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RAMplex RX78/RX78e

Mini Hub
Hardware Reference

Document No. E-T-MR-RXMINI##-A-0-A1

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Revised: March 8, 2002

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1. INTRODUCTION

1.1 How To Use This Manual

1.1.1 Purpose

This document is a reference manual for the RAMplex Mini Hub. It provides a physical and functional description of the RAMplex Mini Hub and describes how to unpack, set up, install and operate the hardware. Hereafter in this manual, the product will be referred to simply as "Hub" or "Mini Hub."

1.1.2 Scope

This information is intended for RAMplex systems designers, engineers and network installation personnel. You need at least a systems level understanding of general computer processing, memory and hardware operation, and specific host processor characteristics to effectively use this manual.

1.1.3 Style Conventions

- Hexadecimal values are written with a "0x" prefix. For example, 0x03FF.
- Switch, signal and jumper abbreviations are in capital letters. For example, RSW1, J5, etc.

1.2 Related Information

- *RAMplex Hardware Reference for PCI, PMC, CPCI & VME Bus* (Doc. No. E-T-MR-78PCPMCP).

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- Improve the quality of our operations to meet the needs of our customers, suppliers, and other stakeholders.
- Provide our employees with the tools and overall work environment to fulfill, maintain, and improve product and service quality.
- Ensure our customer and other stakeholders that only the highest quality product or service will be delivered.

The British Standards Institution (BSI), the world's largest and most respected standardization authority, assessed Systran's Quality System. BSI's Quality Assurance division certified we meet or exceed all applicable international standards, and issued Certificate of Registration, number FM 31468, on May 16, 1995. The scope of Systran's registration is: "Design, manufacture and service of high technology hardware and software computer communications products." The registration is maintained under BSI QA's bi-annual quality audit program.

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Technical documentation is provided with all of our products. This documentation describes the technology, its performance characteristics, and includes some typical applications. It also includes comprehensive support information, designed to answer any technical questions that might arise concerning the use of this product. We also publish and distribute technical briefs and application notes that cover a wide assortment of topics. Although we try to tailor the applications to real scenarios, not all possible circumstances are covered.

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- Fax: (937) 252-1349
- World Wide Web address: www.systran.com

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2. PRODUCT OVERVIEW

2.1 Overview

This chapter provides an overview of the RAMplex Network Mini Hub.

2.2 Description

The Mini Hub provides for network ring integrity and fault isolation for up to eight nodes. The Mini Hub connects any active nodes together on a logical ring. This provides a management-free reliable network by automatically bypassing inactive nodes.



Figure 2-1 Mini Hub

2.3 Product Features

The RAMplex Mini Hub offers the following features:

- Eight RAMplex Network ports
- 820 nm fiber-optic interface
- Maximum node separation of 300 meters
- Automatic port signal retiming
- Automatic single ring insertion for attached nodes
- Automatic individual node fault isolation
- Cascading hubs for larger configurations

2.4 Network Ring

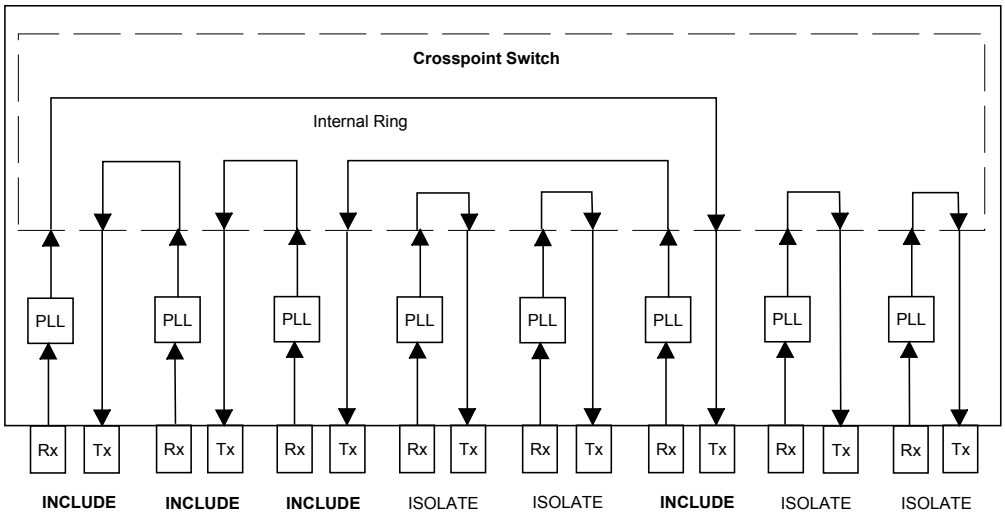


Figure 2-2 Single Ring Concept

The Mini Hub has a single logical ring and eight external ports that allow automatic access to this ring (See Figure 2-2). If the port does not detect a carrier signal from an attached node it switches to isolate state and the node no longer has access to the Mini Hub internal ring. Reasons for carrier loss include: power lost at attached node, optical signal lost from attached node, fiber-optic cable break or RAMplex coded signal not present.

Each Mini Hub port may be connected to an RX78 Network Interface Card (NIC), a ring, or another RAMplex Mini Hub port.

2.5 Power Connection

Power must be connected to the RAMplex Mini Hub using an external power supply. A power supply is included. If you want to use a different power supply, a connector for attachment to the hub is also provided.

2.6 Switches

Each Mini Hub has two switches on the rear panel: SW1 and SW2. The SW1 port-mode switch on the back panel is used to select whether the Mini Hub port is to be connected to a RX78 NIC or to a secondary Mini Hub port. The SW2 Control switch is reserved for factory testing.

2.7 Tx and Rx Connectors

The fiber-optic transmit (Tx) and receive (Rx) connectors physically connect the RAMplex Mini Hub to the Network. The Tx connector is the network transmitter output for the Mini Hub. The Rx connection is the network receiver input.

2.8 LEDs

2.8.1 Carrier Detect LEDs

Each port has its own Carrier Detect LED as shown in Figure 2-3. The Carrier Detect LED is activated whenever a port detects and locks onto a valid carrier signal from a RAMplex node. Assuming at least one node is inserted in the ring, the ring integrity is NOT valid if the fiber-optic cables are connected and the Carrier Detect LED is OFF. This condition indicates improper fiber-optic cabling or problems with the down-line node's transmitter. This LED is labeled “C” on the faceplate.

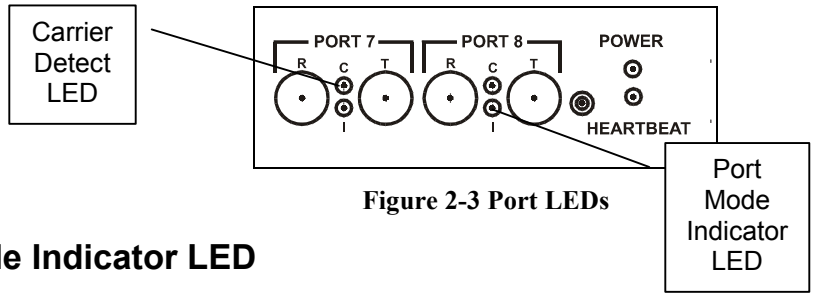


Figure 2-3 Port LEDs

2.8.2 Port Mode Indicator LED

Each port has its own Port Mode Indicator LED. This LED is activated whenever a port is placed in Hub mode. A port is in Hub mode if it is configured for connection to the port of a secondary Mini Hub (SW1 ON). This LED is labeled “I” on the faceplate as shown in Figure 2-3.

2.8.3 Power LED

The Power LED is activated when the Hub is receiving power (+5 VDC) from an external power supply (see Figure 2-3).

2.8.4 Heartbeat LED

The Heartbeat LED flashes periodically (1 Hz) to show that the Mini Hub’s embedded controller is functioning properly (see Figure 2-3).

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3. INSTALLATION

3.1 Overview

This chapter describes the installation of the Mini Hub hardware.

3.2 Unpack the Hardware



CAUTION: Exercise care regarding the static environment. Use an anti-static mat connected to a wristband when handling or installing the Mini Hub enclosure.

Remove the Mini Hub enclosure from the carton.

Save the shipping material in case the hardware needs to be returned.

The optional fiber-optic cables and RX78 RAMplex network-interface cards (NICs) are shipped separately.

3.3 Visually Inspect the Hardware

Check the enclosure for any damage that may have occurred during shipping. In the event that any shipping damage has occurred, call Systran Technical Support.

3.4 Placement

The Mini Hub enclosure may be installed in a 19″ rack or placed on any suitable flat surface or tabletop.

3.5 Set Port Mode Switch (SW1)

Each port can be configured in one of two modes: NIC mode or Hub mode. In general, NIC mode must be used when the port is attached to an RX78 NIC. When cascading and/or interconnecting Mini Hubs, the proper combination of NIC and Hub modes defines the behavior of the architecture (see Chapter 4).

EXAMPLE

Figure 3-1 shows ports 1 through 7 configured in NIC mode and port 8 configured in Hub mode.

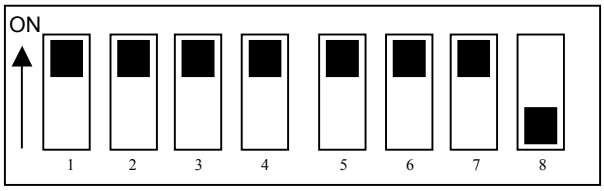


Figure 3-1 SW1 Sample Configuration

3.6 Control Switch (SW2)

This switch is reserved for factory testing.

CAUTION: The Mini Hub will not function properly if the SW2 switch settings are changed from the factory-default positions.

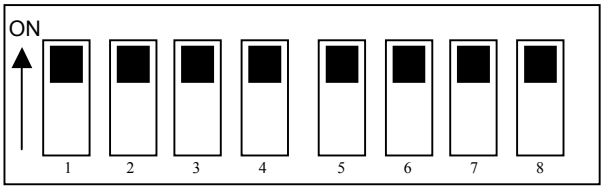


Figure 3-2 SW2 Factory default

3.7 Connect Power to the Hub

Connect power to the Hub using an external power supply provided. This desktop power supply accepts 100 - 240 VAC, 50 – 60 Hz, 0.8 A (max), and provides +5 VDC (+/-5%) at 6 A.

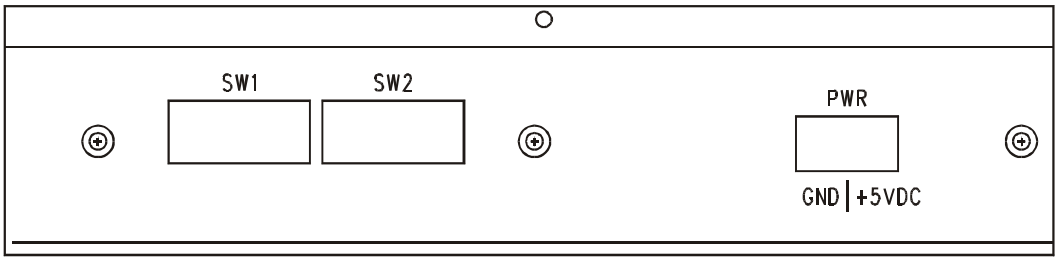


Figure 3-3 Port Mode Switch (SW1), Control Switch (SW2), and Power Connection

3.8 Tx and Rx Connectors

The Tx and Rx connectors are used for physical connection to the RX78 Network. The Tx connector is the network transmitter output for the Mini Hub. It is labeled “T” on the Hub faceplate. The Rx connector is the network receiver input. It is labeled “R” on the Hub.

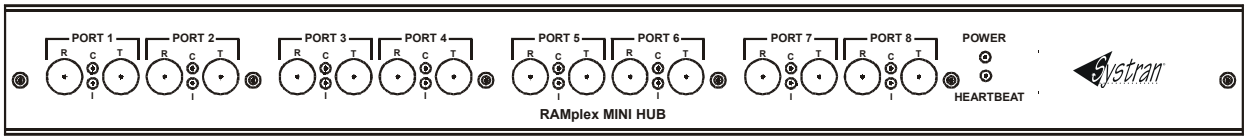


Figure 3-4 Mini Hub Faceplate

3.9 Cabling Configuration and Connection

3.9.1 Fiber-optic Configuration

The most basic Mini Hub network configuration consists of a RAMplex Mini Hub port tied to a RAMplex NIC by fiber-optic cable. A Hub port can also be connected to a ring of NICs or to a secondary Hub port. The maximum recommended distance between the NIC and the Hub is 300 meters. The recommended fiber-optic cable is 62.5/125 micron core multi-mode fiber cable with ST connectors.

3.9.2 Fiber-optic Cables

The optional fiber-optic cables are shipped in a separate carton. The fiber-optic cables are to be attached to the connectors of the Mini Hub port. Remove the rubber boots or plastic protective inserts from each fiber-optic transmitter and receiver as well as the fiber-optic cable protective covers. These should be replaced when cables are not in use or in the event the node must be returned to the factory.

It is important the ends of the fiber-optic cable be kept clean. If there is an exceptional amount of light-power loss experienced, the cable ends should be inspected for cleanliness. Alcohol-based fiber-optic cleaning pads are available to remove minor contaminants such as dust and dirt.

Figure 3-5 is a representation of a fiber-optic connector.

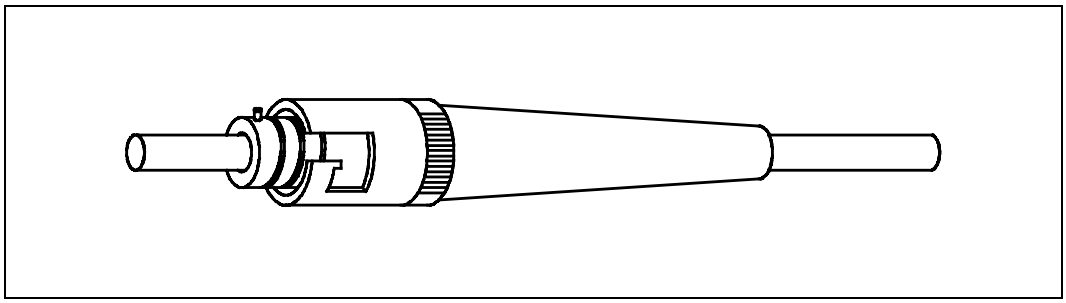


Figure 3-5 Fiber-optic ST Connector

3.9.3 Fiber-optic Connection

There are two types of “bayonet” fiber-optic connectors used on ST fiber-optic cables. The newer type is made by 3M and is smaller than the AT&T ST connector. Install the connector by pushing it onto the card connection and twisting the connector to the right (clockwise) to engage the blade. Remove it by pressing the metal sleeve toward the card and twisting to the left (counter-clockwise) to disengage the blade.

The primary difference between the connector types is that the AT&T connector provides a “locking” mechanism. Before it can engage or disengage the blade on the card connection, the plastic boot must be unscrewed at least 1/4" inch and then re-tightened.

The fiber-optic cable transmitter of the node is connected to the receiver of the Hub port. The Hub port's transmitter is then connected to the node's receiver. This is required to maintain the "daisy chain" connectability of the internal ring.



NOTE: The Rx and Tx connections from a given node must be to the same port. For example, NIC#1 Rx and Tx are connected to Tx and Rx of port 4, respectively; NIC #2 Rx and Tx are connected to the Tx and Rx of port 5, respectively; etc.

FIBER-OPTIC CABLE PRECAUTIONS

Fiber-optic cables are made of glass and may break if crushed or bent in a loop with less than a 2-inch radius.

Perform a visual check of the cable ends before inserting into the transmitter/receiver connector. If debris is inserted into the transmitter/receiver connector it may not be possible to clean it out or could result in damage to the transmitter or receiver lens. Hair, dirt and dust can interfere with the light signal transmission.

Use an alcohol-base wipe to clean cable ends.

See Section 4.2 for the topology of the fiber-optic cable connections.

3.10 Maintenance

No routine maintenance is required for the Mini Hub. Inspect network fiber-optic cabling connectors periodically.

3.11 Installation Troubleshooting

Problem	Solution
Carrier Detect LED will not come on.	Check the node/ring connection to the Hub port receiver. If the connection appears good, then trace the cable back to the node connected to the port. This node should be generating the carrier received by this port. Each node receives carrier from the previous node.

4. OPERATION

4.1 Overview

This chapter describes RAMplex Hub operations including different network hub topologies.

4.2 Topologies

The RAMplex network may be used with or without hubs. There are a variety of approaches that offer different advantages in terms of cost, flexibility, fault-tolerance, and system complexity.

4.2.1 Hub-less Topology

For a hub-less RAMplex network, the fiber-optic cable is connected between the transmitter of the “down-stream” node and the receiver of the “up-stream” node. Continuing this type of connection to all nodes in the network results in a daisy-chain network ring as indicated in Figure 4-1.

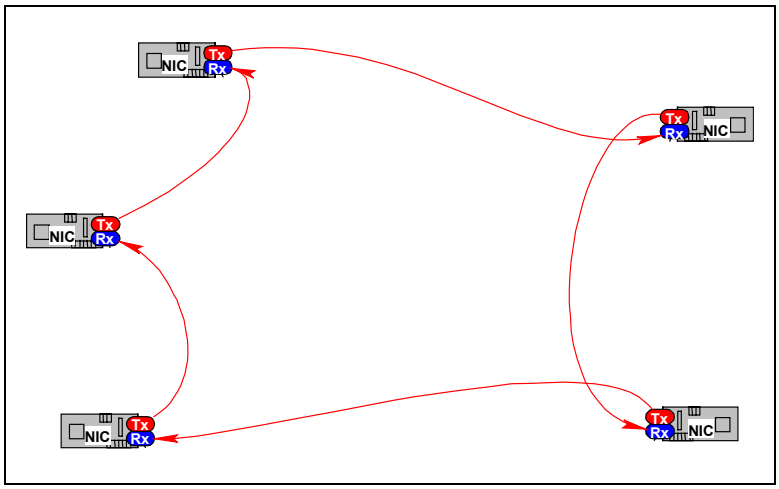


Figure 4-1 Hub-less Topology

In this approach, all nodes in the network must be powered-on for the ring integrity to be maintained. This approach is best suited for a situation where all nodes are located in close proximity, all nodes are powered-on, and cable integrity can be guaranteed. In general, the hub-less operation is not recommended due to the absence of fault tolerance and ease of connectability.

4.2.2 Hub Topologies

Systran offers a hub solution supporting different network topologies.

AUTOMATIC NODE-BYPASS TOPOLOGY

Use hub-based topologies for all but a very small (2 or 3 node) environment. In this scenario, the fiber-optic cable is connected between the transmitter of each node and the receiver of the hub. Similarly, the fiber-optic cable is also connected between the receiver of each node and the transmitter of the hub. Although the cable configuration is not physically a ring, the hub will connect any active nodes together logically on a ring, as indicated in Figure 4-2.

The function of a hub is to provide automatic node bypass in the event of node/cable failure as well as to provide for convenient cable routing.

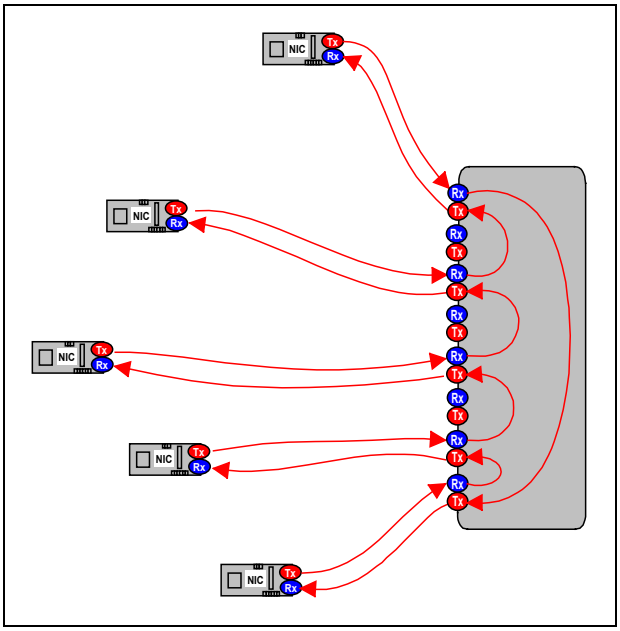


Figure 4-2 Automatic Node-Bypass Topology

The approach shown in Figure 4-2 provides a management-free reliable network by automatically bypassing inactive nodes that may result from a loss of power or cable break. The RAMplex Mini Hub is an excellent solution for these applications. This is the minimum recommended configuration for most applications.

4.2.3 Mini Hub Network Configurations

UP TO 14-NODE NETWORK: TWO MINI HUBS.

At least one of the interconnecting ports on each Mini Hub must be set to Hub mode.

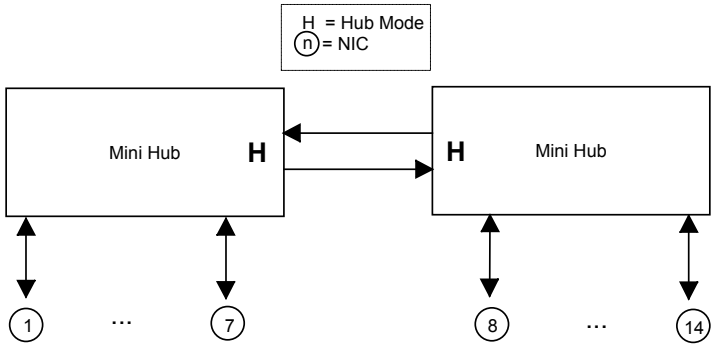


Figure 4-3 Up To 14-Node Network With 2 Mini Hubs

UP TO 26-NODE NETWORK: 4 MINI HUBS

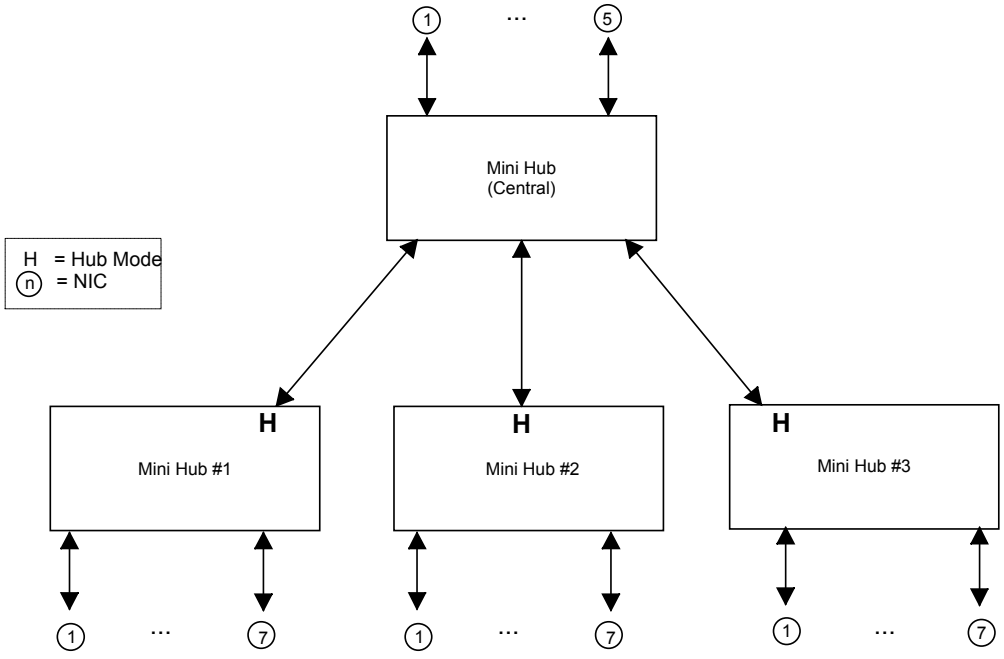


Figure 4-4 Up to 26-Node Network with 4 Mini Hubs

Peripheral hubs need the Hub-mode setting on ports attached to the central hub. The connecting ports on the central hub are not set to Hub mode.

REDUNDANT LINK

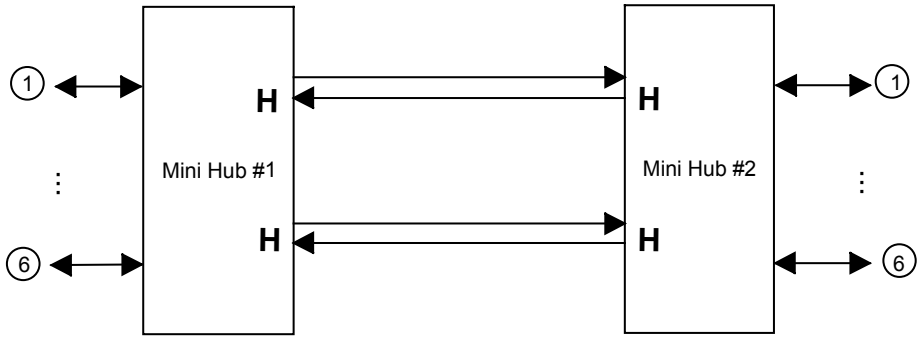


Figure 4-5 Redundant Mini Hub Link

Connectivity is maintained as long as at least one cable/transceiver in each direction is operable.



NOTE: Larger network configurations are possible. Contact Systran for additional information and to obtain recommendations for connectivity topology that is best for you.

4.3 Performance

The measured switching time of the Mini Hub from a change in state of the signal detects to a new application of loop topology is approximately 17 – 30 ms.

4.4 Operation Troubleshooting

Problem	Solution
Carrier Detect LED is not on.	Ensure all nodes connected to the Hub are powered on and cabled correctly. Verify that Control Switch (SW2) is set in the factory default positions. Swap out damaged cable.
The Heartbeat LED is not flashing.	Verify that Control Switch (SW2) is set in the factory default positions.
The Power LED is not on.	Ensure the power supply is connected properly.
Any other problem	Call Systran Customer Support at 800-252-5601 for assistance.

APPENDIX A

SPECIFICATIONS

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FIGURES

Figure 1-1 Hub Internal Card Dimensions A-2

TABLES

Table 1-1 Single Fiber Cable, 62.5 micron core, Multimode A-3

A.1 Hardware Specifications

A.1.1 RAMplex Mini Hub

Hardware Compatibility:.....RAMplex Network Interface Cards

Physical Dimensions:
- Mini Hub Enclosure .....16.73" x 6.00" x 1.72" (mounting brackets not installed)

Weight:
- Mini Hub Enclosure .....3.26 lbs (1.479 kg)

Electrical Requirements:.....+4.75 to +5.25 VDC, 2.4 Amps (typ.)

Temperature Range:
- Storage:.....-40° to +85°C
- Operation:..... 0° to +60°C

Humidity Range:
- Storage.....0% to 95% (non-condensing)
- Operating.....0% to 95% (non-condensing)

Network Line Transmission Rate: .....77.76 million bits/second

Maximum Nodes on Network Ring: 256

Maximum Node Separation:
- Standard Fiber: .....300 meters

Latency:
- Pass-through latency: .....20 ns
- Transmission media delay (fiber-optic): ....5 ns/m
- Switching Time .....17 - 30 ms (typ.)

Phase Jitter .....750 ps per port

Mean Time Between Failures (MTBF)*	**MIL-HDBK-217F**	**BELLCORE 332**
	163,423 hours	105,665 hours

A.1.2 Power Supply

(All specifications according to manufacturer)

Temperature Range
- Operation:..... 0° to +50°C
- Storage..... -40° to +85° C

Humidity Range:
- Operating.....0% to 95% (non-condensing)

Weight.....0.904 lb (410 g)

Mean Time Between Failures (MTBF)*	**MIL-HDBK-217F**	**BELLCORE 332**
	230,000 hours	N/A

* The MTBF numbers are based on calculations using MIL-HDBK-217F, Appendix A; and Bellcore 332, Issue 6, for a ground-benign environment.

A.2 Hub Dimensions

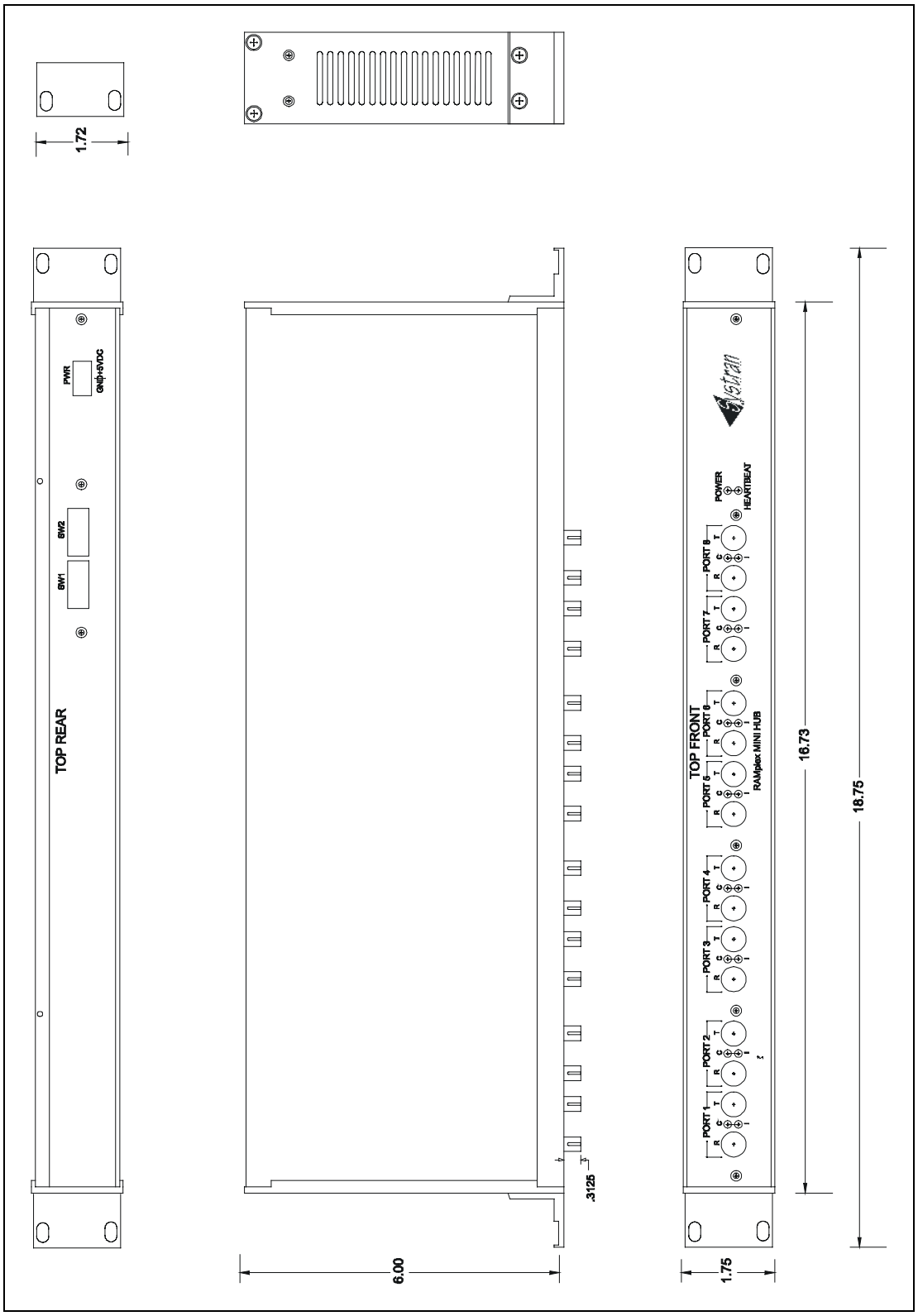


Figure A-1 Hub Internal Card Dimensions

A.2.1 Part Number

The RAMplex Hub part number is in the form:

H-AS-EMNHUB08-20 (Mini Hub)

where:

Code	Definition
H	Hardware
AS	Top Level Assembly
E	RAMplex Product Family
MN	Mini Hub
HUB08-20	8-port Hub card with Standard Fiber-Optic (820 nm) media

A.2.2 Fiber-Optic Cables

Fiber-optic cables may be purchased from Systran or third parties. The recommended fiber-optic cable is 62.5/125 micron core multi-mode fiber cable with ST connectors. Contact Systran regarding the availability of fiber-optic cables.

Table A-1 Single Fiber Cable, 62.5 micron core, Multimode

Part Number	Size
H-PR-WST13000-0	3 METER
H-PR-WST15000-0	5 METER
H-PR-WST11001-0	10 METER
H-PR-WST12001-0	20 METER
H-PR-WST13001-0	30 METER

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APPENDIX B

CONFIGURATION AIDS

NETWORK CONFIGURATION DATA SHEET

PORT #	PORT MODE (H = HUB, N = NIC)	CONNECTION
HUB TYPE _____ HUB SERIAL # _____		
1		
2		
3		
4		
5		
6		
7		
8		
HUB TYPE _____ HUB SERIAL # _____		
1		
2		
3		
4		
5		
6		
7		
8		
HUB TYPE _____ HUB SERIAL # _____		
1		
2		
3		
4		
5		
6		
7		
8		

GLOSSARY

card ---------- A printed circuit card (PCB). It is a collection of electronic components.

carrier detect LED ---------- This indicator is activated whenever a port detects and locks onto a valid carrier signal from a RAMplex node.

carrier loss ---------- A hardware failure reported when the incoming light link has failed because it is too weak or nonexistent in the fiber from the preceding node.

carrier signal ---------- A fiber-optic light wave that can be modulated to transmit data, images, sound, or other signals.

heartbeat LED ---------- This indicator flashes periodically (1 Hz) to show that the Mini Hub's embedded controller is functioning properly.

hub-less network ---------- The fiber-optic cable is connected between the transmitter of the "down-stream" node and the receiver of the "up-stream" node. Continuing this type of connection to all nodes in the network results in a daisy-chain network ring. All nodes in the network must be powered-on for ring integrity to be maintained.

hub mode ---------- A port configured for connection to the port of a secondary RAMplex Mini Hub (SW1 OFF) is in Hub mode.

isolate state ---------- If the port does not detect a carrier signal from an attached node it switches to isolate state and the node no longer has access to the Mini Hub internal ring.

latency, pass-through ---------- The time required to retransmit an upstream node's packet.

latency, receive ---------- The measure of time necessary to update shared memory when an incoming packet arrives.

latency, transmit ---------- The time required to send a packet onto the network after a shared memory write access is performed.

NIC ---------- Network Interface Card

NIC mode ---------- A port configured for connection to a Network Interface Card (SW1 ON) is in NIC mode.

node bypass topology ---------- Provides automatic node bypass in the event of node/cable failure and provides for convenient cable routing

port mode LED ---------- This indicator is activated whenever a port is placed in Hub mode.

Power LED ---------- This indicator is activated when the Hub is receiving power (+5 VDC) from an external power supply

redundant link ---------- Node connectivity is maintained as long as at least one cable/transceiver in each direction is operable.

Rx ---------- The network receiver input.

SW1 ---------- The port-mode switch on the back panel used to select whether the Mini Hub port is to be connected to a RX78 NIC or to a secondary Mini Hub port.

SW2 ---------- A control switch reserved for factory testing.

Tx ---------- The network transmitter output for the Mini Hub.

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