBm Peak)²</i>	<i>Typical Distance (km)¹</i>	<i>Power Budget (dB)</i>
10BaseFL	MM / ST	820	50/125	-16.5/-10.6	-34	-11.2	2	21
100BaseFX	MM / ST	1310	50/125	-15.7	-33.5	-11	2	17
100BaseFX	MM / SC	1300	50/125	-16/-11	-33	-11	2	17
100BaseFX	MM / LC	1310	50 μ /125	-19 / -14	-32	-14	2	15
100BaseFX	MM / MTRJ	1310	50/125	-16/-11	-33.5	-11	2	17
100BaseFX	SM / ST	1310	9/125	-27 / -14	-35	-3	5	8
100BaseFX	SM / SC	1310	9/125	-13/5	-31	-4	20	20
100BaseFX	SM / LC	1310	9/125	-15/-8	-31	-5	15	16.5

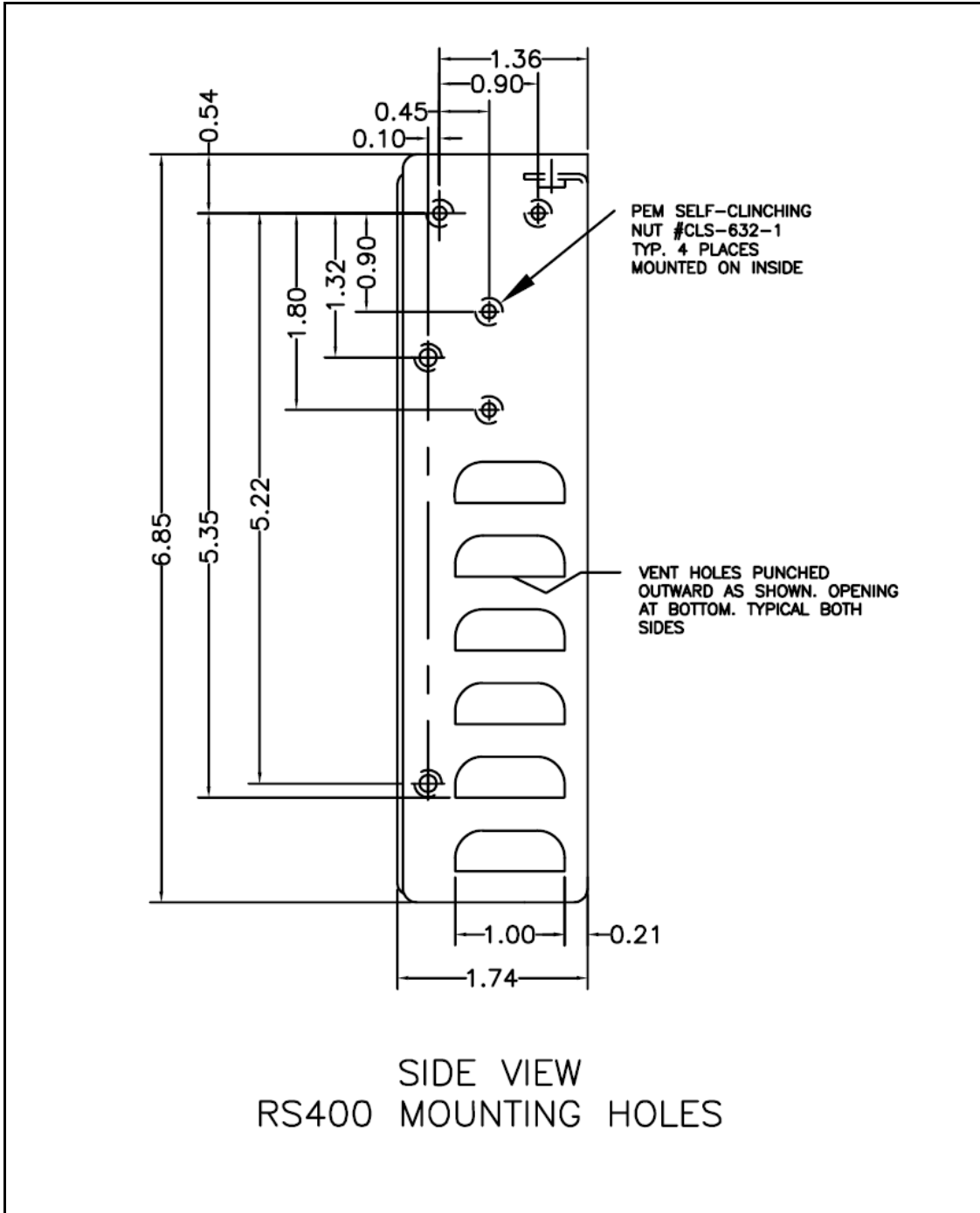
NOTES:

1. Maximum segment length is greatly dependent on factors such as fiber quality, and number of patches and splices. Please consult RuggedCom sales associates when determining maximum segment distances.
2. To convert from average to peak add 3 dBm. To convert from peak to average, subtract 3 dBm.

3.6 Physical Dimensions

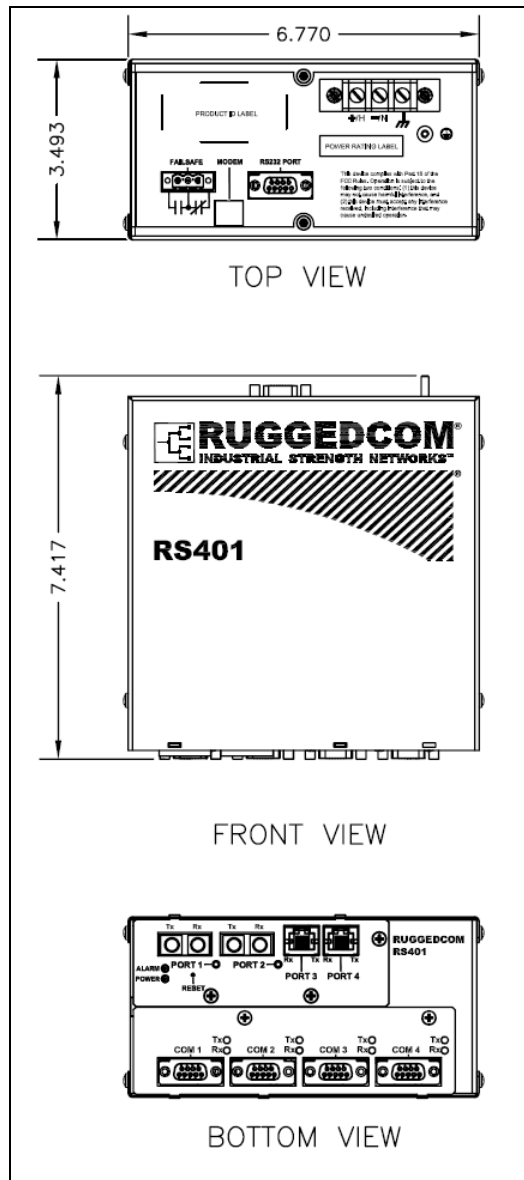
3.6.1 RS400





Parameter	Value	Comments
Dimensions	11.47 x 7.96 x 2.23 inches 29.13 x 20.22 x 5.66 cm	(Length x Width x Height)
Weight	4.8 lb (2.2 Kg)	
Enclosure	18 gauge Galvanized Steel	

3.6.2 RS401



Parameter	Value	Comments
Dimensions	6.77 x 7.42 x 3.49 inches 17.20 x 18.85 x 8.86 cm	(Length x Width x Height)
Weight	4.2 lb (1.9 Kg)	
Enclosure	18 gauge Galvanized Steel	

4 Type Tests

4.1 IEC 61850-3 Type Tests

Test	Description		Test Levels	Severity Levels
IEC 61000-4-2	ESD	Enclosure Contact	+/- 8kV	4
		Enclosure Air	+/- 15kV	4
IEC 61000-4-3	Radiated RFI	Enclosure ports	20 V/m	x
IEC 61000-4-4	Burst (Fast Transient)	Signal ports	+/- 4kV @ 2.5kHz	x
		D.C. Power ports	+/- 4kV	4
		A.C. Power ports	+/- 4kV	4
		Earth ground ports	+/- 4kV	4
IEC 61000-4-5	Surge	Signal ports	+/- 4kV line-to-earth, +/- 2kV line-to-line	4
		D.C. Power ports	+/- 2kV line-to-earth, +/- 1kV line-to-line	3
		A.C. Power ports	+/- 4kV line-to-earth, +/- 2kV line-to-line	4
IEC 61000-4-6	Induced (Conducted) RFI	Signal ports	10V	3
		D.C Power ports	10V	3
		A.C. Power ports	10V	3
		Earth ground ports	10V	3
IEC 61000-4-8	Magnetic Field	Enclosure ports	40 A/m continuous, 1000 A/m for 1 s	N/A
IEC 61000-4-29	Voltage Dips & Interrupts	D.C. Power ports	30% for 0.1s, 60% for 0.1s, 100% for 0.05s	N/A
IEC 61000-4-11		A.C. Power ports	30% for 1 period, 60% for 50 periods 100% for 5 periods, 100% for 50 periods ²	N/A
IEC 61000-4-12	Damped Oscillatory	Signal ports	2.5kV common, 1kV differential mode @ 1MHz	3
		D.C. Power ports	2.5kV common, 1kV differential mode @ 1MHz	3
		A.C. Power ports	2.5kV common, 1kV differential mode @ 1MHz	3
IEC 61000-4-16	Mains Frequency Voltage	Signal ports	30V Continuous, 300V for 1s	4
		D.C. Power ports	30V Continuous, 300V for 1s	4
IEC 61000-4-17	Ripple on D.C. Power Supply	D.C. Power ports	10%	3
IEC 60255-5	Dielectric Strength	Signal ports	2kV AC (Fail-Safe Relay output)	N/A
		D.C. Power ports	1.5kVDC	N/A
		A.C. Power ports	2kVAC	N/A
IEC 60255-5	H.V. Impulse	Signal ports	5kV (Fail-Safe Relay output)	N/A
		D.C. Power ports	5kV	N/A
		A.C. Power ports	5kV	N/A

Table 6 - IEC 61850-3 Type Tests

4.2 IEEE 1613 Type Tests

IEEE Test	IEEE 1613 Clause	Description		Test Levels
C37.90.3	9	ESD	Enclosure Contact	+/- 8kV
			Enclosure Air	+/- 15kV
C37.90.2	8	Radiated RFI	Enclosure ports	35 V/m
C37.90.1	7	Fast Transient	Signal ports	+/- 4kV @ 2.5kHz
			D.C. Power ports	+/- 4kV
			A.C. Power ports	+/- 4kV
			Earth ground ports	+/- 4kV
C37.90.1	7	Oscillatory	Signal ports	2.5kV common mode @ 1MHz
			D.C. Power ports	2.5kV common & differential mode @ 1MHz
			A.C. Power ports	2.5kV common & differential mode @ 1MHz
C37.90	6	H.V. Impulse	Signal ports	5 kV (Failsafe Relay)
			D.C. Power ports	5 kV
			A.C. Power ports	5 kV
C37.90	6	Dielectric Strength	Signal ports	2kVAC
			D.C. Power ports	1.5kVDC
			A.C. Power ports	2kVAC

Table 7 - IEEE 1613 Type Tests

Notes:

- If the unit contains copper ports, the IEEE 1613 conformance is Class 1 (During disturbance, errors may occur but recovery is automatic).
- If the unit contains all fiber ports, the IEEE 1613 conformance is Class 2 (During disturbance, no errors will occur).

4.3 IEC Environmental Type Tests

Test	Description		Test Levels	Severity Levels
IEC 60068-2-1	Cold Temperature	Test Ad	-40 deg. C, 16 Hours	N/A
IEC 60068-2-2	Dry Heat	Test Bd	+85 deg. C, 16 Hours	N/A
IEC 60068-2-30	Humidity (Damp Heat, Cyclic)	Test Db	95% (non-condensing), 55°C, 6 cycles	N/A
IEC 60255-21-1	Vibration		2g @ (10-150) Hz	Class 2
IEC 60255-21-2	Shock		30g @ 11 ms	Class 2

Table 8 - Environmental Type Tests

Note:

- Class 2 refers to “Measuring relays and protection equipment for which a very high security margin is required or where the vibration levels are very high, (e.g. shipboard application and for severe transportation conditions).”

5 Agency Approvals

Agency	Standards	Comments
CSA, CE	CSA C22.2 No. 60950, UL 60950, EN 60950, EN 61000-6-2	Approved
FCC	FCC Part 15, Class A	Approved
CISPR	EN55022, Class A	Approved
FDA/CDRH	21 CFR Chapter 1, Subchapter J	Compliant
IEC/EN	EN60825-1:1994 + A11:1996 + A2:2001	Compliant

6 Warranty

RuggedCom warrants this product for a period of five (5) years from date of purchase. For warranty details, visit <http://www.ruggedcom.com/> or contact your customer service representative.

Should this product require warranty or service contact the factory at:

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