

Installing a Fuel Burning Heater Timer/Remote Into the Discovery 3

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1 Introduction

1. In the beginning there was a machine created by the great LandRover, which consumed the rough ground it passed over without stopping often.
2. And the machine begat other machines, which in turn begat other machines until many decades later the D3 was born.
3. And the D3 consumed the miles of road and rough ground alike with great luxury and sureness of grip.
4. And behold, the great LandRover said “Lo! Here is the D3, and if you become followers we promise you many things!”.
5. And it came to pass that the machine delivered on such promises by the bushel and then some.
6. But yea, there was among these promises one that spake of a parking heater, such that its followers would be granted a toasty car to get into on cold winters mornings. And behold, it was promised in all the shiny literature wherever thou mayst have looked.
7. And in those days of wonder the manual too spake of this mystical feature, yet, behold! It was flawed in its delivery and it worketh not for many people unless they left their radio on, for there were dark secrets within the machine, and lo! When the car was locked, if the radio was off the heater worketh not.
8. And the followers of the D3 muttered and grumbled unto the great LandRover, yet their prayers went unheeded, yea even though they had been promised warm bottoms.
9. Then behold! Unto the followers of the D3 a series of software upgrades came, yea such that they healed many D3s that had fallen often by the wayside.
10. And there was much rejoicing that the compressor may never need changing again and that the bongs of death would no longer be heard in the land.
11. But even as they praised the gift of better reliability delivered from the great Warranty, those followers with toasty bums in the mornings saw that the menu for the heater had been consumed and lost forever.
12. And there was a great wailing and a gnashing of teeth and icy buttocks abounded.

2 So Now what?

The heater where fitted to most D3s has been set up to act as a parking heater, as well as an auxiliary heater. This is evident by the fact that there is an electric pump fitted to the heater, so that the engine coolant can be circulated without the engine water pump being driven.

When considering the D3, I was interested in using the parking heater to reduce cold-engine wear as well as provide an oasis of warmth for my family when all around is frosty. At that time, the summer of 2006 software upgrades were resulting in the heater settings vanishing from the setup menu, and there were no alternatives.

Eventually, thanks to members of the forum I discovered that Webasto finally made a modification of their own available, so I looked into it. They offered to provide and install a modification that will re-enable the parking heater by installing a timer and some other electronics to start up the air-con fans and warm the cabin whilst warming the engine.

Having stretched myself financially in order to get the D3 in the first place, I balked somewhat at their price, and not being afraid of anything electronic wondered if I could do it myself.

Not knowing anything about the internals of the car, I found myself chatting with 10forcash who was as we all know, a valuable mine of detailed information. I learnt much from him regarding the pitfalls of the intended system in the car, and how the various components talked to each other over something called CANbus, and how the CANbus and certain components went to sleep when the car was locked. Frankly, this project wouldn't have gone ahead without his assistance at the start – thanks TFC.

I trawled the internet and learnt about CANbus. I then dug out some electronics papers I happened to have regarding the Microchip PIC series of microprocessors, as I'd seen in them examples of how these chips (there are others too) can be used to talk via CANbus. I expected it just to be a matter of injecting the Heat-Now command into the CANbus and all would be fine. Fine, but expensive – I didn't believe I could deliver a new timer remote system with CANbus control for my set budget of £100, so I ditched the idea,

I then concentrated on the Fuel Burning Heater (FBH) itself. It's made by Webasto, is held in very high regard and is fitted to a large number of luxury cars with very few issues. It had a bespoke model number on it though, which implied it was custom built for LandRover. Once again I started a trawl of the internet.

Very quickly, I discovered many sites that had carried out similar conversions to their auxiliary heaters (auxiliary heaters are needed because engine efficiencies were leading to less spare heat in diesel engines, meaning there wasn't enough heat to comfortably heat the cabin in cold climates).

These conversions simply sent a voltage to one of the pins on the FBH, telling it to 'fire now'. The controller on the FBH handled the ignition sequences and the fuel pump, so it really was that simple. Great I thought! I set up a circuit to create the required signal. It didn't work. For a long time I couldn't work out why. I assumed (incorrectly) that the heater had been converted totally over to CANbus control, and the manual fire feature had been omitted.

I kept trawling the internet, and after noting that Webasto is VERY popular in Germany, started searching for and translating German car forums. Eventually I found gold. Webasto had changed its control mechanism to something called W-BUS. I no longer own an oscilloscope, but I assume that this involves sending a digital pulsed signal rather than a simple voltage on-off; luckily this didn't prove to be a problem.

The W-BUS discovery led me to find what is called the Webasto Oval timer, model number 1533 :



This timer has the rather neat feature of providing the W-BUS output as well as the 'old' simple voltage output. At the time, this was the only producer of a W-BUS signal that I could find – with time I hope that others (including remote control based units) will become available.

I ordered one from eBay along with a connector plug, and it arrived a week later. I made a test harness up with many 20mA fuses to test the unit, and connected it to the heater. I pressed the flame button on the timer - immediately the sound of fans and eventually the sound of a pulse-jet engine sprang from under my bonnet...Start of big grin.

My grin foundered and relaxed for a few months as I tried to source the contact that has to be added to the FBH multiplug, to allow a wire to be connected to it cleanly. I had part numbers coming out of my ears, but was unable to source one from LandRover, Webasto, BMW (their part number is on the plug) or from the manufacturer of the plug. I had to assume that being as LandRover gave a part number for a loom repair kit for the plug (the connector on a length of wire) and yet magically couldn't provide one, that they have some sort of 'agreement' with Webasto to prevent us mere mortals tinkering and restoring our cars to the advertised condition of containing a working parking heater. Eventually I found a substitute and this document was born.

So that's the story of how it all started, the rest is the installation, which follows.

3 Installation

I've split the installation guide into two distinct parts, the part for installing the timer, and the part for installing the timer and a remote control key fob. There is naturally a lot of duplication here, but this way makes it harder to 'cross over' into the wrong set of instructions half way through.

I have also assumed that everyone doing this modification will not necessarily be trained in electronics engineering. All the work I've done to install this has been done using standard non-specialist tools (even when I've had better tools available) just so I knew it could be done by anybody..

Finally, my car was a 2007MY Right hand drive TDV6 D3. I will have to rely on the ingenuity of the owners of other year/handed cars to modify these instructions as appropriate to meet their own needs.

3.1 Timer only

3.1.1 Tools

Small needle nosed pliers.

Small wire cutters.

Soldering iron .

Solder (fluxed) electronics grade lead-free, NOT plumbing grade.

3.1.2 Parts

Webasto Oval timer, model number 1533 – Available from eBay, usually from German sellers



Plug and connectors for Webasto timer 1533, usually from German sellers on eBay.

Waterproof box – Used for housing the connections and remote control receiver. I used a standard mains type 2gang electrical box with blank front from a DIY shop. Don't forget to get some closed 20mm grommets to seal the cables with.

Electrical Connector Strip 4-way 5Amp AKA Choc-Blocs or those white strips of connectors that can be



cut to size that you use to join mains wires to each other.

FBH connector pin - These are available from RS Components (rswww.com) part number 495-9653.

Sadly they are only available in hundreds – when I find where I hid my spare ones I'll put up a post to get a set of three in return for a small donation to disco3.co.uk.

4-core signal wire – I would have used shielded/braided if they had it in stock as it's more robust, but I'm using non-shielded with no issues.

Single 1.6mm wire – Control signal wire for the FBH

Single 3mm wire – for power connections



In-line car style Fuse Holder (Waterproof)

3A fuse for fuse holder

Wire ties.

Electrical grade silicone sealant

16mm circular crimp on connectors x 2 (for attaching to earth point and battery)



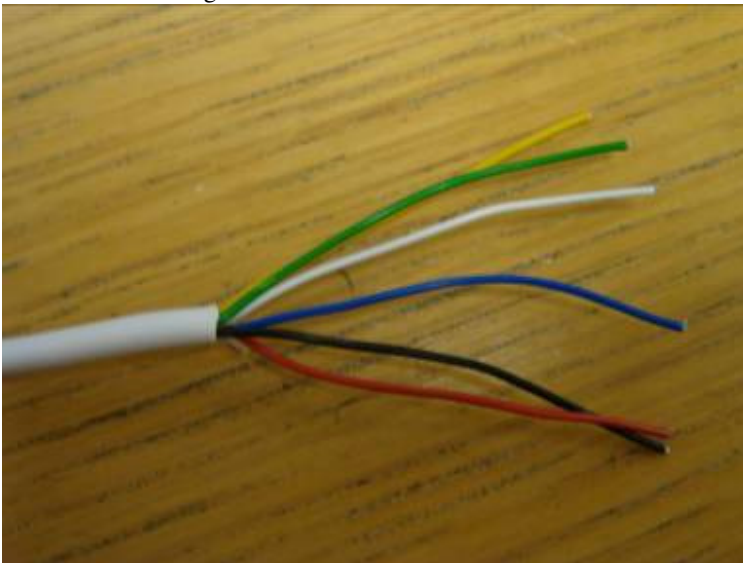
3.1.3 Making the plug for the Timer harness

I started with making up the plug for the timer end of the cable. This means you can rig up the timer to the FBH and ensure that it works before you've invested too much time and money in the project. These instructions work for me, but I only have access to my own car so it hasn't been tested on any other model years. The plug I purchased from the same eBay vendor who sold the Timer itself. It was made of very thin plastic – some care is required that no large forces are used in association with it – it will break under duress.

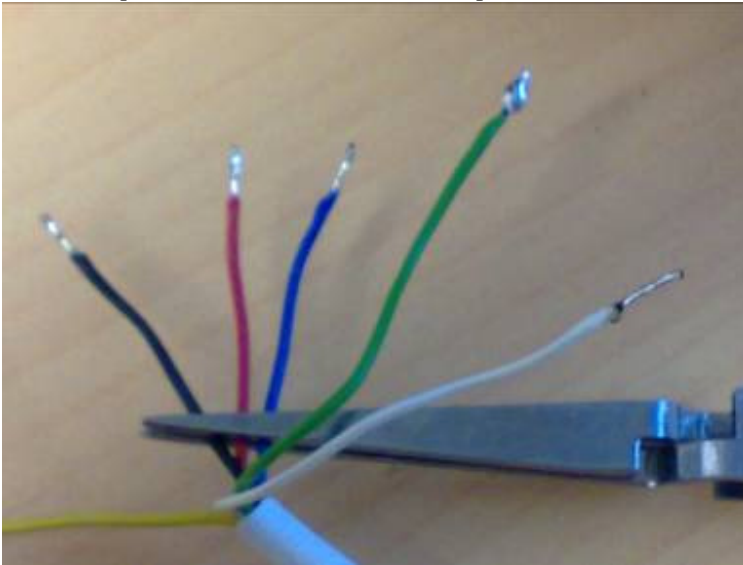


The plug comes with four contacts, each of which has to be crimped onto a wire.

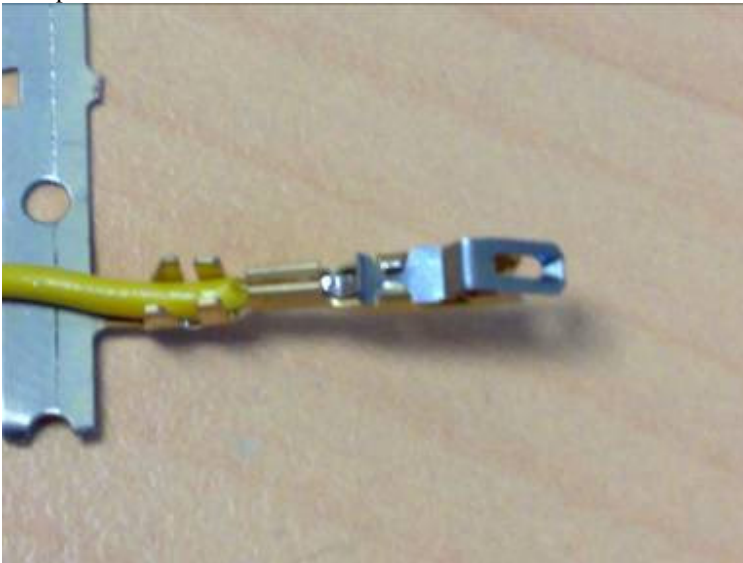
Prepare the 4-way cable (6 way shown) by removing a couple of inches of the external insulation. Be careful not to damage the inner wires or their insulation.



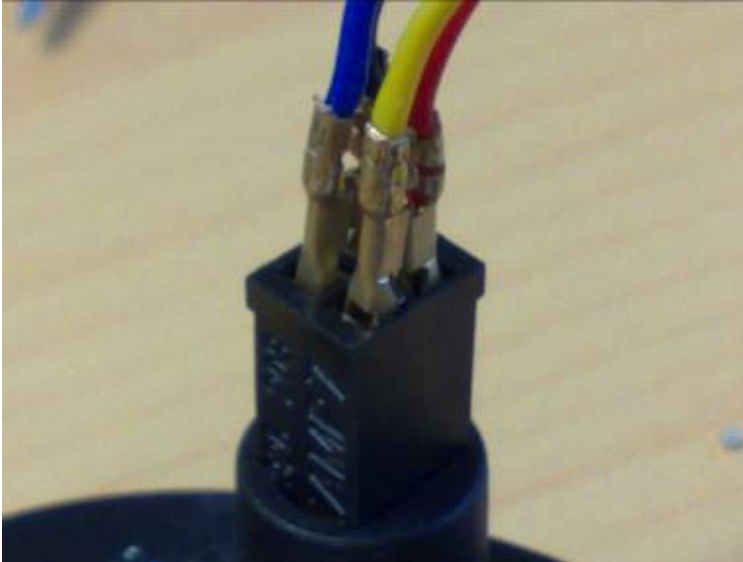
Strip around 4mm of insulation from each wire and tin with solder. Note the green wire, showing a blob – this will require re-work. The other wires are perfect.



Crimp each connector to a wire.



Place the black plug in the timer socket (protect the screen of the timer against scratches by attaching masking tape to its front) and offer up each of the four connectors into it's well in the plug. Now is the time to choose colours for each of the four pins, +VE, -VE, W-BUS and OUT. Tradition says that black is -VE and red is +VE, but as long as you WRITE DOWN what you've used, it'll all be OK.



Note that each connector has a small barb on it, which is designed to lock the connector into the plug – these barbs must engage in the windows in the plug. Without pulling out the connectors, remove the plug from the timer and gently drive each wire down until it locks in place



Note that although the socket on the timer has a provision for a key on the plug to prevent incorrect insertion, the plug I received had no such key – hence I had to ensure that the +VE wire (I chose red) was connected to the socket marked +VE on the back of the timer.

3.1.4 Testing the Timer on your FBH.

To test the timer, unlock the car, open the bonnet and then wait for the car to shut down. There should not be keys in the ignition and all the doors should be shut. I tend to like having the drivers window full open when working on the car 'just in case' but this is optional.

When the 2 minutes is up and the handbrake sign has gone out on the dashboard, remove the control plug from the FBH.

The control plug is the multi pin plug with three wires (2 for the CANbus and one going to the FBH's own fuel pump back near the tank)going into it and several blanked off holes.



In the photograph above, you can see that the wires into the control plug are in two rows. The second one from the left in the lower row is PIN 2 – this is the one we're pitching for.

From your kit of parts, take the fuse holder and fit the fuse. Bare 5mm of cable at each end of the fuse holder wires and by twisting wires together, connect the fuse and the wire that goes to the +VE pin on the timer. Use electricians tape to ensure there's no chance of a short or it pulling apart.

Bare 20mm of the –VE wire, and twist it. Find a suitable bolt or other fitting to twist it round – it must be something that is earthed to the chassis – I used the frame the FBH was mounted on.

Bare 3mm of the W-BUS wire. Place it out of harms way so it can't short with anything.

The intended circuit is :

Chassis to timer –VE

Battery +Ve through fuse to timer +VE

Once you've checked and re-checked this is OK, connect the unconnected wire from the fuse to the +vex battery terminal. Use tape to hold it there and to provide a protective insulating cover to the terminal.

The time on the timer should be flashing 0:00. If it isn't, remove the masking tape you put over the display earlier and look again. If this isn't working, check your connections are all good, and consider somewhere else to make the –VE connection to the chassis. Don't bother setting the clock.

Now the test. For this it's best to get a friend to help. Whilst holding the tip of the wire for the W-BUS against pin 2 of the FBH control plug (second from the left, lower row, remember?) and without touching any other pins get your friend to press the button marked with a flame on the timer.

You should immediately hear a fan start up inside the FBH. After 30-90 seconds it should start to roar and get hot and make smoke. If you break contact with PIN2, the interruption will cause the FBH to shut down, so brace yourself for holding everything in place for at least 2 minutes. If you cause three failed starts in a row, the FBH will assume it's unwell, and won't fire anymore. If this occurs, remove the plug that's below and to the right of the multiplug for a couple of minutes. There's a slot in the locking mechanism on this plug which coincidentally is just the right size for the D3 key tip. It just takes a wiggle to unlock it and the plug can be pulled off the FBH.

Now, for me that worked first time. If yours didn't it could be that:

1. Your battery isn't fully charged – The FBH won't fire unless your battery is providing at least 10.5 volts.
2. You have an older model of the FBH. Disconnect the +VE from the battery to make everything safe, and then bare the 3mm of the wire connecting to OUT on the timer. Retry as above, it's still PIN2 that has to be driven. If this works, remember you have an OUT activated FBH, not an W-BUS activated one.
3. Sorry, I'm stumped. Check and double check your wiring, then ask a friend who knows about electronics/auto electrics for help. I don't know any other model than my own, and it's possible that some FBH units simply can't be fired in this way. I hope this is not the case but if it is, I guess there's always someone on the forum who'll buy the timer from you.

Now you know that it works (or doesn't ☹) disconnect all your test kit, making sure that you remove the fused wire from the battery +VE first for safety.

3.1.5 Routing the Timer cable through the Bulkhead

To do this, open the bonnet and take the lid off the black box that houses your brake master cylinder and ABS unit. Next you have to identify the grommet that will allow access into the cabin. I have an AUTO, but I have a sneaky suspicion that this grommet will allow the clutch controls through on a Manual D3. If this is true, I'm sorry, you'll have to find your own way to share the grommet with the clutch.

Here's my grommet, in plain sight – that's the vacuum brake servo lower left.



Remove it and keep it in a safe place.

Now open the drivers door and remove the knee panel (grab top edge and pull sharply, it is hinged at the bottom and clipped at the top).

Next you need to carefully cut through the felt insulation that lines the inside of the bulkhead. I used a very short penknife blade on a Gerber-like multi-tool to gently cut a small hole from the outside.

You can see the blade projecting into the space behind the steering wheel:



Next take some stiff wire, and form a loop. This will be used to draw the Timer control cable from the cabin



Push it through the slit in the felt insulation so that it's waiting inside the car





Then put the end of the control cable through the loop and pull through – I left about 4 feet of cable inside the car



Using something sharp, make a round hole in the grommet, pass the cable through it (should be a tight fit to keep moisture out) and replace the grommet.



3.1.6 Installing the FBH control cable

Using a stiff thin piece of wire (I used a small size opened out paperclip) GENTLY press the blanking plug out of the pin 2 hole, by pressing from the other side. Keep it safe. This way around, the holes are numbered, and it's the second from the left in the top row we're targeting.



Next strip 5mm of insulation from the FBH control wire and tin it. Crimp on the FBH connector.

Now take a look at the picture above. Above the number two pin marking is a pink slider, with a Morse code “dash dash dot” look.

Using your straightened out paperclip again GENTLY press into the right hand side of the second dash so that the paperclip is at 45 degrees and pushing towards the ‘dot’. The pink slider should move a couple of mm until the pimple that was at the right of the second dash ends up in the dot.

This slider locks all the connectors into the plug – this movement isn't much, but it's enough to unlock all the connectors so that they can be added or removed.

Look for the barb on the connector you're about to fit. When you fit it, the barb points towards the pink slider. Note that the connectors I've found are far from perfect; although they're functional there is a lot of slack and it doesn't fit tightly. Don't worry about this – it's a tight fit on the FBH pin, and this is the most important thing.

Fit the connector into hole number two.

Now it's time to re-fit the plug into the FBH. As you fit it, the pink slider will automatically reset itself so don't worry about this. Very gently start to insert the plug into the FBH, and whilst you do gently wiggle the new wire and connector to help it line up with the pin. You may have to hold the new wire as you insert to stop the connector being pushed out. Once this manoeuvre is complete, none of the connector should be visible from the back of the plug. If it is, then it's not lined up with the pin and been forced out. Try again.

Once completed, use a very small amount of silicone sealant to fill the hole and seal the wire into the number 2 hole. You do NOT want to fill the whole plug with silicone; just the 5mm or so at the back of the plug to keep the water out. Only use electrical grade silicone – household DIY stuff usually excretes Acetic

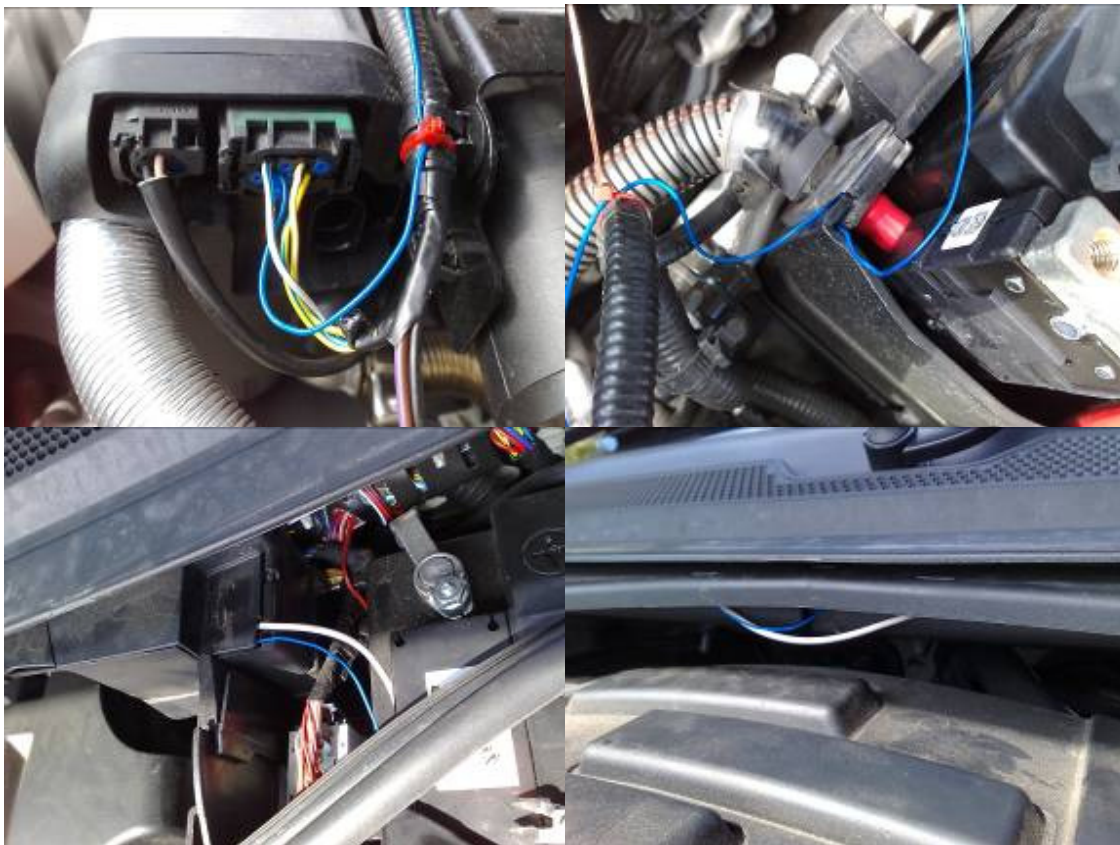
Acid (Vinegar) when it cures. This is highly corrosive. If you can't find a silicone that doesn't smell of vinegar, carefully press the retained blanking plug back into the number 2 hole so that it traps the wire. Just leave the wire coiled up – when you install the +VE power wire you route this one with it.

3.1.7 Installing the permanent 12v line.

First things first. Remove the fuse from the fuse holder. Crimp one of the 16mm ring connectors onto it. This will be attached to the battery +VE. Using a crimp connector join one end of the long 3mm wire to the other side of the fuse holder. To connect the +VE to the battery, first check that you really did remove the fuse and open the bonnet and close all the doors (alarm off – don't lock it, leave it open). Wait for the 2 minutes it takes for the park brake light to go out (and the car systems to write their config data to permanent memory).

I have a tracker in my car that screams for help if the battery is disconnected, so I had to make sure that when I took out the bolt holding the big fat red wire to the battery connector, I didn't break the circuit. Holding the fat red wire to the battery terminal tightly whilst applying downward pressure towards the battery terminal, then whilst continuing to do this, remove the bolt that holds the red wire to the connector. Pop the bolt through the ring connector and replace and re-tighten it. You can let go of the red wire now. If you think your way through this you can have all the right parts and tools near your free hand or alternatively find a friend to help out.

Next route the wires (don't forget the signal wire from the FBH!) from the battery box to the ABS/brake box at the other side of the engine bay. I managed to gently (nothing sharp!) poke the wires into the cable trunk that runs across the top of the engine. Keep it tidy, you don't want wires flapping/chaffing/shorting.



Leave the remaining length of the wires coiled in the brake box

3.1.8 Mounting the Timer on the dashboard

I mounted the timer between the instrument cluster and the air vents to the left of the driving position. I decided early that I didn't want to do anything permanent to the car in the way of drilling or screwing, in case I later decided to re-position or remove it. You'll have to make your own mind up where you want the timer; for instance in the Russian market where you can get the timer installed by LandRover for free (!) the timer instructions appear to place the timer up on the interior lighting cluster above the rear view mirror.

In order to mount my timer at an angle at which it could be seen correctly, I had to make a slanted mount fitting that could take the timer and be stuck to the dash with double sided tape.

Enough blab, here's the picture that's worth a thousand words :



....and following on are some of the steps to get me there. Yes, that really is some sad carbon fibre effect fablon – trust me, it looks better than the foam I mounted it on ;-)

Ignore the beige coloured connector on the wire in these diagrams – this is only for the people fitting the remote control version.





Hope that's all clear. The central console cover surrounding the sat/nav screen, or cubby hole if you've not got a screen is carefully released from the lower half down by the gear lever. Grab and pull straight back each lower 'leg' of the cover, and then rotate it slightly and lift up. There are further instructions in the forum if you're worried. It's a tight fit but it does come off cleanly and easily. After bringing the wire up from the foot well, I then carefully jammed it into the crease in the dash (last photo in the sequence on the left). This was done so that the length of wire showing was exactly right for the position I chose for the timer.

I used double sided foam tape to fix the foam block to the timer and to the dash. So far it's not shifted even a bit.

If I hadn't found an 'easy' route with the block of high density foam, I'd have created an aluminium bracket from some scrap sheet and mounted it that way. There is a bolt-hole under the Webasto badge for those that wish to go down this route.

3.1.9 Joining it all up

Right, now the timer is fitted and connected up.

The battery is connected, and the FBH is connected.

We've not yet found a ground connection though so let's do that next. Do NOT run another wire from the battery for this. You don't want them chafing together and causing fires.

I used a bolt that was inside the brake box, on the upper bulkhead area. Sorry, my photo of this didn't come out and I'm 6000 miles away from my car at the moment so I can't take another one ☹

I crimped another ring connector to a spare piece of 3mm wire and fixed it to this bolt.

Open up the waterproof box you bought, and knock out a hole in one end for one of the blanking grommets to fit in. I then used a very sharp point to pierce the grommet in four places - +VE cable, -VE cable, FBH control wire and 4 way cable to timer. Feed the wires through the grommet, then place the grommet in it's cut-out in the box. Mine wasn't an exact fit, so I silicon'd the grommet into the hole. OK, so I might have got carried away with the silicon, I can't help it.

Here's a picture before I went animal with the silicon – if you join me in my “DIY needs silicon” fetish, let it cure before sealing the lid to let the fumes out:



After this it was just a matter of connecting the wires in the choc block. You DID write down what colour went to which pin didn't you?

-VE ground wire connects to Timer-VE .

+VE wire from battery via fuse goes to Timer +VE

W-BUS from Timer goes to FBH control wire (or OUT from Timer if you decided that yours was an OUT driven FBH)

I used double sided foam tape to secure the choc-block to the inside of the waterproof box, closed the box and then attached it with more double sided foam tape to the inside of the battery box.

Job done. Well almost. Check all your connections and make sure there are no shorts, then fit the 3Amp fuse in the fuse holder and close the waterproof top.

Next use the provided instructions to set the time, length of burn and burn start time in the timer and test it. Remember – if the car is awake when the timer fires....**nothing** will happen.

Alternatively, open the car and open the drivers window fully, then shut the doors with the bonnet open. Wait the now obligatory two minutes for the car to realise you've left it on it's own and the parking brake light to go out on the dash. Reach in and press the button with the flame on it (instant heat). The FBH should now be audible as the fans will have started up. Within 90 seconds it should start making smoke and the funny pulse-jet noise (this usually becomes quieter as it heats up). As per the original test instructions, if it doesn't fire, it may have had several false starts or an error – pull the power plug from the FBH for a couple of minutes before re-fitting and re-trying. If it starts then stops, then it's failed to fire. Did you shut all the doors? If so, there MAY be a fault with the FBH, or you may not have enough fuel in the tank; if the fuel warning light is on or flashing or even if you're near empty, you need to top up first. Did you leave the tailgate/door open whilst fitting it, or the radio on? You might be in flat battery territory – if you can start it, take it for a good 30 minute brisk drive to top off the charge.

Once you have it running DO NOT ATTEMPT TO TOUCH THE EXHAUST FROM THE FBH! This way, bad burns or fatal infections can be avoided. If it's smoking, it's probably running. After 5 minutes the main body of the FBH will be hot to the touch, as will the water pipes heading out the back of it.

I let mine run for a full 30 minutes first time. When it first started up, I got puffs of smoke from the joins from the exhaust to the FBH, but after 30 minutes it had self-sealed itself and this didn't happen again.

That's it, this is the end of your section. I wish you luck and hope it all works as well for you as it has for me.

3.2 Timer and Remote Control

3.2.1 Tools

Small needle nosed pliers.

Small wire cutters.

Soldering iron – low powered 12watt iron recommended .

Solder (fluxed) electronics grade lead-free, NOT plumbing grade.

3.2.2 Parts

Webasto Oval timer, model number 1533 – Available from eBay, usually from German sellers



Plug and connectors for Webasto timer 1533, usually from German sellers on eBay.

Waterproof box – Used for housing the connections and remote control receiver. I used a standard mains type 2gang electrical box with blank front from a DIY shop. Don't forget to get some closed 20mm grommets to seal the cables with.

Electrical Connector Strip 6-way 5Amp AKA Choc-Blocs or those white strips of connectors that can be



cut to size that you use to join mains wires to each other.

FBH connector pin - These are available from RS Components (rswww.com) part number 495-9653.

Sadly they are only available in hundreds – when I find where I hid my spare ones I'll put up a post to get a set of three in return for a small donation to disco3.co.uk.

6-core signal wire – I would have used shielded/braided if they had it in stock as it's more robust, but I'm using non-shielded with no issues.

3m Single 1.6mm wire – Control signal wire for the FBH

3m Single 3mm wire – for power connections



In-line car style Fuse Holder (Waterproof)

3A fuse for fuse holder

Cable ties.

Electrical grade silicone sealant



16mm circular crimp on connectors x 2 (for attaching to earth point and battery)

2 pin connector, plug and contacts:

I used Maplin as it's local to me, there are many alternates.

PCB Latch PI 2w

RK65V

PCB Latch Hsng 2-Way

HB59P

0.1in Skt Terminals

YW25C

1 channel 12Volt remote control receiver and matching keyfob(s). Maplin do such a kit, there are others – your choice

Remote Control Kit 1

L26BK

Just make sure you buy the remote kit before you buy the waterproof box – otherwise it might not all fit inside.

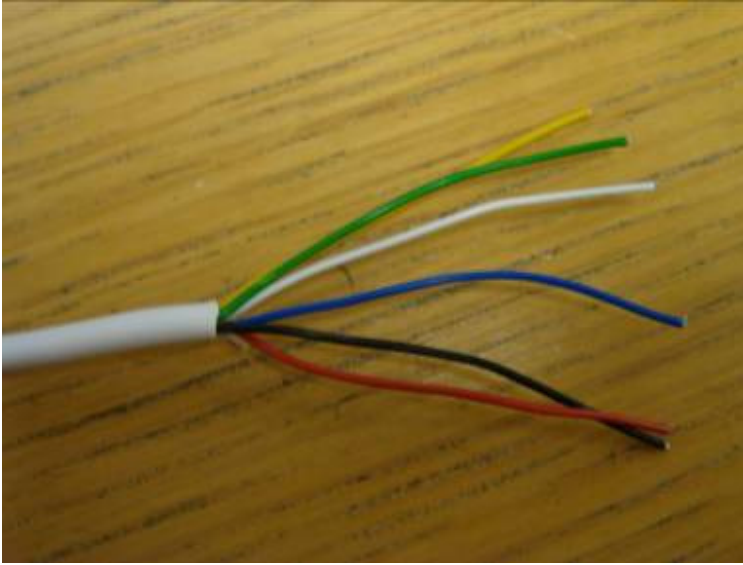
3.2.3 Making the plugs for the Timer harness

I started with making up the plug for the timer end of the cable. This means you can rig up the timer to the FBH and ensure that it works before you've invested too much time and money in the project. These instructions work for me, but I only have access to my own car so it hasn't been tested on any other model years. The plug I purchased from the same eBay vendor who sold the Timer itself. It was made of very thin plastic – some care is required that no large forces are used in association with it – it will break under duress.

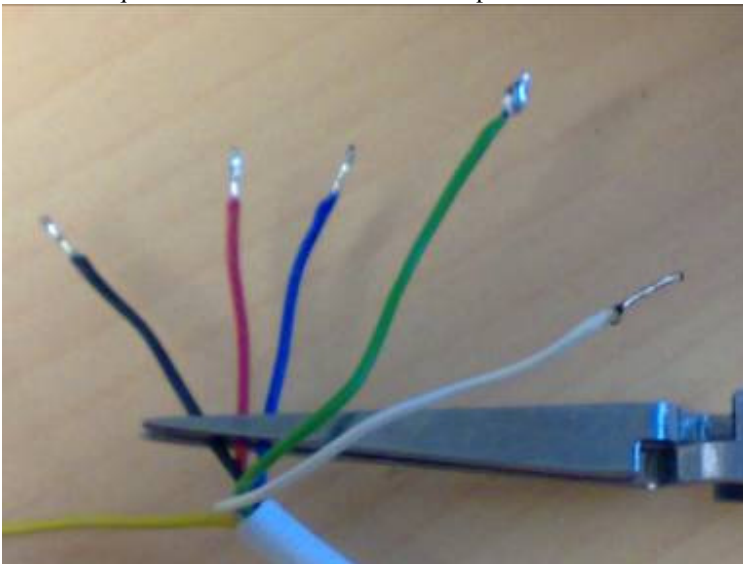


The plug comes with four contacts, each of which has to be crimped onto a wire.

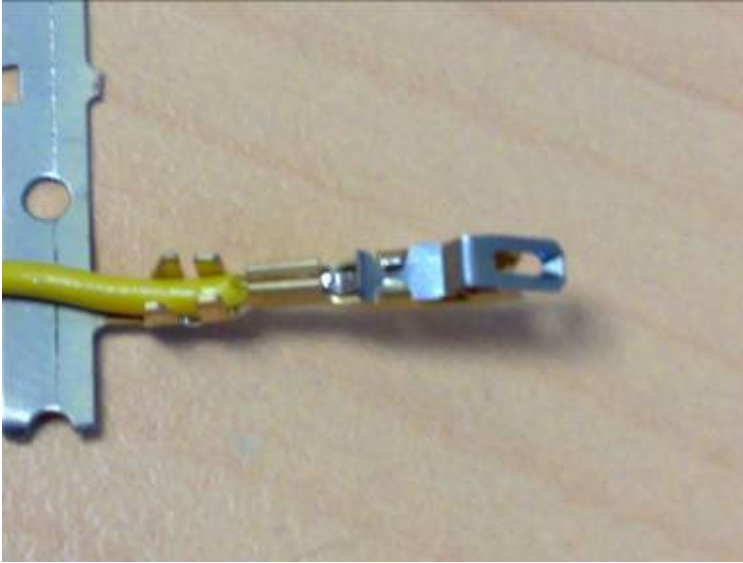
Prepare the 6-way cable (2 wires will be used later) by removing a couple of inches of the external insulation. Be careful not to damage the inner wires or their insulation.



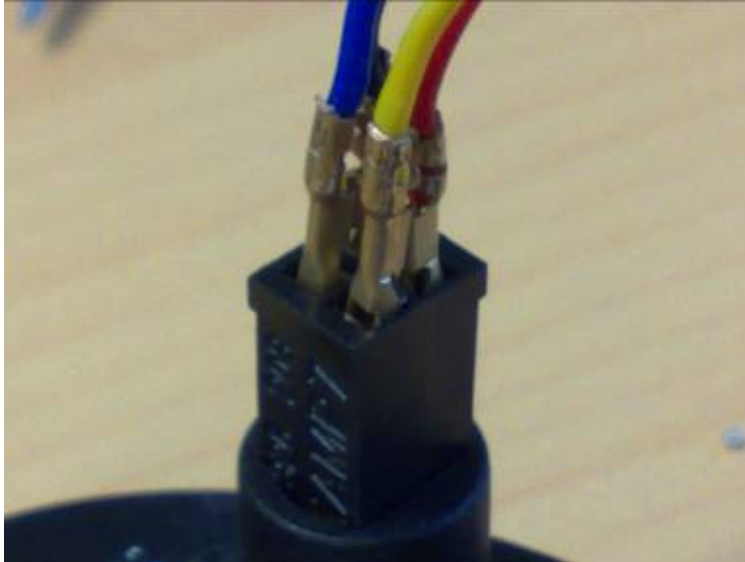
Strip around 4mm of insulation from each wire and tin with solder. Note the green wire, showing a blob – this will require re-work. The other wires are perfect.



Crimp each connector to a wire.



Place the black plug in the timer socket (protect the screen of the timer against scratches by attaching masking tape to its front) and offer up each of the four connectors into it's well in the plug. Now is the time to choose colours for each of the four pins, +VE, -VE, W-BUS and OUT. Tradition says that black is -VE and red is +VE, but as long as you WRITE DOWN what you've used, it'll all be OK.



Note that each connector has a small barb on it, which is designed to lock the connector into the plug – these barbs must engage in the windows in the plug. Without pulling out the connectors, remove the plug from the timer and gently drive each wire down until it locks in place



Note that although the socket on the timer has a provision for a key on the plug to prevent incorrect insertion, the plug I received had no such key – hence I had to ensure that the +VE wire (I chose red) was connected to the socket marked +VE on the back of the timer.

Once this has been done, crimp two of the 0.1" contacts to the remaining two wires from the cable, and pop them into the 2 pin socket – ensuring the barbs on the contacts line up with the holes in the housing. This will fit onto the two pins being mounted on the timer module later.



3.2.4 Testing the Timer on your FBH.

To test the timer, unlock the car, open the bonnet and then wait for the car to shut down. There should not be keys in the ignition and all the doors should be shut. I tend to like having the drivers window full open when working on the car 'just in case' but this is optional.

When the 2 minutes is up and the handbrake sign has gone out on the dashboard, remove the control plug from the FBH.

The control plug is the multi pin plug with three wires (2 for the CANbus and one going to the FBH's own fuel pump back near the tank)going into it and several blanked off holes.



In the photograph above, you can see that the wires into the control plug are in two rows. The second one from the left in the lower row is PIN 2 – this is the one we're pitching for.

From your kit of parts, take the fuse holder and fit the fuse. Bare 5mm of cable at each end of the fuse holder wires and by twisting wires together, connect the fuse and the wire that goes to the +VE pin on the timer. Use electricians tape to ensure there's no chance of a short or it pulling apart.

Bare 20mm of the –VE wire, and twist it. Find a suitable bolt or other fitting to twist it round – it must be something that is earthed to the chassis – I used the frame the FBH was mounted on.

Bare 3mm of the W-BUS wire. Place it out of harms way so it can't short with anything.

The intended circuit is :

Chassis to timer –VE

Battery +Ve through fuse to timer +VE

Once you've checked and re-checked this is OK, connect the unconnected wire from the fuse to the +vex battery terminal. Use tape to hold it there and to provide a protective insulating cover to the terminal.

The time on the timer should be flashing 0:00. If it isn't, remove the masking tape you put over the display earlier and look again. If this isn't working, check your connections are all good, and consider somewhere else to make the –VE connection to the chassis. Don't bother setting the clock.

Now the test. For this it's best to get a friend to help. Whilst holding the tip of the wire for the W-BUS against pin 2 of the FBH control plug (second from the left, lower row, remember?) and without touching any other pins get your friend to press the button marked with a flame on the timer.

You should immediately hear a fan start up inside the FBH. After 30-90 seconds it should start to roar and get hot and make smoke. If you break contact with PIN2, the interruption will cause the FBH to shut down, so brace yourself for holding everything in place for at least 2 minutes. If you cause three failed starts in a row, the FBH will assume it's unwell, and won't fire anymore. If this occurs, remove the plug that's below and to the right of the multipug for a couple of minutes. There's a slot in the locking mechanism on this plug which coincidentally is just the right size for the D3 key tip. It just takes a wiggle to unlock it and the plug can be pulled off the FBH.

Now, for me that worked first time. If yours didn't it could be that:

4. Your battery isn't fully charged – The FBH won't fire unless your battery is providing at least 10.5 volts.
5. You have an older model of the FBH. Disconnect the +VE from the battery to make everything safe, and then bare the 3mm of the wire connecting to OUT on the timer. Retry as above, it's still PIN2 that has to be driven. If this works, remember you have an OUT activated FBH, not an W-BUS activated one.
6. Sorry, I'm stumped. Check and double check your wiring, then ask a friend who knows about electronics/auto electrics for help. I don't know any other model than my own, and it's possible that some FBH units simply can't be fired in this way. I hope this is not the case but if it is, I guess there's always someone on the forum who'll buy the timer from you.

Now you know that it works (or doesn't ☹) disconnect all your test kit, making sure that you remove the fused wire from the battery +VE first for safety.

3.2.5 Modifying the Timer ready for remote control

The timer requires a modification so that a remote control can be used. Basically this involves adding a connector that allows a couple of wires to be attached such that they are across the contacts of the 'fire now' button. By this means the remote control receiver can short these connectors and turn on the heater.

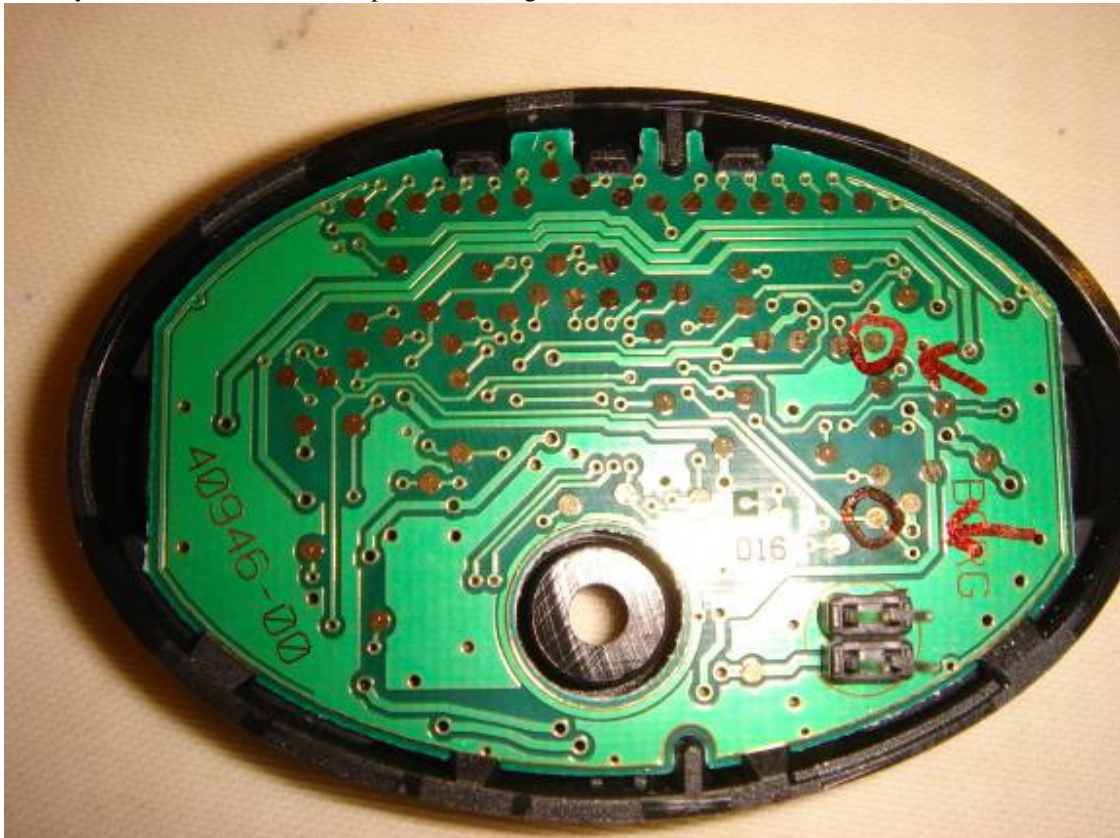
I used a two pin 0.1" locking connector so that I can unplug the timer when required. I guess you could just permanently solder it if you wanted – I didn't fancy it in case I needed to remove it for anything.

For this part of the project, a low powered soldering iron is vital. You will be making very precise and fine solder joints to the delicate innards of the timer. A thinking great iron will dump in too much heat and peel off the copper pads from the circuit board – and that will usually mean buying a new timer.

OK, first off, we need to open the timer up. We're going to be wrestling with it and later fiddling with it's insides, so pop some masking tape over the clear display first to prevent scratches.

Place the timer face down and take a look at the edges – the whole back panel comes off in one piece, and is held in place by a number of very small barbs that hold it into the front cover. I used my thumb-nail to get in between the two parts and gently ease all the barbs open. Don't stick anything sharp in the gap – it could slip and hurt you, or slip and hurt the circuit board inside. Take your time and ease it open with a nail or stiff piece of plastic.

Once open, you'll see a maze of gold and copper wires and pads. I've already done the work for this next bit, so you don't have to – here's a picture showing where the wires need to be connected:



I've circled the pads we're soldering to in red, with arrows pointing at them. Take your time and make sure you also have selected the same pads, and use a fine tipped permanent marker to make the same circles and arrows. Don't skip this; it's very easy to select the wrong pads by accident.

That strange black square lower right on the picture is actually the 4 connector pins.

Cut a couple of 10cm lengths of the 0.6mm wire that will be used for the FBH control cable, strip about 3mm from the ends of both and carefully tin them. Once tinned, trim so that only 2mm or soldered wire remains.

Next, cut two pieces of solder, each about 2mm long. Yes really – that little. We're doing this to ensure we can't accidentally overload the pads on the circuit board with solder and short circuit other pads.

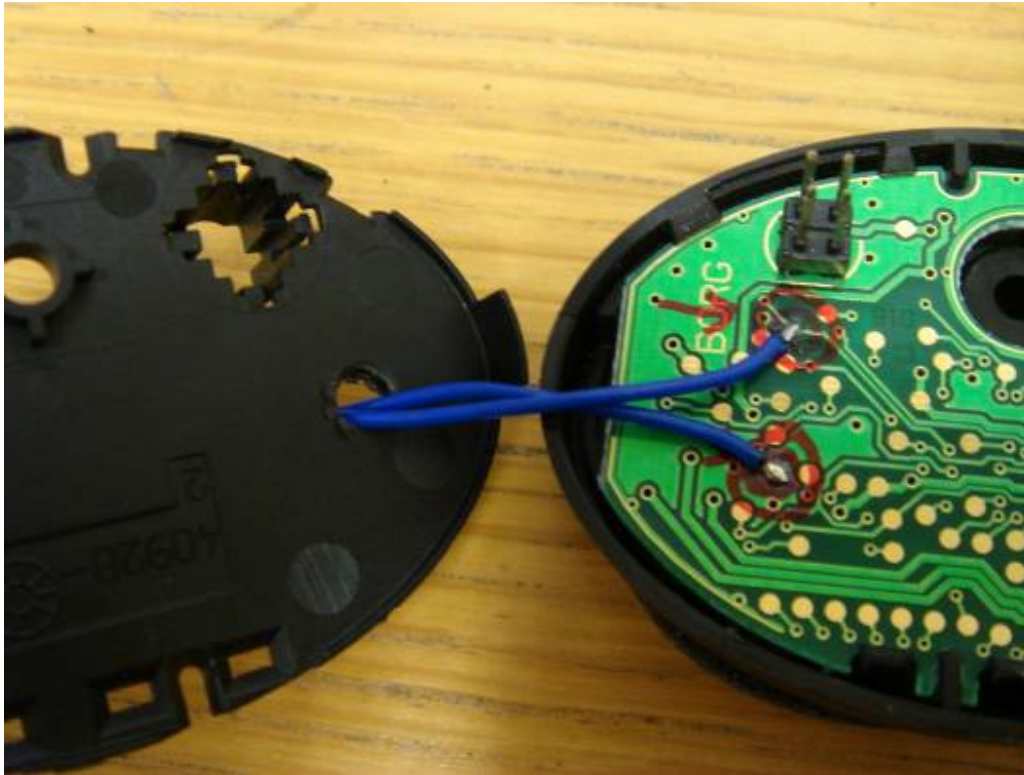
Very carefully, place a piece of solder on one of the pads and touch the 12watt soldering iron on it. After a second or so the solder should melt and flow across the pad. Immediately take the iron off. Repeat for the other pad and allow the whole thing to cool. Do not overdo the time the iron is in contact – over three seconds and chances are that the circuit board will cook, melt the glue that holds the copper pads on and destroy the board. Don't.

Here's mine after the first one has been done:



Next it's time to attach the wires to the pads. Place one soldered wire tip against a soldered pad, and briefly touch the soldering iron. This should be just enough for the solder to melt. Don't allow the wire to move whilst the solder is molten and again, don't cook it – once it's 'flowed' take the iron away.

By now, your timer should look like this – note also that I've cut/melted a hole in the plastic back. This hole is lined up so that it's approximately half-way between the two pads when fitted. Note also that there's just enough solder and the joints don't cross any other pads or tracks:



Re-assemble the timer. It's very tight – my wire was thin enough to fit and still allow the cover to be re-fitted.



Next we need to fit the two pin connector to the back. I started out by cutting and fitting the gasket provided with the timer to cope with the extra connectors; however in my case I didn't end up using it. If you're mounting yours differently, you may indeed need it.

Here's some more photos – I used superglue to stick the connector to the timer back, and then cut, tinned the wires to size and tinned the short end of the pins before soldering the wires to the pins:



That's the timer modification complete.

3.2.6 Routing the Timer cable through the Bulkhead

To do this, open the bonnet and take the lid off the black box that houses your brake master cylinder and ABS unit. Next you have to identify the grommet that will allow access into the cabin. I have an AUTO, but I have a sneaky suspicion that this grommet will allow the clutch controls through on a Manual D3. If this is true, I'm sorry, you'll have to find your own way to share the grommet with the clutch.

Here's my grommet, in plain sight – that's the vacuum brake servo lower left.



Remove it and keep it in a safe place.

Now open the drivers door and remove the knee panel (grab top edge and pull sharply, it is hinged at the bottom and clipped at the top).

Next you need to carefully cut through the felt insulation that lines the inside of the bulkhead. I used a very short penknife blade on a Gerber-like multi-tool to gently cut a small hole from the outside.

You can see the blade projecting into the space behind the steering wheel:



Next take some stiff wire, and form a loop. This will be used to draw the Timer control cable from the cabin



Push it through the slit in the felt insulation so that it's waiting inside the car





Then put the end of the control cable through the loop and pull through – I left about 4 feet of cable inside the car

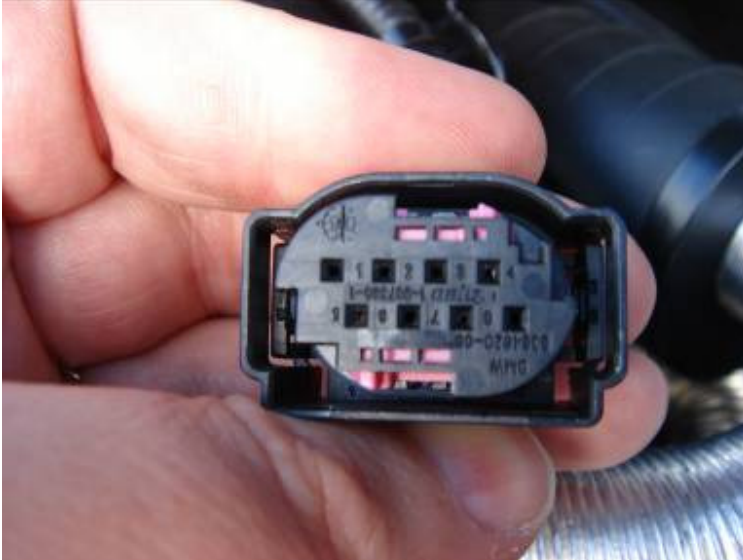


Using something sharp, make a round hole in the grommet, pass the cable through it (should be a tight fit to keep moisture out) and replace the grommet.



3.2.7 Installing the FBH control cable

Using a stiff thin piece of wire (I used a small size opened out paperclip) GENTLY press the blanking plug out of the pin 2 hole, by pressing from the other side. Keep it safe. This way around, the holes are numbered, and it's the second from the left in the top row we're targeting.



Next strip 5mm of insulation from the FBH control wire and tin it. Crimp on the FBH connector.

Now take a look at the picture above. Above the number two pin marking is a pink slider, with a Morse code "dash dash dot" look.

Using your straightened out paperclip again GENTLY press into the right hand side of the second dash so that the paperclip is at 45 degrees and pushing towards the 'dot'. The pink slider should move a couple of mm until the pimple that was at the right of the second dash ends up in the dot.

This slider locks all the connectors into the plug – this movement isn't much, but it's enough to unlock all the connectors so that they can be added or removed.

Look for the barb on the connector you're about to fit. When you fit it, the barb points towards the pink slider. Note that the connectors I've found are far from perfect; although they're functional there is a lot of slack and it doesn't fit tightly. Don't worry about this – it's a tight fit on the FBH pin, and this is the most important thing.

Fit the connector into hole number two.

Now it's time to re-fit the plug into the FBH. As you fit it, the pink slider will automatically reset itself so don't worry about this. Very gently start to insert the plug into the FBH, and whilst you do gently wiggle the new wire and connector to help it line up with the pin. You may have to hold the new wire as you insert to stop the connector being pushed out. Once this manoeuvre is complete, none of the connector should be visible from the back of the plug. If it is, then it's not lined up with the pin and been forced out. Try again.

Once completed, use a very small amount of silicone sealant to fill the hole and seal the wire into the number 2 hole. You do NOT want to fill the whole plug with silicone; just the 5mm or so at the back of the plug to keep the water out. Only use electrical grade silicone – household DIY stuff usually excretes Acetic

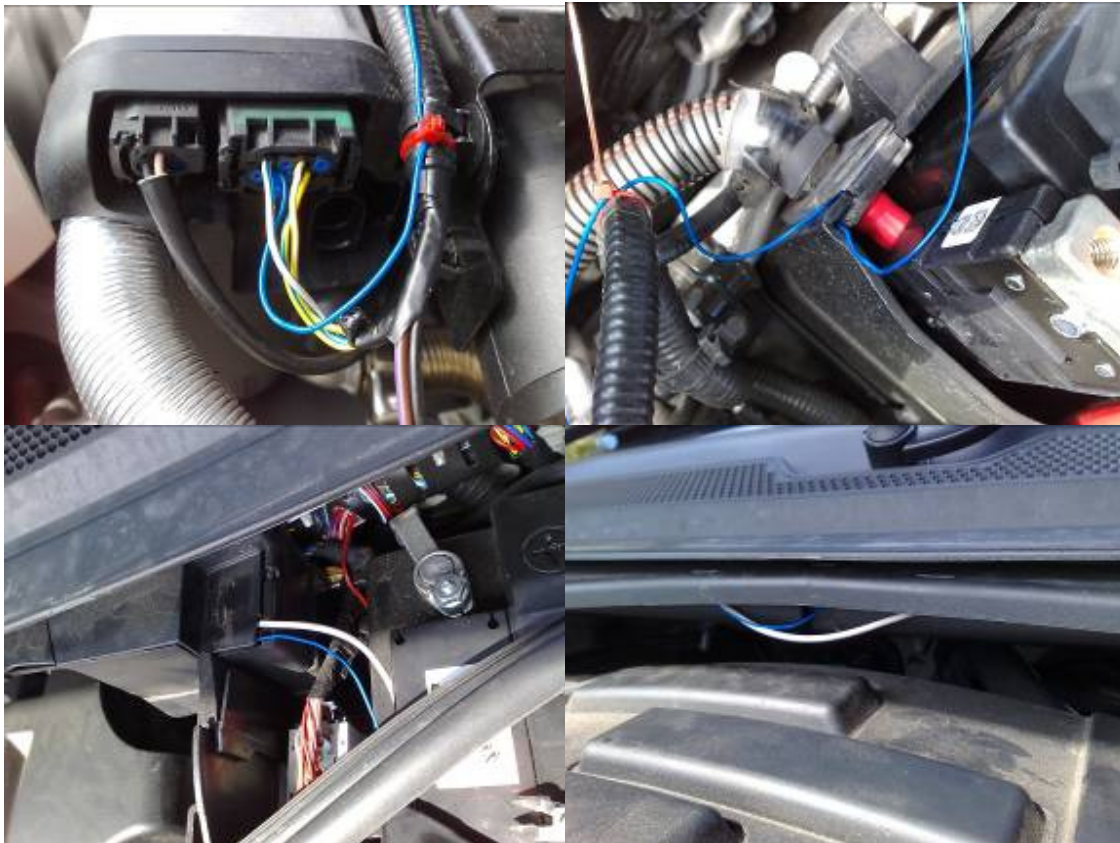
Acid (Vinegar) when it cures. This is highly corrosive. If you can't find a silicone that doesn't smell of vinegar, carefully press the retained blanking plug back into the number 2 hole so that it traps the wire. Just leave the wire coiled up – when you install the +VE power wire you route this one with it.

3.2.8 Installing the permanent 12v line.

First things first. Remove the fuse from the fuse holder. Crimp one of the 16mm ring connectors onto it. This will be attached to the battery +VE. Using a crimp connector join one end of the long 3mm wire to the other side of the fuse holder. To connect the +VE to the battery, first check that you really did remove the fuse and open the bonnet and close all the doors (alarm off – don't lock it, leave it open). Wait for the 2 minutes it takes for the park brake light to go out (and the car systems to write their config data to permanent memory).

I have a tracker in my car that screams for help if the battery is disconnected, so I had to make sure that when I took out the bolt holding the big fat red wire to the battery connector, I didn't break the circuit. Holding the fat red wire to the battery terminal tightly whilst applying downward pressure towards the battery terminal, then whilst continuing to do this, remove the bolt that holds the red wire to the connector. Pop the bolt through the ring connector and replace and re-tighten it. You can let go of the red wire now. If you think your way through this you can have all the right parts and tools near your free hand or alternatively find a friend to help out.

Next route the wires (don't forget the signal wire from the FBH!) from the battery box to the ABS/brake box at the other side of the engine bay. I managed to gently (nothing sharp!) poke the wires into the cable trunk that runs across the top of the engine. Keep it tidy, you don't want wires flapping/chaffing/shorting.



Leave the remaining length of the wires coiled in the brake box

3.2.9 Mounting the Timer on the dashboard

I mounted the timer between the instrument cluster and the air vents to the left of the driving position. I decided early that I didn't want to do anything permanent to the car in the way of drilling or screwing, in case I later decided to re-position or remove it. You'll have to make your own mind up where you want the timer; for instance in the Russian market where you can get the timer installed by LandRover for free (!) the timer instructions appear to place the timer up on the interior lighting cluster above the rear view mirror.

In order to mount my timer at an angle at which it could be seen correctly, I had to make a slanted mount fitting that could take the timer and be stuck to the dash with double sided tape.

Enough blab, here's the picture that's worth a thousand words :



....and following on are some of the steps to get me there. Yes, that really is some sad carbon fibre effect fablon – trust me, it looks better than the foam I mounted it on ;-)





Hope that's all clear. The central console cover surrounding the sat/nav screen, or cubby hole if you've not got a screen is carefully released from the lower half down by the gear lever. Grab and pull straight back each lower 'leg' of the cover, and then rotate it slightly and lift up. There are further instructions in the forum if you're worried. It's a tight fit but it does come off cleanly and easily. After bringing the wire up from the foot well, I then carefully jammed it into the crease in the dash (last photo in the sequence on the left). This was done so that the length of wire showing was exactly right for the position I chose for the timer.

I used double sided foam tape to fix the foam block to the timer and to the dash. So far it's not shifted even a bit.

If I hadn't found an 'easy' route with the block of high density foam, I'd have created an aluminium bracket from some scrap sheet and mounted it that way. There is a bolt-hole under the Webasto badge for those that wish to go down this route.

3.2.10 Preparing the remote receiver

The receiver I bought was from Maplin. It was a single channel 12 volt receiver with relay output, configurable as 'pulsed' which meant that when I pressed the remote control keyfob button, the relay closed for 0.3 seconds and opened again.

I did have lots of photos and fitting instructions, but I've recently discovered that the model I bought has

been discontinued, and hence there's not much point. Maplin does do a replacement model which in fairness is both cheaper, and has better range and lower power consumption. As such, just follow the instructions in the kit as to how to wire it up and program it for pulsed mode – the connections become obvious in the next section.

3.2.11 Joining it all up

Right, now the timer is fitted and connected up – 4 pin and 2 pin plugs connected.

The battery is connected, and the FBH is connected.

We've not yet found a ground connection though so let's do that next. Do NOT run another wire from the battery for this. You don't want them chafing together and causing fires.

I used a bolt that was inside the brake box, on the upper bulkhead area. Sorry, my photo of this didn't come out and I'm 6000 miles away from my car at the moment so I can't take another one ☹

I crimped another ring connector to a spare length of 3mm wire and fixed it to this bolt.

Open up the waterproof box you bought, and knock out a hole in one end for one of the blanking grommets to fit in. I then used a very sharp point to pierce the grommet in four places - +VE cable, -VE cable, FBH control wire and 6 way cable to timer. Feed the wires through the grommet, then place the grommet in it's cut-out in the box. Mine wasn't an exact fit, so I silicon'd the grommet into the hole. OK, so I might have got carried away with the silicon, I can't help it.

Here's a picture before I went animal with the silicon – if you join me in my “DIY needs silicon” fetish, let it cure before sealing the lid to let the fumes out:



After this it was just a matter of connecting the wires in the choc block. You DID write down what colour went to which pin didn't you?

-VE ground wire connects to Timer-VE .

+VE wire from battery via fuse goes to Timer +VE

W-BUS from Timer goes to FBH control wire (or OUT from Timer if you decided that yours was an OUT driven FBH)

Pin one from timer burn now switch to one spare choc connector.

Pin two from timer burn now switch to the other spare choc connector.

Pin one and pin two will be connected

I used double sided foam tape to secure the choc-block to the inside of the waterproof box, closed the box and then attached it with more double sided foam tape to the inside of the battery box.

Job done. Well almost. Check all your connections and make sure there are no shorts, then fit the 3Amp fuse in the fuse holder and close the waterproof top.

Next use the provided instructions to set the time, length of burn and burn start time in the timer and test it. Remember – if the car is awake when the timer fires....**nothing** will happen.

Alternatively, open the car and open the drivers window fully, then shut the doors with the bonnet open. Wait the now obligatory two minutes for the car to realise you've left it on it's own and the parking brake light to go out on the dash. Reach in and press the button with the flame on it (instant heat).

The FBH should now be audible as the fans will have started up. Within 90 seconds it should start making smoke and the funny pulse-jet noise (this usually becomes quieter as it heats up). As per the original test instructions, if it doesn't fire, it may have had several false starts or an error – pull the power plug from the FBH for a couple of minutes before re-fitting and re-trying. If it starts then stops, then it's failed to fire. Did you shut all the doors? If so, there MAY be a fault with the FBH, or you may not have enough fuel in the tank; if the fuel warning light is on or flashing or even if you're near empty, you need to top up first. Did you leave the tailgate/door open whilst fitting it, or the radio on? You might be in flat battery territory – if you can start it, take it for a good 30 minute brisk drive to top off the charge.

Once you have it running DO NOT ATTEMPT TO TOUCH THE EXHAUST FROM THE FBH! This way, bad burns or fatal infections can be avoided. If it's smoking, it's probably running. After 5 minutes the main body of the FBH will be hot to the touch, as will the water pipes heading out the back of it.

I let mine run for a full 30 minutes first time. When it first started up, I got puffs of smoke from the joins from the exhaust to the FBH, but after 30 minutes it had self-sealed itself and this didn't happen again.

That's it, this is the end of your section. I wish you luck and hope it all works as well for you as it has for me.

4 Things I hope to do next

So what can be done to improve this? Firstly there needs to be some form of feedback so you know the heater is running, even from a distance. This doubles as an indication that the car has heard the remote control (where fitted). I expect my first draft of this will be a hi-intensity flashing LED.

The only other thing I'm still working on (very slowly as it's frankly not all that important to me yet) is the inclusion of circuits to run the cabin fans and pre-warm the interior once the engine has warmed up. This is complicated by the fact that normally the fan speed is pulse width modulation controlled by the air-con computer; and this of course is asleep when the heater is active. I have a cunning plan though, and expect to be able to test it soon.

Long term, I hope that Webasto release one of their remote control keyfobs that can drive W-BUS directly. These have a huge range AND they have a feedback light in the remote control keyfob, so you know when the call to heat has been received.

5 Appendix A – Soldering technique

Just a few words of guidance on soldering, and how not to end up injured.

Soldering is not a sport, it can be dangerous and it can result in injuries, including eye injuries.

There's no way that I can teach you to solder from a document, as it's a skill that requires patience and practice.

This site has a pretty good guide, but I'll also throw in a few tips of my own:

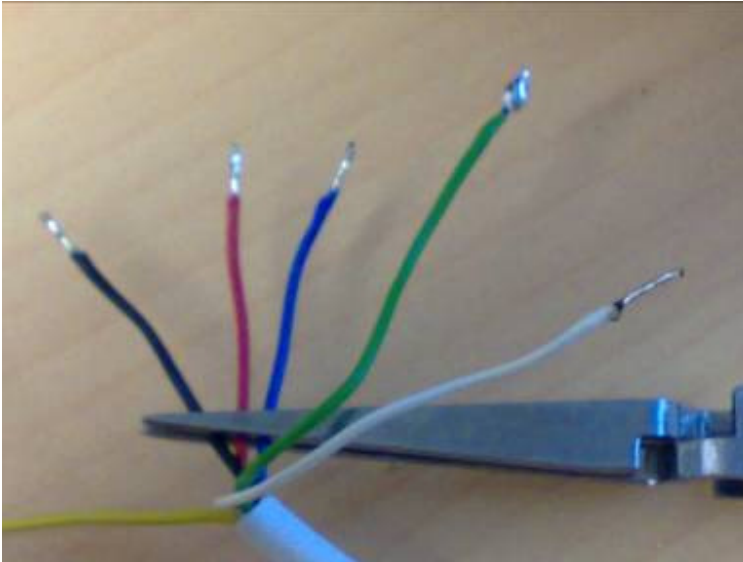
<http://www.epemag.wimborne.co.uk/solderfaq.htm>

1. Get a decent soldering iron. If you don't have one, but intend to fit the remote control part of this guide, then get a 12Watt 240V soldering iron with a 0.5mm pointed tip. This low power and fine tip is ideal for very delicate work, though underpowered for much else. If you're just doing the timer part of the install, you don't need the finesse of the 12W iron, so go for a standard 25Watt iron. I have a personal preference for the Antex brand as unlike some of the cheapie £5 Chinese made soldering irons they have never overheated, blown or had the tip go to 240V on me. Always get a stand for the iron, along with a cleaning sponge (often set in the base of the stand)
2. Don't be cavalier. Flicking the spare solder off the iron tip looks manly, but that little bead of molten silver alloy is still at something like 250 Centigrade. This is enough to burn your skin, lose an eye or set light to some materials. Don't.
3. In carpentry, you measure twice and cut once. In off-roading you think your way through an obstacle, imagining where the wheels will be, how the axles will react and which wheels will be off the ground etc before driving.
In soldering you think through where your hands are at any time, where the hot tip is in relation to pretty much everything else and whether your fingers are far enough down a wire not to get burnt. You also visualise the movements you're going to make to complete the solder joint without hurting anything – if you can't quite work out if you can do it safely, then re-arrange the parts and try again.
4. Keep the bit of the iron clean. Wet the sponge from the stand under the tap and then half wring it out. It should be wet without dripping any water. Clean the tip of the iron often, by wiping the tip across the sponge in about half a second whilst twisting the body of the iron to clean all around the tip.
The sponge should hiss lightly – hissing/bubbling heavily means too much water still in it, no hiss means it's too dry and will burn. Too much water saps too much heat from the iron. Taking too long to clean the tip also saps too much heat.
5. It's utterly useless to say this, but it's true. Only heat up a joint just enough to make the joint. Not enough heat and the alloy will crystallise and you'll get what's called a dry joint. It's a dull colour and may have a cracked appearance. It WONT have joined the wires properly. Too much heat and you can cook the circuit board and release the glue that holds the copper track to the board. This goes way beyond bad karma. Interestingly 'cooking' a joint like this can also result in a dry joint. If you get it just right, it'll be smooth shiny and bright.

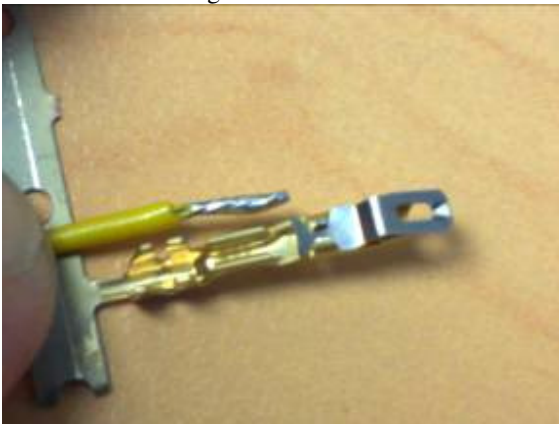
6 Appendix B – How to crimp the connectors to the wires

Just a quick guide for how to do this for those of you that have no experience. If you've done this before and/or have the right tools for the job, don't get all technical with me, this is for beginners to enable them to do a great job with limited tools and experience.

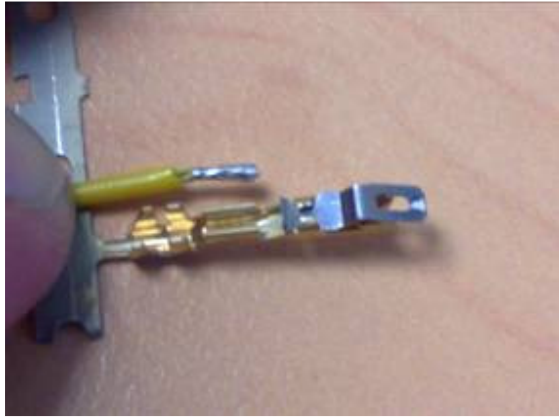
1. Strip down a couple of millimetres of insulation from the wires and gently twist the strands into a straight tight shape. Tin the wires – this helps with the crimping of the connector to the wire when you don't have an official crimping tool. Note in this picture, the white wire is damned near perfect, and the green wire has blobbed. Too much solder leads to blobbing – clean the soldering iron tip on the sponge and then stroke it from the insulation to the end of the soldered section. The iron should pick up some or perhaps all of the excess solder.



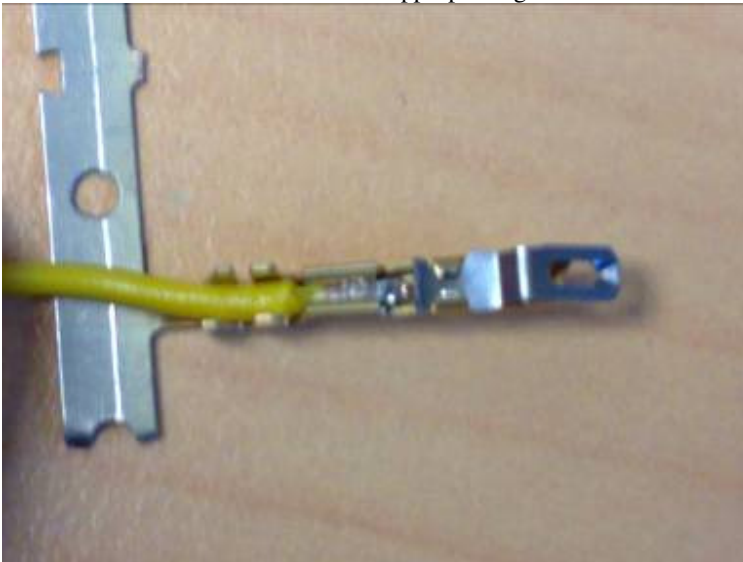
2. Trim down the length of the soldered section till it's the correct length for the crimp in the contact. The two pairs of claws parallel with the insulation in this picture, clamp onto the wires insulation for mechanical strength, the section parallel with the soldered wire is where the wire connection will be made. This one needs a slight trim:



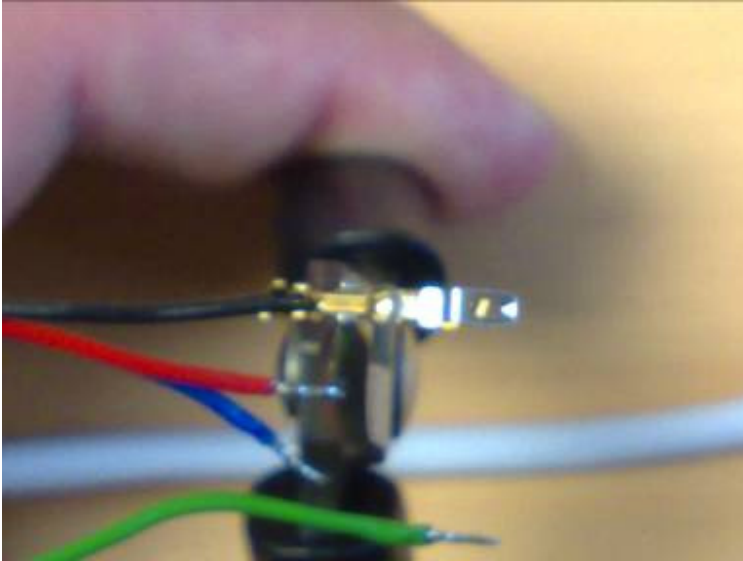
Ahhh, that's better:



3. Place the soldered section into the appropriate groove in the connector: (sorry, blurred)



4. Using the needle nosed pliers **gently** close the crimp. I know the photo is a bit blurred, but the channel the wire has been dropped into in the contact is facing towards the camera.



ERROR: stackunderflow
OFFENDING COMMAND: ~

STACK: