LCA-460 Strain Amplifier
Signal Conditioner Modules for
Strain Gages, Load Cells, and Transducers

User's Manual

Advance Instrument Inc.
service@advanceinstrument.com
Phone: +886-2-8695 1100 • Fax: +886-2-2693 1460

INSTRUCTION MANUAL
LCA-460 Strain Amplifier Signal Conditioner Modules for Strain Gages, Load Cells, and Transducers

Thank you for purchasing Advance Instrument's product -- LCA-460 Strain Amplifier Signal Conditioner Module. Please read this Instruction Manual carefully in order to make full use of the high performance capabilities of this product. Do not use the product in methods other than described in this manual. Generally, company names and trade names described in this Instruction Manual are trademarks or registered trademarks of the respective companies.

INSTRUCTION MANUAL
LCA-460

SAFETY PRECAUTIONS

This Instruction Manual describes detailed instructions for operating the LCA-460 Strain Amplifier Signal Conditioner Module (hereinafter referred to as the LCA-460 Amplifier).
For safe use of the LCA-460 Amplifier, do not forget to read the “Safety Precautions” prior to use.

Advance Instrument Inc. (also known as AI) assumes no liability for any damages resulting from user's failure to comply with the safety precautions.

Advance Instrument Inc.

Following symbol marks are used in the Instruction Manual.

Improper operation of the system may result in injury of the operator and physical damage of the system.

WARNING

- Power supply.

To prevent a fire hazard, ensure that the power supply voltage specified for the LCA-460 Amplifier matches the local line voltage before turning ON the power.

The power supply voltages are described in the following.

DC model: Power dissipation 3.5 W or less

LCA-460-DC48	48 VDC Powered, 48V (36~75V)
LCA-460-DC24	24 VDC Powered, 24V (18~36V)
LCA-460-DC12	12 VDC Powered, 12V (9~18V)
LCA-460-DC5	5 VDC Powered, 5V (4.5~9V)

AC model: Power dissipation 6.5 VA or less

LCA-460-AC	5~305Vac(47 ~ 63Hz) Powered, AC Current< 80mA

- Power cable and power outlet

The LCA-460 Amplifier does not have POWER switch.
Before connecting power cable to the LCA-460 Amplifier, make sure the distribution board does not supply power to the power cable. Or, electricity shock hazard or damage of the amplifier may occur.

- Protective ground.

To prevent any electric shock hazards, be sure to connect the product to the ground before turning ON the power.
When 2P parallel vinyl wire is used for power cable, always connect the GND terminal with a separate ground wire.

- Confirmation of protective functions.

When any trouble occurs in protective functions including the GND terminal and a fuse, do not operate the amplifier to prevent electric shock hazards. Furthermore, before operating the amplifier, always check whether error exists or not in protective functions.

- Fuse.

When the Power lamp does not light up, check the power source.
All models are designed with resettable fuse (fuse replacements are not required.)

- Storage and usage in gases.

Do not use/store the LCA-460 Amplifier in flammable gases, explosive gases, or vapor. Using the LCA-460 Amplifier under the above environment is too risky.

- External connection.

To prevent electric shock hazards, be sure to connect the Earth terminal to the ground before connecting the object to be measured and external control circuit to the amplifier.

CAUTION

- Power supply.

Use the LCA-460 Amplifier only within the specified power voltage.
The LCA-460 Amplifier has 5 types: 5 VDC, 12 VDC, 24 VDC, 48 VDC and 85~305 VAC (47 ~ 63Hz)

PRECAUTIONS FOR USE

- Noise.

Take countermeasures against noise when the input cable (between transducers and LCA-460 Amplifier) is placed near the power lines, transformers, electrical tools, motors, Walkie-talkies, etc.

- Do not use the LCA-460 Amplifier in strong electromagnetic field.

Performance may be lowered and erroneous operation and troubles may result if it is used near a telemetry system, microwave oven, electronic furnace or any other equipment generating a strong magnetic field.

- Avoid installing sensors and LCA-460 Amplifier near a welding machine.

Failure to do so will pose the risk of erroneous data, malfunction and failure.

- Do not disassemble or remodel the LCA-460 Amplifier.

It may cause electric shock hazards or damage to LCA-460 Amplifier. This warranty does not cover any damage or defective parts that result from disassembling or remodeling of the amplifier.

- Output signal (voltage/current) when the transducer cable is broken.

When the transducer cable is broken, the LCA-460 Amplifier may output the following output signal (voltage/current). Therefore, take countermeasures to avoid the adverse effect, from the output signals, on the other measuring instruments.
Output voltage: Around 13 V
Output current: Around 0m A

- Output signal (voltage/current) and unbalance load

Output voltage: Unbalance load should be 2k ohm or more.
Output current: Unbalance load should be 500 ohm or less.

- Operating environment.

Use the LCA-460 Amplifier within temperature ranging from -10 to 50℃ and within humidity ranging from 20 to 85%RH.
Do not use LCA-460 Amplifier under environment with excessive vibration or high impact, under dusty environment, and under humid place. Or, it may lower the performance and cause troubles.

- Cleaning.

Clean the LCA-460 Amplifier with a dry soft cloth when it gets dirty. If dust exists inside the LCA-460 Amplifier, clean it by using an air blowgun. Do not touch the electronic parts.

Limited life parts and preventive maintenance.
The LCA-460 Amplifier consists of various electronic components and those components, if not all, have a limited life span. Using them in exceeding the years of specified useful life according to each part type may affect the characteristics of the LCA-460 Amplifier, resulting in a malfunction or a failure. Replacing parts with a regular preventive maintenance schedule is strongly advise.

Limited life parts used with the LCA-460 Amplifier are as follows.

- Aluminum electrolytic capacitor.
  The signal-noise ratio will lower due to capacity low or smoke emitted due to liquid leak, resulting in a malfunction of the LCA-460 Amplifier.

LCA-460 Amplifier replacement before the end of service life.

- Preventive maintenance and replacement parts are a cost-effective way of keeping the performance and extending the service life of the LCA-460 Amplifier. Regardless of the replacement parts, the LCA-460 Amplifier itself gradually deteriorates with age. Before the expected service life is reached, consider replacing the LCA-460 Amplifier with a new one or the latest series as preventive maintenance.

Precautions on CE marking.

- Be sure to mount the LCA-460 Amplifier on the control panel, etc. Before turning ON the power, make sure the LCA-460 Amplifier is covered to avoid contact with hands.
- The LCA-460 Amplifier connection; jumper changing; BAL/CAL switch operation; adjuster operations; and fuse replacement should be executed by experts in electrical work.
- To immediately turn OFF the LCA-460 Amplifier, place switches or circuit breakers inside the building and near the LCA-460 and display the functions as well. Use switches and circuit breakers conforming to the IEC60947-1 and IEC60947-3.
- Use the LCA-460 Amplifier in area where elevation is 2000 m or below.
- When mounting the LCA-460 in your system, approaches to satisfy the CE marking requirements vary with the configuration of the control panel to be used, the other devices to be connected, and wirings. Therefore, customers are required to check whether the CE marking requirements on the systems are satisfied or not.
- Use shielded cables as input cables, output cables and control cables.

Outline.
The LCA-460 Amplifier is a DIN rail mounting modularize amplifier that is, by connecting to strain gauge type transducer, designed to measure load; pressure; torque; accelerometer and displacement in physical values.
It is provided with only a few portions for adjustment enabling easy handling.
It has voltage and current output connector to be connected to various DVM, recorders and data acquisition device.

Function.

- ZERO balance.
  The LCA-460 Amplifier has a manual balance model.
- The LCA-460 Amplifier is able to change excitation voltage; output signal (voltage/current); span; calibration value (Cal SW) and frequency response.
- The LCA-460 Amplifier is able to change characteristics by using DIP-switches.

Standard accessories.
The following accessories are packed with the LCA-460 Amplifier. When unpacking, check the contents to ensure that all accessories are enclosed.

- Instruction Manual and Warranty

NOTE: A power cable is not included in the accessories. Customers are required to purchase the power cable applied for the power supply specifications.

Optional accessories.
LCA-PAC: AC power cable for 85~305 VAC
LCA-PDC: DC power cable for 5~48 DC

Model (Types).
The LCA-460 Amplifier series has 5 models. Customers are required to purchase the power cable applied for the specific power supply specifications.

Model	Power supply specs
LCA-460-AC	85~305 VAC (47 ~ 63Hz)
LCA-460-DC5	5 VDC Powered, 5V (4.5~9V)
LCA-460-DC12	12 VDC Powered, 12V (9~18V)
LCA-460-DC24	24 VDC Powered, 24V (18~36V)
LCA-460-DC48	48 VDC Powered, 48V (36~75V)

1. SPECIFICATIONS

LCA-460 Strain Amplifier Signal Conditioner Module is ideal for applications wherein high performance signal conditioning is needed, and critical space limitation is also to be considered. LCA-460 Amplifier is designed for high accuracy strain measurement. Each module is designed with maximum frequency response at 2 kHz.
The application examples for the measuring strain gage type transducer are for the temperature, accelerator, load cell, micro-displacement, torque and pressure transducers.

Features:
▪ Single channel signal conditioner
▪ Highly accurate bridge excitation 2.5VDC~15VDC, 150mA
▪ Precision four wire bridge excitation remote sense function
▪ Input range 0.625mV~640mV
▪ Provides high-level voltage or 20mA signal output
▪ Output Mode: ±10V, ±5V, 0~10V, 0~5V, 0~20mA, 4~20mA
▪ Four to eight transducer wiring
▪ Internally adjustable fine gain (AV)
▪ Precision low noise differential amplifier
▪ Max frequency response: 2 kHz
▪ Selectable low-pass active 4-pole Butterworth filter 3, 20, 200, 2k Hz standard
▪ Balance ± 100%
▪ Internal and external bridge shunt-calibration resistor function
▪ DIN Rail or Screw fixed
▪ Power option: 85~305 VAC, or 1600 Volts Isolation Between Input, Output and Power Supply on DC-Powered Models

Applications:
Load Cell Signal Conditioning
Foil Strain Gage Signal Conditioning
Semiconductor Strain Gage Signal Conditioning
Dynamic Material Test
Strain/Stress Analysis
Dynamic Material Elasticity Testing

Specification:
- Input

▪ Input Impedance: 10 GΩ, 2 PF
▪ Input Current: 2 nA

- Excitation

▪ Mode : Constance Voltage 2.5~15 VDC, max 150mA
▪ Precision four wire bridge excitation remote sense function
▪ Noise: 100 μV ± 0.002% Vpp
▪ Load Regulation: ± 200 μV, ± 0.01%

- Amplifier

▪ Eight Input range from 0.625 to 640 mV selectable by DIP-switch
▪ Fine Input range regulation via potentiometer

▪ Frequency Response
- DC to 2 kHz; -3 (± 0.2 dB) at all gain settings

▪ Noise: 350 Ω source impedance, DC coupled
▪ Referred-to-Input (RTI):
10 Hz 5 μV-pp
100 Hz 22 nV
1 kHz 18 nV
▪ CMR (Common-Mode Rejection):
- Ration DC to 60 Hz

- Balance Range

▪ Coarse balance: ± 100% adjust via potentiometer
▪ Fine balance: ± 2% adjust via potentiometer

- Output Mode:

▪ ±10V, ±5V, 0~10V, 0~5V, Uni-polar to 20mA, Bi-polar to 20mA selection by dip switch

- Output

▪ Output load: 2 kΩ min. resistance
▪ Wide Bandwidth: DC to 2 kHz, - 3 dB nominal
▪ Output noise: Less than 400 μVRMS at 400 μV/με output level

- Calibration

▪ Internal bi-polar shunt calibration resistors
(175k as 0.5mV/V @Ro=350, 87.3k /1.0mV/V @Ro=350) are provided across switch
▪ External bi-polar shunt calibration resistors are provided across switch

- Filter

▪ Low-pass active 4-pole Butterworth filter 3, 20, 200, 2k Hz standard
▪ Selectable by DIP-switch

- Size & Weight

▪ Whole unit case 102 x 81 x 35mm; 125g

- Operational Environment

▪ Operation temperature: -10°C ~ 50°C
▪ Storage temperature: -20°C ~ 60°C
▪ Humidity: 20 to 85% RH, non-condensing

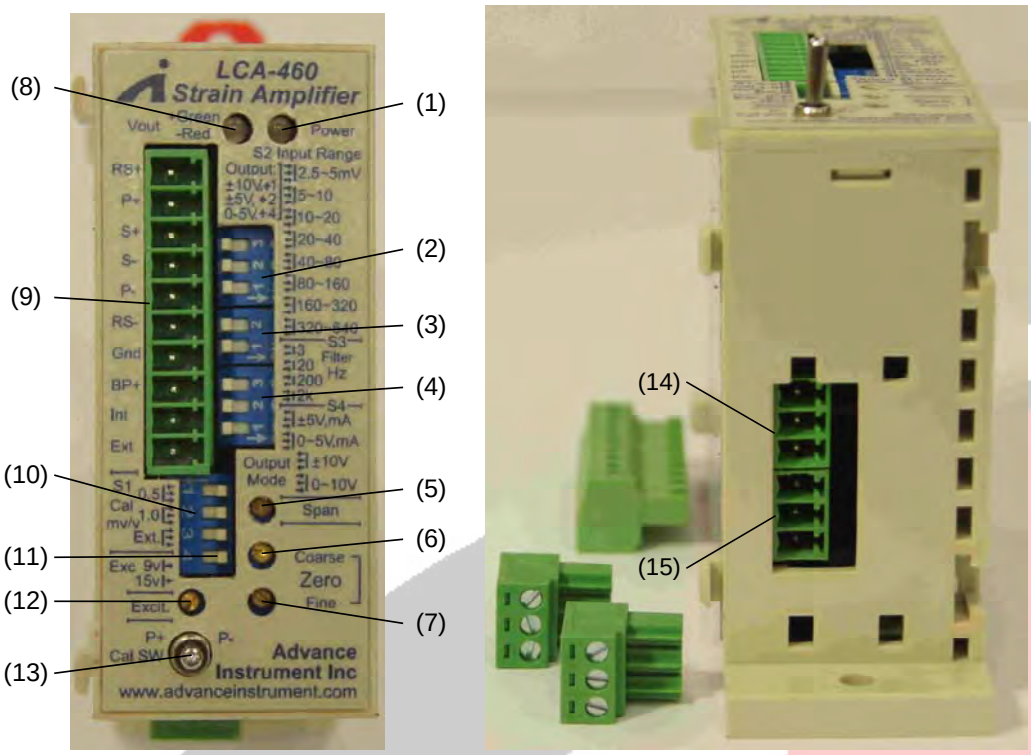
- Order Code:

LCA-460-AC	85~305VAC Powered, 47 ~ 63Hz
LCA-460-DC5	5 VDC Powered, 5V (4.5~9V)
LCA-460-DC12	12 VDC Powered, 12V (9~18V)
LCA-460-DC24	24 VDC Powered, 24V (18~36V)
LCA-460-DC48	48 VDC Powered, 48V (36~75V)

2. CONTROLS, INDICATORS AND CONNECTOR

2-1 CONTROLS AND INDICATORS

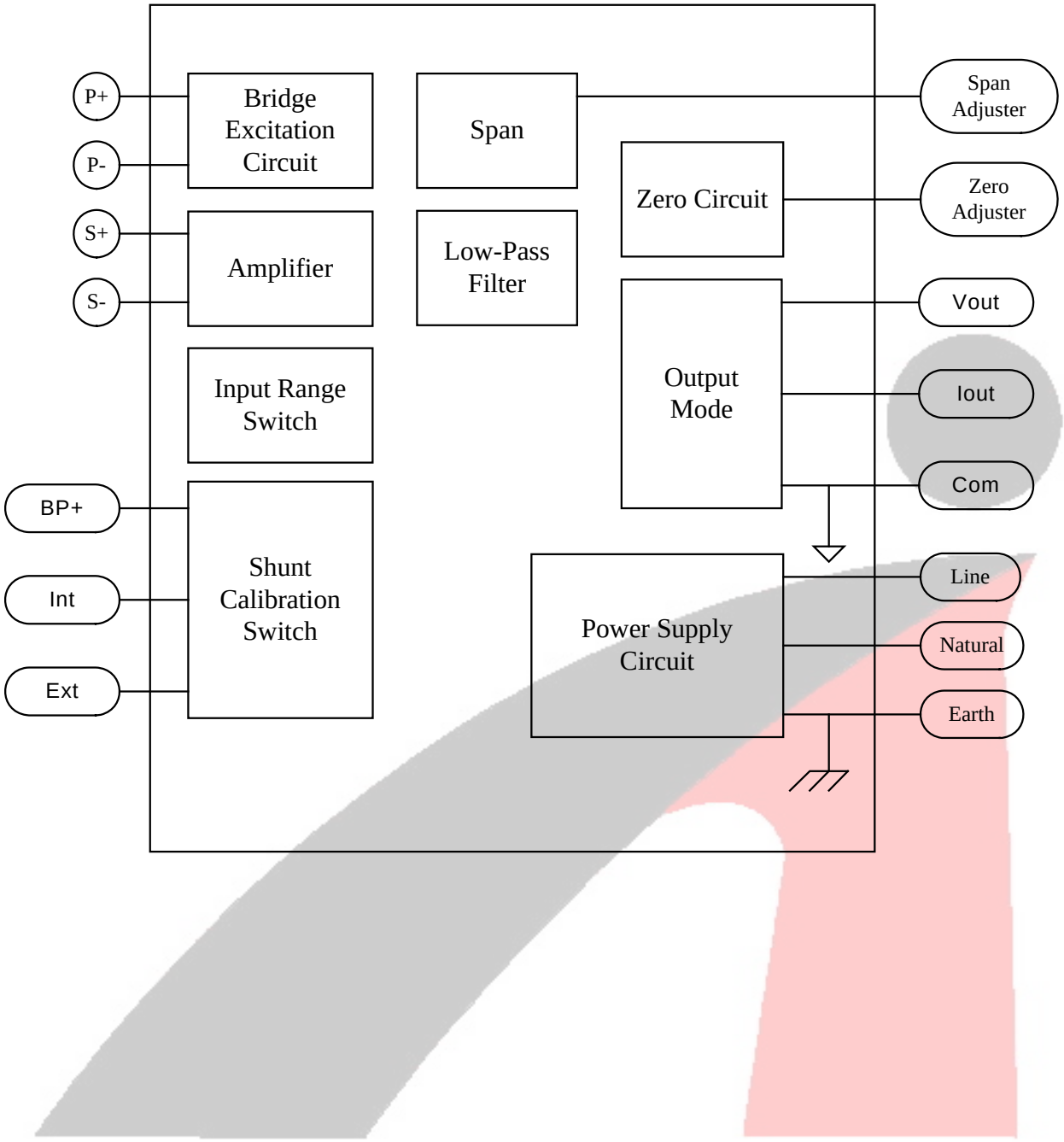
- Front Panel Bottom Panel



Front Panel	
(1) Power	Power Indicator
(2) S2 Input Range	Amplifier Input Voltage Range Setting DIP-Switch
(3) S3 Filter	Output Filter Setting DIP-Switch
(4) S4 Output Mode	Voltage and Current Output Mode Setting DIP-Switch
(5) Span	Gain Fine Adjuster
(6) Zero Coarse	Output Zero Coarse Adjuster
(7) Zero Fine	Output Zero Fine Adjuster
(8) Vout	Output Zero Voltage Indicator
(9) Input	Transducer Input Connector (Pluggable)
(10) S1 Cal mv/v	Shunt Calibration Resistance Setting DIP Switch
(11) Exc	Transducer Excitation Voltage Setting DIP Switch
(12) Excit.	Transducer Excitation Voltage Fine Adjusting Potentiometer
(13) Cal SW	Calibration Switch for Span adjuster

Bottom Panel	
(14) V/I Output	Voltage and Current Output Connector (Pluggable)
(15) Power Input	Power Supply Input Connector (Pluggable)

2-2 BLOCK DIAGRAM



2-3 CONNECTORS WITH PIN ASSIGNMENT

This section describes pin assignment of connectors.

- Power Supply Input Connector

Pow (Power Supply Input Connector) : AC Model	
Pin Signal Name	Signal Details
Line	AC Power Line: 85~305Vac(47 ~ 63Hz)
Natural	AC Power Natural: 85~305Vac(47 ~ 63Hz)
Ear	Earth
Applicable Plug Part Number: AHD-516H-03P	

Pow (Power Supply Input Connector): DC Model	
Pin Signal Name	Signal Details
Vdc +	DC Power Supply: Vdc +
Vdc -	DC Power Supply: Vdc -
Ear	Earth
Applicable Plug Part Number: AHD-516H-03P	

- Transducer Input Connector

Inp (Transducer Input Connector)	
Pin Signal Name	Signal Details
RS+	Bridge excitation remote sense + side
P+	Bridge excitation + side
S+	Bridge output + side
S-	Bridge output – side
P-	Bridge excitation – side
RS-	Bridge excitation remote sense – side
Shi	Shield wire
BP+	Internal Calibration Bridge excitation + side
Int	Internal Shunt Calibration Resistance side
Ext	External Shunt Calibration Resistance side
Applicable Plug Part Number: AEC350V-10P	

- Output Connector

V/I Out (Output Connector)	
Pin Signal Name	Signal Details
Vout	Positive side of the voltage output（±10 V ）
Iout	Positive side of the current output (4 ~20mA)
Out-	Negative side of the voltage output/current output (the same potential as the COM)
Applicable Plug Part Number: AHD-516H-03P	

3. CONNECTION

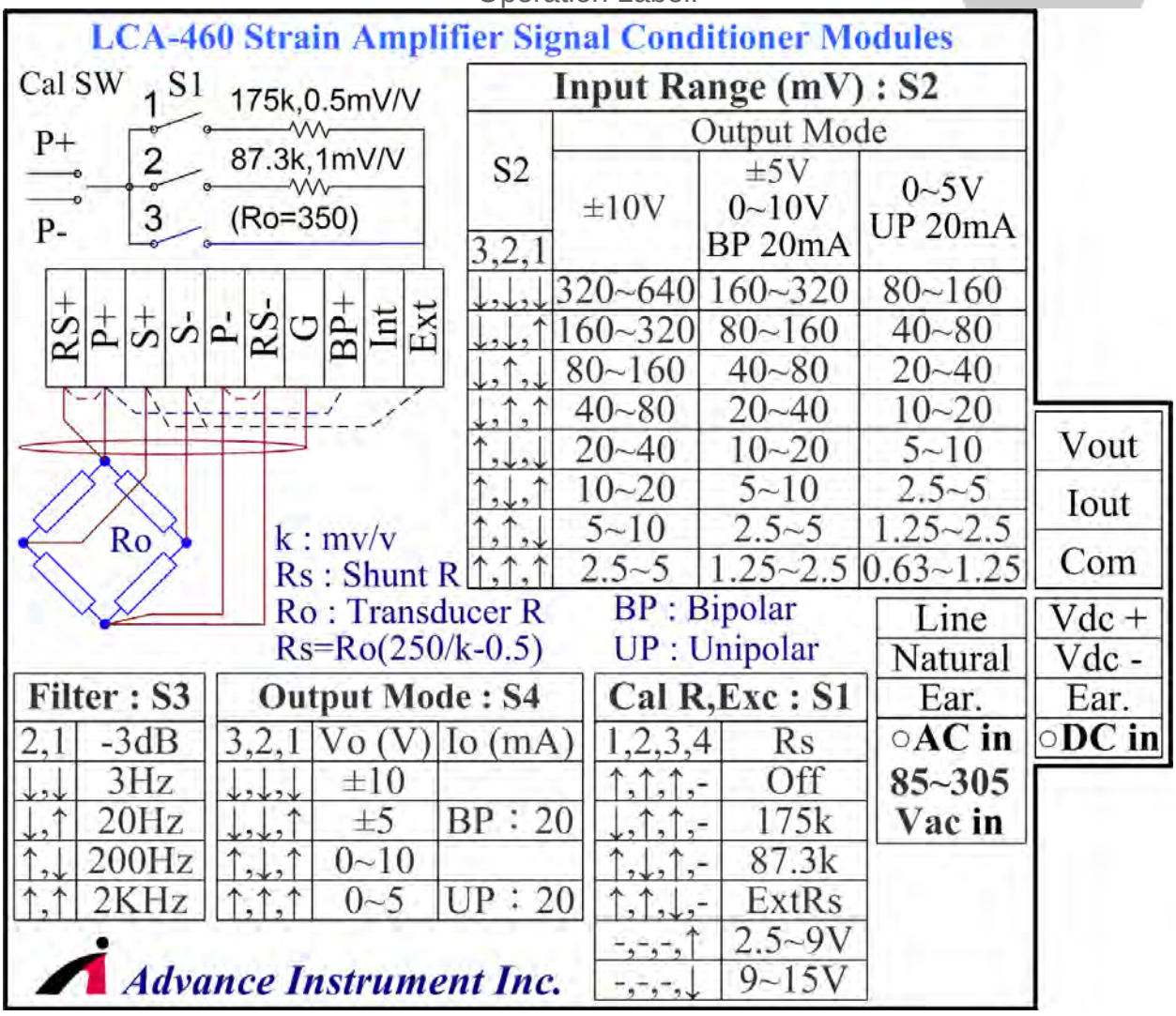
The LCA-460 Amplifier does not include cables since the device is an amplifier designed to be used in a system.

Configuration component of the LCA-460 Amplifier is described in the following.

1) LCA-460 Strain Amplifier Signal Conditioner Module for Transducer Amplifier 1

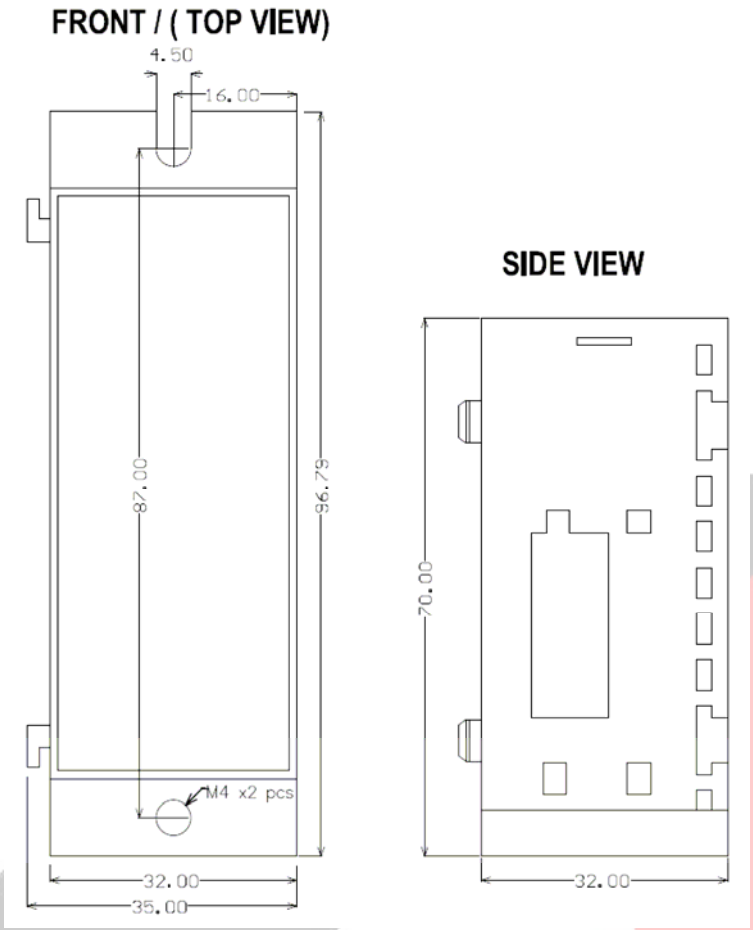
2) Submitted Document
Instruction Manual (Include Warranty)……1

Operation Label:

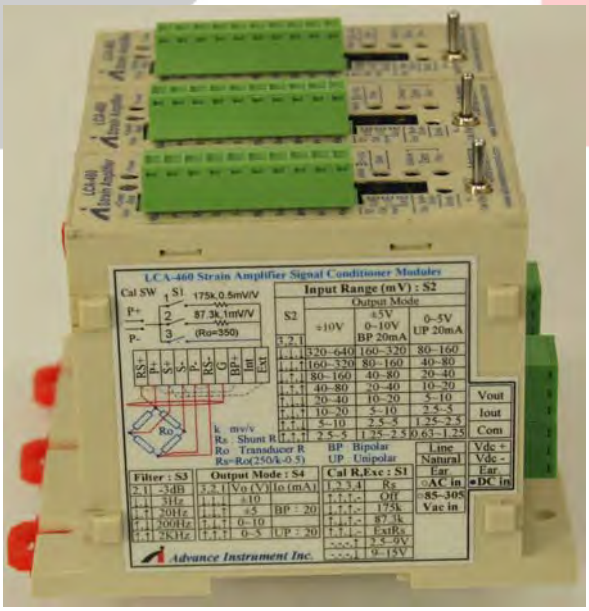


3-1 TO FIX THE LCA-460 AMPLIFIER

The LCA-460 Amplifier is able to be mount by using 2x M4 screw on the fitting base plate.
The LCA-460 Amplifier is able to mount on the DIN rail directed.



Unit: mm



3-2 TO CONNECT POWER SUPPLY

(1) For 100 VAC model/200 VAC model/240 VAC model

- AC power cable for 85~305 VAC: LCA-460-PAC
- To use the other cables, use European-style terminals for copper wire.
- Connect the following power supply to the power supply input connector.
  VAC: 85~305Vac(47 ~ 63Hz), 60 mA or more
- The withstand voltage of the cable should be the power supply voltage or more.
- After completing wirings to the connector, plug in the connector to the socket back.

(2) For DC power supply model

- Use cables having the European-style terminals for copper wire.
- Connect the power supply, to the power supply input connector.
- The withstand voltage of the cable should be the power supply voltage or more.
- After completing wirings to the connector, plug in the connector to the socket back.

WARNING

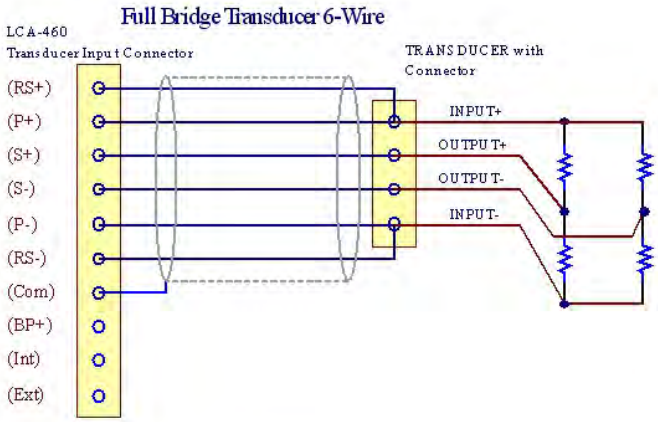
- Do not use the AC power cable (LCA-460-PAC) on the DC models.
- Do not connect the AC power supply to the DC models. Or, it may cause trouble.

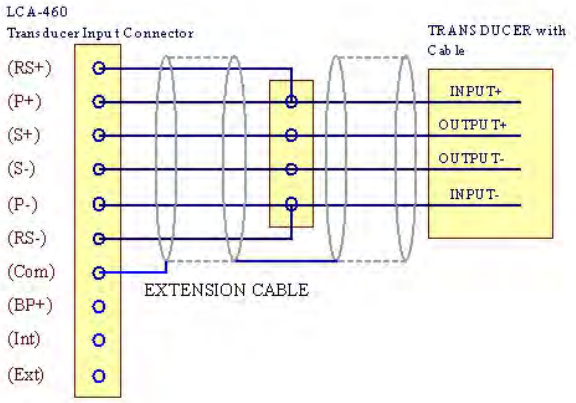
3-3 TO CONNECT TRANSDUCERS

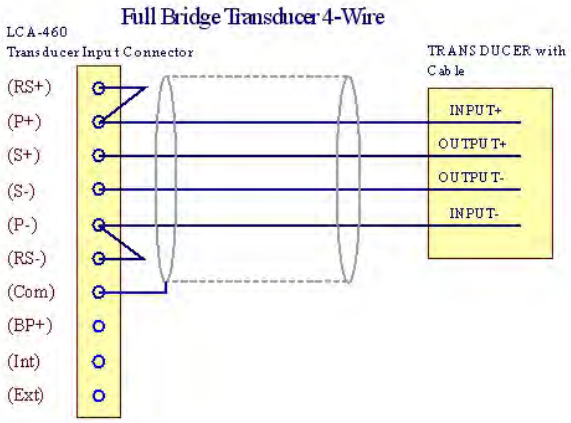
Connecting Input Connector

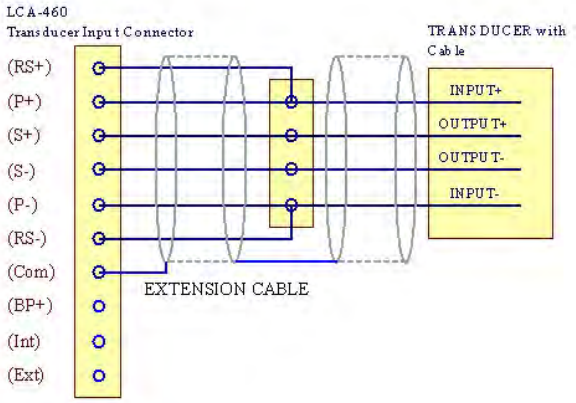
Input connector on the front panel of the LCA-460 Amplifier is a 10-pin connector. Connect a strain gage transducer with 10-pin plug to the LCA-460 Amplifier.

When constructing a Wheatstone bridge with a strain gage transducer connect to each plug pin by referring to the following figure.









3-4 TO CONNECT OUTPUT

The LCA-460 Amplifier has Voltage and Current Output. The LCA-460 Amplifier voltage and current output is proportional to the transducer output. When connecting a voltmeter or recorder, connect a voltage and current output cable to the Voltage and Current Output connector.

Connect the transducers to the Power supply input connector, then turn ON the transducers at last.

- Securely connect the transducers to the transducer input connector. Or, it may cause troubles.
- The LCA-460 Amplifier is able to amplifies the minute electrical signals to output the output signal (±10V or 4 to 20mA).

The LCA-460 Amplifier also amplifies small noises.
When using the LCA-460 Amplifier in noisy areas, take the following countermeasures against noise.

- Keep shielded input cables as short as possible.
- When input cables and power line are crossing each other or are running in parallel, use conduit pipes and/or tubes.
- The Output connectors are as follows.

Connector Pin
Vout : Positive side of the voltage output（±10 V ）
Iout : Positive side of the current output（ 4 to 20 mA）
Com : Negative side of the voltage output/current output (the same potential as the output -).

- Output signal (voltage): The output load should be 2k ohm or more.
  Output signal (current): The output load should be 500 ohm or less.
- Take countermeasures against noise when in outdoors or when in noisy areas due to motors, etc.

4. OPERATION PROCEDURES

(a) Make sure all wires are correctly connected before turning ON the power.
The Power lamp lights up. Preheat the LCA-460 Amplifier for approximately 30 minutes.

(b) Initialize the load or weight of the transducer. (Normally, no load is applied or weight is 0.)

(c) Turn the Span adjuster all the way to the right. Adjust the output signal (voltage) to be 0 V (current: 4mA), by turning the ZERO coarse adjuster and ZERO fine adjuster.

(d-1) Actual load calibration
Apply the actual (known) load or weight to the transducers. Adjust the output signal (voltage/current) to the proper value, by turning the Span adjuster.

(d-2) Span adjustment based on the CAL
When the Actual Load Calibration is not available, use the Cal SW. Adjust the output signal (voltage/current) to the proper value, by turning the SPAN adjuster with the ZERO adjuster. (For details, see “4-5 TO ADJUST SPAN”)

4-1 TO TURN ON THE POWER

Although the LCA-460 will be in operating state immediately after turning ON the power, we recommend you to preheat the LCA-460 30 minutes for stable measurements.

4-2 TO ADJUST THE EXCITATION VOLTAGE

Excitation voltage is provided to allow users selecting bridge excitation voltage at their discretions by the excitation Setting DIP-Switch and the Fine Adjusting Potentiometer
(11) Exc: ……..... Transducer Excitation Voltage Setting DIP-Switch
(12) Excit.: …….. Transducer Excitation Voltage Fine Adjusting Potentiometer

- Select Excitation Voltage Range by the “(11) Exc: Transducer Excitation Voltage Setting DIP-Switch”.

[Exc :S2] , [S2, x x x 4] , [x x x ↑] : Transducer Excitation Voltage 2.5~9Vdc
[Exc :S2] , [S2, x x x 4] , [x x x ↓] : Transducer Excitation Voltage 9~15Vdc
Note : “x” don’t care

- Adjust the value on the digital DC voltmeter, connected to the Input connector (RS+ and RS-), by turning the “(12) Excit.: Transducer Excitation Voltage Fine Adjusting Potentiometer”.

Usually, manufacturers specify bridge excitations when they manufacture commercial transducers. If the transducer is provided with metallic (foil) gage, the specified bridge

excitation usually means the maximum excitation voltage that can be used until whatever form of excitation reaches its “maximum value”. Under the normal circumstance, transducers function steadily and maintain a satisfactory signal-to-noise ratio when 50% to 75% of maximum values are in use. If semiconductor transducer (Piezo-resistor) is in use, users should comply with the designated excitation procedure and thereby allowing the semiconductor transducer to function in the same way as stated in the catalogue.

LCA-460 Amplifier provides semi-floating type excitation. The excitation voltage symmetries with the circuit system (at 5V, P+ set as +2.5V, P- set as -2.5V) and thereby maintaining the excitation accuracy within ± 2mV after selection.

4-3 TO SETTTING INPUT RANGE AND OUTPUT MODE

Usually, manufacturers specify bridge output sensitivity (mV/V @ Full Load) when they manufacture commercial transducers.
Calculate the load transducer's true output by using the recommend excitation voltage.
Transducer's output = sensitivity (mV/V) x Excitation Voltage

[Example 4-3-1]
Load cell Rated capacity: 1kN
Load cell Calibrated Rated output: 1.95 mV/V, +/- 0.1%
Recommend excitation voltage: 10V
Transducer's output = 1.95 (mV/V) x 10 (V)=19.5 mV

Output Mode +/-5V : [Input Range (mV):S2] , [S2, 3 2 1] , [↑ ↓ ↓]

Select Output Mode Match your DAS or Recorder, Select Input range by Transducer's output (mV) as follow:

Input Range (mV) : S2			
S2	Output Mode		
3,2,1	±10V	±5V 0~10V BP 20mA	0~5V UP 20mA
↓,↓,↓	320~640	160~320	80~160
↓,↓,↑	160~320	80~160	40~80
↓,↑,↓	80~160	40~80	20~40
↓,↑,↑	40~80	20~40	10~20
↑,↓,↓	20~40	10~20	5~10
↑,↓,↑	10~20	5~10	2.5~5
↑,↑,↓	5~10	2.5~5	1.25~2.5
↑,↑,↑	2.5~5	1.25~2.5	0.63~1.25

4-4 TO ADJUST THE ZERO

Connect the digital DC voltmeter to the Output terminal (Vout and OUT-).

- Make sure no load is applied to the transducers (weight: 0).
- Turn the Span adjuster all the way to the right.
- Execute the ZERO adjustment.

Adjust the value on the digital voltmeter to be 0 V, by turning the ZERO coarse adjuster and ZERO fine adjuster.

NOTE:
The above procedures indicate how to adjust the ZERO by using the output signal (voltage).
The LCA-460 Amplifier is also able to adjust the ZERO by using the output signal (current).
The output signals (current: 4 to 20 mA) move in tandem with the voltage output signals.

4-5 TO ADJUST THE SPAN

Following are the ways to adjust the span:
BY THE ACTUAL LOAD CALIBRATION
BY SHUNT CALIBRATION
BY THE INTERNAL mV/V CALIBRATOR
BY THE TRANSDUCER MANUFACTURER'S CALIBRATION RESISTANCE
BY THE INTERNAL SHUNT RESISTANCE
BY THE EXTERNAL SHUNT CALIBRATION

4-5-1 BY THE ACTUAL LOAD CALIBRATION

Apply the actual (known) load or weight to the transducers. Adjust the value on the digital voltmeter, connected to the Output connector (Vout / Iout and Com), by turning the Span adjuster.

[Example 4-5-1-1] Actual load calibration 1
Load cell Rated capacity: 1kN
Load cell Normal Rated output: 2 mV/V, +/- 10%
Recommend excitation voltage: 10V
Transducer's Normal output = 2 (mV/V) x 10 (V)=20 mV, +/- 10%

Output Mode +/-10V : [Input Range (mV):S2] , [S2, 3 2 1] , [On, Off, On]

First, with the no load applied, turn the Sensitivity adjuster all the way to the right to execute the zero (balance) adjustment.
Then, with the weight (1kN) applied to the load cell, adjust the output signal to be 10.00 V for reading the weight directly.
Suppose the LCA-460 Amplifier outputs 10.00 V when applying the weight (1kN).
When the LCA-460 Amplifier outputs 8.00V, the applied weight is 0.8kN.

[Example 4-5-1-2] Actual load calibration 2
Load cell Rated capacity: 1kN
Load cell Normal Rated output: 2 mV/V, +/- 10%
Recommend excitation voltage: 10V
Transducer's Normal output = 2 (mV/V) x 10 (V)=20 mV, +/- 10%

Output Mode +/-5V : [Input Range (mV):S2] , [S2, 3 2 1] , [On, Off, Off]

Assuming 5 V output signal is required when 1kN is loaded. When applying the weight (0.8kN), the output signal (voltage, V) is as follows.
Output =0.8×5/1= 4 (V)

First, with the no load applied, turn the Span adjuster all the way to the right to execute the ZERO adjustment.
Then, adjust the output signal to be 4.00 V when applying the weight (0.8kN).
Be sure to use the weight near the maximum weighing capacity. Or, the precision of measurements will be decreased.

4-5-2 BY SHUNT CALIBRATION

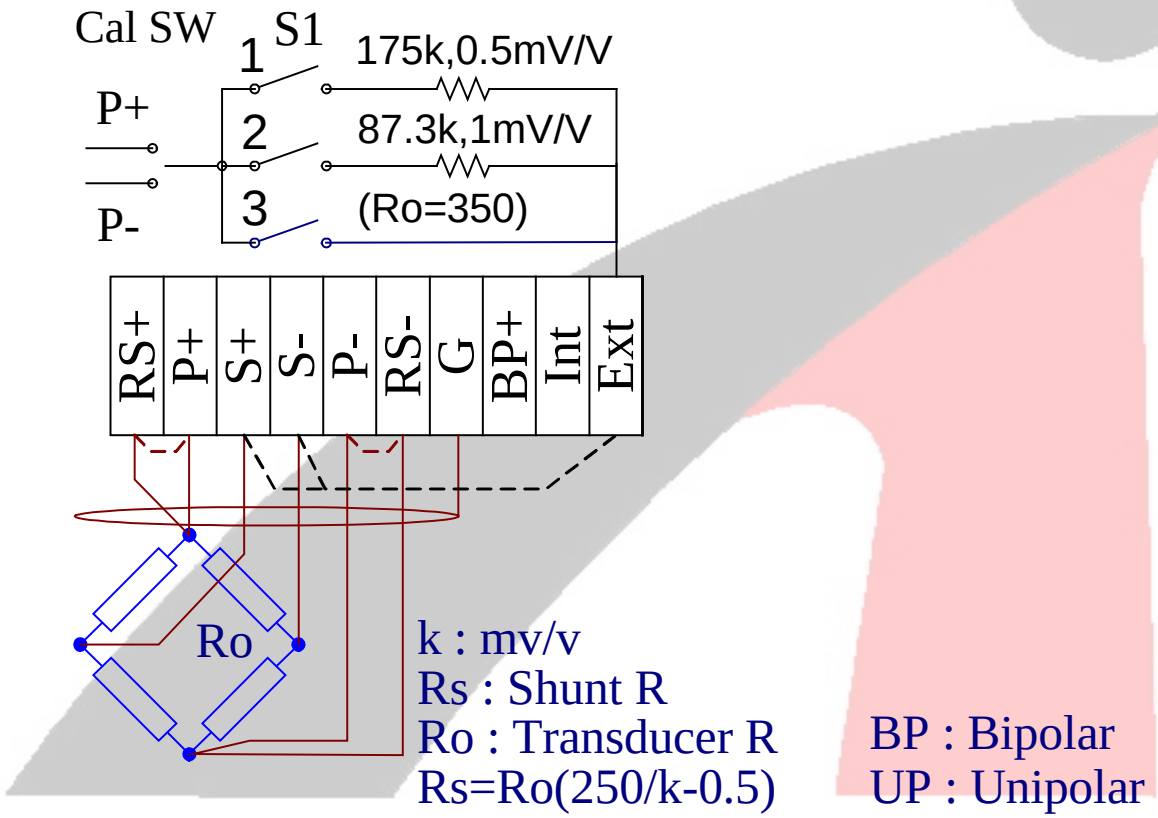
LCA-460 Amplifier is provided with Wheatstone bridge to determine system gains. Shunt calibration is a powerful and indispensable technique in this connection.

Usually, an input bridge arm is shunted with a specified resistor that triggers the arm to produce a specified resistance variation (the variation is designed to simulate the variation occurring to the transducer). Thus, users may read the amplifier's output voltage variation and thereby find out the system sensitivity.

- LCA-460 Amplifier SHUNT CALIBRATION COMPOSITION

Users can find the calibration switches (13) Cal SW. P+ and P- on the front panel. The switche is shunted to P+ \ P- \ S+ \ S-. Users may set the switches in accordance with their needs. For the composition and circuit boards of calibration switches, please refer to the following diagram.

F4.1 Defaulted positions of bridge and shunt calibration before shipment

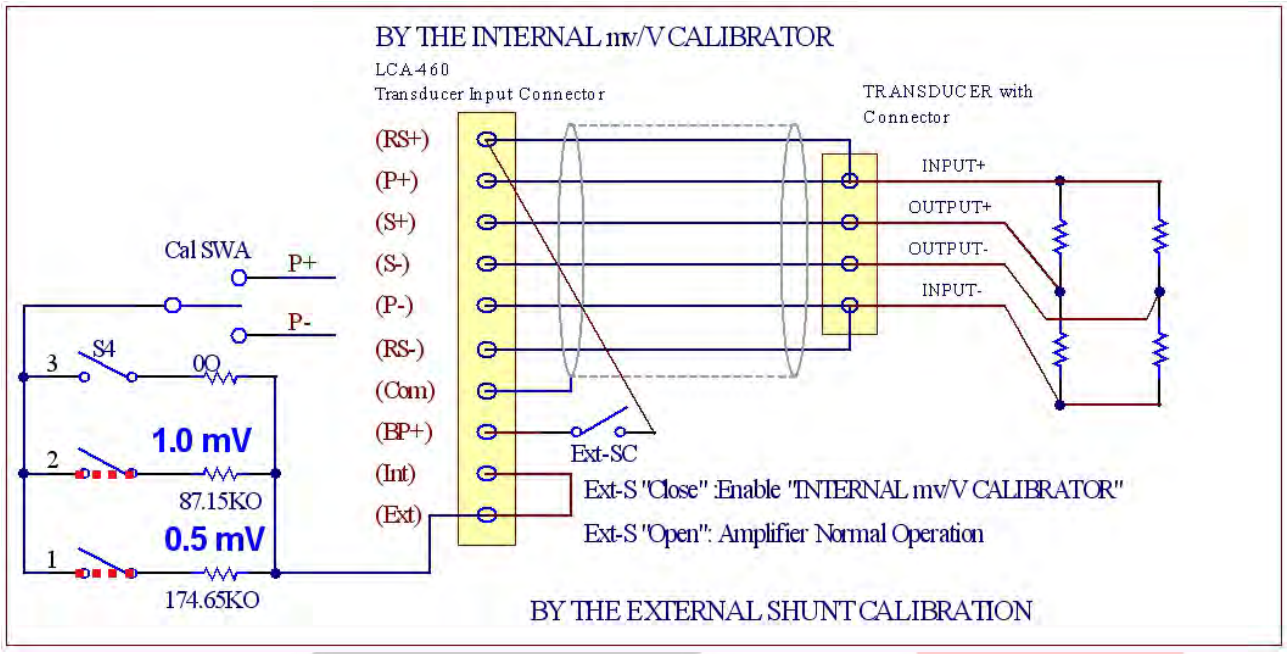


4-5-3 BY THE INTERNAL mV/V CALIBRATOR

LCA-460 Amplifier provide special function of "THE INTERNAL mV/V CALIBRATOR" that can simulate transducer output 0.5 mV/V and 1mV/V with 0.05% accuracy.

After using "THE INTERNAL mV/V CALIBRATION" method of line connections, ZERO and SPAN calibration, simply connect TRANSDUCER, then calibrate ZERO is enough to do all the work.

Should transducer output otherthan 0.5 mV/V and 1mV/V is require, please refer to our AB-350 Strain Indicator Calibrator with 0.02% accuracy, or AT-350 Load Cell Simulator having 0.05% accuracy.



[Example 5-3-1]
Load cell Rated capacity: 5kN
Load cell Calibrated Rated output: 1.95 mV/V, +/- 0.1%
Recommend excitation voltage: 10V
Transducer's output = 1.95 (mV/V) x 10 (V)=19.5 mV
Output Mode +/-5V : [Input Range (mV):S2] , [S2, 3 2 1] , [On, Off, Off]

A: SHUNT CALIBRATION COMPOSITION: [S1, 1 2 3] , [Off, On, Off]
Calibration R (mV/V) = 1.0 (mV/V)
THE INTERNAL mV/V CALIBRATOR signal = 5kN x 1 / 1.95= 2.564kN
THE INTERNAL mV/V CALIBRATOR signal = 2.564kN / 5kN= 51.28 %

B: Close "Ext-S"
Using "THE INTERNAL mV/V CALIBRATION" method of line connections (as above).
The Output = 5V*51.28%=2.564V

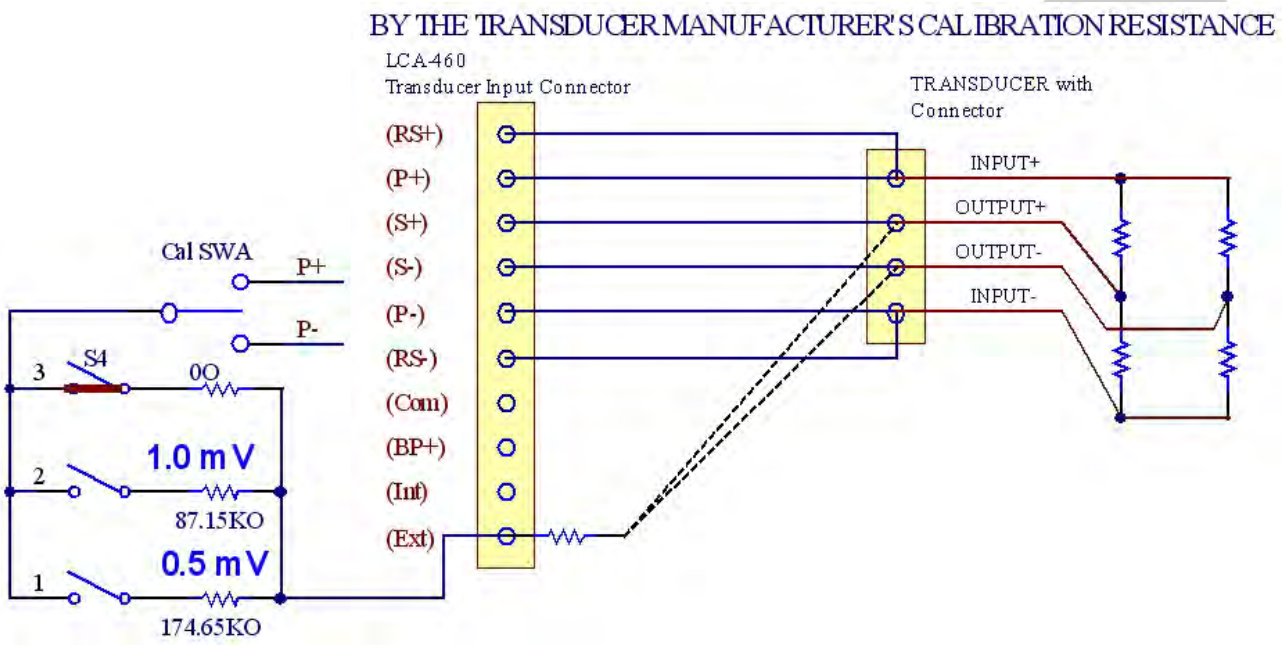
C: Open "Ext-S"
Simply connect TRANSDUCER, then calibrate ZERO is enough to do all the work. (see 3-3 "TO CONNECT TRANSDUCERS")

4-5-4 BY THE TRANSDUCER MANUFACTURER'S CALIBRATION RESISTANCE

Transducer shall mean a full bridge made up of strain gages that have been calibrated already. Therefore, transducers include the commercialized transducers and all other devices designed to measure force or torque.

Commercialized transducers are pretty complicated. Therefore, most manufacturers provide calibration manuals for shunt calibration. The manuals provide the most reliable calibration methods for users. However, the calibration resistors have to be calibrated in accordance with the manufacturer's instructions.

Precision transducer upon delivery will have "calibration resistance". The wiring will be as follow:



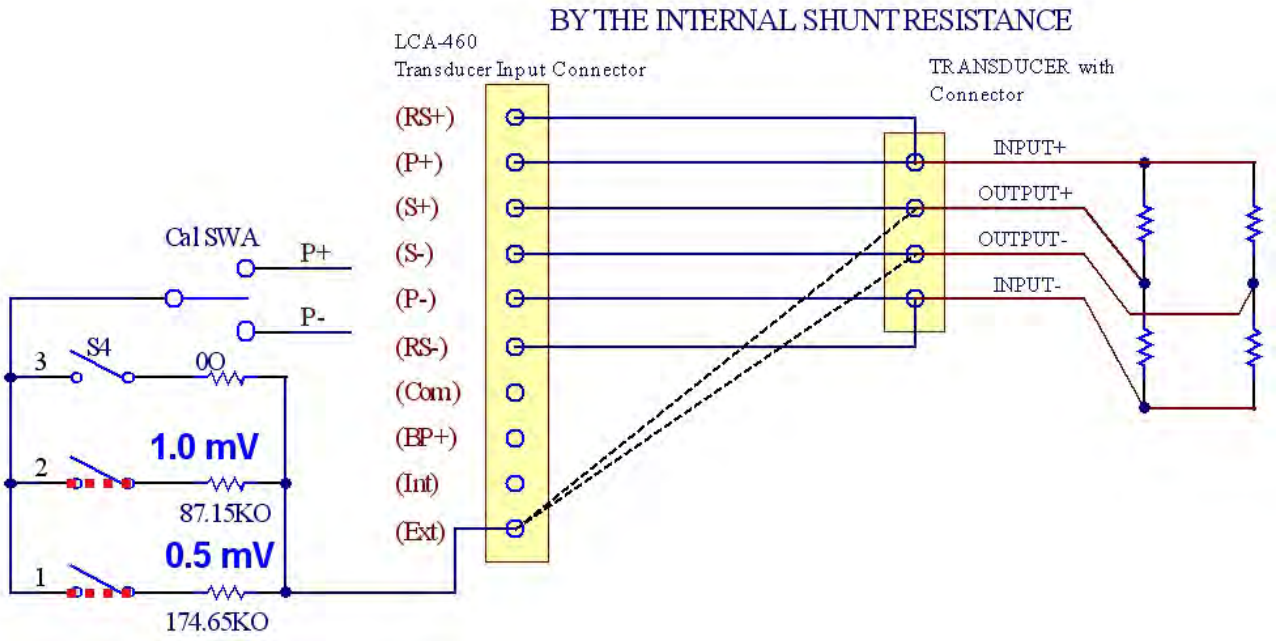
[Example 4-5-4-1]
Load cell Rated capacity: 5kN
Load cell Calibrated Rated output: 1.8 mV/V, +/- 0.1%
Manufacturers Calibration Resistance Output: 1.35 mV/V, 75% (1.35/1.8= 75%)
Recommend excitation voltage: 10V
Transducer's output = 1.8 (mV/V) x 10 (V)=18 mV
Output Mode +/-5V : [Input Range (mV):S2] , [S2, 3 2 1] , [On, Off, Off]

SHUNT CALIBRATION COMPOSITION: [S1, 1 2 3] , [Off, Off, On]
Calibration R (mV/V) = Manufacturers Calibration Resistance (1.35mV/V)

THE CALIBRATOR signal = 1.35 / 1.5= 75.00 %
THE CALIBRATOR signal = 5kN x 1.35 / 1.5= 3.75kN
The Output = 5V x 75%= 3.75V@3.75kN

4-5-5 BY THE INTERNAL SHUNT RESISTANCE

Full bridge equation for a simplified 4-arm resistor:
Rs=Ro*(250/k-0.5)
Rs ：The impedance of shunted resistor
Ro ：The valid output resistance of full bridge output resistance of transducer (usually 350 ohms)
k：The simulated output　mV/V output to be simulated (mV/V)



[Example 4-5-5-1]
Calibration R (mV/V): Calibration Resistance 87.15k ohm (1.0mV/V @ 350 Ohm)
SHUNT CALIBRATION COMPOSITION: [S1, 1 2 3] , [Off, On, Off]

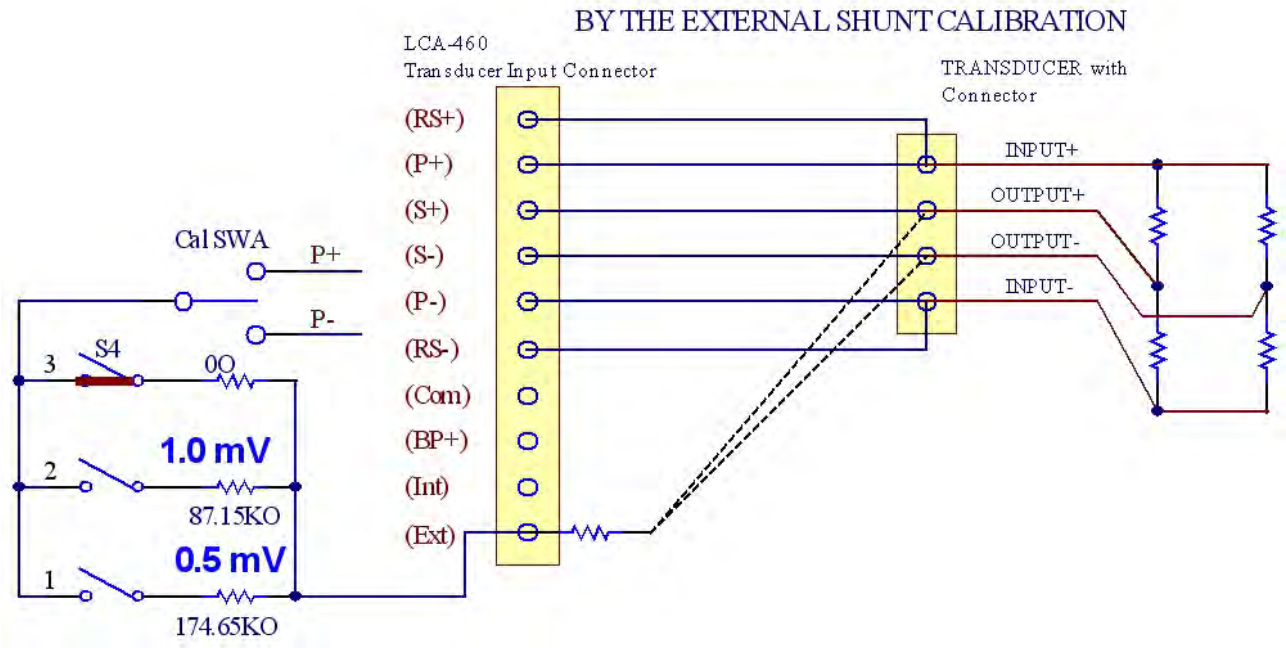
Full bridge input and output resistance of transducer = 352 ohm
k：The simulated output　mV/V output to be simulated (mV/V)
k = 1.0 x 352 / 350 = 1.0057 (mV/V)

[Example 4-5-5-2]
Calibration R (mV/V): Calibration Resistance 174.65k ohm (0.5mV/V @ 350 Ohm)
SHUNT CALIBRATION COMPOSITION: [S1, 1 2 3] , [On, Off, Off]

Full bridge input and output resistance of transducer = 1000 ohm
k：The simulated output　mV/V output to be simulated (mV/V)
k = 0.5 x 1000 / 350 = 1.4286 (mV/V)

4-5-6 BY THE EXTERNAL SHUNT CALIBRATION

Full bridge equation for a simplified 4-arm resistor:
Rs=Ro*(250/k-0.5)
Rs ：The impedance of shunted resistor
Ro ：The valid output resistance of full bridge output resistance of transducer (usually 350 ohms)
k：The simulated output　mV/V output to be simulated (mV/V)



SHUNT CALIBRATION COMPOSITION: [S1, 1 2 3] , [Off, Off, On]
Calibration R (mV/V): External Calibration Resistance

4-6 ACTIVE FILTER

A standard LCA-460 Amplifier is provided with a 4-pole low-pass active filter. The filter frequency is determined in accordance with the position of DIP-switch provided on the front panel. The filter is designed to suppress the noises and signals exceeding the designated frequency: 3Hz, 20Hz, 200Hz or 2kHz. According to the normal practice of instrumentation, the designated frequency output is eliminated by 3dB (30% less than the original value).

When an abrupt step input (e.g. dynamic test) is found, users should be aware if there is a moderate overshoot (approximately 6% with 4 poles) in the Butterworth filter. If yes, users have to check the signals at higher band wide mode in order to prevent the filter from distorting.

For test repeatability. Under unknown dynamic frequency (Fx), it is recommended to observe signal frequency (Fx) in 2kHz mode. Then set low-pass filter cut-off frequency according to the principle that, low-pass filter should be five times (>5Fx) of the observed frequency.

5. MAINTENANCE

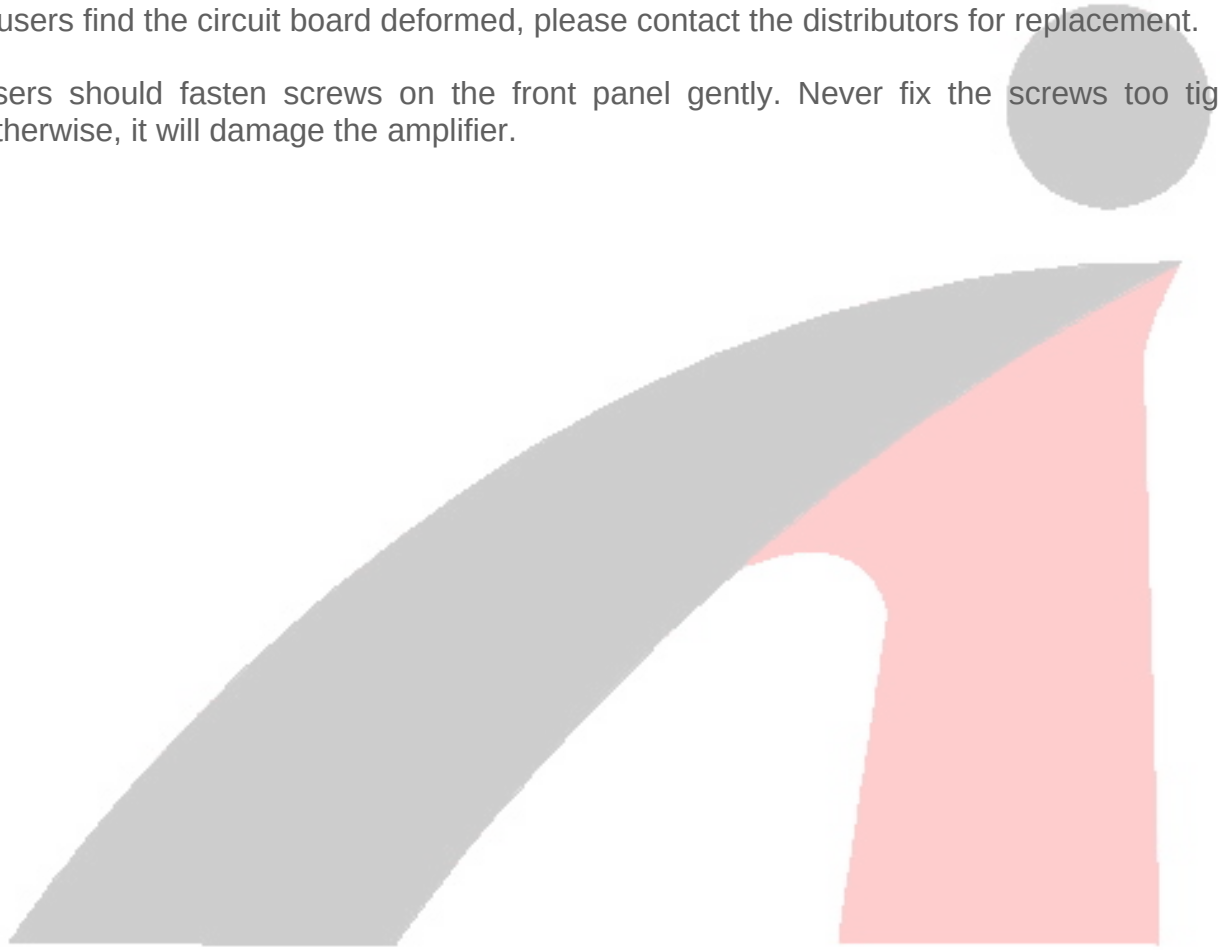
If amplifier is not to be used for a long time, users should pack and store it properly in order to prevent dusts and moistures from running into the device. If not, the device's precision and stability will be severely affected.

Users should check if the power voltage and switch positions are correct before they use their LCA-460 Amplifier.

If users have hard time inserting the amplifier into slot, please do not press it hard.

If users find the circuit board deformed, please contact the distributors for replacement.

Users should fasten screws on the front panel gently. Never fix the screws too tight. Otherwise, it will damage the amplifier.



6. WARRANTY

Advance Instrument Inc. warrants all instruments free from defects in materials, components and workmanship for one year from the date of purchase. Any instrument found defected by Advance Instrument Inc. within the warranty period shall be repaired or replaced at Advance Instrument's discretion.

The warranty is not applicable to the defects or physical damage resulting from abuse, neglect, accident, improper repair, alteration, or unreasonable use of the unit, resulting in (but not limited to) cracked or broken cases or parts, or units damaged by excessive heat.

To order the service prescribed by the warranty statement, you should include proof of purchase, including date and place of purchase, date and place of purchase (a copy of your purchase receipt). Otherwise, we are no liable for repairs or replacement prescribed by the warranty statement.

TECHNICAL CONSULTATION
For technical assistance, please contact:
Advance Instrument Inc.
website: www.advanceinstrument.com
Email: service@ advanceinstrument.com
Tel: +886-2-8695-1100
Fax: +886-2-2693-1460