SMARTLAB
USB 8 CHANNELS RELAY OUTPUT
8 CHANNELS PHOTO ISOLATOR
INPUT BOARD

OPERATION MANUAL

Decision Group Inc.

TABLE OF CONTENTS

CHAPTERS

APPENDICES

- Allow the photo input signals to be completely floated and prevent the ground loops.
- 16 LED correspond to 8 input and 8 output ports activation status.
- By using PC817 photo couple chips.
- Power supplied from External DC +5V.
- For photo couple input channel, the isolation voltage is 5000V, maximum load voltage is 30V, maximum input current is 50mA forward.

- Activation voltage of photo input:

  When short jumpers (input range from 0 to 20V DC)
      0 to 3.3V   inactive
      4.5 to 20V   active
  When open jumpers (input range from 0 to 30V DC)
      0 to 17.6V   inactive
      18 to 30V   active

- Maximum contact rating is 220V/AC, 120V/DC 1AMP, minimum response time is 1ms, maximum contact resistance is 0.1 OHM.

-
- Each digital I/O provides voltage range from 0V to 3.5V, where 0 to 0.4V is OFF and 2.8V to 3.4V is ON.

- Suitable for Linux, MS/Windows ... etc.
- Operating temperature range from 0 to 55 ºC.
- Relative humidity rage from 0 to 90%.

❖ **PACKAGE CONTENTS:**

- SMARTLAB USB 8 channels relay output / photo isolator input board
- USB cable.
- Decision Studio and User's manual CD.
- Two Different Connecter Types can be selected:
  Standard: European P.C.B type terminal blocks
  Professional: Pluggable terminal blocks

Optional

- Extension board with DB9 : RS232 or RS422/485
- PCB Carrier
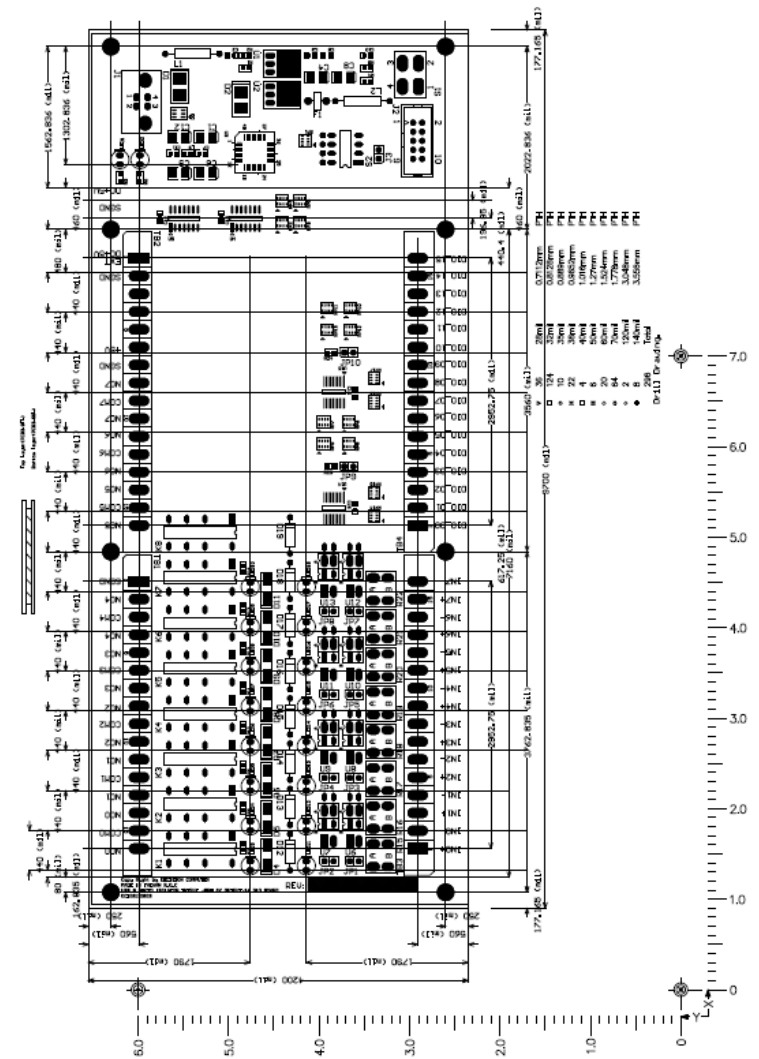
CHAPTER 2
HARDWARE CONFIGURATION

Before you use the USB 8 channels relay output / 8 channels photo couple input board, please ensure that the jumpers and switches setting. The proper jumper and switches settings for the 8 channels relay output / 8 channels photo couple input adapter are described in the following.

2.1 Switch Settings

1. S1 Reset

The S1 switch is used to reset 8051, the signal assignments are shown in the following.

Pin	Signals
3,4	Reset SW+
1,2	Reset SW-

2. S2 USB ID

The S2 switch is used to identify USB board ID. Please set different board ID to each board (do not duplicate board ID setting).

| 1	2	3	4	Card ID
ON	ON	ON	ON	--
OFF	ON	ON	ON	14
ON	OFF	ON	ON	13
OFF	OFF	ON	ON	12
ON	ON	OFF	ON	11
OFF	ON	OFF	ON	10
ON	OFF	OFF	ON	9
OFF	OFF	OFF	ON	8
ON	ON	ON	OFF	7
OFF	ON	ON	OFF	6
ON	OFF	ON	OFF	5
OFF	OFF	ON	OFF	4
ON	ON	OFF	OFF	3
OFF	ON	OFF	OFF	2
ON	OFF	OFF	OFF	1
OFF	OFF	OFF	OFF	0

3. Down load revised firmware

When the S2 switch is set to ON ON ON ON status, means down load revised firmware. please follow the steps shown in the following:

1. Set S2 to ON ON ON ON.
2. Run USBBootloader program to down load revised firmware.

2.2 Jumper Settings

1. Input Voltage Range Selection (JP1 to JP8)
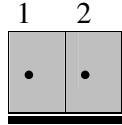
JP1 to JP8 are used to select input voltage range. The JP1 is used to select photo couple input channel 0, and JP2 is used to select photo couple input channel 1 … etc. When short the jumper, the input voltage range from 0 to 20V, and the active voltage form 4.5 to 20V. When open the jumper, the input voltage range from 0 to 30V, and the active voltage from 18 to 30V.

| Jumper	Input Voltage	Inactive Voltage	Active Voltage
open	0 to 30V	0 to 17.6V	18 to 30V
short	0 to 20V	0 to 3.3V	4.5 to 20V

2. Digital Input/Output Selection (JP9 to JP10)
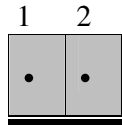
JP9 and JP10 are used to select input/output of digital I/O. When short JP9 means select input mode for D0 to D7, otherwise open JP9 means select output mode for D0 to D7. When short JP10 means select input mode for D8 to D15, otherwise open JP10 means select output mode for D8 to D15.

2.3 USB Connector

1. USB Connector
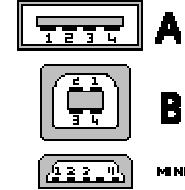
The USB connector is connected to computer USB port by using USB cable.

2.4 LED Status

1. LED1
The LED1 is an indicator to show the power is supplied normally.

2. LED2
The LED2 is an indicator to warning the USB link status. When it lights, it means USB connection works normally, otherwise it is fail.

2.5 Connector and Jumper for Serial Communication

If there isn't a 2x5 header on the board, it means this version doesn't support for serial communication.

1. The connector of serial communication(J2)
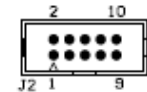
To use RS422/RS485/RS232, please connect J2 to extension board by 10 pins flat cable. (Optional)

2. Enable Serial Port (J3)

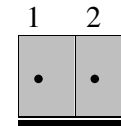J3 is used enable serial port communication, when short the J3, means enable serial port, otherwise, when open the J3, the serial port communication is disable.

2.6 Connector Assignments

The photo isolator input signal and relay output signal pin assignments are shown in the below.

1. **Input Signal Assignments**

Pin	Signal	Description
1	IN0+	Opto-isolator Ch. 00 + Input
2	IN0-	Opto-isolator Ch. 00 - Input
3	IN1+	Opto-isolator Ch. 01 + Input
4	IN1-	Opto-isolator Ch. 01 - Input
5	IN2+	Opto-isolator Ch. 02 + Input
6	IN2-	Opto-isolator Ch. 02 - Input
7	IN3+	Opto-isolator Ch. 03 + Input
8	IN3-	Opto-isolator Ch. 03 - Input
9	IN4+	Opto-isolator Ch. 04 + Input
10	IN4-	Opto-isolator Ch. 04 - Input
11	IN5+	Opto-isolator Ch. 05 + Input
12	IN5-	Opto-isolator Ch. 05 - Input
13	IN6+	Opto-isolator Ch. 06 + Input
14	IN6-	Opto-isolator Ch. 06 - Input
15	IN7+	Opto-isolator Ch. 07 + Input
16	IN7-	Opto-isolator Ch. 07 - Input

2. **Output Signal Assignments**

Pin	Signal	Description
1	NC0	Relay Ch. 00 - Output

2	COM0	Relay Ch. 00 - Output
3	NO0	Relay Ch. 00 - Output
4	NC1	Relay Ch. 01 - Output
5	COM1	Relay Ch. 01 - Output
6	NO1	Relay Ch. 01 - Output
7	NC2	Relay Ch. 02 - Output
8	COM2	Relay Ch. 02 - Output
9	NO2	Relay Ch. 02 - Output
10	NC3	Relay Ch. 03 - Output
11	COM3	Relay Ch. 03 - Output
12	NO3	Relay Ch. 03 - Output
13	NC4	Relay Ch. 04 - Output
14	COM4	Relay Ch. 04 - Output
15	NO4	Relay Ch. 04 - Output
16	SGND	Signal Ground

Pin	Signal	Description
1	NC5	Relay Ch. 05 - Output
2	COM5	Relay Ch. 05 - Output
3	NO5	Relay Ch. 05 - Output
4	NC6	Relay Ch. 06 - Output
5	COM6	Relay Ch. 06 - Output
6	NO6	Relay Ch. 06 - Output
7	NC7	Relay Ch. 07 - Output
8	COM7	Relay Ch. 07 - Output
9	NO7	Relay Ch. 07 – Output
10	SGND	Signal Ground
11	+5V	+5V
12		
13		
14		
15	SGND	Signal Ground
16	EXT +5V	**External DC +5V 3A Power In**

3. Digital Input / Output Signal Assignments

Pin	Signal	Description
1	DIO_00	Digital input/output ch. 00
2	DIO_01	Digital input/output ch. 01
3	DIO_02	Digital input/output ch. 02
4	DIO_03	Digital input/output ch. 03
5	DIO_04	Digital input/output ch. 04
6	DIO_05	Digital input/output ch. 05
7	DIO_06	Digital input/output ch. 06
8	DIO_07	Digital input/output ch. 07
9	DIO_08	Digital input/output ch. 08
10	DIO_09	Digital input/output ch. 09
11	DIO_10	Digital input/output ch. 10
12	DIO_11	Digital input/output ch. 11
13	DIO_12	Digital input/output ch. 12
14	DIO_13	Digital input/output ch. 13
15	DIO_14	Digital input/output ch. 14
16	DIO_15	Digital input/output ch. 15

CHAPTER 3
Digital Input / Output Port Setting

AUSB8PR provide 16 digital channels (TTL level) and allow user to set them as 8 channel input port or 8 channel output port. Default setting is both of the ports as input

When user needs to change the port setting, it must be set in both software and hardware. In software setting, USB Init Tool.exe is a setting tool for USB series products. User can find it in Decision Studio CD with its manual. In hardware setting, JP9 and JP10 on the board are used to select input/output of digital I/O. When shorting JP9 means setting DIO_00 to DIO_07 as input mode, otherwise opening JP9 means setting DIO_00 to DIO_07 as output mode. When shorting JP10 means setting DIO_08 to DIO_15 as input mode, otherwise opening JP10 means setting DIO_08 to DIO_15 as output mode.

DIO Port1(DIO_00~DIO_07)		DIO Port2 (DIO_08~DIO_15)	
as Input	**as Output**	as Input	**as Output**
Short JP9	**Open JP9**	Short JP10	**Open JP10**
▣▣	▢▢	▣▣	▢▢
JP9	JP9	JP10	JP10

After setting by the software, the setting of JP9 and JP10 must match the setting, or it could be dangerous. <u>Especially in setting ports as output, it must open the jump on the board, or it may cause main IC damaged.</u> Please use this function extremely carefully.

CHAPTER 4

DIAGNOSTIC UNDER WINDOWS

USB Test Program.exe is a diagnostic program to test your USB devices under Windows/XP.

User can get USB Test Program.exe programs from Decision Studio CD.

CHAPTER 5

SOFTWARE PROGRAMMING UNDER WINDOWS AND LINUX

Under Windows, we provide function library and dll file for users to program the device in supported language. You can find manual "USBDII_Manual.pdf" and demo code in VB/VC/Delphi from Decision Studio CD.

Under Linux, we provide C source to allow user directly to access device. You can find manual and example in "dcihid-0.5.2.tgz".

APPENDIX A

WARRANTY INFORMATION

A.1 Copyright

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A.2 Warranty Information

SmartLab warrants that for a period of one year from the date of purchase (unless otherwise specified in the warranty card) that the goods supplied will perform according to the specifications defined in the user manual. Furthermore that the SmartLab product will be supplied free from defects

in materials and workmanship and be fully functional under normal usage.

In the event of the failure of a SmartLab product within the specified warranty period, SmartLab will, at its option, replace or repair the item at no additional charge. This limited warranty does not cover damage resulting from incorrect use, electrical interference, accident, or modification of the product.

 All goods returned for warranty repair must have the serial number intact. Goods without serial numbers attached will not be covered by the warranty.

The purchaser must pay transportation costs for goods returned. Repaired goods will be dispatched at the expense of SmartLab.

 To ensure that your SmartLab product is covered by the warranty provisions, it is necessary that you return the Warranty card.

Under this Limited Warranty, SmartLab's obligations will be limited to repair or replacement only, of goods found to be defective a specified above during the warranty period. SmartLab is not liable to the purchaser for any damages or losses of any kind, through the use of, or inability to use, the SmartLab product. SmartLab reserves the right to determine what constitutes warranty repair or replacement.

Return Authorization: It is necessary that any returned goods are clearly marked with an RA number that has been issued by SmartLab. Goods returned without this authorization will not be attended to.

APPENDIX B
DATA SHEET

SHARP   PC817 Series

■ Absolute Maximum Ratings   (Ta= 25°C)

	Parameter	Symbol	Rating	Unit
Input	Forward current	I_F	50	mA
	*1Peak forward current	I_{FM}	1	A
	Reverse voltage	V_R	6	V
	Power dissipation	P	70	mW
Output	Collector-emitter voltage	V_{CEO}	35	V
	Emitter-collector voltage	V_{ECO}	6	V
	Collector current	I_C	50	mA
	Collector power dissipation	P_C	150	mW
	Total power dissipation	P_{tot}	200	mW
	*2Isolation voltage	V_{iso}	5 000	V_{rms}
	Operating temperature	T_{opr}	- 30 to + 100	°C
	Storage temperature	T_{stg}	- 55 to + 125	°C
	*3Soldering temperature	T_{sol}	260	°C

*1 Pulse width<=100μs, Duty ratio : 0.001
*2 40 to 60% RH, AC for 1 minute
*3 For 10 seconds

■ Electro-optical Characteristics   (Ta= 25°C)

	Parameter		Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Input	Forward voltage		V_F	I_F = 20mA	-	1.2	1.4	V
	Peak forward voltage		V_{FM}	I_{FM} = 0.5A	-	-	3.0	V
	Reverse current		I_R	V_R = 4V	-	-	10	μA
	Terminal capacitance		C_t	V= 0, f= 1kHz	-	30	250	pF
Output	Collector dark current		I_{CEO}	V_{CE}= 20V	-	-	10^{-7}	A
Transfer charac-teristics	*4Current transfer ratio		CTR	I_F = 5mA, V_{CE} = 5V	50	-	600	%
	Collector-emitter saturation voltage		$V_{CE(sat)}$	I_F = 20mA, I_C = 1mA	-	0.1	0.2	V
	Isolation resistance		R_{ISO}	DC500V, 40 to 60% RH	5×10^{10}	10^{11}	-	Ω
	Floating capacitance		C_f	V= 0, f= 1MHz	-	0.6	1.0	pF
	Cut-off frequency		f_c	V_{CE}= 5V, I_C= 2mA, R_L = 100Ω, -3dB	-	80	-	kHz
	Response time	Rise time	t_r	V_{CE}= 2V, I_C= 2mA, R_L= 100Ω	-	4	18	μs
		Fall time	t_f		-	3	18	μs

*4 Classification table of current transfer ratio is shown below.

Model No.	Rank mark	CTR (%)
PC817A	A	80 to 160
PC817B	B	130 to 260
PC817C	C	200 to 400
PC817D	D	300 to 600
PC8●7AB	A or B	80 to 260
PC8●7BC	B or C	130 to 400
PC8●7CD	C or D	200 to 600
PC8●7AC	A, B or C	80 to 400
PC8●7BD	B, C or D	130 to 600
PC8●7AD	A, B, C or D	80 to 600
PC8●7	A, B, C, D or No mark	50 to 600

●: 1 or 2 or 3 or 4

Fig. 1 Forward Current vs. Ambient Temperature
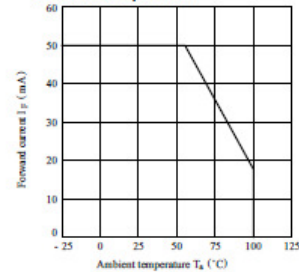
SHARP   PC817 Series

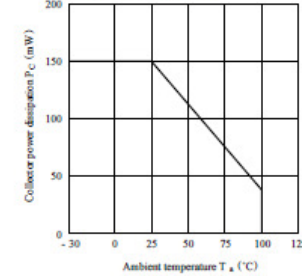**Fig. 2 Collector Power Dissipation vs. Ambient Temperature**

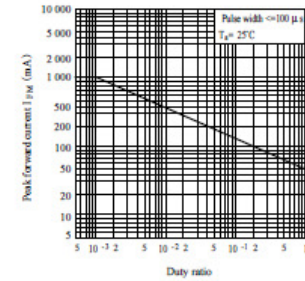**Fig. 3 Peak Forward Current vs. Duty Ratio**

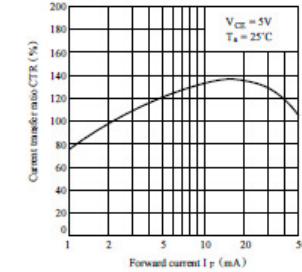**Fig. 4 Current Transfer Ratio vs. Forward Current**
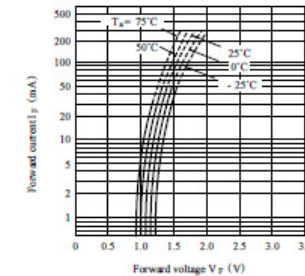

Fig. 5 Forward Current vs. Forward Voltage

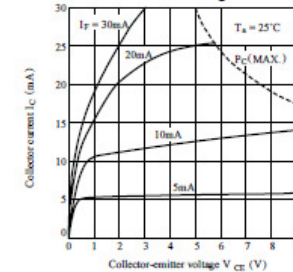**Fig. 6 Collector Current vs. Collector-emitter Voltage**
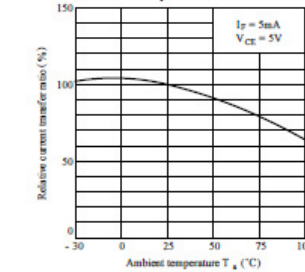

Fig. 7 Relative Current Transfer Ratio vs. Ambient Temperature

SHARP   **PC817 Series**

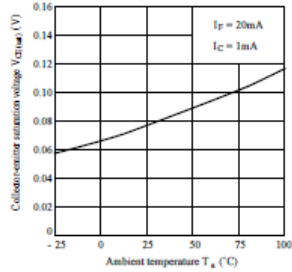**Fig. 8 Collector-emitter Saturation Voltage vs. Ambient Temperature**

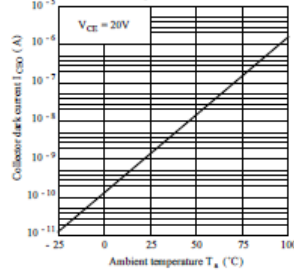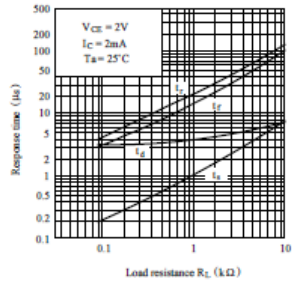**Fig. 9 Collector Dark Current vs. Ambient Temperature**

Fig.10 Response Time vs. Load Resistance

Fig.11 Frequency Response
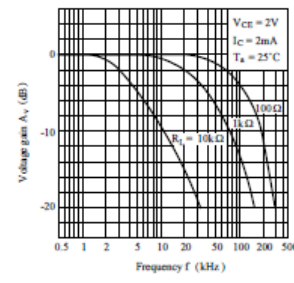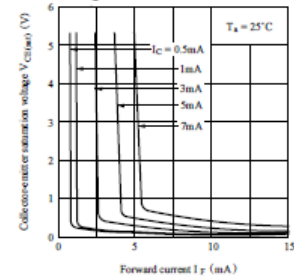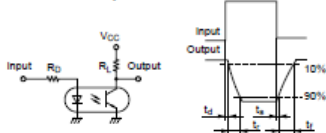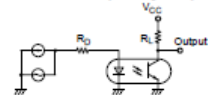
Test Circuit for Response Time

Fig.12 Collector-emitter Saturation Voltage vs. Forward Current

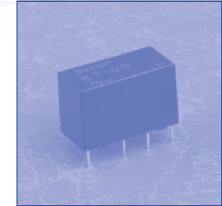**Test Circuit for Frequency Response**

● Please refer to the chapter "Precautions for Use"

■ **FEATURES**

- 2 Form C Contact
- DIL Pitch Terminals
- High Reliability Bifurcated Contact
- Conforms to FCC Part 68 1500V Surge and Dielectric Strength 1000VAC
- Fully sealed
- UL File No. E147052

■ **COIL RATING (at 20 °C)**

Nominal Voltage (VDC)	Coil Resistance (Ω± 10%)	Nominal Current (mA)	Pick-Up Voltage (VDC)	Drop-Out Voltage (VDC)	Maximum Allowable Voltage(VDC)	Power Consumption (mW)
5	167	30	3.5	0.5	6.0	150
6	240	25	4.2	0.6	7.2	150
9	540	16.6	6.3	0.9	10.8	150
12	960	12.5	8.4	1.2	14.4	150
24	2880	8.3	16.8	2.4	28.8	200
48	7680	6.25	33.6	4.8	57.6	300

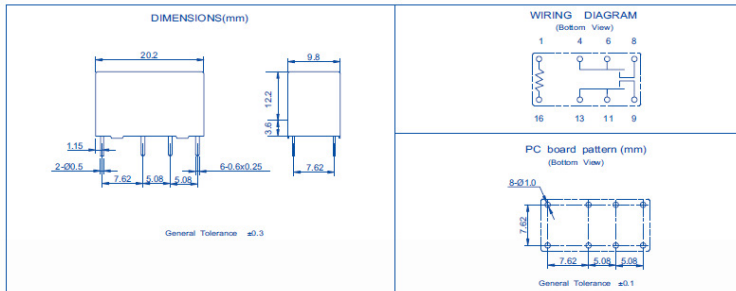■ **ORDERING INFORMATION**

BT-12 S

Coil Voltage	Coil Sensitivity
See Coil Rating	S : 150~300mW low consumption type

*Nil : Power Consumption up to 560mW available upon request

■ SPECIFICATIONS

Model No.		BT
Contact Arrangement		2 Form C
Contact Type		Bifurcated
Contact Material		AgPd+Au Clad
Contact Resistance		Max. 60mΩ (initial)
Contact Rating (at Resistive Load)	Max. Switching Voltage	220VAC, 150VDC
	Max. Switching Current	2A
	Max. Switching Power	30W(DC), 50VA(AC)
	Rated Load	1.25A 24VDC 0.5A 100VAC
Dielectric Strength		
Between Coil & Contacts		1000VAC(1 minute)
Between Contacts		1000VAC(1 minute)
Surge Strength		1500V
Operate Time		Max. 6m Sec
Release Time		Max. 4m Sec
Ambient Temperature		-30°C~+80 °C
Insulation Resistance		Min. 1000MΩ at 500VDC
Vibration Resistance		1.5mm D.A. 10-55HZ
Shock	Functional	10G
	Destruction	100G
Mechanical Life		2×10^7 operations (at no load)
Electrical Life (Resistive Load)		2×10^6 operations at 1mA 20m VAC
		2×10^6 operations at 20mA 20 VDC
		1×10^5 operations at 1.25A 24 VDC
		1×10^5 operations at 0.5A 100 VAC
Weight		Approx. 6g

DIMENSIONS(mm)

20.2   9.8   12.2   3.6

1.15   2-Ø0.5   7.62   5.08   5.08   6-0.6x0.25   7.62

General Tolerance ±0.3

WIRING DIAGRAM (Bottom View)

1   4   6   8
16   13   11   9

PC board pattern (mm) (Bottom View)

8-Ø1.0

7.62   5.08   5.08

General Tolerance ±0.1

APPENDIX C

External Power Installation

**Optional for Decision Group USB I/O series of items*

*** The materials of the external power for Decision Group USB I/O series items are customer-self-supplied or optional purchase, they are not covered in the standard package of Decision Group USB I/O series items.*

1. The Materials of the external power (*customer-self-supplied*)

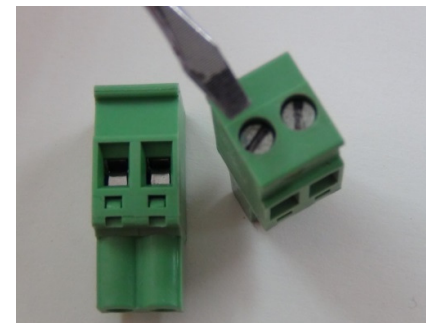* 5V / 1A AC adapter (*Power plug type is subject to the different varieties in different country.*).
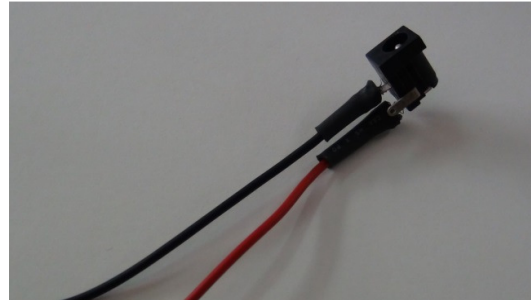
* AC power cord

2. Terminal blocks built-in on Decision Group USB I/O series of Items:
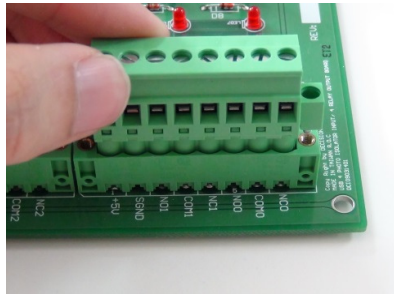

e.g. PCB pluggable terminal blocks. (for PRO type only)
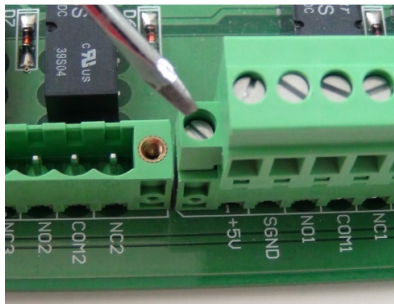
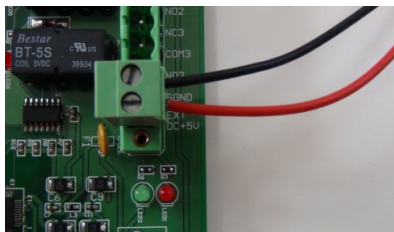## 3. External Power Installation procedure:

To tight / loose the terminal with a minus screwdriver.
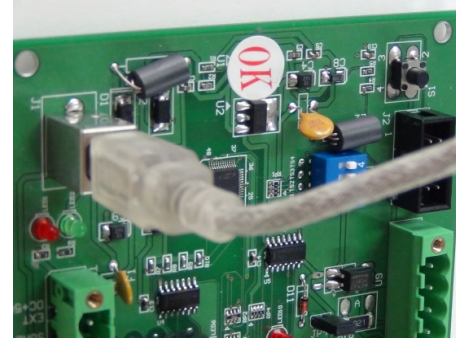
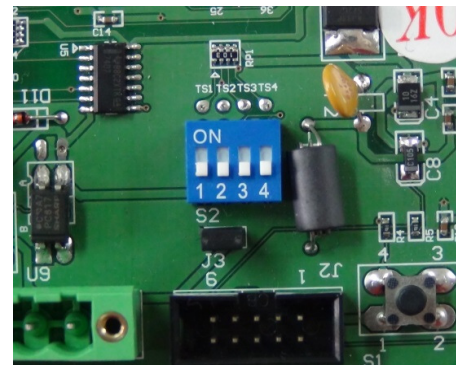Plug the terminal blocks into the socket. (PRO type only)

Fasten both sides of the screws (PRO type only)

Attach the **black** cord to the **SGND** and the **red** cord to the **EXT DC+5V.,** as well as the signals cords

Connect your device to the computer with a USB cable

To confirm all the switches and jumper setting are correct in compliance