Focal Technologies Corporation
A Moog Inc. Company
77 Frazee Avenue
Dartmouth, Nova Scotia, Canada B3B 1Z4
Tel: (902) 468-2263 | www.moog.com/focal

Adaptable Interface Board (AIB) Plug-In Modules

User Guide

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Author(s): Andrew Cress
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Reference Documents

Document Number	Document Title and Description
903-0623-00	Model 903 User's Guide, FMB-X-2.5
903-0628-00	Model 903 High Density User's Guide, FMB-X-2.5
903-2020-00	AIB-CANBUS Configuration
907-0601-00	Model 907 User's Guide
907-2004-00	907-AIB Configuration
914-0601-00	914-HDE Modular Multiplexer System User Manual
914-2004-00	914-AIB Configuration
914-2023-00	914-AX Configuration

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ACRONYMS AND ABBREVIATIONS

ACRONYM / ABBREVIATION	DESCRIPTION
AIB	Adaptable Interface Board
AWG	American Wire Gauge
AX	AIB Expansion
CAN	Controller Area Network (bus)
FMB	Fiber Optic Multiplexer Board
GND	Ground
HDB	High Density Board
ISOGND	Isolated Ground
LED	Light Emitting Diode
PCB	Printed Circuit Board
RX	Receive
RXD	Receive Data
TTL	Transistor – Transistor Logic
TX	Transmit
TXD	Transmit Data

1.0 Introduction

Adaptable Interface Board (AIB) plug-in modules are small, single channel cards used to translate a wide range of analog and digital interface signals to the TTL format required for multiplexing. These flexible modules may be quickly changed to allow easy upgrades or reconfigurations to existing multiplexer systems. Moreover, individual data channels may be changed for efficient use of data channel capacity.

AIB plug-in modules are individually installed in sockets on adapter cards or motherboards.

1.1 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 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 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 AIB Adapter Cards

AIB plug-in modules are compatible with the Model 903, the Model 907, and the Model 914 product lines. The AIB-4 motherboard for the Model 903 has sockets for four AIB plug-in modules, the 907-AIB adapter card has sockets for two AIB plug-ins, and the 914-AIB adapter card has one socket available.

2.1 903 AIB Adapter

Figure 2-1 below shows the front panel view of the Model 903 AIB-4 card, including the location of pin 1 on the WAGO connectors. Channel 1 is at the top of the column of connectors, as marked by the black dot along the left-hand side of the panel. Two data indicator LEDs for each channel are located immediately above the corresponding WAGO connectors.

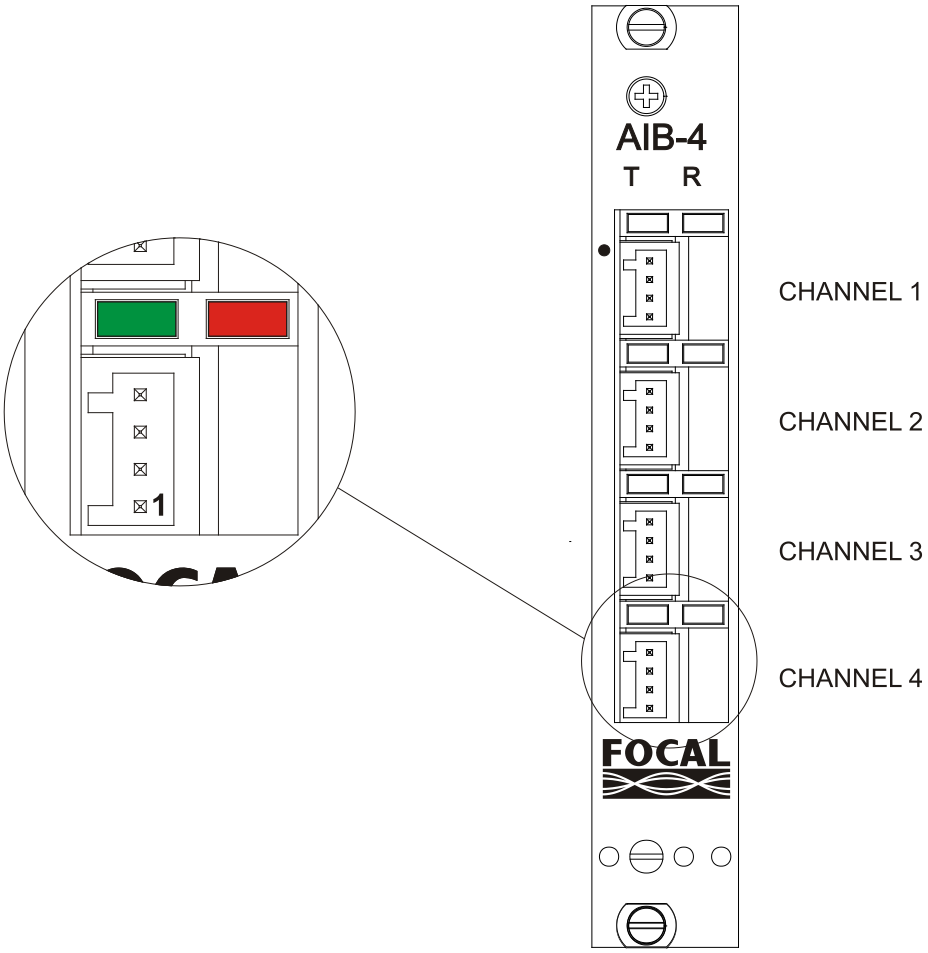

Figure 2-1: Model 903 AIB-4 Front Panel

Figure 2-2 shows the PCB top view for the AIB-4 motherboard. Note that the AIB plug-ins must be installed with their white alignment dots in the same orientation as the alignment dots on the AIB motherboard PCB. A similar socket arrangement is used on the HDB-TX cards. (Refer to the applicable 903 user's guide for more information on the HDB-TX.) WAGO header J2, in the top right corner of the PCB figure, corresponds to channel 1.

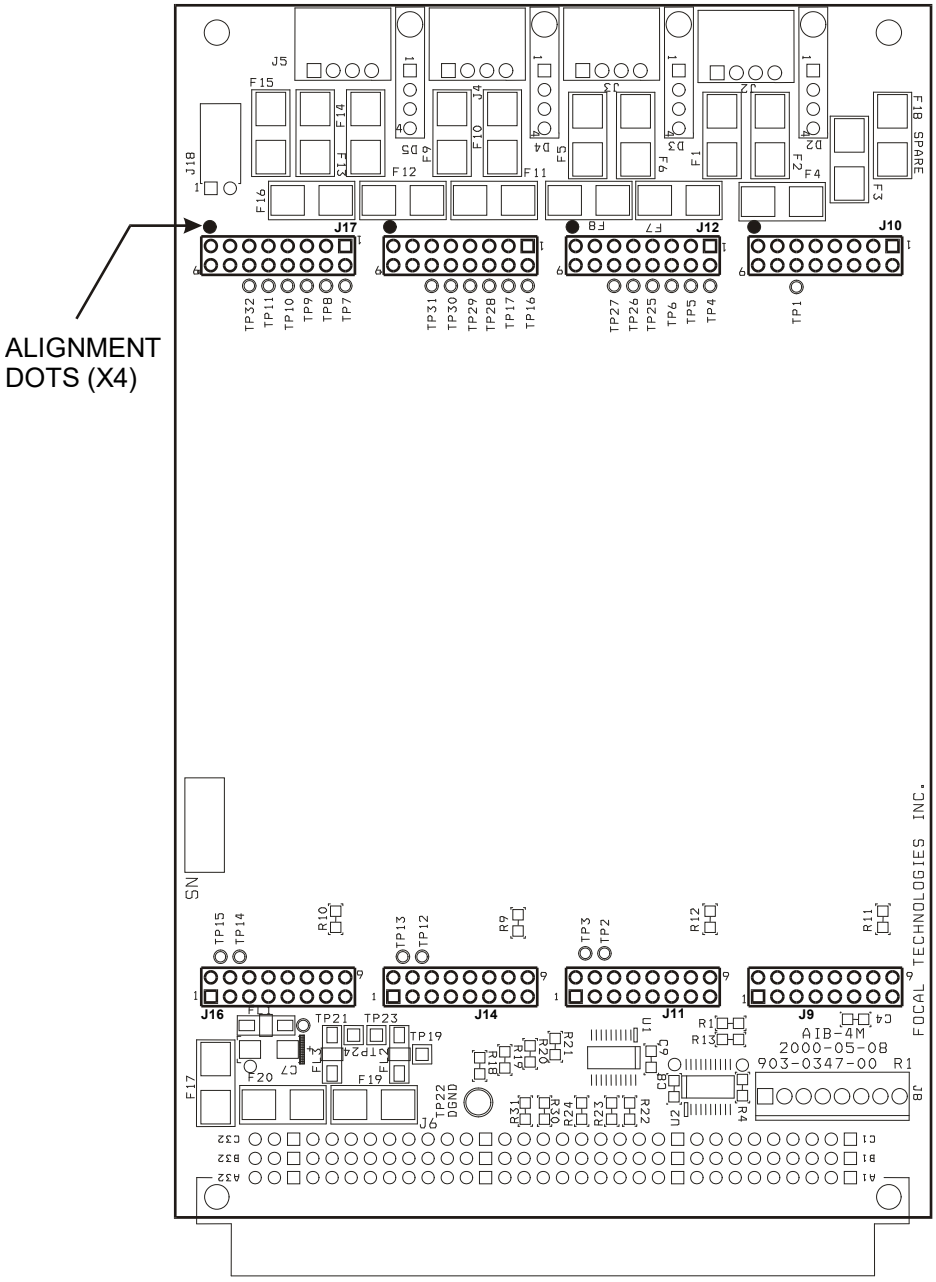

Figure 2-2: Model 903 AIB-4 Motherboard (AIB-4M)

Installation Note:

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 the figure below.

Corresponding pins of the mating connector, shown at left, 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 up by inserting either a WAGO tool or a small screwdriver in the hole immediately above the wire hole.

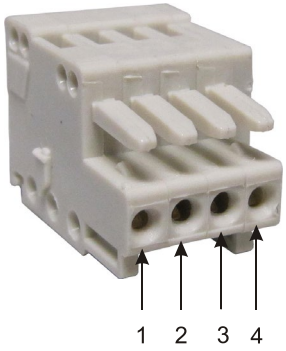

Figure 2-3: 4-Pin WAGO Connector (733-104)

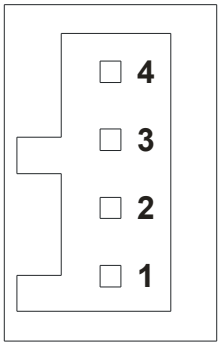

Figure 2-4: 4-Pin WAGO Header

2.2 907 AIB Adapter

Figure 2-5 shows the 907 AIB. As with the Model 903 AIB-4, the alignment dots on the plug-ins must be oriented to match the dots on the adapter cards. Data indicator LEDs function the same as for the 903 AIB-4 card. Access to the plug-in modules is via the WAGO connectors shown (J1 and J2 on 907-AIB and J2 on 914-AIB). Refer to configuration drawing 907-2004-00 for details on S1 settings.

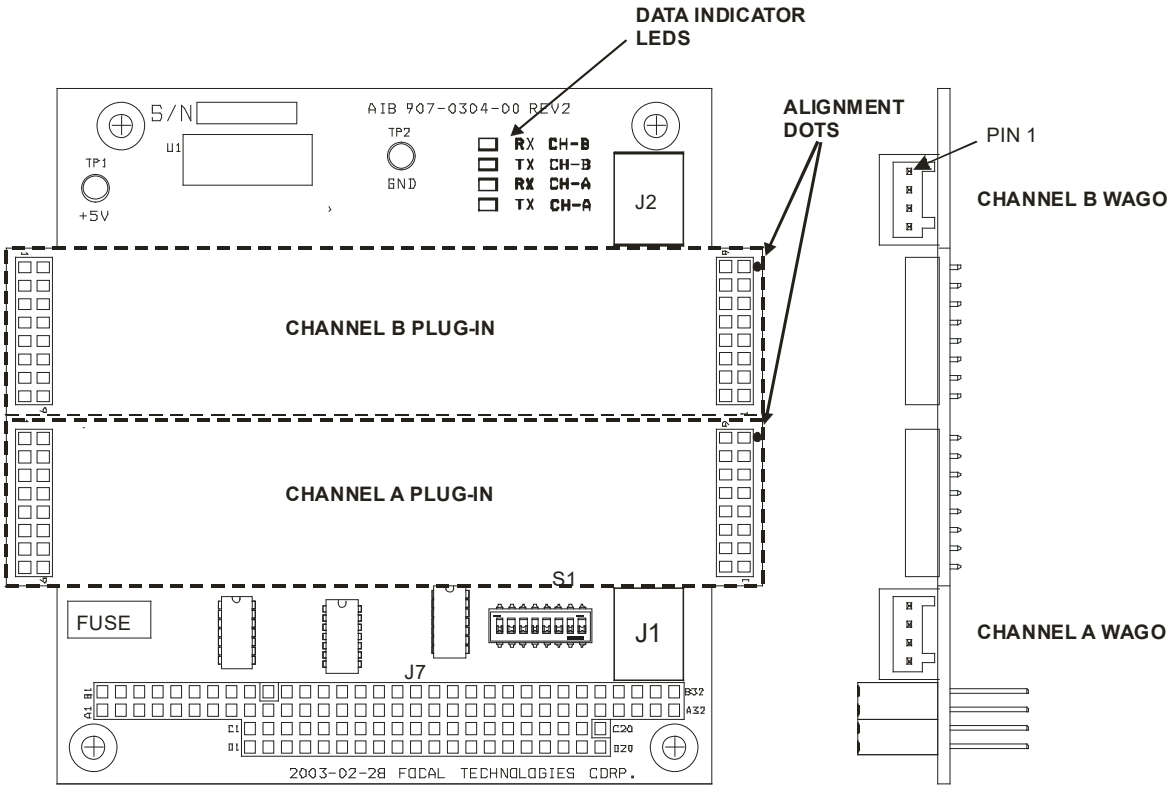

Figure 2-5: 907-AIB Adapter Card

2.3 914 AIB Adapters

There are two flavours of adapters for the 914 family depending on the system level motherboard. For the classic 914-R/C motherboard, the 914-AIB is used. For the 914-HDE Modular Multiplexer System the 914-AX is used. As with the Model 903 AIB-4 and Model 907 AIB, the alignment dots on the plug-ins must be oriented to match the dots on the adapter cards.

2.3.1 914-AIB

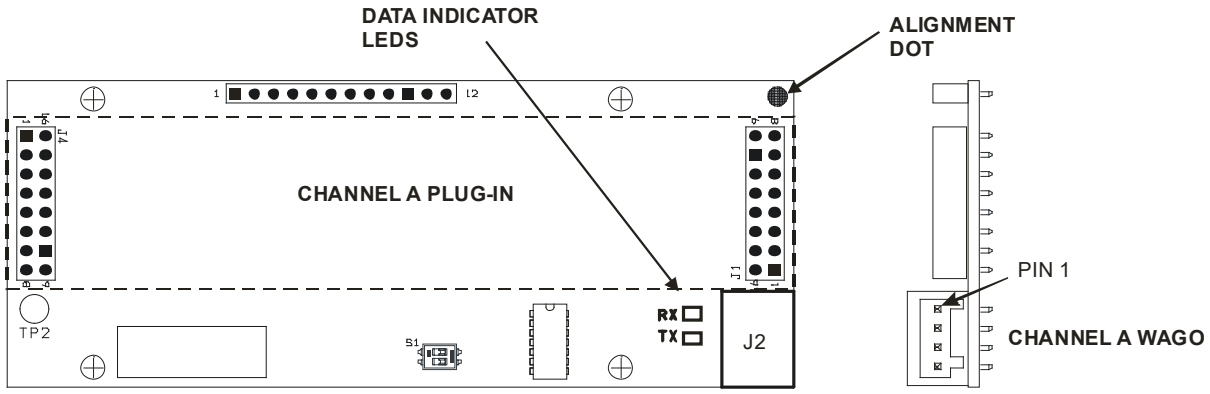

Figure 2-6: 914-AIB Adapter Card

Switch bank S1 on the 907-AIB or 914-AIB adapter card is used to select which data channel on the corresponding motherboard is assigned to each AIB plug-in module. Refer to configuration drawing 914-2004-00 for details on S1 settings.

2.3.2 914-AX

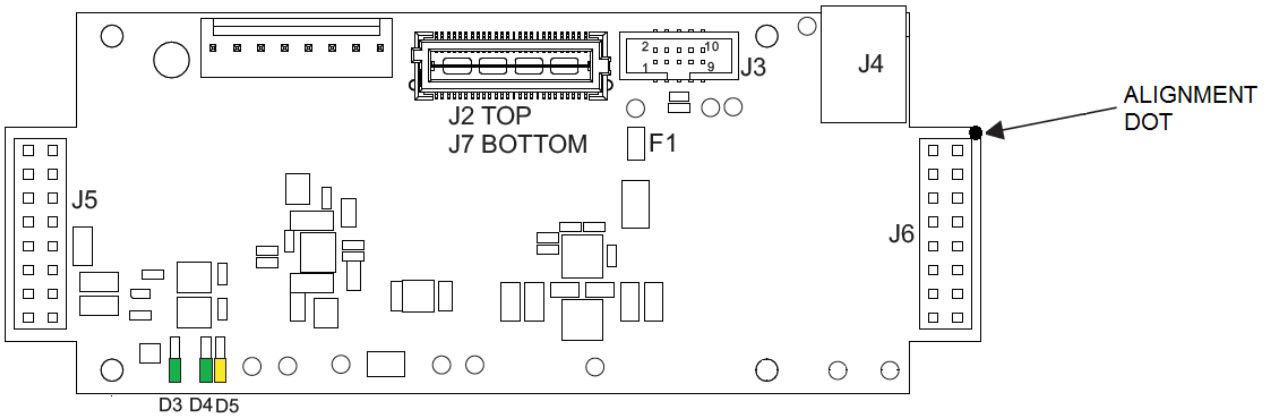

Figure 2-7: 914-AX AIB Adapter Card

The 914-AX does not require switch settings. The data channel used is automatically selected in hardware based on position within the 914-HDE Modular Multiplexer System card stack. The LS (Low Speed) Expansion card closest to the 914-HDE uses LS channel 1, the next card uses LS channel 2, etc…

Refer to configuration drawing 914-2023-00 for more details.

3.0 Diagnostics

LEDs indicate the presence of data on the transmit and receive line for each channel. The green LEDs are typically marked "TX" on the adapter cards or line up under the "T" column on the AIB-4 front panel. These transmit LEDs are on when data is being transmitted from the AIB card to the external devices. The red LEDs are typically marked "RX" on the adapter card or line up under the "R" column on the AIB-4 front panel. These receive LEDs are on when data is being received into the AIB card from external devices. For the 914-AX, the receive LED is yellow.

The exact behaviour of the diagnostics LEDs depend on the type of AIB plug-in module installed. For serial data interfaces, LEDs are on when the corresponding line is in a "space" state (TTL = low) and off when the line is in a "mark" state (TTL = high). Idle lines are typically in the "mark" or off state. If an AIB socket is not populated or the AIB does not use the LEDs, the red LEDs will be on. Occasional bursts of data appear as a flashing LED, whereas continuous data or rapid bursts of data appear as a dim to bright solid LED.

During unidirectional data transfer, an active red (yellow on 914-AX) LED at one end of the system should be matched by an active green LED at the other end of the system. Very short bursts of data may not result in a visible flash from the LEDs.

AIB motherboard serial number information is available through the Model 903 FMB-X-2.5 cards in some systems, and diagnostic information is continually being updated. Please contact the factory for the most current information available through diagnostics.

914-HDE systems with 914-AX cards replicate the status of the Tx and Rx LEDs in the 914 Diagnostic GUI.

4.0 Plug-In Modules

Plug-in modules are available for use with the AIB adapter cards. When installing the modules, ensure the connector marked by the white alignment dot on the module PCB is oriented to match the corresponding header marked with a white dot on the AIB motherboard or AIB adapter card.

When removing a module, carefully extract the plug-in board by pulling both connectors straight out to minimize flexing of the PCB. Uninstalled AIB modules should be handled like integrated circuits: observe ESD handling precautions and store in static dissipating bags or conductive foam.

Interface pins for the AIB plug-in modules are typically accessed at 4-pin WAGO headers on the motherboard or adapter card. (In the case of the HDB-TX cards, the WAGO interface connectors are located remotely on a small I/O board.) WAGO pin configurations for the plug-in modules are the same regardless of where they are mounted.

Plug-in modules with separate pins for transmit and receive lines are identical. Signals coming into the receive pins at one end of the multiplexer are sent out of the transmit pins at the other. With the AIB-232 module, for example, a data stream coming into the receive pin (pin 2, RXD) at the remote end is multiplexed, passed through the optical link, demultiplexed, and sent out of the transmit pin (pin 3, TXD) at the console end of the multiplexer system.

Refer to figures in Figure 2-4 for the location of pin 1 on the WAGO headers.

4.1 RS-232 and Trigger Plug-In

AIB-232 P/N 903-0251-00
AIB-TRIG P/N 903-0251-01

The AIB-232 plug-in module, which supports RS-232, is shown below in Figure 4-1. No jumper or switch settings are required since the board is used solely for RS-232 data at rates up to 120 kbaud. In addition to the ultra-fast fuses on the AIB-4 motherboard, protection for RS-232 inputs and outputs includes transient voltage suppressors and opto-isolators.

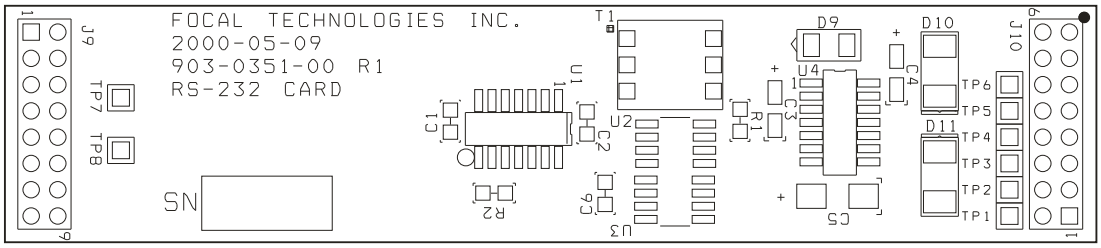

Figure 4-1: AIB RS-232 Plug-In Module

Connector pin designations for the front panel WAGO connector are given in the table below. ISOGND is the common isolated signal ground for both receive and transmit data. LEDs on the motherboard or adapter cards can be used to identify the presence and direction of serial data.

Table 4-1: AIB-232, AIB-TRIG Pin Designations

Pin	Designation
1	ISOGND
2	Receive (RXD)
3	Transmit (TXD)
4	Chassis* (optional)

*The chassis pin is normally left open on the mating connector.

The AIB-TRIG plug-in module is a modified version of the AIB-232 that supports trigger signals for responders and sonars that require trigger voltages between +5 and +25 V. For triggers that require 5 V or less, the AIB-485 card should be used with the TTL configuration.

The RS-232 receiver circuit is unmodified, allowing input signals from -25 V to +25 V but typically configured for positive trigger voltages from the triggering device of up to +25 V. The RS-232 transmit circuit is modified to prevent excessive negative voltage excursions, i.e. a diode clamp limits the voltage to no lower than -0.5 V for connection to the subsea responder. When the trigger input voltage is above +1.5 V at the surface AIB-TRIG, the RS-232 driver output is held high at the subsea AIB-TRIG, typically +8 V with a 3 kΩ load (+5 V min.).

Please consult the factory on recommended interfaces for specific responder triggers.

4.2 RS-485/422/TTL Plug-In

AIB-485 P/N 903-0252-00

The AIB-485 plug-in module, which supports RS-485, RS-422, and TTL, is shown below in Figure 4-2. In addition to the ultra-fast fuses on the AIB-4 motherboard, protection for RS-485/422/TTL inputs and outputs includes transient voltage suppressors and opto-isolators.

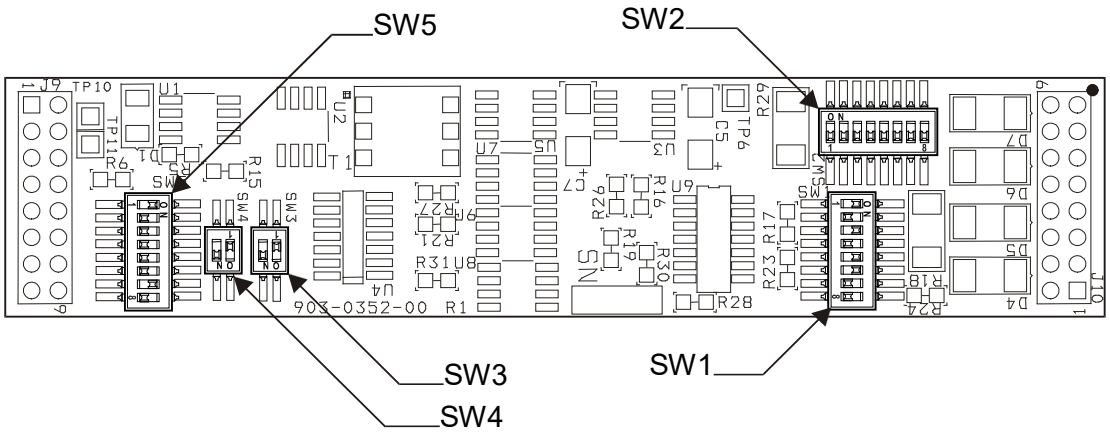

Figure 4-2: AIB RS-485 Plug-In Module

Each channel has the following possible settings: RS-485 autosense (half duplex), RS-485 unidirectional transmitter (simplex Tx), RS-485 unidirectional receiver (simplex Rx), RS-422 four-wire connection (full duplex), or TTL (full duplex).

The equivalent input/output schematic for an RS-422 configuration is shown in Figure 4-3, based on default switch settings. The switches are not shown for clarity. AIB-485 plug-in modules are default configured for RS-485, in which case the transmit and receive circuits of the RS-422 driver IC are connected together.

The RS-485 autosense mode uses a timer circuit to automatically switch from transmit to receive mode. By default, a channel in autosense mode is a receiver waiting for data to come in through the front panel and switches to a transmitter only when it receives data from the backplane. Once the RS-485 channel is in transmitter mode, it will wait ten bit times (one start bit, eight data bits and one stop bit) from the last positive data edge before reverting back to its default receiver state.

This half-duplex mode operates in a ping-pong fashion that must be supported by the end equipment. Although the circuit can act as either a receiver or a transmitter, the data being passed must be sent or received under timing conditions that allow for collision-free data transmission. (If a data collision does occur, transmission out of the front panel connector will override incoming data.) Autosense settings only affect half-duplex operation.

Default settings for the autosense timer (9600 baud) are appropriate for most sonars, even when the sonar is operating at higher baud rates, since delays between sonar send and receive are generally many milliseconds. In some cases, though, the autosense timer needs to be adjusted based on the absolute turnaround time of the external device.

A channel configured in simplex Tx or simplex Rx is a two-wire interface that is only designated to transmit or receive data. Tx is defined as Model 903 transmitting data out the front panel whereas Rx is defined as the Model 903 channel receiving data from an external device.

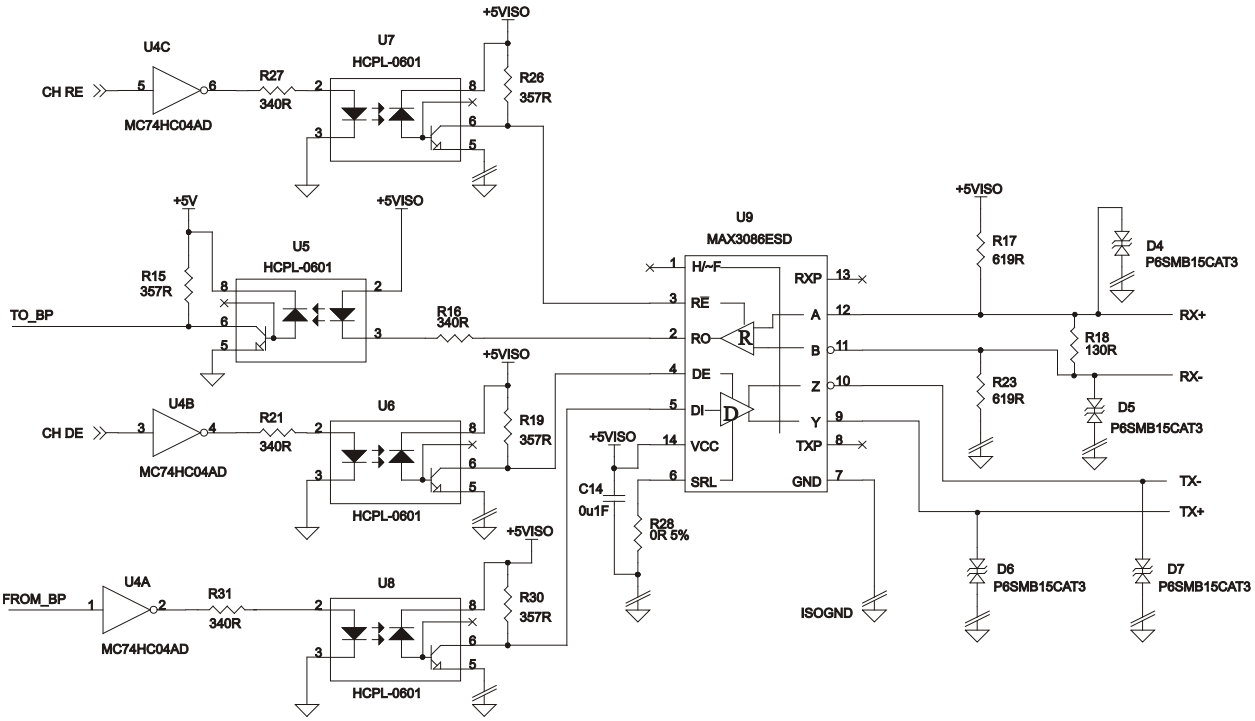

Figure 4-3: AIB RS-422 Interface Schematic

Full duplex communication runs transmit and receive on separate conductors, thus autosense is not required. The AIB modules support full duplex transmission as either RS-422 or TTL data.

Connector pin designations for the WAGO connectors are given in the table below with default configuration shaded.

Table 4-2: AIB-485 Pin Designations

Pin	RS-485 Designation	RS-422 Designation	TTL Designation
1	TX+/RX+	RX+	TTL IN
2	TX-/RX-	RX-	N/C
3	N/C	TX+	TTL OUT
4	N/C (or ISOGND)	TX-	ISOGND

Switch settings for the various configurations are given in Table 4-3. When using the module in RS-422 or TTL input configuration, the autosense mode (SW3, SW4) should be set for full-duplex operation. Autosense baud rate settings (SW5) are ignored when the module is in full-duplex or simplex modes.

As shown in Table 4-2 and Table 4-3, ISOGND for RS-485 configuration can be made available on pin 4 of the WAGO connector by setting switch SW2 circuit #6 to “ON” (=1). This can be used as a 0 V reference for external equipment. (The default setting for pin 4 is N/C.)

Table 4-3: Configuration Settings for AIB RS-485 Module (Defaults Shaded)

AUTOSENSE MODE CONFIGURATION				
FUNCTION	**SW3:1**	**SW3:2**	**SW4:1**	**SW4:2**
Full Duplex	0	0	1	0
Simplex Tx	1	0	1	0
Half Duplex (Autosense)	0	1	0	1
Simplex Rx	0	0	0	0

AUTOSENSE BAUD RATE FOR SW5 DIP SWITCH								
BAUD RATE CCT#	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
9600	1	0	0	0	0	0	1	0
19200	0	1	0	0	0	0	1	0
28800	0	0	1	0	0	0	1	0
57600	0	0	0	1	0	0	1	0
115.2K	0	0	0	0	1	0	0	1
≥230.4K	0	0	0	0	0	1	0	1
KRAFT*	0	0	0	1	0	0	0	1

INPUT CONFIGURATION FOR SW1 DIP SWITCH								
FORMAT CCT#	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
RS-485	1	0	1	0	1	1	0	0
RS-422	1	1	0	0	1	0	0	0
TTL	1	0	0	0	0	0	1	0
KRAFT*	0	0	1	1	0	1	0	1

INPUT CONFIGURATION FOR SW2 DIP SWITCH								
FORMAT CCT#	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
RS-485	0	0	0	0	0	0**	0	0
RS-422	0	0	0	0	1	0	0	1
TTL	0	0	0	0	0	1	0	1
KRAFT*	0	0	0	0	0	0	0	0

*KRAFT manipulators use an AC-coupled RS-485 format with short turnaround time
**Set to '1' to make ISOGND for RS-485 available on WAGO pin 4.

4.3 Tritech Sonar ARCNET Plug-In

AIB-ARCNET P/N 903-0261-00

The AIB-ARCNET plug-in module, which supports the version of ARCNET used by sonars manufactured by Tritech International Ltd., is shown below in Figure 4-4: AIB Tritech ARCNET Plug-In ModuleFigure 4-4. In addition to the ultra-fast fuses on the AIB-4 motherboard, protection for Tritech inputs and outputs includes transient voltage suppressors and AC-coupled isolation through capacitors and transformers.

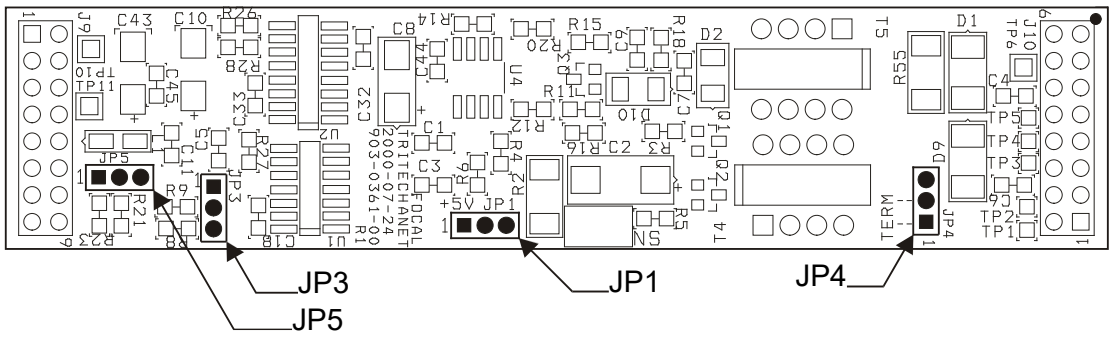

Figure 4-4: AIB Tritech ARCNET Plug-In Module

The Tritech sonar interface may be configured for +5 V (default) or +12 V drive levels and a data rate of 156.2 kbps (default) or 78.1 kbps, as shown in Table 4-4. The +12 V drive setting may be needed for long cable runs to the sonar equipment, but is typically not required. The lower data rate setting is available for compatibility with existing sonars configured for 78.1 kbps operation.

Table 4-4: Configuration Settings for AIB Tritech Module (Defaults Shaded)

OUTPUT DRIVE LEVEL				
VALUE	JP1	JP3	JP5	JP4
+5 V Output	1-2	*	*	*
+12 V Output	2-3	*	*	*
BAUD RATE				
78.1 kbps	*	1-2	1-2	*
156.2 kbps	*	2-3	2-3	*
TERMINATION				
68 Ohms	*	*	*	1-2
Unterminated	*	*	*	2-3

*setting does not affect given parameter

The Tritech interface lines may be terminated with jumper JP4: for an internal 68 ohm terminator, pins 1 and 2 of jumper JP4 should be shorted (default); for no internal terminator, pins 1 and 2 of jumper JP4 should be left open (short pin 2 to pin 3, which is open, to store the shunt).

In most applications, the 68 ohm terminators on the AIB cards should be enabled. One exception is when the sonar head has a 39 ohm terminator installed with a “short” cable connection to the multiplexer. In this case, the 68 ohm terminator on the AIB card should be disabled. (But the preferred configuration is with no terminator on the sonar head and the 68 ohm terminator on the AIB card.)

The default settings illustrated in the shaded rows of Table 4-4 are typically used for systems with *short* cables, i.e. a few meters, between the sonar components and the multiplexer modules:

Short Cables (default)

Sonar Head	No terminator
Remote Mux	68 ohm terminator, +5V drive
Console Mux	68 ohm terminator, +5V drive
Sonar Processor	No terminator or 270 ohm terminator

For systems with a *long* run of cable between the sonar head and remote module, the recommended configuration is the following:

Long Cables

Sonar Head	39 ohm terminator
Remote Mux	68 ohm terminator, +12V drive
Console Mux	68 ohm terminator, +12V drive
Sonar Processor	270 ohm terminator

The definition of a *short* versus *long* cable is dependent on the data rate and the cable type, but typically < 5 m is short, and > 100m would be considered long. If the cable length is in between these, the user may need to try both configurations. There is not a definitive configuration of termination resistors and drive voltages that is guaranteed to work for all cable types and lengths and it may be necessary to optimize the signals. Tritech recommends the signal voltages to operate in the 7-15 Vpp range. Be aware that many Tritech sonars are by default configured for +12V drive voltages and may need to be adjusted for short cable operation.

Note that the AC coupling of the ARCNET interface circuits and pulse nature of the signal makes it impossible to verify termination resistance or signal level with a standard multimeter. To measure signals, a suitable oscilloscope and probe should be used with input set for 1 MΩ and AC coupling.

Pin designations for the AIB-ARCNET plug-in modules are given in the table below. Corresponding connections to Tritech sonar heads and surface equipment should be to the LAN A and LAN B pins indicated by Tritech documentation. Note that the correct polarity of the wiring must be used at both ends of the multiplexer. Crossing the wires at either end, or both ends, will cause the ARCNET link to fail. Furthermore, lack of terminators on any of the connections can also cause the link to fail.

Table 4-5: AIB-ARCNET Pin Designations

Pin	Designation
1	Chassis* (optional)
2	LAN A
3	LAN B
4	N/C

*The chassis pin is normally left open on the mating connector.

Data indicator LEDS, as shown in Figure 2-1, Figure 2-2, Figure 2-5, and Figure 2-6, may be used for troubleshooting. Red (yellow on 914-AX) LEDs indicate a signal coming into the multiplexer and green LEDs indicate a signal being transmitted from the multiplexer to the external sonar device. Only the presence of green LEDs verifies that signals are being carried through the multiplexer. Lack of a red LED at either end indicates no external signal is coming from the local sonar equipment, implying an error with wiring or other fault condition external to the multiplexer.

4.4 Hydrophone/Analog Plug-In

AIB-HYDRO	P/N 903-0244-00
AIB-IRIG	P/N 903-0244-01 Modified for IRIG-B
AIB-HYDRO	P/N 903-0244-02 Modified for +12V supply

The AIB-HYDRO hydrophone plug-in module, shown below in Figure 4-5, is suitable for use with many hydrophones and other types of low-level analog signals. The board is used at both ends of the system and must be jumper configured, typically, as an input for the remote (subsea) module or as an output for the console (surface) module per the settings in Table 4-6.

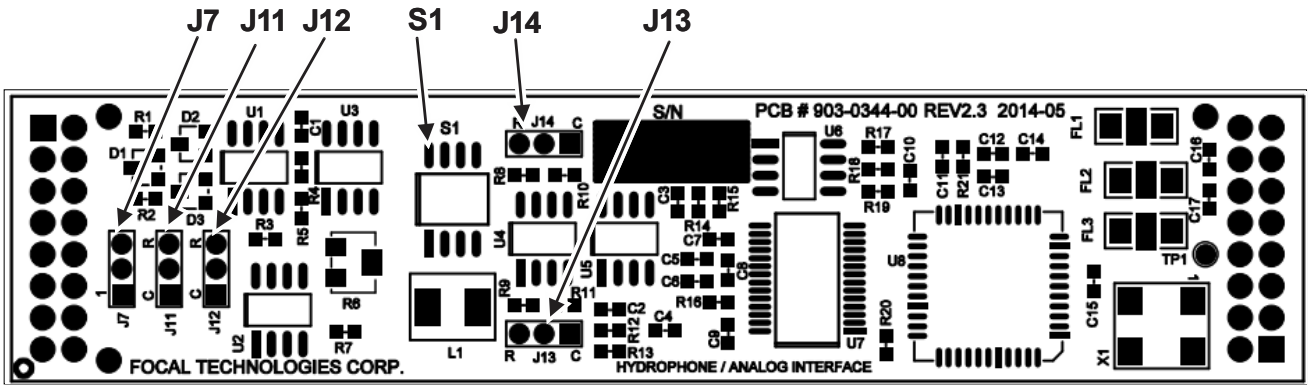

Figure 4-5: AIB Hydrophone Plug-In Module

Table 4-6: Configuration Settings for AIB Hydrophone Module

BOARD CONFIGURATION	JUMPER CONFIGURATION*				
	J11	J12	J13	J14	J7
Input Board (Remote)	2-3	2-3	2-3	2-3	2-3**
Output Board (Console)	1-2	1-2	1-2	1-2	1-2

* **Place shunts across the indicated pins of each jumper**

** **This jumper is only used with single ended inputs. Do not place for dual inputs.**

The hydrophone board input circuits include a front-end preamplifier with a fixed 36 dB gain and additional gain supplied by switch bank S1. Inputs are protected with diode clamps and current limiting resistors as well as ultra-fast fuses on the AIB motherboard. Table 4-7 shows the switch S1 gain settings and corresponding maximum input voltage.

Table 4-7: Hydrophone Gain Settings (Defaults Shaded)

S1 Gain Av (dB)	S1 Settings				Total Gain With Preamp	Maximum Input Voltage (mVpp)
	1	2	3	4		
30	1	0	0	0	66	1
20	0	1	0	0	56	3.2
10	0	0	1	0	46	10
0	0	0	0	1	36	32
-3	1	1	1	1	33	45

1 = ON = CLOSED SWITCH, 0 = OFF = OPEN SWITCH

Although the card is configured to operate with two-wire, un-amplified hydrophone inputs, the hydrophone plug-in may be factory modified to provide +12V to an external hydrophone pre-amplifier on a third conductor and bypass the gain of the internal pre-amplifier.

Pin designations for the AIB-HYDRO plug-in modules are given in the Table 4-8.

Table 4-8: AIB-HYDRO Pin Designations

Pin	Designation
1	Chassis* (optional)
2	N/C (+12 VDC optional)
3	- Signal (GND on output)
4	+ Signal

*The chassis pin is normally left open on the mating connector.

Frequencies from 16 Hz to 28 kHz (-3 dB points) are passed through the system, though frequencies slightly outside this range may be transmitted if the added loss can be compensated by additional S1 gain. If low frequency noise pick up (typically 50 or 60 Hz) is introduced by improper shielding, the lower cutoff frequency may be raised by adding a shunt resistor across pins 3 and 4 to attenuate the lower frequencies. The chassis pin on the WAGO connector should be connected to the shield of the hydrophone cable.

The analog signal on the input board (remote end) is digitized at 73 kilosamples per second with a 12-bit resolution after amplification and reconstructed at the output board (console end) with no additional gain. (Switch bank S1 is not active when the hydrophone board is configured for output.) Output impedance is approximately 34 ohms, which is suitable for high impedance loads and is even capable of directly driving 8-ohm speakers, although with a corresponding loss in output power. Maximum output level is limited to 2 Vpp, yielding a dynamic range of roughly 66 dB. All S1 gain setting are based on the load being 50 ohms. Gains will be higher for higher loads.

AIB-HYDRO cards may be modified for compatibility with different input voltage levels, such as IRIG-B or outputs from pre-amps. For large input signals (> 45 mVpp) the on-board pre-amp is typically bypassed. Modified AIB-HYDRO cards will have different variants in the part numbers (-XX). For example, AIB-HYDRO with P/N 903-0244-02 is modified to provide +12 VDC supply at the WAGO connector on pin 2, and the input pre-amp is bypassed. (Since the input and output circuits are independent of each other, the same card variation can usually be used at subsea as well as at the surface.)

4.5 MS900 Analog Sonar Plug-In

AIB-MS900 P/N 903-0250-00
AIB-MS900L P/N 903-0250-01 modified for low frequency (LF)

The MS900 Analog Sonar Interface AIB plug-in (AIB-MS900) is compatible with the analog telemetry used by the Mesotech MS900 sonar system. The AIB uses only one configuration jumper, J11, shown below in Figure 4-6. Pin 1 of J11 is the square pin, which is also marked with a silk-screened "C". If the jumper is placed across pins 1 - 2, the board is configured for the console module, which interfaces with the MS900 controller. With the jumper across pins 2 - 3 of J11, the board is configured for the remote module, which interfaces with the Model 971 sonar head. No other jumper settings are required.

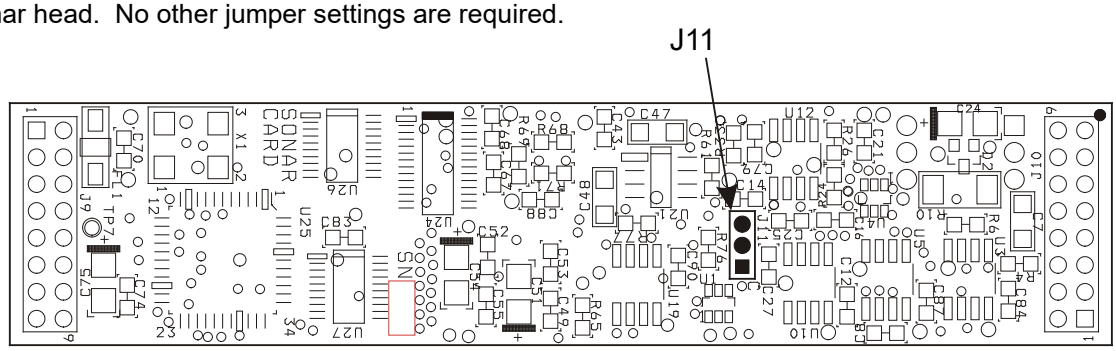

Figure 4-6: AIB MS-900 Plug-In Module (Top View)

The MS900 interface must be installed on a motherboard or adapter card supporting AIB plug-ins, such as the AIB-4 or the HDB-TX.

Because of the high-speed sampling required, the MS900 plug-in cannot be used in the medium-speed data slots on the Model 903. The MS900 plug-in can be used with the GLINK-based Model 903 high-speed data slot (typically adjacent the FMB) or with the Model 907 or Model 914 adapter cards. The 2.5G Model 903 systems (with FMB-X-2.5) support the MS900 module in any data slot.

Pin designations for the AIB-MS900 plug-in modules are given in the table below. The polarity of the signal lines does not matter.

Table 4-9: AIB-MS900 Pin Designations

Pin	Designation
1	Chassis * (optional)
2	N/C
3	Sonar Signal/Data
4	Sonar Signal/Data

*The chassis pin is normally left open on the mating connector.

The standard AIB-MS900 plug-in is designed for compatibility with the high frequency (HF) telemetry system used by the MS900 system. The card may be modified to the AIB-MS900L version for compatibility with the less common low frequency (LF) analog telemetry system, used mainly for commercial fishing applications.

Sonars with digital telemetry, such as the MS900D and MS1000, should be used with a digital serial interface AIB plug-in, such as the AIB-485 or AIB-232.

4.6 CANBUS Plug-In

AIB-CANBUS P/N 903-0297-00

The CAN bus interface AIB plug-in (AIB-CANBUS), as shown in Figure 4-7, provides transparent extension of CAN 2.0A and 2.0B over the fiber optic multiplexer system. Each AIB card acts as a node on the local CAN bus, handling media access and packet acknowledgements. The AIB cards at either end of the multiplexer system are connected through the fiber optic link as a bridge between two separate CAN bus networks. Packets relayed through the optical bridge are regenerated as CAN format packets at the other end and placed on the local bus.

This CAN bus bridge configuration is particularly well suited to sensor networks where all of the sensors are at one end of the system, e.g. an ROV, and the bus master controller, typically a PC, is at the opposite end. Due to the latency inherent in the optical bridge -- typically 200 us at 1 Mbps and 1 ms at 125 kbps -- this link may not be suitable for more complex CAN bus configurations or systems requiring fast responses, such as TTCAN. The optical fiber itself adds 5 us/km of latency in each direction.

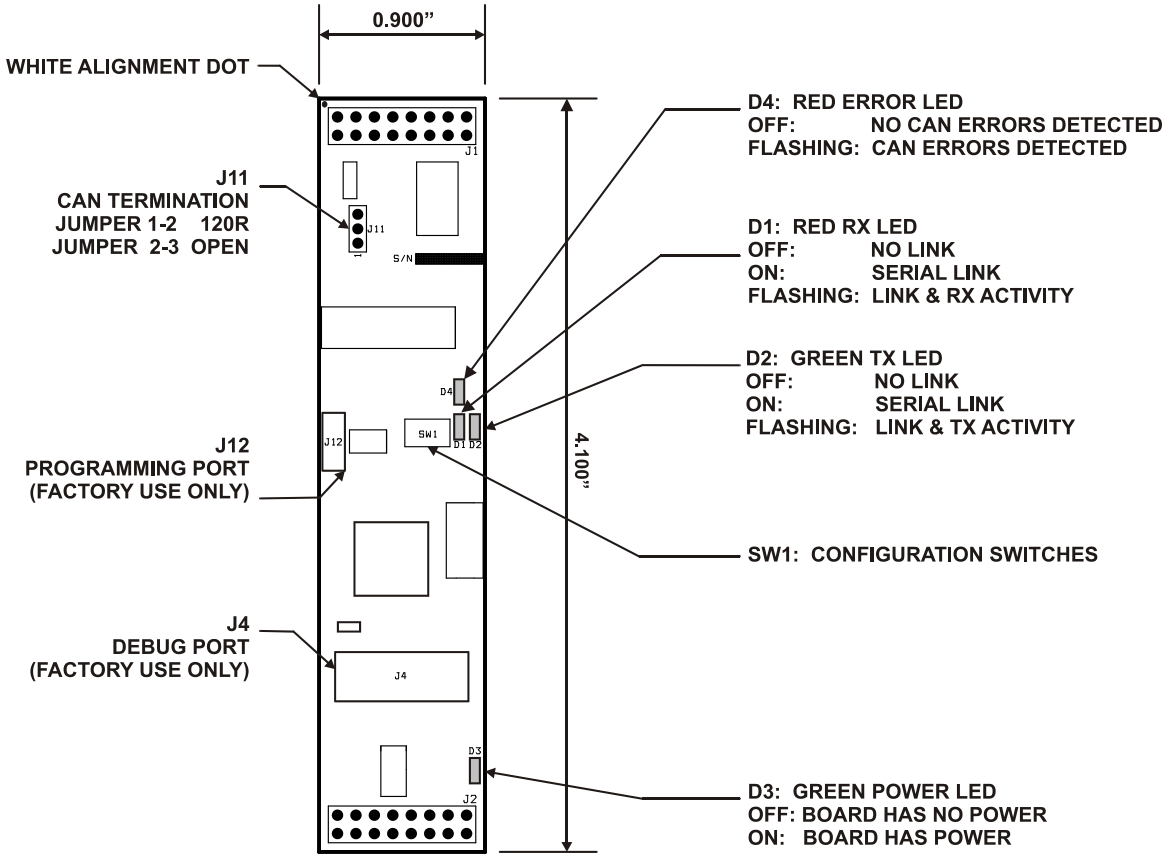

Figure 4-7: AIB-CANBUS Plug-In Module (Top View)

The optical bridge maintains the full 1 Mbps maximum data rate of CAN when used with the Model 914, Model 907, or in the high speed data slot of a GLINK-based Model 903 system. In a low speed data slot on a GLINK-based Model 903 system, the optical link supports up to 250 kbps CAN traffic. The 2.5G Model 903 systems (with FMB-X-2.5) support the full 1 Mbps rate of the AIB-CANBUS in any data slot.

Maximum sustained CAN throughput is typically limited by the bus master, not the AIB-CANBUS cards. Messages are transmitted through the optical link in a proprietary frame supported by 32-bit CRC to ensure data reliability. Time-outs in applications or higher layer protocols may need to be adjusted to account for the latency through the fiber link. The maximum unidirectional throughput is 75% at 1 Mbps and 100% at all other speeds.

For real-time control systems, average bus loads above 30% are not recommended due to the non-linear increase in latency inherent with contention based protocols. For non-critical applications, average bus loads should be kept below 50% to maintain good performance.

LEDs on the AIB-CANBUS card may be used for diagnostics during bench testing. Diode D3 is on when power is applied to the card. Link LEDs D1 and D2 are both on when the optical link is established and off if the optical link is not working. Link LEDs also indicate traffic on the local CAN bus: the green TX LED (D2) flashes when there are frames going out to the local CAN bus; the red RX LED (D1) flashes when there are frames being received from the local CAN bus. Error LED D4 is on for roughly half a second when a local CAN frame error is detected and flashes when multiple errors are detected. LEDs D1, D2, and D4 are only active in bridge mode. Note that the LEDs flash five times on power up to indicate the card is ready for operation.

When the cards are configured in "Bridge Mode", optical frames received with errors are dropped at the receiving AIB and flagged by the error LED. Excessive optical link errors force the CAN port into reset until a good optical link is re-established. On firmware revision A, a local CAN error or packet collisions forces a five second reset of the CAN ports at both ends; firmware version B does not force a CAN reset, so other methods must be used to convey detection of remote errors.

An on-board 120 ohm CAN terminator, shown in Figure 4-7, is for bench testing only (shunt across J11 pins 1-2 to enable) and is normally left open (shunt across J11 pins 2-3 to disable). In typical industrial CAN networks operating with 12 or 24 VDC power, an external terminator should be used with sufficient power rating to handle a short to these voltage rails and ground under worst-case fault conditions. (A 5W, 120-ohm terminating resistor is needed for 24 VDC systems, for example.) Regardless, each CAN bus end node should be terminated with 120 ohms to ensure a net bus load of 60 ohms.

Switch SW1 on the AIB-CANBUS card may be used to set the optical link bit rate of the cards, indicated in the table below. Remote and console cards must have the same settings.

Table 4-10: CAN Speed Settings (Defaults Shaded)

Speed	SW1 Settings			
	1	2	3	4
62.5 kbps, Bridge Mode	0	0	0	1
125 kbps, Bridge Mode	0	0	1	1
250 kbps, Bridge Mode	0	1	0	1
500 kbps, Bridge Mode*	0	1	1	1
1000 kbps, Bridge Mode*	1	0	0	1
62.5 kbps, Repeater Mode	X	X	X	0

1 = ON = CLOSED SWITCH, 0 = OFF = OPEN SWITCH, X = DON'T CARE

*Requires high speed data slot in Model 903 with medium or high speed backplane.

A slow (62.5 kbps) repeater mode is available in which the bridge mode is disabled and the optical link simply maintains a direct "virtual wired connection" between the paired AIB-CANBUS CAN ports. This provides extremely low latency, typically less than 4 us, but can only be used with short fiber links and is not recommended for ROV configurations. LEDs D1, D2, and D4 are disabled in this mode

Pin connections for the WAGO connector used with the plug-in are shown in Table 4-11. Typically shielded, impedance controlled (120 ohm) twisted pair cabling is required to maintain signal quality.

Table 4-11: AIB-CANBUS Pin Designations

Pin	Designation
1	CAN H
2	CAN L
3	BUS - (Ground)
4	Shield

Refer to drawing 903-2020-00 for additional configuration details on the AIB-CANBUS card.