

# EBOX Data Sheet

Model ID: CS-3230

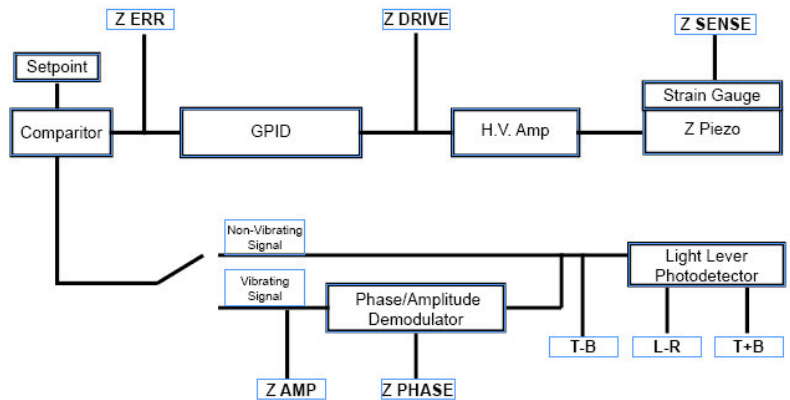
The Ebox is a versatile SPM controller that may be used for controlling almost any SPM stage or experiment.

Associated with the Ebox is SPM control software written in LabVIEW; VI's for this software are available. All of the schematics for the Ebox are provided with the product.

All electronic connections to the Ebox are at the rear of the unit. Communication with the control computer is with a USB cable. There are two connectors at the rear of the Ebox: a 60 pin connector for driving an SPM stage, and a 50 pin cable for connections to external applications.

## Architecture

The Ebox architecture allows for large dynamic-range, low-noise scanning. This is achieved with an analog feedback GPID circuit for Z axis control, and a microprocessor controlled XY scan function, both the Z and XY scan functions have 15 stages of gain. Images are captured with a 14 bit ADC which, when combined with the gain control, gives 22 bits of resolution in the XY and Z axis. The electronic controller operates independently of the control computer. Z axis signals are measured at 8 separate points.

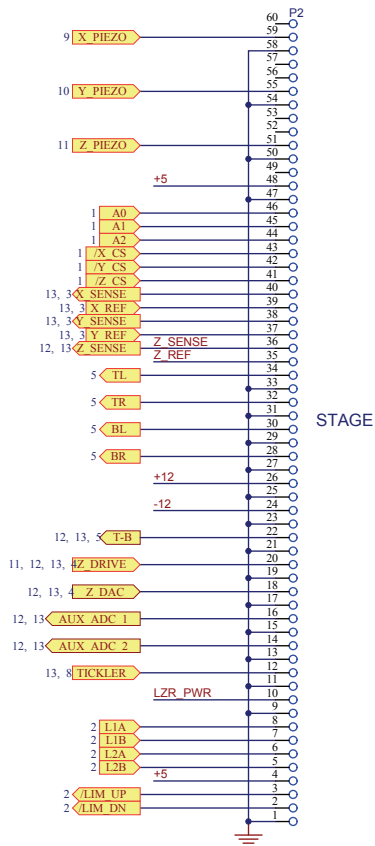


Front and rear of Ebox

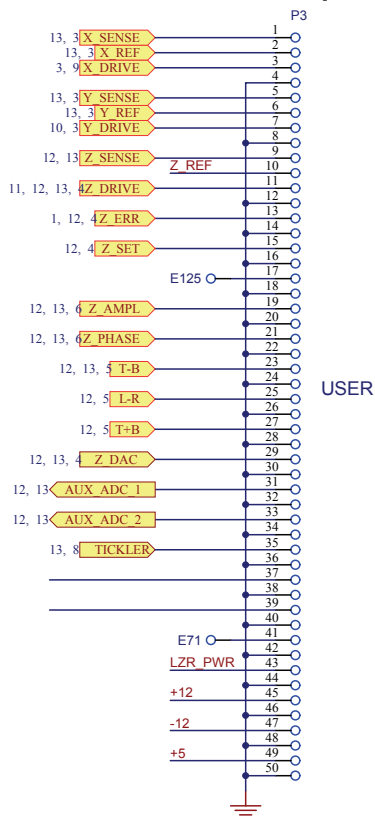


## Cable Signals

### 60 Pin Cable (stage)

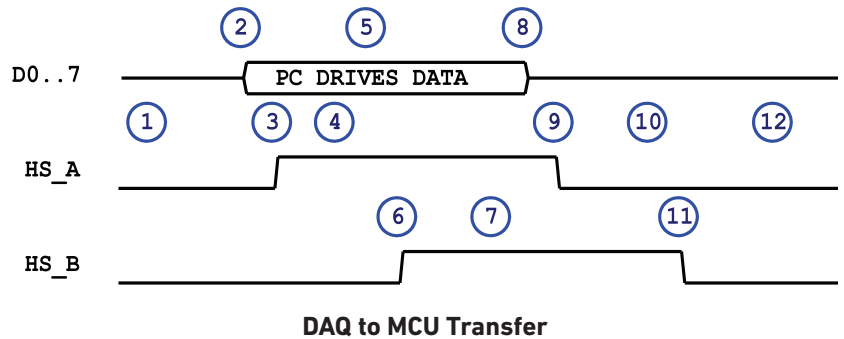


### 50 Pin Cable (open)



## Software

Commands are sent and received to the microprocessor (MCU) in the EBox via an 8 bit digital bus found on the NI USB 6009 board. Below is an example of the timing used for sending bits to the MCU. Receiving bits has a similar protocol.



Time	Description
1	Interface idle and ready
2	Host drives a byte onto data bus
3	Host asserts handshake A
4	MCU sees handshake A is high
5	MCU reads byte from bus
6	MCU asserts handshake B
7	Host sees handshake B is high
8	Host releases data bus
9	Host de-asserts handshake A
10	MCU sees handshake A is low
11	MCU de-asserts handshake B
12	Host sees handshake B is low, return to idle state

### Communication timing with the MCU

Each bit sent to the EBox controls a different function. Although LabVIEW is used for the AFMWorkshop command and control software, any language capable of transmitting bits through the NI ADC card may be used. The EBox documentation package includes a detailed description of all the programmable functions.

## Specifications

- » Connection: USB
- » XY Scanning
  - DAC Number 2
  - DAC Bits 24
  - Feedback Control GPID
  - Frequency 7KHz
  - Voltage Range 0-150 V
  - Gain Control 4 Bits
  - Bandwidth >200 Hz
- » Control DAC
  - Number 2
  - Bits 14
  - Frequency 2 KHz
- » ADC
  - Number 8
  - Bits 14
  - Frequency 48 KHz
- » Amplitude/Phase Detection
  - Frequency Range 2kHz-800kHz
  - Output Voltage 10 Vpp
  - Gain Control Yes
- » Z Feedback
  - Type Analog
  - Control GPID
  - Sample Hold Yes
  - Voltage Range 0-150 Volts
  - Gain Control 4 bits

## Ebox Block Diagram

