MGTC Electrical Circuits

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Abingdon Rough Riders
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Version 1.2

MGTC Electrical Circuits

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Revision Log

This is a working document, as such changes will be made as new information emerges, enhancement to improve the readability or errors are found. Below is a list of these updates.

December 23, 2018 – Version 1.0 Initial Issue

December 27, 2018 – Version 1.1 Updates

- Added section called “A Bit of History and Confusion”
- Added Ammeter to list of Multiple Circuit Components
- Revised the Circuit Variants diagrams
- Revised the Appendix regarding color codes

September, 2020 – Version 1.2 Updates

- Revised RF95 Control Box showing directional indicator connections
- Revised wire colors for the Directional Indicators added notes regarding the ammeter and screenwiper motor
- Added Appendix item Colors Used in Circuit for Variation 1 & 2
- Added Appendix item Colors Used in Circuit for Variation 3 & 4
- Added Appendix item RF95 Harness connections for Variations 3 & 4
- Added Appendix item Behind the Dash Main Harness connections for Variations 3 & 4
- Added Appendix item Behind the Dash Turn Signal connections for Variations 3 & 4
- Added Appendix item Behind the Dash Sub-Harness connections for Variations 3 & 4
- Added Appendix item Switching from Positive to Negative Ground
- Added Wiring Diagrams for Variations 1 thru 4 to Appendix

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Introduction

Background

I put this paper together as a project to educate myself on the individual electrical circuits used on the MGTC. This was prompted by the number of times I was challenged to track down a problem and was faced with what I felt was poor documentation. I mean have you ever attempted to trace an electrical line using the schematic diagrams in any of the reference manuals?

And then the variations, the instruction manual lists five variations:

1. M.G. Midget (Series "TC") 1945/8 Home
   - Early color code series
   - Single Dip Filament – Left side
   - 30 MPH Warning Light

2. M.G. Midget (Series "TC") 1945/8 R.H.D. and L.H.D. (Export)
   - Early color code series
   - Dual Dip Filament

3. M.G. Midget (Series "TC") 1948 R.H.D. and L.H.D. (Export)
   - Revised color code series
   - Dual Dip Filaments

4. M.G. Midget (Series "TC") 1948/9 Home
   - Revised color code series
   - Single Dip Filament – Left Side
   - 30 MPH Warning Light

5. M.G. Midget (Series "TC") 1948/9 U.S.A. (Export)
   This is the "EXU" model, which contains a number of modifications including:
   - Directional Indicators
   - Multiple Stop Lights
   - No Fog Lamp
   - Dual Horns under the bonnet

For this paper I am using the variation number 3 for schematics and color schemes, mostly because both my cars are 1948's and use this variation. However, when looking at the diagrams I see very little differences between the first 4 variations. The only real exception is for the "EXU" model. To be as inclusive as possible I have included diagrams to cover the "exceptions" noted for variations 1 and 4. Variation 2 is the same as Variation 3 except for color.

One last point, I do not profess to be any form of expert on electronics. All the information I am presenting here is extracted from numerous references and direct observation of the electrical system in my cars. Should you detect an error, please let me know at TCStormer01@gmail.com and I will update the document.

Nomenclatures

Some notes regarding labeling of item:

- In all cases "Left" is the passenger side, "Right" is driver's side.
- LH is Left Hand, RH is Right Hand
- Sw is Switch
- w/ stands for With
- The names Generator and Dynamo are interchangeable. I have chosen to use Generator
- Lamp and Light are interchangeable. I have chosen to use Light, except for the D-Lamp name.

A Bit of History and Confusion

The labeling of individual wires in all documentation has been by wire number along with a chart that translates that number to colors. In the early cars, 1945 to sometime in 1948 the works used a 33-color chart as seen on the right. These cars are referred to in the Brown Book as "M.G. MIDGET (Series "TC") 1945/8 Home" (Variation 1 above) and "M.G. MIDGET (Series "TC") 1945/8 R.H.D. and L.H.D. (Export)" (Variation 2 above).

KEY TO CABLE COLOURS			
1	RED	18	BLUE & PURPLE
2	RED & YELLOW	19	BLUE & BLACK
3	RED & BLUE	20	WHITE
4	RED & WHITE	21	WHITE & GREEN
5	RED & GREEN	22	WHITE & BROWN
6	RED & BROWN	23	WHITE & PURPLE
7	RED & BLACK	24	WHITE & BLACK
8	YELLOW	25	GREEN
9	YELLOW & BLUE	26	GREEN & BROWN
10	YELLOW & GREEN	27	GREEN & PURPLE
11	YELLOW & BROWN	28	GREEN & BLACK
12	YELLOW & PURPLE	29	BROWN
13	YELLOW & BLACK	30	BROWN & PURPLE
14	BLUE	31	PURPLE
15	BLUE & WHITE	32	PURPLE & BLACK
16	BLUE & GREEN	33	BLACK
17	BLUE & BROWN		

Then in 1948 a change was made to expand the color chart to 64 colors as shown below and reassign the wire numbers to color reference. For example, Red in the old chart is "1", in the new chart it's "41".

KEY TO CABLE COLOURS				
1 Blue	14 White *with* Purple	27 Yellow *with* Blue	40 Brown *with* Black	53 Purple *with* White
2 Blue *with* Red	15 White *with* Brown	28 Yellow *with* White	41 Red	54 Purple *with* Green
3 Blue *with* Yellow	16 White *with* Black	29 Yellow *with* Green	42 Red *with* Yellow	55 Purple *with* Brown
4 Blue *with* White	17 Green	30 Yellow *with* Purple	43 Red *with* Blue	56 Purple *with* Black
5 Blue *with* Green	18 Green *with* Red	31 Yellow *with* Brown	44 Red *with* White	57 Black
6 Blue *with* Purple	19 Green *with* Yellow	32 Yellow *with* Black	45 Red *with* Green	58 Black *with* Red
7 Blue *with* Brown	20 Green *with* Blue	33 Brown	46 Red *with* Purple	59 Black *with* Yellow
8 Blue *with* Black	21 Green *with* White	34 Brown *with* Red	47 Red *with* Brown	60 Black *with* Blue
9 White	22 Green *with* Purple	35 Brown *with* Yellow	48 Red *with* Black	61 Black *with* White
10 White *with* Red	23 Green *with* Brown	36 Brown *with* Blue	49 Purple	62 Black *with* Green
11 White *with* Yellow	24 Green *with* Black	37 Brown *with* White	50 Purple *with* Red	63 Black *with* Purple
12 White *with* Blue	25 Yellow	38 Brown *with* Green	51 Purple *with* Yellow	64 Black *with* Brown
13 White *with* Green	26 Yellow *with* Red	39 Brown *with* Purple	52 Purple *with* Blue	

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The confusion began when reprints of the Brown Book used the 64-color chart as reference to the Variation 1 and 2 layouts. Doug Pelton, of From The Frame Up, in his Tech Tip "EL960 Wiring diagram errors and corrections, early TC", reported this error.

When checking the individual circuits wire by wire and their wire numbers between Variations 1 and 2 versus Variations 3 and 4, we find that there are six color combinations that actually line up. They are:

33 Color Chart		64 Color Chart	
1	Red	41	Red
2	Red & Yellow	42	Red w/Yellow
20	White	9	White
25	Yellow	8	Yellow
31	Purple	49	Purple
33	Black	57	Black

All remaining circuit wire colors do not line up. For example, in the early cars the wire between the Starter and the Ammeter is labeled as 13 or Yellow & Black and in the 1948 and later it's labeled as 33 or Brown. So, the early cars truly had a different color scheme.

Please refer to the Appendix – Cross Reference of Revised and Early Used Colors as a guide for translating the early colors to the revised colors in the following diagrams.

References

Lucas / Technical Service / Overseas Technical Correspondence Course

- Section 3, Coil Ignition
- Section 4, Generators, and
- Section 5 Generator Output Control.

This series also served as the source of some of the illustrations.

The full set of these manuals is available on line at
https://www.fromtheframeup.com/Lucas_Manual_CTYJ.html

No Author Listed. 1954, *The Instruction Manual for the MG Series "TC" Midget*

Ball, Kenneth. 1968, *MG Autobook One*

Blower, W. E. 1952, *The MG Workshop Manual From "M" Type to "T.F. 1500"*

For references on the use of the DB10 Directional Relay I relied heavily on a website called 'The MGA with an Attitude" - https://www.mgaguru.com/mg01.htm. Specifically https://mgaguru.com/mgtech/electric/et105.htm, and https://mgaguru.com/mgtech/electric/et104.htm

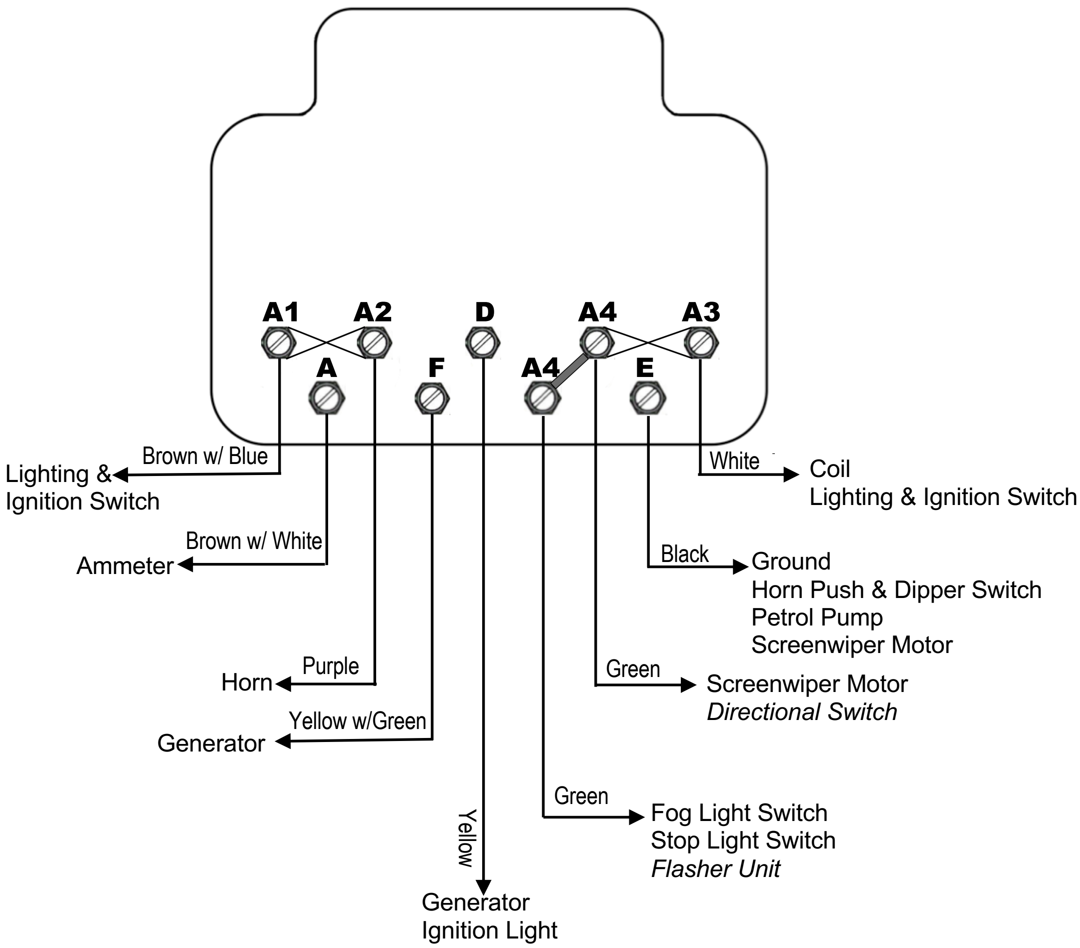
Multiple Circuit Components

Four of the components are used in multiple circuits. Since each circuit description only deals with the wiring that is used by just that circuit, I'm including an overall look of all the connections used by each of these components.

RF95 Control Box

Please refer to the Battery Charging and Power Supply section for a full description of the power flow within the Control Box.
Notes:

1. Although the schematic shows a connection for the Screenwiper motor, none exists in the harness
2. Connections for cars with directional indicators are noted in *italics*.

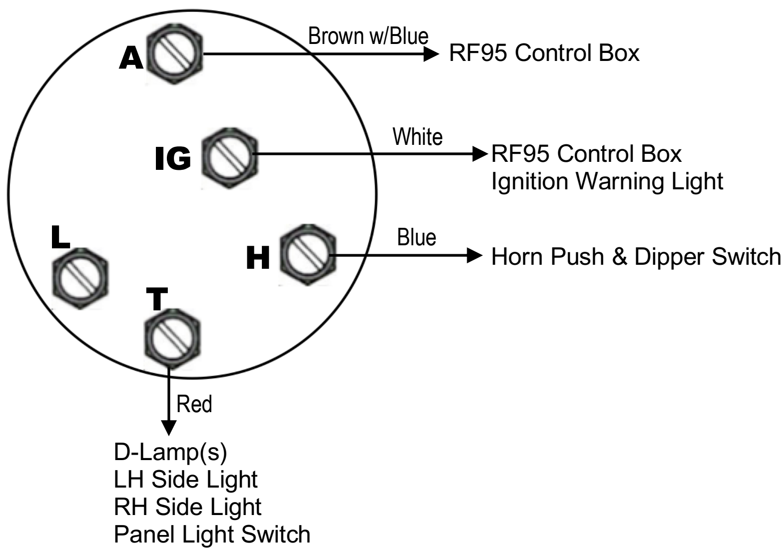


Lighting & Ignition Switch (L&I Sw)

Power enters the switch at connection A (Input) and exits through IG (Ignition), H (Headlights) and T (Tail and Side Lights). Connection L (Lighting) is not used.

When the key is turned on a connection is made between A and IG, which then connects to terminal A3 on the RF95 Control Box. All "Ignition On" circuits are controlled by this connection.

Setting the switch to S (Side / Tail) will create a connection between A and T. When set to H (Headlights) this connects A to both H and T.

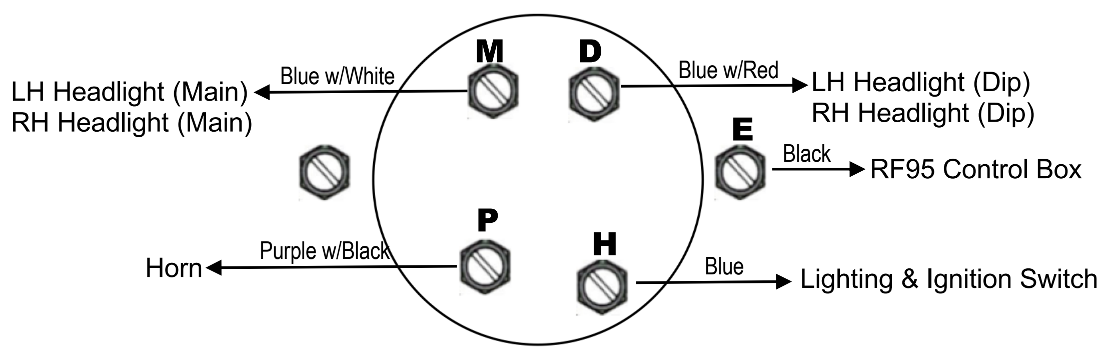


Horn Push & Dipper Switch (HP&D Sw)

Since there are no pre-assigned connection identifiers, I have taken the liberty to give each point of attachment a letter code. These are: H (Headlight), M (Main), D (Dip), P (Push) and E (Earth).

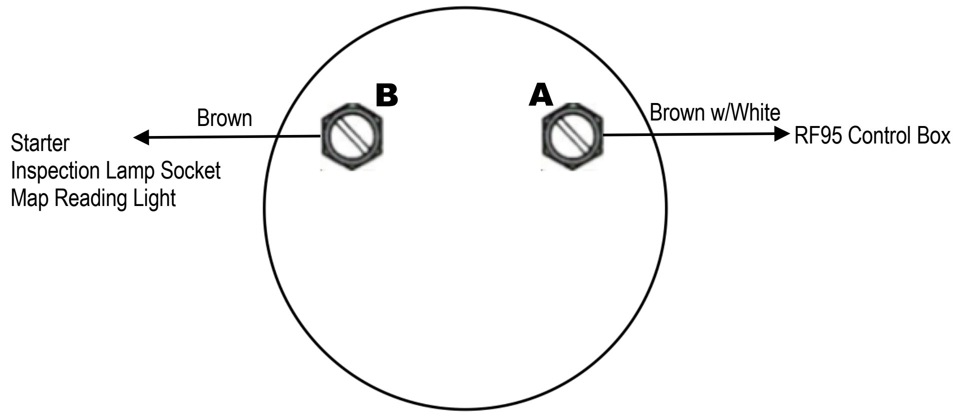
Power to the switch is via connection H and then based on the switch setting it either leaves by of M (H on the front of the switch) or D (D on the front of the switch). When the button is pushed a connection is made from E to P.

A note of interest, on all the wiring diagrams, it shows that the Horn and the headlight Main connections are reversed, that is, Horn on the top and Main on the bottom. Yet, the physical switch is as shown below. Additionally, the diagrams show a dedicated connection for the Earth. In both of my cars, there is no dedicated connection and the Earth is actually connected to the mounting lug.



Ammeter

Note the labeling of B and A is consistent in all the wiring diagrams. When looking at the Ammeter from the back, the heavy Brown wire from the Starter should attach to the left side (B) of the meter for Positive ground systems and on the right side (A) for Negative ground systems. Below shows Positive ground system.



Basic Circuits

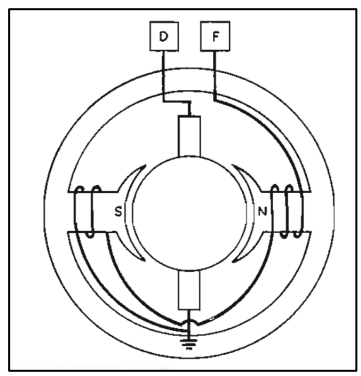
Battery Charging and Power Supply

The Battery Charging Circuit is no doubt the most complex of all circuits in the TC. There are a number of components that go into the makeup of this circuit and each has a part to play. The three main players are the Battery, the Generator and the RF95 Control Box. In addition, it uses the Ammeter, the Lighting & Ignition Switch, and the Ignition Warning Light.

This circuit does more than just charge the battery. It is also responsible for providing and controlling the power for all electronic components in the car. To understand why things, happen in this circuit it's necessary to examine both the Generator and the RF95 Control Box.

Generator

The generator affixed to our TC's is a "shunt-wound" type design. These generators output direct current in which the field and armature windings are connected in parallel, and the armature, connection "D", supplies both the load and the field current.



Because of this it's necessary that you are aware of only two things:

- The two output terminals; "D" and "F" must be connected to each other in order to complete a circuit thus produce electrical output, and
- That the faster the generator spins, the more power it will output.

Both of these items are the reason there is a RF95 Control Box.

RF95 Control Box

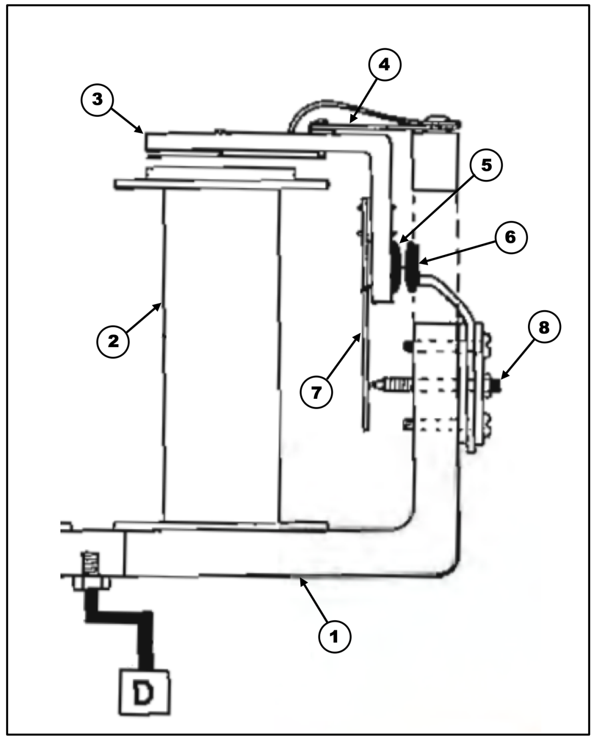
The RF95 Control Box, sometimes referred to as a "regulator," is the heart of maintaining a proper charge in the car's battery. It serves three functions;

- Voltage Regulator - Ensuring that the output from the Generator is kept at a safe level
- The Cut-Out – Provides the actual charging circuit for the battery, auxiliary power when additional components, such as headlights, are used, and protects the battery against Generator failure or when the car is running slow or idling, and
- Acts as a terminal strip for connecting wires

The first two functions are controlled by the use of two electro-magnets. As you look at the Control Box, the electro-magnet on the left is the Voltage Regulator and the Cut-Out is on the right. They each provide the same basic function, to connect or disconnect a circuit. It's important to note, that even though the Generator powers both these switches, they act independently of each other.

Before jumping into how it works, it's necessary to review the basic construction of the unit. The major parts are:

- The Iron Frame or Yoke (1)
- The Iron Bobbins or Electro-Magnet (2)
- A pivoted bracket or Armature (3)
- The Mounting Spring Blade (4)
- The Moveable Contact (5)
- The Fixed Contact (6)
- The Tension Spring Blade (7), and
- The Adjusting Screw (8)



Both of the electro-magnet switches are identical except for one item, the Contacts (5 & 6). On the Voltage Regulator the contacts are closed when the switch is at rest, that is, when no power is running through the system. And the Contacts on the Cut-Out switch are open when the switch is at rest.

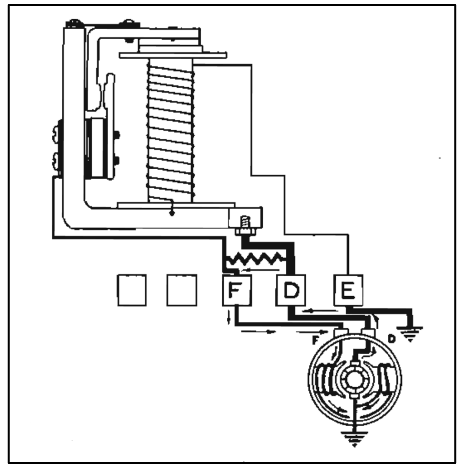
The purpose of the Tension Spring Blade (7) and Adjusting Screw (8) is to maintain the proper magnetic pull necessary to move the Armature. This tension is set by the manufacture and is based on generator model.

Voltage Regulator Circuit

As discussed in the section about the Generator we know that the Generator will put out more volts when spun at a higher speed. Without regulating this output, it is possible to over charge the battery and/or burn out the Generator, thus the Voltage Regulator. Controlling is simple. If we break the D/F connection, then power output from the Generator will fall off lowering the output voltage.

The regulating circuit begins with the Generator. Output is sent through terminal D to the Control Box where it is connected to terminal D and the Yoke (1). From there it travels across the Mounting Spring Blade (4), down the Armature (3), across the Contacts (5 & 6), then returns to the Generator via Terminal F to complete the circuit.

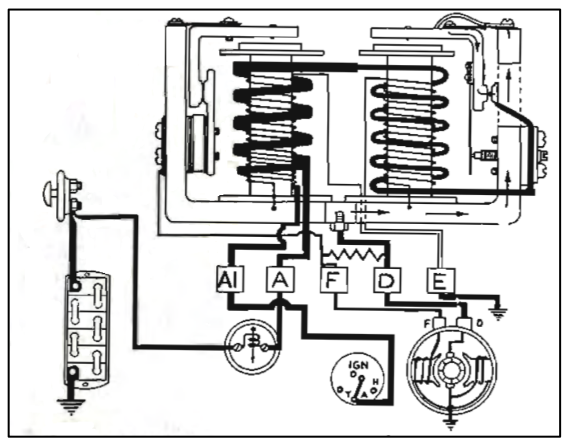
To break this circuit, we need to open up the Contacts (5 & 6). This is done by the use of the Bobbin (2), which is an electrical magnet. It has an iron core with fine copper wire wrapped around it. When power from the Generator is applied to the copper wound Bobbin (2), it turns the iron core into a magnet. The more power the stronger the magnet. As the output from the Generator increases the electro-magnet becomes stronger until it overcomes the Tension Spring (7) to pull the Armature (3) down. This action disconnects the Contacts (5 & 6), breaking the D/F circuit.



Power from the Generator falls off as soon as the circuit is broken. The reduced power then causes the electro-magnet to lose power. The magnetic pull is reduced and the Armature (3) is released from the magnet and the contacts are joined again reconnecting the D/F circuit. Then the whole cycle begins again. This entire process repeats between 60 and 100 times per second. The result of all this is a smooth regulated power flow from the Generator.

The Cut-Out Circuit

The Cut-Out controls the flow of power to the battery for recharging and the auxiliary power required when additional electrical components (e.g. Headlights) are in use. It also performs the important task of not letting the battery discharge through the generator field windings should the generator fail or when the engine is running at slow RPM’s.



The charging circuit is like the regulator circuit, except that we want to connect a circuit that runs from the Generator to the battery. Since the contacts (5 & 6) are “normally” open, it becomes necessary to close these contacts in order to complete this task. For this we will start with the electro-magnetic circuit.

Power again starts at the generator with the output from Terminal D, then to the RF95 Control Box Terminal D, then the Yoke (1) and to the copper windings around the Bobbin (2). As output from the Generator increases, so to does the power of the electro-magnet. Again, when the magnet becomes powerful enough it will move the Armature (3) down causing the Contacts (5 & 6) to close.

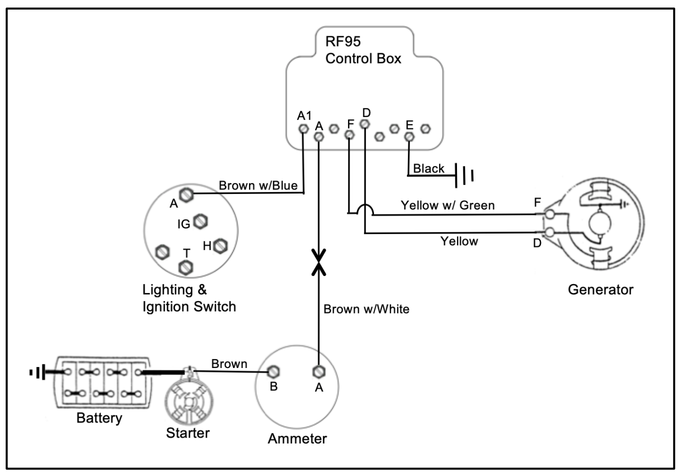
With the Contacts closed, power from the Generator will flow via Terminal D, to the Yoke (1), across the Mounting Spring Blade (4), down the Armature (3), through the Contacts (5 & 6), across the Heavy Coils on the outside of the Bobbins (2) and out Terminals A1 and A.

The other major function of the Cut-Out is protecting the Battery. When the Generator fails to produce enough power, either by slower speeds or failure, then the Contacts (5 & 6) will open. If this did not happen, then power from the Battery would flow backwards through the system. From the Battery to the Starter Switch, across the Ammeter, to Terminal A, the Heavy Coils, across the Contacts (5 & 6), then the Armature (3), down the Yoke (1) out Terminal D and to the windings in the Generator and to the ground. This would result in draining the Battery.

The Charging and Auxiliary Power Circuits

Now that we have power from the Generator through the RF95 Control Box feeding the system via Terminals A1 and A, lets see how these circuits work.

Output from the Generator through Terminal A on the Control Box is sending power to the "A" side of the Ammeter, which is then connected to the Battery. At the same time the Battery is attempting to send power in opposite direction. But this means that we have power from both the Battery and the Generator being sent into the same circuit. When this happens, one of three things will occur.



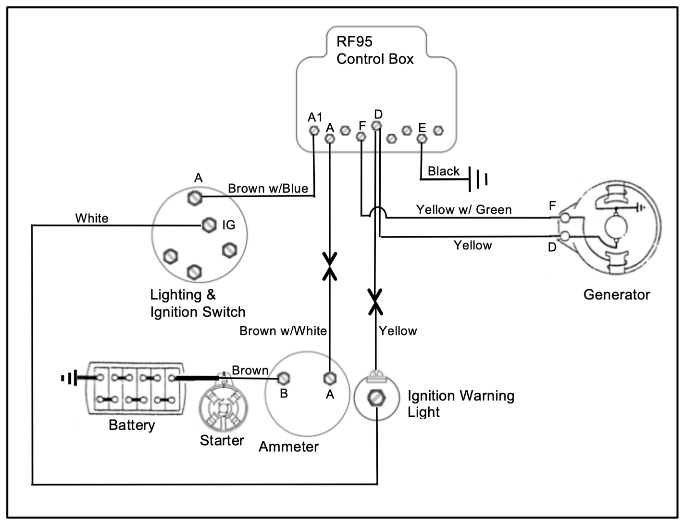
- If the output from the Battery and the Generator are both the same, then the two opposing electrical forces will result in no current flow, and the Ammeter will show neither negative nor positive charging. Output from the Generator will, however, flow from Terminal A1 and then to connection A on the Lighting & Ignition Switch and on to various components by way of the IG, H and T connections.

- If the Generator output is greater than the Battery, then the circuit will flow from the Generator to the Battery via the Control Box's Terminal A and the Ammeter will register a positive battery charging. The electrical output will also flow through Terminal A1 to the rest of the car via the Lighting & Ignition Switch connection A and out via connections IG, H and T.

- If the Battery is greater than the Generator output, then power will flow from the Battery, through the Ammeter to Terminal A then across to Terminal A1 and then to connection A on the Lighting & Ignition Switch and out via connections IG, H and T. This will result in the Ammeter showing a negative charge and the battery will power all electronics in the car.

The Ignition Warning Light Circuit

So, have you ever wondered why the red light comes on when the Generator is not producing output? I mean it takes power to make the light come on, but no power? To solve this mystery, we need to review its circuit.



Starting at the Battery, the circuit attaches to the Ammeter terminal B, across the gauge, out terminal A, then on to the RF95 Control Box at terminal A. Then out terminal A1 where it attaches to the Lighting & Ignition Switch at connection A. Assuming the key is on, power then exits the switch at connection IG where it attaches to one side of the Ignition Warning Light. The other side of the Light is attached to terminal D of the RF95 Control Box. Terminal D is then grounded via the Control Box, thus completing the circuit.

If the engine is not running or running slow, and therefor little or no power is being produced by the Generator, then electricity will flow through the circuit, from the battery to the RF95 Control Box and the light will come on being powered by the battery. When the car starts, and the generator produces enough output which is equal to or more than the battery output, then the two opposing flows will cancel each other out, no power will flow through the circuit and the light will go out.

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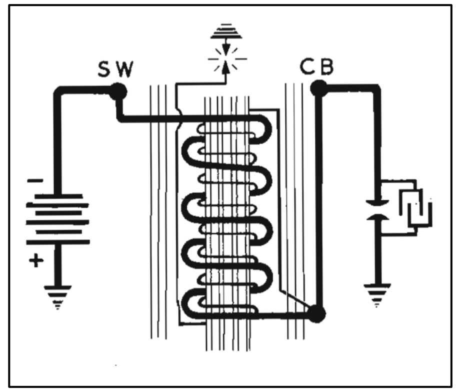
Ignition

The Ignition Circuit is rather simple one, wire wise, only a few connections. But like the Charging circuit there is an element that deserves a more in-depth review, the Coil.

Coil

The purpose of the coil is to build up enough power to create a spark across the sparkplug gap in order to ignite the air / fuel mixture in the cylinder. To accomplish this there are three parts:

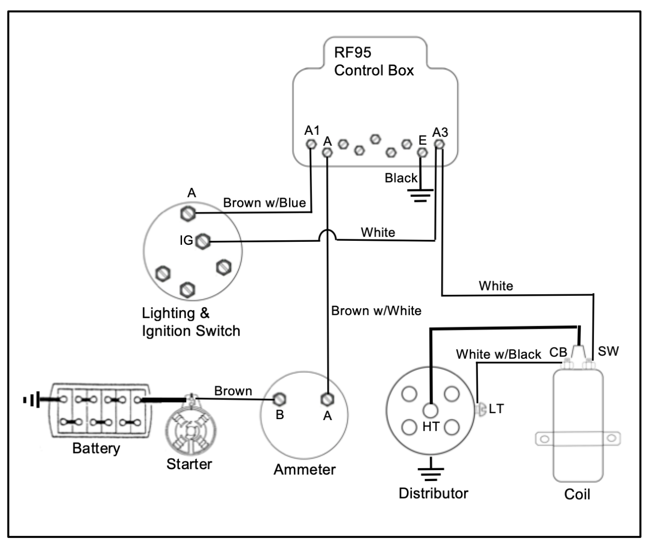
- The Primary Coil
- The Secondary Coil, and
- A Magnetic Field generated by the Primary Coil.



Both the Primary and Secondary Coils are windings around an iron core. When power is applied to the Primary Coils (show in bold) this creates a strong magnetic field within the iron core. When the distributor points open, the current will stop flowing and the Magnetic Field collapses. However, the collapse will induce a current impulse in the fine windings of the Secondary Coil that can, based on the number of windings, produce an output of 20,000 volts exiting the Coil through the H.T. (High Tension) and connection on the top of the Distributor.

Ignition Circuit

As with all circuits we begin with the battery, across the Ammeter and connects to the RF95 Control box at terminal A through the external coil and on to terminal A1. There it is joined with output from the Generator and exits the Control Box. From there it attaches to the Lighting and Ignition Switch at connection A. When the key is turned on the current leaves via the IG connection and attaches to Terminal A3 of the Control Box and on to the SW (Switch) side of the Coil. The power going to the Primary Coil will leave the Coil using the CB (Control Breaker) connection, and then on to the Distributor attach to the L.T. (Low Tension) terminal. Inside the Distributor, the circuit continues across the closed points and finally to earth.

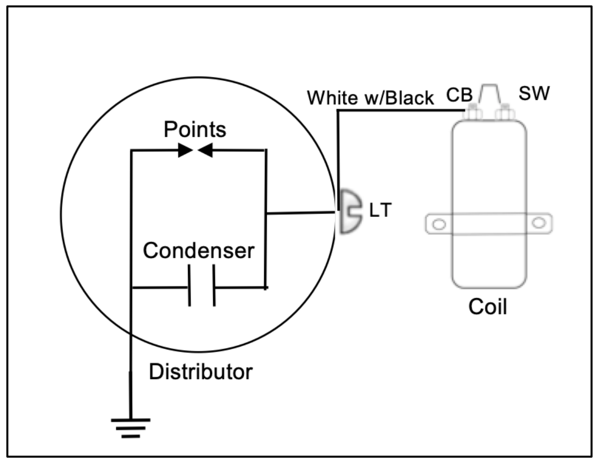


Power builds in the Magnetic Field, and when the Starter Switch is pulled the Distributor will rotate causing the Contact Points to open and close. This action will cause the Coil to perform in the manner noted above.

When the Magnetic Field collapses and converts to high voltage via the Secondary Coil it exits the Coil through the H.T. connection and enters the Distributor Cap via its H.T. connection. From there it is sent to the sparkplugs by way of the rotor.

Condenser

There is one more item to cover, the Condenser under the distributor cap. The term Condenser is an engineering term that covers a number of items, one of which is the cylindrical item attached to the points. In electronics it's called a capacitor.



Capacitors are used in electronic circuits to store and release electricity in order to ensure that the flow of electricity is smooth. This is especially important in items such as sound systems, computers and measuring devices where uninterrupted supply is critical.

In our case the capacitor or condenser is used to protect the points by draining off unwanted voltage. When the points open and the Primary Coil circuit disconnect, and the large surge of power leaves via the Secondary Coils, a new induced voltage occurs in the Primary Coils, which can rise to as high as 250 to 300 volts. This happens just as the points open and this voltage enters the Distributor via the L.T. connection. Without the capacitor, the volts would spark across the points in an attempt to reach the ground causing sever damage to the points. With the capacitor, the extra voltage is stored in the capacitor and then released on the other side and to the ground.

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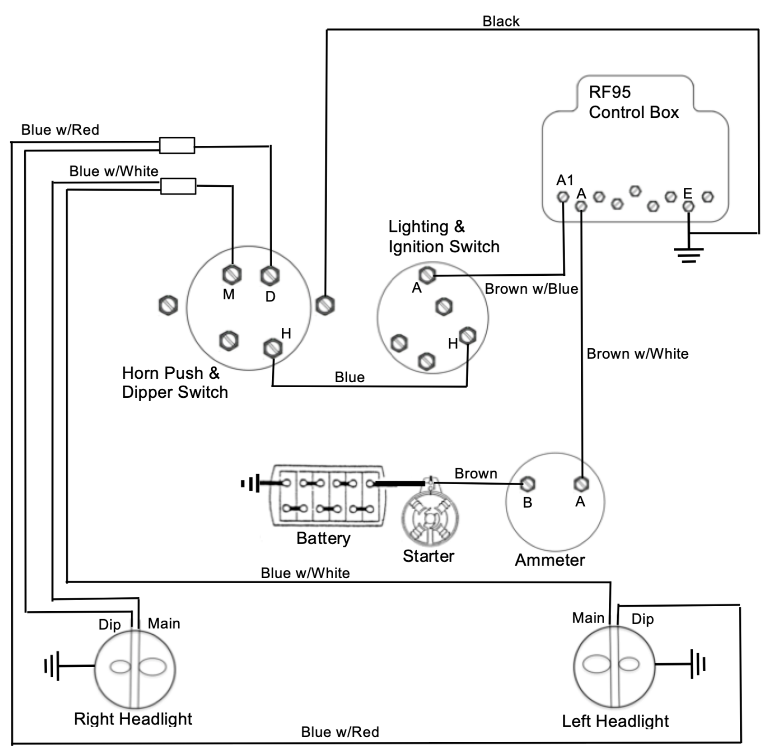
Headlights

Power Source:	Battery and/or Generator	
Ignition On or Off:	Either	
Switch Settings:	Lighting & Ignition Switch:	H
	Horn Push & Dipper Switch:	D or H

Power starts at the Battery, across the Ammeter, to the Control Box at terminal A, across the external coils, then joins with output from the Generator at terminal A1. From there it goes to connection A on the Lighting & Ignition Switch.

When the Lighting & Ignition switch is set to H (Headlights) a connection is made between connection A and connection H, which then connects to H on the Horn Push and Dipper Switch. The Dipper Switch can be set to either D (Dip) or H (High / Main), which connects to the correct filament on the headlights. The circuit is complete by way of the headlight buckets grounded to the frame.



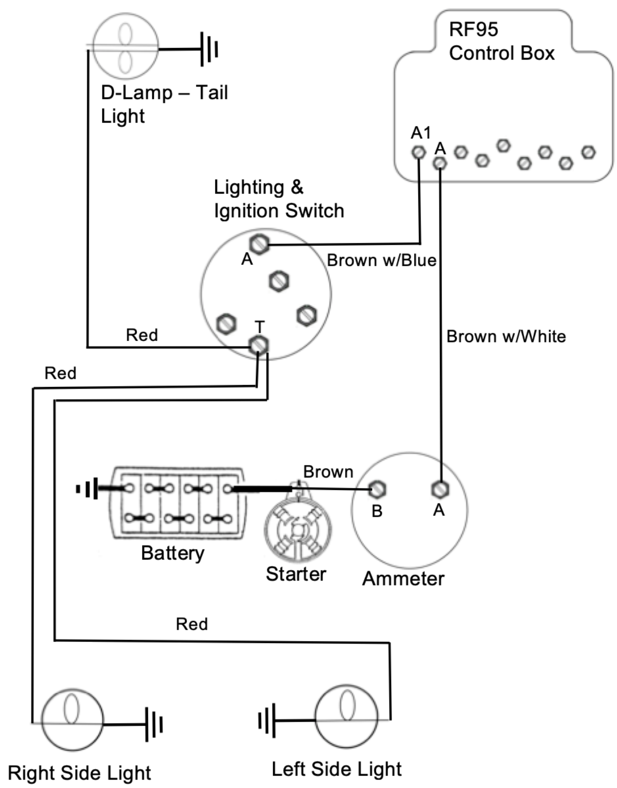
Side and Tail Lights

Power Source: Battery and/or Generator

Ignition On or Off: Either
Switch Settings: Lighting & Ignition Switch: S or H

Power starts at the Battery, across the Ammeter, to the Control Box at terminal A, across the coils, then joins with output from the Generator at terminal A1. From there it goes to connection A on the Lighting & Ignition Switch.

When the Lighting & Ignition Switch is set to S (Side Lights) or H (Headlights) a connection is made between connection A and connection T, which then connects to both Side Lights and the D-Lamp Tail Light filaments. Final completion of the circuit is via the individual light buckets and D Lamp(s) being ground to the frame.



MGTC Electrical Circuits

Stop Light

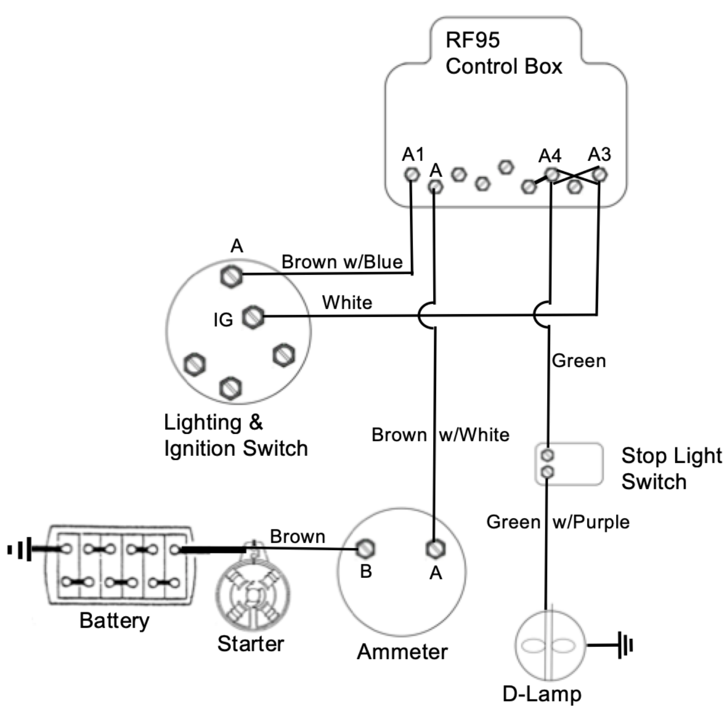
Power Source: Battery and/or Generator

Ignition On or Off: On
Switch Settings: N/A

Power starts at the Battery, across the Ammeter, to the Control Box at terminal A, across the coils, then joins with output from the Generator at terminal A1. From there it goes to connection A on the Lighting & Ignition Switch.

When the ignition key is turned on the current leaves the Lighting & Ignition Switch via the IG connection and attaches to Terminal A3 that is connected to the A4 terminals by way of a fuse. Power continues to the Stop Light Switch. When the brakes are applies it closes the Stop Light Switch and connects with the D-Lamp and the Stop Light filament. The D Lamp ground completes the circuit.

Note: When using the DB10 Directional Relay, the connection from the Stop Light Switch is not sent directly to the D-Lamp. Instead it is routed to Connection 5 on the Directional Relay.

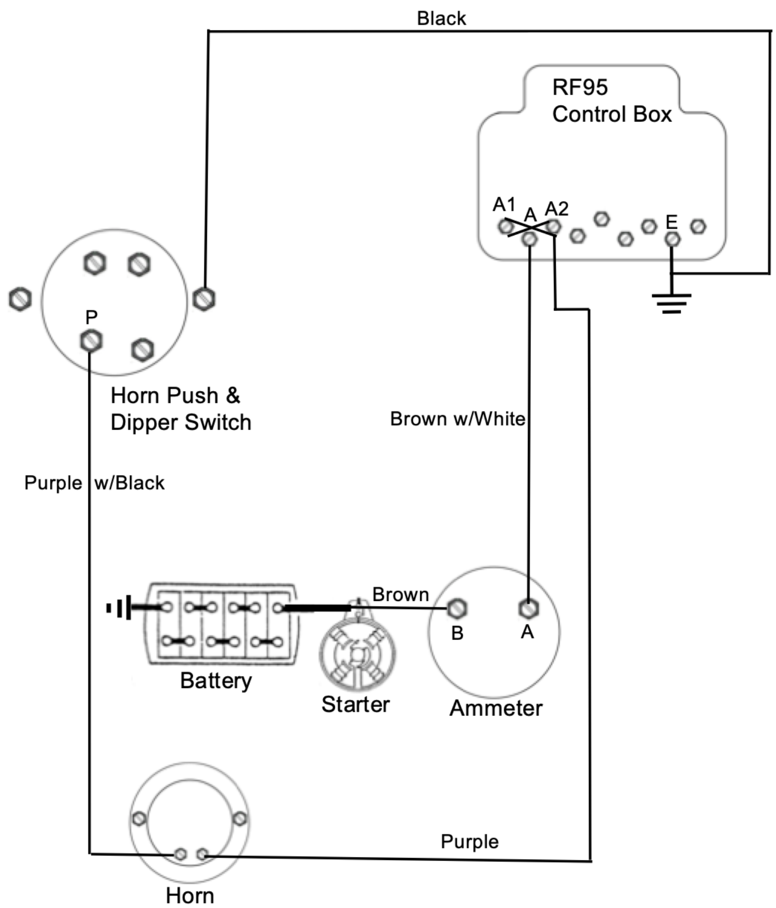


Horn

Power Source: Battery and/or Generator

Ignition On or Off: Either
Switch Settings: Horn Push & Dipper Switch: Horn Button Pushed

This circuit starts with the battery, across the Ammeter and connects to the RF95 Control box at terminal A and on to A1 then connects to A2 via a fuse and flows to the Horn. The other side of the circuit begins at the Horn Push & Dipper Switch. When the button is pushed it makes a connection with the ground and connection P (for Push), thus completing the circuit and the Horn hopefully sounds.

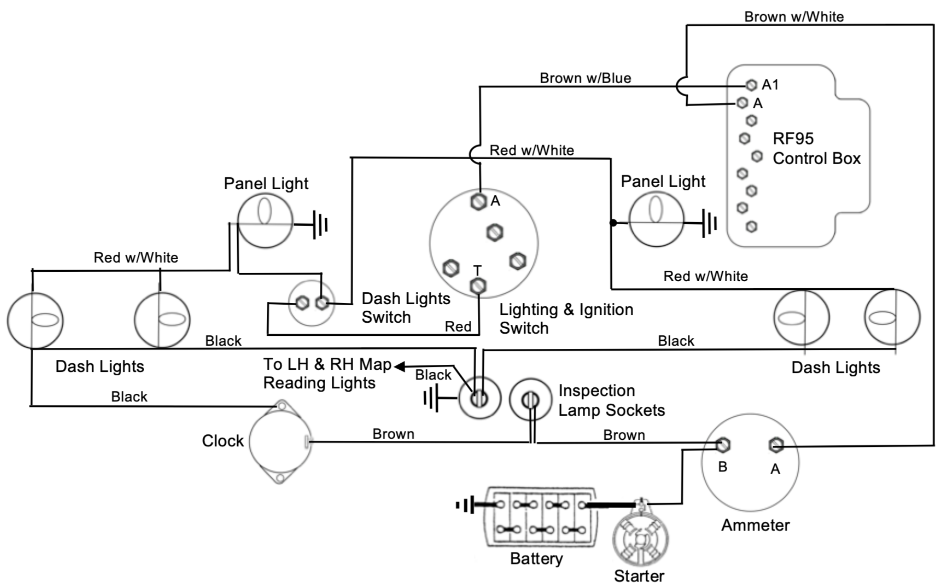


Dash/Panel Lights, Clock and Inspection Sockets

Power Source:	Clock:	Battery
	Dash/Panel Lights:	Battery and/or Generator
	Inspection Sockets:	Battery
Ignition On or Off:	Either	
Switch Settings:	Clock:	N/A
	Inspection Sockets:	N/A
Dash/Panel Light:		
	Lighting & Ignition Switch:	S or H
	Dash Light Switch:	On

There are two sources of power for this circuit diagram. The Clock and the Inspection Light Socket derive their power directly from the Battery via the B connection on the Ammeter. The Dash / Panel Light, however, obtain their power from the A1 terminal on the RF95 Control Box via the Lighting & Ignition Switch. But they all get their ground connection from the earth side of the Inspection Lamp Sockets.

For the Dash Lights the Lighting and Ignition Switch must first be set to either S for Side or H for Headlight. From there it exits at connection T and attaches to one side of the Dash Lights Switch, which feeds the Dash and Panel Lights. Grounding is way of a dedicated wire that attaches to the grounded Inspection Lamp Socket.



MGTC Electrical Circuits

Fog Light and Petrol Warning Light

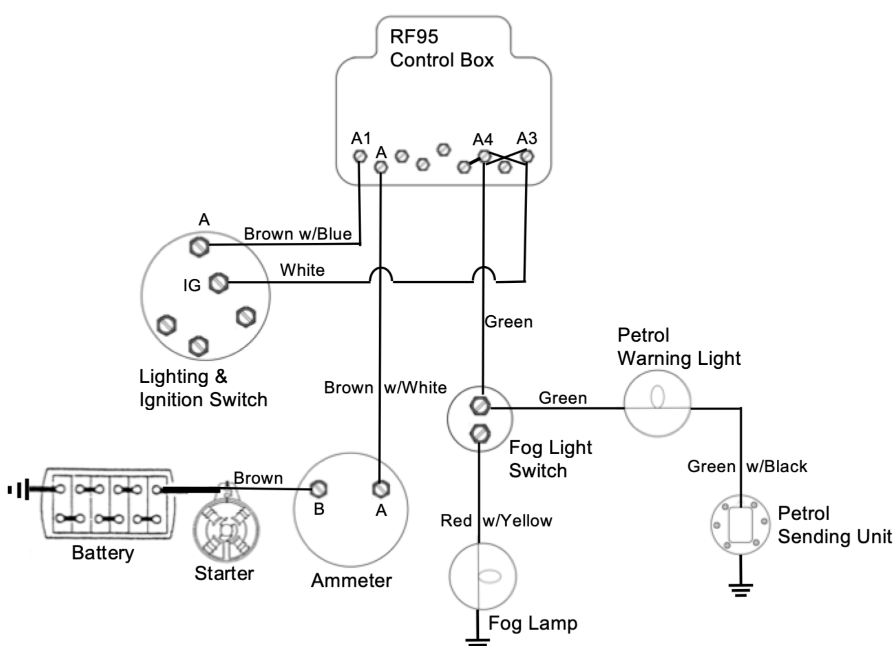
Power Source: Battery and/or Generator

Ignition On or Off:	On	
Switch Settings:	Fog Light Switch:	On
	Petrol Light:	N/A

This seems like a strange combination, but heck grab any connection that's available. As before power is from the Battery & Generator meeting at the A1 terminal, from there to the Lighting and Ignition Switch. When the key is turned on power flows back to the Control Box and attaches at terminal A3, then across the fuse to terminal A4. Connection is then made to the Fog Light Switch, which makes a convenient connection for the Petrol Warning Light.

When the Fog Light Switch is turned on, the power flow to the Fog Light, which completes its circuit through the Fog Light bucket ground to the car frame.

For the Petrol Warning Light, power is taken off the Fog Light switch and connects to one side of the Petrol Warning Light. The other side of the light is connected to the Petrol Sending Unit mounted on the back of the petrol tank. When the fuel drops the float arm inside moves downward allowing the Sending Unit to complete a ground connection, and letting us know it's time to fill up.



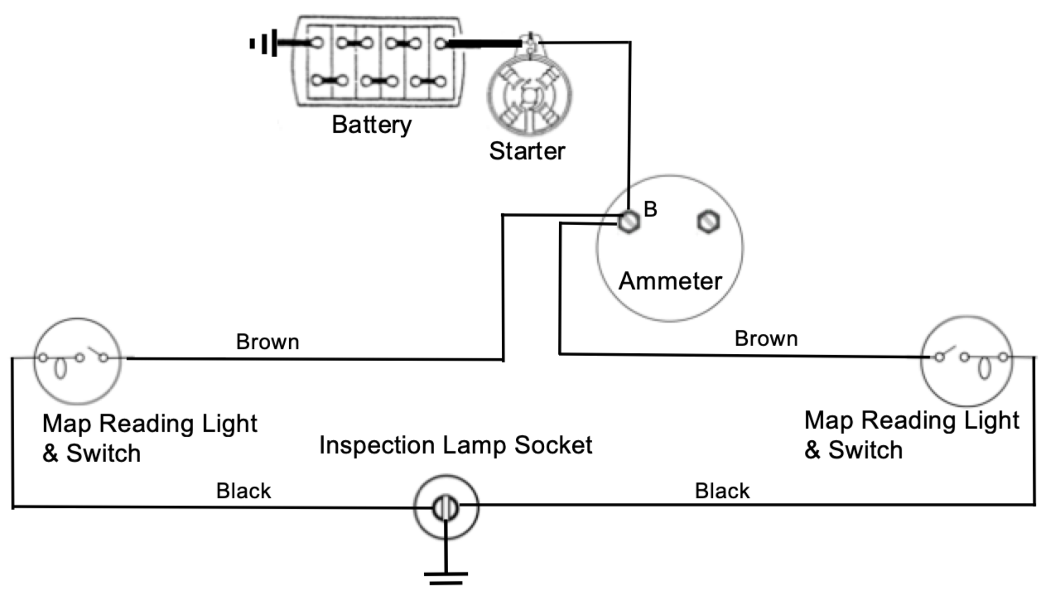
Map Lights

Power Source: Battery

Ignition On or Off: Either
Switch Settings: Map Reading Light Switch: On

Next to the Clock, this is no doubt the simplest circuit on the car. Power starts at the Battery, which connects to terminal B of the Ammeter. From there separate lines attach to each of the Map Reading Light. To complete the circuit, dedicated ground lines are run from each Map Light to the grounded Inspection Lamp Socket.

There are no external switches, instead relying on the internal switch in each of the Map Reading Light units.



MGTC Electrical Circuits

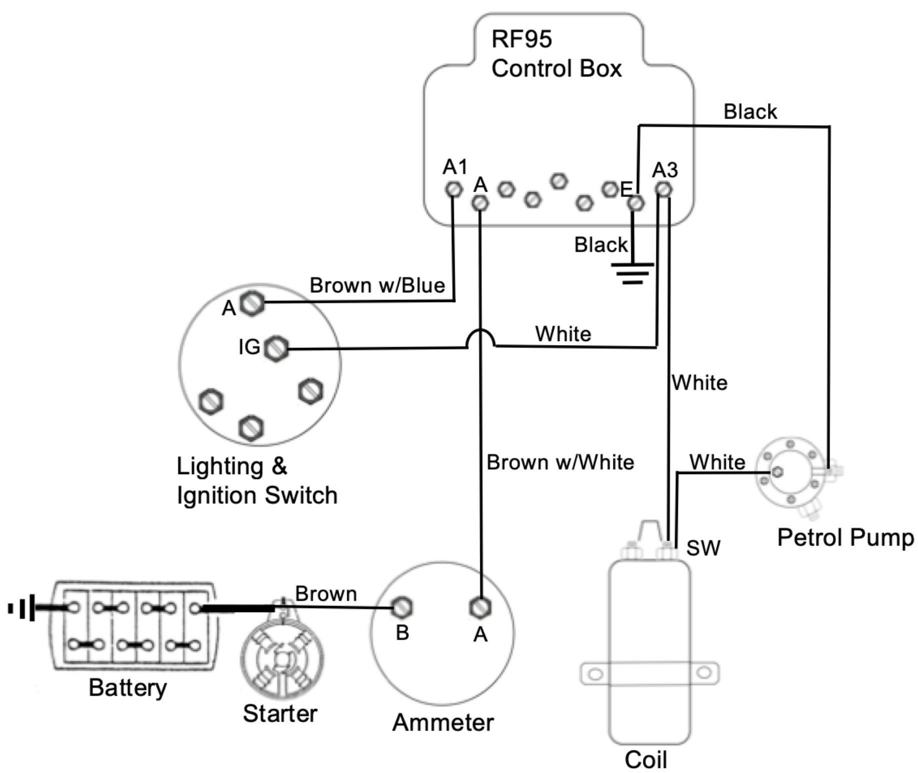
Petrol Pump

Power Source: Battery and/or Generator

Ignition On or Off: On
Switch Settings: N/A

Power starts at the Battery, across the Ammeter, to the Control Box at terminal A, across the coils, then joins with output from the Generator at terminal A1. From there it goes to connection A on the Lighting & Ignition Switch.

With the Ignition Switch turned on, power exits at connection IG and attaches to terminal A3 on the Control Box. From there a separate wire connects to the SW side of the Coil and continues on to the top connection on the Petrol Pump. Another wire connected to the side of the Petrol Pump then returns to the Control Box and connection at terminal E in order to provide a ground for the circuit.



Screenwiper Motor

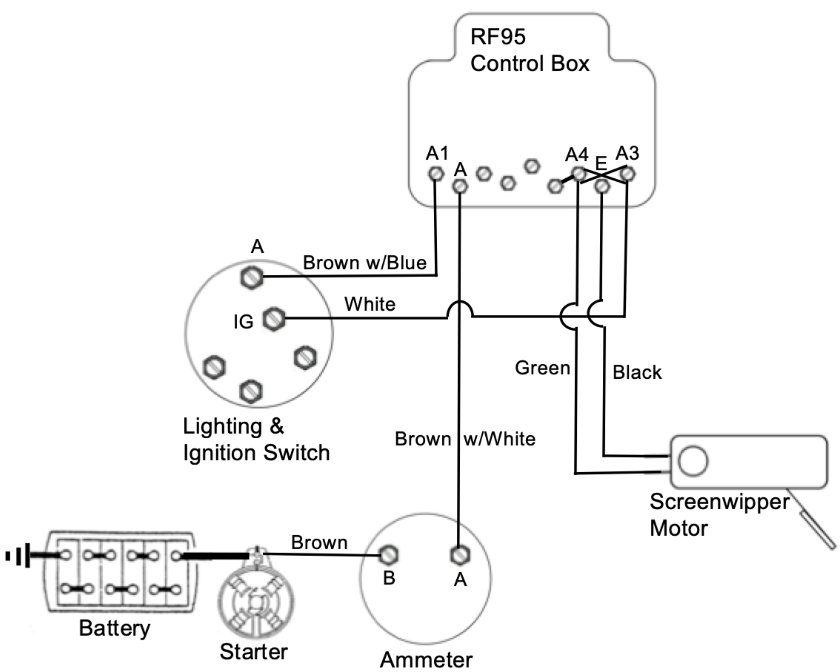
Power Source: Battery and/or Generator

Ignition On or Off: On
Switch Settings: Screenwiper Switch: On

Another simple circuit, although the wiring documentation shows this being wired directly to the RF95 Control Box, these wires are not included in the wiring loom. Most people find convent places behind the dash to connect the Screenwiper motor.

Power flows from the Lighting and Ignition Switch via the IG connection to the A3 connection on the Control Box, across the fuse to A4, then on to the Screenwiper Motor. When the Wiper Switch is turn on, the circuit is completed via a second wire to the Control Box attached to the E terminal and the earth.

Note: Despite what is shown in the Brown Book and other documentation there are no dedicated wires in the harness for the screenwiper motor. Most people add a green line attached to the fog light switch and a ground to some place behind the dash.



Circuit Variations

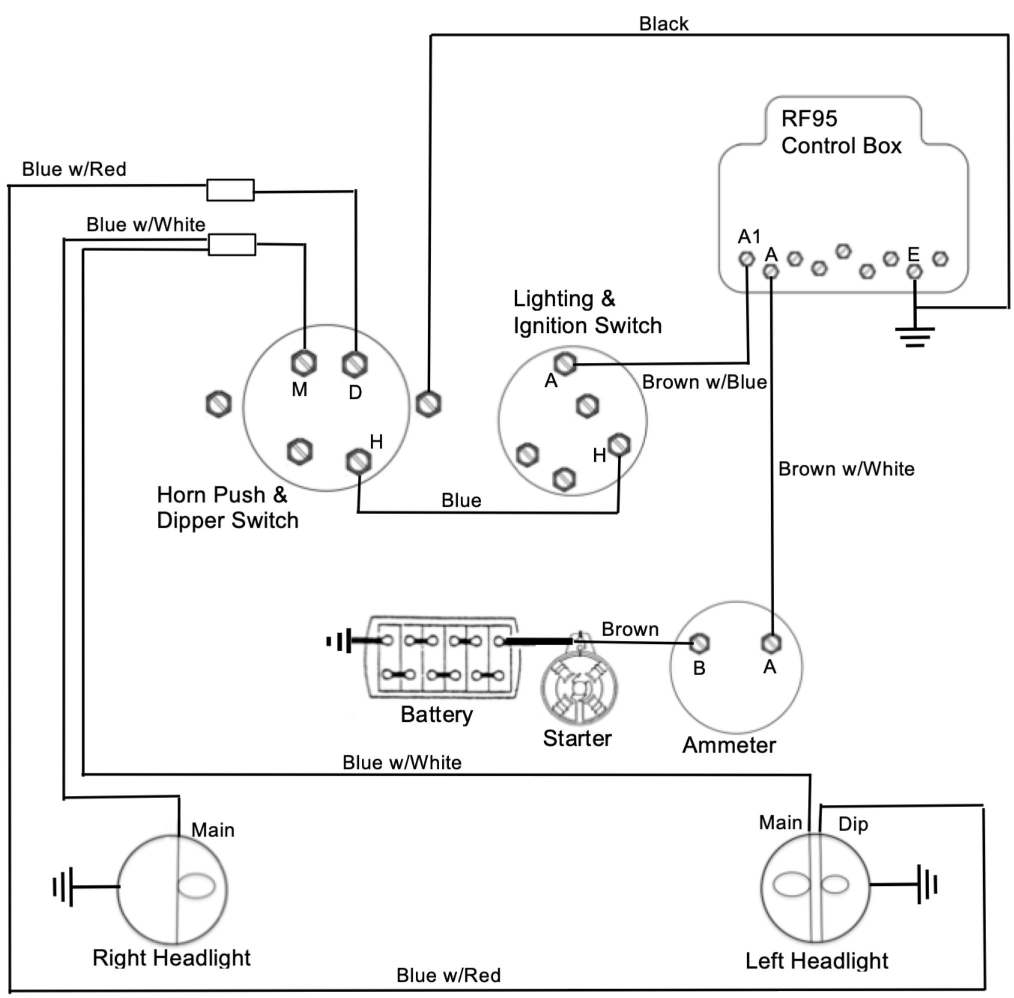
Single Dip Headlamp – Variation 1 and 4

Power Source: Battery and/or Generator

Ignition On or Off: Either

Switch Settings: Lighting & Ignition Switch: H

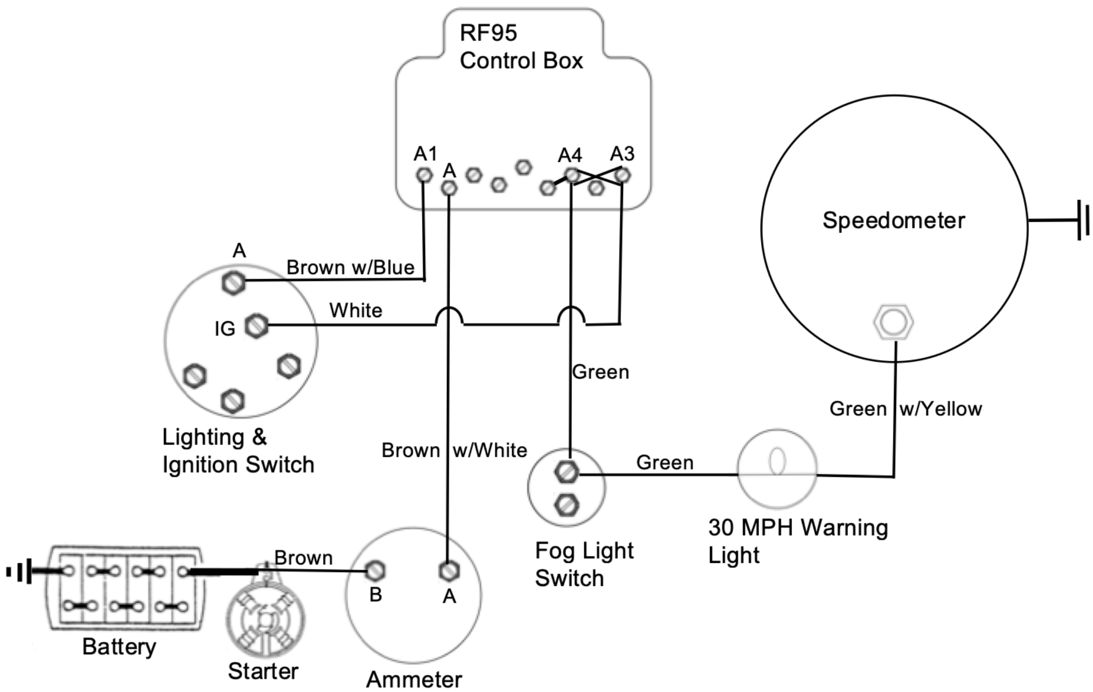
Horn Push & Dipper Switch: D or H



30 MPH Warning Light – Variations 1 and 4

Power Source: Battery and/or Generator

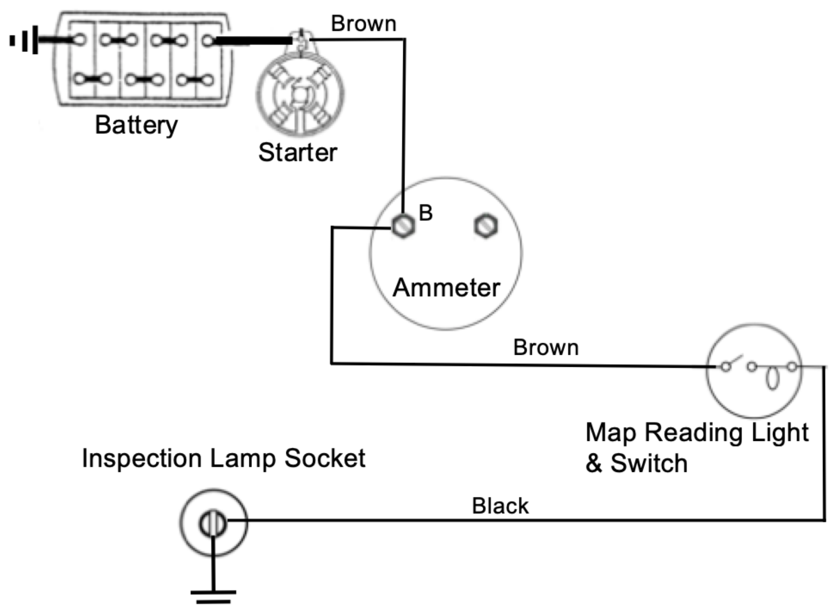
Ignition On or Off: On
Switch Settings: N/A



Map Light with 30 MPH Warning Light – Variations 1 and 4

Power Source: Battery

Ignition On or Off: Either
Switch Settings: Map Reading Light Switch: On



Optional Circuits

Directional Indicator Lights and Stop Lights

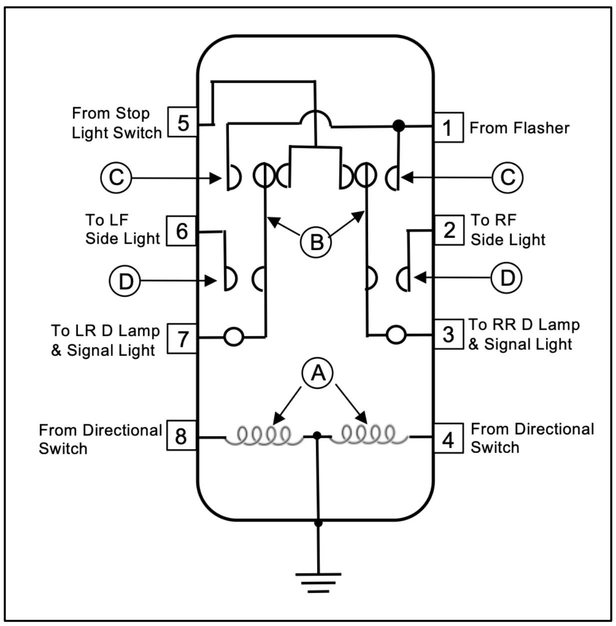
Directional Indicator Lights (Turn Signals) were first added to a TC by the factory with the EXU model. Retro fitting the older TCs with this option requires some modifications to the car and a fair amount of new electrical wiring. It is, however, a very common practice. To perform this modification requires the following new items:

- Replacing the front side lights sockets with ones that accept a double filament
- Adding a second D-Lamp
- Adding rear turn signal lamps
- Adding the DB10 Directional Relay
- Adding a Flasher Unit
- Adding a Directional Switch

Before we look at the Directional Indicator circuit, we need to understand how the Relay and the Flasher units work.

The DB10 Directional Relay Internals

The Directional Relay controls the stop lights and which directional (turn signal) lights flash when the Directional Switch is set to either right- or left-hand turn. The EXU models had dual relays, one for left hand and one for right hand. The modern equivalent is the DB10 Eight Post Directional Relay unit controlling both right- and left-hand turns. Originally these units were mechanical, that is, they used coiled relays like the Control Box, but today's version is all solid-state. Regardless of mechanical or solid-state, it works the same way. The only real difference is that you cannot repair the solid-state versions, if it goes bad just throw it away.



Inside the box there are:

- Two Magnetic Coils (A)
- Two Moveable Armature (B)
- Stop Light Contacts (C), and
- Directional Light Contacts (D)

Directional Relay Circuits

Power for the relay comes from four separate sources:

- The Flasher (1),
- The Stop Light Switch (5),
- The Right Hand Turn Directional Switch (4), and
- The Left Hand Turn Directional Switch (8)

All four act independently, and if one should fail, the others can continue to work.

There are four outputs,
- The Right Front Side Light (2),
- The Right Rear Stop (D-Lamp) and Signal Light (3),
- The Left-Hand Front Side Light (6), and
- The Left-Hand Rear Stop (D-Lamp) and Signal Light (7)

Note: For the rear Stop and Signal Light connections (3 & 7) there is only one wire for both the Stop and Signal Lights. Thus, the same wire is connected to both the Stop (D-Lamp) and Signal Light. Because of this, the Stop Light and the Rear Signal Lights act as both Stop Lights and Turn Signal Lights.

When power enters the relay from the Directional Switch to either connection 4 or 8, the coils wound around the corresponding iron core will become magnetized. This magnet will then pull its matching Moveable Armature (B) away from its "at rest" state (shown in the above diagram) and will make contact with both the Stop Light (C) and Directional Light (D) contacts (left or right). When contact is made, this will complete the circuit for the Flasher to send power through connection 1, across the Moveable Armature (B) and out to both the Front Side Lamp (2 or 6) and Stop and Signal Lamps (3 or 7).

Looking at the diagram above, you will notice that the Stop Light Contacts (C) are always connected regardless of the position of the Moveable Armature (B). When the Turn Signals are activated, and the Moveable Armature (B) is moved from its "at rest" position to signal a turn, the Stop Light disconnects from the Stop Light Switch power and reconnects to the new contact with power from the Flasher. This will cause the Stop Light on that side of the car to blink. Basically, turning it into a Directional Light. The Stop Light for the other side will still continue to be powered from the Stop Light Switch and will thus behave as a "normal" Stop Light.

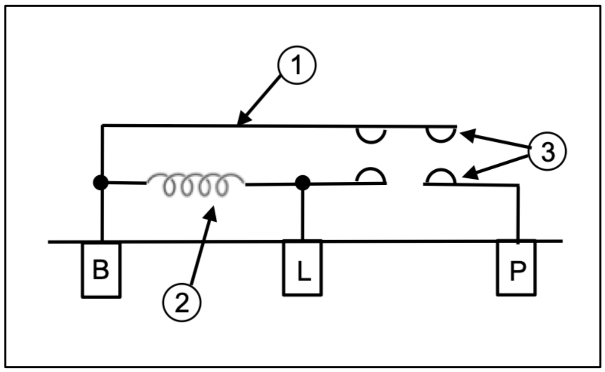
The Flasher Unit

The Flasher Unit is a simple electro-mechanical device that turns a circuit on and off through the use of heat. In the diagram there are three connections:

- B – for Battery
- L – for Load, and
- P – for Panel

Inside the Flasher there is the Tension Spring Blade (1), a Heating Coil (2) and two sets of Contacts (3).

When the Directional Switch is set to either a right- or left-hand turn, it completes a circuit from A4 of the Control Box to the B connection through the Coil (2) and out the L connection to a ground. When this happens the Coil heats up, which then heats the Tension Spring Blade (1) causing it to bend and bringing the Contacts (3) together. Once this occurs the electricity will take the path of least resistance bypassing the Coil sending power to both the L and P outputs. These in turn will send power to both the Directional Signal Lights (L) and the bulb on the Directional Switch (P).



Without power through the Coil it will cool which in turn allows the Tension Spring Blade to cool resulting in it snapping back making a clicking sound and disconnecting the Contacts (3). The power will then return to the Coil (2) and the entire cycle repeats itself yielding the clicking and blinking light effect.

MGTC Electrical Circuits

Directional Indicator Circuits

Power Source: Battery and/or Generator

Ignition On or Off: On

Switch Settings:	Directional Switch:	Left or Right Turn and/or
	Stop Light Switch:	Brakes Applied

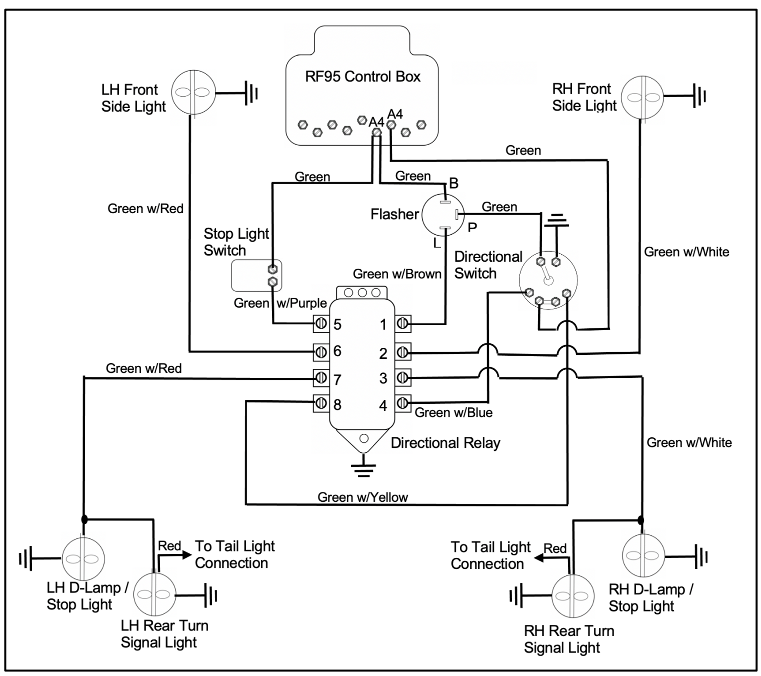
There are actually three separate but integrated circuits represented in this diagram, one for the Stop Lights and two for the Directional Lights. As a note, the color scheme follows the MGA, where the DB10 was first used and not the "EXU".

The Stop Lights

For the stop lights, power begins at the A4 connection of the RF95 Control Box, just as it does for the normal Stop Light circuit. It then continues to the Stop Light Switch, but instead of going straight to the D-Lamp it attaches to the Directional Relay at connection 5. From there it flows through the Relay and out connections 3 and 7 to the right- and left-hand D-Lamps and rear Turn Signal Lights.

The Directional Lights

The Directional Lights begins again at A4 on the Control Box, then on to the Directional Switch. When the Switch is turned to indicate a right- or left-hand turn, power exits the switch and connects to the Directional Relay at 4 for a right-hand turn or 8 for a left-hand turn. This results in the Moveable Armature moving and completing a circuit for the Flasher unit, which starts at A4 on the Control Box, then to connection B on the Flasher and out both connection L and P.



The P circuit continues to the Directional Switch where it powers the indicator light. The L circuit enters the Relay at connection 1 where it flows through the relay and out both 6 and 7 for a left-hand turn or 2 and 3 for a right-hand turn.

Appendix

Used Wire Number and Colors by Wire Number

You will note that the Early Color Chart used the wording of "and" as in "Red & White", while the Revised set use "With" as in "Blue w/Red". Not sure if this is meaningful or not.

Revised Colors

Nbr	Color
1	Blue
2	Blue w/Red
4	Blue w/White
9	White
16	White w/Black
17	Green
22	Green w/Purple
24	Green w/Black
25	Yellow
29	Yellow w/Green
33	Brown
36	Brown w/ Blue
37	Brown w/White
41	Red
42	Red w/Yellow
44	Red w/White
49	Purple
56	Purple w/Black
57	Black

Early Colors

Nbr	Color
1	Red
2	Red & Yellow
3	Red & Blue
7	Red & Black
8	Yellow
12	Yellow & Purple
13	Yellow & Black
14	Blue
15	Blue & White
18	Blue & Purple
20	White
22	White & Brown
23	White & Purple
24	White & Black
28	Green & Black
31	Purple
32	Purple & Black
33	Black

Colors Used in Circuits – Early Colors

By Colors

Nbr	Color		Circuits
1	Red		Side and Tail Lights
2	Red & Yellow		Fog Lamp
3	Red & Blue		30 MPH Warning Light
7	Red & Black		Headlights (Dip)
8	Yellow		Charging and Auxiliary Power Ignition Warning Light
12	Yellow & Purple		Horn
13	Yellow & Black		Charging and Auxiliary Power Inspection Socket Map Light Clock
14	Blue		Headlights (Main) Dash Lights
15	Blue & White		Headlights
18	Blue & Purple		Petrol Warning Light
20	White		Ignition Ignition Warning Light Petrol Pump
22	White & Brown		Ignition
23	White & Purple		Charging and Auxiliary Power
24	White & Black		Charging and Auxiliary Power
28	Green & Black		Charging and Auxiliary Power
31	Purple		Stop Light Horn
32	Purple & Black		Stop Light Petrol Warning Light Screenwiper Motor 30 MPH Warning Light
33	Black		Earth on numerous circuits

Colors Used in Circuits – Early Colors

By Circuit

Circuit	Nbr	Color
30 MPH Warning Light	3 32	Red & Blue Purple & Black
Charging and Auxiliary Power	8 13 23 24 28	Yellow Yellow & Black White & Purple White & Black Green & Black
Clock	13	Yellow & Black
Dash Lights	14	Blue
Earth on numerous circuits	33	Black
Fog Lamp	2	Red & Yellow
Headlights (Main and Dip)	7 14 15	Red & Black Blue Blue & White
Horn	12 31	Yellow & Purple Purple
Ignition	20 22	White White & Brown
Ignition Warning Light	8 20	Yellow White
Inspection Socket	13	Yellow & Black
Map Light	13	Yellow & Black
Petrol Pump	20	White
Petrol Warning Light	18 32	Blue & Purple Purple & Black
Screenwiper Motor	32	Purple & Black
Side and Tail Lights	1	Red
Stop Light	31 32	Purple Purple & Black

Colors Used in Circuits – Revised Colors

By Color

Nbr	Color		Circuits
1	Blue		Headlights
2	Blue w/Red		Headlights (Dip)
4	Blue w/White		Headlights (Main)
9	White		Ignition Ignition Warning Light Petrol Pump
16	White w/Black		Ignition
17	Green	 (1) (2)	Stop Light Petrol Warning Light Screenwiper Motor 30 MPH Warning Light Directional Indicators
18	Green w/Red	(2)	Directional Indicators
19	Green w/Yellow	(1) (2)	30 MPH Warning Light Directional Indicators
20	Green w/Blue	(2)	Directional Indicators
21	Green w/White	(2)	Directional Indicators
22	Green w/Purple		Stop Light
23	Green w/Brown	(2)	Directional Indicators
24	Green w/Black		Petrol Warning Light
25	Yellow		Charging and Auxiliary Power Ignition Warning Light
29	Yellow w/Green		Charging and Auxiliary Power
33	Brown		Charging and Auxiliary Power Inspection Socket Map Light Clock
36	Brown w/Blue		Charging and Auxiliary Power
37	Brown w/White		Charging and Auxiliary Power
41	Red		Side and Tail Lights
42	Red w/Yellow		Fog Lamp
44	Red w/White		Dash Lights
49	Purple		Horn
56	Purple w/Black		Horn
57	Black		Earth on numerous circuits

(1) Variation 4 only
(2) Optional Circuit

MGTC Electrical Circuits

Colors Used in Circuits – Revised Colors

By Circuit

Circuit		Nbr	Color
30 MPH Warning Light	(1)	17 19	Green Green w/Yellow
Charging and Auxiliary Power		25 29 33 36 37	Yellow Yellow w/Green Brown Brown w/Blue Brown w/White
Clock		33	Brown
Dash Lights		44	Red w/White
Directional Indicators	(2)	17 18 19 20 21 23	Green Green w/Red Green w/Yellow Green w/Blue Green w/White Green w/Brown
Earth on numerous circuits		57	Black
Fog Lamp		42	Red w/Yellow
Headlights (Main and Dip)		1 2 4	Blue Blue w/Red Blue w/White
Horn		49 56	Purple Purple w/Black
Ignition		9 16	White White w/Black
Ignition Warning Light		9 25	White Yellow
Inspection Socket		33	Brown
Map Light		33	Brown
Petrol Pump		9	White
Petrol Warning Light		17 24	Green Green w/Black
Screenwiper Motor		17	Green
Side and Tail Lights		41	Red
Stop Light		17 22	Green Green w/Purple

(1) Variation 4 only
(2) Optional Circuit

Cross Reference of Revised and Early Used Colors

The first two columns in the chart below are the wire color codes and their numbers shown in the wiring diagrams above. The last two columns are the equivalent colors and numbers used by the early cars for those same wires.

Revised Colors			Early Color Equivalent	
Nbr	**Color**		**Nbr**	**Color**
1	Blue		15	Blue & White
2	Blue w/Red		7	Red & Black
4	Blue w/White		14	Blue
9	White	(1)	20	White
16	White w/Black		22	White & Brown
17	Green		32	Purple & Black
22	Green w/Purple	(2)	31	Purple
24	Green w/Black		18	Blue & Purple
25	Yellow	(1)	8	Yellow
29	Yellow w/Green		28	Green & Black
33	Brown		13	Yellow & Black
36	Brown w/ Blue		24	White & Black
37	Brown w/White		23	White & Purple
41	Red	(1)	1	Red
42	Red w/Yellow	(1)	2	Red & Yellow
44	Red w/White		14	Blue
49	Purple	(1)	31	Purple
56	Purple w/Black		12	Yellow & Purple
57	Black	(1)	33	Black

(1) These colors actually line up old to new
(2) Purple was used in the old scheme for both Purple and Green w/Purple

RF95 Relay Harness Connections – Var 3 & 4

Nbr	Color		From	To
36	Brown w/Blue		L&I Sw– A	RF95 – A1
37	Brown w/White		Ammeter – A (2)	RF95 – A
49	Purple		Horn	RF95 – A2
29	Yellow w/Green		Generator – F	RF95 – F
25	Yellow		Generator – D	RF95 – D
25	Yellow		Ignition Light	RF95 – D
17	Green		Fog Light Sw	RF95 – A4.1
17	Green		Stop Light Sw	RF95 – A4.1
17	Green	(1)	Flasher Unit – B	RF95 – A4.1
17	Green	(1)	Directional Sw	RF95 – A4.2
57	Black		HP&D Sw – Ground Lug	RF95 – E
57	Black		Petrol Pump	RF95 – E
57	Black		Ground – Brake 3 Way Conn.	RF95 – E
9	White		Coil	RF95 – A3
9	White		L&I Sw – IG	RF95 – A3

(1) These connections are only there if the harness includes wiring for turn signals
(2) Positive ground system. For Negative ground use B side

Note: Despite the schematic layouts in numerous documents, there is no dedicated green and/or black line in the harness for the screenwiper motor.

HP&D Sw: Horn Push & Dipper Switch
L&I Sw: Lighting & Ignition Switch

MGTC Electrical Circuits

Behind the Dash Main Harness Connections – Var 3 & 4

Basic connections without Turn Signals

Nbr	Color		From	To
37	Brown w/White		RF95 – A	Ammeter – A (3)
33	Brown		Starter	Ammeter – B (4)
42	Red w/Yellow		Fog Light	Fog Light Sw
17	Green		RF95 – A4.1	Fog Light Sw
2	Blue w/Red		Headlight – Dip	HP&D Sw – D
57	Black		RF95 – E	HP&D Sw – Ground Lug
1	Blue	(1)	L&I Sw – H	HP&D Sw – H
4	Blue w/White		Headlight – Main	HP&D Sw – M
56	Purple w/Black		Horn	HP&D Sw – P
25	Yellow		RF95 – D	Ignition Warning Light
36	Brown w/Blue		RF95 – A1	L&I Sw – A
1	Blue	(1)	HP&D Sw – H	L&I Sw – H
9	White		RF95 – A3	L&I Sw – IG
41	Red		Left Front Side Lamp	L&I Sw – T
41	Red	(2)	Left Rear D-Lamp	L&I Sw – T
41	Red		Right Front Side Lamp	L&I Sw – T
41	Red		Right Rear D-Lamp	L&I Sw – T
24	Green w/Black		Petrol Sending Unit	Petrol Warning Light

(1) The blue wire actually loops in the main harness with both ends emerging at the "Behind the Dash" location
(2) Optional Circuit – second D-Lamp
(3) Positive ground system. For Negative ground use A side
(4) Positive ground system. For Negative ground use B side

Note: Despite the schematic layouts in numerous documents, there is no dedicated green and/or black line in the harness for the screenwiper motor. See Sub Harness below.

HP&D Sw: Horn Push & Dipper Switch
L&I Sw: Lighting & Ignition Switch

Behind the Dash Turn Signals Connections – Var 3 & 4

In addition to the connections listed above for Behind the Dash, the following are included in the harness when using turn signals.

Wires from the "Behind the Dash" end

Nbr	Color		From	To
20	Green w/Blue		DB10 – 4	Directional Sw
19	Green w/Yellow		DB10 – 8	Directional Sw
17	Green	(1)	Flasher – P	Directional Sw
57	Black	(2)	Ground	Directional Sw
17	Green		RF95 – A4.2	Directional Sw

(1) This is normally a modern plastic covered wire.
(2) This wire is not in the harness and will have to be supplied.

Wires from the "DB-10 Relay" end

Nbr	Color		From	To
23	Green w/Brown		Flasher – L	DB10 – 1
21	Green w/White	(1)	Right Front Side Lamp	DB10 – 2
21	Green w/White	(1)	Right Rear D-Lamp	DB10 – 3
20	Green w/Blue		Directional Sw	DB10 – 4
22	Green w/Purple		Stop Light Sw	DB10 – 5
18	Green w/Red	(1)	Left Front Side Lamp	DB10 – 6
18	Green w/Red	(1)	Left Rear D-Lamp	DB10 – 7
19	Green w/Yellow		Directional Sw	DB10 – 8

(1) These colors follow the schematic in the Brown Book for the TC EXU model. However, modern harnesses may also use:

- 14 – White w/Purple left rear
- 15 – White w/Brown right rear
- 18 – Green w/Red left front
- 21 – Green w/White right front

These were the colors used by the TD employing the DB10 Relay.

Wires from the "Flasher" outlet

Nbr	Color		From	To
17	Green		RF95 – A4.1	Flasher – B
23	Green w/Brown		DB10 – 1	Flasher – L
17	Green	(1)	Directional Sw	Flasher – P

(1) This is normally a modern plastic covered wire.

Behind the Dash Sub-Harness Connections – Var 3 & 4

Included in the Sub Harness

Nbr	Color		From	To
44	Red w/White		Dash Lights	Dash Light Switch
9	White		L&I Sw – IG	Ignition Warning Light
33	Brown		Ammeter – B (2)	Inspection Light Socket
57	Black		Numerous	Numerous
41	Red		L&I Sw – T	Panel Light Switch
19	Green w/Yellow	(1)	Speedometer	Right Hand Map Light

(1) Variation 4 only
(2) Positive ground system. For Negative ground use A side

Not included in the Sub Harness. You will have to supply these yourself.

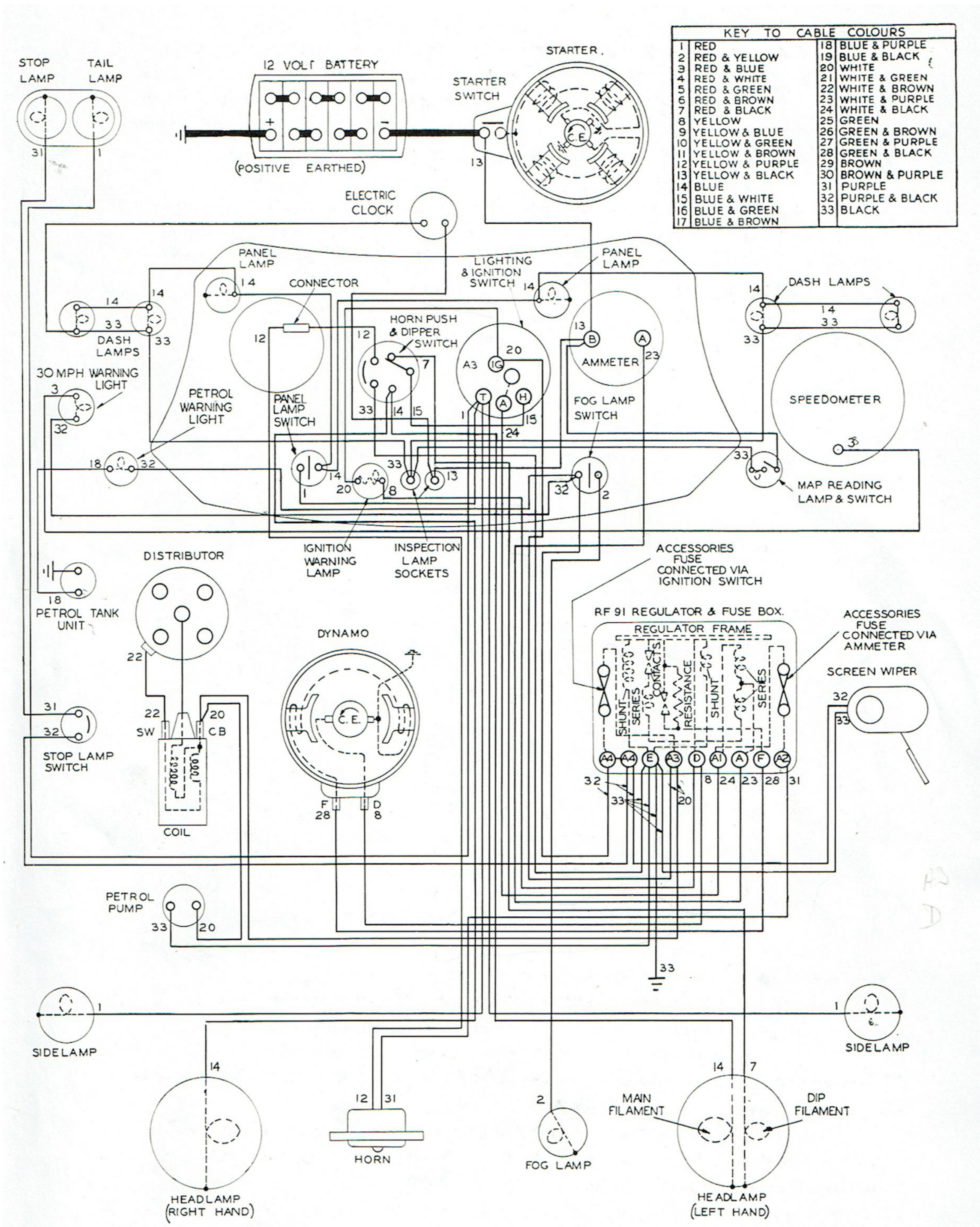
Nbr	Color		From	To
57	Black		Clock	Ground
57	Black		Map Reading Lights	Ground
57	Black		Screenwiper Motor	Ground
33	Brown		Clock	Inspection Socket
33	Brown		Ammeter – B (2)	Map Reading Light(s)
17	Green		Fog Light Switch	Petrol Warning Light
17	Green	(1)	Screenwiper Motor	Power

(1) The schematic shows this being connected to RF95 – A4.2. The most convent place I found was the Inspection Light Socket.
(2) Positive ground system. For Negative ground use A side

HP&D Sw: Horn Push & Dipper Switch
L&I Sw: Lighting & Ignition Switch

Wiring Diagram Variation 1

Early color codes, single dip filament on left side, and 30 MPH warning light.



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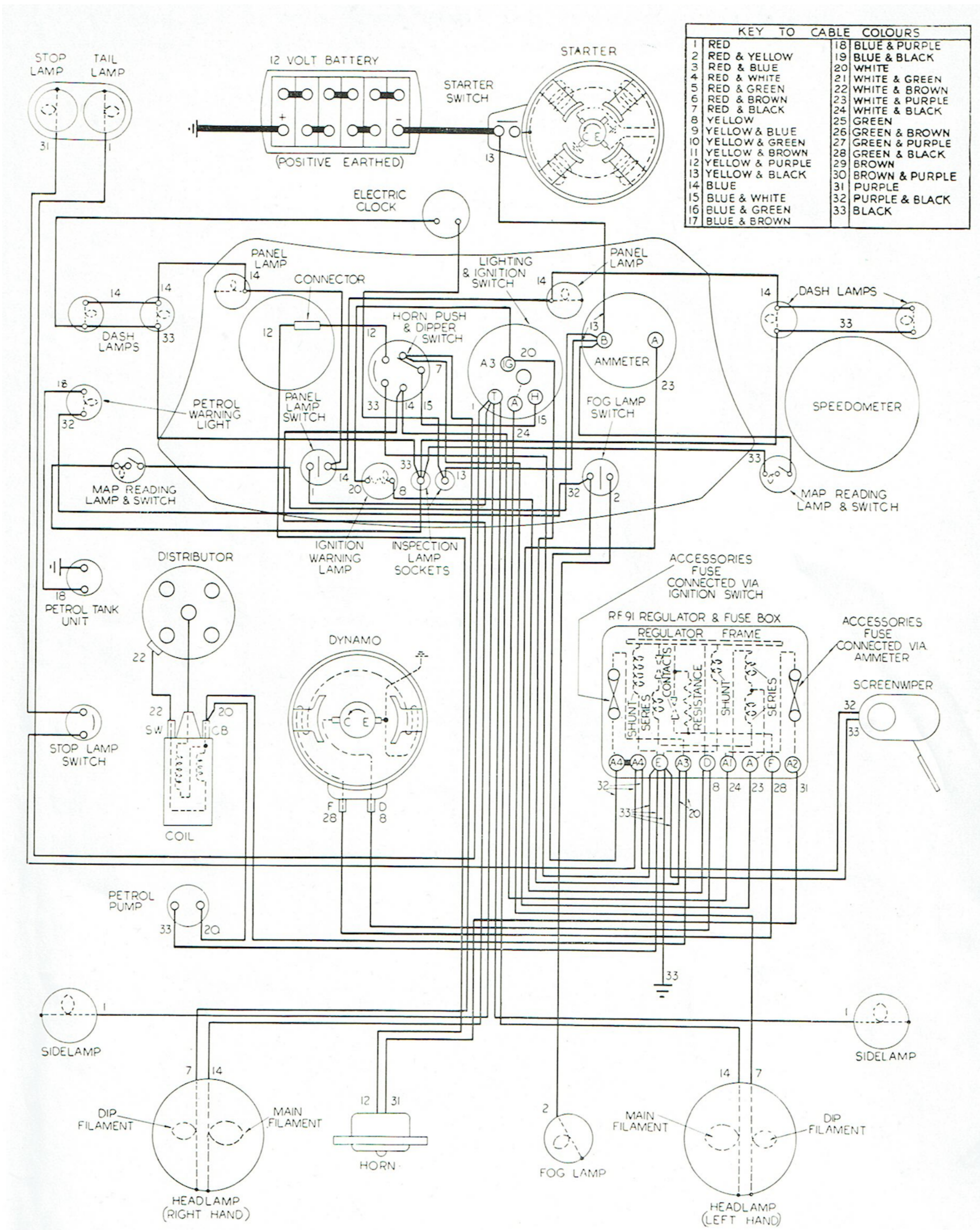
Wiring Diagram Variation 2

Early color codes, dual dip filament, and no 30 MPH warning light.



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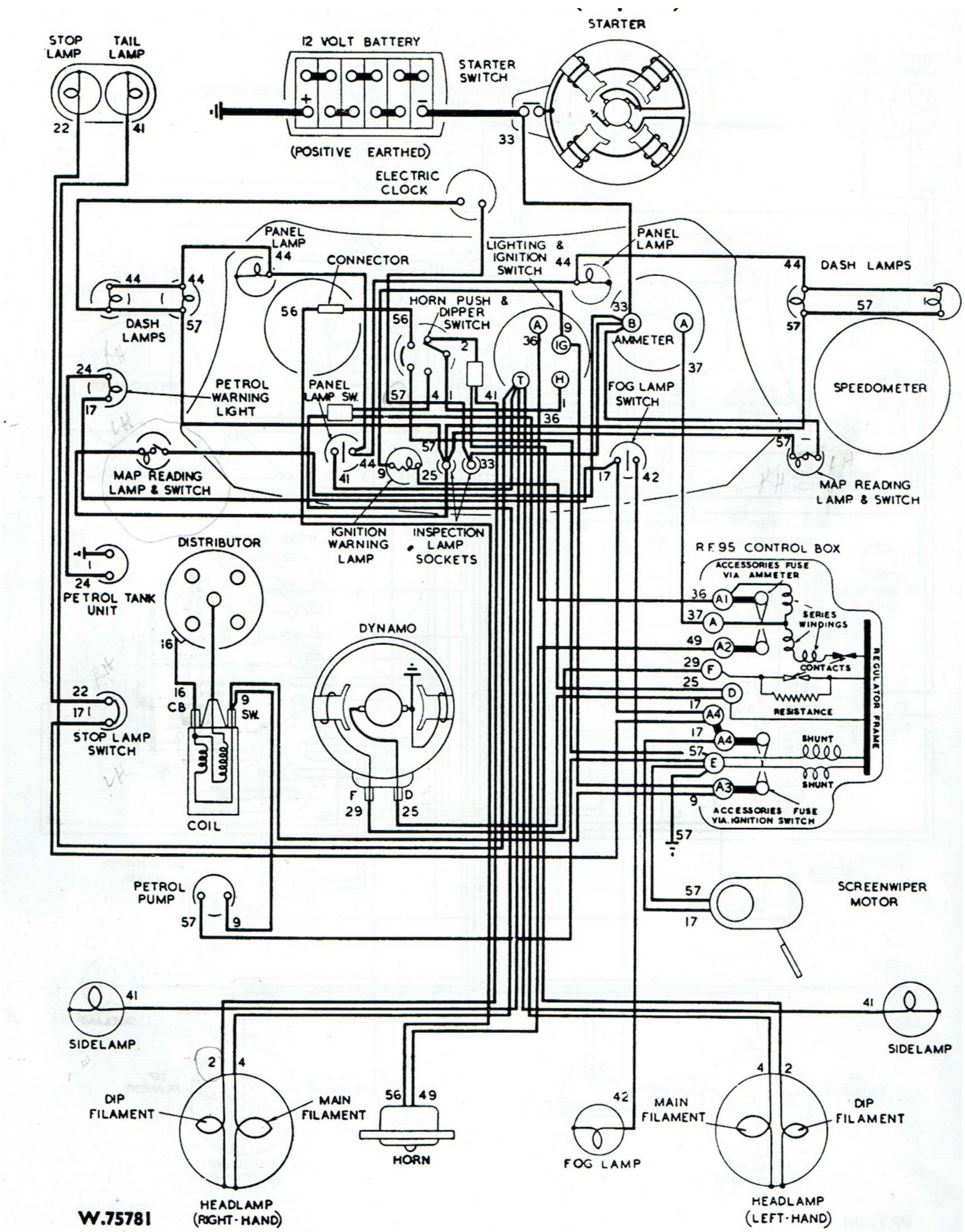
Wiring Diagram Variation 3

Revised color codes, dual dip filament, and no 30 MPH warning light.



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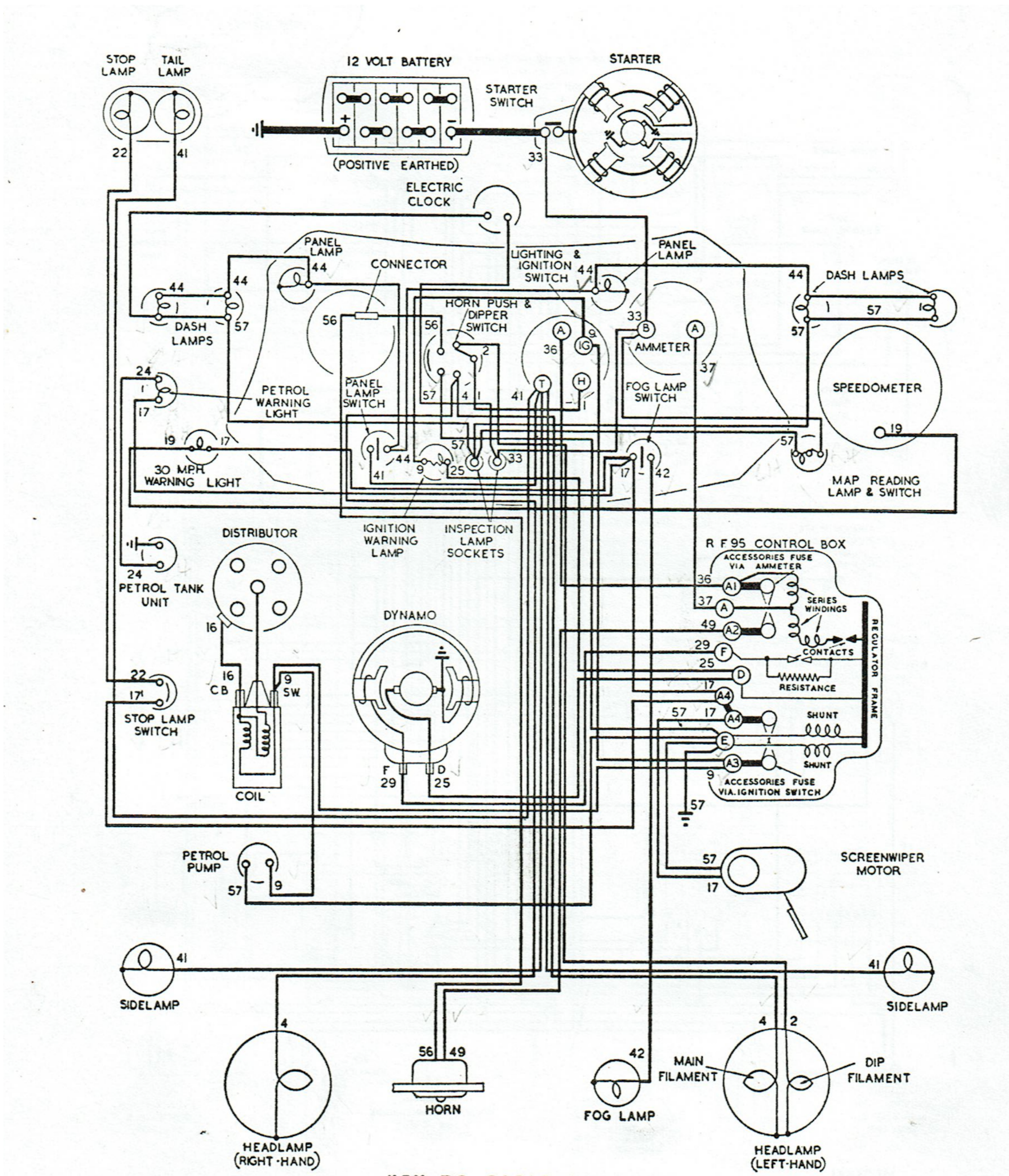
Wiring Diagram Variation 4

Revised color codes, single dip filament on left side, and 30 MPH warning light.



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Switching from Positive to Negative Ground

All the wiring diagrams in this document assume a positive ground system and all components, with the exception of the battery, Ammeter, and generator are NOT sensitive to polarity. However, several new items including LED lights and Pertronix ignition are and will have to be replaced prior to switching polarity.

To change to a negative system, do the following:

1. Dis-connect the battery and turn it around, do no re-connect at this time.
2. Flip the connections on the Ammeter of the Brown (33) and Brown w/White (37) wire so Brown attaches to the "A" side and the Brown w/White to the "B" side. The other Brown (33) connections can stay on the "B" side or be moved to the "A" side.
3. Re-connect the battery.
4. Using a length of wire, re-polarize the generator by connecting one end to the "F" lead on the generator and then touch the other end to the negative side of the battery. It should produce a small spark.