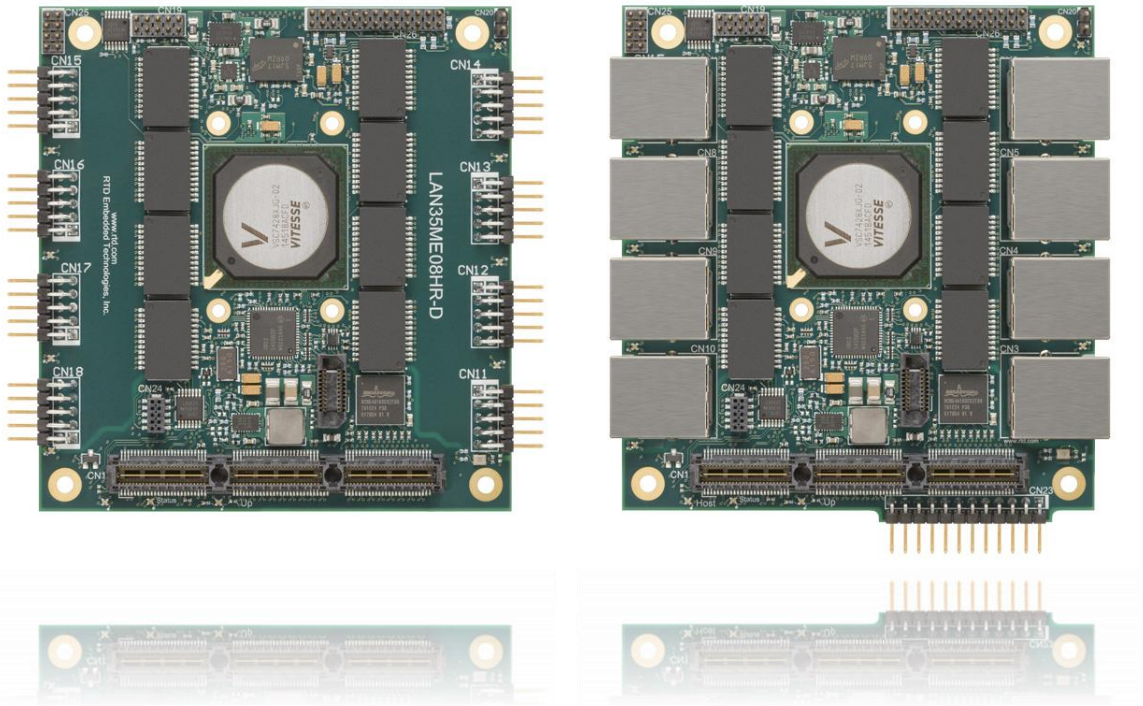
# LAN35MH08HR-D & LAN35ME08HR-D, LAN35MH08HR-RJ & LAN35ME08HR-RJ,

*Gigabit Ethernet Managed Switches*

## User's Manual

BDM-610020135 Rev. A

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# Revision History

| | | |
|---|---|---|
| Rev A | Initial Release | 10/13/2016 |

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# 1 Introduction

## 1.1 Product Overview

The LAN35Mx08 series boards (LAN35MH08HR and LAN35ME08HR) are fully managed 10-port Gigabit Ethernet switches for expanding the networking capabilities of any system. The boards can be used either in a PCIe/104 system or as a standalone expandable switch. The onboard CEServices Carrier Ethernet switching software provides a rich Layer 2 switching solution with Layer 3-aware packet processing. All of the industry-standard managed Ethernet switching features found in an enterprise rackmount switch are provided, such as VLANs, Spanning Tree, QoS, and SNMP. Additionally, the CEServices software provides features for carrier and timing-critical networks such as OAM, Synchronous Ethernet, and IEEE 1588. The switch may be configured via a web GUI interface, or a command-line console via USB, Telnet, or SSH.

The LAN35Mx08 features the RTD StackNET® connector, which allows additional RTD Ethernet switches and routers to be stacked in a PCIe/104 system with direct board-to-board Ethernet connectivity. The LAN35MH08HR is intended to be the host of a StackNET® stack and features a PCI Express Gigabit Ethernet controller for connection to a PCIe/104 cpuModule. The LAN35ME08HR is intended to be an expansion module in a StackNET® stack, and provides two StackNET® connectors (upward and downward). One or more LAN35ME08HR boards may be stacked above an LAN35MH08HR to provide additional switch ports.

As standalone modules they each provide eight Ethernet ports, any of which may be used as uplink ports. The LAN35MH08HR includes a power connector for true standalone operation without a CPU board or PCIe/104 power supply. Both modules are PCIe/104 "universal" boards, and are compatible with both Type 1 and Type 2 CPUs. The boards are available in an enclosure as part of an RTD IDAN®, HiDAN® or HiDANplus® system.

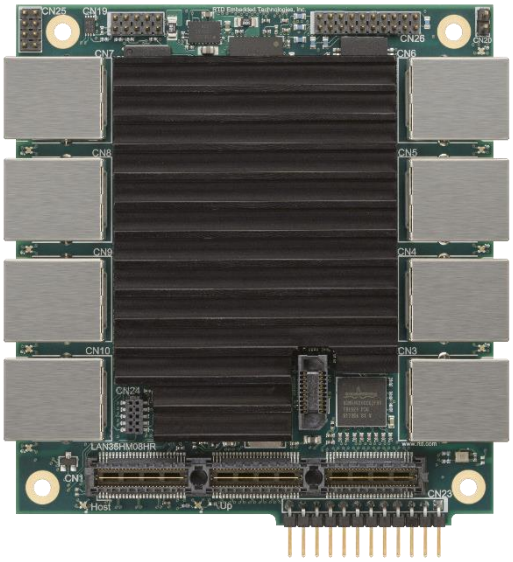


***Figure 1: LAN35MH08HR-RJ shown with standard passive heatsink.***

## 1.2 Board Features

- LAN35MH08HR with host interface
  - PCIe/104 Universal stack through connector (PCIe x1 link)
  - Intel I210PCI Express Ethernet Controller for interface to host cpuModule
  - Eight 1000/100/10 Mbps Ethernet ports
  - One upward StackNET® port for stacking switch expansion
  - Power connector for standalone applications
- LAN35ME08HR expansion switch
  - PCIe/104 Universal stack through connector (for power only)
  - Eight 1000/100/10 Mbps Ethernet ports
  - One upward StackNET® port for stacking switch expansion
  - One downward StackNET® port for stacking switch expansion
  - Directly interfaces to the StackNET® connector of the board beneath it.

    - Note: Due to mechanical interference considerations with the downward StackNET® connector, the LAN35ME08HR is not intended for non-StackNET® applications.
- I/O Connector Options
    - –D has eight 10-pin 0.1" dual-inline connectors
    - –RJ has eight RJ45 connectors
    - LAN35MH08HR has a 0.1" single-inline power connector
    - IDAN has two 37-pin "D" connectors for Ethernet, and a USB connector for console
- Microsemi/Vitesse VSC7428 managed Ethernet Switch
    - Integrated 416MHz MIPS Processor
    - 4Mbit Packet Memory
    - 8K MAC and 4K VLAN Table
    - Multistage TCAM Engine
- Microsemi/Vitesse CEServices Carrier Ethernet Switching Software
    - Port Control:
        - Speed/Duplex settings
        - Jumbo Frame Support (1518-9600 bytes)
        - Port Status and Statistics
    - Quality of Service (QoS)
        - Up to 8 traffic classes
        - Shaping/policing per queue and per port
        - Hierarchical MEF compliant policing and scheduling
    - Layer 2 Switching:
        - VLAN support, IEEE 802.1Q
        - Spanning Tree Protocol (STP), IEEE 802.1D
        - Rapid Spanning Tree (RSTP), IEEE 802.1w
        - Multiple Spanning Tree (MSTP), IEEE 802.1s
        - Loop Guard
        - Link Aggregation (Static and LACP), IEEE 802.3ad
        - BPDU Guard
        - Error Disable Recovery
        - IGMP snooping
        - DHCP snooping
        - Port Mirroring
    - Layer 3 Aware
        - DHCP Option 82 Relay
        - UPNP
        - IPv4 Static Routing (Unicast)
        - IPv6 Static Routing (Unicast)
    - Security:
        - Port-based access control based on IEEE 802.1X
        - MAC-Based Authentication
        - VLAN Assignment for authenticated users/devices
        - QoS Assignment for authenticated users/devices
        - Guest VLAN for unauthenticated users/devices
        - RADIUS Authentication, Authorization, and Accounting
        - Limit number of MAC Addresses per port
        - IP-MAC binding restrictions
        - TACACS+ Authentication, Authorization, and Accounting
        - User Authentication for Web and ICLI interfaces
        - 15 User Authorization Levels for Web and ICLI interfaces
        - Access Control Lists (ACLs) for filtering/policing/port copy
        - IP source guard
    - Time Synchronization:
        - Synchronous Ethernet (SyncE) with SSM
        - IEEE 1588v2 with one or two-step clock
        - Peer-to-Peer Transparent Clock
        - End-to-End Transparent Clock
        - Boundary Clock
        - Redundant Masters and Multiple Timing Domains
        - ITU G8265.1 Best Master Selection
        - PTP over IPv4 (unicast and multicast)
        - NTPv4 Client
    - OAM & Test:
        - Y.1731
        - IEEE 802.1ag

    - G.8021
- Power and Thermal:
    - PHY power savings (user-configurable)
    - LED power savings (user-configurable)
    - Thermal Protection (user-configurable)
- Management:
    - JSON-RPC
    - DHCP and DHCPv6 Client
    - DHCP Server
    - DNS Client, Proxy
    - Web Interface via HTTP or HTTPS
    - Industrial Command Line Interface (ICLI) via USB Serial Console, Telnet, or SSHv2
    - IPv6 Management
    - SNMP v1, v2c, v3c (MIBs and Traps)
    - RMON
    - Link Layer Discovery Protocol (LLDP), IEEE 802.1AB, TIA 1057
    - Cisco Discovery Protocol (CDP) – Receive Only
    - sFlow
    - Configuration Download/Upload
- Exar XR21B1411IL16 USB UART for Serial Console Interface
- PCIe/104 Universal interface operates on Type 1 and Type 2 PCIe/104 buses

## 1.3 Ordering Information

RTD's line of PCIe/104 Gigabit Ethernet Switches are available with RJ45 or 10-pin DIL connectors. The LAN35MH08HR "host" version may be used as a stand-alone device, and include a power connector, while the LAN35ME08HR "expansion" version must be used with a host. The LAN35MH08HR & LAN35ME08HR are available with the following standard options:

***Table 1: Board Ordering Options***

| Part Number | Host / Expansion | Ethernet Connector Type | Power Connector |
|---|---|---|---|
| LAN35MH08HR-RJ | Host | RJ45 | Yes |
| LAN35MH08HR-D | Host | 10-pin DIL | Yes |
| LAN35ME08HR-RJ | Expansion | RJ45 | No |
| LAN35ME08HR-D | Expansion | 10-pin DIL | No |

Cable kits for the board-level ordering options are shown in the table below:

***Table 2: Board Cable Kits***

| Part Number | Description |
|---|---|
| XK-CM83 | Cable kit for LAN35MH08HR-D and LAN35ME08HR-D to adapt the 10-pin DIL connector to RJ45 (includes one adapter cable) |
| XK-CM123 | Cable kit for LAN35MH08HR-D and LAN35ME08HR-D to provide a Mini USB Type B connection to the USB Serial Console |

### 1.3.1 IDAN ORDERING OPTIONS

The Intelligent Data Acquisition Node (IDAN®) building block can be used in just about any combination with other IDAN building blocks to create a simple but rugged 104™ stack. This module can also be incorporated in a custom-built RTD HiDAN® or HiDANplus® High Reliability Intelligent Data Acquisition Node.

Unlike the board level Ethernet switch options, the IDAN ordering options do not include a power connector. All IDAN ordering options include a Mini USB Type B connection for the USB Serial Console.

***Table 3: IDAN Ordering Options***

| Part Number | Host / Expansion | Ethernet Connector Type | Power Connector |
|---|---|---|---|
| IDAN-LAN35MH08HRS-D | Host | 37-pin "D" | No |
| IDAN-LAN35ME08HRS-D | Expansion | 37-pin "D" | No |

Cable kits for the IDAN ordering options are shown in the table below:

***Table 4: IDAN Cable Kits***

| Part Number | Description |
|---|---|
| IDAN-XKCM48 | Cable kit for IDAN-LAN35MH08HRS-D and IDAN-LAN35ME08HRS-D to break the 37-pin "D" connectors to RJ45 |

Contact RTD sales for more information on our high reliability systems.

## 1.4 Contact Information

### 1.4.1 SALES SUPPORT

For sales inquiries, you can contact RTD Embedded Technologies sales via the following methods:

Phone: 1-814-234-8087 Monday through Friday, 8:00am to 5:00pm (EST).
E-Mail: sales@rtd.com

### 1.4.2 TECHNICAL SUPPORT

For support with this product, or any other RTD product, you can contact RTD Technical Support via the following methods:

Phone: 1-814-234-8087 Monday through Friday, 8:00am to 5:00pm (EST).
E-Mail: techsupport@rtd.com

# 2 Specifications

## 2.1 Operating Conditions

*Table 5: Operating Conditions*

| Symbol | Parameter | Test Condition | Min | Max | Unit |
|---|---|---|---|---|---|
| $V_{cc5}$ | 5V Supply Voltage | | 4.75 | 5.25 | V |
| $T_a$ | Operating Temperature | With supplied passive heatsink | -40 | +85 | C |
| $T_s$ | Storage Temperature | | -55 | +125 | C |
| RH | Relative Humidity | Non-Condensing | 0 | 90% | % |
| MTBF | Mean Time Before Failure | LAN35MH08HR, 30°C | 478,925 | | Hours |
| | | IDAN-LAN35MH08HR-D, 30°C | TBD | | |
| | | LAN35ME08HR, 30°C | 690,068 | | |
| | | IDAN-LAN35ME08HR-D, 30°C | TBD | | |

## 2.2 Electrical Characteristics

*Table 6: Electrical Characteristics*

| Symbol | Parameter | Test Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| P | Power Consumption LAN35MH08HR | Onboard MAC/PHY linked at 1Gbps<br>Onboard MAC/PHY plus 1 port linked at 1Gbps<br>Onboard MAC/PHY plus 2 ports linked at 1Gbps<br>Onboard MAC/PHY plus 3 ports linked at 1Gbps<br>Onboard MAC/PHY plus 4 ports linked at 1Gbps<br>Onboard MAC/PHY plus 5 ports linked at 1Gbps<br>Onboard MAC/PHY plus 6 ports linked at 1Gbps<br>Onboard MAC/PHY plus 7 ports linked at 1Gbps<br>Onboard MAC/PHY plus 8 ports linked at 1Gbps<br>Onboard MAC/PHY, upward StackNET, plus 8 ports all linked at 1Gbps | | 3.4<br>3.7<br>3.9<br>4.2<br>4.5<br>4.8<br>5.1<br>5.3<br>5.7<br>5.9 | | W |
| P | Power Consumption LAN35ME08HR | No ports linked<br>Downward StackNET port linked at 1Gbps<br>Downward StackNET plus 1 ports linked at 1Gbps<br>Downward StackNET plus 2 ports linked at 1Gbps<br>Downward StackNET plus 3 ports linked at 1Gbps<br>Downward StackNET plus 4 ports linked at 1Gbps<br>Downward StackNET plus 5 ports linked at 1Gbps<br>Downward StackNET plus 6 ports linked at 1Gbps<br>Downward StackNET plus 7 ports linked at 1Gbps<br>Downward StackNET plus 8 ports linked at 1Gbps<br>Downward and upward StackNET plus 8 ports all linked at 1Gbps | | 3.1<br>3.4<br>3.7<br>3.9<br>4.2<br>4.5<br>4.8<br>5.1<br>5.3<br>5.7<br>5.9 | | W |
| **PCIe/104 Bus (CN1 and CN2)** | | | | | | |
| | Differential Output Voltage | | 0.8 | | 1.2 | V |
| | DC Differential TX Impedance | | 95.2 | | 116.9 | Ω |
| | Differential Input Voltage | | 0.175 | | 3.3 | V |
| | DC Differential RX Impedance | | 92.7 | | 115.8 | Ω |
| | Electrical Idle Detect Threshold | | 61 | | 173 | mV |
| **USB Serial Console (CN19)** | | | | | | |
| $V_{CCUSB}$ | USB Supply Voltage | Only required when main power is off ($V_{CC}$ = 0V) | 4.5 | 5.0 | 5.5 | V |
| $I_{CCUSB}$ | USB Supply Current | Only required when main power is off ($V_{CC}$ = 0V) | | 10.5 | 12 | mA |
| **External LED Signals (CN26 pins 1-22)** | | | | | | |
| | Output Voltage | Even-numbered pins | | 5.0 | | V |
| | Sink Current | Odd numbered pins | | 24 | | mA |

*Table 6: Electrical Characteristics*

| Symbol | Parameter | Test Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **IEEE1588 Time Tick I/O (CN26 pin 23)** | | | | | | |
| *f* | Frequency | Frequency is programmable, 1Hz-25MHz | 1 | | 25000000 | Hz |
| | Clock Duty Cycle | Measured at 50% threshold | 45 | | 55 | % |
| $t_R$, $t_F$ | Rise and Fall time | 20% to 80% threshold | 1 | | | ns |
| | Peak-to-Peak Jitter | 10MHz output<br>(**Note:** Some frequencies may generate an additional 4ns of jitter, because frequency is synthesized based on the internal system clock. | | 100 | | ps |
| $V_{OH}$ | Output high voltage | $I_{OH}$ = -12 mA | 1.7 | | | V |
| $V_{OH}$ | Output high voltage | $I_{OH}$ = -2mA | 2.1 | | | V |
| $V_{OL}$ | Output low voltage | $I_{OL}$ = 12 mA | | | 0.7 | V |
| $V_{OL}$ | Output low voltage | $I_{OL}$ = 2 mA | | | 0.4 | V |
| $V_{IH}$ | Input high voltage | | 1.85 | | 3.6 | V |
| $V_{IL}$ | Input low voltage | | -0.3 | | 0.8 | V |
| $I_{IH}$ | Input high current | | | | 10 | µA |
| $I_{IL}$ | Input low current | | -10 | | | µA |
| $C_I$ | Input capacitance | | | | 10 | pF |

# 3 Board Connections

## 3.1 Board Handling Precautions

To prevent damage due to Electrostatic Discharge (ESD), keep your board in its antistatic bag until you are ready to install it into your system. When removing it from the bag, hold the board at the edges, and do not touch the components or connectors. Handle the board in an antistatic environment, and use a grounded workbench for testing and handling of your hardware.

## 3.2 Physical Characteristics

STEP model is available upon request; contact RTD Tech Support for more information.

- LAN35Mx08HR-D Weight: Approximately 91 g (0.20 lbs) – with heatsink
- LAN35Mx08HR-RJ Weight: Approximately 109 g (0.24 lbs) – with heatsink
- Dimensions: 90.17 mm L x 95.89 mm W (3.550 in L x 3.775 in W)

***NOTE: The LAN35ME08HR "expansion" version has a downward StackNET® connector (CN8) on the underside of the board, which extends approximately 11mm downward. This connector exceeds the component height restrictions of the PCIe/104 specification, and may cause mechanical interference with traditional PCIe/104 boards! The expansion version should only be stacked above another RTD StackNET® product. For applications that do not require StackNET® connectivity, the LAN35MH08HR "host" version should be used.***

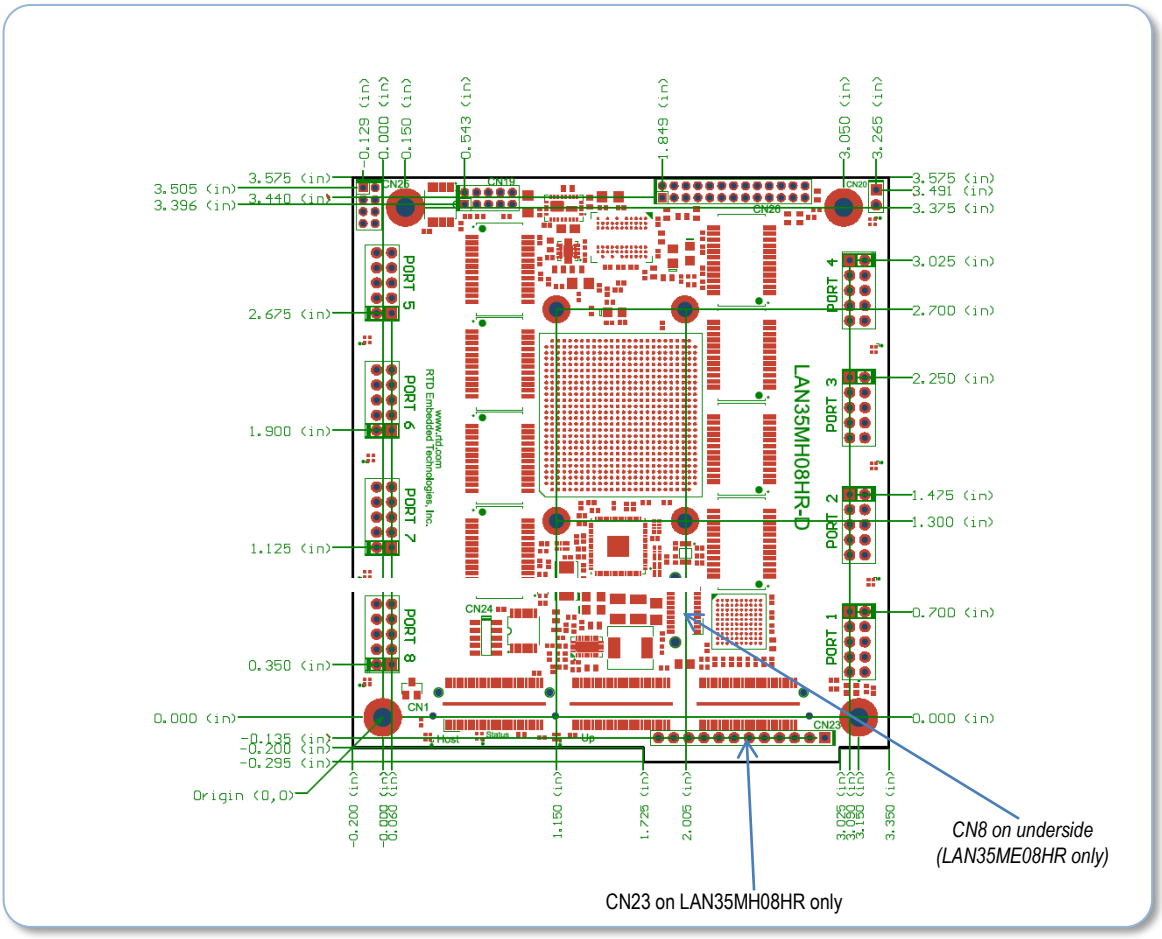


***Figure 2: LAN35MH08HR-D & LAN35ME08HR-D Mechanical Drawing***

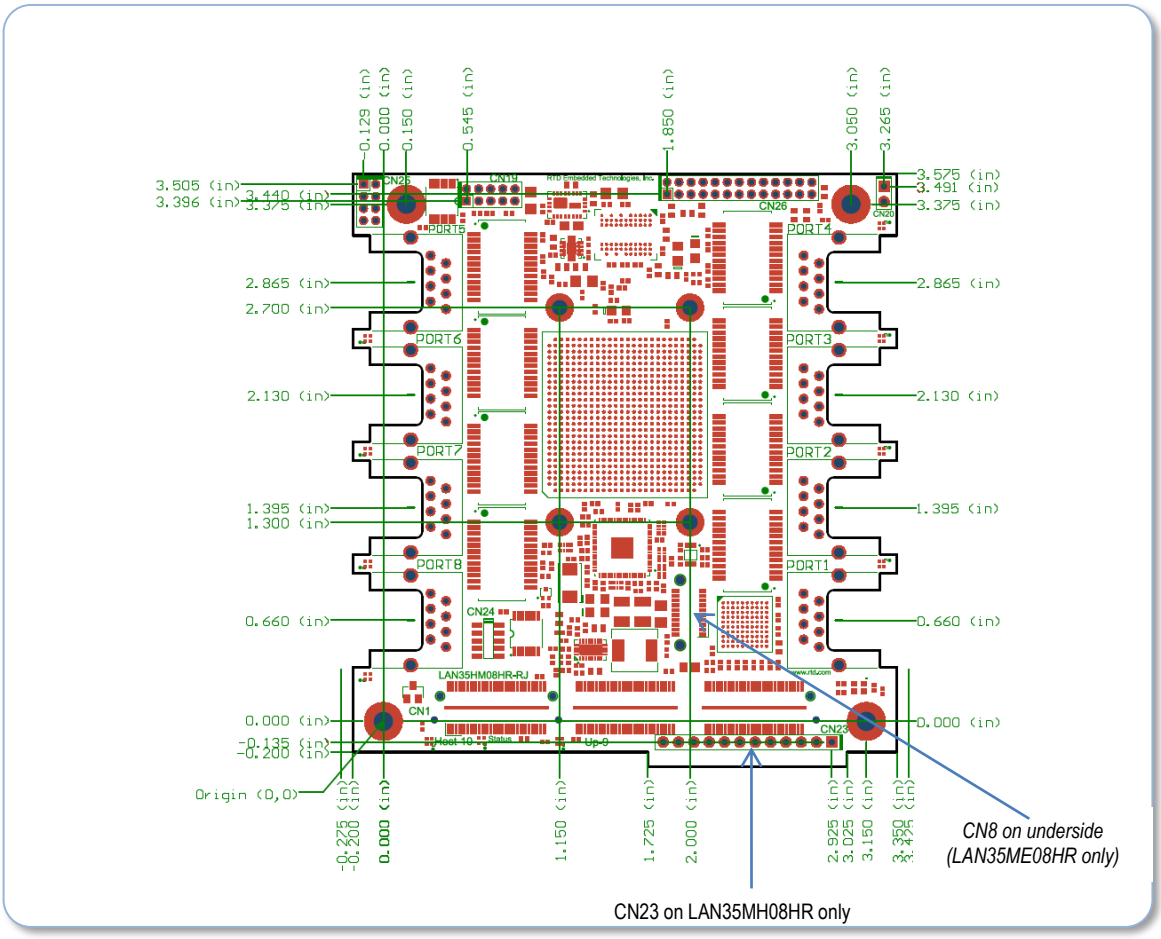


***Figure 3: LAN35MH08HR-RJ & LAN35ME08HR-RJ Mechanical Drawing***

## 3.3 Connectors and LEDs

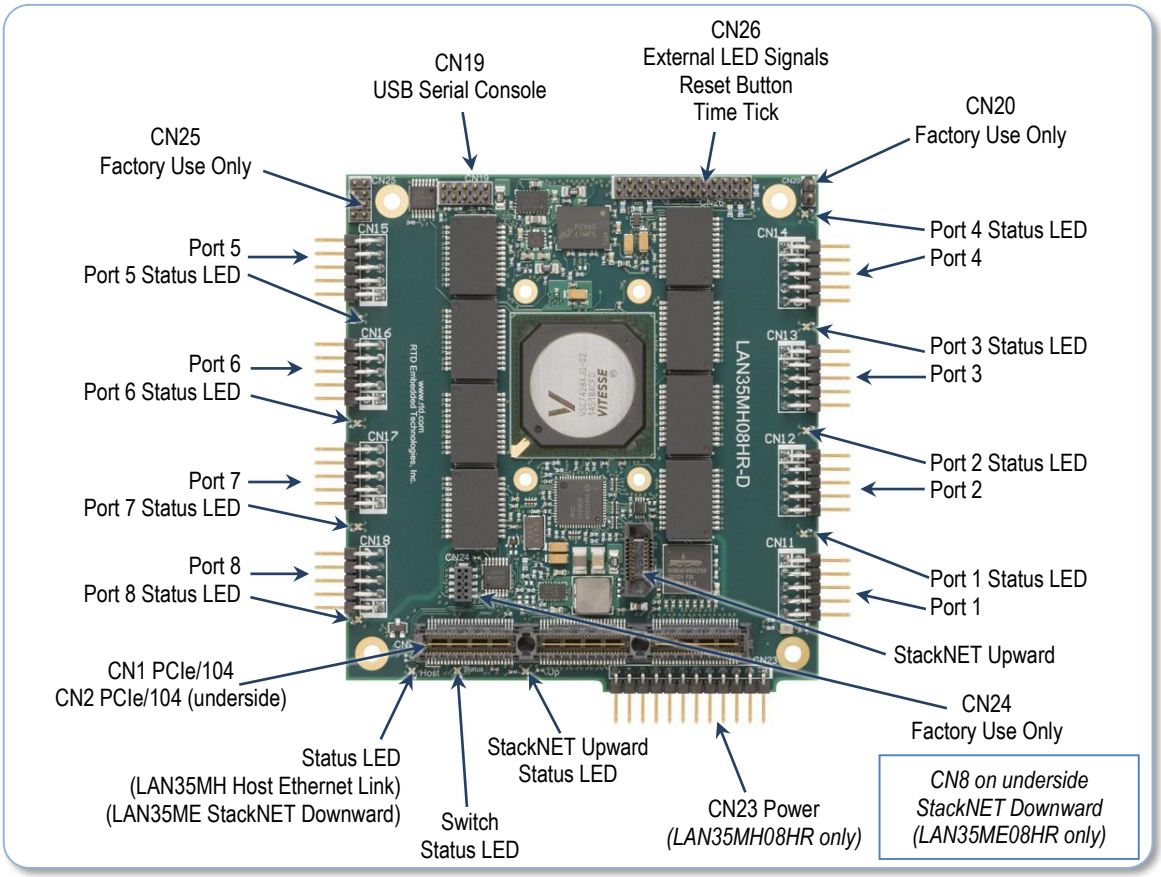


***Figure 4: LAN35MH08HR-D & LAN35ME08HR-D Board Connections***

***Table 7: Mating Connectors***

| Designator | Function | Size and Pitch | Mating Connector |
|---|---|---|---|
| CN11 | Port 1 | 2x5, 0.1", right angle | 3M 89110-0001 |
| CN12 | Port 2 | 2x5, 0.1", right angle | 3M 89110-0001 |
| CN13 | Port 3 | 2x5, 0.1", right angle | 3M 89110-0001 |
| CN14 | Port 4 | 2x5, 0.1", right angle | 3M 89110-0001 |
| CN15 | Port 5 | 2x5, 0.1", right angle | 3M 89110-0001 |
| CN16 | Port 6 | 2x5, 0.1", right angle | 3M 89110-0001 |
| CN17 | Port 7 | 2x5, 0.1", right angle | 3M 89110-0001 |
| CN18 | Port 8 | 2x5, 0.1", right angle | 3M 89110-0001 |
| CN19 | USB Serial Console | 2x5, 2mm, vertical | FCI 89947-710LF |
| CN20 | *Factory Use Only* | | |
| CN23 | Power *(LAN35MH08HR only)* | 1x12, 0.1", right angle | FCI 65039-025LF |
| CN24 | *Factory Use Only* | | |
| CN25 | *Factory Use Only* | | |
| CN26 | External LED Signals, Reset Button, Time Tick | 2x13, 2mm, vertical | FCI 89947-726LF |

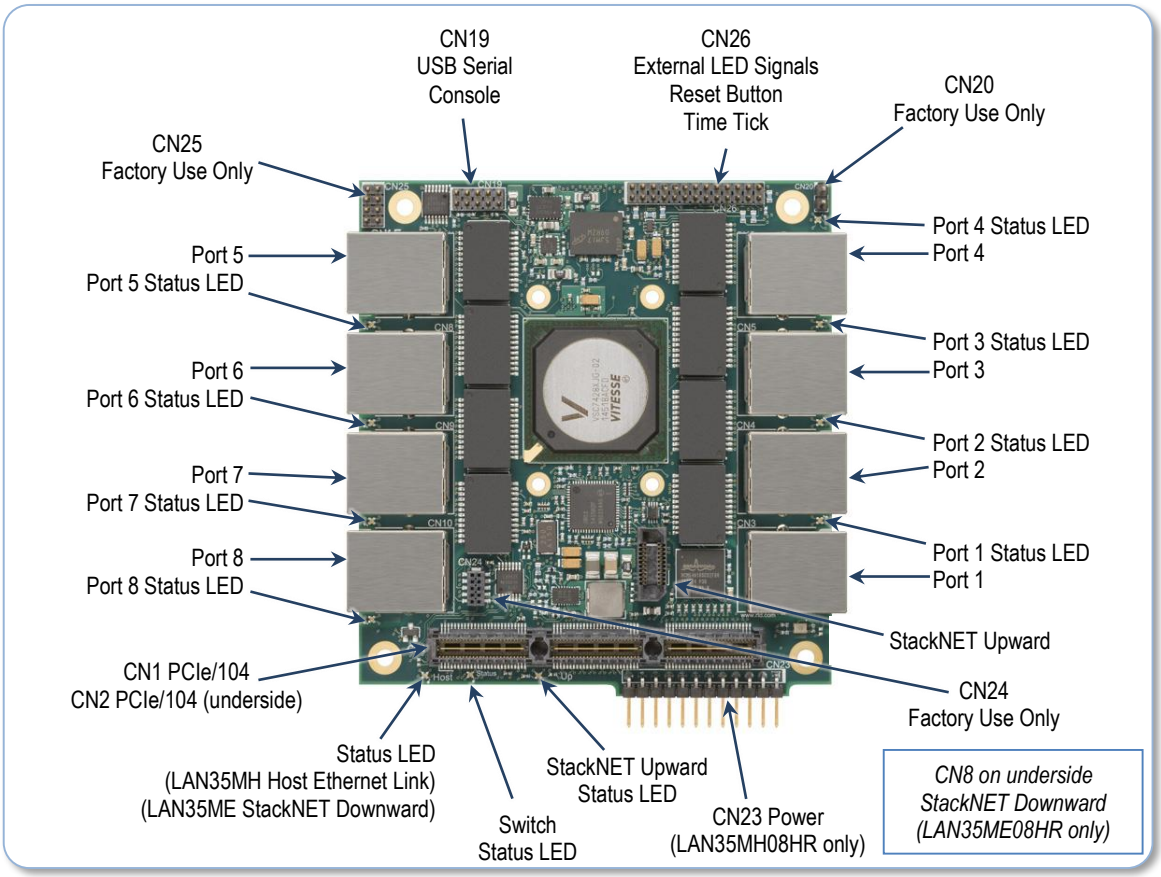


***Figure 5: LAN35MH08HR-RJ & LAN35ME08HR-RJ Board Connections***

### 3.3.1 PORT 1-8, 10-PIN DIL ETHERNET (-D VERSION)

Port 1 – Port 8 are 10/100/1000 Ethernet connectors in a 10-pin DIL configuration with 0.1" pin spacing. The pinout of all eight connectors is the same and is listed in the table below. Pin 1 is indicated by a square solder pad.

| | | | | |
|---|---|---|---|---|
| Pin 9 | Pin 7 | Pin 5 | Pin 3 | **Pin 1** |
| Pin 10 | Pin 8 | Pin 6 | Pin 4 | Pin 2 |

***Figure 6: Ethernet DIL Pin Numbering***

The pin functions are described as follows:

| Pin | 1000 Function | 10/100 Function | RJ45 Pin |
|---|---|---|---|
| 1 | MDI_B+ | Receive + | 3 |
| 2 | MDI_B- | Receive - | 6 |
| 3 | MDI_C+ | Not Used | 4 |
| 4 | MDI_C- | Not Used | 5 |
| 5 | MDI_A+ | Transmit + | 1 |
| 6 | MDI_A- | Transmit - | 2 |
| 7 | MDI_D+ | Not Used | 7 |
| 8 | MDI_D- | Not Used | 8 |
| 9 | Shield Ground | | n/a |
| 10 | Shield Ground | | n/a |

***Table 8: Ethernet DIL Signal Descriptions***

### 3.3.2 PORT 1-8, RJ45 TWISTED PAIR ETHERNET (-RJ VERSION)

Port 1 – Port 8 are standard RJ45 female connectors and follow the 10/100/1000 Base-T Ethernet pinout. They are designed to be used with Cat5e UTP (Unshielded Twisted Pair) or similar cables. The pinout of all eight connectors is the same. The figure below shows the pin numbering when ***looking into the connector***:

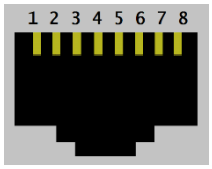


***Figure 7: RJ45 Pin Numbering***

The pin functions are described as follows:

| Pin | 1000 Function | 10/100 Function |
|---|---|---|
| 1 | MDI_A+ | Transmit + |
| 2 | MDI_A- | Transmit - |
| 3 | MDI_B+ | Receive + |
| 4 | MDI_C+ | Not Used |
| 5 | MDI_C- | Not Used |
| 6 | MDI_B- | Receive - |
| 7 | MDI_D+ | Not Used |
| 8 | MDI_D- | Not Used |

***Table 9: RJ45 Signal Descriptions***

### 3.3.3 CN5 (TOP) & CN8 (BOTTOM) STACKNET® CONNECTORS

The StackNET® connector is a board-to-board Gigabit Ethernet connection which allows the LAN35Mx08 to be stacked with other RTD StackNET® products. Multiple LAN35Mx08 boards may be stacked together to increase the overall port count of the system. In addition to switches, RTD also offers router products which incorporate the StackNET® connector, allowing the user to create a complete "communications hub" in a single system.

The LAN35MH08HR "host" version has an upward StackNET® connector only. It is intended to be placed at the bottom of a StackNET® board stack. The LAN35ME08HR "expansion" version has both upward and downward StackNET® connectors. It is intended to be stacked above the host board. Multiple LAN35ME08HR boards may be stacked above a LAN35MH08HR. Since the downward StackNET® connector on the LAN35ME08HR exceeds the PCIe/104 component height specification, it should only be stacked above other RTD StackNET® products.

### 3.3.4 CN19 USB SERIAL CONSOLE

The USB Serial Console connector is primarily used for initial configuration and troubleshooting of the switch via the Industrial Command Line Interface (ICLI). CN19 is a USB "device" port, with an Exar XR21B1411IL16 USB UART device. It is intended to be connected to the USB port of a PC (RTD cpuModule, laptop, or desktop). The USB signals comply with the USB 2.0 specification (Full Speed, 12Mbit/sec).

To provide an uninterrupted console connection while the switch is power-cycled, a USB power input pin is provided. This pin is intended to be connected to the USB power output signal of the PC's USB port. If this signal is not connected, the switch will operate normally but the console connection will be lost if the switch is power-cycled. As a result, initial boot messages may be missed. Providing USB power via CN19 is recommended.

CN19 is a 10-pin DIL connector with 2mm pin spacing. The pinout is described in the table below. Pin 1 is indicated by a square solder pad.

| | | | | |
|---|---|---|---|---|
| Pin 9 | Pin 7 | Pin 5 | Pin 3 | **Pin 1** |
| Pin 10 | Pin 8 | Pin 6 | Pin 4 | Pin 2 |

***Figure 8: CN19 Pin Numbering***

CN19 pin functions are described as follows:

| CN19 Pin | Function | Description |
|---|---|---|
| 1 | USB VCC | USB input power (+5V) |
| 3 | USB- | Negative half of USB differential pair |
| 5 | USB+ | Positive half of USB differential pair |
| 7, 9 | GND | Ground connection |
| 2, 4, 6, 8, 10 | n/a | No Connect |

***Table 10: CN19 Signal Descriptions***

***NOTE: The LAN35Mx08 is a USB device, not a host. If you are building your own cable to interface to CN19 to a standard USB connector, be sure to select an appropriate device-side connector, such as USB Type-B female or Mini-B female.***

### 3.3.5 CN23, POWER INPUT (LAN35MH08HR ONLY)

CN23 is a power connector to allow the use of the LAN35MH08HR as a standalone device without a CPU or power supply board. The LAN35MH08HR only requires +5V and ground, however if +12V is supplied it will be provided to the PCIe/104 bus connectors. CN23 is only available on the host version of the board. CN23 may be used to power just a single LAN35MH08HR, or it may be used to power a stack of multiple RTD StackNET boards (e.g. one LAN35MH08HR plus several LAN35ME08HR boards).

CN23 is a 12-pin SIL connector with 0.1" pin spacing. Pin 1 is indicated by a square solder pad. The pinout is described in the table below.

| Pin 12 | Pin 11 | Pin 10 | Pin 9 | Pin 8 | Pin 7 | Pin 6 | Pin 5 | Pin 4 | Pin 3 | Pin 2 | **Pin 1** |
|---|---|---|---|---|---|---|---|---|---|---|---|

***Figure 9: CN23 Pin Numbering***

CN23 pin functions are described as follows:

| Pin | Function |
|---|---|
| 1 | Ground |
| 2 | +5V |
| 3 | +5V |
| 4 | Ground |
| 5 | Ground |
| 6 | +12V |
| 7 | +12V |
| 8 | Ground |
| 9 | Ground |
| 10 | +5V |
| 11 | +5V |
| 12 | Ground |

***Table 11: CN23 Signal Descriptions***

If the stack is to powered from CN23, care must be taken to ensure good power connections. The power and ground leads must be twisted together, or as close together as possible to reduce lead inductance. A separate lead must be used for each of the power pins. All +5V pins, and all ground pins must be connected. If +12V is required for other boards in the stack, then +12V must be connected as well. Do not use wire smaller than 20 gauge, and take care to ensure the length of the wire does not exceed 2 ft. The power supply solution must be verified by measuring voltage at CN23 and verifying that it meets the input voltage specifications defined in Chapter 2. The voltage at the connector should be checked with an oscilloscope while the system is operational.

***WARNING: If the stack contains a +5V power supply, do not apply power via CN23! If two +5V power supplies conflict, all boards in the stack may be damaged or destroyed. If a stack powered by CN23 contains any boards other than an RTD StackNET product (not recommended), be sure the non-StackNET board(s) do not back feed +5V onto the bus before applying power.***

### 3.3.6 CN26 External LED, Switch Reset Button and Time Tick connector

Connector CN26 provides three different functions:

1. External LED interface signals. Power is supplied from the even-numbered pins (LED anode). The odd-numbered pins (LED cathode) are driven low when the LED is illuminated and tri-stated when off. Refer to Chapter 2 for the electrical specifications. Each signal pair includes a 374 Ohm current limiting resistor. A typical LED circuit is shown below:

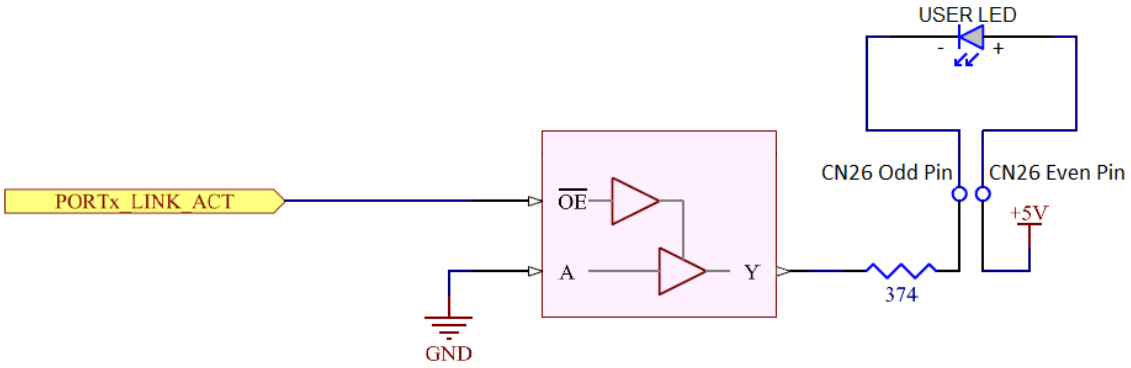


***Figure 10: External LED Drive Circuit***

2. Pin 25 is a reset input to the VSC7428. Shorting this pin to ground with either a jumper or push button will cause the processor core in the VSC7428 to reset, rebooting the CEServices software. Refer to the Functional Description chapter for details on the reset behavior.

3. Pin 23 is connected to the IEEE1588 Time Tick signal of the VSC7428. This pin can be programmed as either an input or output in the CEServices software. It can be used as an input pulse for the synchronization of the internal 1588 master timer or as programmable divided-frequency outputs from the internal 1588 master timer. The programmable divided frequency is between 25 MHz and 1 Hz while the programmed output signal's duty cycle can depend on the programmed divider factor. Refer to Chapter 2 for the electrical specifications of this pin.

***NOTE: CN26 Pin 23 is connected directly to the VSC7428. Be sure to not exceed the voltage specifications on this pin, as the board may be destroyed. External devices may require signal conditioning or voltage translation to interface with the Time Tick Signal.***

CN26 is a 26-pin DIL connector with 2mm pin spacing. Pin 1 is indicated by a square solder pad. The pinout is described in the table below.

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pin 25 | Pin 23 | Pin 21 | Pin 19 | Pin 17 | Pin 15 | Pin 13 | Pin 11 | Pin 9 | Pin 7 | Pin 5 | Pin 3 | **Pin 1** |
| Pin 26 | Pin 24 | Pin 22 | Pin 20 | Pin 18 | Pin 16 | Pin 14 | Pin 12 | Pin 10 | Pin 8 | Pin 6 | Pin 4 | Pin 2 |

***Figure 11: CN26 Pin Numbering***

CN26 pin functions are described as follows:

| CN26 Pin | Function | Description |
|---|---|---|
| 1 | Port 1 Status LED cathode | Low when linked, tri-state with activity or no link |
| 3 | Port 2 Status LED cathode | Low when linked, tri-state with activity or no link |
| 5 | Port 3 Status LED cathode | Low when linked, tri-state with activity or no link |
| 7 | Port 4 Status LED cathode | Low when linked, tri-state with activity or no link |
| 9 | StackNET Upward Status LED cathode | Low when linked, tri-state with activity or no link |
| 11 | Port 5 Status LED cathode | Low when linked, tri-state with activity or no link |
| 13 | Port 6 Status LED cathode | Low when linked, tri-state with activity or no link |
| 15 | Port 7 Status LED cathode | Low when linked, tri-state with activity or no link |
| 17 | Port 8 Status LED cathode | Low when linked, tri-state with activity or no link |
| 19 | Host Ethernet Status LED (LAN35MH)<br>StackNET Down Status LED (LAN35ME) | Low when linked, tri-state with activity or no link |
| 21 | Switch Status LED cathode | Low when illuminated, tri-state when off |
| 23 | IEEE1588 Time Tick | Programmable as input or output,<br>1Hz-25MHz, LVCMOS 2.5V |
| 25 | Switch Reset Button Input | Short to ground to reset the VSC7428 |
| 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22 | +5 Volts (LED anode) | Power for LEDs |
| 24, 26 | GND | Ground Connection |

***Table 12: CN26 Signal Descriptions***

### 3.3.7 CN1 (TOP) & CN2 (BOTTOM) PCIE/104 BUS CONNECTORS

The PCIe connector is the connection to the CPU board. The position and pin assignments are compliant with the *PCI/104-Express Specification* (see PC/104 Specifications on page 53). The LAN35Mx08 boards are "Universal" and may be connected to either a Type 1 or Type 2 PCIe/104 bus.

In the case of the LAN35MH08HR "host" version, a single PCI Express x1 link is used by the onboard Intel I210 Ethernet controller. All other signals are passed through per the *PCI/104-Express Specification*. The board may be stacked above or below the CPU board, as long as the CPU has PCIe links available.

The LAN35ME08HR "expansion" version uses the PCIe/104 bus for power only. All bus signals (PCIe, USB, etc) are passed through per the *PCI/104-Express Specification*. The board may be stacked above or below the CPU board, as long as power is available (and there is no mechanical interference with the downward StackNET connector).

***Table 13: Bus Connectors***

| Connector | Function | Location | Size and Pitch | Mating Connector |
|---|---|---|---|---|
| CN1 | PCIe/104 Universal Bus | Top | 156-pin, 0.635mm | Samtec ASP-186622-01 |
| CN2 | PCIe/104 Universal Bus | Bottom | 156-pin, 0.635mm | Samtec ASP-129637-03 |

## 3.4 Steps for Installing

1. Always work at an ESD protected workstation, and wear a grounded wrist-strap.
2. Turn off power to the PC/104 system or stack.
3. Select and install stand-offs to properly secure the module in the stack.
4. Remove the module from its anti-static bag.
5. Check that pins of the bus connector are properly positioned.
6. Check the stacking order; make sure all of the busses used by the peripheral cards are connected to the cpuModule.
7. If multiple StackNET boards are to be installed in the system, review the guidelines on StackNET in the previous sections.
    a. The Host Ethernet switch (LAN35MH08HR) should be the lowest StackNET board. Regular boards may be stacked beneath it.
    b. The Expansion modules (LAN35ME08HR or similar) should be stacked above the Host. Due to mechanical interference concerns with the downward StackNET connector, one should avoid stacking regular boards under a StackNET expansion module.
8. Hold the module by its edges and orient it so the bus connector pins line up with the matching connector on the stack.
9. Gently and evenly press the module onto the PC/104 stack.
10. If any boards are to be stacked above this module, install them along with the necessary stand-offs.
11. If no boards are to be stacked above this module, be sure to use screws to secure the board to the stand-offs.
12. Attach any necessary cables to the PC/104 stack.
13. Re-connect the power cord and apply power to the stack.
14. Boot the system and verify that all of the hardware is working properly.
15. If this is a LAN35MH08HR paired with a cpuModule:
    a. Verify the onboard Intel I210 is detected by the cpuModule.
    b. Load the I210 drivers for your Operating System and configure the network interface (see section 4.3 for details).
16. Connect to the USB Serial Console and configure VSC7428.
    a. Refer to section 4.5 for details on the serial port connection.
    b. Configure the CEServices software via the ICLI (see the software configuration information later in this document for details).

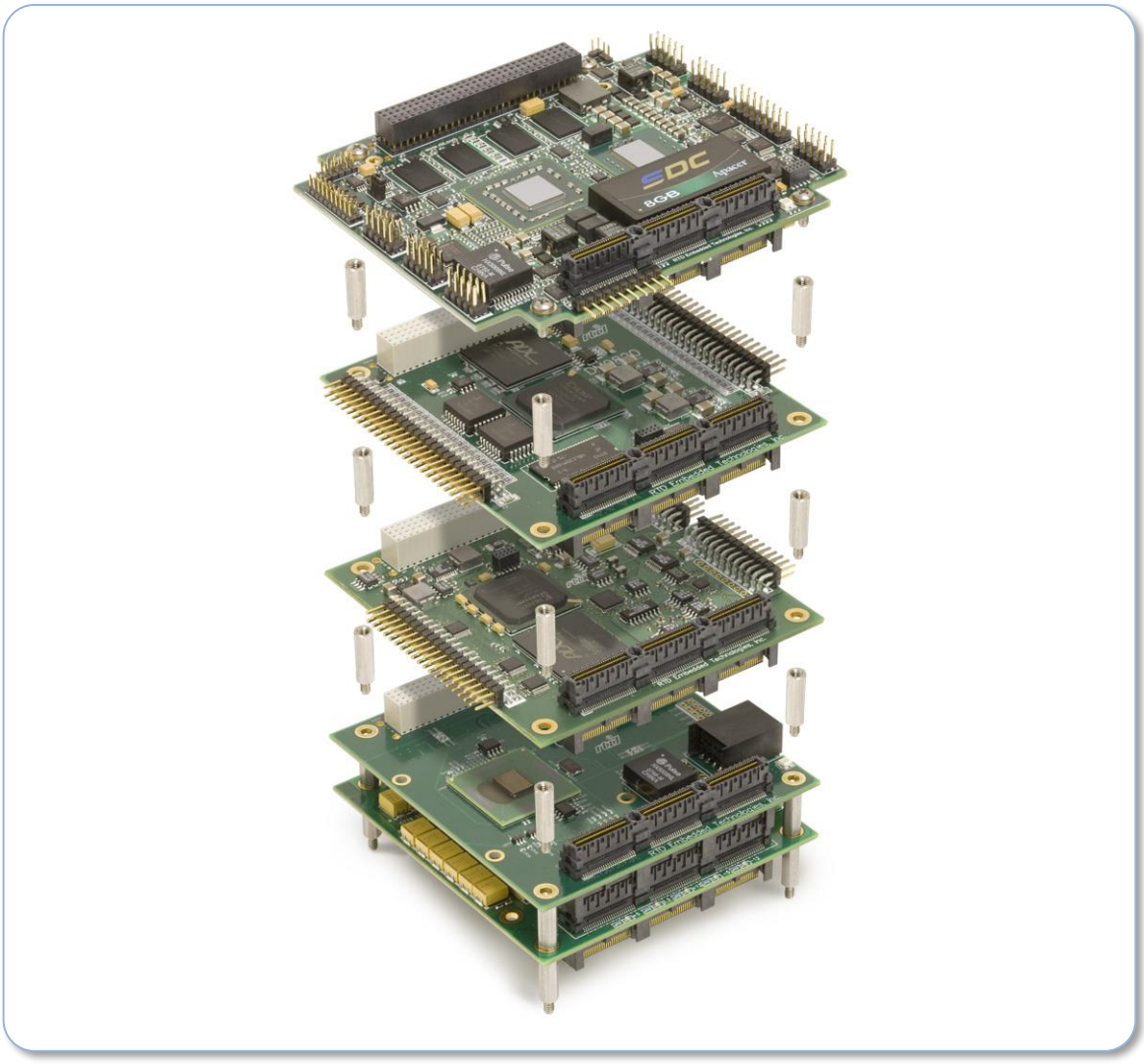

*Figure 12: Example 104™ Stack*

# 4 IDAN Connections

## 4.1 Module Handling Precautions

To prevent damage due to Electrostatic Discharge (ESD), keep your module in its antistatic bag until you are ready to install it into your system. When removing it from the bag, hold the module by the aluminum enclosure, and do not touch the components or connectors. Handle the module in an antistatic environment, and use a grounded workbench for testing and handling of your hardware.

## 4.2 Physical Characteristics

- Weight: Approximately TBD Kg (TBD lbs.)
- Dimensions: 152 mm L x 130 mm W x 17 mm H (5.983 in L x 5.117 in W x 0.669 in H)

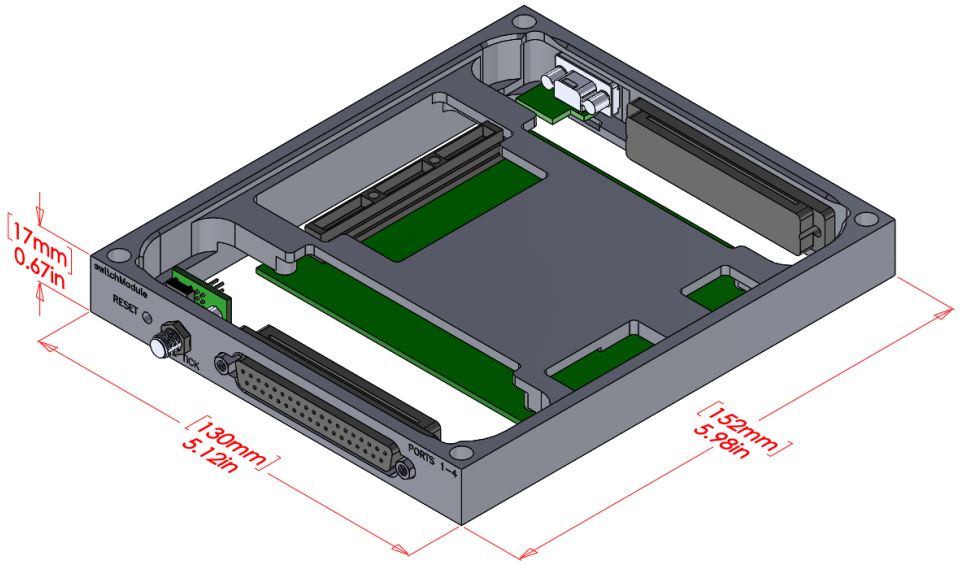


***Figure 13: IDAN-LAN35Mx08HR-D Dimensions***

## 4.3 Connector Locations

The diagrams below show the connector locations for the headers of the LAN35Mx08 as they are brought out on the front and back panels of the IDAN-LAN35MH08HR-D and IDAN-LAN35ME08HR-D. For a full description of each connector on the LAN35Mx08, refer to Chapter 3.

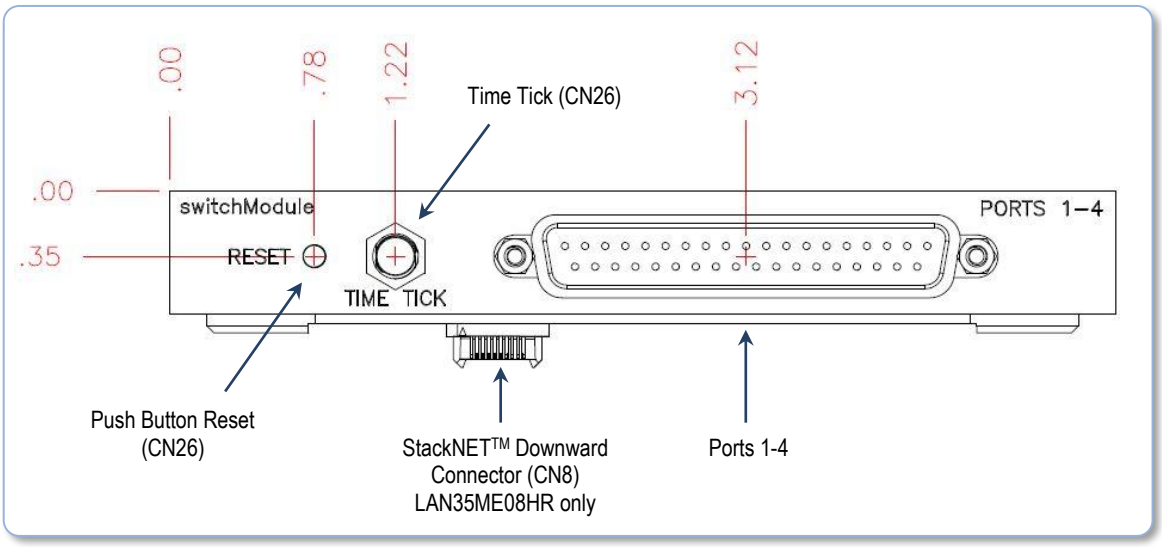


***Figure 14: IDAN Front Panel Connectors***

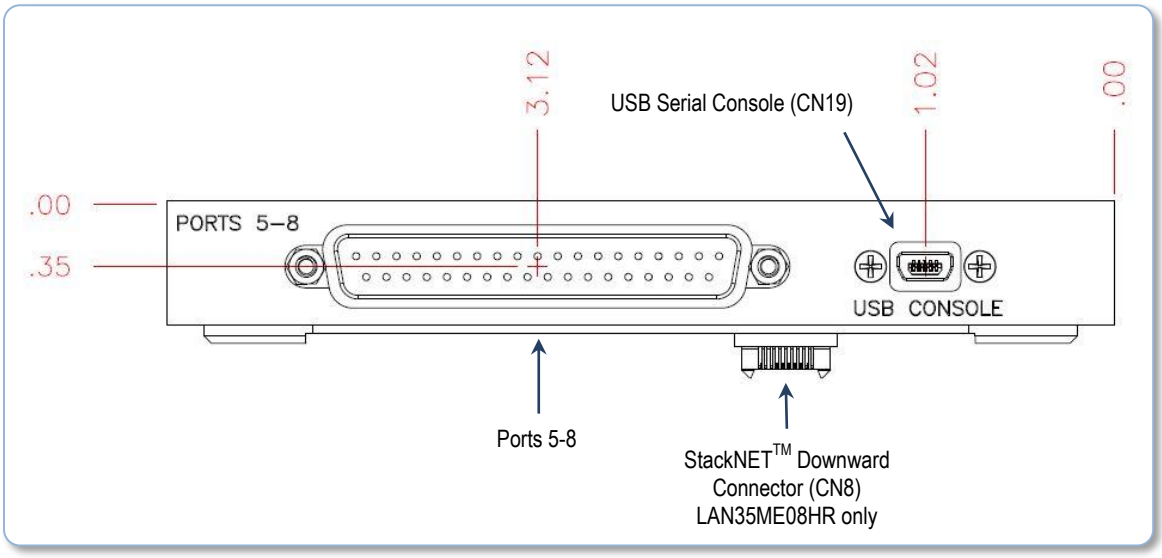


***Figure 15: IDAN Back Panel Connectors***

## 4.4 Connector Pinouts

***Table 14: IDAN Panel Connectors and Mating Connectors***

| Board Designator | Function | Connector Description | IDAN Panel Connector | Mating Connector |
|---|---|---|---|---|
| CN19 | USB Serial Console | Mini USB Type B | Amphenol MUSB-B151-30 | Amphenol Mini USB Type A *(Various)* |
| CN11<br>CN12<br>CN13<br>CN14 | Gigabit Ethernet (Ports 1-4) | 37-pin D (socket) | AMP / TE Connectivity 1658610-1 | AMP / TE Connectivity 1658608-1 |
| CN15<br>CN16<br>CN17<br>CN18 | Gigabit Ethernet (Ports 5-8) | 37-pin D (socket) | AMP / TE Connectivity 1658610-1 | AMP / TE Connectivity 1658608-1 |
| CN26 | IEEE1588 Time Tick | SMA Jack, 50 Ohm | Amphenol RF 132421 | Amphenol RF SMA Plug *(Various)* |
| CN26 | Reset Input | Push button | n/a | n/a |

### 4.4.1 IDAN USB Serial Console (CN19)

The USB Serial Console port on the IDAN front panel is a Mini USB Type B receptacle, which interfaces to connector CN19 on the LAN35Mx08HR board. The pinout and orientation are shown below.

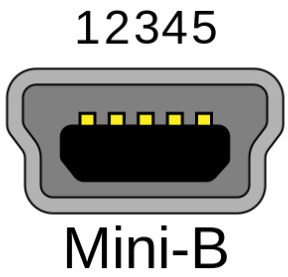


***Figure 16: Mini USB Type B Receptacle Pinout***

| CN19 Pin | IDAN Pin | Signal | Function |
|---|---|---|---|
| 1 | 1 | USB VCC | USB input power (+5V) |
| 2 | n/a | – | No Connect |
| 3 | 2 | USB- | Negative half of USB differential pair |
| 4 | n/a | – | No Connect |
| 5 | 3 | USB+ | Positive half of USB differential pair |
| 6 | n/a | – | No Connect |
| 7 | 5 | GND | Ground connection |
| 8 | n/a | – | No Connect |
| 9 | 5 | GND | Ground connection |
| 10 | n/a | – | No Connect |

***Table 15: IDAN USB Console Pinout***

### 4.4.2 IDAN IEEE1588 TIME TICK (CN26, PIN 23)

The IEEE1588 Time Tick function of CN26 pin 23 is accessible on the IDAN front panel via 50-ohm SMA bulkhead receptacle.

| CN26 Pin | IDAN Pin | Signal | Function |
|---|---|---|---|
| 23 | SMA Inner Sleeve | IEEE1588 Time Tick | Programmable as input or output, 1Hz-25MHz, LVCMOS 2.5V |
| 24 | SMA Outer Barrel | GND | Ground Connection |

***Table 16: IDAN Time Tick Pinout***

### 4.4.3 IDAN PORTS 1-4 AND PORTS 5-8

The IDAN-LAN35MH08HR-D and IDAN-LAN35ME08HR-D both feature rugged 37-pin "D" connectors which each connect to four of the onboard Ethernet ports. These connectors can easily be adapted to RJ45 connections by using RTD cable kit IDAN-XKCM48.

| IDAN | Signal | | LAN35MH08HR or LAN35ME08HR | | IDAN-XKCM48 Cable Kit |
|---|---|---|---|---|---|
| Pin | 1000 Function | 10/100 Function | Port | Pin | 9 Pin "D" Connector (Male) |
| 1 | MDI_B+ | Receive + | 4 | 1 | PORT 4-1 |
| 20 | MDI_B- | Receive - | | 2 | PORT 4-6 |
| 2 | MDI_C+ | Not Used | | 3 | PORT 4-2 |
| 21 | MDI_C- | Not Used | | 4 | PORT 4-7 |
| 3 | MDI_A+ | Transmit + | | 5 | PORT 4-3 |
| 22 | MDI_A- | Transmit - | | 6 | PORT 4-8 |
| 4 | MDI_D+ | Not Used | | 7 | PORT 4-4 |
| 23 | MDI_D- | Not Used | | 8 | PORT 4-9 |
| 5 | Shield Ground | Shield Ground | | 9 | PORT 4-5 |
| n/a | No Connect | No Connect | | 10 | No Connect |
| 24 | MDI_B+ | Receive + | 3 | 1 | PORT 3-1 |
| 6 | MDI_B- | Receive - | | 2 | PORT 3-6 |
| 25 | MDI_C+ | Not Used | | 3 | PORT 3-2 |
| 7 | MDI_C- | Not Used | | 4 | PORT 3-7 |
| 26 | MDI_A+ | Transmit + | | 5 | PORT 3-3 |
| 8 | MDI_A- | Transmit - | | 6 | PORT 3-8 |
| 27 | MDI_D+ | Not Used | | 7 | PORT 3-4 |
| 9 | MDI_D- | Not Used | | 8 | PORT 3-9 |
| 28 | Shield Ground | Shield Ground | | 9 | PORT 3-5 |
| n/a | No Connect | No Connect | | 10 | No Connect |
| 10 | MDI_B+ | Receive + | 2 | 1 | PORT 2-1 |
| 29 | MDI_B- | Receive - | | 2 | PORT 2-6 |
| 11 | MDI_C+ | Not Used | | 3 | PORT 2-2 |
| 30 | MDI_C- | Not Used | | 4 | PORT 2-7 |
| 12 | MDI_A+ | Transmit + | | 5 | PORT 2-3 |
| 31 | MDI_A- | Transmit - | | 6 | PORT 2-8 |
| 13 | MDI_D+ | Not Used | | 7 | PORT 2-4 |
| 32 | MDI_D- | Not Used | | 8 | PORT 2-9 |
| 14 | Shield Ground | Shield Ground | | 9 | PORT 2-5 |
| n/a | No Connect | No Connect | | 10 | No Connect |
| 33 | MDI_B+ | Receive + | 1 | 1 | PORT 1-1 |
| 15 | MDI_B- | Receive - | | 2 | PORT 1-6 |
| 34 | MDI_C+ | Not Used | | 3 | PORT 1-2 |
| 16 | MDI_C- | Not Used | | 4 | PORT 1-7 |
| 35 | MDI_A+ | Transmit + | | 5 | PORT 1-3 |
| 17 | MDI_A- | Transmit - | | 6 | PORT 1-8 |
| 36 | MDI_D+ | Not Used | | 7 | PORT 1-4 |
| 18 | MDI_D- | Not Used | | 8 | PORT 1-9 |
| 37 | Shield Ground | Shield Ground | | 9 | PORT 1-5 |
| n/a | No Connect | No Connect | | 10 | No Connect |
| 19 | No Connect | No Connect | n/a | n/a | No Connect |

***Table 17: IDAN-LAN35Mx08HR-D, Front Connector Pin Out***

| IDAN | Signal | | LAN35MH08HR or LAN35ME08HR | | IDAN-XKCM48 Cable Kit |
|---|---|---|---|---|---|
| Pin | 1000 Function | 10/100 Function | Port | Pin | 9 Pin "D" Connector (Male) |
| 1 | MDI_B+ | Receive + | 8 | 1 | PORT 8-1 |
| 20 | MDI_B- | Receive - | | 2 | PORT 8-6 |
| 2 | MDI_C+ | Not Used | | 3 | PORT 8-2 |
| 21 | MDI_C- | Not Used | | 4 | PORT 8-7 |
| 3 | MDI_A+ | Transmit + | | 5 | PORT 8-3 |
| 22 | MDI_A- | Transmit - | | 6 | PORT 8-8 |
| 4 | MDI_D+ | Not Used | | 7 | PORT 8-4 |
| 23 | MDI_D- | Not Used | | 8 | PORT 8-9 |
| 5 | Shield Ground | Shield Ground | | 9 | PORT 8-5 |
| n/a | No Connect | No Connect | | 10 | No Connect |
| 24 | MDI_B+ | Receive + | 7 | 1 | PORT 7-1 |
| 6 | MDI_B- | Receive - | | 2 | PORT 7-6 |
| 25 | MDI_C+ | Not Used | | 3 | PORT 7-2 |
| 7 | MDI_C- | Not Used | | 4 | PORT 7-7 |
| 26 | MDI_A+ | Transmit + | | 5 | PORT 7-3 |
| 8 | MDI_A- | Transmit - | | 6 | PORT 7-8 |
| 27 | MDI_D+ | Not Used | | 7 | PORT 7-4 |
| 9 | MDI_D- | Not Used | | 8 | PORT 7-9 |
| 28 | Shield Ground | Shield Ground | | 9 | PORT 7-5 |
| n/a | No Connect | No Connect | | 10 | No Connect |
| 10 | MDI_B+ | Receive + | 6 | 1 | PORT 6-1 |
| 29 | MDI_B- | Receive - | | 2 | PORT 6-6 |
| 11 | MDI_C+ | Not Used | | 3 | PORT 6-2 |
| 30 | MDI_C- | Not Used | | 4 | PORT 6-7 |
| 12 | MDI_A+ | Transmit + | | 5 | PORT 6-3 |
| 31 | MDI_A- | Transmit - | | 6 | PORT 6-8 |
| 13 | MDI_D+ | Not Used | | 7 | PORT 6-4 |
| 32 | MDI_D- | Not Used | | 8 | PORT 6-9 |
| 14 | Shield Ground | Shield Ground | | 9 | PORT 6-5 |
| n/a | No Connect | No Connect | | 10 | No Connect |
| 33 | MDI_B+ | Receive + | 5 | 1 | PORT 5-1 |
| 15 | MDI_B- | Receive - | | 2 | PORT 5-6 |
| 34 | MDI_C+ | Not Used | | 3 | PORT 5-2 |
| 16 | MDI_C- | Not Used | | 4 | PORT 5-7 |
| 35 | MDI_A+ | Transmit + | | 5 | PORT 5-3 |
| 17 | MDI_A- | Transmit - | | 6 | PORT 5-8 |
| 36 | MDI_D+ | Not Used | | 7 | PORT 5-4 |
| 18 | MDI_D- | Not Used | | 8 | PORT 5-9 |
| 37 | Shield Ground | Shield Ground | | 9 | PORT 5-5 |
| n/a | No Connect | No Connect | | 10 | No Connect |
| 19 | No Connect | No Connect | n/a | n/a | No Connect |

***Table 18: IDAN-LAN35Mx08HR-D, Rear Connector Pin Out***

## 4.5 Steps for Installing

1. Always work at an ESD protected workstation, and wear a grounded wrist-strap.
2. Turn off power to the IDAN system.
3. Remove the module from its anti-static bag.
4. Check that pins of the bus connector are properly positioned.
5. Check the stacking order; make sure all of the busses used by the peripheral cards are connected to the cpuModule.
6. If multiple StackNET boards are to be installed in the system, review the guidelines on StackNET connector in the previous sections.
    a. The Host Ethernet switch (LAN35MH08HR) should be the lowest StackNET board. Regular boards may be stacked beneath it.
    b. The Expansion modules (LAN35ME08HR or similar) should be stacked above the Host. Due to mechanical interference concerns with the downward StackNET connector, one should avoid stacking regular boards under a StackNET expansion module.
7. Hold the module by its edges and orient it so the bus connector pins line up with the matching connector on the stack.
8. Gently and evenly press the module onto the IDAN system.
9. If any boards are to be stacked above this module, install them.
10. Finish assembling the IDAN stack by installing screws of an appropriate length.
11. Attach any necessary cables to the IDAN system.
12. Re-connect the power cord and apply power to the stack.
13. Boot the system and verify that all of the hardware is working properly.
14. If this is a LAN35MH08HR paired with a cpuModule:
    a. Verify the onboard Intel I210 is detected by the cpuModule.
    b. Load the I210 drivers for your Operating System and configure the network interface (see section 4.3 for details).
15. Connect to the USB Serial Console and configure VSC7428.
    a. Refer to section 4.5 for details on the serial port connection.
    b. Configure the CEServices software via the Command Line Interface (see the software configuration information later in this document for details).

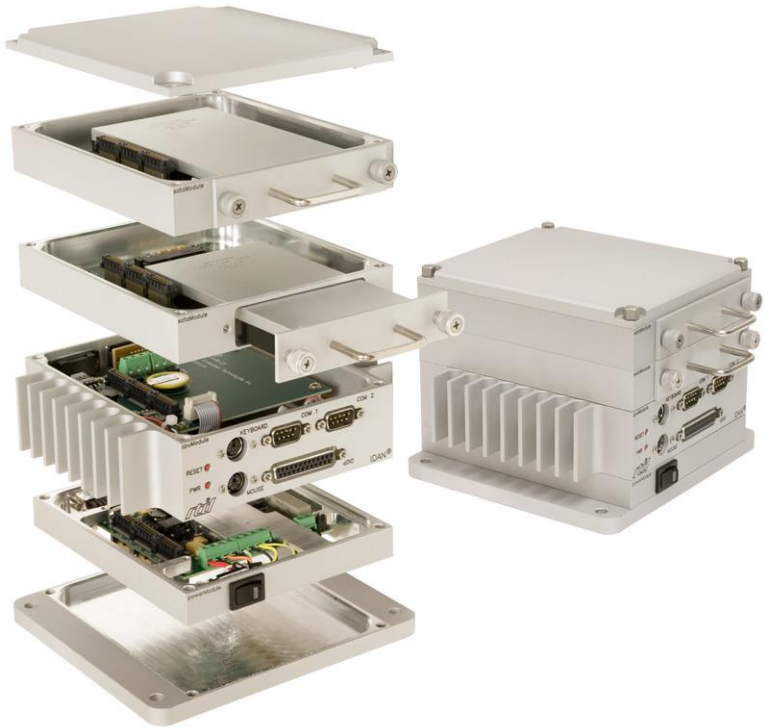

***Figure 17: Example IDAN System***

# 5 Functional Description

## 5.1 Block Diagrams

The Figures below shows the functional block diagram of the LAN35MH08HR and LAN35ME08HR. The key features of the board are discussed in the following sections.

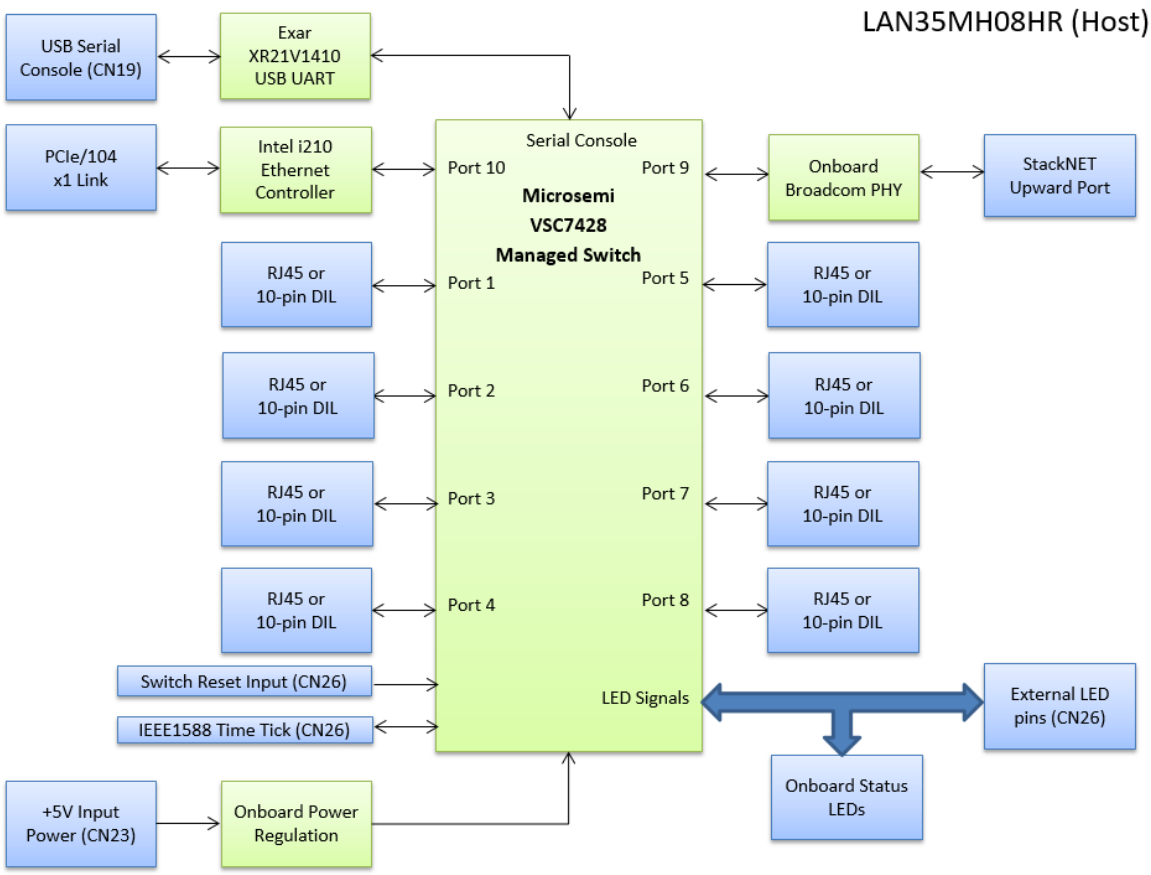


*Figure 18: LAN35MH08HR Block Diagram*

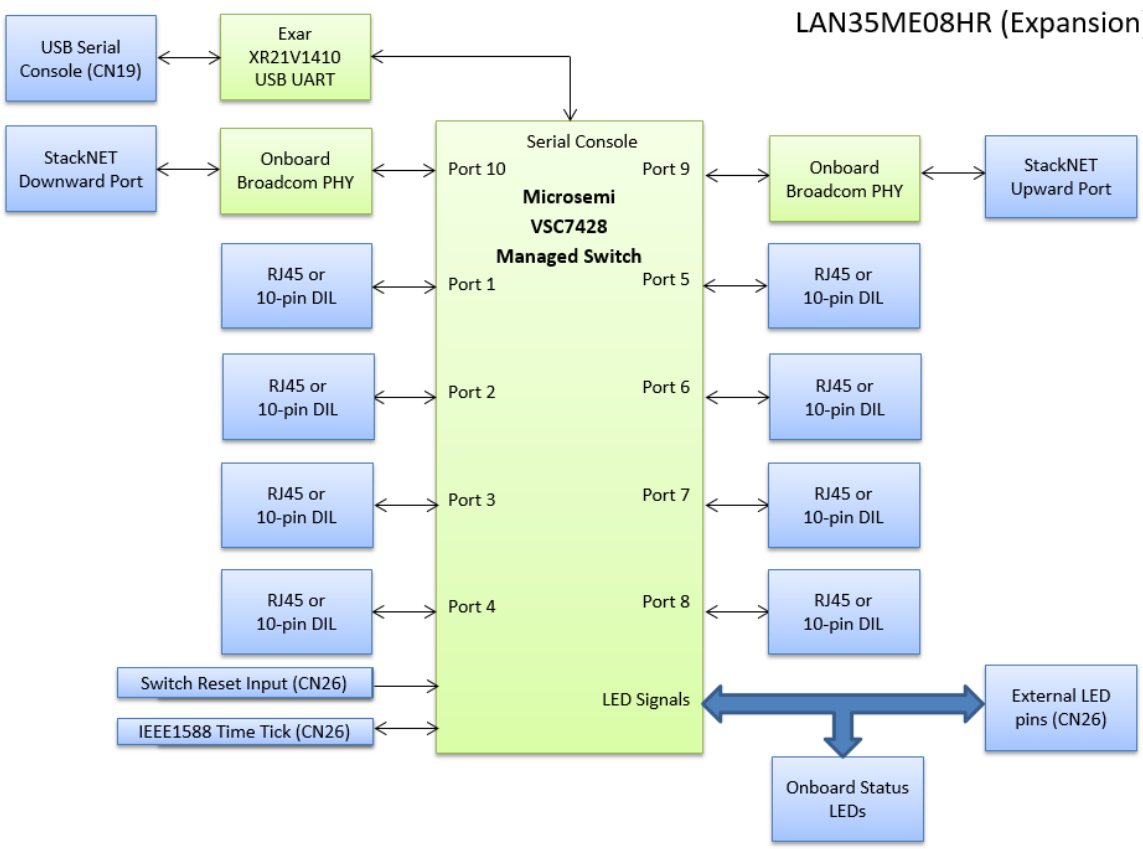


***Figure 19: LAN35ME08HR Block Diagram***

## 5.2 Microsemi VSC7428 Managed Ethernet Switch and CEServices

The core component of the LAN35Mx08 is the Microsemi VSC7428 Managed Ethernet Switch (formerly Vitesse) and its corresponding CEServices Carrier Ethernet switching software. It is an industrial temperature rated, 10 port Gigabit Ethernet switch. The switch features an integrated MIPS32 processor, DDR2 RAM, and a SPI Flash device to run CEServices. CEServices is built on top of the open source eCos operating system and Redboot boot loader.

Initial configuration of CEServices should be done via the USB Serial Console using the Industrial Command Line Interface (ICLI). Once the switch has basic configuration settings (IP address, subnet mask, admin password, etc), it may be managed via the network. Network management is possible via ICLI (SSH/Telnet), or a GUI interface with a web browser (HTTP/HTTPS), or programmatically via JSON or SNMP. It is up to the user to determine the correct IP address for their network. Note that once an IP address is assigned to the VSC7428, it may be accessed by any client on the network unless appropriate security precautions are taken (setting a password, only allowing encrypted management protocols, etc). Implementing proper network security is the customer's responsibility.

## 5.3 Intel I210 Gigabit Ethernet Controller (LAN35MH08HR only)

The LAN35MH08HR has an onboard Gigabit Ethernet controller, the Intel I210. This allows a direct Ethernet connection to a PCIe/104 compatible CPU in the stack without the need for an external cable between the boards. Since the Intel I210 is a PCI Express x1 device, it should be detected automatically by the CPU

To use the I210, the appropriate networking drivers must be loaded in your Operating System. The I210 is a common Ethernet controller, so it is supported by many OSes. RTD distributes the Intel PRO Ethernet drivers for Windows 7 and later. For Linux, support is built into kernel 3.5 or later using the ***igb*** driver. For other operating systems, check with the operating system vendor.

Once the device is detected and networking drivers are loaded in the Operating System, the I210 should appear as an additional Ethernet interface. This interface is independent of the onboard Ethernet port(s) of the CPU. To communicate on the network, the I210 interface must be configured with basic network settings such as IP address, subnet mask, and default gateway. It is up to the user to determine the correct IP addressing scheme for their network.

Note the I210 is separate device from the VSC7428 switch, with its own IP address. They must not be configured with the same IP address. However, to manage the VSC7428 from the I210 Ethernet port, they should generally be configured for the same subnet (e.g. 192.168.0.5 and 192.168.0.6).

## 5.4 Onboard Status LEDs and External LED pins

The LAN35Mx08 provides a set of onboard multi-color LEDs to indicate status of the switch and the individual Ethernet links.

Ethernet Ports 1-8, the StackNET port(s), and the Host Ethernet Link each include an LED to indicate link status, speed, and activity. The colors are as follows:

| LED Color | Description |
|---|---|
| Off | No Link |
| Green | Link at 1000 Mbps, flash with activity |
| Blue | Link at 100 Mbps, flash with activity |
| Red | Link at 10 Mbps, flash with activity |

***Table 19: Link Status LEDs***

The Switch Status LED indicates the status of the switch management software. The colors are as follows:

| LED Color | Description |
|---|---|
| Off | No Power |
| Flashing Green | Redboot Boot Loader<br>(Takes approximately 10 seconds to boot.) |
| Solid Green | CEServices has booted<br>(Switch is operating normally.) |
| Red | Error Condition<br>(Check log for details.) |

***Table 20: Switch Status LED***

In addition to the onboard LEDs, the LAN35Mx08 also provides status LED signals as discrete pins on CN26 so they may be wired to a custom enclosure. Only a single LED color is available per port on CN26. Refer to the Board Connections chapter for wiring details. Note that for IDAN versions of this product, the external LED signals are not brought to the outside of the frame.

## 5.5 USB Serial Console

The USB Serial Console connector is primarily used for initial configuration and troubleshooting of the managed switch. It is a USB "device mode" port, with an Exar XR21B1411IL16 USB UART interface. The USB Serial Console may be connected to a USB port on an RTD cpuModule, laptop, or a desktop PC.

Modern versions of Windows include drivers for the USB UART. For older versions of Windows, a driver is provided by RTD. Once USB is connected and the drivers are loaded, the console interface will appear as a serial COM port in the PC's operating system (e.g. COM5). The COM port number can vary depending on how ports were enumerated by the operating system, so it is difficult to predict. The easiest way to determine the COM port number is to connect the console, load the drivers, and then check the Device Manager (Start > Run > C:\Windows\System32\devmgmt.msc) once it is installed. Note that when working with multiple LAN35Mx08 boards, each one may be assigned a different COM port number.

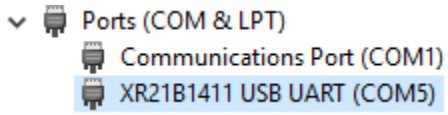


***Figure 20: Windows Device Manager COM Port Numbering***

Accessing the USB Serial Console port requires terminal emulation software such as PuTTY, TeraTerm, HyperTerminal, or similar. After installing the software on the PC, configure the serial connection as follows:

- Baud Rate = 9600
- Data Bits = 8
- Parity = None

- Stop Bits = 1
- Flow Control = None

If the console is connected before power is applied to the switch, the initial boot messages may be seen. It is also possible to connect the console while the switch is powered, however the initial boot messages will be missed. If the console is connected after the switch has booted, it may be necessary to press Enter a few times before any text is displayed.

```
+M25PXX : Init device with JEDEC ID 0x20BA19.
Luton10 board detected (VSC7428 Rev. D).

RedBoot(tm) bootstrap and debug environment [ROMRAM]
RTD-compiled release, version 1_20-Vitesse--01.01.101730-RTD - built 16:06:23, Aug  5 2016

Copyright (C) 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009
Free Software Foundation, Inc.
RedBoot is free software, covered by the eCos license, derived from the
GNU General Public License. You are welcome to change it and/or distribute
copies of it under certain conditions. Under the license terms, RedBoot's
source code and full license terms must have been made available to you.
Redboot comes with ABSOLUTELY NO WARRANTY.

Platform: VCore-III (MIPS32 24KEc) LUTON26
RAM: 0x80000000-0x88000000 [0x800280c0-0x87fdfffc available]
FLASH: 0x40000000-0x41ffffff, 512 x 0x10000 blocks
== Executing boot script in 3.000 seconds - enter ^C to abort
RedBoot> diag -a
Hardware self-test: ... Passed
IS1 TCAM self-test: ... Passed
IS2 TCAM self-test: ... Passed
ES0 TCAM self-test: ... Passed
DDR SDRAM: Testing [0x800280c0-0x87fdfffc] - Zero  Sweep Done
DDR SDRAM: Testing [0x800280c0-0x87fdfffc] - Write Sweep ..............................
..........................................................................................
.... Done
DDR SDRAM: Testing [0x800280c0-0x87fdfffc] - Read  Sweep ...............................
..........................................................................................
.... Done
3 tests completed successfully.
RedBoot> fis load -d managed
Image loaded from 0x80040000-0x8104d398
RedBoot> go

Press ENTER to get started
```

***Figure 21: USB Serial Console Typical Boot Messages***

After the switch is booted, it may be necessary to press Enter a few times before the login prompt (or command prompt if already logged in) is displayed. In the factory default configuration, the username is admin with no password (just press enter when prompted for a password). The default command prompt is **#**.

```
Press ENTER to get started

If you require support, please contact RTD Embedded Technologies, Inc.

Username: admin
Password:

TIP: If Backspace does not work, use Ctrl-H for Backspace.
#
```

***Figure 22: USB Serial Console Default Configuration Login and Command Prompt***

***NOTE: By default, no password is required for the admin login. Customers are strongly urged to set a password immediately after logging in for the first time. Refer to the software configuration information later in this document for details.***

## 5.6 Reset Behavior

Since the VSC7428 contains an internal MIPS32 processor, it may be reset independently of any other boards in the stack. The VSC7428 may be reset via a software command or the reset pin on CN26. This will trigger a reboot of the CEServices software. Any unsaved configuration data will be lost. All Ethernet connections to the switch will be interrupted while it reboots. The onboard Intel I210 Ethernet controller will not be reset as it is controlled by the CPU (LAN35MH08HR version only). Any other boards in the stack (other switches, CPU, etc) will not be reset.

In the case of a system that contains a CPU board, a "warm" reboot of the CPU would not affect the VSC7428. The Ethernet switch ports will remain functional. However, any network communication with the CPU board would be interrupted while the CPU reboots (including Intel I210 Ethernet controller on the LAN35MH08HR). A "cold" reset which interrupts power to the LAN35MHx08 (RSM reset, ACPI S3 standby, etc) will reset the VSC7428.

# 6 CEServices Software Overview

## 6.1 General Expectations

The LAN35Mx08 and its onboard CEServices Carrier Ethernet switching software is a complex product. It supports a wide variety of enterprise switching technologies (VLAN, Spanning Tree, LLDP, etc). It provides a rich management interface that may be accessed via a variety of methods (ICLI, Web GUI, SNMP, etc). To use the LAN35Mx08, it is assumed that one is already familiar with network engineering concepts.

The remaining sections in this chapter provides introductory information on how to configure and use CEServices. An in-depth explanation of enterprise switching technologies and network architecture is beyond the scope of this manual. To ensure the switch is configured correctly and securely, enlisting the services of an experienced network engineer is strongly recommended.

## 6.2 ICLI Basics

The command line interface of CEServices is called the Industrial Command Line Interface (ICLI). The ICLI interface is accessible via the USB Serial Console, or via the network using SSH or Telnet. To access the USB Serial Console, refer to the previous chapters for connection details. To use SSH/Telnet, an IP address must first be set (using the USB Serial Console for initial configuration). Both methods of accessing the ICLI require terminal emulation software such as PuTTY, TeraTerm, HyperTerminal, or similar.

The ICLI has the following key characteristics:

1. It closely follows the de-facto structure and behavior of other enterprise network equipment CLIs. A user with experience using other industry-standard network equipment will be comfortable using ICLI.
2. It is modal – There are different modes (exec/configuration), which determines the available commands.
3. It is line-based – Commands are entered one line at a time.
4. Commands are executed upon pressing Enter. Configuration changes take effect immediately.
5. Configuration changes are not persistent, unless they are saved to the startup configuration.
6. It supports multiple user accounts with varying privilege levels. For example, it is possible to create a limited user account which can only view the switch status and configuration, without changing it.
7. It supports multiple simultaneous user sessions. It is possible to be logged into the USB Serial Console and an SSH session simultaneously.
8. Commands may be abbreviated or truncated (as long as the command is unambiguous). For example, the command **configure terminal** may be abbreviated as **config t**.

By default, when first logging into the switch, the ICLI is in exec mode, which is indicated by the command prompt **HOSTNAME#**. (By default, the hostname is not set, so the default command prompt is simply **#**.)


***Figure 23: ICLI exec mode***

ICLI provides a rich context-aware help system. For a list of available commands, type **?**. The question mark can also be used to display a list of options for a command. Using this technique, it is possible to discover most of the functionality in the CLI.

```
# ?
    clear          Reset functions
    configure      Enter configuration mode
    copy           Copy from source to destination
    delete         Delete one file in flash: file system
    dir            Directory of all files in flash: file system
    disable        Turn off privileged commands
    do             To run exec commands in config mode
    dot1x          IEEE Standard for port-based Network Access Control
    enable         Turn on privileged commands
    erps           Ethernet Ring Protection Switching
    exit           Exit from EXEC mode
    firmware       Firmware upgrade/swap
    help           Description of the interactive help system
    ip             IPv4 commands
    ipv6           IPv6 configuration commands
    link-oam       Link OAM configuration
    logout         Exit from EXEC mode
    more           Display file
    no             Negate a command or set its defaults
    ping           Send ICMP echo messages
    platform       Platform configuration
    ptp            Misc non persistent 1588 settings
-- more --, next page: Space, continue: g, quit: ^C
```

***Figure 24: Listing Commands***

```
# copy ?
    <url_file>         File in FLASH or on TFTP server. Sytax: <flash:filename |
                       tftp://server/path-and-filename>. A valid file name is a
                       text string drawn from alphabet (A-Za-z), digits (0-9),
                       dot (.), hyphen (-), under score(_). The maximum length
                       is 63 and hyphen must not be first character. The file
                       name content that only contains '.' is not allowed.
    running-config     Currently running configuration
    startup-config     Startup configuration
# copy
```

***Figure 25: Listing Options for a Command***

In addition to the interactive help, a complete list of all possible commands is provided in the release package for the Managed Switch Firmware. The release package also contains an application note from Microsemi/Vitesse which provides additional information on using the ICLI. These files are provided on the Companion CD that is delivered with the board. Newer versions of the firmware may provide additional commands. The command reference is automatically generated during the compilation process of the firmware, so it provides the most up-to-date reference of possible commands.

## 6.3 ICLI Configuration Mode Overview

To alter the configuration of the switch, one must switch from exec mode to configuration mode. This is achieved with the **configure terminal** command. Once in configuration mode, the command prompt changes from **HOSTNAME#** to **HOSTNAME(config)#**. In the factory default configuration with no host name set, the prompt will simply be **(config)#**.

```
# configure terminal
(config)# ?
    aaa                 Authentication, Authorization and Accounting
    access              Access management
    access-list         Access list
    aggregation         Aggregation mode
    banner              Define a login banner
    clock               Configure time-of-day clock
    default             Set a command to its defaults
    do                  To run exec commands in config mode
    dot1x               IEEE Standard for port-based Network Access Control
    enable              Modify enable password parameters
    end                 Go back to EXEC mode
    eps                 Ethernet Protection Switching.
    erps                Ethernet Ring Protection Switching
    evc                 Ethernet Virtual Connections
    exit                Exit from current mode
    green-ethernet      Green ethernet (Power reduction).
    gvrp                Enable GVRP feature
    help                Description of the interactive help system
    hostname            Set system's network name
    interface           Select an interface to configure
    ip                  Internet Protocol
    ipmc                IPv4/IPv6 multicast configuration
-- more --, next page: Space, continue: g, quit: ^C
```

*Figure 26: Entering ICLI Configuration Mode*

In configuration mode, the list of available commands changes. Press **?** to see a list of possible configuration commands. It is possible to invoke an exec mode command by prefixing it with **do**. For example, in exec mode, one would use the command **show running-config** to show the current configuration. In configuration mode, this command would be **do show running-config**.

To alter the switch configuration, use the configuration mode commands. One can use the ICLI online help to discover available commands, or use the command reference files provided with the Managed Switch Firmware package. When done configuring the switch, use **exit** to exit configuration mode. The changes take effect immediately. To save the new configuration changes to flash, use the exec command **copy running-config startup-config**.

***NOTE: Unless the configuration is saved to the flash, it will be lost when the switch it rebooted. Be sure to remember to save your changes! If one accidentally makes a bad configuration change (e.g. cutting off network access), simply reboot without saving. The switch will revert to the previously-saved configuration.***

The following screenshot demonstrates a common configuration task; setting the switch's host name and then saving that configuration to the flash:

```
# configure terminal
(config)# hostname RTD-SWITCH
RTD-SWITCH(config)# exit
RTD-SWITCH# copy running-config startup-config
Building configuration...
% Saving 2460 bytes to flash:startup-config
RTD-SWITCH#
```

*Figure 27: Setting a host name with ICLI*

The currently running configuration of the switch may be viewed in exec mode by using the command **show running-config**.

```
RTD-SWITCH# show running-config
Building configuration...
banner exec "TIP: If Backspace does not work, use Ctrl-H for Backspace."
banner login "If you require support, please contact RTD Embedded Technologies, Inc."
hostname RTD-SWITCH
logging level notice
username admin privilege 15 password none
!
vlan 1
!
!
!
!
ip http secure-server
ip http secure-redirect
aggregation mode dmac
spanning-tree mst name 00-d0-81-0d-00-00 revision 0
thermal-protect grp 0 temperature 0
thermal-protect grp 1 temperature 0
thermal-protect grp 2 temperature 0
thermal-protect grp 3 temperature 0
no snmp-server
-- more --, next page: Space, continue: g, quit: ^C
```

***Figure 28: Viewing running configuration with ICLI***

## 6.4 ICLI Configuration Command Negation

After running a configuration command, one may choose to remove that configuration. The ICLI allows you to negate a command by prefixing it with no. The screenshot below demonstrates how to use negation to unset the switch's host name.

```
RTD-SWITCH# configure terminal
RTD-SWITCH(config)# no hostname
(config)# exit
# copy running-config startup-config
Building configuration...
% Saving 2440 bytes to flash:startup-config
#
```

***Figure 29: Negating a configuration command with ICLI***

## 6.5 CEServices Physical Interface Mapping

Each port of the managed switch is identified in CEServices as an *interface*. Interfaces names follow the convention *InterfaceType SwitchNumber/PortNumber*. (Since each LAN35Mx08 switch operates independently, *SwitchNumber* is always 1.) The mapping of physical Ethernet ports to CEServices interfaces is as follows:

- Port 1 = GigabitEthernet 1/1
- Port 2 = GigabitEthernet 1/2
- Port 3 = GigabitEthernet 1/3
- Port 4 = GigabitEthernet 1/4
- Port 5 = GigabitEthernet 1/5
- Port 6 = GigabitEthernet 1/6
- Port 7 = GigabitEthernet 1/7
- Port 8 = GigabitEthernet 1/8

- Port 9 (StackNET Upward Port CN5) = 2.5GigabitEthernet 1/1
- Port 10 (either I210 Host Connection or StackNET Downward Port CN8) = 2.5GigabitEthernet 1/2

***NOTE: Even though Ports 9 and 10 are identified as "2.5GigabitEthernet", they are in fact limited to 1 Gigabit speeds. They appear as 1 Gigabit fiber interfaces in the CEServices software.***

In ICLI exec mode, one can view the interface details with the **show interface** command. For example, one could use the command **show interface * status** to view the status of all interfaces.

```
# show interface * status
Interface              Mode     Speed & Duplex  Flow Control  Max Frame  Excessive  Link
---------------------  -------  --------------  ------------  ---------  ---------  --------
GigabitEthernet 1/1    enabled  Auto            disabled      9600       Discard    Down
GigabitEthernet 1/2    enabled  Auto            disabled      9600       Discard    Down
GigabitEthernet 1/3    enabled  Auto            disabled      9600       Discard    Down
GigabitEthernet 1/4    enabled  Auto            disabled      9600       Discard    Down
GigabitEthernet 1/5    enabled  Auto            disabled      9600       Discard    Down
GigabitEthernet 1/6    enabled  Auto            disabled      9600       Discard    Down
GigabitEthernet 1/7    enabled  Auto            disabled      9600       Discard    Down
GigabitEthernet 1/8    enabled  Auto            disabled      9600       Discard    Down
2.5GigabitEthernet 1/1 enabled  1Gfdx           disabled      9600       Discard    1Gfdx Fiber
2.5GigabitEthernet 1/2 enabled  1Gfdx           disabled      9600       Discard    1Gfdx Fiber
#
```

***Figure 30: Showing interface status with ICLI***

***NOTE: Due to technical details of the StackNET PHY connection, the CEServices software will always report that the StackNET upwards (CN5) and downwards (CN8) connectors have a link status of "up", regardless of what is physically connected. This is expected behavior.***

## 6.6 ICLI Physical Interface Configuration Overview

Each interface may be configured from ICLI configuration mode. To configure the interface, use the command **interface GigabitEthernet 1/1**. You may specify an individual interface (e.g. GigabitEthernet 1/1), or a range of interfaces (e.g. GigabitEthernet 1/1-8). Interface ranges are a convenient method to apply the same configuration to several interfaces with only a few commands. Once in the interface configuration sub-mode, the command prompt changes from **HOSTNAME(config)#** to **HOSTNAME(config-if)#**. To switch back to "global" configuration mode, type **exit**.

```
(config)# interface GigabitEthernet 1/1
(config-if)# ?
    access-list           Access list
    aggregation           Create an aggregation
    do                    To run exec commands in config mode
    dot1x                 IEEE Standard for port-based Network Access Control
    duplex                Interface duplex
    end                   Go back to EXEC mode
    evc                   Ethernet Virtual Connections
    excessive-restart     Restart backoff algorithm after 16 collisions (No
                          excessive-restart means discard frame after 16
                          collisions)
    exit                  Exit from current mode
    flowcontrol           Traffic flow control.
    frame-length-check    Drop frames with mismath between EtherType/Length
                          field and actually payload size.
    green-ethernet        Green ethernet (Power reduction)
    gvrp                  Enable GVRP on port(s)
    help                  Description of the interactive help system
    ip                    Internet Protocol
    ipv6                  IPv6 configuration commands
    lacp                  Enable LACP on this interface
    link-oam              Enable or Disable(when the no keyword is entered)
                          Link OAM on the interface
-- more --, next page: Space, continue: g, quit: ^C
```

***Figure 31: ICLI physical interface configuration***

Some common interface configuration settings which may be applied (not an exhaustive list):

- Setting port speed and duplex (using the **speed** and **duplex** commands).
- Disabling/enabling the interface (using the **shutdown** or **no shutdown** command).
- Assigning a VLAN for access (using the **switchport access vlan** command).
- Configuring a VLAN trunk (using the **switchport trunk** command).

It is not possible to directly configure one of the physical ports with an IP address, as all physical ports on the LAN35x08 are Layer 2 interfaces. To set an IP address, one should create a VLAN interface and set an IP address there, then assign one or more physical interfaces to the newly-created VLAN. By default, all ports are part of VLAN 1, which already exists in factory default configuration. Refer to the following sections for details.

## 6.7 Common Configuration Task: Setting a Password with ICLI

By default, the switch has no password set for the admin user account. One of the first things that should be done is to set a sufficiently complex password on the admin account, as a basic security precaution. This is especially important if the switch is to be configured with an IP address and managed over the network. (An unauthorized login to the switch can compromise the entire network.)

The following screenshot demonstrates how to set the admin password to MustBeChanged. ***Replace the text MustBeChanged with your own desired password. If multiple LAN35Mx08 boards are present in the stack, be sure to set a password on all of them.***

```
# configure terminal
(config)# username admin privilege 15 password unencrypted MustBeChanged
(config)# exit
# copy running-config startup-config
Building configuration...
% Saving 2233 bytes to flash:startup-config
#
```

***Figure 32: Setting a Password with ICLI***

Note that the term unencrypted in the above command specifies how the password is to be passed on the command line. It *does not* specify how the password is stored in the configuration file. ***The LAN35Mx08 always stores passwords in an encrypted format, as demonstrated in the screenshot below (note the last line):***

```
# configure terminal
(config)# username admin privilege 15 password unencrypted MustBeChanged
(config)# exit
# copy running-config startup-config
Building configuration...
% Saving 2233 bytes to flash:startup-config
# show running-config
Building configuration...
banner exec "TIP: If Backspace does not work, use Ctrl-H for Backspace."
banner login "If you require support, please contact RTD Embedded Technologies, Inc."
logging level notice
username admin privilege 15 password encrypted TXVzdEJlQ2hhbmdlZA==
```

***Figure 33: Encrypted Password Storage***

The above commands demonstrate the most basic method of setting a password. The CEServices software supports a variety of authentication options, including:

- Multiple user accounts with privilege levels from 0 to 15 (full admin is level 15)
- **enable secret** to provide a secondary password to elevate a non-privileged account
- Authentication from a remote user database using RADIUS or TACACS+ (requires an additional server to provide authentication)

Configuring most of these methods can be determined by studying the provided command reference files and the Microsemi/Vitesse application note. If you required assistance, contact RTD techsupport.

## 6.8 Common Configuration Task: Setting a Static IP Address with ICLI

By default, the LAN35Mx08 does not have an IP address configured. The LAN35Mx08 is capable of serving as an Ethernet switch without an IP address. However, to manage the switch via the network (using SSH or the Web GUI), an IP address must be configured.

As explained previously section, all physical interfaces on the switch are Layer 2. So, an IP addresses must be assigned to a VLAN interface, and then one or more physical interfaces may be assigned to that VLAN. VLAN 1 already exists as part of the default configuration. All physical interfaces are a member of VLAN 1 unless configured otherwise. For a small network, the most expedient way to set an IP address for the switch is to set an IP address on the VLAN 1 interface.

The screenshot below demonstrates how to configure the managed switch for an IP address of 192.168.0.5, using VLAN 1. This example assumes a /24 subnet mask (255.255.255.0). It is up to the user to determine the appropriate IP address scheme for their network. If multiple LAN35Mx08 boards are present in the stack, they should each be configured with a unique IP address.

```
# configure terminal
(config)# interface vlan 1
(config-if-vlan)# ip address 192.168.0.5 255.255.255.0
(config-if-vlan)# exit
(config)# exit
# copy running-config startup-config
Building configuration...
% Saving 2230 bytes to flash:startup-config
#
```

***Figure 34: Set static IP address via ICLI***

***NOTE: The IP address in the screenshot above was chosen for demonstration purposes only. Users should verify the IP address does not cause a conflict prior to connecting the switch to the network!***

In addition to an IP address, it may be necessary to configure a default gateway (default route). If the LAN35Mx08 is only expected to communicate on the local subnet (in the case of the example above 192.168.0.x), the default gateway is not required. However, for complex networks with multiple subnets, a route for the default gateway should be specified.

A default gateway may be specified by adding a route for 0.0.0.0/0 with the **ip route** configuration command. The routing table of the switch may be viewed with the **show ip route** exec command. Refer to the screenshot below for an example. In this case, the default gateway is 192.168.0.1 (consistent with the previous example). All IP traffic which does not match one of the more specific routes will be directed to the default gateway (e.g. anything not on the local subnet, loopback, or multicast).

```
# configure terminal
(config)# ip route 0.0.0.0 0.0.0.0 192.168.0.1
(config)# exit
# copy running-config startup-config
Building configuration...
% Saving 2267 bytes to flash:startup-config
# show ip route
0.0.0.0/0 via 192.168.0.1 <UP GATEWAY HW_RT>
127.0.0.1/32 via 127.0.0.1 <UP HOST>
192.168.0.0/24 via interface index 1 <UP HW_RT>
224.0.0.0/4 via 127.0.0.1 <UP>
#
```

***Figure 35: Adding a default route via ICLI***

## 6.9 Common Configuration Task: Configuring a DHCP client with ICLI

Instead of a static IP address (see above), your network may be configured to dynamically assign addresses using DHCP. The LAN35Mx08 supports DHCP client operation. This configuration assumes a DHCP server is present in your network, and is properly configured to serve addresses to clients. It is up to the user to setup a DHCP server and ensure it is running properly prior to deploying the LAN35Mx08 as a DHCP client.

The following screenshot demonstrates how to configure the VLAN 1 interface for DHCP. The DHCP status may be checked with the exec command **show ip interface brief**.

```
# configure terminal
(config)# interface vlan 1
(config-if-vlan)# ip address dhcp
(config-if-vlan)# exit
(config)# exit
# copy running-config startup-config
Building configuration...
% Saving 2257 bytes to flash:startup-config
# show ip interface brief
Interface        Address             Method   Status
---------------- ------------------- -------- ------
VLAN 1           10.1.1.110/24       DHCP     UP
#
```

***Figure 36: Configure DHCP client via ICLI***

## 6.10 Common Configuration Task: Configuring a DHCP server with ICLI

For smaller networks, it may be desirable to have the LAN35Mx08 be the DHCP server. In this configuration, any clients that connect to the LAN35MHx08 will get an IP address delivered to them. Before proceeding, one should make certain that no other DHCP servers are present on the network. DHCP servers have several settings that may be adjusted. The examples below merely illustrate a common configuration.

The screenshot below demonstrates how to configure the LAN35Mx08 as a DHCP server. Continuing from our previous example, we use the 192.168.0.x subnet. The DHCP pool named TESTPOOL starts at 192.168.0.10, with a reserved IP range from 192.168.0.1-10 to accommodate any devices that require a static IP. The DHCP server provides a default gateway to the clients (192.168.0.1). It also provides DNS servers to the clients (8.8.8.8 and 8.8.4.4). DHCP lease time is 1 day. To be a DHCP server, the switch must be configured with a static IP address. In this case, we use the same static IP address as before (192.168.0.5).

```
# configure terminal
(config)# ip dhcp server
(config)# ip dhcp pool TESTPOOL
(config-dhcp-pool)# network 192.168.0.10 255.255.255.0
(config-dhcp-pool)# default-router 192.168.0.1
(config-dhcp-pool)# dns-server 8.8.8.8 8.8.4.4
(config-dhcp-pool)# lease 1 0 0
(config-dhcp-pool)# exit
(config)# ip dhcp excluded-address 192.168.0.1 192.168.0.10
(config)# interface vlan 1
(config-if-vlan)# ip address 192.168.0.5 255.255.255.0
(config-if-vlan)# ip dhcp server
(config-if-vlan)# exit
(config)# exit
# copy running-config startup-config
Building configuration...
% Saving 2440 bytes to flash:startup-config
#
```

***Figure 37: Configure DHCP server via ICLI***

## 6.11 Network Management with ICLI via SSH

Once an IP address has been configured, it is possible to login and manage the LAN35Mx08 via the network. The USB Serial Console requires direct physical access to the LAN35Mx08, which may not always be feasible. The same ICLI functionality is also available via Secure Shell (SSH). SSH is an encrypted protocol, so it is preferred to other insecure protocols such as Telnet. (Telnet is disabled by default as a security precaution.)

Accessing the LAN35Mx08 via SSH will require a terminal emulator program with SSHv2 support, such as PuTTY or TeraTerm. SSH access is enabled as soon as the switch is configured with an IP address, using the default SSH port of 22. The screenshots below demonstrate how to connect to the switch using PuTTY, assuming the switch is configured with an IP address of 192.168.0.5. The client PC should be configured with an IP address that is capable of reaching the switch, typically on the same subnet (e.g. 192.168.0.6).

Login using the same username and password as you would for the USB Serial Console. Once you are logged in, the ICLI interface behaves identical to the USB Serial Console.

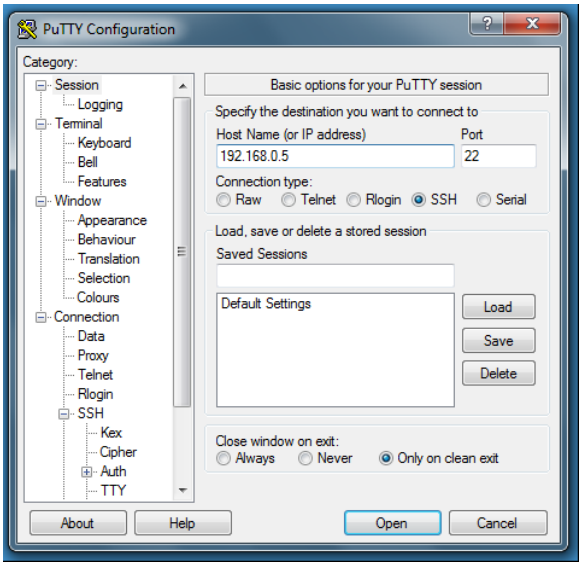


*Figure 38: Connecting with PuTTY (click Open to connect)*

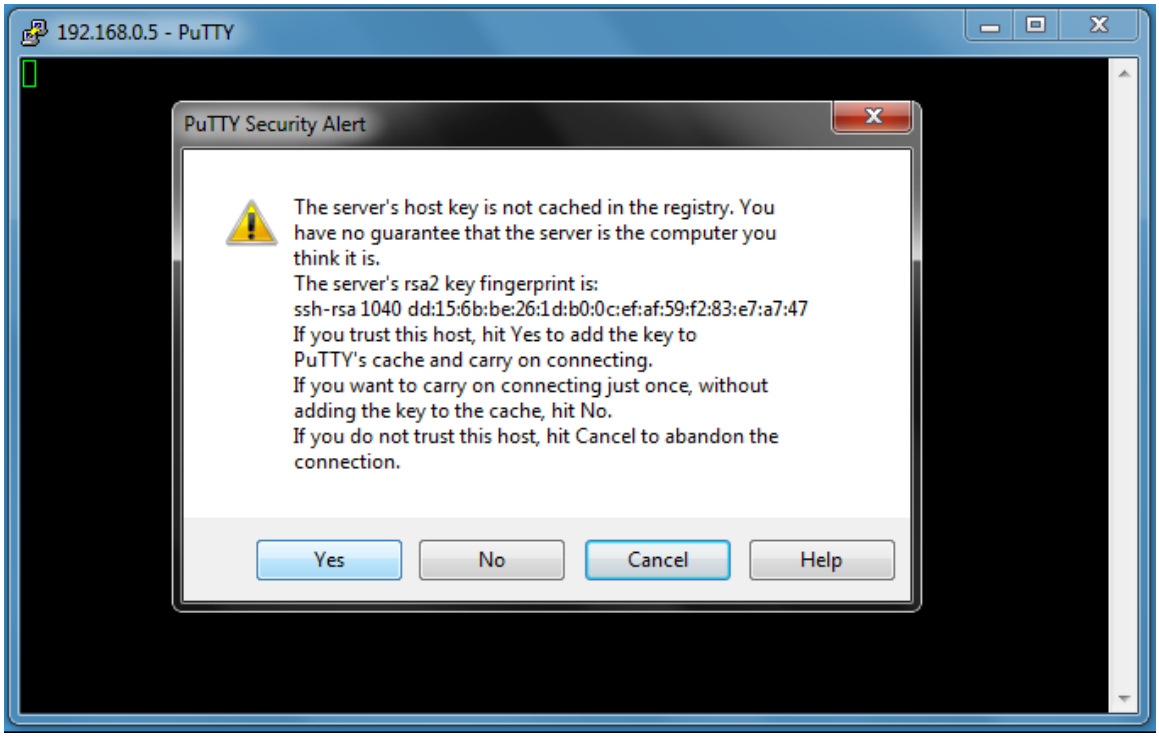


*Figure 39: First time connection with PuTTY (click Yes to accept the key)*

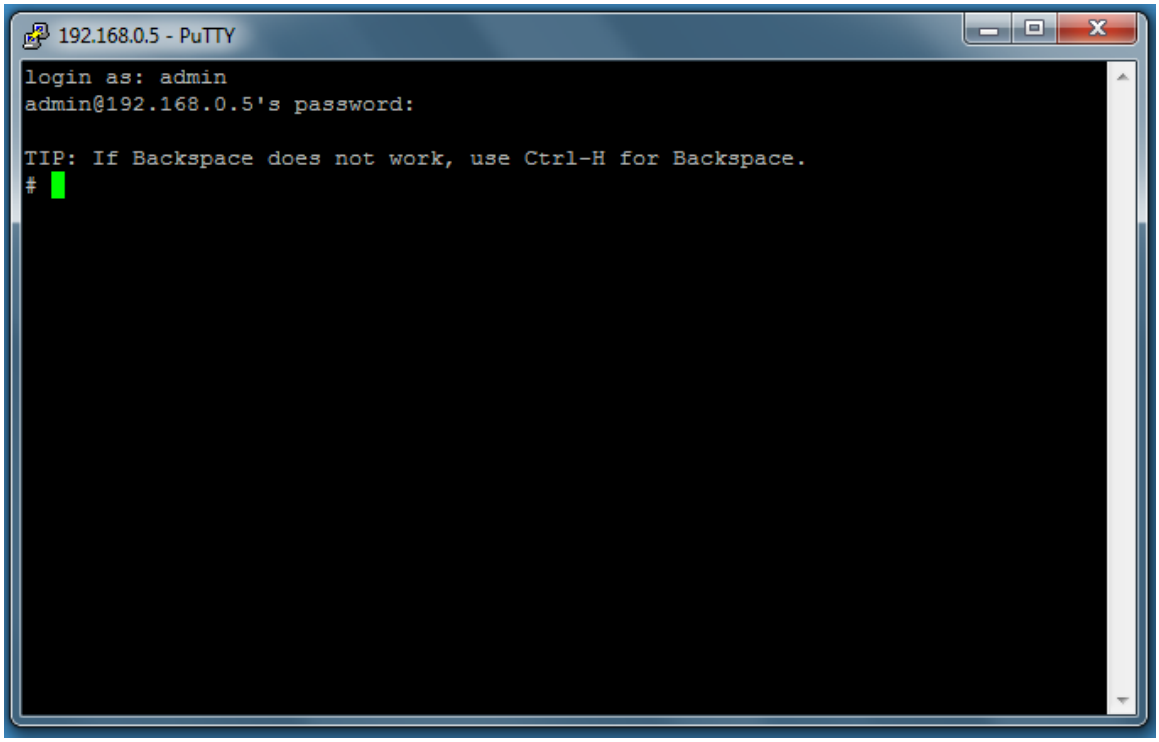


*Figure 40: Command prompt after logging in with PuTTY (same user as USB Serial Console)*

SSH access is enabled in the factory default configuration. It may be disabled with the configuration command **no ip ssh**. To re-enable it, use the configuration command **ip ssh**.

```
# configure terminal
(config)# no ip ssh
(config)# exit
# copy running-config startup-config
Building configuration...
% Saving 2450 bytes to flash:startup-config
#
```

*Figure 41: Disabling SSH access with ICLI*

## 6.12 Network Management with Web GUI

While the ICLI interface is very powerful and scriptable, it may be non-intuitive for certain users. The LAN35Mx08 provides a GUI interface to manage most common configuration tasks. The switch may be managed with any modern web browser, such as Internet Explorer 11, Google Chrome, or Firefox. The screenshots below demonstrate how to access the Web GUI, assuming the switch is configured with an IP address of 192.168.0.5. The client PC should be configured with an IP address that is capable of reaching the switch, typically on the same subnet (e.g. 192.168.0.6).

The LAN35Mx08 is capable of providing the Web GUI over unencrypted HTTP (port 80), or encrypted HTTPS (port 443). As a security precaution, the factory default configuration automatically redirects HTTP requests to use HTTPS instead. ***By default, the LAN35Mx08 ships with a self-signed SSL certificate for the HTTPS interface, which will trigger a certificate warning on most browsers. This warning is to be expected and may be ignored. When presented with a certificate warning, click Continue or Proceed.*** To remove this warning, the user must deploy a PKI infrastructure, generate their own SSL certificate, and then load it into the LAN35Mx08. Setting up a PKI infrastructure is beyond the scope of this manual.

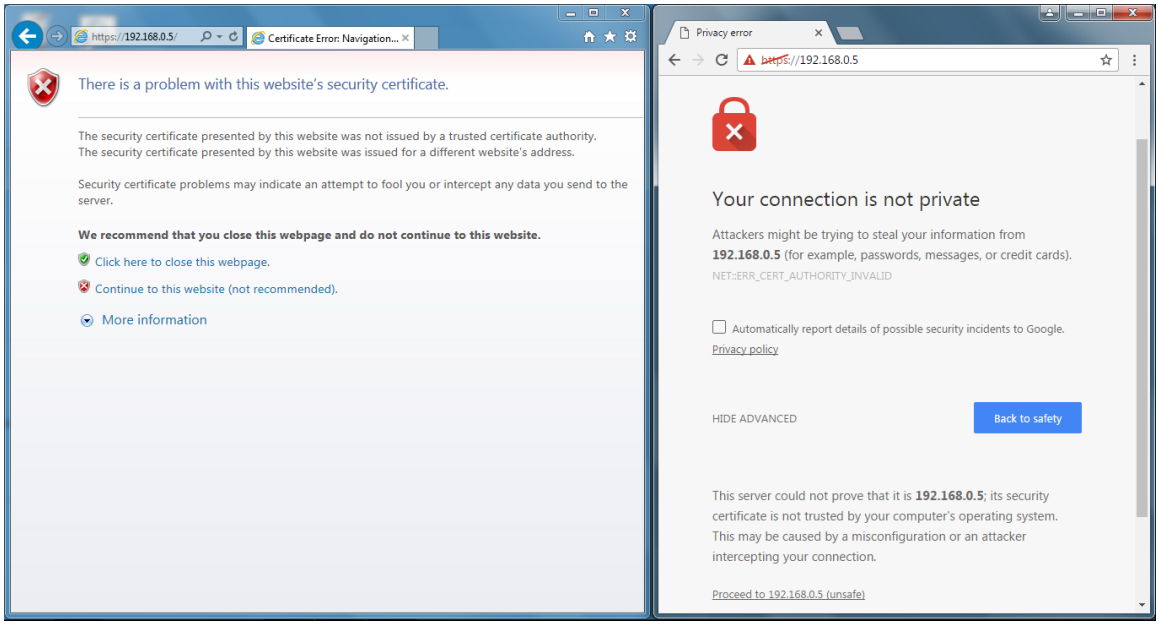


***Figure 42: SSL certificate warnings with Web GUI (click Continue/Proceed)***

You will be prompted to login. Use the same username and password as you would for the USB Serial Console or SSH. The appearance of the login prompt may vary depending on your web browser.

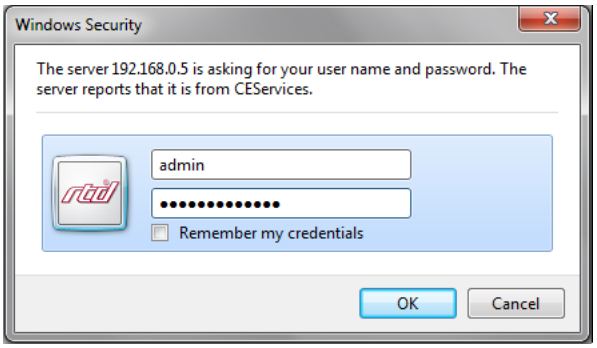


***Figure 43: Web GUI login (same user as ICLI)***

After logging in, you will be presented with a status overview for the switch. Use the links on the left to navigate through the various screens. Configuration, Monitor, Diagnostics, and Maintenance may each be expanded to show a number of sub-options.

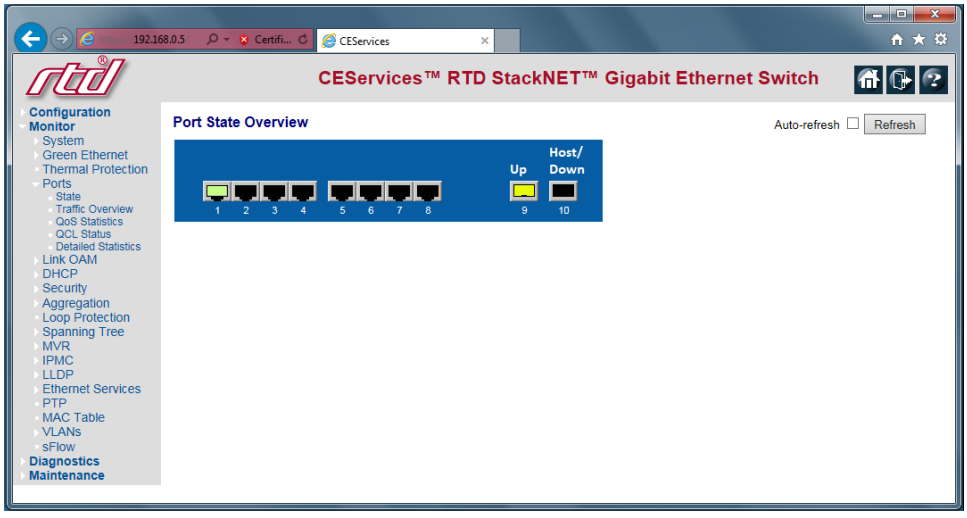


***Figure 44: Web GUI home page (click the links on the left)***

The Web GUI provides a rich help system that explains all of the options available on a page. Click the **?** icon on the top right to display the help.

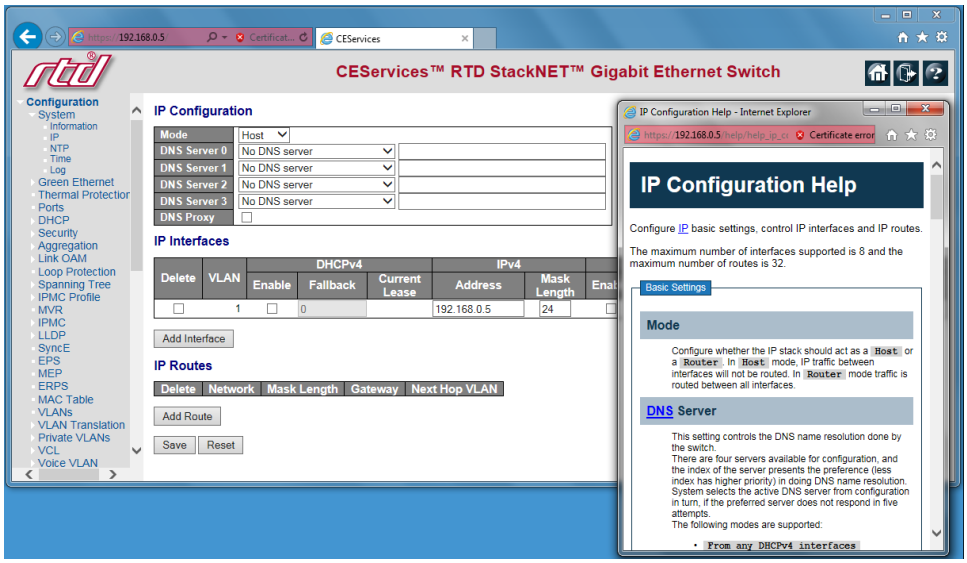


***Figure 45: Web GUI help (click the ? on the top right)***

Similar to ICLI, one must remember to save their configuration changes to the flash, or they will be lost when the switch is rebooted. Under the Web GUI, the configuration may be saved under **Maintenance > Configuration > Save startup-config**.

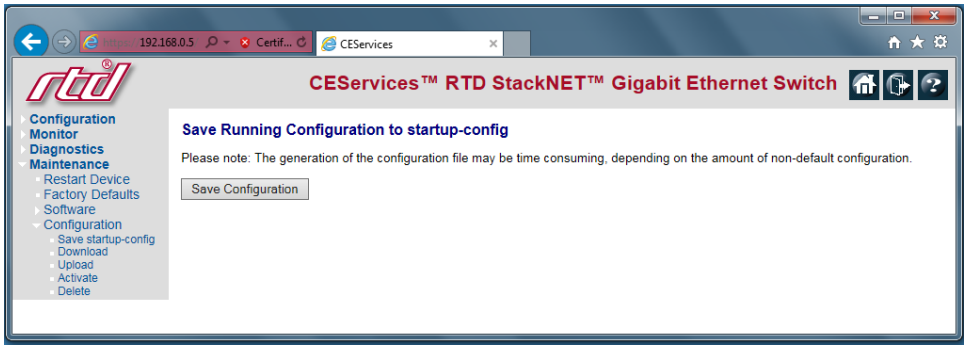


***Figure 46: Web GUI save configuration (Remember to do this!)***

## 6.13 Backing Up the Switch Configuration

As a best practice, one should make regular backups of the CEServices configuration. This allows you to keep progress of your work configuring the switch. The saved configuration file may be applied to other switches as needed. Since the configuration is plain text with human readable commands, it may be saved as a .TXT file, edited as needed, and checked into a version control system such as Subversion (SVN) or Git. A saved configuration may be restored using methods similar to the ones listed below.

### 6.13.1 Saving The Configuration With A Terminal Emulator

Under ICLI, you may use the command **show running-config** to view the configuration. Press "g" when prompted to display the entire configuration without pausing. Once the entire configuration is printed, it may be copied and pasted into a text file with Notepad or similar and then saved. This may be done via either USB Serial Console, SSH, or Telnet.

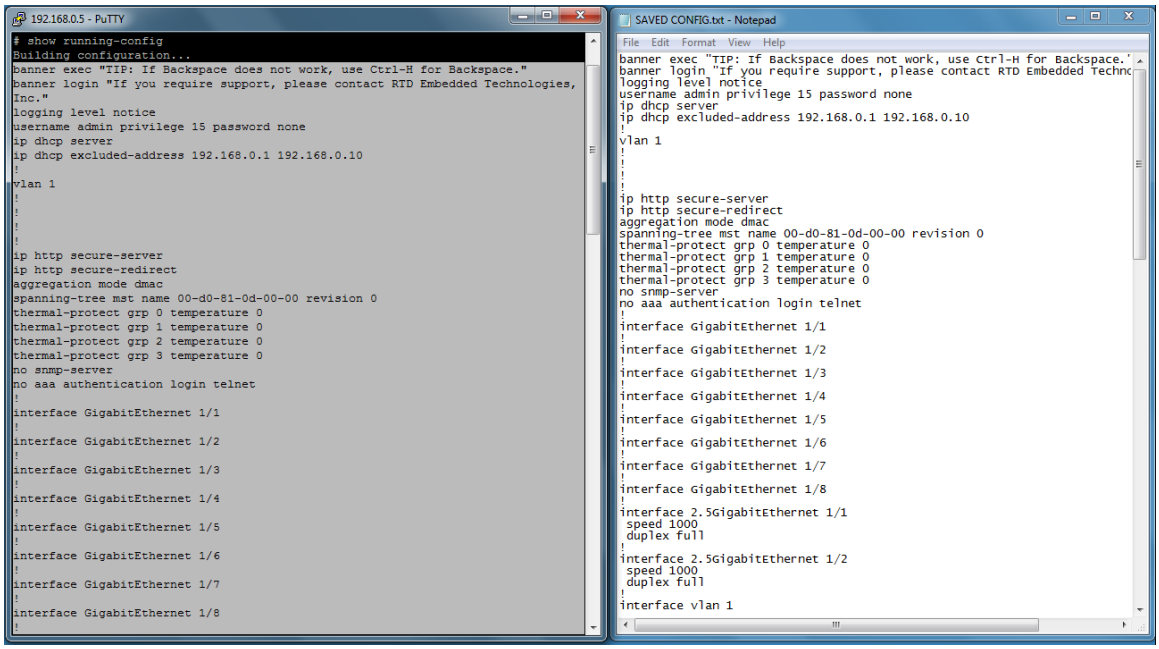


***Figure 47: Configuration backup using Terminal Emulator***

PuTTY and other terminal emulators include a session logging feature which automatically saves the session contents to a text file. This allows for automatic backups of a configuration. Every time **show running-config** is run, it is automatically captured to the log, where it may be extracted later.

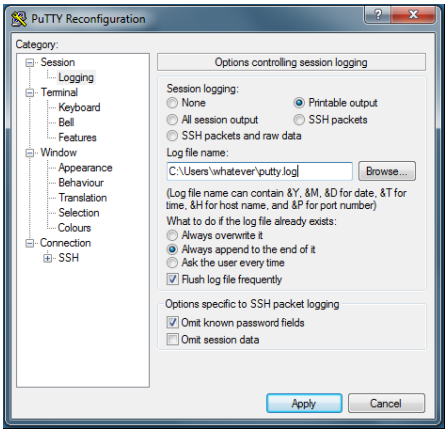


***Figure 48: PuTTY session logging to facilitate automatic configuration backup***

## 6.13.2 Downloading The Configuration via ICLI

The ICLI **copy** command allows you to copy the configuration to a TFTP server on your local network. The switch must be configured with an IP address and able to reach the TFTP server. The TFTP server must be setup and prepared to accept incoming connections, without a firewall to inhibit the connection. The open source utility Ttfpd32 is commonly used as a TFTP server. (Configuring Tftpd32 is beyond the scope of this manual.)

The screenshot below demonstrates how to backup the configuration using TFTP from ICLI:

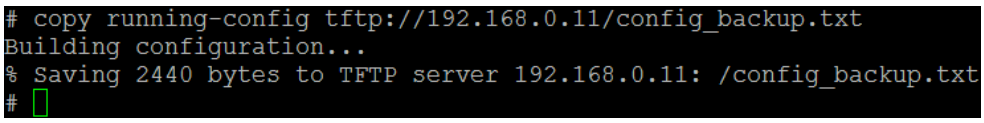


***Figure 49: Configuration backup using TFTP via ICLI***

### 6.13.1 Downloading The Configuration via Web GUI

The Web GUI allows you to download the configuration from **Maintenance > Configuration > Download**. The switch must be configured with an IP address and accessible from the client PC.

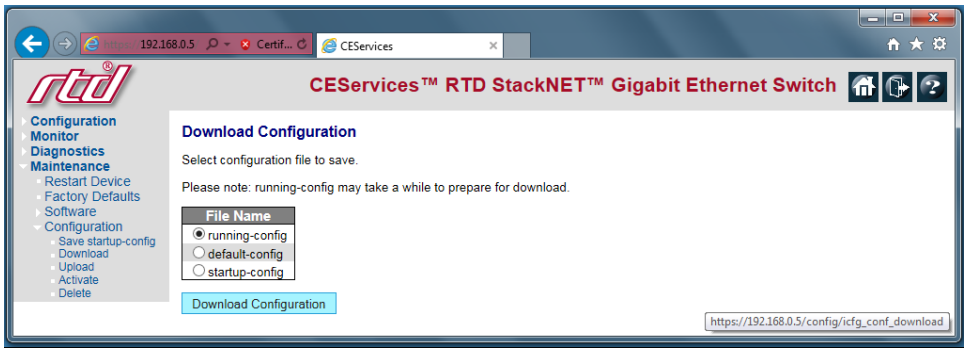


*Figure 50: Configuration backup using Web GUI*

## 6.14 Loading Factory Default Settings

When configuring the LAN35Mx08, a situation may arise where it is desirable to return the switch to the factory default configuration. The CEServices software provides several mechanisms for doing so. This will remove any configured passwords and IP address settings. Note that resetting CEServices to defaults does not affect the configuration of the Intel I210, as it is controlled by the CPU board (LAN35MH08 only).

### 6.14.1 Loading Defaults via ICLI

Under ICLI, the factory defaults may be loaded by deleting the startup configuration from the flash, and then rebooting CEServices. This may be done via either USB Serial Console, SSH, or Telnet. Once the startup configuration is deleted, a few errors may appear on the console while the running configuration is regenerated. These errors are to be expected and may be ignored. They will disappear one a new startup configuration is saved.

```
# delete flash:startup-config
# reload cold
% Cold reload in progress, please stand by.
```

*Figure 51: Factory default configuration using ICLI*

### 6.14.2 Loading Defaults via Web GUI

Under the Web GUI, the factory defaults may be loaded under **Maintenance > Factory Defaults**.

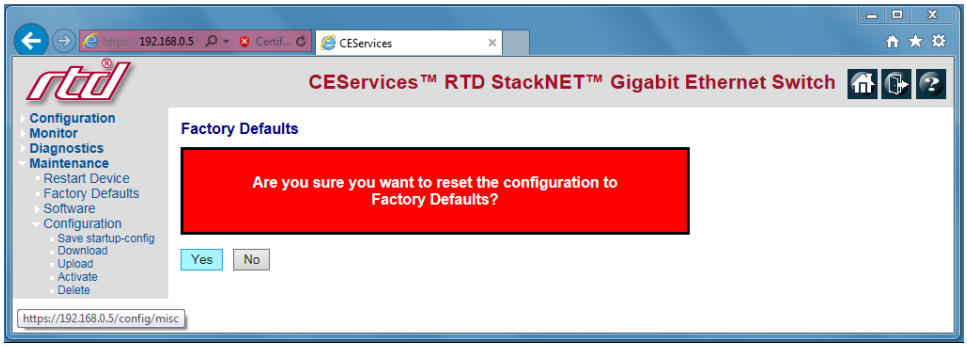


*Figure 52: Factory default configuration using Web GUI*

### 6.14.3 Loading Defaults via External Loopback

The factory default configuration may be loaded temporarily by connecting Port 1 to Port 2 (GigabitEthernet 1/1 to 1/2) with an Ethernet patch cable. At boot time, the LAN35Mx08 checks for a loopback on these ports and loads defaults accordingly. The ports must be connected together before the switch it booted. This method of loading defaults is useful for situations where the password has been lost.

To verify that defaults were loaded, use the command **show logging** and look for a LOOP_BACK_DETECTED message:

```
# show logging
Switch logging host mode is disabled
Switch logging host address is null
Switch logging level is notice

Number of entries on Switch 1:
Error        : 0
Warning      : 0
Notice       : 4
Informational: 1
All          : 5

ID          Level          Time & Message
----------  -------------  --------------
         1  Informational  1970-01-01T00:00:01+00:00
                           SYS-BOOTING: Switch just made a cold boot.

         2  Notice         1970-01-01T00:00:03+00:00
                           LINK-UPDOWN: Interface 2.5GigabitEthernet 1/1, chang
                           ed state to up.

         3  Notice         1970-01-01T00:00:05+00:00
                           LINK-UPDOWN: Interface GigabitEthernet 1/1, changed
                           state to up.

         4  Notice         1970-01-01T00:00:05+00:00
                           LINK-UPDOWN: Interface GigabitEthernet 1/2, changed
                           state to up.

         5  Notice         1970-01-01T00:00:06+00:00
                           LOOP_DETECT-LOOP_BACK_DETECTED: Loop-back detected o
                           n Interface GigabitEthernet 1/2GigabitEthernet 1 ...

#
```

***Figure 53: Viewing log after loading defaults via external loopback***

Note that using the external loopback ***does not*** load defaults permanently. The startup configuration is not altered. If you disconnect the loopback and reboot, the LAN35Mx08 will return to its previously-saved startup configuration. To permanently restore the switch to the defaults, one must run the command **delete flash:startup-config** and then reboot the switch. This method is described in an earlier section of this manual. One the startup configuration has been deleted, the loopback may be removed.

# 7 Troubleshooting

If you are having problems with your system, please try the following initial steps:

- **Restore Factory Defaults** – Restore the LAN35Mx08 to the factory default configuration using the steps described in the previous chapter.
- **Simplify the System** – Remove modules one at a time from your system to see if there is a specific module that is causing a problem. Perform you troubleshooting with the least number of modules in the system possible.
- **Swap Components** – Try replacing parts in the system one at a time with similar parts to determine if a part is faulty or if a type of part is configured incorrectly.

If problems persist, or you have questions about configuring this product, contact RTD Embedded Technologies via the following methods:

Phone: +1-814-234-8087
E-Mail: techsupport@rtd.com

Be sure to check the RTD web site (http://www.rtd.com) frequently for product updates, including newer versions of the board manual and application software.

# 8 Additional Information

## 8.1 PC/104 Specifications

A copy of the latest PC/104 specifications can be found on the webpage for the PC/104 Consortium:

www.pc104.org

## 8.2 PCI and PCI Express Specification

A copy of the latest PCI and PCI Express specifications can be found on the webpage for the PCI Special Interest Group:

www.pcisig.com

# 9 Limited Warranty

RTD Embedded Technologies, Inc. warrants the hardware and software products it manufactures and produces to be free from defects in materials and workmanship for one year following the date of shipment from RTD Embedded Technologies, Inc. This warranty is limited to the original purchaser of product and is not transferable.

During the one year warranty period, RTD Embedded Technologies will repair or replace, at its option, any defective products or parts at no additional charge, provided that the product is returned, shipping prepaid, to RTD Embedded Technologies. All replaced parts and products become the property of RTD Embedded Technologies. Before returning any product for repair, customers are required to contact the factory for a Return Material Authorization (RMA) number.

This limited warranty does not extend to any products which have been damaged as a result of accident, misuse, abuse (such as: use of incorrect input voltages, improper or insufficient ventilation, failure to follow the operating instructions that are provided by RTD Embedded Technologies, “acts of God” or other contingencies beyond the control of RTD Embedded Technologies), or as a result of service or modification by anyone other than RTD Embedded Technologies. Except as expressly set forth above, no other warranties are expressed or implied, including, but not limited to, any implied warranties of merchantability and fitness for a particular purpose, and RTD Embedded Technologies expressly disclaims all warranties not stated herein. All implied warranties, including implied warranties for merchantability and fitness for a particular purpose, are limited to the duration of this warranty. In the event the product is not free from defects as warranted above, the purchaser's sole remedy shall be repair or replacement as provided above. Under no circumstances will RTD Embedded Technologies be liable to the purchaser or any user for any damages, including any incidental or consequential damages, expenses, lost profits, lost savings, or other damages arising out of the use or inability to use the product.

Some states do not allow the exclusion or limitation of incidental or consequential damages for consumer products, and some states do not allow limitations on how long an implied warranty lasts, so the above limitations or exclusions may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

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