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

OPERATION MANUAL

Decision Computer Int'l. Co., Ltd.

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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.

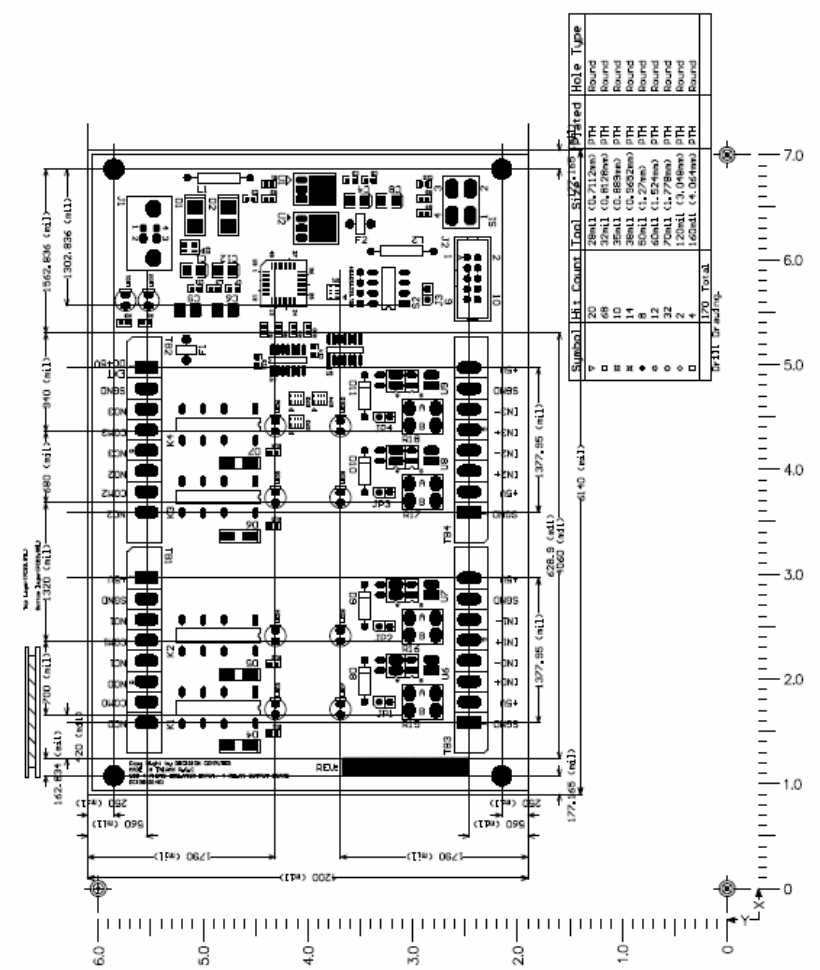
- For photo couple input channel, the isolation voltage is 5000V, maximum load voltage is 30V, maximum input current is 50mA forward.
- Activation voltage of photo input:
  When short jumpers (input range from 0 to 20V DC)
  0 to 3.3V inactive
  4.5 to 20V active
  When open jumpers (input range from 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 33C.
- 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 8 channels relay output board, please ensure that the jumpers and switches setting. The proper jumper and switches settings for the 8 channels relay output board are described in the following.

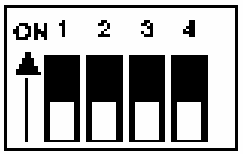
2.1 Switch Settings

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

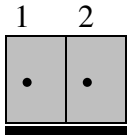
3. Download revised firmware

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)

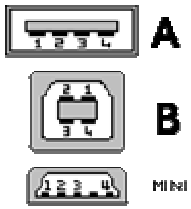


JP1 to JP4 are used to select input voltage range. The JP1 is used to select photo couple input channel 0, and JP2 is used to select photo couple input channel 1 … etc. When short the jumper, the input voltage range from 0 to 20V, and the active voltage form 4.5 to 20V. When open the jumper, the input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

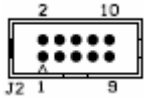
The LED1 is an indicator to show the power is supplied normally.

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.

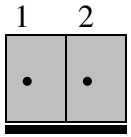
2.5 Connector and Jumper for Serial Communication

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/XP

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/XP 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-0.5.1.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

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.

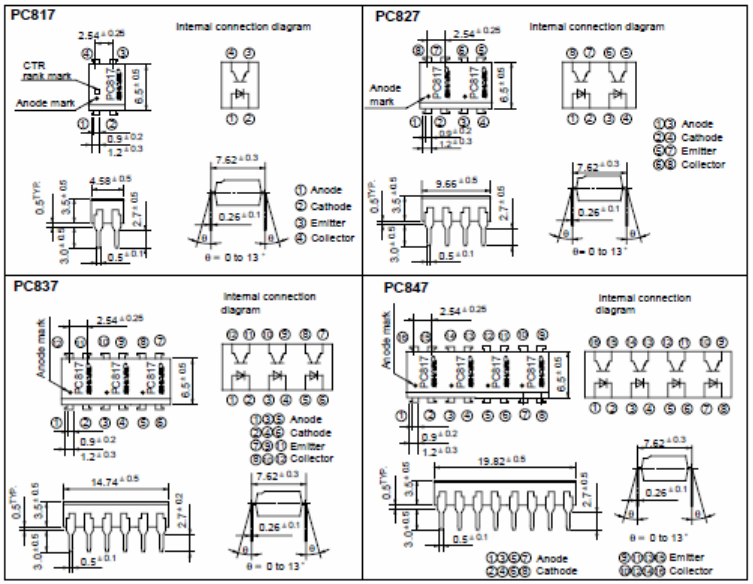
■ Features

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 000V_{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<=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

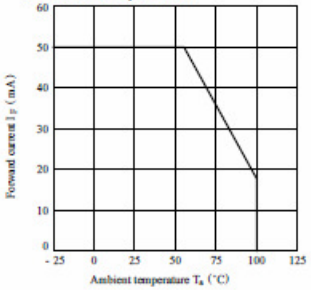


Fig. 2 Collector Power Dissipation vs. Ambient Temperature

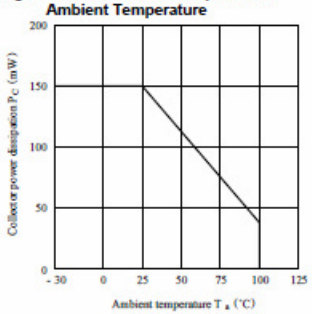


Fig. 3 Peak Forward Current vs. Duty Ratio

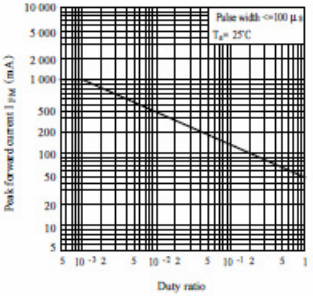


Fig. 4 Current Transfer Ratio vs. Forward Current

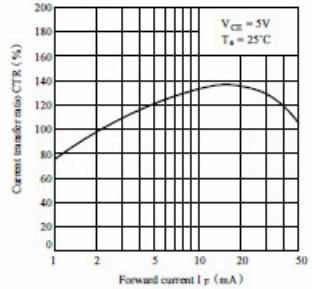


Fig. 5 Forward Current vs. Forward Voltage

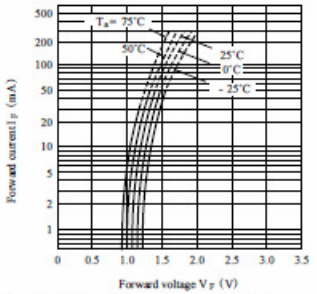


Fig. 6 Collector Current vs. Collector-emitter Voltage

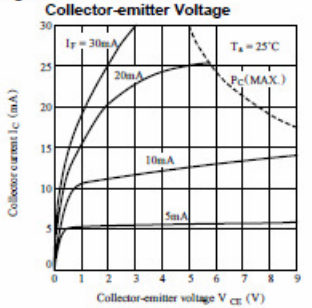


Fig. 7 Relative Current Transfer Ratio vs. Ambient Temperature

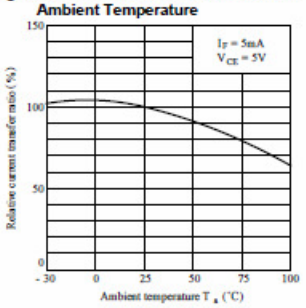


Fig. 8 Collector-emitter Saturation Voltage vs. Ambient Temperature

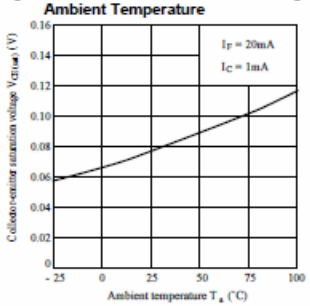


Fig. 9 Collector Dark Current vs. Ambient Temperature

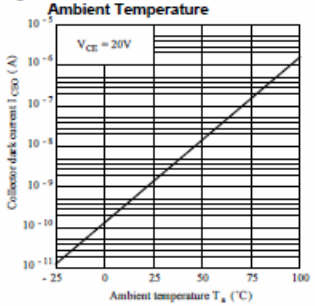


Fig.10 Response Time vs. Load Resistance

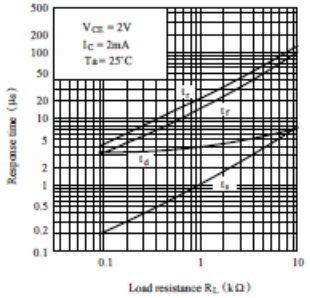
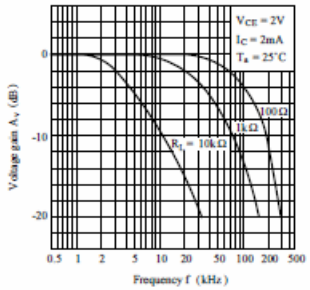
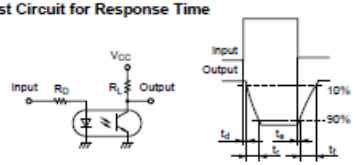


Fig.11 Frequency Response



Test Circuit for Response Time



Test Circuit for Frequency Response

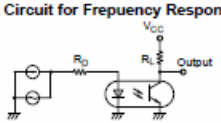
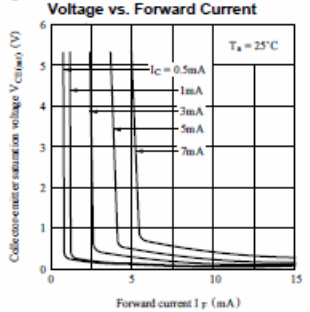
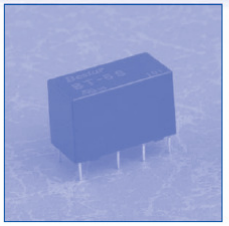


Fig.12 Collector-emitter Saturation Voltage vs. Forward Current



● 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 x 10^7 operations (at no load)
Electrical Life (Resistive Load)		2 x 10^6 operations at 1mA 20m VAC
		2 x 10^6 operations at 20mA 20 VDC
		1 x 10^5 operations at 1.25A 24 VDC
		1 x 10^5 operations at 0.5A 100 VAC
Weight		Approx. 6g