

MR2 Spyder 2AR-FE Swap Wiring Instructions



The MR2 Spyder 2AR-FE swap uses a junction box circuit board to replace the contents of the stock ECU and the two following jumpers are used along with a reworked Scion TC engine harness in order to complete the wiring for the car.

This documentation is provided as an alternative for those that would rather make their own wiring harness instead of purchasing the Frankenstein Motorworks plug and play solution. This is also the exact same pinout as the solution I sell so it can be used if diagnosis is ever needed.

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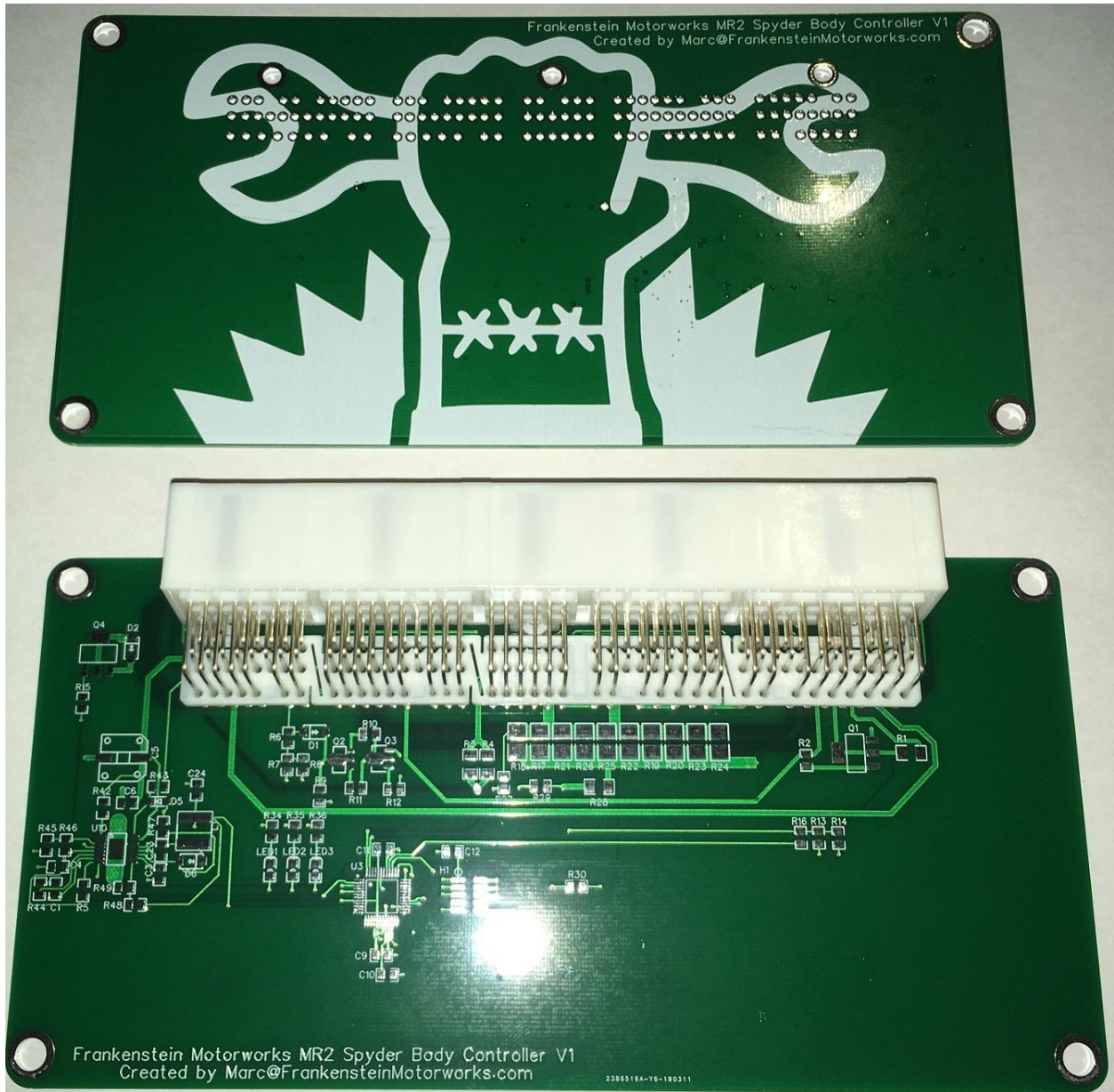
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All connector layout images in this document are documented as if you're looking at the connector from the pin side, not the wire side.

Feel free to reach out to Marc@FrankensteinMotorworks.com with questions about this documentation or any other part of the 2AR-FE swap into the MR2 spyder.

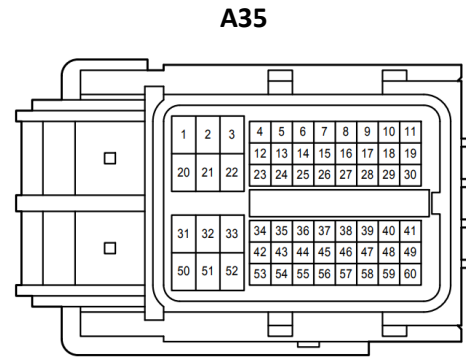
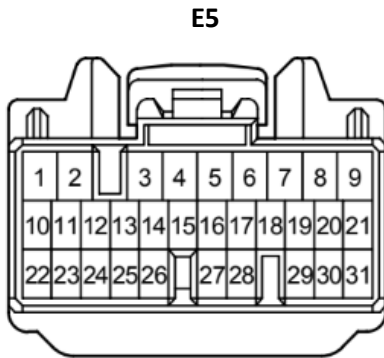
Junction box:

The junction box is a circuit board that gets installed in the stock ECU case and makes wiring this swap much easier. In the near future it will also provide BEAN network functionality for A/C and gauge cluster functionality. Both versions use the same circuit board, the non BEAN version simply does not have the components populated on the board.



Junction Box to ECU jumper:

This jumper connects between the junction box and the small plug on the 2AR-FE ECU.



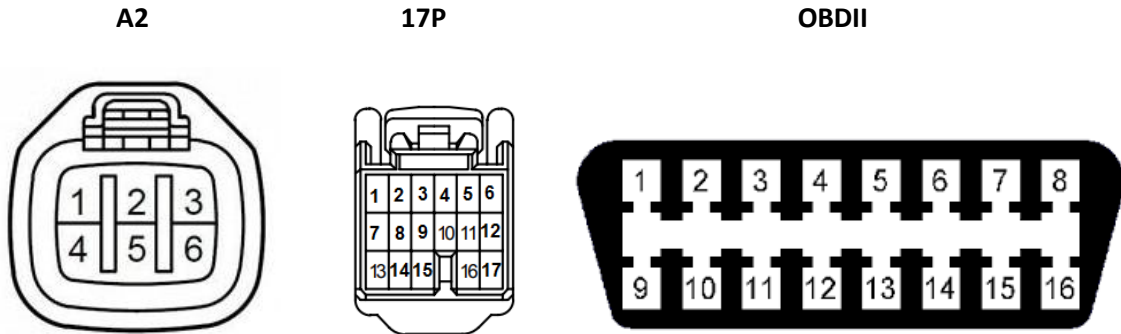
Wire as follows:

Pin Name	A35	E5	Gauge
+B2	1	31	16
+B	2	21	16
BM+	3	1	16
CANL	5	28	20
MREL	6	14	20
TC	7	25	20
FC	8	8	20
CANH	13	27	20
VSS	15	26	20
BATT	20	9	16
FANL	21	3	18
FANH	22	4	18
Tach	26	24	20

Pin Name	A35	E5	Gauge
IGSW	28	30	20
STP	29	15	20
ELS1	31	5	18
EC	32	29	18
W	36	17	20
ST1	39	16	20
CCS	40	20	20
ELS3	41	6	20
VPA	55	10	20
VPA2	56	11	20
VCPA	57	12	20
VCP2	58	13	20
EPA	59	22	20
EPA2	60	23	20

Junction Box to DBW & OBDII:

This jumper connects the junction box to the DBW pedal and also provides the OBDII port. Note that there are extra pins on the junction box, these are provided to assist with installations that do not use the stock gauge cluster. It is safe to ignore these extra pins if they are not needed.



Wire as follows:

Pin Name	A2	17P	OBDII	Gauge
TACH		2	9	20
Check Engine		3		20
GND		4	5	18
Alternator Light		5		20
Oil Press		6		20
B+		7	16	18
TC		8	13	20
VCP2	4	9		20
VCPA	6	10		20
VPA2	2	11		20
VPA	5	12		20
CANL		13	14	20
CANH		14	6	20
GND		15	4	18
EPA2	1	16		20
EPA	3	17		20

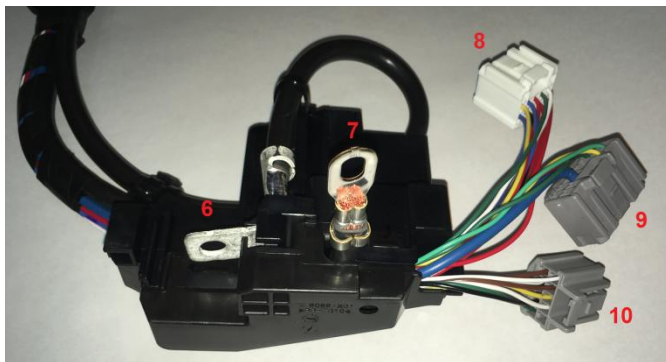
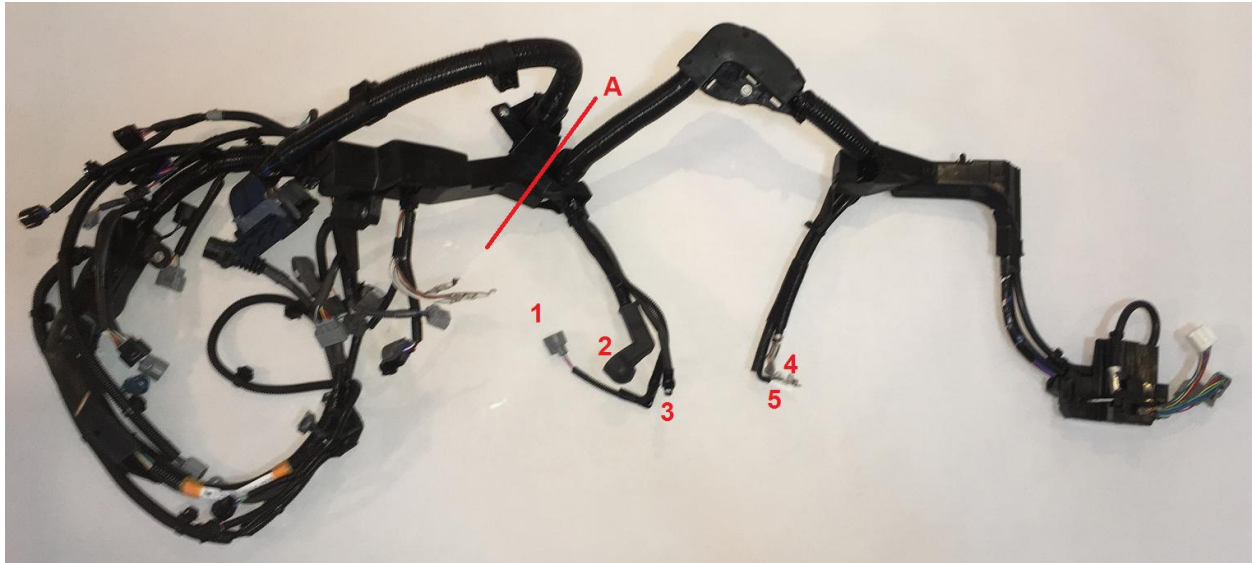
Note1: the CANH and CANL wires need to be twisted together approximately one to two twists per inch. Alternately they can be run inside a metal shield grounded at only at the 17P plug end.

Note2: The car already contains an OBDII connector but it does not have the pins required for the CAN bus. If desired the CAN wires could be wired to the stock OBDII connector with appropriate pins added and everything would work as intended.

2ar-fe Engine harness rework:

This section is for starting with manual transmission 2011-2016 Scion TC engine harness part number 82121-21540. Note that starting with an automatic transmission harness is not significantly different from these instructions but it is not currently documented.

We will only be modifying part of the harness to the right of line "A" in this diagram

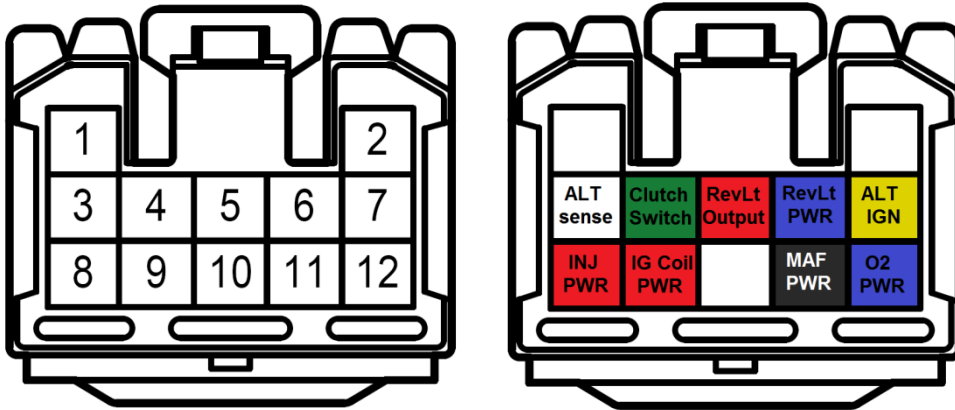


The connectors labeled above are:

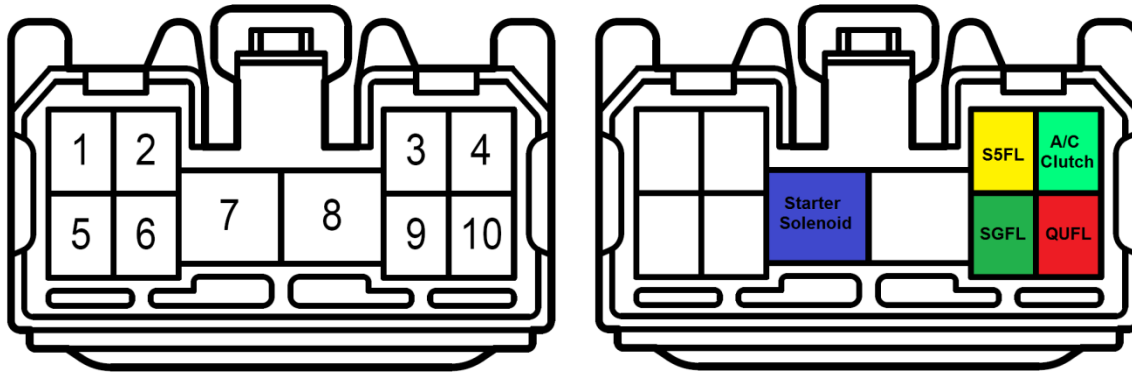
- 1) Reverse connector, this will be remaining
- 2) Starter power. This will be removed from the harness but the wire will be modified and used.
- 3) Starter solenoid, this will be remaining
- 4) This is the battery terminal side of the starter power (#2 in the diagram), it will be removed
- 5) This is power to the Scion TC fuse box. This will be removed
- 6) This is the alternator charging wire. This will be modified lightly and fit into the scion TC fuse box
- 7) This is the other end of #5, it will also be removed.
- 8) This connector is the BA1 connector that will need to be remapped into the Spyder's harness.
- 9) This is the BA2 connector that will need to be remapped into the Spyder's harness.
- 10) This is the BA3 connector that will need to be remapped into the Spyder's harness.

This is the pinout on the BA1, BA2 and BA3 wires. Note that the wire colors are provided but some of the colors are reused so this swap cannot be wired strictly by color.

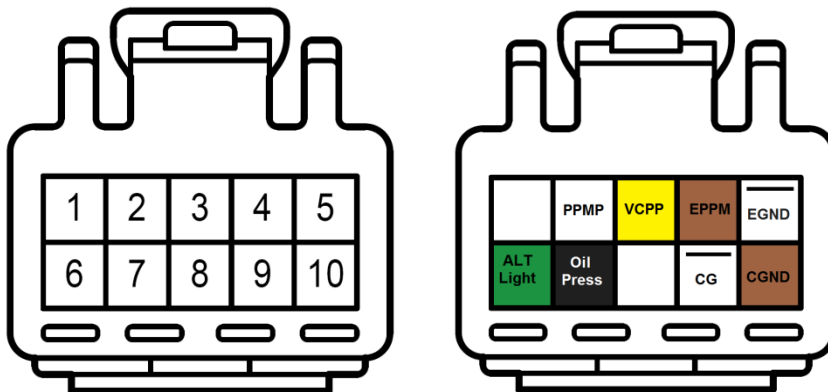
BA1 Pin Numbering and Functions:



BA2 Pin Numbering and Functions:

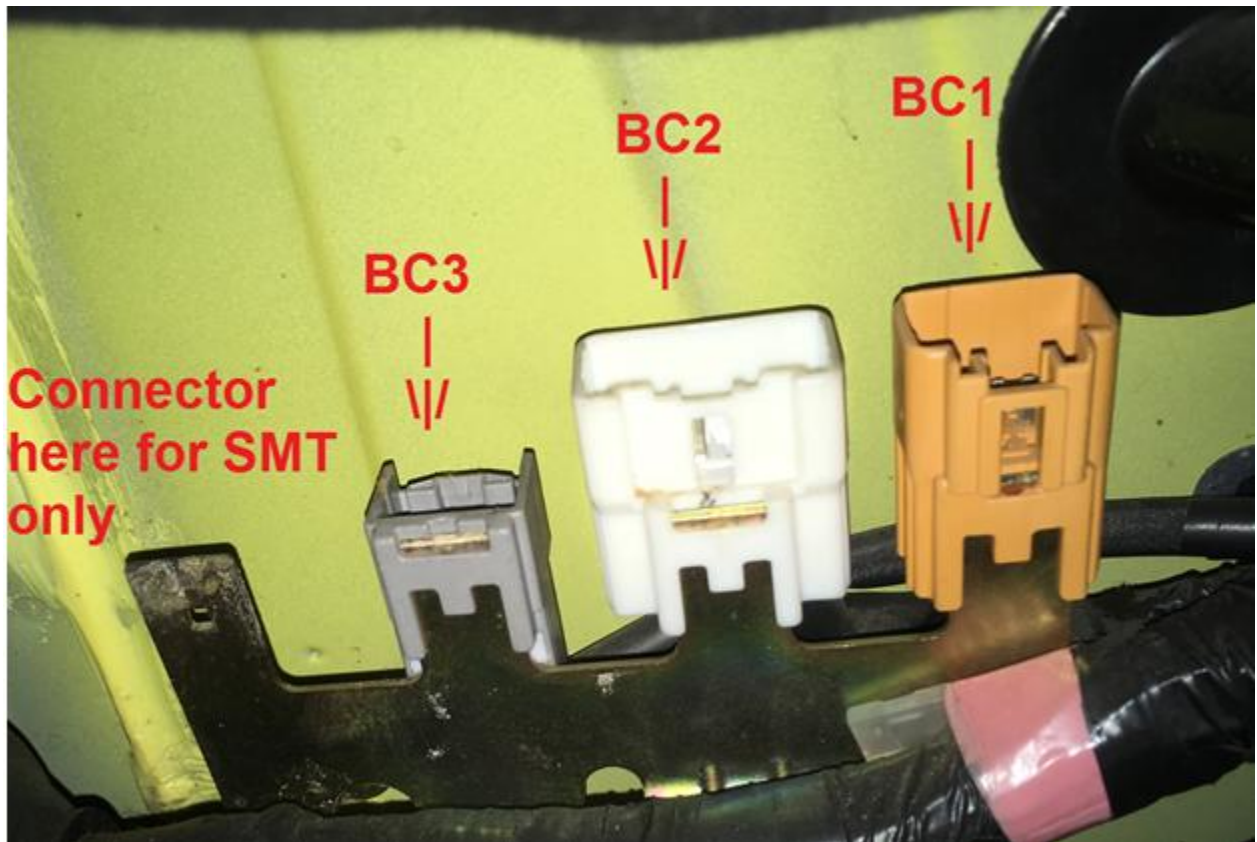


BA3 Pin Numbering and Functions:



All 22 of these wires should get labeled by function and depinned from the scion TC housings in preparation for insertion into the Spyder's connector housings.

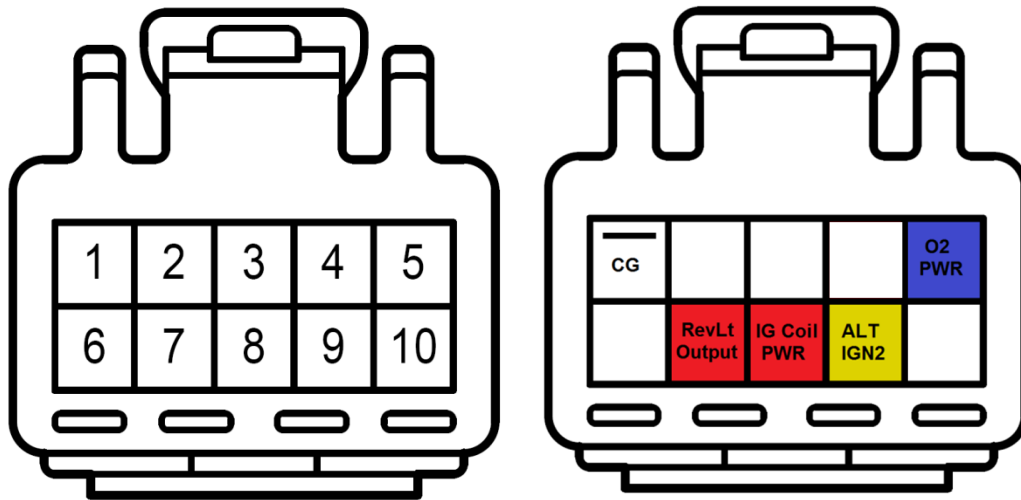
In the Spyder we will be repining all of the above wires into the following locations. Note that BC1 and BC2 match two of the connectors from the Scion TC but the pinout does not match. This document will refer to the connectors as BC1 and BC2 when talking about the MR2 Spyder pinout. These connectors are located behind the left seat right next to the ECU:



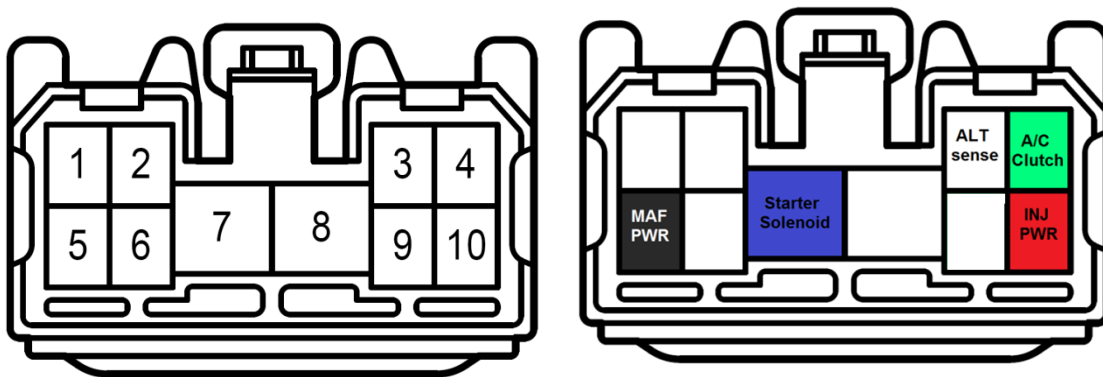
Some wires will also go to the junction box now located inside the stock ECU case also behind the left seat.

The following is how BC1, BC2, BC3 and E4 should be pinned. Wire colors given in these pictures are the Scion TC colors. Note that there are extra pin names that are not from the scion TC harness, These will be found in pairs and simply mean that a jumper should be placed between these two pins. For example “DRL” is a wire that goes from BC3 to E4 and does not go into the engine harness but becomes part of this new combined harness. The wire colors for those new wires are just suggestions.

BC1 Pin Numbering and Functions:



BC2 Pin Numbering and Functions:

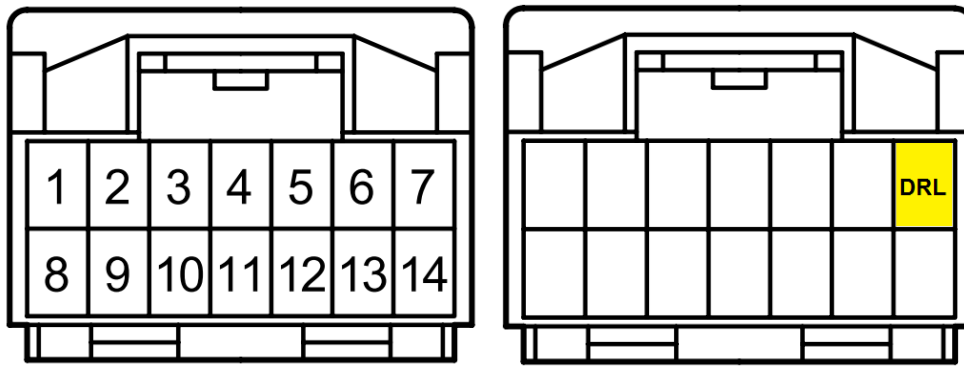


Unused wires:



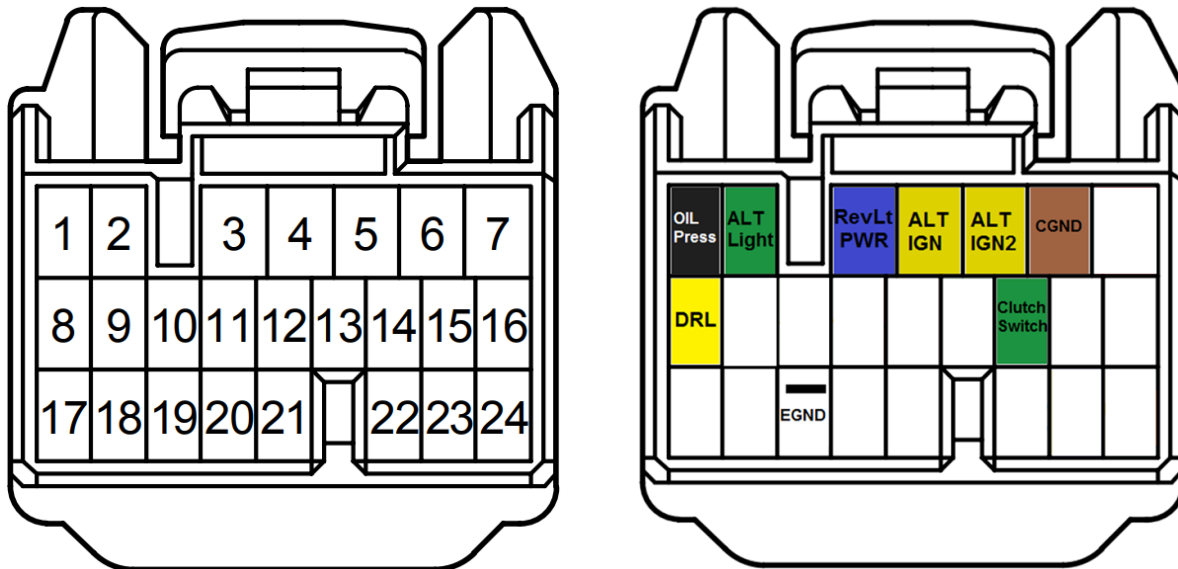
These can just be cut out of capped off and left in the harness.

BC3 Pin Numbering and Functions:



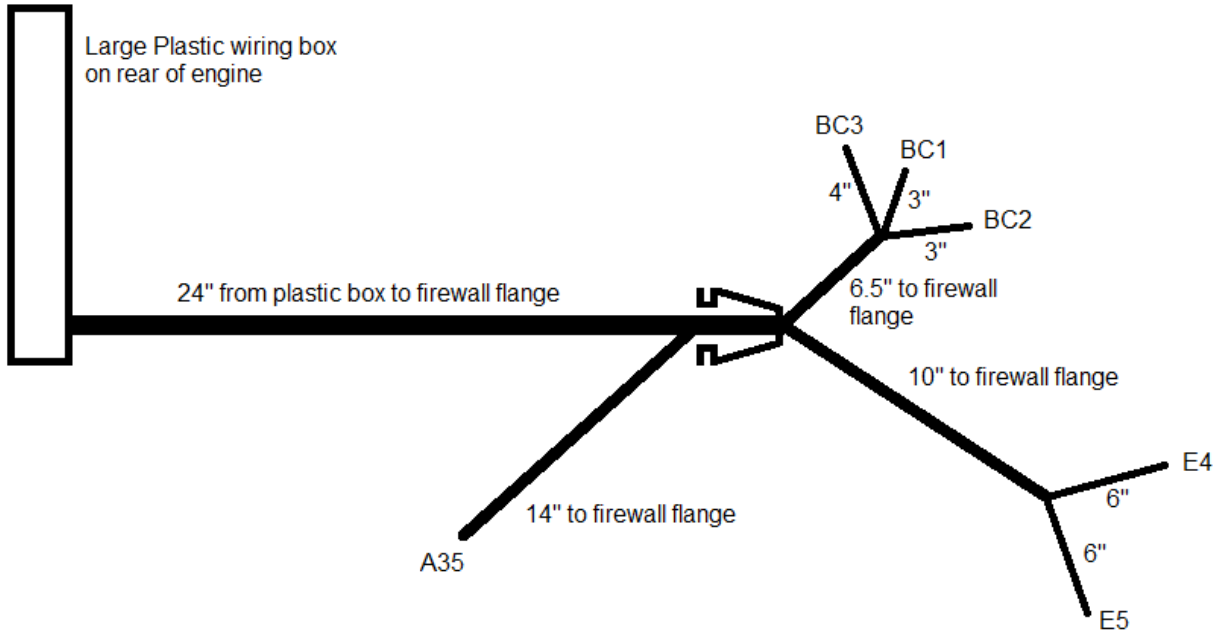
**note, if the DRL pin is left out it will disable daytime running lights. This can be done with no side effects.*

E4 Pin Numbering and Functions:



Branch Lengths:

After all the wiring is connected, it can be taped and loomed with these branch lengths



Appendix A: Sources for connectors

The connectors needed for the above work can be sourced from several places, it's generally exceedingly expensive to buy them from Toyota directly. Their housings are reasonably priced but the wire pigtails are absurdly priced. I've found the following is the best way to acquire all the connectors if you choose to not buy the pre-made harnesses from Frankenstein Motorworks:

E5: This connector does not need to be sourced, it exists on the 1zz engine harness that has been removed from the car to make room for this swap

A35: This connector is best gotten at the same time as the engine is sourced. It can often be picked up for free with the purchase of the engine. It can also be purchased at a very reasonable cost from Frankenstein Motorworks: <https://frankensteinmotorworks.squarespace.com/mr2-spyder-shop/2-plug-ecu-small-pigtail> and you can also search e-bay for 90920-12588, that's the part number for the lever not the connector but it's the part number that most listings use, sometimes they are quite cheap on e-bay.

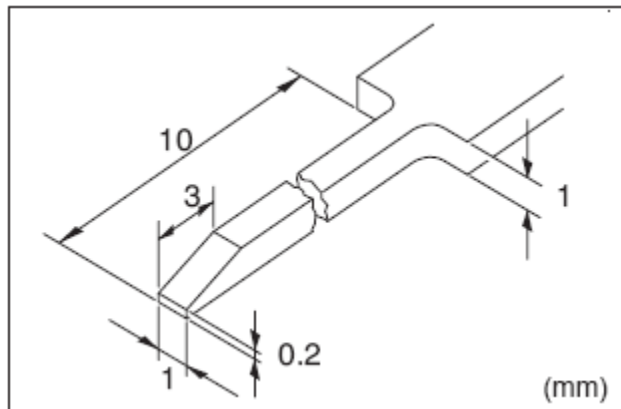
A2: This connector is actually shared with the idle control motor on the 1JZ and 2JZ and has huge aftermarket support. Searching the internet for "2JZ IACV connector" returns a ton of links at reasonable prices.

17P: This connector is on many early 90's Toyota ECUs but there is no really reliable place to get it. The easiest way to get this is to order 90980-11586 from the dealer, this will give you the housing without wires for about \$10 and wires pigtails can be salvaged from the stock ECU connector to wire it up.

OBDII: This is just an industry standard connector. Searching the internet for "OBDII connector" will result in many cheap options.

Appendix B: How to remove and insert a terminal from a connector

Officially the tool you need to remove the terminals on the connectors needed for this work has these dimensions:

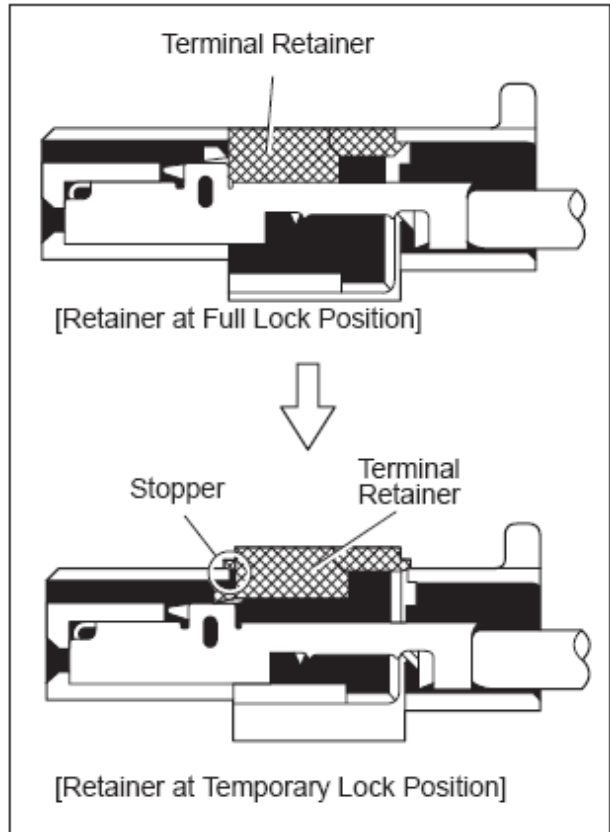
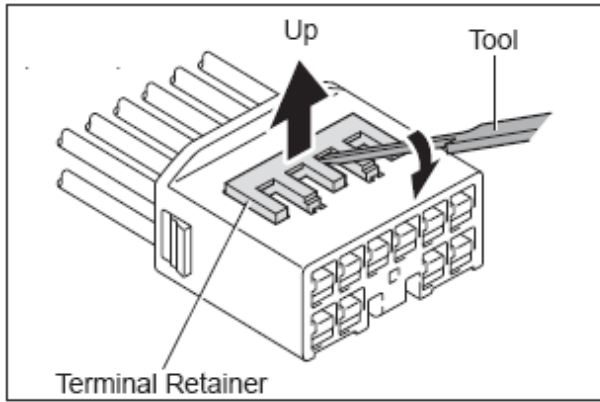


That exact style terminal extractor is expensive but this alternative works well:

<https://www.amazon.com/beler-Terminal-Maintenance-Fulfilled-hermeshine/dp/B071CVM8BB> With this set there are two tools that are chisel shaped with very similar dimensions to the above mentioned "official" tool dimensions and two others that are "V" shaped that work great for lifting locks.

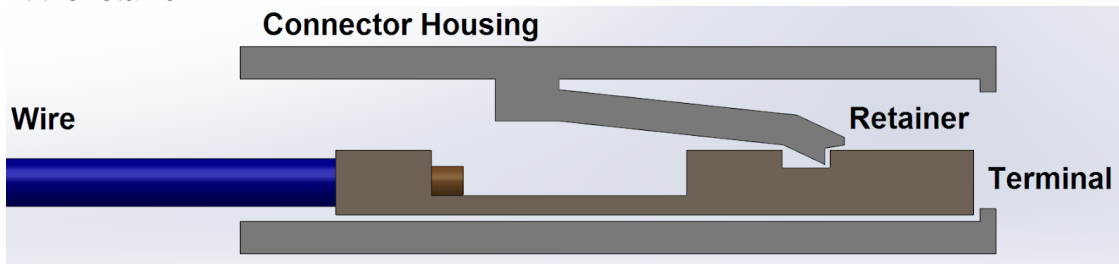


To remove a pin from a connector first disengage the secondary locks if there is one. Note that the secondary lock only lifts up a little and does not fully get removed. Be careful when working with a connector with a secondary lock because it is easy to accidentally relock it without noticing it and the terminals won't be possible to remove.



Once the secondary lock is disengaged, the retainer on each terminal can be disengaged to remove one wire using the following instructions.

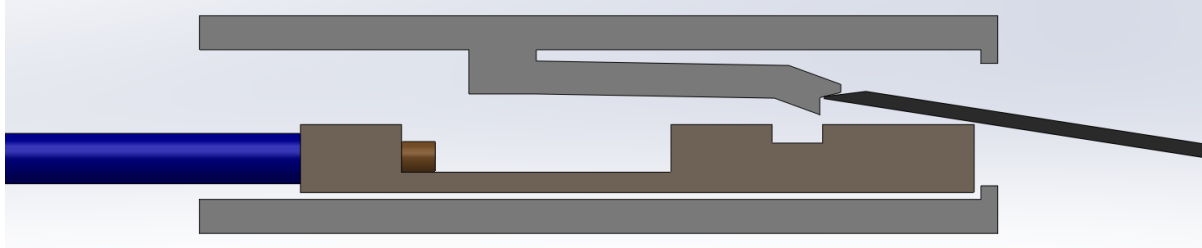
Here is a cross section of one wire in the housing and how it is retained, to release the wire we need to lift the retainer and the wire pulls out. Note that you need to lift the retainer before pulling the wire, if there is tension on the wire before lifting the retainer it will be very difficult to lift the retainer.



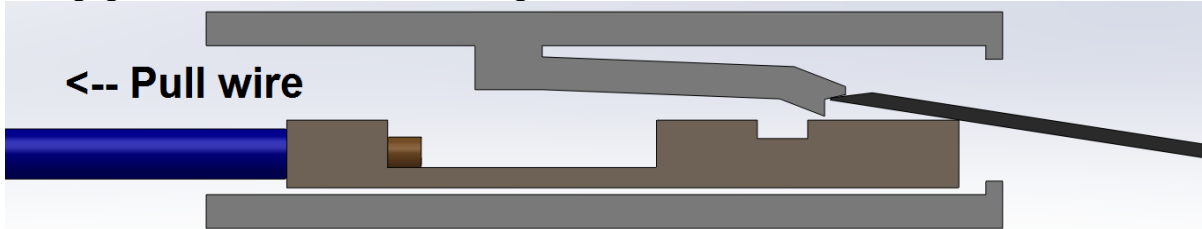
- 1) Place the tool in the small opening between the terminal and the retainer, being careful to align the chisel point as indicated by the picture:



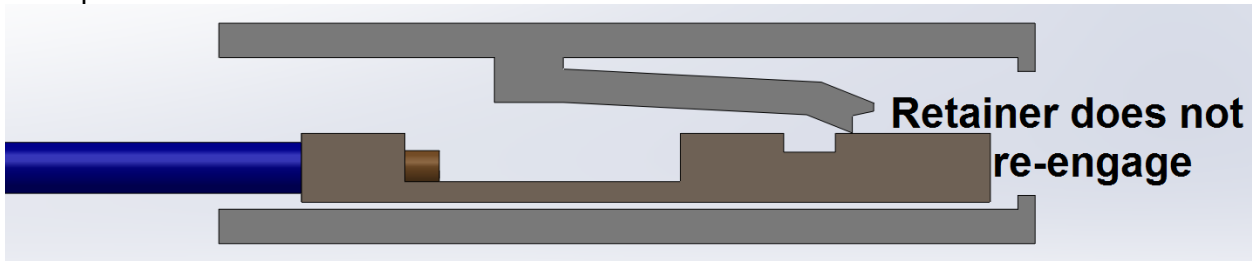
2) Pivot the tool against the end of the terminal to raise the retainer, it isn't necessary to raise the retainer until it hits the top of the housing, this usually just results in the tool slipping off the retainer.



3) Pull on the wire gently to remove it. There should be no resistance to removing the wire and terminal. If there is resistance it is likely the retainer or secondary lock is not fully disengaged. Push the wire back in and go back to the start.



4) note that once the terminal has moved more than 1-2mm the retainer no longer needs to be held up and can be removed



If a secondary lock was unlocked at the beginning don't forget to push it back in after the work is done.