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Model 914-X Series
Modular Multiplexer System
User Manual

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Rev 6.0	**General:** • Updated hyperlinks throughout the document • Updates to formatting **Section 3.0: System Overview** • Updated images to properly represent a 914-X stack **Section 4.0: 914-HDE Motherboard Overview** • Added H1 firmware option for 914-HDE • Reflect changes implemented in Rev. 7 of 914-HDE PCBA: o Updated serial features: ▪ Isolated serial channels ▪ TTL mode • Information about older revision 914-HDE PCBAs **Section 5.0: Model 914-X Series Unified Diagnostic GUI** • Complete overhaul of section to reflect the 914-0401-04 Unified Diagnostic GUI **Section 6.0: 914-X Series Expansion Cards** • **6.1: 914-VDX** o Updated section to reflect changes implemented in Rev. 4 of 914-VDX PCBA: o Updated serial features: ▪ Isolated serial channels ▪ TTL mode o Included information about older revision 914-VDX PCBAs o Removed mentions of 914-0401-00 Diagnostic GUI, updated with 914-0401-04 Unified Diagnostic GUI information • **6.2: 914-EX** o Updated section to reflect changes implemented in Rev. 5 of the 914-EX PCBA: o Included information about older revision 914-EX PCBAs o Removed mentions of 914-0401-00 Diagnostic GUI, updated with 914-0401-04 Unified Diagnostic GUI information • **6.3: 914-AX:** Removed mentions of 914-0401-00 Diagnostic GUI, updated with 914-0401-04 Unified Diagnostic GUI information • **6.4: 914-DX:** Added new section for 914-DX expansion card	KM, RP	2025-04-01

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Reference Documents

DOCUMENT NUMBER	DOCUMENT TITLE AND DESCRIPTION
914-0401-04	Model 914-X Unified Diagnostic GUI
914-0401-01	Model 914 Firmware Updater
914-2016-00	Model 914-HDE Configuration Drawing
914-2017-01	Model 914-CWDM-8R Configuration Drawing
914-2017-02	Model 914-CWDM-4R1 Configuration Drawing
914-2018-00	Model 914-HDV2 Configuration Drawing
914-2020-00	Model 914-VDX Configuration Drawing
914-2021-00	Model 914-DX Configuration Drawing
914-2022-00	Model 914-EX Configuration Drawing
914-2023-00	Model 914-AX Configuration Drawing
914-2025-00	Model 914-FOS Configuration Drawing
914-2026-00	Model 914-SPLIT Configuration Drawing
700-0271-00	AIB Plug-in Module User Manual

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ACRONYMS AND ABBREVIATIONS

The list below contains the acronyms and abbreviations used in this user manual.

ACRONYM / ABBREVIATION	DESCRIPTION
AIB	Adaptable Interface Board
AX	AIB EXpansion Adaptor Card
3G	3 Gbps HD Video
BER	Bit Error Rate
CWDM	Coarse Wavelength Division Multiplexer / Multiplexing
DX	Serial Data EXpansion
DIP	Dual In-line Package
EIA	Electronic Industries Association
ESD	Electrostatic Discharge
EX	Ethernet EXpansion
FORJ	Fiber Optic Rotary Joint
FPGA	Field Programmable Gate Array
GBE	Gigabit Ethernet
Gbps	Gigabits Per Second
GUI	Graphical User Interface
HD	High Definition
HS	High Speed
HDE	HD-Video, Serial Data, Ethernet
HDV2	Dual (2) HD Video
I/O	Input/output
I^2C	Inter-Integrated Circuit
JSON	JavaScript Object Notation
kbps	Kilobits Per Second
LC/PC	Lucent Connector / Physical Contact
LED	Light Emitting Diode
LS	Low Speed
Mb/s	Megabits Per Second
MDI/MDIX	Automatic medium-dependent interface crossover
Mfr	Manufacturer
MS	Medium Speed
MSA	Multi-Source Agreement
P/N	Part Number
PCB	Printed Circuit Board
PCBA	Printed Circuit Board Assembly
PPS	Pulse Per Second
REF	Reference
RLSS	Remote Ethernet Link Speed Synchronization
SD	Standard Definition
SDI	Serial Digital Interface
SFP	Small Form-factor Pluggable (Optical Transceiver)
SMT	Surface Mount Technology
TDM	Time Division Multiplexer / Multiplexing
TTL	Transistor-Transistor Logic
VDX	Composite Video, Serial Data, EXpansion
VOAT	Variable Optical Attenuator
WDM	Wavelength Division Multiplexer / Multiplexing

1.0 Introduction

The Moog Focal Model 914-X Series Modular Multiplexer System is a compact and rugged transmission system designed for industrial environments and other applications that require transmission of HD video, serial data, and Ethernet over an optical link. The 914-X Series has been optimized for low power operation and delivery of low latency, uncompressed video and Ethernet data.

A series of expansion cards are available, allowing additional composite video channels, serial data channels, Ethernet ports, as well as many specialty signals such as TTL, hydrophone, CAN bus, and custom sonars to be added to any 914-X Series system without requiring extra fibers or wavelengths.

The rich feature set and vast signal options are packaged in an incredibly small form factor. The credit card size, along with the geometry and location of connectors, allow the 914-X Series multiplexers to be installed in very small enclosures. Multiple card systems can be configured either as stacks or via flexible high speed ribbon cable, providing even further installation flexibility.

This manual provides 914-X Series system users with detailed information relevant to the design, configuration, installation, and operation of any 914-X Series system. This manual, and the appropriate reference documents, should be reviewed prior to installation or configuration of the multiplexer system.

The figures below show different configurations and stacking options for a 914-X series system. Figure 1-1 shows a standalone 914-HDE motherboard. Figure 1-2 shows the 914-HDE and a sample of expansion cards (914-EX, 914-VDX and AX-232) stacked together and held into place via standoffs. In Figure 1-3, a similar stack is shown but instead uses high-speed ribbon cables to accommodate applications such as bottles or low profile enclosures.

Figure 1-1: 914-X Series HDE Motherboard

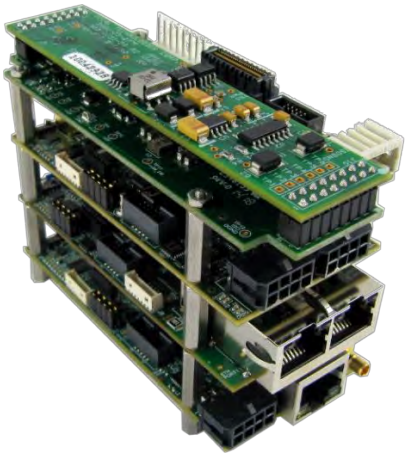


Figure 1-2: 914-X Series System with Stacked Expansion Cards

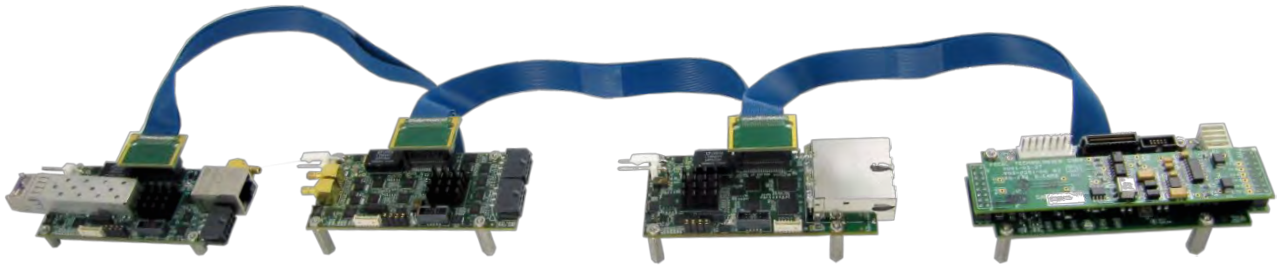


Figure 1-3: 914-X Series System with Tethered Expansion Cards

1.1 Model 914-X Series Benefits

- Modular design, configured to custom requirements
- Very high bandwidth optical options replace many lower speed options
- High budget optics allow for extended link distances
- Extremely small size allows systems to fit in cost effective enclosures
- Upgrades available to add features or cards when required
- Low cost of spare parts
- Software configuration of features and settings
- Software configurable multi-protocol isolated serial ports.
- Full diagnostics are provided via an advanced GUI, included with every system
    - GUI's system-level configurator streamlines board settings configuration
    - GUI's data snapshots enhance the efficiency of tech support
- Non-switched Ethernet ports guarantee throughput without collisions in real time
- Full bandwidth real time video with no compression and no compromises
- Latency for all signals is measured in microseconds
- Simple integration of complex systems with user friendly instructions
- Moog Focal direct support whenever required
- Custom OEM options available

1.2 System Accessories and Options

Included:

- Mounting Hardware
- Pigtailed diagnostic (RS232) plug and wires
- Pigtailed power plug and cable for the 914-HDE Motherboard
- Modules individually packaged with configuration drawings
- 914-0401-04 914-X Series Diagnostic GUI – downloadable from www.moog.com/focal/914-x-series, or see Section 5.1
- Default configuration settings
- Moog Focal direct support

Optional:

- Fiber jumpers and attenuators
- Mating connectors and plugs
- Thermal gap pad material
- Extended factory testing
- Factory custom configuration
- Factory multi-card system integration, build and testing
- Enclosure options:
    - Pressure bottles
    - 19" racks with diagnostic LEDs
    - Custom enclosures for OEM

1.3 Safety Precautions

The following safety precautions should be observed before using this product:

This product is intended for use by qualified personnel who recognize shock hazards and are familiar with the safety precautions required to avoid possible injury. Do not make module connections unless qualified to do so.

Before connecting this product to the power source, verify that the output voltage is within the specifications of the product's power supply.

Do not attempt to modify or repair any circuit unless recommended by the manufacturer.

Protect the power cable from being walked on or pinched by items placed on or against them.

Always unplug the power cable at the plug, do not pull on the cord itself.

Do not block any ventilation openings.

Do not look into the end of a fiber when it is plugged into a transceiver or active fiber, especially when using a magnifying instrument, such as a fiber microscope.

Handle optical fiber with extreme care. Glass fiber is subject to breakage if mishandled.

2.0 Setup Procedure

This section provides a step-by-step checklist to set up a 914-X series system, both physically and through electronic configuration. Details regarding each step can be found in this manual via the referenced section links.

Table 2-1: Setup Checklist

STEP	DESCRIPTION
1	Expansion card configuration: a. Set dip switch to an appropriate setting. Refer to the following sections for more information on dip switch configurations: • 914-VDX: Section 6.1.8.1 • 914-EX: Section 6.2.8.1 • 914-DX: Section 6.4.7.1 b. The card closest to the 914-HDE should be set to [OFF, OFF] (Expansion 1). c. MS and LS expansion channels are independent.
2	Mounting the cards: a. 5/32” (4mm) minimum clearance under the 914-HDE (included standoff P/N: EL-M0260). b. 21/32” (16.67 mm) nominal standoffs of #2-56 type between cards (included standoff P/N: EL-M0247). c. All 914-X series cards provide electrically isolated conductive cooling via the mounting holes. d. Thermal gap material (optional P/N: 914-0118-00) to provide conductive cooling to an enclosure should be placed under the 914-HDE. e. Stacking order is 914-HDE on bottom, then medium speed (MS) expansion cards directly above (ensure EX cards are placed closer to HDE than VDX cards), ending with low speed (LS) expansion cards on top. Media converters and optical cards do not require electrical connection via the expansion connector, they can be the furthest away from the 914-HDE. f. Refer to Section 10.1 for more information on the 914-X series installation procedure.
3	Connect console to remote via LC-to-LC fiber jumper: a. For short links, attenuation is required. 10 dB is the suggested minimum attenuation in the fiber link. b. Refer to Section 4.8.1 for instructions on flux budget calculation.
4	a. Connect the RS232 diagnostic port of the *console* 914-HDE to a computer using either the local COM port or a serial-to-USB converter. b. Install and run the 914-X Series Diagnostic GUI, P/N: 914-0401-04. Contact factory for the latest software release. c. Refer to Section 5.0 for an overview of the GUI, and Section 5.1 for installation instructions.
5	a. Connect the 914-HDE to a DC power supply with 5V or 12V power. (12 V recommended) b. Verify power LEDs on each card (914-HDE and any expansion cards) are lit green. c. Verify all system voltages in the 914-X Series Diagnostic GUI. d. Refer to Section 4.2 for information on applying power to the 914-HDE. Refer to Section 5.0 for an overview of the GUI.

STEP	DESCRIPTION
6	Configure all cards (except 914-AX) via 914-X Series Unified Diagnostic GUI: a. Console 914-HDE: i. Set as console. Refer to Section 5.5.1 for instructions. ii. Set video direction to output. Refer to Section 5.5.2 for instructions. iii. Set serial protocol. Refer to Section 5.5.3 for instructions. iv. Set Ethernet auto-negotiate settings. Refer to Section 5.5.4 for instructions. v. **(If any 914-AX or 914-DX cards are in system)** Set low speed expansion type to appropriate card. Refer to Section 5.5.5 for instructions. b. Console 914-VDX: i. Set as console. Refer to Section 6.1.8.1 for instructions. ii. Set video direction to output. Refer to Section 6.1.8.2 for instructions. iii. Set serial protocol. Refer to Section 6.1.8.3 for instructions. c. Console 914-EX: i. Set as console. Refer to Section 6.2.8.1 for instructions. ii. Set Ethernet auto-negotiate settings. Refer to Section 6.2.8.2 for instructions. d. Console 914-DX: i. Set as console. Refer to Section 6.4.7.1 for instructions. ii. Set serial protocol. Refer to Section 6.5.7.2 or instructions. e. Remote 914-HDE: i. Set as remote. Refer to Section 5.5.1 for instructions. ii. Set video direction to input. Refer to Section 5.5.2 for instructions. iii. Set serial protocol. Refer to Section 5.5.3 for instructions. iv. Set Ethernet auto-negotiate settings. Refer to Section 5.5.4 for instructions. f. Remote 914-VDX: i. Set as remote. Refer to Section 6.1.8.1 for instructions. ii. Set video direction to input. Refer to Section 6.1.8.2 for instructions. iii. Set serial protocol. Refer to Section 6.1.8.3 for instructions. g. Remote 914-EX: i. Set as remote. Refer to Section 6.2.8.1 for instructions. ii. Set Ethernet auto-negotiate settings. Refer to Section 6.2.8.2 for instructions. h. Remote 914-DX: i. Set as remote. Refer to Section 6.4.7.1 for instructions. ii. Set serial protocol. Refer to Section 6.5.7.2 for instructions. i. Turn the power off, wait 10 seconds, then power on again (power cycle). j. Confirm the settings are correct using the 914-X Series Unified Diagnostic GUI.
7	a. Establish video, Ethernet, and serial connections as required. b. Verify status and activity in the 914-X Series Unified Diagnostic GUI. i. HD Video: Refer to Section 4.3 for information. ii. Ethernet: Refer to Section 4.5 for information. iii. Serial: Refer to Section 4.4 for information. iv. Composite video: Refer to Section 6.1.2 for information.
8	a. Perform bench level testing to verify links. b. Refer to Section 10.4 for more information.
9	a. Install cards in system. Ensure good thermal contact via mounting hardware, thermal gap pads, and heat spreaders. b. Refer to Section 10.0 for information.
10	Save the system configuration for future reference, return to factory defaults, or to clone for similar identical systems. See Section 5.9.1.
11	Verify and monitor FPGA and SFP temperatures and voltages during operation using the 914-X Series Unified Diagnostic GUI. All values should remain green.

3.0 System Overview

3.1 914-X Series System Card Options

Users can combine the modular 914-X Series cards into complex fiber optic telemetry systems. 914-X Series cards are sorted into five basic categories:

1. **Motherboards**: These cards have optical transceivers that multiplex various data types onto a single data stream over fiber. This is the foundation to any 914 multiplexing system. In addition, they provide expansion channels for expansion card integration.
   Card: 914-HDE.
2. **Expansion Cards**: These cards add more signal interfaces to the system. They draw power from the motherboard and do not require their own optical transceiver. They do not operate on their own. They require one or more low speed (LS) or medium speed (MS) expansion channels on a motherboard to operate.
   Cards: 914-VDX, 914-EX, 914-DX and 914-AX.
3. **Media Converters**: These cards convert a single data type to fiber, usually in a 1:1 signal to optical wavelength conversion. They can operate standalone, or they can be optically combined with other multiplexers or media converters.
   Card: 914-HDV2.
4. **Optical Cards**: These cards combine multiple optical wavelengths onto a single fiber or create optical redundancies for increased system reliability.
   Cards: 914-CWDM, 914-CWDM-4, 914-CWDM-8, 914-SWITCH, 914-FOS, 914-SPLIT
5. **System Cards**: These cards include power interface boards and other types of subassemblies used to build up 914 stacks or special configurations. Many cards are custom built for unique applications.
   Cards: 914-DC-05, 914-DC-12

Table 3-1: 914-X Series System Modular Card List

CARD ID	ETHERNET	VIDEO	SERIAL DATA	OTHER	OPTICS	EXPANSION CHANNELS
MOTHERBOARDS						
914-HDE L1 (1)	1x 10/100/1000 Mb/s	1x HD/SD-SDI	2x Isolated RS232/485/422	TTL	Requires two wavelengths: Uplink and Downlink	4x LS
914-HDE M1	1x 10/100/1000 Mb/s	1x 3G/HD/SD-SDI				4x LS 4x MS
914-HDE H1	1x 10/100/1000 Mb/s	1x 3G/HD/SD-SDI				4x LS 4x MS
EXPANSION CARDS						
914-EX	2x 10/100/1000 Mb/s	—	—	—	Via 914-HDE	1x MS (2x MS Optional)
914-VDX	—	2x NTSC/PAL	4x Isolated RS232/485/422	TTL		1x MS
914-DX	—	—	6x Isolated RS232/485/422	TTL		1x LS
914-AX w/903-AIB	—	—	1x Isolated RS232/485/422	TTL MS900 ARCnet Hydrophone CAN bus	Via 914-HDE w/ 903-AIB installed on 914-AX	1x LS
MEDIA CONVERTERS						
914-HDV2	—	2x 3G/HD/SD-SDI	—	—	Requires one wavelength per video channel	None
OPTICAL CARDS						
914-CWDM	—	—	—	—	2 wavelengths + 1310/1550 bypass to single fiber	N/A
914 4CH CWDM	—	—	—	—	4 wavelengths to single fiber	N/A
914 8CH CWDM	—	—	—	—	8 wavelengths to single fiber	N/A
914-FOS	—	—	—	—	Selects between two optical fibers for redundant operation	N/A
914-SPLIT	—	—	—	—	Splits an optical signal for redundant operation	N/A

CARD ID	ETHERNET	VIDEO	SERIAL DATA	OTHER	OPTICS	EXPANSION CHANNELS
SYSTEM CARDS						
914-DC-05	—	—	—	Steps down from +24VDC to +5VDC.		—
914-DC-12	—	—	—	Steps down from +24VDC to +12VDC.		—

[1] L1 versions of the 914-HDE support HD-SDI video ***or*** 1000 BASE-T Ethernet. The default is to support HD-SDI.

3.2 Defining a 914-X Series System

914-X Series systems are used as linked pairs (one remote side and one console side) to provide a transparent video, serial data, and Ethernet link over optical fiber(s). Cards are added as linked pairs; a card of the same type is required at both the console and remote ends. The installed optical transceivers determine the maximum optical link speed, fiber type, number of fibers (1 or 2), and link distance. The card version sets the operational bandwidth, which is independent from the optical data rate. The optical link uses a proprietary data protocol which ensures reliable transmission with extremely low latency using highly efficient and dynamic bandwidth utilization.

Typically, the uplink (remote to console) and downlink (console to remote) signals are combined on a single fiber – multimode or singlemode (standard) – with a passive optical coupler known as a Wavelength Division Multiplexer (WDM). The WDM is integrated in the optical transceiver. Standard, single fiber systems operate with 1310 nm uplink and 1550 nm downlink wavelengths. In larger systems, multiple 914-X Series stacks may be combined on a single fiber using a Coarse Wavelength Division Multiplexer (CWDM) to take advantage of the high bandwidth of optical fiber.

Figure 3-1 illustrates an example of a simple 914-X Series system configuration using a standard, standalone 914-HDE motherboard, which supports the multiplexing of one (1) 3G/HD/SD-SDI channel, two (2) bidirectional RS232/RS485/RS422/TTL serial data channels, and one (1) Gigabit Ethernet channel over a single optical fiber. This is the base card of any 914-X Series system.

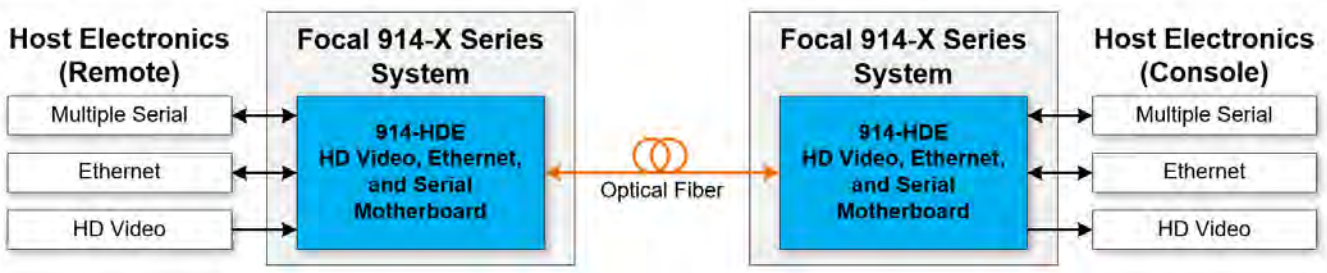


Figure 3-1: 914-HDE Motherboard

Note the HD video *source* (e.g. input from an HD camera) is connected at the remote end. The HD video *output* is provided at the console end (e.g. output to an HD monitor).

The external fiber optic system includes optical components such as optical connectors and a Fiber Optic Rotary Joint (FORJ).

An expansion connector on the 914-HDE supports eight expansion card ports: four low speed (LS) and four medium speed (MS). Expansion cards allow a full, customized system to be built using the 914-HDE Motherboard as the base optical card. Optional expansion cards are detailed in Section 0.

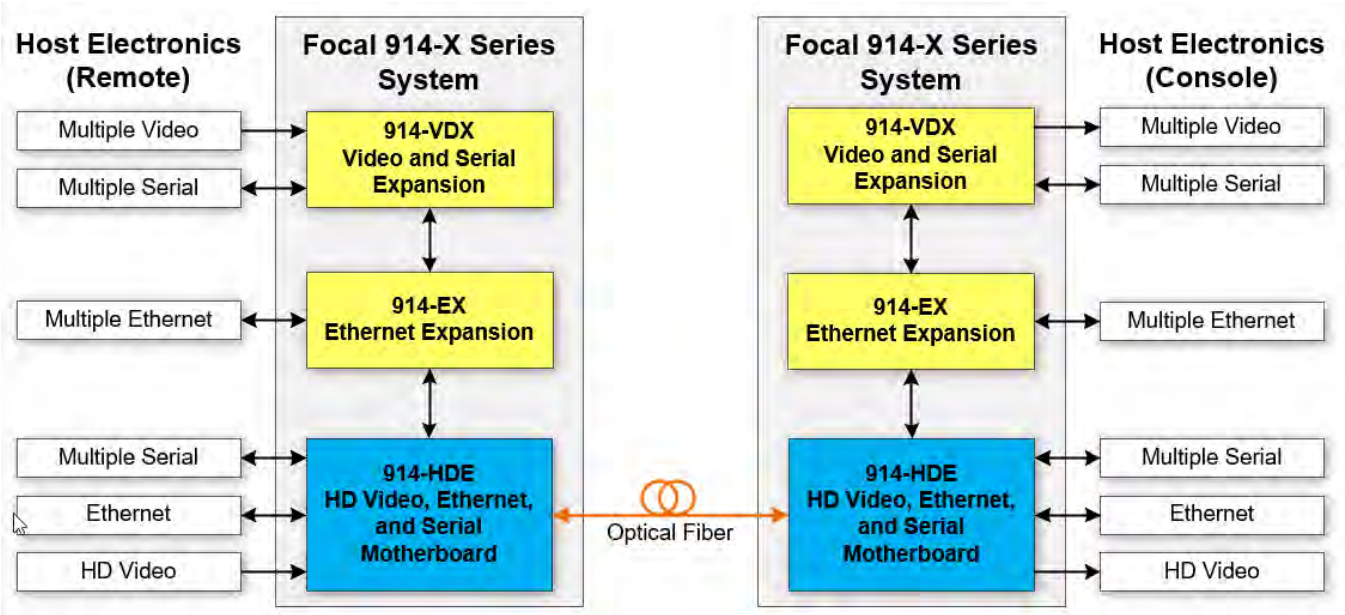


Figure 3-2: 914-X Series System with Expansion Cards Example

Figure 3-2 shows a 914-X Series system with 914-EX and 914-VDX expansion cards added. These cards stack on top of the 914-HDE motherboard to provide more video, Ethernet, and serial data channels. No extra optical components are required for these additional expansion cards.

For larger systems requiring more optical bandwidth than a single 914-X Series stack can provide, Moog Focal has a series of CWDM products that allow many optical data streams to be combined onto a single fiber. These cards can handle the addition of 2, 4, 6, 8 or more systems onto a single fiber.

Figure 3-3 shows a simple four channel CWDM that would combine four optical wavelengths onto a single fiber.

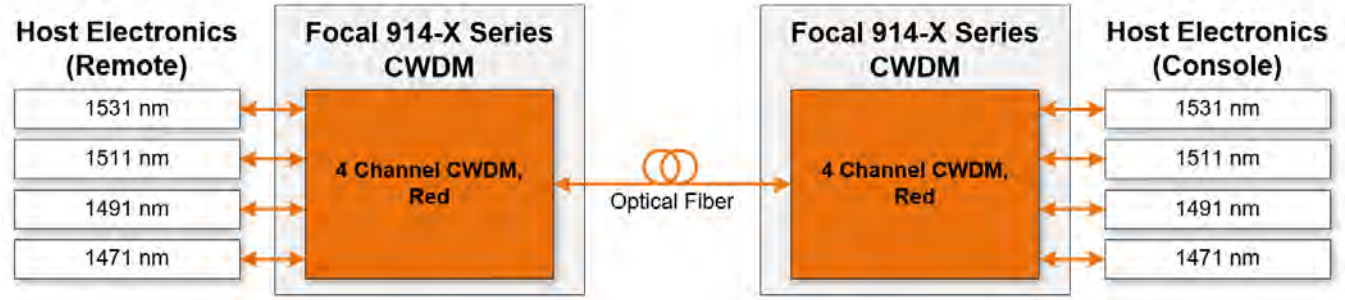


Figure 3-3: 914 4CH CWDM Card

Figure 3-4 shows how a 914-X Series system can be combined with the 914-HDV2 media converter using a four channel CWDM.

This example system has 3x HD video channels, 2x NTSC/PAL channels, 3x Gigabit Ethernet channels and 6x serial data channels, all combined in real time onto a single bidirectional fiber link.

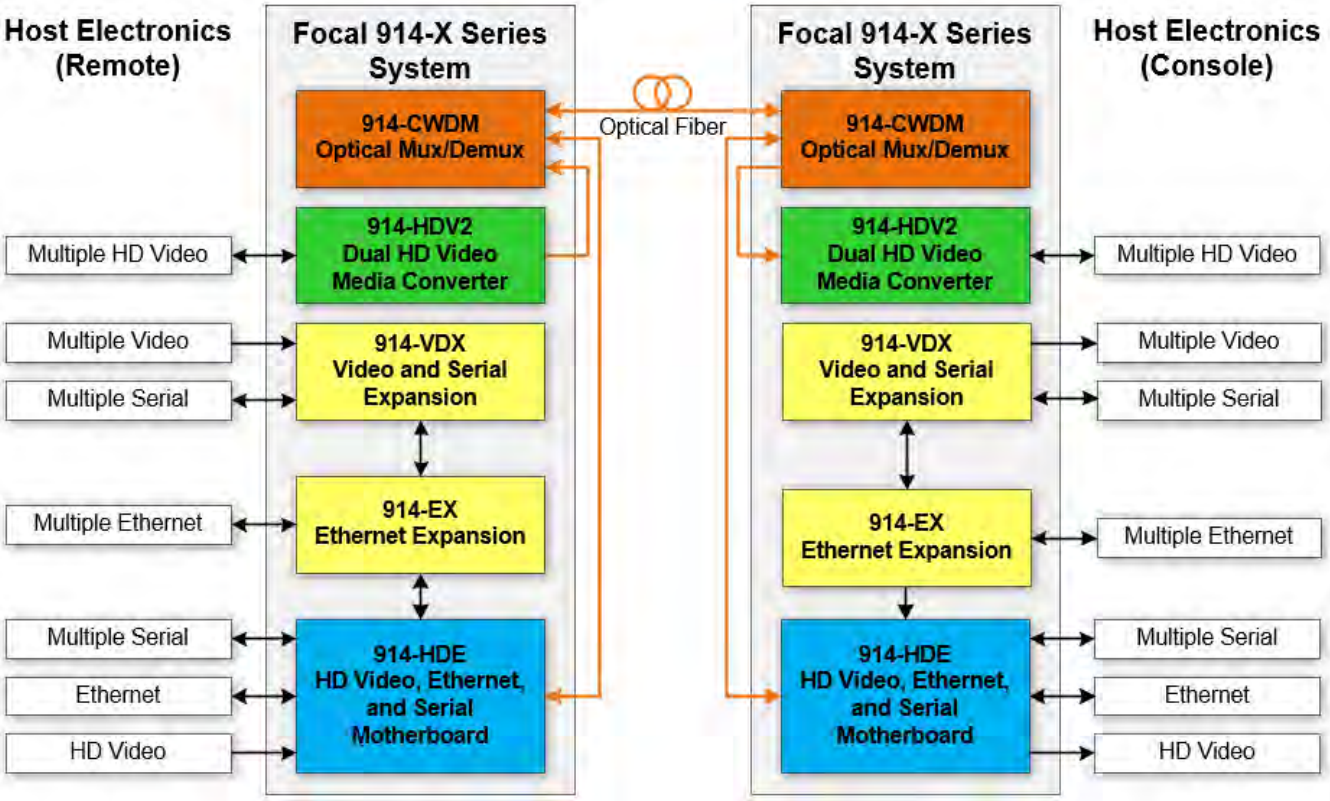


Figure 3-4: 914-X Series System with 914-HDV2 and CWDM Example

3.3 System Specification

When specifying a 914-X Series system, ensure there is enough available optical bandwidth to support the required signals and data throughput. Moog Focal has released three versions of the 914-HDE motherboard with pricing linked to bandwidth. This allows users who do not require expansion cards, 3G-SDI, or gigabit Ethernet to select a more cost-effective solution. Moog Focal will work with users to configure a complete optical multiplexer solution. The following section shows signal bandwidths and sample system configurations. This allows users to weigh the tradeoffs between system bandwidth, cost, size, and power, while also showing the upgrade potential of any 914-X Series system.

Table 3-2: Signal Types and Required Bandwidths

SIGNAL TYPE OR EXPANSION CARD	REQUIRED BANDWIDTH
914-HDE base bandwidth for serial channels, diagnostics, and all low speed (LS) expansion channels	150 Mb/s (Always Enabled)
914-VDX base bandwidth (serial channels)	50 Mb/s total per card (Always Enabled)
10 Mb/s Ethernet	Up to 10 Mb/s
100 Mb/s Ethernet	Up to 100 Mb/s
1000 Mb/s Ethernet	Up to 1000 Mb/s
SD-SDI	300 Mb/s
HD-SDI	1550 Mb/s
3G-SDI	3050 Mb/s
Analog video (NTSC or PAL)	250 Mb/s per video channel
914-DX	0 Mb/s Included with 914-HDE base bandwidth
914-AX	0 Mb/s Included with 914-HDE base bandwidth

Table 3-3: Available Bandwidth by Motherboard Card Version

914-HDE VERSION	AVAILABLE BANDWIDTH	EXPANSION CHANNELS SUPPORTED
L1	1800 Mb/s	4 low speed (LS) channels
M1	3500 Mb/s	4 low speed (LS) channels 4 medium speed (MS) channels
H1	5600 Mb/s	4 low speed (LS) channels 4 medium speed (MS) channels

Using the above two tables as a reference, it becomes possible to specify a full system and ensure a lossless, low-latency optical link.

3.4 Steps for Choosing an Optimal 914-X Series System Architecture

1. Calculate the bandwidth of the required signals based on Table 3-2.
2. Choose the 914-HDE motherboard version based on required bandwidth. Multiple 914-X Series systems may be required for very high bandwidth applications. Refer to Table 3-3.
3. Consider using 914-HDV2 for systems requiring more than one HD video channel.
4. Choose 914 expansion card(s) with the required number and type of interfaces required.
5. Ensure the base bandwidths for the 914-HDE and any 914-VDX cards are included with the bandwidth calculations.
6. Verify expansion channels available vs. required, refer to Table 3-1.
7. Balance expansion cards between motherboards in very large systems.

3.4.1 Example 914-X Series L1 System

Table 3-4: Example 914-X Series L1 System Requirements

QTY	REQUIRED SIGNAL	BANDWIDTH
1	HD-SDI video	1550 Mb/s
8	Serial channels	150 Mb/s (914-HDE base bandwidth)
1	CAN bus	Included
1	Hydrophone	Included
1	Fast Ethernet channel	100 Mb/s
	Total:	**1800 Mb/s** (= Max L1 bandwidth)

Table 3-5: Example 914-X Series L1 System Solution

REQUIRED CARD	QTY	SIGNALS	EXPANSION CHANNELS
914-HDE (L1)	1	1x HD-SDI 2x Serial 1x Fast Ethernet	4x Low speed
914-DX	1	6x Serial channels (6 per Card)	1x Low speed
914-AX with AIB-CAN bus	1	1x CAN bus	1x Low speed
914-AX with AIB-HYDRO	1	1x Hydrophone	1x Low speed

3.4.2 Example 914-X Series M1 System

Table 3-6: Example 914-X Series M1 System Requirements

QTY	REQUIRED SIGNAL	BANDWIDTH
1	HD-SDI video	1550 Mb/s
18	Serial channels	200 Mb/s (914-HDE + 914-VDX base bandwidth)
1	Gigabit Ethernet channel	1000 Mb/s
2	Fast Ethernet channels	200 Mb/s (100 Mb/s each)
2	NTSC video channels	500 Mb/s (250 Mb/s each)
	Total:	**3450 Mb/s** (< 3500 Mb/s Max for M1)

Table 3-7: Example 914-X Series M1 System Solution

REQUIRED CARD	QTY	SIGNALS	EXPANSION CHANNELS
914-HDE (M1)	1	1x HD-SDI 2x Serial 1x Gigabit Ethernet	4x Low speed 4x Medium speed
914-DX	2	12x Serial channels (6 per card)	2x Low speed
914-VDX	1	2x Analog video 4x Serial	1x Medium speed
914-EX	1	2x Fast Ethernet channels	1x Medium speed

3.4.3 Example 914-X Series H1 System

Table 3-8: Example 914-X Series H1 System Requirements

QTY	REQUIRED SIGNAL	BANDWIDTH
1	3G-SDI Video	3050 Mb/s
16	Serial Channels	250 Mb/s (914-HDE + 2x 914-VDX base bandwidth)
1	Gigabit Ethernet Channel	1000 Mb/s
2	Fast Ethernet Channels	200 Mb/s (100 Mb/s each)
4	PAL Video Channels	1000 Mb/s (250 Mb/s each)
1	CAN bus	Included
1	Hydrophone	Included
	Total:	**5500 Mb/s** (< 5600 Mb/s Max for H1)

Table 3-9: Example 914-X Series H1 System Solution

REQUIRED CARD	QTY	SIGNALS	EXPANSION CHANNELS
914-HDE (H1)	1	1x 3G-SDI 2x Serial 1x Gigabit Ethernet	4x Low speed 4x Medium speed
914-VDX	2	4x Analog video (2 per card) 8x Serial (4 per card)	2x Medium speed
914-EX	1	2x Fast Ethernet channels	1x Medium speed
914-DX	1	6x Serial	1x Low speed
914-AX with AIB-CAN bus	1	1x CAN bus	1x Low speed
914-AX with AIB-HYDRO	1	1x Hydrophone	1x Low speed

3.4.4 Choosing an Optical Card

For systems requiring more than a single 914-X Series stack with a single fiber bidirectional transceiver, an optical CWDM card may be used to combine more signals onto the same fiber.

Please refer to Section 8.0 for more details.

4.0 914-HDE Motherboard Overview

Card P/N	See Section 13.1
Config. Dwg	914-2016-00

Figure 4-1 shows the top view of a 914-HDE card with user interface connectors highlighted. The remote and console 914 cards are physically identical; the only difference between them is the EEPROM configuration and optical transceiver. The 914-HDE does not use physical dip switches for system configuration and settings. All settings are accessed via the 914-X Series Unified Diagnostic GUI and are saved in non-volatile memory. Firmware updates may also be available. Please visit the following link to check for updated software and/or manuals: http://www.moog.com/products/multiplexeRSmedia-converters/focal-multiplexer-product-line/multiplexer-technical-documents.html

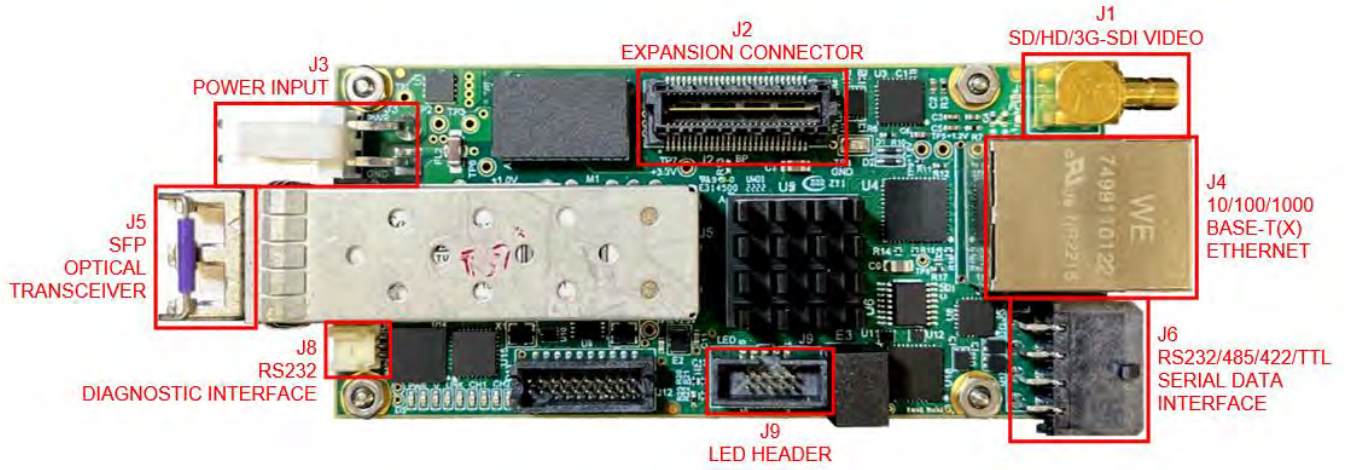


Figure 4-1: 914-HDE Top View

4.1 914-HDE Versions

Different versions of the 914-HDE are available depending on system requirements. Each version supports different optical bandwidths and expansion cards. Version upgrades are possible. Please contact Moog Focal for availability. For more information regarding the expansion cards, system bandwidth capabilities, and system configurations, please consult Sections 6.0 and 3.3.

Table 4-1: 914-HDE Versions

VERSION	AVAILABLE BANDWIDTH	SERIAL CHANNELS	ETHERNET	VIDEO	SUPPORTED EXPANSION CHANNELS
L1	1.8 Gb/s	2x Isolated RS232/485/422/TTL	1x 10/100/1000 Mb/s (1, 2)	1x HD/SD-SDI	4x LS
M1	3.5 Gb/s			1x 3G/HD/SD-SDI	4x LS 4x MS (3)
H1	5.6 Gb/s			1x 3G/HD/SD-SDI	

[1] In L1 versions, either HD-SDI video ***or*** 1000 BASE-T Ethernet is supported. The default is to support HD-SDI video. If HD-SDI video is not required, this feature can be traded for 1000 BASE-T via the Diagnostic GUI in the Ethernet: Negotiation options.

[2] In M1 versions, both 3G-SDI and full bandwidth gigabit Ethernet cannot be supported simultaneously. While 3G-SDI video is passing through the system, the maximum available bandwidth for Ethernet is 350 Mb/s.

[3] MS expansion channels have limited available bandwidth, especially when 3G-SDI is active.

4.2 914-HDE Power

Power to the 914-HDE card is provided through connector J3, Molex P/N 09-75-2024. The mating plug is Molex P/N 26-03-4020 with crimps P/N 08-52-0113. The pinout is provided in the table and figure below.

Table 4-2: 914-HDE Power Connector Pinout

PIN	FUNCTION
1	GND
2	VCC

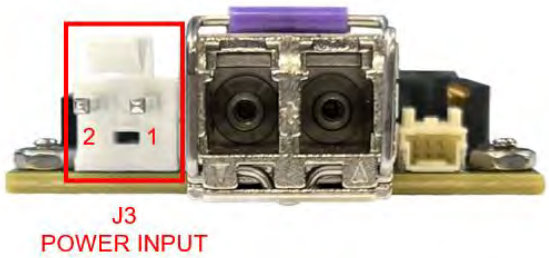


Figure 4-2: 914-HDE Power Input Connector Location

The recommended input voltage range is 4.5 VDC to 13.0 VDC (typically +5 or +12 VDC regulated). Nominal power consumption is 5 W, increasing to 5.5 W at 60°C ambient temperature. This power consumption does not include expansion card power requirements. Power leads should be AWG 18 – 20. Refer to Section 10.5 for more details on the system electrical and environmental specifications.

The onboard surface mount fuse, F1, is rated to 2A and is not intended to be field replaceable. If the power fuse is blown, the card should be evaluated for damage by the Moog Focal factory or a trained service personnel prior to any repair.

4.3 914-HDE HD Video Channel

The 914-HDE card has one video port, supporting 3G/HD/SD-SDI video conforming to SMPTE 259M-C, SMPTE 292M, and SMPTE 424M-A/B. On the remote card the video is an input, and on the console, it is an output.

The connector is a Mini SMB jack, Amphenol P/N 142146-75. Recommended mating plug is Cinch P/N 131-8403-101, although other 75 Ω Mini SMB plugs may be suitable. Cabling should be RG-179, 75 Ω coaxial type. Video latency through the mux/demux system is less than 50 µs, not including fiber delays of 5 us/km.

Figure 4-3: 914-HDE Mini SMB Jack – Amphenol P/N 142146-75

Figure 4-4: 914-HDE Video Channel 1 Connector Location

4.4 914-HDE Serial Data Ports

The 914-HDE has two isolated serial ports supporting RS232, RS485, RS422, and TTL signaling protocols.[1] These protocols may be configured by the user in the field via the 914-X Series Unified Diagnostic GUI. All data rates are supported up to 2.5 Mbaud for RS485 and RS422 and up to 500 kbaud for RS232 and TTL. Each port can support completely independent serial data links with independent baud rates. By default, RS485 and RS422 inputs are terminated differentially with an onboard 120 Ω resistor that can be disabled via software configuration. Latency through the Mux/Demux system is less than 50 µs, not including fiber delays of 5 us/km.

For RS485, which is a half-duplex protocol, a programmable turnaround time is implemented. The default turnaround time (timeout between TX and RX) is set to 1 ms. Serial port settings, including protocol, timeouts, and terminations may be accessed and changed via the 914-X Series Unified Diagnostic GUI.

The serial port connector is Molex Micro-fit P/N 43045-0800. The mating plug is Molex Micro-fit P/N 0430250800 with Molex crimps P/N 0430300010. The pinout is detailed in Table 4-4. TX refers to data transmitted from the 914-HDE to external equipment. RX refers to data received into the 914-HDE from external equipment. Data coming into the RS422 RX lines at the remote, for example, will exit from the RS422 TX lines at the console.

Table 4-3: 914-HDE Serial Data Port Numbering

PORT NUMBER	REFERENCE DESIGNATOR
1	J6 (lower pin row)
2	J6 (upper pin row)

Table 4-4: 914-HDE Serial Data Connector Pinout

REF.	CHANNEL / PIN				MODE			
					RS232	RS485	RS422	TTL
J6	CH1	1	CH2	5	RS232 RX	RS485+ [2]	RS422 RX+	TTX RX
		2		6	ISO GND [5]	ISO GND [5]	RS422 RX-	ISO GND [5]
		3		7	RS232 TX [3]	RS485+	RS422 TX+	TTL TX
		4		8	RS232 TX [3]	RS485-	RS422 TX-	NC [4]

[1] Note that for 914-HDE Rev 5 or earlier, serial channels are *non-isolated* and TTL is *not* supported.
[2] Do not connect for Rev5 and earlier hardware, only connect one of the RS485+ pins
[3] Connect only one tx output
[4] Do not connect
[5] Isolated ground is **shared** between the ports

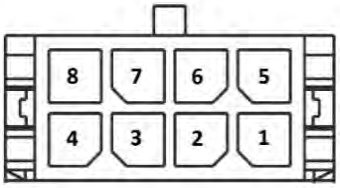


Figure 4-5: 914-HDE Molex Micro-fit P/N 43045-0800

Figure 4-6: 914-HDE Serial Ports 1 and 2

4.5 914-HDE Ethernet Port

The 914-HDE provides an un-switched, low latency 10/100/1000 BASE-T(X) Ethernet link through the optical port. The part is configured for 10/100 BASE-T(X) by default for the L1 version, and 10/100/1000 BASE-T(X) by default for M1 and H1 versions. Auto-negotiate settings can be accessed via the 914-X Series Unified Diagnostic GUI. A standard 8P8C (RJ45) modular jack provides the mechanical interface for the Ethernet port. The port is auto MDI/MDIX capable, and supports jumbo frames up to 9000 bytes.

In 914-HDE **H1** (high speed) cards with FPGA Firmware versions 0xB9 and greater, and in 914-HDE **L1** or **M1** (low or medium speed) cards with FPGA Firmware versions 0xE9 and greater, the feature "Remote Ethernet Link Speed Synchronization" (RLSS) is enabled by default, and can be disabled via the Diagnostic GUI. This feature forces the console side 914-HDE to match the speed and duplex settings of the remote side 914-HDE.

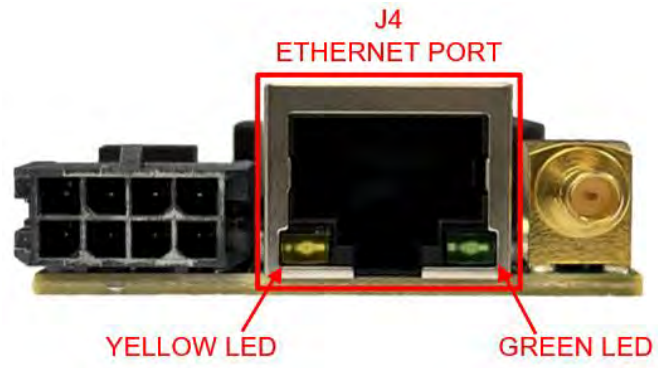


Figure 4-7: 914-HDE Ethernet Port

Integrated LEDs show Ethernet Link Status as shown in Table 4-5.

Table 4-5: 914-HDE Ethernet LEDs

LED STATUS		FUNCTION
YELLOW (LEFT)	GREEN (RIGHT)	
OFF	OFF	No Link
OFF	ON	Linked at either 1000 BASE-T or 10 BASE-T
ON	ON	Linked at 100 BASE-TX
OFF	FLASHING	Link Activity at either 1000 BASE-T or 10 BASE-T
ON	FLASHING	Link Activity at 100 BASE-TX

End-to-end latency through the multiplexer is a calculation adding a fixed electronic latency to the Ethernet frame time, which is a function of the frame length, and the optical latency, which is a function of distance. Adding all three together gives a total latency figure.

Table 4-6: 914-HDE Ethernet Latency

LATENCY COMPONENT / LINK SPEED	10 MB/S	100 MB/S	1000 MB/S
FEL (Fixed Electronic Latency)	30 µs	6 µs	3 µs
FT (Frame Time)	# Bytes * 0.8 µs	# Bytes * 0.08 µs	# Bytes * 0.008 µs
OL (Optical Latency)	5 µs / km	5 µs / km	5 µs / km

Total Latency = FEL + FT + OL

4.6 914-HDE Diagnostic LEDs

The 914-HDE card includes nine onboard diagnostic LEDs. A description and location of each LED is provided in Table 4-7 and Figure 4-8.

Table 4-7: 914-HDE Diagnostic LEDs

REF	COLOUR	DESCRIPTION
D5	Red	Indicates power fault when lit. A power fault is encountered when the input voltage falls outside of the supported range of 4.5 to 13.5 V. Recommended input voltage is 12 VDC. When this LED is lit, the card is not powered properly and will not function.
D6	Green	Indicates that the card is powered properly when lit.
D7	Green	Indicates a valid video signal is present when lit
D8	Green	Indicates a valid optical link is being received. (data frames are present)
D9	Red	Indicates that insufficient optical power is present at the receiver.
D10	Green	Flashing LED indicates serial Channel 1 is transmitting to external equipment.
D11	Yellow	Flashing LED indicates serial Channel 1 is receiving from external equipment.
D12	Green	Flashing LED indicates serial Channel 2 is transmitting to external equipment.
D13	Yellow	Flashing LED indicates serial Channel 2 is receiving from external equipment.

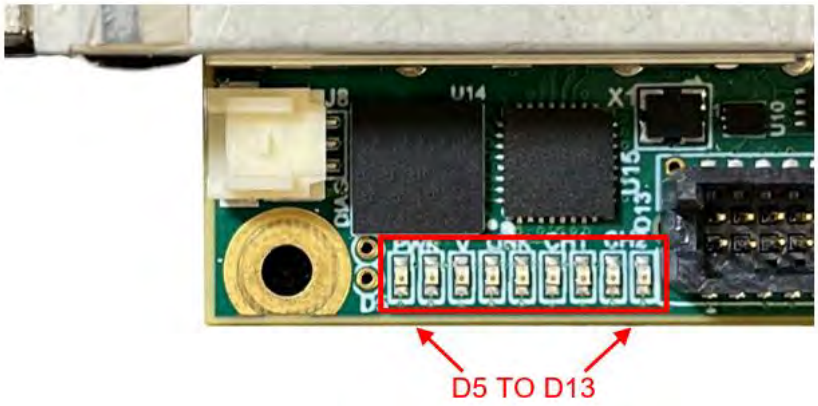


Figure 4-8: 914-HDE Diagnostic LED Locations

4.7 914-HDE Diagnostic LED Header

The 914-HDE card includes a 10-pin header capable of driving eight LEDs. This is useful for LED integration into an enclosure. Each LED pin is driven low to turn on an LED, and includes a 267 Ω series resistor to limit current draw. Maximum current draw per LED pin is 8 mA.

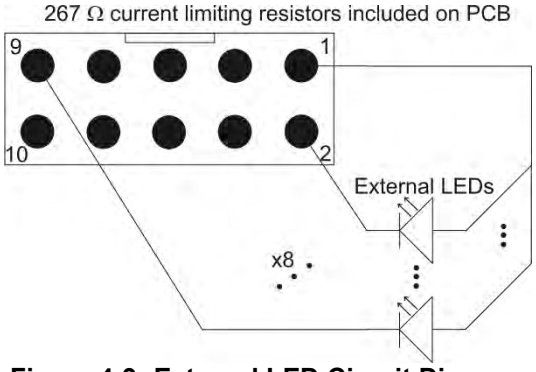


Figure 4-9: External LED Circuit Diagram

This header may optionally become an input via the Diagnostic GUI with L1/M1 firmware revisions greater than B1 or any H1 firmware.

The LED header J9 is FCI P/N 20021521-00010T1LF, and the mating part is FCI P/N 20021444-00010T1LF. This can be used with most 0.050" (1.27mm) spacing ribbon cables.

Table 4-8: 914-HDE Diagnostic LED Header Pinout

PIN	NAME	DESCRIPTION
1	3.3V	3.3V. This pin can be used to drive the LEDs, Maximum current is 0.5A.
2	LINK	Indicates a valid optical link is being received. Active low.
3	LINK FAULT	Indicates that insufficient optical power is present. Active low.
4	VIDEO	Indicates a valid video signal is present when lit. Active low.
5	ETHERNET	Indicates that an Ethernet link is established locally. Active low.
6	SER1 RX	Flashing LED indicates serial Channel 1 receive activity. Active low.
7	SER1 TX	Flashing LED indicates serial Channel 1 transmit activity. Active low.
8	SER2 RX	Flashing LED indicates serial Channel 2 receive activity. Active low.
9	SER2 TX	Flashing LED indicates serial Channel 2 transmit activity. Active low.
10	GND	Ground

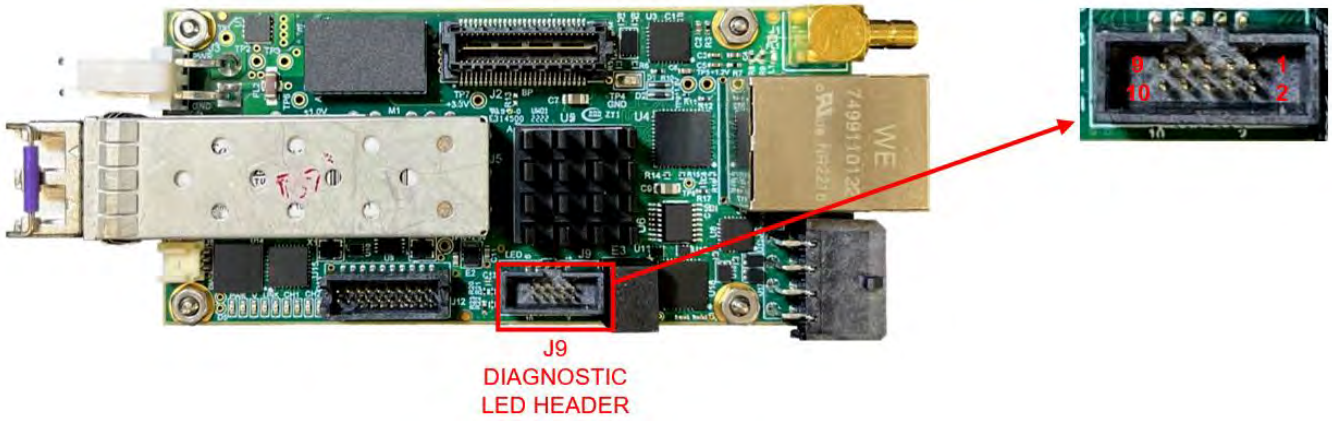


Figure 4-10: 914-HDE Diagnostic LED Header

4.8 914-HDE Optics

An SFP or SFP+ transceiver provides the optical interface for the 914-HDE. Many options exist, including:

- Singlemode or multimode fiber;
- Bidirectional 1310/1550 nm transceivers (L1 and M1 versions);
- Bidirectional 1270/1330 nm transceivers (H1 version);
- CWDM wavelengths (L1, M1 or H1 versions);
- Non-standard optical budgets.

Due to the high data rates, singlemode fiber is standard. Multimode fiber is only suitable for very short links (< 300 m). Contact Moog Focal for multimode options. Typical link budgets for singlemode fiber are 20 dB for bidirectional single fiber, or 24 dB for dual fiber CWDM. Moog Focal has compatible CWDM modules that can be mounted and stacked with 914-HDE systems. Please refer to Section 8.0 for more details.

4.8.1 914-HDE Flux Budget Calculation

When specifying an optical system, it is important to analyze system losses and fiber link distances to calculate the required optical configuration. The following table shows a sample flux budget calculation for a system with multiple ST bushings, a 10 km singlemode fiber link, and a FORJ. Actual losses can vary widely from this; each system flux budget calculation must use data based on actual parts in use.

Table 4-9: 914 HDE Sample Flux Budget Calculations

UPLINK (1310 nm) FLUX BUDGET CALCULATION

Given the following information:

Component	Value	Qty. in System
Connector dB loss	0.3 dB	6
FORJ dB loss	4.0 dB	1
Cable dB loss (for 10 km SMF length) 0.4 dB/km @ 1310 nm; 0.3 dB/km @ 1550 nm	4.0 dB	1
Typical output power	-1.0 dBm	Not applicable
Dispersion penalty	1.0 dB	Not applicable
Typical receive sensitivity	-21.0 dBm	Not applicable

Total loss = (6 * connector loss) + (1 * FORJ loss) + (1 * cable loss)
Total loss = (6 * 0.3 dB) + (1 * 4.0 dB) + (1 * 4.0 dB)
Total loss = (1.8 dB) + (4.0 dB) + (4.0 dB) = **9.8 dB**

Receive power = (typical output power) – (total losses)
Receive power = (-1.0 dBm) – (9.8 dB) = **-10.8 dBm**

Required receive sensitivity = (receive power) – (dispersion penalty)
Required receive sensitivity = (-10.8 dBm) – (1.0 dB) = **-11.8 dBm**

Available margin = (typical receive sensitivity) – (required receive sensitivity)
Available margin = (-21.0 dBm) – (-11.8 dBm) = **-9.2 dB**

DOWNLINK (1550 nm) FLUX BUDGET CALCULATION

Given the following information:

Component	Value	Qty. in System
Connector dB loss	0.3 dB	6
FORJ dB loss	4.0 dB	1
Cable dB loss (for 10 km SMF length) 0.4 dB/km @ 1310 nm; 0.3 dB/km @ 1550 nm	3.0 dB	1
Typical output power	-1.0 dBm	Not applicable
Dispersion penalty	1.0 dB	Not applicable
Typical receive sensitivity	-21.0 dBm	Not applicable

Total loss = (6 * connector loss) + (1 * FORJ loss) + (1 * cable loss)
Total loss = (6 * 0.3 dB) + (1 * 4.0 dB) + (1 * 3.0 dB)
Total loss = (1.8 dB) + (4.0 dB) + (3.0 dB) = **8.8 dB**

Receive power = (typical output power) – (total losses)
Receive power = (-1.0 dBm) – (8.8 dB) = **-9.8 dBm**

Required receive sensitivity = (receive power) – (dispersion penalty)
Required receive sensitivity = (-9.8 dBm) – (1.0 dB) = **-10.8 dBm**

Available margin = (typical receive sensitivity) – (required receive sensitivity)
Available margin = (-21.0 dBm) – (-10.8 dBm) = **-10.2 dB**

4.8.2 Optical Safety

All lasers used in the 914-HDE system are Class I laser devices per IEC-60825 unless otherwise specified in installation or configuration drawings. No special control measures or warning labels are required, although any needless exposure of the eye should be avoided as a matter of good practice, and **fibers should never be viewed with magnifying instruments, e.g. fiber scopes, while optical power is present.** Note that the optical wavelengths are in the infrared range, so not visible, but magnifying instruments can cause serious damage to the eye.

4.9 Legacy 914-HDE Information (Board Rev. 5 and Earlier)

The 914-HDE and expansion cards 914-VDX, 914-EX, 914-DX, and 914-HDV2, were all updated in 2022. Most connector pinouts are the same between old and latest board revisions, however this section describes important details about the differences in older revisions of the 914-HDE. Any details **not** covered in this section imply that no changes occurred between board revisions. Refer to later sections for details on older revisions of expansion cards.

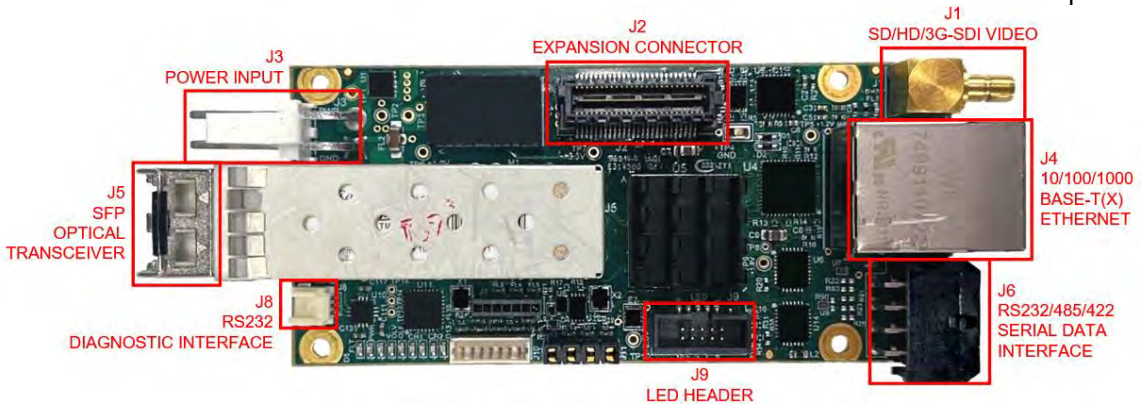


Figure 4-11: 914-HDE Top View (Board Revisions 5 and Earlier)

4.9.1 Legacy 914-HDE Diagnostics Connector

The part used for diagnostics connector J8 was replaced in board revision 4 and is installed on all later revisions. The pinout for the connector is the same between older and new revisions. An isolated ground was introduced in board revision 6. Earlier revisions have non-isolated ground.

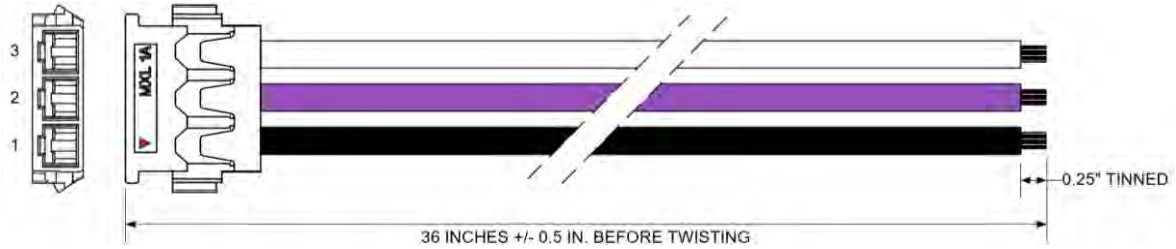


Figure 4-12: Legacy 914-HDE Diagnostic Interface Cable

Table 4-10: Legacy 914-HDE J8 Pinout

PIN	FUNCTION	
	REV 5 AND EARLIER	REV 6 AND LATER
1	GND	ISO GND
2	TX	TX
3	RX	RX

Table 4-11: Legacy 914-HDE Mating Connectors

DESIGNATOR	DESCRIPTION	MFR.	PART NUMBER / FOCAL PN	CRIMP PINS / FOCAL PN
J8 (≤ Board Rev 3)	Diagnostics (Old revs)	Molex	0781720003 / EL-J0579	0781720410 / EL-J0580
J8 (≥ Board Rev 4)	Diagnostics	Molex	0151330306 / EL-J0710	N/A

4.9.2 Legacy 914-HDE Serial Data

TTL serial protocol was introduced to the 914-HDE in board revision 6. All earlier revisions only support RS232, RS485, and RS422. Refer to the table below for details.

Table 4-12: Legacy 914-HDE Serial Data Connector Pinout

REF.	CHANNEL / PIN				MODE		
					RS232	RS485	RS422
J6	CH1	1	CH2	5	RS232 RX	DO NOT CONNECT	RS422 RX+
		2		6	GND	GND	RS422 RX-
		3		7	RS232 TX	RS485+	RS422 TX+
		4		8	RS232 TX	RS485-	RS422 TX-

5.0 Model 914-X Series Unified Diagnostic GUI

The 914-X Series has advanced system diagnostics available over a dedicated RS232 port on the **console** 914-HDE motherboard. This one port gives access to all(1) 914 cards in the 914-X Series system, including those at the remote side when there is an established fiber optic link. This diagnostic link is critical during the setup phase of any system, as it gives access to the settings of any port in the system. This is useful to configure serial port protocols, Ethernet negotiation settings, and any special video settings. ***Do not connect directly to the RS232 diagnostic port on the REMOTE 914-HDE for configuration purposes, as the settings will not be retained.***

[1] 914-HDV2 has its own diagnostic port.

Figure 5-1 shows a typical setup between a console 914-HDE card and a PC to obtain diagnostics information from both console and remote ends.

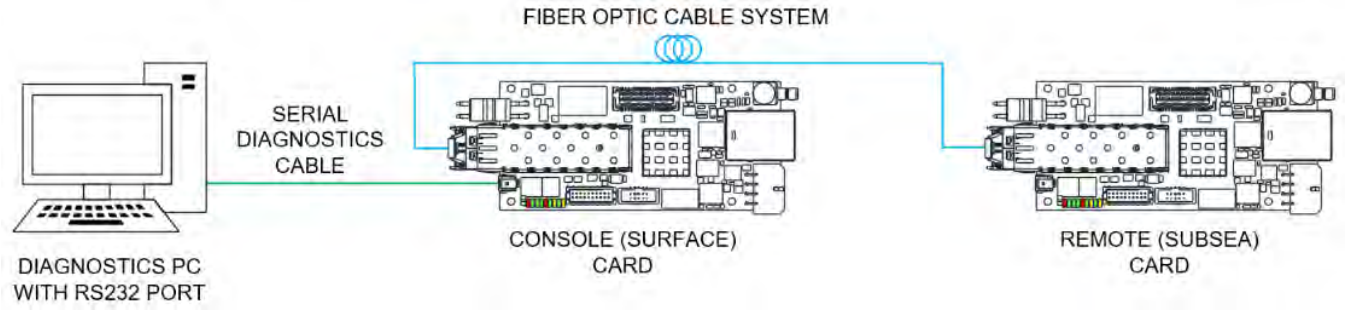


Figure 5-1: Basic Diagnostics Setup

The diagnostics serial port configuration is as follows:

- Speed: 115200 baud
- Data bits: 8
- Stop bits: 1
- Parity: None
- Flow Control: None

Included with every 914-X Series card is a pigtailed jumper for the RS232 diagnostic port, as shown in the figure below. This cable plugs into J8 on the console 914-HDE board. To install the cable, the plug is pushed into the onboard connector. Extra cables provide firmware update access for individual cards.

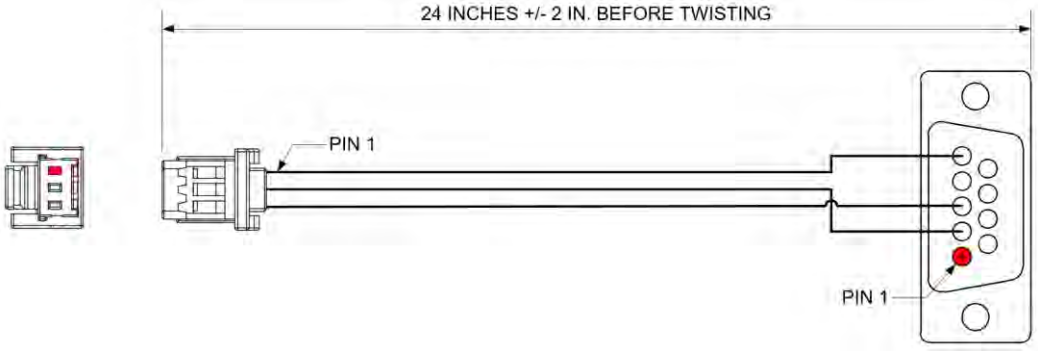


Figure 5-2: 914-HDE Diagnostic Interface Cable

Note that in 914-HDE board revisions 3 and earlier, the diagnostic interface cable and connector is different. Refer to Section 4.9.1 for details.

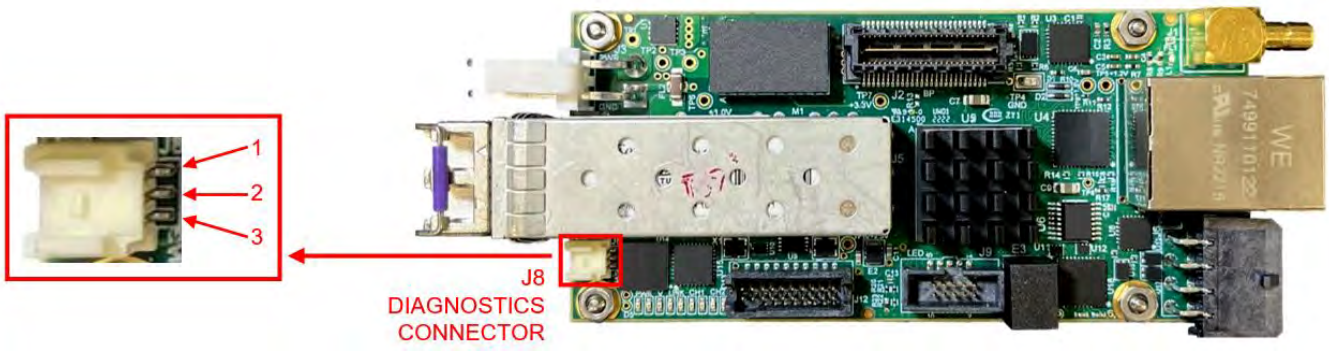


Figure 5-3: 914-HDE Diagnostic Connector

Table 5-1: 914-HDE J8 Diagnostic Connector Pinout

PIN #	FUNCTION
1	GND
2	RS232 TX (Data from 914-HDE to PC GUI)
3	RS232 RX (Data from PC GUI)

Table 5-2: 914-HDE J8 Diagnostic Connector Part Numbers

J8	PART NUMBER
Connector	Molex Pico-Clasp 501953-0305
Mating Plug assembly	Molex Pico-Clasp 0151330306

5.1 Installing the Model 914-X Series Unified Diagnostic GUI

The 914-X Series Unified GUI is only compatible with Microsoft Windows Operating Systems. Ensure that the device which the GUI is installed onto has an RS232 serial (COM) port, which will be used to connect to the 914-HDE diagnostic port. **Verify the computer is equipped with the Latest Microsoft Visual C++ Redistributable for both x86 and x64 architectures.** Restart the computer after installation.

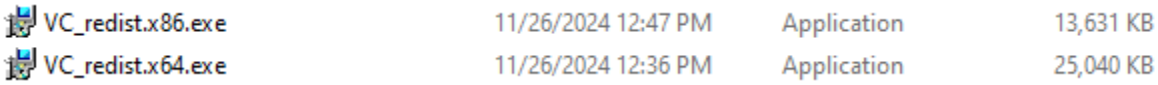


Figure 5-4: Visual C++ Redistributable Files

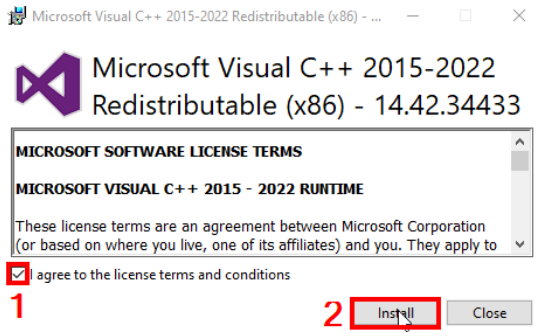


Figure 5-5: x86 Redistributable Install Steps

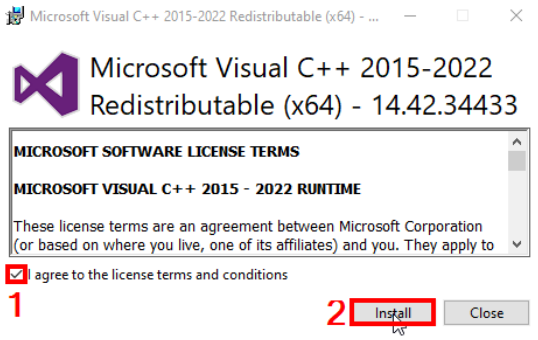


Figure 5-6: x64 Redistributable Install Steps

Go to Focal's 914-X webpage and scroll down to the *Resources* section. Expand the *Downloads* dropdown and click on the *.zip file titled **914-X Series Unified Diagnostic GUI**. This will begin the download of the folder.

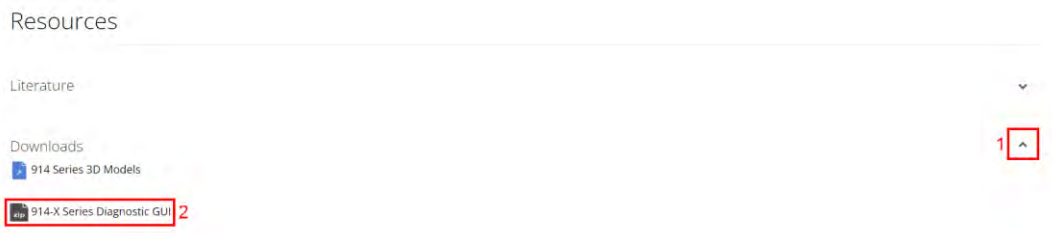


Figure 5-7: Moog Focal Website Unified Diagnostic GUI Download Location

Navigate to the location which the *.zip file downloaded and extract it to "C:\Focal\". Open the extracted file and double click on the **914-X Series Unified Diagnostic GUI** executable to run the GUI.

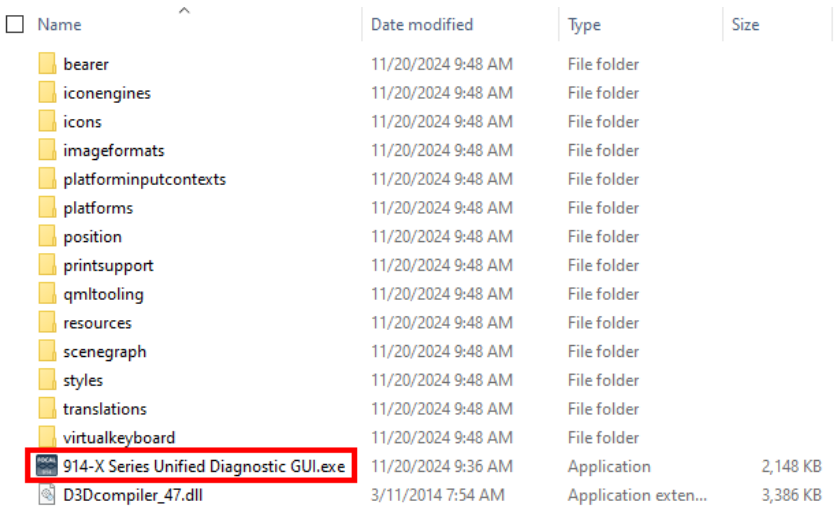


Figure 5-8: Executable Location

5.1.1 Connecting Hardware to the GUI

Once installed, open the software and select which board the GUI will be used with. Note that expansion cards, such as 914-VDX, 914-EX, 914-DX, and 914-AX, are all accessed via the 914-HDE diagnostics connection.

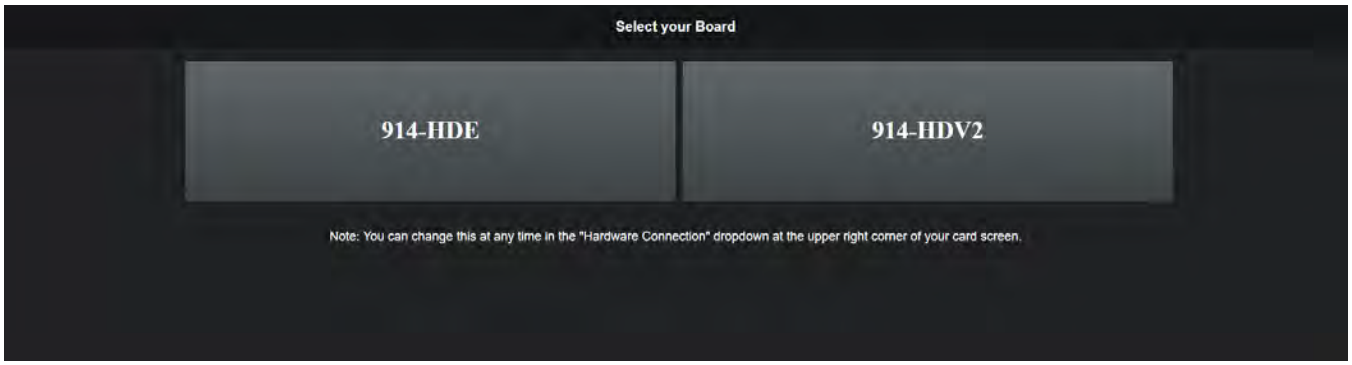


Figure 5-9: Diagnostic GUI Start Screen

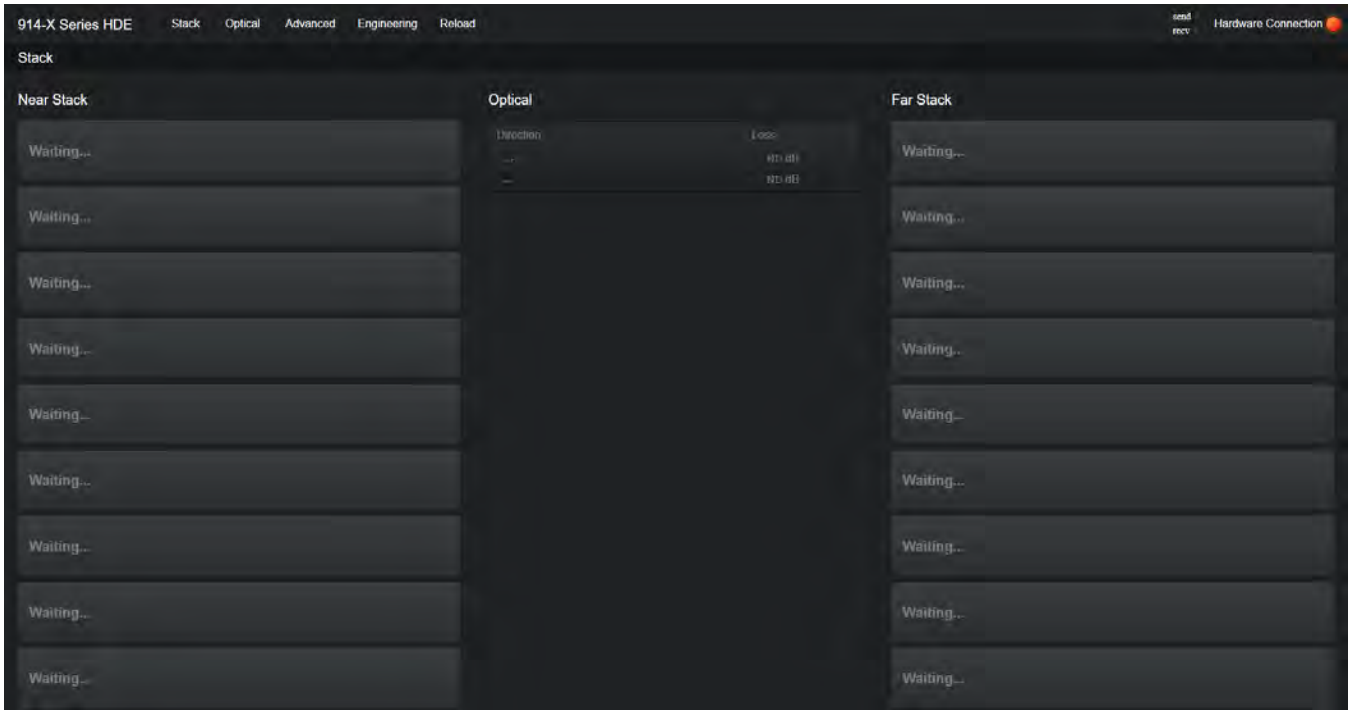


Figure 5-10: 914-HDE Stack View

This selection can be modified at any time by pressing “Hardware Connection” at the top right corner of the screen and adjusting the board type option. The GUI will automatically load to the last selected main screen upon reopening.

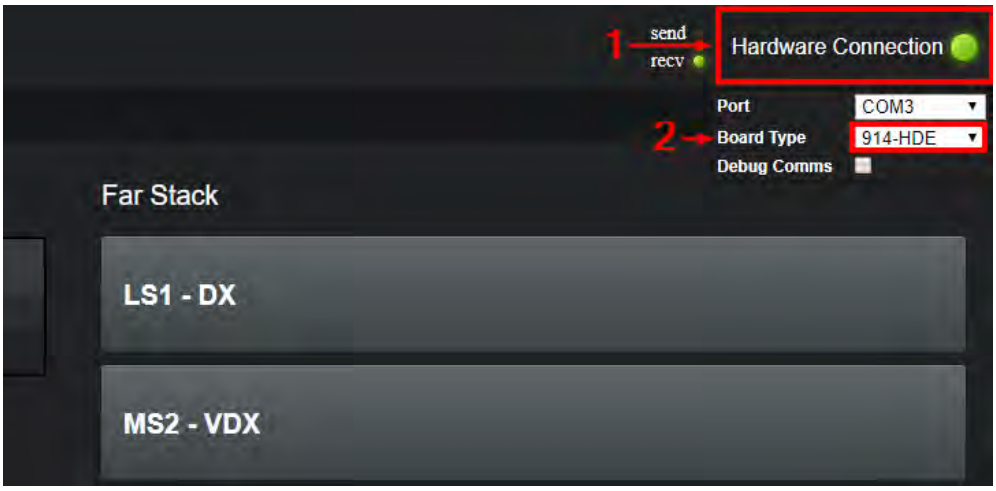


Figure 5-11: Changing the Board Type

Press “Hardware Connection” in the top right corner to set up the COM link. Give time for the software to identify available COM ports, then select the port which the console side 914-HDE is connected to. Close the Hardware Connection tab by clicking elsewhere on the screen. The selected COM port will be remembered the next time the GUI is opened.

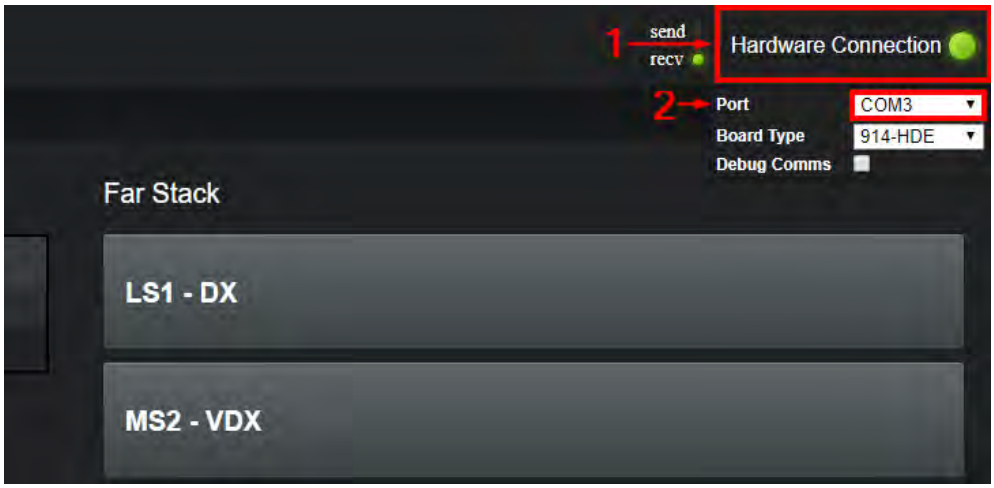


Figure 5-12: Selecting a COM Port

If a successful link to the 914-HDE is established, the LED to the right of “Hardware Connection” will be green and data will begin refreshing. If the LED appears red or amber, the link has not been established. Verify the COM port number and the wiring harness to the board, and ensure power is applied to the 914-HDE. If problems persist, refer to item #1 of Section 14.0. **Users should always be aware of the Hardware Connection LED’s status, as it is the main indicator for the state of communications with the console HDE.**

When the link is established (verify with the green LED), the connected hardware should appear in the GUI. An example of a valid system is detailed in Figure 5-13, with its GUI counterpart shown in Figure 5-14.

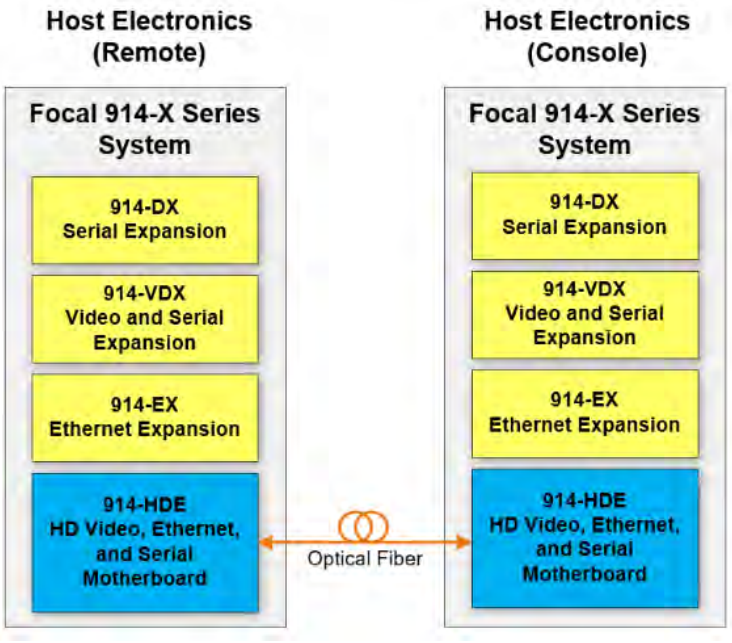


Figure 5-13: Example 914-X System

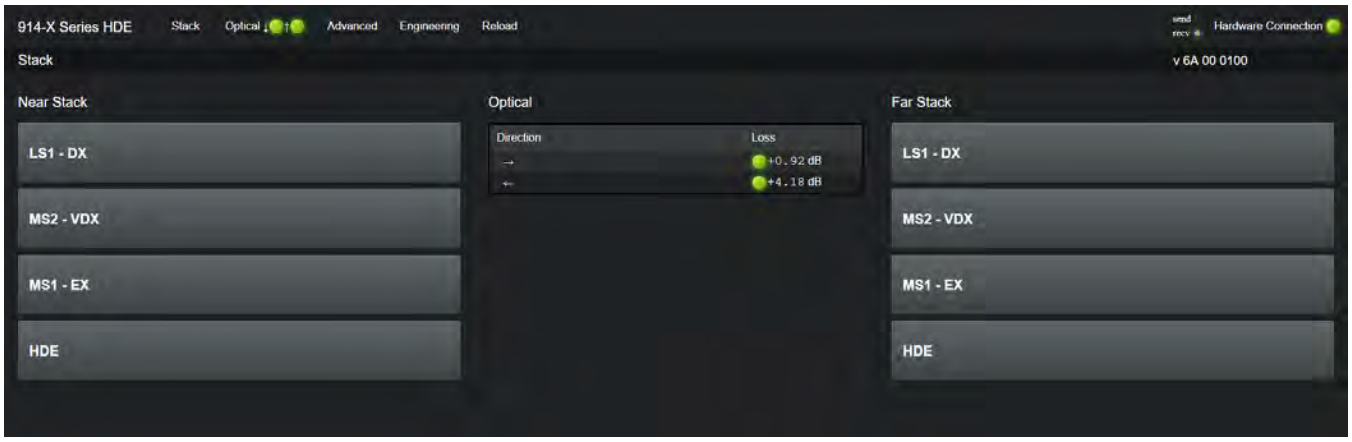


Figure 5-14: 914-HDE Stack View for Example System

5.2 914-HDE Diagnostic Header

The bar on the top of the screen is referred to as the header and does not change between pages. The header contains shortcuts to the stack view, optical, engineering, and advanced pages. It also has a *Reload* option, which can be pressed to reload a page if GUI issues are encountered. The LEDs to the right of the Optical shortcut show the fiber status of the downlink (console data to remote) and uplink (remote data to console) optical connections. **These LEDs only display on status pages.** Green indicates a valid link while red represents a link loss. Users who are experiencing problems with their stack and notice at least one red optics LED should refer to item #6 in Section 14.0.

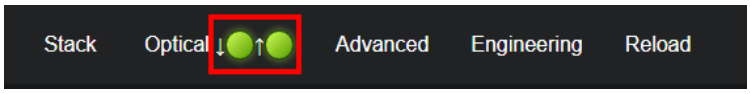


Figure 5-15: Header Optical LEDs

The “send” and “recv” LEDs on the header (left of the “Hardware Connection” button) flash when serial information is being sent to and received from the board respectively. They should blink regularly unless the user is on a settings page or the advanced page. They indicate that healthy communication is taking place between the serial port and the console 914-HDE.

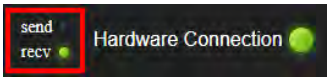


Figure 5-16: Header Send and Receive LEDs

Debug communications can be toggled by pressing the Hardware Connection button on the header and then checking/unchecking the "Debug Comms" box. When enabled, the serial read/write commands sent by the GUI are logged in the upper right corner of the screen. The GUI preserves the state of the debug communications selection between uses.

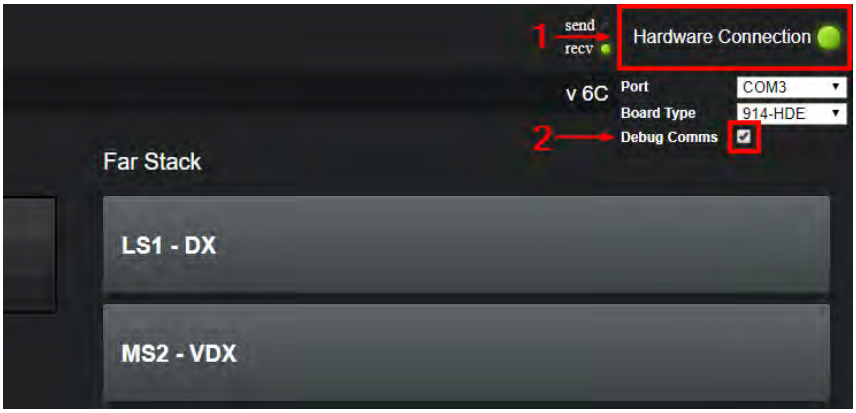


Figure 5-17: Debug Communications Selection

5.3 914-HDE Stack View

The stack view is the central hub of the Diagnostic GUI's 914-HDE pages. It allows navigation to the HDE and expansion card status pages; finds and displays configuration errors on attached 914 stacks; and provides an overview of the fiber optic connection between remote and console. It can be accessed at any time by selecting the "Stack" option on the header. The stack view is a status page.

The left side of the page describes the near stack (console), which includes the HDE connected to the PC. **The console stack should always be on the near (left) side.** Expansion cards are prefixed with **card** and **slot** identifiers. The *card* value identifies what expansion number the card is set as based on its dip switch configuration. The *slot* value identifies if the card is a low speed (LS) or medium speed (MS) expansion. Expansions with lower card values are positioned below those with higher ones. LS expansions will always be positioned above MS expansions.

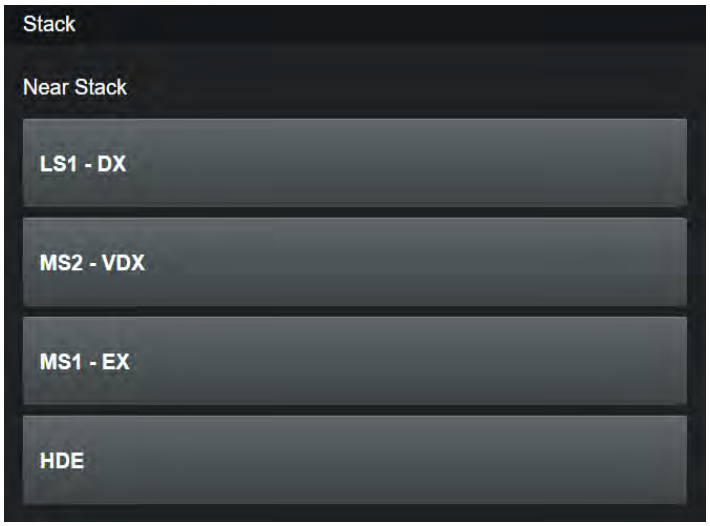


Figure 5-18: Near Side Stack Details

In the center of the screen is the optical table, which shows the current loss and overall status of the optical link between the near and far stack. The top row describes the downlink status (console data to remote), and the bottom row describes the uplink status (remote data to console). By hovering over and clicking on this table (or by pressing the *Optical* option on the header), the user will be brought to the Optical page. See Section 5.6 for more information. Additionally, warning messages (enclosed by a red border) can display below the optical table, outlining potential hardware or software problems. More information on these warnings and how to fix them can be found in Section 5.3.1.

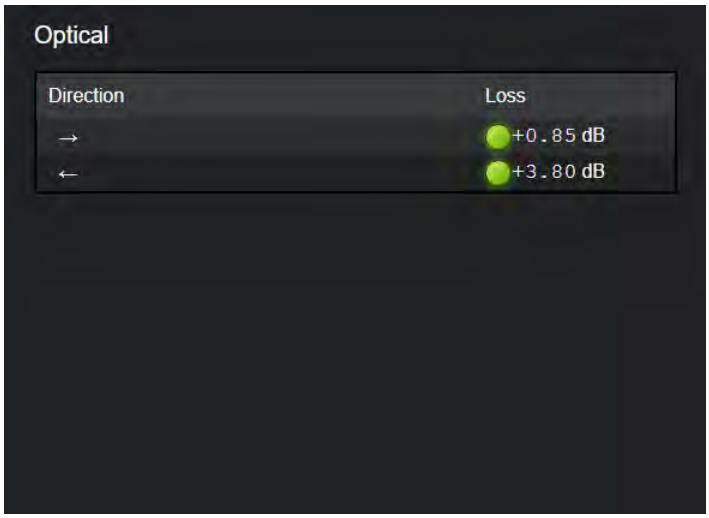


Figure 5-19: Optical Stack Details

The right side of the page details the far stack (remote). **The remote stack should always be on the far (right) side.** Clicking on either the near or far card tiles will bring the user to that card's status page. For example, hovering over and selecting the "LS1 – DX" tile (seen in Figure 5-20) will bring up the status page for the DX card connected to low speed expansion 1.

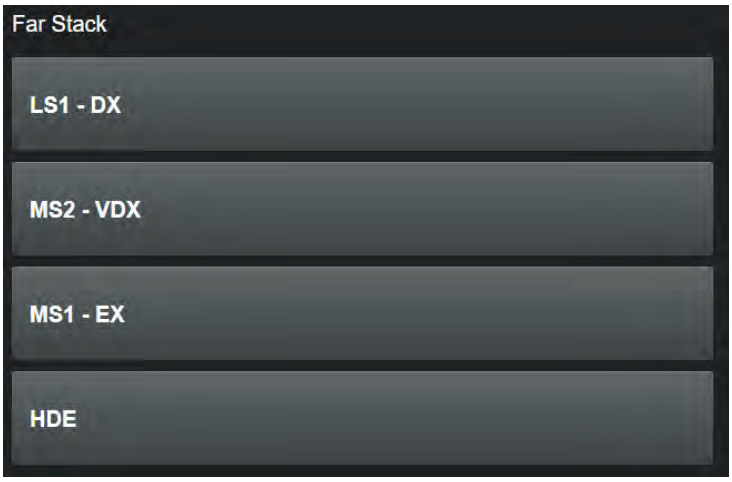


Figure 5-20: Far Side Stack Details

It is essential that the Diagnostic GUI stack accurately reflects the hardware stack. The stack is considered error-free if: no warnings are displayed in the stack view; the Optical and Hardware Connection LEDs on the header are green; and each expansion slot matches on the near and far sides (verify that the prefixes of each expansion are the expected card and slot values).

5.3.1 Stack View Error Messages

Warning messages are displayed below the optical table on the stack view. These outline potential hardware or software problems identified on the stack. Below are the types of error messages that may appear and their fixes.

5.3.1.1 Expansion Cards Are Different

An expansion card on one side is paired with an empty slot on the other side, or an EX card on one stack and a VDX card on the other are set to the same expansion channel. Verify that the dip switches are correctly set by referring to Section 6.1.6 for a VDX, Section 6.2.6 for an EX, and Section 6.4.5 for a DX. Figure 5-21 showcases a situation where the dip switches on the console DX were set to expansion channel 2 while the remote DX remained at expansion channel 1.

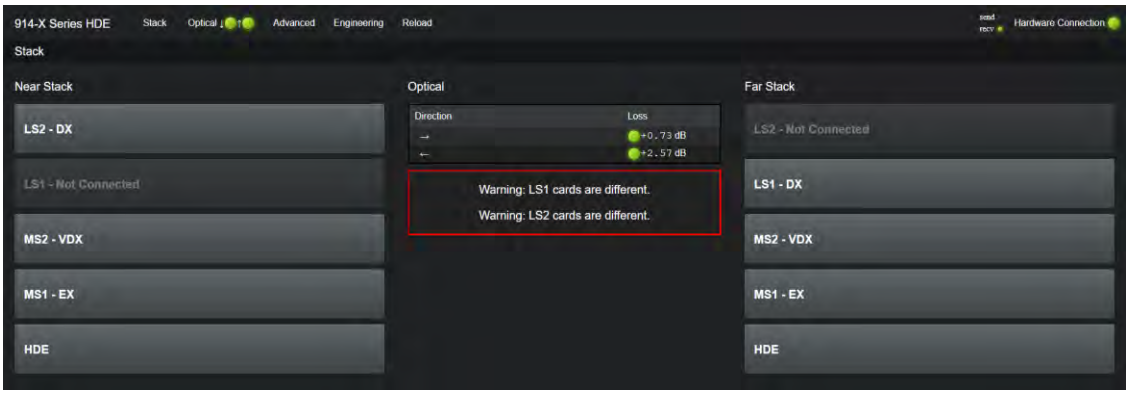


Figure 5-21: Low Speed Expansion Mismatch Warning Message

5.3.1.2 Card is Configured as an AX

The GUI has identified a DX card on the stack. However, the expansion slot this DX card populates is configured as an AX on the HDE. To fix this, refer to Section 6.3.7.

Figure 5-22: AX Warning Message

5.3.1.3 Near Configured as Remote, Far Configured as Console

The specified card on the near stack is configured as a remote, or the specified card on the far stack is configured as a console. **The console stack should always be on the near (left) side.** Ensure that the serial diagnostics cable is connected to the console stack. If it is, configure the specified card to the proper mode. For details on how to achieve this, refer to Section 5.5.1 for an HDE, Section 6.1.8.1 for a VDX, Section 6.2.8.1 for an EX, and Section 6.4.7.1 for a DX.

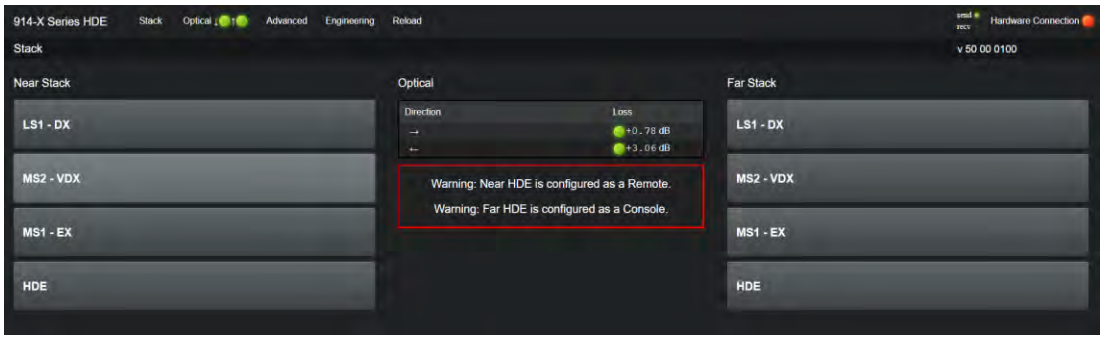


Figure 5-23: Card Configuration Warning Message

5.3.1.4 Card Does not Identify as an HDE

The card connected to the diagnostic port is likely not an HDE. This occurs when loading onto the HDE screen while connected to an HDV2 card. To change to the HDV2 screen, refer to Section 5.1.1.

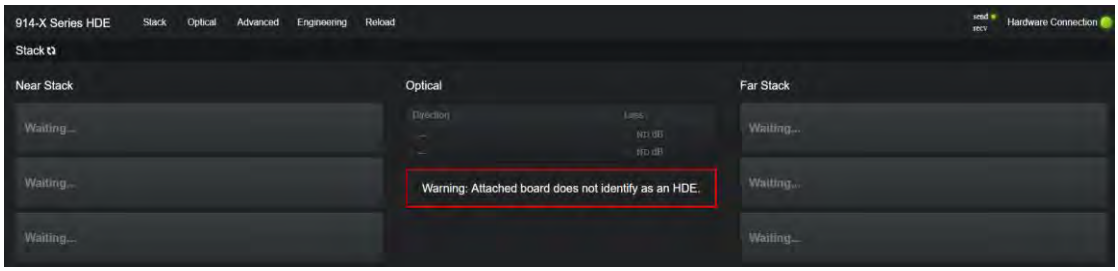


Figure 5-24: HDV2 on HDE Screen Warning Message

5.3.2 Losing Optical Uplink

If uplink is lost, transmitted data from the remote is not received at the console. Remote information on the right side of the screen will not be refreshed, and stale data will populate the fields. To indicate if this has occurred, **status pages** will surround all remote data in a red border on uplink loss. Refer to item #6 in Section 14.0 for ways to reestablish uplink.

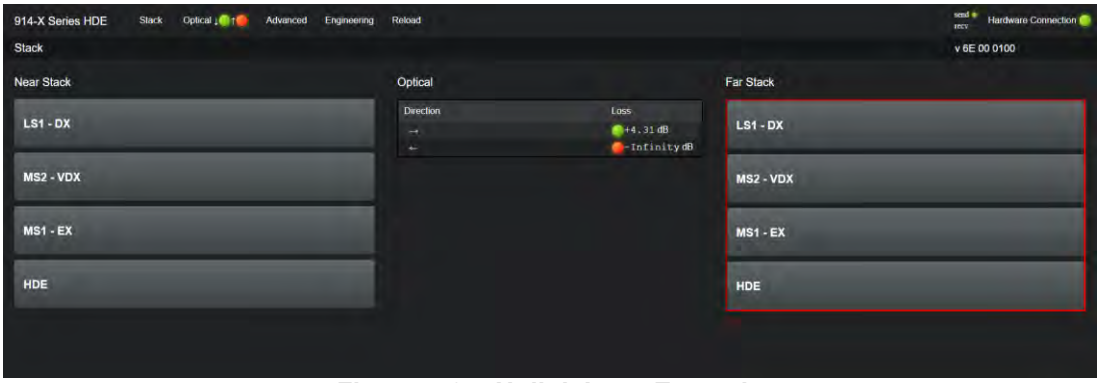


Figure 5-25: Uplink Loss Example

5.4 914-HDE Status Page

Hovering over and selecting the near or far HDE tile in the stack view will open the HDE status page, where relevant information about the near (left) and far (right) HDEs is found.

Figure 5-26: 914-HDE Status Page Overview

Generic card information (such as the serial number or device DNA) is found in the *Card Details* table.

Figure 5-27: 914-HDE Card Information

Below this are the voltages and temperatures. A green LED indicates that the observed status is within the normal range. Red LEDs indicate potential problems that need to be addressed and yellow LEDs give warnings. Low and high limits clarify the value at which the LEDs will turn red.

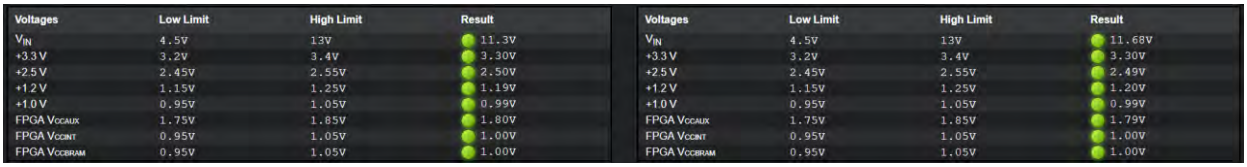


Figure 5-28: 914-HDE Voltage and Junction Temperature Information

Figure 5-29 shows the generic optical link status. Further details on the optics are available on the optics page (see Section 5.6).

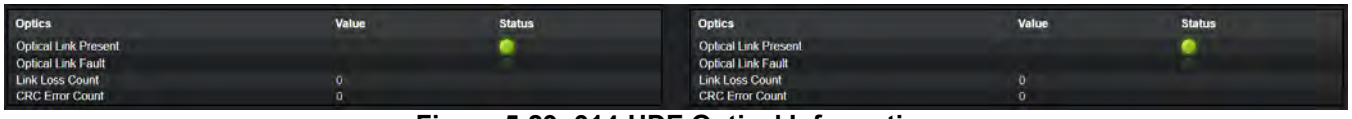


Figure 5-29: 914-HDE Optical Information

Figure 5-30 shows the FOS status, including the selected fiber and mode of operation. FOS information only displays on the near side.

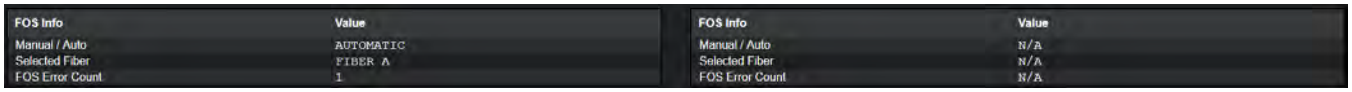


Figure 5-30: 914-HDE FOS Information

Figure 5-31 shows the details and status of each input / output signal (video, serial and Ethernet). Serial and Ethernet data can be collapsed and expanded by selecting the arrows highlighted in red below.

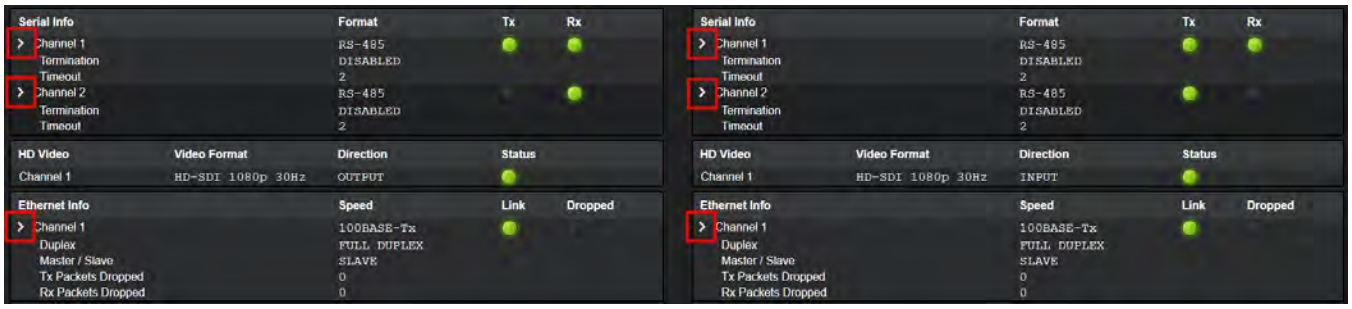


Figure 5-31: Serial, HD Video, and Ethernet Information

Figure 5-32 shows the status of each of the low-speed expansions and LED headers. Headers configured as input will remain inactive.

Figure 5-32: Low Speed Expansion and LED Header Information

Enabling FOS mode will change the display of the LED headers

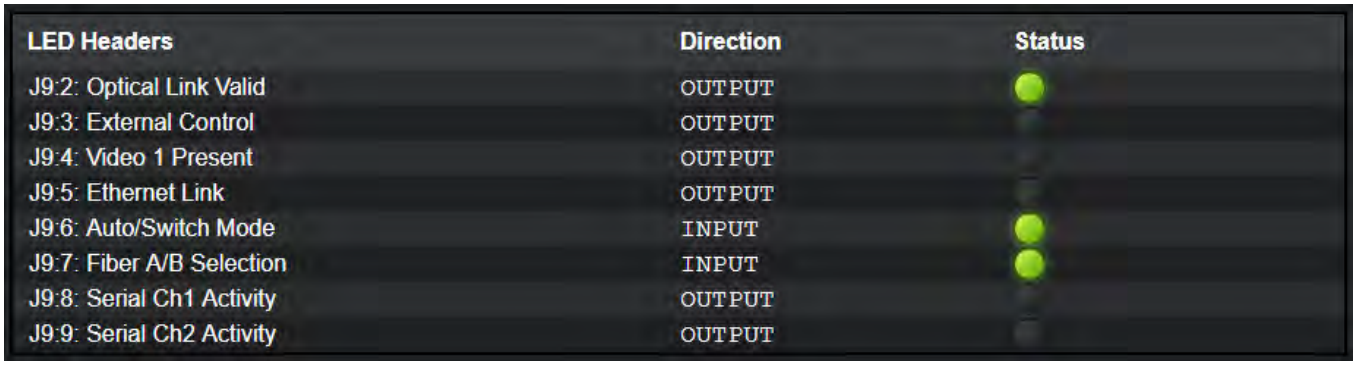


Figure 5-33: Alternative LED Header Display with FOS

Figure 5-34 shows the current feature set of both HDEs, located at the bottom of the status page.

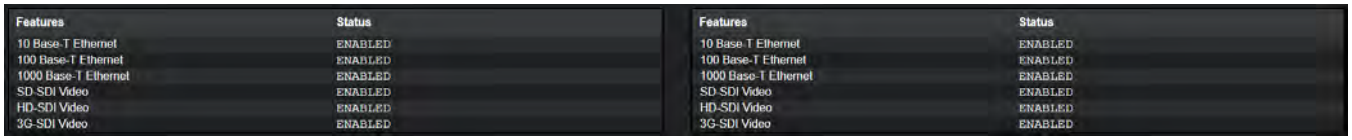


Figure 5-34: Feature Set Information

Figure 5-35 shows the subheader, located directly below the main header. The “Back” button returns the user to the stack view. Pressing “Modify HDE Settings” will bring the user to the HDE settings page (see Section 5.5). The remaining options reset all statistics stored in the near and far HDE (link loss counts, for example) respectively.

Figure 5-35: 914-HDE Sub-Header

5.5 914-HDE Settings Page

All 914-HDE cards are shipped with the following settings by default (unless ordered with a custom C-Code):

- Both serial ports configured for RS232;
- Ethernet ports set to auto-negotiate all speeds (10/100/1000M) and duplex settings (full/half);
  - Note that the L1 version of 914-HDE cards support HD-SDI video **or** 1000 BASE-T Ethernet speed. The default is to support HD-SDI. This setting can be swapped in the Diagnostic GUI by enabling "Trade HD for GbE" under Ethernet settings.
  - Note that the M1 version of 914-HDE cards support 3G-SDI **or** 1000 BASE-T Ethernet speed. When 3G-SDI is plugged, Ethernet is limited to 300M bandwidth.
- Remote Ethernet link speed synchronization enabled on the console side 914-HDE.

HDE settings can be changed at any time through the Diagnostic GUI. To get to the 914-HDE settings page, navigate to the stack view and select either of the tiles labelled "HDE".

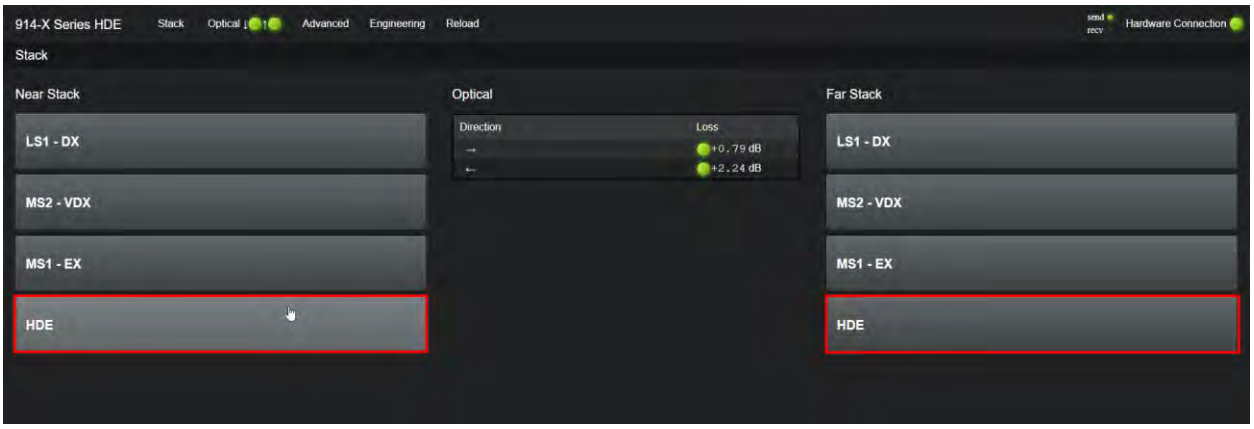


Figure 5-36: 914-HDE Diagnostic Status Selection

Select the "Modify HDE Settings" option to open the HDE settings page.

Figure 5-37: 914-HDE Diagnostic Settings Selection

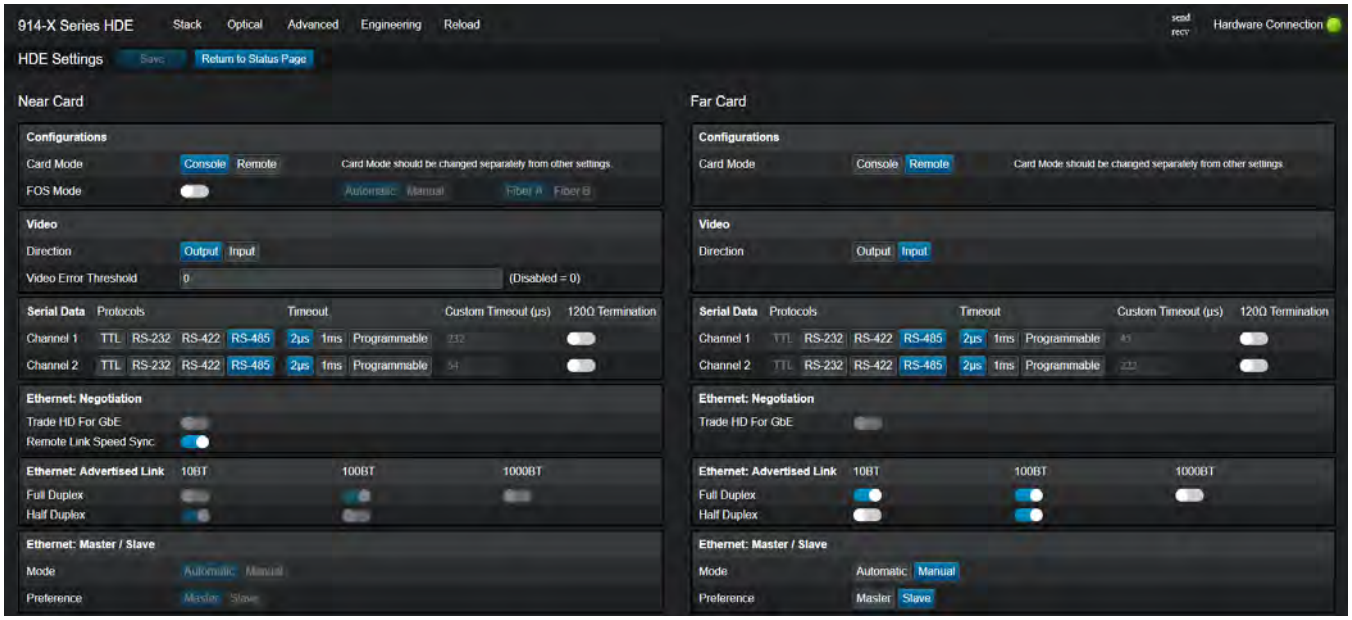


Figure 5-38: 914-HDE Settings Page

Upon loading or refreshing the settings page, the data fields are automatically populated with the current configurations of the near (left) and far (right) 914-HDEs. System Status is not refreshed while in the settings page. Users should not anticipate the send/receive LEDs on the header to be active unless they are in the process of a save or they are loading the page. Additionally, the remote warning border and optical status LEDs on the header are not displayed on this page.

Settings are displayed in three formats: segmented buttons, toggles, and text boxes. Segmented boxes permit a single selection from multiple options (selected by hovering over and pressing the option of choice), with the active value highlighted in blue. Text boxes allow for custom inputs (by pressing on them and typing in a number). Toggles indicate an off state (to the left, white in color) or an on state (to the right, blue in color), and can be toggled by hovering over and pressing them. Figure 5-39 below illustrates examples of the three possible setting display types. The Timeout option (seen on the left) uses segmented buttons and is currently set to "Programmable". The Custom Timeout value (seen in the middle) is currently set to 0, displayed in a text box. The Termination option (seen on the right) is represented by a toggle, which is currently disabled.

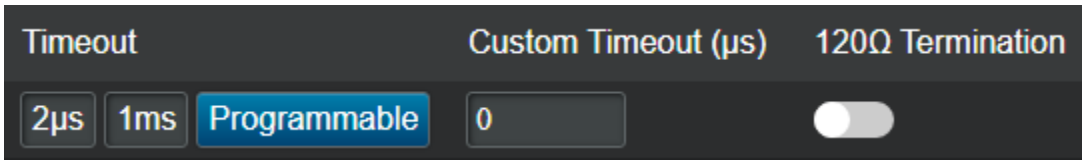


Figure 5-39: 914-HDE Data Field Types

Located beneath the main header is the settings page's subheader. The “Save” button will prompt the user to confirm their action and subsequently save board settings on the page to the attached HDEs. This button is only clickable if the user has proposed changes to the settings. The "Return to Status Page" button navigates the user back to the HDE's status page. To the right of this button is the loading icon, which only appears when the page is loading and when settings are being saved. The page is disabled while settings are being saved.

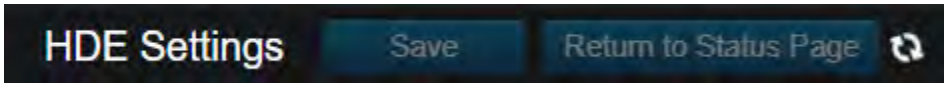


Figure 5-40: 914-HDE Settings Page Sub-Header

Modified settings that are not yet saved to the HDEs are highlighted with a red border and will revert to their original values if the page is reloaded before saving. All settings on the page can be modified and saved simultaneously, apart from card mode, which should be changed independently, if at all. Allow up to five seconds for proposed changes to be applied to the HDEs. If proposed changes are not being applied when saving, refer to item #4 in Section 14.0.

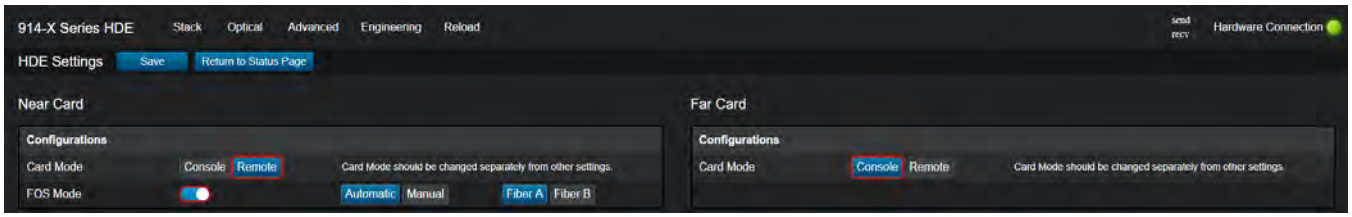


Figure 5-41: 914-HDE Unsaved Settings

5.5.1 914-HDE General Configuration

Figure 5-42 shows the 914-HDE's card mode settings. These settings are non-volatile and do not need to be reconfigured each time the 914-HDE is powered. **The near side should always be configured as a console, while the far side should always be configured as a remote**. Card Mode should be adjusted and saved separately from other settings. Once configured correctly, card mode typically does not require further changes. If adjustments are necessary, they should be made independently of other settings. Details on the FOS Mode settings shown below can be found in Section 8.1.4.1, and additional HDE technical settings are discussed in Section 5.8. Once the desired settings are selected, press “Save” and confirm to apply them to the board.

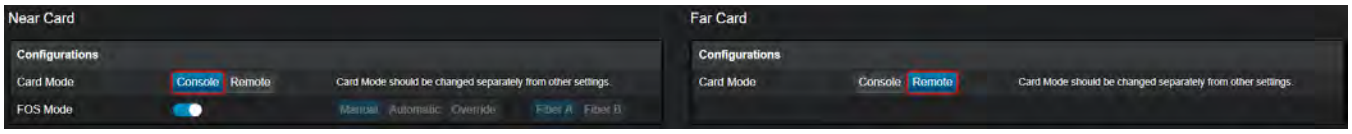


Figure 5-42: 914-HDE Card Mode Configuration

Shown in Figure 5-43 is a configuration example for the HDE's LED headers. LEDs set to input will always remain off in the GUI. Enabling FOS mode disables header configurations. These settings are non-volatile and do not need to be reconfigured each time the 914-HDE is powered. Once the desired settings are selected, press “Save” and confirm to apply them to the board.

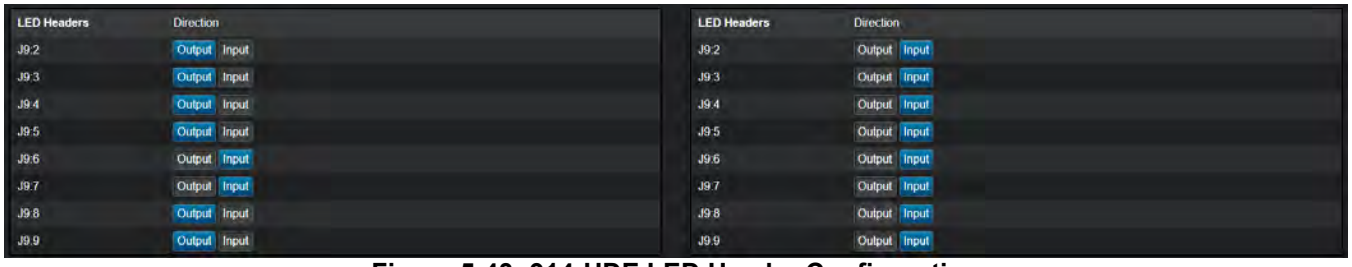


Figure 5-43: 914-HDE LED Header Configuration

5.5.2 914-HDE Video Configuration

Figure 5-44 shows the HDE's video port configurations. The direction of the near (console) side card should be output, while the far (remote) side should be input. A custom video error threshold value can be used, or it can be disabled by saving the value as 0. These settings are non-volatile and do not need to be reconfigured each time the 914-HDE is powered. Once the desired settings are selected, press “Save” and confirm to apply them to the board.

Figure 5-44: 914-HDE Video Configuration

5.5.3 914-HDE Serial Configuration

Figure 5-40 shows how to configure each serial port. Select the desired protocol and, if applicable, choose the termination and/or timeout settings. Additionally, a custom timeout value can be entered if the programmable timeout setting is enabled. If a protocol does not support termination or timeout, these options will be disabled. These settings are non-volatile and do not need to be reconfigured each time the 914-HDE is powered. Once the desired settings are selected, press “Save” and confirm to apply them to the board.

Typical Settings: (Refer to Section 4.4)

- RS485: 1 ms timeout; terminations enabled
- RS422: Terminations enabled
- RS232: No options
- TTL: No options (not supported for legacy revisions of the HDE; refer to Section 4.9).

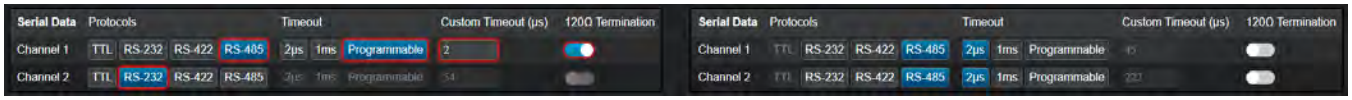


Figure 5-45: 914-HDE Serial Configuration

5.5.4 914-HDE Ethernet Configuration

Figure 5-46 shows the Ethernet port negotiation, advertised link, and master/slave settings. These settings are non-volatile and do not need to be reconfigured each time the 914-HDE is powered. By default, the system will auto-negotiate to the highest possible speed. Configuring these settings can be useful to ensure both the console and remote ends negotiate to the
same speed and duplex if they do not automatically do this upon startup.

Ethernet link speed mismatches must be avoided. Typically, PCs will link at 1G on the console side and sensor Ethernet equipment on the remote side might link at 100M. In this case, both the console and remote cards should be set to 100M, or the PC should be forced to 100M (the lower speed) to ensure that all elements in the Ethernet link are set at the same speed.

Enabling Remote Link Speed Sync helps solve a speed mismatch problem by ensuring the console Ethernet port links at the same speed and duplex as the remote Ethernet port. When this setting is enabled, the user does not have access to the advertised link and master/slave settings at the console.

The option to “Trade HD for GbE” is only available for L1 cards (see Section 5.5). Once the desired settings are selected, press “Save” and confirm to apply them to the board.

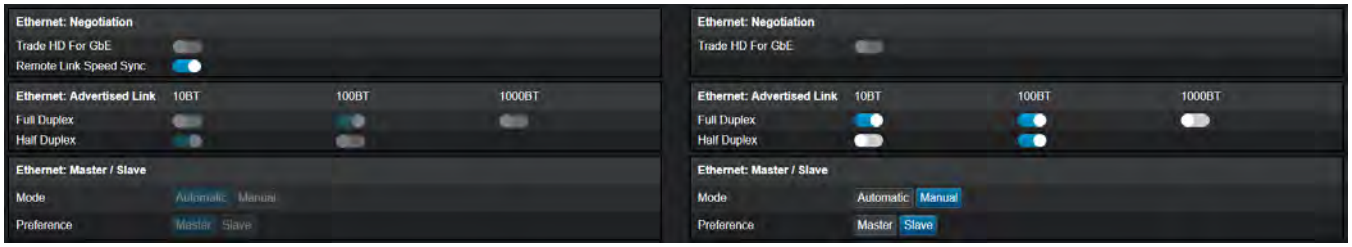


Figure 5-46: 914-HDE Ethernet Configuration

5.5.4.1 914-HDE Forced Ethernet Configurations

Forced negotiation is an outdated setting that is no longer recommended. If enabled on connected hardware, a warning message (as shown in Figure 5-47) will prompt the user to switch to automatic negotiation. Upon doing so, the negotiation mode will be updated, and the setting will disappear. Once the desired settings are selected, press “Save” and confirm to apply them to the board.

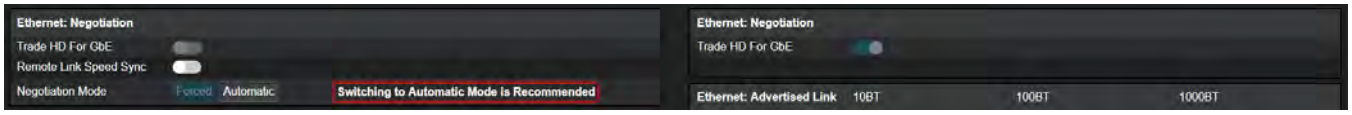


Figure 5-47: 914-HDE Forced Ethernet Configuration

5.5.5 914-HDE Low Speed Expansion Configuration

If there are any 914-AX or 914-DX cards in the 914-X system, the 914-HDE low speed expansion channels must be configured properly to support the required card(s). By default, all four LS expansion channels are configured for 914-AX cards. Figure 5-48 shows where to configure the low-speed expansion channel settings. Changes made to the console will apply to the remote as well. These settings are non-volatile and do not need to be reconfigured each time the 914-HDE is powered. Once the desired settings are selected, press “Save” and confirm to apply them to the board.

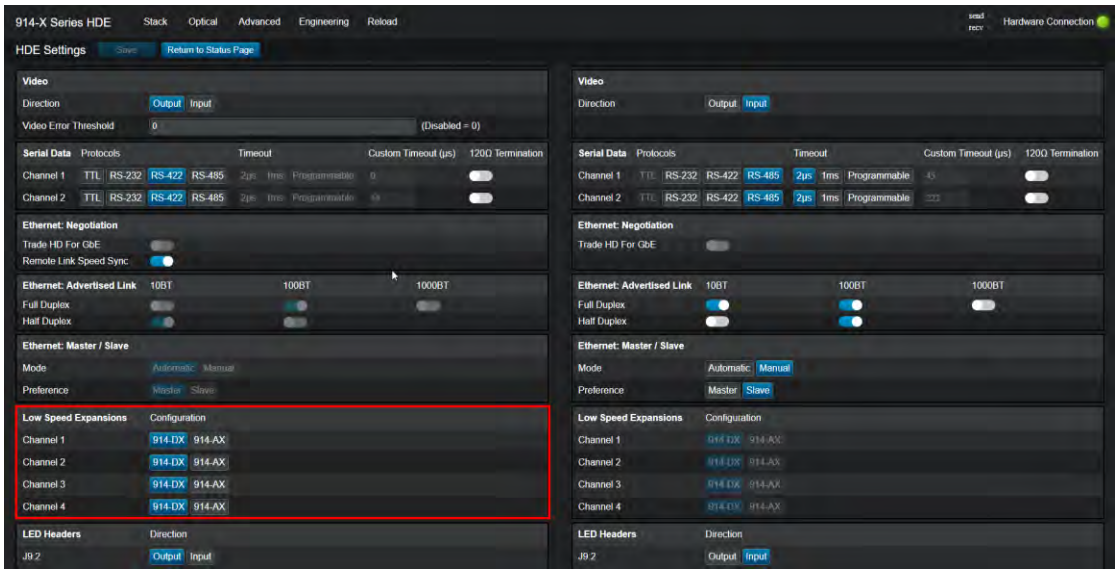


Figure 5-48: 914-HDE Low Speed Expansion Configuration

5.6 914-HDE Optical Page

Advanced details of the 914-HDE's fiber optic connection and attached SFPs can be viewed using the Diagnostic GUI. To access the Optical page, users can either select the "Optics" option on the header or hover and click on the optics table in the stack view.

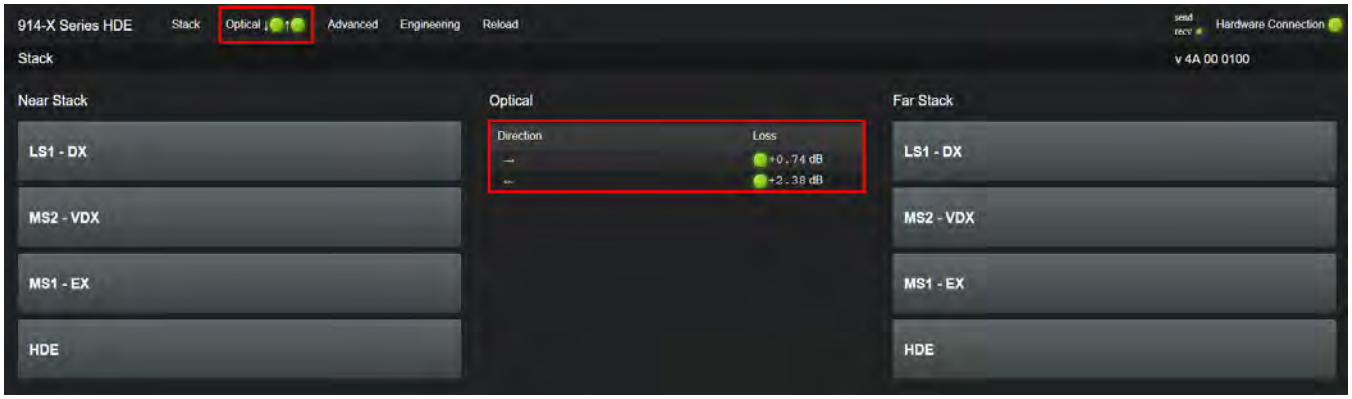


Figure 5-49: 914-HDE Optical Selection

From here, users can observe the optical link status, including information provided by the optical transceiver, such as transmit and receive optical power and transceiver temperature.

Figure 5-50: 914-HDE Optical Page

Figure 5-51 shows the optical subheader, located directly below the main header. The “Back” button returns the user to the stack view. The reset statistics options clear all statistical data stored in the near and far HDE (link loss counts, for example) respectively.

Figure 5-51: 914-HDE Optical Sub-Header

5.7 914-HDE Engineering Status Page

Information and options that are not typically relevant to users are kept in the Diagnostic GUI's Engineering page. The page can be accessed by hovering over and selecting the "Engineering" option on the header.

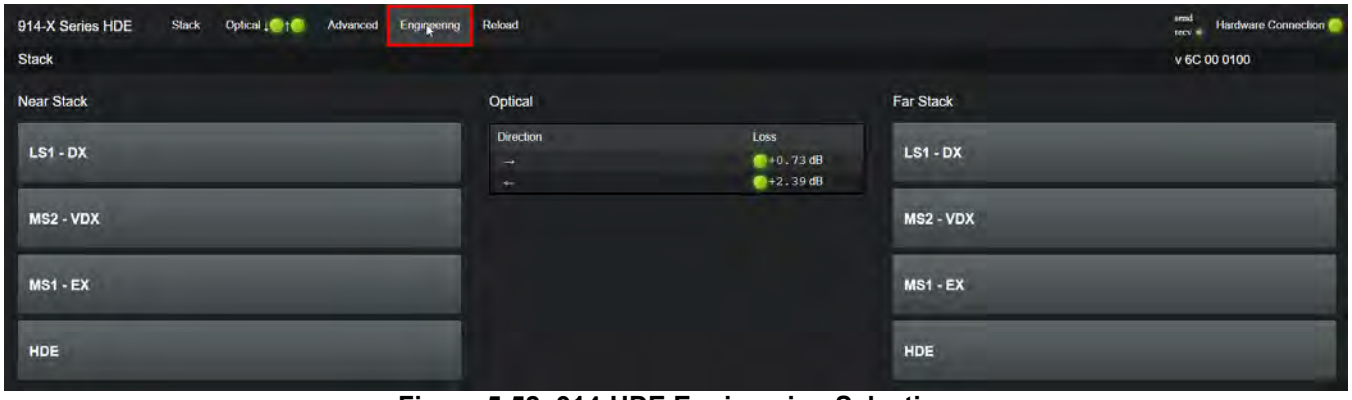


Figure 5-52: 914-HDE Engineering Selection

The data on this page is primarily for the HDEs on the stack, indicated by "(HDE)" in the table headers. However, if an EX is detected in hardware, engineering statistics for that board will be displayed as well, indicated by "(EX)" in the table header. Details on this EX-specific table can be found in Section 6.2.7.

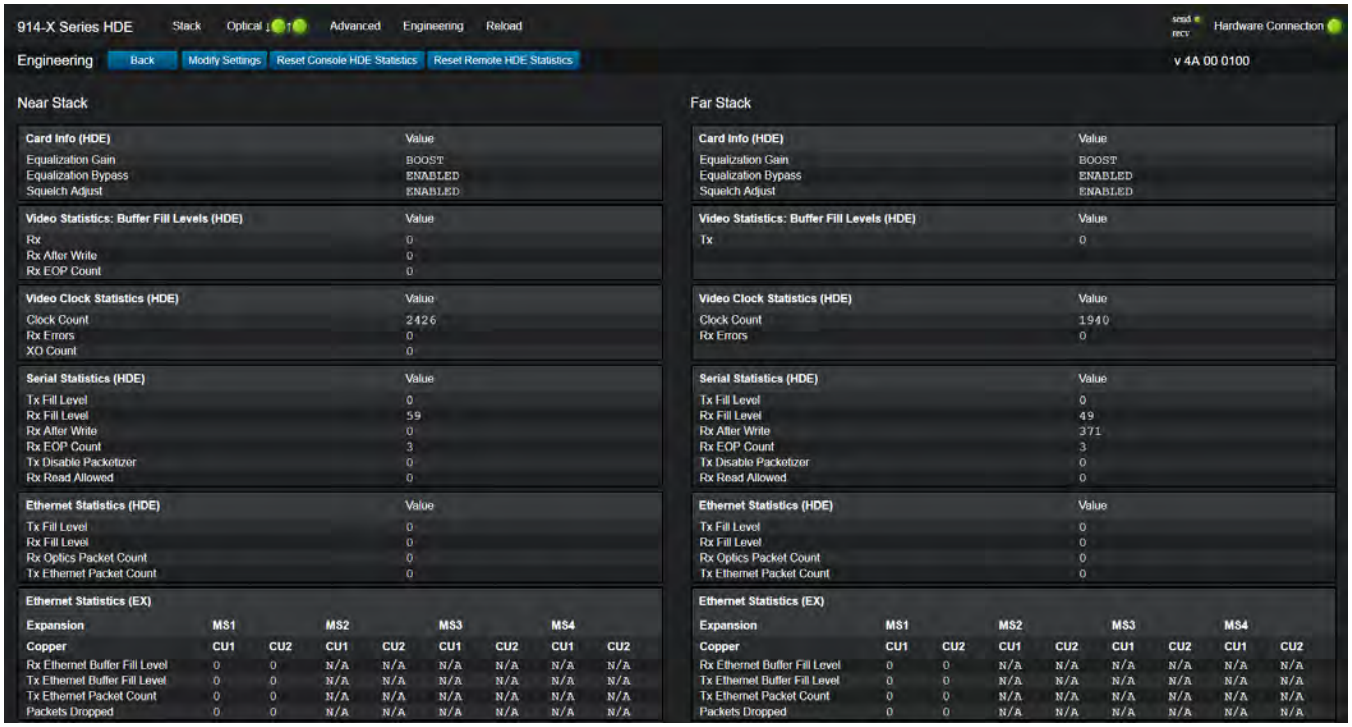


Figure 5-53: 914-HDE Engineering Page

Generic card information can be found in the *Card Info (HDE)* section.

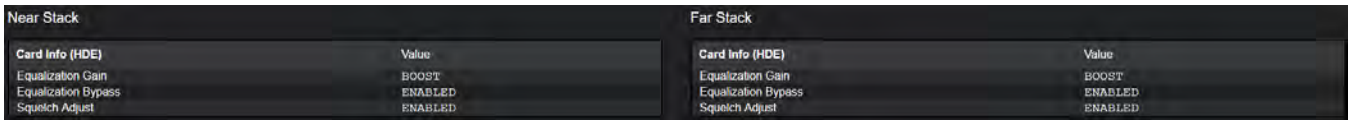
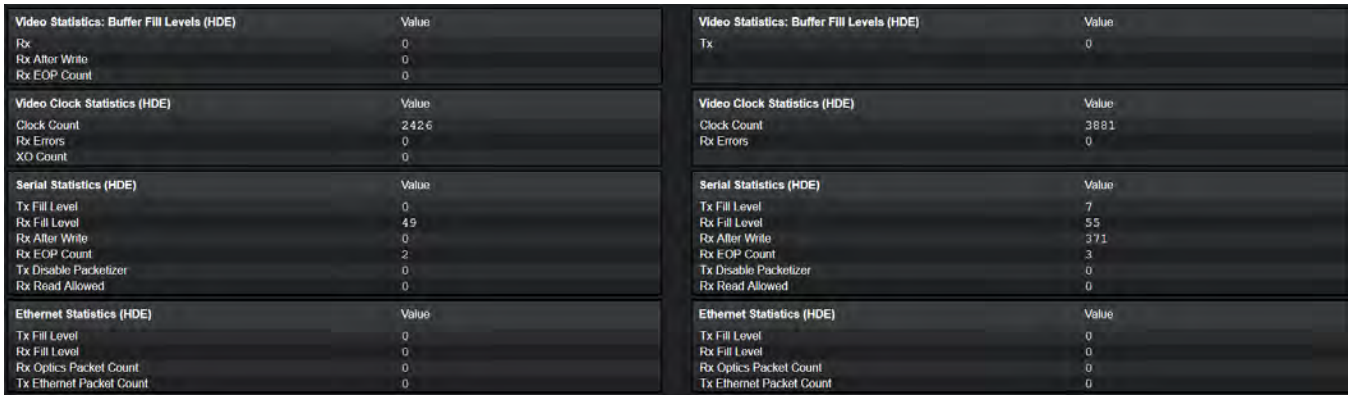


Figure 5-54: 914-HDE Additional Card Information

Below the card information table are the video, Ethernet, and serial information tables for the HDEs.



Video Statistics: Buffer Fill Levels (HDE)	Value
Rx	0
Rx After Write	0
Rx EOP Count	0

Video Clock Statistics (HDE)	Value
Clock Count	2426
Rx Errors	0
XO Count	0

Serial Statistics (HDE)	Value
Tx Fill Level	0
Rx Fill Level	49
Rx After Write	0
Rx EOP Count	2
Tx Disable Packetizer	0
Rx Read Allowed	0

Ethernet Statistics (HDE)	Value
Tx Fill Level	0
Rx Fill Level	0
Rx Optics Packet Count	0
Tx Ethernet Packet Count	0

Video Statistics: Buffer Fill Levels (HDE)	Value
Tx	0

Video Clock Statistics (HDE)	Value
Clock Count	3881
Rx Errors	0

Serial Statistics (HDE)	Value
Tx Fill Level	7
Rx Fill Level	55
Rx After Write	371
Rx EOP Count	3
Tx Disable Packetizer	0
Rx Read Allowed	0

Ethernet Statistics (HDE)	Value
Tx Fill Level	0
Rx Fill Level	0
Rx Optics Packet Count	0
Tx Ethernet Packet Count	0

Figure 5-55: 914-HDE Serial, Ethernet, and Video Statistic Information

Figure 5-56 shows the subheader, located directly below the main header. The “Back” button returns the user to the stack view. Pressing “Modify Settings” will bring the user to the engineering settings page (see Section 5.8). The remaining options reset all statistics stored in the near and far HDE (link loss counts, for example) respectively.

Figure 5-56: 914-HDE Engineering Sub-Header

5.8 914-HDE Engineering Settings Page

The engineering settings page contains technical configuration options that aren't typically modified by users. It is also where feature upgrades can be completed; details on this process are covered in Section 12.0. Engineering settings can be changed at any time through the Diagnostic GUI. To get to the 914-HDE Engineering settings page, press the "Engineering" button on the header.

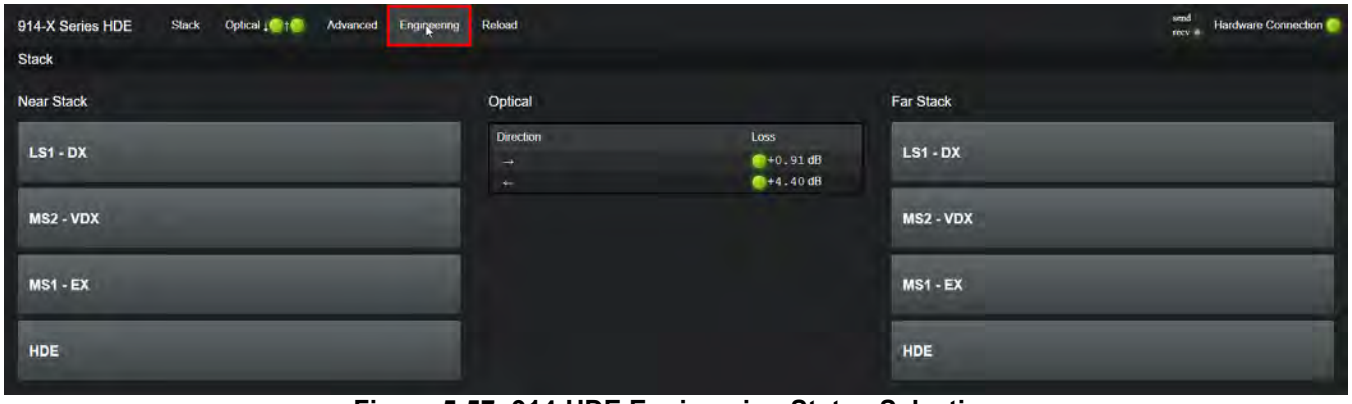


Figure 5-57: 914-HDE Engineering Status Selection

Select the "Modify Settings" option to open the Engineering settings page.

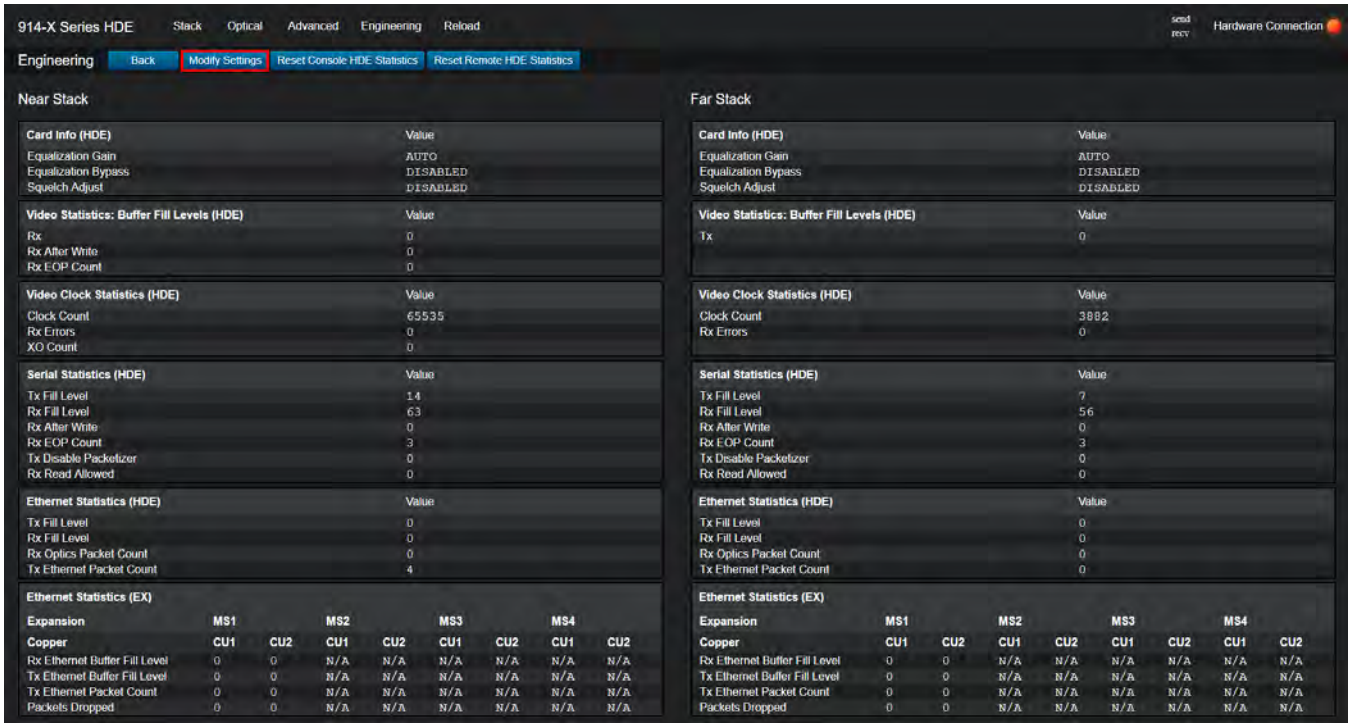


Figure 5-58: 914-HDE Engineering Settings Selection

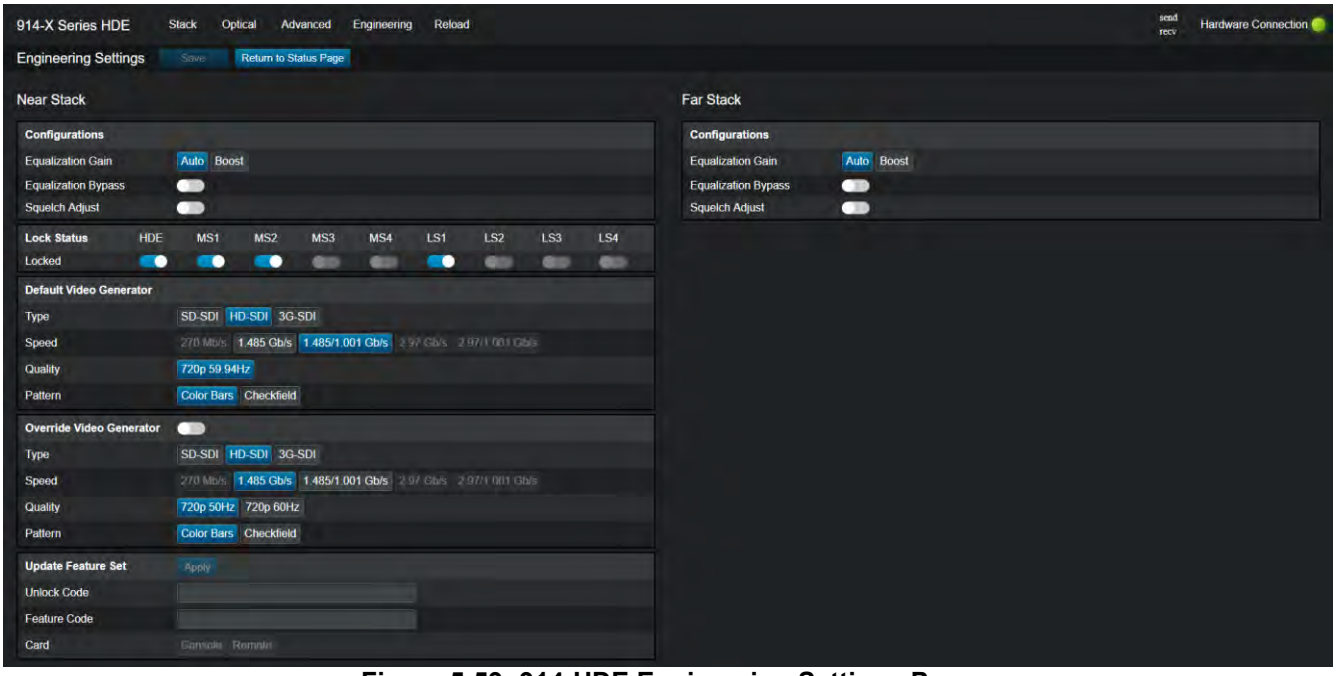


Figure 5-59: 914-HDE Engineering Settings Page

Upon loading or refreshing the settings page, the data fields are automatically populated with the current configurations of the near (left) and far (right) 914-HDEs. System Status is not refreshed while in the settings page. Users should not anticipate the send/receive LEDs on the header to be active unless they are in the process of a save or they are loading the page. Additionally, the remote warning border and optical status LEDs on the header are not displayed on this page.

Located beneath the main header is the settings page's subheader. The “Save” button will prompt the user to confirm their action and subsequently save board settings on the page to the attached HDEs. This button is only clickable if the user has proposed changes to the settings. The "Return to Status Page" button navigates the user back to the Engineering page. To the right of this button is the loading icon, which only appears when the page is loading and when settings are being saved. The page is disabled while settings are being saved.

Figure 5-60: 914-HDE Engineering Settings Page Sub-Header

Modified settings that have not yet been saved to the HDEs are highlighted with a red border and will revert to their original values if the page is reloaded before saving. All settings on the page can be modified and saved simultaneously. Feature codes are saved with their own “Apply” button. Allow up to five seconds for proposed changes to be applied to the HDEs. If proposed changes are not being applied when saving, refer to item #4 in Section 14.0.

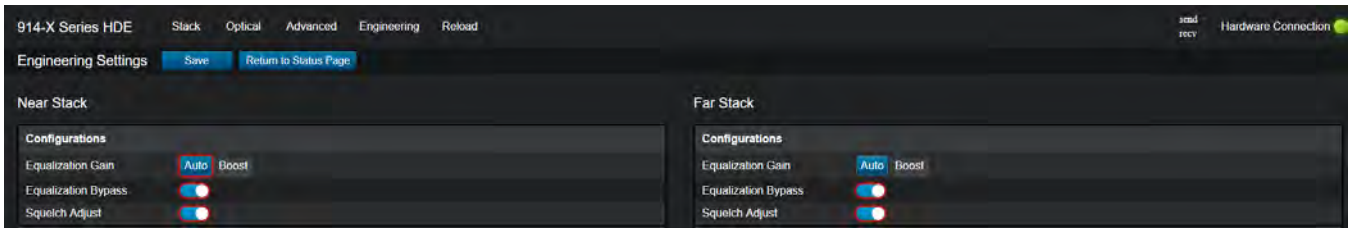


Figure 5-61: 914-HDE Unsaved Engineering Settings

5.8.1 914-HDE General Engineering Configuration Settings

Figure 5-62 shows the 914-HDE’s general engineering settings. These settings are non-volatile and do not need to be reconfigured each time the 914-HDE is powered. Once the desired settings are selected, press “Save” and confirm to apply them to the board.

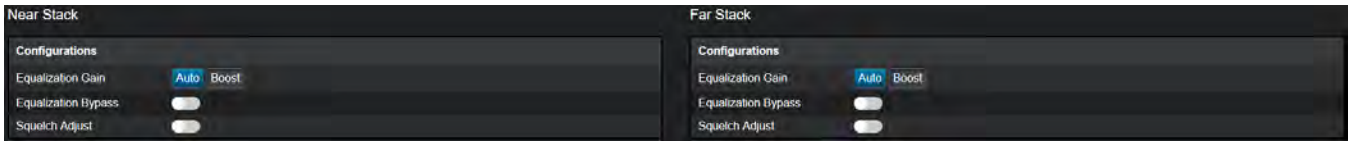


Figure 5-62: 914-HDE Engineering Configurations

5.8.2 914-X Series Lock Settings

The 914-X Series cards are equipped with a lock feature. By default, and after being turned on, each board will be locked, preventing any data modifications (the GUI automatically unlocks and relocks boards when saving settings). If a user needs to manually unlock a card (for example, to change an I^2C value on the Advanced page), this can be done on the Engineering Settings page. **Cards should not remain unlocked for a prolonged period.** Turning off a toggle will unlock the board in the specified slot. Grayed-out options indicate that no card is currently present in that slot on the user’s stack.

These settings are **volatile** and will revert to a locked state each time the card is powered or when a setting is saved for that card. Once the desired cards have been locked or unlocked, press “Save” and confirm to apply the changes to each board.

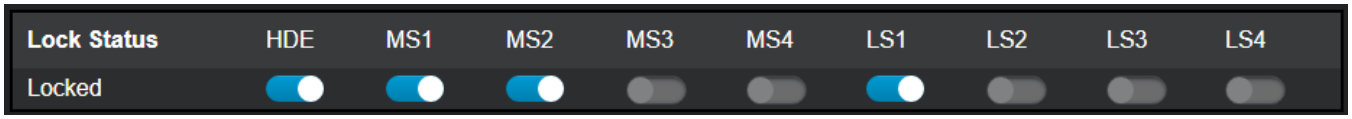


Figure 5-63: 914-X Series Lock Configurations

5.8.3 914-HDE Video Test Pattern Generation Settings

The 914-HDE will output a custom video signal when no signal is currently present. This output signal can be modified through the **Default Video Generator** configuration settings on the Engineering page. Alternatively, the current video signal can be overridden to display a custom signal specified in the **Override Video Generator** configurations by enabling the toggle button at the top of the Override section.

To modify these settings, first select a video type. Next, choose a valid speed, followed by a quality setting, and finally, a pattern. It is crucial to follow this sequence, as each selection will determine the available options for subsequent settings. These settings are non-volatile and do not need to be reconfigured each time the 914-HDE is powered. Once the desired settings are selected, press “Save” and confirm to apply them to the board.

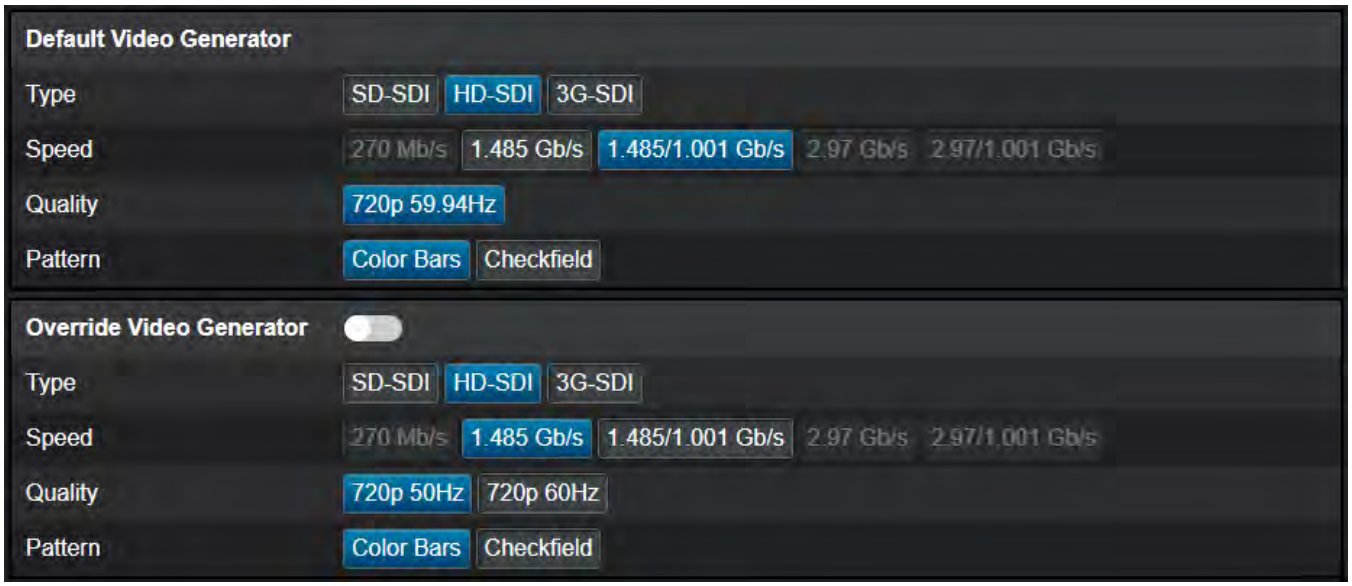


Figure 5-64: 914-HDE Video Generation Configurations

5.9 914-X Series Advanced Page

The Advanced page offers essential debugging and configuration features. To access this page, hover over the "Advanced" option on the header and select it.

Figure 5-65: 914-HDE Advanced Selection

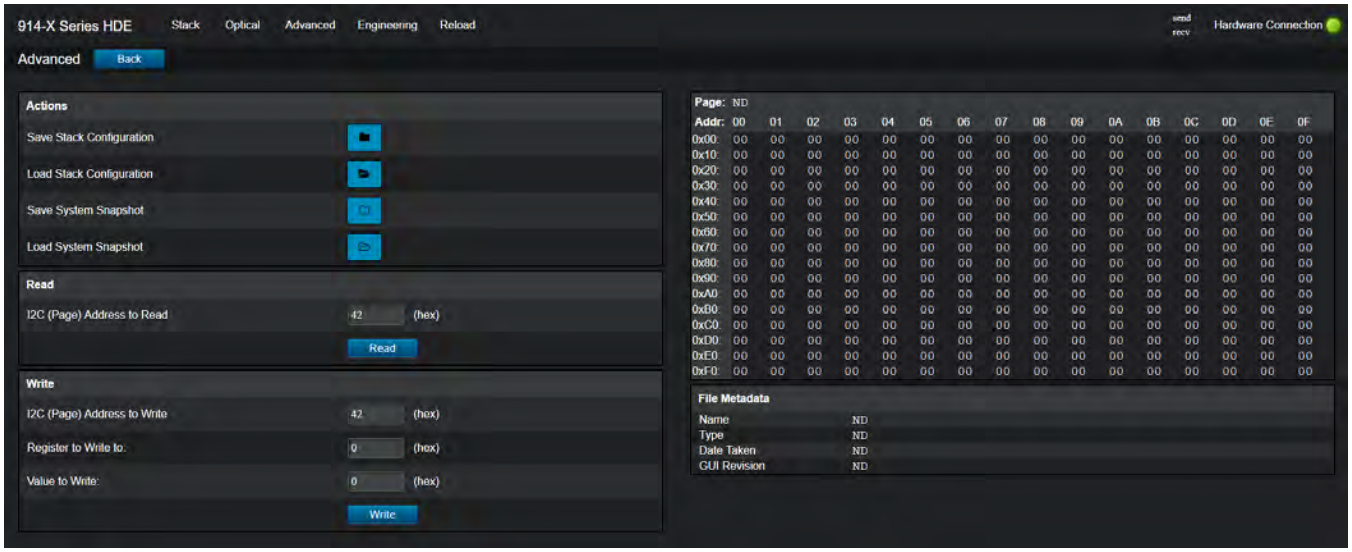


Figure 5-66: 914-HDE Advanced Page

The stack view can be returned to at any time by pressing "Back" on the subheader or "Stack" on the header.

5.9.1 System-Level Configurations

The system-level configurator allows for the saving and loading of all settings for an entire stack in one button press. By selecting the “Save Stack Configuration” option, the GUI will prompt the user to select (or create) a JSON (JavaScript Object Notation) file. Then, it will scan the stack connected to the COM port and save all board settings into the file. To ensure configuration data does not get corrupted, these files should not be modified without contacting Moog Focal first.

System level configurations are useful for two primary reasons:

1. A saved default configuration allowing an operator to return to a known working configuration.
2. Cloning settings between systems, great for OEMs to maintain consistency of default settings.

Figure 5-67: Save Stack Configuration Option

Below this is the “Load Stack Configuration” option. Upon selection, the user will be prompted to choose a stack configuration JSON file to load into the GUI. Once a file is selected, the GUI will scan for potential errors, either aborting the process entirely or warning the user and prompting them to continue (see Section 5.9.1.1 and Section 5.9.1.2 for details). If the user chooses to proceed (or if no errors were found), the settings from the file will be written to the stack connected to the selected COM port. Allow up to three minutes for the stack configuration to complete.

Figure 5-68: Load Stack Configuration Option

Metadata (file name, date taken, name, and GUI revision) about the loaded configuration file can be seen on the bottom right of the advanced page.

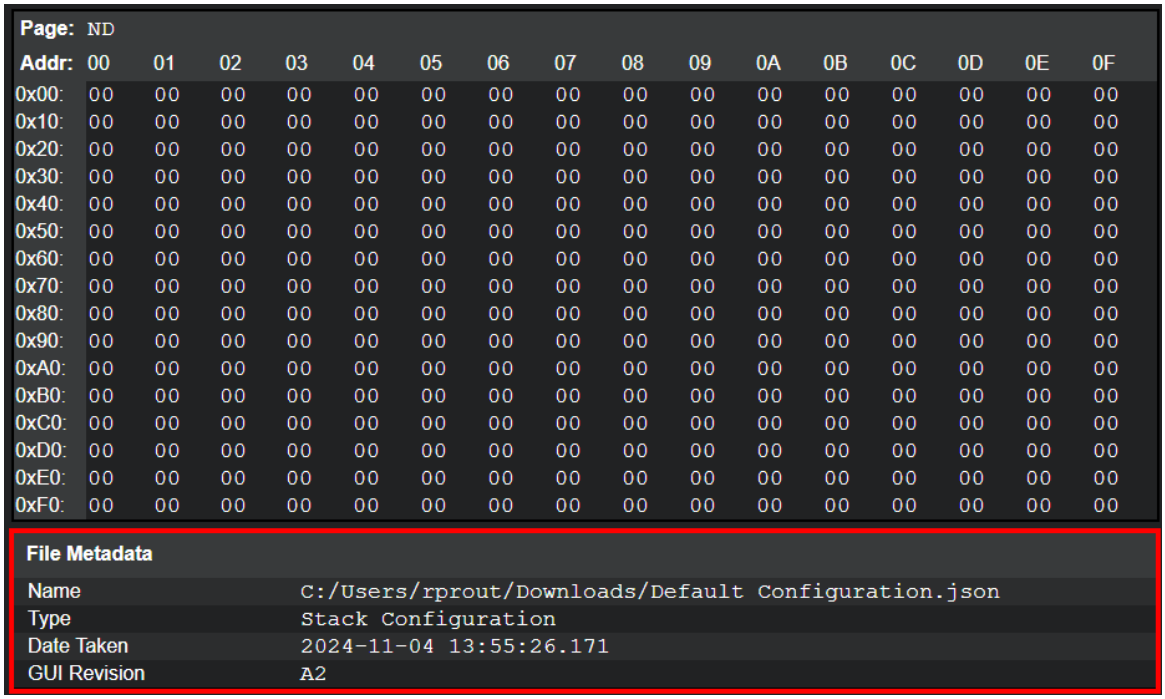


Figure 5-69: System Configuration File Metadata

As an example, consider the stack seen in Figure 5-70 is connected to the GUI.

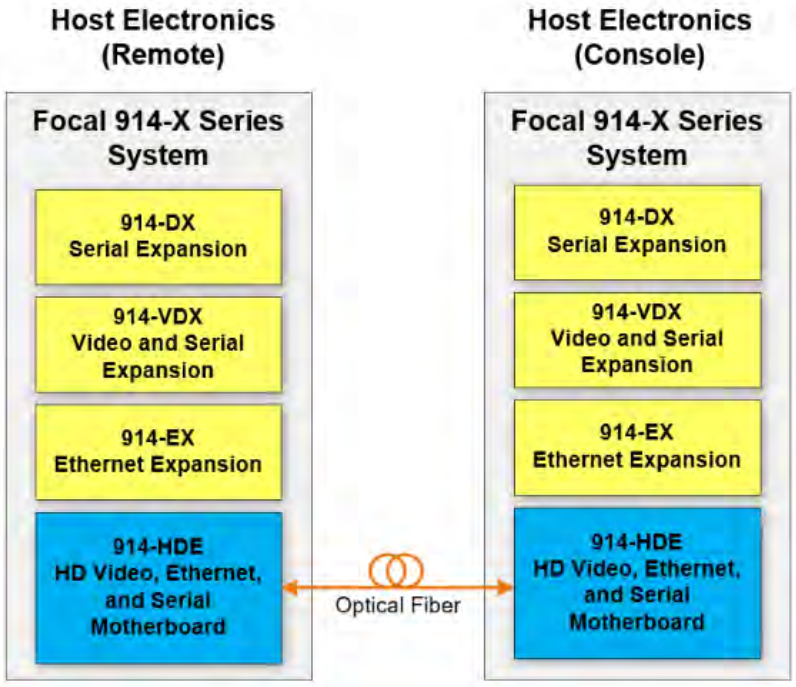


Figure 5-70: Configuration Example Stack

On saving this configuration, all Ethernet, video, serial, and general setting information of the console and remote 914-HDE, 914-EX, 914-VDX, and 914-DX is written into a chosen JSON file. This file can then be loaded back into the GUI at any point to restore the configuration. The configuration file can also be used to configure other stacks with the same expansion card layout.

If the stack connected to the COM port does not match the stack specified in the configuration file, the GUI will alert the user and prompt them to confirm whether they wish to proceed. Detailed information on the severity and outcomes of various stack inconsistencies, as well as other potential issues that may arise during configurations, are provided in the sections below.

5.9.1.1 Error Messages Loading System-Level Configurations

This section details common error messages that may be encountered when using the configurator. Error messages force the configuration process to stop and typically have to do with syntax errors in the JSON file (NOT problems with the user's stack).

5.9.1.1.1 No Valid Data Found

The syntax of the JSON file was updated and/or invalid. Ensure that the most recent version of the GUI is installed. If problems persist, Contact Moog Focal with the file attached or create a new configuration file.

5.9.1.1.2 Invalid Character Found

A non-hexadecimal character has been identified in the configuration file. The file has either been manually updated or was corrupted during the writing process. Contact Moog Focal with the file attached or create a new configuration file.

5.9.1.1.3 Stack Data in File has Been Changed – Console no Longer Matches Remote

The section of the file detailing the stack has been manually updated or corrupted, now representing an invalid stack where one or more expansion slots do not match between the console and remote. Contact Moog Focal with your stack information and the attached configuration file or create a new configuration file.

5.9.1.1.4 Troubleshooting Other Errors

Other errors can arise due to invalid syntax or formatting within the file itself; if the user attempts to load a data snapshot file into the configurator; or if the GUI fails to open the selected file. In each case, the user should first open the file and ensure it contains valid data.


```
{"software":"A2",
 "timeOfSnapshot":"2024-11-04 13:55:26.171",
 "fileType":"Stack Configuration",
 "data":"120030001200300000023911111811184d34ff0003000
```


Figure 5-71: Valid Stack Configuration File

The data in Figure 5-71 has been separated onto new lines for readability; normally, they are placed on the same line. It is critical that the "software," "timeOfSnapshot," "fileType," and "data" fields are all present and spelled exactly as shown. The snapshot's software value should match the GUI's software version, and the fileType value should always be "Stack Configuration". If problems persist after verifying the above statements, the file should be considered deprecated.

5.9.1.2 Warning Messages for System-Level Configurations

This section details common warning messages that may be encountered when using the configurator. Warning messages do not stop the configuration and typically are caused when the user and file stacks are inconsistent.

5.9.1.2.1 Configuration has Been Manually Updated

The configuration file has been changed since it was created. If this was done on purpose, the user should continue at their own discretion. Otherwise, a new configuration file should be created to avoid an incorrect configuration.

5.9.1.2.2 Far || Near Expansion Card is not Present

The current stack has an empty slot where the file stack has an expansion card. Ensure that the dip switches for each expansion are positioned correctly, as per Section 6.1.6 for VDX cards, Section 6.2.6 for EX cards, and Section 6.4.5 for DX cards. If the user chooses to proceed, this expansion slot will be bypassed during the configuration process.

5.9.1.2.3 Expansion Card Detected – Will not be Configured

The current stack has an expansion card where the file stack has an empty slot. Ensure that the dip switches for each expansion are positioned correctly, as per Section 6.1.6 for VDX cards, Section 6.2.6 for EX cards, and Section 6.4.5 for DX cards. If the user chooses to proceed, this expansion slot will be bypassed during the configuration process.

5.9.1.2.4 Expansion Card in File does not Match Expansion Card on Stack

The current stack has a different medium speed expansion card than what the file stack has (the current stack has an EX/VDX while the file stack has a VDX/EX). Ensure that the dip switches for each expansion are positioned correctly, as per Section 6.1.6 for VDX cards, Section 6.2.6 for EX cards, and Section 6.4.5 for DX cards. If the user chooses to proceed, this expansion slot will be bypassed during the configuration process.

5.9.1.2.5 Incompatible with TTL

A VDX or HDE card on the stack is a legacy card that does not support the TTL serial protocol (see Section 4.9 for the HDE and Section 6.1.9 for the VDX), and the configuration file uses TTL. If the user decides to continue, the serial channels configured as TTL will be configured as RS-485 instead.

5.9.2 914-HDE Data Snapshots

A system snapshot captures the status and settings of the attached stack at the moment it is taken. **Data Snapshots should always be included in customer support emails to Moog Focal**, as they significantly simplify the troubleshooting process.

To take a snapshot, users can navigate to the Advanced page and select the “Save System Snapshot” option. This will prompt the user to either create a new JSON file or use an existing one. Then, it will refresh all register data and write it into the file.

Figure 5-72: Save System Snapshot Option

Data snapshots can be loaded back into the GUI by selecting the “Load System Snapshot” option. This will force the GUI into “Offline Mode.”

Figure 5-73: Load System Snapshot Option

Metadata (file name, date taken, name, and GUI revision) about the loaded snapshot file is found on the bottom right section of the advanced page.

Page: ND

Addr:	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
0x00:	14	12	ED	E0	AA	73	37	44	20	0E	00	00	00	D6	35	4D
0x10:	18	0F	1E	00	00	00	06	0F	00	00	06	00	00	34	03	F6
0x20:	0E	6C	06	06	BE	8F	06	06	00	00	00	00	0E	00	2A	00
0x30:	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0x40:	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0x50:	7A	09	FF	FF	00	00	00	00	13	13	02	03	00	00	00	00
0x60:	23	02	00	00	01	00	00	00	00	00	00	00	00	00	00	00
0x70:	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0x80:	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0x90:	00	00	00	00	00	00	00	00	00	00	00	00	00	02	02	00
0xA0:	5C	68	19	34	04	D4	5C	00	32	B7	60	55	75	99	24	55
0xB0:	00	00	00	00	00	00	00	00	02	00	00	00	00	00	00	00
0xC0:	87	30	00	00	02	00	00	00	02	00	00	00	00	00	00	00
0xD0:	00	00	00	00	02	00	00	DC	00	00	00	00	FE	FF	0C	30
0xE0:	02	02	00	00	DE	FE	02	02	00	01	18	00	44	44	44	44
0xF0:	00	00	00	00	00	00	00	00	00	00	00	00	00	00	54	00

File Metadata

Name	C:/Users/rprout/Downloads/System Snapshot.json
Type	Data Snapshot: HDE
Date Taken	2024-11-26 14:36:15.549
GUI Revision	A3

Figure 5-74: Data Snapshot File Metadata

In offline mode, the GUI disconnects from any attached hardware and utilizes information from the snapshot to populate data fields. While in offline mode, settings cannot be changed, and statistics cannot be reset. To exit offline mode, users must select the “Exit Offline Mode” button located on the top right of the header. If a stack was connected before entering offline mode, the GUI will automatically attempt to reconnect to it when exiting offline mode.

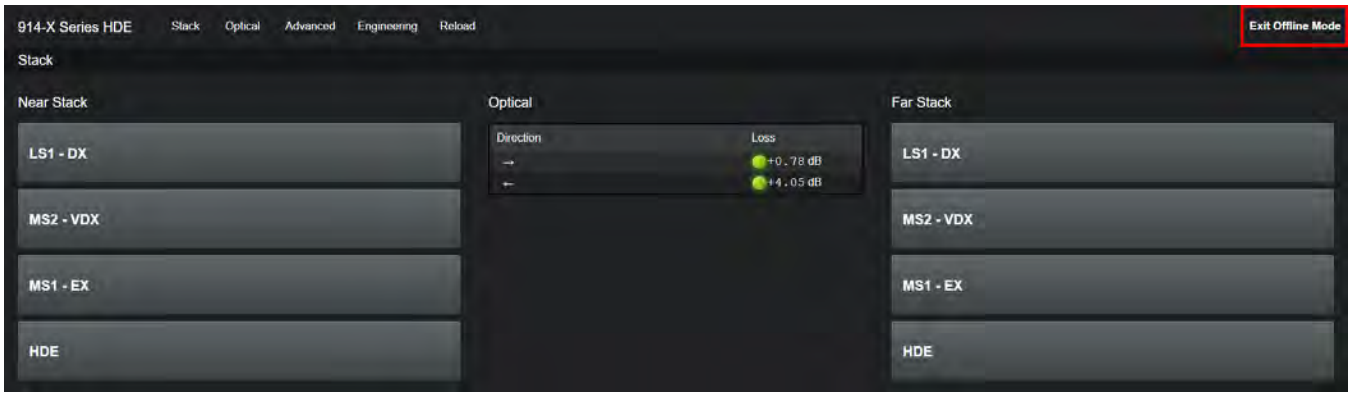


Figure 5-75: Exit Offline Mode Option

5.9.2.1 Loading Data Snapshots – Potential Errors

Data snapshots are supported for both the 914-HDE and 914-HDV2. Attempting to load a 914-HDV2 snapshot through the 914-HDE Advanced page will abort the loading process and alert the user of a failure. If the user does not have permission to access a selected file, or if the selected file is empty, the loading process will fail. Additionally, if a custom error message is displayed indicating a problem, it is likely due to a modified or corrupted snapshot file.

5.9.3 Reading and Writing I²C Data

At the low level, GUI statistics and settings are translated from raw byte values obtained from the console 914-HDE. These bytes are stored in I²C pages, which can be read from directly on the advanced page. To do this, specify an I²C page and select *Read*. The requested data will then populate the I²C table on the right side of the screen.

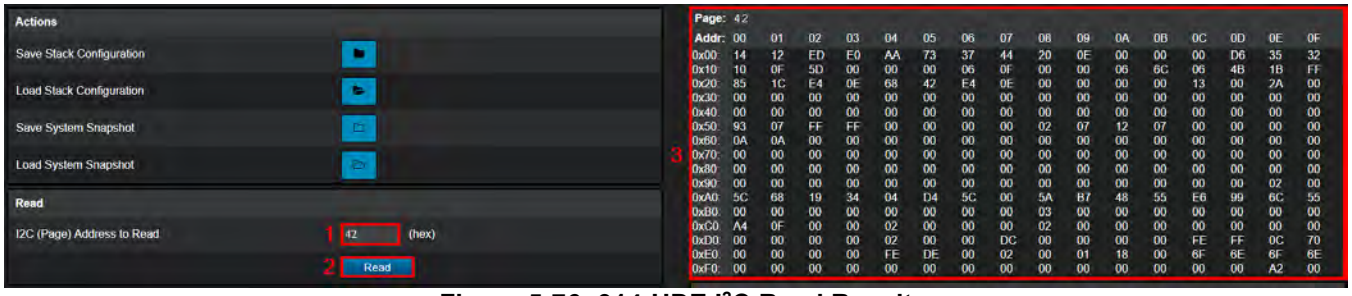


Figure 5-76: 914-HDE I²C Read Result

I²C data may be written to the console 914-HDE as well. To do this, users must specify an I²C address, register, and value to write before selecting the *Write* button on the screen. The I²C table on the right will then refresh with the specified page's updated information. **Using the I²C write feature should only be done with expert advice from Moog Focal**. These writes could corrupt a system configuration.

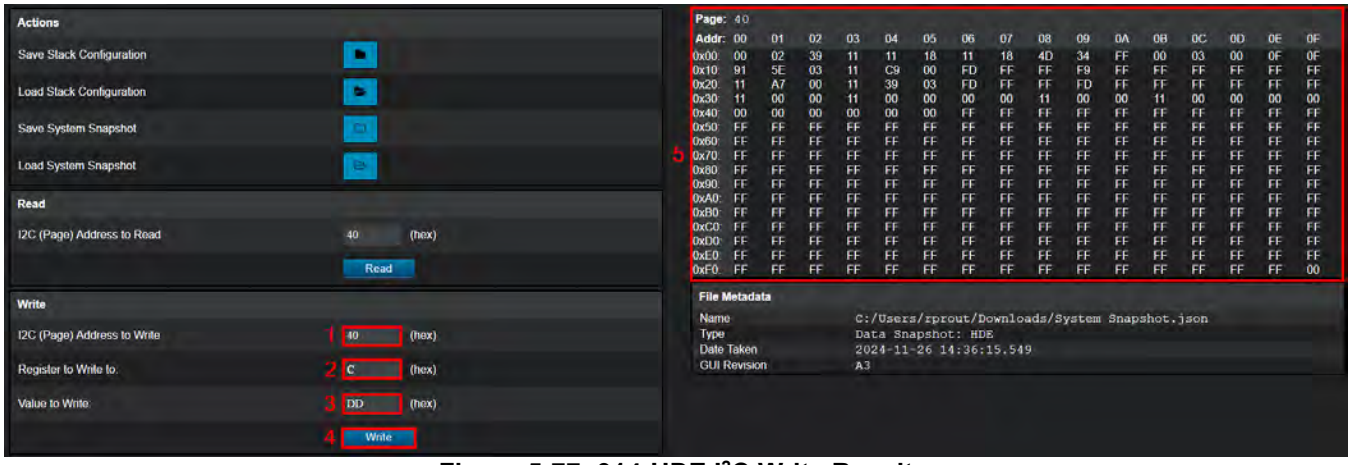


Figure 5-77: 914-HDE I²C Write Result

Before attempting a write operation, all cards on the stack should be unlocked. Cards are locked by default (including when powered up) to prevent accidental configurations. To unlock a card, refer to Section 5.8.2. Ensure that after writing to the cards, they are all relocked.

5.10 Restarting the GUI

If connection issues with the 914-X Unified Diagnostic GUI persist after referring to item #1 or item #2 in Section 14.0 the following steps should be taken.

1. Open the 914-X Series Unified Diagnostic GUI.
2. Close the GUI using Task Manager.
    a. Right-click on the taskbar located at the bottom of the screen.
    b. Select **Task Manager**.

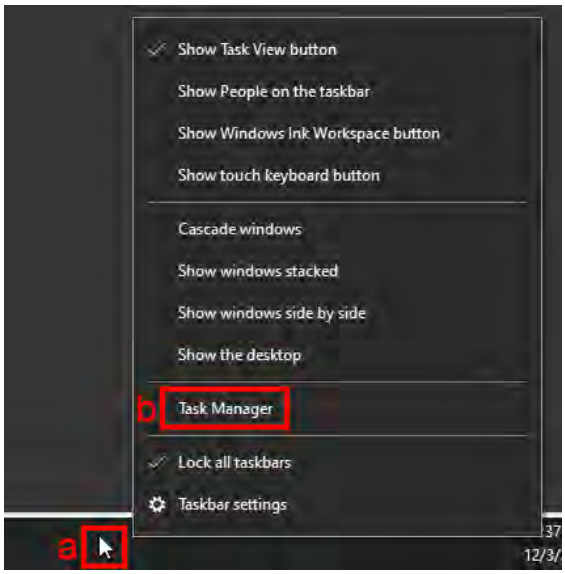


Figure 5-78: Accessing Task Manager

    c. In the **Apps** section, right-click on the GUI executable.
    d. Select **End Task.**

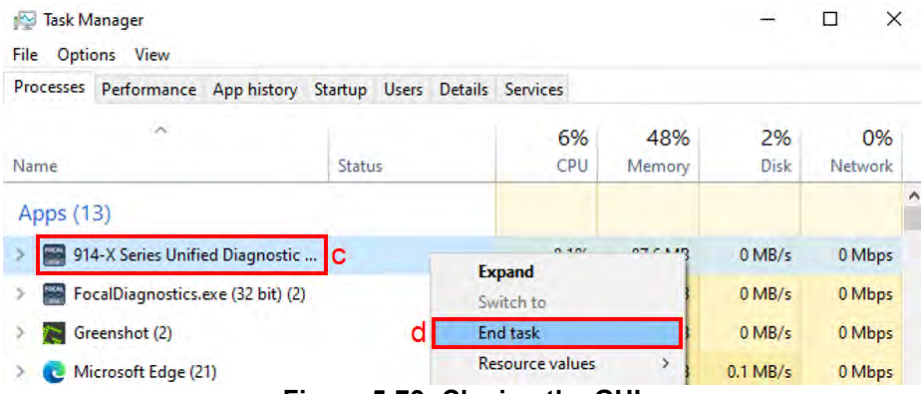


Figure 5-79: Closing the GUI

3. Power off the connected 914-X system and wait for five seconds.
4. Power the 914-X system back on and wait for 10 more seconds.
5. Open the 914-X Series Unified Diagnostic GUI. Reconnect to the COM port (see Section 5.1.1) and allow up to twenty seconds for the 914-X system to connect.

5.11 Updating Versions of the Diagnostic GUI

The 914-X Unified Diagnostic GUI is maintained by Moog Focal, with new versions of the software released as necessary. The current software version is displayed the top left corner of the screen, within the box highlighted in red in the image below. Additionally, the *.zip file used to download the GUI includes the software version in its title.

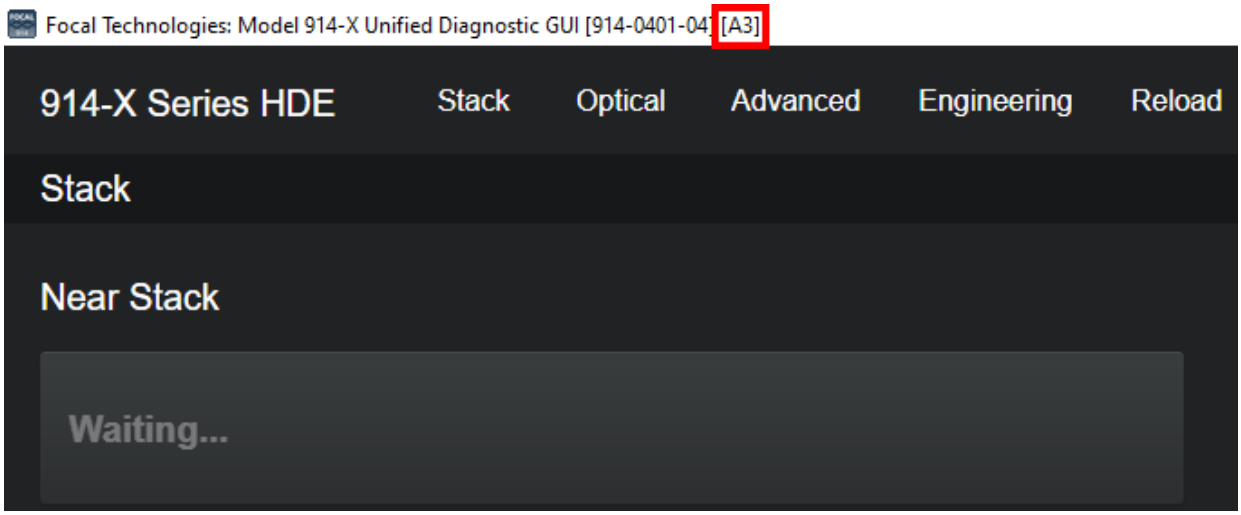


Figure 5-80: Software Version Location

Revisions are released in ascending hexadecimal order. For instance, version A5 of the software is older than version AA, which in turn is older than version B0.

To compare the GUI version installed on the user's PC with the most recent version, follow the instructions in Section 5.1 until the GUI *.zip file has been downloaded. Then, compare the software version displayed in the name of the *.zip file with the software version installed on the PC. The PC's GUI is up to date if the versions match.

6.0 914-X Series Expansion Cards

The 914-HDE motherboard is a full multiplexing system capable of supporting up to eight expansion cards simultaneously through a multi-gigabit board-to-board expansion connector. A separate backplane card is not required for expansion connections. Moog Focal has developed a family of compatible expansion cards that allow the user to specify more signals without adding more fibers or optical wavelengths. This reduces cost and size as compared to adding media converters or additional multiplexer cards. The expansion connector offers four medium speed (MS) channels and four low speed (LS) channels.

The expansion connector provides for 21/32” (16.67 mm) spacing between cards when directly stacked together. For tight spaces and/or larger stacks, Moog Focal can provide high speed ribbon cables to allow cards to sit up to 18” (46 cm) apart. Please refer to Section 10.3 for more information.

6.1 914-VDX

Card P/N	See Section 13.2
Config. Dwg	914-2020-00

The 914-VDX (video and serial data expansion card) provides two channels of analog (composite) video and four channels of serial data, isolated in pairs. The serial channels can be individually configured for RS232 (default), RS485, RS422, or TTL. The video channels are compatible with both NTSC and PAL standards. Diagnostics from this card are provided to the 914-HDE and are available via the 914-X Series Unified Diagnostic GUI. This expansion card requires one medium speed expansion channel and up to 550 Mb/s of bandwidth from the 914-HDE motherboard.

Figure 6-1: 914-VDX

6.1.1 914-VDX Serial Data Ports

The 914-VDX has four serial ports (isolated in pairs) supporting RS232, RS485, RS422, or TTL signaling protocols.[1] These four protocols may be configured by the user in the field via the 914-X Series Unified Diagnostic GUI. All data rates are supported up to 1.25 Mbaud for RS485 and RS422, and up to 500 kbaud for RS232 and TTL. Each port can support completely independent serial data links with independent baud rates. By default, RS485 and RS422 inputs are terminated differentially with an onboard 120 Ω resistor that can be disabled via software configuration. Latency through the Mux/Demux system is less than 500 µs, not including fiber delays of 5 µs/km.

For RS485, which is a half-duplex protocol, a programmable turn-around time ("timeout") is implemented. The default turn-around time (timeout between TX and RX) is set to 1 ms. Serial port settings, including protocol, timeouts, and terminations may be accessed and changed via the 914-X Series Unified Diagnostic GUI (see Section 6.1.8.3).

The serial port connector is Molex Micro-fit P/N 43045-0800. The mating plug is Molex Micro-fit P/N 0430250800 with Molex crimps P/N 0430300010. The pinout is detailed in Table 6-3. TX refers to data transmitted from the 914-VDX to external equipment. RX refers to data received into the 914-VDX from external equipment. Data coming into the RS422 RX lines at the remote, for example, will exit from the RS422 TX lines at the console.

[1] Note that on Revisions 3 and earlier 914-VDX, the four serial channels are *non-isolated* and TTL is not supported.

Table 6-1: 914-VDX Serial Parameters

PROTOCOL	PARAMETER	MIN	TYP	MAX	UNIT
RS232	Input Threshold Voltage	0.6	1.5	2.5	V
	Output Swing	10	12	15	V
RS485 / RS422	Differential Output Voltage	1.5	—	6.0	V
	Terminating Resistor (optional)	108	120	156	Ω
TTL	Output Voltage	0	—	5.0	V
	Input Threshold	2.0	2.5	3.0	V
All Modes	Data Rate	—	—	1250	kbaud
	Latency[2]	—	500	—	µs

[2] Does not include fiber delay of 5µs per kilometer.

Table 6-2: 914-VDX Serial Channel Numbering

CH#	REFERENCE DESIGNATOR
1	J5 (lower pin row)
2	J5 (upper pin row)
3	J2 (lower pin row)
4	J2 (upper pin row)

Table 6-3: 914-VDX Serial Data Connector Pinout

REF.	CHANNEL / PIN				MODE			
					RS232	RS485	RS422	TTL
J5	CH1	1	CH2	5	RS232 RX	RS485+ [4]	RS422 RX+	TTL RX
		2		6	ISO GND [6]	ISO GND [6]	RS422 RX-	ISO GND [6]
J2	CH3	3	CH4	7	RS232-TX [5]	RS485+	RS422 TX+	TTL TX
		4		8	RS232 TX	RS485-	RS422 TX-	NC[3]

[3] NC = Do not connect
[4] Starting at Revision 4, the user may use either RS485+ pin, but not both.
[5] Use only one of the RS232-TX pins, not both.
[6] Isolated ground is **shared** between the ports

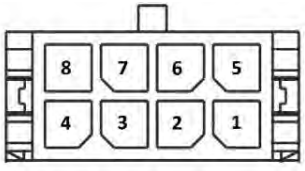


Figure 6-2: 914-VDX Molex Micro-fit, P/N 43045-0800

Figure 6-3: 914-VDX Serial Ports

6.1.2 914-VDX Composite Video Channels

The 914-VDX has two NTSC or PAL compatible composite video channels. The channel directions (input vs output) are configured via the 914-X Series Unified Diagnostic GUI (see Section 6.1.8.2). Each channel uses approximately 250 Mb/s of available bandwidth from the 914-HDE. No bandwidth is used if the video input is unplugged, or if that channel has been disabled via the GUI. Latency through the Mux/Demux system is less than 500 µs, not including fiber delays of 5 us/km. Console side cards should have video direction configured for output, and remote side cards should have video direction configured for input.

Coaxial shielding on the connectors is directly tied to ground (VIN-). Care must be taken to ensure a common ground to all video equipment, or isolation must be installed external to the 914-VDX. The video signal is AC coupled on the board.

The connector is a Mini SMB jack, Amphenol P/N 142146-75. Recommended mating plug is Cinch P/N 131-8403-101, although other 75 Ω Mini SMB plugs may be suitable. Cabling should be RG-179, 75 Ω coaxial type. Video latency through the Mux/Demux system is less than 25 µs, not including fiber delays of 5 s/m.

Figure 6-4: 914-VDX Mini SMB Jack - Amphenol P/N 142146-75

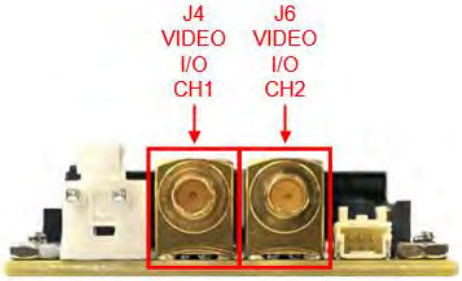


Figure 6-5: 914-VDX Video Connector Locations

6.1.3 914-VDX Power

Power to the 914-VDX card is provided via the expansion connector J3. Power input connector J3 should ***not*** be used during normal operation with the 914-VDX. It can optionally be used for standalone operation for firmware updates or configuration.

If the 914-VDX is to be self-powered, this is accomplished via connector J3, Molex P/N 09-75-2024. The mating plug is Molex P/N 26-03-4020 with crimps P/N 08-52-0113. The pinout is provided in the table and figure below.

Table 6-4: 914-VDX Power Connector Pinout

PIN #	FUNCTION
1	GND
2	VCC

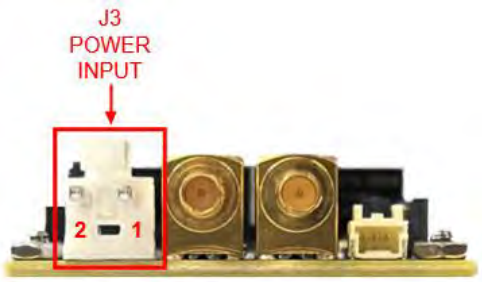


Figure 6-6: 914-VDX Power Input Connector Location

The recommended input voltage range is 4.5 VDC to 13.0 VDC (typically +12 VDC regulated). Nominal power consumption is 5 W, increasing to 5.5 W at 60°C ambient temperature. Power leads should be 18-20 AWG.

The onboard surface mount fuse, F1, is rated to 2A and is not intended to be field replaceable. If the power fuse is blown, the card should be evaluated for damage by the factory or trained service personnel prior to any repair.

6.1.4 914-VDX Diagnostic LEDs

The 914-VDX card includes fifteen onboard diagnostic LEDs. A description and location of each LED is provided in Table 6-5 and Figure 6-7.

Table 6-5: 914-VDX Diagnostic LEDs

REF	COLOUR	DESCRIPTION
D1	Green	Flashing LED indicates serial Channel 3 is transmitting to external equipment.
D2	Yellow	Flashing LED indicates serial Channel 3 is receiving from external equipment.
D3	Green	Flashing LED indicates serial Channel 4 is transmitting to external equipment.
D4	Yellow	Flashing LED indicates serial Channel 4 is receiving from external equipment.
D7	Red	Indicates a power fault when lit. A power fault is encountered when the input voltage falls outside of the supported range of 4.5 to 13.5 V. Recommended input voltage is 5 VDC. When this LED is lit, the card is not powered properly and will not function.
D8	Green	Indicates that the card is powered properly when lit.
D9	Green	Indicates the 914-VDX is configured for Console mode.
D10	Green	Indicates a valid video signal is present on Channel 1 when lit
D11	Green	Indicates a valid video signal is present on Channel 2 when lit
D12	Green	Indicates a valid expansion link is being received. (data frames are present)
D13	Red	Indicates the expansion link is in fault condition. (little or no valid data is present)
D14	Green	Flashing LED indicates serial Channel 1 is transmitting to external equipment.
D15	Yellow	Flashing LED indicates serial Channel 1 is receiving from external equipment.
D16	Green	Flashing LED indicates serial Channel 2 is transmitting to external equipment.
D17	Yellow	Flashing LED indicates serial Channel 2 is receiving from external equipment.

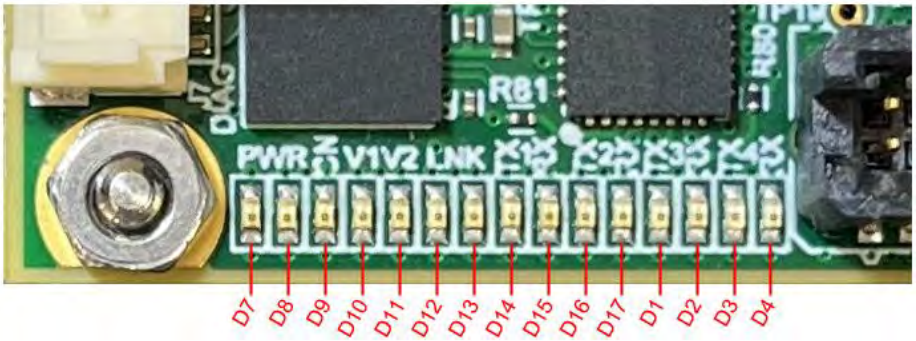


Figure 6-7: 914-VDX Diagnostic LED Locations

6.1.5 914-VDX Diagnostic LED Header

The 914-VDX card includes a 10-pin header capable of driving eight LEDs. This is useful for LED integration into an enclosure. Each LED pin is driven low to turn on an LED, and includes a 267 Ω resistor in series to limit the current draw. Maximum current draw is 8 mA. Refer to Section 4.7 for a sample connection diagram.

Serial data activity header pins can be configured for TX (Transmit Activity), RX (Receive Activity), or both (Default) via the GUI.

The LED header is FCI P/N 20021521-00010T1LF, and the mating part is FCI P/N 20021444-00010T1LF. This can be used with most 0.050" (1.27mm) spacing ribbon cables.

The LED header on the 914-VDX can be configured as either 'Option A' or 'Option B' (see Section 6.1.8.1), as outlined in the tables below. Option A is the default as-shipped configuration.

Table 6-6: 914-VDX Diagnostic LED Header Pinout (Option A, Default)

PIN #	NAME	DESCRIPTION
1	3.3V	3.3V. This pin can be used to drive the LEDs, Maximum current is 0.5A.
2	VIDEO CH1	Indicates a valid video signal is present on Channel 1 when lit. Active low.
3	VIDEO CH2	Indicates a valid video signal is present on Channel 2 when lit. Active low.
4	SER CH1 ACT	Flashing LED indicates serial Channel 1 activity. Active low.
5	SER CH2 ACT	Flashing LED indicates serial Channel 2 activity. Active low.
6	SER CH3 ACT	Flashing LED indicates serial Channel 3 activity. Active low.
7	SER CH4 ACT	Flashing LED indicates serial Channel 4 activity. Active low.
8	EXPANSION LINK	Indicates a valid expansion link is present. Active low.
9	EXPANSION LINK FAULT	Indicates that the expansion link is in a fault condition. Active low.
10	GND	Ground, non-isolated, connected to 914-HDE input voltage ground.

Table 6-7: 914-VDX Diagnostic LED Header Pinout (Option B)

PIN #	NAME	DESCRIPTION
1	3.3V	3.3V. This pin can be used to drive the LEDs, Maximum current is 0.5A.
2	EXPANSION LINK	Indicates a valid expansion link is present. Active low.
3	EXPANSION LINK FAULT	Indicates that the expansion link is in a fault condition. Active low.
4	VIDEO CH1	Indicates a valid video signal is present on Channel 1 when lit. Active low.
5	VIDEO CH2	Indicates a valid video signal is present on Channel 2 when lit. Active low.
6	SER CH1 ACT	Flashing LED indicates serial Channel 1 activity. Active low.
7	SER CH2 ACT	Flashing LED indicates serial Channel 2 activity. Active low.
8	SER CH3 ACT	Flashing LED indicates serial Channel 3 activity. Active low.
9	SER CH4 ACT	Flashing LED indicates serial Channel 4 activity. Active low.
10	GND	Ground, non-isolated, connected to 914-HDE input voltage ground.

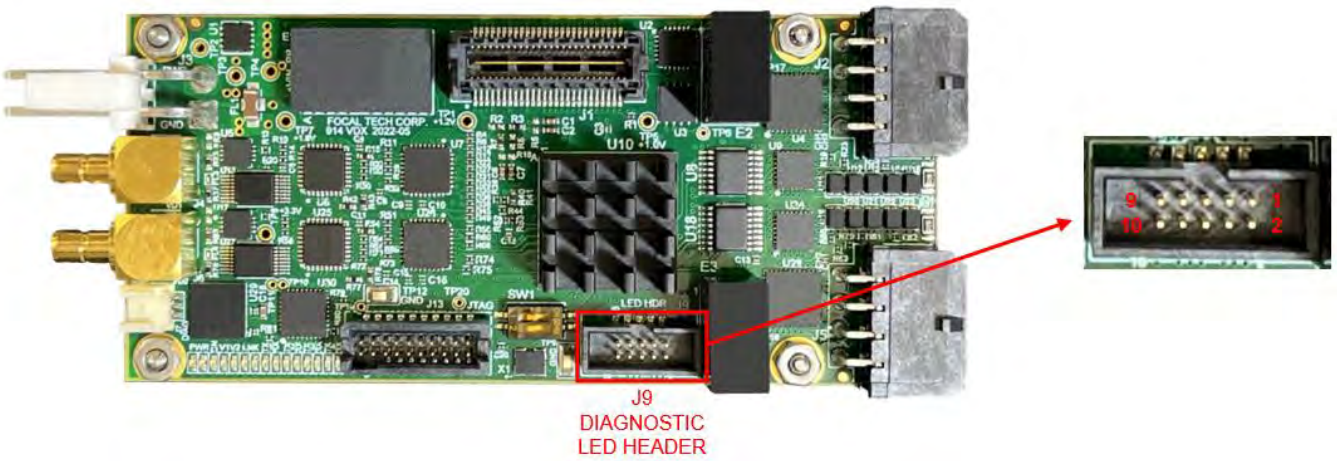


Figure 6-8: 914-VDX Diagnostic LED Header

6.1.6 914-VDX Expansion Channel Configuration

Up to four 914-VDX cards may be stacked on each 914-HDE, depending on available optical bandwidth. Dip switch SW1 configures which 914-HDE expansion channel the expansion card uses. The card closest to the 914-HDE must be configured for expansion Channel 1, with each subsequent card configured for the next channel in succession. No channels may be skipped.

Low Speed (LS) and Medium Speed (MS) expansion channels are independent. MS cards should be stacked on the 914-HDE first, and LS cards last.

Table 6-8: 914-VDX Expansion Channel Configuration

SW1		SETTING
1	2	
OFF	OFF	MS Expansion Channel 1
ON	OFF	MS Expansion Channel 2
OFF	ON	MS Expansion Channel 3
ON	ON	MS Expansion Channel 4

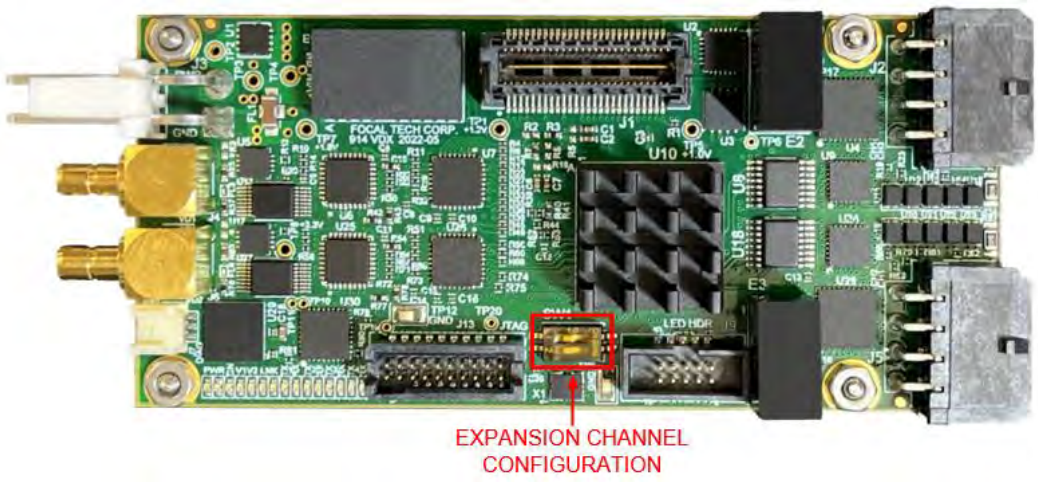


Figure 6-9: 914-VDX Diagnostic LED Header

Figure 6-10: 914-VDX SW1 Position and Orientation

6.1.7 914-VDX Status Page

To view the status of a VDX card, connect the console 914-HDE to the 914-X Series Unified Diagnostic GUI via a local COM port. Ensure a stable optical link is present and the cards are stacked together in the correct order with the correct expansion settings as per the Section 5.0.

By hovering over and selecting a near or far VDX tile within the Diagnostic GUI's stack view, a VDX status page for that expansion slot will be opened. This page contains relevant information regarding the near (left) and far (right) VDX cards located in the specified expansion slot. Figure 6-11 showcases an example stack where the MS2 slot is occupied by a pair of VDX cards. Selecting either of the two tiles will navigate the user to the VDX status page for the MS2 slot.

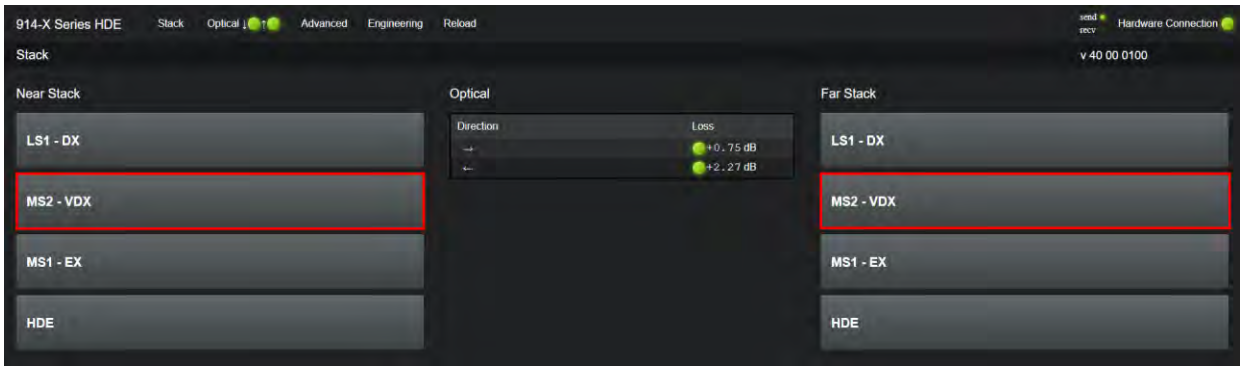


Figure 6-11: 914-VDX Diagnostic Status Selection

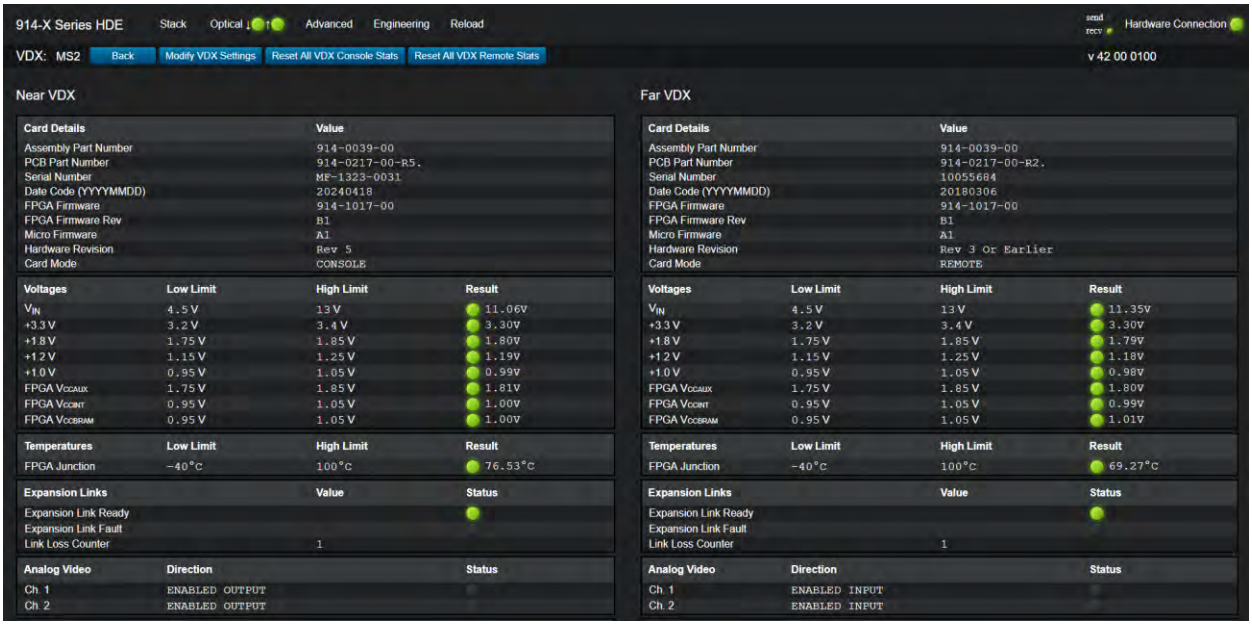


Figure 6-12: 914-VDX Status Page Overview

Generic card information (such as the serial number or hardware revision) can be found in the *Card Details* table.

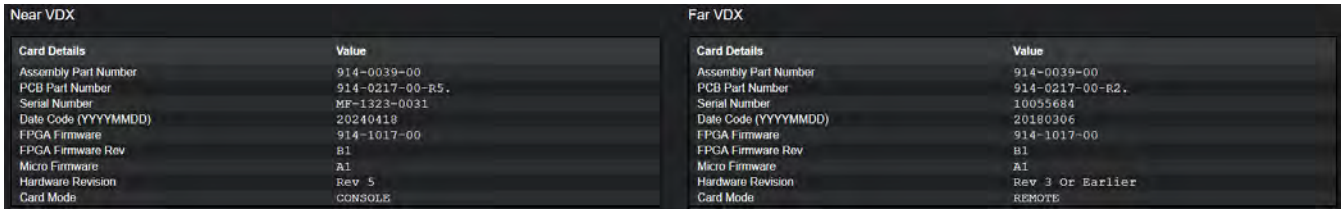


Figure 6-13: 914-VDX Card Information

Below these are the voltages and temperatures. A green LED indicates that the observed status value is within the expected range. Red LEDs indicate potential problems that need to be addressed, and yellow LEDs give warnings. Low and high limits clarify the value at which the LEDs will turn red.

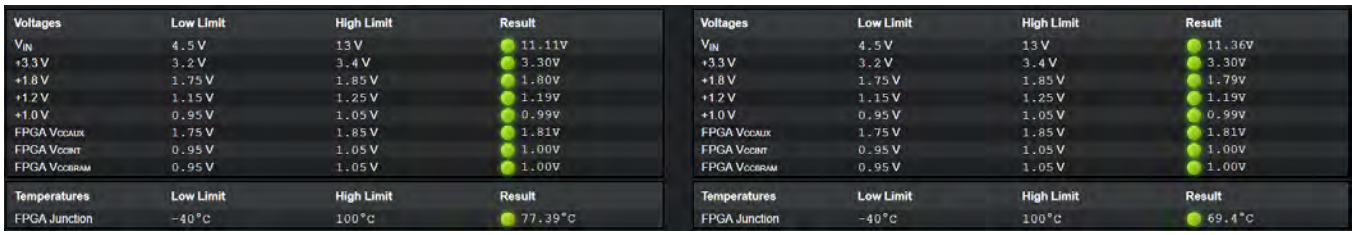


Figure 6-14: 914-VDX Voltage and Junction Temperature Information

Figure 6-15 shows the expansion link details.

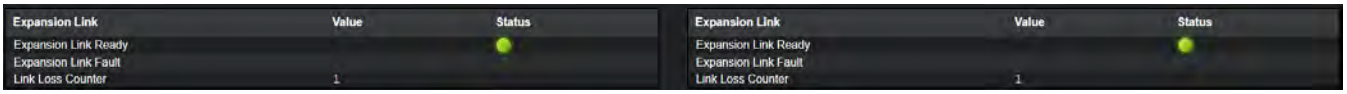


Figure 6-15: 914-VDX Expansion Link Information

Figure 6-16 shows the details and status of each input / output signal (analog video and serial).

Figure 6-16: 914-VDX Serial and Analog Video Information

Figure 6-17 shows the status of each of the LED headers.

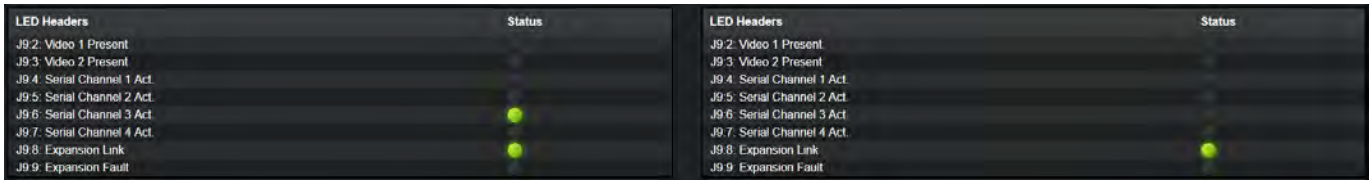


Figure 6-17: 914-VDX LED Header Information

Figure 6-18 shows the subheader, located directly below the main header. The expansion type and number are displayed on the left side; in this instance, it is the medium speed expansion slot #2. The “Back” button returns the user to the stack view. Pressing “Modify VDX Settings” will bring the user to the VDX settings page (see Section 6.1.8). The remaining options reset all statistics stored in the near and far VDX (link loss counts, for example) respectively.

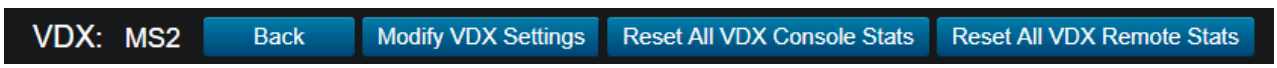


Figure 6-18: 914-VDX Sub-Header

6.1.8 914-VDX Settings Page

By default, all 914-VDX cards are shipped with these settings:

- Remote configuration;
- Both video channels are inputs and enabled;
- All serial channels are set to RS232.

To change configuration, connect the console 914-HDE to the 914-X Series Unified Diagnostic GUI via a local COM port. Ensure a stable optical link is present and the cards are stacked together in the correct order with the correct expansion settings as per Section 6.1.6. To get to the 914-VDX settings page, navigate to the stack view and select either of the tiles labelled “VDX” in the proper expansion slot.

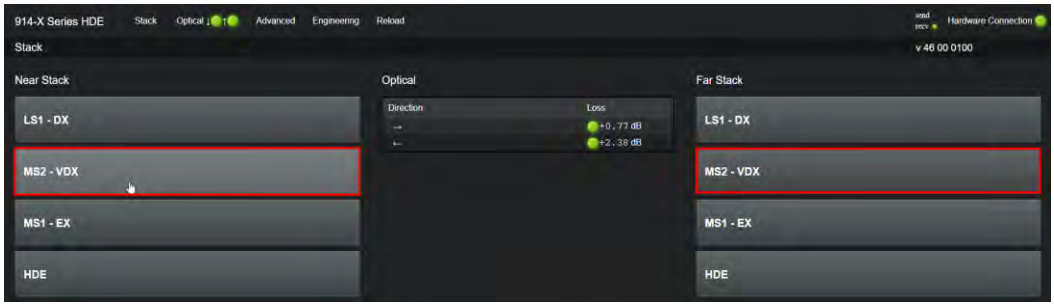


Figure 6-19: 914-VDX Diagnostic Status Selection

Select the “Modify VDX Settings” option to open the VDX settings page.

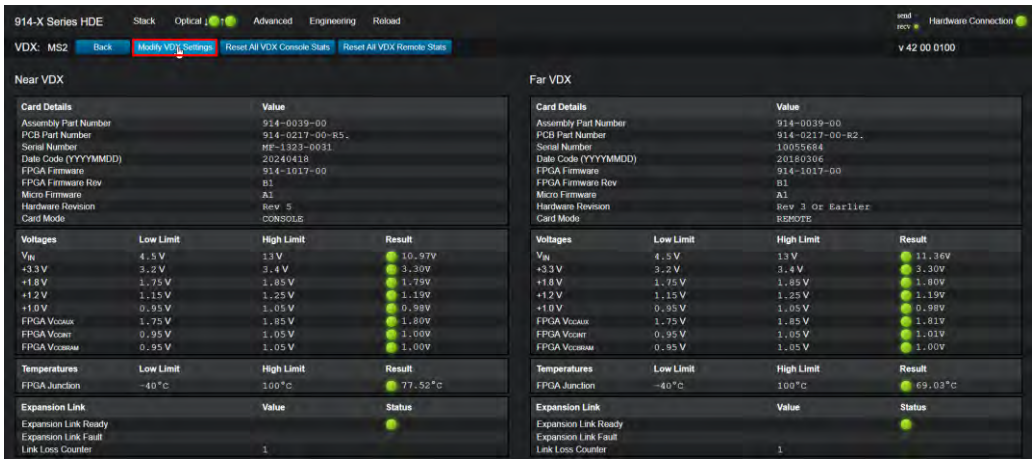


Figure 6-20: 914-VDX Diagnostic Settings Selection

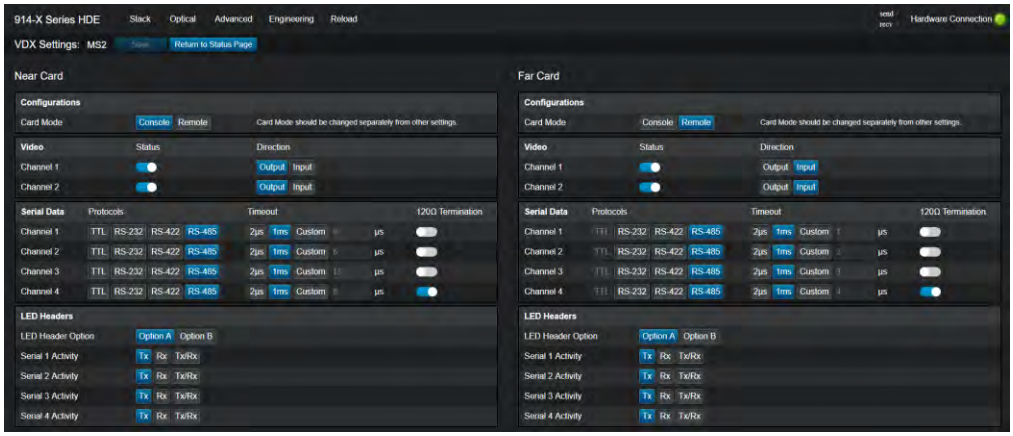


Figure 6-21: 914-VDX Settings Page

Upon loading or refreshing the settings page, the data fields are automatically populated with the current configurations of the near (left) and far (right) 914-VDX cards. System Status is not refreshed while in the settings page. Users should not anticipate the send/receive LEDs on the header to be active unless they are in the process of a save or they are loading the page. Additionally, the remote warning border and optical status LEDs on the header are not displayed on this page.

Settings are displayed in three formats: segmented buttons, toggles, and text boxes. Segmented boxes permit a single selection from multiple options (selected by hovering over and pressing the option of choice), with the active value highlighted in blue. Text boxes allow for custom inputs (by pressing on them and typing in a number). Toggles indicate an off state (to the left, white in color) or an on state (to the right, blue in color), and can be toggled by hovering over and pressing them. Figure 6-22 below illustrates examples of the three possible setting display types. The Timeout option (seen on the left) uses segmented buttons and is currently set to "Programmable". The Custom Timeout value (seen in the middle) is currently set to 0, displayed in a text box. The Termination option (seen on the right) is represented by a toggle, which is currently disabled.

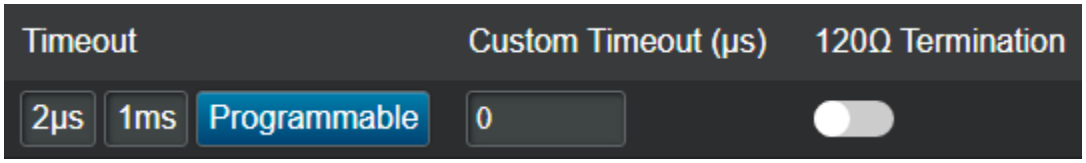


Figure 6-22: 914-VDX Data Field Types

Located beneath the main header is the settings page's subheader. The “Save” button will prompt the user to confirm their action and subsequently save board settings on the page to the attached VDX cards. This button is only clickable if the user has proposed changes to the settings. The "Return to Status Page" button navigates the user back to the VDX status page. To the right of this button is the loading icon, which only appears when the page is loading and when settings are being saved. The page is disabled while settings are being saved.

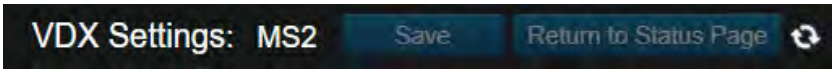


Figure 6-23: 914-VDX Settings Page Sub-Header

Modified settings that have not yet to be saved to the VDX cards are highlighted with a red border and will revert to their original values if the page is reloaded before saving. All settings on the page can be modified and saved simultaneously, apart from card mode, which should be changed independently, if at all. **Allow up to twenty seconds for all proposed changes to be applied to the VDX cards**. If proposed changes are not being applied when saving, refer to item #4 in Section 14.0.

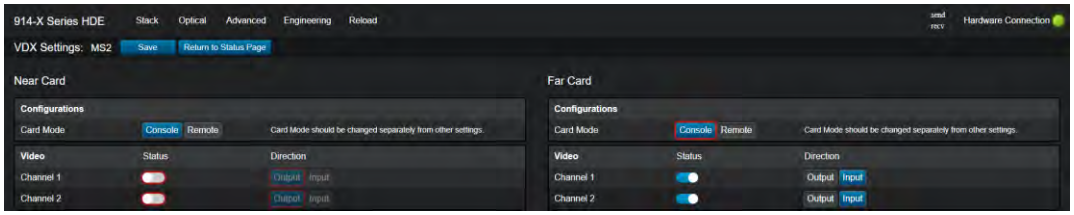


Figure 6-24: 914-VDX Unsaved Settings

6.1.8.1 914-VDX General Configuration

Figure 6-25 shows the location of the 914-VDX card mode settings. These settings are non-volatile and do not need to be reconfigured each time the 914-VDX is powered. **The near side should always be configured as a console, while the far side should always be configured as a remote**. Card Mode should be adjusted and saved separately from other settings. Once configured correctly, card mode typically does not require further changes. If adjustments are necessary, they should be made independently of other settings. Once the desired settings are selected, press “Save” and confirm to apply them to the board.

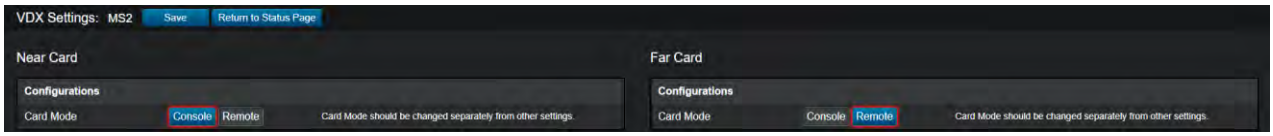


Figure 6-25: 914-VDX Card Mode Configuration

Shown in Figure 6-26 is a configuration example for the VDX’s LED headers. The serial activity setting dictates the type of data transfer that will activate the VDX's LEDs, whether it be transmit (TX), receive (RX), or both (TX/RX). The LED header option changes the display order of the LEDs themselves (see Section 6.1.5). These settings are non-volatile and do not need to be reconfigured each time the 914-VDX is powered. Once the desired settings are selected, press “Save” and confirm to apply them to the board.

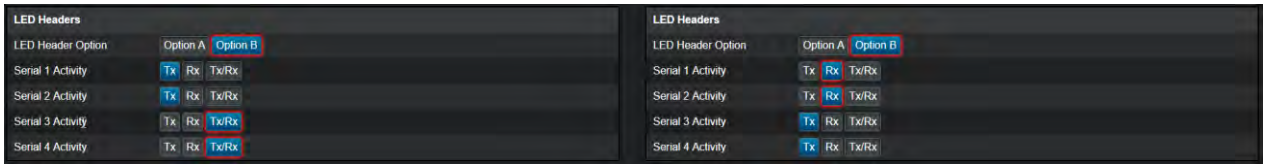


Figure 6-26: 914-VDX LED Header Configuration

6.1.8.2 914-VDX Analog Video Configuration

Figure 6-27 shows how to configure the VDX’s video ports. The direction of the near (console) side card should be output, while the far (remote) side should be input. The video channels can also be optionally enabled and disabled. These settings are non-volatile and do not need to be reconfigured each time the 914-VDX is powered. Once the desired settings are selected, press “Save” and confirm to apply them to the board.

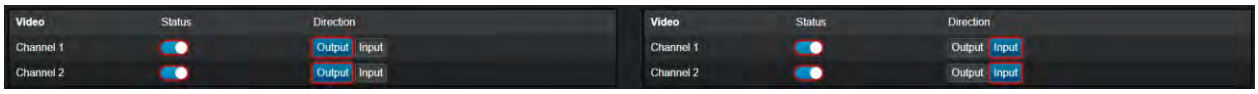


Figure 6-27: 914-VDX Analog Video Configuration

6.1.8.3 914-VDX Serial Configuration

Figure 6-28 shows the serial port configuration. Select the desired protocol and, if applicable, choose the termination and/or timeout settings. Additionally, a custom timeout value can be entered if the programmable timeout setting is enabled. If a protocol does not support termination or timeout, these options will be disabled. These settings are non-volatile and do not need to be reconfigured each time the 914-VDX is powered. Once the desired settings are selected, press “Save” and confirm to apply them to the board.

Typical settings per protocol (Refer to Section 6.1.1):

- RS485: 1 ms timeout; terminations enabled
- RS422: Terminations enabled
- RS232: No options
- TTL: No options (not supported for legacy revisions of the VDX; refer to Section 6.1.9)

Figure 6-28: 914-VDX Serial Configuration

6.1.9 Legacy 914-VDX Information (Board Rev. 3 and Earlier)

The 914-HDE and expansion cards 914-VDX, 914-EX, 914-DX, and 914-HDV2, were all updated in 2022. Most connector pinouts are the same between old and latest board revisions, however this section describes important details about the differences in older revisions of the 914-VDX. Any details **not** covered in this section imply that no changes occurred between board revisions.

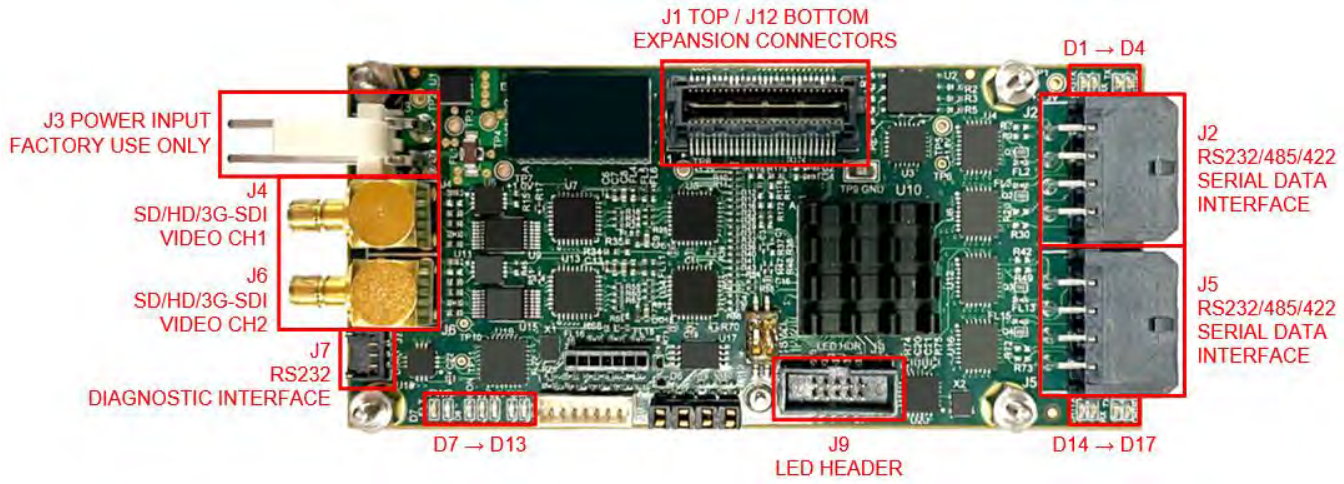


Figure 6-29: 914-VDX Top View (Board Revisions 3 and Earlier)

6.1.9.1 Legacy 914-VDX Diagnostics Connector

The part used for diagnostics connector J7 was replaced in board revision 3 and is installed on all later revisions. The pinout for the connector is the same between older and new revisions, however, an isolated ground was introduced in board revision 4. Earlier revisions have non-isolated ground. See Figure 4-12 for a diagram of the diagnostic interface cable for older PCBA revisions.

Table 6-9: Legacy 914-VDX J7 Pinout

PIN	PIN FUNCTION	
	REV 3 AND EARLIER	REV 4 AND LATER
1	GND	ISO GND
2	TX	TX
3	RX	RX

Table 6-10: Legacy 914-VDX Mating Connectors

DESIGNATOR	DESCRIPTION	MFR.	PART NUMBER / FOCAL PN	CRIMP PINS / FOCAL PN
J7 (≤ Board Rev 2)	Diagnostics (Old revs)	Molex	0781720003 / EL-J0579	0781720410 / EL-J0580
J7 (≥ Board Rev 3)	Diagnostics	Molex	0151330306 / EL-J0710	N/A

6.1.9.2 Legacy 914-VDX Serial Data

TTL serial protocol was introduced to the 914-VDX in board revision 4. All earlier revisions only support RS232, RS485, and RS422. The ground reference for the serial ports are non-isolated for Revision 3 and earlier hardware. Refer to the table below for details.

Table 6-11: Legacy 914-VDX Serial Data Connector Pinout

REF.	CHANNEL / PIN				MODE		
					RS232	RS485	RS422
J5	CH1	1	CH2	5	RS232 RX	DO NOT CONNECT	RS422 RX+
		2		6	GND	GND	RS422 RX-
J2	CH3	3	CH4	7	DO NOT CONNECT	RS485+	RS422 TX+
		4		8	RS232 TX	RS485-	RS422 TX-

6.1.9.3 Legacy 914-VDX Diagnostic LEDs

The 914-VDX card includes fifteen onboard diagnostic LEDs on both the old and new board revisions. Locations of these LEDs on old vs. new boards are slightly different. Descriptions and locations of each LED for old board revisions are provided in Table 6-12 and Figure 6-30.

Table 6-12: Legacy 914-VDX Diagnostic LEDs

REF.	COLOUR	DESCRIPTION
D1	Green	Flashing LED indicates serial Channel 3 is transmitting to external equipment.
D2	Yellow	Flashing LED indicates serial Channel 3 is receiving from external equipment.
D3	Green	Flashing LED indicates serial Channel 4 is transmitting to external equipment.
D4	Yellow	Flashing LED indicates serial Channel 4 is receiving from external equipment.
D7	Red	Indicates a power fault when lit. A power fault is encountered when the input voltage falls outside of the supported range of 4.5 to 13.5 V. Recommended input voltage is 5 VDC. When this LED is lit, the card is not powered properly and will not function.
D8	Green	Indicates that the card is powered properly when lit.
D9	Green	Indicates the 914-VDX is configured for Console mode.
D10	Green	Indicates a valid video signal is present on Channel 1 when lit
D11	Green	Indicates a valid video signal is present on Channel 2 when lit
D12	Green	Indicates a valid expansion link is being received. (data frames are present)
D13	Red	Indicates the expansion link is in fault condition. (little or no valid data is present)
D14	Green	Flashing LED indicates serial Channel 1 is transmitting to external equipment.
D15	Yellow	Flashing LED indicates serial Channel 1 is receiving from external equipment.
D16	Green	Flashing LED indicates serial Channel 2 is transmitting to external equipment.
D17	Yellow	Flashing LED indicates serial Channel 2 is receiving from external equipment.

Figure 6-30: 914-VDX Diagnostic LED Locations (Board Revisions 3 and Earlier)

6.2 914-EX

Card P/N	See Section 13.3
Config. Dwg	914-2022-00

The 914-EX (Ethernet expansion card) provides two additional 10/100/1000 BASE-T(X) ports to a 914-HDE system. These ports are multiplexed into the 914-HDE optical data stream. This design is switchless, ensuring no mixing of Ethernet traffic between ports, i.e. data input to Port 1 is an output on Port 1 at the far side of the optical link. Diagnostics from this card are provided to the 914-HDE and are available to the 914-X Series Unified Diagnostic GUI.

The 914-EX can use a single 914-HDE medium speed (MS) expansion channel (*single expansion mode*) for up to 1000 Mb/s of bandwidth dynamically shared between the two Ethernet ports, or two 914-HDE medium speed (MS) expansion channels (*dual expansion mode*) allowing for a full 1000 Mb/s of bandwidth per Ethernet port. Single and dual expansion modes can be configured using the 914-X Series Unified Diagnostic GUI. Single expansion mode is default.

Note: Care must be taken to ensure the 914-HDE motherboard optical interface has sufficient bandwidth to support the required Ethernet traffic. Actual bandwidth requirements are based on the external devices connected to the Ethernet ports. Ensure there is enough available bandwidth when using either single or dual expansion modes.

Figure 6-31: 914-EX

6.2.1 914-EX Ethernet Ports

The 914-EX provides two un-switched, low latency 10/100/1000 BASE-T(X) Ethernet links through the 914-HDE optical port. Both ports are configured for 10/100/1000 BASE-T(X) auto-negotiation by default. Auto-negotiation settings can be accessed via the 914-X Series Unified Diagnostic GUI when connected to the console 914-HDE diagnostic port. A standard 8P8C (RJ45) modular jack provides the mechanical interface for the Ethernet port. The port is auto MDI/MDIX capable and supports jumbo frames up to 9000 bytes. Note: sustained back-to-back jumbo frames are supported up to 4000 bytes, larger frame sizes require increased interframe gaps. The 914-HDE motherboard Ethernet port can sustain back-to-back jumbo frames of 9000 bytes if this feature is required for a given system.

In 914-EX cards with FPGA Firmware 0xB0 or greater, the “Remote Ethernet Link Speed Synchronization” (RLSS) feature is enabled by default and can be disabled via the GUI. This feature forces the console side 914-EX to match the speed and duplex settings of the remote side 914-EX. This greatly simplifies the setup and ensures the 914-EX card adapts to the remotely plugged equipment for lossless communication. This setting is recommended and should only be disabled if the configuration has another method to ensure link speed symmetry.

When configured for single expansion mode (default), the 914-EX combines the traffic from both Ethernet ports, along with diagnostic information, onto a single medium speed expansion channel on the 914-HDE. This bandwidth is dynamically shared between the two Ethernet ports, allowing for total throughput of up to 1000 Mb/s.

Optionally, the 914-EX can be configured for dual expansion mode, which uses two medium speed expansion channels on the 914-HDE. This mode allows for a full 1000 Mb/s of bandwidth per Ethernet port and is ideal for high bandwidth video over IP or GigE vision applications. Since the 914-HDE motherboard multiplexes the Ethernet data from the 914-EX card and other expansion cards in the system, the total system bandwidth usage must be considered, and be at (or under) the maximum optical bandwidth available for the system. Refer to Section 3.2 for detailed information 914-X series card bandwidth usage.

End-to-end latency through the multiplexer is a calculation which adds a fixed electronic latency to the Ethernet frame time, which is a function of the frame length; and the optical latency, which is a function of distance. Adding all three together gives a total latency figure.

Table 6-13: 914-EX Ethernet Latency

LATENCY COMPONENT / LINK SPEED	10 Mb/s	100 Mb/s	1000 Mb/s
FEL (Fixed Electronic Latency)	40 µs	12 µs	15 µs
FT (Frame Time)	# Bytes * 0.8 µs	# Bytes * 0.08 µs	# Bytes * 0.008 µs
OL (Optical Latency)	5 µs / km	5 µs / km	5 µs / km

Latency = FEL + FT + OL

6.2.2 914-EX Ethernet RJ45 LEDs

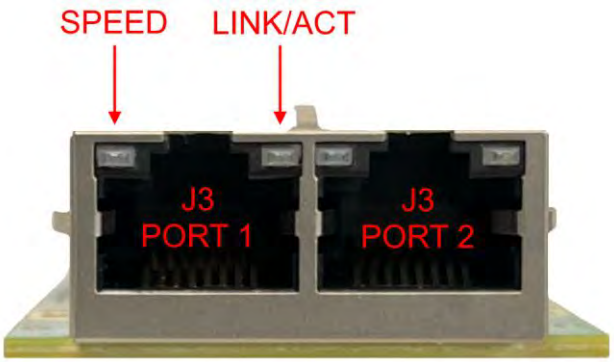


Figure 6-32: 914-EX Ethernet Ports

Integrated LEDs show Ethernet Link Status as shown in Table 6-14.

Table 6-14: 914-EX Ethernet LEDs

LED STATUS		FUNCTION
LEFT GREEN/ORANGE	RIGHT YELLOW	
OFF(1)	X	10 BASE-T
ORANGE	X	100 BASE-TX
GREEN	X	1000 BASE-T
X	ON	LINKED
X	FLASHING	LINKED WITH ACTIVITY

[1] Speed indication only valid when link LED is on or flashing.

6.2.3 914-EX Power

Power to the 914-EX card is provided via the expansion connector J9. Power input connect J2 ***should not be used*** during normal operation with the 914-EX. It can optionally be used for standalone operation during firmware updates or configuration.

If the 914-EX is to be self-powered, this is accomplished via connector J2, Molex P/N 09-75-2024. The mating plug is Molex P/N 26-03-4020 with crimps P/N 08-52-0113. The pinout is provided in the table and figure below.

Table 6-15: 914-EX Power Connector Pinout

PIN #	FUNCTION
1	GND
2	VCC

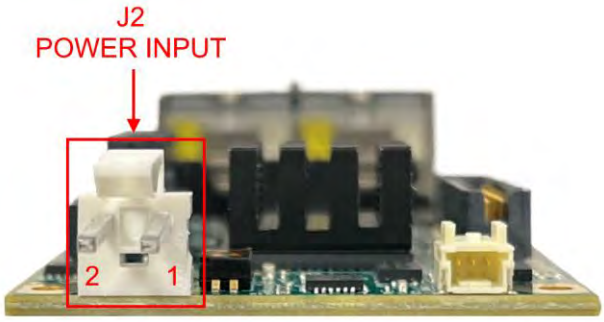


Figure 6-33: 914-EX Factory Power Input Connector Location

The recommended input voltage range is 4.5 VDC to 13.0 VDC (typically +12 VDC regulated). Nominal power consumption is 3.5 W, increasing to 4.2 W at 60° C ambient temperature with both ports linked at 1000 BASE-T. Power leads should be AWG 18 – 20.

The onboard surface mount fuse, F1, is rated to 2A and is not intended to be field replaceable. If the power fuse is blown, the card should be evaluated for damage by the factory or trained service personnel prior to any repair.

6.2.4 914-EX Diagnostic LEDs

The 914-EX card includes six onboard diagnostic LEDs. A description and location of each LED is provided in Table 6-16 and Figure 6-34.

Table 6-16: 914-EX Diagnostic LEDs

REF.	COLOUR	DESCRIPTION
D2	Red	Power Fault. Only lit if power is sourced via J2 and input voltage is outside nominal 4.5 to 13.0 VDC.
D3	Green	Power. Lit when powered.
D4	Red	Primary Expansion channel fault. No link established to partner card via 914-HDE across the optical link.
D5	Green	Primary Expansion channel link. Valid link established to partner card via 914-HDE across the optical link.
D6	Red	Secondary Expansion channel fault. No link established to partner card via 914-HDE across the optical link.
D7	Green	Secondary Expansion channel link. Valid link established to partner card via 914-HDE across the optical link.

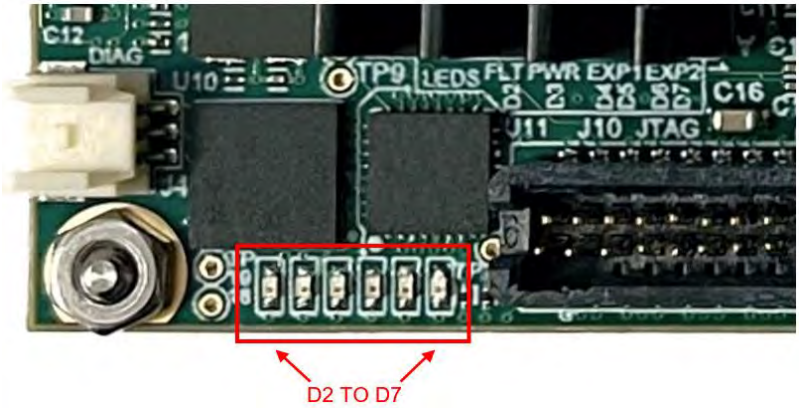


Figure 6-34: 914-EX Diagnostic LED Locations

6.2.5 914-EX Diagnostic LED Header

The 914-EX card includes a 10-pin header capable of driving eight LEDs. This is useful for LED integration into an enclosure. Each LED pin is driven low to turn on an LED, and includes a 267 Ω series resistor to limit the current draw. Maximum current draw is 8 mA. Refer to Section 4.7 for a sample connection diagram.

The LED header is FCI P/N 20021521-00010T1LF, and the mating part is FCI P/N 20021444-00010T1LF. This can be used with most 0.050" (1.27mm) spacing ribbon cables.

Table 6-17: 914-EX Diagnostic LED Header Pinout

PIN	NAME	DESCRIPTION
1	3.3V	3.3V. This pin can be used to drive the LEDs, Maximum current is 0.5A.
2	EXPANSION 1 LINK	Primary Expansion channel link. Valid link established to partner card via 914-HDE across the optical link. Active low.
3	EXPANSION 1 FAULT	Primary Expansion channel fault. No link established to partner card via 914-HDE across the optical link. Active low.
4	EXPANSION 2 LINK	Secondary Expansion channel link. Valid link established to partner card via 914-HDE across the optical link. Active low.
5	EXPANSION 2 FAULT	Secondary Expansion channel fault. No link established to partner card via 914-HDE across the optical link. Active low.
6	ETHERNET PORT 1 ACTIVITY	Activity present on Ethernet Port 1. Active low.
7	ETHERNET PORT 1 LINK	Ethernet Port 1 is linked. Active low.
8	ETHERNET PORT 2 ACTIVITY	Activity present on Ethernet Port 2. Active low.
9	ETHERNET PORT 2 LINK	Ethernet Port 2 is linked. Active low.
10	GND	Ground, non-isolated, connected to 914-HDE input voltage ground.

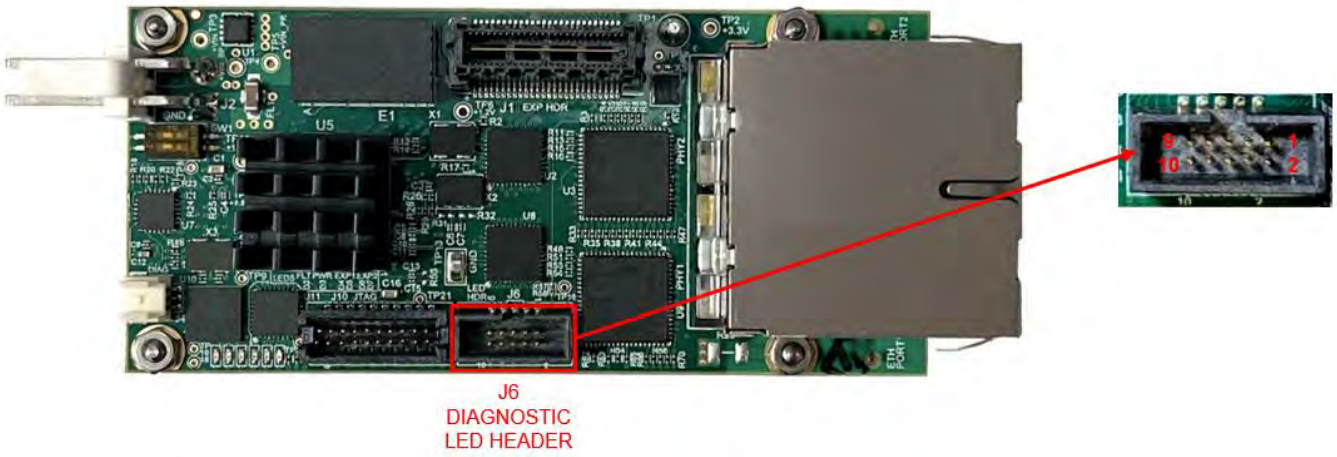


Figure 6-35: 914-EX Diagnostic LED Header

6.2.6 914-EX Expansion Channel Configuration

Up to four 914-EX cards giving up to eight additional Ethernet ports may be stacked on each 914-HDE, depending on available optical bandwidth. Dip switch SW1 configures which 914-HDE medium speed (MS) expansion channel the expansion card uses. The card closest to the 914-HDE must be configured for MS expansion Channel 1, with each subsequent card configured for the next channel in succession. No channels may be skipped, however when using the 914-EX in dual expansion mode, the card will occupy 2 MS channels in the stack.

Low Speed (LS) and Medium Speed (MS) expansion channels are independent. MS cards should be stacked on the 914-HDE first, and LS cards last.

Table 6-18: 914-EX Expansion Channel Configuration

SW1		SETTING
1	2	
OFF	OFF	MS Expansion Channel 1
ON	OFF	MS Expansion Channel 2
OFF	ON	MS Expansion Channel 3
ON	ON	MS Expansion Channel 4

Figure 6-36: 914-EX Diagnostic LED Header

Figure 6-37: 914-EX SW1 Position and Orientation

6.2.7 914-EX Status Page

To view the status of a 914-EX card, connect the console 914-HDE to the 914-X Series Unified Diagnostic GUI via a local COM port. Ensure a stable optical link is present and the cards are stacked together in the correct order with the correct expansion settings as per the previous section.

By hovering over and selecting a near or far EX tile within the Diagnostic GUI's stack view, an EX status page for that expansion slot will be opened. This page contains relevant information regarding the near (left) and far (right) EX cards located in the specified expansion slot. Figure 6-38 showcases an example stack where the MS1 slot is occupied by a pair of EX cards. Selecting either of the two tiles will navigate the user to the EX status page for the MS1 slot.

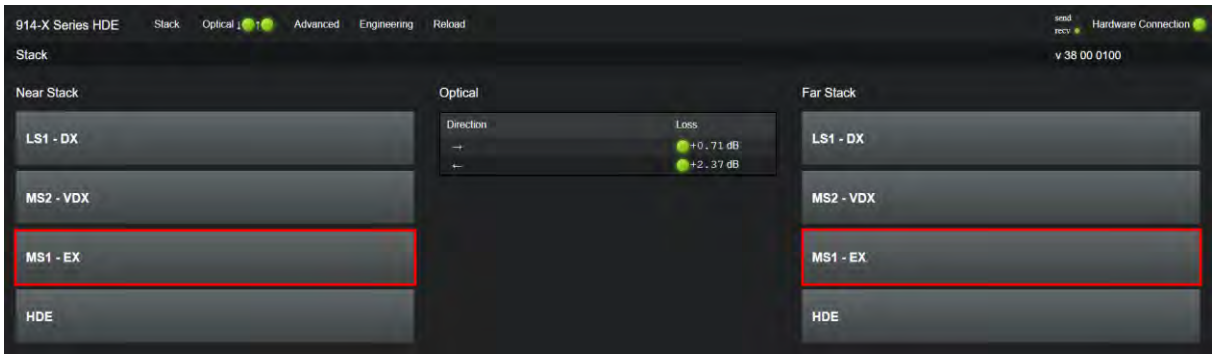


Figure 6-38: 914-EX Diagnostic Status Selection

Figure 6-39: 914-EX Status Page Overview

Generic card information (such as the serial number or hardware revision) can be found in the *Card Details* table.

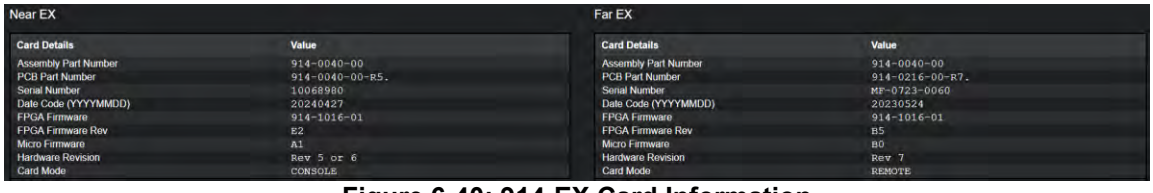


Figure 6-40: 914-EX Card Information

Below these are the voltages and temperatures. A green LED indicates that the observed status value is within the expected range. Red LEDs indicate potential problems that need to be addressed, and yellow LEDs give warnings. Low and high limits clarify the value at which the LEDs will turn red.

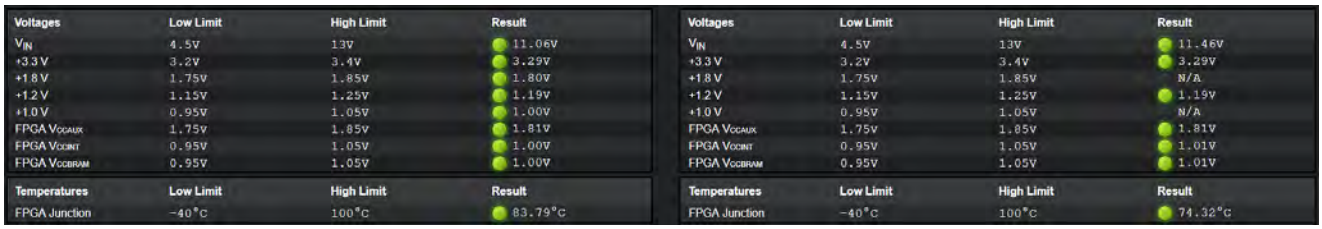


Figure 6-41: 914-EX Voltage and Junction Temperature Information

Figure 6-42 shows the expansion link details.

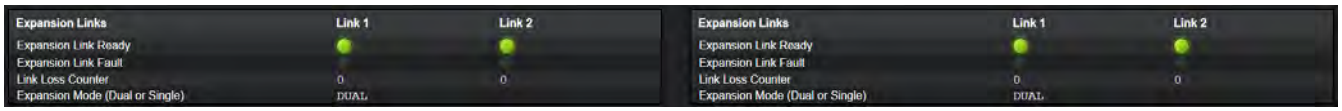


Figure 6-42: 914-EX Expansion Link Information

Figure 6-43 shows the details and status of each Ethernet port.

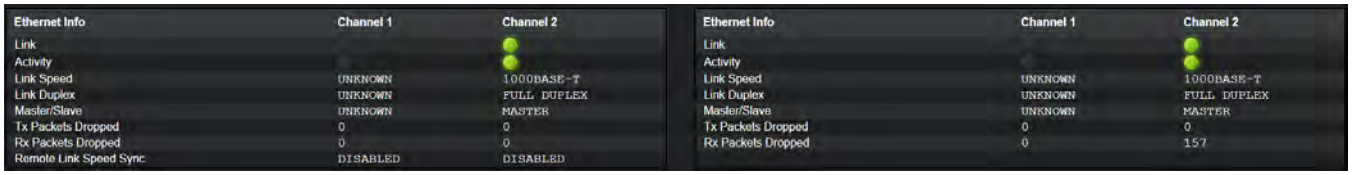


Figure 6-43: 914-EX Ethernet Information

Figure 6-44 shows the status of each of the LED headers.

Figure 6-44: 914-EX LED Header Information

Figure 6-45 shows the subheader, located directly below the main header. The expansion type and number are displayed on the left side; in this instance, it is the medium speed expansion slot #1. The “Back” button returns the user to the stack view. Pressing “Modify EX Settings” will bring the user to the EX settings page (see Section 6.2.8). The remaining options reset all statistics stored in the near and far EX (link loss counts, for example) respectively.

Figure 6-45: 914-EX Sub-Header

Additional EX Ethernet Statistic information for attached cards can be found at the bottom of the Engineering page (see Section 5.7). This table only displays if at least one EX card pair is connected to the stack.

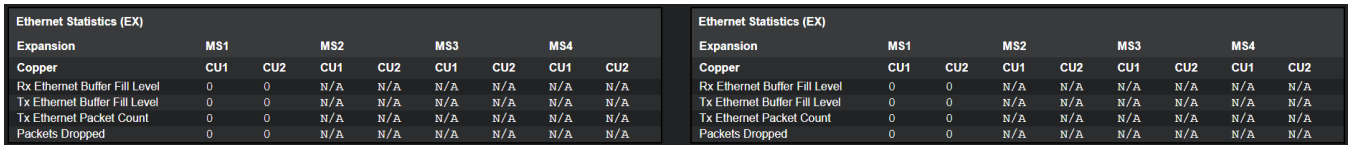


Figure 6-46: 914-EX Engineering Statistic Information

6.2.8 914-EX Settings Page

By default, all 914-EX cards are shipped with these settings:

- Remote configuration;
- Single Expansion mode;
- Both Ethernet ports set to auto-negotiate all speeds (10/100/1000M) and duplex settings (full/half);
- Remote Ethernet Link Speed Synchronization enabled.

To change configuration, connect the console 914-HDE to the 914-X Series Unified Diagnostic GUI via a local COM port. Ensure a stable optical link is present and the cards are stacked together in the correct order with the correct expansion settings as per Section 6.2.6. To get to the 914-EX settings page, navigate to the stack view and select either of the tiles labelled “EX” in the proper expansion slot.

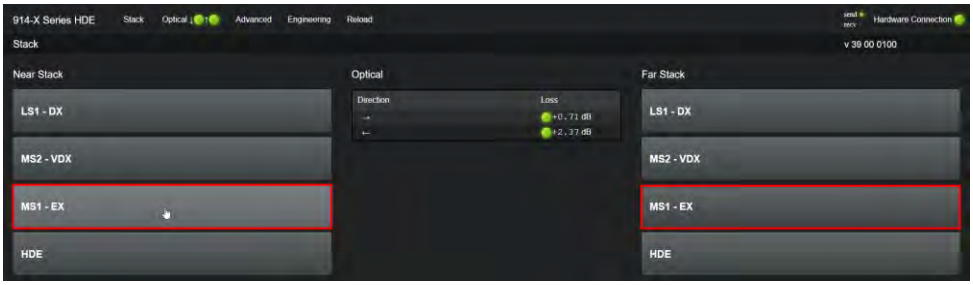


Figure 6-47: 914-EX Diagnostic Status Selection

Select the “Modify EX Settings” option to open the EX settings page.

Figure 6-48: 914-EX Diagnostic Settings Selection

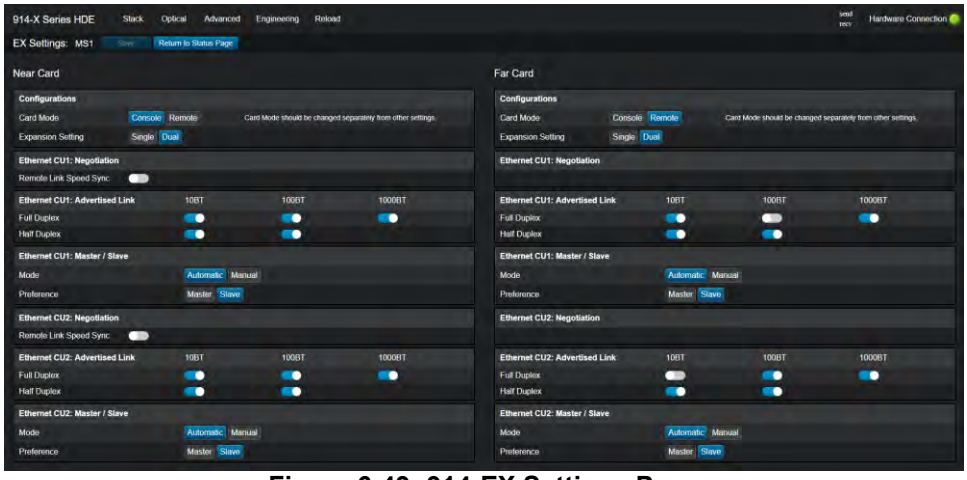


Figure 6-49: 914-EX Settings Page

Upon loading or refreshing the settings page, the data fields are automatically populated with the current configurations of the near (left) and far (right) 914-EX cards. System Status is not refreshed while in the settings page. Users should not anticipate the send/receive LEDs on the header to be active unless they are in the process of a save or they are loading the page. Additionally, the remote warning border and optical status LEDs on the header are not displayed on this page.

Settings are displayed in three formats: segmented buttons, toggles, and text boxes. Segmented boxes permit a single selection from multiple options (selected by hovering over and pressing the option of choice), with the active value highlighted in blue. Text boxes allow for custom inputs (by pressing on them and typing in a number). Toggles indicate an off state (to the left, white in color) or an on state (to the right, blue in color), and can be toggled by hovering over and pressing them. Figure 6-50 below illustrates examples of the three possible setting display types. The Timeout option (seen on the left) uses segmented buttons and is currently set to "Programmable". The Custom Timeout value (seen in the middle) is currently set to 0, displayed in a text box. The Termination option (seen on the right) is represented by a toggle, which is currently disabled.

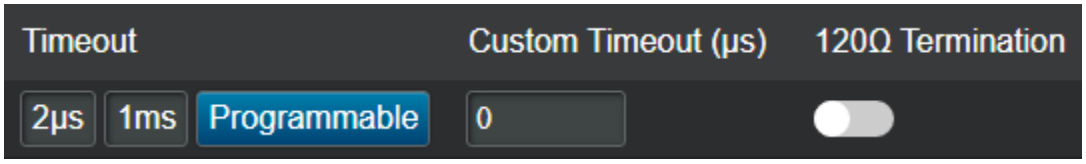


Figure 6-50: 914-EX Data Field Types

Located beneath the main header is the settings page's subheader. The “Save” button will prompt the user to confirm their action and subsequently save board settings on the page to the attached EX cards. This button is only clickable if the user has proposed changes to the settings. The "Return to Status Page" button navigates the user back to the EX status page. To the right of this button is the loading icon, which only appears when the page is loading and when settings are being saved. The page is disabled while settings are being saved.

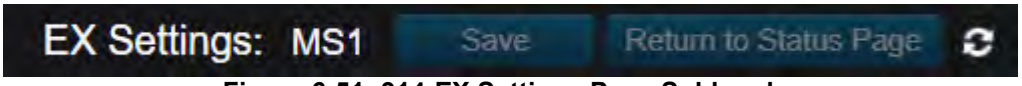


Figure 6-51: 914-EX Settings Page Subheader

Modified settings that have not yet to be saved to the EX cards are highlighted with a red border and will revert to their original values if the page is reloaded before saving. All settings on the page can be modified and saved simultaneously, apart from card mode, which should be changed independently, if at all. **Allow up to twenty-five seconds for all proposed changes to be applied to the EX cards**. If proposed changes are not being applied when saving, refer to item #4 in Section 14.0.

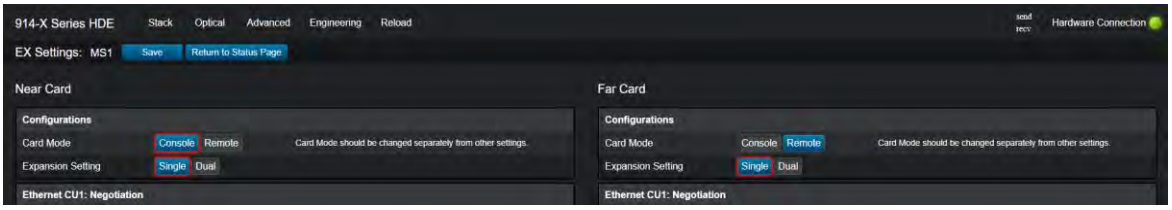


Figure 6-52: 914-EX Unsaved Settings

6.2.8.1 914-EX General Configuration

Figure 6-53 shows how to configure the 914-EX card mode settings. These settings are non-volatile and do not need to be reconfigured each time the 914-EX is powered. **The near side should always be configured as a console, while the far side should always be configured as a remote**. Card Mode should be adjusted and saved separately from other settings. Once configured correctly, card mode typically does not require further changes. If adjustments are necessary, they should be made independently of other settings. Once the desired settings are selected, press "Save" and confirm to apply them to the board.

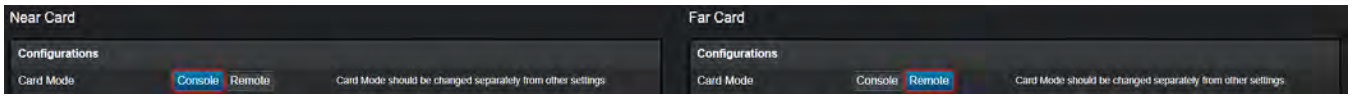


Figure 6-53: 914-EX Card Mode Configuration

Figure 6-54 shows how to configure the expansion mode. Selecting "Dual" will give each Ethernet port 1000 Mb/s of bandwidth, while "Single" will share 1000 Mb/s of bandwidth between both ports. These settings are non-volatile and do not need to be reconfigured each time the 914-EX is powered. Once the desired settings are selected, press "Save" and confirm to apply them to the board.

Figure 6-54: 914-EX Expansion Mode Configuration

6.2.8.2 914-EX Ethernet Configuration

Figure 6-55 shows how to configure the Ethernet port negotiation, advertised link, and master/slave settings for CU1 (top) and CU2 (bottom). These settings are non-volatile and do not need to be reconfigured each time the 914-EX is powered. By default, the system will auto-negotiate to the highest possible speed. Configuring these settings can be useful to ensure both the console and remote ends negotiate to the same speed and duplex, if they do not automatically do this upon startup.

Ethernet link speed mismatches should be avoided. Typically, newer PCs will link at 1G on the console side and older Ethernet equipment on the remote side might link at 100M. In this case, both the console and remote cards should be set to 100M and the PC should be forced to 100M (the lower speed) to ensure that all elements in the Ethernet link are set at the same speed.

Enabling Remote Link Speed Sync at the console prevents the user from modifying the locally advertised link and master/slave settings. Once the desired settings are selected, press "Save" and confirm to apply them to the board.

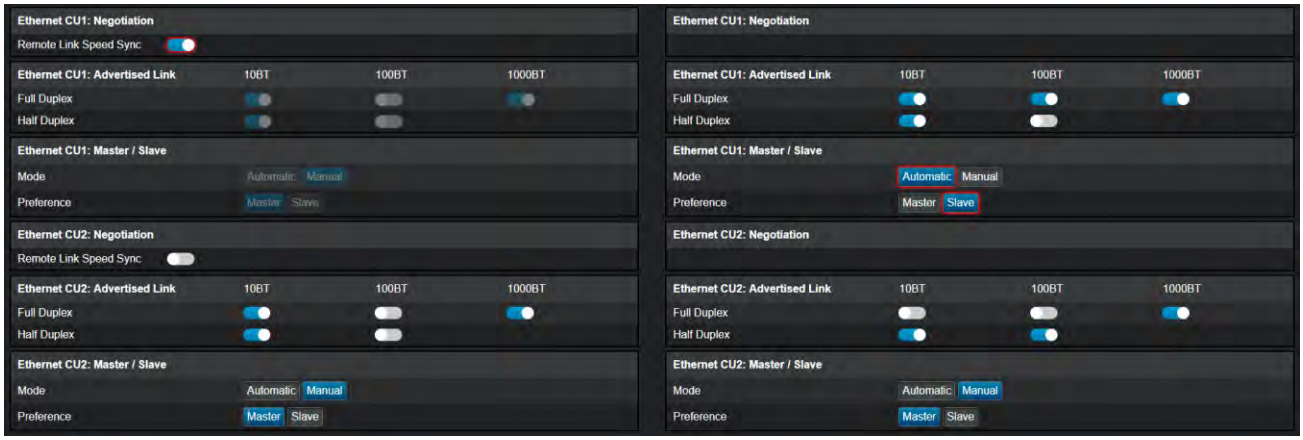


Figure 6-55: 914-EX Ethernet Configuration

6.2.8.2.1 914-EX Forced Ethernet Configurations

Forced negotiation is an outdated setting that is no longer recommended. If enabled on connected hardware, a warning message (as shown in Figure 6-56) will prompt the user to switch to automatic negotiation. Upon doing so, the negotiation mode will be updated, and the setting will disappear. Once the desired settings are selected, press “Save” and confirm to apply them to the board.

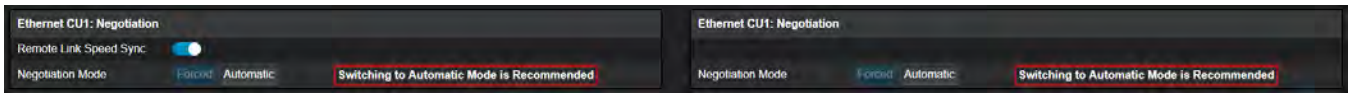


Figure 6-56: 914-EX Forced Ethernet Configuration

6.2.9 Legacy 914-EX Information (Board Rev. 4 and Earlier)

The 914-HDE and expansion cards 914-VDX, 914-EX, 914-DX, and 914-HDV2, were all updated in 2022. Most connector pinouts are the same between old and latest board revisions, however this section describes important details about differences in older revisions of the 914-EX. Any details **not** covered in this section imply no changes between board revisions.

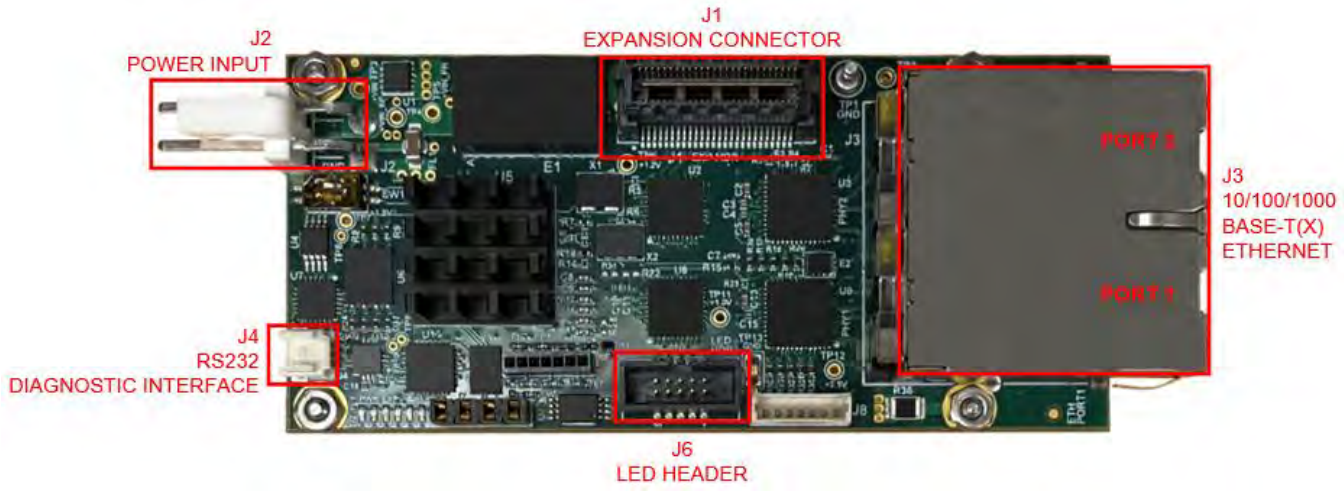


Figure 6-57: 914-EX Top View (Board Revisions 4 and Earlier)

6.2.9.1 Legacy 914-EX Diagnostics Connector

The part used for diagnostics connector J4 was replaced in board revision 3 and is installed on all later revisions. The pinout for the connector is the same between older and new revisions, however, an isolated ground was introduced in board revision 5. Earlier revisions have non-isolated ground. See Figure 4-12 for a diagram of the diagnostic interface cable for older PCBA revisions.

Table 6-19: Legacy 914-EX J4 Pinout

J4 PIN	PIN FUNCTION	
	REV 4 AND EARLIER	REV 5 AND LATER
1	GND	ISO GND
2	TX	TX
3	RX	RX

Table 6-20: Legacy 914-EX Mating Connectors

DESIGNATOR	DESCRIPTION	MFR.	PART NUMBER / FOCAL PN	CRIMP PINS / FOCAL PN
J4 (≤ Board Rev 2)	Diagnostics (Old revs)	Molex	0781720003 / EL-J0579	0781720410 / EL-J0580
J4 (≥ Board Rev 3)	Diagnostics	Molex	0151330306 / EL-J0710	N/A

6.3 914-AX

Card P/N See Section 13.4
Config. Dwg 914-2023-00

The 914-AX (Adaptable Interface Board Expansion) is an adaptor board to provide one data channel which can support a range of AIB (Adaptable Interface Board) modules. These boards provide simple single channel interface add-ons for serial data, sonar data, TTL signals, CAN bus or hydrophones. These ports are multiplexed into the 914-HDE optical data stream. This expansion card bandwidth is included with the baseline 914-HDE bandwidth, and uses one of the four Low Speed (LS) expansion channels on the 914-HDE.

Figure 6-58: 914-AX

Figure 6-59: 914-AX with AIB-232 Module (Example)

Figure 6-59 shows an example where one (1) isolated RS232 channel can be added via the onboard expansion connector to the 914-HDE card. As shown, the small AIB module is plugged on top of the 914-AX card. Access to the isolated RS232 channel is via the 4-pin WAGO connector (shown at the bottom right corner).

6.3.1 914-AX AIB Module Options

Table 6-21: AIB Module Options

MODULE ID	AIB 485	AIB 485	AIB 485	AIB 232	AIB HYDRO	AIB ARCNET	AIB MS900	AIB CANBUS
Signal	RS485	RS422	TTL	RS232	Hydrophone	Tritech ARCNET	MS900 Sonar	CAN bus
AIB Module Part Number	903-0252-00	903-0252-00	903-0252-01	903-0251-00	903-0244-00	903-0261-00	903-0250-00	903-0297-00

Please refer to 700-0271-00 AIB Plug-in Module User Manual for details and configurations.

6.3.2 914-AX AIB Module Installation

When installing an AIB module onto the 914-AX across connectors J5 and J6, ensure the white dots on both the AIB module and the 914-AX line up for proper orientation.

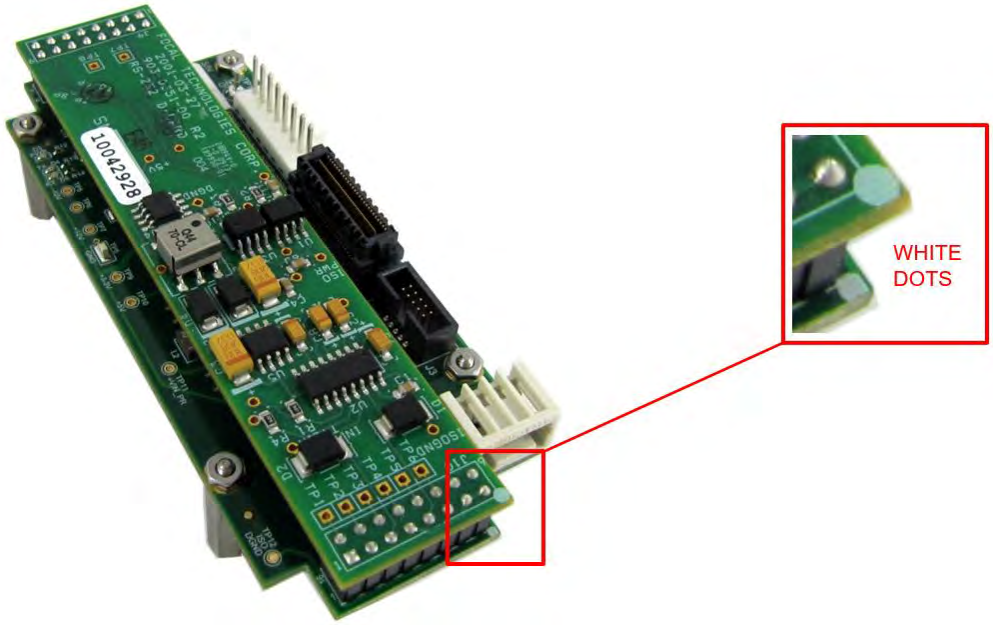


Figure 6-60: AIB Module Orientation

6.3.3 914-AX Interface Connector

The pinout of the WAGO connector P/N 733-364 on the 914-AX card is dependent on the installed AIB module.

Table 6-22: 914-AX Interface Connector Pinouts

PIN	AIB-485 (RS485)	AIB-485 (RS422)	AIB-485 (TTL)	AIB-232 (RS232)	AIB-HYDRO (Analog)	AIB-ARCNET (Tritech)	AIB-MS900 (Sonar)	AIB-CANBUS
1	A (+)	+RX	INPUT	ISOGND	CHASSIS	CHASSIS	CHASSIS	CAN H
2	B (-)	-RX	N/C	RXD	N/C	LAN A	N/C	CAN L
3	N/C	+TX	OUTPUT	TXD	HYDRO-	LAN B	SONAR	BUS (GND)
4	N/C	-TX	ISOGND	CHASSIS	HYDRO+	N/C	SONAR	Shield

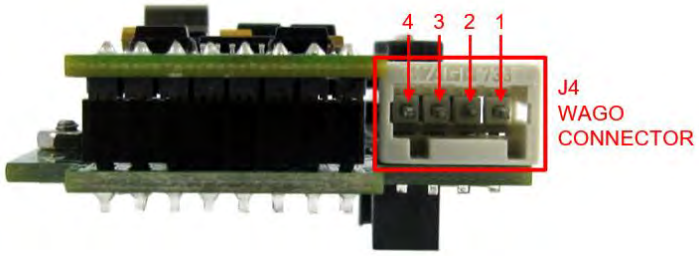


Figure 6-61: 914-AX WAGO Connector

Headers for the external connections are all four-pin, right-angled 733 series WAGO connectors (mating WAGO connectors are P/N 733-104). Pin locations of the WAGO headers are shown in Figure 6-61. Corresponding pins of the mating connector, use cage clamps rather than screw terminals to hold wires in place. External wires should be 20-28 AWG stranded conductors with 0.22” - 0.24” stripped ends. The clamp for each pin can be opened by inserting either a WAGO tool or a small screwdriver in the hole immediately above the wire hole.

Figure 6-62: 914-AX WAGO Connector Mating Plug

6.3.4 914-AX Diagnostic LEDs

The 914-AX card includes three onboard diagnostic LEDs. A description and location of each LED is provided in Table 6-23 and Figure 6-63.

Table 6-23: 914-AX Diagnostic LEDs

LED REF.	COLOUR	DESCRIPTION
D3	Green	Power. Lit when power is received via the expansion connector.
D4	Green	AIB TX data. TX refers to transmit from the 914-AX.
D5	Yellow	AIB RX data. RX refers to receive at the 914-AX.

Figure 6-63: 914-AX Diagnostic LEDs

6.3.5 914-AX Diagnostic LED Header

The 914-AX card includes a 10-pin header capable of driving eight LEDs. This is useful for LED integration into an enclosure. Each LED pin is driven low to turn on an LED, and includes a 267 Ω series resistor to limit the current draw. Maximum current draw is 8 mA. Refer to Section 4.7 for a sample connection diagram.

The LED header is FCI P/N 20021521-00010T1LF, and the mating part is FCI P/N 20021444-00010T1LF. This can be used with most 0.050" (1.27mm) spacing ribbon cables.

Table 6-24: 914-AX Diagnostic LED Header Pinout

PIN	NAME	DESCRIPTION
1	3.3V	3.3V. This pin can be used to drive the LEDs, Maximum current is 0.5A.
2	AIB TX DATA	Data is transmitting from the AIB module. Active low.
3	AIB RX DATA	Data is received at the AIB module. Active low.
4	N/C	N/C
5	N/C	N/C
6	N/C	N/C
7	N/C	N/C
8	N/C	N/C
9	N/C	N/C
10	GND	Ground, non-isolated, connected to 914-HDE input voltage ground.

Figure 6-64: 914-AX Diagnostic LED Header

6.3.7 914-AX Configuration and Diagnostics

The 914-AX does not require any specific configuration, however, the installed AIB module may require configuration. Please refer to the AIB Plug-In Modules User's Manual 700-0271-00 for configuration details specific to the installed AIB module.

Up to four 914-AX with associated AIB modules may be added to a 914-HDE system. The 914-AX closest to the 914-HDE will show up as channel one in the Diagnostic GUI. TX and RX activity may be observed in the 914-HDE status page's "Low Speed Expansion" table (see Section 5.1.4). **The low speed expansion channel which the AX is attached to must be configured as an AX**; for instructions, see Section 5.5.5.

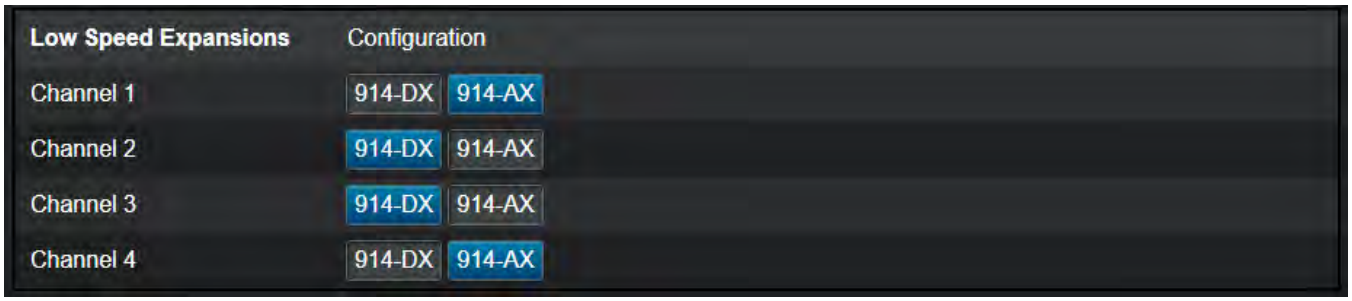


Figure 6-65: 914-AX Configuration Setup

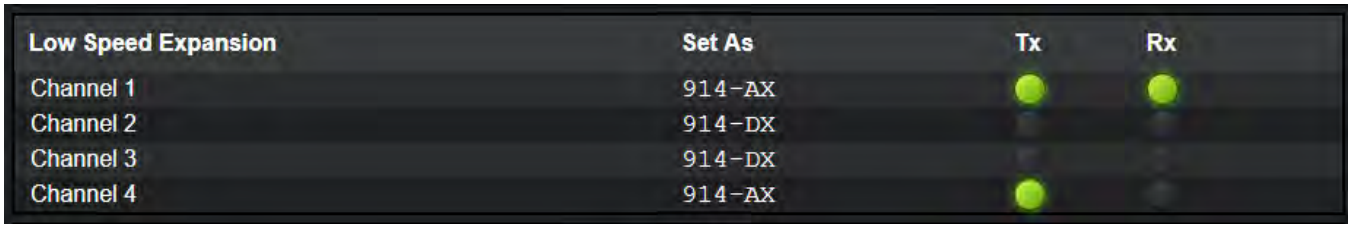


Figure 6-66: 914-AX Data Activity

6.4 914-DX

Card P/N	See Section 13.6
Config. Dwg	914-2021-00

The 914-DX (serial data expansion card) provides six channels of serial data isolated in pairs. The serial channels can be individually configured for RS232, RS485, RS422 or TTL. The 914-DX does not require additional bandwidth from the 914-HDE, as it is already included with the standard 914-HDE bandwidth calculation. Diagnostics from this card are provided to the 914-HDE and are available via the 914-X Series Unified Diagnostic GUI. This expansion card requires one low speed expansion channel on the 914-HDE.

Each serial port can be configured via the 914-X Series Unified Diagnostic GUI for each specific protocol. By default, all ports are set to RS232 at the factory unless a custom configuration is specified. The 914-HDE must be configured to accommodate the 914-DX within the Diagnostic GUI prior to operation.

The maximum baud rate of each channel must not exceed 250 kbaud for reliable communication.

Figure 6-67: 914-DX

6.4.1 914-DX Serial Data Ports

The 914-DX has six serial data ports (isolated in pairs) supporting RS232, RS485, RS422, or TTL signaling protocols. These six protocols may be configured by the user in the field via the 914-X Series Unified Diagnostic GUI. All data rates are supported up to 250 kbaud for each protocol. Each port can support completely independent serial data links with independent baud rates. By default, RS485 and RS422 inputs are terminated differentially with an onboard 120 Ω resistor that can be disabled via software configuration. Latency through the Mux/Demux system is less than 500 µs, not including fiber delays of 5 us/km.

For RS485, which is a half-duplex protocol, a programmable turn-around time is implemented. The default turnaround time (timeout between TX and RX) is set to 1 ms. Serial port settings, including protocol, timeouts, and terminations may be accessed and changed via the 914-X Series Unified Diagnostic GUI.

The serial port connector is Molex Micro-fit P/N 43045-0800. The mating plug is Molex Micro-fit P/N 43025-0800 with Molex crimps P/N 43030-0010. The pinout is detailed in Table 6-26. TX refers to data transmitted from the 914-DX to the external equipment. RX refers to data received into the 914-DX from the external equipment. Data coming into the RS422 RX lines at the remote, for example, will exit from the RS422 TX lines at the console.

Table 6-25: 914-DX Serial Parameters

PROTOCOL	PARAMETER	MIN	TYP	MAX	UNIT
RS232	Input Threshold Voltage	0.6	1.5	2.5	V
	Output Low Voltage	-7.5	-5.7	-5.0	V
	Output High Voltage	5.0	6.2	7.5	V
RS485 / RS422	Differential Output Voltage	1.5	—	6.0	V
	Common Mode Voltage	—	—	3.0	V
	Input threshold Voltage	—	—	± 200	mV
	Terminating Resistor (optional)	108	120	156	Ω
TTL	Output Voltage	0	—	5.0	V
	Input Threshold	2.0	2.5	3.0	V
All Modes	Data Rate	—	—	250	kbaud
	Latency(1)	—	5	—	µs

[1] This is the latency added by the 914-DX, which must be combined with the latency of the 914-HDE serial data and fiber optic delays to give a total latency value.

Table 6-26: 914-DX Serial Data Connector Pinout

REF.	CHANNEL / PIN				MODE			
					RS232	RS485	RS422	TTL
J5 J1 J4	CH1 CH3 CH5	1	CH2 CH4 CH6	5	RS232 RX	RS485+	RS422 RX+	TTL RX
		2		6	ISO GND [2]	ISO GND [2]	RS422 RX-	ISO GND [2]
		3		7	RS232 TX	RS485+	RS422 TX+	TTL TX
		4		8	RS232 TX	RS485-	RS422 TX-	DO NOT CONNECT

[2] Isolated ground is **shared** between the ports

There are two RS232 TX pins and two RS485+ pins depending on the selected protocol. Only connect to one and leave the other disconnected. This hybrid pinout allows for a universal 3-pin option to support both RS232 and RS485.

Figure 6-68: 914-DX Serial Ports (Top View)

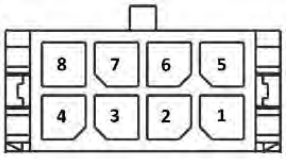


Figure 6-69: 914-DX Molex Micro-fit, P/N 43045-0800

Figure 6-70: 914-DX J4 Front View

Figure 6-71: 914-DX J5, J1 Front Views

6.4.2 914-DX Power

Power to the 914-DX card is provided via the expansion connector J3. Power input connector J3 should ***not*** be used during normal operation with the 914-DX. It can optionally be used for standalone operation during firmware updates or configuration.

If the 914-DX is to be self-powered, this is accomplished via connector J3, Molex P/N 09-75-2024. The mating plug is Molex P/N 26-03-4020 with crimps P/N 08-52-0113. The pinout is provided in the table and figure below.

Table 6-27: 914-DX Power Connector Pinout

PIN #	FUNCTION
1	GND
2	VCC

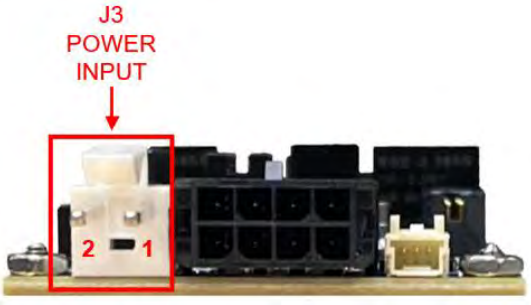


Figure 6-72: 914-DX Factory Power Input Connector Location

The recommended input voltage range is 4.5 VDC to 13.0 VDC (typically +12 VDC regulated). Nominal power consumption is 3 W, increasing to 4 W at 60°C ambient. Power leads should be 18-20 AWG.

The onboard surface mount fuse, F1, is rated to 2A and is not intended to be field replaceable. If the power fuse is blown, the card should be evaluated for damage by the factory or trained service personnel prior to any repair.

6.4.3 914-DX Diagnostic LEDs

The 914-DX card includes sixteen onboard diagnostic LEDs. A description and location of each LED is provided in Table 6-28 and Figure 6-73.

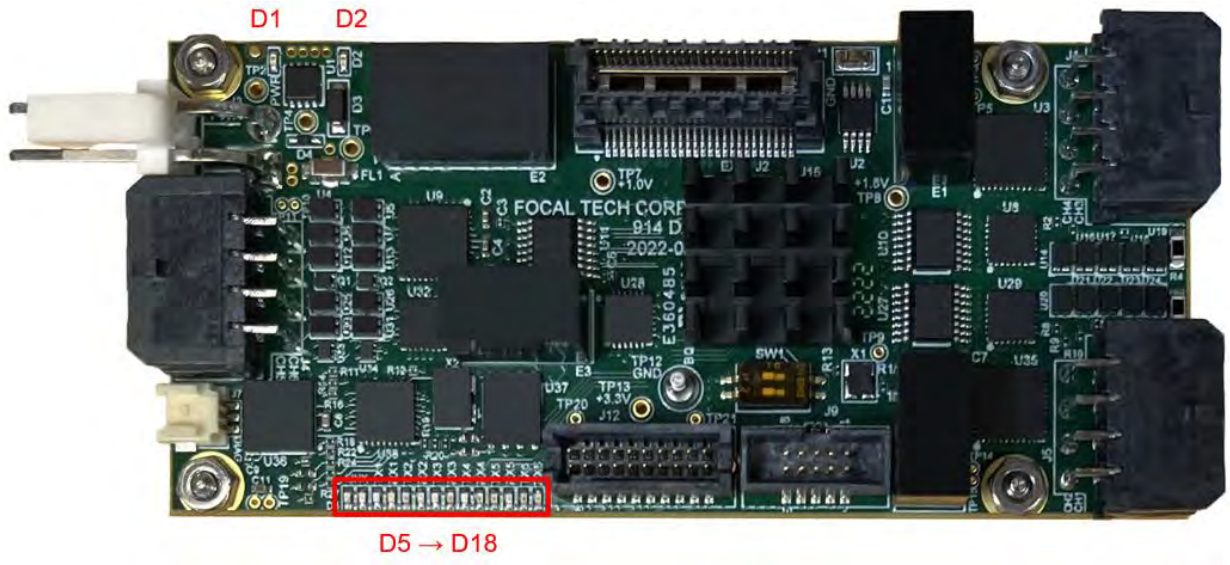


Figure 6-73: 914-DX Diagnostic LED Locations

Table 6-28: 914-DX LEDs

REF.	COLOUR	FUNCTION
D1	GREEN	Power Good
D2	RED	Power Fault
D5	GREEN	Expansion Link Valid
D6	RED	Expansion Link Fault
D7	GREEN	Serial Channel 1 TX Activity
D8	YELLOW	Serial Channel 1 RX Activity
D9	GREEN	Serial Channel 2 TX Activity
D10	YELLOW	Serial Channel 2 RX Activity
D11	GREEN	Serial Channel 3 TX Activity
D12	YELLOW	Serial Channel 3 RX Activity
D13	GREEN	Serial Channel 4 TX Activity
D14	YELLOW	Serial Channel 4 RX Activity
D15	GREEN	Serial Channel 5 TX Activity
D16	YELLOW	Serial Channel 5 RX Activity
D17	GREEN	Serial Channel 6 TX Activity
D18	YELLOW	Serial Channel 6 RX Activity

6.4.4 914-DX Diagnostic LED Header

The 914-DX card includes a 10-pin header capable of driving eight LEDs. This is useful for LED integration into an enclosure. Each LED pin is driven low to turn on an LED, and includes a 267 Ω series resistor to limit the current draw. Maximum current draw is 8 mA. Refer to Section 4.7 for a sample connection diagram.

The LED header is FCI P/N 20021521-00010T1LF, and the mating part is FCI P/N 20021444-00010T1LF. This can be used with most 0.050" (1.27mm) spacing ribbon cables.

Table 6-29: 914-DX Diagnostic LED Header Pinout

PIN	NAME	DESCRIPTION
1	3.3V	3.3V. This pin can be used to drive the LEDs, Maximum current is 0.5A.
2	SERIAL CH1 ACTIVITY	Activity detected in either direction for serial CH1.
3	SERIAL CH2 ACTIVITY	Activity detected in either direction for serial CH2.
4	SERIAL CH3 ACTIVITY	Activity detected in either direction for serial CH3.
5	SERIAL CH4 ACTIVITY	Activity detected in either direction for serial CH4.
6	SERIAL CH5 ACTIVITY	Activity detected in either direction for serial CH5.
7	SERIAL CH6 ACTIVITY	Activity detected in either direction for serial CH6.
8	EXPANSION LINK	Expansion channel link. Valid link established to partner card via 914-HDE across the optical link. Active low.
9	EXPANSION FAULT	Expansion channel fault. No link established to partner card via 914-HDE across the optical link. Active low.
10	GND	Ground, non-isolated, connected to 914-HDE input voltage ground.

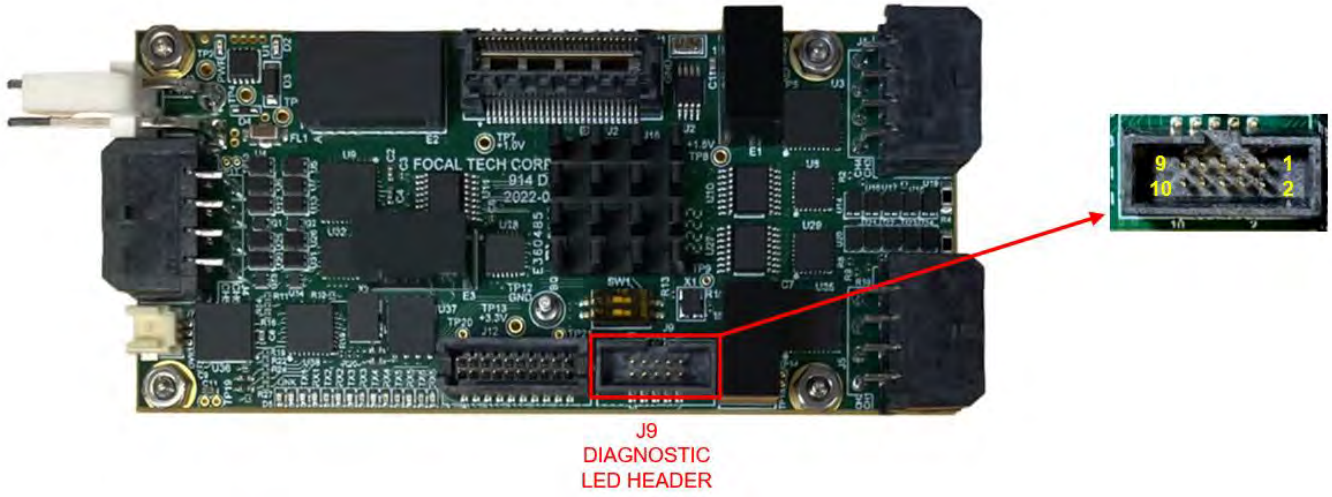


Figure 6-74: 914-DX Diagnostic LED Header

6.4.5 914-DX Expansion Channel Configuration

Up to four 914-DX cards may be stacked on each 914-HDE, providing up to 24 additional serial ports. Dip switch SW1 configures which 914-HDE expansion channel each expansion card uses. The card closest to the 914-HDE must be configured for Low Speed (LS) expansion Channel 1, with each subsequent card configured for the next channel in succession. No channels may be skipped.

Low Speed (LS) and Medium Speed (MS) expansion channels are independent. MS cards should be stacked on the 914-HDE first, and LS cards last.

Table 6-30: 914-DX Expansion Channel Configuration

SW1		Setting
1	2	
OFF	OFF	LS Expansion Channel 1
ON	OFF	LS Expansion Channel 2
OFF	ON	LS Expansion Channel 3
ON	ON	LS Expansion Channel 4

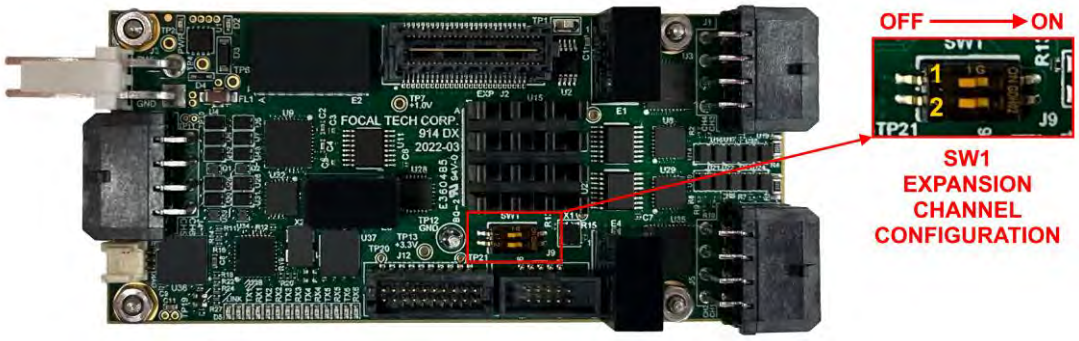


Figure 6-75: 914-DX Expansion Channel Configuration Switch SW1

Figure 6-76: 914-DX SW1 Position and Orientation

6.4.6 914-DX Status Page

To view the status of a DX card, connect the console 914-HDE to the 914-X Series Unified Diagnostic GUI via a local COM port. Ensure a stable optical link is present and the cards are stacked together in a correct order with the correct expansion settings as per the previous section.

By hovering over and selecting a near or far DX tile within the Diagnostic GUI's stack view, a DX status page for that expansion slot will be opened. This page contains relevant information regarding the near (left) and far (right) DX cards located in the specified expansion slot. Figure 6-77 showcases an example stack where the LS1 slot is occupied by a pair of DX cards. Selecting either of the two tiles will navigate the user to the DX status page for the LS1 slot.

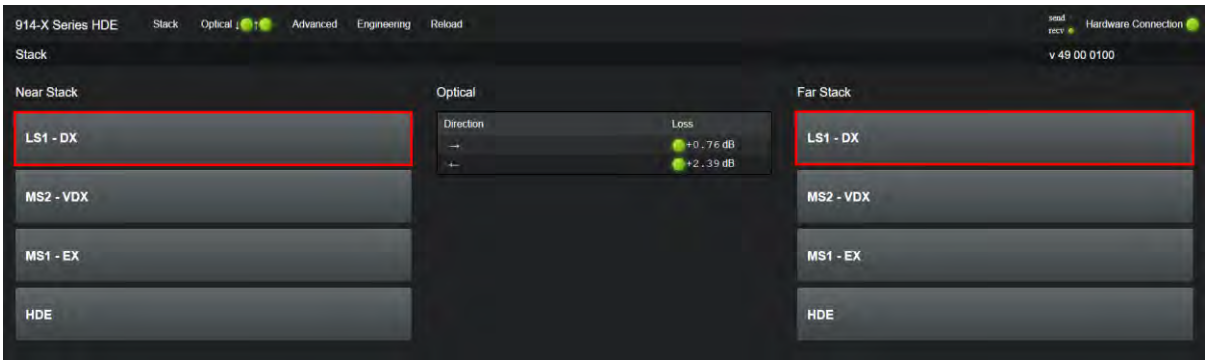


Figure 6-77: 914-DX Diagnostic Status Selection

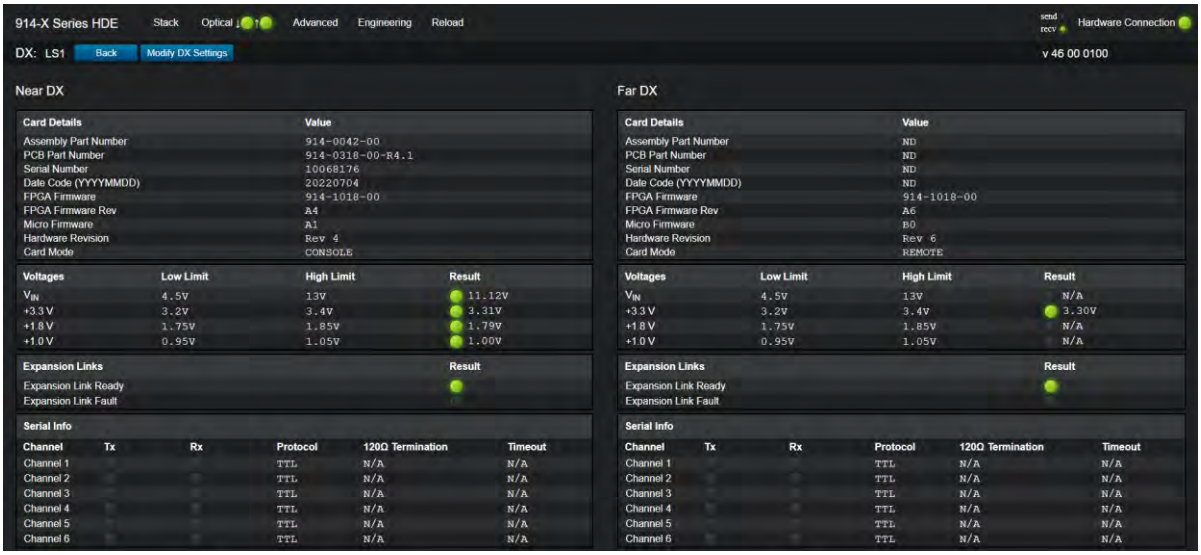


Figure 6-78: 914-DX Status Page Overview

Generic card information (such as the serial number or hardware revision) can be found in the *Card Details* table.

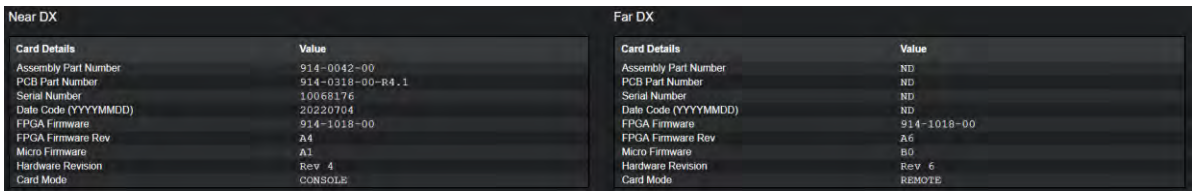


Figure 6-79: 914-DX Card Information

Below this are the DX voltages. A green LED indicates that the observed status value is within the expected range. Red LEDs indicate potential problems that need to be addressed. Low and high limits clarify the value at which the LEDs will turn red.

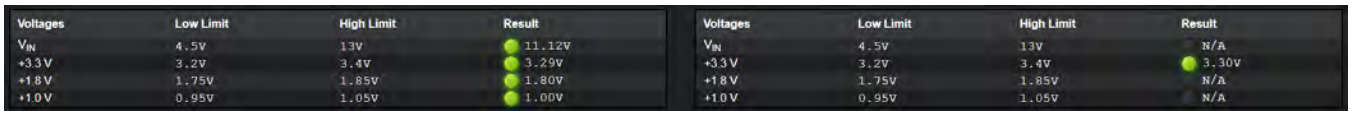


Figure 6-80: 914-DX Voltage Information

Figure 6-81 shows the expansion link details.

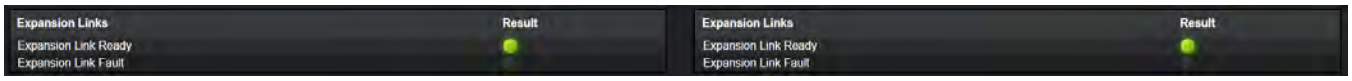


Figure 6-81: 914-DX Expansion Link Information

Figure 6-82 shows the details and status of each serial channel.

Figure 6-82: 914-DX Serial Information

Figure 6-83 shows the status of each of the LED headers.

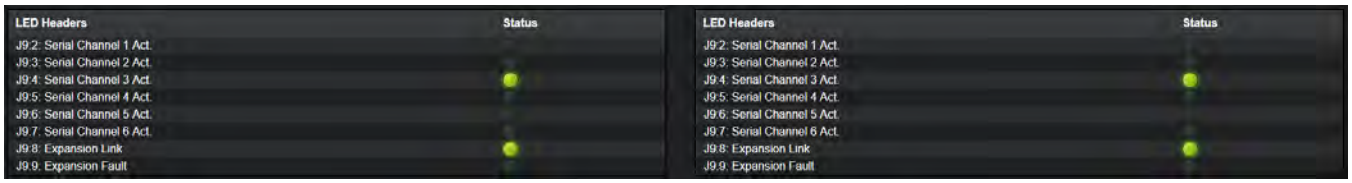


Figure 6-83: 914-DX LED Header Information

Figure 6-84 shows the subheader, located directly below the main header. The expansion type and number are displayed on the left side; in this instance, it is the low speed expansion slot #1. The “Back” button returns the user to the stack view. Pressing “Modify DX Settings” will bring the user to the DX settings page (see Section 6.4.7).

Figure 6-84: 914-DX Sub-Header

6.4.7 914-DX Settings Page

By default, all 914-DX cards are shipped with these settings:

- Remote configuration;
- All serial channels set to RS232.

To change configuration, connect the console 914-HDE to the 914-X Series Unified Diagnostic GUI via a local COM port. Ensure a stable optical link is present and the cards are stacked together in the correct order with the correct expansion settings as per Section 6.4.5. To get to the 914-DX settings page, navigate to the stack view and select either of the tiles labelled “DX” in the proper expansion slot.

Figure 6-85: 914-DX Diagnostic Status Selection

Select the “Modify DX Settings” option to open the DX settings page.

Figure 6-86: 914-DX Diagnostic Settings Selection

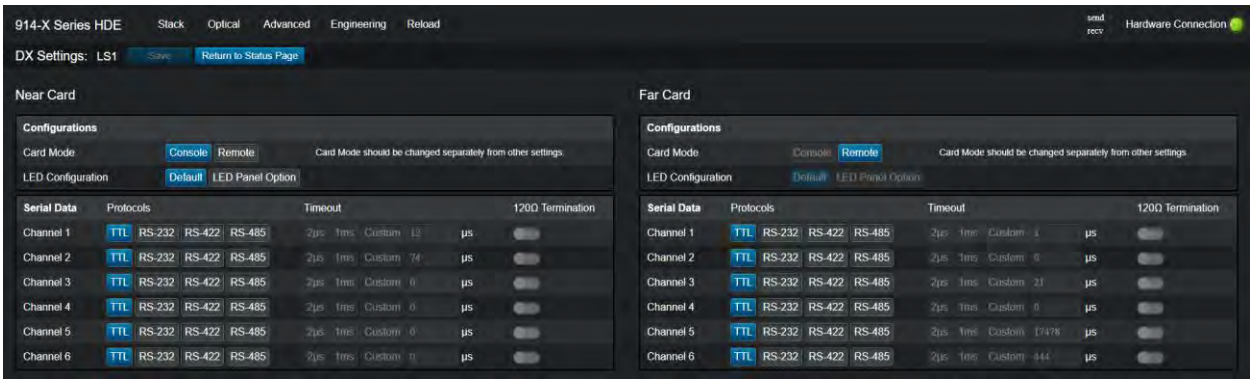


Figure 6-87: 914-DX Settings Page

Upon loading or refreshing the settings page, the data fields are automatically populated with the current configurations of the near (left) and far (right) 914-DX cards. System Status is not refreshed while in the settings page. Users should not anticipate the send/receive LEDs on the header to be active unless they are in the process of a save or they are loading the page. Additionally, the remote warning border and optical status LEDs on the header are not displayed on this page.

Settings are displayed in three formats: segmented buttons, toggles, and text boxes. Segmented boxes permit a single selection from multiple options (selected by hovering over and pressing the option of choice), with the active value highlighted in blue. Text boxes allow for custom inputs (by pressing on them and typing in a number). Toggles indicate an off state (to the left, white in color) or an on state (to the right, blue in color), and can be toggled by hovering over and pressing them. Figure 6-88 below illustrates examples of the three possible setting display types. The Timeout option (seen on the left) uses segmented buttons and is currently set to "Programmable". The Custom Timeout value (seen in the middle) is currently set to 0, displayed in a text box. The Termination option (seen on the right) is represented by a toggle, which is currently disabled.

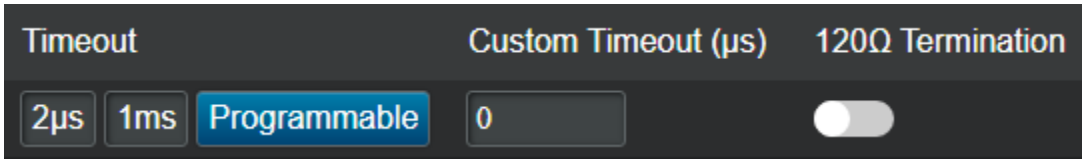


Figure 6-88: 914-DX Data Field Types

Located beneath the main header is the settings page's subheader. The “Save” button will prompt the user to confirm their action and subsequently save board settings on the page to the attached DX cards. This button is only clickable if the user has proposed changes to the settings. The "Return to Status Page" button navigates the user back to the DX status page. To the right of this button is the loading icon, which only appears when the page is loading and when settings are being saved. The page is disabled while settings are being saved.

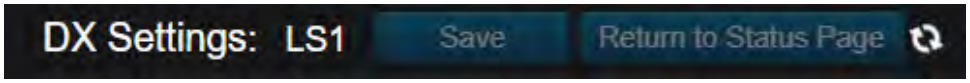


Figure 6-89: 914-DX Settings Page Subheader

Modified settings that have not yet to be saved to the DX cards are highlighted with a red border and will revert to their original values if the page is reloaded before saving. All settings on the page can be modified and saved simultaneously, apart from card mode, which should be changed independently, if at all. **Allow up to thirty seconds for all proposed changes to be applied to the DX cards**. If proposed changes are not being applied when saving, refer to item #4 in Section 14.0.

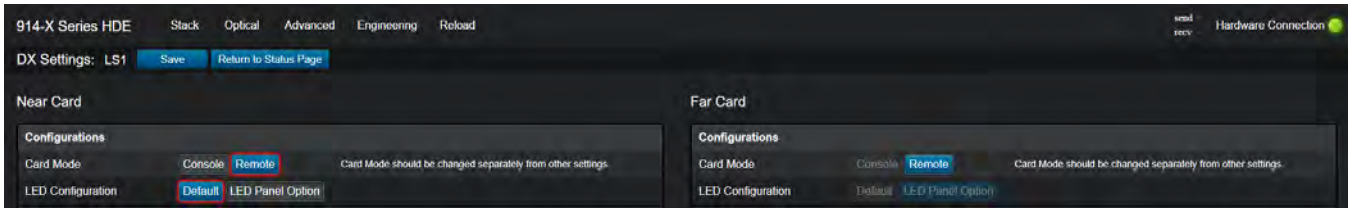


Figure 6-90: 914-DX Unsaved Settings

6.4.7.1 914-DX General Configuration

Figure 6-91 shows how to configure the 914-DX card mode settings. These settings are non-volatile and do not need to be reconfigured each time the 914-DX is powered. **The near side should always be configured as a console, while the far side should always be configured as a remote**. Card Mode should be adjusted and saved separately from other settings. Once configured correctly, card mode typically does not require further changes. If adjustments are necessary, they should be made independently of other settings. Once the desired settings are selected, press “Save” and confirm to apply them to the board.

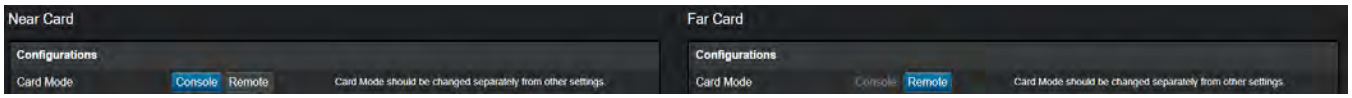


Figure 6-91: 914-DX Card Mode Configuration

Figure 6-92 shows the LED panel configuration option. The selected option will modify the LED header display (the sequence in which LEDs are shown).

Figure 6-92: 914-DX LED Panel Configuration

Note that both the card mode and LED panel configuration settings can only be modified on the near (console) side. If the far card is configured as a console, however, it can be reconfigured as a remote. Adjusting the LED panel option will configure it for both sides.

6.4.7.2 914-DX Serial Configuration

Figure 6-93 shows how to configure each serial port. Select the desired protocol and, if applicable, choose the termination and/or timeout settings. Additionally, a custom timeout value can be entered if the programmable timeout setting is enabled. If a protocol does not support termination or timeout, these options will be disabled. These settings are non-volatile and do not need to be reconfigured each time the 914-DX is powered. Once the desired settings are selected, press “Save” and confirm to apply them to the board.

Typical settings (Refer to Section 6.4.1):

- RS485: 1 ms timeout; terminations enabled
- RS422: Terminations enabled
- RS232: No options
- TTL: No options

Figure 6-93: 914-DX Serial Configuration

6.4.8 Legacy 914-DX Information (Board Rev. 3.3 and Earlier)

The 914-HDE and expansion cards 914-VDX, 914-EX, 914-DX, and 914-HDV2, were all updated in 2022. Most connector pinouts are the same between old and latest board revisions, however this section describes important details about differences in older revisions of the 914-DX. Any details **not** covered in this section imply no changes occurred between board revisions.

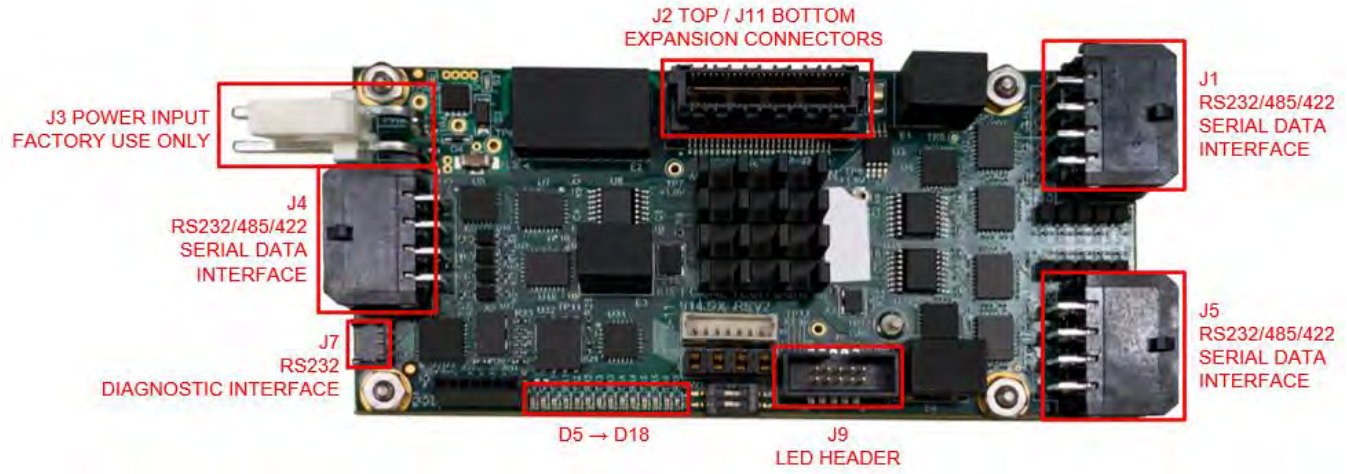


Figure 6-94: 914-DX Top View (Board Revisions 3 and Earlier)

6.4.8.1 Legacy 914-DX Diagnostics Connector

The part used for diagnostics connector J7 was replaced in board revision 3 and is installed on all later revisions. The pinout for the connector is the same between older and new revisions, however, an isolated ground was introduced in board revision 4. Earlier revisions have non-isolated ground. See Figure 4-12 for a diagram of the diagnostic interface cable for older PCBA revisions.

Table 6-31: Legacy 914-DX J7 Pinout

PIN	PIN FUNCTION	
	REV 3 AND EARLIER	REV 4 AND LATER
1	GND	ISO GND
2	TX	TX
3	RX	RX

Table 6-32: Legacy 914-DX Mating Connectors

DESIGNATOR	DESCRIPTION	MFR.	PART NUMBER / FOCAL PN	CRIMP PINS / FOCAL PN
J7 (≤ Board Rev 2)	Diagnostics (Old revs)	Molex	0781720003 / EL-J0579	0781720410 / EL-J0580
J7 (≥ Board Rev 3)	Diagnostics	Molex	0151330306 / EL-J0710	N/A

6.4.8.2 Legacy 914-DX Serial Data

Refer to the table below for details.

Table 6-33: Legacy 914-DX Serial Data Connector Pinout

REF.	CHANNEL / PIN				MODE			
					RS232	RS485	RS422	TTL
J5	CH1	1	CH2	5	RS232 RX	NC(1)	RS422 RX+	TTL RX
J1	CH3	2	CH4	6	ISO GND	ISO GND	RS422 RX-	ISO GND
		3		7	NC(1)	RS485+	RS422 TX+	TTL TX
J4	CH5	4	CH6	8	RS232 TX	RS485-	RS422 TX-	NC(1)

[1] NC = Do not connect. See Table 6-26 for the latest serial data connector pinout details.

6.5 Custom 914-X Series

The 914-HDE expansion connector has been designed to support future upgrades and additions of new 914-X Series cards that can be developed moving forward to support other types of electrical signals or protocols. Please contact Moog Focal to discuss other applications or custom board needs.

7.0 914 Media Converters

Media converters provide conversion of high bandwidth signals to fiber on a 1:1 basis. These are useful additions to systems as upgrades, or act as standalone optical converters for simple systems with only a single data type.

Media converter cards may be added to a 914-HDE system using the same standoffs and 21/32” (16.67 mm) spacing as other 914-HDE system cards when directly stacked together. Media converter cards do not require an electrical link to 914-HDE system cards, or other media converter cards other than the fiber optic link when using a CWDM module.

7.1 914-HDV2

Card P/N	See Section 13.7
Config. Dwg	914-2018-00

The Moog Focal Model 914-HDV2 is a standalone media converter solution for one or two 3G/HD/SD-SDI video feeds per card. This card has the same form factor and mounting requirements as the rest of the 914-X Series, and can have the optical signals combined with a 914-HDE system via available optical CWDM cards.

The compact size and high optical budget make the 914-HDV2 an ideal solution for long distance transmission of uncompressed low latency video signals. 4K video over dual link 3G-SDI is supported using a single 914-HDV2, and multiple 914-HDV2 cards may be combined for transmission of 4K video over quad link 3G-SDI.

Diagnostic information for the 914-HDV2 can be accessed through the 914-X Series Unified Diagnostic GUI. Configuration is not performed through the GUI; instead, dip switches are used to configure the card.

Figure 7-1: 914-HDV2

Figure 7-2: 914-HDV2 Interface Locations

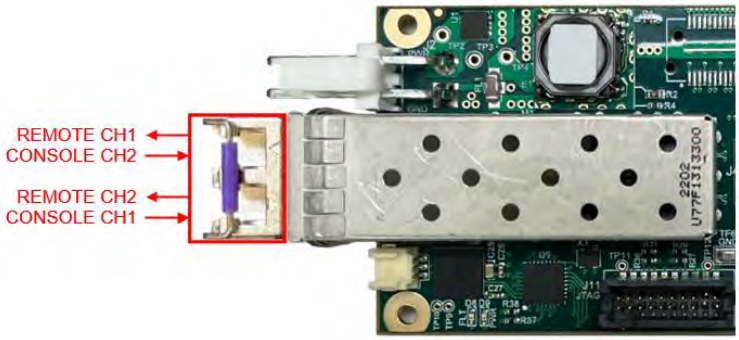


Figure 7-3: 914-HDV2 J4 Optical Transceiver Directions

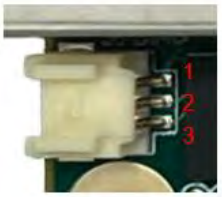


Figure 7-4: 914-HDV2 J6 Diagnostic Connector

7.1.1 914-HDV2 Video Connections

The 914-HDV2 card has two video ports, supporting 3G/HD/SD-SDI video conforming to SMPTE 259M-C, SMPTE 292M, and SMPTE 424M. On the remote card the video channels are inputs, and on the console they are outputs.

The connectors are a Mini SMB jack, Amphenol P/N 142146-75. Recommended mating plug is Cinch P/N 131-8403-101, although other 75 Ω Mini SMB plugs may be suitable. Cabling should be RG-179, 75 Ω coaxial type. Video latency through the media converter system is less than 1 µs, not including fiber delays of 5 us/km.

Figure 7-5: 914-HDV2 Mini SMB Jack - Amphenol P/N 142146-75

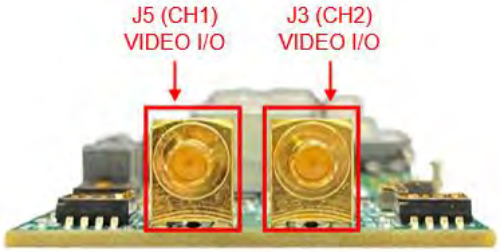


Figure 7-6: 914-HDV2 Video I/O Locations

7.1.2 914-HDV2 Optical Connections

914-HDV2 cards typically use dual transmitter optics at the remote end, and dual receivers at the console. Note that the channel nomenclature is inverted when switching configurations. For single channel 914-HDV2 configurations, the CH1 location (only) should be used.

All versions of the 914-HDV2 use high powered optical transceivers, a minimum link loss or attenuation of 10 dB is suggested.

Bushings on the SFP optical transceiver are standard LC. Fiber type is single mode.

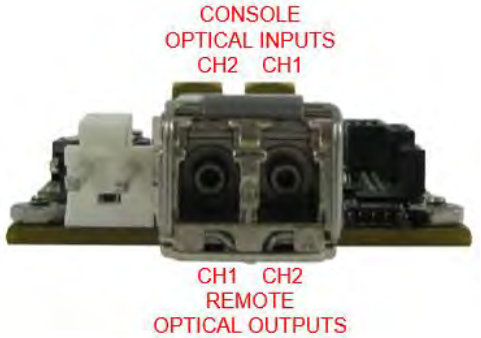


Figure 7-7: 914-HDV2 Optical Interface

7.1.3 914-HDV2 Power

Power to the 914-HDV2 card is provided through connector J2, Molex P/N 09-75-2024. The mating plug is Molex P/N 26-03-4020 with crimps P/N 08-52-0113. The pinout is provided in the table and figure below.

Table 7-1: 914-HDV2 Power Connector Pinout

PIN #	FUNCTION
1	GND
2	VCC

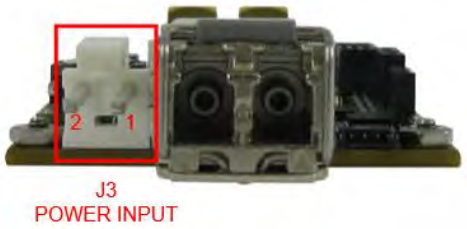


Figure 7-8: 914-HDV2 Power Input Connector Location

The recommended input voltage range is 4.5 VDC to 13.0 VDC (typically +12 VDC regulated). Nominal power consumption is 2.8 W, increasing to 3.2 W at 60° C ambient temperature. Power leads should be AWG 18 – 20.

The onboard surface mount fuse, F1, is rated to 2A and is not intended to be field replaceable. If the power fuse is blown, the card should be evaluated for damage by the factory or trained service personnel prior to any repair.

7.1.4 914-HDV2 Configuration

The 914-HDV2 is configured via dip switches, and not by software. Dip switches are pre-set to the appropriate settings based on the as-shipped configuration and part number. MSA (Multi-Source Agreement) refers to single video channel assemblies using standard SFP transceivers, non-MSA refers to dual uni-directional transceivers that are default for the 914-HDV2. There are hardware differences between the MSA and non-MSA boards; do not alter the switch settings without consulting Moog Focal. The exceptions are SW2 and SW6, EQ and CD settings. This can be tuned to the video resolution and cable lengths as required.

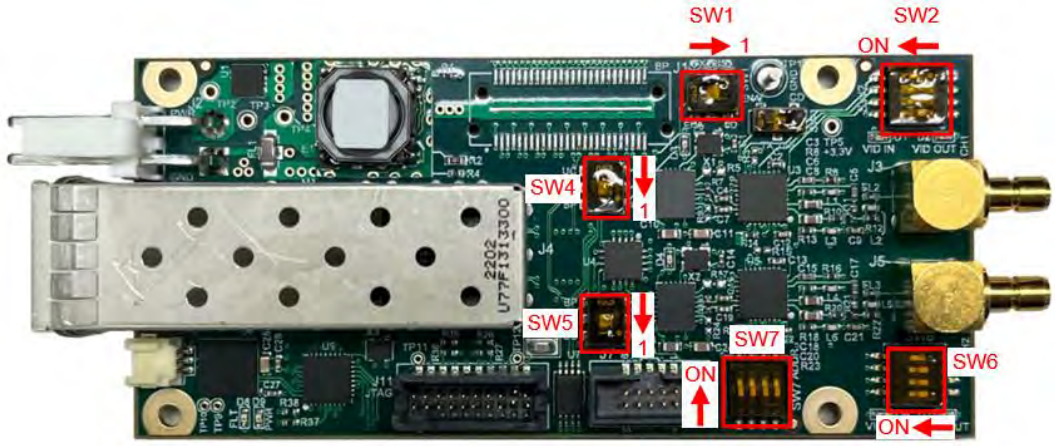


Figure 7-9: 914-HDV2 Configuration Dip Switches

Table 7-2: 914-HDV2 SW1 - SFP Transmitter Disable Non-MSA Mode

SWITCH	FUNCTION	SWITCH POSITION
SW1	SFP Transmitter Disabled when no video is present (**default**)	1
	SFP transmitter is always enabled, or MSA mode	2
SW3	SFP Transmitter Disabled when no video is present (**default**)	1
	SFP transmitter is always enabled	2
SW4/SW5[1]	Factory Programming Mode	1
	Diagnostics Mode (**default**)	2

[1] Both SW4 and SW5 positions need to be set for the corresponding mode.

Table 7-3: 914-HDV2 SW7 - Diagnostics in MSA or Non-MSA

FUNCTION	SW7[1]	SW7[2]	SW7[3]	SW7[4]
Diagnostics Mode (**default**)	OFF	OFF	OFF	N/A
Non-MSA Mode (**default**)	N/A	N/A	N/A	OFF
MSA Mode	N/A	N/A	N/A	ON

Table 7-4: 914-HDV2 SW2 (Channel 1) and SW6 (Channel 2): Input EQ or Output Cabled Driver Settings

FUNCTION	SWX[1]	SWX[2]	SWX[3]	SWX[4]
Video Output CD Mode	OFF (**CONSOLE**)	N/A	N/A	N/A
Video Input EQ Mode	ON (**REMOTE**)	N/A	N/A	N/A
EQ Gain Normal	N/A	OFF (**DEFAULT**)	N/A	N/A
EQ Gain Boost 6dB	N/A	ON	N/A	N/A
EQ Enabled	N/A	N/A	OFF (**DEFAULT**)	N/A
EQ Bypass	N/A	N/A	ON	N/A
Cable driver in SD Mode	N/A	N/A	N/A	OFF
Cable driver in HD Mode (console)	N/A	N/A	N/A	ON (**DEFAULT**)

7.1.5 914-HDV2 Diagnostic LEDs

The 914-HDV2 card includes eight onboard diagnostic LEDs. A description and location of each LED is provided in Figure 7-10 and Table 7-5.

Table 7-5: 914-HDV2 Diagnostic LEDs

LED	DESCRIPTION	COLOUR
D1	Video Channel 1 input valid (remote)	Yellow
D2	Video Channel 1 output valid (console)	Green
D3	Video Channel 1 lock detect (remote)	Green
D4	Video Channel 2 lock detect (remote)	Green
D6	Video Channel 2 input valid (remote)	Yellow
D7	Video Channel 2 output valid (console)	Green
D8	Power Fault. Outside of +4.5 V to +13.0 V range.	Red
D9	Power Good	Green

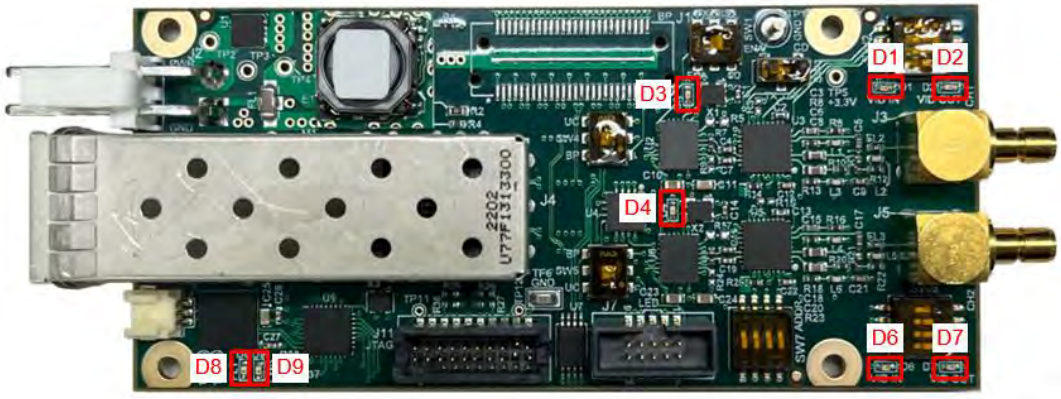


Figure 7-10: 914-HDV2 Diagnostic LED Locations

7.1.6 914-HDV2 Diagnostic LED Header

The 914-HDV2 card includes a 10-pin header capable of driving eight LEDs. This is useful for LED integration into an enclosure. Each LED pin is driven low to turn on an LED, and includes a 267 Ω resistor in series to limit the current draw. Maximum current draw is 8 mA.

The LED header is FCI P/N 20021521-00010T1LF, and the mating part is FCI P/N 20021444-00010T1LF. This can be used with most 0.050" (1.27mm) spacing ribbon cables.

Table 7-6: 914-HDV2 Diagnostic LED Header J7 Pinout

J7 PIN	NAME	DESCRIPTION
1	3.3V	3.3V. This pin can be used to drive the LEDs, Maximum current is 0.5A.
2	RX OPT LINK	Receive Optical Link Valid (MSA SFP only). Active low.
3	VID CH1 CD	Video Channel 1 Carrier Detect. Remote side only. Active low.
4	VID CH2 CD	Video Channel 2 Carrier Detect. Remote side only. Active low.
5	FAULT	Fault. (no SFP, No I^2C diagnostics) Active low.
6	RX OPT LINK CH2	Receive Channel 2 Optical Link Valid (non-MSA SFP only). Active low.
7	RX OPT LINK CH1	Receive Channel 1 Optical Link Valid (non-MSA SFP only). Active low.
8	VID CH1 VALID	Video Channel 1 output is valid. Console only. Active low.
9	VID CH2 VALID	Video Channel 2 output is valid. Console only. Active low.
10	GND	Ground

Figure 7-11: 914-HDV2 J7 LED Header

7.1.7 914-HDV2 Diagnostics

The 914-X Unified Diagnostic GUI is compatible with the 914-HDV2. The GUI cannot be used to change settings, nor can it access remote side diagnostics. It gives information regarding the health of the fiber links, the status of the video channels, and some standard board-level diagnostics, including voltages and temperatures. It also gives software access to all status LEDs.

Section 5.1 details on how to install the GUI. Access to the RS232 diagnostic interface is via connector J6. Please refer to Section 5.0 for more information regarding this connector, pinout and cabling.

7.1.7.1 Connecting 914-HDV2 Hardware to the GUI

Once installed, open the software and select the 914-HDV2 tile.

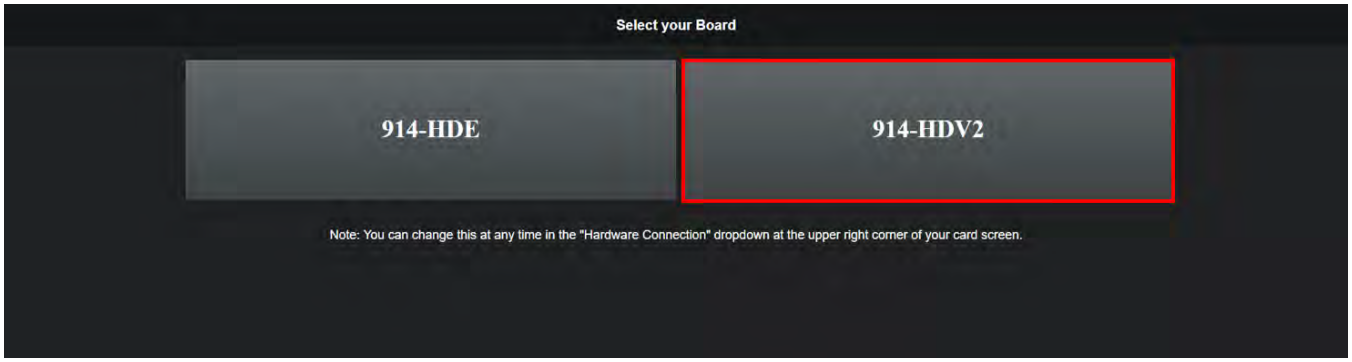


Figure 7-12: Diagnostic GUI HDV2 Selection

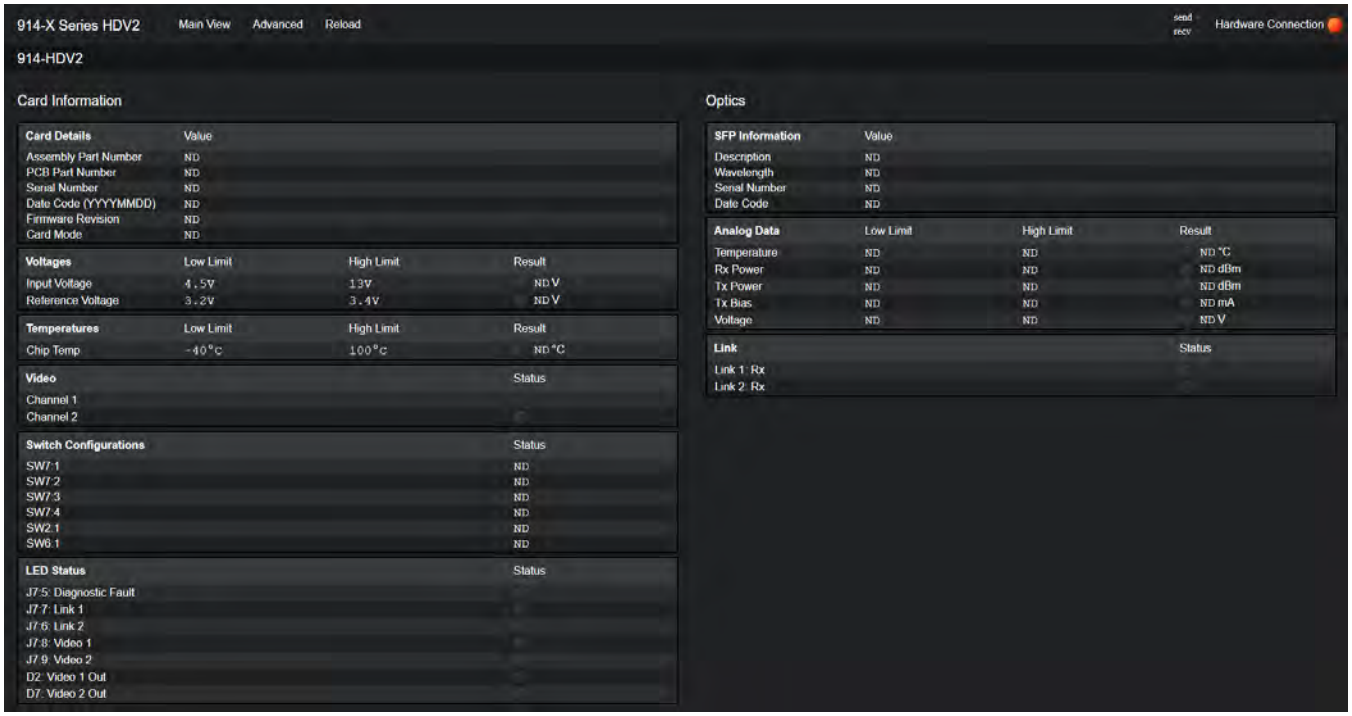


Figure 7-13: 914-HDV2 Main View

This selection can be modified at any time by pressing “Hardware Connection” at the top right corner of the screen and adjusting the board type option. The GUI will automatically load to the last selected main screen upon reopening.

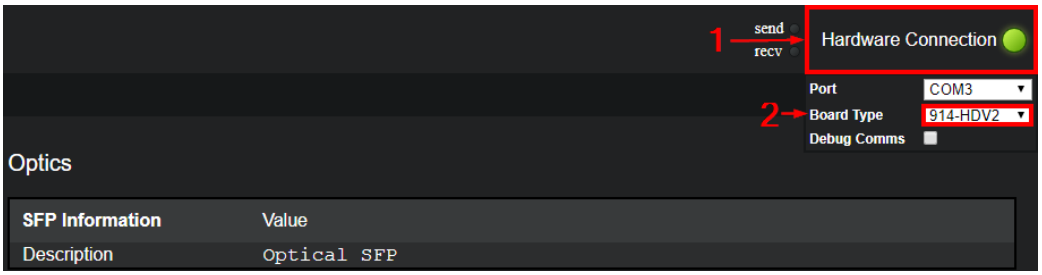


Figure 7-14: Changing the Board Type

Press “Hardware Connection” in the top right corner to set up the COM link. Give time for the software to identify available COM ports, then select the port the console side 914-HDV2 is connected to. Close the Hardware Connection tab by clicking elsewhere on the screen. The selected COM port will be remembered the next time the GUI is opened.

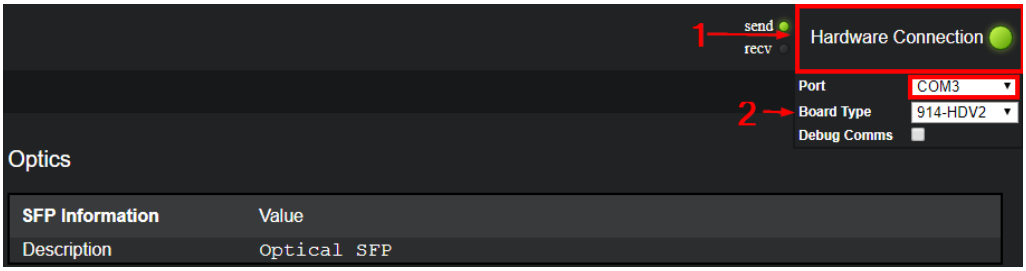


Figure 7-15: Selecting a COM Port

If a successful link to the 914-HDV2 is established, the LED to the right of “Hardware Connection” will be green and data will begin refreshing. If the LED appears red or amber, the link has not been established. Verify the COM port number and the wiring harness to the board, and ensure power is applied to the 914-HDV2. If problems persist, refer to item #2 of Section 14.0. **Users should always be aware of the Hardware Connection LED’s status, as it is the main indicator for the state of communications with the console HDE.**

7.1.7.2 914-HDV2 Diagnostic Header

The bar on the top of the screen is referred to as the header and does not change between pages. The header allows the user to change between the main view and advanced screens. It also has a *Reload* option, which can be pressed to reload a page if GUI issues are encountered.

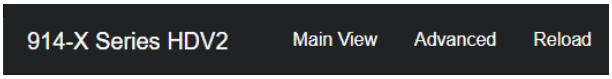


Figure 7-16: 914-HDV2 Header Options

The “send” and “recv” LEDs on the header (left of the “Hardware Connection” button) flash when serial information is being sent to and received from the board respectively. They should blink regularly, which indicates that healthy communication is taking place between the serial port and the console 914-HDV2.

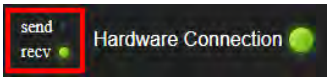


Figure 7-17: Header Send and Receive LEDs

7.1.7.3 914-HDV2 Main View

The HDV2 main page displays status information regarding the connected HDV2, including dip switch states and SFP information. The data displayed on the page varies depending on whether the connected card is configured as a console or remote, and whether the card is non-MSA or MSA (see Section 7.1.4 for details on MSA/non-MSA). Table 7-7 outlines these diagnostics: green checkboxes indicate that the diagnostic is present and displayed, while red empty checkboxes indicate that the diagnostic is absent and not displayed.

Table 7-7: 914-HDV2 Configuration-Specific Diagnostics

DIAGNOSTIC	CONSOLE, MSA	REMOTE, MSA	CONSOLE, NON-MSA	REMOTE, NON-MSA
SFP INFORMATION				
SFP Date Code	☒	☒	☐	☐
SFP Serial Number	☒	☒	☐	☐
SFP Wavelength	☒	☒	☐	☐
Wavelength Tx1	☐	☐	☐	☒
Wavelength Tx2	☐	☐	☐	☒
SFP ANALOG INFORMATION				
TX Power	☒	☒	☐	☐
RX Power	☒	☒	☐	☐
TX Bias	☒	☒	☐	☐
RX Power (Port 1)	☐	☐	☒	☐
RX Power (Port 2)	☐	☐	☒	☐
TX Power Port 1	☐	☐	☐	☒
TX Power Port 2	☐	☐	☐	☒
OPTICAL LINK				
Link 1	☒	☐	☒	☐
Link 2	☐	☐	☒	☐
VIDEO				
Video 2	☐	☐	☒	☒

When a valid link is established (verify with the green hardware connection LED), the data fields on the HDV2 main page should populate with status information.

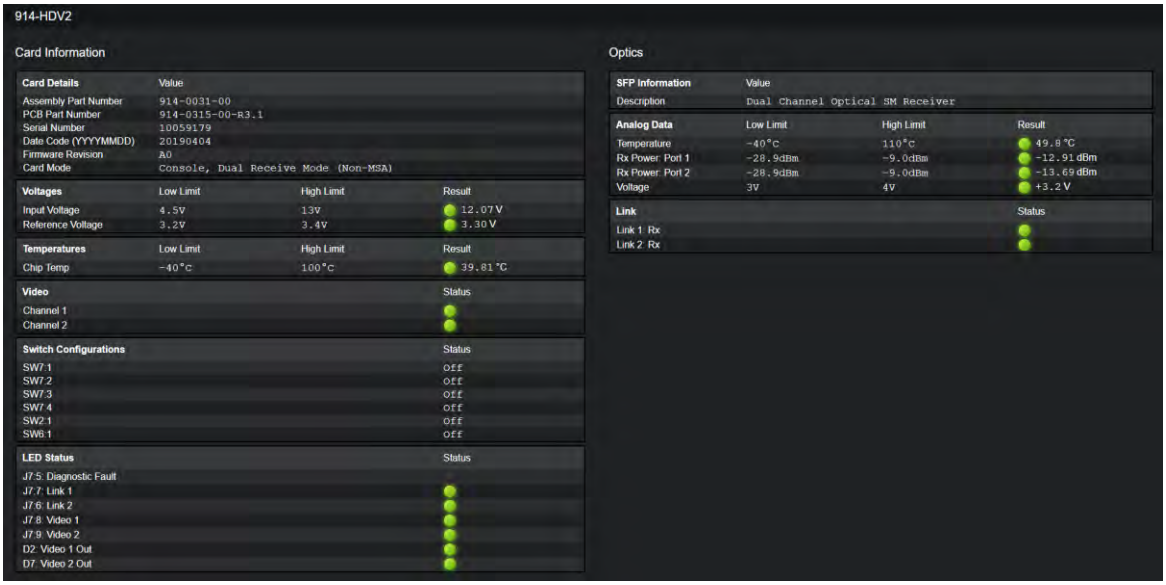


Figure 7-18: 914-HDV2 Main View Example

If nothing displays (the screen appears like Figure 7-13), refer to item #2 in Section 14.0.

7.1.7.3.1 Main View Error Messages

Warning messages may appear below the optics section, located on the right side of the main view. These messages indicate potential issues with the connected HDV2 hardware. The following section outlines the types of error messages that may appear and provides instructions on how to resolve them.

7.1.7.3.1.1 Card Does not Identify as an HDV2

The card connected to the diagnostic port is likely not an HDE. This occurs when loading onto the HDV2 screen while connected to an HDE card.

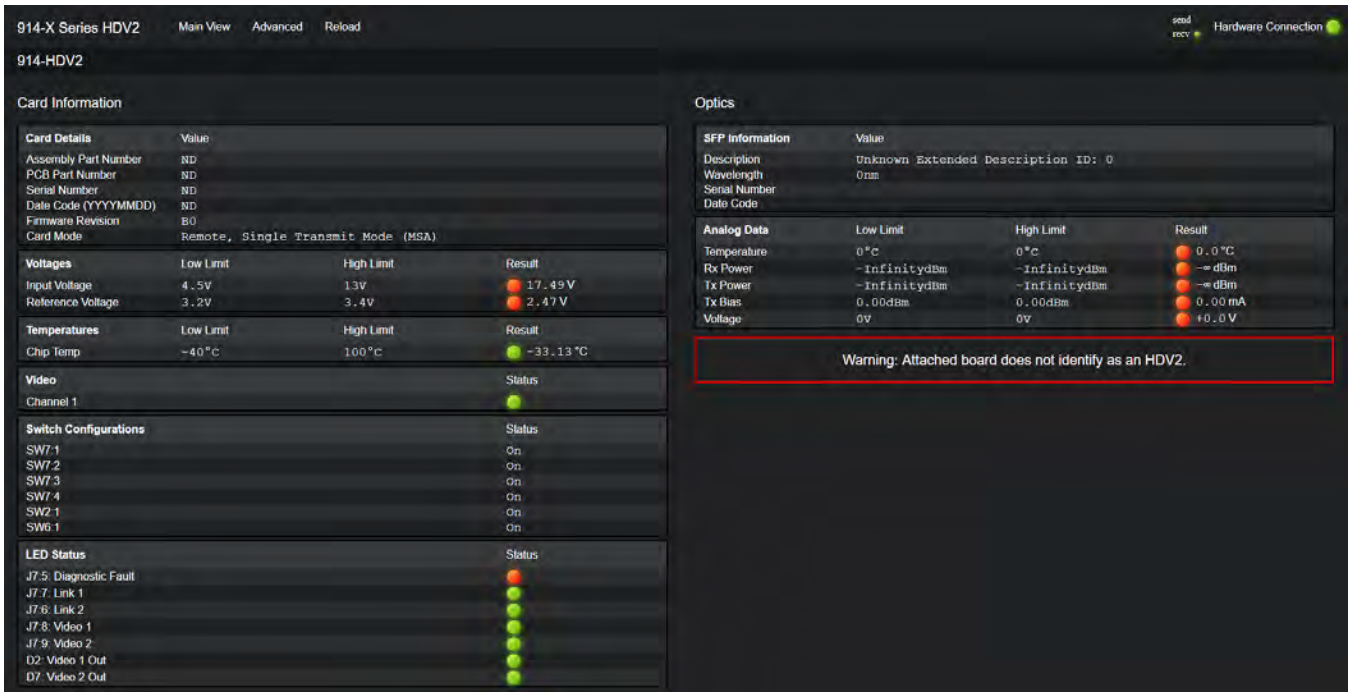


Figure 7-19: HDE on HDV2 Screen Warning Message

7.1.7.3.2 914-HDV2 Status Diagnostics

Located on the left side of the screen below the subheader is the card information section, which provides details about the connected HDV2. Generic card information (such as serial number or assembly part number) can be found in the *Card Details* table on the left side of the screen.

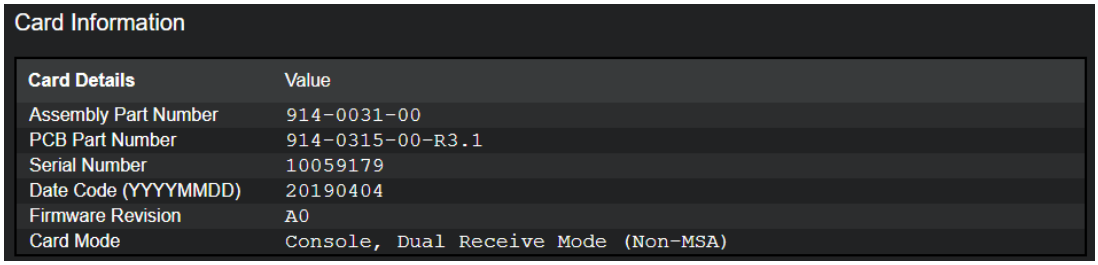


Figure 7-20: 914-HDV2 Card Information

Below these are voltage and temperature diagnostics. A green LED indicates that the observed status is within the normal range. Red LEDs indicate potential problems that need to be addressed, and yellow LEDs give warnings. Low and high limits clarify the value at which the LEDs will turn red.

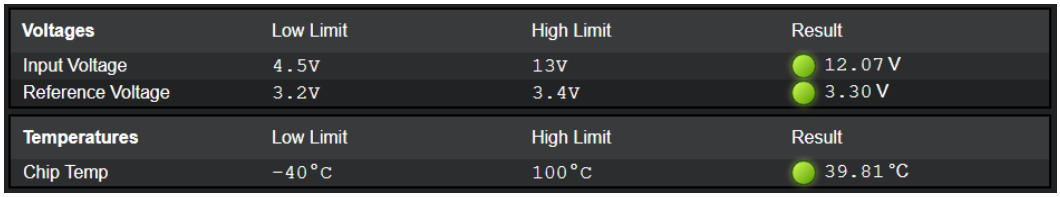


Figure 7-21: 914-HDV2 Voltage and Temperature Information

Under this is the status of the 914-HDV2 video channel(s). This display may change depending on the connected hardware (see Table 7-7).

Figure 7-22: 914-HDV2 Video Information

Figure 7-23 shows the switch configuration table, which depicts the current dip switch positions on the linked HDV2.

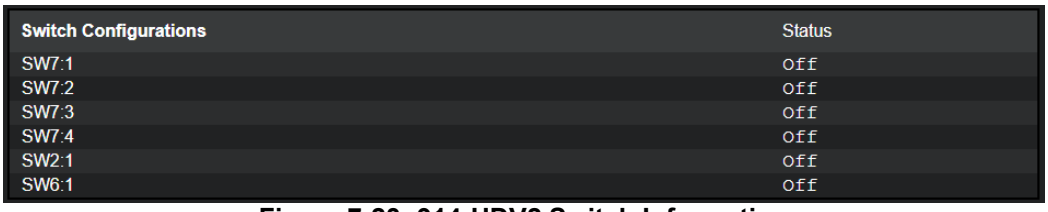


Figure 7-23: 914-HDV2 Switch Information

Figure 7-24 shows the current state of the board's diagnostic LED headers.

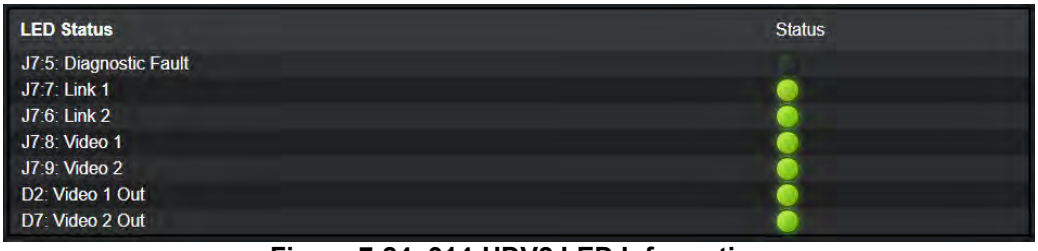


Figure 7-24: 914-HDV2 LED Information

Located on the right side of the screen below the subheader is the optics section, which provides details about the attached SFP. All tables in the optics section display differently depending on the connected hardware (see Table 7-7). Generic information about the attached SFP can be found in *SFP Information* table.

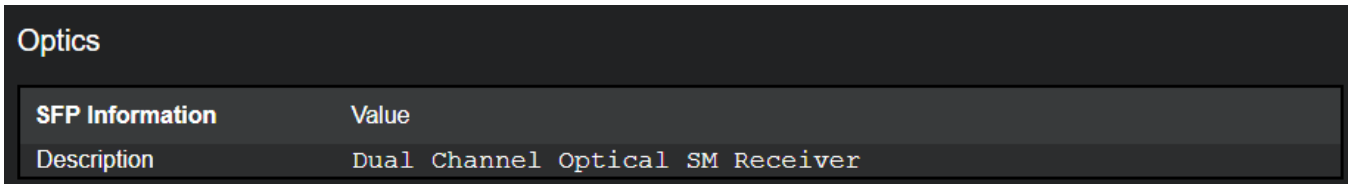


Figure 7-25: 914-HDV2 General SFP Information

Below this is the SFP analog data table, seen in Figure 7-26. A green LED indicates that the observed status value is within the expected range. Red LEDs indicate potential problems that need to be addressed, and yellow LEDs give warnings. Low and high limits clarify the value at which the LEDs will turn red.

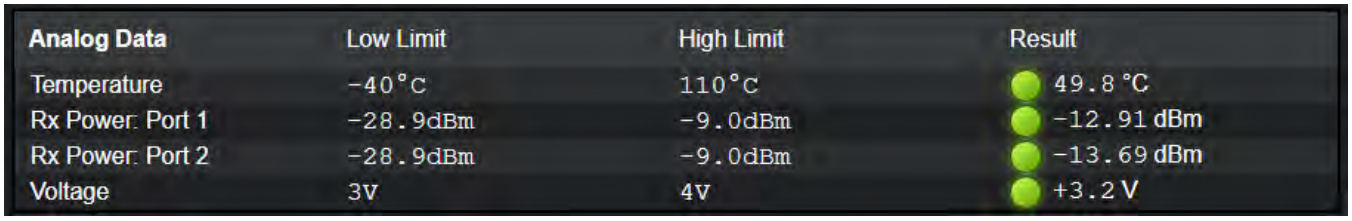


Figure 7-26: 914-HDV2 Analog SFP Information

Figure 7-27 illustrates the optical link table, which displays the status of the fiber optic connection(s).

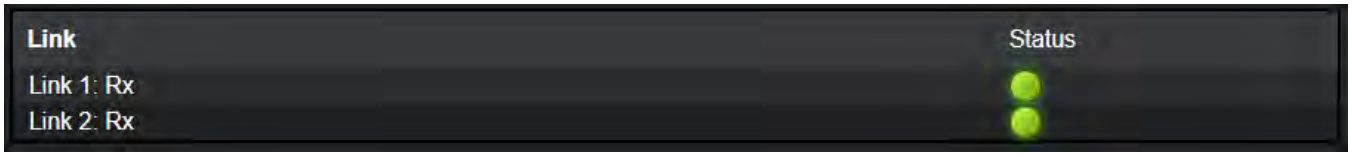


Figure 7-27: 914-HDV2 Optical Link Information

7.1.7.4 914-HDV2 Advanced Page

The Advanced page offers essential debugging and quality of life features. To access this page, hover over the "Advanced" option on the header and select it.

Figure 7-28: 914-HDV2 Advanced Page Selection

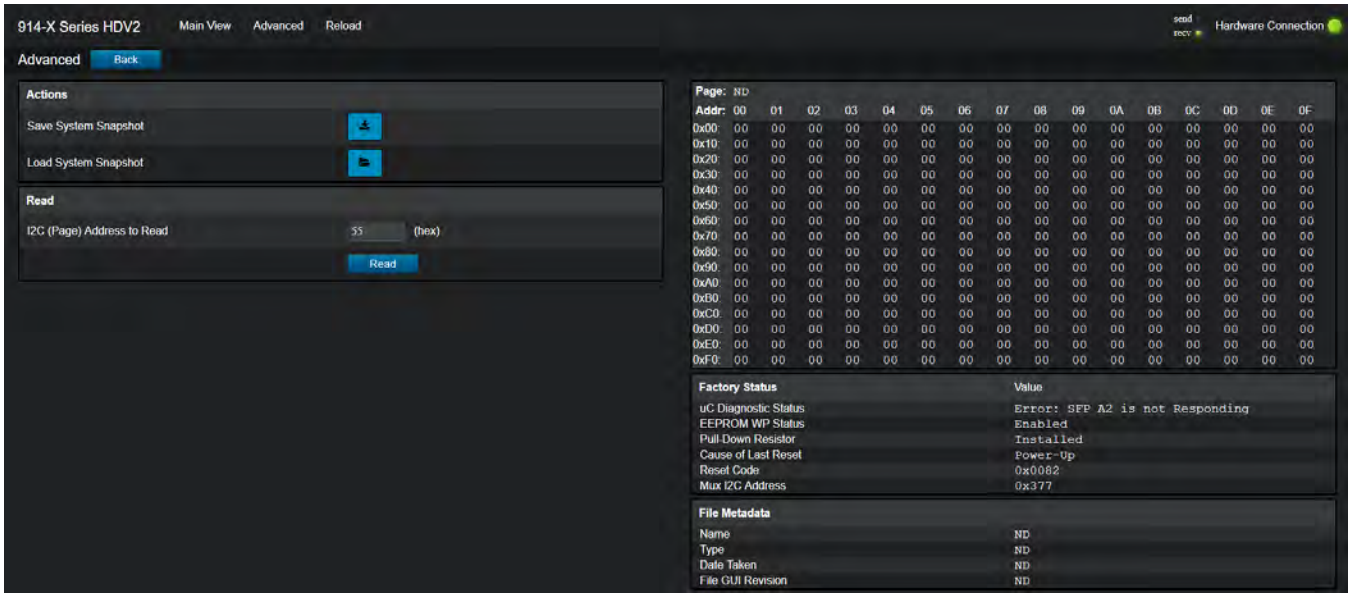


Figure 7-29: 914-HDV2 Advanced Page

The main view can be returned to at any time by pressing "Back" on the subheader or "Main View" on the header.

Engineering information is displayed below the I²C table in the "Factory Status" table.

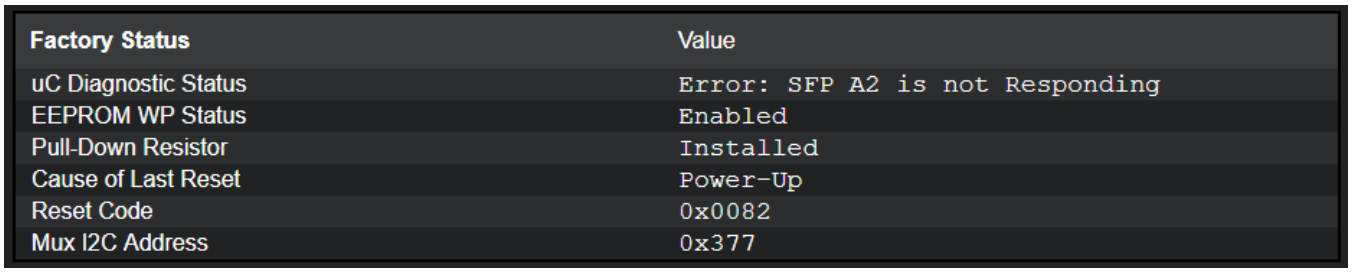


Figure 7-30: 914-HDV2 Factory Status Information

7.1.7.4.1 914-HDV2 Data Snapshots

A system snapshot captures the status of the attached HDV2 at the moment it is taken. **Data Snapshots should always be included in customer support emails to Focal**, as they significantly simplify troubleshooting.

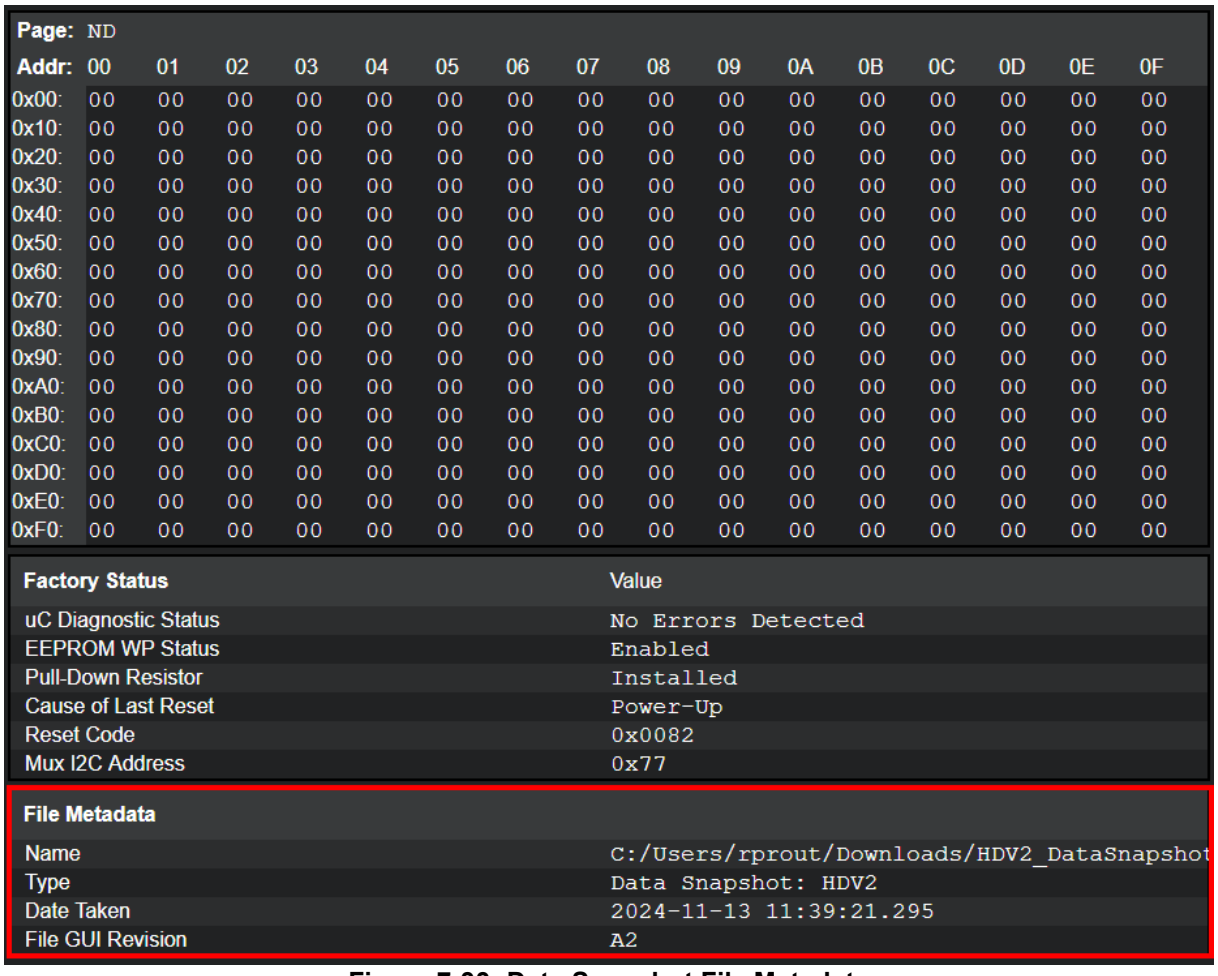
To take a snapshot, users can navigate to the Advanced page and select the “Save System Snapshot” option. This will prompt the user to either create a new JSON file or use an existing one. Then, it will write all HDV2 data into the chosen file.

Figure 7-31: Save System Snapshot Option

Data snapshots can be loaded back into the GUI by selecting the “Load System Snapshot” option. This will force the GUI into “Offline Mode.”

Figure 7-32: Load System Snapshot Option

Metadata (file name, date taken, name, and GUI revision) about the loaded snapshot file is found on the bottom right section of the advanced page.



Page: ND

Addr:	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
0x00:	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0x10:	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0x20:	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0x30:	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0x40:	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0x50:	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0x60:	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0x70:	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0x80:	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0x90:	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0xA0:	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0xB0:	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0xC0:	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0xD0:	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0xE0:	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0xF0:	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00

Factory Status	Value
uC Diagnostic Status	No Errors Detected
EEPROM WP Status	Enabled
Pull-Down Resistor	Installed
Cause of Last Reset	Power-Up
Reset Code	0x0082
Mux I2C Address	0x77

File Metadata	
Name	C:/Users/rprout/Downloads/HDV2_DataSnapshot
Type	Data Snapshot: HDV2
Date Taken	2024-11-13 11:39:21.295
File GUI Revision	A2

Figure 7-33: Data Snapshot File Metadata

In offline mode, the GUI disconnects from any attached hardware and utilizes information from the snapshot to populate data fields. To exit offline mode, users can select the “Exit Offline Mode” button located on the top right of the header. If 914-HDV2 was connected before entering offline mode, the GUI will automatically attempt to reconnect to it when exiting offline mode.

Figure 7-34: Exit Offline Mode Option

7.1.7.4.1.1 Loading Data Snapshots – Potential Errors

Data snapshots are supported for both the 914-HDV2 and 914-HDE. Attempting to load a 914-HDE snapshot through the 914-HDV2 Advanced page will abort the loading process and alert the user of a failure. If the user does not have permission to access a selected file, or if the selected file is empty, the loading process will fail. Additionally, if a custom error message is displayed indicating a problem, it is likely due to the selected snapshot file being modified by a user or corrupted.

7.1.7.4.2 Reading 914-HDV2 I²C Data

At the low level, GUI statistics and settings are translated from raw byte values obtained from the attached 914-HDV2. These bytes are stored in I²C pages, which can be read from directly on the advanced page. To do this, specify an I²C page and select *Read*. The requested data will then populate the I²C table on the right side of the screen.

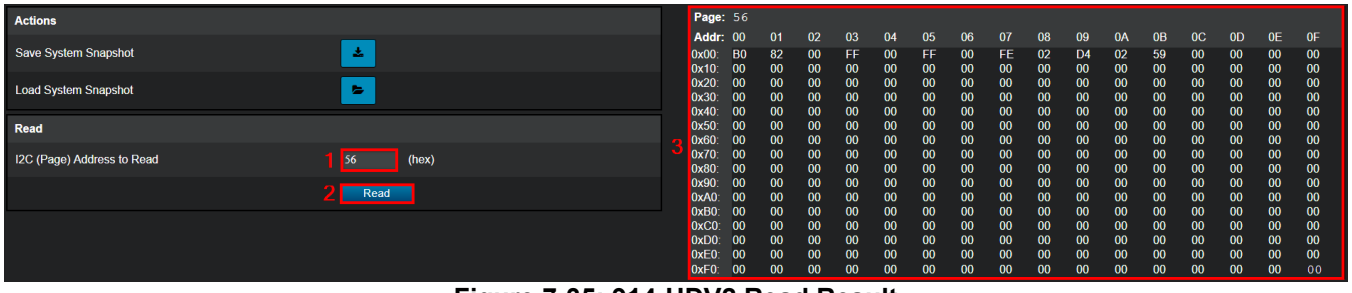


Figure 7-35: 914-HDV2 Read Result

7.1.8 Legacy 914-HDV2 Information (Board Rev. 3.3 and earlier)

The 914-HDE and expansion cards 914-VDX, 914-EX, 914-DX, and 914-HDV2, were all updated in 2022. Most connector pinouts are the same between old and latest board revisions, however this section describes important details about differences in older revisions of the 914-HDV2. Any details **not** covered in this section imply no changes between board revisions.

Figure 7-36: 914-HDV2 Top View (Board Revisions 3.3 and Earlier)

7.1.8.1 Legacy 914-HDV2 Diagnostics Connector

The part used for diagnostics connector J6 was replaced in board revision 4 and is installed on all later revisions. The pinout for the connector is the same between older and new revisions, however older revisions do *not* have isolated ground. An isolated ground was introduced in board revision 4. Earlier revisions have non-isolated ground.

Table 7-8: Legacy 914-HDV2 J6 Pinout

PIN	PIN FUNCTION	
	REV 3.3 AND EARLIER	REV 4 AND LATER
1	GND	ISO GND
2	TX	TX
3	RX	RX

Table 7-9: Legacy 914-HDV2 Mating Connectors

DESIGNATOR	DESCRIPTION	MFR.	PART NUMBER / FOCAL PN	CRIMP PINS / FOCAL PN
J7 (≤ Board Rev 3.3)	Diagnostics (Old revs)	Molex	0781720003 / EL-J0579	0781720410 / EL-J0580
J7 (≥ Board Rev 4)	Diagnostics	Molex	0151330306 / EL-J0710	N/A

8.0 Other 914 Cards

8.1 Optical Cards

8.1.1 914-CWDM

Card P/N 914-0017-04
Config. Dwg 914-2017-00

The 914-CWDM optics card, shown in Figure 8-1, allows a standard 1310 / 1550 nm bidirectional single fiber system to be upgraded with two new wavelengths. The standard upgrade is for 1471 / 1491 nm which can be used for a second 914-HDE system or for a 914-HDV2 dual HD video upgrade.

To daisy chain the 914-CWDM optics card, the bypass port ST1B should be connected to a 1310/1550 nm 914 card, and the common port ST2B should be connected to the external cable system per the configuration drawing.

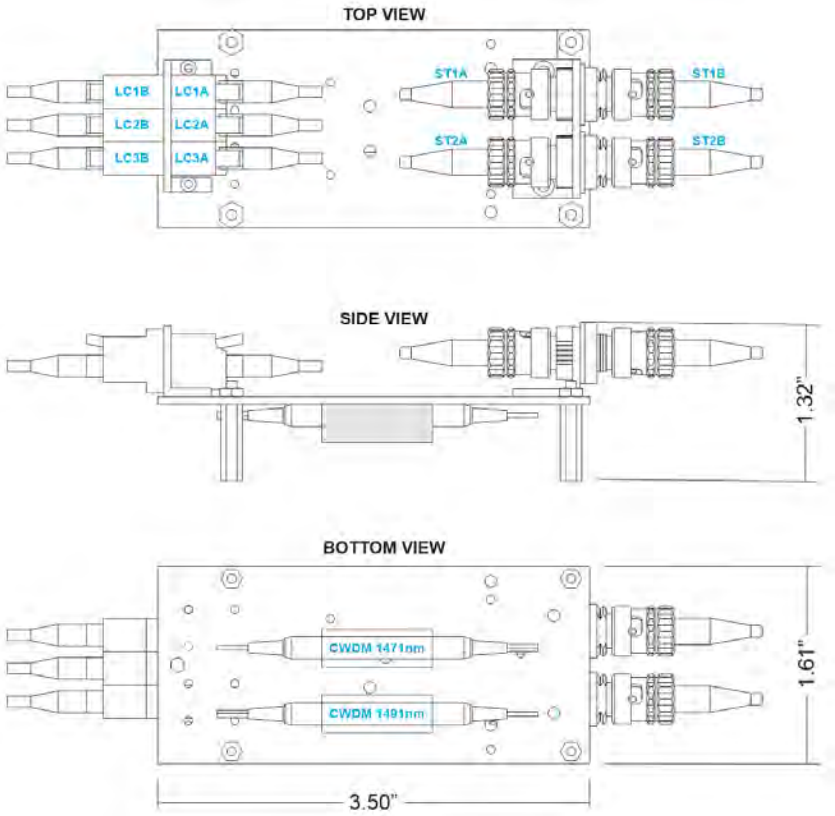


Figure 8-1: 914-CWDM Optics Card

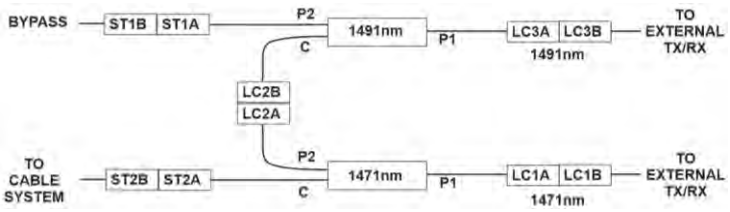


Figure 8-2: 914-CWDM Connection Diagram

The standard 1471 nm and 1491 nm CWDM wavelengths used on the 914-CWDM optics card can be changed to other wavelengths upon request, but only the 1471/1491 nm version can be daisy chained with existing 1310/1550 nm systems.

8.1.2 914-CWDM-4R1

Card P/N **914-0017-11**, 914-0017-17
Config. Dwg 914-2017-01

The 914-CWDM-4R1, shown in Figure 8-3 and Figure 8-4, is used to optically multiplex four standard CWDM channels with 20 nm spacing from LC1, LC2, LC3, and LC4, into a single common optical fiber (COM) for connection to the external fiber system, typically at an ST/PC bushing. The same card is used to de-multiplex signals from a single fiber into four optical channels. 1471 / 1491 / 1511 / 1531 nm are the four multiplexed wavelengths. A blue band bypass is optional for system upgrades, and other wavelength options are possible.

A 914-CWDM-4R1 card with P/N 914-0017-11, for example, multiplexes singlemode CWDM channels 1471, 1491, 1511, and 1531.

Optical insertion loss is typically less than 2.5 dB per 914-CWDM-4R1 card. Optical link analysis must account for CWDM cards at both ends of the system.

Table 8-1: 914-CWDM-4R1 Wavelength Allocations

LC CONN.	WAVELENGTH
LC1	1471 nm
LC2	1491 nm
LC3	1511 nm
LC4	1531 nm

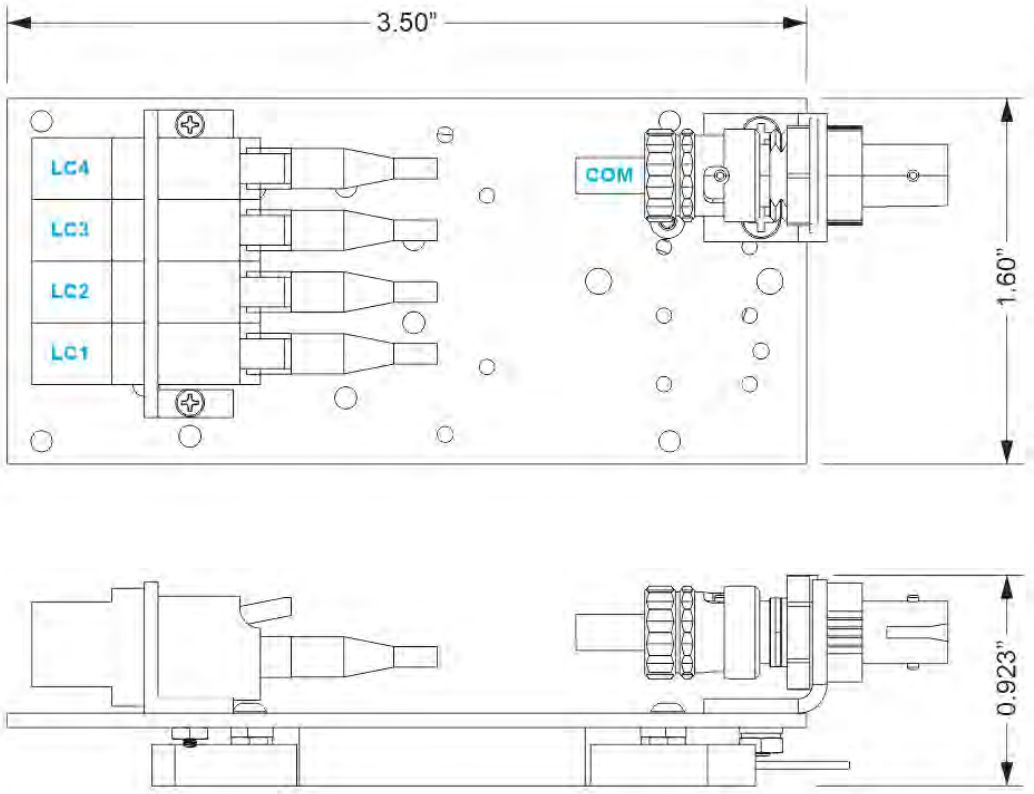


Figure 8-3: 914-CWDM-4R1, 4-Channel CWDM Optics Card, Assembly 914-2017-11

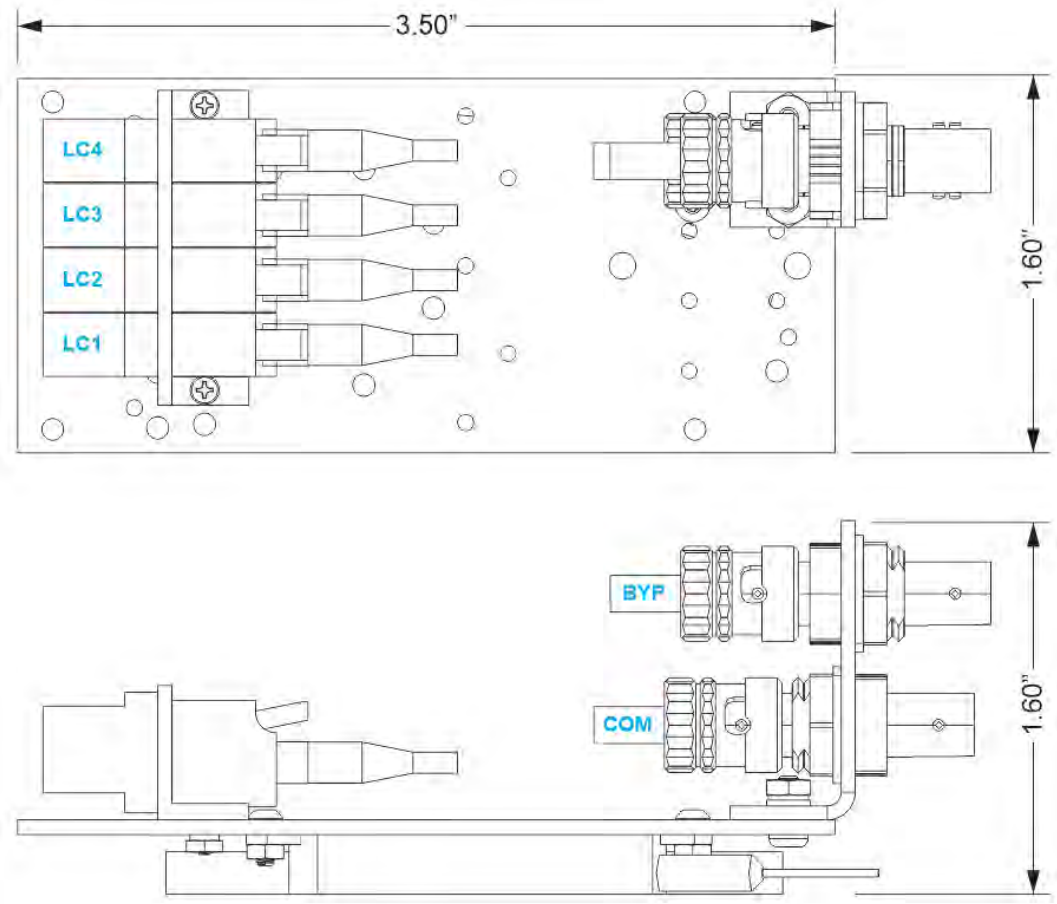


Figure 8-4: 914-CWDM-4R1, 4-Channel CWDM Optics Card with Bypass, Assembly 914-2017-17

8.1.3 914-CWDM-8R

Card P/N **914-0017-16**, 914-0017-20, 914-0017-21
Config. Dwg 914-2017-02

The 914-CWDM-8R, shown in Figure 8-5, Figure 8-6, and Figure 8-7, is used to optically multiplex eight standard CWDM channels with 20 nm spacing into a single common fiber (COM) for connection to the external fiber system. The same card is used to de-multiplex signals from a single fiber into eight optical channels. 1471 / 1491 / 1511 / 1531 / 1551 / 1571 / 1591 / 1611 nm are the eight multiplexed wavelengths (red band). A blue band bypass is optional for system upgrades.

A 914-CWDM-8R card with P/N 914-0017-16, for example, multiplexes singlemode CWDM channels 1471, 1491, 1511, 1531, 1551, 1571, 1591, and 1611.

Optical insertion loss is typically no greater than 2.0 dB per 914-CWDM-8R card. Optical link analysis must account for CWDM cards at both ends of the system.

Table 8-2: 914-CWDM-8R LC Bushing Wavelengths

	1	2	3	4
A	1471 nm	1491 nm	1511 nm	1531 nm
B	1551 nm	1571 nm	1591 nm	1611 nm

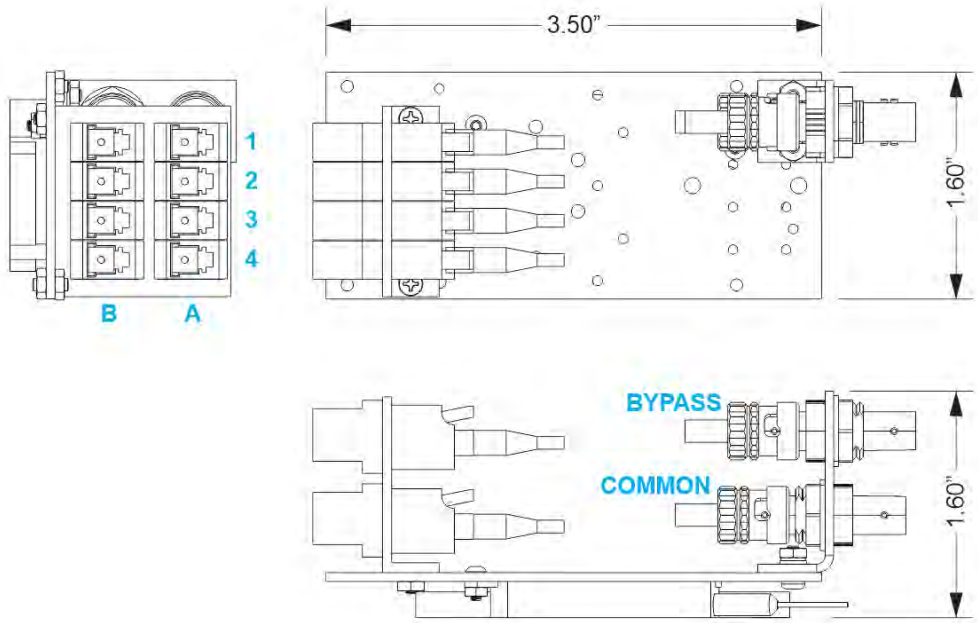


Figure 8-5: 914-CWDM-8R, 8-Channel CWDM Optics Card, Assembly 914-0017-16

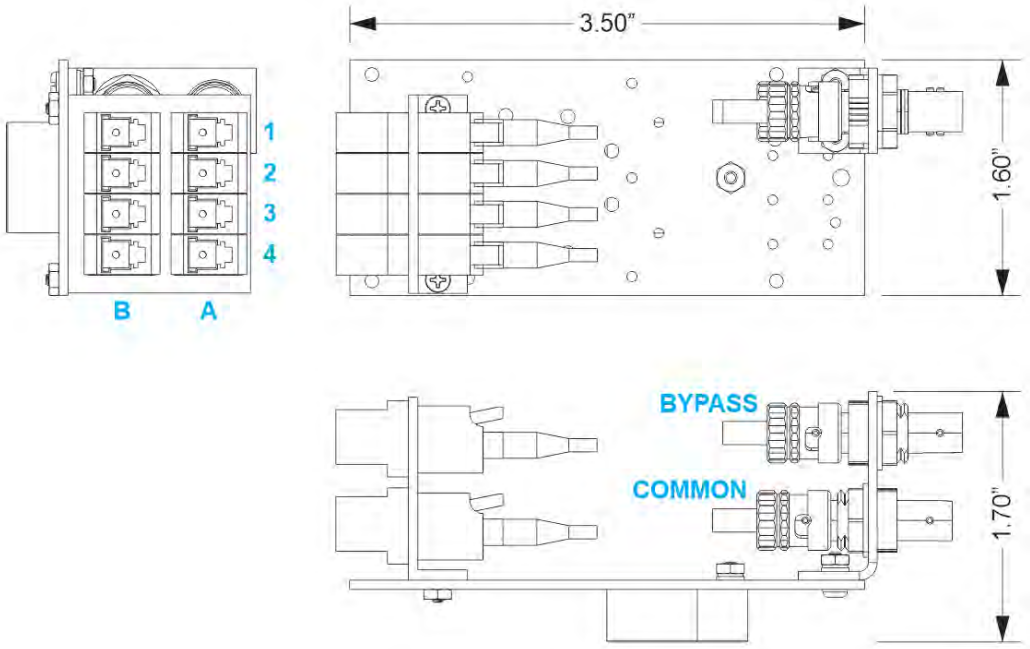


Figure 8-6: 914-CWDM-8R, 8-Channel CWDM Optics Card, Assembly 914-0017-20

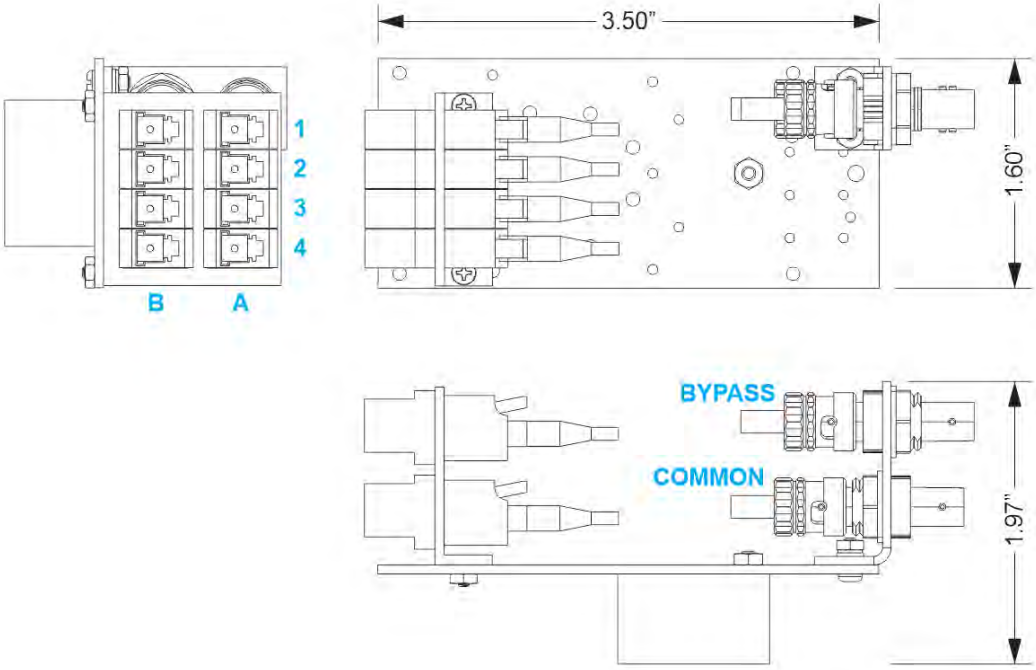


Figure 8-7: 914-CWDM-8R, 8-Channel CWDM Optics Card, Assembly 914-0017-21

8.1.4 914-FOS

Card P/N **914-0017-10**
Config. Dwg 914-2025-00

The 914-FOS card, shown in Figure 8-8, is an optical switch card that can be manually or electrically switched to choose one of two optical fiber inputs in redundant systems. The optical input signal from either Fiber A or Fiber B is switched to a common output fiber, COM, via toggle switch SW1, a remote switch connection at J1, or through the 914-X Series Unified Diagnostic GUI, when SW1 is configured for "Auto/Prog" mode (POS. 3 in Figure 8-8). Typically, the two fiber inputs are connected through an umbilical and tether to a remote card with a splitter (914-SPLIT), or two separate remote cards for optimal redundancy subsea.

Diagnostic LEDs D1, D2, and D3, turn on when Fiber B is routed, the card has +3.3VDC input power, or Fiber A is routed, respectively.

Connector J1 allows for the use of a remote SPDT toggle switch. When used, ensure the onboard toggle switch (SW1) is in position 2. See the table below for a summary of switch positions.

Table 8-3: 914-FOS Toggle Switch Modes

TOGGLE SWITCH SW1 POSITION	MODE	FIBER SWITCH ROUTING
Position 1	Manual	Fiber A
Position 2	Manual	Fiber B
	External Control (via J1)	Fiber A: Short J1:1 and J1:2
		Fiber B: All J1 pins open
		Auto Mode: Short J1:2 and J1:3
Position 3	Auto / Programmable ("Auto/Prog")	See below for details.

When SW1 is in position 3, the 914-FOS enters "Auto/Prog" mode. **While in this position** and connected to a 914-HDE via J2, the 914-X Series Unified Diagnostic GUI can be used to force the optical routing to Fiber A or Fiber B. The card will remember this routing until it is put into "Auto" mode via the Diagnostic GUI. While in "Auto" mode, the 914-FOS automatically switches every two seconds for 10 cycles until a valid link is established on either Fiber A or Fiber B. If no link is established after 10 cycles, it will stop searching and wait for a link on the active fiber. Ensure that the onboard switch SW1 is in position 3 for both modes.

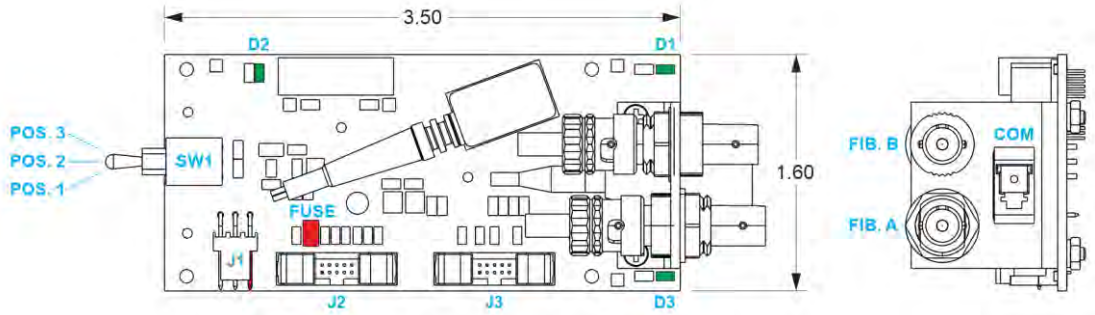


Figure 8-8: 914-FOS, Fiber Optic Switch Card

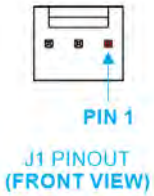


Figure 8-9: 914-FOS J1 Pinout (External Switch Connector)

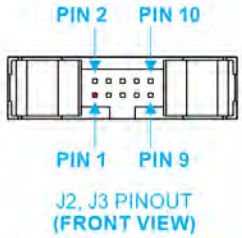


Figure 8-10: 914-FOS J2 (HDE Input), J3 (LED Output) Pinout

8.1.4.1 914-FOS Configuration

FOS information and configuration options are accessed in the 914-X Unified Diagnostic GUI. To enable FOS operation via the GUI, open the 914-HDE settings page (see Section 5.5). On the near card, select **Console** for "Card Mode", **Output** for Video "Direction", and **enable the toggle button** for "FOS Mode". Press "Save" to apply these settings.

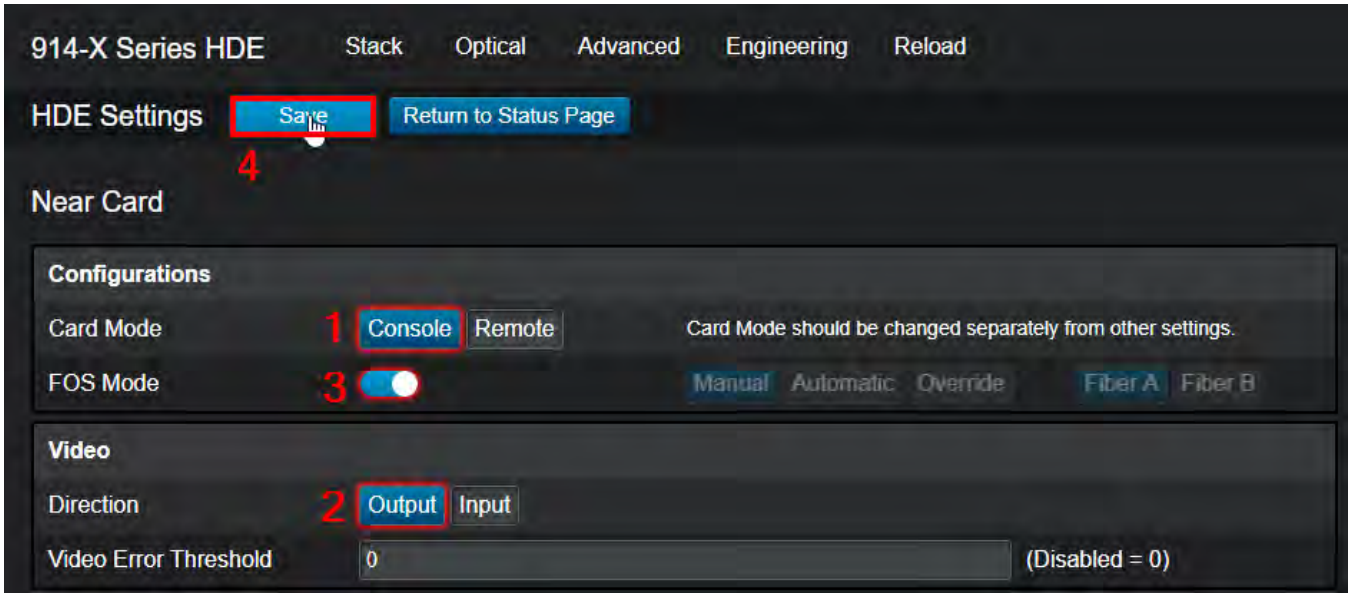


Figure 8-11: 914-FOS GUI Enable

Once the 914-FOS is enabled (and a 914-FOS is attached), FOS options can be configured. **Note that the onboard toggle switch must be in position 3 to interact with the following settings.** Press "Save" to apply all changes.

- **Mode:**
  - **Automatic**: The 914-FOS automatically switches every two seconds for 10 cycles until a valid link is established on either Fiber A or Fiber B. If no link is established after the 10 cycles, it stops searching and waits for a link on the active fiber. This setting disregards the selected fiber option on the rightmost side of the FOS row.
  - **Override**: Allows forcing the fiber optic routing onto a specific fiber, as specified on the rightmost side of the FOS Mode row.

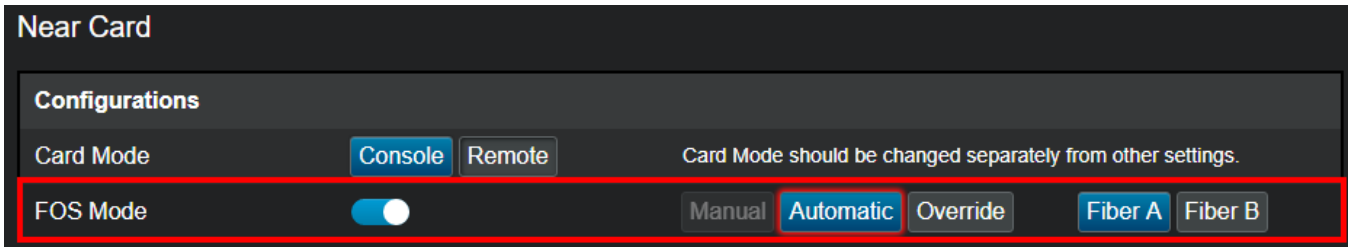


Figure 8-12: 914-FOS Configuration Options

8.1.5 914-SPLIT

Card P/N 914-0017-07, **914-0017-09**
Config. Dwg 914-2026-00

The 914-SPLIT, shown in Figure 8-13, is a 1x2 optical splitter card used to split an optical signal for redundant operation. The 914-SPLIT is typically installed at the remote end of a 914-X system. This card splits the optical power from a multiplexer or media converter card equally into two fiber outputs, Fiber A and Fiber B. Typical loss through the splitter is 4.0 dB, with a 1.0 dB level of power uniformity between the two output fibers. Usually a 914-FOS is included at the console to select which fiber is active. Alternatively, fibers can be manually selected and reconnected to the console card.

The 914-SPLIT is available in a pressure tolerant version (914-0017-07).

CAUTION: Splitters can only be used at one end of a system, as recombining signals at the far end with another splitter will corrupt data due to differences in the fiber delays and possibly due to interference of the laser signal.

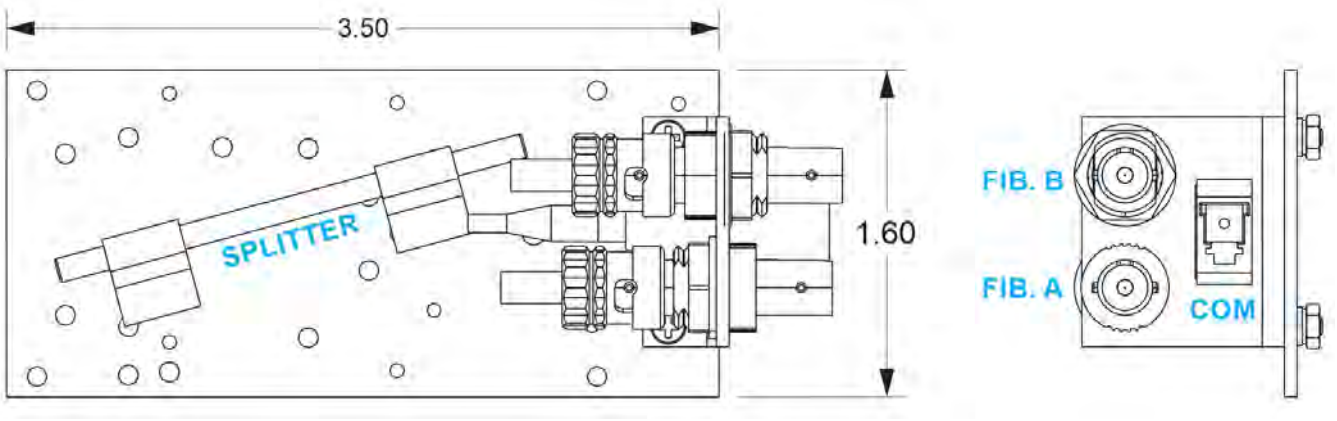


Figure 8-13: 914-SPLIT, 1x2 Optical Splitter Card

8.2 System Cards

8.2.1 914-DC-05

Card P/N 914-0224-01, 914-0224-03
Config. Dwg 914-2027-01

The 914-DC-05 card, shown in Figure 8-14, is a system card used to distribute power to several Model 914 cards/substacks. Power input to the DC-DC converter card via the 2-pin WAGO connector, J1, can range from +9 to +36VDC (+24VDC is nominal). Reverse protection and a 5A slow blow type fuse are included in the power input circuit. Note that the fuse is soldered to the board and is not replaceable in the field. Wire gauge for the input power harness should be 20-22 AWG, and wire gauge for the output power harness(es) should be 18-20 AWG.

Two separate +5VDC outputs are accessible via the 2-pin Molex connectors, J2 and J3. Outputs are fused to the cards to which they are connected. Maximum output current on any single output connector should not exceed 4A. The aggregate current output of the DC-DC converter should not exceed 8A. Typically, the 914-DC-05 is installed separately but near the 914 stack.

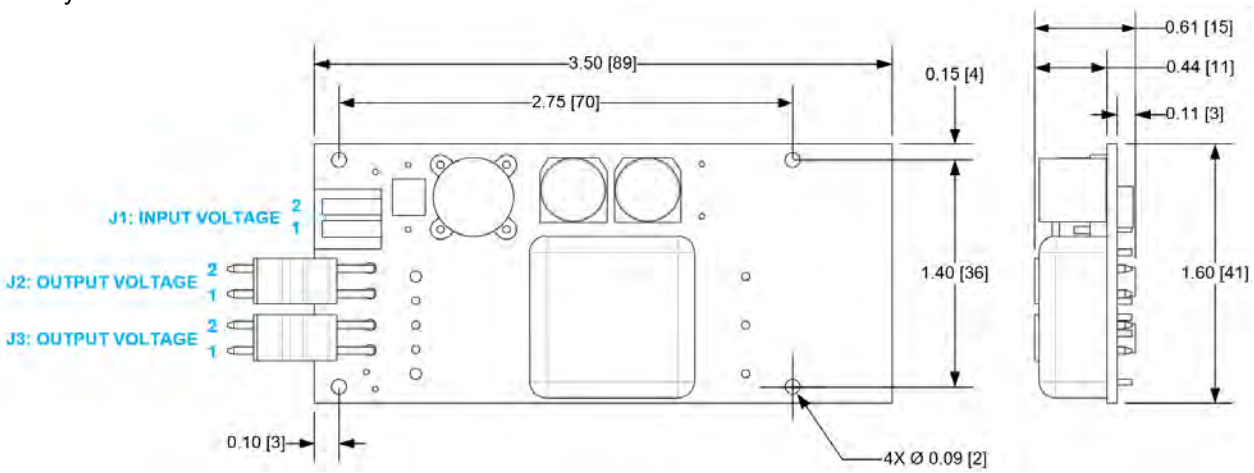


Figure 8-14: 914-DC-05 System Card, (Dimensions in inches [mm])

Table 8-4: 914-DC-05 J1 Power Input Pinout

J1 PIN	FUNCTION
1	GND
2	+24VDC IN

Table 8-5: 914-DC-05 J2/J3 Power Output Pinout

J2/J3 PIN	FUNCTION
1	GND
2	+5VDC OUT

Table 8-6: 914-DC-05 Specifications

ELECTRICAL PARAMETERS	MIN	TYP	MAX	UNITS
Input voltage (through J1)(1)	9	24	36	VDC
Output voltage (through J2 and J3)	—	5	—	VDC
Output regulation (over line, load, and temp)	-3	—	+3	%
Isolation voltage(2)	—	1000	—	VDC
Output power	—	—	40	W
Efficiency(3)	—	90	—	%
ENVIRONMENTAL PARAMETERS	**MIN**	**TYP**	**MAX**	**UNITS**
Operational temperature	-40	—	+85	°C
Storage temperature	-55	—	+125	°C
Thermal shutdown	—	+135	—	°C

[1] The input voltage is filtered by both 'pi' and differential type filters to reduce input noise.
[2] Isolation is between input and output.
[3] Efficiency rating is at full load.

8.2.2 914-DC-12

Card P/N 914-0224-00, 914-0224-02
Config. Dwg 914-2027-00

The 914-DC-12 card, shown in Figure 8-15, is a system card used to distribute power to several Model 914 cards/substacks. Power input to the DC-DC converter card via the 2-pin WAGO connector, J1, can range from +18 to +75VDC (+24VDC is nominal). Reverse protection and a 5A slow blow type fuse are included in the power input circuit. Note that the fuse is soldered to the board and is not replaceable in the field. Wire gauge for the input power harness should be 20-22 AWG, and wire gauge for the output power harness(es) should be 18-20 AWG.

Two separate +12VDC outputs are accessible via the 2-pin Molex connectors, J2 and J3. Outputs are fused to the cards to which they are connected. Maximum output current on any single output connector should not exceed 3A. The aggregate current output of the DC-DC converter should not exceed 6A. Typically, the 914-DC-12 is installed separately but near the 914 stack.

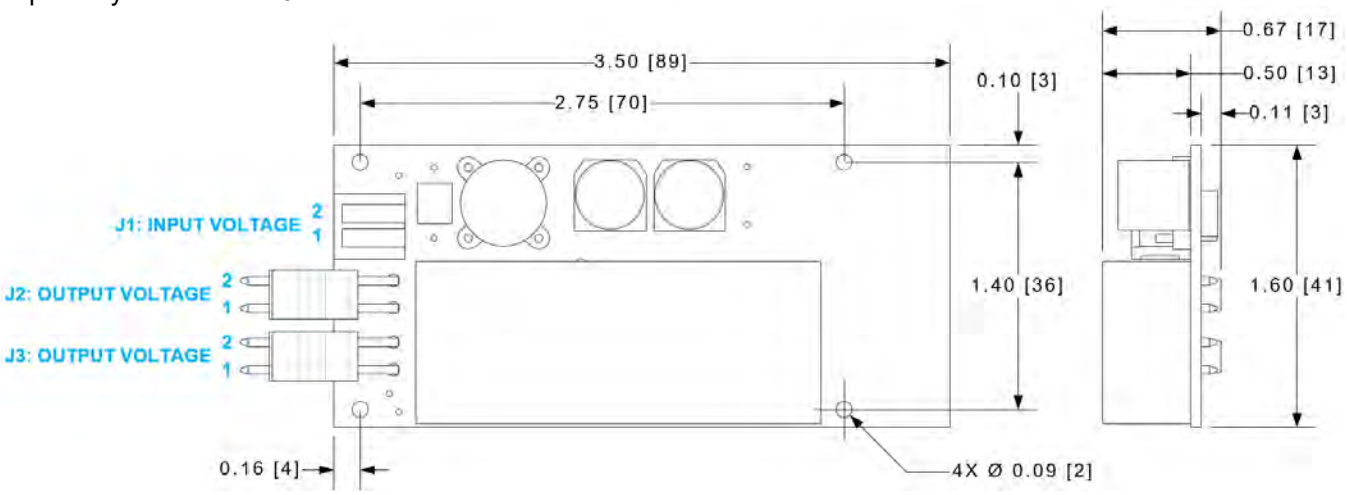


Figure 8-15: 914-DC-12 System Card, (Dimensions in inches [mm])

Table 8-7: 914-DC-12 J1 Power Input Pinout

J1 PIN	FUNCTION
1	GND
2	+24VDC IN

Table 8-8: 914-DC-12 J2/J3 Power Output Pinout

J2/J3 PIN	FUNCTION
1	GND
2	+12VDC OUT

Table 8-9: 914-DC-12 Specifications

ELECTRICAL PARAMETERS	MIN	TYP	MAX	UNITS
Input voltage (through J1)(1)	18	24	75	VDC
Output voltage (through J2 and J3)	—	12	—	VDC
Output regulation (over line, load, and temp)	-3	—	+3	%
Isolation voltage(2)	—	1000	—	VDC
Output power	—	—	72	W
Efficiency(3)	—	92	—	%
ENVIRONMENTAL PARAMETERS	**MIN**	**TYP**	**MAX**	**UNITS**
Operational temperature	-40	—	+85	°C
Storage temperature	-55	—	+125	°C
Thermal shutdown	—	+135	—	°C

[1] The input voltage is filtered by both 'pi' and differential type filters to reduce input noise.
[2] Isolation is between input and output.
[3] Efficiency rating is at full load.

9.0 Moog Focal Optical Transceivers

Moog Focal OEM SFP optical transceivers are available for sparing, replacements, and upgrades. Pressure tolerant versions of the 4.25 Gbps SFPs are available.

Table 9-1: SFP Optical Transceiver Options

	4.25 Gbps BIDIRECTIONAL SFP	4.25 Gbps CWDM SFP	10.3 Gbps BIDIRECTIONAL SFP	10.3 Gbps CWDM SFP
Wavelengths (nm)	1310 / 1550	All 18 CWDM wavelengths	1270 / 1330	All 8 red CWDM wavelengths
Connector Type	Single LC bidirectional	Dual LC TX / RX	Single LC bidirectional	Dual LC TX / RX
Fiber Type	Singlemode	Singlemode	Singlemode	Singlemode
Min Bit Rate (Gbps)	0.125	0.125	0.6	0.6
Max Bit Rate (Gbps)	4.25	4.25	10.3	10.3
Max Distance (km)	10	10	10	10
Optical Budget (dB)	20	24	20	23
TX Power (dBm) MIN	0	0	0	0
RX Sensitivity (dBm)	-20	-24	-20	-23
Case Operating Temperature (°C)	-40 to +85	-20 to +85	-40 to +85	-20 to +75
Available As Pressure Tolerant (Max. 3000 Psi)	Yes ✓	Yes ✓	No ✗	No ✗
Compatibility	914-HDE L1/M1	914-HDE L1/M1	914-HDE H1	914-HDE H1

Refer to Section 0 for part numbers.

10.0 914-X Series System Installation and Operation

10.1 Installation

The 914-X Series is intended to be installed in an enclosure with access to conductive cooling, or in an environment with airflow. It is designed to ensure low power consumption and tolerance of wide operating temperatures. It is, however, the responsibility of the system integrators to ensure that adequate cooling is provided to the units. In particular, the optical transceiver of the 914-HDE (J5) must not exceed a case temperature of +85°C, and the FPGA (U5) should not exceed a junction temperature of +100°C, as reported by the Diagnostic GUI. To accomplish this, it is recommended to provide direct conductive cooling to the four mounting holes.

Recommended mounting hardware is #2-56 type and is included with the cards. Ensure any mating hardware (standoffs, nuts, washers) are fully clear of any onboard parts, solder joints, and electrical traces. Thermally conductive hardware is recommended for mounting the card stacks. The mounting holes are electrically isolated from the system ground and are connected to a thermal layer in the PCB. These mounting holes should be used to provide conductive cooling to the PCB.

Stacking height for expansion cards is 16.00 mm to 17.22 mm. Nominal height should be minimum 16.15 mm (0.636”) to take into account component tolerances. A 4.00 mm (minimum) standoff should be used under the 914-HDE to ensure bottom side components have sufficient clearance. Standard 5/32” standoffs are supplied with the 914-HDE for mounting, along with 21/32” standoffs for expansion and media converter cards. Thermal gap material should be used under the 914-HDE to further extract heat from the card.

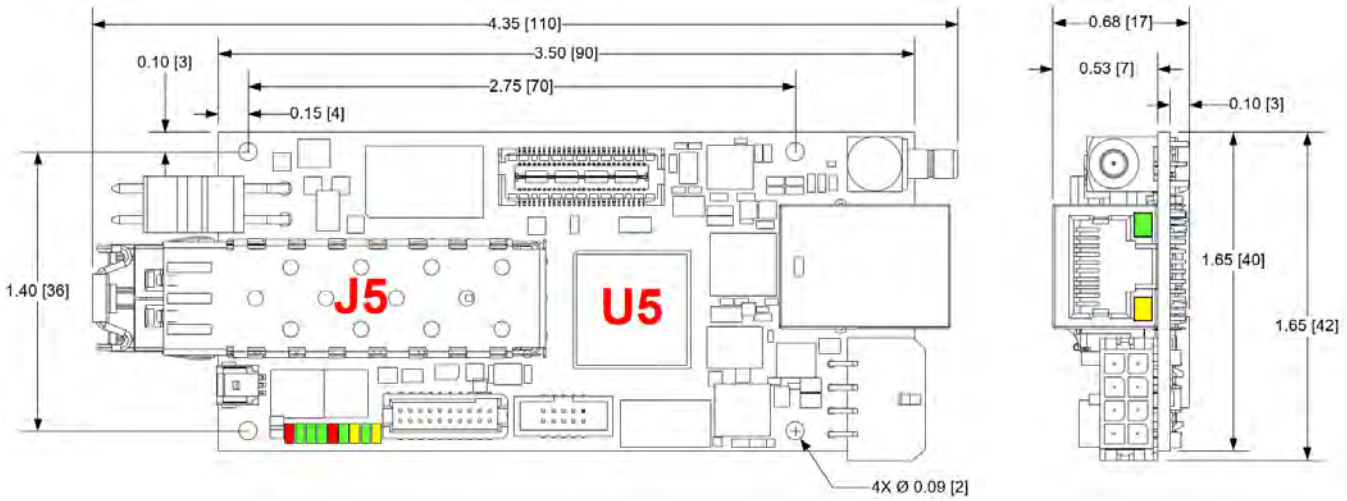


Figure 10-1: 914-HDE Dimensions (inches [mm])

When mounting, disassembling, or reassembling the 914-HDE (and stack), ensure that no fibers are subjected to bends in excess of those held by the natural routing of the fibers. The minimum bend radius of the fibers should be no less than 25 mm, though single partial bends may be less than this – as low as 15 mm – without damaging the fiber. Allowable long term values for bend radius are dependent on the fiber type and environment. Avoid even temporary bends with a radius less than 15 mm, which may affect the long-term reliability of the fiber.

To ensure that the system maintains link and reliability through high shock and/or vibration environments, it is recommended to secure the fiber LC connectors in the transceiver bushings using MIL-A-46146 equivalent RTV, such as Dow Corning 3145 clear RTV. RTV may also be applied to power and data connectors, if required.

10.2 Card Stacking

Expansion cards are stacked using the expansion connectors as a high speed backplane system. Ensure the orientation of the cards match, and observe the genders of the expansion connectors. Male connectors are always on the top (component) side of the board, and female connectors on the bottom.

Never stack or un-stack cards when powered!

1. Bench level testing of the 914-HDE system should be performed prior to permanent installation of the cards using Loctite and/or epoxy. This will allow all interfaces to be configured and tested with the user equipment prior to committing to the assembled hardware configuration.
2. Mounting order (in order from top to bottom, where **A** is top and **E** is bottom/base):
    A. **Top card**: Optical card(s) [914-CWDM; 914-FOS; 914-SPLIT]
    B. Media converter card(s) [914-HDV2]
    C. Low speed expansion card(s) [914-AX; 914-DX]
    D. Medium speed expansion Card(s) [914-EX; 914-VDX] (EX cards should be positioned closer to the HDE than VDX cards)
    E. **Base card**: Motherboard [914-HDE]
3. Install the 914-HDE Motherboard to a suitable mounting plate.
    A. Use the 5/32” standoffs with thermal gap material under the card to provide a good conductive cooling path to the mounting plate and/or enclosure.
    B. Alternatively ensure there is adequate airflow to provide cooling to the 914-HDE Motherboard.
    C. If no expansion cards are required, install the supplied nuts with Loctite 290 (or similar).
    D. If expansion cards are required, move to step 4.
4. Install the supplied 21/32” standoffs with Loctite 242 (or similar) to the 914-HDE or 914 card directly under the next expansion card.
    A. Stack the expansion card carefully onto the expansion header while lining up the standoffs to the mounting holes. The card should seat directly down on all sides simultaneously with little resistance.
    B. Optionally, install a 914-HDE high speed ribbon cable with Loctite SI 595 CL RTV for expansion connector retention. Refer to Section 10.3 for details.
        i. Complete the first card with supplied nuts and Loctite 290 or similar.
        ii. Start the next stack with the male end of the ribbon cable epoxied to the bottom side female expansion connector. Use Loctite SI 595 CL RTV to retain this connector in place.
        iii. Start the new stack with supplied 21/32” standoffs.
    C. Repeat step 4 for each Expansion card.
5. Complete the stack with supplied nuts and Loctite 290 (or similar) to retain the top card.

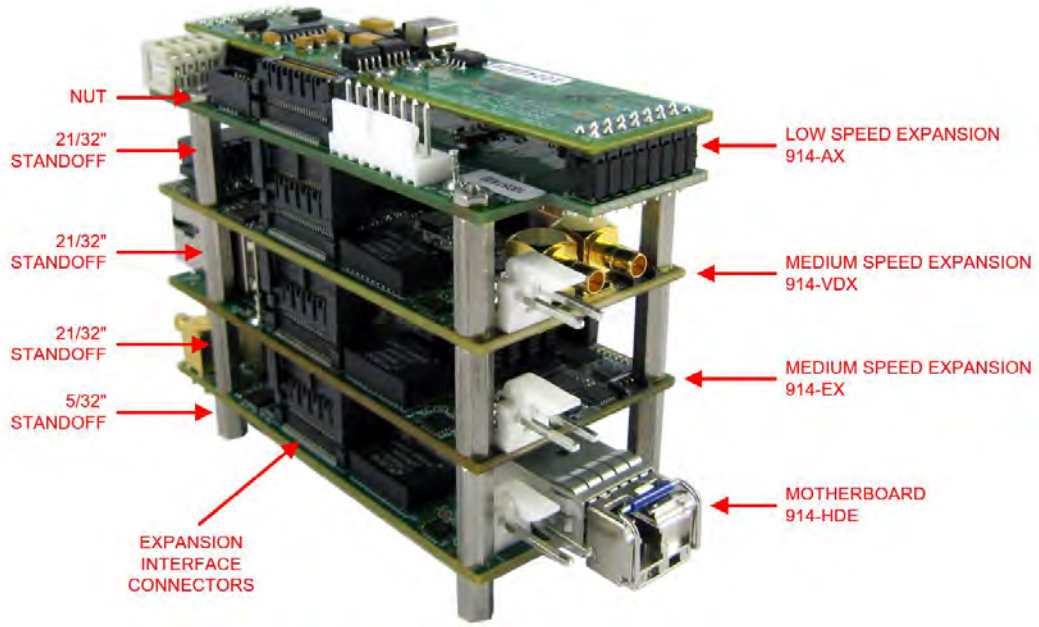


Figure 10-2: 914-X Series System Stack

10.3 914-X Series Expansion Interface Ribbon Cables

When specifying a large stack to fit into a small enclosure or pressure bottle, it may be desirable to break the stack into smaller pieces. This can be accomplished with Moog Focal 914-X Series expansion interface high speed ribbon cables. Specify lengths from 3” to 18” with orientations for inline mounting vs side-to-side mounting.

Figure 10-3: 914-X Series Expansion Interface High Speed Ribbon Cable

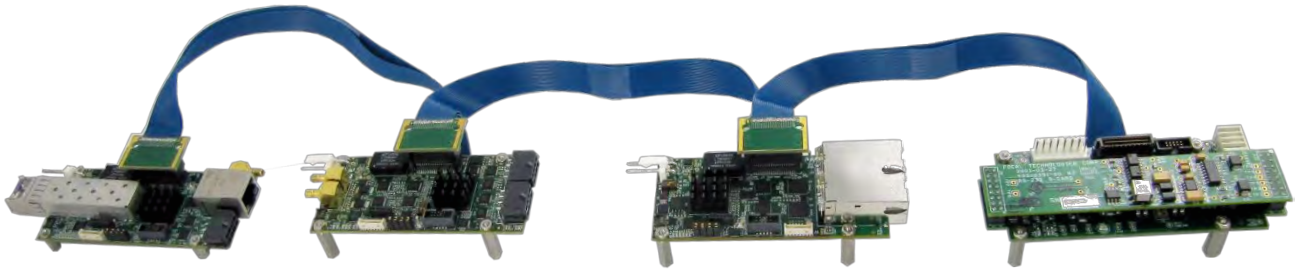


Figure 10-4: 914-X Series Linear (inline) Layout

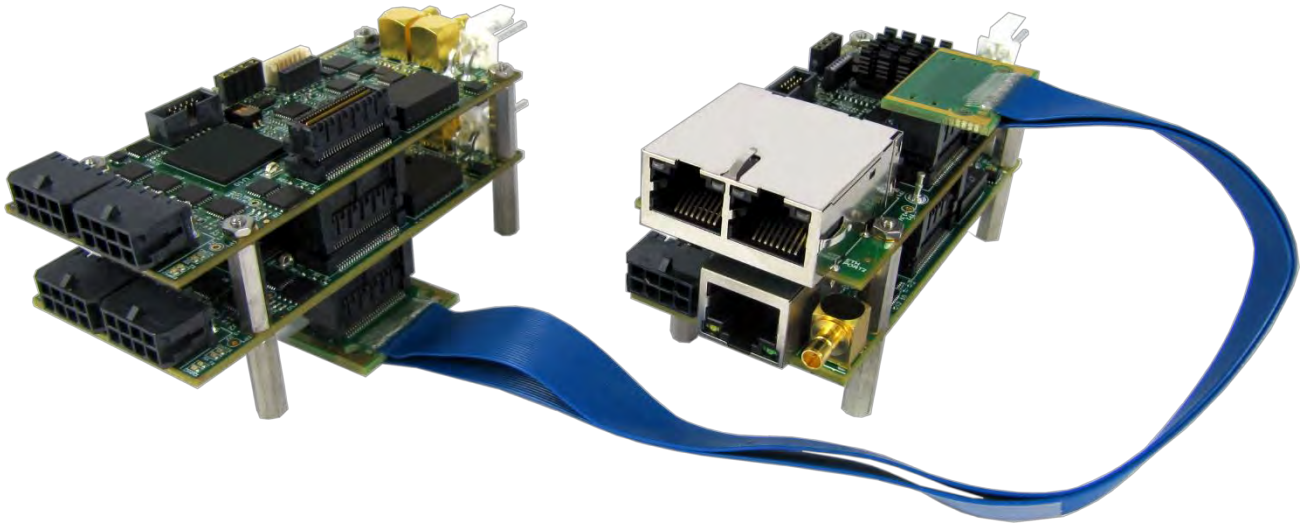


Figure 10-5: 914-X Series System Dual Stack (side-to-side) Layout

Many other configurations are possible, these are representative examples.

10.4 914-X Series Bench Test

Basic Link Operation

Basic operation of the uplink (remote to console) and downlink (console to remote) can be verified in a bench test simply by connecting fiber jumpers between the optical transceivers. The number of jumpers and the optical attenuation required depends on the optical configuration of the system under test. In some optical configurations, it may be required to use 5 or 10 dB optical attenuators placed between the fiber bushings on the mux (remote) card and the bushings on the demux (console) card to ensure the optical receivers are not saturated. Complete a flux budget calculation for your system, referring to the optical transmit power and receive overload level to determine whether optical attenuation is required or not.

After power is applied to the 914-HDE, the power LED D6 should be on (green). A red Link Fault LED D9 indicates insufficient received optical power, typically due to excessive loss in the fiber link. Excessive loss may be caused by poor fiber connections (contaminated bushings, damaged fiber, damaged ferrules) or excessive fiber bends.

CAUTION: Care must be taken when handling fiber cables. Do not touch the tips of fiber cables (ferrules). Touching the tip of a fiber cable can cause contamination. All fiber connections must be inspected and verified to be clean prior to final installation.

If the basic optical link is present (LED D8 is on), there should be data continuity through the multiplexer system to provide video and serial data links.

Optical Power Budget Test

1. To verify the console to remote flux budget (downlink), measure the transmit power of the console card by connecting the optical output directly to a calibrated optical power meter using a short, low-loss, test jumper. (Ensure the correct fiber type is used. All fibers must be of the same type. e.g. for SM normally 9 um core, for MM 50 um or 62.5 um core)

2. Remove the test jumper and install a variable optical attenuator (VOAT) between the console and remote cards.

3. Adjust the VOAT until the red Link LED on either one of the modules turns on, then reduce the loss to the point where both green link LEDs are continuously on. A stable serial data connection is a good reference point.

4. Measure the received optical power at the remote side by connecting that end of the VOAT to the optical power meter. The difference between the transmit power previously measured and this receive measured power is an estimate of optical power budget. A spool of fiber used with the VOAT can also be used to simulate dispersion effects over long cable lengths.

5. Repeat steps 1-4 with connections reversed to verify the remote to console (uplink) optical budget.

10.5 914-X Series Electrical and Environmental Specifications

The tables below summarize the electrical power requirements and environmental specifications of standard products. Cards can be configured and/or screened at the factory for extended performance, such as higher operational temperatures.

Table 10-1: Electrical Specifications

ELECTRICAL SPECIFICATION	MIN	TYP	MAX	UNITS
Input Voltage (VDC)	4.5	12	13.0	V
Power 914-HDE	—	5.0	6.0[1]	W
Power 914-VDX[2]	—	2.9	3.6[1]	W
Power 914-EX[2]	—	5.8	6.5[1]	W
Power 914-AX[2]	—	0.10[4]	1.15[1]	W
Power 914-DX[2]	—	3.0	4.0	W
Power 914-HDV2	—	2.8	3.2[1]	W

Table 10-2: Environmental Specifications

ENVIRONMENTAL SPECIFICATION	MIN	TYP	MAX	UNITS
Temperature Range (Operational)	-10		+60[3]	°C
Temperature Range (Storage)	-50		+85	°C
Humidity			85% RH, non-condensing	
Shock			30 g, 11 ms half sine, 3 axes	g
Vibration			5 g, 25-1000 Hz, 3 axes	g, Hz

[1] The maximum power is with a 12V input at +60°C.
[2] This power is *in addition to* the 914-HDE, all stacked cards and their associated power ratings must be combined to calculate a total system power rating.
[3] Higher operational temperatures are possible by using thermal management to ensure electronic parts do not exceed a case temperature of +85°C.
[4] 914-AX power is highly dependent on the AIB module installed.

Input amperage must not exceed 4A, if close to 20W is required, the power supply must use a higher nominal voltage e.g. 12V.

10.6 914-X Series Maintenance

The unit requires no routine maintenance or calibration for the specified performance. Maintenance of the units is limited to cleaning the various components using the methods described below.

Dust or dirt on the cards can be blown off using compressed air. If severe contamination of the cards should occur, they can be removed and cleaned using distilled water. **Cards must be thoroughly dried before reapplying power.**

In order to maintain optical performance, please refer to the following optical considerations.

Optical Considerations

1. **Observe the bend radius of fiber optic cables at all times**
   When mounting, disassembling, or reassembling the cards in your system, ensure that no fibers are subjected to bends in excess of those held by the natural routing of the fibers. The minimum bend radius of the fibers should generally be no less than 25 mm, though single loops may be less than this – as low as 15 mm – without damaging the fibers. Keep in mind that allowable values are dependent on the type of fiber and the environment, and cable manufacturers typically specify the minimum bend radius. Avoid even temporary bends with a radius less than 15 mm, which may induce cracks that affect long-term reliability of the fibers. In general, fiber jumpers and pigtails should be periodically inspected for damage, such as nicks in the jackets or excessive bends.

2. **Ensure fiber optic components are of the same type**
   All jumpers, cables, connectors, couplers, and Fiber Optic Rotary Joints (FORJs) used in the external optical system connecting the remote to console multiplexer must use the same type of fiber.

   The 914-X Series system has singlemode SFP transceivers installed and therefore all components in the fiber link should also be singlemode, typically Corning SMF-28 (9/125 µm) or equivalent. A single mismatched jumper in the system may cause intermittent or persistent optical link errors. Do not rely on cable jacket or connector colours alone to determine the type of optical fiber.

3. **Use clean connectors**
   It is critical to ensure all fiber connectors are clean and free of dirt and debris. Even a small amount of dirt or fluid contaminant may degrade link performance, and most reported optical link problems are due simply to poor or contaminated optical connections.
   - Keep protective dust covers on fiber connectors and bushings when not in use.
   - Do not touch the white ceramic ferrules of the connectors with bare hands or objects, other than cleaning materials.
   - Prior to making a fiber connection, clean the barrel and tip of the ferrule using a suitable solvent, such as reagent grade isopropyl alcohol, and a lint free optics cleaning tissue, such as *Kimwipes® EX-L*. Carefully dab any dirt or debris off the face of the ceramic ferrules. Excessive dirt may need to be cleared with pressurized air from a can prior to wiping the ferrule to avoid scratching the fiber itself. Do not used air from a compressor as it may be contaminated with oil.
   - During mating or unmating of fiber connectors with bushings, keep the connector aligned as straight as possible. Avoid side loading the ceramic ferrule, which can crack the internal alignment sleeve in the bushing.
   - It is recommended that each fiber connector is inspected with a handheld fiber microscope prior to final assembly to ensure there are no scratches, pits, debris, or fluid contamination on the fiber face.

NEVER look into the end of a fiber when it is plugged into a transceiver or active fiber, especially when using a magnifying instrument, such as a fiber microscope.

Figure 10-6 shows an LC connector which is a small form-factor fiber optic connector that uses a 1.25 mm ferrule and incorporates a push-and-latch design similar to an RJ-45 connector. Figure 10-7 shows an ST fiber optic connector that uses a 2.5 mm ferrule. The ST connector is latched into place by twisting to engage a spring-loaded bayonet socket.

Figure 10-6: LC connector

Figure 10-7: ST connector

4. Maintain good optical connections

SFP optical transceivers typically have a transmit and receive optical bushing (LC type), which requires dual fiber operation. The transmit side (TX) and the receiver side (RX) of a dual LC port SFP is shown in the figure below.

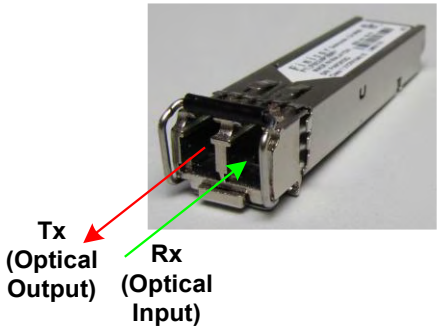


Figure 10-8: SFP Transceiver (Dual LC)

5. Maintain proper optical power levels

Optical receivers will experience errors if the received optical power is too low. Ensure the total optical losses of the components in the external cable system (jumpers, cable, connectors, couplers, FORJ, etc.) are less than the specified optical power budget of your system. For any detailed measurements or trouble-shooting a calibrated optical power meter should be used.

Optical receivers can also saturate and experience errors if the received optical power is *too high*, especially when using high power transceivers. Use a 5 or 10 dB fixed attenuator in line with each fiber during bench tests or with short, low loss links to ensure a minimum level of attenuation is present. A variable optical attenuator (VOAT) can also be used for testing. In some high power systems, receivers can actually be damaged by excessive optical power, so a fixed attenuator is recommended even with a VOAT.

10.7 914-X Series System Product Handling

General Handling

Care must always be taken during the handling of the 914-X Series cards to ensure product integrity. The following guidelines should be observed while working with the card:

- Handle products at an ESD safe workstation with a clean surface.
- Ensure fibers are not crimped or moved away from their intended routes.
- Ensure any disconnected optical connectors are cleaned immediately prior to reconnection.
- Do not exceed the recommended minimum fiber bend radius, even momentarily.
- Mishandling may cause damage to the optical transceiver, video or serial connectors, or internal components. The multiplexers must always be handled appropriately during installation, operation, maintenance, storage, and transportation to ensure safe and problem free operation.
- Any visible damage or evidence of loose parts requires removal of the multiplexer from operation and investigation by qualified service personnel.

10.8 914-X Series Accessories

Model 914 accessory kits are available from Moog Focal, these include mating cables for all interfaces. Please contact your local Moog Focal representative for more information including orderable part numbers.

10.9 914-X Series Dimensions

10.9.1 914-HDE

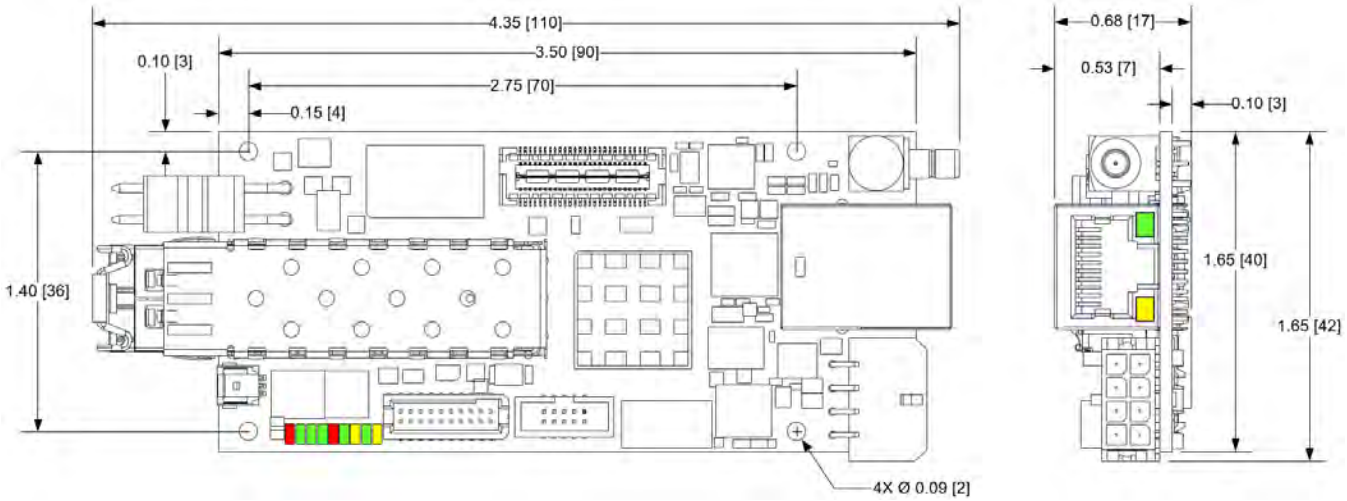


Figure 10-9: 914-HDE Dimensions (inches [mm])

10.9.2 914-VDX

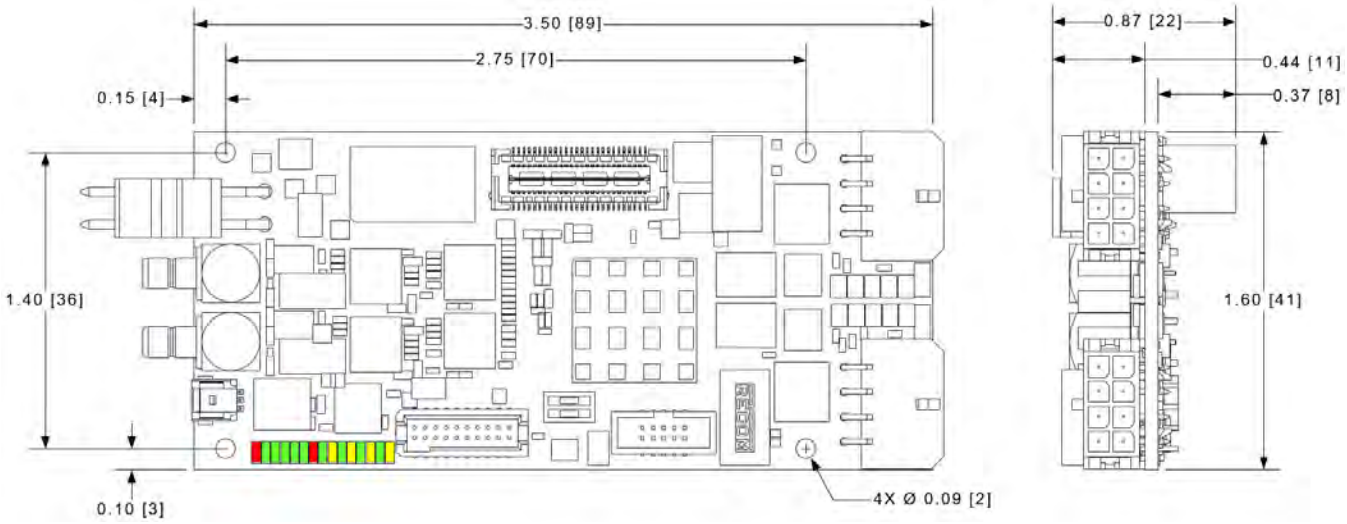


Figure 10-10: 914-VDX Dimensions (inches [mm])

10.9.3 914-EX

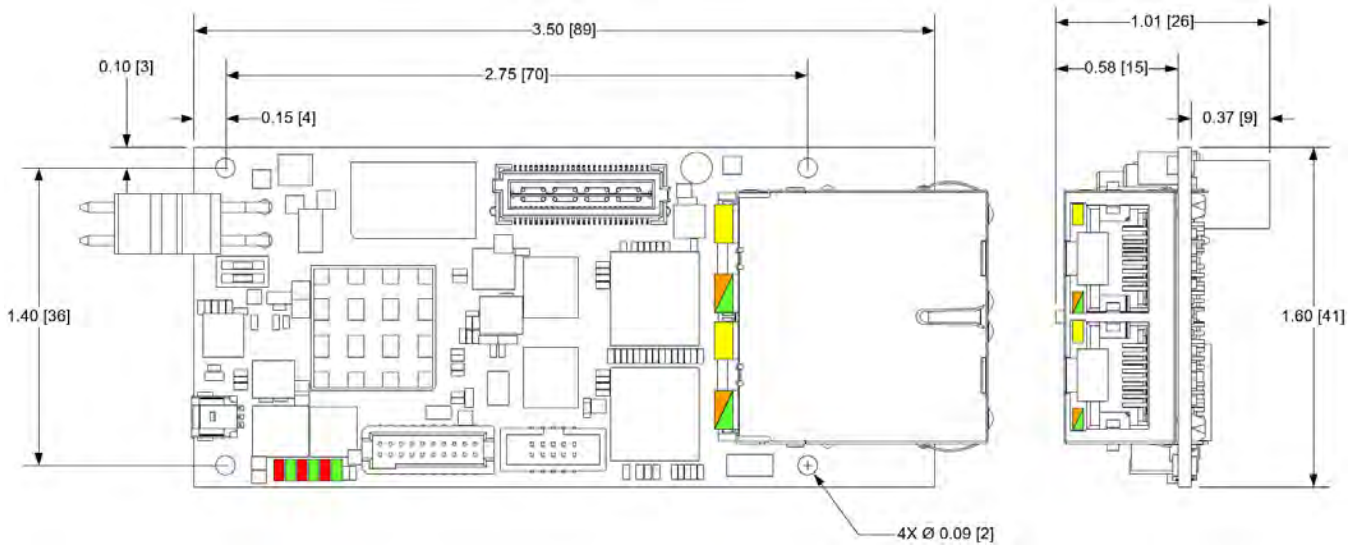


Figure 10-11: 914-EX Dimensions (inches [mm])

10.9.4 914-AX

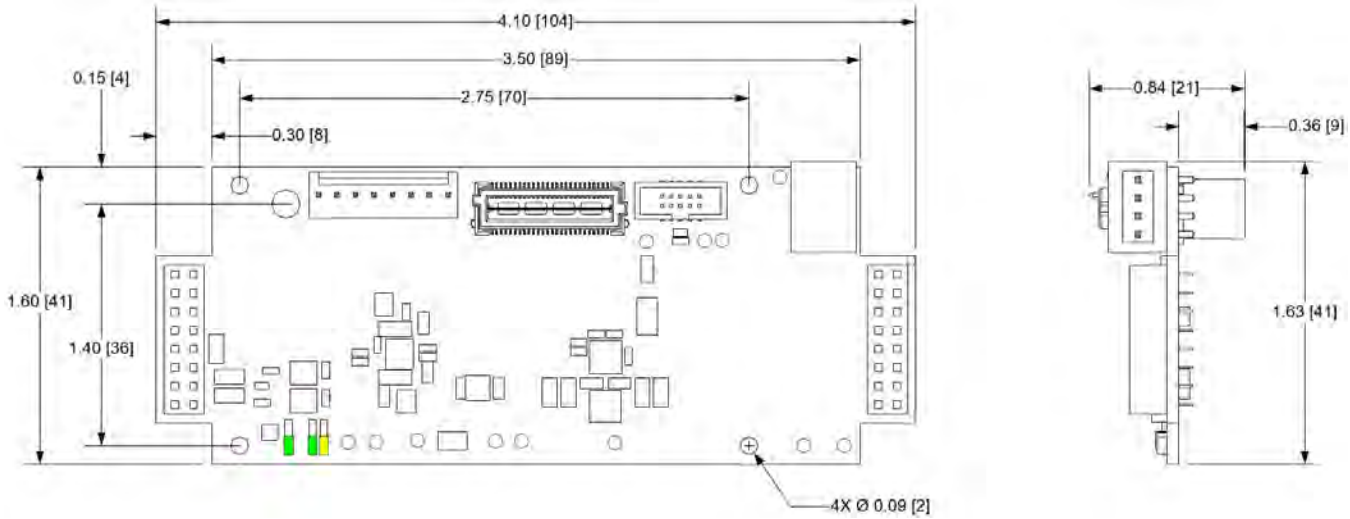


Figure 10-12: 914-AX Dimensions (inches [mm])

10.9.5 914-DX

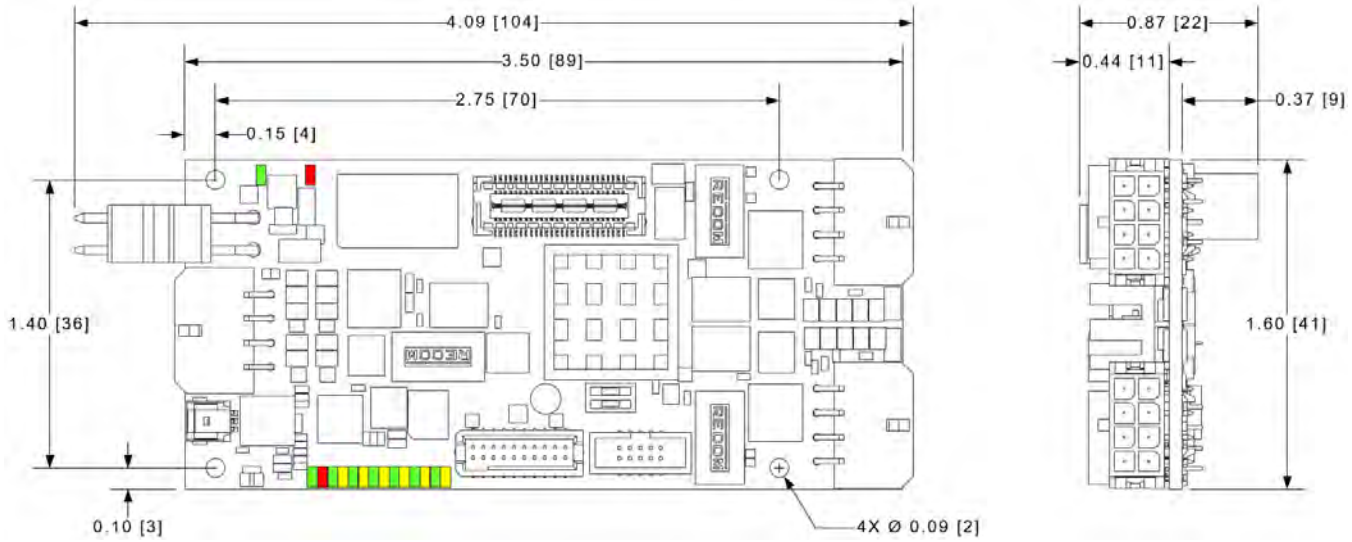


Figure 10-13: 914-DX Dimensions (inches [mm])

10.9.6 914-HDV2

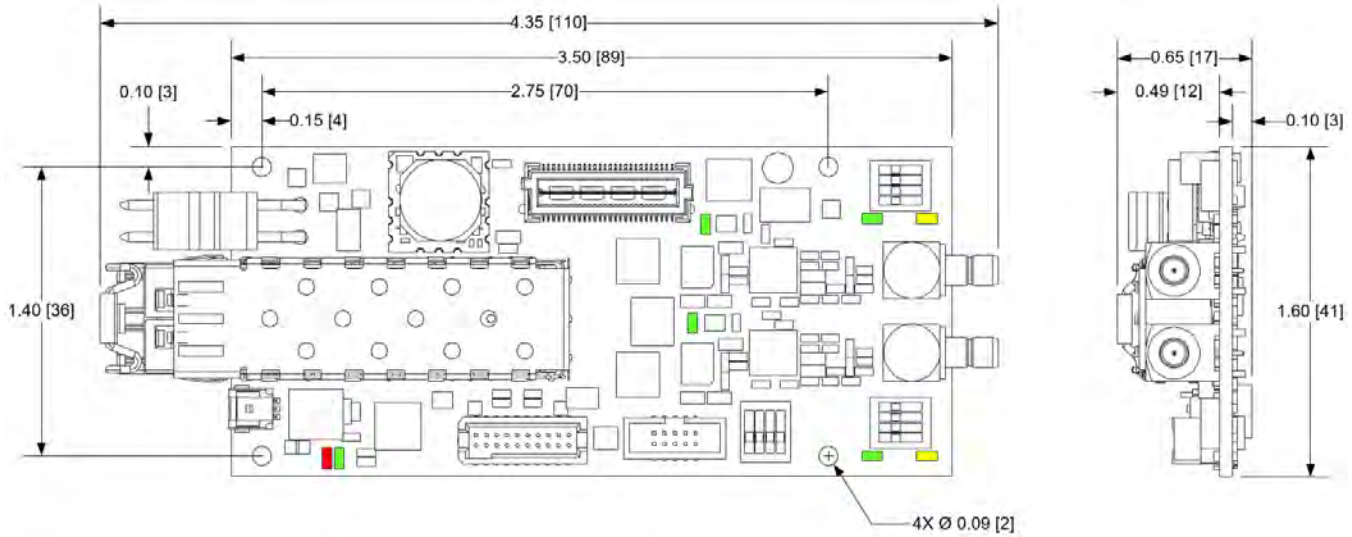


Figure 10-14: 914-HDV2 Dimensions (inches [mm])

10.10 Connector Part Numbers

The table below provides a list of the part numbers of onboard connectors and their mating connector parts.

Table 10-3: Connector Part Numbers

CARD	TYPE	BOARD REF	MFR. NAME	ONBOARD P/N [DESCRIPTION]	MATING P/N [DESCRIPTION]
914-HDE	Power	J3	Molex	09-75-2024 [2-pin]	26-03-4020 [plug] 08-52-0113 [Crimps]
	Video	J1	Amphenol	142146-75 [SMB]	131-8403-101 [Cinch 75 Ω SMB plug, other SMB plugs will work, RG179 cabling is recommended]
	Ethernet	J4	Wurth Elektronik	7499110122 [RJ45]	Standard 8P8C RJ45 plug; CAT5 or better cabling.
	Serial Data	J6	Molex	43045-0800 [8-pin Microfit]	043025-0800 [plug] 043030-0007 [crimps]
	LED Header	J9	FCI	20021521-00010T1LF [10-pin; 2 row]	20021444-00010T1LF [plug compatible with most 10 wire 0.05“ spacing ribbon cables]
	Diagnostics	J8	Molex	501953-0305 [3-pin picoclasp]	015133-0306 [3-pin plug]
914-VDX	Power	J3	Molex	09-75-2024 [2-pin]	26-03-4020 [plug] 08-52-0113 [Crimps]
	Video	J4 / J6	Amphenol	142146-75 [SMB]	131-8403-101 [Cinch 75 Ω SMB plug, other SMB plugs will work, RG179 cabling is recommended]
	Serial Data	J2 / J5	Molex	43045-0800 [8-pin Microfit]	043025-0800 [plug] 043030-0007 [crimps]
	LED Header	J9	FCI	20021521-00010T1LF [10-pin; 2 row]	20021444-00010T1LF [plug compatible with most 10 wire 0.05“ spacing ribbon cables]
	Diagnostics	J7	Molex	501953-0305 [3-pin picoclasp]	015133-0306 [3-pin plug]
914-EX	Power	J2	Molex	09-75-2024 [2-pin]	26-03-4020 [plug] 08-52-0113 [Crimps]
	Ethernet	J3	Bel Fuse	0826-1X2T-23-F [Dual RJ45 Array]	Standard 8P8C RJ45 plug; CAT5 or better cabling.
	LED Header	J6	FCI	20021521-00010T1LF [10-pin; 2 row]	20021444-00010T1LF [plug compatible with most 10 wire 0.05“ spacing ribbon cables]
	Diagnostics	J4	Molex	501953-0305 [3-pin picoclasp]	015133-0306 [3-pin plug]
914-AX	Data	J4	WAGO	733-364 [4-pin 2.5 mm]	733-104 [4-socket plug]
	LED Header	J3	FCI	20021521-00010T1LF [10-pin; 2 row]	20021444-00010T1LF [plug compatible with most 10 wire 0.05“ spacing ribbon cables]
914-DX	Power	J3	Molex	09-75-2024 [2-pin]	26-03-4020 [plug] 08-52-0113 [Crimps]
	Serial Data	J1 / J4 / J5	Molex	43045-0800 [8-pin Microfit]	043025-0800 [plug] 043030-0007 [crimps]
	LED Header	J6	FCI	20021521-00010T1LF [10-pin; 2 row]	20021444-00010T1LF [plug compatible with most 10 wire 0.05“ spacing ribbon cables]
	Diagnostics	J7	Molex	501953-0305 [3-pin picoclasp]	015133-0306 [3-pin plug]
914-HDV2	Power	J2	Molex	09-75-2024 [2-pin]	26-03-4020 [plug] 08-52-0113 [Crimps]
	Video	J3 / J5	Amphenol	142146-75 [SMB]	131-8403-101 [Cinch 75 Ω SMB plug, other SMB plugs will work, RG179 cabling is recommended]
	LED Header	J7	FCI	20021521-00010T1LF [10-pin; 2 row]	20021444-00010T1LF [plug compatible with most 10 wire 0.05“ spacing ribbon cables]
	Diagnostics	J6	Molex	501953-0305 [3-pin picoclasp]	015133-0306 [3-pin plug]

10.11 Signal Specifications

Table 10-4: Signal Specifications

SIGNAL / PARAMETER		MIN.	TYP.	MAX.	UNITS
Diagnostics	RS232		115		kbaud
Digital Video	SD/HD/3G-SDI	270	1485	2970	Mb/s
	Latency (914-HDE)(1)	20	25	30	µs
	Latency (914-HDV2)(1)			1	µs
Ethernet	Speed	10	100	1000	Mb/s
	Latency (914-HDE)(1, 2)	3	6	30	µs
	Latency (914-EX)(1, 2)	15	12	40	µs
Serial Data	RS232 Data Rate			500	kbaud
	RS485/422 Termination		120	open	Ω
	RS485/422 Data Rate (914-HDE)			2500	kbaud
	RS485/422 Data Rate (914-VDX)			1250	kbaud
	RS485/422 Data Rate (914-DX)			500	kbaud
	Latency (914-HDE)(1)			50	µs
	Latency (914-VDX)(1)			500	µs
	Latency (914-DX)(1)			55	µs
Composite Video NTSC/PAL	Input Level		1	1.4	V
	Output Level		1	1.4	V
	Input / Output Impedance		75		Ω
	Digital Resolution		10		bits
	Signal to Noise Ratio		58		dB
	Differential Gain		1.4	2	%
	Differential Phase		0.6	1	Deg. (°)
	Luminance Nonlinearity		4.0	6.0	%
	Latency(1)			500	µs
AIB Plug-in Modules	Latency(1, 3)			50	µs

[1] Latency figures comprise end-to-end electronic latency. Fiber optic latency of 5 µs/km is not included.

[2] Ethernet Latency is one frame time at the given Ethernet link speed plus the latency expressed in the table. Minimum latency is for 1000 BASE-T, typical for 100 BASE-TX, and maximum for 10 BASE-T.

[3] Does not include latency through the AIB plug-in modules. Specifications for the AIB plugin modules are contained in the 700-0271-00 user manual.

11.0 Firmware Updates

If the factory has recommended a firmware update, the instructions below describe how to perform the update via the diagnostic interface:

1. Receive both the 914-0401-01_FW_UPDATER_GUI_Release.7z installer and the new firmware revision *.bin file from Moog Focal.
2. Decompress (unzip) the 914-0401-01_FW_UPDATER_GUI_Release.7z file to the computer you plan to use to update the 914 card(s). If the file you received contains an ‘x’ in the file extension, remove it.
3. Save the firmware *.bin file to the same computer.
4. Ensure the card is powered OFF.
5. Connect the diagnostic port on the card being updated to an RS232 COM port on the computer as per section 3 of this manual:
    a. J8 on the 914-HDE
    b. J7 on the 914-VDX
    c. J4 on the 914-EX
    d. J7 on the 914-DX
6. Run the “Model914FWUpdater.exe” application.
7. Select the COM port that is connected to RS232 diagnostic port of the 914 card.
8. Select the Model # to be updated (914_HDE or 914_Expansion for the VDX/EX/DX).
9. Select “Clear Flash”.
10. Select “FPGA”.
11. Click “Select FW File” and select the firmware *.bin file provided by Moog Focal.
12. Press “Start FW Update”.
13. Power ON the 914 card.
14. Wait for the update to complete (this may take several minutes).
15. Power cycle the 914 card (a power cycle is necessary after firmware updates to any card).
16. Repeat for all 914 cards that require an update.

Note that linked card pairs (remote and console sides) must both have a compatible firmware version.

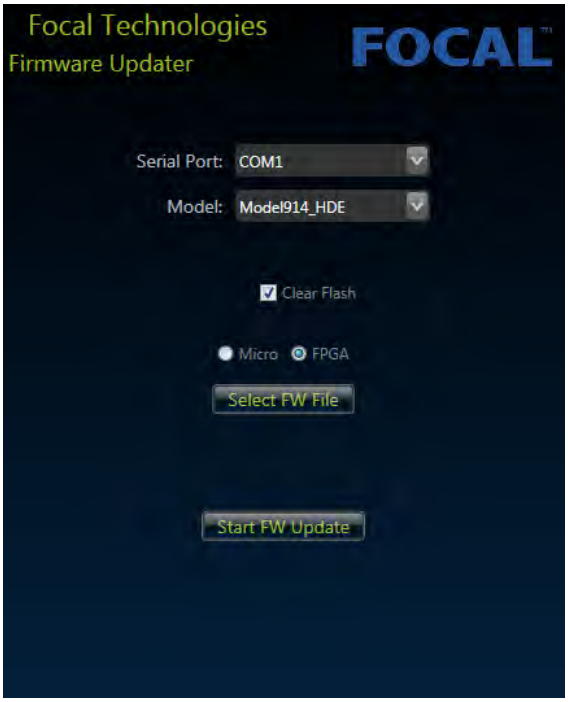


Figure 11-1: Firmware Update GUI

11.1 Firmware Compatibility

Table 11-1 shows compatible revisions in rows. Ideally cards should be updated to a “Current Revision” for cross compatibility with other cards. Old revision firmware is not compatible with current revision firmware. Please contact Moog Focal for more information and the files required to update older systems.

Table 11-1: Firmware Revisions

RELEASE DATE	CARD	914-HDE L1 / M1									914-HDE H1								914-VDX						914-EX								914-DX					
	REV	2	3	5	6	7	8	9	10		3	5	6	7	8	9	10		2	3	4	5	6		2	3	4	5	6	7	8		2	3	4	5	6	
2015/09		A0	—	—	—	—	—	—	—		—	—	—	—	—	—	—		—	—	—	—	—		—	—	—	—	—	—	—		—	—	—	—	—	
2015/11		A1	—	—	—	—	—	—	—		—	—	—	—	—	—	—		—	—	—	—	—		—	—	—	—	—	—	—		—	—	—	—	—	
2015/12		A2	—	—	—	—	—	—	—		—	—	—	—	—	—	—		—	—	—	—	—		—	—	—	—	—	—	—		—	—	—	—	—	
2016/03		B0	—	—	—	—	—	—	—		—	—	—	—	—	—	—		—	—	—	—	—		—	—	—	—	—	—	—		—	—	—	—	—	
2016/06		B1	C1	—	—	—	—	—	—		—	—	—	—	—	—	—		—	—	—	—	—		—	—	—	—	—	—	—		—	—	—	—	—	
2017/07		—	C2	—	—	—	—	—	—		—	—	—	—	—	—	—		A1	—	—	—	—		—	—	—	—	—	—	—		—	—	—	—	—	
2017/11		—	C3	—	—	—	—	—	—		—	—	—	—	—	—	—		A1	—	—	—	—		—	—	—	—	—	—	—		—	—	—	—	—	
2018/05		—	C4	—	—	—	—	—	—		—	—	—	—	—	—	—		A2	—	—	—	—		A0	—	—	—	—	—	—		—	—	—	—	—	
2018/09		—	C6	—	—	—	—	—	—		—	—	—	—	—	—	—		A2	—	—	—	—		A0	—	—	—	—	—	—		—	—	—	—	—	
2018/11		B2	C8	—	—	—	—	—	—		—	—	—	—	—	—	—		A2	—	—	—	—		A0	—	—	—	—	—	—		—	—	—	—	—	
2019/02		—	C9	—	—	—	—	—	—		—	—	—	—	—	—	—		A2	—	—	—	—		A0	—	—	—	—	—	—		—	—	—	—	—	
2019/03		—	D6	—	—	—	—	—	—		—	—	—	—	—	—	—		A2	—	—	—	—		A1	—	—	—	—	—	—		A1	—	—	—	—	
2019/04		—	D8	—	—	—	—	—	—		A1	—	—	—	—	—	—		A2	—	—	—	—		A2	—	—	—	—	—	—		A1	—	—	—	—	
2019/06		—	D8	—	—	—	—	—	—		A2	B1	—	—	—	—	—		A2	—	—	—	—		A2	—	—	—	—	—	—		A1	—	—	—	—	
2019/09		—	D9	D9	—	—	—	—	—		B3	B3	—	—	—	—	—		A2	—	—	—	—		A2	—	—	—	—	—	—		A1	—	—	—	—	
2019/11		—	D9	D9	—	—	—	—	—		B3	B3	—	—	—	—	—		A3	A3	—	—	—		A2	—	—	—	—	—	—		A1	A1	—	—	—	
2020/01		—	E2	E2	—	—	—	—	—		B3	B3	—	—	—	—	—		A3	A3	—	—	—		A2	—	—	—	—	—	—		A1	A1	—	—	—	
2020/02		—	E3	E3	—	—	—	—	—		B5	B5	—	—	—	—	—		A6	A6	—	—	—		A2	—	—	—	—	—	—		A1	A1	—	—	—	
2020/04		—	E3	E3	—	—	—	—	—		B5	B5	—	—	—	—	—		A7	A7	—	—	—		A2	—	—	—	—	—	—		A1	A1	—	—	—	
2020/05		—	E4	E4	—	—	—	—	—		B5	B5	—	—	—	—	—		A9	A9	—	—	—		A2	—	—	—	—	—	—		A1	A1	—	—	—	
2020/08		—	E6	E6	—	—	—	—	—		B7	B7	—	—	—	—	—		A9	A9	—	—	—		A2	—	—	—	—	—	—		A1	A1	—	—	—	
2021/04		—	E6	E6	—	—	—	—	—		B7	B7	—	—	—	—	—		A9	A9	—	—	—		A5	—	—	—	—	—	—		A1	A1	—	—	—	
2021/06		—	E6	E6	—	—	—	—	—		B7	B7	—	—	—	—	—		A9	A9	—	—	—		A5	—	—	—	—	—	—		A2	A2	—	—	—	
2021/12		—	E7	E7	—	—	—	—	—		B8	B8	—	—	—	—	—		A9	A9	—	—	—		A5	—	—	—	—	—	—		A2	A2	—	—	—	
2022/01		—	E9	E9	—	—	—	—	—		B9	B9	—	—	—	—	—		A9	A9	—	—	—		B1	B1	B1	—	—	—	—		A2	A2	—	—	—	
2022/03		—	E9	E9	—	—	—	—	—		B9	B9	—	—	—	—	—		A9	A9	—	—	—		B2	B2	B2	—	—	—	—		A2	A2	—	—	—	
2022/04		—	E9	E9	—	—	—	—	—		B9	B9	—	—	—	—	—		A9	A9	—	—	—		B2	B2	B2	—	—	—	—		A3	A3	A3	—	—	
2022/05		B3	E9	E9	—	—	—	—	—		B9	B9	—	—	—	—	—		A9	A9	—	—	—		B2	B2	B2	—	—	—	—		A3	A3	A3	—	—	
2022/07		B3	E9	E9	—	—	—	—	—		B9	B9	—	—	—	—	—		A9	A9	—	—	—		B2	B2	B2	E2(1)	—	—	—		A4	A4	A4	—	—	
2022/08		B3	EA	EA	EA	—	—	—	—		BA	BA	BA	—	—	—	—		A9	A9	—	—	—		B2	B2	B2	E2(1)	—	—	—		A4	A4	A4	—	—	
2022/09		B3	EA	EA	EA	EA	EA	EA	—		BA	BA	BA	BA	BA	BA	—		B0	B0	B0	—	—		B2	B2	B2	E2(1)	—	—	—		A4	A4	A4	—	—	
2023/01		B3	EA	EA	EA	EA	EA	EA	—		BA	BA	BA	BA	BA	BA	—		B0	B0	B0	—	—		B2	B2	B2	E2(1)	B3	—	—		A4	A4	A4	A4	—	
2023/03		B3	EA	EA	EA	EA	EA	EA	—		BA	BA	BA	BA	BA	BA	—		B1	B1	B1	B1	—		B2	B2	B2	E2(1)	B3	—	—		A4	A4	A4	A4	—	
2023/05		B3	EA	EA	EA	EA	EA	EA	—		BA	BA	BA	BA	BA	BA	—		B1	B1	B1	B1	—		B2	B2	B2	E2(1)	B3	B4	—		A4	A4	A4	A4	—	
2023/06		B3	EA	EA	EA	EA	EA	EA	—		BA	BA	BA	BA	BA	BA	—		B1	B1	B1	B1	—		B2	B2	B2	E2(1)	B3	B4	B5		A4	A4	A4	A4	—	
2023/09		B3	EA	EA	EA	EA	EA	EA	—		BA	BA	BA	BA	BA	BA	—		B1	B1	B1	B1	—		B2	B2	B2	E2(1)	B3	B4	B5		A5	A5	A5	A5	—	
2024/06		B3	EA	EA	EA	EA	EA	EA	—		BA	BA	BA	BA	BA	BA	—		B1	B1	B1	B1	—		B2	B2	B2	E2(1)	B3	B4	B5		A6	A6	A6	A6	A6	
2024/08		B3	ED	ED	ED	ED	ED	ED	ED		BD	BD	BD	BD	BD	BD	BD		B2	B2	B2	B2	B2		B2	B2	B2	E2(1)	B3	B4	B5		A6	A6	A6	A6	A6	

OLD REVISIONS / CURRENT REVISIONS

1. 914-EX Rev 5 hardware is only compatible with Rev E2 firmware. This is due to a different installed FPGA on the hardware. E2 is functionally equivalent with B2, B3, B4 and B5 firmware (Current Revisions).
2. Current revisions are compatible with each other, there is no reason to update. Example: 914-VDX Rev 3 hardware with Rev A9 firmware is compatible with Rev 5 hardware with Rev B1 firmware.
3. Revisions within the same date row are compatible with each other. Example: 914-HDE with Rev D9 firmware is compatible with 914-VDX with A3 firmware.
4. Green text indicates a new revision release.

12.0 Feature Upgrades

If a feature upgrade has been purchased, it can be applied in the Diagnostic GUI. Feature upgrades allow 914-HDE L1 cards to be updated to M1 cards. Contact Moog Focal for card upgrade options.

1. There are two codes required for the feature upgrade to take place: a Feature Code and an Unlock Code. Obtain these 16-digit hexadecimal alphanumeric codes from Moog Focal.
2. Open the 914-X Series Unified Diagnostic GUI with the Console 914-HDE connected to a local COM port, as per Section 5.0.
3. Navigate to the Engineering settings page (see Section 5.8)
4. In the bottom left of the engineering settings page, enter both the Unlock Code and the Feature code (with or without hyphens, it does not matter).
5. Under Card, select “Console”.
6. Press “Apply” and confirm. Allow up to ten seconds for the feature codes to be written.
7. Disconnect the console card from the COM port and connect the remote card. *This is the only instance in which this action should ever be performed.*
8. Repeat Steps 1 – 6 exactly. Once completed, disconnect from the remote and reconnect to the console.

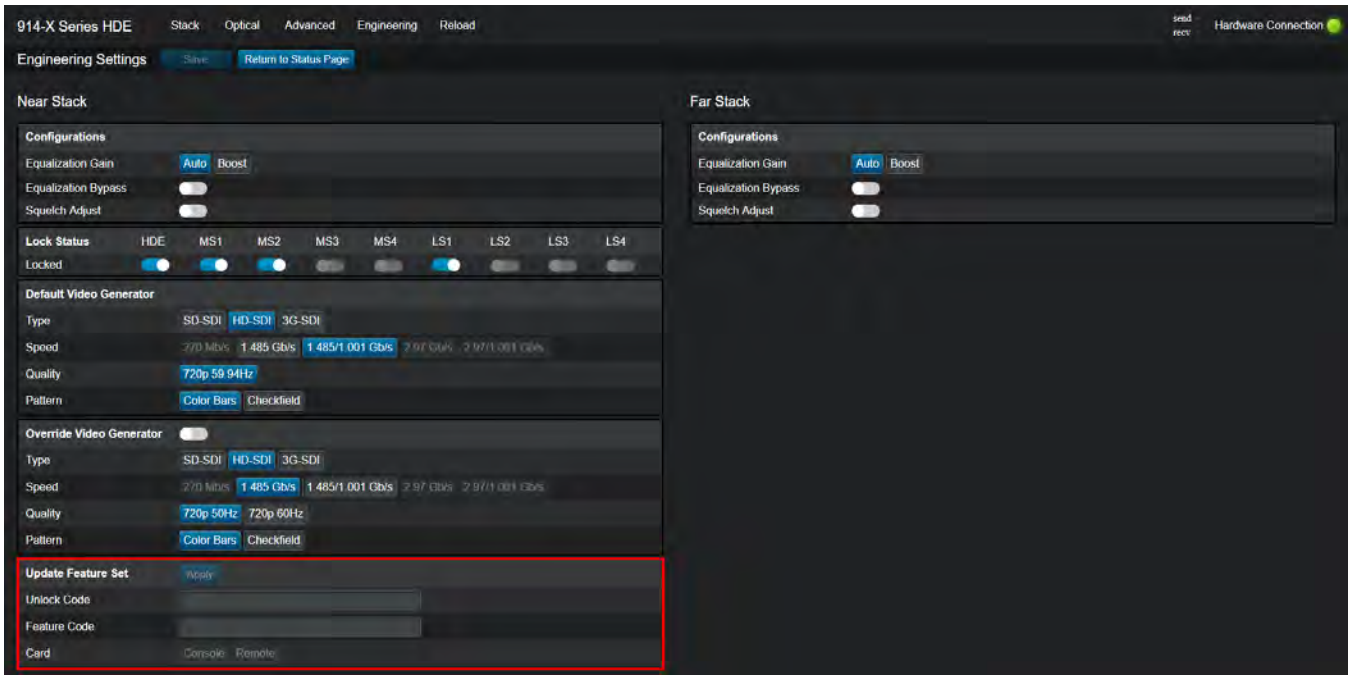


Figure 12-1: 914-HDE Engineering Settings Page

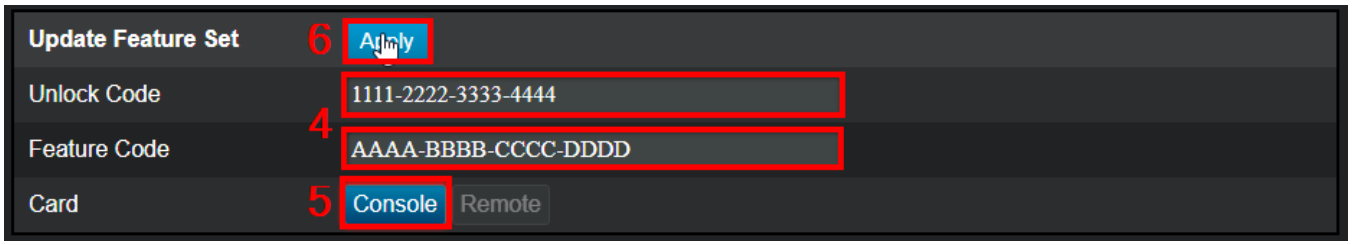


Figure 12-2: Feature Update Via Configuration Tool

13.0 Part Numbers

13.1 914-HDE Motherboard Part Numbers

914-HDE cards are typically specified in pairs of remote and console sides of the system. Pairs must have the same firmware, board version (L1, M1 or H1), and compatible (different) optical wavelengths. Single fiber bidirectional systems put the lower wavelength (1310 or 1270 nm) at the remote, and the higher wavelength (1550 or 1330 nm) at the console. CWDM wavelengths must be compatible with the chosen CWDM module, and must be unique between remote and console cards, or from any other optical component in the system.

Table 13-1: 914-HDE Part Numbers

PART NUMBER	DESCRIPTION
914-0023-13-CYZZ[2]	Remote Configuration, 1310 nm, SM, bidi single fiber, L1 Version[3], 20dB
914-0023-XX[1]-CYZZ[2]	Remote Configuration, 1XX0 nm, SM, CWDM dual fiber, L1 Version[3], 24 dB
914-0023-99-CYZZ[2]	Remote Configuration, No SFP, L1 Version[3]
914-0024-15-CYZZ[2]	Console Configuration, 1550 nm, SM, bidi single fiber, L1 Version[3], 20 dB
914-0024-XX[1]-CYZZ[2]	Console Configuration, 1XX0 nm, SM, CWDM dual fiber, L1 Version[3], 24 dB
914-0024-99-CYZZ[2]	Console Configuration, No SFP, L1 Version[3]
914-0026-13-CYZZ[2]	Remote Configuration, 1310 nm, SM, bidi single fiber, M1 Version[3], 20 dB
914-0026-XX[1]-CYZZ[2]	Remote Configuration, 1XX0 nm, SM, CWDM dual fiber, M1 Version[3], 24 dB
914-0026-99-CYZZ[2]	Remote Configuration, No SFP, M1 Version[3]
914-0027-15-CYZZ[2]	Console Configuration, 1550 nm, SM, bidi single fiber, M1 Version[3], 20 dB
914-0027-XX[1]-CYZZ[2]	Console Configuration, 1XX0 nm, SM, CWDM dual fiber, M1 Version[3], 24 dB
914-0027-99-CYZZ[2]	Console Configuration, No SFP, M1 Version[3]
914-0029-12-CYZZ[2]	Remote Configuration, 1270 nm, SM, bidi single fiber, H1 Version[3], 20 dB
914-0029-XX[1]-CYZZ[2]	Remote Configuration, 1XX0 nm, SM, CWDM dual fiber, H1 Version[3], 23 dB
914-0029-99-CYZZ[2]	Remote Configuration, No SFP, H1 Version[3]
914-0030-13-CYZZ[2]	Console Configuration, 1330 nm, SM, bidi single fiber, H1 Version[3], 20 dB
914-0030-XX[1]-CYZZ[2]	Console Configuration, 1XX0 nm, SM, CWDM dual fiber, H1 Version[3], 23 dB
914-0030-99-CYZZ[2]	Console Configuration, No SFP, H1 Version[3]
914-0037-13-CYZZ[2]	Remote Configuration, 1310 nm, SM, bidi single fiber, L1 Version[3], 20 dB, PT3K[4]
914-0037-XX[1]-CYZZ[2]	Remote Configuration, 1XX0 nm, SM, CWDM dual fiber, L1 Version[3], 24 dB, PT6K[4]
914-0037-99-CYZZ[2]	Remote Configuration, No SFP, L1 Version[3], PT6K[4]
914-0038-13-CYZZ[2]	Remote Configuration, 1310 nm, SM, bidi single fiber, M1 Version[3], 20 dB, PT3K[4]
914-0038-XX[1]-CYZZ[2]	Remote Configuration, 1XX0 nm, SM, CWDM dual fiber, M1 Version[3], 24 dB, PT6K[4]
914-0039-99-CYZZ[2]	Remote Configuration, No SFP, M1 Version[3], PT6K[4]

[1] Refer to Table 13-3 for details.
[2] Refer to Table 13-5 for details.
[3] Refer to Table 13-4 for details.
[4] PT6K refers to pressure tolerant assemblies rated to 6000 PSI.

Table 13-2: 914-HDE Included Accessories

QUANTITY	DESCRIPTION
1	Power harness, 6', pigtailed
1	RS232 Diagnostic cable, 6", pigtailed
4	#2-56, 3/16", 21/32" tall standoff
4	#2-56, 3/16", 5/32" tall standoff
4	#2-56, hex nut

Table 13-3: 914-HDE CWDM Options

XX	DESCRIPTION	CWDM BAND	STATUS
27	1271 nm optical transmitter	Blue	Special Order
29	1291 nm optical transmitter	Blue	Special Order
31	1311 nm optical transmitter	Blue	Special Order
33	1331 nm optical transmitter	Blue	Special Order
35	1351 nm optical transmitter	Blue	Special Order
37	1371 nm optical transmitter	Blue	Special Order
39	1391 nm optical transmitter	Blue	Special Order
41	1411 nm optical transmitter	Blue	Special Order
43	1431 nm optical transmitter	Blue	Special Order, Not recommended
45	1451 nm optical transmitter	Blue	Special Order, Not recommended
47	**1471 nm optical transmitter**	**Red**	**Recommended, compatible with 914-CWDM**
49	**1491 nm optical transmitter**	**Red**	**Recommended, compatible with 914-CWDM**
51	1511 nm optical transmitter	Red	Recommended
53	1531 nm optical transmitter	Red	Recommended
55	1551 nm optical transmitter	Red	Upgrade
57	1571 nm optical transmitter	Red	Upgrade
59	1591 nm optical transmitter	Red	Upgrade, not for use with Moog Focal OMS
61	1611 nm optical transmitter	Red	Upgrade, not for use with Moog Focal OMS

- Red wavelengths are recommended, particularly 1471 to 1571 nm.
- 1591 and 1611 nm wavelengths are not recommended for use with the Moog Focal Optical Monitoring System (OMS).
- When configuring a system, it is best to choose adjacent wavelengths and not to mix red band with blue band wavelengths.

Table 13-4: 914-HDE Factory Versions

FEATURE	PARAMETER	L1	M1	H1
Video	Speed	HD/SD	3G/HS/SD	3G/HD/SD
Ethernet	Speed (Mb/s)[1, 2]	10/100/1000	10/100/1000	10/100/1000
Serial Channels	Format	RS232, RS485, RS422, TTL		
LS Expansion Channels	Quantity	4		
MS Expansion Channels	Quantity[3]	0	4	4
Optical Bandwidth	Gb/s	1.8	3.5	5.6

[1] L1 Version Supports HD-SDI or 1000 BASE-T, default is to support HD-SDI. This can be changed via the 914-X Series Unified Diagnostic GUI

[2] M1 Version supports 3G-SDI or 1000 BASE-T. When 3G-SDI is plugged, Ethernet is limited to 300Mb/s bandwidth.

[3] Limited to available optical bandwidth. Refer to Section 3.3.

Table 13-5: 914-HDE Factory Configurations

SETTING OPTION	SERIAL CH1	SERIAL CH2	VIDEO	ETHERNET
BLANK (C000)	RS232		Enabled[1]	Auto-negotiate[2]
C001	RS485			
C002	RS422			
C003	RS232	RS485		
C004	RS232	RS422		
C005	RS485	RS422		
C006	TTL[4]			
C007	TTL[4]	RS232		
C008	TTL[4]	RS485		
C009	TTL[4]	RS422		
C010	RS232		Enabled[1]	Negotiate 100 Base-TX Full Duplex Only
C011	RS485			
C012	RS422			
C013	RS232	RS485		
C014	RS232	RS422		
C015	RS485	RS422		
C016	TTL[4]			
C017	TTL[4]	RS232		
C018	TTL[4]	RS485		
C019	TTL[4]	RS422		
C020[3]	RS232		SD-SDI Only	Auto-negotiate up to 1000 BASE-T
C021[3]	RS485			
C022[3]	RS422			
C023[3]	RS232	RS485		
C024[3]	RS232	RS422		
C025[3]	RS485	RS422		
C026[3]	TTL[4]			
C027[3]	TTL[4]	RS232		
C028[3]	TTL[4]	RS485		
C029[3]	TTL[4]	RS422		

[1] HD/SD-SDI enabled for L1 version, 3G/HD/SD-SDI enabled for M1/H1 versions.
[2] 10/100 BASE-T(X) default for L1 version, 10/100/1000 BASE-T(X) for M1/H1 versions.
[3] L1 Version only.
[4] TTL only available on 914-HDE PCBAs of revision 6 and up.

Notes:

- Factory configuration options represent “as shipped” settings.
- Users may alter all allowable configurations via the Diagnostic GUI.
- Default configuration is recommended for spare assemblies.
- Other factory settings are possible. Contact Moog Focal for more options.
- Configurations other than the default are subject to a surcharge.

13.2 914-VDX Part Numbers

Table 13-6: 914-VDX Part Numbers

PART NUMBER	DESCRIPTION
914-0039-00	VDX Default Configuration[1]
914-0039-00-CYZZ[2]	Standard 914-VDX
914-0039-01	914-EX PT6K[3] Default Configuration[1]
914-0039-01-CYZZ[2]	914-VDX PT6K[3]

[1] Refer to row 1 of Table 13-8
[2] CYZZ refers to factory configurations (refer to Table 13-8)
[3] PT6K refers to Pressure Tolerant Assembly rated to 6000 PSI

Table 13-7: 914-VDX Included Accessories

QUANTITY	DESCRIPTION
1	RS232 Diagnostic cable, 6", pigtailed
4	#2-56, 3/16", 21/32" tall standoff

Table 13-8: 914-VDX Factory Configuration Options

Remote	Console	Serial CH1 Setting	Serial CH2 Setting	Serial CH3 Setting	Serial CH4 Setting
Blank/C000	C100	RS232			
C001	C101	RS485(1)			
C002	C102	RS422(2)			
C003	C103	RS232			RS485(1)
C004	C104	RS232		RS485(1)	
C005	C105	RS232	RS485(1)		
C006	C106	RS232			RS422(2)
C007	C107	RS232		RS422(2)	
C008	C108	RS232	RS422(2)		
C009	C109	RS485(1)			RS422(2)
C010	C110	RS485(1)		RS422(2)	
C011	C111	RS485(1)	RS422(2)		
C012	C112	RS232		RS485(1)	RS422(2)
C013	C113	RS232	RS485(1)		RS422(2)
C014	C114	RS232	RS485(1)	RS422(2)	
C015	C115	TTL[3]			
C016	C116	RS232			TTL[3]
C017	C117	RS232		TTL[3]	
C018	C118	RS232	TTL[3]		
C019	C119	RS485(1)			TTL[3]
C020	C120	RS485(1)		TTL[3]	
C021	C121	RS485(1)	TTL[3]		
C022	C122	RS422(2)			TTL[3]
C023	C123	RS422(2)		TTL[3]	
C024	C124	RS422(2)	TTL[3]		
C025	C125	RS232		RS485(1)	TTL[3]
C026	C126	RS232	RS485(1)		TTL[3]
C027	C127	RS232	RS485(1)	TTL[3]	
C028	C128	RS232		RS422(2)	TTL[3]
C029	C129	RS232	RS422(2)		TTL[3]
C030	C130	RS232	RS422(2)	TTL[3]	
C031	C131	RS485(1)		RS422(2)	TTL[3]
C032	C132	RS485(1)	RS422(2)		TTL[3]
C033	C133	RS485(1)	RS422(2)	TTL[3]	

[1] RS485 has differential 120 Ω terminations enabled with a timeout of 1 ms
[2] RS422 has differential 120 Ω terminations enabled
[3] TTL only available on 914-VDX PCBAs of revision 4 and up.

Notes:
- Factory configuration options represent "as shipped" settings.
- Users may alter all configurations via the Diagnostic GUI in combination with dip switches.
- Default configuration is recommended for spare assemblies

- SW1 is always set to [OFF, OFF] for expansion Channel 1. Ensure systems with multiple MS expansion cards have unique channel settings, and that each corresponding MS expansion's SW1 is configured in line with Section 6.1.6.
- Other factory settings are possible. Contact Moog Focal for more options.
- Configurations other than the default are subject to a surcharge.

13.3 914-EX Part Numbers

Table 13-9: 914-EX Part Numbers

PART NUMBER	DESCRIPTION
914-0040-00	914-EX Default Configuration[1]
914-0040-00-CYZZ[2]	Standard 914-EX
914-0040-01	914-EX PT6K[3] Default Configuration[1]
914-0040-01-CYZZ[2]	914-EX PT6K[3]

[1] Refer to row 1 of Table 13-11
[2] CYZZ refers to factory configurations (refer to Table 13-11)
[3] PT6K refers to Pressure Tolerant Assembly rated to 6000 PSI

Table 13-10: 914-EX Included Accessories

QUANTITY	DESCRIPTION
1	RS232 Diagnostic cable, 6", pigtailed
4	#2-56, 3/16", 21/32" tall standoff

Table 13-11: 914-EX Factory Configuration Options

REMOTE	CONSOLE	ETHERNET PORT 1	ETHERNET PORT 2	# EXPANSION CHANNELS USED
Blank	C100	10/100/1000 BASE-T(X)		1
C001	C101	10/100/1000 BASE-T(X)	100 BASE-TX	
C002	C102	10/100/1000 BASE-T(X)	10 BASE-T	
C003	C103	100 BASE-TX		
C004	C104	100 BASE-TX	10 BASE-T	
C005	C105	10 BASE-T		
C006	C106	10/100 BASE-T(X)		
C007	C107	10/100/1000 BASE-T(X)	10/100 BASE-T(X)	
C008	C108	10/100 BASE-T(X)	100 BASE-TX	
C009	C109	10/100 BASE-T(X)	10 BASE-T	
C200	C400	10/100/1000 BASE-T(X)		2
C201	C401	10/100/1000 BASE-T(X)	100 BASE-TX	
C202	C402	10/100/1000 BASE-T(X)	10 BASE-T	
C203	C403	100 BASE-TX		
C204	C404	100 BASE-TX	10 BASE-T	
C205	C405	10 BASE-T		
C206	C406	10/100 BASE-T(X)		
C207	C407	10/100/1000 BASE-T(X)	10/100 BASE-T(X)	
C208	C408	10/100 BASE-T(X)	100 BASE-TX	
C209	C409	10/100 BASE-T(X)	10 BASE-T	

Notes:

- Factory configuration options represent "as shipped" settings.
- Users may alter all configurations via the 914-X Series Unified Diagnostic GUI in combination with dip switch settings.
- Default configuration is recommended for spare assemblies
- SW1 is always set to [OFF, OFF] for expansion Channel 1. Ensure systems with multiple MS expansion cards have unique channel settings, and that each corresponding MS expansion's SW1 is configured in ascending order in line with Section 6.2.6.
- Other factory settings are possible. Contact Moog Focal for more options.
- Configurations other than the default are subject to a surcharge.
- Remote Ethernet Link Speed Synchronization (RLSS) is enabled by default for all cards configured for console mode for PCBA revisions 5 and later. This setting can be disabled in the Diagnostic GUI.
- Default configuration for all cards is remote, Ethernet ports set to auto-negotiate all speeds. These settings can be updated via the Diagnostic GUI when integrated into a system and stacked onto a 914-HDE. This configuration should be verified before connecting Ethernet ports.

13.4 914-AX Part Numbers

Table 13-12: 914-AX Part Numbers

PART NUMBER	DESCRIPTION
914-0041-00	Standard 914-AX
914-0041-01	914-AX PT6K[1]

[1] PT6K refers to Pressure Tolerant Assembly rated to 6000 PSI

Table 13-13: 914-AX Included Accessories

QUANTITY	DESCRIPTION
4	#2-56, 3/16", 21/32" tall standoff

13.5 AIB Module Part Numbers

Please refer to 700-0271-00 AIB Plug-In Modules User Manual for module details and configuration.

Table 13-14: AIB Module Part Numbers

PART NUMBER	CARD ID	DESCRIPTION
903-0244-00	AIB-HYDRO	Default hydrophone gain of 36 dB
903-0244-01	AIB-IRIG	Modified for IRIG-B
903-0244-02	AIB-HYDRO	Provides 12 V to the hydrophone, gain is bypassed
903-0244-03	AIB-HYDRO-P6	Provides 12 V to the hydrophone, gain is bypassed, pressure tolerant assembly rated to 6000 PSI
903-0250-00	AIB-MS900	MS900 Analog Sonar Interface
903-0250-01	AIB-MS900L	MS900 Analog Sonar Low Frequency Interface
903-0251-00	AIB 232	RS232 Interface
903-0251-01	AIB TRIG	Modified RS232 for +5 to +25 V for trigger signals.
903-0251-02	AIB-TRIG-P6	Modified RS232 for +5 to +25 V for trigger signals, pressure tolerant assembly rated to 6000 PSI.
903-0252-00	AIB 485/422	RS485/RS422 Interface
903-0252-01	AIB TTL	TTL Interface, 0 to +5 V TTL signals
903-0252-02	AIB 485-P6	RS482/RS422 Interface, pressure tolerant assembly rated to 6000 PSI.
903-0261-00	AIB-ARCNET	Tritech ARCNET compatible interface
903-0261-01	AIB-ARCNET-P6	Tritech ARCNET compatible interface, pressure tolerant assembly rated to 6000 PSI.
903-0297-00	AIB-CANBUS	CAN bus interface, up to 1 Mb/s supported

13.6 914-DX Part Numbers

Table 13-15: 914-DX Part Numbers

PART NUMBER	DESCRIPTION
914-0042-00-CYZZ[1]	Standard 914-DX
914-0042-01-CYZZ[1]	914-DX PT6K[2]

[1] CYZZ refers to factory configurations (refer to Table 13-17)
[2] PT6K refers to Pressure Tolerant Assembly rated to 6000 PSI

Table 13-16: 914-DX Included Accessories

QUANTITY	DESCRIPTION
1	RS232 Diagnostic cable, 6", pigtailed
4	#2-56, 3/16", 21/32" tall standoff

Table 13-17: 914-DX Factory Configuration Options

REMOTE	CONSOLE	SERIAL CH1	SERIAL CH2	SERIAL CH3	SERIAL CH4	SERIAL CH5	SERIAL CH6
Blank	C100	RS232					
C001	C101	RS485(1)					
C002	C102	RS422(2)					
C003	C103	TTL					
C004	C104	RS232				RS485(1)	
C005	C105	RS232		RS485(1)			
C006	C106	RS232				RS422(2)	
C007	C107	RS232		RS422(2)			
C008	C108	RS485(1)				RS422(2)	
C009	C109	RS485(1)		RS422(2)			
C010	C110	RS232				TTL	
C011	C111	RS232		TTL			
C012	C112	RS485(1)				TTL	
C013	C113	RS485(1)		TTL			
C014	C114	RS422(2)				TTL	
C015	C115	RS422(2)		TTL			
C016	C116	RS232		RS485(1)		RS422(2)	
C017	C117	RS485(1)		RS422(2)		TTL	
C018	C118	RS232		RS485(1)		TTL	
C019	C119	RS232		RS422(2)		TTL	

[1] RS485 has 120 Ω differential terminations enabled with a timeout of 1 ms
[2] RS422 has 120 Ω differential terminations enabled

Notes:

- Factory configuration options represent "as shipped" settings.
- Users may alter all configurations via 914-X Series Unified Diagnostic GUI in combination with dip switches.
- Default configuration is recommended for spare assemblies
- SW1 is always set to [OFF, OFF] for LS expansion channel 1. Ensure systems with multiple LS expansion cards have unique channel settings, and that each corresponding LS expansion's SW1 is configured in ascending order in line with Section 6.4.5.
- Other factory settings are possible. Contact Moog Focal for more options.
- Configurations other than the default are subject to a surcharge.
- **RS422:** On board 120 Ω termination resistors are enabled between RS422 RX+ and RS422 RX- lines by default. The board has no pull up or pull down biasing resistors in place. If needed, these can be added externally.
- **RS485:** On board 120 Ω termination resistors are enabled between RS485 RX+ and RS485 RX- lines by default. The board has no pull up or pull down biasing resistors in place. If needed, these can be added externally. Configurable timeouts may be set via the 914-X Series Unified Diagnostic GUI.

13.7 914-HDV2 Part Numbers

Table 13-18: 914-HDV2 Part Numbers

PART NUMBER	DESCRIPTION	STATUS
DUAL CHANNEL OPTIONS		
914-0031-00	HDV2 Console non-MSA dual video output; 1260 nm to 1620 nm optical inputs	**Recommended**
914-0032-00	HDV2 Remote non-MSA dual video input; CWDM output wavelengths: CH1 1271 nm and CH2 1291 nm	Special Order
914-0032-01	HDV2 Remote non-MSA dual video input; CWDM output wavelengths: CH1 1311 nm and CH2 1331 nm	Special Order
914-0032-02	HDV2 Remote non-MSA dual video input; CWDM output wavelengths: CH1 1351 nm and CH2 1371 nm	Special Order
914-0032-03	HDV2 Remote non-MSA dual video input; CWDM output wavelengths: CH1 1391 nm and CH2 1411 nm	Special Order
914-0032-04	HDV2 Remote non-MSA dual video input; CWDM output wavelengths: CH1 1471 nm and CH2 1491 nm; Recommended for use with 914-CWDM	**Recommended**
914-0032-05	HDV2 Remote non-MSA dual video input; CWDM output wavelengths: CH1 1511 nm and CH2 1531 nm	**Recommended**
914-0032-06	HDV2 Remote non-MSA dual video input; CWDM output wavelengths: CH1 1551 nm and CH2 1571 nm	**Recommended**
914-0032-07	HDV2 Remote non-MSA dual video input; CWDM output wavelengths: CH1 1591 nm and CH2 1611 nm	**Recommended**[3]
SINGLE CHANNEL OPTIONS		
914-0033-00	HDV2 Console MSA single video output; 1260 nm to 1620 nm optical input	Recommended
914-0034-XX[1]	HDV2 Remote MSA single video input; CWDM output wavelength: CH1 1XX1 nm	See Table 13-20
914-0043-XX[1]	HDV2 Remote MSA single video input; CWDM output wavelength: CH1 1XX1 nm PT6K[2]	See Table 13-20

[1] XX Refer to Table 13-20
[2] PT6K refers to Pressure Tolerant Assembly rated to 6000 PSI
[3] Not for use with Moog Focal OMS (Optical Monitoring System)

Table 13-19: 914-HDV2 Included Accessories

QUANTITY	DESCRIPTION
1	Power harness, 6', pigtailed
1	RS232 Diagnostic cable, 6", pigtailed
4	#2-56, 3/16", 21/32" tall standoff
4	#2-56, 3/16", 5/32" tall standoff
4	#2-56, hex nut

Table 13-20: 914-HDV2 CWDM Options

XX	DESCRIPTION	CWDM BAND	STATUS
27	1271 nm optical transmitter	Blue	Special Order
29	1291 nm optical transmitter	Blue	Special Order
31	1311 nm optical transmitter	Blue	Special Order
33	1331 nm optical transmitter	Blue	Special Order
35	1351 nm optical transmitter	Blue	Special Order
37	1371 nm optical transmitter	Blue	Special Order
39	1391 nm optical transmitter	Blue	Special Order
41	1411 nm optical transmitter	Blue	Special Order
43	1431 nm optical transmitter	Blue	Special Order, Not recommended
45	1451 nm optical transmitter	Blue	Special Order, Not recommended
47	**1471 nm optical transmitter**	**Red**	**Recommended, compatible with 914-CWDM**
49	**1491 nm optical transmitter**	**Red**	**Recommended, compatible with 914-CWDM**
51	1511 nm optical transmitter	Red	Recommended
53	1531 nm optical transmitter	Red	Recommended
55	1551 nm optical transmitter	Red	Upgrade
57	1571 nm optical transmitter	Red	Upgrade
59	1591 nm optical transmitter	Red	Upgrade, not for use with Moog Focal OMS
61	1611 nm optical transmitter	Red	Upgrade, not for use with Moog Focal OMS

Notes:
- Other dual wavelength CWDM options are possible. Contact Moog Focal for details.

- Single channel remote assemblies can be linked to dual channel console assemblies. This is useful in pressure tolerant systems where two 914-HDV2 PT cards can link to a single console 914-HDV2.

13.8 914-X Series Optical Card Part Numbers

Table 13-21: 914 Optical Card Part Numbers

PART NUMBER	CARD ID	SALES ID	DESCRIPTION
914-0017-04	914-CWDM	914-CWDM-SM2+4-R1-P0F	914-CWDM Optics Card, 2-ch, SM, Red band + 1310/1550 nm Bypass
914-0017-07	914-SPLIT, PT6K	914-SPLIT-SM-P6F	914-SPLIT Fiber-Optic Splitter Card, SM, 1x2, Non-Stacking, pressure tolerant up to 6000 psi
914-0017-09	914-SPLIT	914-SPLIT-SM-P0F	914-SPLIT Fiber-Optic Splitter Card, SM, 1X2, Non-Stacking
914-0017-10	914-FOS	914-FOS-SM-P0F	914-FOS Fiber-Optic Switch Card, SM, 2X1, Stacking
914-0017-11	914-CWDM-4R1	914-CWDM-SM4+N-R5-P0F	914-CWDM Optics Card, 8-ch, SM, Red band
914-0017-16	914-CWDM-8R	914-CWDM-SM8+N-R7-P0F	914-CWDM Optics Card, 4-ch, SM, Red band

13.9 SFP Optical Transceiver Part Numbers

Table 13-22: 914 Standard Optical SFP Part Numbers

PART NUMBER	DESCRIPTION	CWDM BAND
4.25 Gbps BIDI		
925-0016-13	4.25G; TX 1310 nm / RX 1550 nm; single fiber bidirectional SFP	
925-0016-15	4.25G; TX 1550 nm / RX 1310 nm; single fiber bidirectional SFP	
4.25 Gbps CWDM		
925-0014-27	4.25G; TX 1271 nm dual fiber CWDM SFP	Blue
925-0014-29	4.25G; TX 1291 nm dual fiber CWDM SFP	Blue
925-0014-31	4.25G; TX 1311 nm dual fiber CWDM SFP	Blue
925-0014-33	4.25G; TX 1331 nm dual fiber CWDM SFP	Blue
925-0014-35	4.25G; TX 1351 nm dual fiber CWDM SFP	Blue
925-0014-37	4.25G; TX 1371 nm dual fiber CWDM SFP	Blue
925-0014-39	4.25G; TX 1391 nm dual fiber CWDM SFP	Blue
925-0014-41	4.25G; TX 1411 nm dual fiber CWDM SFP	Blue
925-0014-43	4.25G; TX 1431 nm dual fiber CWDM SFP	Blue
925-0014-45	4.25G; TX 1451 nm dual fiber CWDM SFP	Blue
925-0014-47	4.25G; TX 1471 nm dual fiber CWDM SFP	Red
925-0014-49	4.25G; TX 1491 nm dual fiber CWDM SFP	Red
925-0014-51	4.25G; TX 1511 nm dual fiber CWDM SFP	Red
925-0014-53	4.25G; TX 1531 nm dual fiber CWDM SFP	Red
925-0014-55	4.25G; TX 1551 nm dual fiber CWDM SFP	Red
925-0014-57	4.25G; TX 1571 nm dual fiber CWDM SFP	Red
925-0014-59	4.25G; TX 1591 nm dual fiber CWDM SFP	Red
925-0014-61	4.25G; TX 1611 nm dual fiber CWDM SFP	Red

Notes:

- Blue wavelength CWDM SFPs are special order items.
- Refer to Section 9.0 for SFP specification.

Table 13-23: 914 High Speed Optical SFP Part Numbers

PART NUMBER	DESCRIPTION	CWDM BAND
4.25 Gbps BIDI		
925-0022-12	10G; TX 1270 nm / RX 1330 nm; single fiber bidirectional SFP	
925-0022-13	10G; TX 1330 nm / RX 1270 nm; single fiber bidirectional SFP	
4.25 Gbps CWDM		
925-0024-47	10G; TX 1471 nm dual fiber CWDM SFP	Red
925-0024-49	10G; TX 1491 nm dual fiber CWDM SFP	Red
925-0024-51	10G; TX 1511 nm dual fiber CWDM SFP	Red
925-0024-53	10G; TX 1531 nm dual fiber CWDM SFP	Red
925-0024-55	10G; TX 1551 nm dual fiber CWDM SFP	Red
925-0024-57	10G; TX 1571 nm dual fiber CWDM SFP	Red
925-0024-59	10G; TX 1591 nm dual fiber CWDM SFP	Red
925-0024-61	10G; TX 1611 nm dual fiber CWDM SFP	Red

Notes:

- Refer to Section 9.0 for SFP specification.

Table 13-24: 914 Pressure Tolerant Optical SFP Part Numbers

PART NUMBER	DESCRIPTION
4.25 Gbps BIDI, PRESSURE TOLERANT	
925-5004-00	4.25G; TX 1310 nm / RX 1550 nm; single fiber bidirectional SFP; 3000 PSI; LC Conn.
925-5004-01	4.25G; TX 1550 nm / RX 1310 nm; single fiber bidirectional SFP; 3000 PSI; LC Conn.
925-5004-02	4.25G; TX 1310 nm / RX 1550 nm; single fiber bidirectional SFP; 3000 PSI; ST Conn.
925-5004-03	4.25G; TX 1550 nm / RX 1310 nm; single fiber bidirectional SFP; 3000 PSI; ST Conn.
4.25 Gbps CWDM, PRESSURE TOLERANT	
925-5000-27	4.25G; TX 1271 nm; dual fiber CWDM SFP; 6000 PSI; LC Conn.
925-5000-29	4.25G; TX 1291 nm; dual fiber CWDM SFP; 6000 PSI; LC Conn.
925-5000-31	4.25G; TX 1311 nm; dual fiber CWDM SFP; 6000 PSI; LC Conn.
925-5000-33	4.25G; TX 1331 nm; dual fiber CWDM SFP; 6000 PSI; LC Conn.
925-5000-35	4.25G; TX 1351 nm; dual fiber CWDM SFP; 6000 PSI; LC Conn.
925-5000-37	4.25G; TX 1371 nm; dual fiber CWDM SFP; 6000 PSI; LC Conn.
925-5000-39	4.25G; TX 1391 nm; dual fiber CWDM SFP; 6000 PSI; LC Conn.
925-5000-41	4.25G; TX 1411 nm; dual fiber CWDM SFP; 6000 PSI; LC Conn.
925-5000-43	4.25G; TX 1431 nm; dual fiber CWDM SFP; 6000 PSI; LC Conn.
925-5000-45	4.25G; TX 1451 nm; dual fiber CWDM SFP; 6000 PSI; LC Conn.
925-5000-47	4.25G; TX 1471 nm; dual fiber CWDM SFP; 6000 PSI; LC Conn.
925-5000-49	4.25G; TX 1491 nm; dual fiber CWDM SFP; 6000 PSI; LC Conn.
925-5000-51	4.25G; TX 1511 nm; dual fiber CWDM SFP; 6000 PSI; LC Conn.
925-5000-53	4.25G; TX 1531 nm; dual fiber CWDM SFP; 6000 PSI; LC Conn.
925-5000-55	4.25G; TX 1551 nm; dual fiber CWDM SFP; 6000 PSI; LC Conn.
925-5000-57	4.25G; TX 1571 nm; dual fiber CWDM SFP; 6000 PSI; LC Conn.
925-5000-59	4.25G; TX 1591 nm; dual fiber CWDM SFP; 6000 PSI; LC Conn.
925-5000-61	4.25G; TX 1611 nm; dual fiber CWDM SFP; 6000 PSI; LC Conn.

Notes:

- Pressure tolerant SFPs are special order items.
- Refer to Section 9.0 for SFP specification.

13.10 914-X Series High Speed Ribbon Cable Part Numbers

Table 13-25: 914-X Series High Speed Ribbon Cable Part Numbers

PART NUMBER	DESCRIPTION	ORIENTATION
914-5105-09	EXP HS RIBBON 9" INLINE	Inline
914-5105-12	EXP HS RIBBON 12" INLINE	Inline
914-5106-03	EXP HS RIBBON 3" SIDE-TO-SIDE	Side – to – Side
914-5106-06	EXP HS RIBBON 6" SIDE-TO-SIDE	Side – to – Side

Notes:

- Inline orientations are designed for a linear line of 914-X Series cards down the length of a narrow enclosure such as a pressure bottle. The narrow ends of each card would face each other.
- Side-to-Side orientation ribbon cables are designed for a sideways orientation of cards, wide ends beside each other. This is useful for larger enclosures such as 19” rack enclosures.
- The length is measured connector to connector on the ribbon cable, this does not imply card-to-card spacing.
- Other lengths are available up to 18”, please contact Moog Focal.
- Included accessory hardware allows for the completion of one stack and the start of the next.

Table 13-26: 914-X Series High Speed Ribbon Cable Included Accessories

QUANTITY	DESCRIPTION
4	#2-56, 3/16”, 21/32” tall standoff
4	#2-56, hex nut

14.0 Troubleshooting

This section contains information to help users solve common problems while setting up or using a 914-X Series system. The 914-X Series Unified Diagnostic GUI is an essential troubleshooting tool that allows users to quickly identify problems. **Setting up the GUI and connecting it to the *console* 914-HDE card is a required first step**. Please refer to Section 5.0 for GUI installation and operation instructions.

Here are some common problems and potential solutions:

1. **The Unified Diagnostic GUI is not connecting to the 914-HDE.**
    a. Check the connection status to Header J8 on the console 914-HDE card, looking for loose connections or shorts. Verify the pinout as per Section 5.0.
    b. Verify that the COM port used in the GUI matches the COM port the 914-HDE is connected to.
    c. Verify the installed GUI is up to date. See Section 5.11 for details.
    d. Verify the 914-HDE is plugged in and supplied with either 5 V or 12 V. Ensure that power LED D6 is lit GREEN (red indicates power fault).
    e. If issues persist, restart the GUI by following the steps outlined in Section 5.10.

2. **The Unified Diagnostic GUI is not connecting to the 914-HDV2.**
    a. Ensure header J7:5 (Diagnostic Fault) on the attached 914-HDV2 card is off. Verify that valid COM port and SFP connections are in place. Verify the pinout as per Section 5.0.
    b. Verify that the COM port used in the GUI matches the one connected to the 914-HDV2.
    c. Verify the installed GUI is up to date. See Section 5.11 for details.
    d. Verify the device is plugged in and supplied with either 5 V or 12 V. Ensure that power LED D9 is lit, and that power LED D8 is off.
    e. If issues persist, restart the GUI by following the steps outlined in Section 5.10.

3. **An expansion card in the stack does not appear in the Diagnostic GUI.**
    a. Verify the expansion channel switch settings of the expansion card(s), following Step 1 of Table 2-1 from Section 2.0.
    b. Verify that the card pairs have compatible firmware versions on both sides (console and remote) per Section 11.1.
    c. Verify optical link is valid through the Optics page in the GUI, or by the LEDs on the board.
        i. Section 6.1.4 for 914-VDX
        ii. Section 6.2.4 for 914-EX
        iii. Section 6.4.3 for 914-DX
    d. Verify power status via LEDs.
        i. Section 6.1.4 for 914-VDX
        ii. Section 6.2.4 for 914-EX
        iii. Section 6.4.3 for 914-DX
    e. If issues persist, restart the GUI by following the steps outlined in Section 5.10.

4. **Configuration changes are not being saved in the Diagnostic GUI.**
    a. Ensure diagnostic connection is made with the 914-HDE Console unit only. Do not connect directly to the remote 914-HDE card; the remote stack is accessed via the fiber optic link.
    b. Verify all cards, including expansions, are correctly configured as Console or Remote before attempting to configure other settings.
    c. Navigate to the stack view and confirm a connection is established between the cards and the GUI using the **send, recv**, and **Hardware Connection** LEDs as a guide (refer to Section 5.2).
    d. Confirm a stable optical link is present (see item #6). A stable optical link is required to configure remote cards.
    e. Confirm a stable expansion link is present. A stable expansion link is required to configure expansion cards.
    f. If problems persist, please contact Moog Focal describing the problem with a system snapshot attached (refer to Section 5.9.2).

5. **Power issues:**
    a. Verify that power is only supplied to the 914-HDE motherboard or 914-HDV2 media converter. 914-X Series Expansion cards (VDX, EX, DX) draw their power from their connection to the 914-HDE motherboard.
    b. Verify that the green power LED D6 is lit on the 914-HDE. The power fault LED D5 should only ever be lit red during over, under, or reverse voltage events.
    c. For larger stacks using more power, voltage drops can occur over the power leads. Verify power received by the 914-HDE is greater than 4.5 V. If not:
        i. Increase voltage: 12 V is best for systems that require > 20 W
        ii. Use heavier gauge wire
        iii. Use shorter power leads
    d. Verify rail and input voltages using the Diagnostic GUI.
    e. Ensure the power supply is rated for at least 50% more power than required by the 914-X Series system.

6. **Optical issues:**
    a. Verify received optical power is valid using the GUI's Optical page. All LEDs on the page should be green, indicating acceptable values. The optical loss in each direction should be similar.
        i. Excessive optical power is a saturation condition. Attenuation is required in the fiber link. 10 dB is the suggested minimum attenuation.
        ii. Insufficient optical power could be due to:
            - Dirty fiber contacts and bushings
            - Bent or broken fibers
            - Fiber type mismatches
            - Non-functional far side 914-HDE
            - Excessive fiber length
            - Malfunctioning Fiber Optic Rotary Joint
    b. Refer to Section 10.6 for more details regarding Optical fiber care and maintenance.

7. **Video Issues:**
    a. Does the Diagnostic GUI report video on both ends (console and remote)?
    b. Confirm that the cards in question are configured as Console and Remote properly, and that their video directions are correctly set. The console should be video output, and remote side should be video input.
        i. Section 5.5.1 and Section 5.5.2 for 914-HDE
        ii. Section 6.1.8.1 and Section 6.1.8.2 for 914-VDX
    c. Verify the optical link is valid. See item #6 above.
    d. Verify the power status on both ends of the system. See item #5 above.
    e. Verify that the firmware revisions of the cards are compatible (see Section 11.1).
    f. Verify that the 914-HDE card speeds are compatible (H1 to H1, M1 to M1, L1 to L1)
    g. If no video is present at the remote side:
        i. Check cabling at the remote side.
        ii. Verify power status.
        iii. Ensure composite video is plugged to the 914-VDX card.
        iv. Ensure SDI video is plugged into the 914-HDE card.
        v. Ensure the remote cards are configured for video input using the GUI.
    h. If video is present at the remote, but not at the console:
        i. Verify the optical link.
        ii. Ensure the console cards are configured for video output using the GUI.
    i. If video is present at both ends of the system, but not displayed:
        i. Ensure video monitors are on and compatible with the video signal type being used.
        ii. 3G-SDI video can only be used with M1 speed 914-HDEs with no 914-VDX or 914-EX cards attached, and Ethernet limited to 100 Mb/s.

8. Ethernet Issues:

a. Verify near settings match far settings using the Diagnostic GUI. Ethernet issues often are attributed to negotiation settings mismatches; enabling RLSS at the console is recommended.
b. Confirm that both ends of the system are linked using the Diagnostic GUI. If they are not:
   i. Verify the auto-negotiate settings of each end, ensuring they match the connected equipment.
   ii. Ensure proper cabling and pinout for the ports, which are auto-MDI/X.
   iii. Ensure cabling is no longer than 100m.
c. If Ethernet channels are linked, but frames are dropped:
   i. Check connection status in GUI. Are both ends linked at the same speed? If not, enable RLSS on the console side.
   ii. Is the GUI reporting dropped frames? If so, too much bandwidth is required by your system. The cards can have their versions upgraded from L1 to M1, or M1 to H1. Verify required bandwidth using guidelines from Section 3.3.
   iii. In M1 speed cards, if 3G-SDI video is passing through the system, available bandwidth becomes limited for all other signals. No 914-VDX or 914-EX cards may be stacked on the M1 version of the 914-HDE when 3G-SDI video is required.
d. Verify that the firmware revisions of the cards are compatible (see Section 11.1).
e. Verify that the 914-HDE card speeds are compatible (H1 to H1, M1 to M1, L1 to L1)
f. Are Ethernet cables correct according to speed?
   i. If running 1000 Mb/s Ethernet speed, verify Ethernet cable is a 4-pair (8-wire) cable. Cables that are 2-pair (4-wire) will **not** work with 1000 Mb/s speeds.
      - Either 2-pair (4-wire) OR 4-pair (8-wire) will work with 10/100 Mb/s speeds.

9. Serial Port Issues:

a. Ensure the console and remote serial channels in use are both configured for the correct protocol.
b. Verify the correct half of the connector is being used for each channel. The lower row is the first channel, while the upper row is the second channel (see Figure 4-6 in Section 4-4).
c. For legacy 914-X Series cards with non-isolated ports, confirm the equipment connected is powered from the same ground reference as the 914-HDE stack.
d. Ensure TX and RX are not crossed; TX is transmitted from the 914-X card and RX is received by the 914-X card.
e. Verify the polarity (+/-) is not swapped (for RS485/422).
f. For RS485, confirm if the timeout configured for the port is appropriate for the baud rate of the attached equipment. Slower data rates typically require longer timeouts, where the timeouts represent the turnaround time of the half duplex protocol to change from RX to TX and vice-versa. The minimum timeout is 10 bit times at the linked baud rate. Example: 115.2 kbaud timeout > 86 μs.
g. Check if differential termination is required for RS422/485. This can be enabled and disabled via the GUI. In a multi-drop RS485 network, only the final node requires termination. The 914-HDE serial ports default to enabling the 120 Ω onboard termination; this must be disabled if termination already exists in the system.

10. Overheating issues:

a. Verify the junction temperatures of each card's FPGA in the system. None should exceed 100°C (red) in the GUI.
b. Check the measured temperature of the optical transceiver on the 914-HDE, ensuring it does not enter the yellow or red zones in the GUI.
c. If excess temperature is an issue, better thermal management is required:
   i. Better conductive cooling via mounting standoffs. All 914-X Series cards have a thermal plane in the PCB connected to the mounting holes. This thermal plane is isolated from digital ground and may be conductively tied to the installed enclosure for cooling purposes.
   ii. Consider attaching thermal spreaders to high temperature components.
   iii. Consider installing thermal gap pads below the 914-HDE motherboard to push heat to the enclosure.
   iv. Apply airflow to surface systems.

11. The 914-EX/914-VDX Expansion channel is showing faults.

a. Verify that the firmware revisions of the cards are compatible (see Section 11.1).

12. The 914-VDX Serial Data LEDs are constantly flashing, even when nothing is plugged in.

a. Verify that the firmware revisions of the cards are compatible (see Section 11.1).
b. Rule out expansion channel corruption. See item #10 above.
c. Rule out optical link issues. See item #6 above.

13. Additional problem, not listed

a. Ensure all cards in the system are shown in the GUI. If not, refer to item #3 above.
b. Navigate the Diagnostic GUI's pages and look for red LEDs. Check for:
    i. Voltages
    ii. Temperatures
    iii. Optical power
    iv. Dropped Ethernet frames
    v. Optical link problems
    vi. Expansion link problems
c. Contact Moog Focal (focal@moog.com), describing the problem and attaching a system snapshot (see Section 5.9.2).

14.1 Moog Focal Technical Support Contact Information

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