

# Spray Pyrolysis Deposition System

## KV-25

for thin film formation

from



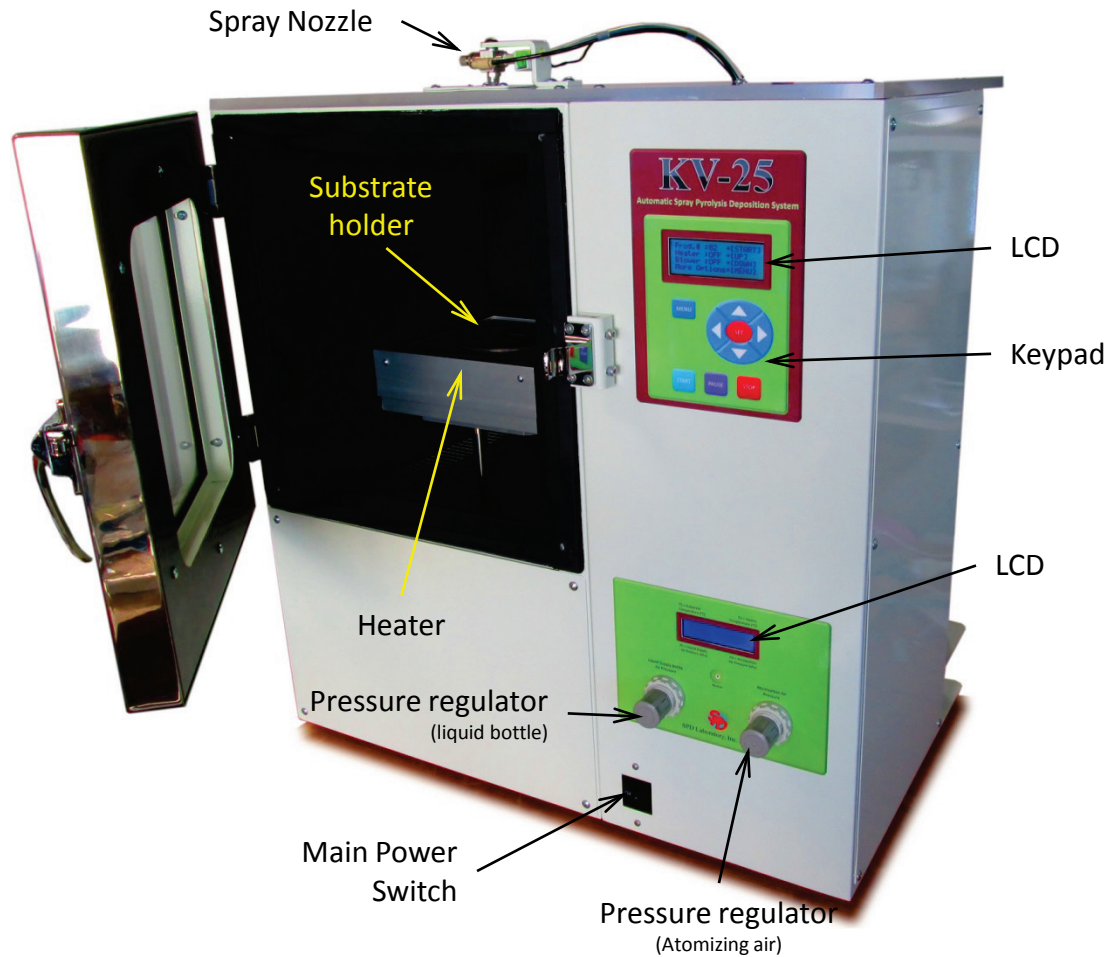
SPD Laboratory, Inc.  
JAPAN



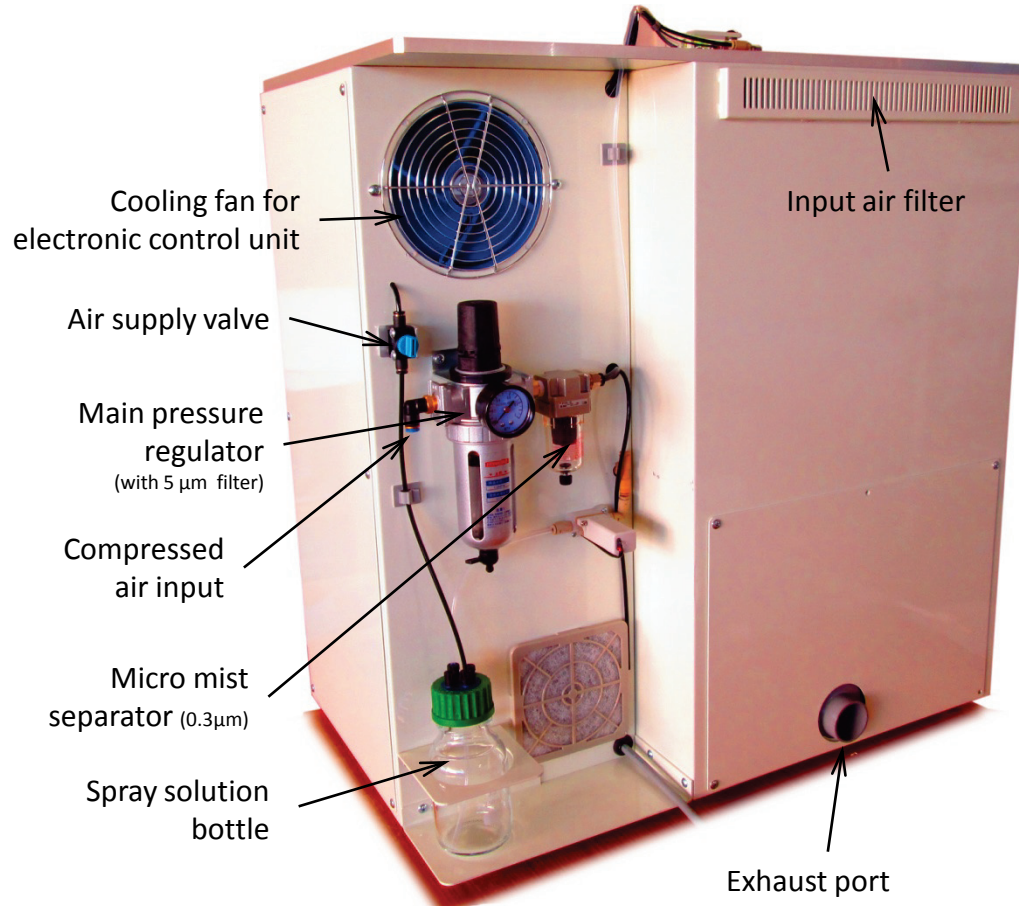
# KV-25 Specifications

Substrate size	Up to 25 mm × 25 mm
Substrate temperature	Max. 650 °C
Spray distance	150 mm to 300 mm (with ±0.5 mm accuracy)
Reaction chamber	W320 mm x D360 x H360 mm Teflon coated for corrosion resistance
External dimensions	W650 mm x D400 mm x H730 mm
Weight	60 kg
Capacity of solution bottle	250 ml
Power supply and power consumption	100 VAC Single phase, 50/60 Hz, 1.5 kW
Air source pressure	Over 0.6 MPa (oil free air only, inlet: 6 mm ø)
Exhaust system	Built-in exhaust pump with powder filters. Exhaust outlet: 45 mm

# KV-25 Specifications



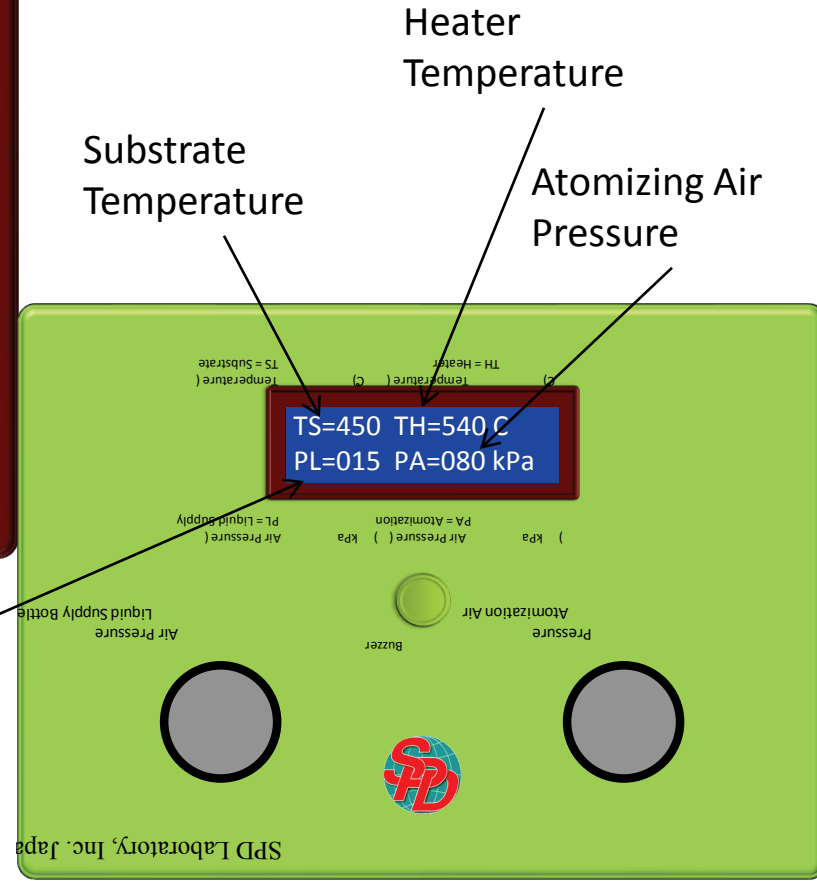
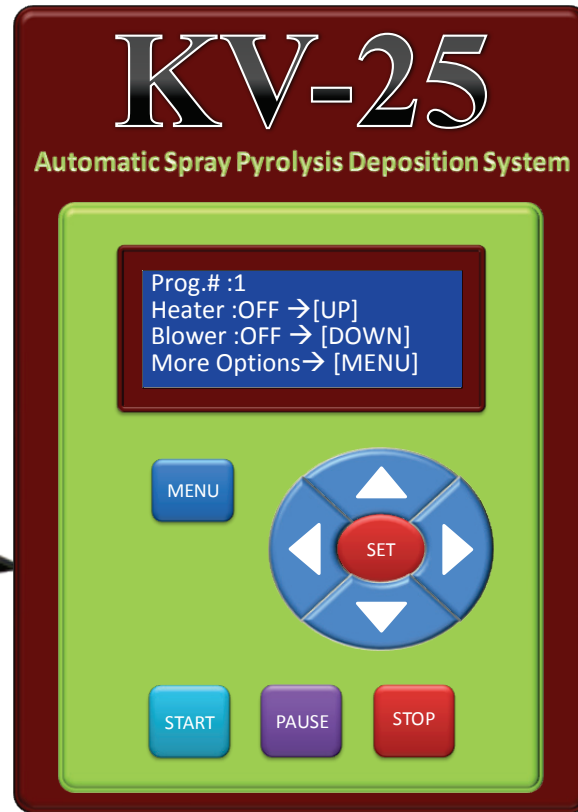
# KV-25 Specifications



# KV-25 Unique Features

1

**User friendly interface and easy setting of operation parameters through keypad and LCD.**



Liquid Bottle Air Pressure

# KV-25 Unique Features

1

**User friendly interface and easy setting of operation parameters through keypad and LCD.**

## Main Menu

-----Main Menu-----

- 1. SPD Parameters
- 2. Load Program
- 3. Save Program

-----Main Menu-----

- 4. Maintenance
- 5. Advanced Settings
- 6. Exit Main Menu

## Maintenance Menu

Maintenance Menu

- 1. Monitor Flow Rate
- 2. Manual Operation
- 3. Refill liquid

Maintenance Menu

- 4. Return Liquid
- 5. Clean Tubs
- 6. Return to MainMenu

## SPD Parameter Menu

SPD Parameters Menu

- 1. Spray Time:00.5 s
- 2. Interval :12.0 s
- 3. Cycles :200

SPD Parameters Menu

- 4. Rate(ml/s):0.150
- 5. P.Atomiz :070 kPa
- 6. P.Liquid :015 kPa

SPD Parameters Menu

- 7. Subs.Temp.:480 C
- 8. Tot. Volume:015.0ml
- 9. Distance :20.0 cm

SPD Parameters Menu

- 10. Opt. Mode:7
- 11. Ex. Off Dly:10min
- 12. Anne. Temp.500 C

SPD Parameters Menu

- 13. Anne. Time:01min
- 14. Return to main

## Advanced Settings Menu

Advanced Settings

- 1. A-L Delay :0.20 s
- 2. Temp.Tol. :05 C
- 3. Press.Tol.:03 kPa

Advanced Settings

- 4. Cal.Cons 1:3.620
- 5. Cal.Cons 2:0.000
- 6. PID Mode :1

Advanced Settings

- 7. P1: 007.5
- 8. I1: 004.0
- 9. D1: 002.5

Advanced Settings

- 10. P2: 008.5
- 11. I2: 003.0
- 12. D2: 001.5

Advanced Settings

- 13. Heater Limit:680C
- 14. Flow Tol.:0.010
- 15. Temp.Ramp:15C/min

Advanced Settings

- 16. Flow Calibrate
- 17. Return to M.Menu

# KV-25 Unique Features

2

**Storage capability of various thin film formation recipes.**

Parameter	Units	Program 1 FTO	Program 2 TiO <sub>2</sub>	Program 3 Pt	Program 4 ITO	Program 5 TiO <sub>2</sub> dense	Program 6	Program 7	Program 8	Program 9
1. Spray Time	sec	xx.x	xx.x	xx.x	xx.x	xx.x				
2. Interval	sec	xx.x	xx.x	xx.x	xx.x	xx.x	<b>Machine comes with optimized recipes for FTO, TiO<sub>2</sub>(porous), Pt, ITO TiO<sub>2</sub>(dense).</b>			
3. Cycles	-	xxx	xxx	xxx	xxx	xxx				
4. Spray Flow Rate	ml/s	x.xxx	x.xxx	x.xxx	x.xxx	x.xxx				
5. Atomizing Air Pressure	kPa	70	90	70	70	80				
6. Liquid Bottle Air Pressure	kPa	15	20	15	15	20				
7. Substrate Temperature	°C	xxx	xxx	xxx	xxx	xxx				
8. Total Spray Amount	ml	15.0	10.8	4.4						
9. Nozzle to Substrate Distance	cm	20.0	20.0	20.0	20.0	20.0				
<b>10. Operation Mode</b>	-	<b>11111</b>	<b>11111</b>	<b>11111</b>	<b>11111</b>	<b>11111</b>				
11. Exhaust Blower Stop Delay	min	10	2	3	10	10				
12. Annealing Temperature	°C	500	500	450	370	500				
13. Annealing Time	min	1	30	15	1	1				

# KV-25 Operation Modes

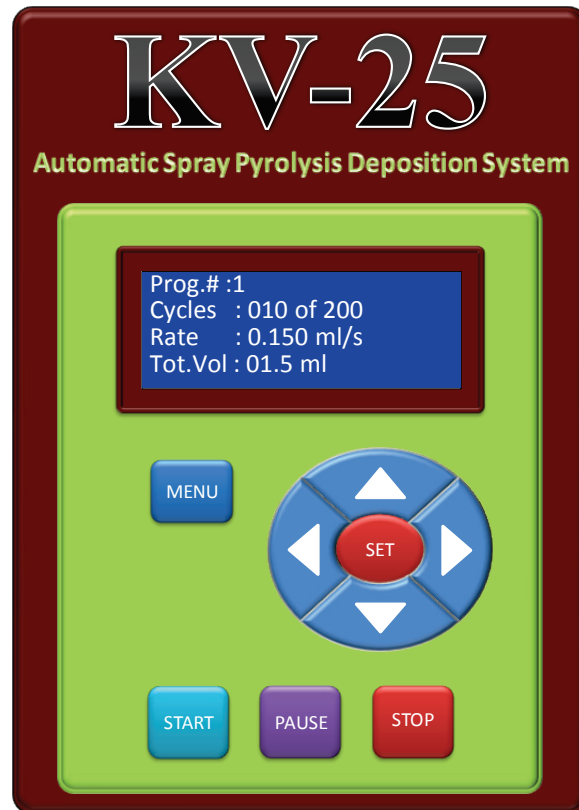
Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Nozzle Rotation	Flow rate monitoring	Flow rate Measuring	Temperature monitoring	Pressure monitoring
0/1	0/1	0/1	0/1	0/1

- Bit 4     **Nozzle Rotation:** Spray nozzle circular motion selection bit  
 1 = Nozzle motion enable     0 = Nozzle motion disable
- Bit 3     **Flow rate monitoring:** Flow rate monitoring function selection bit  
 1 = Flow rate monitoring enable     0 = Flow rate monitoring disable
- Bit 2     **Flow rate Measuring:** : Flow rate measuring function selection bit  
 1 = Flow rate measuring enable     0 = Flow rate measuring disable
- Bit 1     **Temperature monitoring:** Temperature monitoring function selection bit  
 1 = Temperature monitoring enable     0 = Temperature monitoring disable
- Bit 0     **Pressure monitoring:** Pressure monitoring function selection bit  
 1 = Pressure monitoring enable     0 = Pressure monitoring disable



# KV-25 Unique Features

- 3 **Equipped with a real time liquid flow monitoring system to display actual spray volume in each spray and total volume sprayed.**



Automatic-spray-operation-stopping-condition can be set to fixed number of cycles or fixed volume.

# KV-25 Unique Features

4

## **Automatic functions for supporting and maintaining operations**

### **1. Fill Tube:**

Remove air from tubes when new raw material bottle connected.

### **2. Return Liquid:**

Return liquid in the tube back to bottle before removing raw material bottle from the system.

### **3. Clean Tube:**

Wash out liquid transporting tube with a solvent such as EtOH or IPA before changing to new material.

### **4. Monitor Flow Rate:**

Test actual flow rate by discharging liquid through nozzle (without atomizing air). Help user to adjust the flow rate by changing nozzle opening.

### **5. Manual Operation:**

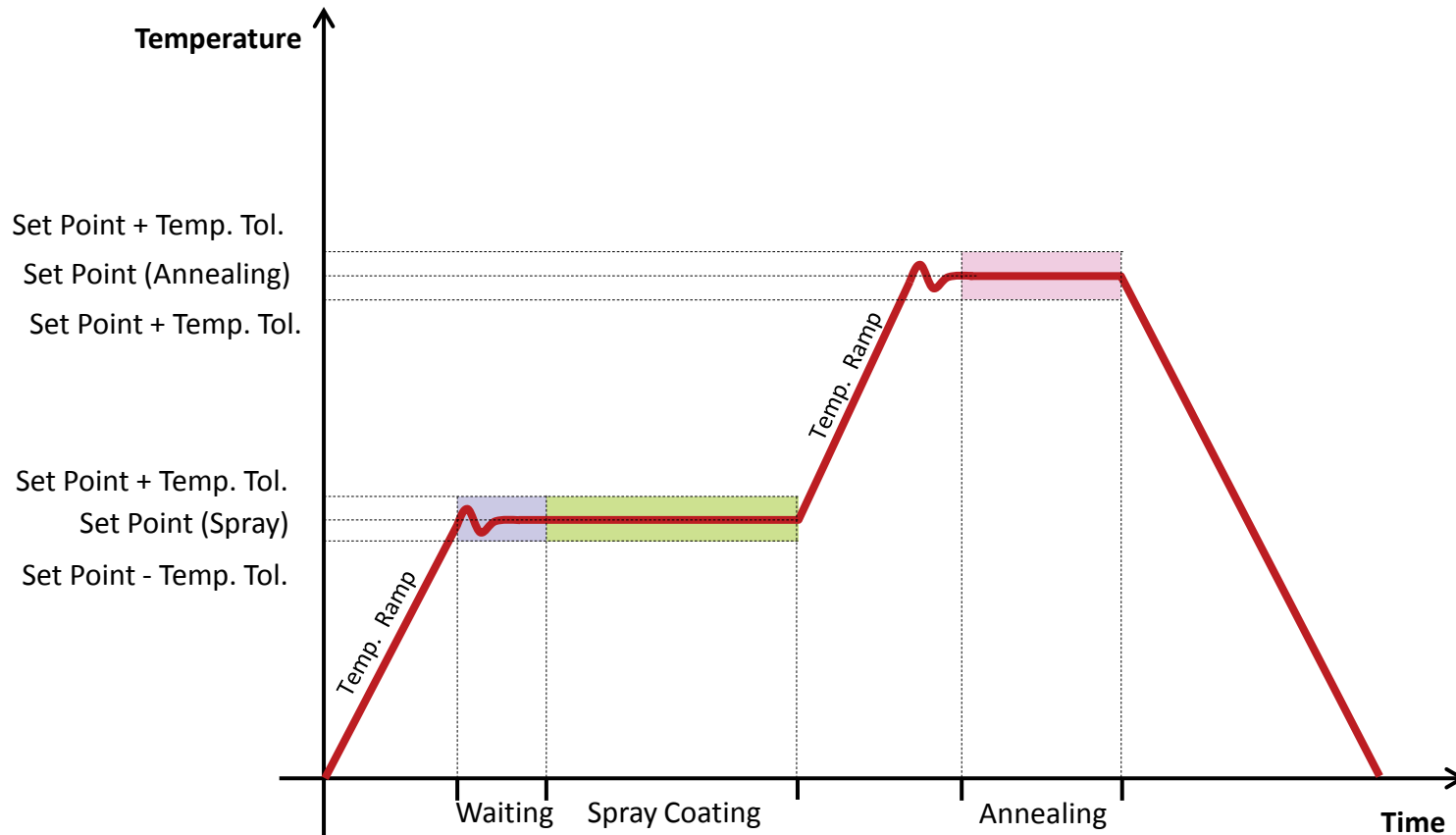
Allow user to manually perform spray operation.

# KV-25 Unique Features

5

## Programmable coating and post annealing temperature profiles.

Heating rate can be change from 1 to 60° C/min



# KV-25 Unique Features

6

## **Dedicated substrate heater**

1. Controlled by cascade PID controller with 2 temperature sensors.
2. Continuously display substrate and heater temperature on LCD.
3. Five different sets of PID constants stored in the controller and automatically select when select required substrate temperature.

# Advanced Setting Values Stored in KV-25

Setting Name	Units	Description	Factory Default Value				
1. A-L Delay	sec	Air to liquid delay in the nozzle when turn “ON” and “OFF” the nozzle	x.xx				
2. Temp.Tol.	°C	Allowed maximum deviation (tolerance) for substrate temperature	5.0				
3. Press.Tol.	kPa	Allowed maximum deviation (tolerance) for atomizing and liquid air pressures	4.0				
4. Cal.Cons 1	-	Flow rate calibration constant 1 (factory set value)	3.620				
5. Cal.Cons 2	-	Flow rate calibration constant 2 (factory set value)	x.xxx				
6. PID Mode	-	Operation mode of PID Temperature controllers 0= Open, 1= Cascade	1				
			0 - 200 °C	200 - 299 °C	300 - 399 °C	400 - 499 °C	500 - 600 °C
7. P1	-	Proportional gain constant for PID controller 1	5.0	17.0	5.0	7.5	8.0
8. I1	-	Integral gain constant for PID controller 1	3.5	8.0	8.0	4.0	12.0
9. D1	-	Derivative gain constant for PID controller 1	1.5	6.0	5.0	2.5	4.5
10. P2	-	Proportional gain constant for PID controller 2	5.0	15.0	5.0	8.5	15.0
11. I2	-	Integral gain constant for PID controller 2	7.2	2.0	2.0	3.0	6.0
12. D2	-	Derivative gain constant for PID controller 2	1.0	3.0	2.0	1.5	2.5
13. Heater Limit	°C	Maximum limit for heating element temperature	280	390	500	650	750
14. Flow Tol.	ml/s	Allowed maximum deviation (tolerance) for flow rate	0.01				
15. Tmp. Ramp	°C/min	Heating rate of the substrate heater. (Do not set above 20 °C/min for ceramic substrate holders)	15.0				
16. Flow Calibrate	-	Flow rate calibration procedure (procedure already done in the factory)	-				

# KV-25 New Features

7

**Built-in exhaust pump with input and output dust filters**



# KV-25 Unique Features

8

**Easily changeable spray distance  
(nozzle to substrate distance)**



# KV-25 Optional Features

Multi spray nozzles

Up-to 3 spray-nozzles with individual liquid containers, tubes, and flow-rate measuring units.

Moving spray nozzle

In the case of porous oxide film making it is recommend to use optional feature of rotating nozzle.

Data logging and computer control

Optional USB port will allow personal computer to connect with KV-25 and controlled its functions and data logging.