AdquiriLogger™ Instrument Hardware Manual

2

1. Introduction

User Manual Organization

The user instructions for use of the AdquiriLogger™ Data Logging, Alarming and Reporting System consists of two manuals:

AdquiriLogger™ Instrument Hardware Manual (this manual)

Provides details on the actual instrument components, installation, operation and wiring.

HyperWare-III™ Software Manual

Provides detailed instruction on installation and use of the HyperWare-III software for communication between a PC and the AdquiriLogger™, programming of the AdquiriLogger™ , real-time data viewing and logged data download

AdquiriLogger™ System: `The BIG PICTURE'

The AdquiriLogger™ is a rugged, low-power stand-alone instrument that samples analog and digital inputs from various signals and sensors, processes the data, then stores it to internal memory for later analysis. In addition to data acquisition, the AdquiriLogger™ simultaneously performs local alarming and basic control.

With its rugged design, it is well suited to most environments ranging from industrial plant floors to onboard vehicles to outdoor environments. As a low-power instrument, it is well suited to battery operation.   The AdquiriLogger™ finds itself equally at home as a permanent monitoring system or a remote field data acquisition, alarming and reporting instrument.

The AdquiriLogger™ is accompanied by HyperWare-III software, which is used for configuration of the instrument, real-time trending of data and data download and review.

Optionally, the AdquiriLogger™ can be configured to transmit logged data, status and alarm conditions to a customer portal at www.logicbeach.cloud. Via the portal, users can configure inter-channel calculations, data plotting, automated reporting and alarming with Text (SMS) or email notifications. Multiple AdquiriLogger™ instruments can be reporting to the portal making it a powerful global data aggregation network.

AdquiriLogger™ System Components

An AdquiriLogger™ system consists of a number of components... both hardware and software as follow:

- AdquiriLogger™ Instrument
- Input / Output channel expansion Interface Modules (optional)
- HyperWare-III Windows Application
- Accessory components and communication options
- Optional www.logicbeach.cloud customer portal for data aggregation, display and reporting

AdquiriLogger™ Instrument

The AdquiriLogger™ instrument is available in various models supporting stand-alone operation, various communication modes and options. The System Base includes user configurable analog and digital inputs and outputs, a Liquid Crystal Display (LCD), user buttons, audible alarm and various communication connectors.

Differences between models are explained in Chapter 2. An AdquiriLogger™ is shown in Fig 1; AdquiriLogger™ Instrument

Fig 1; AdquiriLogger™ Instrument

Interface Expansion Modules

Input and Output channel count in an AdquiriLogger™ system can be expanded by the addition of one or more analog and/or digital Interface Modules. Modules are connected to the System Base via the integral BBus connector… allowing up to 16 modules to be daisy-chained to a single AdquiriLogger™.

For example, one of the family of Interface Modules, the ILIM-7 adds eight high-resolution, isolated analog input channels to the system. Each of the eight analog inputs can be user configured for use with thermocouple, voltage or current type inputs.
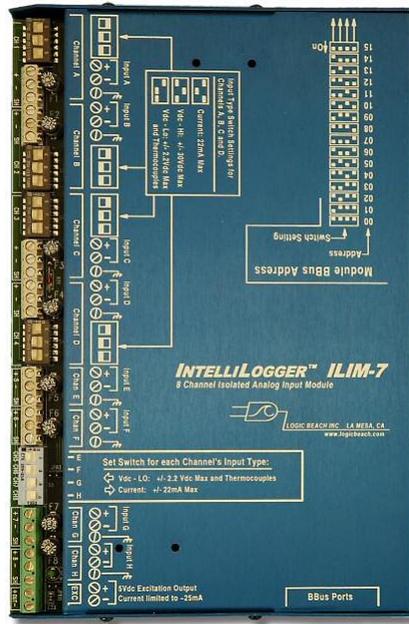
Fig 2; ILIM-7 Isolated Analog Input Interface Module

HyperWare-III Software

Supplied with the AdquiriLogger™ is a powerful Windows based software package called HyperWare-III (Fig 3).
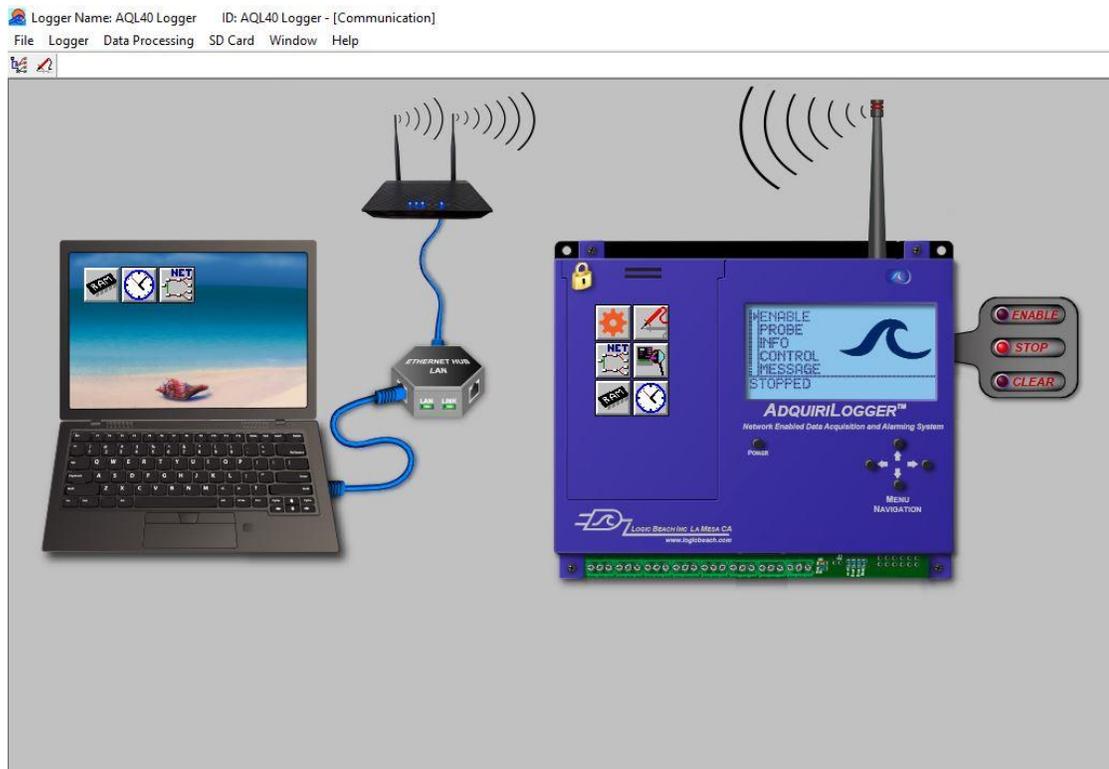
Fig 3; Communications Window with WiFi Connection Established

HyperWare-III, running on a PC under the Microsoft Windows environment (Win7, Win8, Win10, Win11) supports interface with the AdquiriLogger™ including:

♦ Communications with the AdquiriLogger™ via USB, Ethernet, WiFi and Cellular

♦ Programming of the AdquiriLogger™ using the powerful and intuitive HyperNet™ visual icon-based programming method.

♦ User customizable "annunciator" panel display of Real-Time data as it is being acquired and processed by the AdquiriLogger™

♦ Data downloads and file conversion to industry standard data file formats

    ▪

Accessory Components

An expanding family of accessory components is offered for the AdquiriLogger™ system. A few of the accessories…

♦ **WiFi connectivity** for DHCP or Static connection to a local area network

♦ **Cellular Gateway** for communication with the AdquiriLogger™ over the cellular data network

♦ **Weatherproof enclosures** with optional auxiliary battery packs

♦ **SD Card** memory for data logging memory expansion, field reprogramming and transportable data storage

♦ **Terminal Strip Expander** facilitates connection of larger gauge I/O wiring

♦ **DIN Mounting Clips** for DIN rail mounting of instrument

Features (standard and optional)

Designed with the User in mind, the AdquiriLogger™ instrument has a multitude of integrated features and options ranging from powerful hardware to unlimited software programmability and data review.

Features include:

♦ Included HyperWare-III™ software for drag and drop, icon-based programming of the AdquiriLogger™. Programming of engineering units conversion, inter-channel calculations, data reduction, intelligent data acquisition, alarming, automated report outputs and much more. Intuitive icon-based programming implements a quick learning curve without writing cryptic lines of code or experiencing the rigors of excruciating two button menu tree nightmares.

♦ Integrated USB port. Optional Ethernet, Cellular or WiFi communications

♦ Four high-resolution analog inputs, user programmable for direct input of six types of thermocouple and multiple ranges of bipolar Vdc and mAdc input

♦ Optional BBus connected multi-channel Interface Modules accept a multitude of signal types and ranges *all on a single module*.

♦ Email output for alarms or updates

♦ Multi-function back-lit liquid crystal display (LCD) for real-time readings, system status, alarm messaging and more

♦ FTP (File Transfer Protocol) data output for periodic automated archiving of logged data to a remote PC running an FTP Server

♦   Low power design optimized for long term field operation from internal or external batteries

♦   Two digital inputs user programmable for Event, Count and Frequency (1) measurement

♦   Relay output (optional 2nd relay)

♦   Audio alarm output

♦   Modbus RTU Master or Slave interface to other Modbus transducers or controls (option)

♦   Modbus TCP Client or Server interface to other Modbus transducers or controls (option)

♦   Integral SD card socket for log memory expansion, field reprogramming and/or transportable log memory

♦   MQTT data feed to the subscription www.logicbeach.cloud portal providing easy world-wide access to data display, user configurable alarming and reporting from one or multiple AdquiriLoggers™

♦   HyperNet™ visual icon based programming provides unlimited flexibility in programming, *yet maintains simplicity with drag and drop icon configuration.*

♦   Intelligent logging methodologies include logging only upon change of an input (Delta-Logging), Conditional logging based on input levels, Conditional logging based on time of day or elapsed time, dual speed logging initiated by User programmed conditions, and much more.

♦   User defined alarm and status reporting messages via email, text messaging or local display

FCC Information

This equipment complies with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

The FCC limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

♦   Reorient or relocate the receiving antenna.

♦   Increase the separation between the equipment and receiver.

♦   Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

♦   Consult the dealer or an experienced radio/TV technician to help.

2. AdquiriLogger™ Instrument

Overview

The AdquiriLogger™ data acquisition, alarming and reporting instrument consists of molded enclosure which houses the main microprocessor, internal memory, liquid crystal display, internal battery pack, user buttons, and all I/O and support circuitry. With the addition of sensor and optionally external power connections, the unit is a fully self-contained data acquisition, alarming and reporting instrument.

Model Variations

The AdquiriLogger™ is provided in several different models. Each model can also be configured with various options.

AQL-Basic Model:

Optimized for low power operation and will run from internal AA batteries for approximately 30 days (time depends on Programming). No network connectivity. Has limited Input/Output expansion.

AQL-Basic-WiFi Model:

Same as AQL-Basic however it has an integral WiFi interface and antenna. Duration of autonomous operation from internal AA battery will be dependent on WiFi usage. For longer duration autonomous operation with WiFi, the optional weatherproof enclosure with auxiliary battery pack option can be ordered.

AQL-Ethernet Model

Provided with Ethernet RJ45 jack for direct connection to LAN using DHCP or Static IP address. This model is designed for use with external power. As external power is available, more I/O expansion is also possible.

AQL-WiFi Model

Provided with internal WiFi module and antenna. Supports IEEE 802.11 b/g/n for wireless DHCP or Static IP address to LAN Access Point. This model is designed for use with external power. As external power is available, more I/O expansion is also possible.

AQL-Cellular Model

Provided with internal Cellular Gatewayfor wireless connection to the Verizon cellular network. Dual antennas. This model is designed for use with external power. As external power is available, more I/O expansion is also possible.

Additional details on each Model's capabilities and options are shown in Table 1.

	AQL Basic	AQL-Basic-WiFi	AQL-Ethernet	AQL-WiFi	AQL-Cellular
Feature:					
USB Comm port	Yes	Yes	Yes	Yes	Yes
Internal AA Battery	Yes	Yes	Yes	Yes	Yes
AA Battery use	Main power[1]	Main power[2]	Power Fail[3]	Power Fail[4]	Power Fail[5]
External Power	Allowed	Allowed	Required	Required	Required
Operation from USB Power	Yes	Yes	Yes	Yes	Yes
Ethernet Port	No	No	Yes	No	No
WiFi connectivity	No	Yes	No	Yes	No
Cellular connectivity	No	No	No	No	Yes
I/O expansion via BBus	1 module	1 module	16 modules	16 modules	16 modules
Analog Inputs (4)	standard	standard	standard	standard	standard
DIO (Programmable Event/Count input or Open Collector output)	standard	standard	standard	standard	standard
GPDI (Programmable Event/Counter/Freq input)	standard	standard	standard	standard	standard
Relay	standard	standard	standard	standard	standard
2nd Relay	Option	Option	Option	Option	Option
Audio alarm	standard	standard	standard	standard	standard
Email messaging	No	Yes	Yes	Yes	Yes
FTP messaging	No	Yes	Yes	Yes	Yes
MQTT messaging	No	Option	Option	Option	Option
Modbus RTU Master	Option	Option	Option	Option	Option
Modbus RTU Slave	Option	Option	Option	Option	Option
Modbus TCP Client	No	No	Option	Option	Option
Modbus TCP Server	No	No	Option	Option	Option
Internal Memory (~250,000 readings)[6]	standard	standard	standard	standard	standard
Internal Memory (~1,000,000 readings)[7]	Option	Option	Option	Option	Option
SD Card slot	Option	Option	Option	Option	Option
Weatherproof enclosure	Option	Option	Option	Option	Option
Weatherproof enclosure and auxiliary battery pack	Option	Option	N/A	N/A	N/A
Terminal Strip Adapter	Option	Option	Option	Option	Option

Table 1; AdquiriLogger Model Capabilities and Options

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[1] Days to in excess of a month stand-alone operation off of internal AA cells. Is a function of programmed data acquisition complexity and speed.

[2] Limited stand-alone session length as a function of WiFi duty-cycle. WiFi function consumes considerable power during transmit and receive operations

[3] Used for external power failure mode maintenance and/or orderly shutdown

[4] Used for external power failure mode maintenance and/or orderly shutdown

[5] Used for external power failure mode maintenance and/or orderly shutdown

[6] Actual data storage depends on data logging program. Readings cited is based on 4 analog channels per scan.

[7] Actual data storage depends on data logging program. Readings cited is based on 4 analog channels per scan.

Electro-Static Discharge (ESD) and Electronic Circuitry

The following is general educational information pertinent to certain procedures with the AdquiriLogger™ however it is applicable when working with any electronic equipment.

This manual notes "ESD Caution" when procedures that are susceptible to ESD events are discussed and in those cases, this section should be reviewed and followed.

ESD Theory

When two objects at different electrical potentials (voltages) come in close proximity to each other an electrical arc (spark) will occur between the two objects. This spark will transfer electrical charge and equalize the voltage potentials, bringing the two objects to the same potential level. In the electronics world, this is referred to as an electro-static discharge (ESD) event.

A common real-world example of an ESD event is walking across a carpeted room and touching a metal water faucet. Walking across the carpet builds up an electrical potential (many thousands of volts) in your body. The water faucet is near to earth ground potential as the plumbing serves as an electrical conductor to the Earth. When your hand comes close to the faucet you can commonly feel a spark "zap".which serves to equalize your body's potential and the Earth grounded faucet potential. Even if you do not see nor feel the spark, this equalization occurs.

Electronic circuitry can be VERY sensitive and damaged by these ESD events if the spark enters a component or circuit board clad at a sensitive node. Some circuitry can be damaged by as little as 10's of volts which humans will not feel as a spark.   For this reason, electronic equipment is designed with ESD protection circuitry at locations where humans will normally touch the device (eg buttons or the wiring terminal strip on the AdquiriLogger™). However, when performing certain operations such as battery replacement, DIP switch adjustment, etc. the instrument will be open with sensitive circuitry exposed and ESD events could damage sensitive circuitry.

ESD Damage Prevention

To prevent ESD damage in electronics production facilities many precautions are taken such as working on grounded conductive desk mats, wearing a conductive strap on your wrist to discharge body potential, conductive waxed floors, humidity control and much more. Obviously these conditions are not easily met in the field where customers will use and deploy instrumentation. However, some simple steps can be taken to minimize the potential for ESD damage in the field.

Where possible, use the following procedures to minimize ESD damage:

- ✓ Work on a conductive surface such as a metal bench.
- ✓ Before opening the instrument, touch the metal bench
- ✓ If a metal bench is not available, before working on the instrument touch a grounded appliance or plumbing which will discharge the human body potential.
- ✓ Before actually opening the AdquiriLogger™, touch the terminal strip labeled ChGnd (chassis ground). This will bring the instrument and your body to the same potential in a safe way
- ✓ Once work starts, try not to walk around or roll on a chair or take any other actions that can rebuild your body's electrical potential. If necessary to do these actions, upon return to the work station repeat the above steps to safely equalize your body and the instrument potentials.

AdquiriLogger™ Instrument Topology

Enclosure

The AdquiriLogger™ is a compact, self-contained instrument, housed in an ABS molded housing. Key features are identified in Fig 4 and Fig 5.

Fig 4; Front Face

Logic Beach Incorporated   *La Mesa, California*   www.logicbeach.com
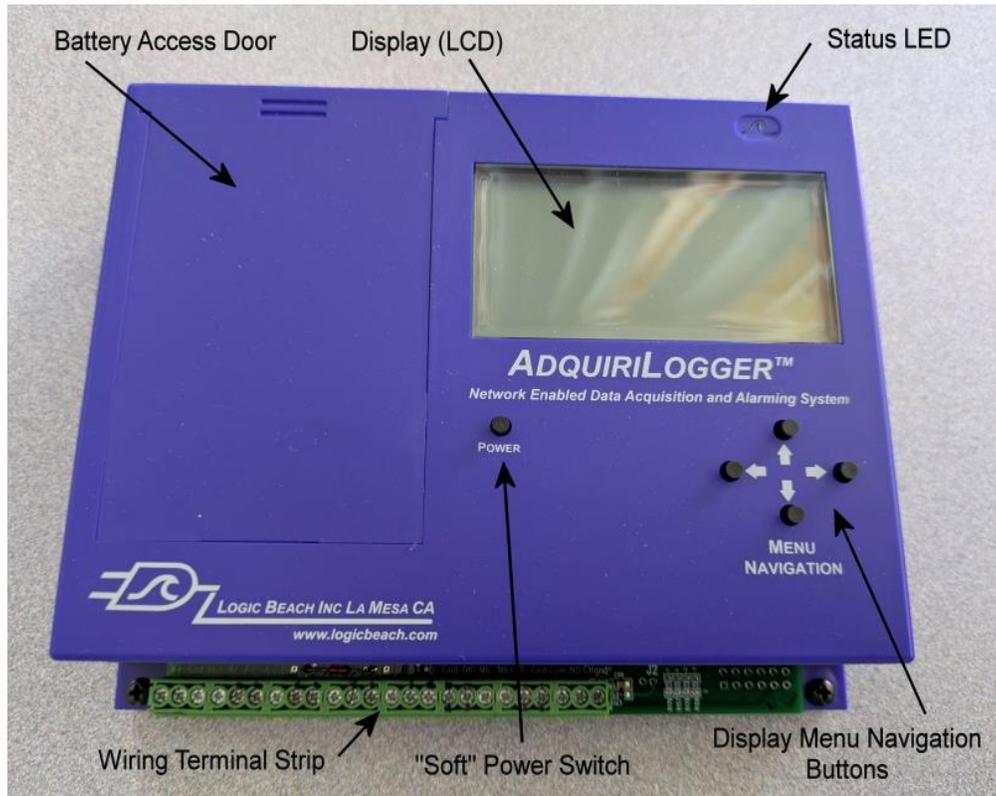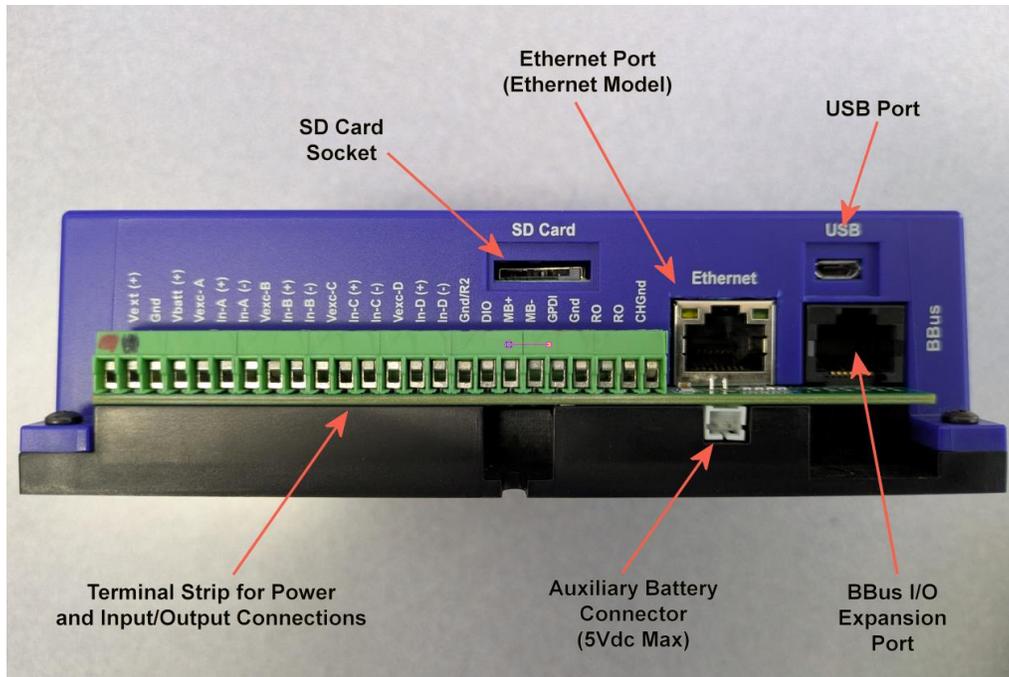
Fig 5; Connections

SD Card (Option)

The AdquiriLogger™ has internal non-volatile memory for storage of logged data as well as the Program Net and other system settings. As an option, the AdquiriLogger™ can be provided with an active SD Card socket (Fig 5). If an SD Micro Card is inserted, the card will be automatically recognized by the AdquiriLogger™ and used for logged data storage. Use of an SD card allows for transport of logged data and Program Nets, field reflash, as well as expanded logged data capacity.

The socket is a push-push type socket.

NOTE: Only install or remove the SD Card when the AdquiriLogger™ is Stopped.

ESD Caution

Refer to Electro-Static Discharge section Page 11

Although the SD card circuitry is protected, a good practice is to touch the ChGND terminal before inserting a card to bring your body and the SD Card to the same potential as the AdquiriLogger™ before insertion.

SD Card Insertion

To install a card, orient the SD card as shown in Fig 6 and carefully insert the card into the SD socket. Press the card in completely and it will lock into place. It may be necessary to use the end of a pen or other small blunt tool to insert the card completely.

Removal

To remove the card, gently press in on the visible edge of the card and release and the card will eject. Another card can then be inserted and logging *Enabled*. Once *Enabled*, the display with show *Logging to SD Card* indicating that the card has been detected, initialized and actively storing data.

Fig 6; SD Card orientation for insertion

SD Card Size Considerations

The AdquiriLogger™ is very efficient in bytes used per sample. For example, an 8GB SD Card will store approximately 80 million data samples.

- Cards larger than 32GB must be formatted in the AdquiriLogger™ in order to be compatible[8]
- Larger cards take longer to format
- Extremely large data files can overload follow-on processing software
- Larger cards take longer to initialize and finalize at the Enable and Stop of logging sessions

For the above reasons, it is recommended that smaller SD Cards are used if available.

> **NOTE:**
> With HyperWare-III™ programming, many intelligent data acquisition strategies can be employed to reduce the volume of acquired data without the loss of information. Conditional logging, Delta logging, Min/Max Average and other

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[8] The AdquiriLogger™ uses FAT32 format. Cards larger than 32GB if formatted under Windows will be formatted in exFAT format which is NOT compatible with the AdquiriLogger™. If cards larger than 32GB are to be used, format the card in the AdquiriLogger™ using the Format SD Card menu.

functions can be easily implemented using HyperWare-III™. Refer to the HyperWare-III™ manual for details.

NOTE:
With the low cost of memory, the tendency may be to deploy an AdquiriLogger™ for extended unattended periods (eg months to years). Without periodic checking of operation and data download, if something fails in the system (eg a sensor or connection fails) loss of valuable data may result.

USB Port

All AdquiriLogger™ models are provided with a USB socket (Fig 5) and USB cable for direct connection to a PC running HyperWare-III™. Configuration of the USB port within HyperWare-III™ is explained in the Software User Manual.

BBus Expansion Port (Option)

The AdquiriLogger™ can be provided with an active BBus RJ45 port (Fig 5). If the model has this option enabled, external Input/Output (I/O) expansion module(s) such as the ILIM-2 and ILIM-7 can be daisy-chain connected to this port using conventional Ethernet Cat5 (or above) rated cabling. Expansion module connection and function are defined in the Expansion Module section of this manual.

Ethernet Port (Ethernet Model)

A standard RJ45 style 10/100Mb Ethernet port is provided on the AQL-ETH model for direct wired connection to a LAN. Via HyperWare-III™ the Ethernet port can be configured for static or DHCP IP address assignment. Refer to the HyperWare-III™ Software User Manual for configuration details. Once configured, the AdquiriLogger™ can be accessed from any device that has credentials via the LAN.

Two LED indicators are provided on the Ethernet Jack frame:

♦ LAN Activity Indicator – Green flashes whenever communication packets are sent or received.

♦ LINK Status indicator – Yellow displays steady when a physical connection to a LAN is established (i.e. valid link pulses are detected).

The Ethernet port is also used for optional interface to LAN connected Modbus TCP Client or Server devices. The AdquiriLogger™ can be configured as a Client or Server allowing data collection, control and sharing of internal register values with connected Modbus TCP devices.

Display and Button User Interface

The AdquiriLogger™ is provided with a backlit, multi-line liquid crystal display (LCD) and buttons (Fig 4) for Power control and navigation through the LCD menu tree.

Power Button

A "soft" power control button (Fig 4) is provided to turn the power to the AdquiriLogger™ On and Off. Press and hold the button momentarily to toggle the instrument On and Off.

If the unit is Enabled (executing a Program Net) a warning message will display requiring user confirmation that the power is to be cycled Off.

Navigation Buttons

Four buttons (Fig 7) are provided for navigation within the LCD menu.
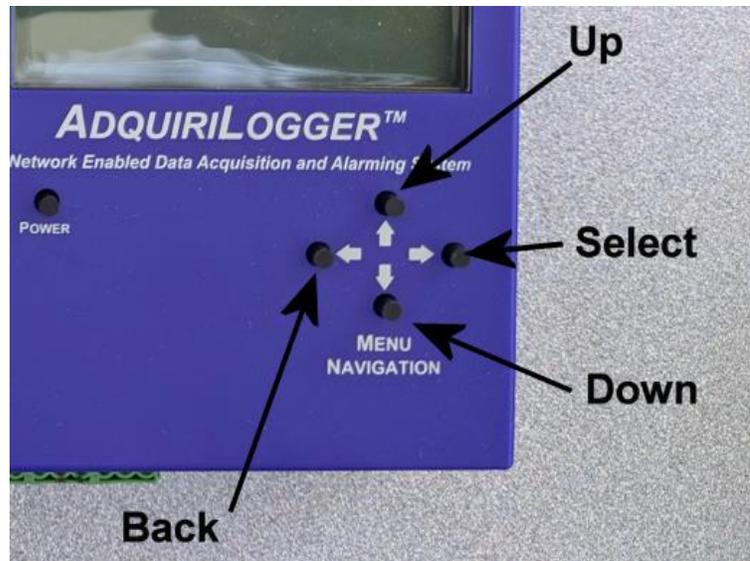
Fig 7; Display Navigation Buttons

Display

A multi-line liquid crystal display (LCD) is provided for reporting of instrument Status, configuring settings, real-time display of readings and other utility functions. Use the Navigation buttons to move within the LCD Menu Tree (Fig 8).

Via the Navigation buttons and the LCD, the following functions can be performed...

▪ **Enable / Stop Net Execution**

Stop and start execution of the Program Net currently in the AdquiriLogger™ memory. The unit may be Enabled such that new data is appended to the existing logged data or that logged data in memory is cleared and a new session is started.

▪ **Real-Time Reading View**

Real-time display of readings as the Program Net executes. Values associated with a Probe Point icon within the Program Net are viewable. Manual or Automatic sequencing of readings supported. If Automatic sequencing is selected, a sequencing rate can be specified.

▪ **AdquiriLogger™ Information**

A suite of operational and status information can be viewed including active Error and Status messages, Program Net name, memory usage, time, network configuration, BBus connected modules, unit temperature, supply voltage, etc

▪ **Control**

Display settings, output (eg relay) manual override, memory clear and sequence for changing the internal battery while unit is Enabled.

OUTPUT CONTROL

The Program Net may have relay, digital and/or audible alarm outputs controlled by the Program Net. Using the Output Override function from the LCD, manual on-site state changes to turn outputs ON or OFF can be forced by the operator. If the manual override is to be returned to control by the Program Net, select **Release** from the menu.

When output states are forced ON or OFF, the display will update stating status (eg Audible Output is or is NOT forced) such that the user will be aware of the current operational state.

CHANGE BATTERY

The internal battery pack can be changed while the AdquiriLogger™ is enabled when low state of charge is detected. Refer to Fig 9 and Battery (AA Cells) Access and Replacement section.

- **Message Display**

  Viewing of active operational messages[9] as user defined and generated by the Program Net with manual or automatic sequencing. If Automatic sequencing is selected, a sequencing rate can be specified.

- **SD Card Utilities (Fig 11)**

  Implements various SD Card functions including...

  ### FORMAT SD CARD

  Erases all data on the card and prepares for use in the AdquiriLogger™

  ### COPY PROGRAM NET FROM THE ADQUIRILOGGER™ TO THE SD CARD

  Copies the Program Net currently in the AdquiriLogger™ to the SD Card for transport

  ### COPY PROGRAM NET ON THE SD CARD TO THE ADQUIRILOGGER™

  One or more Program Nets can be copied on to an SD Card using HyperWare-III™. The card can then be taken to the AdquiriLogger™ location, inserted into the unit and a Program Net can then be selected and copied into the AdquiriLogger™ for execution.

  > NOTE:
  >
  > The Program Net must be copied to the SD Card
  >
  > using HyperWare-III™ as special processing is done
  >
  > by HyperWare-III™ to prepare it for use in the
  >
  > AdquiriLogger™ .

  ### REFLASH OF FIRMWARE[10]

  A new version of AdquiriLogger™ firmware can be reflashed (i.e. programmed) into a field installed AdquiriLogger™ from the SD card. Copy the latest version of the firmware (eg from www.logicbeach.com) onto the card, insert the card into the AdquiriLogger™ and select and follow the LCD steps. If multiple firmware versions are on the SD Card, one step will be to select the desired version to use.

The display menu tree is mapped in the following figures (starting with Fig 8).

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[9] Using HyperWare-III™ , Conditional and/or Latched Message icons can be included into a Program Net for display on the LCD per user specified conditions (eg "Over-Temp!")

[10] "Firmware" is the application code that Logic Beach develops. The firmware is used by the microcontroller within the AdquiriLogger™. Not to be confused with the Program Net which is user developed and instructs the AdquiriLogger™ on taking readings, performing calculations, controlling outputs, etc. Versions of the latest Firmware (as well as HyperWare-III™ can be downloaded from www.logicbeach.com

Display Menu Tree;
Enable, Probe and Info (partial) Menus

[Menu Layout page 1 of 4]

Enable: nnnn KB Free.
ENABLE will append to memory and Enable

CLR-EN: Clears memory then starts a new logging session

Cancel: Cancels and returns up one level

Enable
Probe
Info
Control
Message
SD Card

Enable
Probe
Info

Manual Probe Sequence
Auto-Probe Sequence
Auto-Probe Rate Set

Manual Sequenc
Auto Sequence
Sequence Cadence

Manual Probe Sequence
Probe Points display with Names and Values from all Probe Points specified in the Program Net.

Stepping through the queue of Probe Points is done manually via the Up/Down buttons.

Auto-Probe Sequence
Probe Points display with Names and Values from all Probe Points specified in the Program Net.

Probe Points will scroll through display per timing specified in Auto-Probe Rate Set

Auto-Probe Rate Set
Select a automatic scroll update rate. Highllight and Select:

2, 4, 8, 16 second

Logger
Session
Message
Network
IP Config
Vsupply
BBus
Features

Logger
Session
Message

Active Message Queue:
Error and Status messages with associated time.

(Use Up/Down buttons to step through messages)

Net Name:
Currently loaded Program Net

Operating Mode:
Enabled / Stopped
Internal or SD Card memory
Memory use mode

Memory Size:
Megabytes of installed memory

Memory Used:
Kb/Mb used and apx percentage of installed

Logger Time:
AQL internal Date/Time

Session Start Time:
Time when unit was Enabled

Name:
User specified in Net

ID:
2nd user specified name

AppVersion
Current firmware version

SerialNo:
Production Serial Number

Logger Temp:
Internal unit temperature

Battery Volts:
Internal AA cell voltage

Date/Time:
AQL current time

Logger Clock:
Current internal microcontroller clock frequency. 24MHz, 60MHz or 120MHz.

Fig 8; Enable, Probe and Info (partial) LCD Menu Tree

Fig 9; Info and Control (partial) LCD functions

Display Menu Tree;
Control (partial) and Message Menus

[Menu Layout page 3 of 4]

Enable
Probe
Info
Control
Message
SD Card

Display Control
Change Battery
Erase Log Memory
Output Override

Control

Cancel — Select ERASE to
ERASE — clear entire data memory.
No Un-Do!

Erase Log Memory

Output Override

Relay Output
Event Output
Audible Alarm

Relay Output

ON — Relay output is
OFF — Not Forced
Release
Cancel

ON → Forces Relay Output ON

OFF → Forces Relay Output OFF

Release → Relay released to Program Net control

Event Output

ON — Event output is
OFF — Not Forced
Release
Cancel

ON → Forces Event Output ON

OFF → Forces Event Output OFF

Release → Event released to Program Net control

Audible Alarm

Control

System Errors NOT Shown
Manual Sequence
Auto Sequence
Auto Rate Select

Net Messages Display
(use UP/DOWN to step through message queue)
BACK to continue

Net Messages Display
(messages in queue auto-sequence to LCD per Auto Rate setting)
BACK to continue

2 Sec — Set auto-update
4 Sec — rate
8 Sec
16 Sec
Cancel

ON — Audible output is
OFF — Not Forced
Release
Cancel

ON → Forces Audible Output ON

OFF → Forces Audible Output OFF

Release → Audible released to Program Net control

Fig 10; Control (partial) and Message LCD functions

Top Level Display Menu Tree;
SD Card Operations Menu

[Menu Layout page 4 of 4]

Enable
Probe
Info
Control
Message
SD Card

SD Card

SD Card Status
Format SD Card
Copy Net to SD Card
Copy Net on Card to AQL
Reflash AQL from Card .bin

SD Card
Status

Size: nnnnnn MB
Free: nnnnnn MB

Format
SD Card

Operation will require
time to complete...

SELECT to continue

Formatting in Process
Wait for completion...

SD Formatting
Complete

Copy Net
to SD Card

Complete

Copy to AQL

Global Settings 1
>Global Settings 2
Global Settings 3

(Select Program Net to
use. The names shown
are from the Program
Net's Global icon name
field)

Net Programming
Complete

BACK to continue

Reflash AQL from
.bin file on SD Card

AQL_03_02_01_01.bin
> AQL_03_02_01_02.bin
AQL_03_02_01_03.bin

(Select reflash file to
use)

Reflash file
selected

Validate .bin file..

Copy file to Logger...

Execute reflash...

Rest Logger

Bootloader v.6.02
Normal boot
App CRC Valid
Syst reflash request
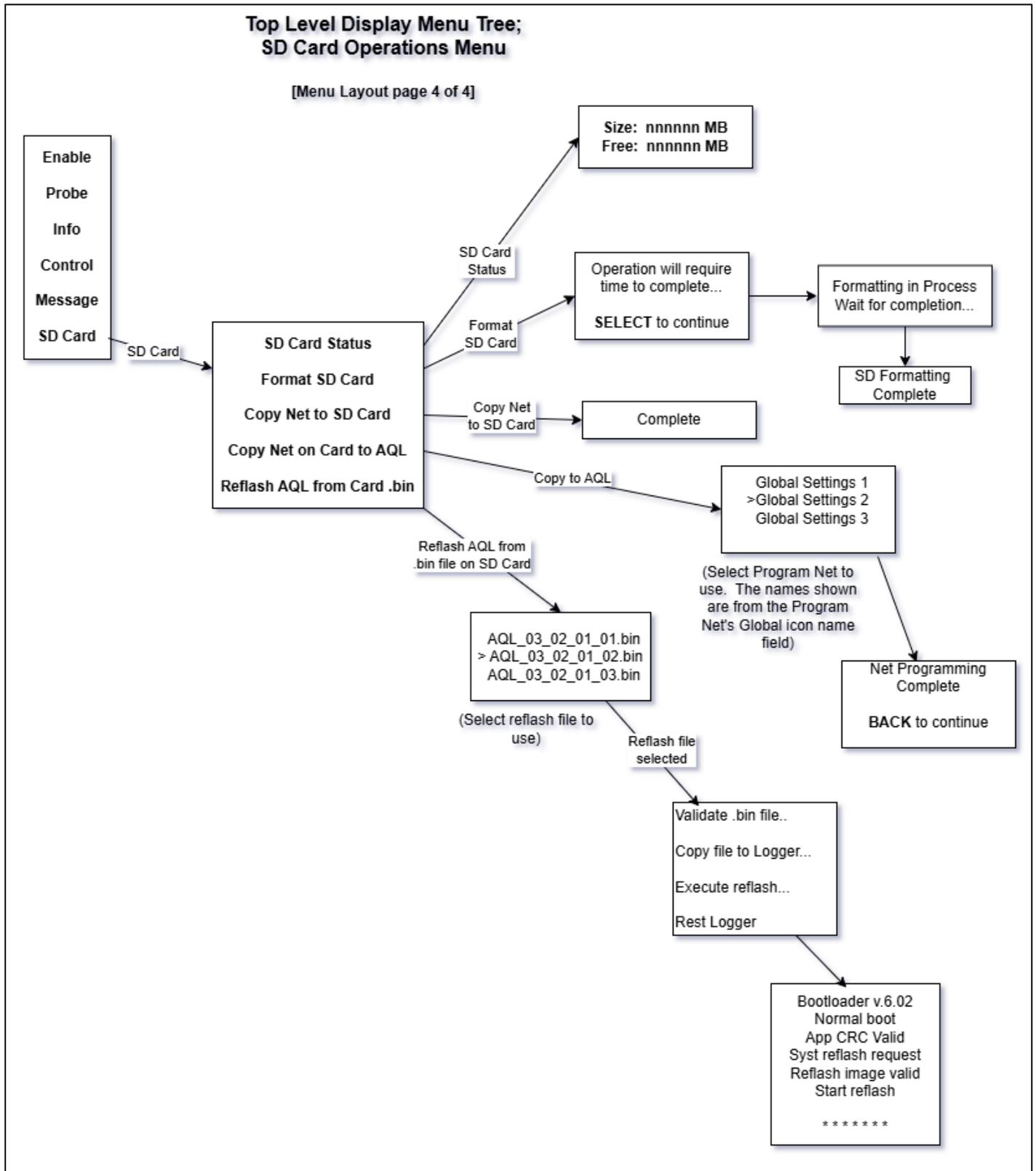Reflash image valid
Start reflash

* * * * * * *

Fig 11; SD Card Utilities

Wave LED

A general purpose LED is provided in the upper right corner of the AdquiriLogger™ (Fig 4). Its state can be controlled from within the Program Net for visible user feedback.

Internal AA Battery Pack

The AdquiriLogger™ has an internal battery pack containing three AA alkaline cells. The battery has multiple functions:

- Provides energy for orderly shut-down in the event of main power failure on network models

- Float through power allowing for uninterrupted operation in the event of an external (Vext or Vbatt) power source failure on AdquiriLogger™ Basic and Basic-WiFi models.

- Main power source for short term (typically up to a month) operation in the AdquiriLogger™ Basic and Basic-WiFi models

Battery State of Charge (SOC) Monitoring

The state of charge (SOC) of the batteries is estimated by periodic reading of the pack voltage by the AdquiriLogger™ circuitry. Warnings are displayed when the battery voltage passes through multiple discharge voltage thresholds.

If the SOC drops below a critical level, the AdquiriLogger™ will stop Program Net execution and perform an orderly shutdown. Until the batteries are replaced, the unit cannot be Enabled (see *Emergency Start-Up* section following).

The SOC voltage thresholds can be modified from within HyperWare-III™ and are discussed in the HyperWare-III™ Software Manual.

Battery (AA Cells) Access and Replacement

ESD Caution

Refer to Electro-Static Discharge section Page 11

Replacing Batteries

Power the AdquiriLogger™ off before replacing the batteries.

The battery pack is accessed by sliding the door on the left face of the AdquiriLogger™ up as shown in Fig 12. The pack can then be removed (to the extent of the attached wires) and batteries can be replaced observing polarity per Fig 13.

When reinstalling the battery pack, the end with the leads should be down, toward the DIP switches. When replacing the cover, press down slightly on the battery pack (as there is a foam pad under the pack to provide cushioning) and slide the cover into place.

CAUTION

The batteries should always be removed during periods (eg months) of non-use. There is a very slight discharge on the batteries at all times and over long periods of time, the batteries can slowly be discharged.

Removing batteries will also prevent possible AdquiriLogger™ internal circuitry damage from leaking acid which will occur in all alkaline type batteries eventually over time

---

Battery Replacement while Enabled

If a battery SOC warning is received while the AdquiriLogger™ is executing a Program Net the batteries can be replaced without interrupting the Net execution. As the battery voltage is periodically tested, a special procedure has to be followed to replace the batteries while Enabled. If this procedure is not followed the battery voltage might measured and reported as Critical with following shut-down. This sequence disables the battery voltage measurement during the battery replacement procedure.

The sequence is initiated via the AdquiriLogger™ front panel buttons and Display and is detailed in Fig 9. The steps are summarized following:

1. Using the navigation buttons and the display, step down through the display menu and select Control then Change Battery.

2. Connect a USB cable or external power to the terminal strip

3. Press SELECT and the display will indicate that it is now OK to replace batteries

4. Replace batteries

5. Press SELECT and if desired, remove the USB cable or External power

Emergency Start-Up with Completely Discharged AA Cells

In the event that the AA Cells within and AdquiriLogger™ are completely discharged, the instrument will be stopped and unable to boot… even with the addition of external power. The simple solution to this problem is to replace the AA cells, however in the event that replacement AA cells are not available and it is critical to get the AdquiriLogger™ to communicate (eg to download critical data at a remote location), the following procedure MAY be successful in reviving the AdquiriLogger™ sufficiently for basic functions.

NOTE
This procedure is only for emergency use and is not guaranteed to revive an AdquiriLogger™ with completely discharged AA cells. Always replace the AA cells when Low State of Charge is indicated by the AdquiriLogger™ to prevent getting into this problematic situation.

1. Remove one of the AA cells

2. Connect an external power source to the Vext or Vbatt terminals

3. Hold the Power button down for 30+ seconds. (this will put a small charge on some internal capacitors from the Vext source)

4. Release the Power button and then tap it again and the AdquiriLogger™ most likely will turn ON.

5. The unit will stay ON running from the Vext source and USB Communication, etc can be performed as required.

6. Do not attempt to Enable the unit and leave it in the field to function… the AA Cells MUST be replaced before Enabling to ensure data security.

Fig 12; Internal battery pack access

CAUTION
Although the battery holder contains reverse installation protection, when reinstalling AA cells, ensure correct orientation/polarity as shown in Fig 13 to prevent permanent damage.

Logic Beach Incorporated   *La Mesa, California*   www.logicbeach.com

Fig 13; Battery polarity

Auxiliary Power Connector (Fig 5)

A polarized connector is available for connection of an external battery pack with voltage of 5Vdc (absolute maximum) or less. This connector is used when the AdquiriLogger™ is installed in the optional AQL-ENC-Batt enclosure. This option includes a D-cell battery pack (and weatherproof enclosure) for extended autonomous operation from battery.

The mating plug with pigtail leads is available for user connection of batteries (LBPN AQL-ABC).

CAUTION

This specialty Auxiliary Power Connector port is <u>NOT polarity nor over-voltage protected</u> . Maximum input voltage is 5.0Vdc. Designed for three series alkaline cells.

Alternatively for general purpose battery powered AdquiriLogger™ operation, use the wide voltage range input Vbatt terminals on the terminal strip.

Clock Battery

An internal BR2325 lithium coin cell provides backup power for the Real Time Clock time and date when power is disconnected from the AdquiriLogger™. This battery will last for up to 10 years (mainly depending on ambient

temperature affected self-discharge rate) as the current draw is extremely low. The battery voltage is a nominal 3Vdc when new. End of life voltage is approximately 2Vdc and can be checked via the LCD menu (Info/Vsupply/Clock Battery) or via a query of the Status icon from the HyperWare-III™ Comm Window. When the Clock Battery voltage droops to a critical level, a warning message will display on the LCD as well as within the Status dialog from within HyperWare-III™.

Clock Battery Replacement

The clock battery is retained in a socket on the bottom side of the main printed circuit board in the AdquiriLogger™. Replacement requires partial disassembly of the unit as follows:

> CAUTION
>
> ESD Advisory
>
> Refer to Electro-Static Discharge section Page 11

3. If desired, using HyperWare-III™, download and save the Program Net and any logged data.
4. Disconnect external power and USB connection
5. Remove sliding battery cover and one battery
6. Remove four black screws in each corner of the blue Top and gently lift cover off while observing routing of battery wires and antenna wiring (if so equipped).
7. Gently set the Top along side the unit without putting strain on any wires (Fig 14)
8. Carefully remove the four corner screws securing the circuit board assembly to the black plastic base. Take care that the screwdriver tip does not slip and gouge the circuit board or any components. (Fig 14)
9. With a finger or non-conductive stick (eg a popsicle stick), slide the BR2330 coin cell sideways out of its holder without applying excessive upward force that could bend the spring arm that holds the coin cell in place. (Fig 15)
10. Slide a new coin cell into the holder
11. Replace the PCA on the black base and install four mounting screws
12. Carefully replace the Top while routing the battery wires and antenna wires such that they are not crimped
13. Replace the four Top retaining screws
14. Replace the AA cell into the holder.. observing polarity
15. Reinstall the holder into the battery pocket and slide the door closed
16. Apply external power if necessary and turn the unit ON
17. Step through the Display and check the Clock Battery voltage (Info/Vsupply) which should display above 2.9Vdc
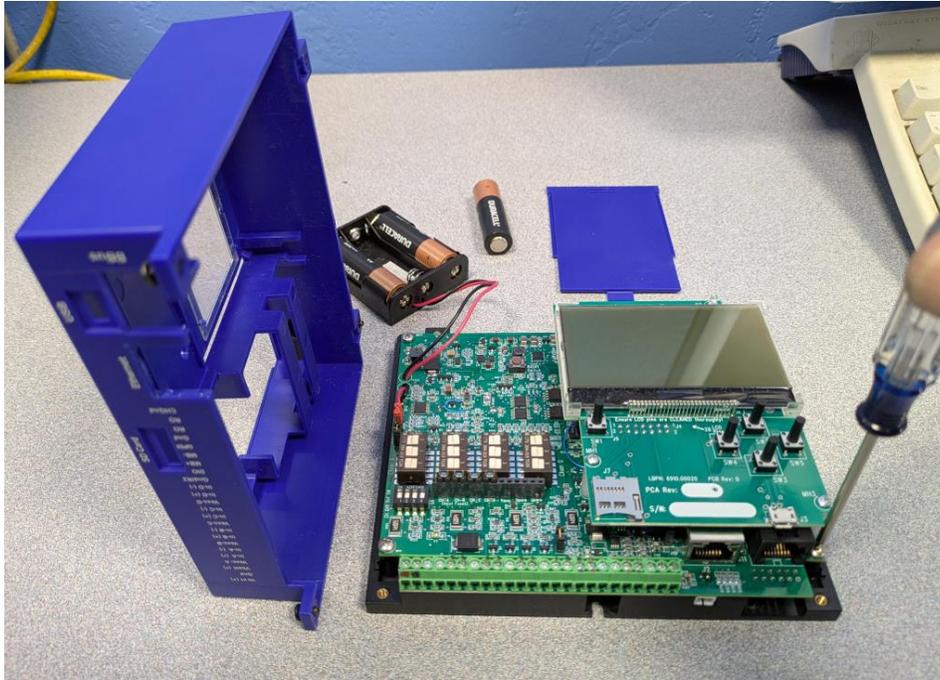
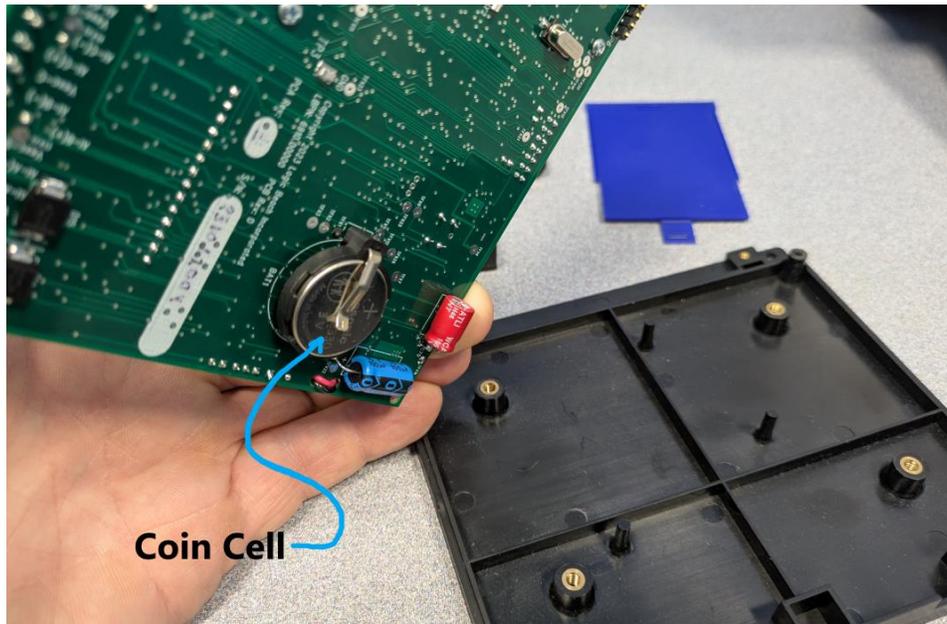**Fig 14; One AA cell removed and Top removed**

Coin Cell

Fig 15; Coin Cell and socket

Terminal Strip Adapter (option)

Two models of Terminal Strip Expansion Board (LBPN: AQL-TSA and AQL-TSAP) are available which have larger terminal strips (Fig 16) to handle heavier gauge I/O wiring. The AQL-TSAP has pluggable terminal strips allowing for quick disconnect and reconnect of I/O wiring from the AdquiriLogger™ while keeping the wiring organized when separated from the AdquiriLogger™ instrument.

Fig 16; AQL-TSA Terminal Strip Adapter shown installed
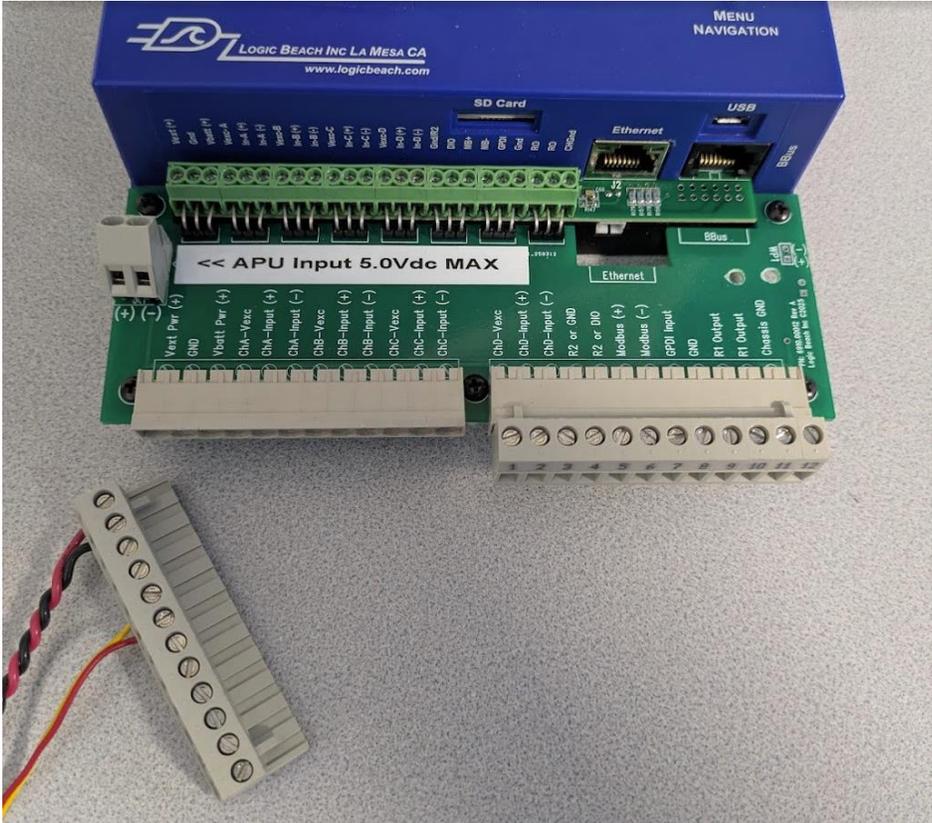
Fig 17; AQL-TSAP with pluggable terminal blocks

Harsh Environment Enclosure options

The AdquiriLogger™ enclosure is not weatherproof, so for deployment in harsh or outdoor environments Logic Beach can supply the AdquiriLogger™ in various industrial enclosures. Contact Logic Beach or view on www.logicbeach.com for enclosure options.

Fig 18; AdquiriLogger mounted in optional enclosure

Instrument Mounting

The AdquiriLogger™ can be provided with DIN Clips (LBPN: 3522.27100) for mounting on 35mm DIN rail (LBPN: 3522.70110). The clips are attached to the back of the unit with provided 6-32 x 5/8" FH machine screws which thread into the four molded inserts. Once installed, the AdquiriLogger™ can be easily mounted on industry standard 35mm DIN rail allowing for easy installation and removal.

Mounting CAUTION

If alternative user mounting utilizes the molded inserts in the back of the AdquiriLogger™, ensure that the 6-32 machine screws length does NOT project more than 0.25" into the enclosure (measured from the back surface of the enclosure) or circuit damage will occur.
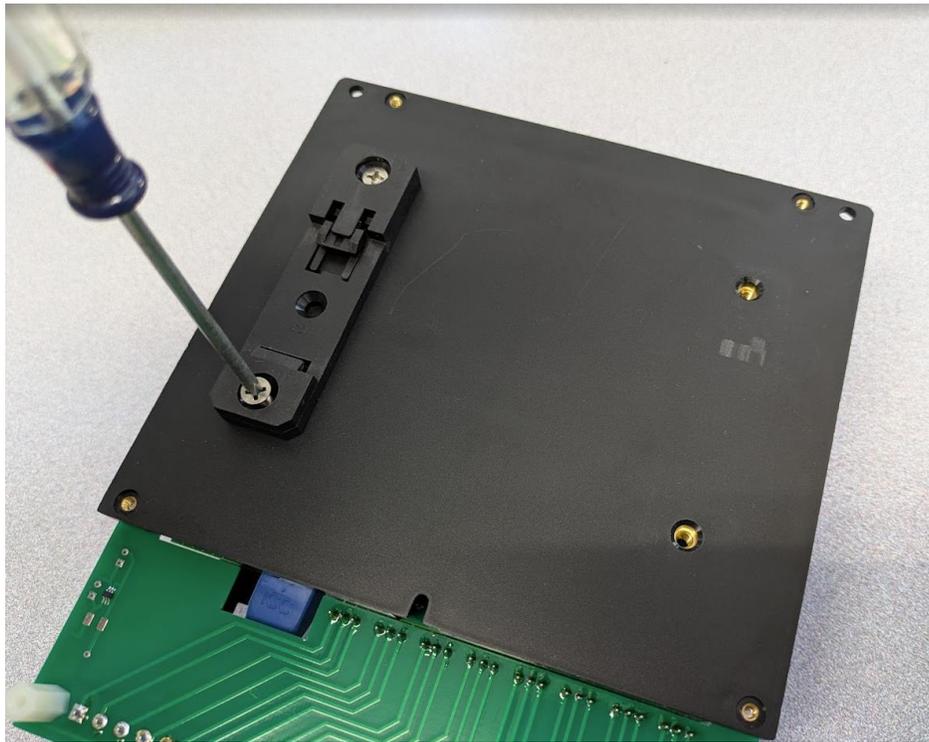

Fig 19; Attaching DIN Clips to back of AdquiriLogger™

3. AdquiriLogger™ Instrument Inputs and Outputs

Input / Output Overview

The AdquiriLogger™ has the capability to directly connect to and acquire sampled values from thermocouples, analog currents, analog voltages, Event, high-speed Count and Frequency inputs. With this integral versatility, the input channels can interface to most types of sensors and transducers.

The AdquiriLogger™ also has multiple user configurable outputs for alarms or basic control including relay(s), Open-Collector output, audible alarm and an indicator LED.

The operation of these various inputs and outputs (I/O) is under control of a user developed Program Net that executes within the AdquiriLogger™. In addition to sampling inputs and providing outputs, extensive calculations, conditional actions, data reductions and logical decisions can be implemented via the Program Net.

In addition to the hardware I/O the AdquiriLogger™ can optionally interface to Modbus RTU or TCP devices serving or garnering readings to/from Modbus devices via digital serial communications. Data (register values) read from Modbus connected devices can be processed by the user configured Program Net the same as the hardware I/O samples mentioned previously.

Shielding – A Brief Tutorial Overview

Signals connected to the AdquiriLogger™ from the source (eg a sensor or transducer) can be affected by stray electromagnetic radiation "noise" resulting in degradation of signal quality. The AdquiriLogger™ has advanced noise filtering circuitry that minimizes errors due to noise. However, the use of wiring to minimize noise pickup can add to the quality of measurements in extremely "noisy" environments as found in industrial plants and factories. Twisted pair or shielded wiring can be employed to minimize the pickup of this noise. Shielded wire has a braided or foil covering under the outer jacket surrounding the wire conductors carrying the input signal. The shield then serves as a conduction path to shunt the noise to ground preventing it from affecting the signal conductors.

Twisted pair wires expose the signal conducting wires somewhat equally to the noise resulting in a more balanced pickup of noise in both signal conductors. This resulting "common-mode" noise is more easily filtered out and rejected by the AdquiriLogger™ input signal conditioning circuitry.

In most applications, use of twisted pair leads is sufficient for GPDI Event and Counter applications and the use of shielded cable for event, counter signals is not necessary due to the input circuitry noise margins.

Frequency inputs are amplified by the AdquiriLogger™ input circuitry. When applying low level input signals (e.g. amplitudes less than ~500mV) in electrically noisy environments, improvements in measurement quality may be seen by the use of shielded cable. In this case, connect the cable shield to the AdquiriLogger™ ChGnd terminal (detailed following). The cable shield should then be allowed to float (i.e. no connection made) at the signal source end. Shielded cable use for frequency signals will also minimize cable to cable noise cross-talk to sensitive analog inputs connected to other channels of the AdquiriLogger™ .

In electrically noisy environments, low level analog signals from sensors should be connected with shielded wire for best performance. As described above, one end of the shield should be connected to the CHGnd terminal and the other remote end left floating.

Connections

Input, Output, Modbus RTU and Power connections are made via the terminal strip (Fig 20) on the edge of the AdquiriLogger™. Terminal strip connection details follow.
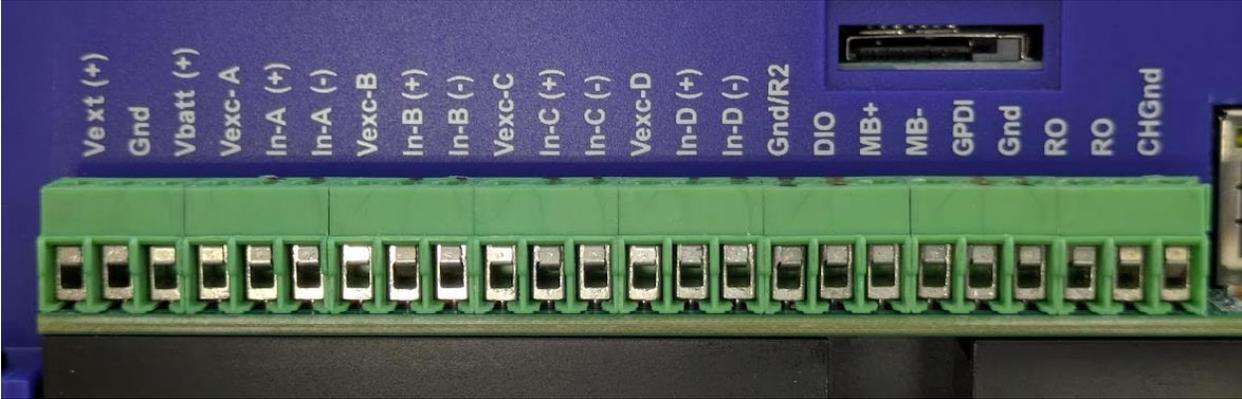
Fig 20; I/O and Power Connection Terminal Strip

Vext (+) Terminal

Main external power source positive connection. Input range is 7 - 28Vdc (polarity protected)

Gnd (two terminals provided)

Ground connection used by internal circuitry. External power "negative" would connect to this terminal.   This terminal is duplicated near the right end of the terminal strip (for use with other I/O). Both terminals connect to the common instrument circuit Ground.

Ground Difference Warning

In shared power supply installations, before making electrical connection to the AdquiriLogger™ ensure that the 'ground' of the two power sources can be connected together without problems. This condition can sometimes be found in Industrial applications with transmitters powered from different power supplies. There may be a voltage potential between the "Ground" terminal.

Measuring the voltage between the "Grounds" with a volt meter can verify if this condition exists.

This also applies to connections to the analog input (-) terminal that are receiving signals from transducers powered from different power supplies.

If this condition exists, the *fully isolated* analog inputs of the ILIM-7 Analog Expansion module can be used.

Vbatt (+) Terminal

Second external power source positive connection. Input range is 7 – 28Vdc. This terminal and the Vext (+) are connected together internally via reverse polarity protection diodes.

Some applications may have two power sources such as a utility powered wall transformer and a backup battery. For these applications, the wall transformer Positive lead can be connected to the Vext terminal as mentioned above and the backup battery Positive lead can be connected to the Vbatt(+) terminal. Both sources would have their Negative leads connected to the GND terminal. With this method, in the event ot a grid power failure, the AdquiriLogger™ power will automatically be supplied by the backup battery.

IN-A (+) and IN-A (-) Terminals

Four differential analog input channels are provided (A, B, C and D) each with a pair of positive and negative terminal inputs for signal connection. The analog inputs are user configurable for thermocouple/bipolar DC Voltage or bipolar DC Current input from sensors or transducers. Each input is over-current protected with a replaceable fuse. Signal type for each channel is programmed via a DIP switch. After channel signal type is configured via the DIP switches, ranges and thermocouple type are then programmed via the HyperWare-III™ software.

Signal Configuration via DIP Switch (Fig 21)

Pre-scaling and input type (voltage or current) is programmed via the four DIP switches that are accessible under the battery pack. To access the switches, turn the unit OFF, slide the battery cover up and off and remove the battery pack.

The four DIP switches correlate to the four analog channels (e.g. *S1; Chan A Switch* in Fig 21). Within each DIP switch package there are three individual switches numbered 1, 2 and 3. Switches are flipped On and Off by sliding the white actuator with a small screwdriver or other small tool resulting in a pattern of On and Off settings for the switches on the DIP. This pattern configures pre-scaling for the type of input to be connected to that analog input.

The switch configurations for signal types are printed on the inside of the battery cover for convenient reference.

Fig 21; Analog Input Signal Type Configuration DIP Switch

Input Type	Switch 1	Switch 2	Switch 3
Voltage (Low ranges) and thermocouple	ON	OFF	OFF
Voltage (High ranges)	OFF	ON	OFF
Current (mAdc ranges)	ON	OFF	ON

Analog Input Over-Current Fuses

Each of the analog input channels has a dedicated 50mA (LBPN 7530.90000) fuse for over-current protection. Fuses F1-F4 are shown in Fig 22. Two spare fuses are included at location F8 and F9 in Fig 22.

Analog Input Common-Mode Voltage Input Range

The Common-Mode input range on the analog channels is +/-4Vdc. This means that neither the Positive nor Negative analog signal levels can be higher or lower than 4Vdc from the AdquiriLogger™ circuit ground for normal operation.

When using the Hi-Vdc range, the AdquiriLogger™ front end circuitry employs a voltage divider, hence only the negative analog signal input has to stay in this Common-Mode range.

Analog Input Ground Reference Switch

In normal operation, for some protection, the negative analog input is connected to AdquiriLogger™ circuit Ground via a 20K ohm resistor. In Fig 22, the Ground Reference Switches identified as A through D can be switched ON to bypass this 20K resistor. This capability can be advantageous for certain non-normal input configurations however, before switching the analog inputs direct to Ground via these switches, it is best to contact Logic Beach for Technical Support.

Vexc-A, B, C and D Terminals

Each of the four channels has an Excitation terminal associated with it. These terminals can be configured to provide a voltage output under program control. Depending on the AdquiriLogger™ configuration, various functions can be implemented.

- **Vexc Control via the Excitation Icon**

    Within HyperWare-III™ an "Excitation" programming icon is available which can be used within a Program Net to control the Vexc output terminal state. Details on the use of this icon are covered in the HyperWare-III™ Software Manual.

    When the Excitation icon is cycled ON, the voltage provided at the Vext or Vbatt terminals will be sourced simultaneously to all four channel's Vexc terminals.

    Use of the Excitation Icon can implement an additional Digital Output function (in addition to the relays, GPDI, DIO).

    The terminals are fused with one common 125mA fuse (LBPN7530.90001) F5 shown in Fig 22 to protect from accidental shorts or over-current loads.

- **Vexc Control via Analog Channels Configuration**

    Within HyperWare-III™, each Analog Input channel Configuration dialog has an optional "Sensor Excitation Time" setting. If a time is set, all four Vexc outputs will cycle ON for the specified time duration before the input signal to that channel is sampled. This allows use of the Vexc output to automatically power a sensor requiring excitation, wait a period of time (as specified in the "Sensor Excitation Time" setting for a sensor to stabilize, then take a input signal reading.
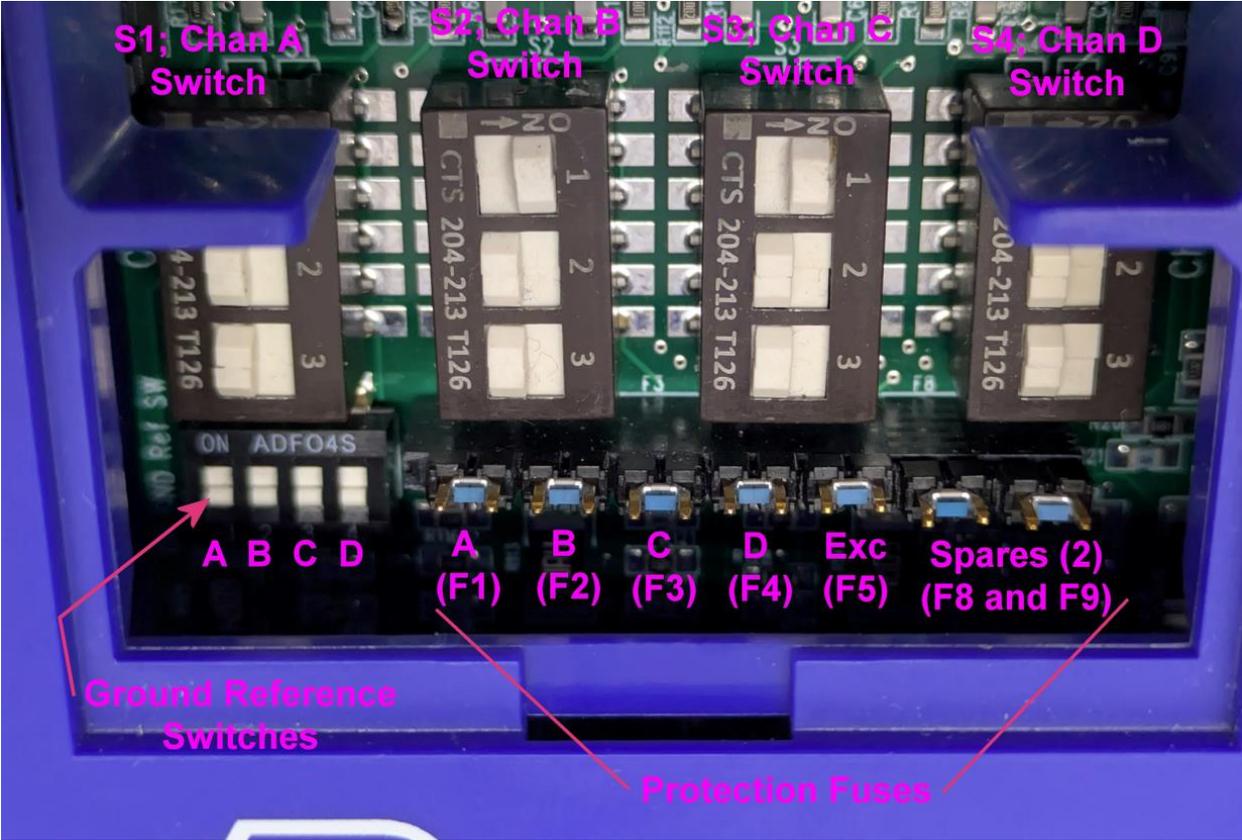
Fig 22; Channel Configuration Switches, Ground Reference Switch and Fuses

R2 or GND and R2 or DIO Terminals

These two terminals have different functions depending on if a second output relay (R2) is installed as an option at order time.

- **With Second Relay Option**

    The terminals provide Normally Open (NO) low-voltage, isolated relay contacts. The contacts are "isolated" in that they are simply an open or closed pair of contacts (like a switch) that are not connected to other internal circuitry. The state of the relay contacts (On or Off) is under control of the "Relay 2" icon within the HyperWare-III™ programming window.

    The contact's factory default setting is Normally Open. Normally Open means that when the relay coil is not powered, the relay contacts are open (off). Users can change the default to Normally Closed by changing jumper JPR3 (Fig 23). Changing this jumper setting requires partial disassembly of the AdquiriLogger™ as the jumper is on the bottom of the circuit board. Access is gained using the same procedure as the Coin Cell replacement in the prior chapter.
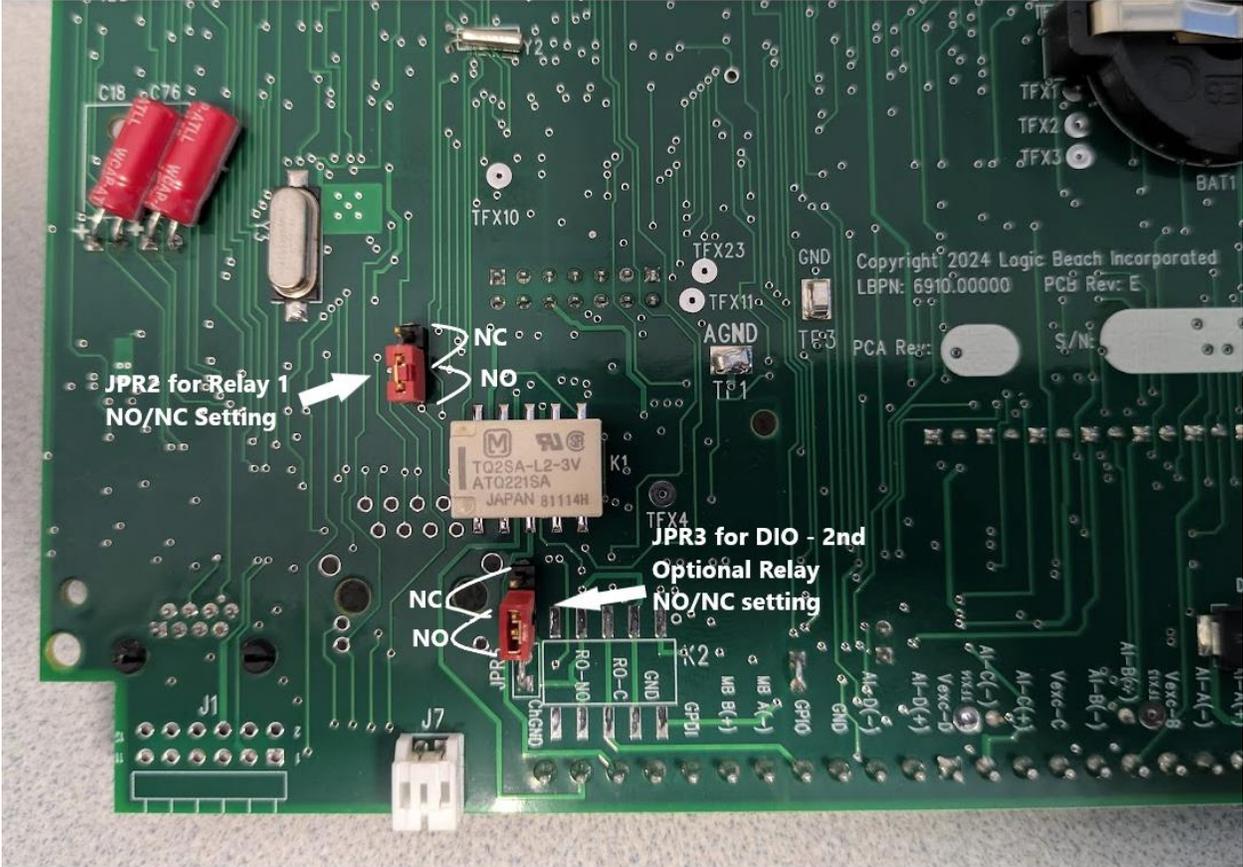
Fig 23; JPR2 and JPR3 Jumpers for setting Normally Open or Normally Closed relay output states

- **With DIO - Digital Input/Output**

  If the Second Relay option is not installed, these two terminals can be configured to provide one of three different Digital Input/Output functions. The selection of a function is configured with the Program Net from within HyperWare-III™.

  EVENT

  Sample switch type (dry contact) or low-voltage driven input state. A Pull-Up can be enabled for non-powered switch type inputs.

  COUNTER

  Count switch type (dry contact) or low-voltage driven input Hi/Lo transitions. A Pull-Up can be enabled for non-powered switch type inputs. The DIO has input signal period and pulse width requirements as specified within the DIO icon Configuration Dialog.

  OUTPUT

  Switched output current limited to 100mA via an Open-Collector (technically Open-Drain) transistor.

MB+ and MB- (Modbus Interface)

Two terminals providing RS-485 Modbus RTU communication for optional Master or Slave operation.

GPDI and GND Terminals

Two terminals implementing Event, high speed Counter or Frequency input sampling. The selection of the input type is configured with the Program Net from within HyperWare-III™.

- **Event**

    Allows recording of the state of an ON/OFF, switch or 'discrete' type input. Configured as an Event input, a channel will accept a low voltage powered input signal (see Specifications section) or a contact closure (dry contact) input.

    - For powered input signals, the signal voltage levels must comply with the Low level (maximum) and the High Level (minimum) voltages per the Specifications section.
    - For contact closure type inputs, internal "contact wetting" power can optionally be supplied from the Event input channel circuitry via an internal circuitry pull-up resistor. A setting within the Program Net icon allows for user control of this pull-up resistor.

- **High-Speed Counter**

    The Counter function of the GPDI provides an accumulating total of signal transitions received at its input. This input is well suited to counting pulses from flow meters, power meters, etc.

    - For powered input signals, the signal voltage levels must comply with the Low level (maximum) and the High Level (minimum) voltages per the Specifications section.
    - For contact closure type inputs, internal "contact wetting" power can optionally be supplied from the Coiunter input channel circuitry via an internal circuitry pull-up resistor. A setting within the Program Net icon allows for user control of this pull-up resistor.

    When a mechanical switch is the source of the input signal, it is common that the mechanical contacts of the switch will bounce a few times upon closure until they settle into a steady closed state. The GPDI circuitry is fast enough to detect these bounces as many On/Off signals and that signal could be logged as multiple transitions. To filter out this bouncing, a 40mS debounce/filter circuit can be enabled in the Program Net icon, which filters out this contact bounce.

- **Frequency Measurement**

    A GPDI channel configured as a Frequency type input can measure input frequencies ranging from approximately 0.1Hz to 10KHz. The channel will accurately measure frequencies of sine, square, or sine approximating input waveforms. Channel input impedance is greater than 30Kohm within the specified input range.

    For special applications, a voltage pull-up and filtering can be enabled within the GPDI Frequency icon during construction of the Program Net. Typically these settings are not necessary when this channel is configured for Frequency input mode.

R1 Terminals (2)

Every AdquiriLogger™ is provided with one relay output. These terminals provide Normally Open (NO) low-voltage, isolated relay contacts. The contacts are "isolated" in that they are simply an open or closed pair of contacts (like a switch) that are not connected to other internal circuitry.   The state of the relay contacts (On or Off) is under control of the "Relay " icon within the HyperWare-III™ programming window.

This is a latching relay which means that it only consumes a short burst of energy when the relay changes state. It is stable without added energy in either the Open or Closed state making it ideal for low power (battery) applications.

The contact's factory default setting is Normally Open. Normally Open means that when the relay coil is not powered, the relay contacts are open (off).   Users can change the default to Normally Closed by changing jumper JPR2 (Fig 23). Changing this jumper setting requires partial disassembly of the AdquiriLogger™ as the jumper is on the bottom of the circuit board. Access is gained using the same procedure as the Coin Cell replacement in the prior chapter.

CHGnd Terminal

For optimum system accuracy and protection of the AdquiriLogger™ from electrostatic discharge damage, it is highly recommended that an Earth ground connection be made to Terminal 18 (ChGnd). Ideally a short wire will be connected from this terminal to a known Earth ground connection such as an electrical panel ground in industrial environments or a ground rod driven 6' into the Earth in outdoor/remote installations. Ensure that the lead does not have excessive length or coils as this adds inductance and lessens the effective protection.

Hardware Reset Switch

For certain failure conditions (eg precipitated by an ESD event) the AdquiriLogger™ microcontroller may get "lost in the weeds" and become unresponsive. In this event, a Hardware Reset may restore normal operation. This reset is performed by inserting a paper clip into the Reset Switch access hole (Fig 24) in the AA cell battery cradle support and gently pressing. There is a small tactile switch below this hole and the paper clip press will momentarily close the switch, implementing the Reset.
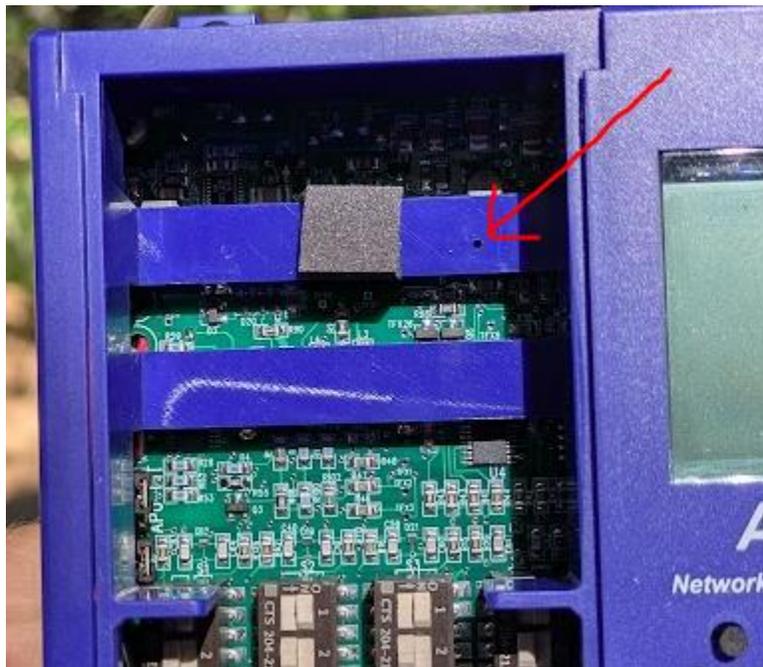
Fig 24; Hardware Reset Switch access hole

Interface Modules

Overview

To expand the input and output channel capability of the AdquiriLogger™ , one or more Interface Modules can be connected to AdquiriLogger™ instruments that have the BBus Expansion Port option. Additional Interface Modules are added by connecting them in a daisy-chain wiring method to the AdquiriLogger™ via the BBus expansion bus.

BBus Interconnect

The BBus is a serial data link for communication between the AdquiriLogger™ System Base and one or more Interface Module(s). In addition to communication, it also provides a limited amount of power for powering up to approximately 3 modules.

Modules that are connected on the BBus must be assigned unique Module Addresses such that communications from the AdquiriLogger™ instrument can be routed to the correct module.

With the use of distributed ILIM-x modules to collect data from pockets of sensors, the sensor to data acquisition instrument wiring runs can be minimized. A single Ethernet BBus cable then connects the ILIM-x modules to a centrally located AdquiriLogger™. This radically decreases the installation labor and materials and and minimizes sensor wiring pickup of noise.
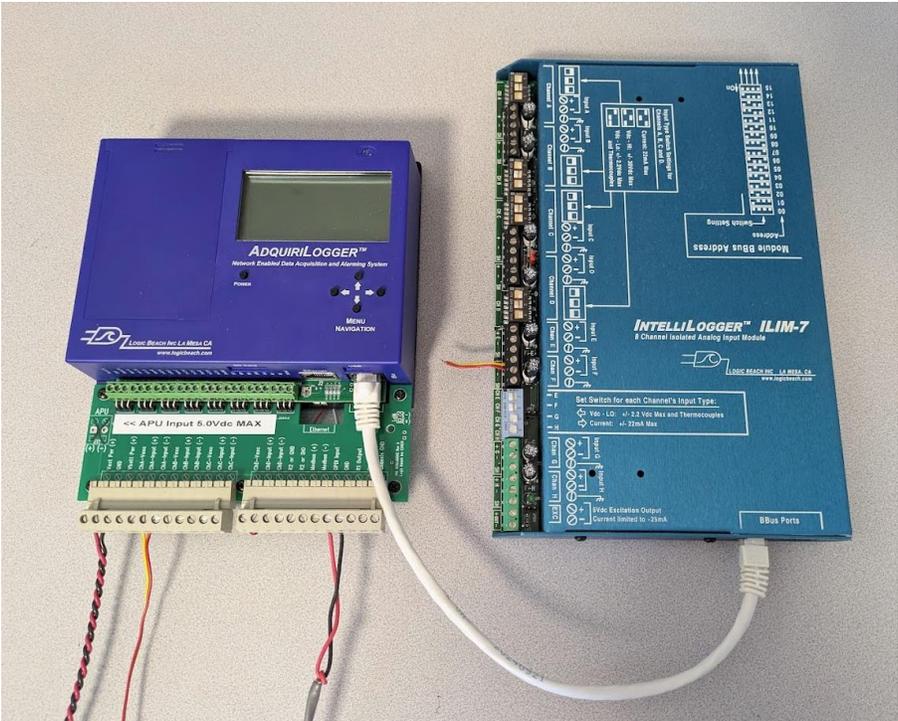
Fig 25; AdquiriLogger shown with BBus connected external ILIM-7 Module

Interface Module BBus Connection

The AdquiriLogger™ has a BBus connector (RJ-45.. which looks like an Ethernet jack) as shown in Fig 26.

Fig 26; BBus Connection Port

BBus Interconnect Cabling

The BBus interconnecting cable starts at the System Base BBus connector and daisy chains up to a total of 16 BBus modules. Each Interface Module has two BBus connectors at the bottom end (Fig 27). For systems with multiple expansion modules, the cable runs into one connector then out of the other and on to the next module. Both connectors are identical so either can be used in any order.
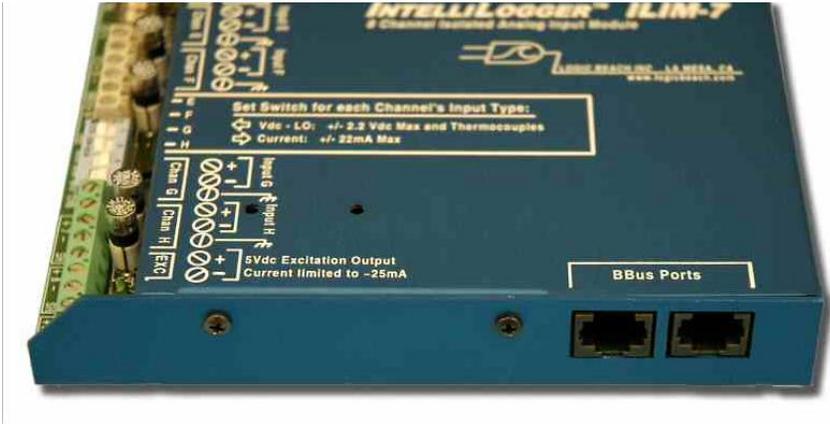

Fig 27; BBus connectors on bottom end of ILIM-x module

CAT5 or better cable should be used for BBus connections. This cable is the same cable used for Ethernet based networks and is readily available from most computer stores as well as from Logic Beach.

The last module in AdquiriLogger™ deployments with long (typically over 10 feet) BBus runs should have a BBus terminator stub (LBPN 9020.50090) plugged into the unused second BBus connector. This terminator serves to minimize signal distortion. If erratic communication manifests in a BBus network, install the BBus terminator.

Module Address

Each module that is connected onto the BBus must have a unique Address such that all modules will be uniquely identified. The address is defined by configuration of the Module BBus Address DIP switch (Fig 28) which is accessible at the top end of the module. 16 unique addresses can be set by the combination of the 4 switches integral in the DIP Address switch.

As shown in Fig 28, all switches in the OFF position indicate an address of 00 and all switches ON sets the address to 15. The actual address used is not critical, but ensure that each module on the BBus has a unique address.

Fig 28; Interface Module Address Setting Switch

Once all of the Interface Modules have unique ID's set and are connected to the AdquiriLogger™ , a quick check can be done via the front panel LCD or via HyperWare-III™.

Via the AdquiriLogger™ LCD

From the top menu, scroll down to *INFO* , Select and then scroll down to *BBus* and Select. The connected modules will be listed along with their BBus address previously assigned via the Address DIP Switch.

Via HyperWare-III™

Alternatively, upon making a connection to the AdquiriLogger™ with a PC running HyperWare-III™, the installed and correctly addressed Interface Modules will display graphically around the AdquiriLogger™ in the Communication Window (Fig 29).
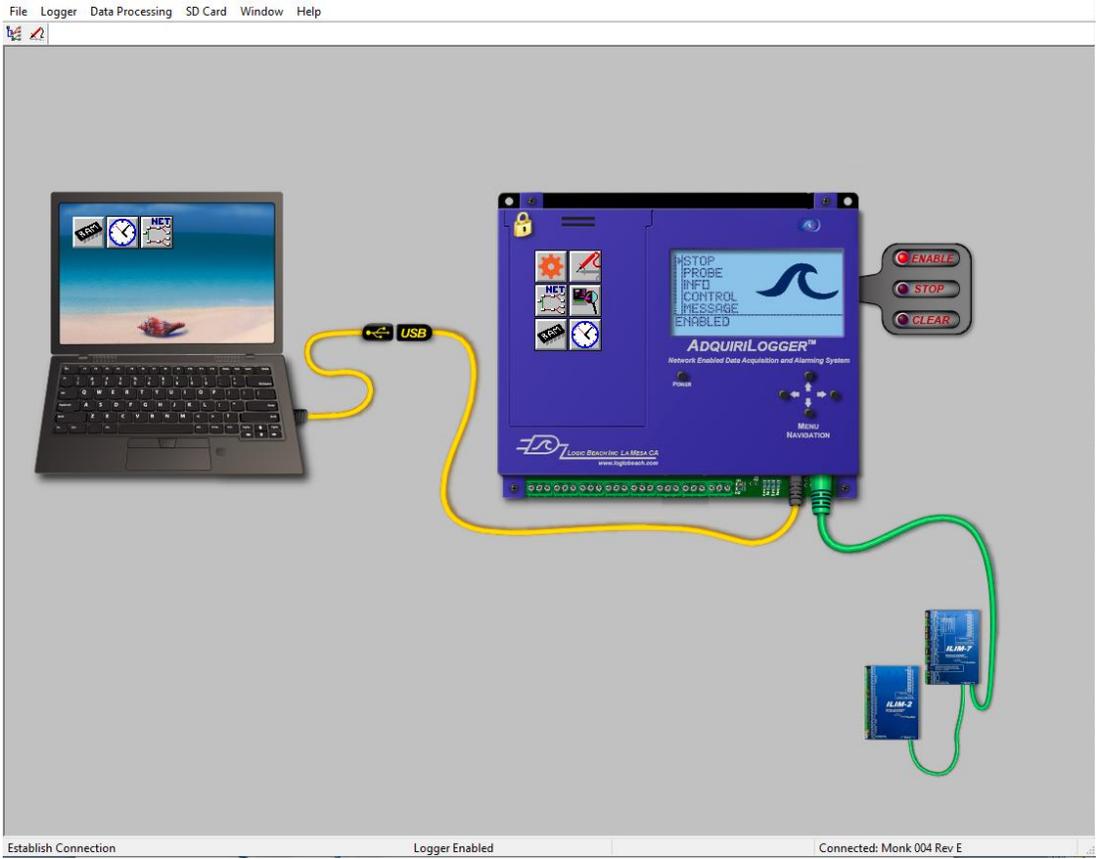
Fig 29; HyperWare-III Communication Window showing two Expansion Modules Connected

Module Properties

Clicking on any of the expansion module graphic images will result in an informational dialog (Fig 30) showing the module type, address, Serial Number, Firmware version (if the module includes a microcontroller) and more. Additionally, a name can be assigned to the module from this dialog.
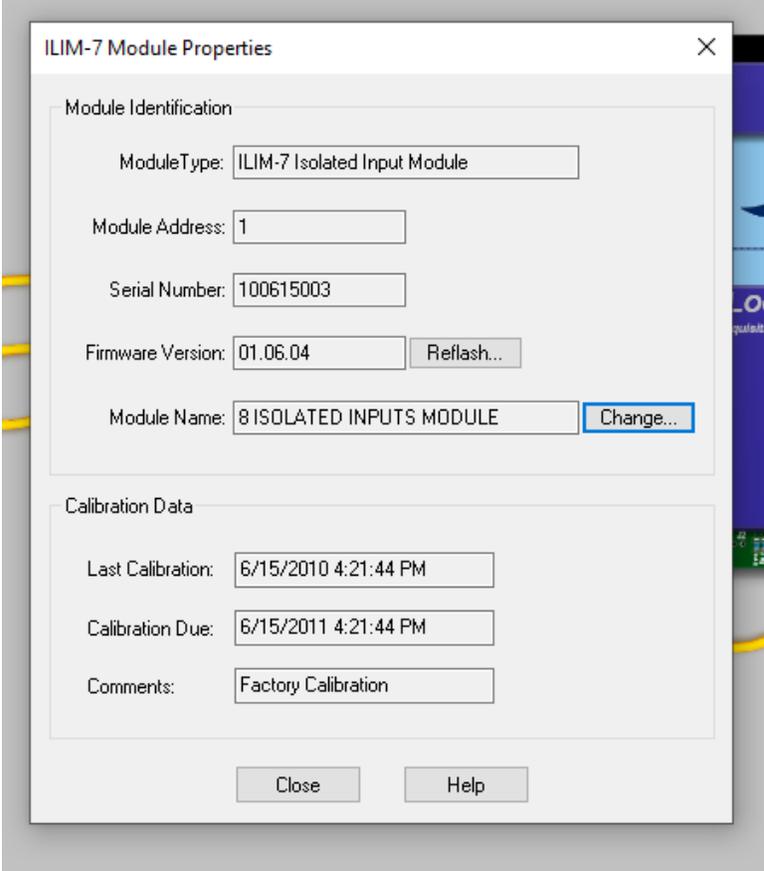
Fig 30; Expansion Module Properties dialog

Assigning a Module Name

To change the name given to a particular module click the "Change…" button next to the module name in the "Module Properties" dialog. The following "Change Module Name" dialog allows editing as desired.
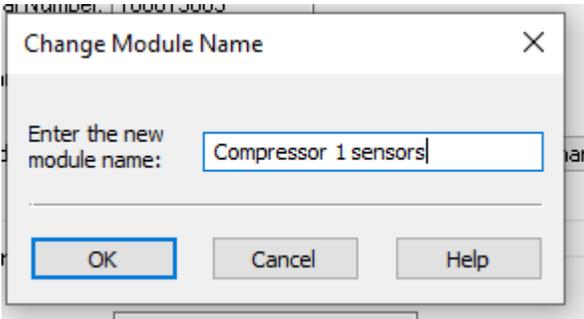
Fig 31; Module Name Change dialog

Interface Module Firmware Reflash

Periodically, new versions of Interface Module firmware may be released to improve performance, fix known bugs, and/or to add features. Latest releases are posted in the *Resource Center* of the Logic Beach Website.

Updating of the firmware (reflashing) of an Interface Module in the field is performed using the "Reflash…" button next to the firmware version in the "Module Properties" dialog. This will bring up a standard Open File dialog for the user to navigate to the new firmware file and select it to begin the module Reflash operation.

Note that this is a different operation than the Reflash of the AdquiriLogger™ base unit as this sequence pertains only to the selected Interface Module.

BBus Power Booster (BPB-1)

The BPB-1 (Fig 32) is an optional component available from Logic Beach that can be used to inject additional power to the BBus for installations utilizing more than approximately three Interface Modules. The AdquiriLogger™ instrument as the ability (when externally powered) to source power for approximately 3 to 5 expansion modules (depending on type).

The BPB-1 has two BBus connectors (in and out) and is daisy-chained in a BBus network just like an Interface Module. The BPB-1 is powered from a plug-in wall adapter or external battery source. Refer to www.logicbeach.com or contact Logic Beach directly for additional information.

Fig 32; BPB-1 shown with provided 120/240Vac power adapter

ILIM-7; Isolated Analog Input Module

The ILIM-7 is one of the family of AdquiriLogger™ Interface Modules (Fig 33) that provides 8 isolated analog inputs as well as a 5Vdc output that can be used for sensor excitation. Each of the inputs is field programmable for thermocouple, Vdc and mAdc input.   The input channels are all isolated, channel to channel as well as channel to System Base by 200Vac.

> **CAUTION**
> Although the channels provide electrical isolation up to 200 Vac, the AdquiriLogger™ and accessories including the ILIM-7 module are designed for use only with Class-2 (30Vdc) voltages and the inputs should not be connected to any high voltage sources as potentially lethal injury could result.

The ILIM-7 has optional mounting hardware to allow it to be surface mounted using the Surface Mounting Bracket (LBPN 3539.30010).
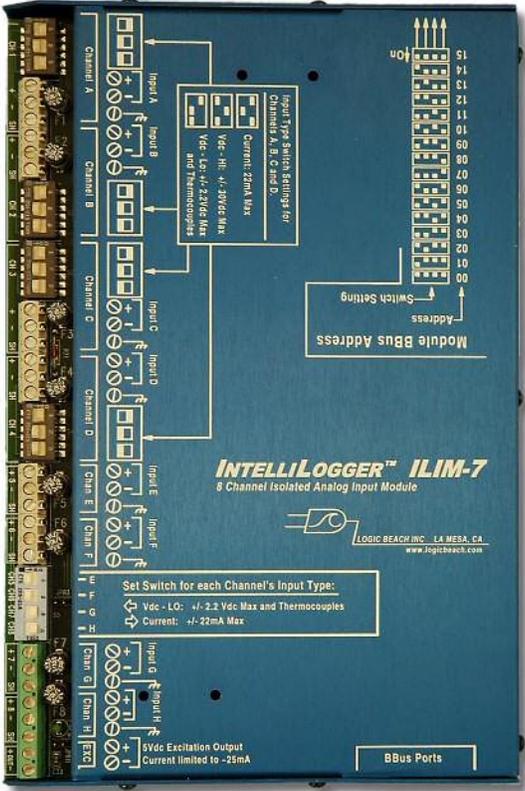

Fig 33; ILIM-7 Isolated Analog Input BBus Connected Module

Analog Inputs

Eight bipolar analog inputs are provided on the ILIM-7 and are identified as Channels A through H. All eight channels are identical in range and input type offering with the exception that the first four channels (A through D) offer an additional range (Vdc-Hi) that allows for direct connection of Vdc signals up to +/-30Vdc.
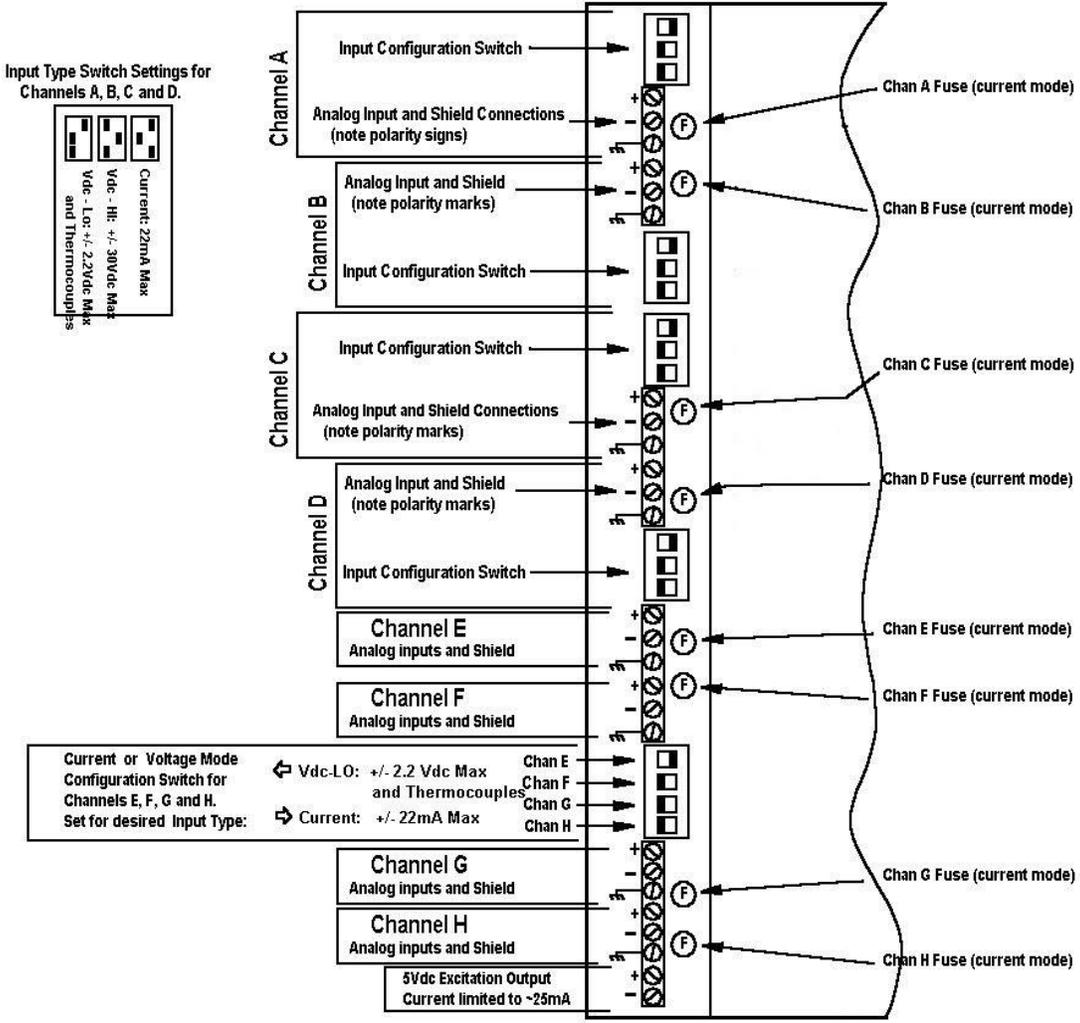
Fig 34; ILIM-7 Terminal strip Connections, Functions and Fuses

Analog input channels are configured for current or voltage/thermocouple via a DIP switch setting on a channel by channel basis. Within each input type, multiple full-scale ranges are offered and are selected during Program Net development from within the HyperWare-III™ software (see HyperWare-III™ User Manual).

Input Types

The following inputs can be connected to the ILIM-7.

Thermocouple

J, K, E, T, R and S type thermocouples can be directly connected to the ILIM-7 inputs. Cold junction compensation is handled automatically on board such that thermocouple readings read by the System Base are compensated for ILIM-7 ambient temperature.

Vdc-Hi

Input channels A through D offer a bipolar Vdc-Hi input type that allow for direct connection of signals up to +/-30VDC. As a Vdc-Hi input, 3 sub-ranges can be selected via the HyperWare-III software channel settings.

Vdc-Lo

All eight input channels offer bipolar Vdc-Lo input that allows for direct connection for signals up to +/-2.2Vdc. As a Vdc-Lo input, 8 sub-ranges (ranging down to +/-19mV) can be selected via the HyperWare-II software channel settings.

DC Current

All eight input channels offer bipolar mAdc input that allows for direct connection for signals up to +/-22 mAdc. As a current input, 8 sub-ranges (ranging down to +/-190uA) can be selected via the HyperWare-III software channel settings.

Configuration Switches

Channels A through D each have a 3 switch DIP (dual in-line package) for input type configuration. Channels E through F share a single 4 switch DIP for input configuration.
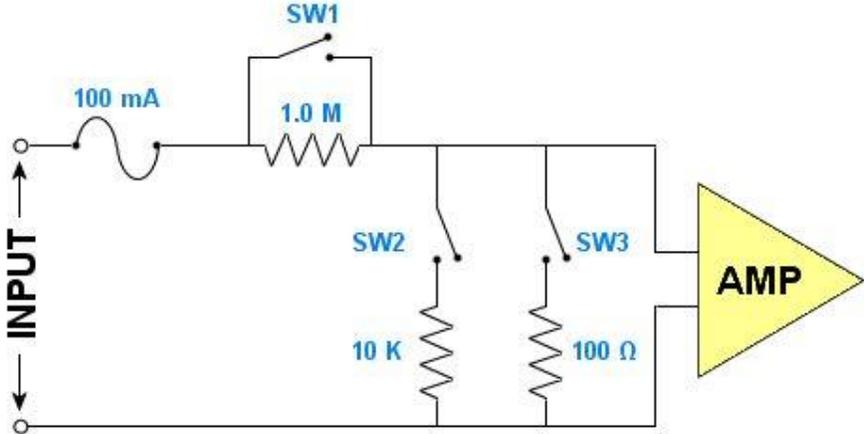
Channels A through D:

The combination of the DIP 3 switches On/Off states sets the Input Type per pattern Table 2; Channels A through D Input Signal Configuration Switch SettingsTable 2. This information is also printed on the front cover of the ILIM-7.

Table 2; Channels A through D Input Signal Configuration Switch Settings

Input Signal / Type	SW 1	SW2	SW3
Thermocouple or Low-Level Vdc (2.2Vdc or less)	ON	OFF	OFF
Vdc-Hi; Up to +/- 30Vdc	OFF	ON	OFF
DC Current; Up to 22mA	ON	OFF	ON

The schematic representation of these four input channels is shown in Fig 35.

Fig 35; Simplified Input Schematic for Channels A, B, C and D

Channels E through H:

Channels E through H share a single 4 switch DIP (Fig 36). Each of the 4 switches is associated with one of the channels. The On/Off state of each of the individual switches sets that channel for Current or Lo-Vdc/thermocouple use (Table 3).
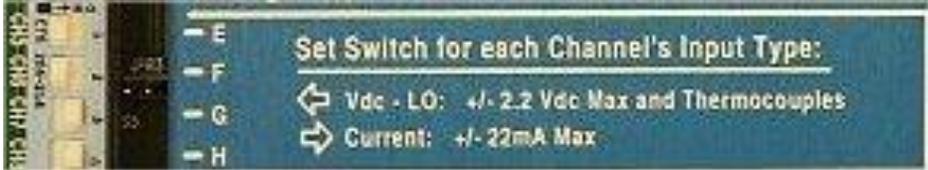
Fig 36; Channels E to H Switch Settings

Table 3; Channels E through H Single Switch Input Type Selection

Input Signal / Type	SW
Thermocouple or Low-Level Vdc (2.2Vdc or less)	OFF
DC Current; Up to 22mA	ON

The schematic representation of channels E through H is slightly different than the schematic for Channels A to D as Hi-Vdc input is not supported (Fig 37).

> **Tip**
>
> If additional Hi-Vdc channels are desired and channels A through D are committed, external resistor dividers can be used on channels E through F to effect higher voltage input. Scaling correction for the external user provided dividers can be readily implemented within the HyperWare-III™ programming of those externally scaled channel(s).
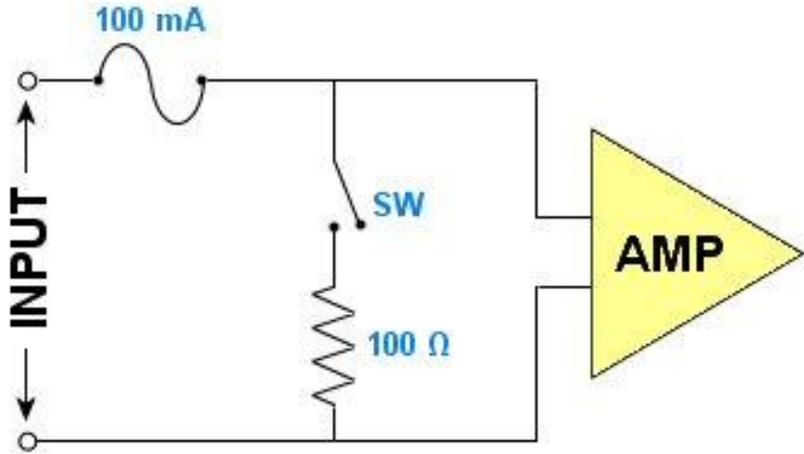

Fig 37; Simplified Input Schematic for Channels E, F, G and H

ILIM-7 Channel Configuration Via HyperWare-III

When an ILIM-7 channel is configured as a particular type of input via the module configuration switches, the configuration will be automatically detected by the connected AdquiriLogger™ upon power-up. This channel type information is then communicated to the PC running HyperWare-III when a Hardware Query command[11] is performed from the Programming window. Icons representing the currently configured channel type will display

---

[11] Refer to Programming Chapter in the HyperWare-II manual for further details on Query command.

and be available for use during the development of a Program Net.   Software input range configuration and utilization of the ILIM-7's channels in a Program Net is covered in HyperWare-III™ Software Manual.

Input Over-current Protection Fuses

Each of the eight input channels is protected by a 50mA fuse (Fig 34)   This fuse will protect the module channel from over-current surges received from malfunctioning or improperly connected sensors and 4-20mA transmitters.

In the event that a channel on a module stops responding with proper values, it may be an indication that this protective fuse has blown. The fuse can be removed from the circuit and checked for continuity with an ohm-meter (an open fuse will read infinite or over-range and a good fuse should be near 0 ohms). Fuses (LBPN 3046.00032) are available from Logic Beach.

To remove the fuse, grasp it gently with your fingers or use a small set of long-nose pliers to grip it b the black plastic base and pull straight up to extract it from its socket base.

NOTE
If using pliers, be sure to gently grip the fuse by the black plastic base, NOT by the ceramic fuse element which will be damaged.

TIP

Commonly, this fuse is blown during installation of 4-20mA current channels where the power supply powering the 4-20mA transmitter is accidentally shorted directly across the logger input channel. To avoid this inconvenience, always check wiring prior to powering up system power supplies.

Thermocouple Applications

Following are guidelines for connecting thermocouple type inputs to the ILIM-7 input channel terminal connectors.

Thermocouple Connection

To utilize an ILIM-7 channel as a thermocouple input, configure that channel's Input Configuration Switch as explained earlier in this chapter.

Channels configured as thermocouple inputs utilize two or three terminal strip connections per input; a Positive lead, and a Negative lead and optionally a shield.
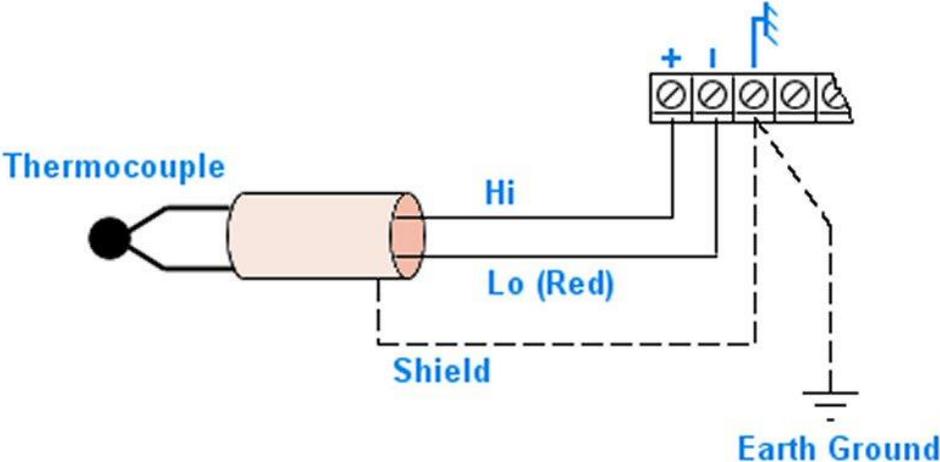

Fig 38; Thermocouple (and optional shield) terminal strip connection

Connect the thermocouple positive and negative (red in USA) leads to the correct pair of terminals on the module terminal strip. Polarity markings are printed on the circuit board next to the terminal strip. Polarity is critical, as reverse connected thermocouples will log positive temperatures as negative temperatures.

Shielded thermocouple wire is recommended in electrically noisy environments for optimum signal protection. If shielded wire is used, the shield should be connected to the terminal marked 'SH'. The Shield serves to conduct away electrical noise picked up by the thermocouple shield and shunt it to Earth ground. Note that for the Shield to be effective a wire should be connected from any of the Shield connections on the ILIM-7 terminal strip and then to a known Earth ground. All Shield connections on the terminal strip are interconnected so a single Earth ground connection suffices.

Cold Junction Compensation (CJC):

For thermocouple measurements, the temperature of the terminal strip connections is required in the voltage to temperature conversion equation used by the AdquiriLogger™ . This temperature is measured by the CJC sensor located internal to the ILIM-7 module. Any differential temperature from the metal terminal strip connections to the CJC sensor on the ILIM-7 circuit board will result in direct measurement errors.

The ILIM-7 is thermally designed to provide good CJC sensor vs. terminal strip temperature tracking however, to minimize this potential error, avoid installations or effects that will induce extreme temperature differential. The most accurate readings will be achieved when the ILIM-7 module has been allowed to temperature stabilize. In rapidly changing temperature environments, additional accuracy can be achieved if the ILIM-7 is housed within another enclosure, which will provide better temperature uniformity throughout the system.

Vdc-Lo Applications

All of the ILIM-7 input channels can be configured for low-level Vdc input per the switch settings shown above.   The configuration switch settings to configure a channel as a Vdc-Lo input are the same as the setting when using the channel as a thermocouple input channel. The selection of thermocouple or Vdc-Lo as well as selection of sub-ranges is performed from within HyperWare-III in the input icon Configuration dialog. Clicking a button within the dialog swaps the channel function.

TIP

For best accuracy and absolute resolution, when configuring the channel within HyperWare-III™, utilize the lowest range possible that will cover the input signal's dynamic range without over-ranging.

Signal Wiring Connection:

Interface Module channels configured as VDC inputs provide three terminal strip connections per input; a Positive lead, and a Negative lead and a Shield connection.

Connect the VDC signal positive and negative leads to the correct pair of terminals on the module terminal strip. Observe polarity or the output signal will be reversed.

Shielded and/or twisted pair wire is recommended in electrically noisy environments for optimum signal protection. If shielded wire is used, the shield should be connected to the terminal marked 'SH'. The Shield serves to conduct away electrical noise picked up by the thermocouple shield and shunt it to Earth ground. Note that for the Shield to be effective, a wire should be connected from any of the Shield connections on the ILIM-7 terminal strip and then to a known Earth ground. All Shield connections on the terminal strip are interconnected so a single Earth ground connection suffices.

Shielded wire minimizes the amount of noise picked up by the internal conductors carrying the signals by providing an `electrical shell' or Faraday cage around the internal conductors.

Twisted pair wiring exposes both conductors equally to the ambient electrical noise. This common-mode type noise is easier to reject by the Interface Modules input signal conditioning circuitry than unbalanced (or differential) noise.

Vdc-Hi Applications

Channels A through D have additional input range capability in that they can be field configured to directly accept up to +/-30Vdc. Vdc-Hi Input Configuration Switch setting (Table 1-1) enables a front end precision voltage divider circuit which expands the channel's acceptable input range. Correction for the precision front-end resistor divider is handled automatically and transparently by the ILIM-7 so no user scaling for the divider is required.

Selection of a sub-range is performed within the HyperWare-III Icon Configuration dialog for that channel.

TIP

For best accuracy and absolute resolution, utilize the lowest range possible that will cover the input signal's dynamic range without over-ranging.

Signal Wiring Connection:

Interface Module channels configured as VDC inputs provide three terminal strip connections per input; a Positive lead, and a Negative lead and a Shield connection.

Connect the VDC signal positive and negative leads to the correct pair of terminals on the module terminal strip. Observe polarity or the output signal will be reversed.

As with thermocouple inputs, shielded and/or twisted pair wire is recommended in electrically noisy environments and/or for very low-level signals for optimum signal measurement accuracy. If shielded wire is used, the shield should be connected to the terminal marked 'SH'. The Shield serves to conduct away electrical noise picked up by the shield and shunt it to Earth ground. Note that for the Shield to be effective, a wire should be connected from any of the Shield connections on the ILIM-7 terminal strip and then to a known Earth ground. All Shield connections on the terminal strip are interconnected so a single Earth ground connection suffices.

Shielded wire minimizes the amount of noise picked up by the internal conductors carrying the signals by providing an `electrical shell' or Faraday cage around the internal conductors.

Twisted pair wiring provides protection by exposing both conductors equally to the ambient electrical noise. This common-mode type noise is easier to reject by the Interface Modules input signal conditioning circuitry than unbalanced (normal or differential) noise.

mAdc Application

All of the ILIM-7 input channels can be configured to accept direct current milliAmp current inputs. Switch settings (Table 2 and Table 3) enable a front end precision 100 ohm 'burden' resistor current shunt (and fuse) in the circuit which allows the channel to measure the dc current up to +/-22mAdc. Many sub-ranges can be selected via the HyperWare-II Icon Configuration dialog to allow measurement into uAdc.

Due to the isolation offered by the ILIM-7 module, current measurements (e.g. 4-20mA process loop signals) can be readily made on loops with separate power supplies or at different potentials.

mA Signal Wiring Connection:

Interface Module channels configured as mAdc inputs typically will only use two of the three provided terminal strip connections.

Connect the mAdc signal positive and negative leads to the correct pair of terminals on the module terminal strip (Fig 34). Observe polarity or the output signal will be reversed.

Current Protection Fuse

Each channel is protected from permanent damage due to over-current via an inline fuse. In the event that a signal cannot be discerned on a channel configured as a current input, it may be that the fuse is blown.

Refer to the section earlier in this chapter titled Input Over-Current Protection Fuses for details on the fuse function and replacement.

Excitation Output

The ILIM-7 is equipped with a semi-regulated 5Vdc output that can be used as an excitation source for many sensors requiring excitation (e.g. strain gauge bridge pressure sensors or load cells). The excitation output voltage is cycled on prior to a channel reading for a period of time then a channel reading is taken and the excitation supply is turned off. The Excitation time can be adjusted within the Analog Input channel configuration dialog within HyperWare-III™.

Output Characteristics

The Excitation Output is derived from the regulated 5Vdc system voltage on the ILIM-7. The output is controlled via a series transistor, which results in a bit of voltage drop, resulting in an output voltage of approximately 4.8 to 4.9Vdc actual output.

Additionally, the output incorporates over-current protection circuitry that starts reducing the voltage when the load current draw exceeds approximately 25mA.
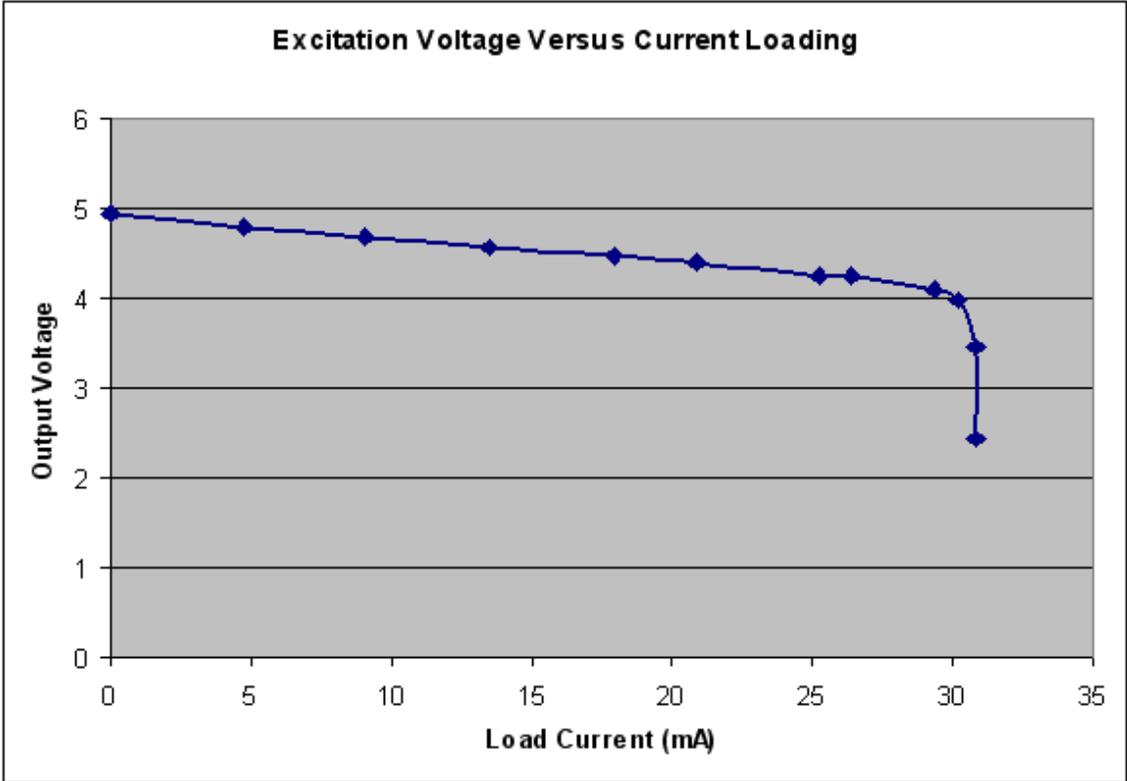

Fig 39;   Excitation Output Voltage vs Current

For many sensor excitation applications, the output voltage can be measured once with a voltage meter and this value can be used in any signal derivation equations that are a function of the excitation voltage (e.g. bridge signals). For applications requiring a precision known voltage supply, one of the ILIM-7 channels can be dedicated to reading the Excitation Output actual voltage and another channel can be dedicated to reading the bridge signal

output. Within the Program Net, a Math icon can then be used to normalize the output signal as a function of the Excitation voltage[12].

Current Limit Over-ride Jumper

The 25mA nominal over-current protection circuit for the Excitation Voltage output can be bypassed with installation of a jumper across the two pins marked 'JPR11' which are located right behind the terminal strip connections for the Excitation Output. Caution must be exercised if using the over-ride jumper as excessive current draw can cause permanent damage to the power supply section of the ILIM-7 necessitating factory repair.

In a lightly loaded BBus application, it is possible to draw up to approximately 50mA from the Excitation Outputs for momentary sensor excitation without permanent damage. Contact Logic Beach for assistance.

Excitation Output Enable

If enabled by the user, the Excitation Output cycles on for a period of time prior to an ILIM-7 analog input channel taking a reading, then automatically cycles OFF after the reading is complete. Use of the Excitation Output can be enabled for use on a channel by channel basis. Within the Configuration Dialog for each of the ILIM-7 input channels, there is a checkbox called Enable Excitation During Reading. Checking this box will enable operation.

Excitation Output On-Time Extension

The duration that the Excitation Output voltage is ON prior to the actual reading being taken by an ILIM-7 input channel is user programmable for analog inputs that are configured as Vdc-Lo or Thermocouple input types.

Within the Configuration Dialog on Vdc-Lo or thermocouple channels, there is an additional checkbox titled Extend Settling/Excitation Time and an associated drop-down list box that allows the user to specify the additional settling time to be added to the default time. For sensors that require 'warm-up' or longer stabilization times after power-up, this feature in most cases can meet the requirements in that up to approximately 2 additional seconds (1992mS) can be specified.

Note that adding Excitation time will slow down the sampling throughput of the AdquiriLogger™ system as the additional Excitation time will delay the advance of the Program Net.

For transducers or sensors requiring longer Excitatiion times to stabilize, the Warm-Up icon can be used within the Program Net . Refer to the HyperWare-III™ Software Manual for details.

Connections

Two terminal strip connections at the bottom end of the module provide the Excitation Output voltage. The terminals are marked with positive and negative marks.

---

[12] For example, dividing the measured output signal (Vsignal) from a strain gauge bridge by the measured Excitation Output voltage, Vexc will result in a normalized mV of signal per V of excitation. This normalized value can then be used for the Engineering units calculation associated with that sensor.

ILIM-2; Digital Interface Module

The ILIM-2 is a BBus Interface Module specifically designed to read and work with low-voltage (ie less than 30Vdc) digital Inputs. It is intended for use with signals and sensors that source on/off voltage signals, pulse trains, on/off switched signals and AC or square wave signals. Flow meters and power meters are two common types of transducers that generate pulse or frequency outputs commonly input to the ILIM-2.   The ILIM-2 can connect with up to 16 discrete digital inputs, and each channel can be configured independently by the user to match the type of digital data coming in from the sensor.

Fig 40; ILIM-2 Digital Interface Module

The ILIM-2 is an external, stand-alone module that is connected to the AdquiriLogger™ System Base via a BBus cable.   A Surface Mounting Bracket (LBPN 3539.30010) can optionally be fastened to the back of the ILIM-2 and allows mounting onto any external surface.

The mix of Input/Output Channels offered by the ILIM-2 are listed in Table 4.

Table 4; ILIM-2 Channel Offering

Channel Type	Qty	Function
Event or Counter	8	Individually user programmable for Event (On/Off) or Counter input
Event, Counter Input, Output	8	Individually user programmable for Event (On/Off) or Counter input or Open Collector Outputs
Frequency Input	2	Frequency measuring inputs
Output	3	Discrete (on/off) or Frequency Generating Outputs
5Vdc Output	1	Current limited 5Vdc output

As with the other Expansion Modules, channels on the ILIM-2 are configured via the HyperWare-III software. Sampling rates and settings for each channel are integrated into the Program Net and uploaded into the AdquiriLogger™   for execution.

Signal Connections

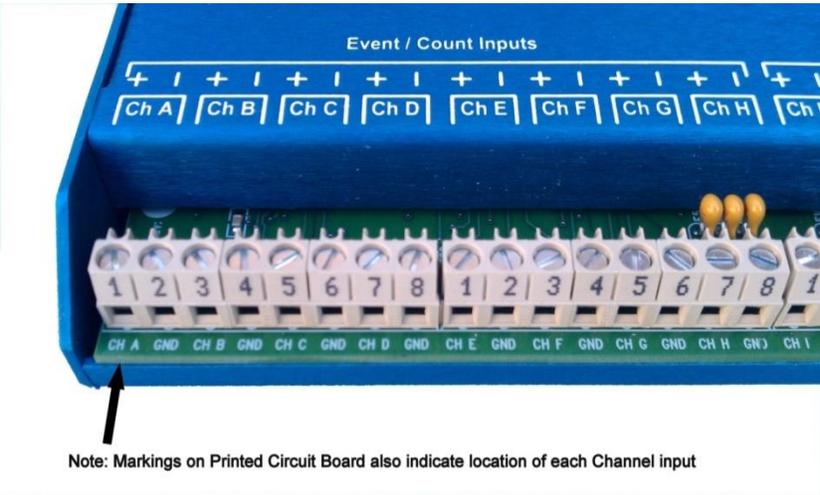Wiring connections are marked on the top of the ILIM-2 module.

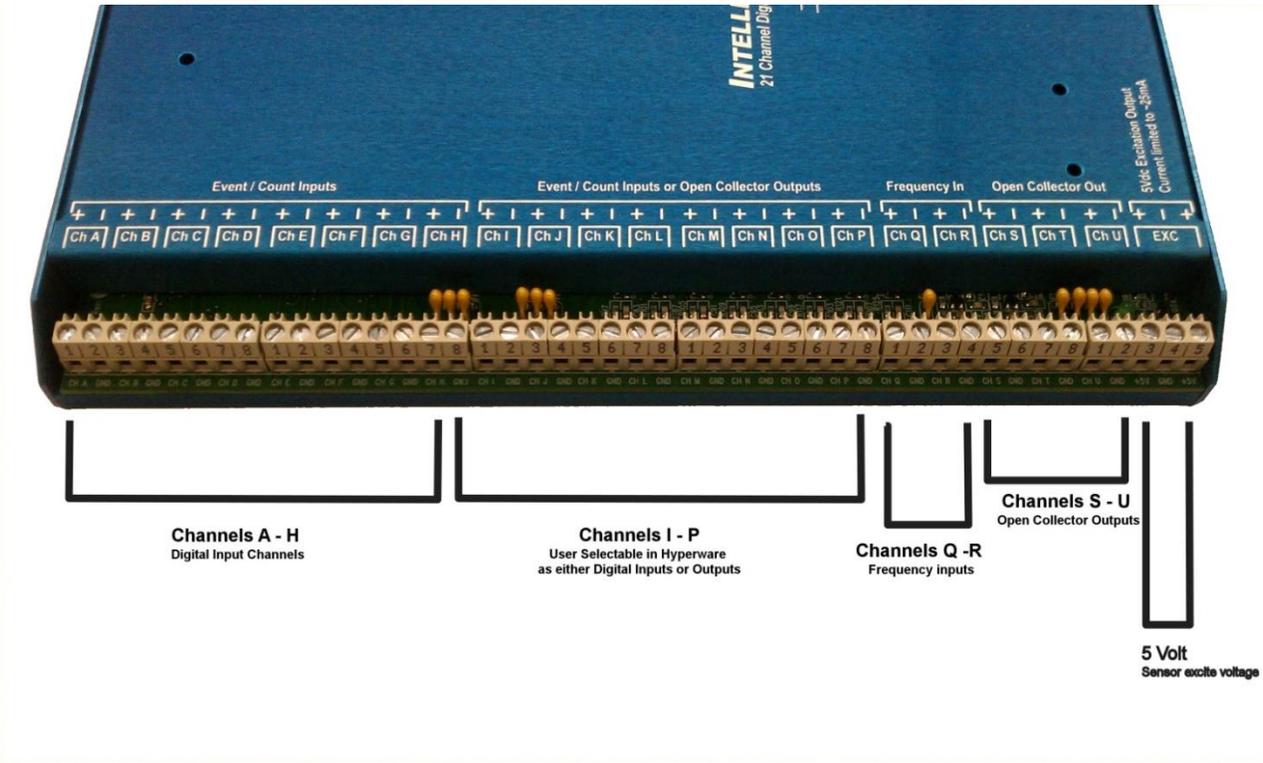**Fig 41; Digital Channel markings are visible on both enclosure top and PCB of ILIM-2**

Fig 42;   ILIM-2 location of all Channels by Group

CAUTION!
A direct electrical connection exists between the common (-) terminal on all eight of the General Purpose Digital Inputs. Connecting digital inputs with different ground potentials can damage the digital inputs and damage the ILIM-2 Interface Module. For this reason, Users must ensure that signals supplied from different digital inputs all share the same electrical potential on the negative lead before connecting them to the ILIM-2.

Event/Counter Digital Inputs Channels (A – H)

The ILIM-2 has 8 channels that can be user configured as Event or High-Speed Counter Inputs. These Digital Inputs are identified as channels A-through-H on both the chassis and the printed circuit board. Each channel on the ILIM-2 is paired with its own Ground connection (GND) next to the input terminal. Users configure each channel independently in HyperWare and upload the settings as part of their Program Net.
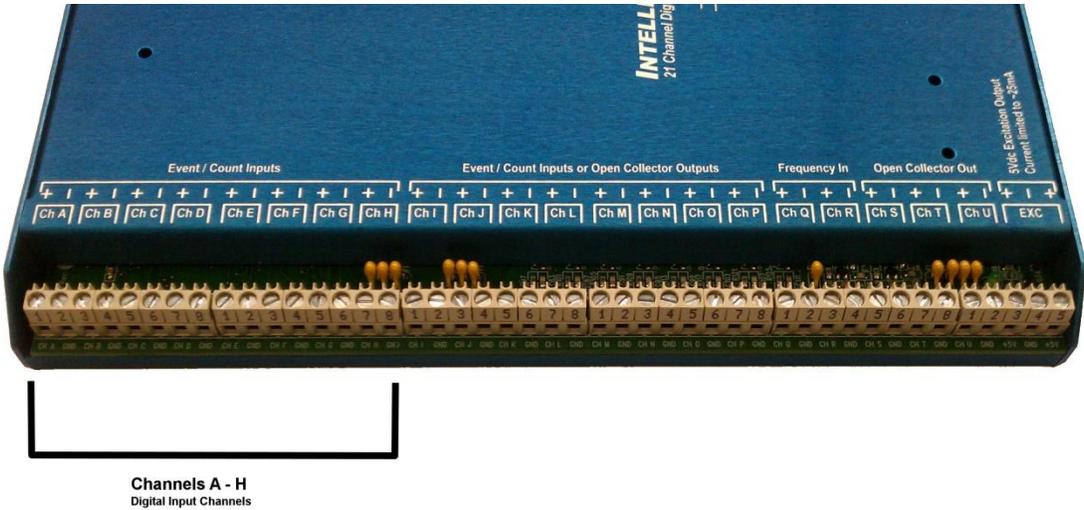

Fig 43;   Location of Channels A through H

Using channels as Event Inputs

During Program Net execution channels configured as Event inputs are scanned per the sampling rate configured in the Program Net by the user. The state of the input is only updated in the Program Net operation (for example stored to memory) if it has changed since the prior state was scanned. This insures that memory will not be wasted with non-changing state data.

An example of an Event-type sensor input is a door intrusion alarm switch.

TIP:

When analyzing Event inputs, it is important to remember that the captured data only represents the state of a digital input at the time of sampling. The state of a digital input can change in between samplings; and the same value in successive readings does not necessarily indicate the value was constant for the whole time in between readings.

Using Channels as High Speed Counter Inputs

When configured as a high-speed Counter Input, high speed hardware counters on the channel increment their internal count with each Low to High or High to Low signal transition (as programmed). This running count total is then periodically read from this hardware counter and optionally cleared as programmed by the user in the Program Net. This method allows for extremely high-speed pulse train capture.

An example of a Counter-type sensor input is a pulse output power meter where each pulse corresponds to a Watt-hour of energy. By accumulating these counts over a period of time, the energy used during that period can be totalized (eg a month).

TIP:

Counter values can be programmed in the Program Net to continually increment or be cleared (reset to zero) after each read. Pay special attention to the counter settings in the HyperWare dialog boxes when setting up your Program Net.
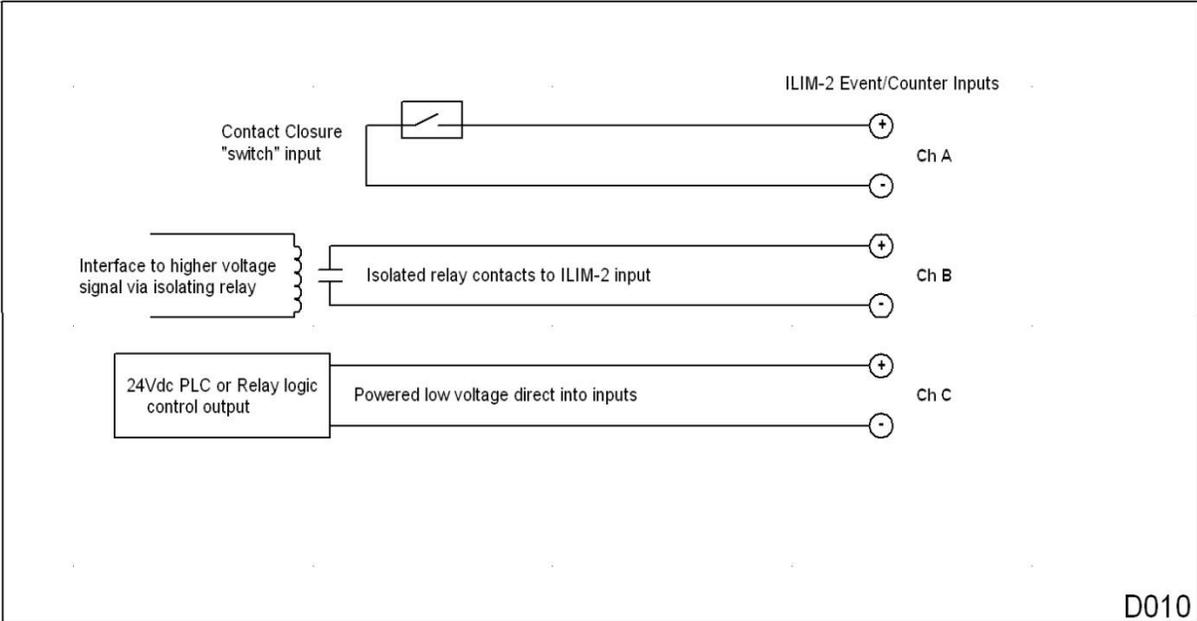
Fig 44; Interfacing various signal types to the ILIM-2 Event/Counter Input Channels

Event / Counter Signal Specifications:

Whether used in Counter mode or Event mode, all Digital Inputs on the ILIM-2 share the same input signal specifications as detailed in the Specifications Chapter of this manual.

Pull-up (Wetting) voltage:

The Counter / Event inputs have a software configured hardware option to provide a voltage for non-powered switch inputs (eg a reed switch or open-collector transistor). A nominal 3.3V pull-up voltage (commonly referred to as a "contact wetting voltage") is supplied at each Input Channel via an internal 51kohm resistor to the 3.3Vdc internal supply. This voltage eliminates the need for users to connect an external power source in order to sense the open or closed state of a non-powered switch input. When the switch is open, the input will be 3.3Vdc (High) and when closed, 0Vdc (Low).

Over-Driving Event Inputs:

As the Pull-Up voltage is provided via a 51kohm internal resistor, over-driving it from a powered input (eg a PLC output that swings between 24Vdc and 0Vdc) is readily done without harm to the input channel. Do not exceed 30Vdc input.

Debounce option:

Contact bounce is a phenomenon that can occur when a mechanical switch closes. During switching, the physical electrical contacts inside the switch can bounce against each other a number of times opening and closing the circuit before they settle to their final state. As the counter input circuitry in the logger is extremely fast, these bounces may be counted as transitions (in count mode), resulting in technically accurate but undesired counts.

To help correct for this problem, a 40mS hardware debounce circuit is built into each channel. By enabling the debounce function, typical short duration contact bounce will be filtered out. Activate Hardware Debounce within the channel configuration dialog if you suspect false transitions due to switch bouncing.
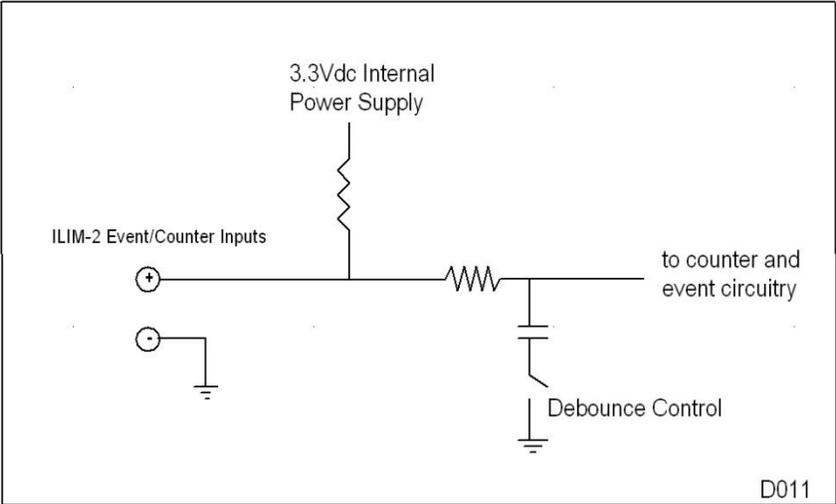

Fig 45; Simplified Event/Counter Input Channel Schematic

Event/Count/Output Channels (Channels I – P)

The ILIM-2 has 8 additional channels that can be configured by the user as either Event, high-speed Counter inputs or as Open Collector Outputs. These channels are identical to Event/Counter channels A to H (see above) except that they alternatively can be configured as Outputs on a channel by channel basis. Users configure

each Channel using HyperWare, and upload the settings into the host system as part of their Program Net. The User-Selectable Input and Output modes are briefly described below.
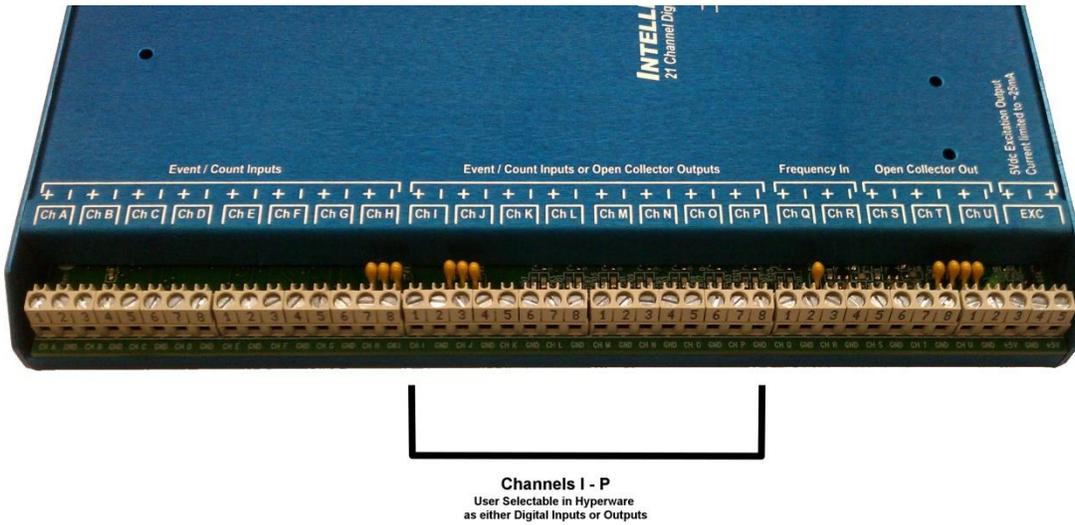

Fig 46; Location of Event, Counter and Output Channels I through P

Using Event/Count/Output channels as Event/Counter Inputs

When configured in HyperWare as Digital Inputs, channels I-through-P perform identically to Channels A-through-H (described earlier in this chapter).

Using Event/Count/Output Channels as Outputs

When configured in HyperWare as a Digital Outputs, Channels I-through-P will function as Open Collector Outputs which can be programmed to turn "on" and "off". The Output state of each channel is determined by the user defined programming in the Program Net.

OPEN COLLECTOR OUTPUTS (FIG 47)

Open Collector Outputs are a transistor switch that when ON, short the channel "+" output terminal to the "-" terminal. The switches are not ideal in that they do have some resistance and current carrying limits but for most low-current signaling applications they can be perceived as a switch.

Note that the negative "-" terminal on all of the channels are interconnected.
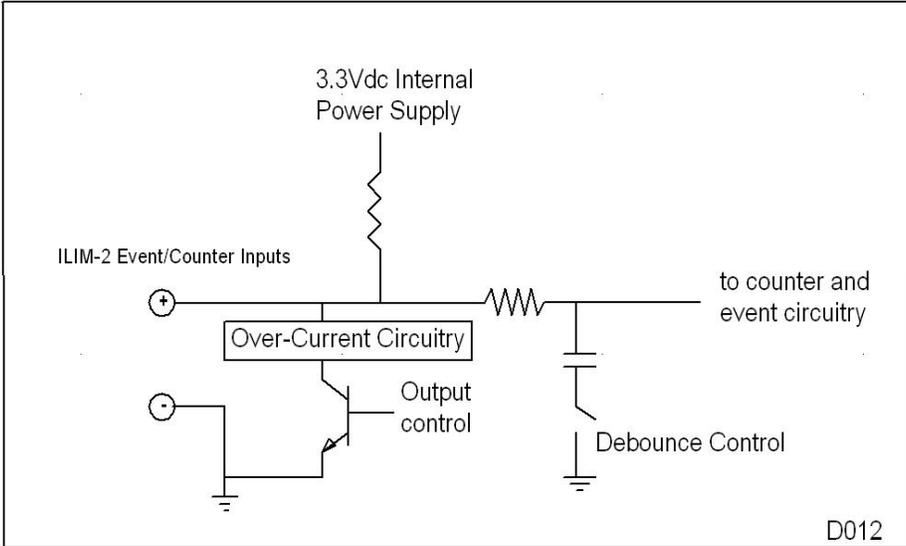
Fig 47; Input / Output Channel simplified schematic

MAX INPUT VOLTAGE:

30Vdc. Note that these channels are only to be used for switching DC loads ONLY and switching of AC loads should not be attempted.

OPEN COLLECTOR CURRENT LIMITS:

Each Channel can sink a maximum of 100mA of current when programmed as Open Collector Outputs.

OVERCURRENT PROTECTION:

The Open Collector Outputs are protected against over-current by a resettable thermal fuse.   If an output is overloaded, the output will appear to be floating (ie not grounded). Once the overload condition is removed and a short time is allowed for the thermal fuse to cool, the output should return to normal operation.

CAUTION 1

Some loads may require higher start-up currents (inrush) than their continuous ON currents. High inrush currents may exceed the current handling capability of the Open Collector Outputs and protection circuitry and cause permanent damage.

CAUTION 2

Switching inductive loads (for example relays and solenoids) can result in damaging reverse high-voltage "fly-back" transient spikes that can damage Open Collector outputs. The ILIM-2 Open Collector outputs are designed with integral snubbing circuits to protect from these transients however if larger inductive loads are to be controlled, it is advisable to utilize external isolators (opto-isolators or signal relays).

Frequency Inputs (Channels Q and R)

Channels Q and R are dedicated for measuring the frequency of a time varying (sinusoidal or square wave) input waveform. These Frequency Input channels have internal amplification to increase the sensitivity for low amplitude input waveforms. Frequency Input Channels also include a 3.3V pull-up voltage and Debounce circuitry both of which can be enabled/disabled as desired via the Channel Configuration Dialog.
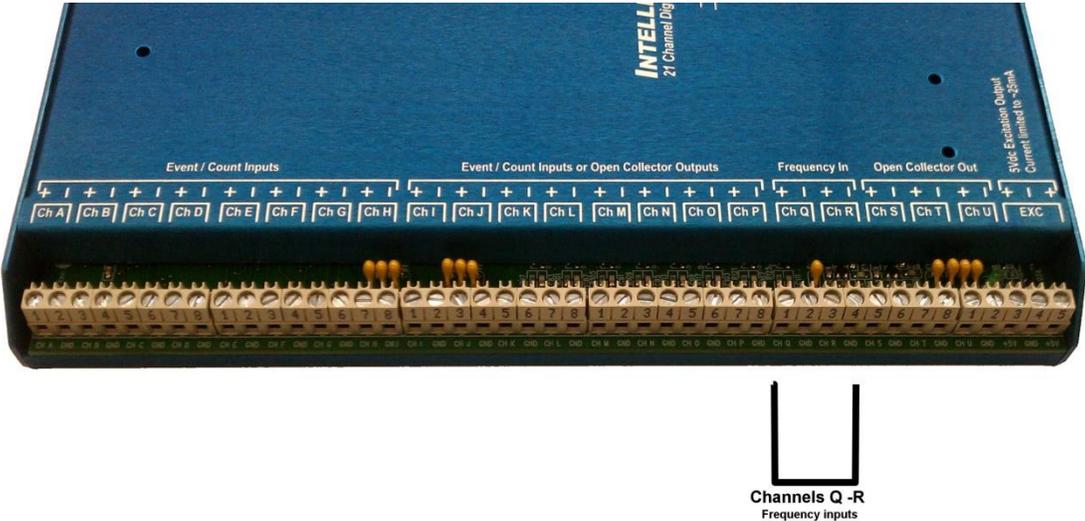

Fig 48; Location of Channels Q and R

Input Voltage Range:

Powered input signals for these Frequency Input channels may range from 0VDC to a maximum of 30VDC. Voltages outside these ranges may damage the Module.

Input Frequency Range:

Frequency Input channels can sample frequencies ranging from 0.25Hz to 10KHz depending on the waveform and peak to peak amplitude of the incoming signal.

Signal Sensitivity: Input amplifiers are integral to each channel. Incoming signals as low as 100mV peak-to-peak can be sampled reliably in the range of 0.25Hz to 10KHz.
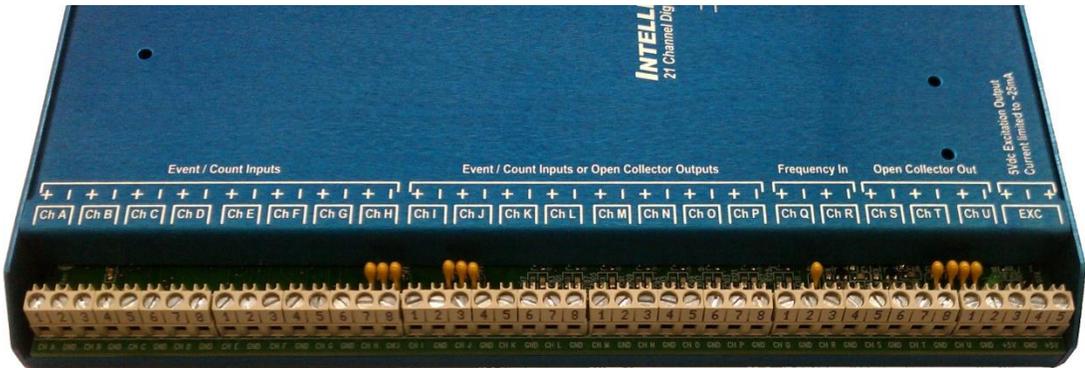
Debounce and Pull-Up options:

Although not normally utilized when measuring frequency of input signals, the ILIM-2 offers users the ability to enable Debounce and/or a 3.3Vdc current limited Pull-up on each of the Frequency input channels via the HyperWare-II software. This could be of value in measuring the frequency of a switched type input where a "wetting" voltage is required and/or contact bounce could occur.

Be aware that enabling the Debounce filter will attenuate the input signal for higher frequency inputs.

Frequency /Discrete Output Channels (Channels S, T and U)

Channels S, T and U are dedicated as Output Channels, and can be configured to run as either Discrete (On/Off) Outputs, or as Frequency Outputs.

Fig 49; Location of Channels S through U

Discrete; Open Collector Outputs

In Open Collector mode, these channels perform identically to Channels I through P (described above).

Frequency Output Mode

When configured for Frequency Output Mode, these channels accept an integer value (provided by the Program Net) and use it to generate a square-wave output.

The Frequency Output Signals:

Two methods of interface to the Frequency Output exist:

VOLTAGE OUTPUT:

The output is a driven square-wave which cycles between a Low state (the output is shorted to circuit ground "-") and a High state (the output is pulled up to an internal 3.3Vdc supply through a 1Kohm resistor). Under no-load conditions this results in a 3.3Vdc square-wave output. Under load, the 3.3Vdc signal will droop due to voltage losses across the 1Kohm pull-up resistor.

OPEN COLLECTOR OUTPUT:

Although not truly an open collector output (since there is a 1Kohm resistor to the internal 3.3Vdc supply) loads can be interfaced to this output as if it is an Open Collector output. Care must be taken to not exceed 10Vdc on any applied load external supply else the 3.3Vdc supply will be back-fed through the internal 1Kohm resistor.
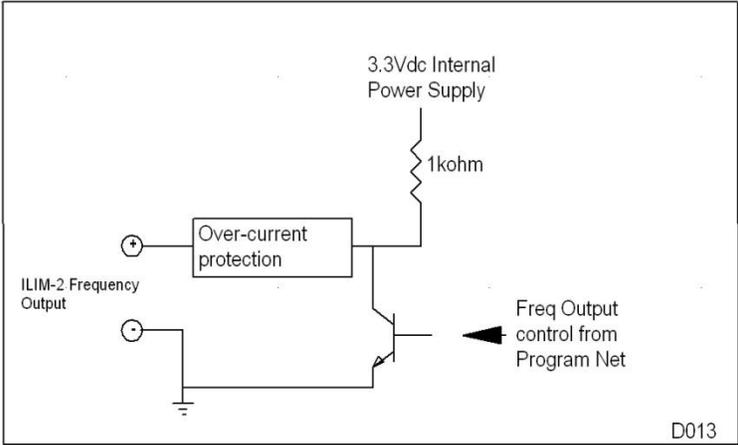
Fig 50; Simplified Frequency Output Channel schematic

Although the HyperWare Frequency Output Programming Icon can accept any integer input, the actual square-wave function that can be output at the terminal is limited to between 0-and-600 pulses per minute which corresponds to 0-10Hz.

TIP:

Do NOT assume Hz (cycles per second) when programming output frequencies! This is a common error when programming in HyperWare. The integer values for frequency output are defined in the Program Net as "Cycles per Minute" (not cycles per second).

Dedicated 5 volt Output Channel (EXC)

A single 5Vdc regulated output is provided on the ILIM-2. This 5V source can be used for driving loads as well as sensor excitation. The 5Vdc Excitation output is short circuit current limited to approximately 25mA. Control of this output is via the Program Net built from within HyperWare-II.

Interface module Mounting

The ILIM-7 and ILIM-2 share the same mounting configurations, and with the use of the optional Surface Mounting Bracket (LBPN 3539.30010) modules can be surface mounted to a wall. Additionally, they can be stacked with other Expansion Modules in a stair-step fashion and in turn to a surface mounting bracket.

Surface Mounting (Fig 51)

An optional Surface Mounting Plate (LBPN 3539.30010) can be attached to the back of the module with four flat-head 4-40 x 3/8" machine screws (provided with Mounting Plate kit). The module can then be mounted to a wall or other flat surface with user provided fasteners.
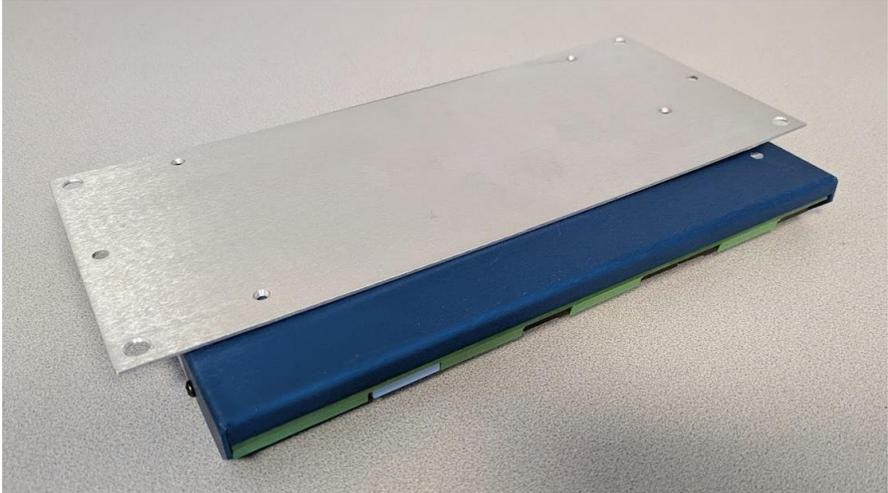
Fig 51; ILIM-7 With Surface Mounting Plate

Module Stacking

Two or more modules can be fastened together by use of multiple optional Angle Bracket Kits. This assembly can then be fastened to the wall via the Surface Mounting Plate (above). Assembly instructions are included with the Angle Bracket Kit.

Fig 52; Two modules shown stacked using the Angle Bracket Kit

4. Specifications

All specifications at 25C and 30% RH

AdquiriLogger™ Instrument

External Power Supply Voltage Input

Vext Input Range	7-28Vdc	
Vbatt Input Range	7-28Vdc	

Power Supply Current

Load-State / Power Source	Vext Power Source	APU or AA Internal Cells	Comment
Power OFF	1.6 mAdc	375uA at 4.5Vdc	
ON - Stopped	10.3mAdc	530uA at 4.5Vdc	APU/Internal current varies as a function of Vbatt
Enabled – Between Rdgs	11 mA at 12Vdc Vext (132mW)	800uA (3.6mA)	Net execution enabled; low power sleep mode between readings.
Enabled - Reading Burst	140 mA at 12Vdc Vext	85mAdc	Burst current during analog readings (eg 500us duration for 4 analog reading Program Net)
LCD Backlight ON	+2 mA at 12Vdc Vext (24mW)	+4mA (18mW)	Brightness level 6
Relay 1 ON Current	0 mAdc	0 mAdc	Relay 1 is a latching relay (current drawn only on state switching)
Relay 2 ON Current	+20mAdc at 12Vdc (375mW)	54mA (240mW)	Relay 1 is a latching relay (current draw only on switching)
Audible Alarm	+300uAdc at 12Vdc (3.6mW)	700uA (3.1mW)	Continuous ON mode
WiFi	**Listen:** 51mAdc **Transmit:** ~150mAdc spikes for ~1mS	TBD	Transmit power usage will depend on volume and frequency of data transmission. Spec shown is for a 4 Channel Program Net real-time viewing.
Cellular Gateway	**Listen:** **Transmit:**	NA	

APU and Internal AA Battery Supply Voltage Input

APU input	3-5Vdc (MAX)	Do NOT exceed 5Vdc on APU input
Internal AA Cells	3-5Vdc (MAX)	Do NOT substitute higher per cell voltage batteries (eg lithium) that can exceed 5Vdc MAX input voltage.

Vexc Output

	Vext Power Source	APU or AA Internal Cells	Comment
Voltage Out	**S**ame as Vext power supply less ~500mV.	Total for all outputs combined	
Current drive	Current limited by 100mA replaceable fuse	Current limited per output	

Relay Output Load Rating (both relays)

Voltage:	32Vdc / Vac Max	
Current	1A continuous	NOT over-current protected

Digital Input / Output Channel (DIO)

Open Collector Output Mode	32Vdc Max 100mAdc	Over-current protected with 100mA automatic reset fuse

Event Input Mode	**Input Resistance:** 120K ohm
	Input Signal Thresholds:
	  LOW (max): 0.5Vdc (1.09Vdc typical)
	  HIGH (min): 1.3Vdc (1.13Vdc typical)
	
	 Optional Pull-Up
	  Current (max): 660uAdc (280uAdc typical)
	  Voltage: 3.3Vdc (2.7Vdc typical)
		40mV of hysteresis

Counter Input Mode	**Input Resistance:** 120K ohm
	
	Input Signal Thresholds:
	  LOW (max): 0.5Vdc (1.09Vdc typical)
	  HIGH (min): 1.3Vdc (1.13Vdc typical)
	
	 Optional Pull-Up
	  Current (max): 660uAdc (280uAdc typical)
	  Voltage: 3.3Vdc (2.7Vdc typical)
	
	Input Freq: 100Hz (max)
		40mV of hysteresis

General Purpose Digital Input (GPDI)

Event Input Mode	**Input Resistance:** ~30K ohm **Input Signal Thresholds:**	

	LOW (max): 1.0Vdc (1.60Vdc typical) HIGH (min): 2.0Vdc (1.7Vdc typical) **Optional Pull-Up** Current (max): 330uAdc Voltage: ~3.2Vdc (2.5Vdc typical)	
Counter Input Mode	**Input Resistance:** ~30K ohm **Input Signal Thresholds:** LOW (max): 1.0Vdc (1.60Vdc typical) HIGH (min): 2.0Vdc (1.7Vdc typical) **Optional Pull-Up** Current (max): 330uAdc Voltage: ~3.2Vdc (2.5Vdc typical **Input Freq:** 10KHz (max) **Optional Debounce:** ~20mS TC	Count increments on High to Low transition
Frequency Input Mode	**Input Impedance:** 120K ohm (DC) **Input Signal Peak to Peak:** 500mV Min P-P **Input Freq:** Max: 10KHz Min: 0.01Hz **Optional Debounce:** ~20mS TC	Sine, square and triangle waveforms

Analog Input Channels

Input Channels:	**Quantity:** 4 **Input Types (field selectable):** Thermocouple with CJC Vdc (11 bipolar ranges plus auto-range) mAdc (7 bipolar ranges plus auto-range)	
Thermocouple Mode	**Types:** J, K, E, T, R, S, N direct connection **TC Burn-Out Detect:** Yes **Cold Junction Compensation (CJC):** integral **CJC Range: -40 to 70C** **CJC Accuracy: +/- 0.3C (0 to 50C)** **Thermocouple Rdg Accuracy: +/-0.5C +/- CJC** **Input Ranges:** J -200 to 1000C K -270 to 1370 E -270 to 1000C T -270 to 400C R -50 to 1768C S -50 to 1768C N -270 to 1300C	**Optonal Settings:** 50/60Hz AC Noise rejection filtering Programmable extended settling time DegC or DegF
Vdc (Low) Mode	**Common Mode Input Range:** +/-4Vdc **Input Impedance:** ~2Megohm (DC to low f) **7 Bipolar Ranges (field selectable):** **+/- 18mVdc** **+/- 39mVdc**	**Optonal Settings:** 50/60Hz AC Noise rejection filtering Programmable extended settling time

	+/- 78mVdc **+/- 156mVdc** **+/- 312mVdc** **+/- 625mVdc** **+/- 1.25Vdc** **Autorange:** auto-scales all ranges **Accuracy: +/-0.3%FS**	
Vdc (High) Mode	**Common Mode Input Range:** +/-4Vdc **Input Impedance:** ~250K ohm **4 Bipolar Ranges (field selectable)** **+/-20Vdc** **+/-10Vdc** **+/-5Vdc** **+/-2.5Vdc** **Autorange:** auto-scales all ranges **Accuracy: +/-0.3%FS**	**Optonal Settings:** 50/60Hz AC Noise rejection filtering Programmable extended settling time
mAdc Mode	**Burden Resistance:** 60.4 ohms **Common Mode Input Range:** +/-4Vdc **7 Bipolar Ranges (field selectable):** **+/- 20mAdc** **+/- 10mAdc** **+/- 5mAdc** **+/- 2.5mAdc** **+/- 1.25mAdc** **+/-625uAdc** **+/- 312uAdc** **Autorange:** auto-scales all ranges **Accuracy: +/-0.3%FS**	**Over-Current Protection:** 50mA replaceable fuse **Optonal Settings:** 50/60Hz AC Noise rejection filtering Programmable extended settling time

Physical Dimensions

Enclosure	5.8W x 5.1H x 1.7D (1.8 with buttons) (inches)	
Weight	19oz	With AA cells installed
Liquid Crystal Display (LCD)	**Resolution:** Graphic 128 x 64 **Backlight:** Yes **Operating Temperature:** -20 to 70C	

ILIM-2 Digital Input/Output Expansion Module Specifications

Power

Power Source	BBus link	From AdquiriLogger™ or BPB-1 BBus Power Booster
Idle	~19mA	
Active -1	~20mA	Intermittent Readings (eg Event, Freq)
Active -2	~22mA	Frequency Output
Active -3	~45mA	+5Vdc Output at Full Current Limit

Input / Output Channels

I/O Type	Chan Qty	Function	Details
Event or Count	8	Event or High-Speed Count. Signal Debounce is software configurable on a per channel basis. Fixed integral pull-ups allow for "dry" contact (non-powered switch) inputs. Can also accept Vdc driven input signals up to 12Vdc. Schmitt circuitry adds hysteresis for slower transitioning input waveforms. Channels are individually configurable through HyperWare-II as Event or High-Speed Counter inputs.	**Event Mode:** Input's state is sampled at a frequency as defined in the IntelliLogger Program Net. Input only stored when it changes state (On to Off or Off to On). **Count Mode:** Per sample rate in IntelliLogger Program Net, the count total is periodically sampled and stored to memory or used in further processing (e.g. totalization, KWh calculations, volume flow, etc)
		.	
Event, Count or Open Collector Output	8	Input or Output Signal Debounce is software configurable on a per channel basis. Fixed integral pull-ups allow for "dry" contact (non-powered switch) inputs. Can also accept Vdc driven input signals up to 12Vdc. Schmitt circuitry adds hysteresis for slower transitioning input waveforms.	Same as Inputs above with the addition of **Open Collector outputs** (100mA max) for each channel with over-current and ESD protection.
Frequency	2	**OUTPUT;** Open Collector output	**Output:** 100mA. Over-current protected. **Frequency Output Mode:**Under IntelliLogger Program Net control, these outputs can be configured to generate a varying square wave output as a function of the Program Net parameters.
Open Collector output	3	**OUTPUT;** Open Collector output	**Output:** 100mA. Over-current protected. **Frequency Output Mode:**Under IntelliLogger Program Net control, these outputs can be configured to generate a varying square wave output as a function of the Program Net parameters.
+5Vdc Output	1	**OUTPUT;** +5Vdc regulated output	**Output** is under IntelliLogger Program Net On/Off control. Current limited to approximately 25mA

Input Switching Thresholds

Vdc Input MAX	12Vdc	
Logic Voltage Thresholds:		
Powered Input	0.8Vdc Max (Low)	Integral 300mV hysteresis and software enabled ~40mS debounce
	2.0Vdc Min (High)	
Switched Input (dry contacts)	Short Circuit Current: 65uA Open Circuit Voltage: 3.3Vdc	3.3Vdc Pull-Up through 51.1K

Counter

Vdc Input MAX	12Vdc	
Input Frequency Range	0 to 10KHz	
Logic Voltage Thresholds:		
Powered Input	0.8Vdc Max (Low)	Integral 300mV hysteresis and software enabled ~40mS debounce
	2.0Vdc Min (High)	
Switched Input (dry contacts)	Short Circuit Current: 65uA Open Circuit Voltage: 3.3Vdc	3.3Vdc Pull-Up through 51.1K

Frequency Input

Vdc Input MAX	12Vdc	
Input Frequency Range	0.25 to 10KHz (Sine or Square)	Minimum 100mV peak to peak to meet Input Freq spec.

Output Characteristics

Open Collector Outputs	12Vdc Max 100mA Max	Resettable thermal fuse protected
Frequency Output	4.5Vdc Min (HIGH) (no load) 0.2Vdc Max (LOW)	5Vdc Pull-Up through 1K (source impedance) 0 to 600 Pulses PER MINUTE (i.e. 0 to 10Hz)
Powered Input	0.8Vdc Max (Low)	Integral 300mV hysteresis and software enabled ~40mS debounce
	2.0Vdc Min (High)	
Switched Input (dry contacts)	Short Circuit Current: 65uA Open Circuit Voltage: 3.3Vdc	3.3Vdc Pull-Up through 51.1K

Physical

Weight	19 oz	
Length x Width x Thickness	9.5 x 6.2 x 1.0 (inches)	

ILIM-7 Analog Input Expansion Module Specifications

Power (from BBus)

Power Source	BBus link	From AdquiriLogger™ or BPB-1 BBus Power Booster
Idle	600uA	Between readings
Active -1	~50mA	During analog readings

Analog Input Channels

Input Channels:	**Quantity:** 8 plus CJC 4 Chan: thermocouple, Vdc-Hi, Vdc-Lo and mAdc 4 Chan: thermocouple, Vdc-Lo and mAdc 1 Chan; Cold Junction Compensation temperature **Input Types (field selectable):** Thermocouple with CJC Vdc (11 bipolar ranges plus auto-range) mAdc (7 bipolar ranges plus auto-range)	
Module Connection Temperature	**CJC Range: -40 to 70 C** **CJC Accuracy: +/- 0.3C (0 to 50C)**	Used for Cold Junction Compensation in thermocouple measurement. Channel can be used to log ambient temperature simultaneously.
Thermocouple Mode	**Types:** J, K, E, T, R, S, N direct connection **Cold Junction Compensation (CJC):** integral **Thermocouple Rdg Accuracy: +/-0.5C +/- CJC** **Input Ranges:** J -200 to 1034C K -270 to 1370 E -270 to 1000C T -270 to 400C R -50 to 1768C S -50 to 1768C N -270 to 1370C	**Optonal Settings:** 50/60Hz AC Noise rejection filtering Programmable extended settling time Resolution (20 bit max) vs Speed selection DegC or DegF Automatic Cold Junction Compensation correction
Vdc (Low) Mode	**Common Mode Input Range:** +/-4Vdc **Input Impedance:** ~2Megohm (DC to low f) **Accuracy: +/-0.3%FS** **8 Bipolar Ranges (field selectable):** **+/- 19mVdc** **+/- 39mVdc** **+/- 78mVdc** **+/- 150mVdc** **+/- 300mVdc**	**Optional Settings:** Resolution (20 bit max) vs Speed selection 50/60Hz AC Noise rejection filtering Programmable extended settling time

	+/- 600mVdc +/- 1.2Vdc +/- 2.2Vdc	

Vdc (High) Mode	**Common Mode Input Range:** +/-4Vdc
	Input Impedance: ~1M ohm
	Accuracy: +/-0.3%FS
	3 Bipolar Ranges (field selectable)
	+/-30Vdc
	+/-15Vdc
	+/-7.5Vdc
		Optonal Settings:
		  50/60Hz AC Noise rejection filtering
		  Programmable extended settling time
		  Resolution (19 bit max) vs Speed selection

mAdc Mode	**Burden Resistance:** 100 ohms
	Common Mode Input Range: +/-4Vdc
	Accuracy: +/-0.3%FS
	
	8 Bipolar Ranges (field selectable):
	+/- 22mAdc
	+/- 12mAdc
	+/- 6mAdc
	+/- 23mAdc
	+/- 1.5mAdc
	+/-780uAdc
	+/- 390uAdc
	+/- 190uAdc
		Over-Current Protection:
		  50mA replaceable fuse
		Optonal Settings:
		  50/60Hz AC Noise rejection filtering
		  Programmable extended settling time
		  Resolution (19 bit max) vs Speed selection