

XE-650 Series Piezo Controller User Manual

Version: V1.0



XE-650.CA



XE-650.OA



XE-650.OW

This document describes the following products:

- XE-650.CA Analog Servo Controller 1 Channel SGS sensor
- XE-650.OA Analog Open Loop Controller 1 channel
- XE-650.OW Spontaneous Waveform Open Loop Controller 1 channel

DECLARATION

Declaration!

This user manual is a integrated user manual of the XE-650 series piezoelectric controller. Please read this user manual carefully before using this controller. Follow the instructions in the manual during use. If there is any problem, please contact us for technical support. If you do not follow this manual or disassemble and modify the product yourself, the company will not be liable for any consequences arising therefrom.

Please read the following to avoid personal injury and to prevent damage to this product or any other product connected to it. In order to avoid possible hazards, this product can only be used within the specified range.

Notice!

Do not touch any exposed ends of the product and its accessories.

There is high voltage inside. Do not open the case without permission.

Do not connect or disconnect input, output, or sensor cables with power on.

Please keep surface of XE-650 clean and dry, don't operate in humid or static environment.

After use, output voltage should be cleared to zero before turning off the controller switch, such as switching the servo state to the open-loop state.

Danger!

The piezoelectric power amplifier described in this manual is a high-voltage device capable of outputting high currents, which can cause serious or even fatal damage if not used properly.

It is strongly recommended that you do not touch any parts that connect to the high voltage output. Special Note: If you connect it with other products in addition to our company, please follow the general accident prevention procedures.

Operating the high-voltage amplification requires training professional operators.

Warning!

If the voltage exceeds the PZT's tolerable range, it will cause permanent damage to the PZT. Before adding voltage to the PZT poles, it must be ensured that the positive and negative poles of the PZT are connected correctly and the operating voltage is within the allowable range of this PZT.

Cautious!

XE-650 housing should be installed on a horizontal surface in an area with a 3CM air flow area to prevent internal convection in the vertical direction.

Insufficient airflow can cause equipment to overheat or premature instrument damage.

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1.1 Introduction

- ▶ Please keep surface of XE-650 clean and dry.
- Do not operate in the humid or static environment.
- > XE-650 is used to drive capacitive loads (such as piezo actuators).
- > XE-650 should not be used in user manuals of other products of the same name.
- Pay special attention XE-650 cannot be used to drive resistive or inductive loads.
- > XE-650 could be used for static and dynamic operating applications.
- XE-650 piezo controller with SGS sensors can operate in a closed loop mode.

1.2 Safety Instructions

XE-650 is based on the national safety standard. Improper use may cause personal injury or damage to the piezo controller. The operator is responsible for the correct installation and operation of the piezo controller.

- ▶ Please read the user manual in detail.
- Please eliminate any faults and potential safety hazards caused by the faults.

If the protective ground wire is not connected or connected incorrectly, there will be a possibility of leakage. If you touch the XE-650 piezo controller, it may cause serious or even fatal injuries.

If the piezo controller housing is opened without permission, touching the live parts may cause electric shock, resulting in serious or even fatal injury or damage to the piezo controller.

- Only authorized professional technicians with corresponding qualifications could open the piezo controller.
 - ▶ When opening XE-650 series controller, please disconnect the power plug.
 - Please do not touch any internal parts when operating under bare conditions.

1.3 Notes

▶ The contents in the user manual are all standard descriptions, and the customized parameters are not explained in detail in this manual.



- ▶ The latest user manual is available for download on CoreMorrow website.
- ▶ When operating the XE-650, the user manual should be placed near the system for easy reference in time. If the user manual is missing or damaged, please contact CoreMorrow customer service department.
- ▶ Please timely add all the information given in the manufacturer's user manual, such as supplements or technical descriptions.
- ▶ If your user manual is incomplete, it will miss a lot of important information, cause serious or fatal injuries, and cause property damage. Please read and understand the content in the user manual before installing and operating the XE-650.
- ▶ Only professionals who are authorized to meet the technical requirements could install, operate, maintain and clean the XE-650.



The XE-650 piezo controller is a small, single-channel device that offers features such as closed or open loop or waveform control. XE-650 is specifically designed to power low-voltage piezoelectric actuators or nano- positioning stations. It consists of a special circuit that provides either a constant voltage or a range of variable voltages. XE-650.OW integrates a variety of waveform generator functions, adjustable amplitude and frequency parameters, can meet different use requirements. The circuit is equipped with perfect protection function, high safety and reliability.

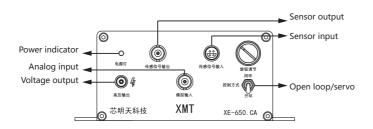
2.1 Series

Model	Description
XE-650.CA	Piezo controller, 1 channel, SGS sensor, Analog control
XE-650.OA	Piezo controller, 1 channel, Analog control
XE-650.OW	Piezo controller, 1 channel, Waveform trigger control

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2.2 Appearance

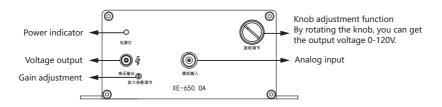
2.2.1 XE-650.CA Front Panel



Symbol	Function	Description
Power indicator	LED green	Power indicator is always on, the XE-650 is in working condition.
Sensor Input	LEMO ERA.0S.304. CLL	Sensor input signal,connect to the signal line of the closed-loop piezo or micro platform sensor (SGS).
Analog Input	BNC	Connect to external signals (signal generator, analog signal power supply, DA card, etc.).
Voltage output	LEMO ERA.00.250.CT	Output votlage to drive piezo actuator(PZT)
Sensor output	BNC	Sensor output signal monitoring terminal. Output range is 0 to 10V.
Knob adjustment function	10 turns - potentiometer	Manually adjust the input, and the signal is superimposed to "analog input".10 laps correspond to the full stroke
Control mode	Toggle switch	Open/closed-loop switch, open-loop position is open-loop control mode, closed-loop position is closed-loop control mode.

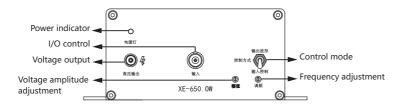


2.2.2 XE-650.OA Front Panel



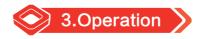
Symbol	Function	Description
Power indicator	LED green	Power indicator is always on, the XE-650 is in working condition.
Analog Input	BNC	Connect to external signals (signal generator, analog signal power supply, DA card, etc.).
Voltage output	LEMO ERA.00.250.CT	Output votlage to drive piezo actuator(PZT)
Knob adjustment function 10 turns - potentiometer		Manually adjust the input, and the signal is superimposed to "analog input".10 laps correspond to the full stroke
Gain adjustment	Potentiometer	Adjust the gain ratio of input signal to output signal.

2.2.3 XE-650.OW Front Panel



Symbol	Function	Description
Power indicator	LED green	Power indicator is always on, the XE-650 is in working condition.
Input	BNC	Input control. 0V Stop triggers stop (default state); 5V Trigger output.
Control mode	Toggle switch	Input control: Trigger control through the "input" port; Output waveform: Manually triggered.
Voltage output	LEMO ERA.00.250.CT	Output votlage to drive piezo actuator(PZT)
Voltage amplitude adjustment	Potentiometer	Adjust the output voltage amplitude of the waveform
Frequency adjustment	Potentiometer	Adjust the frequency of waveform output





3.1 Open-Box Checking

XE-650 piezo controller has been carefully checked for electrical and mechanical aspects before shipment. When you receive the device, unpack and inspect the surface of the system for any obvious signs of damage. If it is damaged, it may be damaged during transportation, please contact our customer service department in time. Check whether the accessories are complete according to the packing list. Please keep the original packaging materials for subsequent maintenance and using.

3.1.1 XE-650.CA include the following items

- XE-650.CA piezo controller
- Power cable
- Analog control cable
- Sensor output cable
- ▶ PZT output cable(depending on whether there is encapsulated piezo, nanopositioning stage, micromotion stage)
 - ▶ User manual of XE-650 Piezo Controller(this manual)

3.1.2 XE-650.OA include the following items

- ▶ XE-650.OA piezo controller
- Power cable
- Analog control cable
- ▶ PZT output cable (depending on whether there is encapsulated piezo, nanopositioning stage, micromotion stage)
 - User manual of XE-650 Piezo Controller(this manual)

3.1.3 XE-650.OW include the following items

- XE-650.OW piezo controller
- Power cable
- Analog control cable

- ▶ PZT output cable(depending on whether there is encapsulated piezo, nanopositioning stage, micromotion stage)
 - User manual of XE-650 Piezo Controller(this manual)

3.2 System operation and Security measures

Attention! Improper installation of the XE-650 can result in personal injury or damage to the XE-650!

- ▶ The installation of XE-650 should be close to the power supply so that the power plug can be easily and quickly disconnected from the main power supply.
 - ▶ Connect the XE-650 using the supplied power line.
- ▶ If the power line provided by our company must be replaced, please use a power line of sufficient diameter size and ensure effective connection.

Attention! When connected to the XE-650, the piezo controller may cause oscillations, causing irreparable damage!If you find an oscillation, follow these steps:

- ▶ When the closed- loop operation is in use, turn off the servo mode immediately.
- ▶ When the open- loop operation is in use,stop driving the piezo actuator immediately.
 - Power off the XE-650.1

Attention! If the XE-650is used directly without preheating, thermal instability will occur!

▶ Before using XE-650, please power the XE-650 for at least half an hour and then carry out the corresponding operation.

Attention! When the XE-650is stopped, the piezo drive should be stopped first, and then the system power off disposal!

- ▶ Turn off trigger mode (XE-650.OW).
- ▶ Turn off the servo mode (open loop operation).
- ▶ The voltage of piezo is set to 0 V.
 - 1) Analog mode: The target value of input voltage is 0 V.
 - 2) Knob operation: Adjust the knob to set the target value to 0 V.

Attention! Pay attention to frost and dew when the XE-650 is electrified in winter, so as not to burn out the controller!



- ▶ Visual check whether the controller has frost and dew phenomenon before power on (frost and dew phenomenon usually occurs when moving from outdoor to indoor).
- ▶ If the controller frost, dew should be cleaned or dried and stored in the room for more than two hours before power on the relevant operation.



4.1 Attention

Danger! Electric shock hazard!

Touching live parts can result in electric shock, serious injury or death if operated with the XE-650 on.

The XE-650 controller can only be opened when authorized and qualified technicians are available. Disconnect the power supply before turning it on.

Attention! Static damage equipment!

Improper handling of the XE-650 may damage electrostatic sensitive devices.Before you touch the XE-650 electrostatic component, you need to wear an anti-static wrist band or a touchable ground conductor to release static electricity.Make sure no conductive parts (such as metal dust, scrap, broken pencil lead, loose screws) are in contact with the exposed PCB.

Tip! Set system parameters carefully!

When changing system Settings, you may cause system oscillations or reduce positioning accuracy. If you need to change the XE-650 internal system Settings or you not sure whether to change the system Settings, please contact our customer service department! If the parameters need to be adjusted, you can adjust the following parameter Settings inside the XE-650 case or on the external interface;

- ▶ Internal zero potentiometer adjustment (XE-650.CA)
- External magnification adjustment (XE-650.OA)
- External amplitude and frequency adjustment (XE-650.OW)

4.2 Opening

4.2.1 Condition

- ▶ Have read and understood the general notes for adjustment Settings.
- Disconnect the XE-650 power supply.

4.2.2 Tools and Accessories

With PH1 crosshead screwdriver, open the top cover:

- ▶ Remove the two upper crosshead screws from the front and rear panels.
- Lift the top cover.

4.3 Parameter adjustment

4.3.1 XE-650.CA

The control section of XE-650.CA controller consists of the following two submodules

- 1) Signal processing sub-module (V1-P018), which provides excitation signal and feedback signal.
- Zero potential adjustment (DR2) -- Changes in mechanical load or temperature will cause small zero deviation of the sensor. No operation is required after zero adjustment. (If the closed-loop works normally, zero potential does not need to be adjusted.)
- 2) Servo control sub-module, including notch filter and analog proportional integral algorithm.
 - Notch filter adjustment suppression of mechanical resonance frequency.
- Simulated proportional integral adjustment -- Adjusting the proportional integral parameters can improve the dynamic characteristics of the system (such as overshoot and stabilization time). The factory calibration is aimed at optimal stability time (to avoid oscillation). The optimal proportional integral setting depends on the actual requirements of the piezo products.

Attention! The above two parameters have been calibrated at factory. The user should not adjust any potentiometer. Improper operation may damage the piezo device or the XE-650 controller. Any calibration needs to communicate with technical personnel or professional technical personnel to operate!



4.3.2 XE-650.OA

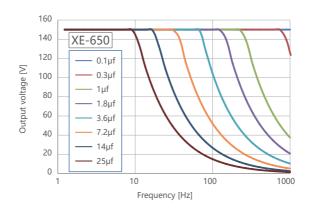
Parameters	Minimum	Maximum
Gain adjustment	0 (output 0V)	Rated output /input voltage

4.3.3XE-650.OW

Parameters	Minimum	Maximum
Amplitude	0V	Rated voltage
Frequency	270Hz	1400Hz



5.1 Frequency VS Load Curves



5.2 Maximum rating

Basic nominal data of XE-650 operation:

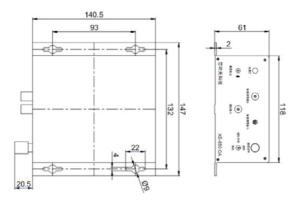
Models	Maximum operating voltage range	Frequency	Maximum output power range
XE-650.CA			
XE-650.OA	200 — 240VAC (Fuse: 2A-250V)	50-60Hz	26VA
XE-650.OW			

5.3 Service Conditions

XE-650 must comply with the following conditions:

Conditions	Explanation	
Application domain	Only for use indoor	
Humidity	Maximum relative humidity is 80%, temperature up to 30°C Minimum relative humidity 50%, temperature up to 40°C	
Operating temperature	0°C ~ +50°C	
Storage temperature	-10°C ~ +85°C	

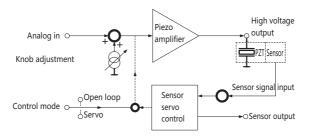
5.4 Drawing



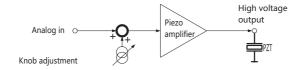


5.5 Driving Principle

5.5.1 XE-650.CA



5.5.2 XE-650.OA



5.5.3 XE-650.OW



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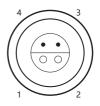
5.6 Pin Definition

5.6.1 PZT —LEMO ERA.00.250.CTL

Shell	PZT
Inner core	PZT+

5.7.2 Sensor input——LEMO ERA.0S.304.CLL

No.	Colour	Pin definition
1	Red	+10V
2	White	Sensor feedback signal 1
3	Blue	Sensor feedback signal 2
4	Black	GND
Shell	-	GND(Protect)



4-contacts LEMO Sensor input socket



6.1 Driving power calculation

• Average output (Sine wave operation mode)

Pa ≈ Upp • Us • f• Cpiezo

Pa=Average output[W] Cpiezo=Piezo actuator capacitance[F]

Upp=Peak and peak drive voltage [V] f=Operating frequency of the sine wave[Hz]

Us=Drive voltage[V] ((Vs+) - (Vs-))





7. Maintenance, Storage, Transportation

7.1 Cleaning measures

Note! The PCB board of the function module in the XE-650 system is an ESD (electrostatic discharge) sensitive device. Take precautions against any static build-up of these devices before use to avoid contact with circuit component leads and PCB wiring. Before touching any electronic components, the body first touches the grounding conductor to discharge static electricity, ensuring that any type of conductive particles (metal, dust or debris, pencil lead, screws) enter the device. Be careful not to drop the equipment when cleaning, to avoid any form of mechanical shock!

- Disconnect the power plug of the XE-650system before cleaning.
- Prevent cleaning fluid and any liquid from entering the system module to avoid short circuits.
- ▶ The surface of the system chassis and the front panel of the module, please do not use an organic solvent for surface wiping.

Note: Pay attention to frost when the XD-650 series piezo controller is powered on in winter to avoid burning the controller!

- ▶ Check whether the controller has frost before power on (frost usually occurs when moving from outdoor to indoor)
- ▶ If the controller is frosted, wipe or dry it,and store it indoors for more than two hours before powering it up.

7.2 Transportation and Storage

- ▶ This product is packed in carton. Transportation must be carried out under product packaging conditions, and direct rain and snow, direct contact with corrosive gases and strong vibrations should be avoided during transportation.
- ▶ The instrument can be transported under various conditions of normal transportation, and should avoid damp, load, collision, extrusion, irregular placement and other adverse conditions during transportation.
- ▶ If the instrument is not used for a long time, the instrument should be packaged and stored.

- ▶ The instrument should be stored in a non-corrosive atmosphere and in a well ventilated, clean room.
- ▶ In the process of transportation, storage and use, attention should be paid to fire prevention, shockproof, waterproof and moisture proof.



8.1 Disposal

- ▶ When disposing of old equipment, please abide by the national regulations and local regulations. Please dispose of the old equipment properly. Please contact CoreMorrow for the upgrade and replacement of old equipment in order to meet the customer's handling of system products.
- ▶ If you have an old device or an unusable device that cannot be handled, you can ship it to the following address:

Address: 1F, Building I2, No.191 Xuefu Road, Nangang District, Harbin, Heilongjiang

8.2 After-sales Service

- > XE-650 does not contain user repairable components.
- > XE-650 must be returned to factory for any service and repair.
- ▶ Any part of XE-650 is dismantled, there will be no warranty service.
- > XE-650 is a precision instrument which should be handled with care.
- ▶ In case of any problem, please record the problem and contact CoreMorrow to be repaired by professional technicians.





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