Dear Customer

Thank you for choosing one of our products. We hope that you will be completely satisfied with this extension board and that it fully meets your expectations. This manual has been compiled in order to provide you with all the information you need to get acquainted with the board and use it efficiently.

Check Your Board

Upon receipt of the shipment, please immediately inspect the goods. Unless you provide a written notice to Hamletronics Limited of any claim for lack, defect or dissatisfaction with the goods, within fourteen (14) days following receipt of the shipment, such goods shall be deemed definitively inspected, checked and accepted, the absence of notification being deemed a waiver of any such claims.

Operating Conditions

Parameter	*Min*	*Max*	*Unit*
Operating temperature range	0	85	°C
Storage temperature range	-25	85	°C
DC supply voltage	4.5	12.0	V
Maximum continuous current in J1-J8		200	mA
Maximum peak current in J1-J8, (t<100ms)		500	mA
Total peak current in all J1-J8		2500	mA
Maximum input voltage on J9,J10, P4, P5	-0.9	3.6	V
Maximum load current in P4, P5 pins		24	mA

Connectors and Board Layout

Board Features

HIT4 board layout is given on Figure 1. The board contains the following features:

- Photo detector IC1: IR receiver channel CAP0 (corresponds to /dev/irt0 device)
- Barrel 3.5mm connectors J1-J8: IR transmitter channels PWM0-PWM7 correspondingly
- Barrel 3.5mm connectors J9, J10: IR receiver channels CAP1, CAP2 correspondingly
- Barrel 5.5mm/2.5mm power connector J11
- P1 connector mating with Raspberry Pi©[1] P1 connector (please refer to Table 1 for details)
- P3 footprint for an optional DC/DC convertor
- P4 footprint for an External I/O Ports (please refer to Table 3 for details)
- P5 header with External I/O Ports (please refer to Table 2 for details)
- HL1 - green LED indicating "Power On"
- HL2 - yellow LED indicating "Heartbeat" (1 Hz pulse when in operable state)
- HL3 - red LED indicating reception of input signal on any CAPx channel
- HL4 - yellow LED indicating data communication with Raspberry Pi©
- HL5 - green LED indicating signal transmission on any PWMx channel

[1] Trademark note: Raspberry Pi® is a trademark of the Raspberry Pi Foundation

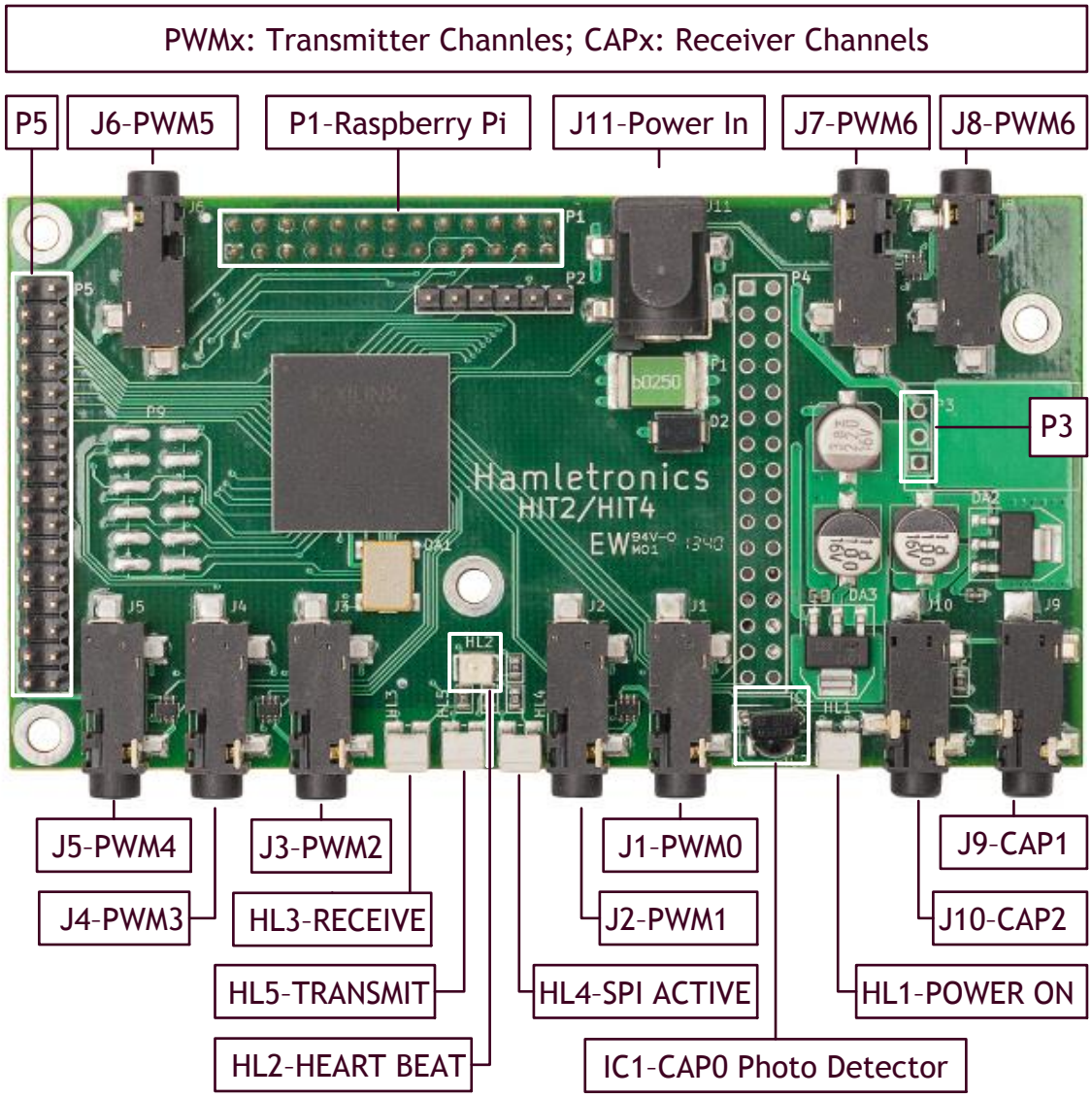


Figure 1. HIT4 Board Layout

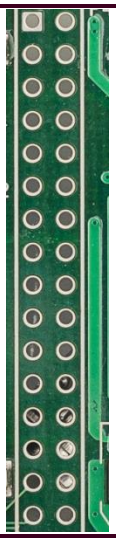
Table 1. Raspberry Pi© P1/HIT4-P1 connector pinout

P1 Pin	*Pi-Designator*	*Pi-Direction*	*HIT-Designator*	*Description*
7	GPIO4	IN	INT_O	Alternate interrupt output
11	GPIO17	OUT	RST_N	Alternate reset signal (active low, pull up)
12	GPIO18	IN	INT_O	Primary interrupt output
13	GPIO27	OUT	RST_N	Primary reset signal (active low, pull up)
19	GPIO10 (MOSI)	OUT	MOSI	SPI Master Output Slave Input
21	GPIO9 (MISO)	IN	MISO	SPI Master Input Slave Output
23	GPIO11 (SCLK)	OUT	SCLK	SPI Clock
24	GPIO8 (CE0)	OUT	CE0	Primary SPI Chip Enable
24	GPIO7 (CE1)	OUT	CE1	Alternate SPI Chip Enable

Table 2. P5 Header pinout

Description	Func.	Pin #	P5	Pin #	Func.	Description
IR transmitter channel	PWM11	32		31		IR transmitter channel
IR transmitter channel	PWM9	30		29		IR transmitter channel
Discrete output	DO11	28		27	DO10	Discrete output
Discrete output	DO9	26		25	DO8	Discrete output
Discrete output	DO7	24		23	DO6	Discrete output
Discrete output	DO5	22		21	DO4	Discrete output
Discrete output	DO3	20		19	DO2	Discrete output
Discrete output	DO1	18		17	DO0	Discrete output
Discrete input	DI11	16		15	DI10	Discrete input
Discrete input	DI9	14		13	DI8	Discrete input
Discrete input	DI7	12		11	DI6	Discrete input
Discrete input	DI5	10		9	DI4	Discrete input
Discrete input	DI3	8		7	DI2	Discrete input
Discrete input	DI1	6		5	DI0	Discrete input
IR receiver channel	CAP3	4		3	3V3	Power rail 3.3V
Ground	GND	2		1	PWR	Power rail PWR

Table 3. P4 Footprint pinout

Description	Func.	Pin #	P4	Pin #	Func.	Description
Power rail PWR	PWR	1		2	GND	Ground
Power rail 3.3V	3V3	3		4	CAP0	IR receiver channel
Discrete input	DI12	5		6	DI13	Discrete input
Discrete input	DI14	7		8	DI15	Discrete input
Discrete input	DI16	9		10	DI17	Discrete input
Discrete input	DI18	11		12	DI19	Discrete input
Discrete input	DI22	13		14	DI21	Discrete input
Discrete input	DI24	15		16	DI23	Discrete input
Discrete output	DO12	17		18	DO13	Discrete output
Discrete output	DO14	19		20	DO15	Discrete output
Discrete output	DO16	21		22	DO17	Discrete output
Discrete output	DO18	23		24	DO19	Discrete output
Discrete output	DO20	25		26	DO21	Discrete output
Discrete output	DO22	27		28	DO23	Discrete output
Reserved	–	29		30	–	Reserved
Reserved	–	31		32	–	Reserved

Mating Connectors

Figure 2

J11 - Power

J11 connector mates with a barrel plug 5.5 mm outer dia, 2.5 mm inner dia, such as CUI Inc PP3-002B.

Pinout:

Outer contact - ground, negative power rail
Inner contact - positive power rail

Figure 3

J9, J10 - IR signal input

These barrel connectors mate with stereo jack 3.5mm.

Note: The distance between J9 and J10 is 11 mm on axes. If two jacks are used at the same time, their body dia should not exceed 11 mm

Pinout:

sleeve - GND
ring - signal
tip - 3.3V

Figure 4

J1- J8 - IR signal input

These barrel connectors mate with mono (or stereo) jack 3.5mm.

Note: The distance between adjacent connectors is 10 mm on axes. If two jacks are used at the same time, their body dia should not exceed 10 mm

Pinout:

sleeve - signal (open drain)
tip - power supply rail

Mounting Board to Raspberry Pi©

For secure mounting HIT board we recommend our mounting kit KIT1-IT-A01 (not included). The kit has two M3 16mm spacers, four M3 4 mm spacers and a bump-on.

Figure 5

Step 1. Mount Bumpon

Tear off protective film from the bump-on and stick the bumpon to Raspberry Pi©'s LAN connector.

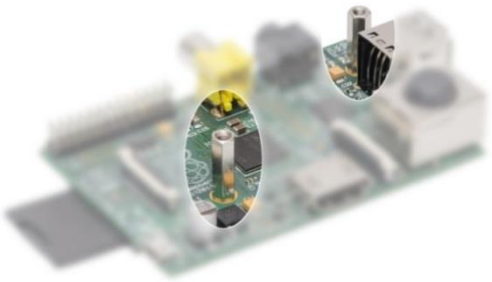


Figure 6

Step 2. Mount spacers on the Raspberry Pi©

Insert two 4mm spacers into Raspberry Pi© mounting holes from the bottom of the board. Screw both 16mm spacers as shown on the image.

Figure 7

Step 3. Attach HIT board to the Raspberry Pi©

Attach the HIT board to the Raspberry Pi© board by inserting Raspberry Pi©'s P1header to HIT P1 receptacle

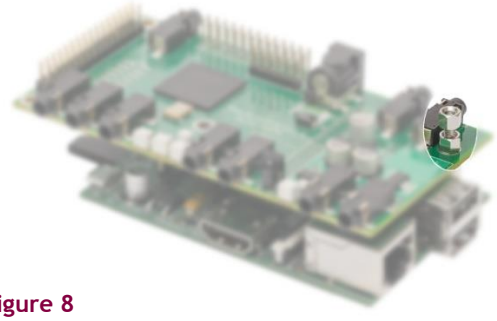


Figure 8

Step 4. Screw the top-right spacer

We recommend first screwing a spacer on the right, using the other spacer as a helper, as shown on the image

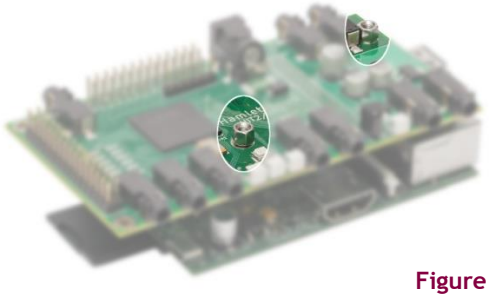


Figure 9

Step 5. Screw the top-left spacer

Screw the remaining spacer.
The HIT board is now mounted.

Connecting Power

Selecting Supply Voltage

The board can be powered with DC supply voltage in range 4.5-12V. The transmission signal paths are designed to achieve 200 mA on a typical IR led with supply voltage at 5V level. This is done with onboard 22 Ohm resistors. If you are using single IR LED emitters with lower permitted forward current, you should

add series resistors to limit the forward current at the permitted level. If your IR emitters are already equipped with a current limiting resistor, power the board with supply voltage recommended for the IR emitters (but not exceeding 12V).

Connecting Power Supply

Connect power supply to J11. Please refer to Mating Connectors/J11 - Power for details on the connector. When the board is powered, HL1 LED should light up and HL2 led should start blinking, indicating operational status of the board. Please note - HL2 does not blink if the reset signal (GPIO27, pin 13 on P1) is kept low.

Powering Raspberry Pi©

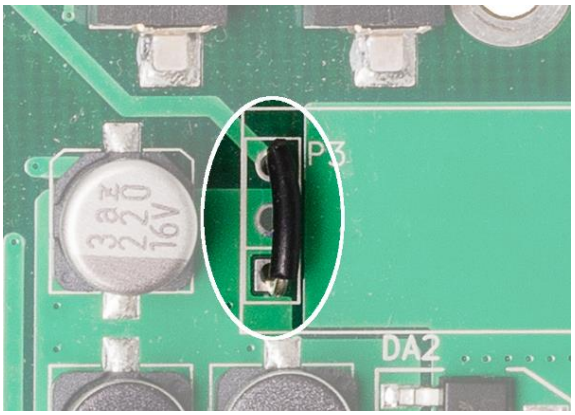


Figure 10

By default, Raspberry Pi© power rails are disconnected from the board's rails. If you power the board with a 5V power supply, you can shunt pin 1-3 of P3 connector as shown on Figure 11. This will apply power supply voltage to Raspberry Pi© power rails.

For other supply voltages a DC/DC converter should be used.

We recommend `OKI-78SR-5/1.5-W36H-C` from Murata Power Solutions. The board has sufficient space to mount this DC/DC converter on the spare space

Note: DC current from P3 bypasses the Raspberry Pi©'s fuse. Therefore improper voltage, if applied to pin 3 of P3 may damage the Raspberry Pi©

Connecting IR Emitters

Connect IR emitters to J1-J8. IR emitters should have wiring as shown on the Figure 11. Optional resistor R limits current as listed in Table 4 with supply voltage at 5V level. Table 5 lists estimated currents for different supply voltages.

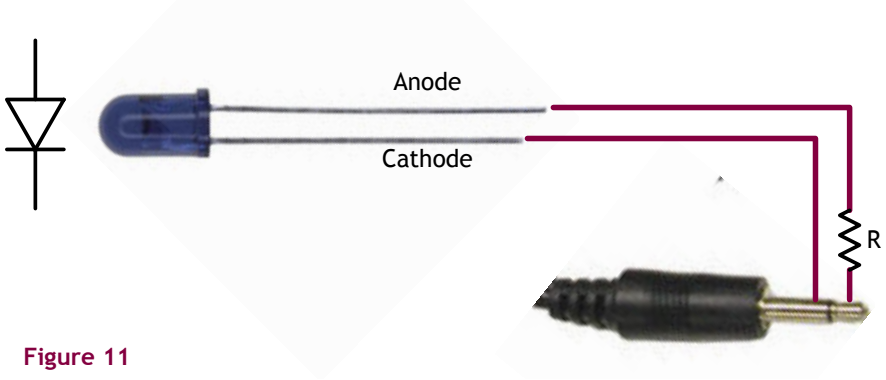


Figure 11

Table 4

V supply = 5V			
R, Ohm	0	22	47
I, mA	170	80	50

Table 5

R = 0				
V supply	5	6	9	12
I, mA	170	210	350	460

Connecting IR Photo-Sensors

Connect external photo sensors to J9, J10 as shown on Figure 12. The photo sensors could be either with carrier out or with demodulator. The latte ones are normally tuned to a certain carrier frequency and reject signal with other carrier frequencies. Signal form additional sensor can be connected to pin 4 on P5 header.

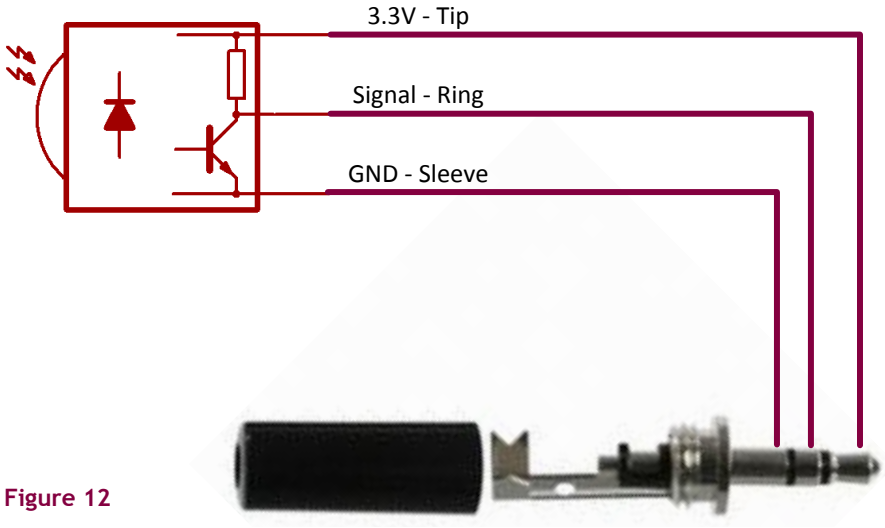


Figure 12

Installing Software

Download and flash raspbian image

We recommend Raspbian or minibian for using with HIT boards.

Raspbian:
http://downloads.raspberrypi.org/raspbian/images/raspbian-2014-01-09/2014-01-07-wheezy-raspbian.zip

Minibian:
http://heanet.dl.sourceforge.net/project/minibian/2013-10-13-wheezy-minibian.tar.gz

Please follow Raspberry Pi© guide on flashing on of these images to an SD card. Once flashing is done, insert the flashed SD to your Raspberry Pi©, connect it to Internet and boot it.

Installing Hamletronics Software

1. Login to Raspberry Pi© either via console or ssh.
2. Download packages from Hamletronics site by executing the following command or in other convenient way

```
$ wget http://hamletronics.com/repo/linux-image-3.6.11hit+_1.0_armhf.deb \
    http://hamletronics.com/repo/hit4_1.0_armhf.deb \
    http://hamletronics.com/repo/spe_1.0_armhf.deb
```

3. Obtain root privileges (if not logged is as root)

```
$ sudo su
```

4. Install Hamletronics packages

```
# dpkg --install linux-image-3.6.11hit+_1.0_armhf.deb \
     hit4_1.0_armhf.deb \
     spe_1.0_armhf.deb
```

The spe package will prompt to accept Hamletronics Proprietary License. Full text of the license can be found on this link: http://hamletronics.com/repo/Hamletronics-Proprietary-License.pdf
Shortly – this license grants rights to use the software from package spe with Hamletronics products only. The other package - hit4 is distributed on dual GPLv2/BSD license terms.

5. Replace the stock kernel with newly installed and reboot (provided kernel image releases spi bus for the Hamletronics driver).

```
# mv /boot/kernel.img /boot/kernel.img.old
# mv /boot/vmlinuz-3.6.11hit+ /boot/kernel.img
# reboot
```

6. After rebooting login again and check the results:

```
# uname -sr
Linux 3.6.11hit+
# cat /sys/devices/hit/hit/hit0.0/model
HIT4-RP-A10.57
```

Installing LIRC

LIRC is a package for decoding IR signals (please refer to http://www.lirc.org/ for details).

1. Obtain root privileges (if not logged is as root)

```
$ sudo su
```

2. Install lirc package

```
# apt-get update
# apt-get install lirc
```

Configuring Software

Remote Control Files

Great variety of remote control files is available in the lirc repository:
http://lirc.sourceforge.net/remotes/.

Learning a Remote

If no suitable remote control available, you may record your remote with irrecord.
Start irrecord with the following command and follow instructions printed on the screen

```
$ irrecord -n -d /dev/irt0 myremote
```

Configuring irc* devices

To create irc0 device associated with pwm0 transmitter channel (J1 connector) execute the following command:

```
# irc-config --pwm0 --irc0 --lirc myremote
myremote:: note:OK:irc0:myremote:
myremote:: note:OK:irc0:myremote:18
```

To make this irc0 device auto-created on boot, copy it to `/etc/hit` directory

```
# cp myremote /etc/hit/
```

and append configuration line to `/etc/hit/irc.conf` file

```
# echo "--pwm0 --irc0 --lirc myremote" >> /etc/hit/irc.conf
```

To test `irc` device, attach an emitter to associated transmitter channel (J1/pwm0) and write a repeat count (positive number) to a remote command, created from the configuration file:

```
$ echo 3 > /sys/devices/hit/irc/irc0/commands/POWERON
```

Configuring gpio

Hamletronics driver exposes Linux's standard gpiochip interface, all discrete input/output pins can be made available via gpio export.

```
# cat /sys/devices/hit/hit/hit0.0/gpiochip/base
208
# echo 208 > /sys/class/gpio/export
# cat /sys/class/gpio/gpio208/value
0
```

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