ISO-LD

Hardware Manual

ICP DAS

Industrial Computer Products
Data Acquisition System

Warranty

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1. Introduction

1.1 General Description

The ISO-LD series is a bus-type isolated loadcell input board. The isolation inputs can operate with up to 500Vrms of common-mode voltage.

The ISO-LD series features a 12 bit analog-to-digital converter, on board 1 K bytes FIFO buffer , one loadcell signal input channel, one analog input channel, 8-channel 12-24V isolated digital inputs, 7-channel isolated open-collector digital outputs, one programmable 8-bit LED indicator to indicate the magnitude of channel_0 or channel_1 analog input signal.

The ISO-LD series board is suitable for static force measurement and dynamic force analysis. Because there are on board excitation voltage, high gain amplifier, you don‘t have to buy any excitation voltage and signal conditioning module. In other words, it save your money and space. The special features are giving as following :

1. 0 to -4.096V, 12-bit programmable offset voltage. Therefore the user can cancel the DC bias and amplify the AC signal
2. The isolated structure eliminate the ground loop noise and protect your computer.
3. On board 1K FIFO buffer support gap-free A/D conversion under DOS and Windows environment.
4. Except the loadcell input channel, there are a lot digital I/O and one analog input channel.
5. The eight bits TTL/LED indicators can show the analog input magnitude real time. If connecting to external LEDs, the people can view the analog value very easy.

1.2 The Block Diagrams

The block diagram of ISO-LD series is shown below :

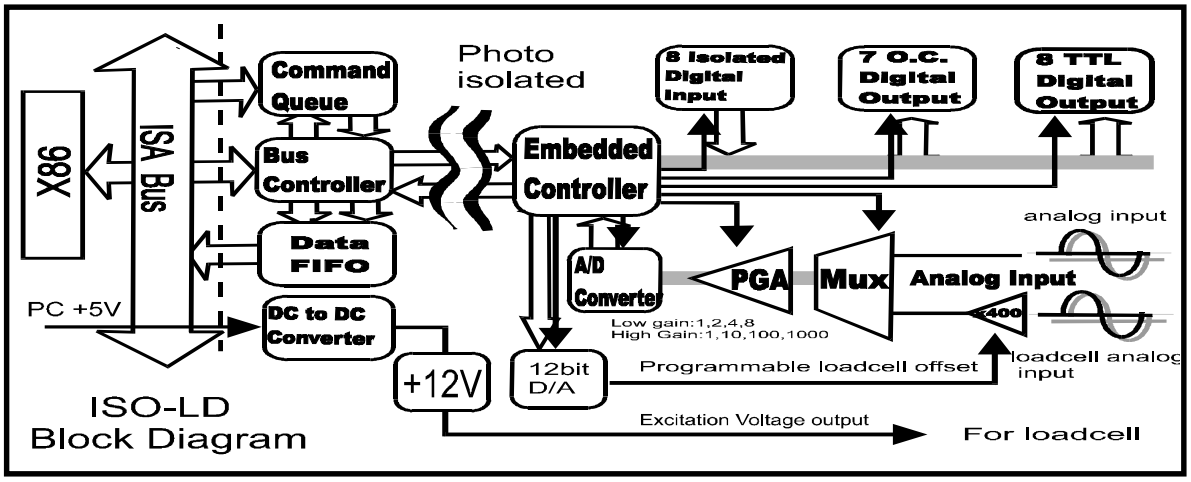


Fig 1 : The block diagram of ISO_LD.

The X86 send one command to command queue through ISA bus. The embedded controller will auto read and execute this command. The results of this command will store in the data FIFO, therefore the X86 can read back and analysis the results through ISA bus.

The X86 site and the embedded controller is fully isolated. Therefore the noise from external device will be isolated from X86, this will improve the X86 reliability.

The X86 only need to send out command and the embedded controller will handle the control details. The features of command set system are given as following:

(1) : reduce X86 load

(2) : easy programming

(3) : OEM/ODM special require function is easy to implement

The functions of the embedded controller are given as following:

(1) function of 8 channels of isolated digital input
(2) function of 7 channels of isolated O.C. output
(3) function of 8 channels of TTL/LED indicator
(4) function of 2 channels of AD converter

1.2.1 8 channels of isolated digital input

The block diagram of isolated digital input is given in Sec. 3.4. These DI can be used as **general purpose input** or **special purpose input such as external trigger signal**. This version firmware only support general purpose input. The OEM/ODM user can specify their special requirement, therefore the embedded controller can implement the detail control and provide a new command set for X86 site application.

1.2.2 7 channels of isolated O.C. output

The block diagram of isolated digital input is given in Sec. 3.5. These DO can be used as **general purpose output** or **special purpose output** such as “real time alarm indicator”. This version firmware only support general purpose output. The OEM/ODM user can specify their special requirement, therefore the embedded controller can implement the detail control and provide a new command set for X86 site application.

1.2.3 8 channels of TTL/LED indicator

The block diagram of isolated digital input is given in Sec. 3.6. These TTL/LED indicators are designed to connect to 8 LEDs for analog input magnitude indicator. For example, the user can set BASE=0x123 and DELTA=0x100, then

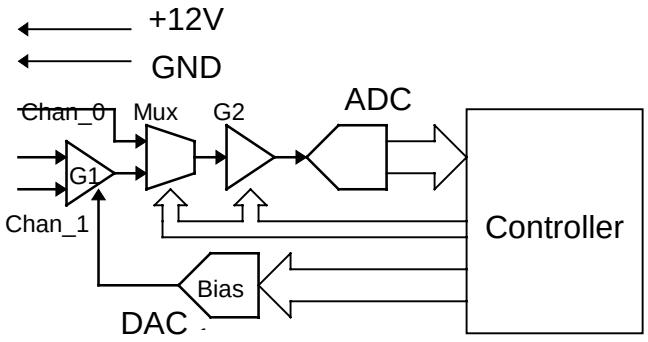
LED1 will ON if AD>0x123
LED2 will ON if AD>0x123+0x100
LED3 will ON if AD>0x123+0x200
LED4 will ON if AD>0x123+0x300
LED5 will ON if AD>0x123+0x400
LED6 will ON if AD>0x123+0x500
LED7 will ON if AD>0x123+0x600
LED8 will ON if AD>0x123+0x700

Because the embedded controller is always perform AD conversion, the AD value will be compared to BASE and DELTA. Therefore the LEDs will show the AD magnitude real time. This is special designed for people watch. In some real world application such as dynamic force monitoring system, the AD magnitude is dynamic changed and these LEDs will dynamic show the AD magnitude for people watch.

If the AD channel changed, these LEDs will show the new channel AD. Also if the gain or DC bias is changed, these LEDs will change too.

1.2.4 2 channels of AD

When we measure force, we maybe have another analog indicator like position or distance to show the physical change by the force. In such a system, the user can use channel_1 to measure loadcell analog input and use channel 0 to measure the relative indicator.



The channel_0 AD is direct connected to MUX.

The channel_1 AD is first connect to G1 amplify. The gain factory of G1 can be from 100 to 10000 setting by VR2. If VR2 is fixed, the G1 is fixed. In the normal condition, the G1 is recommended to setting to 400.

The 12 bits DAC can provided 0V to -4.096V DC bias offset voltage to G1. In the normal condition, this DAC is used to remove the DC level and the G2 will amplify the AC signal.

The G2 is PGA. In ISO-LDL, G2=1/2/4/8. In ISO-LDH, G2=1/10/100/1000.

The ADC is 12 bits resolution and 0 to 10V range, unipolar.

The steps for channel_0 AD conversion is given as following:

(1) select channel_0
(2) set G2 of PGA
(3) performance the AD conversion

The steps for channel_1 AD conversion is given as following:

(1) set G1 in proper value (use VR2, not software programmable)
(2) select channel_1
(3) set DAC to remove the DC level of AD channel_1
(4) select G2 to amplify the AC signal
(5) performance the AD conversion

The data of 12 bits AD data is compared to BASE and DELTA always. (refer Sec. 1.2.3)

1.3 Features

The general features of ISO-AD32 series are given as follows:

- 500 VDC photo-isolation protection
- one channel strain gauge input channel (channel_1)
- One channel analog input channel (channel_0)
- Built-in 1K bytes FIFO
- Excitation voltage for loadcell : 12V, 50mA
- Maximum gain up to 40,000
- Programmable 12 bit resolution DC offset voltage (0~-4.096V)
- Second order low pass filter build-in
- Direct connection to strain gauge type loadcell
- 8-channel 12-24V isolated digital input
- 7-channel isolated open-collector digital output
- Programmable 8 bits LED indicator for analog input signal magnitude.
- Command set programming

1.4 Specifications

Analog Input Specifications

Channels : 1 loadcell input channel & 1 analog input channel
Resolution : 12 bits
Conversion rate : 20 KS/s max
Input Impedance : 10,000MΩ‖6pF
Recommended warm-up time : 10 minutes
On chip sample & hold

ISO-LDH Input Range

Analog input range : 0~10V , 0 ~1V , 0~0.1V , 0~0.01V
Strain Gauge input range : 0 ~ 37.5mV
Resolution

Gain	Input range (mV)
400	0~37.5
4,000	0~15
40,000	0~12.75

ISO-LDL Input Range

Normal input range : 0~10V, 0~5V, 0~2.5V, 0~1.25V
Loadcell input range : 0 to 37.5mV
Loadcell offset voltage adjustment : 0 to -5V, 8 bit
Resolution

Gain	Input range(mV)
400	0~37.5
8,00	0~25
1,600	0~18.75
3,200	0~15.625

Loadcell Offset Voltage Adjustment

0 to -5V, 12 bit resolution

Digital I/O

8 photo-isolated 12~24V digital input
7 isolated open-collector digital output (100mA)
8 TTL/LED analog input magnitude indicator

1.5 Product Check List

In addition to this manual, the package includes the following items:

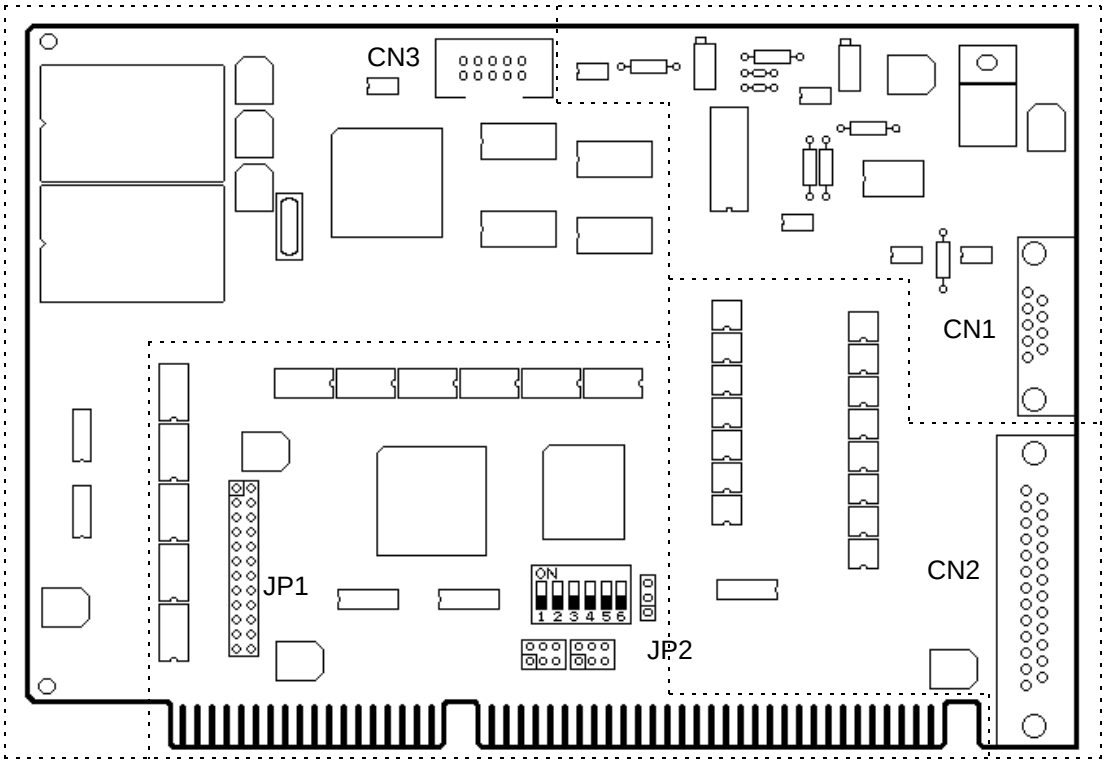
- ISO_LD multifunction card.
- One DOS utility/library diskette.
- One DOS software menu.

Attention !

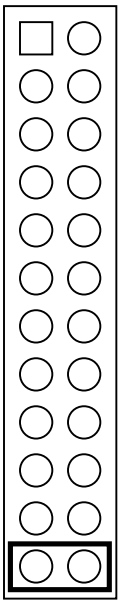
If any of these items is missing or damaged, please contact your local field agent. Save the shipping materials and carton in case you want to ship or store the product in the future.

2. Hardware Configuration

2.1 Board Layout

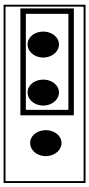


2.2 JP1 : IRQ Channel Selection

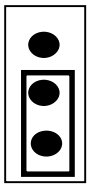


IRQ3
IRQ4
IRQ5
IRQ6
IRQ7
IRQ9
IRQ10
IRQ11
IRQ12
IRQ14
IRQ15
NC **(default)**

2.3 JP2 : Wait State



Normal Speed
(default)



ISA bus select
zero wait

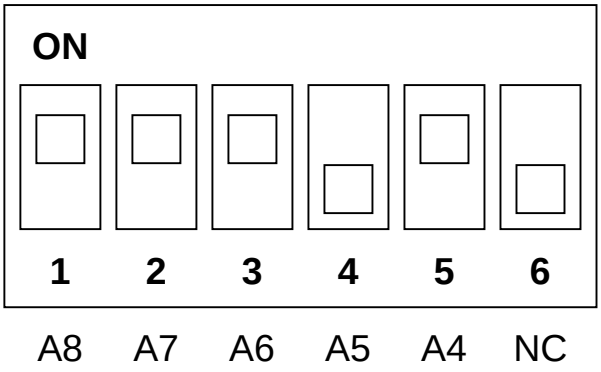
2.4 VRs

VR1 : AD offset adjustment (for both AD channel_0 and channel_1)

VR2 : AD channel_1 gain adjustment, change this VR will change gain from 100 to 10000.

2.5 I/O Base Address Setting

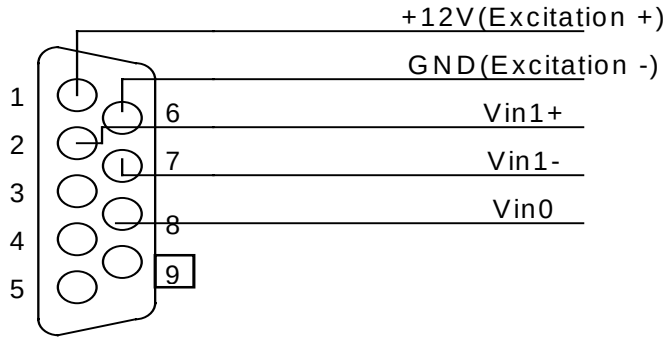
The ISO-LD occupies 8 consecutive locations in I/O address space from BASE to BASE+7. The default setting is 0x220 as following :



Base Addr	A8	A7	A6	A5	A4
200	On	On	On	On	On
210	On	On	On	On	Off
220	On	On	On	Off	On
230	On	On	On	Off	Off
250	On	On	Off	On	Off
:	:	:	:	:	:
300	Off	On	On	On	On
:	:	:	:	:	:
3F0	Off	Off	Off	Off	Off

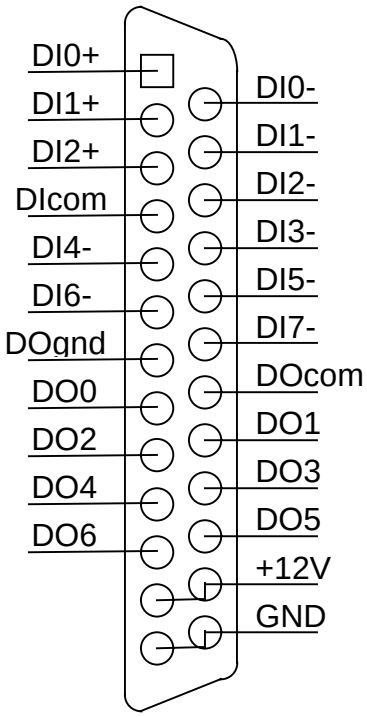
2.6 CN1 Connectors

CN1 : Analog input/output connector, 9 pin D-sub male



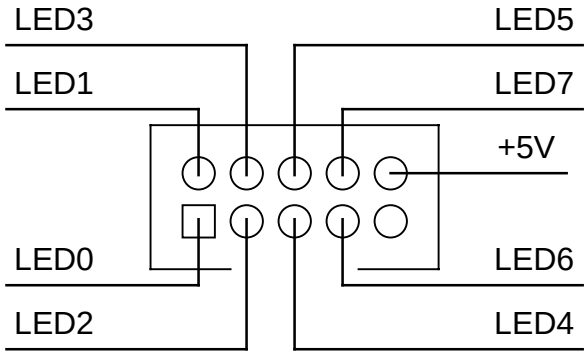
2.7 CN2 Connectors

CN2 : Digital input/output connector, 25 pin D-sub female



2.8 CN2 Connectors

CN3 : 8 LEDs output, 10 pin male



3. Function Operation

3.1 What is loadcell

Loadcell is one kind of bridge sensor. Loadcell is a passtive resistant sensor. The resistance varies for the change of the force. The loadcell is shown in Fig.1. The excitation source may be voltage or current source. The V+ and V- is the differential voltage output, the voltage is proportional to the force. Typically the difference between V+ and V- is about several mV.

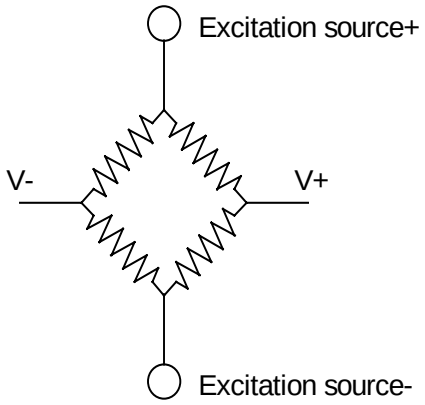


Fig.1

3.1.1 loadcell input Connection

The ISO-LDH/L may connect a loadcell which is powered by excitation voltage. The ISO-LDH/L have the on-board excitation +12V voltage source for loadcell excitation source. The V+/V- connect to the input Vin+/Vin-. The connection show in Fig2.

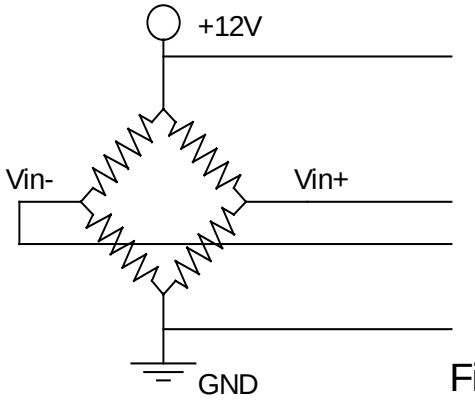


Fig.2

3.2 How to get data from loadcell

A. Amplify the raw signal

The output of loadcell is very small. The typical output is about several mV. For this reason, the amplifier is needed for enlarge the input signal. Typical the gain is about hundreds to thousands for enlarge this small signal before been sampled by analog-to-digital converter. This is essential for accuracy measurement.

B. Bias voltage

The signal of loadcell output is going with common voltage when we want to measure the dynamic variation of the force. After amplify the signal, the common voltage may cause the signal been exceed the measurable dynamic range. For eliminate the common mode voltage, we need supply an extra bias voltage to adjust the signal to the measurable range.

C. Amplifier and bias voltage

In ISO-LDH/L board, we use two stage amplifier for flexible signal condition. The first amplifier, which is fixed gain, with digital controllable bias voltage can adjust the input signal from loadcell to the suitable range for next amplifier. The next amplifier is digital controllable from 1/10/100/1000 (for ISO-LDH or 1/2/4/8 for ISO-LDL). When measure the dynamic variation of signal, we may amplify the signal as large as possible without clamping. The amplifier diagram is shown in fig.3

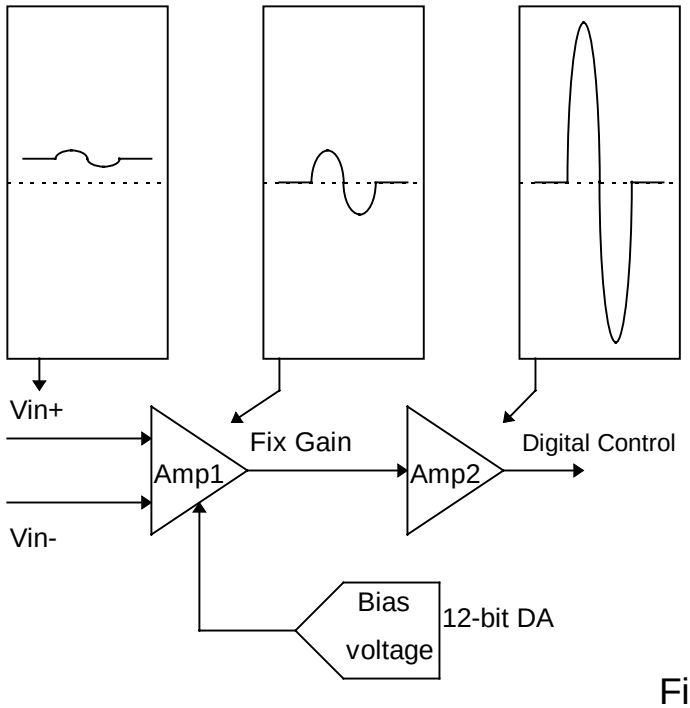


Fig.3

D. Example of amplifier and bias voltage select

For example, the loadcell signal is 2mV with 0.1mV Vp-p, and we choice ISO-LDH to acquire this loadcell signal. The first amplifier is fixed gain in 400 V/V. For get the maximum dynamic readable range, we select the second amplifier in gain=100 to get the dynamic signal range in 4V Vp-p.

0.1mV * 400(first amplifier) * 100(second amplifier) = 4V

With our AD input range is 0 to 10V, we should shift the common voltage in about 5V. With the second amplifier is select in gain 100V/V, the common mode voltage of first amplifier‘s output is adjusted to 50mV. To this requirement, we set the bias voltage to 750mV.

2mV * 400 - 750mV = 50mV
50mV * 100 =5V

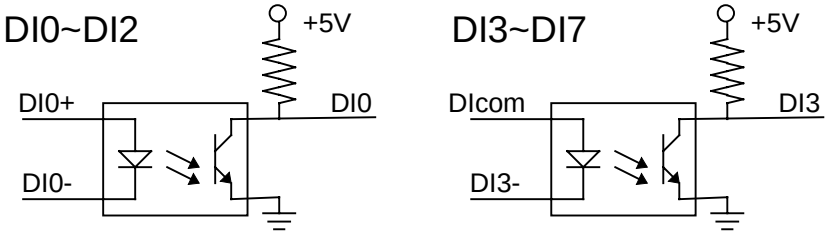
3.3 Why need 2 channels

When we measure force, we often have another analog indicator like position or distance to show the physical change by the force. In such a system, the user can use channel_1 to measure loadcell analog input and use channel 0 to measure the relative indicator.

3.4 Isolated digital input

Programmable digital input mode

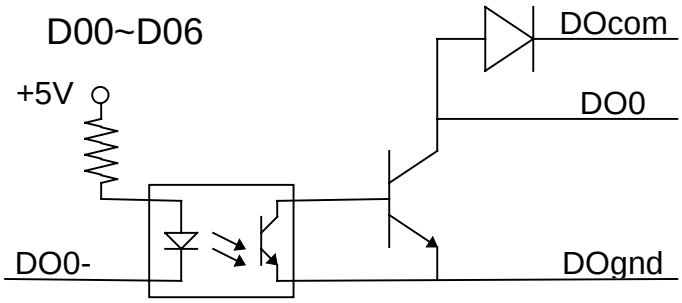
The ISO-LDH/L support 8 isolated digital input. The input signal may from 12 to 30V. These signals are suitable for connect with relay or PLC digital output. The 8 digital input signal may programmable to active high or active low for different input signal. Each input have corresponding latched input with different input mode.

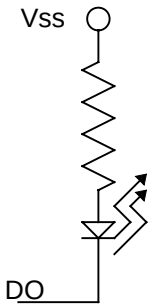


3.5 Isolated digital output

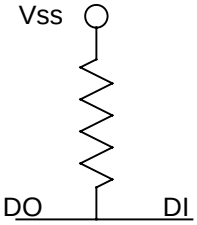
Open collector digital output

The ISO-LDH/L support 7 isolated digital output. These output is open collector. We may use these output to drive LED, relay or other digital input.

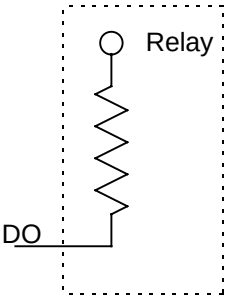




Digital output drive LED
External power source
Vss and external resistor
is needed for drive LED.



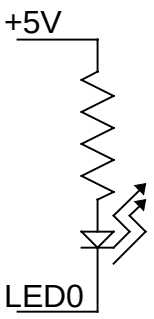
Digital output connect to digital input
External power source
Vss and external resistor
is needed.



Digital output driverelay
Connect relay input node directly. External resistor may cause problem to drive relay.

3.6 TTL/LED indicator diagram

LED0~7



3.7 Diagnostic Program

Refer to “ISO-LD DOS software manual”

3.8 Calibration

Refer to Sec. 1.2.4 first.
The G1 can be from 100 to 10000. Therefore only the “Relative Value” is interesting. The user must perform their calibration based on their G1 setting. In the normal condition, the “Real Value” is not so important as the “Relative Value”.

3.9 Analog Signal Connection

The ISO_AD32 can measure single-ended or differential type analog input signal. Some analog signal can be measured in both of single-end or differential mode but some only can be measured in one of the single-ended or differential mode. The user must decide which mode is suitable for measurement.

In general, there are 3 different analog signal connection method as shown in Fig1 to Fig3. The Fig1 is suitable for grounding source analog input signals. The Fig2 can measure more channels than in the Fig1 but only suitable for large analog input signals. The Fig3 is suitable for thermocouple and the Fig4 is suitable for floating source analog input signals.

Note : In Fig3, the maximum common mode voltage between the analog input source and the AGND is 70Vp-p, so the user must make sure that the input signal is under specification first. If the common mode voltage is over 70Vp-p, the input multiplexer will be damaged forever.

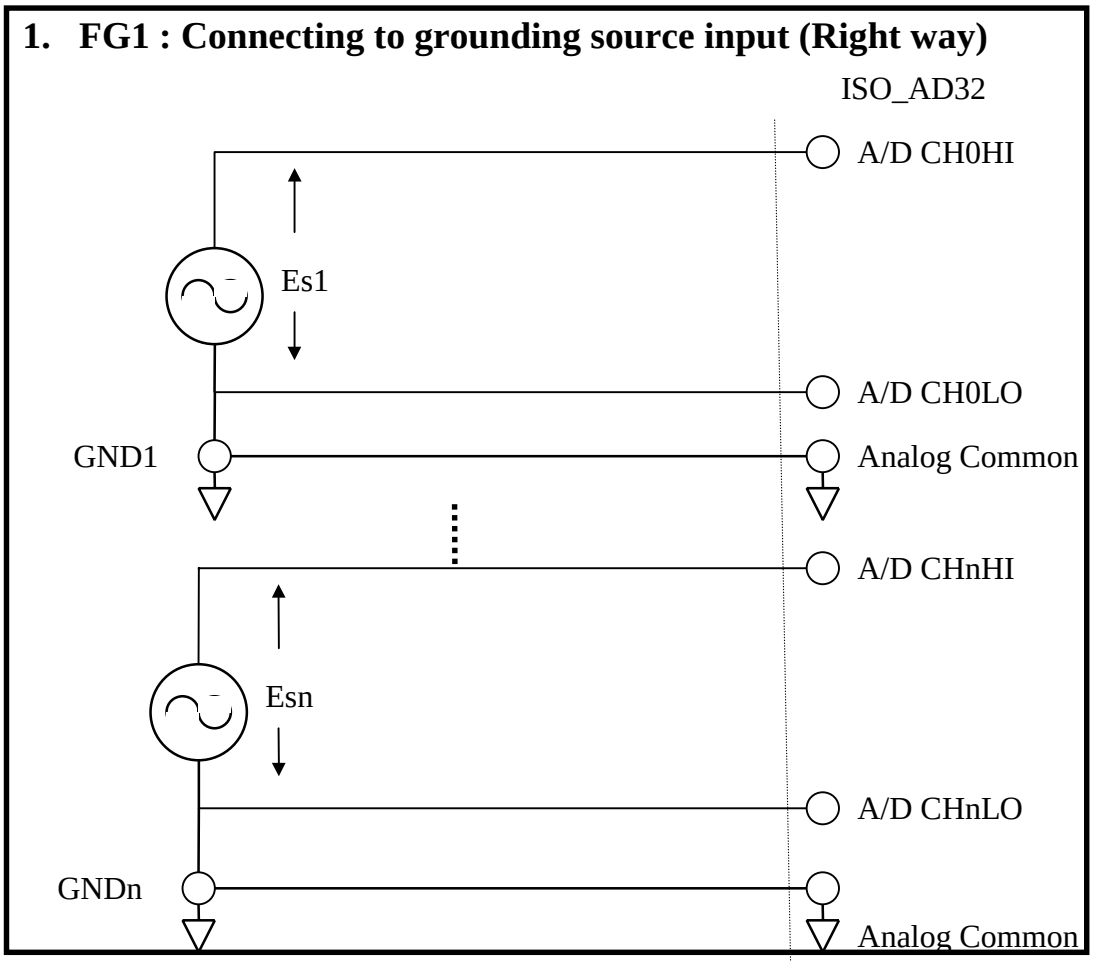
The simple way to select the input signal connection configuration is as below.

1. **Grounding source input signal → select Fig1**
2. **Thermocouple input signal → select Fig3**
3. **Floating source input signal → select Fig4**
4. **If Vin > 0.1V and gain<=10 and need more channels → select Fig2**

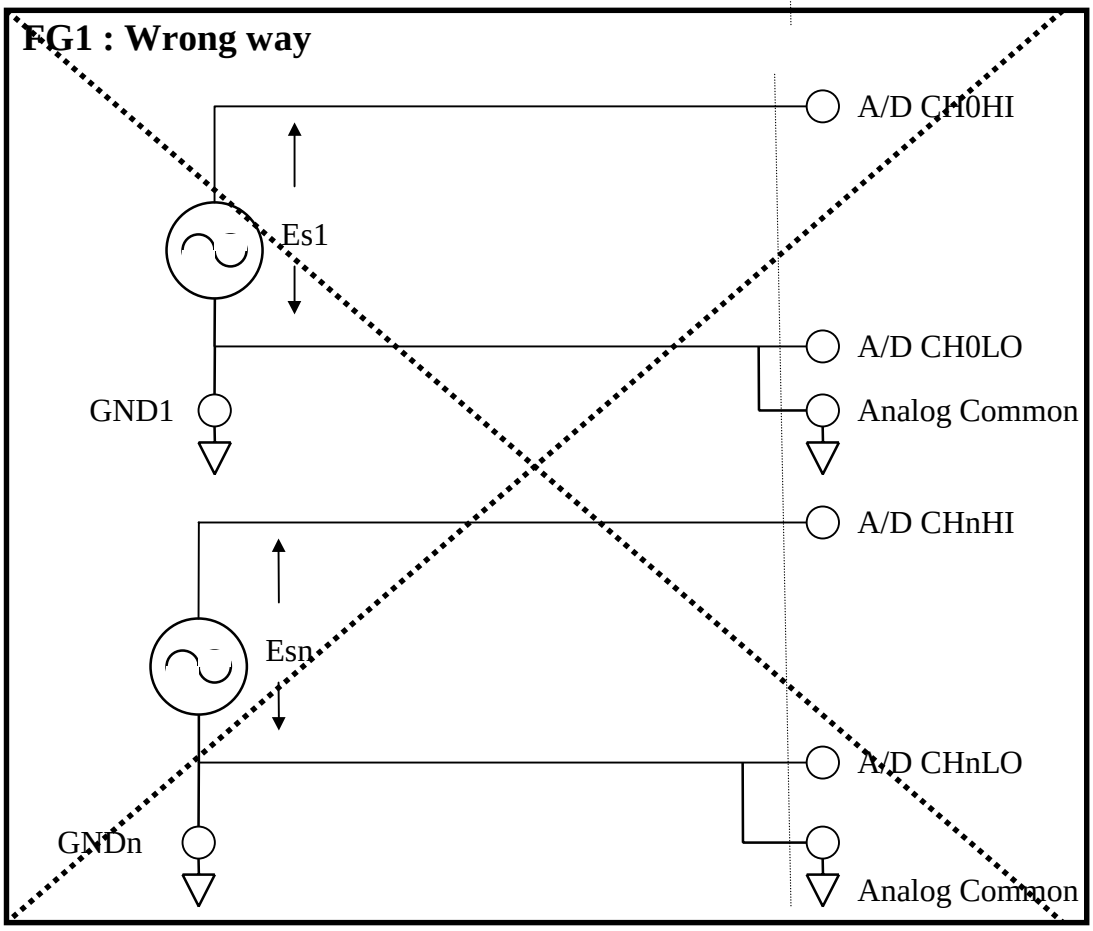
If the user can not make sure the characteristic of input signal, the test steps are given as below:

1. **Step1 : try Fig1 and record the measurement result**
2. **Step2 : try Fig4 and record the measurement result**
3. **Step3 : try Fig2 and record the measurement result**
4. **Compare the measurement result of step1,step2,step3 and select the best one**

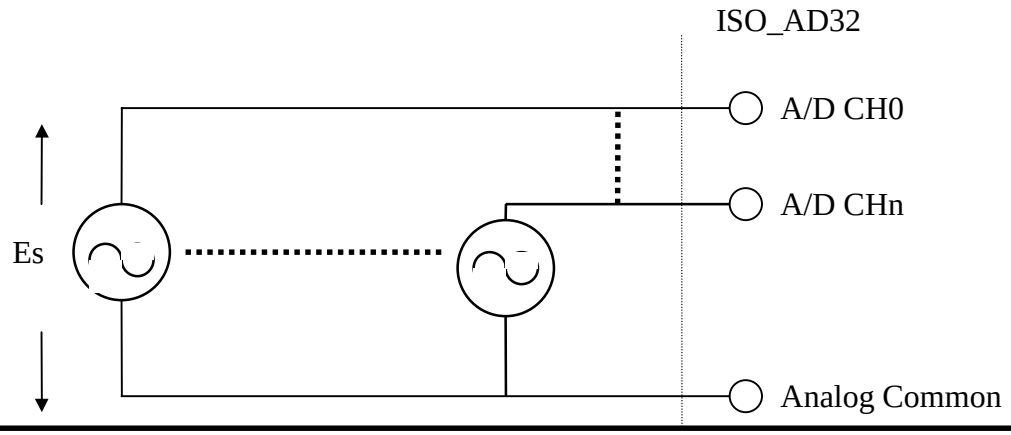
1. FG1 : Connecting to grounding source input (Right way)



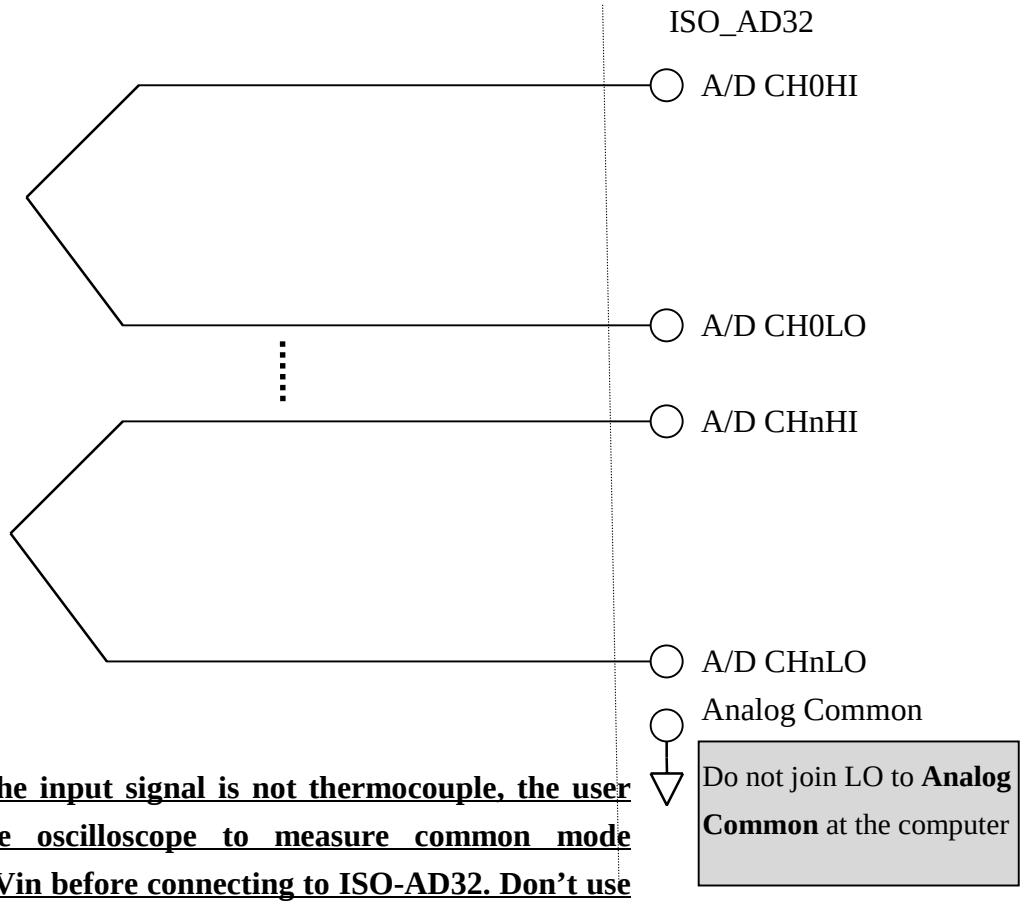
FG1 : Wrong way



FG2 : Connecting to singled-ended input configuration



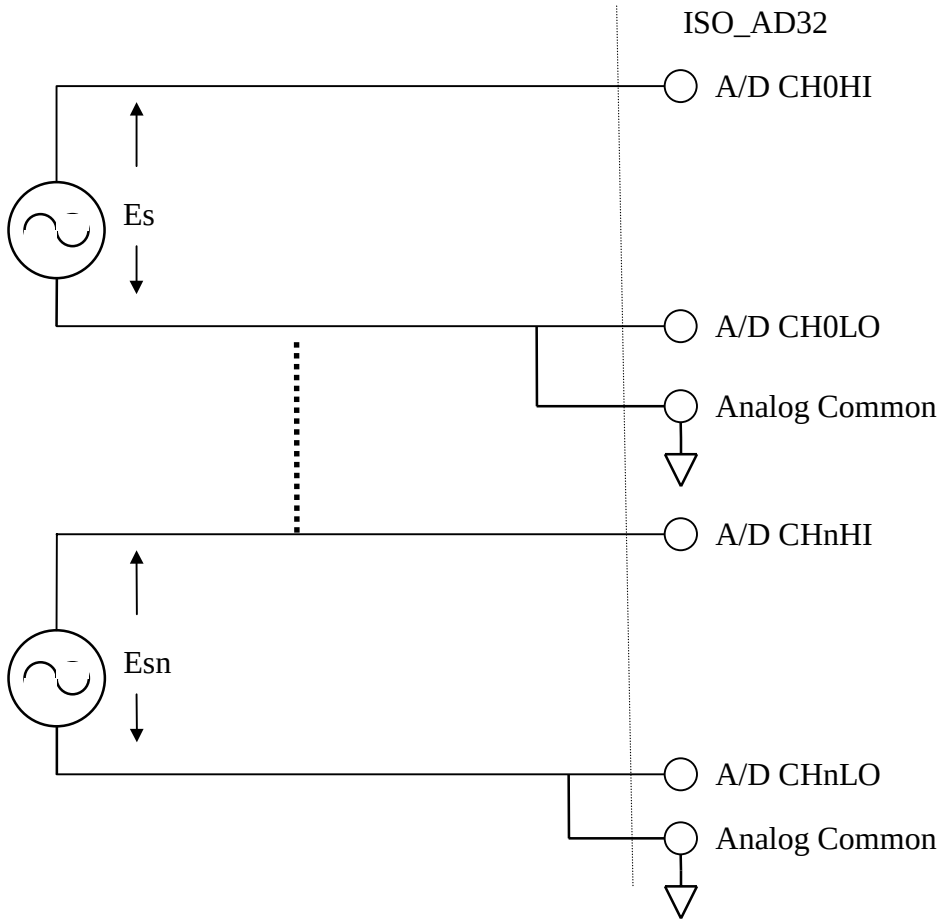
FG3 : connecting to thermocouple configuration



Note : If the input signal is not thermocouple, the user should use oscilloscope to measure common mode voltage of Vin before connecting to ISO-AD32. Don't use voltage meter or multimeter.

CAUTION : In Fig3, the maximum common mode voltage between the analog input source and the AGND is 70Vp-p, so the user must make sure that the input signal is under specification first. If the common mode voltage is over 70Vp-p, the input multiplexer will be damaged forever.

FG4 : connecting to floating source configuration



Signal Shielding

- Signal shielding connections in Fig1 to Fig4 are all the same
- Use single-point connection to **frame ground (not AGND or DGND)**