Civic Hch1 Imac&c

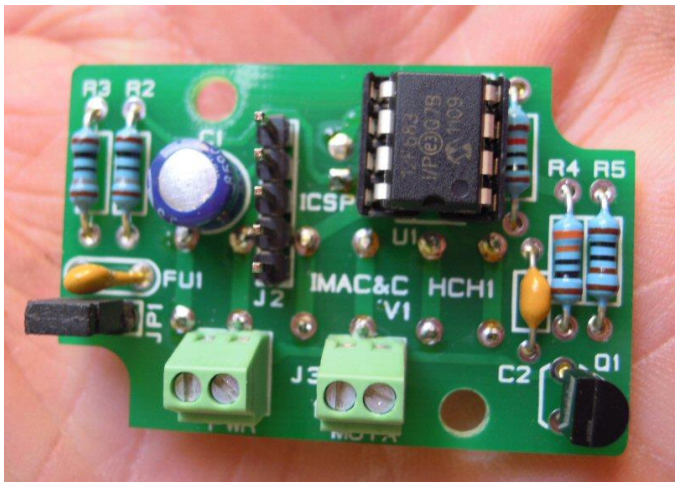
Manual IMA control

Owners manual. Version 151216V01

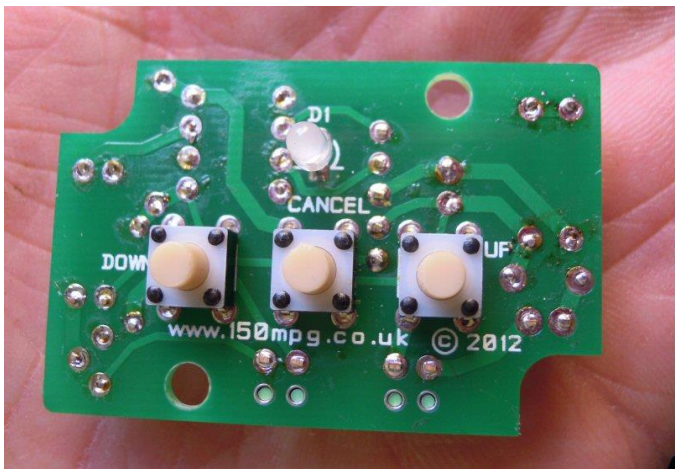
Introduction

If you have had your Civic a while, you may have heard of Imac&c. It's an HCH1 Civic-specific, PIC-based manual IMA control system. Imac&c stands for 'Integrated Motor Assist Command & Control'.

Imac&c is designed and built by me, Peter Perkins, a multi hybrid owner and electronics enthusiast from the UK. You can find me at www.thehybridexpert.co.uk



The custom-built, Civic-specific Imac&c PCB ready for installation. Back view.



PCB front view.

In normal use, the Civic uses the OEM computers and parameters to control how the IMA system operates. It balances assist and regeneration levels with throttle requests, engine load, available battery power and road conditions to give the average owner consistent IMA system operation for normal use.

This, however, can be quite restrictive and is by no means optimal in every situation. It means that the hyper miler or performance enthusiast cannot get the best out of the car.

However, with Imac&c, the skilled and enthusiastic driver gains benefit from taking over the system and controlling how the IMA operates. This can give better acceleration and deceleration performance by maximising assist and regeneration on demand. It can also give better fuel economy by utilising the available battery power and recharging opportunities to match the journey or terrain in a more energy-efficient way.

A good driver can expect to see anything from a 4-7 mpg improvement in fuel consumption when using Imac&c on suitable journeys. Imac&c is suitable for manual gearbox and cvt cars, and has been tested on both types.

Imac&c in its box ready for use.

The basics of IMA manual control rely on the fact that the Insight OEM computer modules are divided into separate units and communicate with each other via the car's wiring loom.

The internal combustion engine is controlled by the ECM (Engine Control Module) which resides behind the glove box.

The IMA motor is controlled by the MCM (Motor Control Module) which is located in the IMA compartment behind the rear seats.

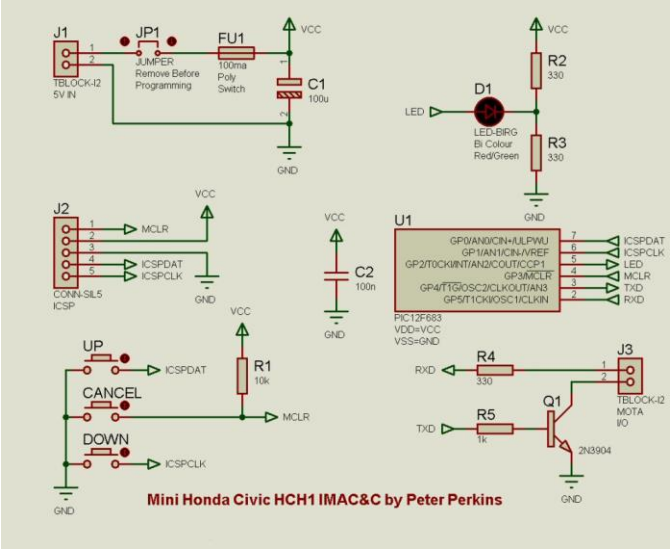
During normal use, the ECM sends requests for IMA assist or regeneration to the MCM and the MCM responds accordingly, providing assist or regeneration as requested. This occurs as long as the IMA battery is within its normal operating range for SOC (State of Charge) and temperature.

Manual IMA control works by intercepting or blocking serial data signals from the ECM to the MCM, and replacing them with new commands and requests. These requests are then acted on by the MCM as if they had come from the ECM. They are carried out without question, but comfortingly the system retains its safety systems and the battery protection provided by the MCM software. So you cannot exceed the battery safe operating zone, even if you request maximum assist for extended periods.

In use, we can request maximum assist or regeneration, or several set levels in between, or we can block ECM requests for the above, or modify them to suit our journey or terrain.

As an example, by simply using a bit more assist to crest a hill, we may be able to avoid depressing the throttle and so remain in lean cruise. We gain that few extra mpg and, as we cruise down the other side of the hill, we can command a touch of regeneration to replace that energy used.

Sometimes the car will annoyingly start force-charging as we ascend a hill because we have depleted the battery. This is a double whammy as the extra load on the engine can force us to change down and use much more throttle than normal, so killing fuel economy. What the car does not know of course is that over the hill is a descent where we can probably use regeneration to replenish our battery while at the same time, controlling our speed without resorting to the brakes. In this scenario, we look ahead and become the computer; with Imac&c we can override the system to shut off charging during our climb and re-engage it during our descent.



Imac&c circuit schematic.

Imac&c uses a dedicated PIC 12F683 microprocessor-based system design. The simple small PCB is fitted with three non locking push button switches and a multicolour led. The PCB is fitted in a small plastic box and this can then be fixed where you wish for convenient use. The module requires four connections into the car wiring loom at the ECM behind the glove box.

So how is Imac&c installed?

Fitting the Imac&c is a very simple matter of:

1. disconnecting the 12v battery under the bonnet
2. unbolting the glove box to get access to the ECM
3. identifying the four wires required and cutting or splicing into them
4. replacing the glove box
5. reconnecting the 12v battery

Updates

I release new software for the Imac&c occasionally and owners can update their devices to get extra functionality and features using a laptop and simple USB/serial PIC programmer.

If you want a hand-built Imac&c for your car, contact me at 150mpg@gmail.com

The price depends on the options selected:

1) Full built, cased and tested Imac&c. $299.

2) Bare PCB only option. $49

To see a demonstration of the system in use in an Insight, and how it can benefit you, watch my work commute YouTube video at 13 Mile Commute Video

My YouTube channel also contains many other videos detailing my devices, and installation instructions for fitting the Imac&c.

Imac&c Introduction.

Imac&c Case.

Install Video One.

Install Video Two.

Install Video Three.

Steering Wheel Buttons Video One.

Steering Wheel Buttons Video Two.

Steering Wheel Buttons Video Three.

Safety

When trying out the Imac&c functions whilst stationery, ensure the car is in neutral and the parking brake is on. The safety factors and interlocks available depend on the software version you have installed. It is possible with some versions to engage assist with the car in gear causing it to move, perhaps unexpectedly! Not all the functions listed below are available with every software version. Some are barely tested and recommended for advanced users only.

Operating Instructions

Imac&c is controlled by the three simple momentary click push buttons. When the car is first turned on the Imac&c system is in the OEM mode and control is by the normal car systems.

Simple button control

The three simple button controls is cheap, very positive and intuitive. Pressing the right button gives four stepped levels of assist, and left gives five stepped levels of regeneration (including the first neutral position). The centre button cancels Imac&c operation and returns to the OEM mode.

The key is to remember we have three buttons, and different lengths of button presses.

<0.5s = Short press/click for Up/Down Buttons [SP]

<1s = Short press for Cancel Button [SP]

<4s = Medium press [MP]

<6s = Long press [LP]

>6s = Very Long press [VLP]

Each button has the following functions.

Assist (Up/Right) Button [Red Led]

Short press = Increment Assist level or Decrement Regen level (Assist has 4 steps/clicks) 25, 50, 75, 100%

Medium press = Max Assist

Long press = Toggle Assist Battery Protect Mode. Limits all Assist request to ~12A

Very Long press = Toggle OEM Assist Enable/Disable

Regen (Down/Left) Button [Green Led]

Short press = Increment Regen level or Decrement Assist level (Regen has 5 steps/clicks) 0, 25, 50, 75, 100%

Medium press = Max Regeneration

Long press = Toggle Regen Battery Protect Mode. Limits all Regen request to ~6A

Very Long press = Toggle OEM Regen Enable/Disable

Cancel (Middle) Button

Short press = Cancel any Manual Assist/Regeneration or Cruise Control Mode

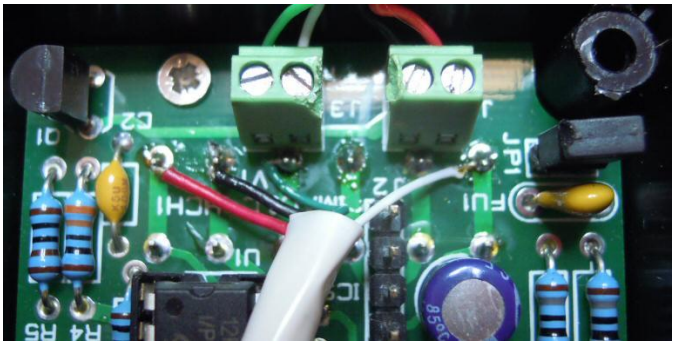
Medium press = Activate Cruise Control Mode. (Target Speed = Speed when Cruise activated) (Flashing Red/Green Led)

Long press = Toggle AutoCancel Assist/Regeneration <5mph Mode. Default is Off

Very Long press = Toggle IMAC&C Enable/Disable and reset to program defaults

Remote buttons

On a manual car it is possible to remote mount three buttons on the steering wheel for ease of use. It's a tricky modification only recommended for those who are confident with soldering etc. Please watch the videos to see how to do it. The picture below shows the four connections on the back of the Imac&c PCB required. The remote buttons duplicate the function of the buttons on the main unit, and both can be used at the same time.



Remote button connections.

LCD screen

Some late versions of the software had provision to drive a small serial LCD screen. It displayed very basic information, and was mainly implemented to aid debugging the device. If you want to implement this then you will need to read the main Imac&c HCH1 thread on Insight Central.

Firmware updates

The Imac&c can be updated with new firmware quickly and simply by the user. The process requires a USB PIC programmer and suitable computer running the PICkit 2 programming software.

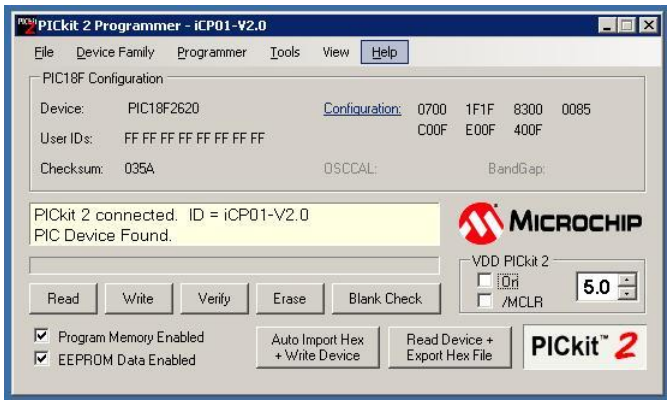
The programmer recommended is the (icp01). It can be ordered, and the software required downloaded from this webpage link.

PIC icp01 programmer

The firmware update process should be carried out with the Imac&c unplugged or disconnected from the car. If there is a jumper on the PCB it should be removed during programming. On the Imac&c PCB is a sil 0.1" 5 pin connector (or holes), labelled "ICSP". The PIC

programmer plugs into a USB port on your computer, and connects to the 5 pin connector or holes on the Imac&c. The red stripe of the programmer cable connects to pin “1” or the square marked pin on the PCB. If pins are not fitted to your PCB then insert some sil 0.1” pins into the programmer connector and then push the pins into the holes on the PCB. Hold it at a slight angle under light pressure to maintain contact with the pads during the programming process.

Once the programmer is connected to the Imac&c, and the software is running on your computer check communication with the PIC on the PCB by using the programming software Tools menu, and the option “Check Communication”. The programmer should flash and the device type for that PCB should appear.



PICkit 2 software screenshot.

Make sure the options “Program Memory Enabled” and “EEPROM Data Enabled” are ticked.

Now open the File menu and select “Import Hex”. Find the new Imac&c firmware hex file you have downloaded and select it. You should see the message “Hex file successfully imported”. Now press the Write button and the new firmware will be uploaded to the Imac&c. If all goes well you should get a green “Programming Successful” message.

If you wish to back up your current software and data before upgrading, use the Read and Export options in the PICkit 2 software to save it

If the firmware update fails check your connections and try re-downloading the hex file. Check the www.insightcentral.net forum for further advice.

Finally

I hope you enjoy using the Imac&c as much as I do. It took hundreds of hours to research, design and build. It is a product specifically built for our fascinating cars, and I hope it helps you get the best out of yours.

Comments and feedback on it, these instructions, or any of my devices are always welcome. Please use the www.insightcentral.net forum HCH1 Civic Imac&c threads for all general questions, feature requests or problems.

Main HCH1 Imac&c thread.

There are lots of experienced users of my devices in the hybrid community, and they are always willing to help on the forum with their experience and knowledge.

Peter Perkins 15/12/2016