Using

the

IntelliLogger™

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1 INTRODUCTION

USER MANUAL ORGANIZATION

The user instructions for use of the IntelliLogger ™ Portable Data Logging System consists of two manuals:

INTELLILOGGER INSTRUMENT MANUAL (THIS MANUAL)

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

HYPERWARE-II™ SOFTWARE MANUAL

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

INTELLILOGGER™ SYSTEM: `THE BIG PICTURE'

The IntelliLogger 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 IntelliLogger simultaneously performs local alarming as well as output of data via FTP, Email, SMS and standard and Custom Web Pages via its integral Web Page Server.

With its rugged design, it is well suited to most environments ranging from industrial plant floors to vehicle to outdoor environments. As a low-power instrument, it is well suited to battery operation. The IntelliLogger finds itself equally at home as a permanent plant monitoring system or a remote field data logging instrument.

The IntelliLogger is accompanied by HyperWare-II software, which is used for configuration of the system and data review. Data and current readings can also be viewed via a standard Web page browser or the custom pages can be viewed with the free Logic Beach GreenWater™ browser.

INTELLILOGGER SYSTEM COMPONENTS

An IntelliLogger portable data logging system consists of a number of components... both hardware and software.

The main components of an IntelliLogger system are listed below and details follow:

- IntelliLogger System Base
- Interface Modules
- HyperWare-II Windows Application
- Accessory components such as modems, CF cards, M2M Probe Sweep Software, etc.

INTELLILOGGER SYSTEM BASE

The System Base refers to the main data acquisition instrument, which is provided in three models, the IL-10, IL-20 and the IL-80. The System Base includes analog and digital inputs and outputs, a Liquid Crystal Display (LCD), user buttons and various communication connectors.

Differences between models are explained in Chapter 2 and mainly relate to the analog and digital input/output (I/O) capacity and channel expansion features. An IL-80 is shown in Figure 1-1

Figure 1-1; IntelliLogger IL-80

INTERFACE MODULES

Channel count (analog and digital) in an IntelliLogger system can be expanded by the addition of one or more Interface Modules. Modules are connected to the System Base via the integral BBus connectors… allowing up to 16 modules to be daisy-chained.

One of the family of Interface Modules, the ILIM-7 (Figure 1-2) for example adds eight optically 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.

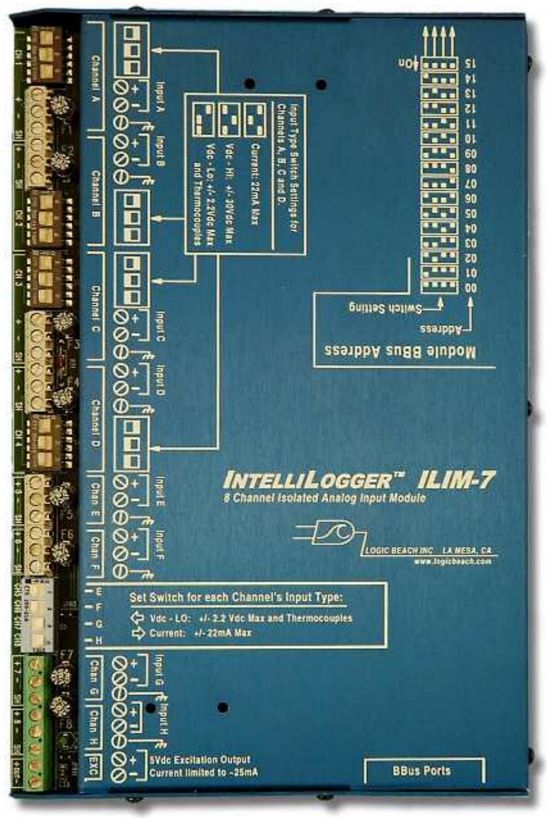


Figure 1-2; ILIM-7 Isolated Analog Input Interface Module

HYPERWARE-II SOFTWARE

Supplied with the IntelliLogger is a powerful Windows based software package called HyperWare-II (Figure 1-3).

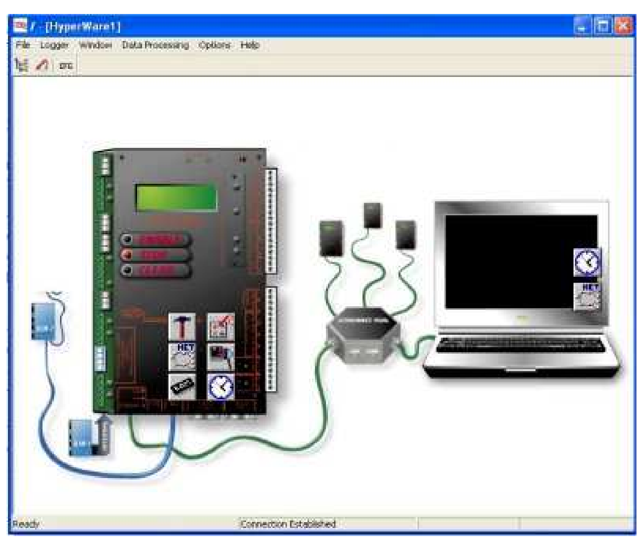


Figure 1-3; Communications Window with Ethernet Connection Established

HyperWare-II, running on a PC under the Microsoft Windows environment (XP, Vista, Win7, Win8, Win10) provides a multitude of functions for setup of the IntelliLogger as well as analysis of collected data including:

- ♦ Serial Communications support between the PC and the IntelliLogger for RS-232, USB, cellular and PSTN modem, and Ethernet.
- ♦ Programming of the IntelliLogger using the powerful HyperNet™ visual icon based programming method.
- ♦ Development of graphic Custom Web Pages with embedded sampled and calculated sensor and signal values.
- ♦ Multi-channel, graphic data display of previously collected data.
- ♦ Screen captures of Plotter graphs for seamless integration into other Windows based software applications such as word processors, spreadsheets, or desk-top publishing packages
- ♦ Download and conversion of collected data files to ASCII text or Microsoft Excel compatible file formats
- ♦ Real-Time graphical display of data as it is being processed by the IntelliLogger

ACCESSORY COMPONENTS

A continually expanding family of accessory components is offered for the IntelliLogger system. A few of the accessories…

- **PSTN Modem** for communication with the IL over conventional telephone lines
- **Cellular Modems** for communication with the IL over the cellular phone network (GSM/GPRS and CDMA/1xrtt supported).
- **RF Links** for unlicensed spread spectrum communication within plants or to remote locations
- **CF Card** memory for industry standard transportable data storage

FEATURES

Designed with the User in mind, the IntelliLogger instrument has a multitude of integral features ranging from powerful hardware to unlimited software programmability and data review. Key features include:

- ♦ BBus Expansion for up to 128 channels of 18+ bit resolution, *isolated* analog input
- ♦ Standard Web Page serving… view readings and system status with your browser
- ♦ Integrated USB, Ethernet, RS-232 (2) ports
- ♦ Configurable Interface Modules accept a multitude of signal types and ranges *all on a single module*.
- ♦ Email output for alarms or updates

- ♦ Custom Web Page serving… drag and drop Web page designer in HyperWare-II allows for Web page development employing animated objects such as motors, pumps, pipes, thermometers, gauges and graphic images. Build pages showing the process being monitored with embedded real-time values.
- ♦ FTP (File Transfer Protocol) data output for periodic automated archiving of logged data to a remote PC running an FTP Server
- ♦ Low power design allows for long term field operation from battery
- ♦ Programmable Analog outputs for sensor excitation and basic control
- ♦ Four digital inputs user programmable for Event, Count and Frequency measurement
- ♦ Four integral alarm outputs including two relays
- ♦ Integral Compact Flash (CF) card socket for expanded and/or transportable log memory
- ♦ HyperNet™ visual icon based programming provides unlimited flexibility in programming, *yet maintains simplicity with drag and drop icon configuration.* Set the IntelliLogger up without writing any cryptic lines of code or experiencing the rigors of excruciating two button menu tree nightmares.
- ♦ 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 more.
- ♦ Integral Liquid Crystal Display (LCD) for system status as well as local real-time display of User defined input and/or calculated values and states
- ♦ User defined alarm messages

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 INTELLILOGGER SYSTEM BASE

OVERVIEW

The IntelliLogger System Base consists of an anodized aluminum enclosure, which houses the main microprocessor, internal memory, liquid crystal display, user buttons, and all I/O and support circuitry. With the addition of power, user program and sensor connections, the unit is a fully self-contained data acquisition, alarming and Web Page serving system.

MODEL VARIATIONS

The IntelliLogger is provided in several different standard models. The differences between the models lie in their integrated analog input channel count and Interface Module expansion capability. Otherwise the units all support the same feature sets of programmability via HyperWare-II, user interface, communication options and Network features (e.g. Email, FTP, Web Page serving, etc).

Model	Analog Inputs	BBus for Interface Module connection
IL-10	Three non-isolated, 10 bit resolution inputs for thermocouple, Vdc and Adc	BBus non-functional
IL-20	Three non-isolated, 10 bit resolution inputs for thermocouple, Vdc and Adc	Functioning BBus for addition of up to 16 ILIM-x Interface Modules
IL-80	Three non-isolated, 10 bit resolution inputs for thermocouple, Vdc and Adc and Eight isolated, 18+ bit resolution inputs for thermocouple, Vdc and Adc (same as ILIM-7)	Functioning BBus for addition of up to 15 additional ILIM-x Interface Modules
IL-90	Three non-isolated, 10 bit resolution inputs for thermocouple, Vdc and Adc And 16 Event/Count input channels, 8 Event/Count/Output channels, 2 Frequency inputs channels, 3 Open collector output channels 1 5Vdc output	Functioning BBus for addition of up to 15 additional ILIM-x Interface Modules

Table 2-1; Model Variations

ENCLOSURE AND MOUNTING

The IntelliLogger is housed in a rugged anodized aluminum housing. The housing is not weatherproof, so for deployment in harsh environments one of the housed systems should be considered (Contact Logic Beach about the IL-250, IL-300).

The IntelliLogger can be surface mounted using the IL Mounting Bracket (PN 3539.30010). This flat plate is first fastened to the back of the IntelliLogger using the screws provided with the Mounting Bracket, then mounted to the desired installation surface.

Figure 2-1; Mounting the IntelliLogger

Additional ILIM-x Interface Modules can be fastened in a stair-step method to the bottom of the IntelliLogger. Back mounting of modules in this way requires the use of the Module Mounting Bracket (PN 3539.30000). Two or three modules can be mounted in this fashion.

Figure 2-2; Back Mounting Modules

User Interface

Various front panel features are built into the IntelliLogger to provide local user interface as well as feedback.

Buttons

Located along the left edge of the front panel are five momentary push buttons providing basic IntelliLogger operational control. Details on the button functions follow:

NEXT and SELECT

The NEXT and SELECT buttons are used for User control of the liquid crystal display (LCD) information displays. Pressing NEXT will advance the LCD display to the next menu item at the current menu level. Pressing the SELECT button selects that menu item and a new level of menus or results are displayed.

A detailed explanation of the operation of the NEXT and SELECT buttons is covered in a later section on the Liquid Crystal Display.

ENABLE

The ENABLE button initiates the execution of the current Program Net residing in IntelliLogger memory. Upon pressing the ENABLE button, the LCD will normally change to display ENABLED.

> ***FYI:*** *The label ENABLE was chosen rather than START for a subtle but important reason. When the ENABLE button is pressed, execution of the Program Net commences... but that does not necessarily mean that data logging to memory has started.*
>
> *For example, a Program Net is developed and uploaded to the IntelliLogger that includes a setpoint function that controls logging to memory. For example log only when the kiln temperature exceeds 150F. Pressing the ENABLE button merely causes the IntelliLogger to take readings of the kiln temperature... but logging to memory STARTS when the temperature rises above the 150F threshold.*

STOP

Pressing STOP at any time causes the IntelliLogger to finish sequencing through the currently executing Program Net, then stop executing. The LCD then updates to show *STOPPED*.

RESET

A hardware reset of the IntelliLogger microprocessor can be performed by depressing and releasing both the STOP and RESET buttons at the same time. This normally should not be required but in the event that an extreme noise glitch or some other malfunction occurs, this manual Reset capability is provided to allow user reset of the microprocessor from the front panel.

Watch-Dog Timer reset

A special automatic reset circuit is incorporated into the System Base to add additional reliability to the IntelliLogger system. This circuitry, called a Watch-Dog Timer will force the IntelliLogger microprocessor to reset and continue operation where it left off (within 2 seconds) in the event that an unforeseen hiccup or noise glitch (for example, from a nearby lightning strike) causes the microprocessor to lose its place or lock-up.

Although this circuit normally should not operate, it adds one more level of robustness to the IntelliLogger for handling unforeseen events.

Power Switch

An ON/OFF power switch is provided in the upper right corner of the IntelliLogger. As with an unexpected power failure (e.g. batteries going dead), cycling the power switch off while the IntelliLogger is logging will not result in a loss of data in memory. The IntelliLogger circuitry detects the collapsing supply voltage and quickly closes out all data logging. Upon return of power (either due to cycling the power switch back ON or reconnection of external power, the IntelliLogger will awaken, assess its status prior to the power failure and continue on. If it was logging when a power failure occurred it will commence logging.

Status Indicator LEDs

Two green LED indicators (labeled *Status*) are located at the center top of the IL front panel. These indicators are under Program Net control and can be programmed by the user for desired visual feedback such as temperature is in bounds, pump is on, etc.

Liquid Crystal Display

An extended temperature range 4-line by 20-character liquid crystal display (LCD) is provided. Information ranging from Operational Mode to System Status to Alarm Messages to signal readings can all be displayed on the LCD. The LCD is continually ON. Information to be displayed is controlled by a User via the SELECT and NEXT fronts panel buttons.

Additionally, alarm messages will be automatically displayed on the LCD when User pre-programmed conditions are met or when the IntelliLogger detects system changes. User messages and conditions are defined by the User in the Program Net developed within HyperWare-II and loaded into IntelliLogger memory. Refer to Appendix A (Program Net Palette Icon Reference) in the HyperWare-II manual for details on programming LCD messages.

Display Operation

Information that can be displayed on the LCD is arranged in a hierarchical format and is accessed by a User via the NEXT and the SELECT buttons on the front panel of the IntelliLogger.

Pressing the NEXT button advances the display to the next available item in that menu level. Repetitive presses of the NEXT button will result in a circular sequencing through all of the available menu items on the current level and eventual repeat of the sequence.

Pressing the SELECT button selects that menu item and a new level of menus or results are displayed.

> ***TIP*** *- a basic comprehension of this LCD menu structure can be achieved by close reading of this section... but better results may be achieved by just `diving in' and poking around with the NEXT and SELECT buttons to develop a feel for the structure. .*

Basic Display Hierarchy

The following is a Listing of the LCD menu structure that can be accessed via the *Next* and *Select* buttons.

HOME MENU

When other menus are not manually selected, the Home Display is shown. Information displayed includes the Model, Firmware (internal code) version number and two lines of Operational and Status messages which indicate what tasks the IntelliLogger is currently performing (e.g. Enabled, Downloading data, Stopped, etc).

From the Home Menu, tapping *Next* will advance the display through a sequence of top level menus. At any top-level menu, tapping *Select* will advance the LCD deeper into that particular branch.

From the Home Menu, pressing Next takes you to… in order…

ENTER DATA MARKER

Allows insertion of pre-defined text into the logged data file. This can be useful for noting when changes are made to the IntelliLogger location, sensors, etc such as in a mobile survey application. The text messages are defined within the Program Net prior to deployment

STATUS

Provides a sequence of system information displays including such items as date/time, memory status, Unit Name, supply and backup memory voltages, hardware listing, etc.

PROBE POINT

Allows for viewing (via manual selection or automatic advancement) of current 'Probe Point' values. These Probe Point values are temperatures, pressures, totals, flows, and other actual or calculated analog and digital values that have been previously tagged within the Program Net. Refer to the Probe Point icon within Appendix A (Program Net Palette Icon Reference).

ACTIVE MESSAGES

System and conditional messages (e.g. alarms) can be reviewed within this branch. Custom messages can be developed within the Program Net to display upon events, alarms, warning conditions, etc.

CHANGE ALARM STATES

Allows front panel control of the various hardware outputs in the System Base such as relays, digital output, etc. Via the front panel and LCD, the outputs can be forced ON or OFF as well as returned to Program Net control.

ERASE LOGGED DATA

Allows for front panel erasure of data logged to internal or removable Compact Flash card memory… assuming that the currently executing Program Net has enabled this function.

FORMAT CF CARD

Allows for front panel formatting of a non-formatted Compact Flash memory card… assuming that the Program Net has enabled this function.

INDICATORS

Front panel LED indicators provide feedback on status of relay outputs, Ethernet connection and User defined logic signals within a Program Net. Use of these indicators is detailed in following sections.

POWER AND GROUND CONNECTIONS

The IntelliLogger requires low-voltage (7-30Vdc) external power to operate. Power can be provided from sources such as batteries or the supplied 120Vac to 12Vdc power adapter (PN DCXF-115/12).

Two numbered, 18 position pluggable terminal strips are provided along the right edge of the IntelliLogger with associated labeling on the front panel. Wiring connections can be made with the terminal strip installed or these terminal strips can be unplugged from their mating connector and wiring connections made.

POWER AND GROUND

Power and ground connections are made via the top terminal strip at connections numbered 15 through 17. For installations with a single power source, connect the power source Positive lead to Terminal 17 (Vdc+) and the Negative lead to Terminal 16 (Gnd).

Some applications may have two power sources such as a utility powered wall transformer and a backup battery. For these applications, the wall transformer leads can be connected as mentioned above and the backup battery can be connected with its Positive lead (black and white) to Terminal 15 (Vbatt) and the battery Negative lead (black) to the shared Terminal 16 (Gnd). Refer to Figure 2-3.

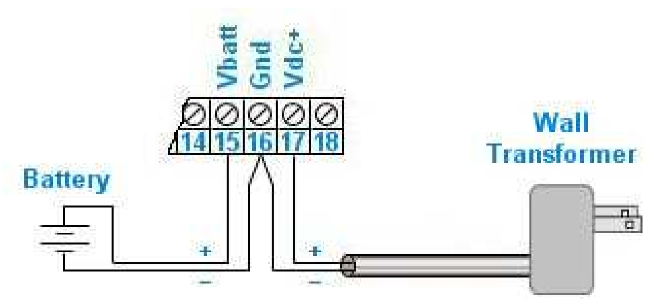


Figure 2-3; Shared External Power Connections

Warning
In shared power supply installations, before making electrical connection to the IntelliLogger insure that the ‘ground’ of the two power sources can be connected together without problems.

Chassis Ground

For optimum system accuracy and protection of the IntelliLogger 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.

Power Fuse

An over-current fuse is provided in the System Base and is the topmost fuse visible projecting slightly from the *Fuse and Input Switch Access Cover* which is located in the upper right corner of the System Base (Figure 2-4). To access the fuse, turn IntelliLogger power OFF, and then use a small Phillips screwdriver to remove the two black screws and the cover. To replace the fuse, use your fingers or a pair of small pliers to tug the fuse straight up and out of its socket. The fuse is rated 3A and is a Littelfuse model 273003, which is commercially available via electronic distribution or direct from Logic Beach.

Analog Inputs

The IntelliLogger System Base provides three over-current protected analog inputs with 10 bit bipolar resolution. Signal connections for these analog inputs are made on the top terminal strip at terminal locations 1 through 9 and are labeled on the front cover as AI_A, B and C.

Two of the channels (AI_A and AI_B) are identical and provide a programmable selection of input types and ranges. The third channel (AI_C) can be configured as a fixed current or a fixed voltage channel. Configuration of input signal type is done via the HyperWare-II Program Net programming (Chapter 4 in the HyperWare-II manual) as well as via hardware Configuration Switches (described below).

Configuration Switches

The IntelliLogger System Base analog inputs are individually field configured for current or voltage measurement via a DIP switch setting. This switch is accessed by powering down and then removing the *Fuse and Input Switch Access Cover* (Figure 2-4) in the upper right corner of the IntelliLogger System Base.

To access the switch, turn IntelliLogger power OFF, and then use a small Phillips screwdriver to remove the two black screws and the cover. A DIP switch is then accessible which contains three individual switches… one for each of the three analog input channels. Use a small screwdriver to set the switches to the ON position for current measurements or OFF for voltage measurements.

The top switch sets Channel AI_A, the middle Channel AI_B and the bottom switch is for Channel AI_C.

Figure 2-4; Configuration Switches

> **Caution**
>
> **Before adjusting switch settings or changing fuses, ensure that you touch the IntelliLogger enclosure. This will equalize the instrument and your body's electrical potential and minimize the chance of electrostatic discharge (ESD) damage.**
>
> **Use care in flipping the DIP switches to different positions so that the screwdriver does not slip and gouge the circuit board below.**

PROGRAMMABLE INPUT TYPES AND RANGES (CHANNELS AI_A AND AI_B)

Channels AI_A and AI_B feature programmable gain amplifiers resulting in up to 8 ranges of input. Each of these analog inputs can be individually configured to accept and process signals from J, K, E, T, R, S and N type thermocouples (Table 2-2) as well as DC voltage and DC currents (Table 2-3).

Thermocouple Types and Ranges

Type	Color (USA)	Range (F)	Range (C)
J	white/red	-328 to 1832F	-200 to 1000C
K	yellow/red	-454 to 2498F	-270 to 1370C
E	purple/red	-454 to 1832F	-270 to 1000C
T	blue/red	-454 to 752F	-270 to 400C
R	black/red	-58 to 3214F	-50 to 1768C
S	black/red	-58 to 3214F	-50 to 1768C
N	orange/red	-454 to 2372F	-270 to 1300C

Table 2-2; Thermocouple input types and ranges

VOLTAGE AND CURRENT RANGES

DC Voltage Input Ranges	DC Current Input Ranges
-10 to +20mV	
-35 to +60mV	
-45 to +80mV	
-60 to +100mV	-0.6 to +1mA
-120 to 200mV	-1.2 to +2mA
-300 to +500mV	-3 to +5mA
-0.6 to +1.0V	-6 to +10mA
-1.2 to +2.0V	-12 to +20mA

Table 2-3; Voltage and Current Ranges

FIXED INPUT TYPE AND RANGE (CHANNEL AI_C)

Channel AI_C is field programmable via the bottom switch for DC current and DC voltage measurement within the ranges of:

Vdc Input: 0.0 to +3.2VDC

Adc Input: 0.0 to +32mAdc

OVER-CURRENT PROTECTION FUSES

Each of the System Base analog inputs is protected from extreme over-current while in the current measurement mode by a series 100mA fuse. Four fuses are visible protruding through the *Fuse and Input Switch Access Cover*. The bottom three fuses are for the analog input channels (the top fuse is a main power fuse… rated 3A). To replace a fuse, use your fingers or a small pair of pliers to tug the fuse straight up and out of its socket. The fuse is rated 100mA and is a Littelfuse model 273.100, which is commercially available via electronic distributors or direct from Logic Beach.

Additional surge and transient protection circuitry is built into the IntelliLogger power supplies and should not normally require service. The fuse is the only component that is field/user replaceable.

COMMON MODE INPUT RANGE

The three analog inputs on the System Base are not isolated and are referenced to instrument circuit ground via a 20Kohm resistor. This circuit ground is common to other non-isolated I/O on the instrument. For this reason, all signals applied to these inputs must be within +/- 4VDC of instrument circuit ground for normal operation.

ANALOG INPUT PROGRAM NET CONFIGURATION

After the analog inputs are configured for the signal type using the above described hardware settings, the channels can then be further configured via the HyperWare-II software in the building of a Program Net. Program Net development is covered in detail in the HyperWare-II manual, Chapter 4 (Icon Based Programming).

GPDI; GENERAL PURPOSE DIGITAL INPUTS

The IntelliLogger System Base has four integral General Purpose Digital Inputs that can each be user configured to accept input signals from one of the following types:

- Event - detection of discrete or On/Off type inputs
- Count - high speed pulse train counting
- Frequency - sampled frequency of an input waveform

Configuration of the channels is performed via the HyperWare-II software in the building of a Program Net. Program Net development is covered in detail in Chapter 4 (Icon Based Programming) and in Appendix B (System Base Icon Reference) in the HyperWare-II manual.

Physical connection and signal interface is discussed in the following section.

GPDI INPUT SIGNAL CONNECTIONS

The four digital inputs are labeled as DI_A, B, C and D on the front panel. Input signal pairs (positive and negative) for each of these channels is made to the lower System Base terminal strip. Terminals 7 to 14 accept signal inputs in pairs. The terminals marked with a minus (-) are common and connect directly to circuit ground.

> ***CAUTION:***
>
> *Note that a direct connection exists between the common (-) terminal on all four of the GPDI inputs. For this reason, ensure that signals supplied from different sources are at the same potential on the negative lead.*
>
> *When connecting to multiple event, counter or frequency signal sources sharing a common ground or reference, ensure that the source's ground or reference is connected to the terminal strip `common' terminal to prevent shorting out of the source signal and possible damage to the input.*

SHIELDING

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 IntelliLogger 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 IntelliLogger ChGnd terminal (top terminal strip, terminal 18). 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 IntelliLogger.

GPDI EVENT INPUT APPLICATION

Event inputs on the System Base allow for the recording of the state of an ON/OFF or 'discrete' type input. Configured as an Event input, a channel will accept a powered input signal (ranging from 0 to a maximum of 30VDC) or a contact closure (dry contact) input.

- ♦ For powered input signals, the System Base Event function defines signals less than 1VDC as a Low level and greater than 4VDC (30VDC max) as a High level.

- For contact closure type inputs, internal power can optionally be supplied from the Event input channel circuitry via a 51Kohm pull-up resistor. A setting within the Program Net icon allows for user control of this pull-up resistor.
- Channel input impedance is greater than 50Kohm.

GPDI Counter Input Application

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.

Configured as a Counter type input, a channel will accept a powered input signal ranging from 0 to a maximum of 30VDC or a contact closure (dry contact) input.

- For powered input signals, the GPDI Counter function defines signals less than 1VDC as a Low level and greater than 4VDC as a High level.
- For contact closure type inputs, internal power (commonly referred to as contact wetting current) can optionally be supplied by the Counter input channel circuitry via a 51Kohm pull-up resistor. A setting within the Program Net icon allows for user enable of this pull-up resistor.
- Channel input impedance is greater than 50Kohm.

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.

GPDI Frequency Input Application

A GPDI channel configured as a Frequency type input can measure input frequencies ranging from approximately 10Hz to 20KHz. The channel will accurately measure frequencies of sine, square, or sine approximating input waveforms with peak to peak amplitudes of 100mVDC to 30VDC. 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.

+5V Output

A single 5Vdc output is provided on the System Base and can be used for driving loads as well as sensor excitation. The state of this output is under control of the Program Net.

Load Connections

The +5V output connections are on the top terminal strip and are labeled *5V Out*. Terminal 11 is the positive and 10 the negative (IntelliLogger ground).

Output Characteristics

The +5V output provides a good time, temperature and load stable 5VDC output at up to 50mA. The output is current limited and can withstand a load short indefinitely. The output voltage is fixed at 5VDC (+/- 150mV). A typical variation in output voltage as a function of load is 25mV (over a load range from 1 to 50mA).

For applications requiring reference or excitation voltage stability exceeding this spec (e.g. bridge measurements), the actual output voltage can be sampled using an analog input channel at the time that the excited sensor output is measured. The excitation voltage can then be normalized (i.e. volts of signal per volt of excitation) within the Program Net.

DIGITAL OUTPUTS

Two digital (on/off) outputs are provided on the System Base. The state of these outputs is under software control via the Program Net.

LOAD CONNECTIONS

Connections for these two outputs, labeled *DO_A* and *DO_B* are made on the top terminal strip terminals 12, 13 and 14. Terminal 13 is a shared circuit ground terminal (GND). Output DO_A load should be connected from terminal 14 (+) to 13 (-) and Output DO_B load across terminals 12 (+) and 13 (-).

OUTPUT CHARACTERISTICS

The Digital Output terminals switch between 5VDC and 0VDC under Program Net control. The outputs are short-circuit protected and can be shorted indefinitely without damage. Protection circuitry in series with the outputs limits the drive current and the output voltage will drop as a function of the delivered current. An effective 200 ohm series source resistance can be used for calculation of the supplied voltage for user applications. For example, with a load that draws 5mA of current, the output voltage will be approximately 5V - (0.005 x 200) = 4V

RELAY OUTPUTS

Two ‘Form C’ relays are provided on the System Base. The state of these relays is under software control via the Program Net.

LOAD CONNECTIONS

Connections for the two relays, labeled RO_A and RO_B are made on the lower terminal strip, terminals 1 through 6. The relay terminals are floating and not connected to internal IntelliLogger power or ground. Each relay has Common (C), Normally Open (NO) and Normally Closed (NC) contacts brought out to the terminal strip.

SWITCHING CAPACITY

The relay switching capacity is 1A ac/dc, 32V maximum.

RELAY ENERGIZED LED INDICATORS

A red LED indicator is provided on the front panel for each of the relays. When the indicator is Off, the relay is not energized and continuity exists between the Com and the NC terminals. When On, continuity exists between the Com and the NO terminals.

ANALOG OUTPUTS

Two voltage sourcing analog outputs are provided on the System Base. The output voltage from these outputs is under software control via the Program Net.

LOAD CONNECTIONS

Connections for these two analog outputs, identified as AO_A and AO_B are on the bottom terminal strip, terminal pairs 17 and 18 (AO_A) and 15 and 16 (AO_B).

OUTPUT CHARACTERISTICS

The analog outputs' voltage range is from 0 to 10Vdc assuming a supply voltage greater than ~10.5Vdc is connected. The output is current limited to ~30mA and can be shorted indefinitely without damage. The 10Vdc is sourced from the unregulated supply voltage. For a full swing to 10Vdc, the voltage powering the IntelliLogger must be approximately 10.5Vdc or greater. In the event that the supply voltage drops below 10.5Vdc, the analog output maximum voltage will be reduced correspondingly.

COMMUNICATION CONNECTIONS

On the bottom end of the IntelliLogger are a variety of communication connectors for RS-232, USB, Ethernet and BBus communications. These connectors are provided for communication between a PC and the IntelliLogger, for network connection, for connection to Interface Modules and for hook-up of external communication equipment such as modems

> *Note:*
>
> The BBus and Ethernet ports both use the same RJ-45 type connector so always double-check that cables for either communication are plugged into the correct connector!

RS-232 (PC)

The DB-9 Female connector on the right end is dedicated to direct connection and communication with a PC RS-232 serial port. It does not have the full suite of control signals implemented.

RS-232 (COMM)

The DB-9 Male connector supports all of the signals for RS-232 communication. This port is dedicated for connection to external communication devices such as modems and RF transceivers. Contact Logic Beach for the latest offering of supported devices.

USB

A single USB 1.0 compliant port is provided. This 'Type B' port is for direct connection via USB cable to a USB port on a PC.

BBUS

An RJ-45 (8 conductor) connector is provided for daisy-chain connection of additional Interface Modules. A standard CAT5 Ethernet cable should be used for the interconnecting cable. Interface modules have two BBus connectors… allowing for a System Base connection to an Interface Module then out of the Interface Module 2nd BBus port to another Interface Module, etc.

ETHERNET

A 10Base-T Ethernet port is provided for direct connection to a PC (via a crossover cable) or to a hub, router or Ethernet Bridge. This port is typically used to connect the IntelliLogger to a network, allowing remote access via HyperWare-II, Web browser and/or GreenWater.

Two front panel indictors are provided for status and troubleshooting.

- LAN Activity indicator - lights whenever communication packets are sent or received.
- LINK Status indicator - displays steady when a LAN connection is established (i.e. valid link pulses are detected).

COMPACT FLASH SOCKET

On the left side of the IntelliLogger, a Compact Flash (CF) card socket is provided. Upon insertion of a CF card, a small ejector lever will project. To remove the card, stop logging (Press Stop) then press on the end of the ejector… and the card will pop out.

The CF card can be used in place of internal memory for storing logged data, which may be able to store considerably more data than possible using internal memory. Details on application of the CF card are provided in Chapter 3 (Communication Window) in the HyperWare-II manual.

Logic Beach, Inc. carries an Industrial 128MB CF card to be used with the IntelliLogger family, P/N CF-IND-128MB. This CF card is highly recommended because of its excellent compatibility and wide operating temperature range.

LITHIUM COIN CELL BACKUP BATTERY

The integral Real-Time Clock and Program Memory in the IntelliLogger are backed up by a 3 volt lithium coin cell battery, Panasonic BR2325 (or equivalent). This lithium coin cell is only used when the IntelliLogger is not powered up. With normal operation this coin cell will operate for many years without needing to be replaced. The condition of this backup battery can be read from the IntelliLogger's display by selecting "Status Menu" and then continuing to "Status-Power" or simply in HyperWare-II under "Logger Status". This coin cell should be replaced promptly when a "LOW" condition is observed. Also, if it is ever noticed that the Date/Time has radically shifted by years or a program net has disappeared after powering up, this could be an indication of a low or dead backup battery.

BATTERY REPLACEMENT

**** ESD Precautions ****

As with all electronic instruments, the IntelliLogger can be damaged by electrostatic discharges. Protective ciruitry is integral to the IntelliLogger to prevent damage from ESD, however when the unit is opened up, more vulnerable circuitry is exposed.

To minimize the chance of damage when changing the lithium coin cell, always dissipate your body's electrostatic charge before touching the IntelliLogger. This can be done by first touching a grounded surface, appliance, conduit, pipe, etc. Always try to maintain contact with the IntelliLogger by holding on to the enclosure while changing the coin cell.

The following instructions will guide you through replacing the lithium coin cell battery:

Download and save any desired logged data along with the Program Net if necessary. Note: The Program Net and all logged Data will be lost while changing the coin cell.

Power the IntelliLogger OFF.

Remove the 12 black Philips head machine screws located on top and around the sides of the black anodized enclosure. It is not necessary to remove the 2 screws holding down the Fuse and Switch Access cover. All of these screws are installed with thread lock so they can be fairly tight to initially break loose. Use a correct fitting screwdriver.

Carefully lift off the top cover while keeping the electronics board stationary. **Do NOT pull upwards on the electronics board because it is still attached at the bottom end.**

The coin cell battery is located in the plastic holder, just below the display.

Carefully slide the coin cell out of the holder without applying upward stress on the retaining clip. The clip is bent such that it presses down and holds the coin cell in place as well as making contact with the top of the coin cell.

Slide in a new Panasonic BR2325 coin cell battery (or equivalent) with the **positive + side <u>face up</u>**. These cells are available from Logic Beach, electronic shops and most major stores that carry electronics.

With a correct installation, the coin cell should drop into the recess in the battery holder and the top contact spring clip should press down securely on the positive + side of the coin cell.

Reinstall the top cover while ensuring that all 6 LED's, 5 pushbutton switches and 4 fuses pass through the top cover. It may be helpful to loosen the 2 black screws on the Fuse and Switch Access cover so that this cover can be properly aligned with the protruding fuses.

After powering up the IntelliLogger you can check for a correct installation by going to the "Status Menu" on the IntelliLogger and verifying that the condition reads "Good". **It will be necessary to set the Date/Time and upload the program net after the battery replacement.**

Properly dispose of the old lithium battery.

3 INTERFACE MODULES

OVERVIEW

To expand the input and output channel capability of the IntelliLogger, one or more Interface Modules can be added to an IL-80, IL-90 or IL-20 System Base. Additional Interface Modules are added by connecting them in a daisy-chain wiring method to the System Base via the IntelliLogger BBus.

BBUS INTERCONNECT

The BBus is a serial data link for communication between the IntelliLogger 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 5 modules.

Modules that are connected on the BBus must be assigned unique Addresses such that communications can be routed correctly.

> ***Note:*** *The IntelliLogger model IL-10… although equipped with a BBus physical connector does not have BBus communication capability.*

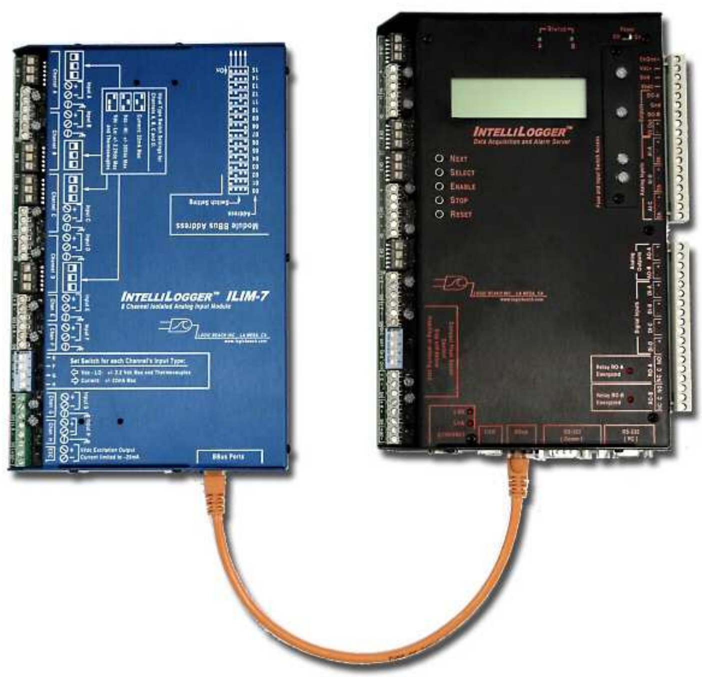


Figure 3-1; IL-80 shown with BBus connected external ILIM-7 Module

INTERNAL INTERFACE MODULE BBUS CONNECTION

Some models of the IntelliLogger have Interface Modules integrated into their enclosure… for example the IL-80 has an integrated internal ILIM-7 module. Although the module is in the same enclosure as the System Base, it still utilizes the BBus interconnection scheme although the physical connection is inside the enclosure rather than outside via a BBus cable.

Internal Interface Modules have their BBus address pre-set to ‘00’.

External Interface Module BBus Connection

The IntelliLogger model IL-80, IL-90 and IL-20 have active BBus connectors and additional Interface Modules can be connected to increase the input/output capability.

BBus Interconnect Cabling

The BBus interconnecting cable starts at the System Base BBus connector (Figure 3-1) and daisy chains to up to a total of 16 BBus modules. Each Interface Module has two BBus connectors at the bottom end (Figure 3-2). For systems with multiple expansion modules, the cable runs into one then out of the other and on to the next module.

Figure 3-2; BBus Interface Module Connection Ports

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 IntelliLogger deployments with long BBus runs should have a BBus terminator stub plugged into the second BBus connector. This terminator serves to minimize signal distortion.

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 (Figure 3-3) 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 Figure 3-3, all switches in the OFF position indicates an address of 00 and all switches ON sets the address to 15. The actual address used is not critical, just ensure that each module on the BBus has a unique address.

> **Note**: Interface Modules packaged within an IL-80 or IL-90 System Base always have an address of '00.' This address cannot be changed. Insure all external Interface Modules installed on the BBus network are set to addresses other than 00.

Figure 3-3; Interface Module Address Setting Switch

Once all of the Interface Modules have unique ID's set, a quick check can be done via the IntelliLogger front panel LCD.

1. From the top menu, use *NEXT* to step to the *Status Menu*
2. Push *Select* to enter into the Status section, then *NEXT* repetitively until the *Installed Hardware* menu appears.
3. Press *SELECT* and a display of the installed Interface Modules will list with their addresses.

Alternatively, if a PC serial connection exists, upon connection to the IntelliLogger, the installed and correctly addressed Interface Modules will display graphically around the IntelliLogger in the Communication Window (Figure 3-4).

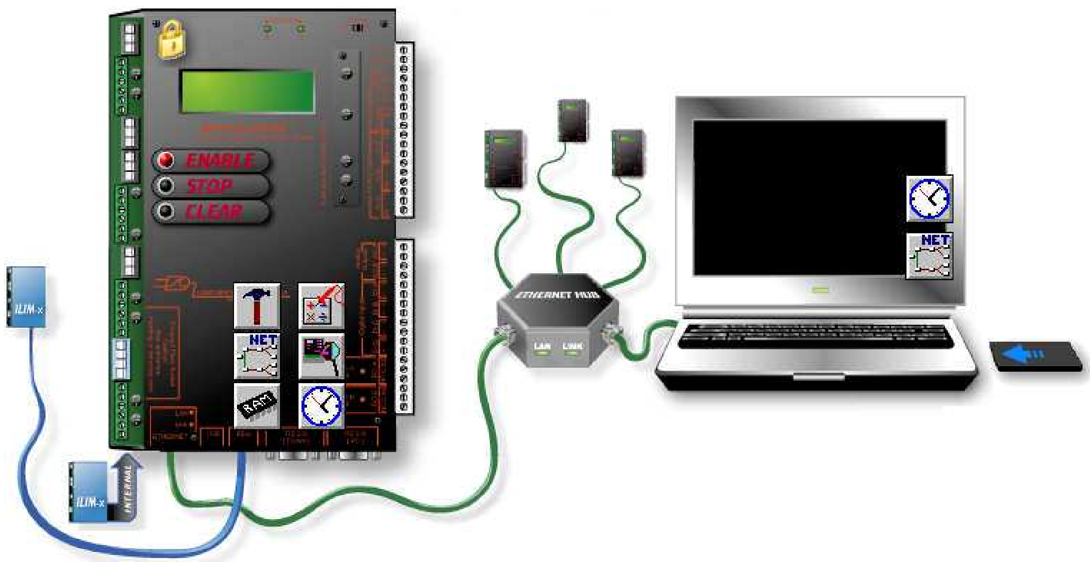


Figure 3-4; HyperWare-II Communication Window showing two Expansion Modules Connected

Clicking on any of the graphics representing modules will result in an informational dialog (Figure 3-5) 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.

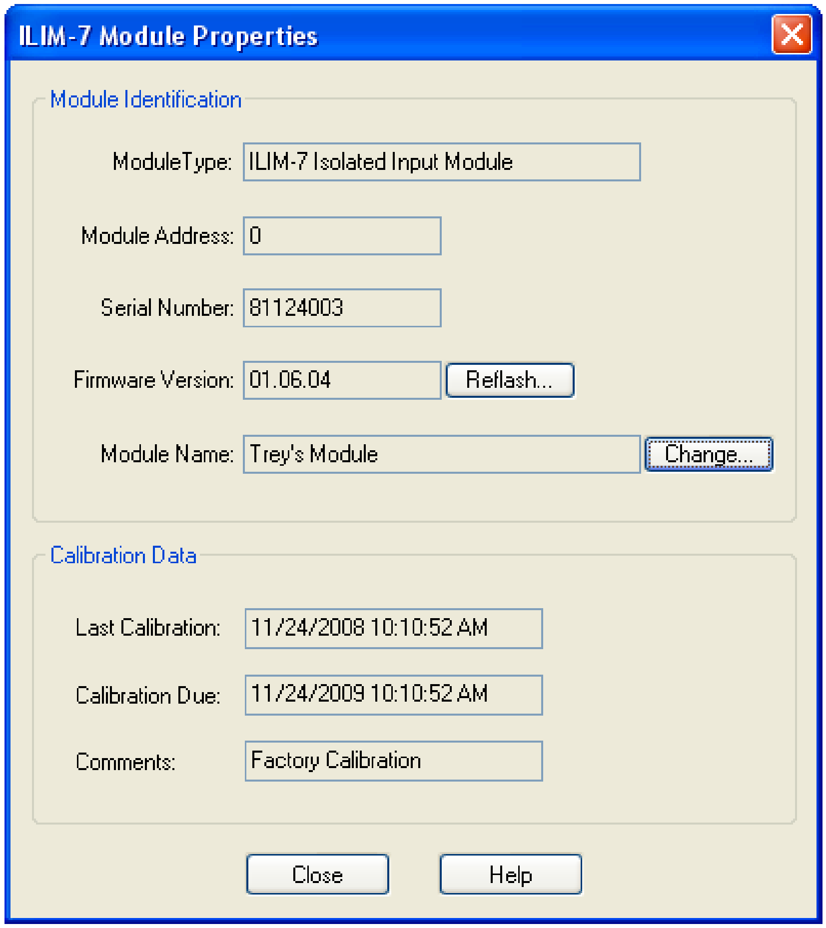


Figure 3-5; Interface Module Properties Dialog

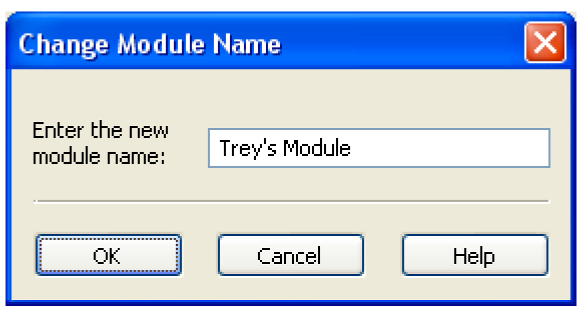


Figure 3-6; Change Module Name Dialog

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 to open the "Change Module Name" dialog and edit as desired.

Interface Module Firmware Reflash

Periodically, new releases of Interface Module firmware may be released to improve performance, fix known bugs, and/or to add features. Updating of the firmware (reflashing) within an Interface Module in the field can be done through HyperWare, click the "Reflash…" button next to the firmware version in the "Module Properties" dialog. This will bring up a standard open dialog that will allow the user to navigate to the new firmware file and open it to begin the module Reflash operation.

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

BBus Power Booster (BPB-1)

The BPB-1 is an optional device available from Logic Beach that can be used to inject additional power to the BBus for applications utilizing more than approximately five Interface Modules. The IntelliLogger system base can only source power sufficient for approximately 5 expansion modules.

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-1gets power from a plug-in wall adapter or external battery source. Contact Logic Beach for additional information.

ILIM-7; Isolated Analog Input Module

The ILIM-7 is one of the family of IntelliLogger Interface Modules (Figure 3-7) 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 IntelliLogger 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.

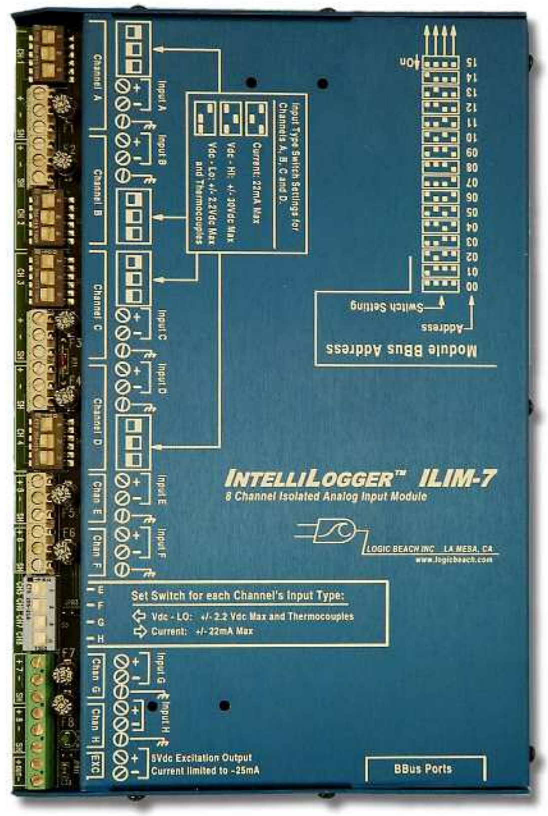


Figure 3-7; ILIM-7 Isolated Analog Input BBus Connected Module

Internal vs Stand-Alone External ILIM-7 Modules

The ILIM-7 can be provided in IntelliLogger systems in two different package formats:

Stand-Alone External Module:

As shown in Figure 3-7, the ILIM-7 can be provided as a stand-alone module that is connected to the IntelliLogger System Base via a BBus cable. This package has optional mounting hardware to allow it to be surface mounted using the Surface Mounting Bracket (PN 3539.30010) or alternatively for attachment to the back of an IntelliLogger System Base using the Stair-Step Mounting Bracket (PN 3539.30000).

System Base Internal Module:

As shown in Figure 3-8, the ILIM-7 is alternatively supplied integrated into the IntelliLogger System Base in the IntelliLogger model IL-80. The function of the Integrated Module is identical to that of the External Module, however the BBus connection between the IntelliLogger System Base and the ILIM-7 assembly is inside the enclosure.

Figure 3-8; IL-80 with Integrated ILIM-7 Module

As an IL-80 integrated module, screen-printing is not provided on the front of the System Base detailing the ILIM-7 Channel and wiring connections. Markings are provided on the actual printed circuit board and in conjunction with the following wiring diagram (Figure 3-9) proper connection points can be identified.

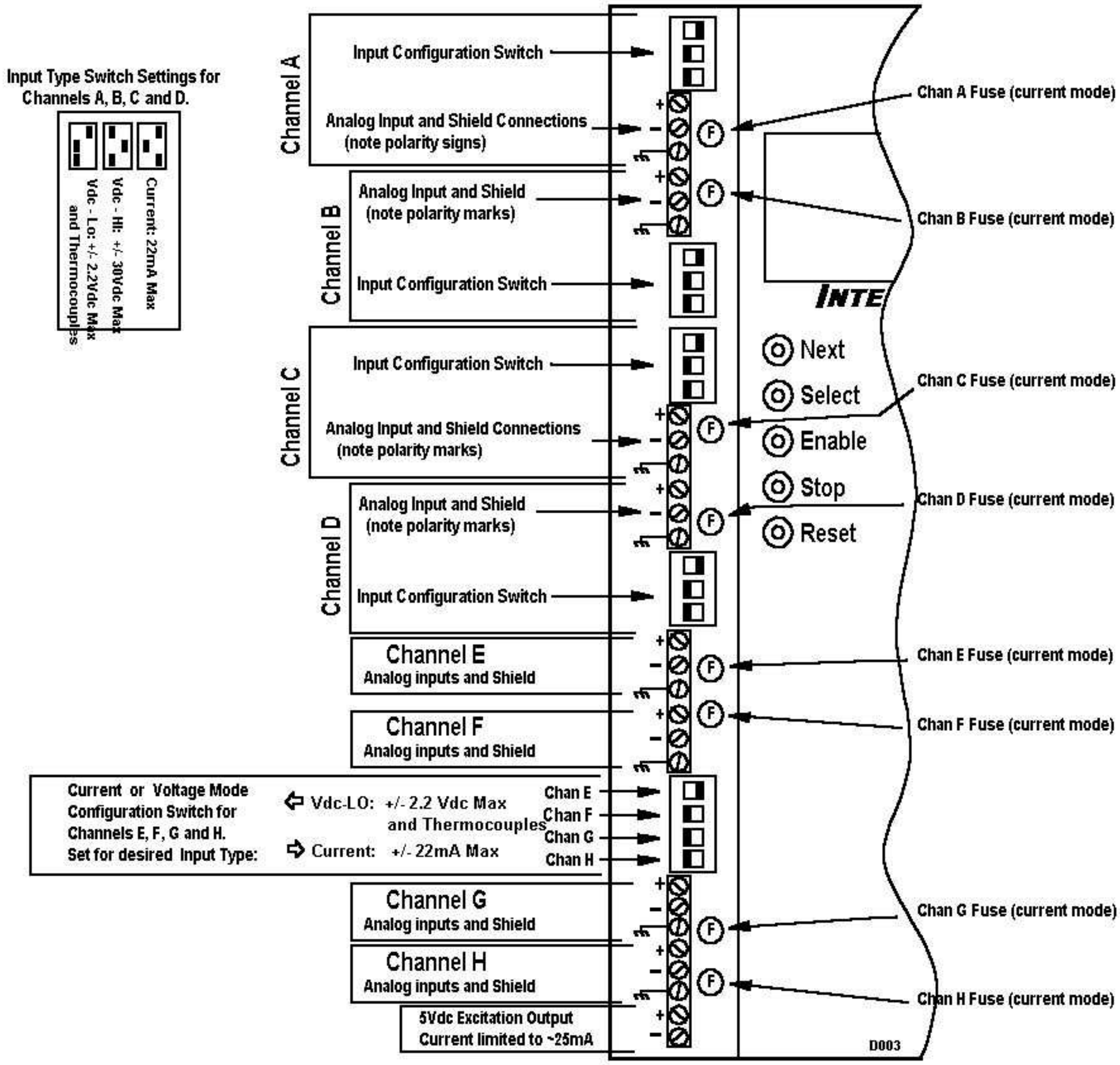


Figure 3-9; Integrated ILIM-7 Configuration Switches and Wiring Connections

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.

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 specified via the HyperWare-II Program Net setup.

Input Types

The following inputs can be connected to the ILIM-7. Input ranges are specified in Appendix D (ILIM-7 Module Icon Reference) in the HyperWare-II manual.

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-II 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.

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-II software channel settings.

Configuration Switches

Channels A through D have a 3 switch DIP switch associated with each channel (Figure 3-9). The combination of these 3 switches On/Off states sets the Input Type per the switch setting pattern table shown in the upper left corner of Figure 3-9 or the following table:

Input Application	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

Table 3-1; Channel A, B, C and D Input Configuration Switch Settings

The schematic representation of these four input channels is shown in Figure 3-10.

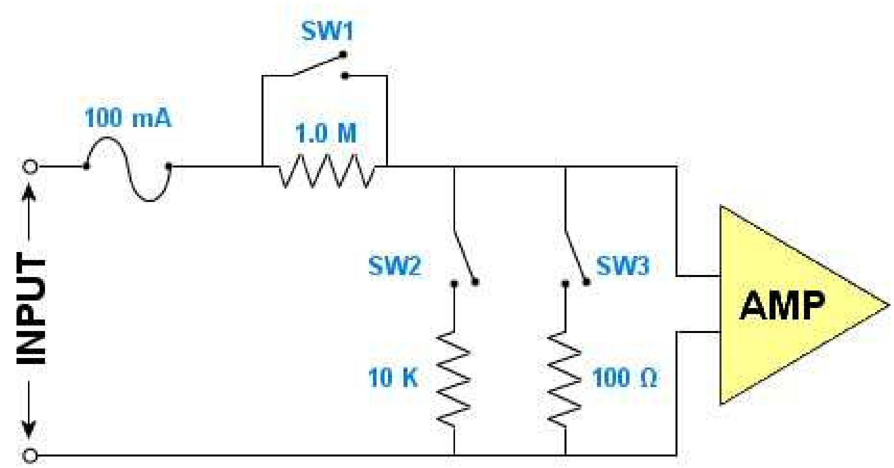


Figure 3-10; Simplified Input Schematic for Channels A, B, C and D

Channels E through H share a single 4 way DIP switch. 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 Vdc/thermocouple use.

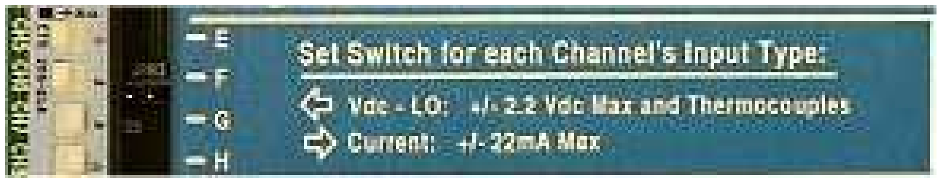


Figure 3-11; Channels E to H Switch Settings

The schematic representation of channels E through H is slightly different than the schematic for Channels A to D and is shown in Figure 3-12.

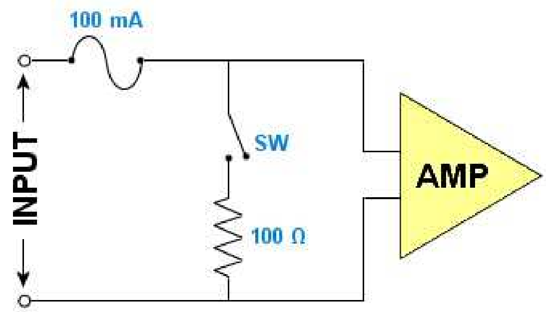


Figure 3-12; Simplified Input Schematic for Channels E, F, G and D nd H

ILIM-7 Channel Configuration Via HyperWare-II

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 IntelliLogger upon power-up. This channel type information is then communicated to the PC running HyperWare-II when a Hardware Query command[1] is done from the Programming window and icons representing the currently configured channel type will 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 Appendix D (ILIM-7 Module Icon Reference) in the HyperWare-II manual.

Input Over-current Protection Fuses

Each of the eight input channels is protected by a 100mA fuse as shown in Figure 3-9 (physical location on module). 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 and/or replaced with a Littelfuse P/N: 273.100 fuse available from Logic Beach Incorporated or many electronic distributors.

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

To remove the fuse, grasp it gently with your fingers or a small set of pliers and pull straight up to extract it from its white socket base.

> *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.

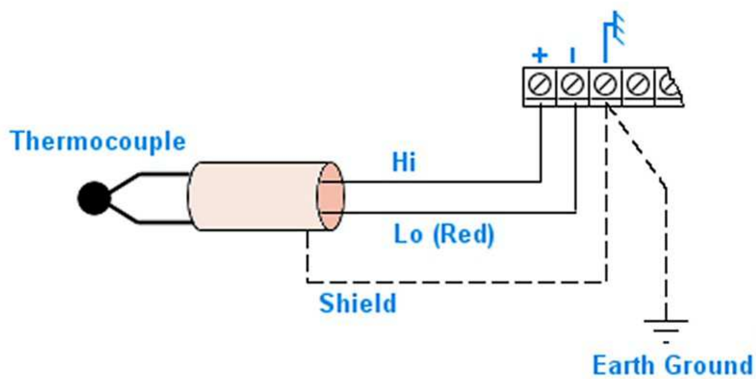


Figure 3-13; Thermocouple (and optional shield) terminal strip connection

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 IntelliLogger. 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 in Table 1-1. 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-II in the input icon Configuration dialog. Clicking a button within the dialog swaps the channel function.

> *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 (Figure 3-9). 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-II Icon Configuration dialog for that channel.

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 (Figure 3-9). 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.

mAdc Application

All of the ILIM-7 input channels can be configured to accept direct current milliAmp current inputs. Switch setting (Table 1-1) enables 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 (Figure 3-9). 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 can not 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.

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.

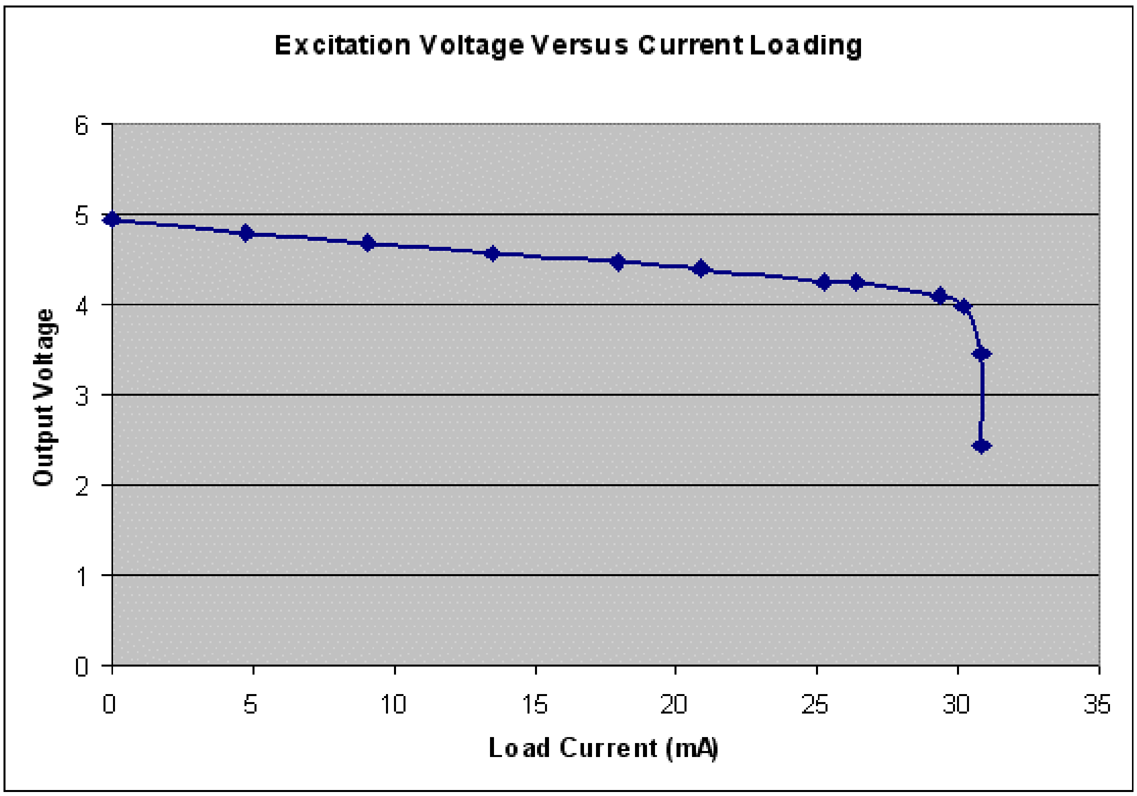


Figure 3-14 Excitation Output Voltage vs Current

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[2].

[2] 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.

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[3] 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 IntelliLogger system as the additional Excitation time will delay the advance of the Program Net.

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.

[3] Details on configuring input channels via HyperWare-II are discussed in Appendix D in the HyperWare-II manual.

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 provide 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.

The mix of Input/Output Channels in the ILIM-2 are listed in Table 3-2.

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

Table 3-2; ILIM-2 Channel Offering

All channels on the ILIM-2 are configured using the HyperWare-II software. Sampling rates and settings for each channel are uploaded into the IntelliLogger as a part of a Program Net. Program Net development is covered in Chapter 7 (Icon Based Programming) and details of the module channels configuration in Appendix B (System Base Icon Reference) in the HyperWare-II manual.

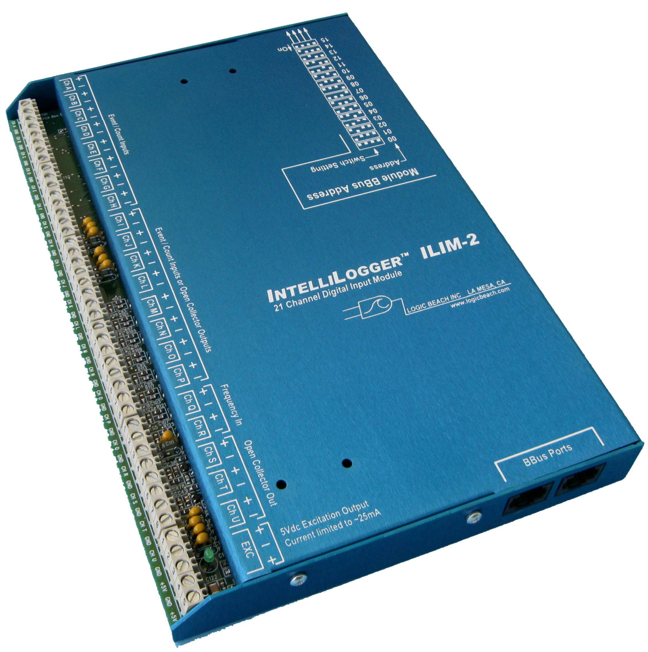


Figure 3-15; ILIM-2 Digital Interface Module

INTERNAL VS. EXTERNAL ILIM-2 MODULES

The ILIM-2 is provided in two different package formats:

External (stand-alone) Module:

The ILIM-2 can be ordered as an external, stand-alone module that is connected to the IntelliLogger System Base via a BBus cable (Figure 3-15). Several mounting options are available for a stand-alone ILIM-2 Interface modules. A Surface Mounting Bracket (P/N 3539.30010) fastens to the back of the ILIM-2 and allows mounting onto any external surface. A Stair-Step Mounting Bracket (PN 3539.30000) allows mounting of the module (or multiple modules) onto the back of an IntelliLogger System Base.

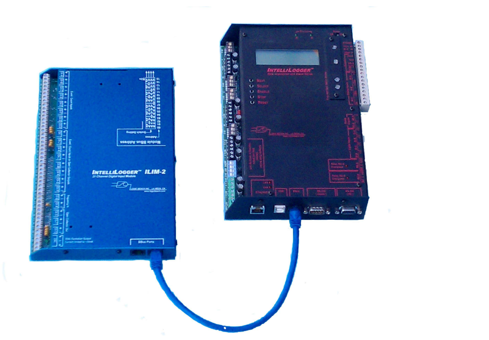


Figure 3-16; ILIM-2 Interface Module connected to an IntelliLogger System Base via BBus

Internal Module:

The ILIM-2 can also be ordered integrated into an IntelliLogger System base enclosure. The IntelliLogger IL-90 contains an ILIM-2 Digital Interface Module already packaged within the System Base. In this configuration, the internal ILIM-2 module operates exactly the same as an external ILIM-2 module; the only difference is that the BBus connection is implemented inside the enclosure.

Figure 3-17; The IntelliLogger IL-90 (ILIM-2 and IntelliLogger System integrated into a single chassis)

TIP:
When integrated as part of the IL-90 chassis, the screen-printed labels on top of the ILIM-2 are not visible to help identify specific input channels, but all channels and connectors are the same on both models. Both models also have labels on the printed circuit board to help identify the proper connection points for each Digital Input. (Figure 3-18)

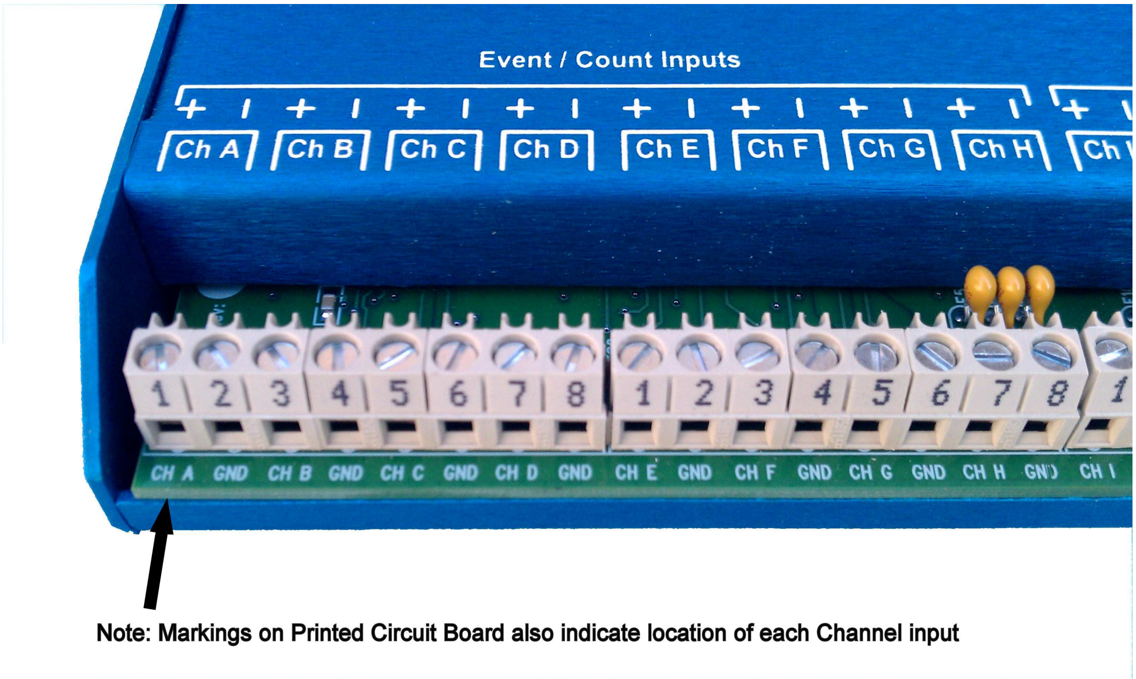


Figure 3-18; Digital Channel markings are visible on both Case and PCB of ILIM-2

INPUT AND OUTPUT CHANNEL DETAILS

This section provides details on the function, signal compatibility and usage of the suite of digital I/O offered in the ILIM-2 module.

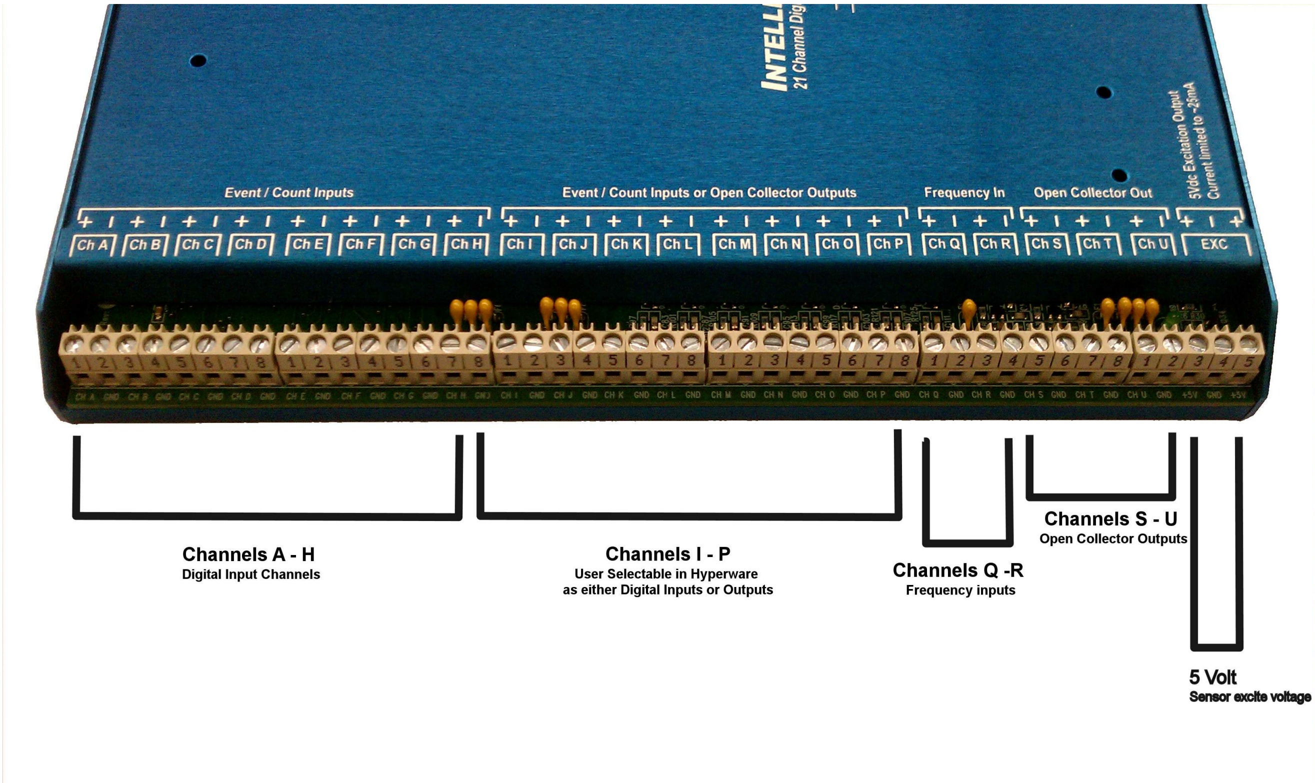
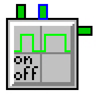
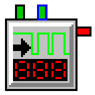


Figure 3-19; ILIM-2 location of all Channels by Group

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 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.

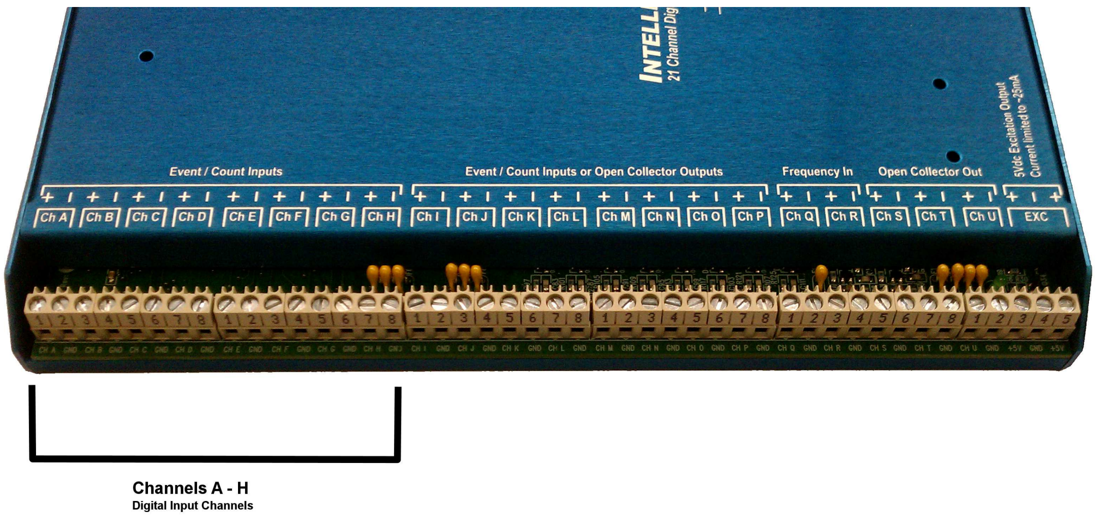


Figure 3-20; Location of Channels A through H

Channels A through H in the ILIM-2 can be configured as either Event inputs or as High-Speed Counters. The two different input modes are described below:

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 logged full 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 transition received (as programmed). This running count total is then read from this hardware counter and optionally cleared as programmed by the user in the Program Net.

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.

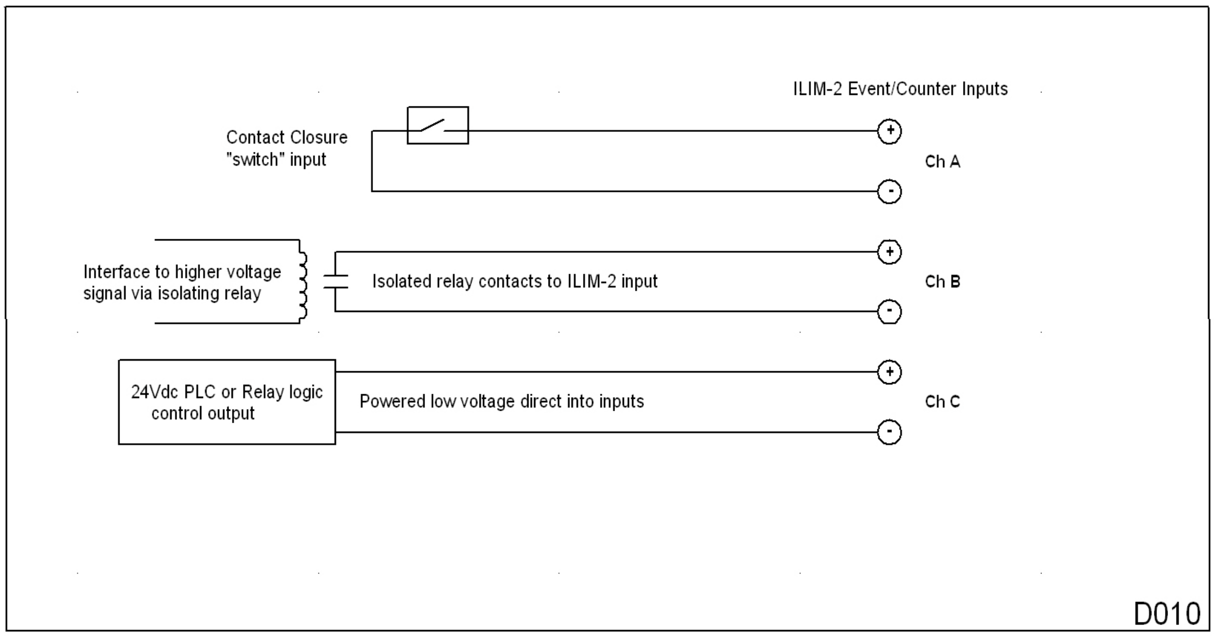


Figure 3-21; Interfacing various signal types to the ILIM-2 Event/Counter Input Channels

EVENT / COUNTER SIGNAL SPECIFICATIONS:
Whether used in Counter mode or Event mode, all Digital Inputs on the ILIM-2 share these same input signal specifications:

- Input Voltage Limits: Powered input signals for these Inputs may range from 0VDC to a maximum of 30VDC. Voltages outside these ranges may damage the Module.

- Logic Voltage Thresholds: For powered input signals a digital signal of less than 0.8 Volts is considered a Logic "Low" signal, and voltages greater than +2.0 Volts as a Logic "High" signal. Digital Input channels have a built in Hysteresis of approximately 0.3 Volts to improve signal acquisition.

Additional Features:

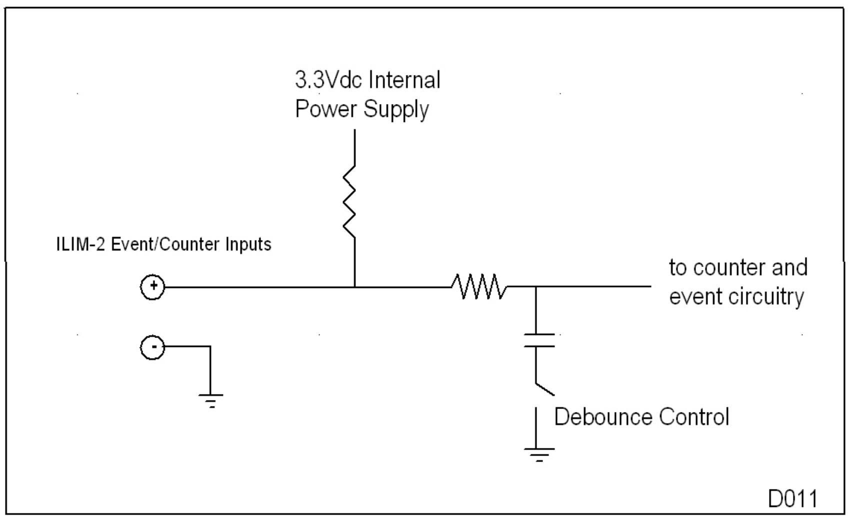
The Digital Input channels on the ILIM-2 have additional features to simplify interface to various types of digital input signals:

PULL-UP (WETTING) 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 the switch. 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.

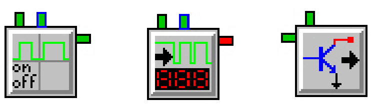
DEBOUNCE OPTION:
Contact bounce is a phenomenon that can occur when a mechanical switch closes. During switching, the physical electrical contacts inside the switch can bounce against each other a number of times opening and closing the circuit before they settle to their final state. As the counter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

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 if you suspect false transitions due to switch bouncing.



3-22; 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.

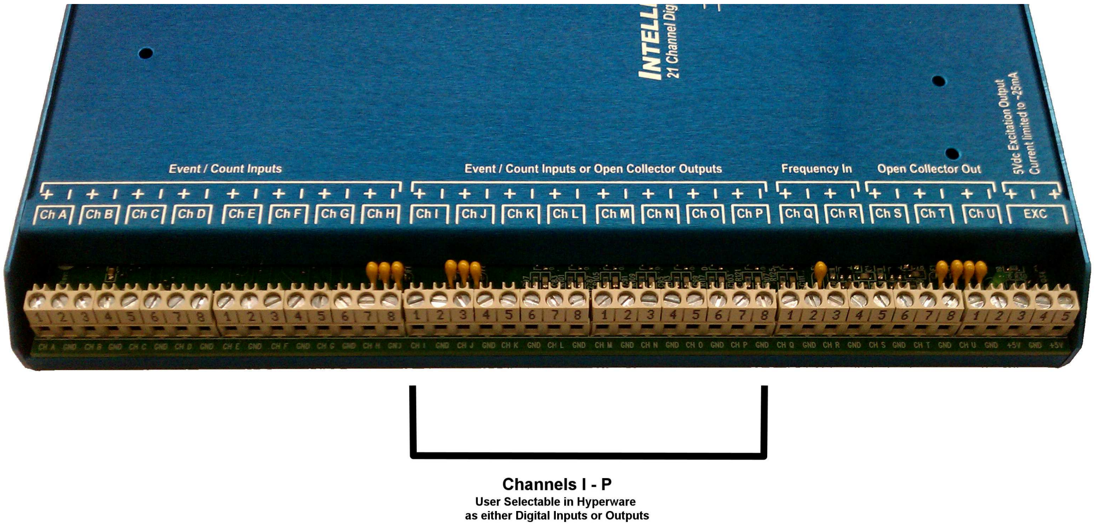


Figure 3-23; Location of Channels I through P

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. These Digital Outputs can be programmed to turn "on" and "off" using HyperWare. The Digital Output of each channel is determined by program logic and User settings within HyperWare, and uploaded as part of the Program Net.

OPEN COLLECTOR OUTPUTS (FIGURE 3-24)
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 "-" terminal on all of the channels are interconnected.

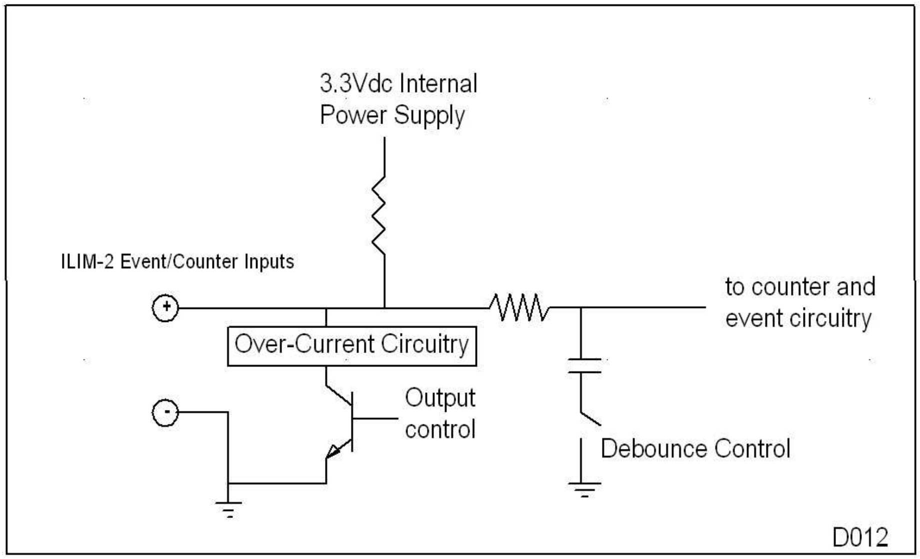


Figure 3-24; Input / Output Channel simplified schematic

MAX INPUT VOLTAGE:

30Vdc. Note that these channels are only to be used for switching DC loads 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.

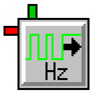
OVERCURRENT PROTECTION:

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.

Note 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.

Note 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.

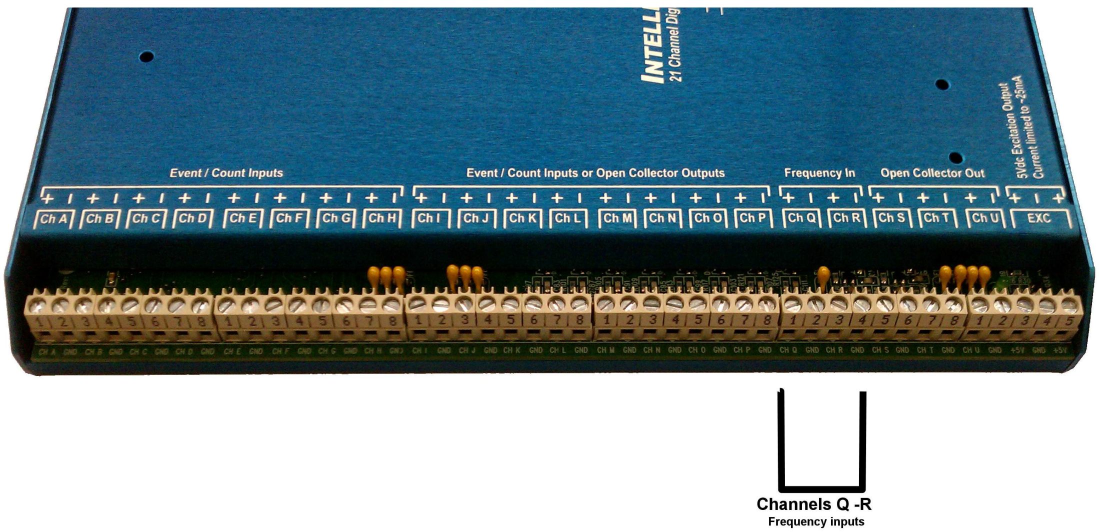


Figure 3-25; Location of Channels Q and R

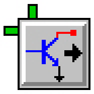
- Input Voltage Range: Powered input signals for these Frequency Input channels may range from 0VDC to a maximum of 30VDC. Voltages outside these ranges may damage the Module.
- Input Frequency Range: Frequency Input channels can sample frequencies ranging from 0.25Hz to 10KHz depending on the waveform 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.

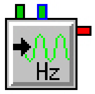
Debounce and Pull-Up options:

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-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.

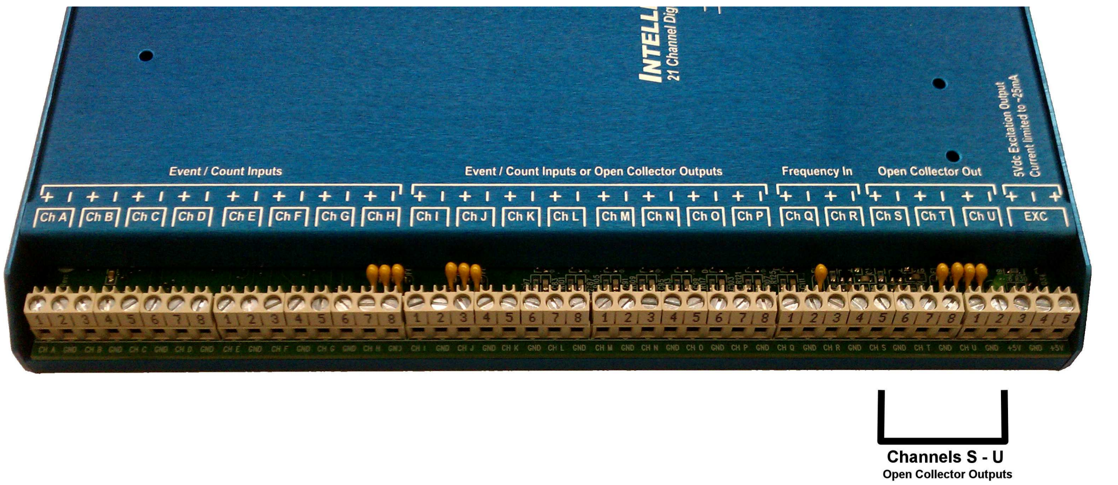


Figure 3-26; Location of Channels S through U

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.

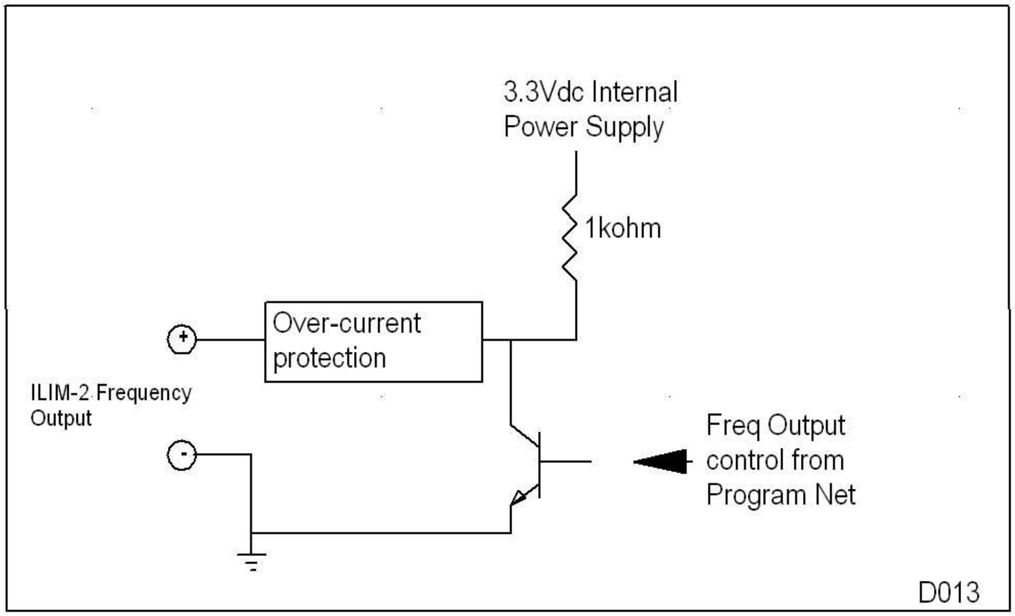
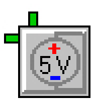


Figure 3-27; Simplified Frequency Output Channel schematic

Although the HyperWare 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 can be surface mounted to a wall or attached in a stair-step fashion onto the back of a logger System Base.

SURFACE MOUNTING (FIGURE 3-28)

An optional Surface Mounting Plate (Logic Beach Part Number 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.

Figure 3-28; ILIM-7 With Surface Mounting Plate

MODULE STACKING TO AN INTELLILOGGER

One or more modules can be attached to the back of a logger base (Figure 3-29) in a stair-step fashion using the Module Mounting Angle Bracket Kit (Logic Beach Part Number 3539.30000).

Figure 3-29; IL20 or IL80 with Attached ILIM-7 Module

Additionally, multiple modules can be fastened together by use of multiple Angle Bracket Kits then the complete assembly fastened to the wall via the Surface Mounting Plate (above).

To attach an Interface Module onto the back of a logger System Base using the Angle Bracket Kit:

1. Remove the cover from the module by removing the two black screws on each end of the module and the three screws on the right edge of the module.

2. Using two of the four screws provided with the Module Mounting Angle Bracket Kit, attach the angle bracket to the back of the logger (Figure 3-30)

Figure 3-30; Module Mounting Angle Bracket

1. Using two of the four screws provided, attach the face of the module to the back of the IL-80 (Figure 3-31). Note that four holes are provided in the face of the module. Two are aligned for use in mounting the module to an IL-80 or IL-90 logger and the other two are aligned for use in mounting the module to an IL-20.

Figure 3-31; Mounting ILIM-x Faceplate to IL Base

4. Re-assemble the module. Align the module bottom to the angle bracket and the module top and reinstall the 2 screws on the top and bottom ends of the module. Then, install the 3 screws through the angle bracket, the module top and the module. It is best to install all of the screws loosely then tighten after all screws have been started.

4 DOCUMENT REVISION HISTORY

JUNE 1, 2011

- Broke single manual into two separate software and hardware documents.

OCTOBER 4, 2016

- Minor updates and corrections.
- Corrected wrong Chapter references after IL/HW-II manual split.
- Added additional CF card information and Lithium Coin Cell Backup Battery section.

5 NOTES

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