

MicroRAPTOR - Hardware Installation Guide



Intelligent Cyber Secure Platform

iMR920



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Preface

This guide is intended for use of network technical support skilled persons who are responsible for installation, commissioning, and maintenance of the device.

Alerts



WARNING alerts describe hazardous situations that, if not avoided, may result in serious injury and/or equipment damage.

CAUTION alerts describe hazardous situations that, if not avoided, may result in equipment damage.



DANGER alerts describe imminently hazardous situations that, if not avoided, will result in death or serious injury.



NOTES provide additional information and details.



Temperature hazard – above TS2 limits. To be accessible by Skilled Persons only



Multiple power source – redundant power



Protective earthing conductor



Electrical hazard – above ES2 limits. To be accessible by Skilled Persons only

Related Documents

- 1) *MicroRAPTOR* Quick Start Guide
- 2) *MicroRAPTOR* WebUI Manuals
- 3) *MicroRAPTOR* CLI User Manuals
- 4) *MicroRAPTOR* Configuration Manuals

Training

Training is a key for customers to continue maintaining and using their iS5Com's device. Customers can select a standard training course or customized training courses at the iS5Com facility or a customer provided facility. Go to <https://is5com.com/training/> to submit your request for training or contact an iS5Com Sales Representative.

iSUPPORT



PHONE SUPPORT

Support can be directed to i55Com's Technical Action Center at <https://is5com.com/isupport/> . You can also call Tech Support: +1 844-475-8324



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1. Introduction

MicroRAPTOR® iMR920 is an Intelligent Cyber Secure Platform running the iBiome OS. The iBiome is an all-encompassing operating system that supports switching and routing on a single platform. iMR920 is available as a base unit with 8-ports 10/100/1000TX, and has a factory configurable second module which supports an additional 8-ports 10/100/1000TX or 100/1000Base-X SFP.

iMR920 supports Layer 2 and Layer 3 Switching and offers industry specific features such as IEEE 1588v2 precision timing support.

iMR920 has been specifically designed to protect and secure critical infrastructure and substation applications in the harshest of environments. It is compliant with IEC 61850 Ed. 2, and IEEE 1613 standards.

Figure 1: iMR920 product view



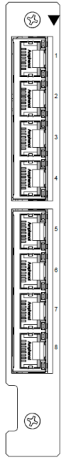
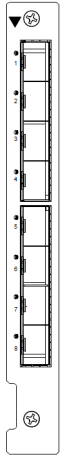
1.1. Key Features and Benefits of iMR920

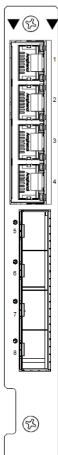
FEATURES		BENEFITS
Flexible Compact Layer 3 Switch		The compact layer 3 switch supports up to 16-ports 10/100/1000TX RJ45. The iMR920 may be ordered with support for 8-ports 10/100/1000TX and 8-ports to be used for SFPs. All configurations are factory configured.
Simplified GUI- easy to use		Allows easy configuration and monitoring with a web-based User Interface; eliminates the need for more complex terminal emulation programs; reduced cost of deployment; one platform—multiple functions
Robust industrial design		-40 °C to +85 °C (-40 °F to 185 °F) operating temperature, no fans needed; IP 40
IEEE 1588 Transparent Clock		All Ethernet ports on the iMR920 support the IEEE 1588v2 Power Profile for Transparent Clock operation.

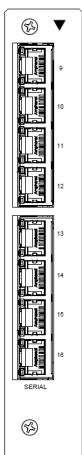
2. Factory Configurable Options

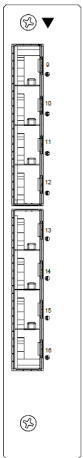
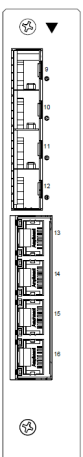
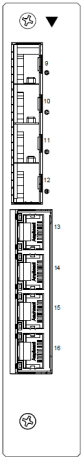
2.1. Communications Options

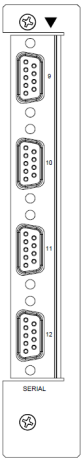
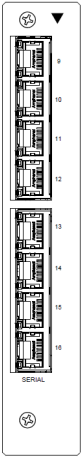
Communications line modules are configured on the iMR920 at the factory. They are fixed modules and not customer configurable. A description of the options are below.

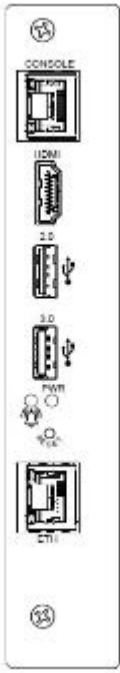

Part #	Image	Slots 1 Line Modules Description
8GRJ45		<p>8 X 10/100/1000Base-T(X) RJ45</p> <p>Both the right and left LEDs for each port behave identically. The green LED will be in an ON state when the link is up, and will flash when there is network activity. The LED will be OFF when the link is down.</p>
8GSFP		<p>8 X 100/1000 Mbps SFP Base-X (optical transceivers not included)</p> <p>For each Ethernet port, the green LED will be in an ON state when the link is up, and will flash when there is network activity. The LED will be OFF when the link is down.</p>

Part #	Image	Slots 1 Line Modules Description
4RJ4SFP		<p>4 X 10/100/1000 Base-T(X) RJ45 plus 4 X 100/1000 Mbps SFP Base-X (optical transceivers not included)</p> <p>For each RJ45 Ethernet port, both left and right LEDs behave identically, the green LED will be in an ON state when the link is up, and will flash when there is network activity. The LED will be OFF when the link is down.</p> <p>For each SFP Ethernet port, the green LED will be in an ON state when the link is up, and will flash when there is network activity. The LED will be OFF when the link is down.</p>

Part #		Slot 2 Line Module Description
8GRJ45		8 X 10/100/1000Base-T(X) RJ45

Part #		Slot 2 Line Module Description
8GSFP		8 X 100/1000 Mbps SFP Base-X (optical transceivers not included)
4RJ4SFP		4 X 10/100/1000 Base-T(X) RJ45 plus 4 X 100/1000 Mbps SFP Base-X (optical transceivers not included)
2RBX		HSR/PRP with support for 2 RedBoxes or 1 QuadBox

Part #		Slot 2 Line Module Description
4DB09		4-ports DB9 Serial
8SRJ45		8-ports RJ45 Serial

Part #		Slot 2 Line Module Description
iROC		<p>Industrial Computing Module is in itself a configurable part and will be described further in its own section of the manual along with its configurable options.</p> <p>Storage on the iROC is available as either 256 GB, 512 GB, 1 TB, or 2 TB SSD with 3K <i>P/E</i> (Program/Erase) cycles. The SSDs are industrial grade rated for a temperature range of -40°C to +70°C. They provide an SATA III 6 Gbps interface.</p> <p>The CPU is an Intel 3950, 4-core, 4-threads, 1.6GHz, and with 8GB LPDDR4 memory.</p> <p>The faceplate has a 1 Gbps network interface, <i>HDMI</i> port capable of 1080p, USB 2.0, USB 3.0 and RJ45 RS232 Console port. There is a reset button and two LEDs (Power and Alarm).</p> <p>Operating temperature is restricted to -40°C to +70°C</p>
BLK		Blank Module

2.2. Notes for 2RBX Option

2RBX - Support for 2 RedBoxes or 1 QuadBox (supported in slot 2)

The numbering convention for the different RedBoxes in the different line module slots are as follows:

Table 1: Naming Convention for RedBoxes

Redundant Switch	LM2
First	Red 1
Second	Red 2

By default, both redundant switches of the HSR-PRP line card are connected to the main switch through the I-port. However, there may be cases when only one or no redundant switch is required. For these cases it is possible to disable redundancy on a redundant interface so that two Ethernet ports can be used instead, thereby by-passing the redundant switch.

Only half of the possible line card ports are routed to the HSR-PRP line card. It is therefore only possible to get four Ethernet ports to the connectors (or two 1G Ethernet ports in the case of LM4 as HSR-PRP line card does not support 10G). The following port combinations can be achieved for the four different slots:

Table 2: LM2 Line Card port description

LM2 Line Card	HSR-PRP				8GRJ45
Red 1 Redundancy	Enable	Enable	Disable	Disable	-
Red 2 Redundancy	Enable	Disable	Enable	Disable	-
Port 1	Red 1A	Red 1A	Gi 0/1	Gi 0/1	Gi 0/1
Port 2	Red 1B	Red 1B	Gi 0/2	Gi 0/2	Gi 0/2
Port 3	Red 2A	Gi 0/3	Red 2A	Gi 0/3	Gi 0/3
Port 4	Red 2B	Gi 0/4	Red 2B	Gi 0/4	Gi 0/4
Port 5	-	-	-	-	Gi 0/5
Port 6	-	-	-	-	Gi 0/6
Port 7	-	-	-	-	Gi 0/7
Port 8	-	-	-	-	Gi 0/8

The HSR-PRP line card has four combo ports consisting of four RJ45 and four SFP interfaces.

Each combo port has one RJ45 and one SFP interface. If an SFP module is detected, the SFP interface is the active combo port interface. If there is no SFP module inserted then the RJ45 interface remains active.

The IEC 62439-3 HSR-PRP standard also requires that Port-A is to the left of Port-B (Raptor) (or above in the case of MicroRaptor). With the line card being flipped up-side-down between odd and even slots the HSR-PRP line card could have either four RJ45 interfaces followed by four SFP slots or the other way round.

The CLI provides a redundancy map to indicate the active ports on the HSR/PRP module:

```
iS5comm# show interfaces redundant map
```

LM3

Redundancy switches:
 Red 5 - Enabled - I-port connected to Gi0/17
 Red 6 - By-passed

External connections:

Position:	1	2	3	4	5	6	7	8
Connector:	SFP	SFP	SFP	SFP	RJ45	RJ45	RJ45	RJ45
SFP Detected:	NO	NO	YES	NO	-	-	-	-
Port:	X	X	Gi0/19	X	Red-5A	Red-5B	X	Gi0/20

LM4

Redundancy switches:
 Red 7 - By-passed
 Red 8 - Enabled - I-port connected to Ex0/3


External connections:

Position:	1	2	3	4	5	6	7	8
Connector:	RJ45	RJ45	RJ45	RJ45	SFP	SFP	SFP	SFP
SFP Detected:	-	-	-	-	NO	NO	YES	YES
Port:	Ex0/1	X	X	X	X	X	Red-8A	Red-8B


```
iS5comm#
```

2.3. iROC Module

iROC label on the MicroRAPTOR:




5895 Ambler Drive
Mississauga, Ontario
Canada, L4W 5B7
www.iS5Com.com



with domestic and
imported parts


iROC Model Name

iRC-1-W10-2A-XX



Serial Number

MR320521-00010



Version

10.3.1





MAC Address

E8E875908345

Base

E8E875908356

Ext ETH

Windows 10 Product Key

W269N-WFGWX-YVC9-4J6C9-T83GX

The iROC module options for the MicroRAPTOR are as follows:

Option	Order Code	Description
Model	iRC	iROC Computing Module, <i>HDMI</i> version 1.4 port supporting 1080p, USB 2.0 Port, USB 3.0 Port, RS 232 Console Port, 10/100/1000TX RJ45 Ethernet Port
CPU and Memory	1	Intel E3940, 4-core, 4-threads, 1.6 GHz, with 8GB LPDDR4 Memory.
Operating System	W1	Windows 10 Professional
	C8	Linux CentOS 8.2
Storage	2A	256 GB SSD with an operating temperature range of -40°C to +70°C. It has a SATA III 6 Gbps interface and 3K P/E cycles.

Option	Order Code	Description
	5A	512 GB SSD with an operating temperature range of -40°C to +70°C. It has a SATA III 6Gbps interface and 3K P/E cycles.
	1T	1 TB Industrial SSD Storage temperature range of -40°C to +70°C. It has a SATA III 6Gbps interface and 3K P/E cycles.
	2T	2 TB Industrial SSD Storage temperature range of -40°C to +70°C. It has a SATA III 6Gbps interface and 3K P/E cycles.
Software Package	XX	None
Module Notes		The LEDs on the console port of the iROC are nonoperational at this time. Note that the USB can supply up to a maximum of 500 mA.

2.4. iROC Network Interfaces on the iMR920

The following table describes the iROCs Ethernet connections and how they appear in CentOS and Windows.

Table 3: Ethernet Connection Names

Connection	CentOS	Windows
Front-panel RJ45 Ethernet	Shows up as enp4s0	Shows up as Ethernet 4 (Intel(R) I211 Gigabit Network Connection)
Back-plane Ethernet connection 1	Shows up as enp1s0	Shows up as Ethernet 5(Intel(R) I210 Gigabit Backplane Connection)
Back-plane Ethernet connection 2	Shows up as enp2s0	Shows up as Ethernet 6(Intel(R) I210 Gigabit Backplane Connection)

This table describes how the iROC backplane connections are mapped to the switch.

Table 4: Ethernet Connection Mapping

iROC Slot Location	enp1s0/Ethernet 5	enp2s0/Ethernet 6
LM2	Gi0/9	Gi0/13

2.5. Power Supply Options

Power supply options are factory configured and not customer changeable. If the HV option is selected, then there is no option to equip the iMR920 with a redundant power supply. The iMR920 may be equipped with a redundant DC power supply.

Part #	Description	Nominal Range/ Operating Range
LV	Low Voltage Power Module	24 VDC Nominal <ul style="list-style-type: none"> • 10-36 VDC Operational • 50W
MV	Medium Voltage Power Module	48 VDC Nominal <ul style="list-style-type: none"> • 36-72VDC Operational • 50W
HV	High Voltage Power Module	100-240 VAC Nominal <ul style="list-style-type: none"> • 50/60 Hz • 85-264 VAC Operational • 50W 100-240VDC Nominal <ul style="list-style-type: none"> • 88-300 VDC Operational • 50VA

3. Chassis

Figure 1: Front View of iMR920



Figure 2: Side View of Chassis with a CD Card Cover, depth is shown in inches (mm)

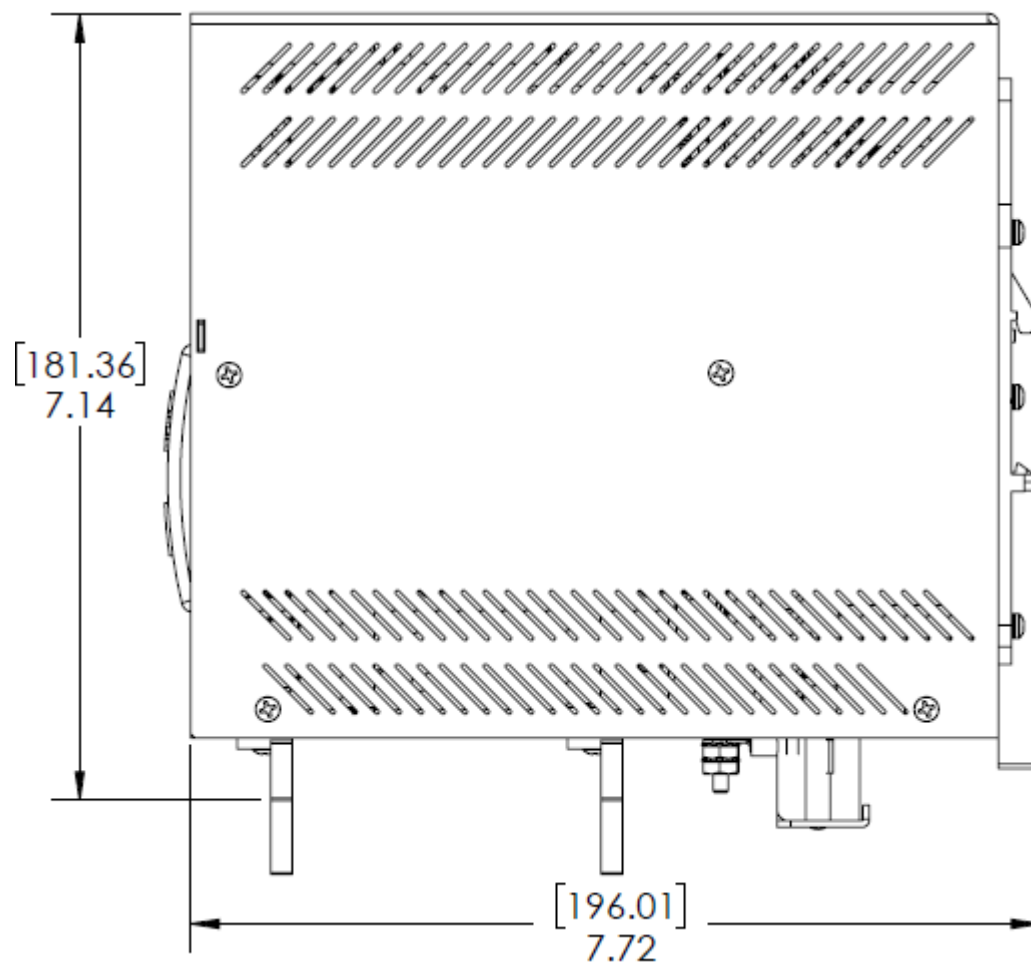


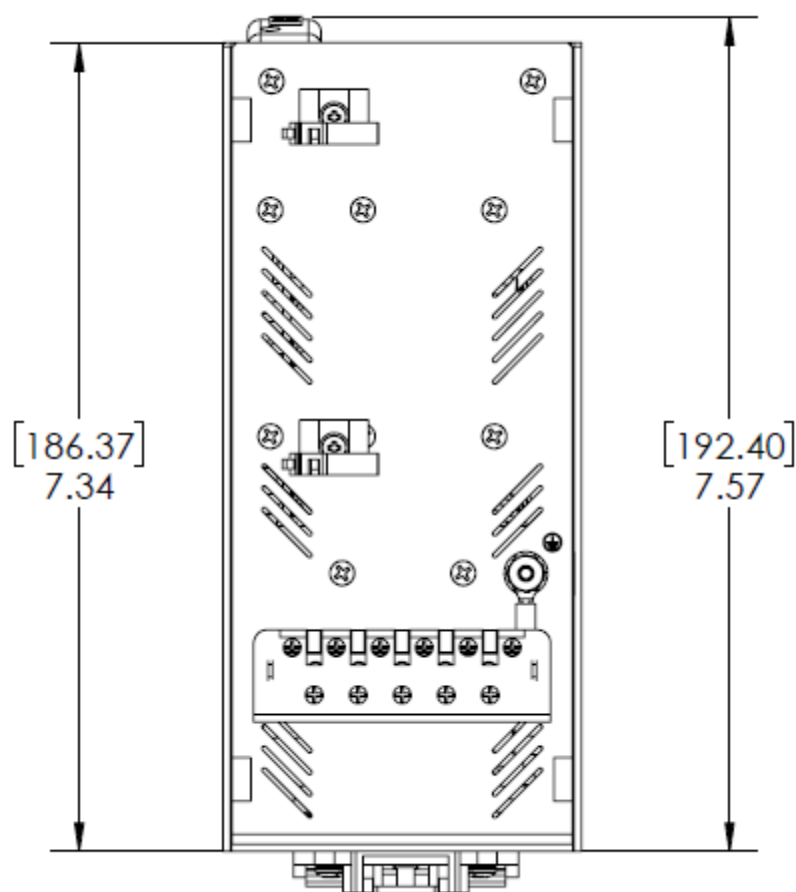
Figure 3: Bottom view of the iMR920

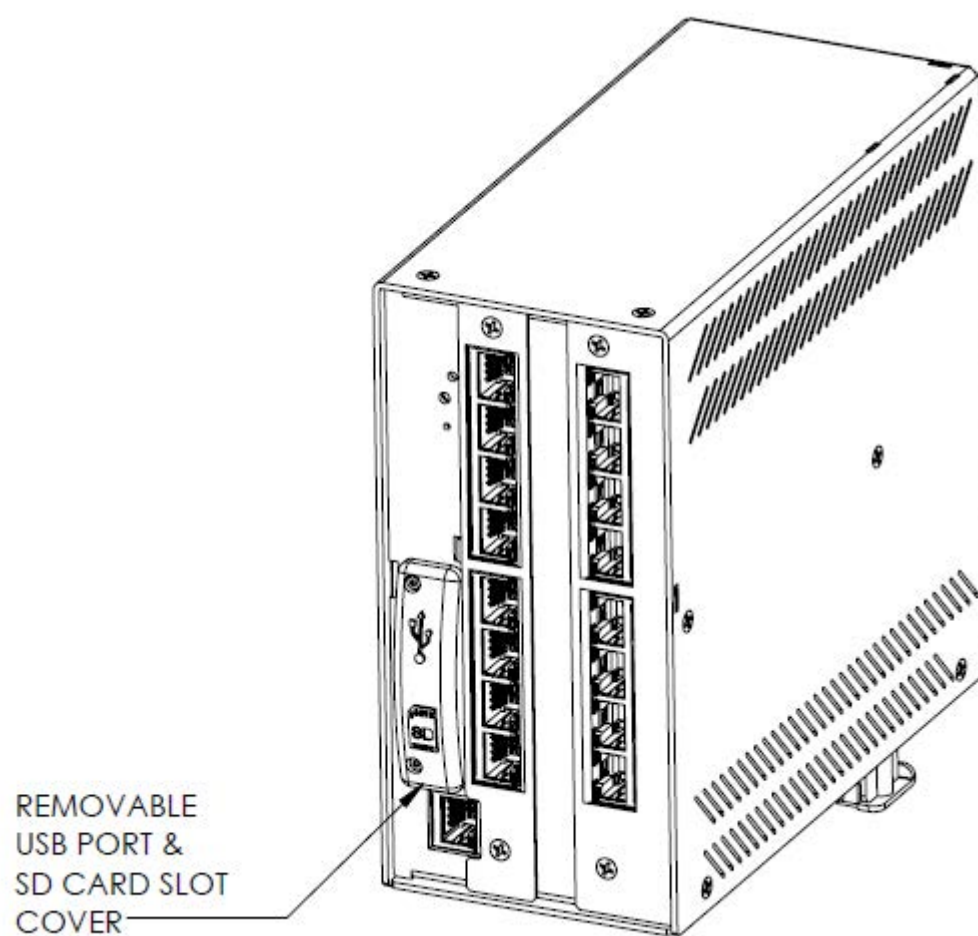
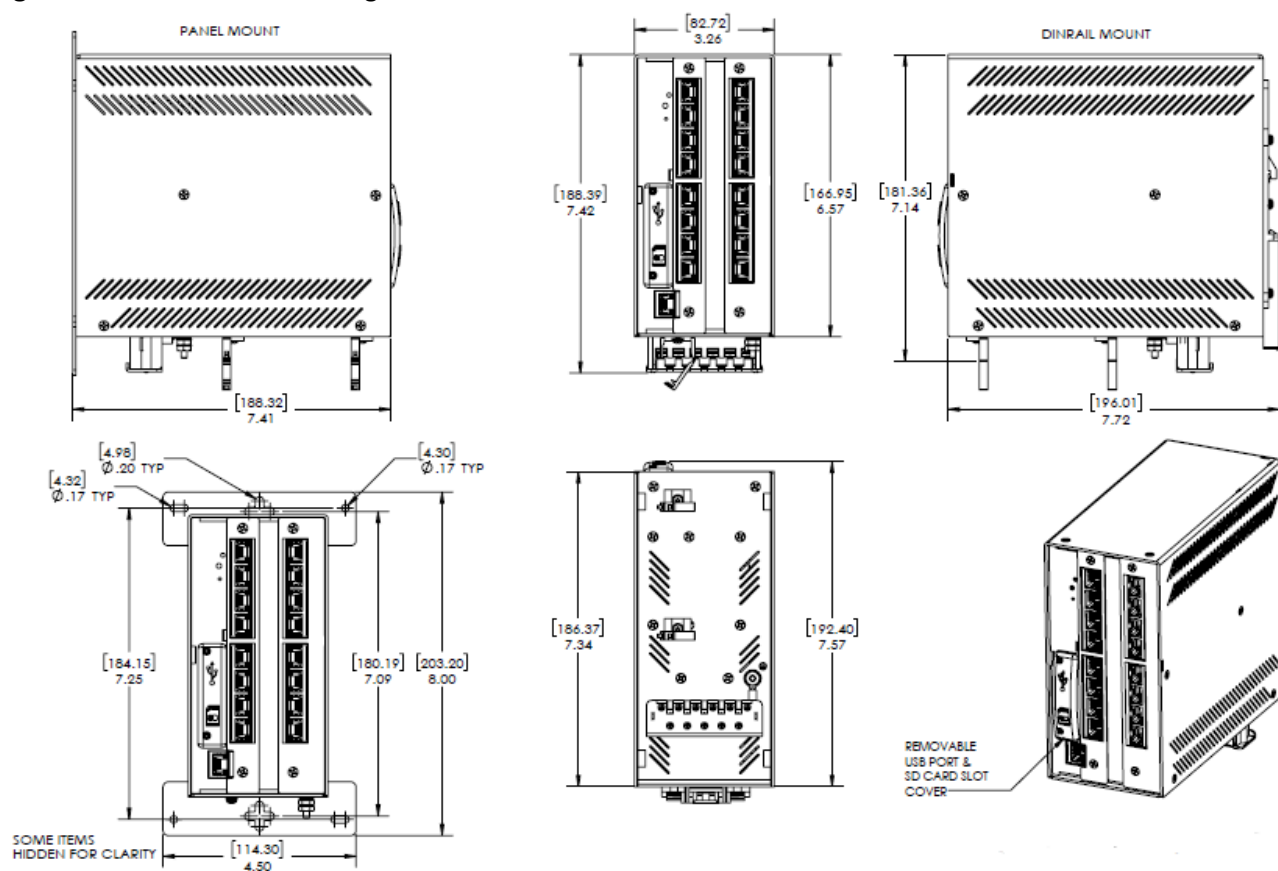
Figure 4: Orthogonal view of the iMR920

Figure 5: Mechanical Drawing of Chassis



NOTE: All dimensions are shown in inches (millimeters).

4. iMR920 Panels Description

This section contains views of the front and back panels of the iMR920. The locations of the power modules, interface module slots, and status indicators are shown.

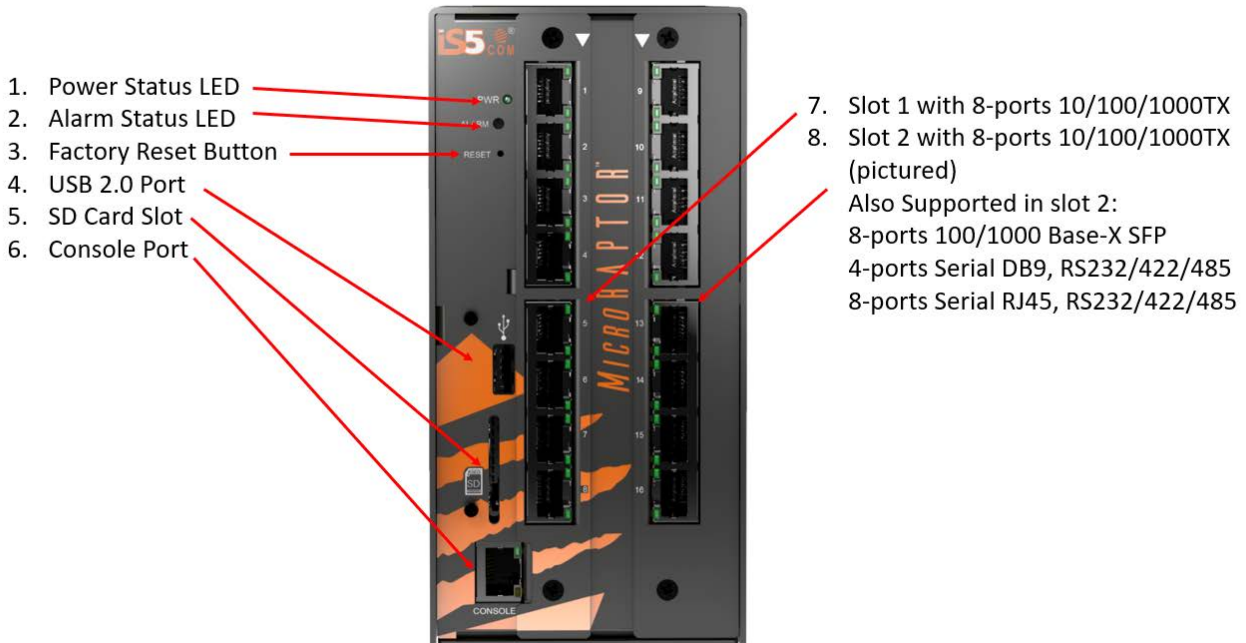
The product label is located at the bottom of the unit.

Figure 1: Product Label

		<p>5895 Ambler Drive Mississauga, Ontario Canada, L4W 5B7 www.iS5Com.com</p>			
Model Number					
iMR320-MV-LV-D-8GRJ45-8GRJ45-XX					
					
MAC Address			Date Manufactured		
E8E8750046DE			05/05/20		
					
Serial Number			Firmware		
MR320720-0002			Ver. 1.2.23		
					
<p>This device complies with Part 15 of the FCC Rules. Operation is subject to the condition that this device does not cause harmful interference. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.</p>					
					

4.1. Front Panel Elements

Figure 2: Front Panel Elements



NOTE: SD Cover plate is not shown in [Figure 2](#)

NOTE: Slot 2 is shown unpopulated and is factory configurable with either 8-ports RJ45 or 8 empty SFP cages.

- 1) **Power Status LED**—the light-emitting diode (LED) indicates the status of the power supply modules.
- 2) **Alarm Status LED**—the light-emitting diode (LED) indicates the status of alarms on the iMR920.
- 3) **Factory Reset Button**—this button is used to reset the iMR920. Depressing it for 2 seconds will reboot the iMR920. Depressing the button for 10 seconds will start a reboot and give the opportunity for a user at the console to perform a factory reset. If there is no user intervention at the console after the factory reset button has been held for 10 seconds, the iMR920 will simply reboot.
- 4) **USB Port** can be used to upgrade or back up the *MicroRAPTOR*'s software or configuration files.
- 5) **SD Card** port may be used to store Syslog files.
- 6) **RS232 Serial Console Port**—this port is for interfacing directly with the device and accessing management functions via serial interface.
- 7) **Slot 1**- This slot supports 8-ports RJ45 10/100/1000TX
- 8) **Slot 2**- This slot supports the following factory configured options:
 - 8-ports RJ45 10/100/1000TX
 - 8-ports SFP 100/1000 Base-X

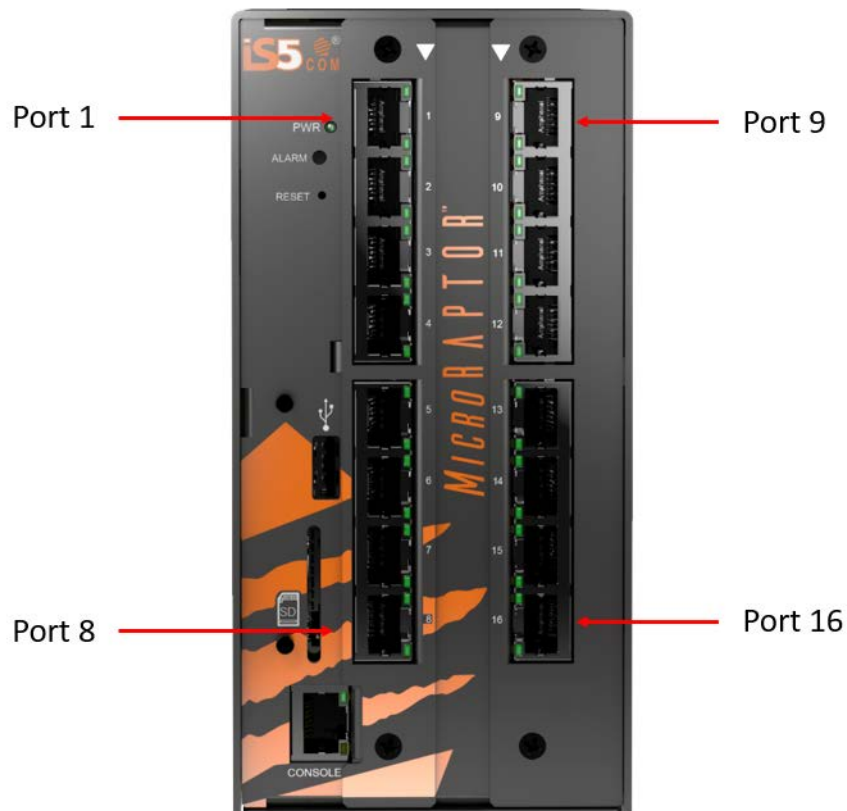
- 4-ports Serial DB9, RS232/422/485
- 8-ports Serial RJ45, RS232/422/485

4.2. LED Indicators Summary

TYPE	DESCRIPTION	Description
PWR	Power Status LED	Green: OK; No light: No power
Alarm	Alarm Indicator LED	Indicates when an alarm condition exists; Red: Alarm is on, No light means no active alarm.
Console	LEDs	Not operational

4.3. Port Layout

The image below shows how the ports are numbered on the iMR920.



5. Mounting and Installing the iMR920

The iMR920 is designed for maximum mounting and display flexibility. It can be equipped with DIN, panel or no mount options.

5.1. Prevention of Electrostatic Discharge Damage

The device components are prone to electrostatic discharge (ESD) damage. ESD damage, which can cause intermittent or complete component failures, can occur by voltages as low as 30 V. Potentially destructive static voltages can happen during handling of plastic or foam packing material or when moving components across plastic or carpets.

Some guidelines to minimize the potential for ESD damage are:

- Always use an ESD wrist strap when you are working with components that are subject to ESD damage, and make sure that ESD wrist strap is in direct contact with your skin.
- If a grounding strap is not available, then to ground yourself, touch the exposed bare metal of the device with the other hand immediately before inserting the component into the device.



To ensure protection by the ESD strap, periodically check its resistance value.

The measured value must be in the range between 1 and 10 MΩ.

- When handling any component that is subject to ESD damage and is to be removed from the device, make sure the equipment end of your ESD wrist strap is attached to the ESD point on the chassis.
- Avoid contact between the component that is subject to ESD damage and clothing. ESD voltages emitted from fabric can damage components.
- When removing or installing a component that is subject to ESD damage, always place its components upside on an antistatic surface, in an antistatic card rack, or in an antistatic bag. If you are returning a component, place it in an antistatic bag before packing it.

5.2. Before Installation

- Ensure that you understand how to prevent ESD damage.
- Place the rack in its permanent location, allowing adequate clearance for airflow and maintenance, and secure it to the structure.
- Remove the switch from the shipping package.

- Ensure that you have all necessary parts and tools needed to mount the switch on the rack.



Do not plan to use the device in a location where children are likely to be present.

5.3. Unpacking Device

- Inspect the package for damage before opening.
- Open the package and visually inspect all items for issues.
- Confirm that all items are available.



If there any missing or damaged items, contact iS5Com Support.

5.4. General Procedure for Installing and Starting the iMR920

- Review the Compliance Specification for any regulatory requirements.
- Mount the device.
- Connect the failsafe alarm relay.
- Connect power to the device and ground the device.
- Connect the device to the network.
- Configure the device.



This equipment is intended only for use in a restricted access area.

5.5. Electrical / Mechanical Hazards Prevention

- When installing the device in a closed or multi-device rack, be aware that the operating ambient temperature of the rack may be higher than the ambient temperature of the room. Make sure the rack is installed in a suitable environment that can withstand the maximum ambient temperature generated by the rack.
- Do not exceed the maximum number of devices or weight restrictions specified by the rack manufacturer.
- Do not overload the supply circuit. Refer to the overcurrent protection and power supply ratings specified by the rack manufacturer.

- Make sure the rack and all devices have a proper ground-to-Earth connection. Pay particular attention to power supply connections other than direct connections to the branch circuit (e.g. power strips). Ensure that the rack mount adapters are installed on the correct side of the chassis.



Electrocution hazard – risk of death, serious personal injury and/or damage to the device.



Caution – Access to wiring terminals and replaceable modules is restricted to Skilled Persons only.

5.6. Humidity and Dust Hazards

Do not store the switch in locations where it will be subject excessive dirt and dust and high humidity. Conformal coating is recommended for humid / moist applications.

5.7. Mounting Raptor on a DIN Rail

Install DIN mount kit on the rear of the iMR920.

Figure 1: Exploded view of DIN mount kit

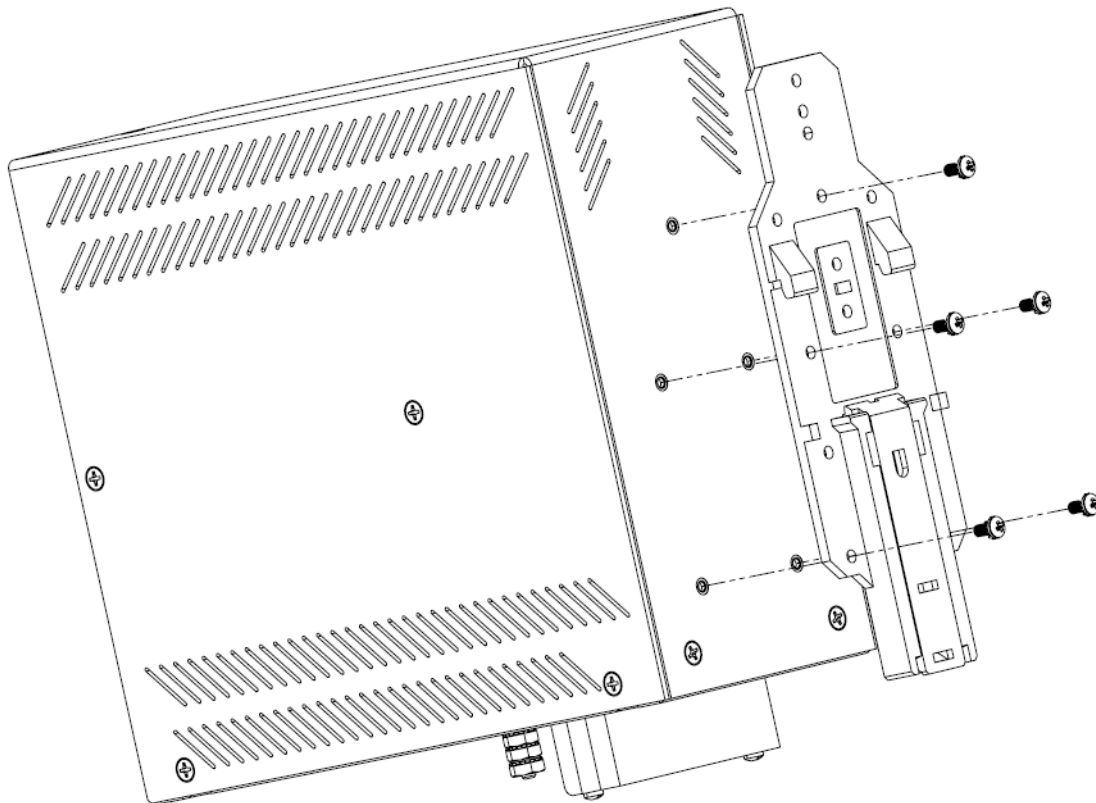
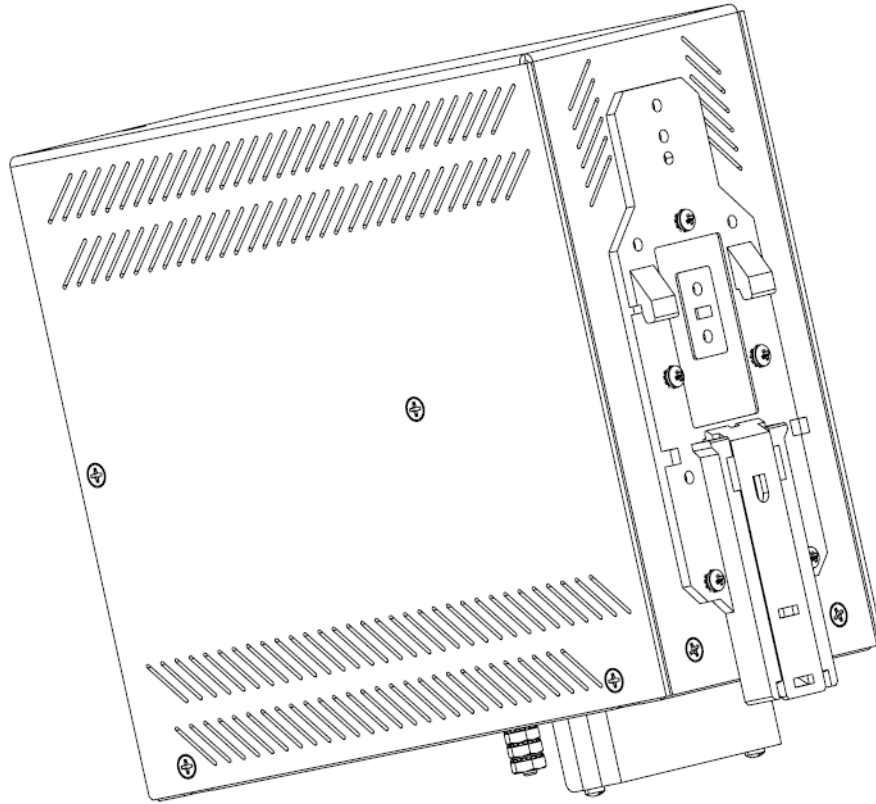


Figure 2: DIN mount kit mounted on the rear of the iMR920



To secure the device to a standard DIN rail, perform the following:

- 1) Securely install the DIN rail.
- 2) Place the iMR920 on the rail, then tilt the iMR920 to hook the DIN mount rail tabs over the top edge of the DIN rail.
- 3) Use a flat head screw driver to pull down the locking clip, and then push the iMR920 down and in, the locking clip can then snap over the bottom edge of the DIN rail.
- 4) The iMR920 will now be secured to the DIN rail.

5.8. Mounting iMR920 in a Panel

Figure 3: Exploded view of Panel Mount

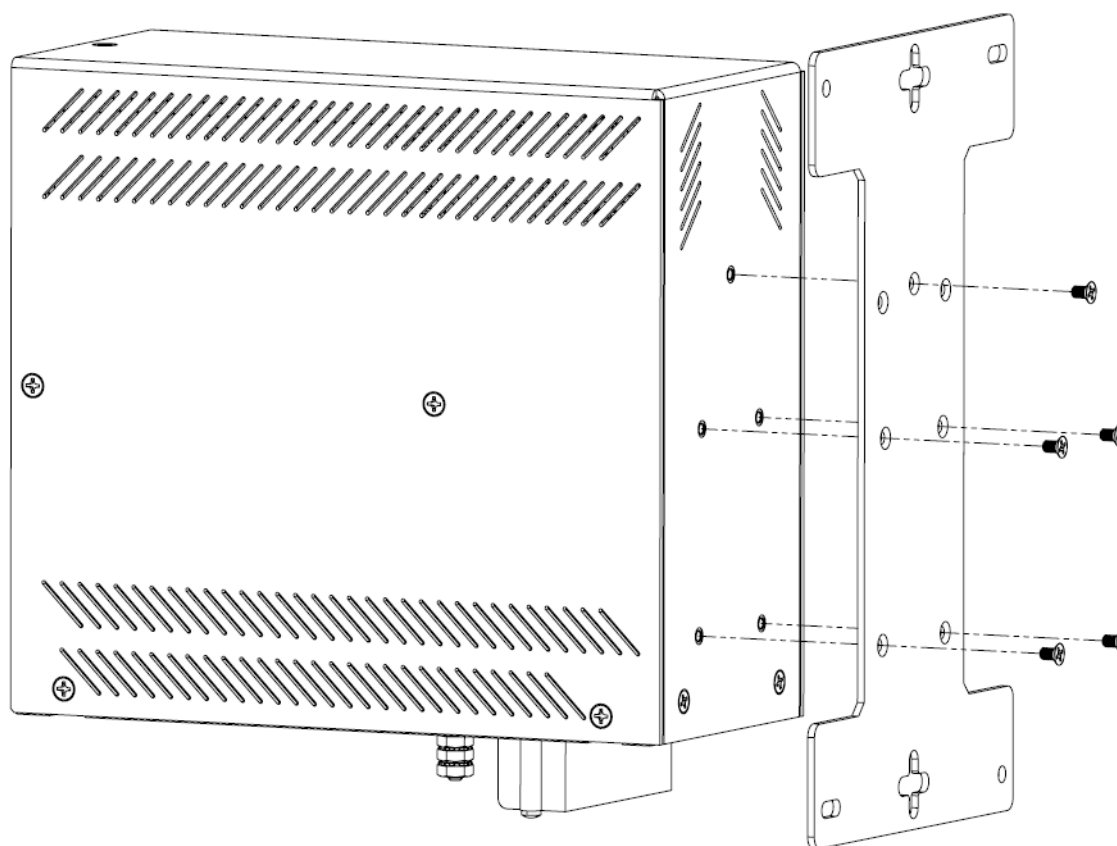
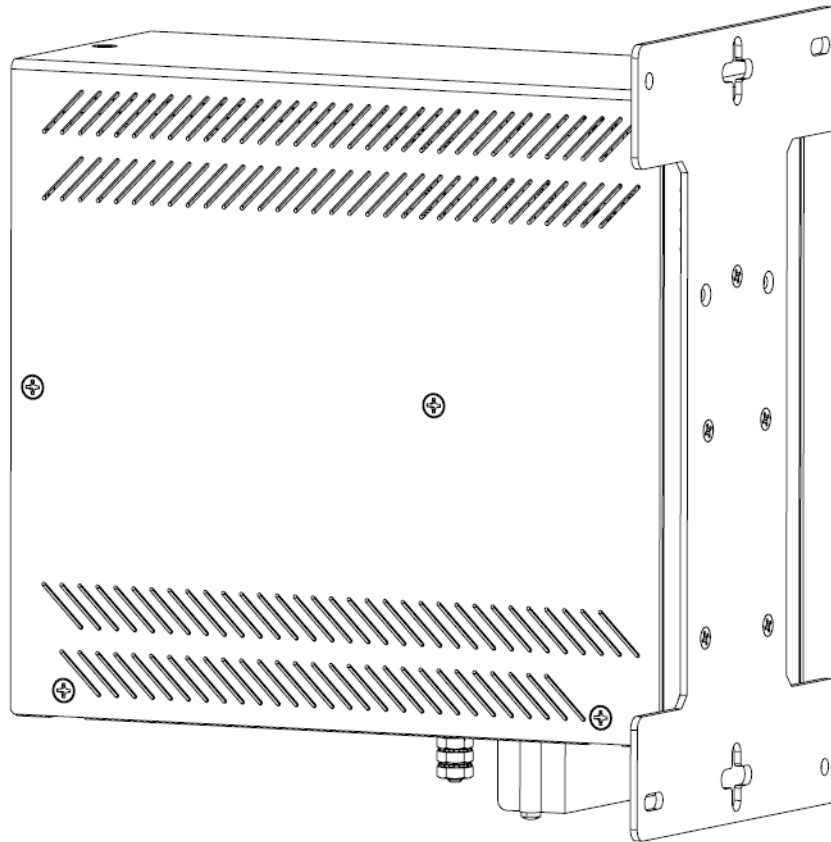


Figure 4: Assembled view of Panel Mount

5.9. Equipment Needed for iMR920 Panel Installation

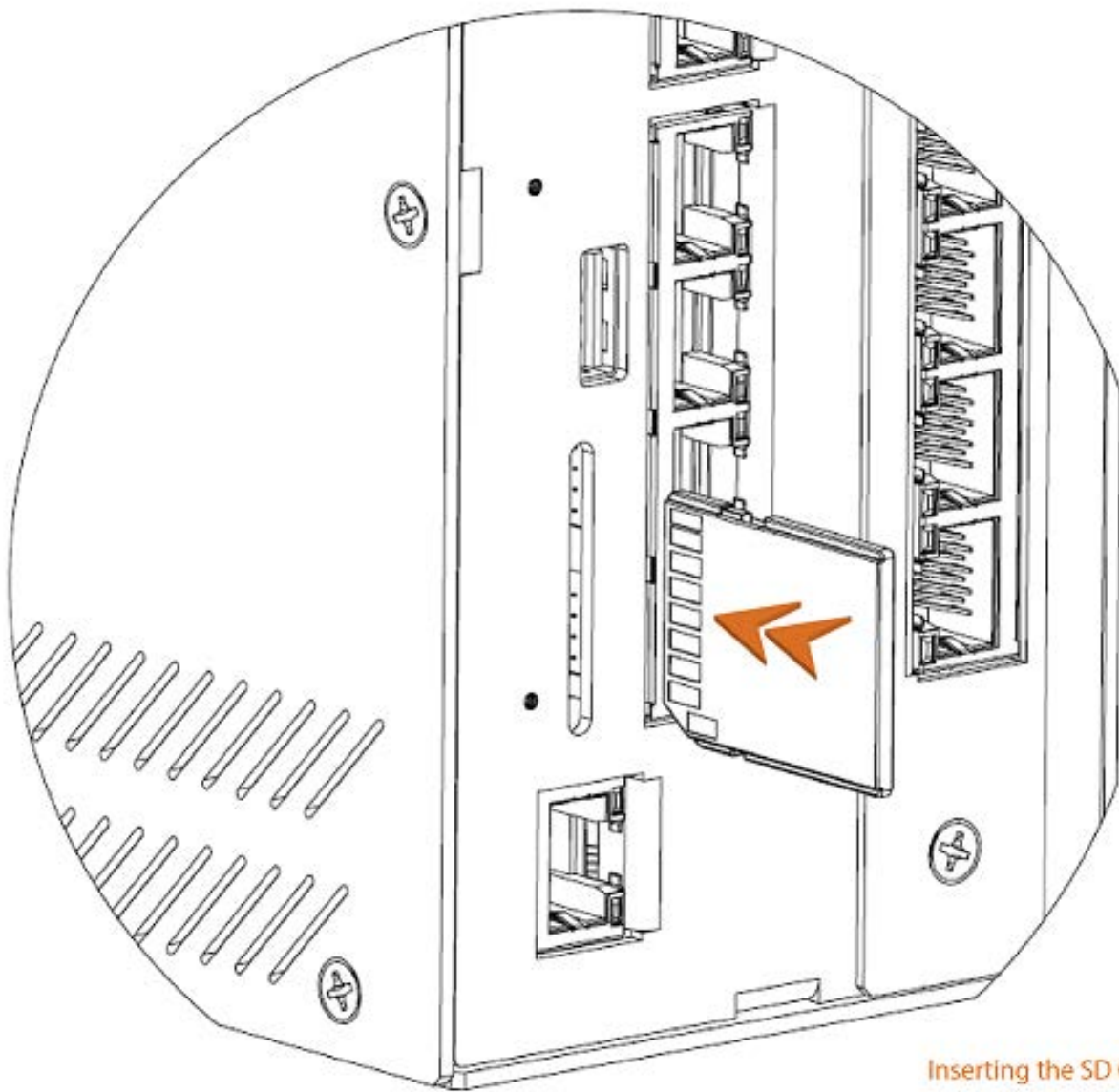
PART #	QTY	DESCRIPTION
1	5 (included)	Mounting screw M3 x 0.5, 8mm Length
2	1 (included)	Mounting bracket, suitable for maximum M4 screws, or equivalent, to panel
3	1 (not included)	Phillips Screwdriver

6. SD Card Insertion and Removal

The iMR920 supports an SD Card for useful operations such as downloading and uploading files, see the user guide for details on what operations can be performed with the SD Card. This section shows how the SD card may be inserted and removed from the iMR920

CONTEXT: The SD Card is covered by a protective piece of hardware. This section shows how to remove and that cover and install the SD Card.

Figure 1: Inserting SD Card in SD Slot (correct orientation shown)



Inserting the SD Card

1. Uninstall the SD card cover by removing the screws. This requires a 1.5mm Hex Key Allen wrench.
2. Insert the SD card as shown in [Figure 1](#) until a click is heard. Ensure that the correct orientation is used.

STEP RESULT: The SD Card has been inserted into the slot.

3. Re-attach the SD Card cover by screwing it back into place.

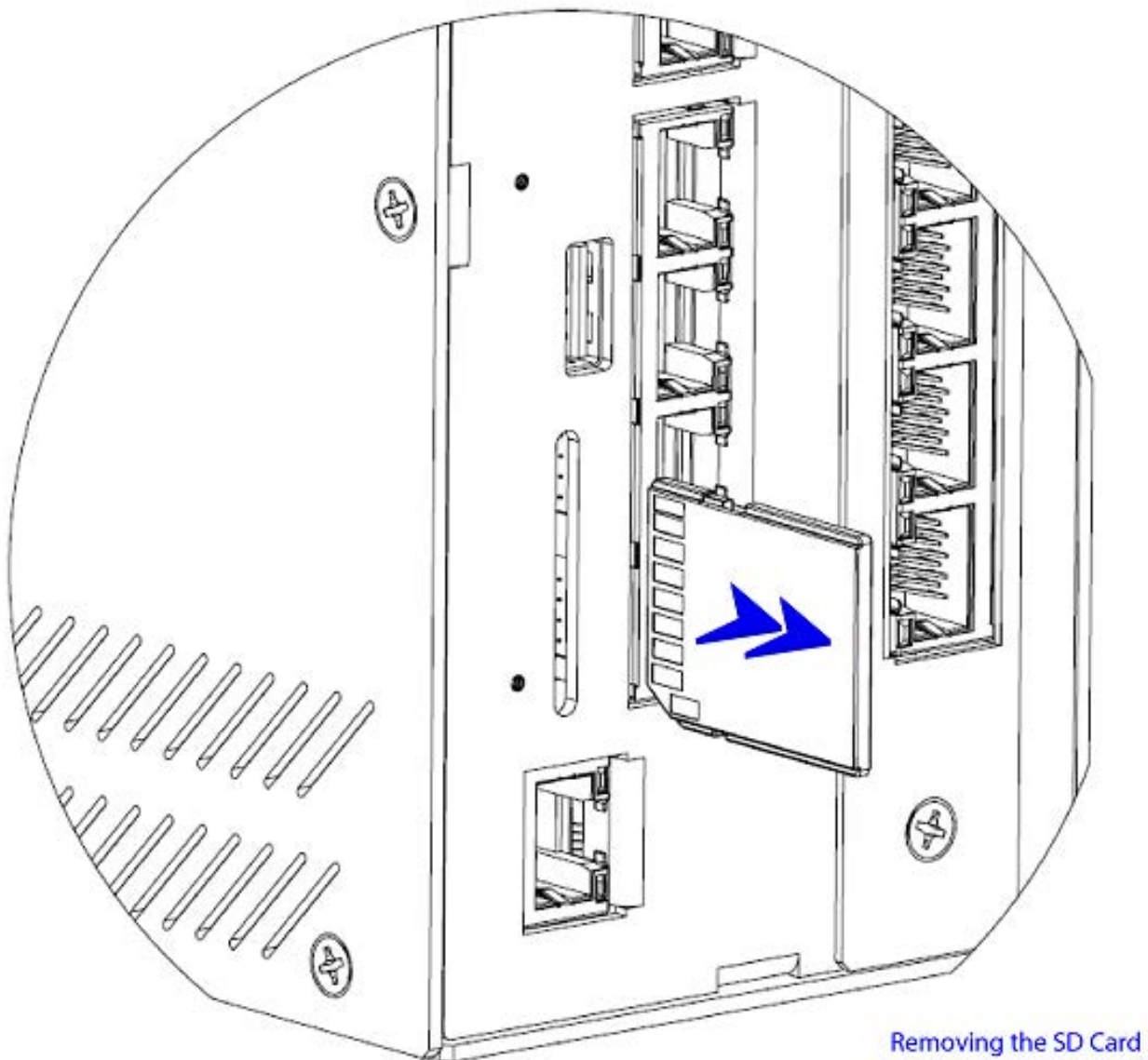
RESULT:

The SD Card has been installed into the iMR920

6.1. Removing SD Card

CONTEXT: This section describes the removal of the SD Card.

Figure 2: Removing the SD Card from SD Slot



1. If SD Cover is in-place, uninstall the SD card cover by removing the two screws affixing it.
2. Push on the SD card gently until a click is heard.

STEP RESULT: This click is the sound of the spring mechanism unlocking. Once the pressure of your finger is release the SD card should begin to be ejected from the slot.

3. Remove the SD card from the slot.
4. Replace the SD card cover and reattach the screws. This requires a 1.5mm Hex Key Allen wrench.

RESULT:

The SD Card has been removed from the iMR920

7. Electrical Wiring

iMR920 supports up to one HV power supply or dual DC power supplies. The connections for the power supply are located on the terminal block.

CONTEXT:



Electrocution hazard – risk of death, serious personal injury and/or damage to the device.



Electrical hazard – risk of damage to equipment. Do not connect AC power cables to a 24 or 48 power supply terminal block. Damage to the power supply may occur.

Caution – Access to wiring terminals and replaceable modules is restricted to Skilled Person only.



Multiple power source – redundant power. Disconnect all power sources.

7.1. Hi-Pot Testing Instructions for High Voltage Power Supplies

Hi-Pot Testing is a dielectric test meant to ensure that no current will flow from one point to another point. This test necessarily involves high voltages and must only be performed by qualified electrical engineers and technicians.

CONTEXT:



Electrical hazard – above ES2 limits. To be accessible by Skilled Persons only

The following instructions apply to **High Voltage** Power Supplies

1. Disconnect the Terminal Block Mating Connector from the MicroRAPTOR unit.
2. Apply 1.5KV for 10 seconds between Line input pin of the HV power path (refer to the terminal block label) and the chassis ground (the stud). Ensure that leakage current is less than 20mA for a pass.
3. Apply 1.5KV for 10 seconds between the Neutral input pin of the HV power path (refer to the terminal block label) and the chassis ground (the stud). Ensure that leakage current is less than 20mA for a pass.
4. Attach the Terminal Block Mating Connector back to the MicroRAPTOR unit.

RESULT:

Hi-Pot testing on the High Voltage Power supply is complete.

7.2. Hi-Pot Testing Instructions for Medium Voltage Power Supplies

Hi-Pot Testing is a dielectric test meant to ensure that no current will flow from one point to another point. This test necessarily involves high voltages and must only be performed by qualified electrical engineers and technicians.

CONTEXT:



Electrical hazard – above ES2 limits. To be accessible by Skilled Persons only

The following instructions apply to **Medium Voltage** Power Supplies

1. Disconnect the Terminal Block Mating Connector from the MicroRAPTOR unit.
2. Apply 500V for 10 seconds between the positive input pin of the MV power path (refer to the terminal block label) and the chassis ground (the stud). Ensure that leakage current is less than 20mA for a pass.
3. Apply 500V for 10 seconds between the negative input pin of the MV power path (refer to the terminal block label) and the chassis ground (the stud). Ensure that leakage current is less than 20mA for a pass.
4. Attach the Terminal Block Mating Connector back to the MicroRAPTOR unit.

RESULT:

Hi-Pot testing on the Medium Voltage Power supply is complete.

7.3. Power Inputs and Fault Relay

The relay contact of the terminal block connector is used to detect user-configured events. The switch provides fail open and fail close contacts to form relay circuits based on requirements. If the device is not powered, or if an active alarm is present, the relay de-energizes, therefore initiating the NO and NC states. The contacts are energized upon power up of the unit and remain energized unless a critical error occurs. One common application for this output is to raise an alarm if a power failure or removal of control power occurs.

CONTEXT: Summary

Table 1: Relay States

Event	NO (Normally Open)	NC (Normally Closed)
No Alarm	Closed	Open
Alarm Present	Open	Closed

7.4. Connecting AC Power

PREREQUISITE:

All equipment must be installed according to applicable local wiring codes and standards.

Always use cables that are rated for the operating ambient temperature of 85°C.

For 100-240 VAC rated equipment, protection for earth fault is provided by max. 20 A branch circuit from AC input in building installation. The protection in the building installation is relied upon for short-circuit backup protection.

- The specification for AC breaker is 5 A, 2P, 277 VAC (min) Circuit breaker, Thermomagnetic or equivalent type.
- The plug connector and wire gauge sizing is to be selected with appropriate design as per the Electrical code for a 60W, 1-phase device.

Note for IT power distribution systems:

- 1) This product is also designed for IT power distribution system with phase-to-phase voltage 230 V.
- 2) This equipment must be connected to an earthed mains socket-outlet.

Before attaching wires to the lug type terminal block remove the protector cover, shown in [Figure 1](#). Re-attach the cover once the wires have been screwed in place.

Figure 1: Protective cover for lug terminal block, showing its placement

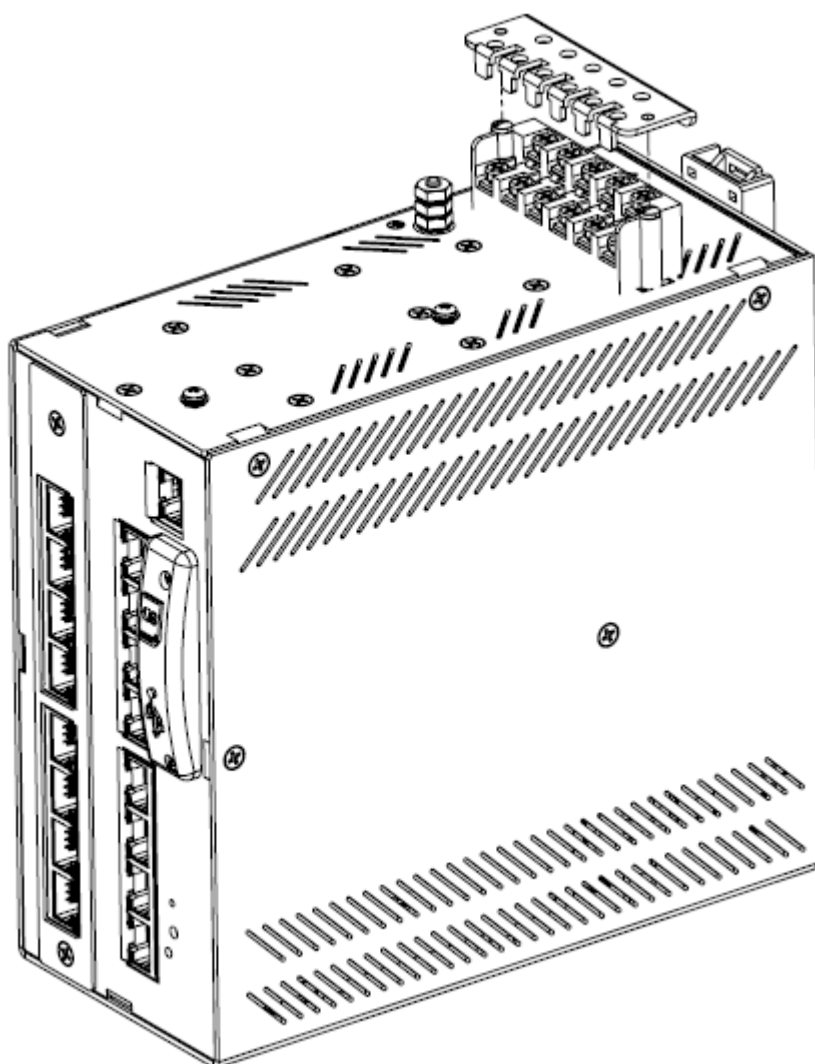


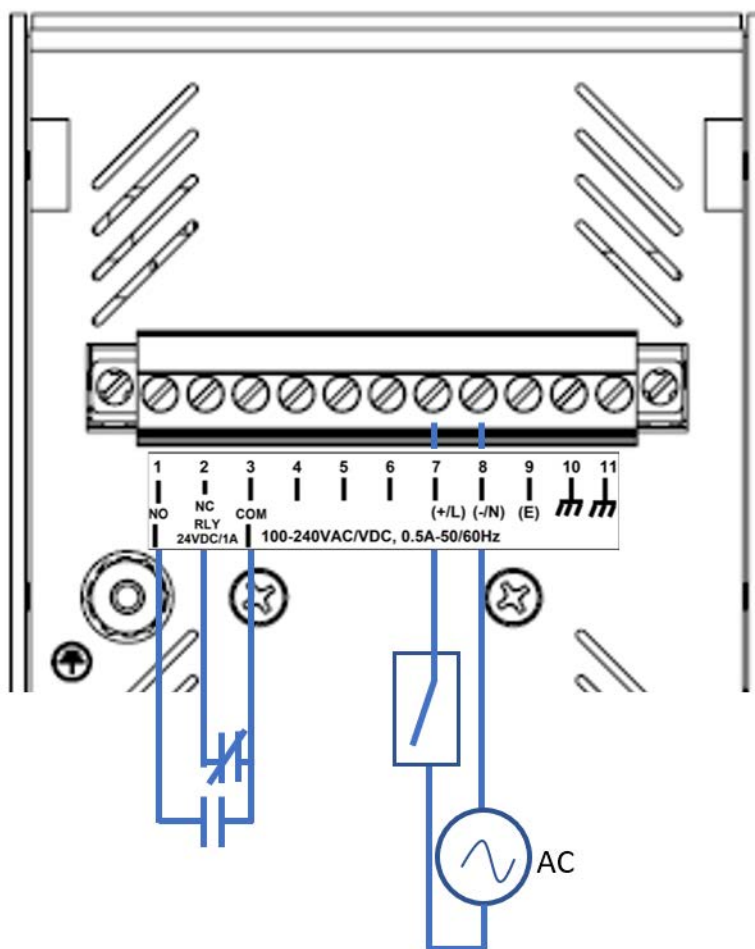
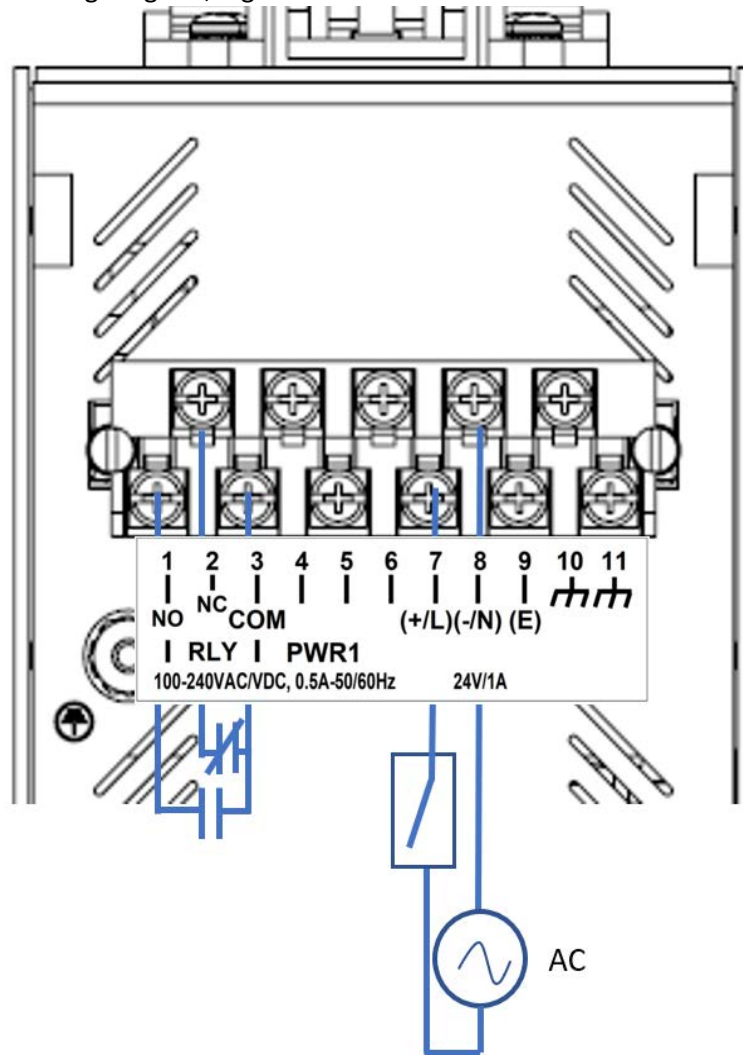
Figure 2: 100-240 VAC Wiring Diagram, raw wire terminal block

Figure 3: 100-240 VAC Wiring Diagram, lug terminal block

L—stands for Live N—stands for Neutral

NO—Normally Open (open = open circuit = not creating a path for the current)

NC—Normally Closed (closed = short circuit = creating a path for the current)

PE—Protective Earth (earth Ground point in the electrical circuit)

To establish AC power connection with the power source turned off, follow the steps below. When following the instructions, refer to [Figure 2](#).

1. Connect the ground from the first power source to GND terminal screw (screw #9).
2. Connect the Live from the first power source to the PWR V+/L terminal screw (screw #7).
3. Connect the Neutral from the first power source to the PWR V-/N terminal screw (screw #8).

To keep the wires from pulling loose, use a small flat-blade screwdriver to tighten the wire-clamp screws on the front of the terminal block connector.

4. After wiring is completed, it is recommended that strain relieving tie wraps be installed. See section [7.8. Strain Relief Feature](#)
5. Connect screw #5 to the ground of the chassis.

7.5. Connecting DC (100-240VDC) Power

CONTEXT:

Figure 4: 100-240 VDC Wiring Diagram, raw wire terminal block

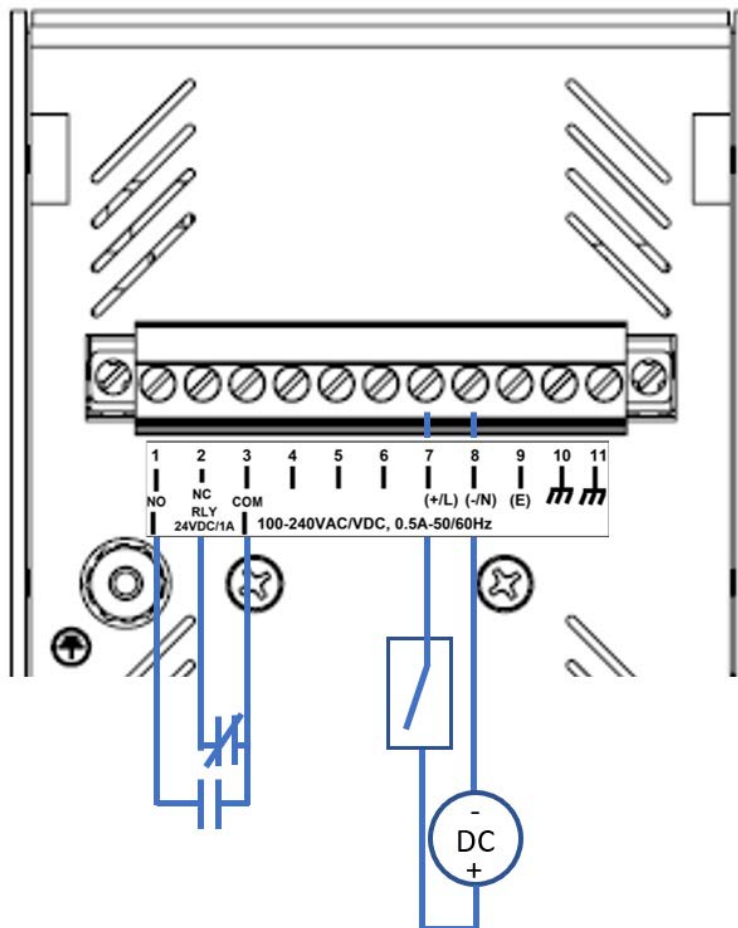
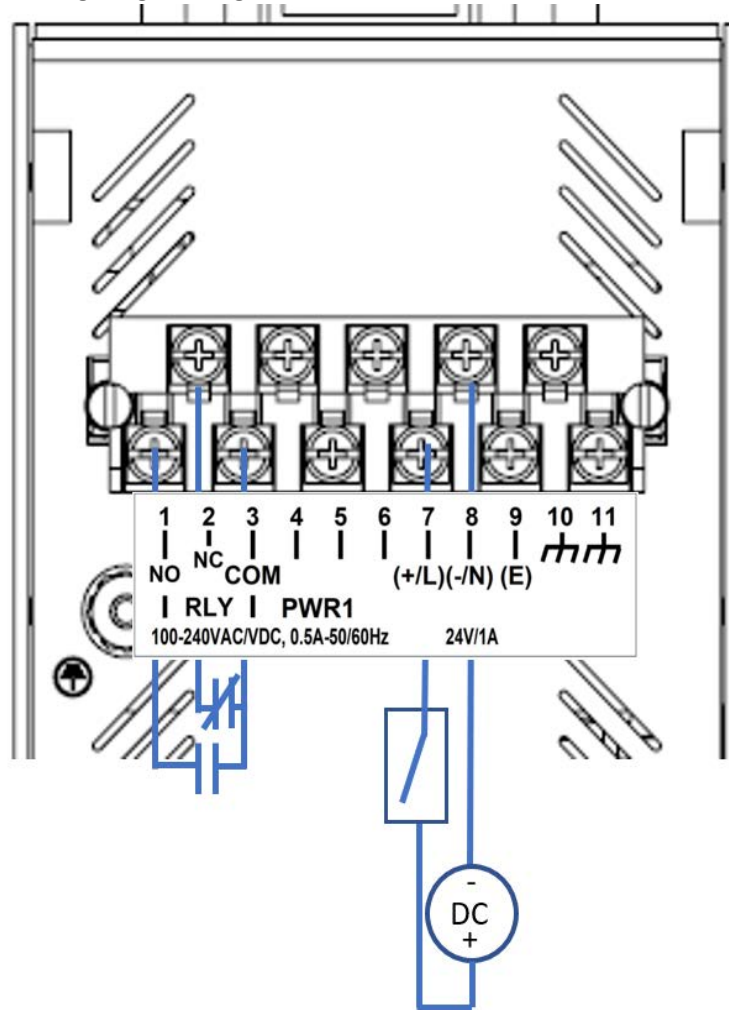


Figure 5: 100-240 VDC Wiring Diagram, lug terminal block

For 100-240 VDC rated equipment, an appropriately rated DC circuit breaker must be installed.

- The specification for HV DC breaker is 5 A, 2P, 300 VDC (min) Circuit breaker, Thermomagnetic or equivalent type. A recommended option for this circuit breaker is: Model No. CX2-B0-14-450-22A-13G, Molded Case Circuit Breaker, 2 P, 5 A, 250/500 VDC.
- Wire gauge sizing is to be selected with appropriate design as per the Electrical code for a 60 W, 1-phase device.

Equipment must be installed according to applicable local wiring codes and standards.

With the power source turned off, refer to figure [Figure 4](#) and perform the following steps:

For a DC Power Supply, carry out steps 1 through 2.

1. Connect the positive wire from the power source to the positive/live (+/L), screw #7, terminal on the terminal block.
2. Connect the negative wire from the power source to the neutral/negative (-/N), screw #8, terminal on the terminal block.

After wiring is completed, perform the following:

3. Connect screw #9 to the ground of the chassis. The ground terminal is used as the ground conductor for surge and transient suppression circuitry internal to the unit.

7.6. Connecting DC (24VDC or 48VDC) Power

CONTEXT:

Figure 6: 24VDC or 48VDC Wiring Diagram

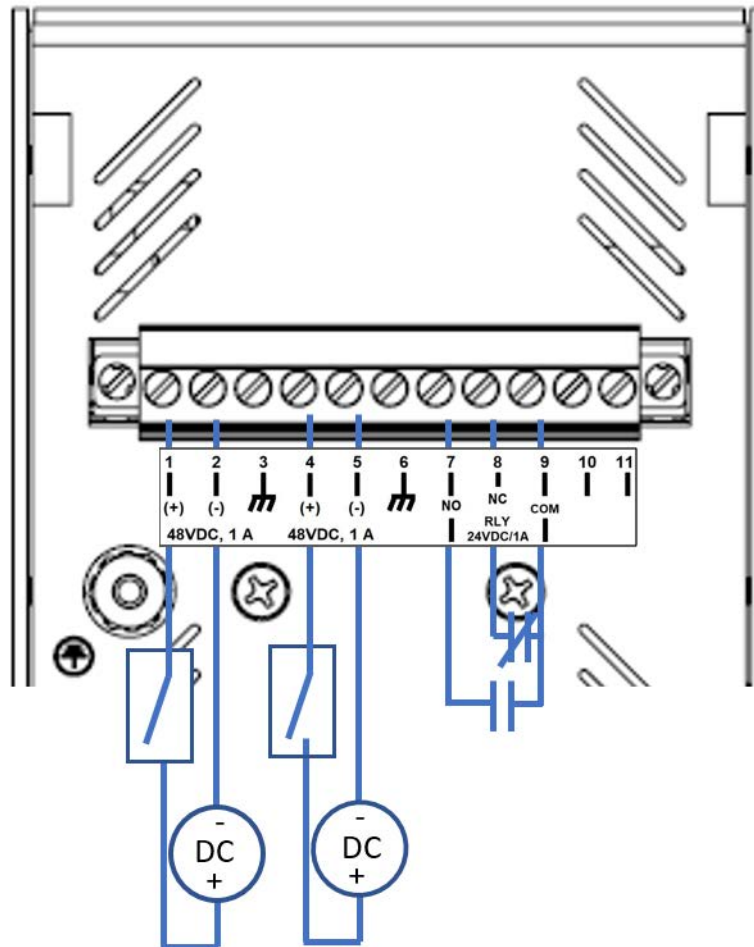
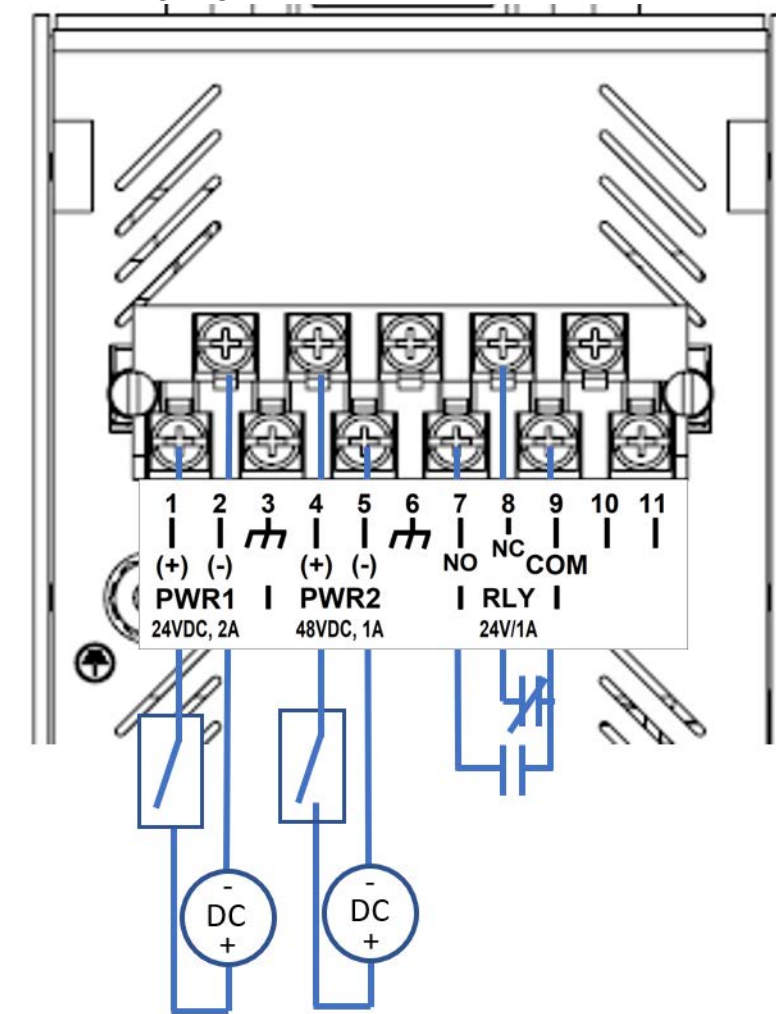


Figure 7: 24VDC or 48VDC Wiring Diagram

Equipment must be installed according to applicable local wiring codes and standards.

With the power source turned off, refer to figure [Figure 6](#) and perform the following steps:

For a DC Power Supply in PS1, carry out steps 1 through 2.

1. Connect the positive wire from the power source to the positive/live (+/L), screw #1, terminal on the terminal block.
2. Connect the negative wire from the power source to the neutral/negative (-/N), screw #2, terminal on the terminal block.

If a DC Power Supply has been installed in PS2, perform the following steps.

3. Connect the positive wire from the power source to the positive/live (+/L), screw #4, terminal on the terminal block.
4. Connect the negative wire from the power source to the neutral/negative (-/N), screw #5, terminal on the terminal block.

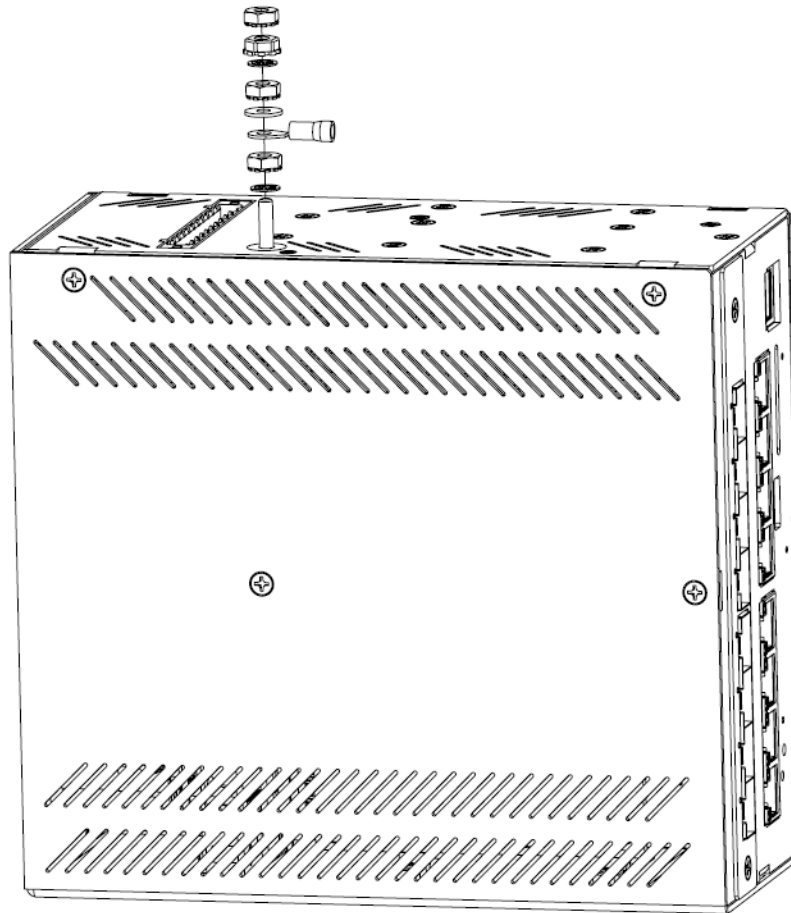
After wiring is completed, perform the following:

5. Connect screw #3 to the ground of the chassis. The ground terminal is used as the ground conductor for surge and transient suppression circuitry internal to the unit.

7.7. Connecting Ground Wire for Safety Precautions

CONTEXT:

Figure 8: Connecting Ground Wire



The earth ground connection must be verified by an electrical engineer or a service person skilled in electrical installation and grounding.

If the Raptor is used as cord-connected mains equipment, for reliable earthing, use it as:

- ◆ pluggable equipment type B, or
- ◆ stationary pluggable equipment type A in a location with equipotential bonding or with a permanently connected protective earthing conductor.

Figure 9: Connecting the braided cable from screw #4 to the chassis. Raw wire terminal block.

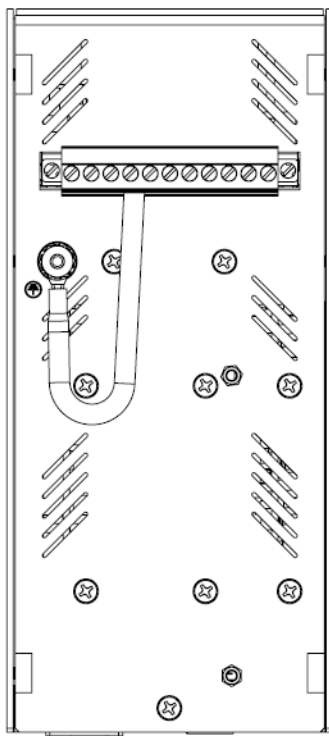
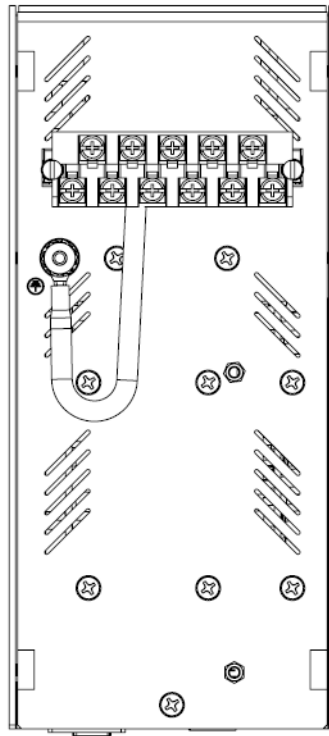


Figure 10: Connecting the braided cable from screw #4 to the chassis. Lug terminal block.

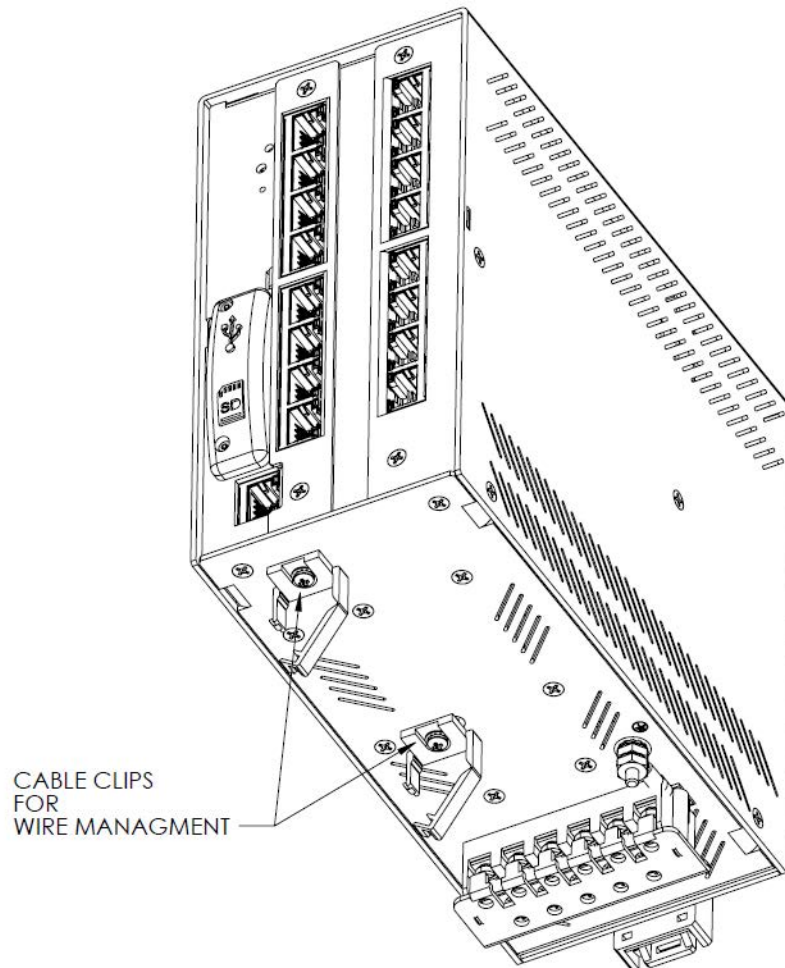


1. Using a braided wire or another appropriate grounding wire, connect the chassis ground connection of the device. The ground screws on the terminal block used for this connection depend on the power supply on the device. Refer to the terminal block label.

7.8. Strain Relief Feature

CONTEXT: The iMR920 provides clips for strain relief to the power cables.

Figure 11: Using strain relief



NOTE: iS5 recommends using the strain relief clips provided.

1. Pass the cable through the strain relief clips.
2. Snap the clips in place.

RESULT:

The cable will not be hanging freely from the terminal block, instead it will be more securely attached to the iMR920.

AFTER COMPLETING THIS TASK:

Periodically inspect the clips for signs of wear. Replace if they are showing cracks or becoming brittle with age.

8. Device Management

8.1. Serial Console

Figure 1: Serial Console



Connect a PC or terminal directly to the serial console to access the boot-time control and *MicroRAPTOR*'s interfaces. The serial console port provides access to the console interface.

The serial console port is RS232 with RJ45 connector with a console cable and port setup of 115200 bps, 8, N, no flow control.



The serial console is intended to be used only as a temporary connection during initial configuration or troubleshooting.

RS232 RJ-45 pin assignments are as follows:

PIN #	TYPE	ASSIGNMENT
1	RS232	RTS
2	RS232	
3	RS232	TX
4	RS232	GND
5	RS232	GND
6	RS232	RX
7	RS232	
8	RS232	CTS

8.2. Ethernet Ports & Communication Cabling

The *MicroRAPTOR* comes with standard Ethernet ports. According to the link type, the switch uses CAT 3, 4, 5, and 5e UTP cables to connect to any other network devices (computers, servers, switches, routers, or hubs).

For RJ-45 cable specifications, refer to the following table.

CABLE	TYPE	MAXIMUM LENGHT
10BASE-T	Cat. 3, 4, 5 100 Ω	UTP 100 m (328 ft)
100BASE-TX	Cat. 5 100 Ω UTP	UTP 100 m (328 ft)
1000BASE-T	Cat. 5/Cat. 5e 100 Ω UTP	UTP 100 m (328 ft)

8.3. RJ45 Ethernet Pin Assignments

With 10/100/1000BASE-T(X) cables, pins 1 and 2 are used for transmitting data, and pins 3 and 6 for receiving data.

10/100 Base-T(X) RJ-45 pin assignments are as follows:

PIN #	TYPE	ASSIGNMENT
1	10/100 Base-T(X)	TD+
2	10/100 Base-T(X)	TD-
3	10/100 Base-T(X)	RD+
4	10/100 Base-T(X)	Not used
5	10/100 Base-T(X)	Not used
6	10/100 Base-T(X)	RD+
7	10/100 Base-T(X)	Not used
8	10/100 Base-T(X)	Not used

1000 Base-T RJ-45 pin assignments are as follows:

PIN #	TYPE	ASSIGNMENT
1	1000 Base-T	BI_DA+
2	1000 Base-T	BI_DA-
3	1000 Base-T	BI_DB+
4	1000 Base-T	BI_DC+

PIN #	TYPE	ASSIGNMENT
5	1000 Base-T	BI_DC-
6	1000 Base-T	BI_DB-
7	1000 Base-T	BI_DD+
8	1000 Base-T	BI_DD-

1000 Base-T MDI/MDI-X pin assignments are as follows:

PIN #	MDI PORT	MDI-X PORT
1	TD+ (transmit)	RD+ (receive)
2	TD- (transmit)	RD- (receive)
3	RD+ (receive)	TD+ (transmit)
4	Not used	Not used
5	Not used	Not used
6	RD-(receive)	TD-(transmit)
7	Not used	Not used
8	Not used	Not used

1000 Base-T RJ-45 pin assignments are as follows:

PIN #	MDI PORT	MDI-X PORT
1	BI_DA+	BI_DB+
2	BI_DA-	BI_DB-
3	BI_DB+	BI_DA+
4	BI_DC+	BI_DD+
5	BI_DC-	BI_DD-
6	BI_DB-	BI_DA-
7	BI_DD+	BI_DC+
8	BI_DD-	BI_DC-

NOTE: “+” and “-” signs represent the polarity of the wires that make each wire pair.

8.4. Recommendations for Cables in High Electrical Noise

Constant electrical noise can be due to the predictable 50 or 60 Hz AC 'hum' from power circuits or harmonic multiples of power frequency close to the data communications cable.

Follow these recommendations for copper data cabling in high electrical noise environments:

- Data cable lengths should be as short as possible, preferably 3 m (10 ft) in length. Copper data cables should not be used for inter-building communications.
- Power and data cables should not be run in parallel for long distances, and they should be installed in separate conduits. Power and data cables should intersect at 90° angles when necessary to reduce inductive coupling.
- Ground loops which are major cause of noise propagation must be avoided.

8.5. Serial RJ45 Pin Configuration

Table 1: Serial RJ45 Pin Configuration

RJ45 Pin	RS232 DTE	RS485-half	RS422/RS485-full
1			
2	Reserved - Future	Reserved - Future	Reserved - Future
3	GND	GND	GND
4	GND	GND	GND
5	RX		RX +
6	TX	TX +/RX +	TX +
7	CTS		RX -
8	RTS	TX -/RX -	TX -

8.6. Serial DB9 Pin Configuration

Table 2: Serial DB9 Pin Configuration (Sheet 1 of 2)

DB9 Pin	RS232 DTE	RS485-half	RS422/RS485-full
1			
2	RX		RX +
3	TX	TX +/RX +	TX +

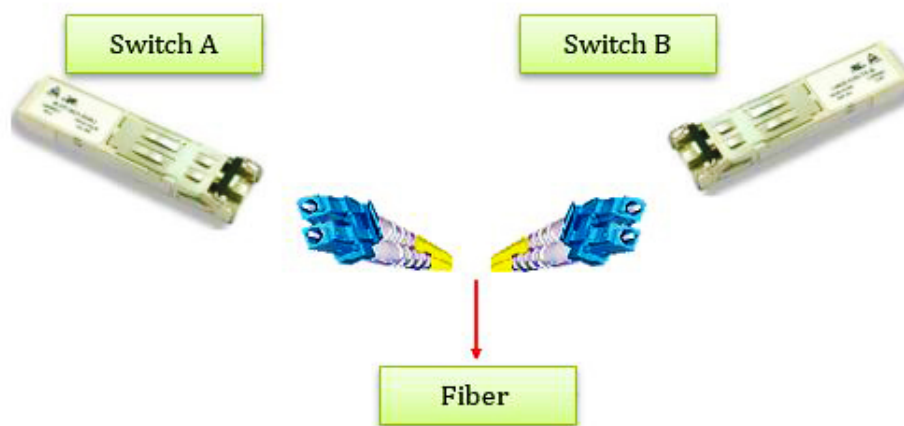
Table 2: Serial DB9 Pin Configuration (Continued) (Sheet 2 of 2)

DB9 Pin	RS232 DTE	RS485-half	RS422/RS485-full
4	Reserved - Future	Reserved - Future	Reserved - Future
5	GND	GND	GND
6	GND	GND	GND
7	RTS	TX -/RX -	TX -
8	CTS		RX -
9	GND		

8.7. SFP

The Raptor supports fiber optic ports that can connect to other devices using SFP (Small Form-factor Pluggable) modules. The fiber optical ports are Multimode (MM) or Singlemode (SM) with LC connectors.

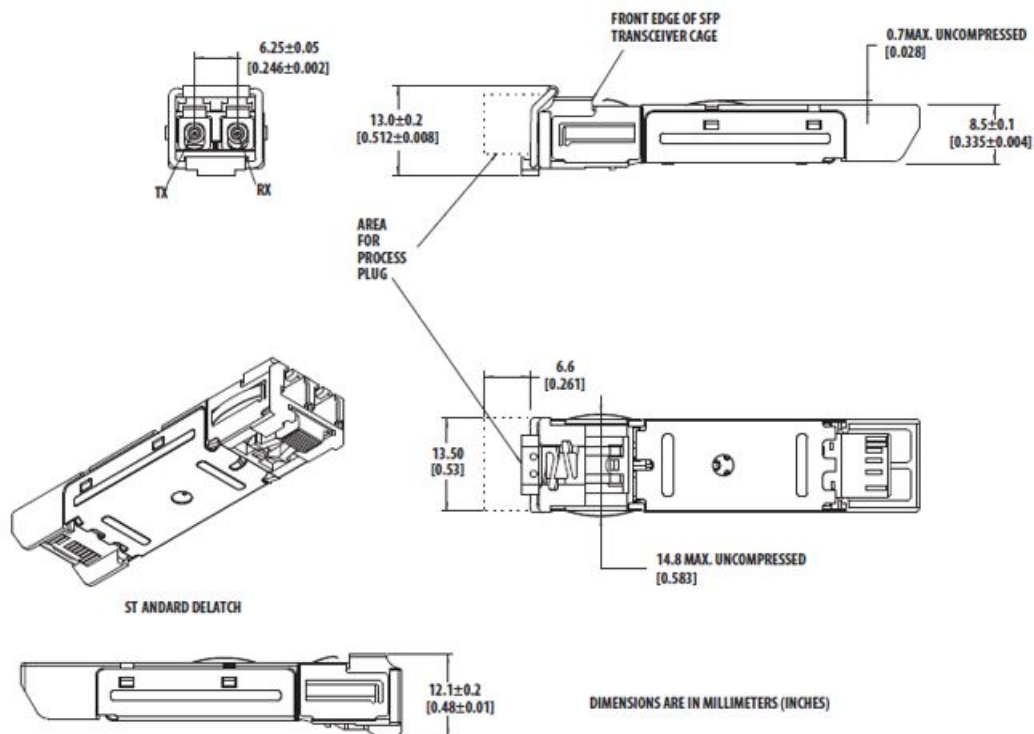
Always connect the TX port of Switch A to the RX port of Switch B.

Figure 2: SFP

The SFP modules are available separately from the Accessories list.

8.8. Mechanical Dimensions of a SFP module

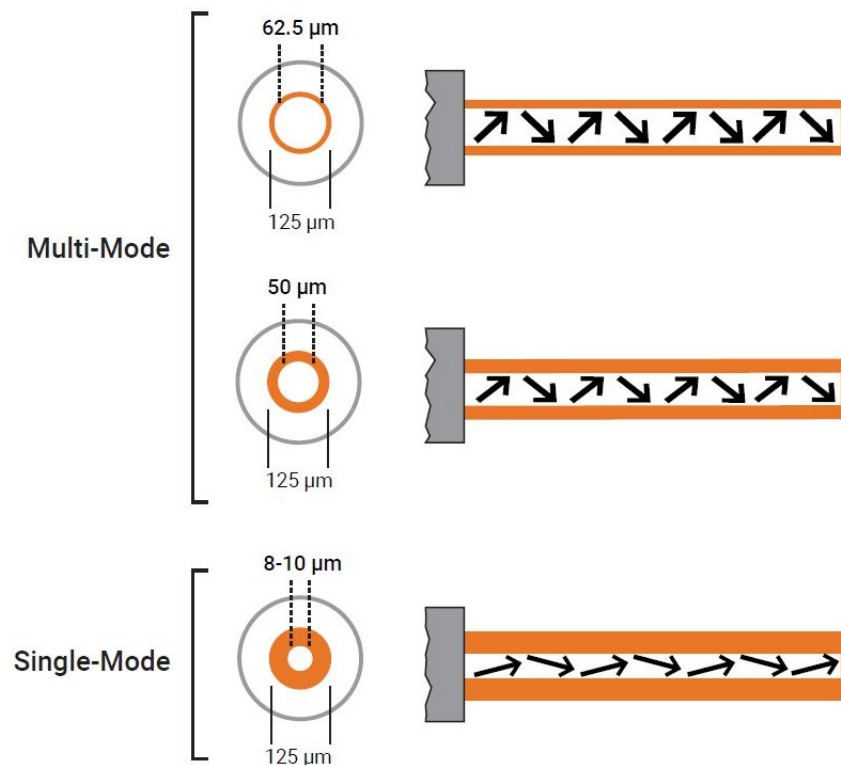
Figure 3: Mechanical Dimensions of a SFP module



The dimensions are in millimeters (inches)

8.9. Differences between SM and MM Fibers

The main difference between MM and SM fibers is that the former has much larger core diameter. Typically, MM has a core diameter of 50 or 62.5 μm and a cladding diameter of 125 μm , while a typical SM fiber has a core diameter between 8 and 10 μm and a cladding diameter of 125 μm .

Figure 4: SM and MM Fibers

SM fibers are better suited for moving information across longer distances and are routinely used by telecommunications. In comparison, MM fibers are ideal for local networks due to their low cost and greater bandwidth.



Laser radiation might be emitted from disconnected fibers or connectors. Do not stare into cables.

8.10. General Fiber Optic Cables Handling Instructions

- Wear finger cots or gloves. Your hands may look clean, but dirt and oils on them can damage the fiber and contaminate connectors.
- Never use the fiber pigtail to pick up or support the weight of the device. Keep both the device and the optical connector together in your hand(s).
- The fiber is made of a very pure expensive glass. Treat it with the same care that would be used when handling expensive crystal glass.
- Do not allow kinks or knots to develop in the fiber. Do not pull on the fiber when kinks or knots are present. Pulling will only cause knots, kinks, and curls to tighten and exceed the minimum bend radius.
- Always use the correct tools for stripping and cleaving the fiber. It will save time and reduce breakage caused by scratches.
- Follow all ESD precautions.

9. Technical Specifications

9.1. Ports

PORTS	
Ethernet Network Ports	Slot #1—8 x 10/100/1000 RJ45; Slot #2—supports up to 8 x 10/100/1000 RJ45s or 8 x 100/1000 SFPs (transceivers not included) per slot;
Serial Console Port	RS-232 in RJ-45 connector with console cable. 115200bps, 8, N, 1
USB Port / SD cards	USB 2.0 for software and configuration update
Alarm	Fault Contact: relay output to carry capacity of 1A at 24VDC
Warning / Monitoring System	Relay output for fault event alarming; Syslog Client for recording and Syslog Relay for forwarding Syslog messages; SMTP for event warning notification via email; Event level selection support;

9.2. Physical Characteristics

Physical Characteristics	
ENCLOSURE	IP 40 Satin coat steel and Aluminium
DIMENSIONS	81.03 (W) x 178.82 (D) x 166.62(H) mm 3.19 (W) x 7.04 (D) x 6.56 (H) inches
WEIGHT	2.5 kg (5.5 lbs.)

9.3. Power

POWER	
Redundant DC power supplies	Dual Power Supplies available in any combination of <ul style="list-style-type: none"> • 24 VDC Nominal, 10-36VDC operating • 48 VDC Nominal, 36-72VDC operating
High Voltage Power Supply	Single Power Supply <ul style="list-style-type: none"> • 100-240VAC Nominal, 85-264VAC Operating • 100-240VDC Nominal, 88-300VDC Operating

POWER	
Power Consumption	50 W / 50 VA
Overload Current Protection	Fast Acting Fuse 3.15 A (can only be replaced in the factory)

10. Compliance Specifications

10.1. Product Safety Tests

Description	Specification	Level
IP Rating	IEC 61850-3 clause 6.6.2 IEC 60529 clause 6.11 ISO 20653:2013	IP40
Clearance and Creepage	IEC 61850-3 clause 6.6.1 IEC 62368-1, clause 6.4.2 & 5.4.3	Overvoltage Category II Pollution Degree II
Impulse Voltage	IEC 61850-3 clause 6.6.3 IEEE 1613 clause 5.3	5kV on auxiliary power supply and digital inputs 1kV on station bus ports
Dielectric Voltage	IEC 61850-3 clause 6.6.4 IEEE 1613 clause 5.2	2kV on auxiliary power supply and digital inputs 0.5kV on station bus ports
Insulation Resistance	IEC 60255-27 clause 10.6.4.4	500VDC
Protective Bonding	IEC 61850-3 clause 6.6.5	Less than 0.1 Ohms
Flammability	IEC 61850-3 clause 6.6.6	V1
Single Fault Condition	IEC 61850-3 clause 6.6.7	5VDC, 12VDC
Product Safety Standards	IEC 62368-1	Product Safety Standard for Europe and North America

10.2. Electromagnetic Compatibility (EMC) Tests

Description	Specification	Level
Radiated Emission	IEC 61850-3 clause 6.7.4 CISPR22 table 5/7	class A
Conducted Emission	IEC 61850-3 clause 6.7.4 CISPR22 table 1/3	class A
1 MHz Damped Oscillatory Wave	IEC 61850-3 clause 6.7.3 IEC 61000-4-18 EEE 1613 clause 6 IEEE 1613.1 clause 5	2.5 kV CM, 1.0kV DM HV/Telec. 2.5 kV CM, 2.5kV DM Zone A

Description	Specification	Level
Electrostatic Discharges	IEC 61850-3 clause 6.7.3 IEC 61000-4-2 IEEE 1613 clause 8 IEEE 1613.1 clause 8	8kV contact, 15kV air
Radiated Radio Frequency Magnetic Field	IEC 61850-3 clause 6.7.3 IEC 61000-4-3 IEEE 1613 clause 7 IEEE 1613.1 clause 7	20 V/m
Fast Transient/Burst	IEC 61850-3 clause 6.7.3 IEC 61000-4-4 IEEE 1613 clause 6 IEEE 1613.1 clause 5	4kV
Surge	IEC 61850-3 clause 6.7.3 IEC 61000-4-5 IEC 1613.1 clause 6	Power Ports: 4kV LE, 2kV LL Signal Ports: 2KV LE, 1KV LL
Conducted Disturbance Induced by RF Fields	IEC 61850-3 clause 6.7.3 IEC 61000-4-6 IEEE 1613.1 clause 9	0.15-80MHz at 10V 27, 68 MHz at 10V
Main Frequency Voltage, Common-mode Disturbances	IEC 61850-3 clause 6.7.3 IEC 61000-4-16 IEEE 1613.1 clause 12	30V; cont. 300V; 1s
Power Frequency Magnetic Field	IEC 61850-3 clause 6.7.3 IEC 61000-4-8 IEEE 1613.1 clause 10	100 A/m cont.; 1000 A/m 3s
D.C. Voltage Dips	IEC 61850-3 clause 6.7.3 IEC 61000-4-29	60%; 0.1s 30%; 0.1s
A.C. Voltage Dips	IEC 61850-3 clause 6.7.3 IEC 61000-4-11	60%; 50 c 30%; 1c
D.C. Voltage Interruptions	IEC 61850-3 clause 6.7.3 IEC 61000-4-29	100%; 0.05s
A.C. Voltage Interruptions	IEC 61850-3 clause 6.7.3 IEC 61000-4-11	100%; 5/50c
D.C. Ripple	IEC 61850-3 clause 6.7.3 IEC 61000-4-17 IEEE 1613 clause 4.2	10% Ur_dc 5% content (different calculation method)
Damped Oscillatory Magnetic Field	IEEE 1613.1 clause 11 IEC 61000-4-10	100 A/m (peak)

10.3. Climatic Environmental Tests

Description	Specification	Level
Dry Heat Operational	IEC 61850-3 clause 6.9.3.1 IEC 60068-2-2, test Bd	+85°C; 16 hours
Dry Heat Operational	IEEE 1613 clause 3.1.1	+85°C
Cold Operational	IEC 61850-3 clause 6.9.3.2 IEC 60068-2-1, test Ad	-40°C; 16 hours
Cold Operational	IEEE 1613 clause 3.1.1	-40°C
Dry Heat Storage	IEC 61850-3 clause 6.9.3.3 IEC 60068-2-2, test Bb	+85°C; 16 hours
Dry Heat Storage	IEEE 1613 clause 3.1.2	+85°C
Cold Storage	IEC 61850-3 clause 6.9.3.4 IEC 60068-2-1, test Ab	-40°C; 16 hours
Cold Storage	IEEE 1613 clause 3.1.2	-40°C
Change of Temperature	IEC 61850-3 clause 6.9.3.5 IEC 60068-2-14 test Nb	-40°C; +85°C 3 hours; 5 cycles
Damp Heat, Steady State	IEC 61850-3 clause 6.9.3.6 IEC 60068-2-78 test Cab	+40°C; 93%, 10 days
Damp Heat, Cyclic	IEC 61850-3 clause 6.9.3.7 IEC 60068-2-78 test Db IEEE 1613 clause 3.1.3	+25°C; 55°C 97%; 93% 6 cycles + 55°C

10.4. Mechanical Environmental Tests

Description	Specification	Level
Vibration Response	IEC 61850-3 clause 6.10.1 IEC 60255-21-1	class 1 0.5g, 10Hz - 150Hz, 1 Octave/min, 1 sweep cycle in each axis, 8min per perpendicular axis

Description	Specification	Level
Vibration Endurance	IEC 61850-3 clause 6.10.1 IEC 60255-21-1	class 1 1g, 10 - 150Hz, 1 Octave/min, 20 sweep cycles in each axis, 160min per perpendicular axis
Shock Response	IEC 61850-3 clause 6.10.2 IEC 60255-21-2	class 1 5g, 11ms, half-sine, 3 shocks/direction/axis (18 total)
Shock Withstand	IEC 61850-3 clause 6.10.2 IEC 60255-21-2	class 1 15g, 11ms, half-sine, 3 shocks/direction/axis(18 total)
Bump	IEC 61850-3 clause 6.10.2 IEC 60255-21-2	class 1 10g, 16ms, half-sine, 1000 pulses
Seismic, Single Axis Sweep	IEC 61850-3 clause 6.10.3 IEC 60255-21-3	class 1 Freq range: Nominal Range 5-35Hz, Cross Over: 8-9HzPeak Displacement: Below cross-overfrequency: 3.5mm[x] x 1.5mm [y] Sweep: 1 Cycle/Axis (x,y,z), 1 Octave/min
Vibration	IEEE 1613 clause 9	V.S.3
Shock	IEEE 1613 clause 9	100 mm

10.5. Altitude

Description	Specification	Level
Altitude	IEC 61850-3 section 4, table 1 IEC 61850-3 section 7.2, table 25	less than or equal to 2000m 86 kPa to 106 kPa

