

Hardware

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COLLABORATORS

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Chapter 1

Hardware

1.1 InfraJoy Hardware

InfraJoy v4.0a © 1994-1995 by Jeroen Steenblik
~~~~~ and Leon Woestenberg (Digital Disturbance)

Infrared Interface Hardware

General Information

|              |          |
|--------------|----------|
| Legal notes  | Features |
| Introduction | History  |

The actual instructions

How does it work?  
Building Instructions  
Ordering the hardware

Patching older hardware

Reaching the authors...

### 1.2 InfraJoy Copyrights and Disclaimers

InfraJoy Copyrights

Copyrights © 1994-1995 by Jeroen Steenblik and Leon Woestenberg. The hardware design is freely distributable and may be used to build a copy of the InfraJoy interface hardware. A copy of the hardware itself may not be sold with a profit, nor included in any commercial product without the written consent of (one of) the authors .

InfraJoy Disclaimers

The authors do not take responsibility for the InfraJoy hardware damaging your Amiga computer, infrared controlled devices or data stored on these machines. The authors can not guarantee that InfraJoy works

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correctly on your configuration.

All hardware we designed has been tried out on my Amiga, and since I'm now typing this guide on this very machine this implies it didn't blow up in my face. To put it very short: if you blow up your Amiga while using/looking at/thinking of/pointing to/etcetera, the InfraJoy hardware, it's NOT our fault.

More, more, more legal mush!

### 1.3 You found the secret part of this guide!

More legal mush

Since only very smart people read this section: we think you should know that this guide contains hypnotic encoded messages which force you to send over any pretty daughters/nieces/sisters/girlfriends (only 18+) ;- ) to us without you even realising it. (If you haven't got any, A4000's will suffice too) =8^).

Back to reality :(

### 1.4 InfraJoy Introduction

InfraJoy Introduction

The InfraJoy hardware is an infrared (IR) transmitter and/or receiver that connects to the joystickport of your Amiga. In combination with the InfraRexx software it enables you to receive and/or transmit IR remote control codes, so it's possible to control most modern equipment with your Amiga AND, vice versa, use IR remote controllers to control your Amiga software.

Since the original design was released, some (minor) improvements have been made, so at this point several versions of the InfraJoy have been released. The new v4.0 design is quite different from it's predecessors. Have a look at the `history` to find out more about this, especially if you ordered the hardware directly from the authors .

### 1.5 InfraJoy Features

InfraJoy v4.0 Features (the new features are boldfaced)

- Uses (and therefore needs) any Amiga model :-)
  - New, greatly improved design, and still not too expensive :)
  - Improved infrared working distance (from Amiga to device) of more than 10 metres (30 feet), without extra wires.
  - Software controllable output modulation frequency for different electronic brands, without extra system overhead!.
-

- Now using two IR-LEDs, to provide a better working angle and distance.
- Improved esthetic value, by using micro-LEDs for transmission and reception indication ;)
- Optional space for surface mounted capacitors, to minimize the space used by the device (important for A2000 owners).
- Large detection range of over 15 metres (50 feet).
- Seperate indication LEDs for both transmission and reception.
- Modular design; throughput, transmitter and receiver are optional.
- Multi-directional placement for the receiver unit for the different Amiga models. (Compare the joystickport position on A2000/A3000/A4000).
- Small size of about 4 x 3.5 cm (1.6 x 1.4 inch).

## 1.6 InfraJoy History

### InfraJoy History

#### Version 1

- Initial design, based around the SFH505A receiver.
- Uses pin 6 for both transmission and reception of IR signals.

#### Version 1.1

- Interim version for registered InfraJoy users only.
- This is actually a patch of the version 1 design to version 2; As the SFH505A receivers were becoming obsolete, we switched to the more sensitive SFH506-xx receivers.
- Needs at least v1.1 of the software.

#### Version 2

- Interim version for registered InfraJoy users only.
- Based around the more sensitive SFH506-xx receiver. Therefore needed separation of transmit/receive signals.
- Uses pin 5 for transmission and pin 6 for reception of IR signals, so that the software could be made transparently compatible.
- Needs at least v1.1 of the software.

#### Version 3

- Second publicly released hardware design with nice building plans.
- Due to the negative influence of the potentiometer circuitry connected to pin 5, in certain circumstances, transmission was poor.
- InfraJoy v3.x therefore uses digital lines only, that is pin 6 for transmission, and pin 3 for reception.
- Needs at least v1.2 of the software.

#### Revision 3.1

- Fixed a missing track on the solder side PCB layouts, that caused the receiver not to work at all. The schematics were alright, though.

#### Revision 4.0

- Greatly improved design with many new features .
  - Completely updated building plans, removed patching instructions for older versions (you should have patched it by now :).
  - No patching instructions to update to this version, there are too many differences...
  - Needs at least version 1.6 of the InfraRexx software to support multi-
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frequency selection.

Revision 4.0a

- Just a small bugfix and some clarifications in the schematics.

Revision 4.0b

- Bugfix on the printer circuit board design, on the +5V throughput.

## 1.7 How does it work?

(How) Does it work?

Before building something, you may wonder how it actually works. For those of you who wonder, we present:

'Everything about the InfraJoy hardware you always wanted to know, but were afraid to ask...' :-)

The receiver

To receive the IR codes, we use a hybrid IR receiver from Siemens, the SFH506-xx series. xx represents the modulation frequency it is optimised for. This IC is an integrated IR receiver with an amplifier, a filter, a demodulator and a TTL driver. It produces clean, digital data streams when it receives IR information and it is very insensitive to ambient light. The output of this IC is fed directly into the Amiga, where it is analyzed by the InfraRexx software.

The transmitter

This is just a bit more complicated (just a bit ;-). To get reasonable working distances (without interference), it's necessary to modulate the binary information that's fed into the IRLEDs. To achieve a greater working distance, the v4.0 design uses a MOS (Metal-Oxide Semiconductor) transistor which is capable of switching larger currents. Now, a current limiting resistor is needed to protect your Amiga's +5V output. To make the most of the output signal, a capacitor is added to provide larger voltage peaks, therefore enhancing the LEDs' output.

The signal is modulated using two Schmitt-trigger NAND ports with an software adjustable RC circuit inbetween. The software adjustability is achieved by using two other output lines of the Amiga joystick port to control two analog switches (integrated into the HEF4066 IC). These switches can both connect a parallel resistor to the RC circuitry, thus creating a total of 4 different resistor values in the RC circuit. This, ofcourse, provides 4 different modulation frequencies, and considering the normal component accuracies this is enough to control most electronic brands.

## 1.8 Building Instructions

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## Building Instructions

This section helps you building the InfraJoy v4.0 hardware. We assume that you are familiar with electronics, print circuit board layouts and schematics. If not, ask someone to assist you in this.

Before proceeding, first consider what you actually want: Do you need to transmit codes only? Do you want to learn or receive codes from remote control units? Do you need connector throughput? Consult the InfraRexx guide for more info on the specific options.

Then proceed through the steps below. Have fun building the hardware!

1. Hardware requirements
2. Making the printed circuit board
3. Drilling the pad holes
4. Soldering the components
5. Fine-tuning the hardware
6. Last but not least...

The picture links in the above sections are only valid using Multiview (available under AmigaOS 3.x). AmigaGuide users (AmigaOS 2.x) will have to use another picture viewer, like Viewtek by Thomas Krehbiel.

## 1.9 Hardware Requirements

### Hardware Requirements

For all designs:

- Sub-D connector, female, 9 pins.  
Note: the print circuit board must fit inbetween the pin rows.
- Double sided print circuit board.  
(Or single sided when building transmitter-only, without throughput.)

Transmitter components:

- HEF 4093 (Schmitt-Trigger NAND)
- HEF 4066 (analog switches)
- BS170 (MOSFET) or equivalent
- 18 Ohms resistor
- 330 Ohms resistor
- 30.1 kiloOhms resistor (= A in schematics and layouts)
- 4.3 kiloOhms resistor (= B in schematics and layouts)
- 22 kiloOhms resistor (= C in schematics and layouts)
- 10 nanoFarad (nF) capacitor
- 100 nanoFarad (nF) capacitor
- 22 microFarad ( $\mu\text{F}$ ) polarized capacitor
- red (mini) LED
- 2-wired cable (for transmission IRLED, up to 10 meters or 35 feet)
- 2 x LD271 IRLED (or similar)

Receiver components:

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- HEF 4093 (same as in the transmitter)
- SFH506-38 or SFH506-xx (see fine-tuning )
- BC547/550 (NPN transistor) or equivalent
- 10 kiloOhms resistor
- 330 Ohms resistor
- 4.7 microFarad ( $\mu\text{F}$ ) polarized capacitor
- green (mini) LED

Throughput components:

- Sub-D connector, male, 9 pins.  
Note: the print circuit board must fit inbetween the pin rows.

## 1.10 Making the Printed Circuit Board

Making the Printed Circuit Board

The printed circuit board consists of a double sided layout, which is shown in the SilkScreen.iff picture in this package. The green parts in this picture correspond to the solderside, the red parts correspond to the componentside of the print.

First print out the "SolderSide.ps" and "ComponentSide.ps" layouts on a PostScript supporting printer. If you don't have access to such a nice device, you can also use the iff files for printing. Be sure you scale them to a size of 40 mm (millimetres) x 35 mm, or 1.57 inch x 1.38 inch.

Use the printouts to either make the printed circuit board yourself, or have it made by an electronics company/service or someone else.

The printed circuit board can also be ordered from the authors . Read the InfraRexx User Guide for more info on this.

If you have problems making a double-sided board, you can also make it single sided, by using the solderside layout only, and then use wires to connect pins 1 and 2 of the HEF 4093 to pin 6 of the female Sub-D connector. You also need to connect pin 12 of the HEF 4066 to pin 8 of the female connector, pin 13 of the HEF 4066 to pin 9 of the female connector and pin 5 of the HEF 4066 to pin 5 of the female connector. Making a throughput version is somewhat trickier, as this needs wires to connect the upper 5 pins of the Sub-D connectors.

## 1.11 Drilling the pad holes

Drilling the pad holes

After you managed to make the printed circuit board, you are now able to destroy it within seconds: just use a drilling machine. But as you are probably not after this, proceed carefully.

Use a small drill diameter size, preferably 0.8 millimeters (mm). Drill every pad, except the pads that are meant to mount the connectors. Beware that

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you need to use a specialized PCB drilling machine or a (powerful) hobby high-speed drilling machine with an accurate drilling-stand. Furthermore, beware that ordinary HSS drills wear down very fast, and that using a blunt drill could damage the pads.

## 1.12 Soldering the components

### Soldering the components

We assume there exists a hot relationship between you and your soldering iron, or at least you know which side is the hot one... :-)

Use the `SilkScreen.iff` and `Schematic.iff` pictures to place and solder the components into place. The "`SilkScreen.iff`" picture represents the component layout. Please take a closer look at this picture before reading on, or even better: make a (draft) printout of it, that you can refer to during reading this guide.

The IRLEDs are attached, using a 2-wire cable, to the two pads marked IRLED in the "`SilkScreen.iff`" picture. The pad the arrow-symbol (diode) is pointing to, is the GND pad.

At least two wire-jumpers have to be made on all versions. Pin 5 of the HEF 4066 has to be connected to pin 5 of the female connector and pin 13 of the HEF 4066 has to be connected to pin 9 of the female connector. Pin 7 of the male Sub-D connector has to be attached to the pad beneath the HEF 4093, on the solderside. Apart from these, a 'via' (connection from one side to the other) has to be made at one of the remaining pads of the SFH-506. If you mounted the SFH receiver, one pad should still be visible on the component-side, this is the pad that you should connect to the corresponding pad on the other side (eg. by soldering a piece of stripped wire in the hole).

The two pads marked RED LED, are meant for the red sending-indication-LED. It can be mounted directly on the PCB (beware of the correct polarity).

Also, mind the correct polarity of the polarized capacitors, they might blow up if you reverse their polarity. For A2000 users mainly, there's an option to solder SMD capacitors directly to the solderside of the PCB.

The SFH can be placed in three directions, needed for A2000/A3000/A4000 models, which each have a different joystickport position/direction. On the `SilkScreen.iff` picture arrows indicate where pin 1 of the SFH 506 would be when you would place the SFH in the direction of that arrow.

A500(+) and A1200 users are advised to use an extension cable, as the receiver must be able to receive infrared light. You can either use an extension cable for the SFH 506, or for the complete hardware.

Don't heat up the HEF 4093, HEF 4066 and SFH506 components for too long; you don't want to destroy them (especially not the SFH, after you saw the price of it).

## 1.13 Fine-tuning the hardware

### Fine-tuning the hardware

Remote controllers send infrared light as a modulated signal, so that other light sources (sun, lamps) don't interfere with the signal. Every manufacturer uses a slightly different modulation frequency.

### Fine-tuning the receiver

The SFH506-xx receiver is available in different versions, optimised for different modulation frequencies, where xx stands for this frequency in kiloHertz (kHz). Currently available are 30, 33, 36, 38, 40 and 56 kHz versions. Choose the best fit, or use an average value, like 36 or 38. Although the receiver is now optimised for your brand(s), you are still able to use different brands, as this is just a fine-tune.

### Fine-tuning the transmitter

On the v4.0 hardware you can control the output modulation frequency by software to gain optimal results. Below, a number of manufactures with their corresponding frequencies are shown so you can pick the most optimum frequency.

| light<br>modulation<br>frequency        | used by these<br>manufacturers    |
|-----------------------------------------|-----------------------------------|
| -----                                   |                                   |
| $\backslash \mathrm{pm} 40 \text{ kHz}$ | Sony, Pioneer, Akai, NEC,         |
| ~~~~                                    | Goldstar, Hitachi, Kenwood,       |
| ~~~~                                    | Onkyo, Teac, Pioneer, Yamaha      |
| $\backslash \mathrm{pm} 37 \text{ kHz}$ | Canon                             |
| $\backslash \mathrm{pm} 35 \text{ kHz}$ | Philips, JVC, Denon, Finlux,      |
| ~~~~                                    | Funai, Panasonic, Technics, Sharp |

## 1.14 Last But Not Least...

### Last But Not Least...

The authors devoted lots of time to this project, and would like to see their work rewarded. If you like InfraRexx and InfraJoy, consider to pay the registration fee of USD 10. You will support the future development (read: improvement) of InfraRexx. Read the InfraRexx User Guide for how to register.

## 1.15 Ordering the hardware

### Ordering the hardware

If you are not familiar with electronics, you can also order the

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hardware directly from the authors . Just throw away the hardware subdirectory and read the InfraRexx User Guide about this.

Also, if you are having difficulties obtaining components or making the double sided printed circuit board, these can be ordered via the authors . Read the InfraRexx User Guide for more info or contact us about specific problems.

## 1.16 Patch Instructions

### Patch Instructions

Due to the big changes in the new v4.0 hardware design, older hardware cannot be (easily) patched to v4.0. However, users of pre-v3.1 hardware may wish to upgrade their hardware to the v3.1 hardware design.

Patch instructions to do this are removed from this archive. They can be found in the Hardware Guide of the InfraRexx 1.5 release, available from Freeware selections such as the Aminet CDs. If you have trouble finding this archive, contact the authors .

## 1.17 Reaching the authors...

### Reaching the authors...

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