



# BIOMEDICAL MEASUREMENT DATA ACQUISITION SYSTEM

KL-710

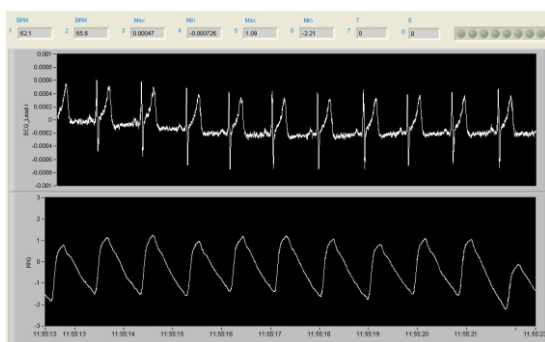


KL-710 is a complete data acquisition system that includes both hardware and software for acquisition and analysis of life-science data. The hardware uses the DAQ interface cards from National Instrument. As for the software, it is written in the LabView program. KL-710 system can use PC, Notebook, or PDA to acquire, analyze, or store data.

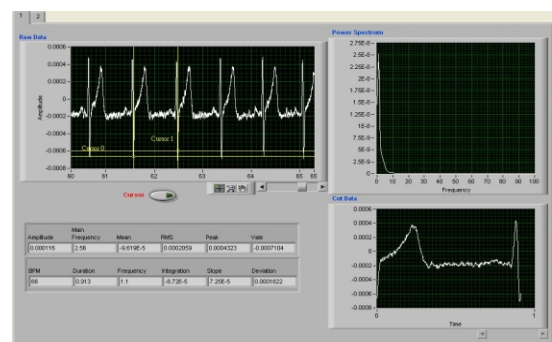
The major software allows you to edit data and control the experiment process appearing on the screen. It performs four general functions:

1. Control the data acquisition process including the analog input, analog output, digital input, digital output, pulse generation and trigger start.
2. Perform real-time calculation including the math functions, digital filter, wave analysis, rate detection and power spectrum.
3. Perform off-line analysis including the statistics, math functions, wave analysis, rate detection and power spectrum.
4. There are various types for saving data.

- The software, written by Labview, allows users to create their own program. Besides, the optional custom-made software is also available at extra cost.



ECG\_PPG



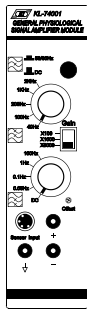
ECG\_PPG

## Module Units Specifications (KL-74001~KL-74011)

### KL-74001 General Physiological Signal (GPS) Amplifier module

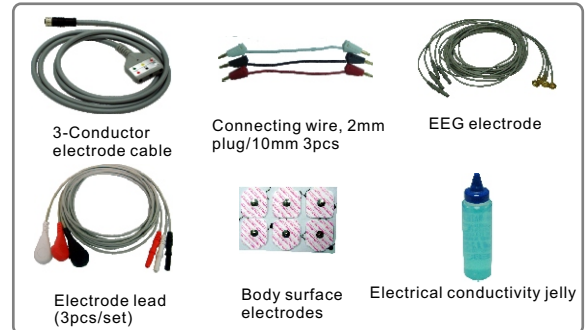
KL-74001 has one instrumentation amplifier with adjustable offset and gain. It is used to amplify low-level physiological signals. With a wide range of filters, it is available to measure the different physiological signals. KL-74001 is intended for use in The following applications:

- Electrocardiogram
- Electromyogram
- Electroencephalogram
- Electrooculogram



#### Specifications:

Input Offset Voltage  $V_{OSI}$  :  $\pm 30 \mu V$   
 Input Bias Current  $I_B$  :  $\pm 2 nA$   
 Input Offset Current  $I_{OS}$  :  $\pm 1 nA$   
 Maximum Input Voltage :  $\pm 10V$   
 Upper Frequency Response : DC or 0.05 Hz or 0.1 Hz or 1 Hz or 100 Hz  
 Lower Frequency Response : 40 Hz or 100 Hz or 200 Hz or 1 K Hz or 2 K Hz  
 Notch Frequency Response : 50/60 Hz  
 CMRR : 100 dB minimum  
 Gain :  $\times 100$ ,  $\times 1000$ ,  $\times 5000$   
 Input Impedance :  $10 G\Omega$

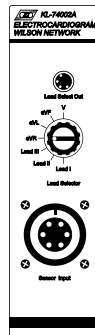
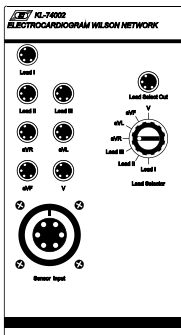


### KL-74002 Electrocardiogram Wilson Network

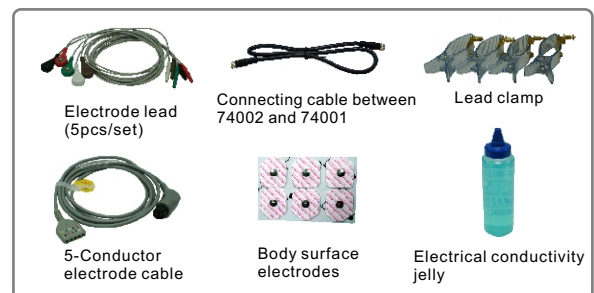
KL-74002 has one Wilson network that gets the bipolar and unipolar leads of ECG. KL-74002 ECG signal is processed via KL-74001 GPS amplifier by means of the following settings:

0.1 Hz high pass filter, 100 Hz low pass filter, 50/60 Hz notch filter and a gain of 1000. KL-74002 can detect seven leads listed below:

KL-74002 can acquire 7 signals from different leads of ECG simultaneously using 7 units of KL-74001. In addition, KL-74002 or KL-74002A can acquire single signal from single lead of ECG adopting the leads selector and one unit of KL-74001.

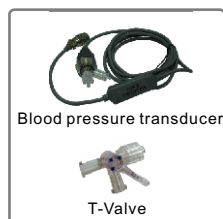
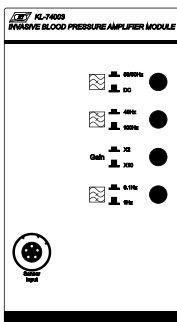


Lead I  
 Lead II  
 Lead III  
 aVR  
 aVL  
 aVF  
 V



### KL-74003 Invasive Blood Pressure (IBP) Amplifier module

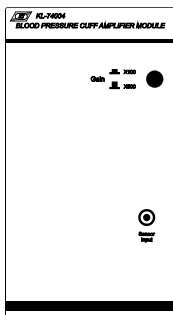
KL-74003 IBP is used to measure direct arterial or venous blood pressure in animals for research or teaching.



#### Specifications:

Maximum Input Pressure : 300 mm Hg  
 Upper Frequency Response : 0.1 Hz or 1 Hz  
 Lower Frequency Response : 40 Hz or 100 Hz  
 Notch Frequency Response : 50/60 Hz  
 CMRR : 85 dB minimum  
 Gain :  $\times 2$ ,  $\times 10$

## KL-74004 Blood Pressure Cuff (BPC) Amplifier module



KL-74004 can measure the indirect arterial blood pressure with the Korotkoff method or oscillometric method. In the Korotkoff method, the Korotkoff sounds are detected using the KL-74005.

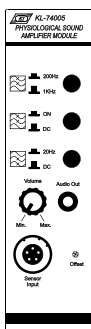
In the oscillometry, the systolic and diastolic ratios must be firstly calibrated by the real blood pressure, and then these systolic and diastolic ratios are adopted to determine the systolic and diastolic pressures from the cuff oscillometric waveform.

### Specifications:

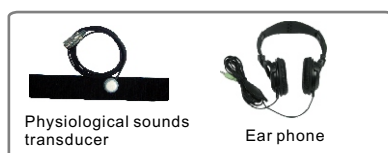
Maximum Input Pressure	: 300 mm Hg
Upper Frequency Response	: 0.3 Hz
Lower Frequency Response	: 10 Hz
CMRR	: 85 dB minimum
Gain	: $\times 100$ , $\times 500$



## KL-74005 Physiological Sound (PS) Amplifier module



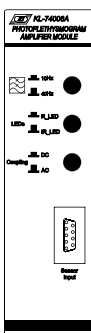
KL-74005 is designed to measure a variety of acoustical signals, including heartbeat, Korotkoff sound, voice and sounds produced by ribbing or bone grinding.



### Specifications:

Excitation Voltage	: 5V
Sensor	: Bridge Piezo-electric
Dimensions	: 22mm(diameter)
Upper Frequency Response	: DC and 20 Hz
Lower Frequency Response	: 200 Hz or 1K Hz

## KL-74006A Photoplethysmogram (PPG) Amplifier module



KL-74006A photoplethysmogram amplifier module is a single channel amplifier with red photo and infrared photo couple sensor. KL-74006A is designed to detect the density in the finger blood for using in the following application:

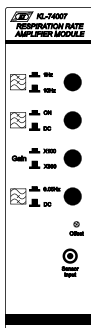
- Pulse rate determination
- Blood pressure waveform analysis
- Exercise physiology studies
- Psychophysiological studies

### Specifications:

Excitation Voltage	: 5V
LEDs	: Red : 660nm Infrared : 940nm
Lower Frequency Response	: 10Hz and 40Hz
Gain	: $\times 200$



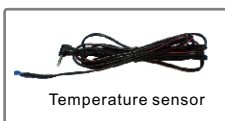
## KL-74007 Respiration Rate (RSR) Amplifier module



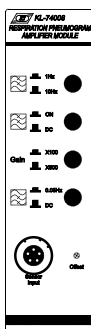
KL-74007 is designed specifically for recording respiration rate with a thermistor.

### Specifications:

Excitation Voltage	: 5V
Upper Frequency Response	: DC and 0.05 Hz
Lower Frequency Response	: 1 Hz or 10 Hz
Gain	: $\times 100$ , $\times 300$



## KL-74008 Respiration Pneumogram (RPG) Amplifier module



KL-74008 is designed specifically for recording respiration efforts that are the abdominal or thoracic expansion and contraction. KL-74008 has following applications:

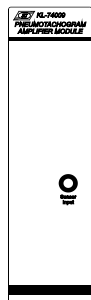
- The determination of respiration rate
- Sleep studies
- Mental work load studies
- Exercise physiology studies
- Allergic responses analysis
- Psychophysiological studies

### Specifications:

Excitation Voltage	: 5V
Sensor	: Bridge Piezo-electric
Upper Frequency Response	: DC and 0.05 Hz
Lower Frequency Response	: 1 Hz or 10 Hz
Gain	: $\times 100$ , $\times 500$



## KL-74009 Pneumotachogram (PTG) Amplifier module

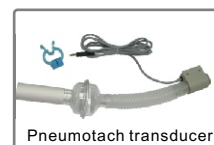


KL-74009 is a high linear, wide range, airflow transducer amplifier. You can perform a variety of tests relating to airflow and lung volume. KL-74009 has following applications:

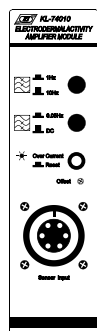
- Exercise physiology studies
- Lung function analysis

### Specifications:

Excitation Voltage	: 6V
Flow Range	: 2-35 L/min
Resolution	: 700P/L
Maximum Operation Pressure	: 25 Bar



## KL-74010 Electrodermal Activity (EDA) Amplifier module (People with cardiac pacemaker must avoid using this)



KL-74010 is a signal channel, high gain, differential amplifier designed especially for measuring skin conductance. KL-74010 measures skin conductance via the constant current Technique.

Phasic EDA includes the electrodermal response, which is most similar to the formerly common measure of Galvanic Skin Resistance (GSR). KL-74010 is designed for following applications:

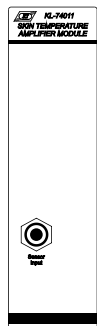
- General eccrine activity measurement
- Mental work load studies
- Vestibular function analysis
- Vertigo and motion sickness studies
- Psychophysiological studies

### Specifications:

Input Offset Voltage $V_{OSI}$	: $30 \mu V$
Input Bias Current $I_B$	: $2nA$
Input Offset Current $I_{OS}$	: $1nA$
Maximum Input Voltage	: $\pm 10V$
Upper Frequency Response	: DC or 0.05 Hz
Lower Frequency Response	: 1 Hz or 10 Hz
CMRR	: 100 dB minimum
Gain	: $\times 5000$



## KL-74011 Skin Temperature (ST) Amplifier module

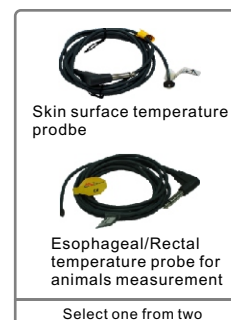


KL-74011 is designed especially for skin and core temperature ranging from  $32^{\circ}C$  to  $42^{\circ}C$ . The applications of KL-74011 are shown below:

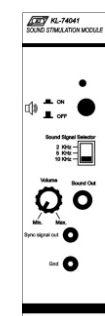
- General temperature measurement
- Sleep studies
- Psychophysiological studies

### Specifications:

Excitation Current	: DC $100 \mu A$
Sensor	: Thermistor $2252\Omega @ 25^{\circ}C$
Range	: $32^{\circ}C \sim 42^{\circ}C$
Sensitivity	: $0.1^{\circ}C$



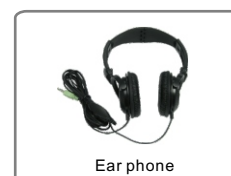
## KL-74041 Sound stimulator module



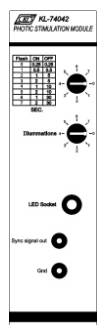
KL-74041 is designed to produce a rhythmic sound for stimulating the hearing nerves, so the evoked potential of EEG could be measured accordingly. KL-74041 needs one independent channel for making the synchronous stimulating signal at the measurement.

### Specifications:

Output frequency	: 2KHz, 5KHz, 10KHz
Output control	: Manual switch
Output power	: 300mW
Volume	: Manual adjustment



## KL-74042 Photic stimulator module



KL-74042 is designed to produce a rhythmic light for stimulating the vision nerves. The evoked potential of EEG could be measured with this stimulation. KL-74042 needs one independent channel for marking the synchronous stimulating signal at the measurement.

### Specifications:

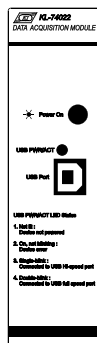
Flash frequency(SEC.)	: 0.5S, 1S, 6S, 7S, 11S, 12S, 31S, 32S
Light intensity	: 96 white light LEDs with 8 levels of adjustable illumination
Power	: DC 9V for light stimulator





**Data Acquisition Module:**

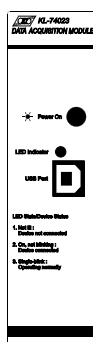
- **KL-74022 Data Acquisition Module (NI USB-6211)**



**Specifications:**

Bus	: USB
Analog Input	
Number of Channels	: 16 Single End 8 Differential
Sampling Rate	: 250K S/s(Aggregate)
Resolution	: 16 bits
Max Input Range	: $\pm 10V$
Analog Output	
Number of Channels	: 2
Output Resolution	: 16 bits
Update Rate	: 250 KS/s
Maximum Voltage	: $\pm 10V$
Digital I/O	
Number of Channels	: 4 DI/4 DO
Logic Level	: TTL
Triggering	: Digital

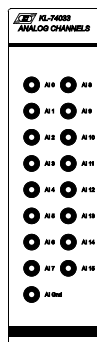
• **KL-74023 Data Acquisition Module (NI USB-6009)**



**Specifications:**

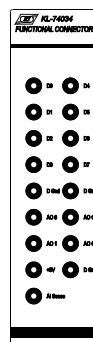
Bus	: USB
Analog Input	
Number of Channels	: 8 Single End 4 Differential
Sampling Rate	: 48K S/s(Aggregate)
Resolution	: 14 bits Differential 13 bits Single-ended
Max Input Range	: $\pm 10V$
Analog Output	
Number of Channels	: 2
Output Resolution	: 12 bits
Update Rate	: 150 S/s
Maximum Voltage	: 0~5V output
Digital I/O	
Number of Channels	: 4 DI/4 DO
Logic Level	: TTL
Triggering	: Digital

· **KL-74033 Analog Channels Module (For KL-74022 use)**



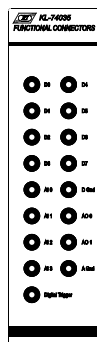
This panel could be applied in 16 channel inputs. The user can adopt the oscilloscope to measure each module output under disconnecting the DAQ device. User also can measure other signals with Acquired Analysis software.

· **KL-74034 Functional Connector Module (For KL-74022 use)**



4 digital input connectors, 4 digital output connectors, 2 analog output connectors, a DC+5V output connector and a NRSE input ground connector from DAQ device

· **KL-74035 Functional Connector Module (For KL-74023 use)**



4 digital input connectors, 4 digital output connectors, 2 analog output connectors, and 4 analog input connectors and a digital trigger input connector from DAQ device

### System Requirement :

- Above INTEL P4 compatible PC
- USB Port
- Above 1G bytes memory
- Disk space more than 2G bytes
- DVD-ROM driver for installing PC
- Windows Vista/XP/2000 OS

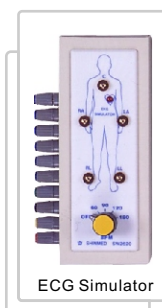
### **Accessories:**

- AC power cord
- Connecting wire, 2mm plug / 30cm (10pcs / set)
- Alcohol prep. pad
- Captured and analysis software



### Optional Accessories:

- ECG simulator
- EEG simulator
- Electrical conductivity jelly
- Body surface electrode
- EEG electrode
- Cup electrode cord
- Position cap for EEG
- T-Valve
- Alcohol prep. pad
- Medical tape



List of Experiments	List of Modules													
	KL-710(4CH)	KL-74001	KL-74002A	KL-74003	KL-74004	KL-74005	KL-74006A	KL-74007	KL-74008	KL-74009	KL-74010	KL-74011	KL-74041	KL-74042
<b>Experiment 1 Electroencephalogram Measurement</b>														
Exp 1-1: Electroencephalogram while calm, with eye-open or closed	1	2												1
Exp 1-2: Measurement of evoked potential of EEG for speedy deep breathing	1	2												1
Exp 1-3: Measurement of evoked potential of EEG for flash stimulation	1	2											1	1
Exp 1-4: Measurement of evoked potential of EEG for audio stimulation	1	2										1		1
<b>Experiment 2 Electrooculogram Measurement</b>														
Exp 2-1: Electrooculogram measurement on rotation and blink of eyeballs	1	1												1
<b>Experiment 3 Electromyogram measurement</b>														
Exp 3-1: Electromyogram on contraction of biceps muscle	1	1												1
Exp 3-2: Electromyogram on contraction of antagonistic muscles	1	2												1
Exp 3-3: Isometric & isotonic contraction of skeletal muscles	1	2												1
Exp 3-4: Tetanus and fatigue of muscle	1	2												1
<b>Experiment 4 Measurement of Heart Beat and Heart Sound</b>														
Exp 4-1: Measurement of heart beats in human being	1						1							1
Exp 4-2: Measurement of heart sound in human being	1					1	1							1
<b>Experiment 5 Electrocardiogram Measurement</b>														
Exp 5-1: Electrocardiogram measurement during resting condition	1	1	1											1
Exp 5-2: The change of electrocardiogram in temperature stimulation	1	1	1											1
<b>Experiment 6 Measurement of Blood Pressure</b>														
Exp 6-1: Measurement of mercury sphygmomanometer														
Exp 6-2: Measurement of blood pressure with oscillometry	1				1									1
Exp 6-3: Measurement of blood pressure with Korotkoff sound	1				1	1								1
<b>Experiment 7 Measurement of Animal Blood Pressure and Temperature Parameters</b>														
Exp 7-1: Invasive measurement of arterial blood pressure	1			1										1
Exp 7-2: Measurement of colonic temperature	1										1			1
<b>Experiment 8 Measurement of Intestinal Sound</b>														
Exp 8-1: Measurement of intestinal sound in normal condition	1					1								1
Exp 8-2: Measurement of intestinal sound on an empty stomach	1					1								1
Exp 8-3: Measurement of intestinal sound in diet	1					1								1
<b>Experiment 9 Respiration Measurement</b>														
Exp 9-1: Measurement of respiration and heart rate in resting condition	1						1	1	1					1
Exp 9-2: Measurement of respiration and heart rate in hyperventilation	1						1	1	1					1
Exp 9-3: Measurement of respiration and heart rate in hypoventilation	1						1	1	1					1
Exp 9-4: Measurement of respiration and heart rate in exercise	1						1	1	1					1
<b>Experiment 10 Pulmonary Function Measurement</b>														
Exp 10-1: Measurement of static pulmonary volume	1									1				1
Exp 10-2: Measurement of dynamic pulmonary volume	1									1				1
Exp 10-3: Measurement of pulmonary volume in exercise	1									1				1
<b>Experiment 11 Psychophysiological Parameters Measurement under Various Emotion Condition</b>														
Exp 11-1: GSR measurement for respiration	1										1			1
Exp 11-2: GSR and heart rate measurement for temperature	1						1				1			1
Exp 11-3: GSR and heart rate measurement for emotion	1						1				1			1



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