ElectroCooler
Electric A/C System
Setup and Test Manual
Issue 2.0

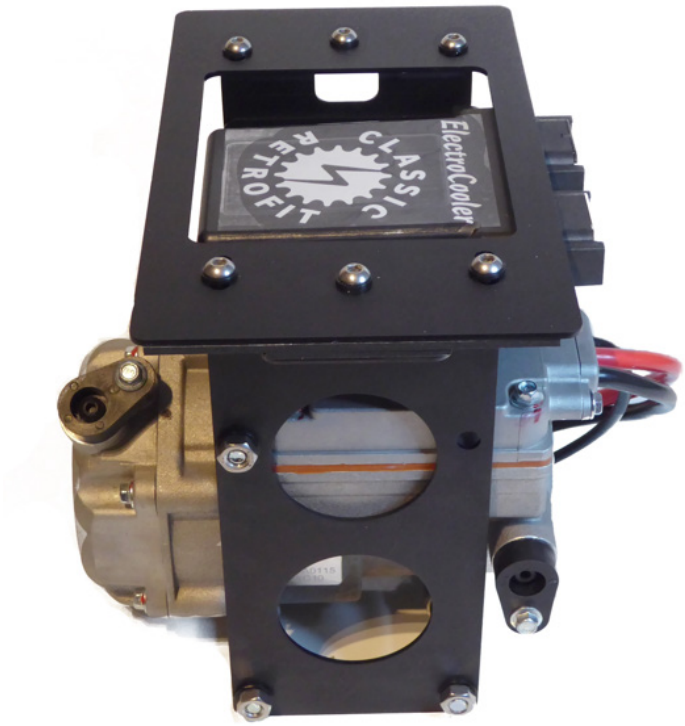


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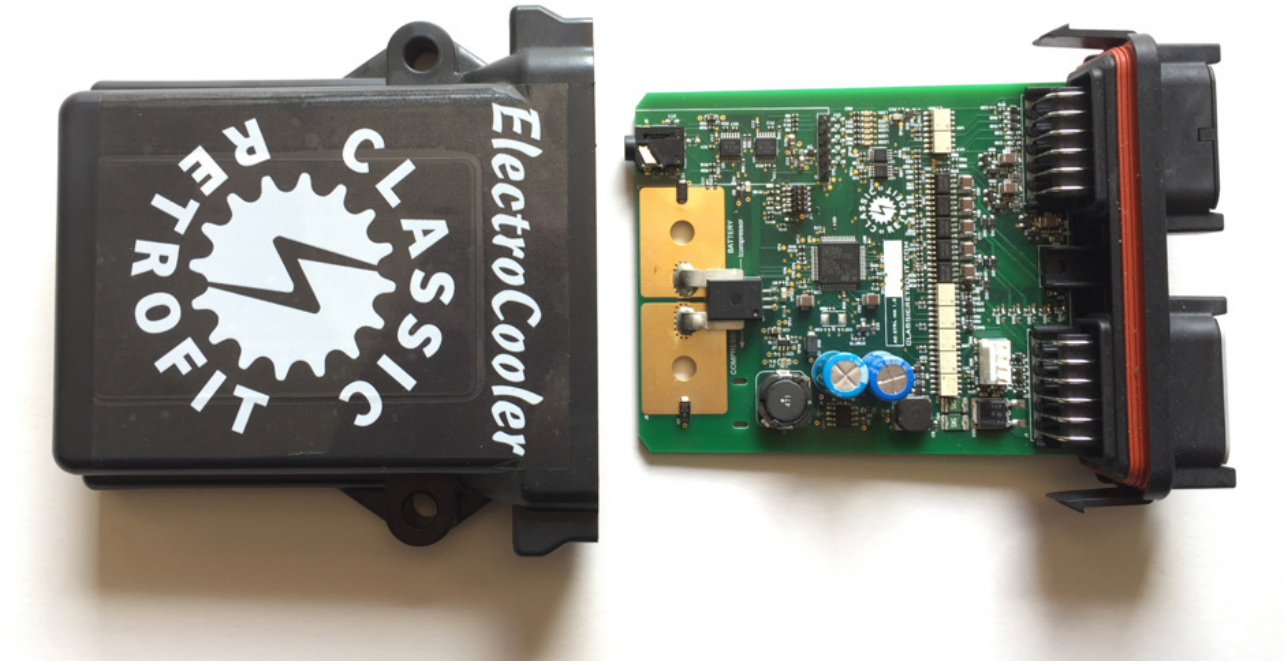
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Introduction

Welcome to the test and setup manual for the Electrocooler Air Conditioning system. In the majority of cases, the default settings already in the controller will be the optimum settings for performance. The system should 'just work' without ever plugging in a laptop. If, however, you need to fault find or adjust a setting, this manual shows how to do that.

Communication with the ECU

The Electrocooler ECU has a 3.5 mm jack plug accessible through a hole on the end of the case. A USB cable is supplied with the system for communication to a Windows based PC or laptop using a standard 'terminal program'.



Download the PC software.

Go to www.classicretrofit.com for the Manuals and Software page. Look for the Electrocooler zip package e.g. Electrocooler_v1.xx.zip

Download and extract the zip file to a Windows computer. You can do this by clicking on the zip file and the dragging the top level folder to your desktop or a folder of your choice on your computer.

[Note the files MUST be extracted. You cannot run the software from 'within' the zip file.]

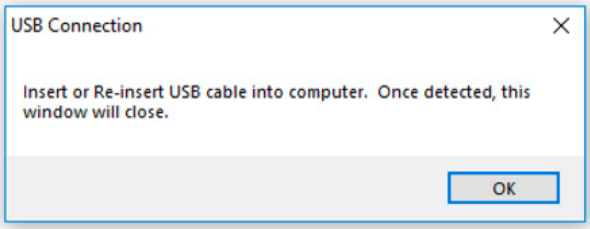
Open the folder ElectroCooler_v1_xx. Inside you will find the following folders and files.

Name	Date modified	Type	Size
Firmware	01/07/2019 10:24	File folder	
Programmer	08/09/2018 11:06	File folder	
Release	08/09/2018 11:06	File folder	
ThirdParty	08/09/2018 11:06	File folder	
Readme.txt	24/04/2018 13:39	Text Document	4 KB
RunMe.bat	02/01/2018 17:04	Windows Batch File	1 KB

To run the App double click RunMe.bat

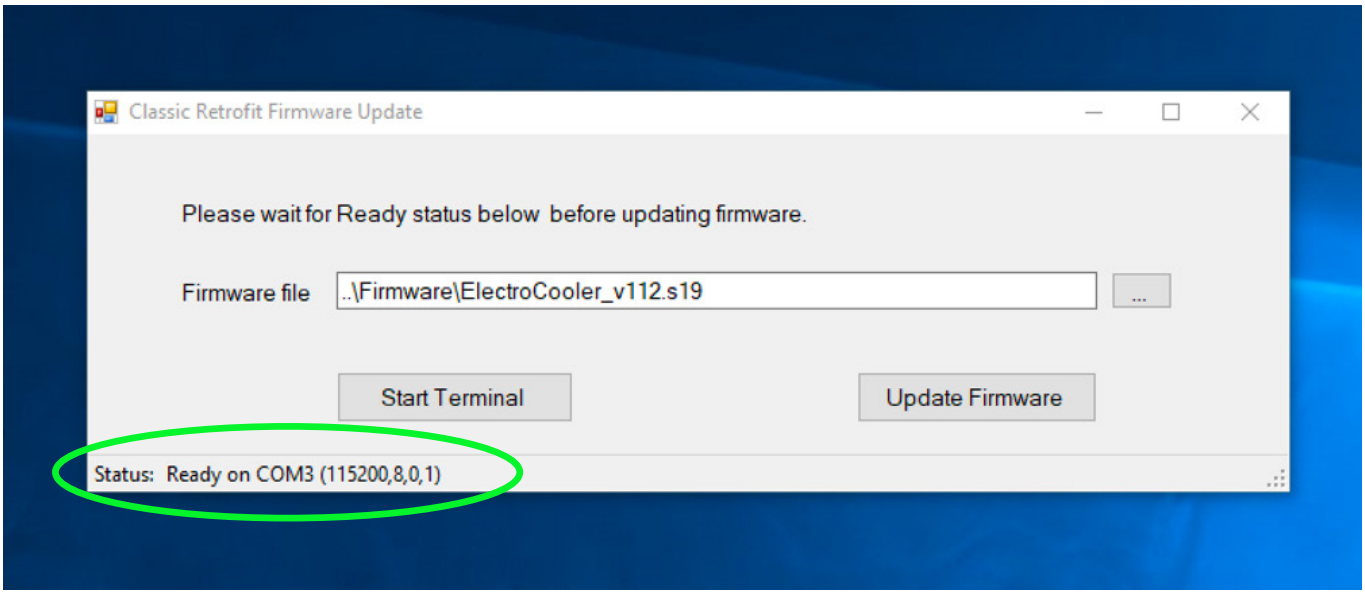
You may get Windows security warnings at this point, so allow the PC to open the App.

The following screen appears:



If this screen doesn't appear, please read Appendix D

Plug the USB cable into the computer (or remove and re-insert it if it is plugged in already). After a few moments, this screen will appear:



At the car, plug the jack plug into the ECU, Press Update firmware and follow the instructions. The update will take a couple of minutes during which a black programming screen will appear.

After the update is done, switch off the ignition and then switch it on again. Press 'Start Terminal' to access the ECU using 'putty'.

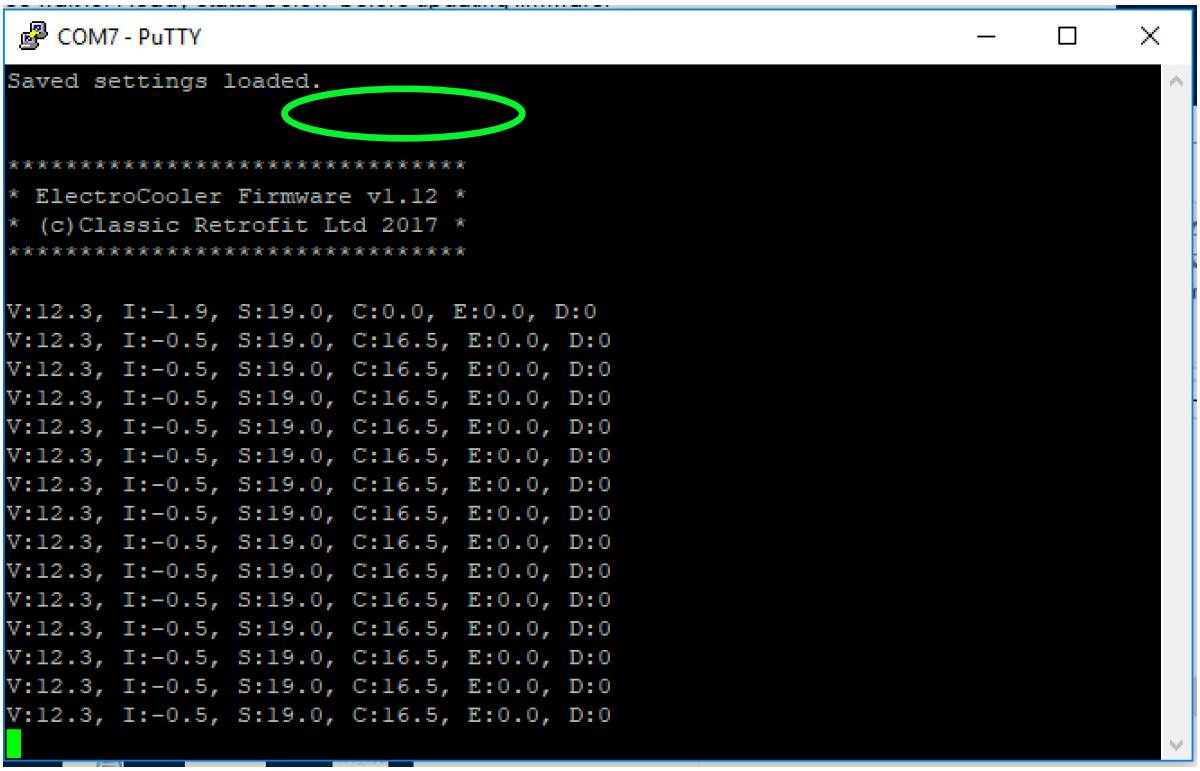
Using 'putty' to talk to Electrocooler.

We use a program called 'putty' to talk to the Electrocooler ECU. When you press 'Start Terminal', putty is opened. You may get more security warnings at this point, so allow the PC to open the putty App.

[Note: The settings for putty are automatically configured but the user must have administrative rights to change the Windows registry. The settings are stored in a registry setting called 'retrofit'. If you have issues with comms or the black window does not appear, see Appendix D]

Alternatively, you can use also run putty directly from the 'ThirdParty' folder but it will need the settings configured manually. Please refer to Appendix D.

Plug the 3.5mm jack plug into the ECU and switch the ignition on in the car. If you're session settings are correct, the following will be displayed. Note the firmware version circled below.



If no text appears, then the most common fault is no power to the ECU. Check the yellow, yellow/black and red wires on the Grey harness. Recycle the ignition OFF/ON. Check the grounds also.

If text appears but it is strange characters, double check the Speed settings in PuTTY. It must be set to 115200. See Appendix D

You are now connected to the ECU and it is 'talking' to your PC.

The numbers that are being displayed are basic diagnostic live readings, left to right of:

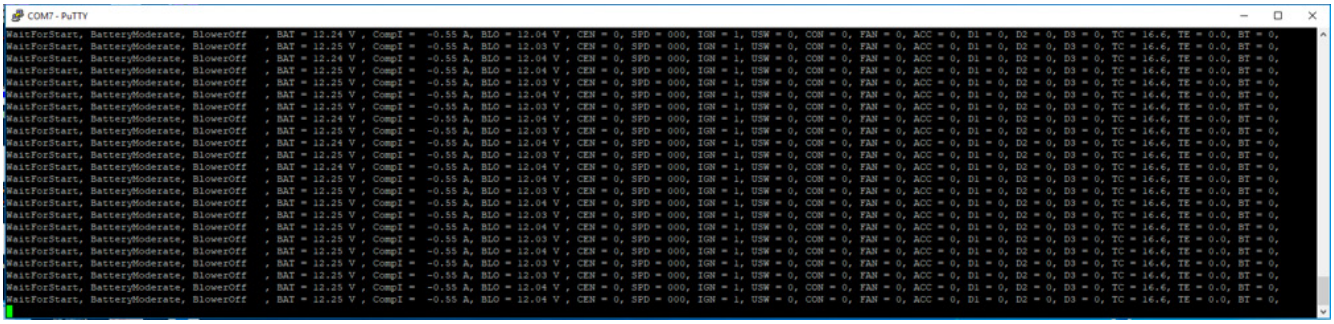
- V: Battery Voltage (V)
- I: Compressor Current (A)
- S: Cabin Temperature Setpoint (deg C)
- C: Cabin Temperature Reading (deg C)
- E: Evaporator Temperature Reading (deg C)
- D: Compressor Duty (speed) (%)

Extended Diagnostics

Electrocooler has a comprehensive 'command based' diagnostics interface. Type a command, press enter and the results are displayed.

You can type the commands while the basic diagnostic numbers are being output. Try typing 'DIAG' and pressing Enter.

You may need to drag your screen window wider to see everything:



From Left to Right:

General State of System

Battery Voltage State

Blower Speed State

BAT: Battery Voltage

CompI: Compressor Current

BLO: Blower sense line voltage (orange wire)

CEN: Compressor Enabled

SPD: Compressor Speed

IGN: Ignition On

USW: User switch (cabin button)

CON: Contactor Relay (if fitted) on/off

FAN: Fan Relay on/off

ACC: AC Cool input (not used)

D1, D2, D3: Defeat inputs.

TC: Cabin Temperature (deg C)

TE: Evaporator Temperature (deg C)

BT: Bluetooth Fitted

You can use the above to diagnose faults while the system is running.

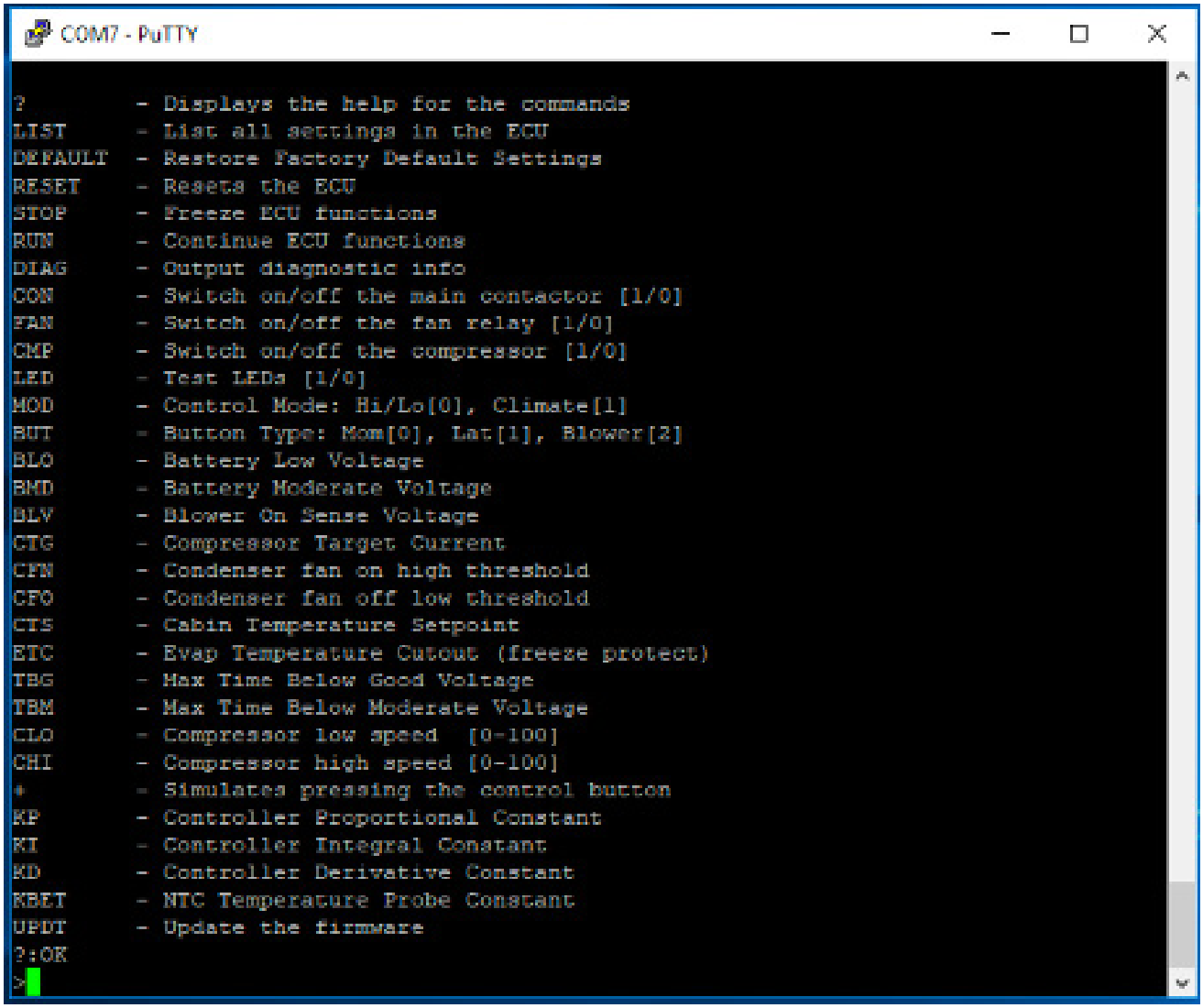
E.g. if your temperature sensors have been installed at the wrong locations you can easily diagnose this by warming the sensor with your fingers and seeing the change on screen.

To exit diagnostics mode, just switch the ignition off/on
Note: On some systems, the evaporator sensor has been disabled and will read 0.0. This is normal.

Test Functions

To perform testing of the wiring installation, several commands are provided. Before using these commands, we must put the system into a manual control mode. To do this, press return (or on early versions type STOP <Enter>). You will notice that the live diagnostic output stops. If you want to return control to electrocooler, either type RUN or turn the ignition OFF/ON

Type ? <enter> and the list of commands is displayed.



The basic test procedure is as follows:

Firstly, press Enter so that the text stops scrolling and the controller is 'frozen' allowing manual testing. In this condition the AC wont run under ECU control. To exit this mode after testing, either type 'RUN' or power cycle the car.

All the commands require pressing Enter afterwards. ECU will respond 'OK'. If the command is not recognised, the ECU will respond 'UNK' (Unknown command).

Fan Relay Test

Fan = 1. Condenser fan relay click and fan should run. If not check fan wiring. Common mistake is no feed to Vfan (red wire) or grey / white wires reversed.

Fan = 0. Condenser fan off

Contactor Relay Test

Con = 1. Main contactor click. Common mistake is grey and black wires on incorrect terminals. Note that the white label printed on the contactor is misleading. The grey wire should be on the right, looking at the front of the relay.

Con= 0. Contactor relay clicks off.

Led Test

Led = 1. Cabin Button LED illuminated. Check 12V feed and GND.

Led= 0. Button LED off.

Temperature Sensor Test

RUN the ECU, type DIAG and verify that the temperature sensors are reading and that they are in the correct positions.

Yellow is cabin.

Red is Evaporator.

Provided all these tests are ok, you can proceed to pressure test and gas the system. Turn the ignition off/on to put the A/C in normal run mode.

Note that on some versions, the evaporator temperature reads 0.0 – this is ok.

Compressor Test

This command should really only be used when the system is charged with R134A. If you want to do a very short test without charging, check the compressor starts, then kill the car ignition immediately.

If you run this command then the controller is in manual mode and no cut outs or safeguards apply. We would not recommend running above speed 5 without a separate current measuring device (current 'clamp') to measure current.

Cmp = 5. Run compressor at speed 5.

Cmp= 0. Stop compressor.

Note: this command also closes the contactor.

Pressure Testing

High pressure testing can be dangerous but is vital to the operation of the system. Please do not skip this test.

Note: Some shops skip pressure testing and perform a vacuum test instead. Unfortunately, it is possible for a system to pass a vacuum test but leak when under pressure in normal operation.

	PERSONAL INJURY, DEATH AND / OR PROPERTY DAMAGE HAZARD Failure to follow this warning could result in personal injury, death or property damage. Improper installation, adjustment, alteration, service, maintenance, or use can cause explosion, fire, electrical shock, or other conditions which may cause personal injury or property damage. Consult a qualified A/C installer, service agency, or Classic Retrofit Ltd for assistance. Read and follow all instructions and warnings. Please consider your and other people's safety before testing.

The testing of refrigerant hose is best done with a pressure test using nitrogen. The system should be pressurised to 10 Bar (150 PSI) and the pressure noted. Leave pressurised for 30 minutes.

The most likely cause of loss of pressure is a split ‘o’ ring. Usually, it is quite easy to hear the leak.

Charging with Refrigerant.

Electrocooler uses R134A refrigerant and the nominal amount is 550 to 580g (around 20 oz) for a single condenser system. Add another 50g for a dual system. The exact amount depends on length of hose runs and size of condenser / evaporator. Note this amount is much LESS than conventional 911 systems.

The Electrocooler compressor is pre-filled with oil, no further oil is needed. The compressor uses POE oil.

As Electrocooler is climatic, the compressor may not run if the cabin temperature is less than the setpoint value (which is preset to 21 deg C). If the A/C technician needs to force the compressor to run, you can heat the cabin sensor with your fingers. Alternatively, you can switch the heating on in the car for a short period!

The system must be charged by WEIGHT.

Typical pressures are shown below with the condenser fan running. 150 PSI high side and 27 PSI low side at 70F ambient.



User Operation.

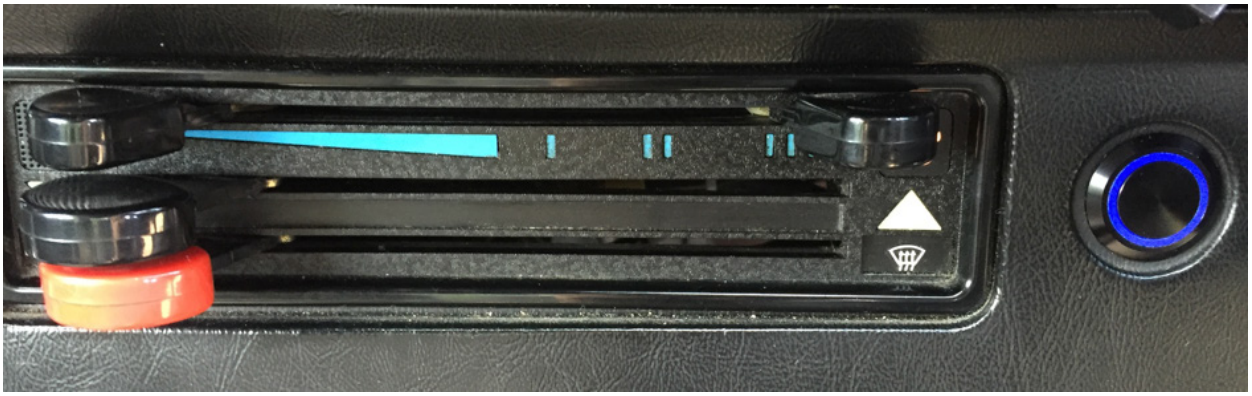
The button LED shows the status of the system. When the car ignition is first switched on Electrocooler waits for the car to be started before it can be used. The LED will be off until the engine is running:

The blower fan MUST be running for the A/C to switch on. Electrocooler detects the fan voltage using the orange wire on the side of the blower.

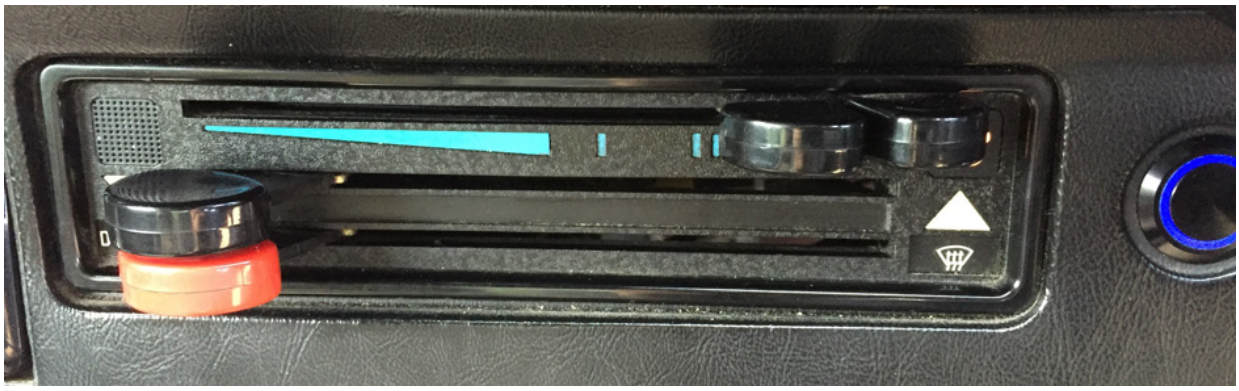
LED State	**Meaning**
Off	Car isn't started
Dim	Car is started. A/C is available but OFF.
Pulse On/Off	A/C is in standby. Either the idle timeout is in effect or the blower fan is not running
Medium	A/C running in low power mode
Bright	A/C running in full power/climatic mode

If the cabin reaches the setpoint as defined in the CTS (Cabin Temperature Setpoint) setting, the compressor may switch off or start to cycle on and off. This is normal. Also, if you use the system when the cabin temperature is cold, it may not run at all!

On a 911, the red 'heat' lever should remain to the left whilst the A/C is operated. This gives the maximum recirculation effect. You can move it to the right when you use the car's heating as before.



Max Centre Vent Cooling



Max Full Body
Cooling

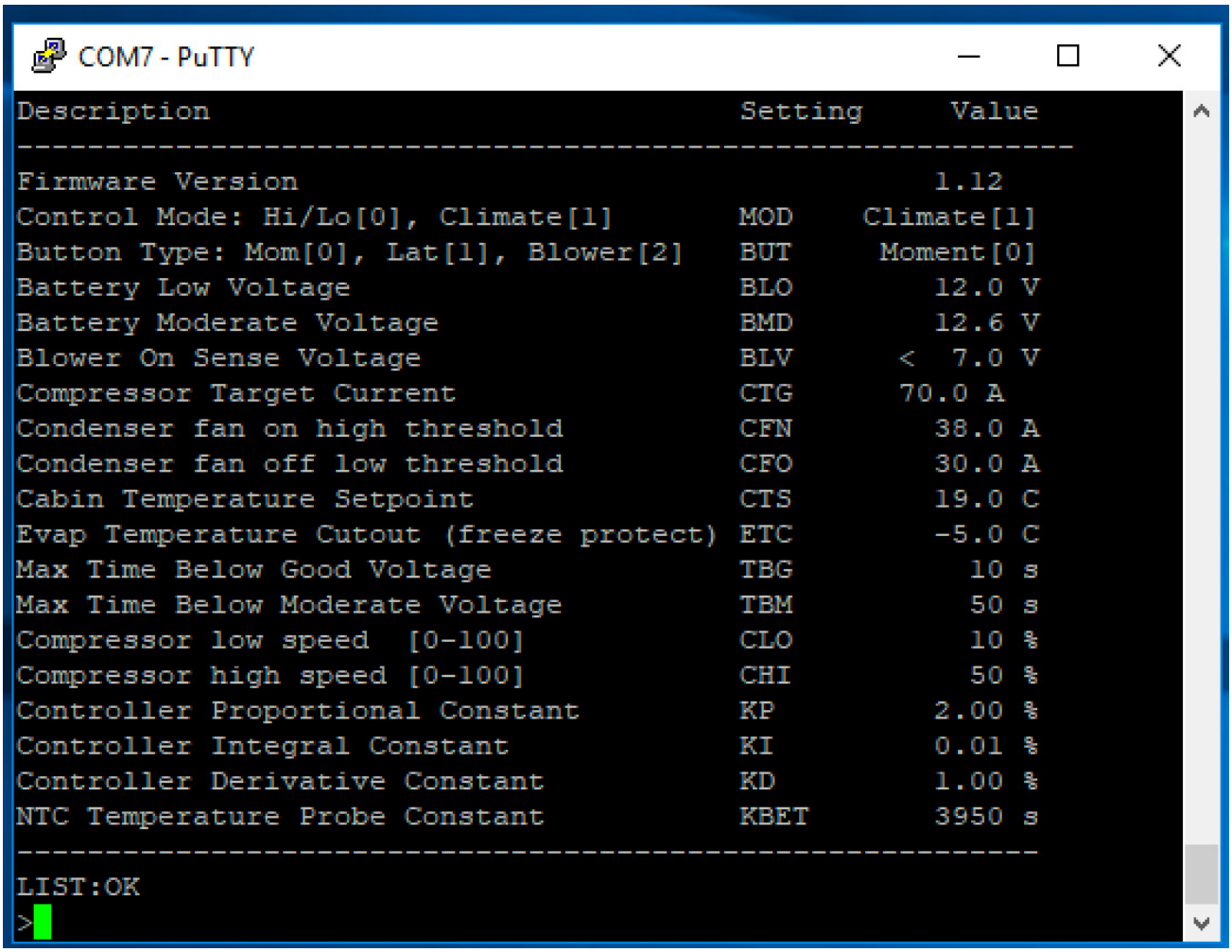


Max windscreen
demist

Fan speed does affect vent temperatures. Sometimes more effective cooling can be achieved with a lower fan speed.

Adjusting settings.

Electrocooler is shipped with settings that are typical for the Porsche 911 with a 175A alternator. Although it is possible to change the settings, some are for expert use only, so please contact us first if you are unsure. You can list the settings using the LIST command:



User Settings

The following settings can be changed by the user. The settings commands require pressing Enter afterwards. ECU will respond 'OK'. If the command is not recognised, the ECU will respond 'UNK' (Unknown command).

BUT - Button operation for AC activation

Electrocooler ships with a momentary switch so the default mode is Momentary[0]. If you want to use a latched switch or input (e.g. from a 944/933 CCU) change this to Latch[1]

- Set the button mode to Latch

BUT=1 <Enter>

CTS - Cabin Temperature Setpoint.

This is used for the climate control. Before you change this, make sure that the cabin temperature sensor is operating correctly. Sometimes, moving the sensor to a different location can change its reading which will affect the output of the A/C.

On 911s, it is particularly important that the rear heat exchanger 'flaps' shut properly. If not, hot are can leak in a give a high reading on the cabin sensor. This will confuse the climate control!

If you want to change the cabin temperature setpoint, use the CTS command, temperature is in degrees Centigrade.

- Set the cabin temperature setpoint to 20 deg C.

CTS=20 <Enter>

Note we do not recommend changing the CTS much below 19 as the compressor will run at full speed all the time in hot weather.

TBG, TBM - Time Below Good/Moderate Battery

If the car engine is left to idle, the battery voltage will drop and the A/C system will start using the battery reserve instead of the alternator. Two timers are used to set the time allowed to run before the compressor is shut down.

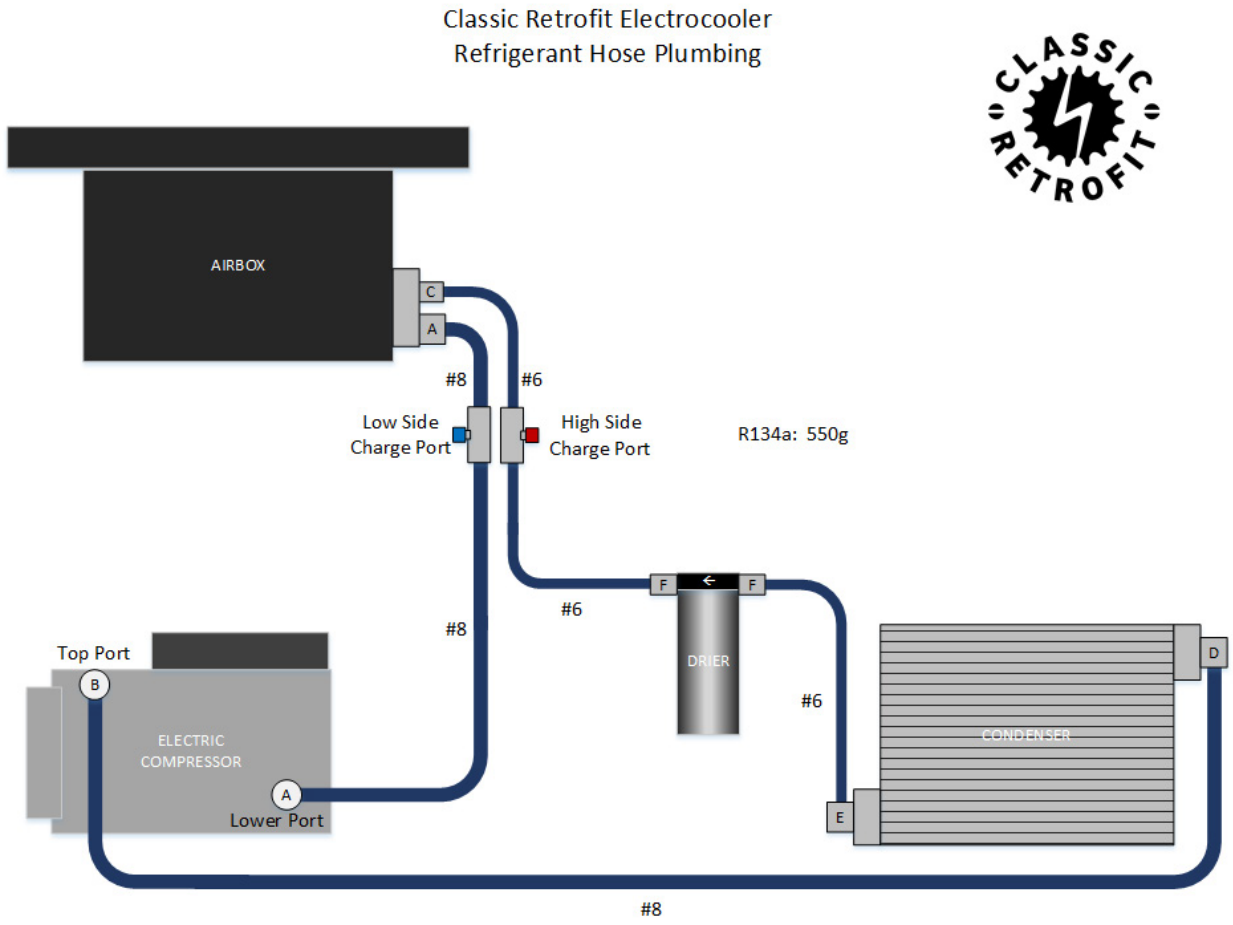
TBG. This is the time (in seconds) that the battery can be below Battery Moderate Voltage (BMD) before compressor drops to low speed.

TBM. This is the time that the battery can be below Battery Low Voltage (BLO) before compressor switches off.

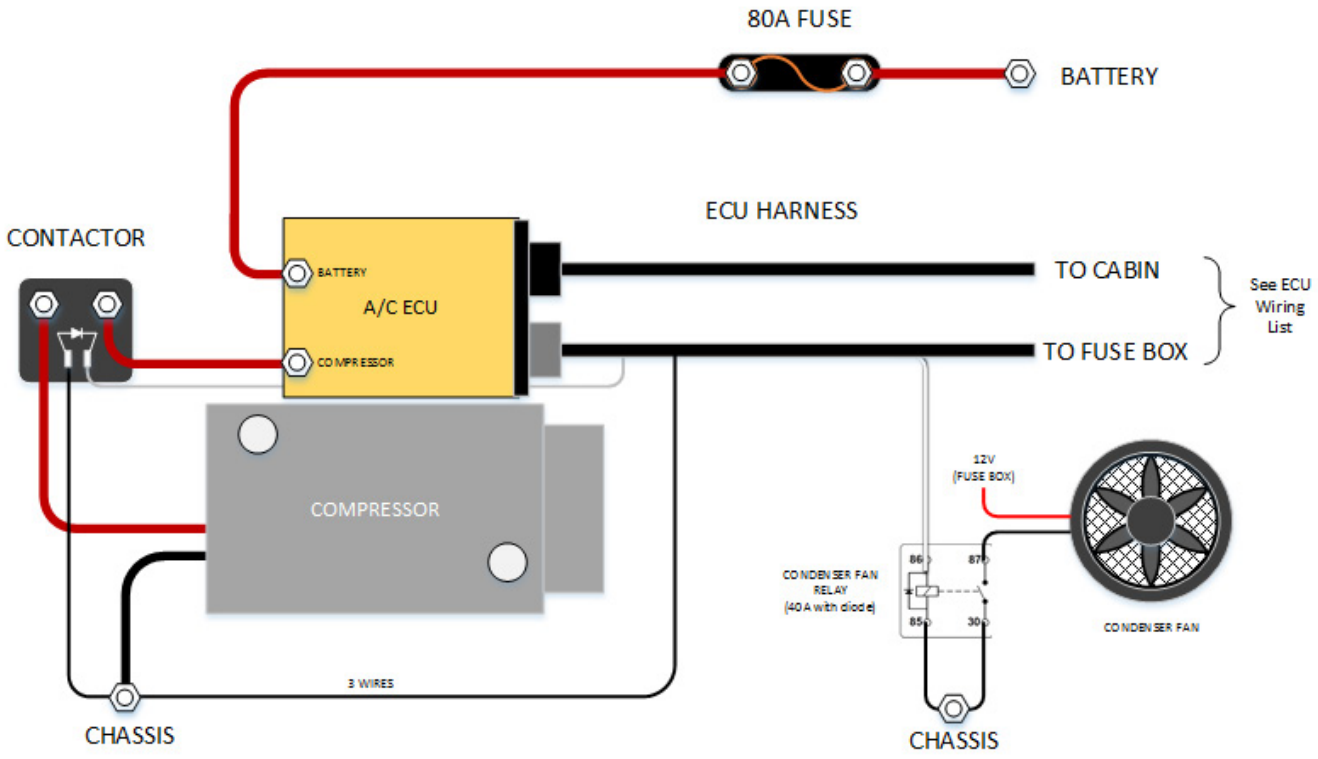
e.g. Set battery low timer timer to 120 seconds before compressor switch off.

BLO = 120 <Enter>

Appendix A. Refrigerant hose circuit.



Appendix B. Wiring and ECU



Note: Grey wire to Contactor, White wire to Fan relay.

Power Connections

16mm2 110A wire.

Red from battery with 80A inline fuse to input terminal on ECU. ECU Output terminal to contact breaker (relay). Other side of contact breaker to compressor 12v Red.

ECU, contactor and inline fuse have M6 studs. Peripheral connections at battery terminal are typically M6 too.

Use 16mm2 M5 crimp terminals for ECU and fuse connections.

Use 16mm2 M6 crimp terminals for contactor relay.

Compressor Gnd (black) to chassis.

ECU and Connections

ElectroCooler's ECU provides the necessary control to regulate the compressor speed in accordance to the power available from the charging system. Without the ECU, the compressor could run beyond the means of the alternator which would result in a flat battery. Either that, or the compressor would be run too slow and compromise the A/C performance.

The ECU contains an algorithm that adjusts the compressor speed (and thus current) based on alternator output, battery voltage, driving conditions and a number of other factors.

The ECU is housed in an automotive enclosure and has two keyed 12 way Deutsch connectors, accepting female 0462 crimp contacts.

All wiring to ECU to be 14/0.30mm, 1mm2., 8.75amp.

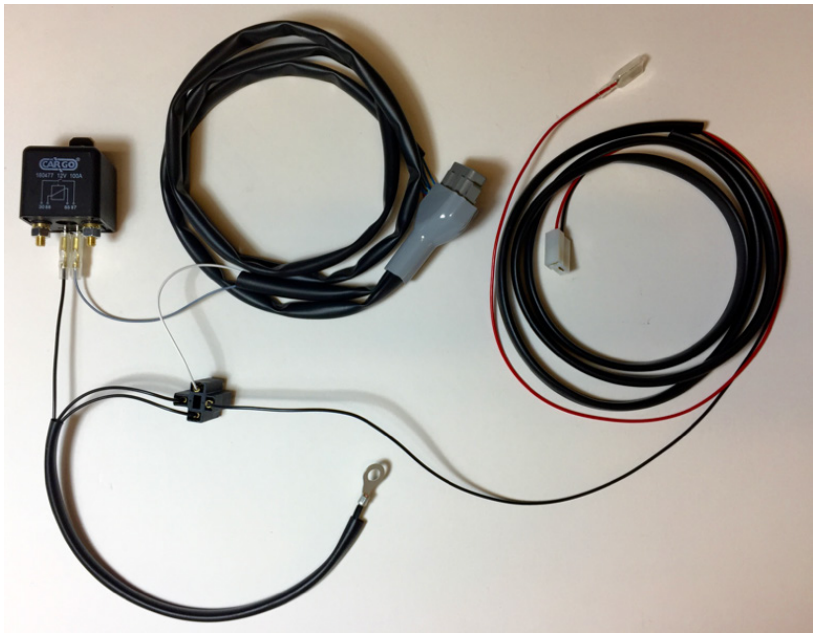
Grey Connector Harness.

Pin	colour	Function	Typical install
1	red	Vfan	Permanent Live
2	Green/red	GPIO1	nc
3	Green/yellow	GPIO2	nc
4	Green/white	GPIO3	nc
5	blue	ACcool	nc
6	Blue/yellow	ACdefeat2*	Main beam*
7	Yellow/black	VacControl	Switched Live
8	Blue/red	ACdefeat1*	Wiper Full Speed*
9	yellow	IGNon	Switched Live
10	Blue/white	ACdefeat3*	Rear Screen Demister*
11	white	FANpwrenable	Condenser fan relay
12	grey	COMPpwrenable	Contact breaker relay

nc – not connected

* The 3 defeat signals tell the ECU whether to slow or stop the AC compressor. Wire them to the 12V feed for higher current accessories. In the above example, they are on the main beams, wiper full speed and the rear screen demister. These connections are not mandatory, the ECU can operate without them.

Pins 11 and 12 both provide 12V to the relay coils. It is expected that the other side of the relay coils are connected to chassis.



Note: The grey wire is on the right of the contactor. The printed label on the contactor is incorrect!

Black Connector Harness

Pin		Function	Typical install
1	Brown/red	STATUSOp1	nc
2	Brown/yellow	STATUSOp2	Cabin control led
3	Grey/red	EVAPTemp	Temp sensor
4	Grey/yellow	CabinTemp	Temp sensor
5	Black/blue	ENCb	nc
6	Black/white	ENCSwitch	Cabin control button
7	orange	BLOWposn	+ve on blower motor
8	black	GND	Chassis
9	Black/red	ENCa	nc
10	black	GND	Chassis
11	Brown/white	StatusOp3	nc
12	black	GND	Chassis

Your harness may not have a full set of wires depending on the installation. We supply the harness unsheathed for custom installations. Please group the wires and sheath them to suit your installation.

Button Harness

The button harness has 4 connections:

Red – 12V switched

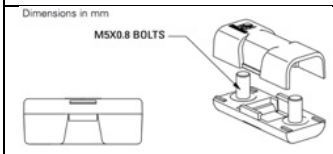
Black – GND

Brown/Yellow – to Brown/Yellow on Black Harness

Black/white – to black/white on Black Harness.

Appendix C. Part numbers

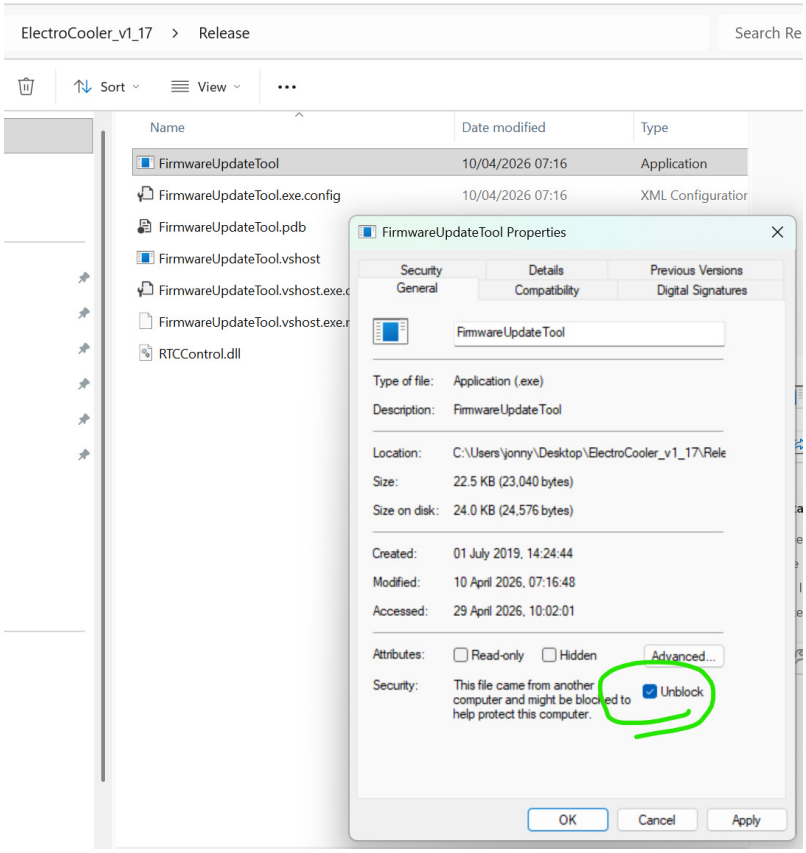
For RS stock numbers listed - please go to uk.rs-online.com

Photo	Description	Mfr Part Number	RS Stock Code
	PFL PCB Case	Deutsch EEC-325X4B	724-2557
	Contactor: 12V Extra Heavy Duty Make/Break Relay - 100A	Durite 0-727-10 -or- Cargo 160477	n/a
	DTM Series, 12 Way Plug Connector, with Crimp Termination. Grey	Deutsch DTM0612SA	724-2576
	DTM Series, 12 Way Plug Connector, with Crimp Termination. Black	Deutsch DTM0612SB	724-2579
	DTM Series Wedge Lock For Use With 12 Way Plug	Deutsch WM12S	724-2573
	0462 Crimp Contact, Female, Crimp, Nickel Plating 20 - 24 AWG	Deutsch 0462-201-20141	425-822
	Crimp Tool DT Series, HD10 Series, HD30 Series, HDP20 Series, 20 → 12 AWG Wire Size	HDT-48-00	425-973
	Uninsulated Tin Plated Tubular Ring Terminal, M5 Stud Size, 16 mm²	RS Pro	122-5002
	Uninsulated Tin Plated Tubular Ring Terminal, M6 Stud Size, 16 mm²	RS Pro	531-043
	100A Midi fuse holder	Littelfuse	04980921GXM5

Appendix D. Windows Security and Manual Configuration of ‘putty’

Unblocking Apps downloaded from the Internet.

Recent Windows updates are marking files ‘blocked’, which can prevent the App or putty from running. If this happens, go into the release folder, find the FirmwareUpdateTool.exe, right click and choose Properties. Check the Unblock box



Repeat the same process for putty.exe in the ThirdParty folder.

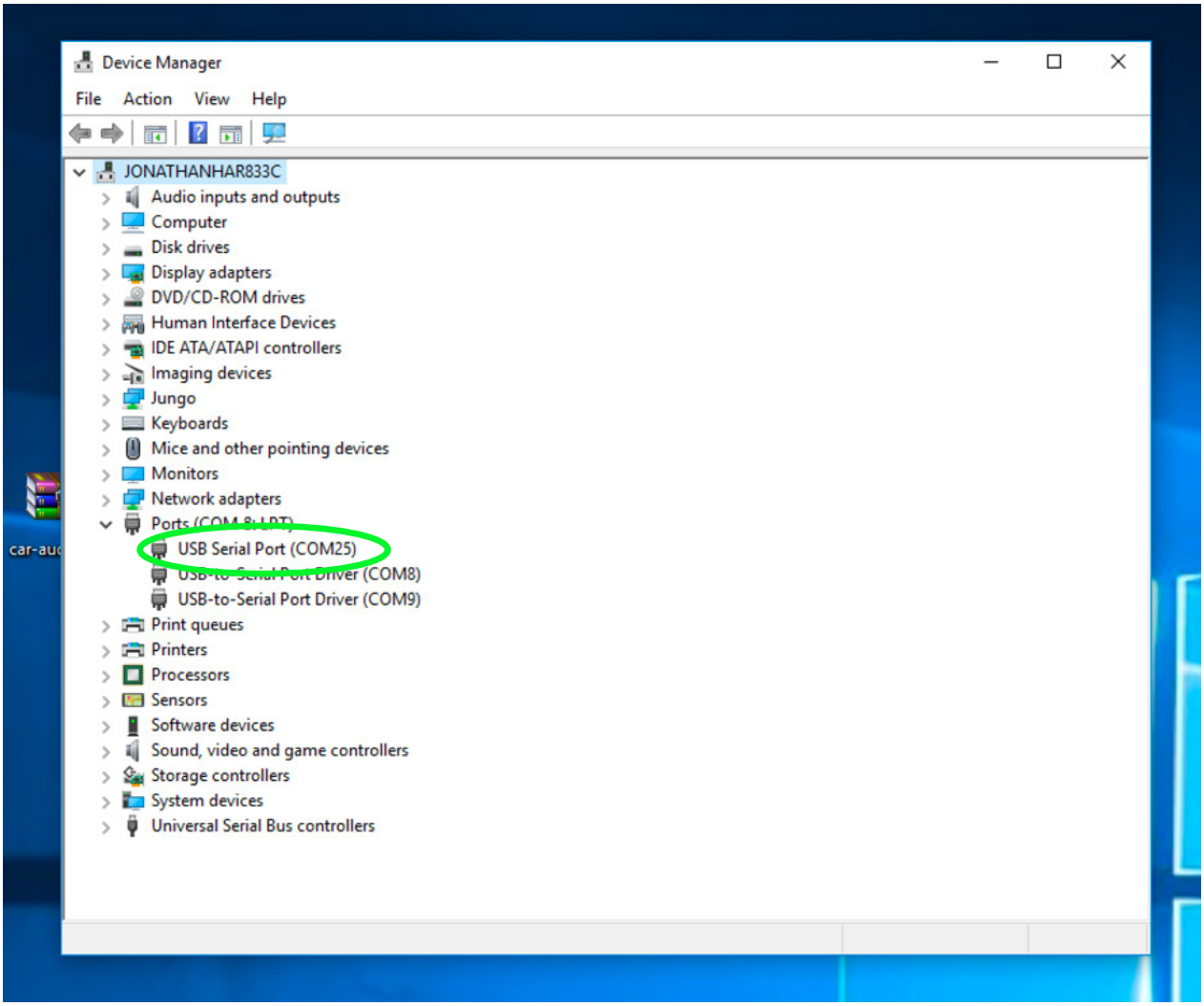
General Windows Security Issues

The software needs to make changes to the Windows registry to apply the correct settings for putty. If your PC does not have sufficient admin rights, then this operation might be prevented. In this case, putty may open but the settings might not be applied. This can result in ‘garbage’ appearing on the terminal screen (due to incorrect comms settings). The following section shows how to set these manually.

Setting up the communications on the PC manually

Away from the car, plug the USB cable into the PC. After a short time, a driver should install and a 'COM Port' (communications port) should appear on your computer. COM Ports are given a unique number. We need to note the port number by running a program called 'Device Manager'

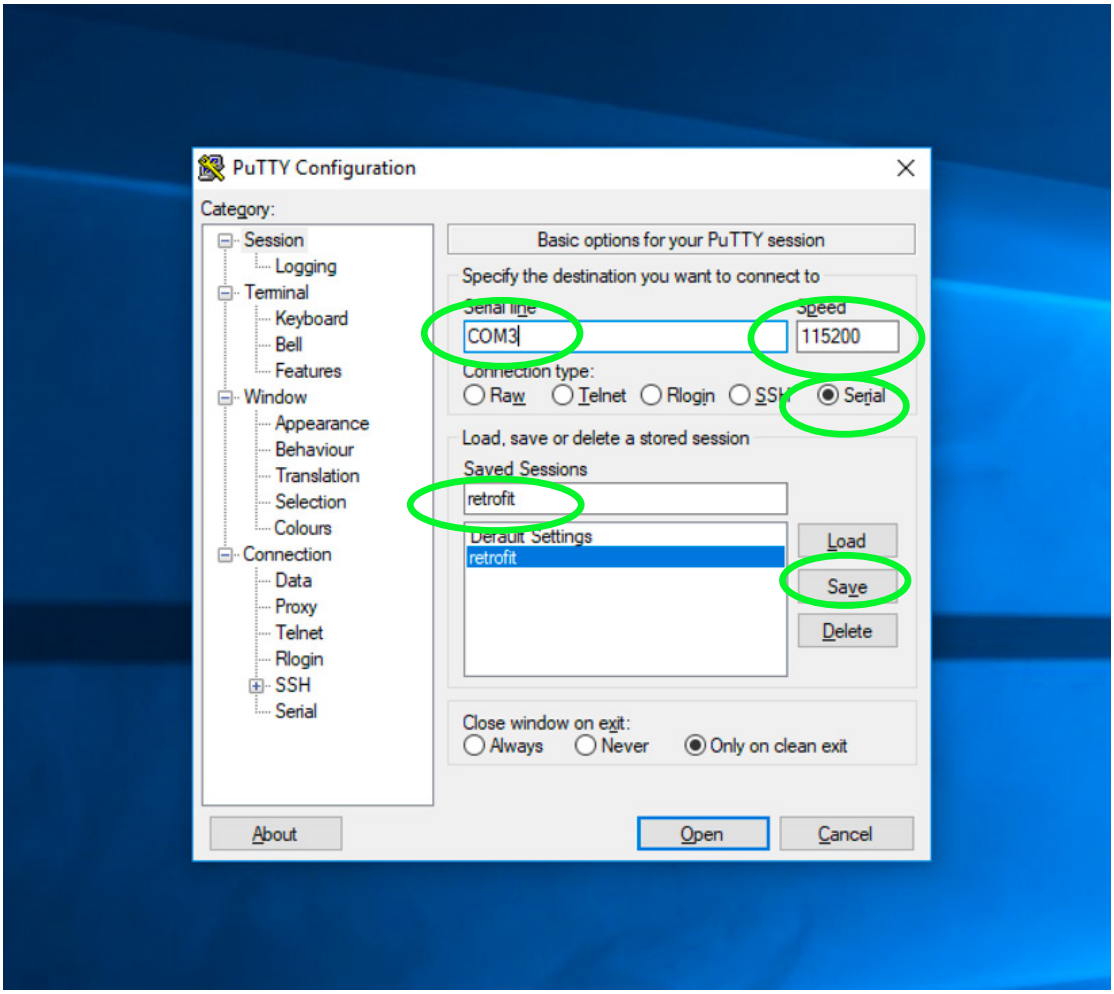
Go to the start bar and type 'Device Manager' (or load it from Control Panel), the following window should appear and have a look under 'Ports' . Look for 'USB Serial Port' and make a note of the number. In the following picture, the COM port number is 25. This shows that the cable driver is loaded and working correctly. Close Device Manager.



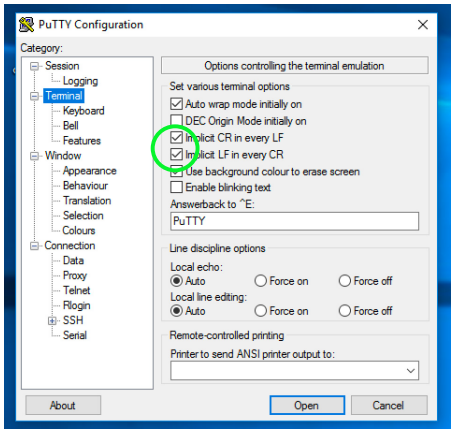
If the COM Port does not appear, you may have to update the drivers on your computer. The cable is a TTL 232R-3V3 made by FTDI. We use the VCP driver available on their website (www.ftdichip.com).

The following settings must be used to talk to Electrocooler. It is very important that you use the correct COM Port number (see Ports in Device Manager) and that you select 'Serial' and a Speed of 115200.

The following screenshots show which settings to change.



Click 'Terminal' on the left and tick the following two boxes shown below:



Return to the Session screen, type the session name 'retrofit' and press 'Save'. Next time you run putty you can 'Load' the retrofit session and not have to enter the values again.

Appendix E. Troubleshooting Guide

Listed below are our most common reported issues. Please note that wiring faults are easy to trace using the DIAG function in our ECU with a laptop. This allows you to see the state of all inputs and outputs and run the condenser fan and compressor pump for testing.

Fault Symptom	**Possible Causes.**
Blue button does not light when button is pressed.	Battery voltage low (engine not started). Main fuse is blown. Button loom has no power on Red/black wires. Check DIAG value USW (user switch). This should change to '1' when the switch is held. Damaged switch. Usually occurs when an installer tries to take the apart the switch to fit it in the dashboard.
Compressor does not start (engine running)	Check AC button wiring. If you have a latching switch or are operating from a latched 12V feed, make sure ECU 'BUT' setting is set to 'Latch'. Black /white wire needs to see 12V to start compressor. Main Fuse is blown. Check Battery voltage reading on ECU Diag. 0V indicates blown fuse. Use Compressor run function on ECU to test compressor. CMP=1 to switch on, CMP=0 to switch off. Blower detection (orange wire) thinks blower is off. Use DIAG to see blower status. If blower detect reports opposite of actual blower state, see the blower threshold is correct. Either < or > value. Default is < 7v for a low side switching blower (e.g. 911).
Compressor runs but switches off after a few minutes.	Battery voltage is below the low voltage threshold and time settings in the ECU. Extended idle testing is not recommended. Drive the car. Overcurrent protection. Is the condenser fan running? Compressor will switch off if condenser fan is not running. Compressor is overpressure or overheating. Usually this is caused by poor condenser function. Check you have your condenser ports correct (inlet hose at the TOP, outlet at the bottom) and you have good airflow. Make sure fan is correct way round – e.g. if rear mounted, the fan should push the engine heat away from the condenser.
Condenser fan does not run.	12V missing from Vfan (red wire). The red wire provides the power to the condenser fan relay. Cold weather. Condenser only runs if compressor current > 38A. Check condenser relay is clicking. Heavy cables to ECU are reversed causing a negative compressor current reading. ECU needs to see a positive current reading to activate fan.