# SMARTLAB
# USB 4 CHANNELS RELAY OUTPUT 4 CHANNELS PHOTO ISOLATOR INPUT BOARD

# OPERATION MANUAL


**Decision Group Inc.**



Operations Manual USB 4 Channel Relay Out / Photo In Board

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# CHAPTER 1
# INTRODUCTION

USB 4 channels relay output / photo isolator input board provides photo couple digital input and relay output channels. The photo isolator input part provides 4 photo couple digital input channels, which allow the input signals to be completely floated and prevent the ground loop. The relay output part provides 4 relays to drive 4 different output channels. Each relay channel can be used to control ON/ OFF of external devices, to drive external power relays, to activate alarms… etc.

The USB 4 channels relay output / photo isolator input board provides Plug and Play (PnP) features, it is a programmable I/O interface board for PC/486, Pentium, or compatibles. The on board high speed 8051 uC provides USB functions run at 12Mbps full speed or 1.5Mbps low speed.

## ❖ The features of USB 4 channels relay output / photo isolator input board are:

- USB2.0 with Plug and Play (PnP) features.
- High speed 8051 uC core.
- Support USB ID selection to identify USB device.
- Support 4 photo couple input channels and 4 relay output channels.
- Allow the photo input signals to be completely floated and prevent the ground loops.
- 8 LED correspond to 4 input and 4 output ports activation status.
- By using PC817 photo couple chips.





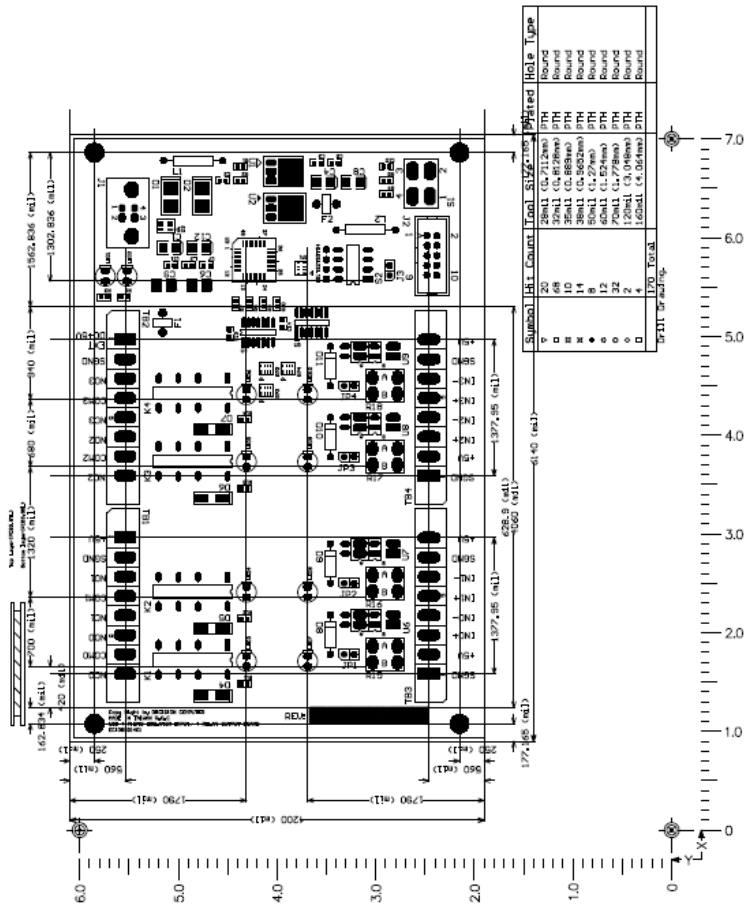
- Power supplied from External DC +5V.
- For photo couple input channel, the isolation voltage is 5000V, maximum load voltage is 30V, maximum input current is 50mA forward.
- Activation voltage of photo input:
  When short jumpers (input range from 0 to 20V DC)
  0 to 3.3V inactive
  4.5 to 20V active
  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.
- Suitable for Linux, MS/Windows ... etc.
- Operating temperature range from 0 to 55ºC.
- Relative humidity rage from 0 to 90%.

## ❖ PACKAGE CONTENTS:

- SMARTLAB USB 4 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 USB 4 channels relay output board, please ensure that the jumpers and switches setting. The proper jumper and switches settings for the 4 channels relay output board are described in the following.

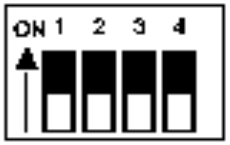
## 2.1 Switch Settings

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 ID setting).

| 1 | 2 | 3 | 4 | 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. Download 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:

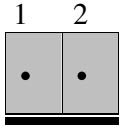
1. Set S2 to ON ON ON ON.
2. Run USBBootloader program to down load revised firmware.





## 2.2 Jumper Settings

Input Voltage Range Selection (JP1 to JP4)

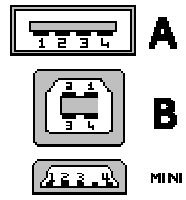



JP1 to JP4 are used to select input voltage range. The JP1 is used to select photo couple input channel 0, and JP2 is used to select photo couple input channel 1 … etc. When short the jumper, the input voltage range from 0 to 20V, and the active voltage form 4.5 to 20V. When open the jumper, the input 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 |

## 2.3 USB Connector

1. USB Connector




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

## 2.4 LED Status

1. LED1

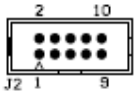
The LED1 is an indicator to show the power is supplied normally.

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.

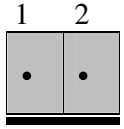
### 2.5 Connector and Jumper for Serial Communication

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 | SGND | Signal Ground |
| 2 | +5V | +5V |
| 3 | IN0+ | Opto-isolator Ch. 00 + Input |
| 4 | IN0- | Opto-isolator Ch. 00 - Input |
| 5 | IN1+ | Opto-isolator Ch. 01 + Input |





| | | |
|---|---|---|
| 6 | IN1- | Opto-isolator Ch. 01 - Input |
| 7 | SGND | Signal Ground |
| 8 | +5V | +5V |
| **Pin** | **Signal** | **Description** |
| 1 | SGND | Signal Ground |
| 2 | +5V | +5V |
| 3 | IN2+ | Opto-isolator Ch. 02 + Input |
| 4 | IN2- | Opto-isolator Ch. 02 - Input |
| 5 | IN3+ | Opto-isolator Ch. 03 + Input |
| 6 | IN3- | Opto-isolator Ch. 03 - Input |
| 7 | SGND | Signal Ground |
| 8 | +5V | +5V |

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 | SGND | Signal Ground |
| 8 | +5V | +5V |
| **Pin** | **Signal** | **Description** |
| 1 | NC2 | Relay Ch. 02 - Output |
| 2 | COM2 | Relay Ch. 02 - Output |
| 3 | NO2 | Relay Ch. 02 - Output |
| 4 | NC3 | Relay Ch. 03 - Output |
| 5 | COM3 | Relay Ch. 03 - Output |
| 6 | NO3 | Relay Ch. 03 - Output |
| 7 | SGND | Signal Ground |
| 8 | EXT+5V | **External DC +5V 3A Power In** |

# CHAPTER 3
# 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 4
# 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



Each piece of SmartLab package permits user to use SmartLab only on a single computer, a registered user may use he program on a different computer, but may not use the program on more than one computer at the same time.

Corporate licensing agreements allow duplication and distribution of specific number of copies within the licensed institution. Duplication of multiple copies is not allowed except through execution of a licensing agreement. Welcome call for details.

## 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

# PC817 Series

**High Density Mounting Type Photocoupler**

● Lead forming type (I type) and taping reel type (P type) are also available. (PC817I/PC817P)
●● TUV (VDE0884) approved type is also available as an option.

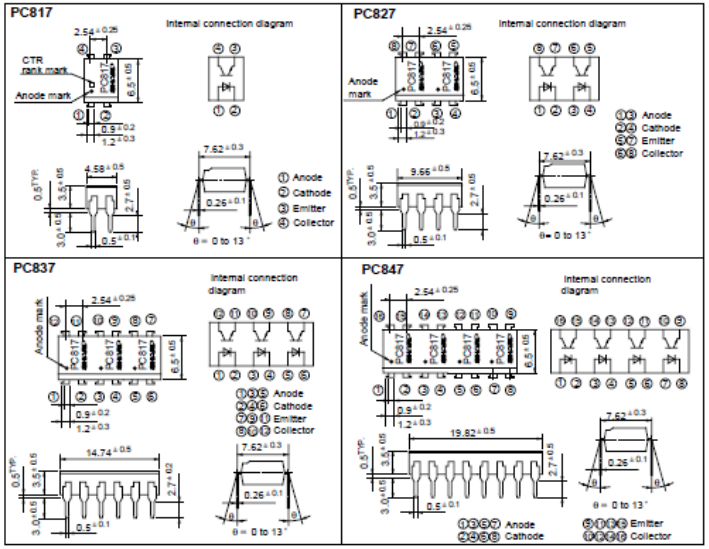
### ■ Features

1. Current transfer ratio (CTR: MIN. 50% at $I_F$ = 5mA, $V_{CE}$=5V)
2. High isolation voltage between input and output ($V_{iso}$: 5 000$V_{rms}$)
3. Compact dual-in-line package
   - PC817 : 1-channel type
   - PC827 : 2-channel type
   - PC837 : 3-channel type
   - PC847 : 4-channel type
4. Recognized by UL, file No. E64380

### ■ Applications

1. Computer terminals
2. System appliances, measuring instruments
3. Registers, copiers, automatic vending machines
4. Electric home appliances, such as fan heaters, etc.
5. Signal transmission between circuits of different potentials and impedances

### ■ Outline Dimensions (Unit : mm)




* In the absence of confirmation by device specification sheets, SHARP takes no responsibility for any defects that occur in equipment using any of SHARP's devices, shown in catalogs, data books, etc. Contact SHARP in order to obtain the latest version of the device specification sheets before using any SHARP's device. *

## ■ 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 <=100 μs, 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 | $5 \times 10^{10}$ | $10^{11}$ | - | 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, $R_L$ = 100 Ω, - 3dB | - | 80 | - | kHz |
| | Response time | Rise time | $t_r$ | $V_{CE}$ = 2V, $I_C$ = 2mA, $R_L$ = 100 Ω | - | 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

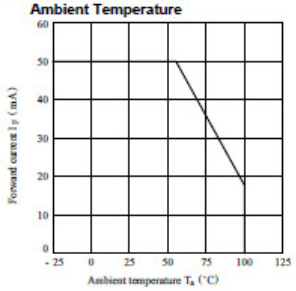









Fig. 2 Collector Power Dissipation vs. Ambient Temperature

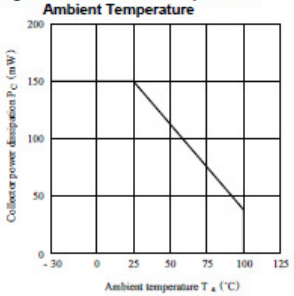



Fig. 3 Peak Forward Current vs. Duty Ratio

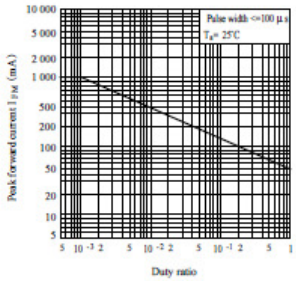



Fig. 4 Current Transfer Ratio vs. Forward Current

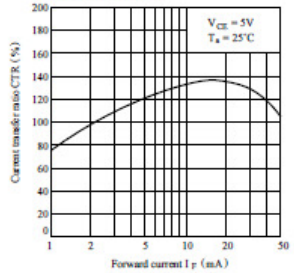



Fig. 5 Forward Current vs. Forward Voltage

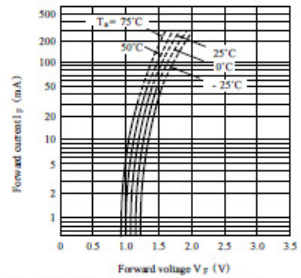



Fig. 6 Collector Current vs. Collector-emitter Voltage

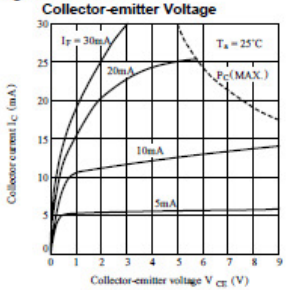
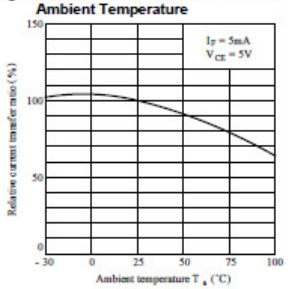



Fig. 7 Relative Current Transfer Ratio vs. Ambient Temperature



SHARP PC817 Series

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

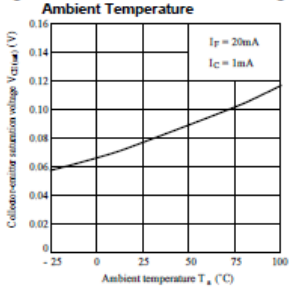



Fig. 9 Collector Dark Current vs. Ambient Temperature

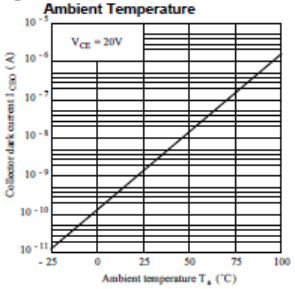



Fig.10 Response Time vs. Load Resistance

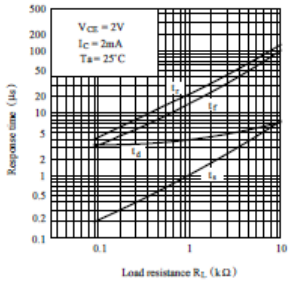
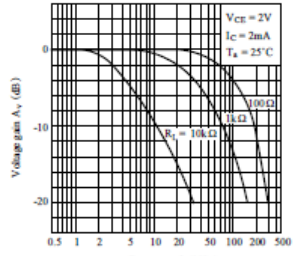



Fig.11 Frequency Response




Test Circuit for Response Time

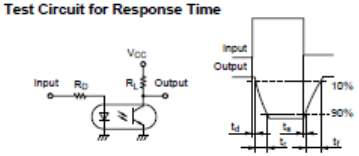
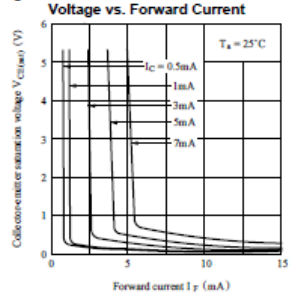
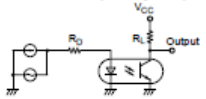



Fig.12 Collector-emitter Saturation Voltage vs. Forward Current




Test Circuit for Frequency Response

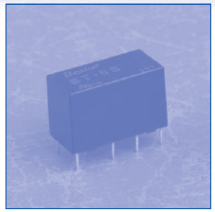



● Please refer to the chapter "Precautions for Use"





## ■ 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

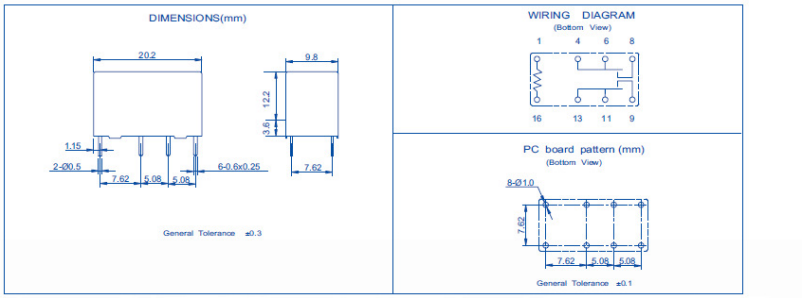
BT-12 S

| 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<br>Between Coil & Contacts<br>Between Contacts | | <br>1000VAC(1 minute)<br>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 x $10^7$ operations (at no load) |
| Electrical Life (Resistive Load) | | 2 x $10^6$ operations at 1mA 20m VAC<br>2 x $10^6$ operations at 20mA 20 VDC<br>1 x $10^5$ operations at 1.25A 24 VDC<br>1 x $10^5$ operations at 0.5A 100 VAC |
| Weight | | Approx. 6g |








# APPENDIX C

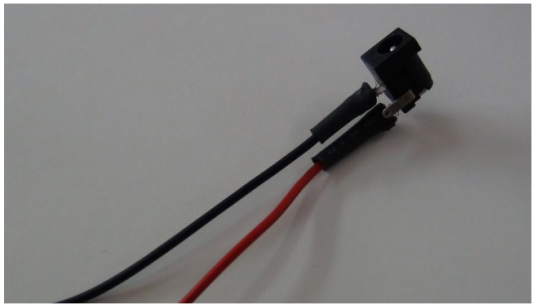
## External Power Installation

***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.).*

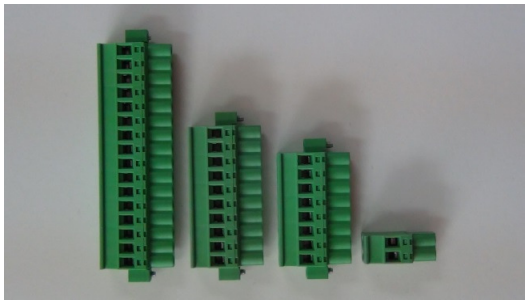


* AC power cord



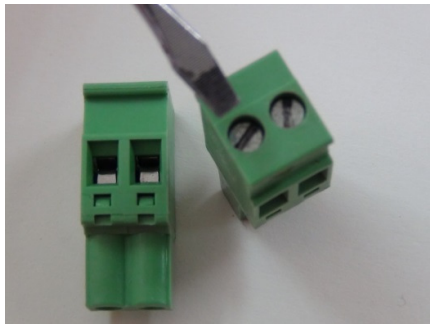


## 2. Terminal blocks built-in on Decision Group USB I/O series of Items:

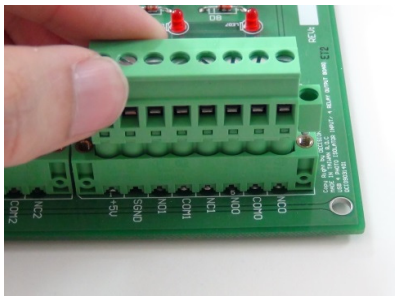


e.g. PCB pluggable terminal blocks. (for PRO type only)

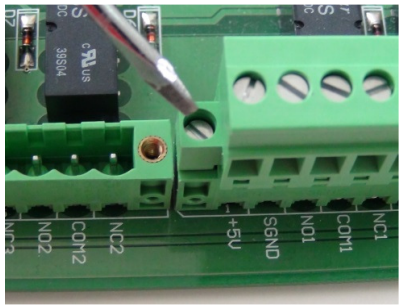
## 3. External Power Installation procedure:



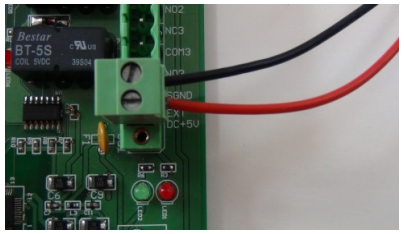
To tight / loose the terminal with a minus screwdriver.



Plug the terminal blocks into the socket. (PRO type only)



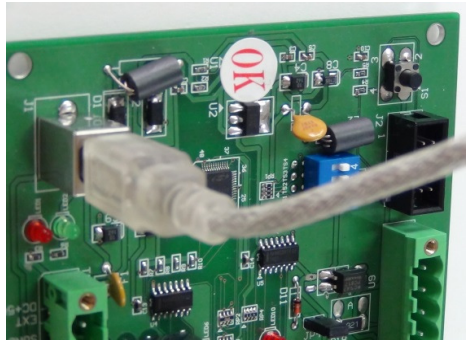

Fasten both sides of the screws (PRO type only)



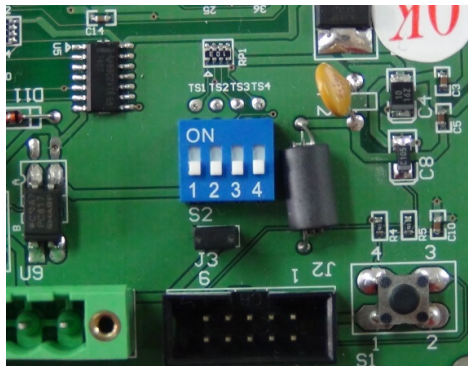

Attach the **black** cord to the **SGND** and the **red** cord to the **EXT DC+5V.,** as well as the signals cords








Connect your device to the computer with a USB cable




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