

DUAL CHANNEL
DC ISOLATION AMPLIFIER

DA-710A

INSTRUCTION MANUAL

Thank you for purchasing KYOWA's product DA-710A Dual Channel DC Isolation Amplifier.

Read this manual carefully to ensure the long life and reliability of the product.

The product should not be used in any manners other than as described in this Instruction Manual.

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STANDARD ACCESSORIES

The following accessories are packed with DA-710A Dual Channel DC Isolation Amplifier. When unpacking, check the contents to ensure that all accessories are enclosed.

AC Power Cable (P-16)	1
3P-2P Conversion Adaptor	1
Input Cable (U-108)	2
Output Cable (U-63)	2
Precision Screwdriver	1
Instruction Manual (CD-ROM)	1
Simplified Instruction Manual	1

SAFETY PRECAUTIONS

PRIOR TO USE

Thank you for purchasing KYOWA's product DA-710A Dual Channel DC Isolation Amplifier (hereinafter referred to as the DA-710A).

For safe use of the product, do not forget to read the safety precautions described below.

KYOWA ELECTRONIC INSTRUMENTS CO., LTD. assumes no liability for damages resulting from usage made against the safety precautions and voids warranty of products handled improperly.

SAFETY SYMBOLS

- The following symbols are used for safety operation of the product.

	Indicates "Protective Ground Terminal." Do not forget to ground the terminal of the product having this mark before operating the instrument.
GND	

- For safety operation of the DA-710A, the following "WARNING" and "CAUTION" symbols are used in SAFETY PRECAUTIONS of this manual and indicated on the product.

 WARNING	Improper operation of the system may result in severe injury or death of the operator.
 CAUTION	Improper operation of the system may result in injury to the operator and physical damage to the system.



WARNING

- **Power supply**

To prevent fire hazards, before turning ON the power switch, ensure that the power supply voltage specified for the DA-710A matches the local line voltage.

- **Power Cable and Power Outlet**

To prevent electric shock hazard or fire hazard, always use the KYOWA's power supply cable and 3P to 2P conversion adaptor and connect them to power outlet having protective ground terminal. When using the 3P power cable with grounding conductor as the power supply cable, always to use the 3P power outlet with protective ground terminal.

Using an extension cable with no protective ground conductor shall make void the protected operation.

Do not forget to turn OFF the power before connecting the power cable to the DA-710A and then, connect the power plug to the power outlet.

- **Protective Ground**

To prevent electric shock hazard, do not forget to connect to protective grounding.

When using the 3P to 2P conversion adaptor, always connect the grounding conductor of the conversion adaptor to the GND terminal.

When using the power cable of 2P parallel vinyl wire, always ground the GND terminal with the grounding conductor separately sold.

- **For Electrical Operator Safety**

To prevent electric shock hazard, operators must be cautioned not to cut the protective grounding conductor or disconnect it from the GND terminal.

- **Confirmation of Protective Ground**

To prevent electric shock hazard, be sure to confirm the safe protective grounding before operating the DA-710A.

Before operating the DA-710A, do not forget to confirm no abnormal state is found in protective functions.

- **Inflammable Gaseous Environment**

To prevent fire and explosion hazards, do not operate the DA-710A in an environment where it is exposed to inflammable gases, vapors, or dust.

- **External Connection**

To prevent electric shock hazard, ensure the safe protective ground of all concerned instruments and then, connect the DA-710A to measuring objects or external control circuits.

HANDLING PRECAUTIONS

- Avoid using the DA-710A in an environment with excessively high or low temperature.
Use the DA-710A in the specified operating temperature ranging from -10 to +50°C.
If use under direct sunlight or in a cold place is inevitable, prepare a sunscreen or take proper measures to keep it warm.
- Avoid using the DA-710A in an environment with excessively high humidity.
Use the DA-710A in the specified operating humidity range of 80% RH or less.
Using the DA-710A at a location where it is exposed to rain or in a humid place may decrease insulation resistance resulting to cause troubles.
- Avoid using the DA-710A in a dusty environment.
Take care not to enter dust or dirt into the DA-710A not only while operation but also in storage. Or, performance of the product may be deteriorated.

1. OUTLINE

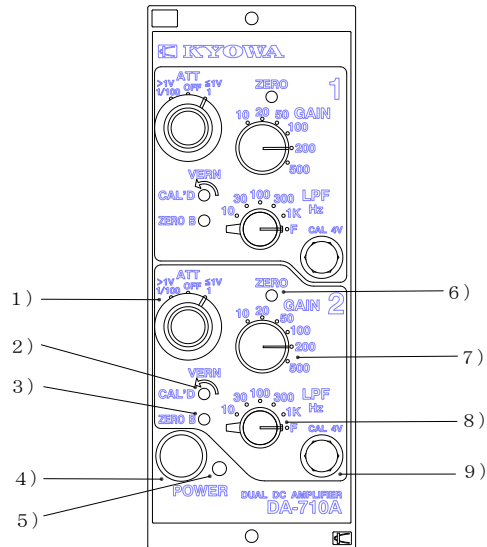
1-1 FEATURES

- The DA-710A is an Isolation DC Amplifier with photo isolated 2 channels built-in between input and output to assure safety and to largely reduce adverse effect of noise.
- The DA-710A is a high precision DC Isolation Amplifier with high input impedance, high gain accuracy and high stability.
- Since isolation is applied between channels, measurement is available even if channels 1 and 2 have different signal source.
- Input changeover switch [ATT] is used for the input circuit. Measurement of up to input voltage of ± 110 volt is available by setting the [ATT] switch to '1/100.'
- Low pass filter is provided to remove unnecessary high frequency component resulting to enable measurement with preferable SN ratio.
- Voltage calibration function is provided to obtain CAL value $4V/GAIN$ as input conversion value based on numeric preset with the [GAIN] switch. In addition, you can obtain the entered voltage.

2. CONTROLS AND INDICATORS

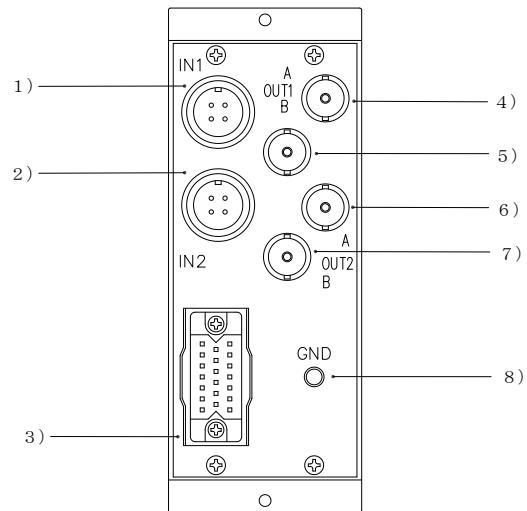
The DA-710A is an amplifier with dual channel installed in 1 unit, each of which 1 and 2 channels can be used independently by using the [POWER] switch LED that is common to both channels.

Front



- 1) [ATT] switch.....Input changeover switch
- 2) [VERN] adjuster.....Vernier fine adjuster
- 3) [ZERO B] adjusterOutput B zero adjuster
- 4) [POWER] switch.....Power switch
- 5) LED lampPower LED
- 6) [ZERO] adjuster.....Output zero adjuster
- 7) [GAIN] switch.....Gain changeover switch
- 8) [LPF] switch.....Cutoff frequency changeover switch
- 9) [CAL] switch.....Calibration switch

Rear



- 1) IN1CH1 input connector
- 2) IN2CH2 input connector
- 3) Power supply connector
- 4) CH1 OUT ACH1 output A
- 5) CH1 OUT BCH1 output B
- 6) CH2 OUT ACH2 output A
- 7) CH2 OUT BCH2 output B
- 8) GNDProtective ground terminal

3. POWER SUPPLY IN USE

Do not forget to check the power supply before using the DA-710A.

3-1 POWER VOLTAGE

Check that the required power supply is 100 VAC within voltage between 90 to 110 volts. Operation in voltage other than the specified may cause the system failure, damage inner parts, and cause accident.

3-2 GROUNDING

For safety of the operator and to prevent hazardous accidents, grounding should be made. When using the AC power, grounding can be automatically made by connecting the accessory 3P power cable to the power source.

- L = Voltage side power supply cable
- N = Grounding side power supply cable
- E = Ground

NOTE

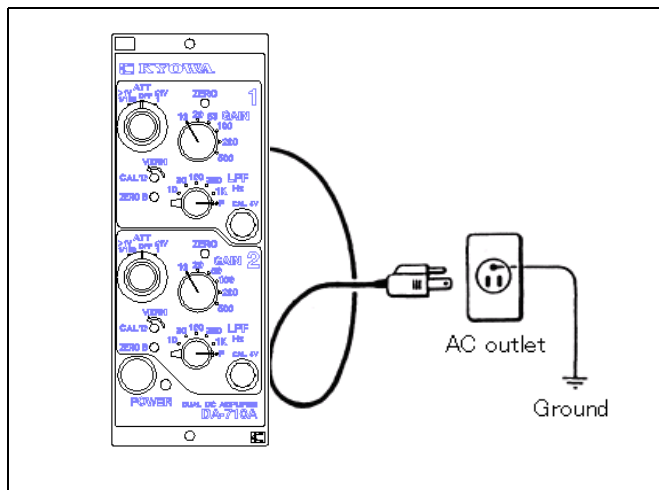
3P-2P conversion adaptor (NEMA) is enclosed as accessories. Do not forget to ground the ground terminal of the NEMA plug.

4. CONNECTION

4-1 CONNECTING POWER SUPPLY

Connect the DA-710A to the AC outlet with the accessory AC power cable.

Do not forget to ground the mid pin of the 3P terminal plug.



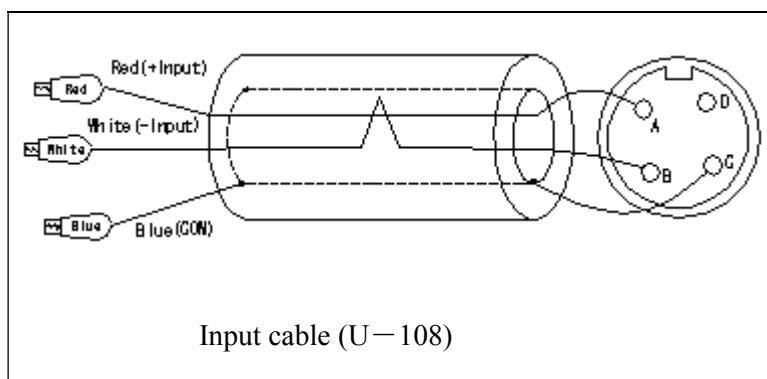
4-2 CONNECTING INPUT CABLE

Input signal source is roughly classified into following 3 types.

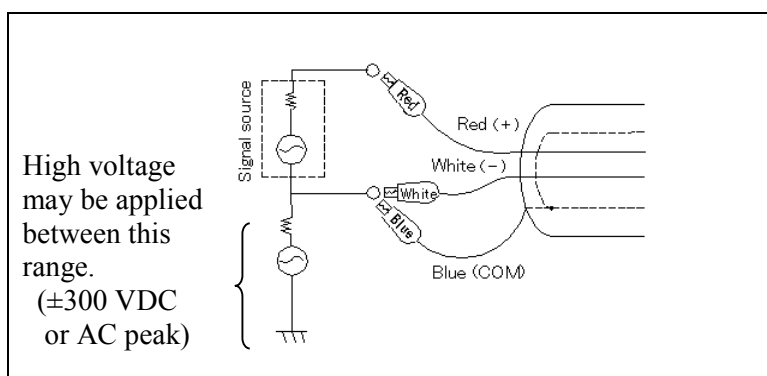
- Ground single end signal source
- Single end signal source with common mode voltage
- Balance differential signal source with common mode voltage

Since balance differential signal is entered to the DA-710A, it is provided with (+) and (-) input terminals and a COM terminal.

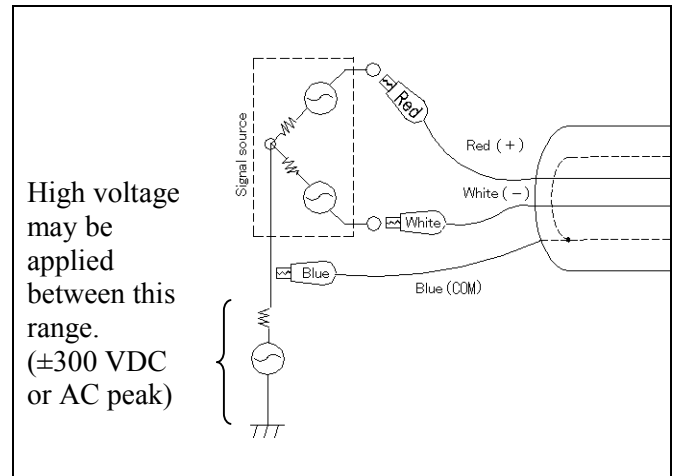
Wirings of the accessory input cables are shown in the right figure.



- Connecting single end signal source



- Connecting balance differential signal source



MEMO

Since channels 1 and 2 are independently isolated, you can use the DA-710A with both channels having different signal source.

NOTE

Take special care if common mode voltage is applied.

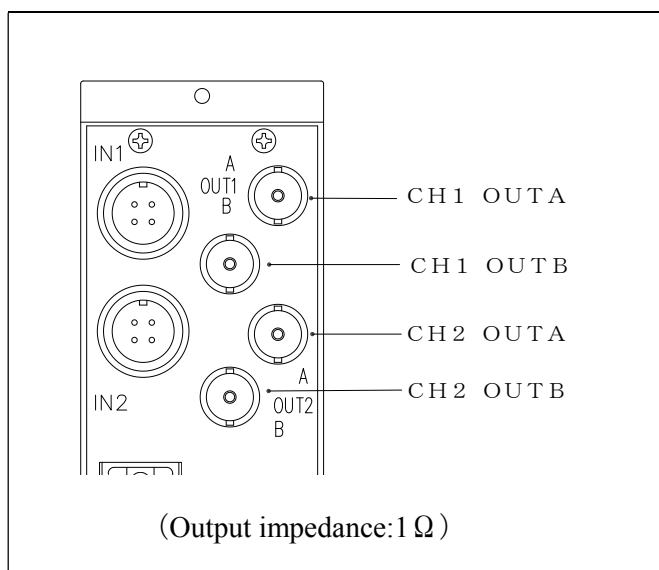
- Do not ground the blue terminal (COM) of the input cable. Always connect this blue terminal (COM) to a COM terminal of the signal source. Or, high voltage may be generated to the input cable resulting to damage the DA-710A. (When the applied voltage exceeds Max. allowable input voltage)

To prevent electric shock hazard, always ground the GND terminal to be protected in case dielectric breakdown should occur.

- Before connecting the input cable, do not forget to check no signal or common mode voltage is applied to the input cable.

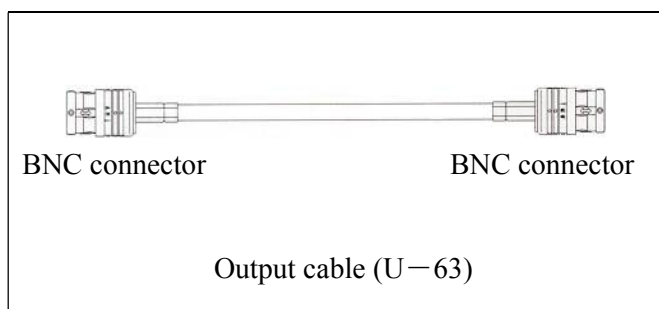
4-3 CONNECTING OUTPUT CABLE

- Connect the accessory output cable to receive the output signal.

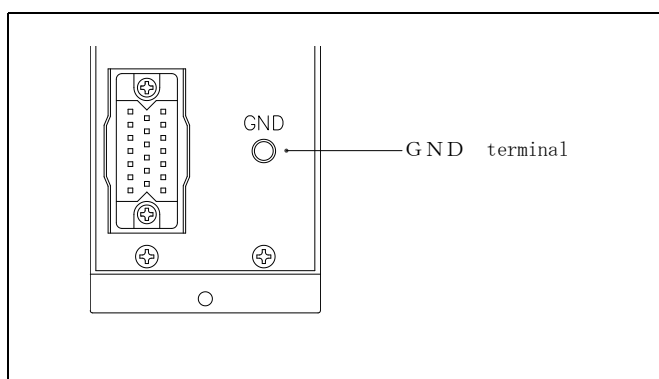


- BNC cable is used as the output cable as shown in the right figure.

The BNC connector is a one touch connector that is capable of fast installation as well as frequent connection and removal of the cable.



- If the output signal is affected by excessive noise, disconnect the grounding conductor on the power supply side and reconnect the GND to the ground with less noise or to the signal source side.



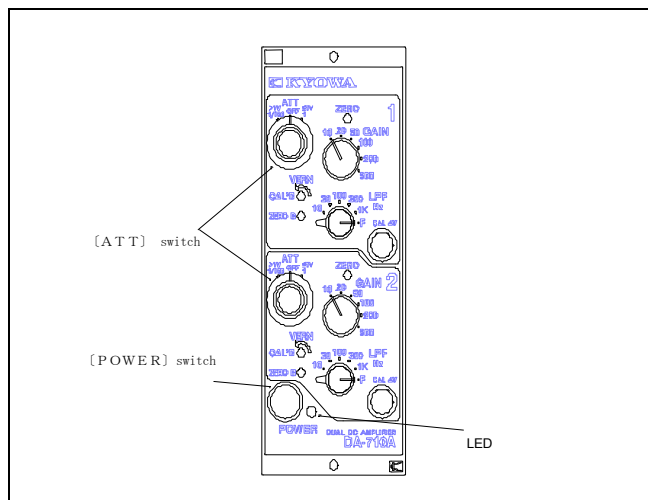
5. ADJUSTING BEFORE THE MEASUREMENT

After connecting the power supply and input/output cables to the DA-710A, conduct zero adjustment with a voltmeter, etc.

5-1 SUPPLYING POWER

Before turning ON the power, set the [ATT] switch to 'OFF.'

Both channels 1 and 2 are operated by turning ON the [POWER] switch. After the power ON, the LED lights up.



MEMO

Do not forget to set the [GAIN] switch to OFF before turning ON the [POWER] switch. If the power is turned ON with the [GAIN] switch set to other than OFF, excessive output may be generated resulting to damage the recorder that is connected to the DA-710A.

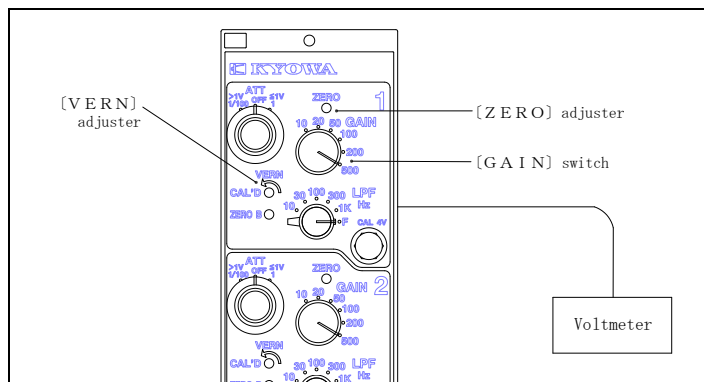
5-2 PRE-HEATING

After the power ON, although the DA-710A becomes immediately ready for operation, preheat it approximately 10 to 15 minutes to have the stable operation.

5-3 ADJUSTING ZERO (AMPLIFIER)

Set the [GAIN] switch to its Max. '500' and fully turn counterclockwise the [VERN] adjuster to the left end.

Connect a voltmeter, etc. to the output connector and turn the [ZERO] adjuster with a screwdriver to have the output voltage indicate '0.'



6-1 CHECKING CONNECTION OF DEVICES

6-2 SETTING GAIN (AMPLIFICATION DEGREE)

- ([GAIN] is always indicated by (Set value of [ATT] switch) $\times$ (Set value of [GAIN] switch))

Diagram of the DA-710A Dual DC Amplifier showing controls for CH1 and CH2. Labels point to the [ATT] switch, [GAIN] switch, and [VERN] adjuster. The diagram includes gain settings (1, 10, 50, 100, 500, 1000) and a power switch.

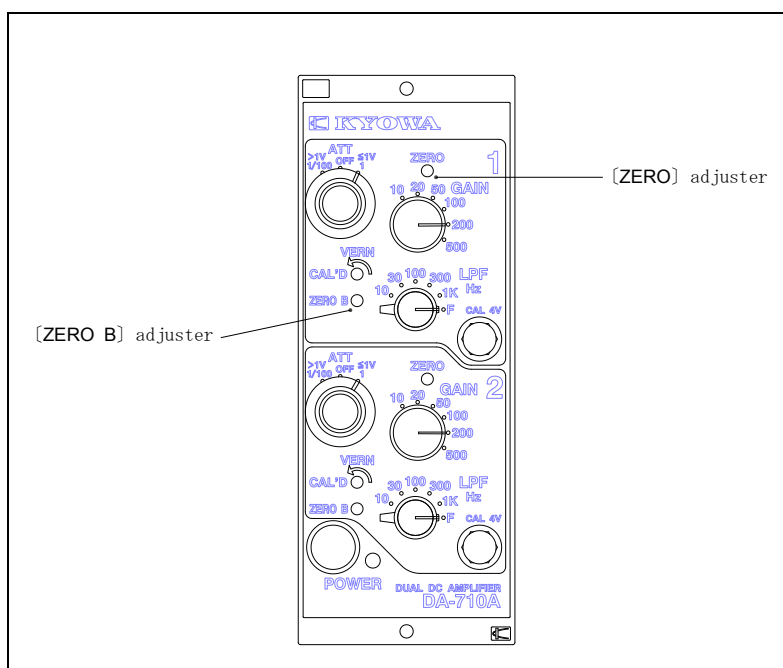
Always fully turn and set the [VERN] adjuster to the left end 'CAL'D.'

Turning the [VERN] adjuster to the left end shall be $\times 1$ to the [GAIN] switch, and $\times 2.5$ or more, by turning the [VERN] adjuster to the right end.

6-3 ADJUSTING [ZERO B] OUTPUT B ZERO ADJUSTER (AMPLIFIER)

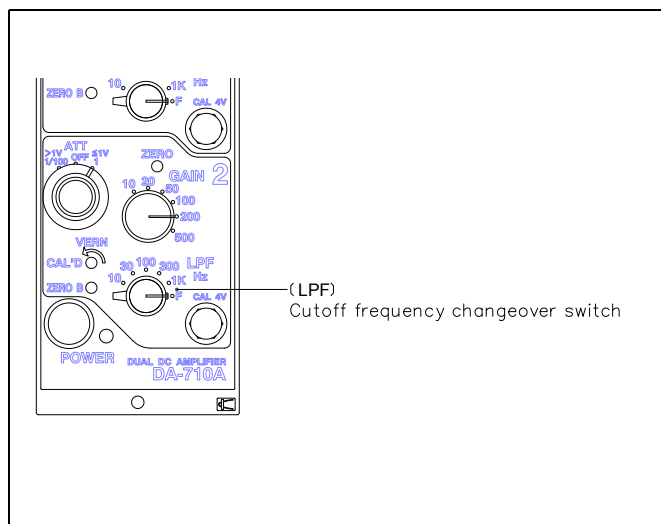
When using the OUT B, fine adjust the OUT B zero point with the [ZERO B] adjuster by the following procedures.

- Adjust the OUT A zero point with the [ZERO] adjuster.
- Fine adjust the OUT B zero point with the [ZERO B] adjuster.



6-4 SETTING [LPF] CUTOFF FREQUENCY CHANGEOVETR SWITCH

Press this [LPF] switch to change the output filter of the DA-710A. The DA-710A has a secondary low pass filter (Butterworth characteristics) built-in. The cutoff frequency has 6 steps; 10, 30, 100, 300, 1 kHz and F (Flat). When “F,” it is (10 kHz +1, -3 dB) Cutoff characteristics is -12 dB/oct. Select and set the desired [LPF] according to a need to a value that does not spoil the measuring signal to conduct measurement with appropriate S/N ratio (Signal-to-Noise ratio).



6-5 SETTING CAL VALUE

It is required to input an appropriate CAL value before the measurement. Generally, the CAL value is entered before starting the measurement.

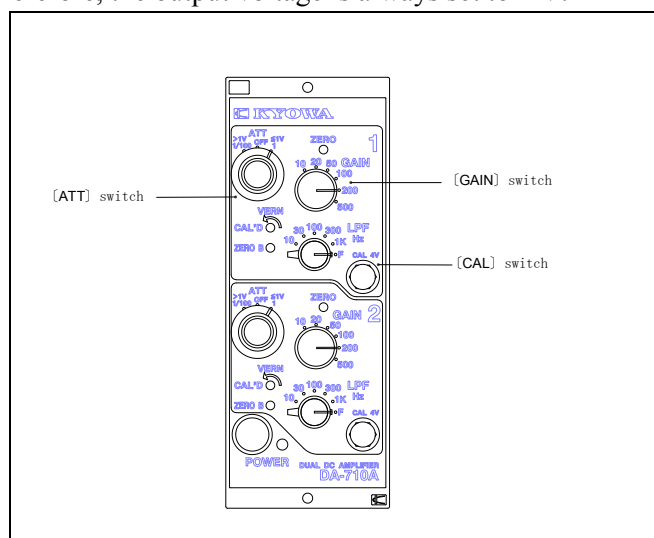
- Every time the [CAL] switched is pressed, CAL value $4V/GAIN$ is obtained as input conversion value based on numeric that is preset with the [GAIN] switch. Therefore, the output voltage is always set to 4 V.

Ex.) Set the [GAIN] switch to 200 ([ATT]: 1 × [GAIN]: 200) and press the [CAL] switch to have the following CAL value.

$$\frac{4V}{200} = 0.02 \text{ V}$$

The output voltage is obtained by the following expression.

$$0.02 \text{ V} \times 200 \text{ (GAIN)} = 4 \text{ V}$$

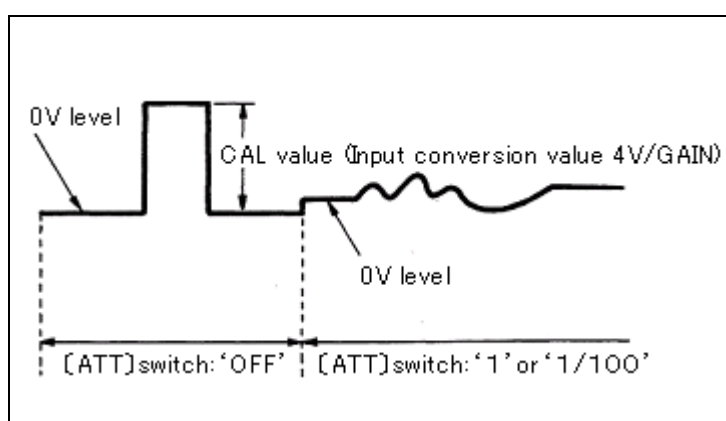


NOTE

When the [VERN] switch is fully turned to the left (CAL'D), the output voltage of the CAL value is always 4V fixed irrespective of the [GAIN] switch.

On the other hand, when the [VERN] is fully turned to the right, the output voltage of the CAL value shall be $4V \times 2.5$ or more.

- Even if the [ATT] switch is set to OFF, CAL value output of 4 V generates by pressing the [CAL] switch. Note that a zero point at this time may not be the same zero point obtained by setting the [ATT] switch to '1' or '1/100.' The CAL value is relevant to 4V/GAIN input voltage. At this time, the [GAIN] is obtained by setting the [ATT] switch to '1.'

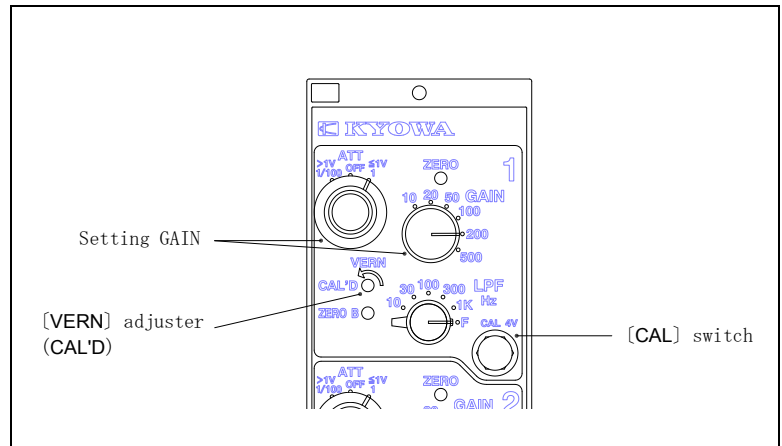


6-6 MEASUREMENT.....HOW TO OBTAIN THE INPUT VOLTAGE

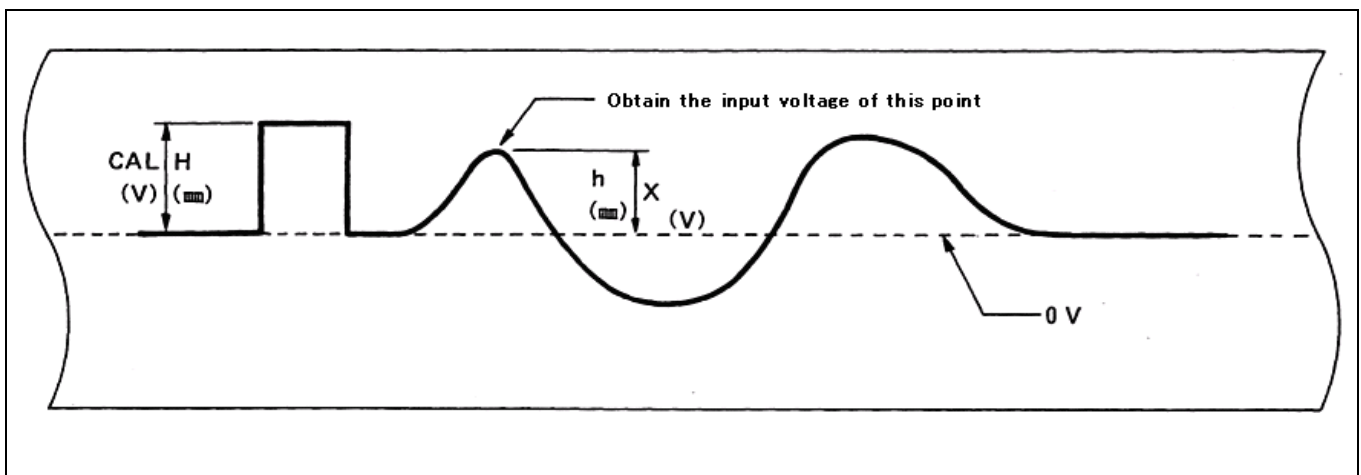
Amplified voltage is obtained by 2 ways; by recording the input voltage into a recorder and by measuring the output voltage to obtain the input voltage with a voltmeter, etc.

- Using a recorder

- 1) Fully turn the [VERN] adjuster to the left end 'CAL'D' and set the [GAIN] (Set value of the [GAIN] switch × Set value of [ATT] switch) according to the size of the input voltage.
- 2) Press the [CAL] switch and after entering the CAL value, the input voltage is generated.



- 3) The following waveform is displayed on the recorder. Obtain peak-to-peak voltage swing width between H and h and substitute it to the following expression to obtain the input voltage (X).



where, CAL(V): Voltage (4V/GAIN) when [CAL] switch is pressed

H (mm): Peak-to-peak voltage swinging width when CAL voltage is generated

X(V):

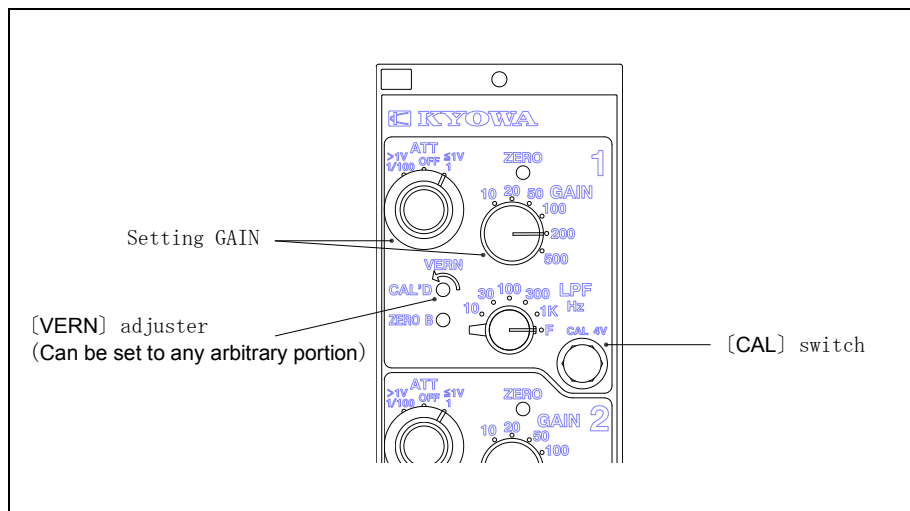
H (mm): Peak-to-peak voltage swinging width of the desired input voltage

$$\text{Input voltage (X)} = \text{CAL} \times \frac{h}{H} \times \frac{4(\text{V})}{\text{GAIN}} = \frac{h}{H} \times$$

$\swarrow$
 GAIN = Set value of [ATT] × Set value of [GAIN]

- Using a voltmeter

- 1) Since the input voltage is obtained by measuring the output voltage, the [VERN] adjuster can be set to any portion.
- 2) After setting the [GAIN] (Set value of [ATT] switch × Set value of [GAIN] switch), press the [CAL] switch and read the CAL value. Then read the desired output voltage.



- 3) Read and calculate the CAL voltage and output voltage and obtain the input voltage from the following expression.

$$\text{Input} = \text{Output voltage} / \left[\frac{\text{CAL voltage}}{4(\text{V})} \times \text{GAIN} \right]$$

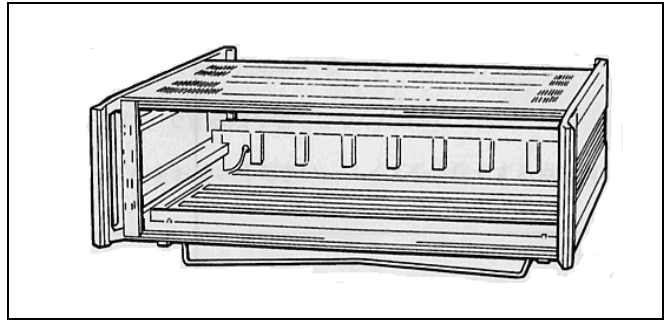
where, Output voltage: Voltage after input voltage is amplified

CAL voltage: CAL voltage generated when the [CAL] switched is pressed

GAIN: Set value of [ATT] switch × Set value of [GAIN] switch

7. HOUSING CASE (SEPARATELY SOLD ACCESSORY)

When the DA-710A is used with multiple channels, the Housing Case YB-A is used for easy handling of the DA-710As by housing them in the case.



- The Housing Case YB-A has 4 types according to the number of units to be housed in.
YB-503A Houses 3 units
YB-504A Houses 4 units
YB-506A Houses 6 units
YB-508A Houses 8 units

However, no CAL is supplied to each of the DA-710As at the same time.

In addition, the DA-710A is provided with no BAL and CHECK functions as well as no DC power supply.

8. TROUBLESHOOTING

8-1 SYSTEM WILL NOT POWER ON

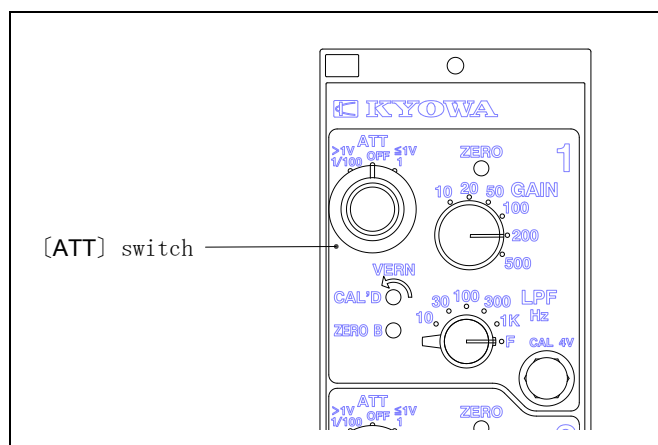
If the [POWER] switch is turned ON but no LED lights up, the power source or power cable connection may be faulty.

Check the power voltage is within range from 90 to 100 volts or the power cable is properly connected.

If the above checked results are normal but the LED still does not light up, the power cable or circuit in the chassis may be faulty.

8-2 NO VOLTAGE IS OUTPUT

- [ATT] switch is set to OFF
Set the [ATT] switch to other than OFF. If it is set to OFF, CAL value is output but no input signal is output.
- Input cable connection is faulty
Check the input cable connection and properly connect the input cable once again.
- Output cable connection is faulty
Check the output cable connection and properly connect the output cable once again.



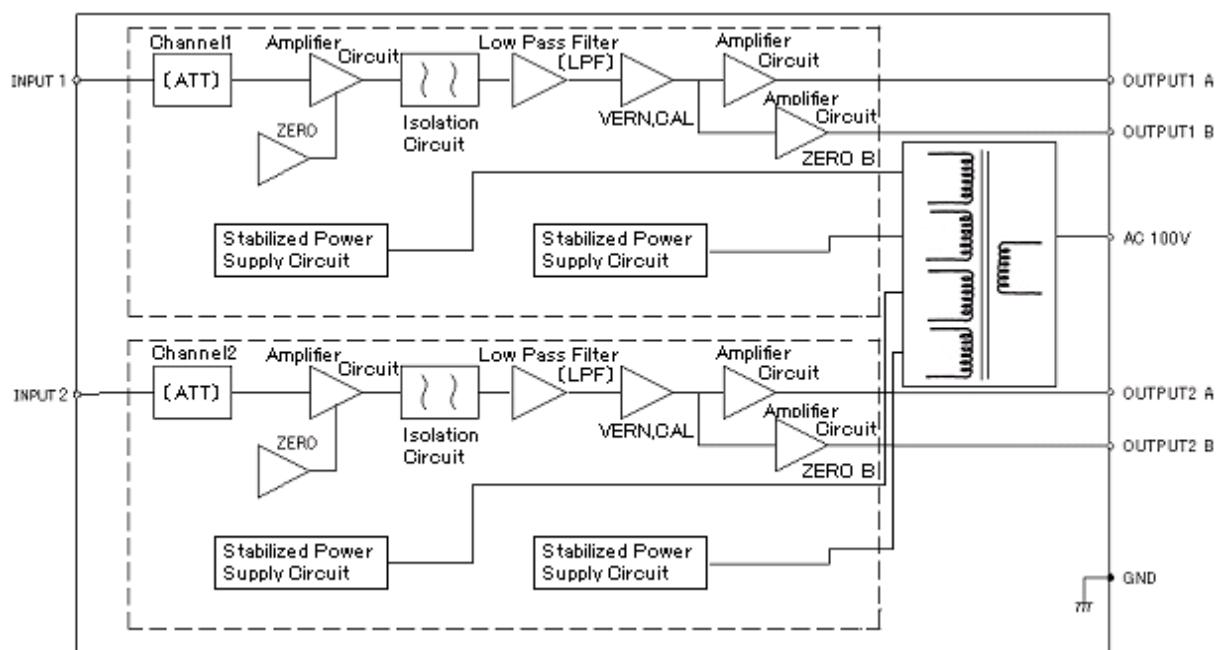
If the above checked results are normal but it is still faulty, contact KYOWA or our representative.

9. SPECIFICATIONS

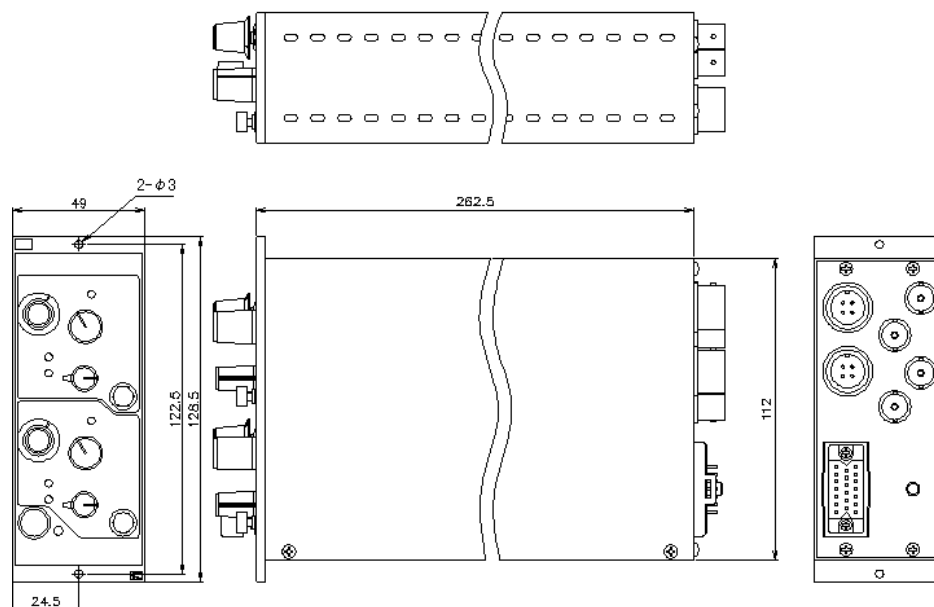
9-1 SPECIFICATIONS

Number of input channels	2 channels
Input Method	Differential input, Isolated between input/output and channels
Withstand voltage	Between [CH1 input terminal] and [Output, case & AC power]: 1 kVAC for 1 min.
	Between [CH2 input terminal] and [Output, case & AC power]: 1 kVAC for 1 min.
	Between [AC power supply] and [Output, case]: 1 kVAC for 1 min.
	Between [CH1 input] and [CH2 input]: 1 kVAC for 1 min.
Isolation method	Photo isolation method
Input impedance	10 M Ω + 10 M Ω or more (ATT: 1 and OFF) 1 M Ω + 1 M Ω or more (ATT: 1/100)
Gain	13 steps: $\times 1$, $\times 1/100$, and OFF of 10, 20, 50, 100, 200, 500, and continuous variable of 1 to 2.5 or more
Gain accuracy	$\pm 0.1\%$ (ATT: 1) $\pm 0.3\%$ (ATT: 1/100)
Stability	Zero: Within $\pm 5 \mu V_{rti}/^{\circ}C$ (Input short, Gain: 500) Gain: Within $\pm 0.02\%/^{\circ}C$
Nonlinearity	Within $\pm 0.05\%$ FS
Response frequency	DC to 10 kHz (+1, -3 dB)
Low pass filter	Secondary Butterworth: 6 steps of 10, 30, 100, 300, 1 kHz and Flat Cutoff point: Within -3 ± 1 dB Cutoff characteristics: -12 dB/oct
Output OUT A	± 10 V (Load resistance 10 k Ω or more)
Output OUT B	± 10 V (Load resistance 10 k Ω or more)
Output impedance	1 Ω or less
Common Mode Rejection Ratio (CMRR)	120 dB or more (DC to 60 Hz) (1 k Ω balance input, Gain: 500, ATT: 1)
Common Mode Voltage (CMV)	± 300 VDC or AC peak Insulation resistance: 100 M Ω or more
Maximum allowable input voltage	± 2 VDC or AC peak (ATT: 1) ± 110 VDC or AC peak (ATT: 1/100)
Zero adjusting range (Output)	± 5 V (OUTs A and B are interlocked); ± 1 V (OUT B independent)
Noise	10 $\mu V(p-p)_{rti}$ + 6 mV(p-p) _{rto} (Input short, Gain: 500, ATT: 1)
CAL voltage (Output)	Within 4 V $\pm 0.2\%$
Settling time	100 μs or less, Output within $\pm 0.1\%$
Overload recovery time	100 μs or less, Output within $\pm 0.1\%$
Cross talk between channels	10 $\mu V(p-p)_{rti}$ + 6 mV(p-p) _{rto} or less
Common Mode Cross Talk Rejection Ratio	10 $\mu V(p-p)_{rti}$ + 6 mV(p-p) _{rto} or less
Operating Temp & Humid Range	-10 to 50 $^{\circ}C$, 20 to 80% RH (Non condensing)
Storage Temp & Humidity Range	-20 to 70 $^{\circ}C$, 5 to 95% RH (Non condensing)
Power Consumption	100 VAC $\pm 10\%$ (50 Hz, 60 Hz), 4.5 VA
Dimensions & Weight	49(W) $\times$ 128.5(H) $\times$ 262.5(D) mm (Protruded portions not included) Approx. 1.0 kg

9-2 BLOCK DIAGRAM



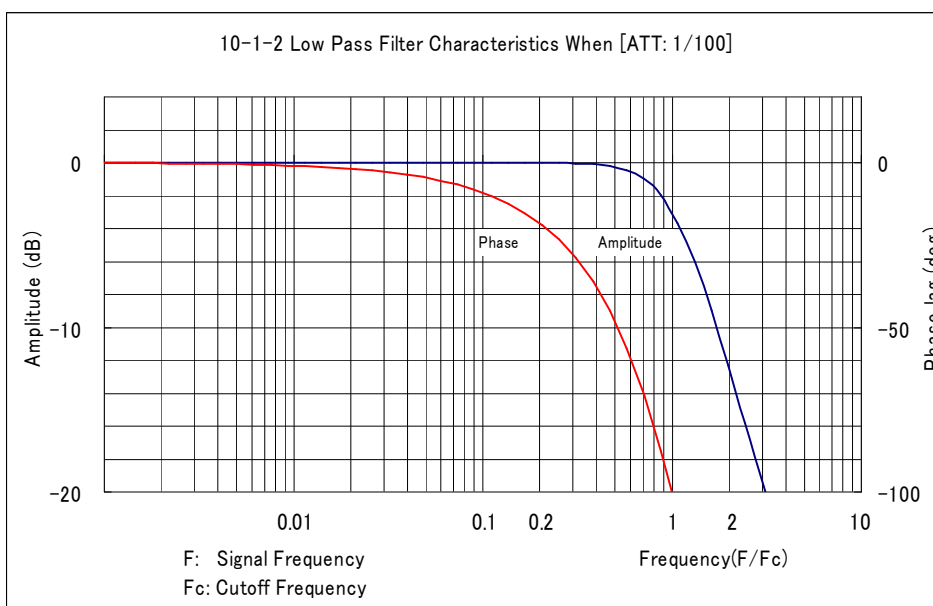
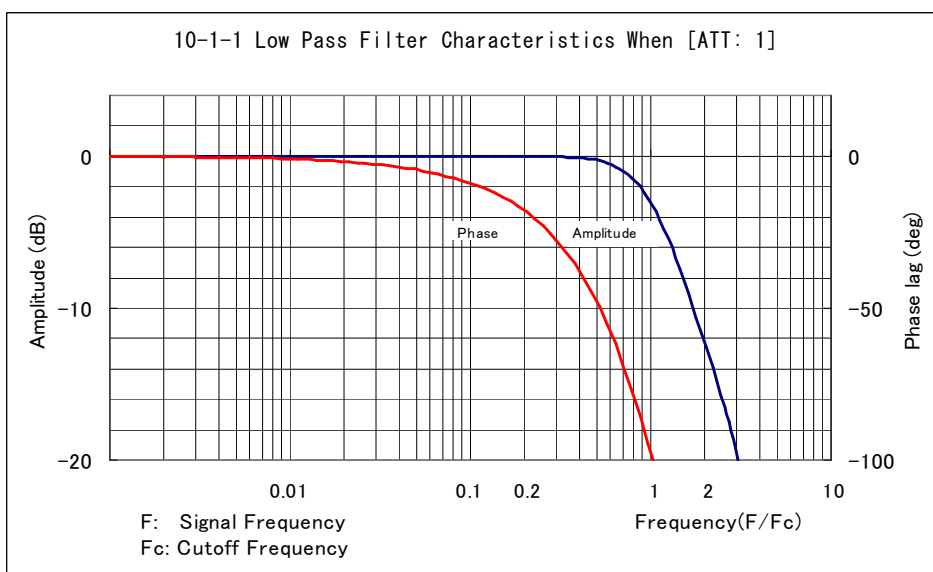
9-3 DIMENSIONS



10. CHARACTERISTICS OF LOW PASS FILTER

Characteristics of low pass filter provided in the DA-710A are described in item 10-1. Frequency characteristics are normalized by cutoff frequency. Relation between amplitude and phase in the specified frequency is shown in the following figure by obtaining the ratio F/F_c of the specified frequency to the cutoff frequency.

Figures in 10-2 shows frequency characteristics when the cutoff frequency is selected and set to 'F.' Both figures in 10-1 and 10-2 show characteristics of low pass filter when [ATT] switch is set to [ATT:1] and [ATT:1/100], respectively.



10-2 FREQUENCY CHARACTERISTICS

(WITH 'F' SET FOR LOW PASS FILTER CUTOFF FREQUENCY)

