

WIRING CONVERSION MGF/TF EPAS STEERING COLUMN & STALK CONTROLS TRANSPLANT TO LATE UK MGB

EPAS description

The EPAS system in the MGF/ TF is simple and reliable. It is more resilient, less prone to failure and far easier to work on than some other EPAS systems. The column contains 2 active electrical parts, a motor and a separate sensor unit. The column wires then run to a separate EPAS ECU which can be mounted elsewhere in the car. In brief the ECU has inputs for +12 volts, earth, road speed and engine speed and the position sensor on the column. It uses these to control a clutch and a motor on the column itself. When the system is transplanted into a different car you will need to replicate the engine speed input as an absolute minimum (it won't run at all without this). There should also be some way of controlling the amount of power assistance it provides at different speeds to ensure assistance at parking speeds but not at high road speeds.

The EPAS ECU needs 2 separate positive 12 volt + connections; a heavy unswitched feed that is permanently live, This can draw up to 30amps at peak use, it needs heavy 3mm wire and it's own fuse and may be best connected to the battery or the battery feed to the starter motor or alternator, heavy stuff. The other live feed can be picked up from any circuit that is live with the ignition. It doesn't need heavyweight wiring as it only runs the electronics in the ECU, quite a light current demand.

In situ the EPAS ECU has a road speed signal to pin 7 of the ECU's #2 connector. [This is Pink/Blue on early MGF ECUs, white/orange on later MGFs & TFs] On early cars this was driven by a reed switch in the mechanical speedo cable, later cars were fed from a gearbox sensor via the car's main ECU.

Two independent torque signals are picked up from the sensor on the column to the EPAS ECU.

When, from the torque sensor signals, the EPAS ECU detects a steering input, it applies the main + 12 volt supply to the EPAS motor. For a right turn, it applies positive to the brown/blue wire and negative to the brown/red wire. It's the other way round for a left turn. The EPAS ECU can apply anything between 0.5 volts up to 12 volts to control the strength of power assistance it provides.

The motor also incorporates a clutch. This only engages when the EPAS is in use and it will disengage if a fault is detected, which also illuminates the EPAS warning lamp in the instrument cluster. Fault codes can be read using Rover's TestBook or PSCACN. (This feature can be kept when transplanting the EPAS to a different car by installing an OBD2 port)

Usual faults

Possible causes for EPAS clutch disengagement or reduced power assistance include; blown main 70 Amp Fuse
Electric Motor overheat (Repeated turning lock to lock) . The ECU senses high demand and will reduce the current available for steering assistance to prevent permanent damage to the EPAS motor.)

Engine racing. If the engine speed is in excess of 2500 rev/min for 30 seconds and no vehicle speed is detected, the EPAS ECU suspects a fault with either the engine speed sensor or the road speed sensor and disengages the clutch. (In a transplant scenario this would happen if the simulated engine speed signal is too high)

If the battery voltage is too low the EPAS clutch can disengage and warning lamp illuminated. Low battery voltage may also cause steering wheel loads to increase as there is less power available to the EPAS motor.

Rewiring the stalk switches.

It is simpler to use the MGF/ TF stalk switches and steering wheel rather than the engineering that would be required to reuse the MGB stalks on the MGF column. Some wiring changes are required but this is simple point to point wiring using the tables below. The only exception is the horn which requires a basic automotive relay to be added due to the fine wires in use in the steering column. Note headlamp arrangement also.

Wash wipe stalk

Though the MGF switch is made to switch the opposite polarity here in the MGB this proved very simple to work around by following this wiring guide & even several of the colours matched.

MG F/ TF switch wire colour	MGB car wiring colour	Function
Green/Slate [GS]	Black	Earth.
Also connect this to the Black wire from the horn switch		
Black (heavy) [B]	Green	+ 12v from ignition switch etc
Light Green/ Black [LGB]	Light Green/ Black	To Washer pump. Applies - voltage
Red/Light Green [RLG]	Red/ Light Green	Slow speed wiper Applies + voltage
Blue/Light Green [ULG]	Blue/ Light Green	Fast speed wiper applies + voltage. Also works on single wipe flash
Light Green/Purple [LGP]	Brown/Light Green (park to motor)	Connects to (MGF) RLG wire when OFF or INT only
Light Green/Green [LGG]	not used (would require a timer to enable this function)	Intermittent. Applies a - voltage for a delay unit when switch @ intermittent only

Position OFF (switch off, arms not parked)

Park function (2 on switch) connected to Low Speed (6 on switch)

Power supplied by green at motor. Motor runs

Position OFF (switch off, arms parked).

Power from green at motor is cut off.

Position LOW. Power from 4 at switch connected to 6 at switch (low speed) Motor runs

Position HIGH Power from 4 at switch connected to 8 at switch (high speed) Motor runs

MGB wiper wiring & function (reference only)

2 - Brown/Light Green (park) 4 - Green (12 volt fused power) 6 - Red/Light Green (low speed)

8 - Blue/Light Green (high speed)

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MGB Lighting switch to MGF stalk

This does away with the need for the separate off/ on/ sidelight switch in the side of the late MGB's steering cowling as that function is now included in the MGF / TF stalks

MG F/ TF switch wire colour	function	MGB switch wiring colour
Brown [N] heavy x 3	+ power in (battery unswitched)	Brown
Red [R] heavy	Sidelights, panel illumination. (live at position 2 and 3)	Red/ Green
Not used.(Connect to Blue on MGB stalk connector for neatness)	Was output to MGB hi/lo stalk switch but not used on this	Blue

MGB Lighting stalk to MGF stalk

MG F/ TF stalk wire colour	function	MGB car wiring colour
Red [R] heavy	Side lights & rear + out	
Blue/Pink [UK] heavy	Low headlamp + (live at position 3). (Stays live irrespective of high/low switch position)	Blue/Red low beam. No relay required to turn off the dipped beams when high is selected as LEDs will automatically cater for this.
Blue/White [UW] heavy	High headlamp + (live only when position 3 AND switched to MAIN . Also goes live on flash) [irrespective of other switch functions]	Blue/ White for high beam
Not used.(Connect to Blue on MGB light switch connector for neatness)	Was feed from MGB light switch to stalk switch, now not used	Blue
Not used on stalk (use this on horn relay now)	Other + feed for flasher. As this not needed with MGF stalks it instead is used as a + supply to the new horn relay's coil	Purple

Please note. This setup will now run both dipped and high beam simultaneously when high beam is selected on the stalk. This was acceptable to me as I am using a type of LED headlamp that automatically disables dipped beam when high beams are used. If the headlamps you are using though cannot allow dipped and high beams to be run at the same time then it will be necessary to add a relay to disconnect the dipped beams whenever the high beams are on.

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Indicator stalk

This one is very straightforward

MG F/ TF switch wire colour	function	MGB car wiring colour
Light Green/Brown	common	Light Green/Brown
Green/Red	Left indicator output	Green/Red
Green/White	Right indicator output	Green/White

There is no need to change the wiring of the complex MGB hazard light switch. It may be an opportunity though to replace the original 2x flasher relays for indicators & hazards with 2 modern, non current dependant flasher relays as these are more reliable and will allow the use of LED replacement indicator bulbs at any future point.

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Horn switch

This is pretty much the only stalk circuit that requires special attention. You must introduce a new simple relay for the horn as the wiring from the MGF steering wheel buttons is delicate and is not capable of switching the full current demanded by the horns.

Wire colour	function	Connects to
[MGF connector] Purple (thin)	button to - relay coil	New relay, connection 86
[MGF connector] Black (thin)	button to earth	Green/Slate wire on MGF Wiper stalk (or any earth point)
MGB connector Purple (heavy) repurposed from MGB lighting connector as otherwise unused now	(unswitched + feed to relay coil)	New relay, connection 85
[MGB connector] [Purple/Black]	+ feed for horn	New relay, connection 30
[MGB connector] Black	Output to horns	New relay, connection 87

There is no way to run the horns other than by adding a relay. If you don't want to introduce a relay for some reason then you will need to mount a separate heavy duty horn button on the dash and wire it separately .

DO NOT use the MGF /TF steering wheel horn buttons without a relay.

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Ignition switch

Only 4 basic wires are needed to replicate the MGB's ignition switch function. Wire colours differ between the switch and the loom wiring on both the MGB and MGF so both are listed for clarity (reference is to UK spec 1979 MGB GT).

MGF loom colour	MGF switch colour	Connector plug	Function	Live poss	MGB loom colour	MGB switch colour
Brown/White [N/W] Heavy	White/black heavy	Large	Main + feed from battery / fuse		Brown	Brown
Brown/Purple [N/P] Heavy	White heavy	Large	2 nd + feed from battery / fuse <u>Join to above</u>		Brown As above	Brown
-	White/Red [WR] 3mm	small	Accessory circuit; radio etc.	1 + 2	White/Green	Green
-	Black/Yellow heavy	Small	Ignition circuit etc.	2 + 3	White	White
White/Red [WR] 2mm	Black/white	Large	Starter circuit	3 only	White/ Red	Red
White/Light Green [WLG]	White/ blue	Large	Live on Run (but not required)	2 only	Not used	
-	Yellow	Small	Live on Run (but not required)	2 only	-Not used	
-	-	-	US spec only. Run on valve	0 + 1	Not Required	Slate (grey)
-	-	-	US spec only Goes to earth when key removed	0	Not Required	Purple
Purple/Red thin [PR]	purple	Large	One side of 5w illumination	-	Not used	
-	purple	Small	Other side 5w illumination	-	Not used	

The MGF switch and it's wiring is heavier duty than the MGB switch so there is no issue. I chose to introduce a large 70Amp in line fuse into the brown feed to the ignition switch, near the connector, to provide additional protection.

Some of the wires on the MGF ignition switch will not be used. These can be cut off near the switch and covered with heat shrink insulation, to simplify things.

The MGF switch has 2 block connectors, referred to above as 'small' and 'large'. Some wire colours are used twice (namely white/red) so it is best to label the wires with which connector they were from, small or large, just to make very sure the wires cannot be confused.

Because there is no socket for the 'small' MGF connector you will probably choose to cut off both the MGF connectors and wire into the original MGB plug instead. [I took a different route, reusing the large MGF connector but this was more work and I would advocate using the MGB connector]

EPAS connections

The EPAS column requires brackets to be made up, which I have covered elsewhere. The EPAS ECU is separate from the column so can be mounted elsewhere in the car with wiring between it and the column. I chose the passenger bulkhead for this, mounted behind where the glovebox fits,. This made use of an existing bolt, that also provided a handy earthing point. A small hole and a self tapper a couple of inches below this made a the 2nd mounting point. In this position the back of the ECU is against a larger oblong rubber bung hence securing it in 2 points on one side only is fine. The only label is on the back, which cant be seen without removal so I wrote it's part number of the front of the ECU in permanent marker for easy reference should it ever need to be replaced in the future.

Power

There are 2 power supplies for the EPAS.

Brown wire to the EPAS ECU needs a permanent unswitched + live. This has a large peak current demand (can peak at 30amps) so should use good 3mm heavy wire and it should have an in line fuse.

Green wire to the EPAS ECU needs a switched + that comes on with the ignition. This does not have a high current demand as it just runs the electronics in the ECU.

Earth is provided by a black wire from the EPAS ECU to any convenient earth point. This should be 3mm cable.

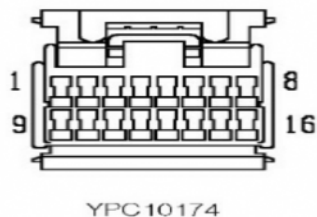
Connectivity

EPAS ECU plug #1 (The motor wiring)

EPAS module wire colour	Function/ to	notes
Brown (heavy) [N]	Unswitched + 12 volt supply	Needs a 3mm wire and in line fuse
Black (heavy) [B]	Unswitched – negative	Needs earthing point
Brown/Red (heavy) [NR]	To motor	Interconnect to column
Brown/ Blue (heavy) [NU]	To motor	Interconnect to column

The EPAS ECU requires heavy duty wiring, both to the motor and for the new positive and negative main supply, of the correct current carrying capacity.

EPAS ECU plug #2 (the sensor and control wiring)



EPAS module wire colour	Function/ to	Function note
1 Green [G]	Ignition switched (position 2) + 12 v	Also use as the switched + supply to the signal generator (plus the warning light+ if used)
2 Yellow/ Green/ [YG]	Warning light – output becomes earthed when light active)	(Note this wire function is Pink/Blue on later MGFs / TFs)
3 Orange [O]	To column sensor	
4 Orange/Blue [OU]	To column sensor	
5 Orange/ Yellow [OY]	To column sensor	
6 empty		
7 Pink/Blue [KU]	Road speed sensor	Note this wire is White/Orange on later MGFs / TFs)
8 Blue/Pink [UK]	To Motor (clutch -)	-V to engage EPAS clutch
9 Pink [K]	To diag socket only	Output to OBD2 diagnostic socket if used
10 White/black [WB]	Engine speed signal	Needs 50Hz signal to simulate engine running
11 Orange/White [OW]	To column sensor	
12 White [W]	To column sensor	
13 Blue/Green [UG]	To column sensor	Connects to cable shielding near ECU also
14 empty		
15 empty		
16 blue/ slate [US]	To Motor (clutch +)	+V to engage EPAS clutch

Where the above mentions different wire colours used between early and late EPAS ECUs it is better to refer to pin numbers as these didn't change, only the colours.

EPAS Steering column Motor wiring

Actual motor to connector	From connector (interconnect)	Connects to
Red (heavy)	Brown/Blue (heavy) [NU]	To ECU Plug 1
Black (heavy)	Brown/Red (heavy) [NR]	To ECU Plug 1
Black plain	Blue /slate [US] (grey interconnect)	From ECU plug 2 clutch -
Black plain	Blue/ pink [UK] (blue interconnect)	From ECU plug 2 clutch +

EPAS Steering column Torque sensor wiring

MG F/ TF sensor wire colour (see later diagrams)	Connecting colour wire (references pre 2001 MGF wiring diag)	notes
Red [R]	Orange [O]	To ECU plug 2
Green [G]	Orange / Blue [OU]	To ECU plug 2
Black [B]	Orange / Yellow [OY]	To ECU plug 2
Blue [U]	Orange/ White [OW]	To ECU plug 2
Yellow[Y]	White [W]	To ECU plug 2
White [W]	Blue/ Green [UG]	To ECU plug 21 and shields cables.

Wiring to add to MGB

Function	Connecting colour wire	notes
EPAS light + (new)	Couple to green from EPAS ECU Plug #2	This is a + 12 Switched live feed for the warning light only (if you are fitting it)
EPAS light – (new)	Pink/Blue EPAS ECU Plug #2	No other connections
Brown (heavy)	Brown (heavy) EPA plug #1	Unswitched permanent + 12 volt. 3mm wire and a heavy duty 40 to 70 amp in line fuse.
Black (heavy)	Black (heavy) EPA plug #1	Should be a 3mm wire to an earth point
green	Green to EPAS ECU plug #2 and feed to signal generator	Ignition switched (position 2) + feed. Only needs a small fuse as this just runs the electronics in the ECU

Signal inputs. The EPAS ECU needs two square wave signals:

- Engine run signal. Pin 10, Black/ white wire, on the EPAS ECU needs a constant feed of around 50Hz square wave to simulate an engine run signal. The EPAS wont run at all without this. It can be provided by a cheap signal generator powered from the ignition switch or it could be provided from a more sophisticated type of unit which also provides the variable road speed signal.
- Road speed is said to need a 100 to 250Hz signal.. Pin 7 on the EPAS ECU The road speed signal is a square wave that increases in frequency as the speed increases. The higher the road speed, the higher the frequency = the less power assistance the EPAS provides. By default full power assistance is enabled when there is no road speed signal at all (EPAS assumes maximum assistance is needed for parking etc) . Early and late EPAS ECUs may have different requirements as the early MGF received its signal from a magnet and reed switch on the speedo cable whilst the later cars provided a signal from the gearbox sensor processed by the main ECU.-

GPS Signal generator

You could choose just to use a simple signal generator for the engine run signal (50 Hz square wave) and not have any signal for road speed but this setup would apply maximum power assistance irrespective of speed which would make the steering too sensitive at road going speeds. This situation could be controlled manually by switching off the EPAS green + 12 volt feed when driving at speed and only enabling it when parking etc. It is preferable to use a variable signal though for road speed which would ensure maximum steering assistance at slow speed and then diminish with increased speed.

I bought a GPS based signal generator from Lite-Steer which provides a variable output for road speed and also usefully included a fixed 50Hz signal for the engine run simulated output, doing away with the need for a separate unit for that. This cost £ 75 in early 2024 direct from Lite-Steer.

Litesteer GPS unit wires	function	Car/ EPAS ECU connection
Red	Constant unswitched + 12 volts	Best taken from the Brown unswitched + feed into the EPAS ECU
Purple	Ignition switched + 12 volt	Best taken from the green ignition switched + feed to the EPAS ECU
Black	Earth	Any good earth point near to ECU
Brown	Engine run signal ~ 50Hz	Pin 10 on the EPAS ECU connector #2 (black/white wire)
Green	Variable road speed signal	Pin 7 on the EPAS ECU connector #2 (Pink/Blue on my early one but White/Orange on some later types)

Location needs to be chosen carefully. The unit is matchbox sized and the manufacturer states it needs to 'see sky'. It can be covered by plastic or glass but must not be covered by metal as this would get in the way of the GPS reception. In my case I carefully cut out a rectangular section of the dash top on the passenger side. The dash top consists of a vinyl layer, a very thin plywood and then metal. It takes a while with a Dremel. The sensor was then recessed into this so it's top was marginally below the surrounding dash top. My sensor had a mounting point at one end so I drilled a hole through the dash top, close to the cut out and then bolted it in place with a small 4ba nut and bolt and a spacer. I then covered the cut out area with suitable vinyl but you could equally use an old (plastic) MG badge.

I measured the following frequencies from the Lite-Steer GPS unit in a drive test with a basic frequency meter. Speed readings are approximate as read from a car speedo display whilst driving, so this is just a guide for interest, you'll have to forgive minor inaccuracies:

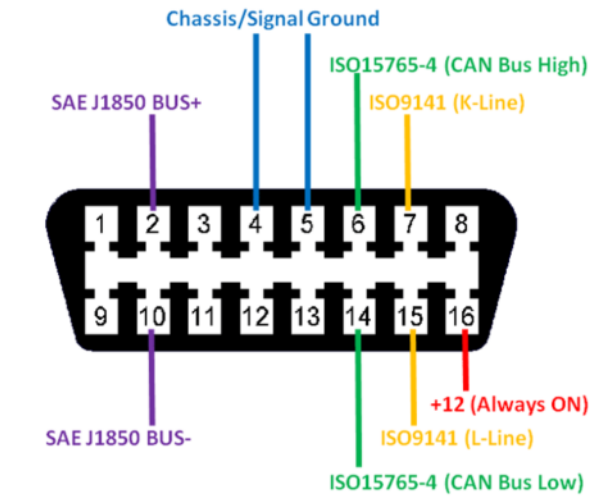
5Mph = 0.032 khz
10Mph = 0.063 khz
15Mph = 0.102 khz
20mph = 0.131 khz
25Mph = 0.169 khz
30Mph = 0.204 khz
35Mph = 0.242 khz
40Mph = 0.269 khz

OBD2 option

An OBD2 port can be fitted to allow diagnostic equipment such as a PSCAN to talk to the EPAS. It won't do anything else (unless you happen to connect an engine or other ECU) but may have some uses. OBD ports are available very cheaply on Ebay and this only needs a live, an earth and the diagnostic wire from the EPAS ECU so is very straightforward.

Pins to connect are: 4 & 5 to earth. 16 to permanent live.

Then its pin 7 should connect to the EPAS ECU's pin 9 (pink wire)



For location OBD ports usually come with a small bracket so this can be discretely screwed onto the underside of the square section transom bar behind the dash on the passenger side, just below the glovebox. (This suggested location assumes you have fitted the EPAS EPC nearby behind the glovebox.)

Colour codes

These are the wiring colour codes used for both the MGB and MGF/ TF.

B Black

G Green

K Pink

LG Light Green

N Brown

O Orange

P Purple

R Red

S Slate (Grey)

U Blue

W White

Y Yellow

In wiring diagrams any striped wires are written as main colour/ trace. For example N/R will be a brown wire with a red stripe.

Parts used.

Lite-Steer GPS speed signal generator

MGF EPAS column with matching ECU

MGF stalk assembly + 'clock spring' + indicator cancel ring

MGF steering wheel

Chris Silk

March 2024



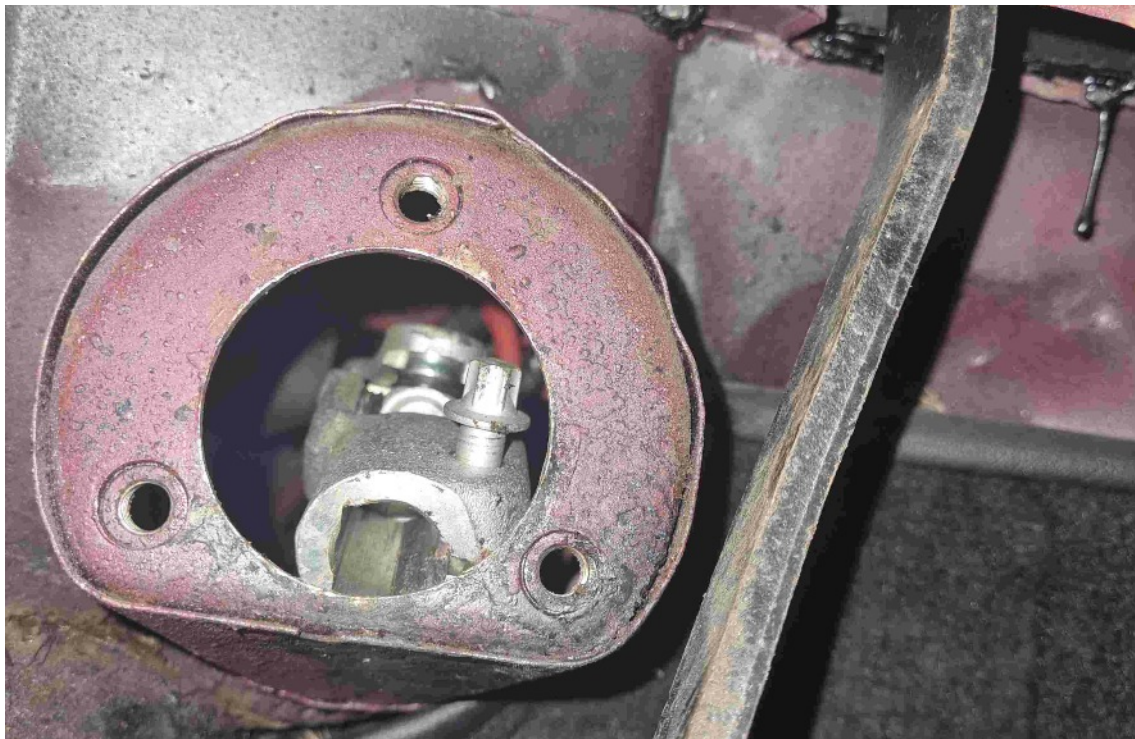
EPAS ECU



Stalk Loom



LightSteer Module



UJ Lower Inside

