CONVERSION OF A LOGITECH SHIFTER FOR FANATEC WHEELBASE COMPATIBILITY, ENABLING 7TH GEAR & OTHER MODIFICATIONS

By B-spec-_-Bob – December 2018

PREFACE

Polyphony Digital's game GT Sport offers a significant advantage to players who can use an H-pattern shifter and clutch pedal to change gears in some road cars. The built-in time delay between the gear shifts of these cars when changed with a paddle or sequential shifter can be made as short and quick as a successfully executed H-pattern and clutch gear change. This can result in gains of a few tenths per sector and is particularly advantageous when accelerating out of slow corners and onto a long straight.

For Fanatec wheelbase users who want an H-pattern shifter, there is currently only 1 option available albeit a very good one. However the ClubSport Shifter SQ V1.5 costs as much as some add-on steering wheels and for players who would normally use the paddle shifters or are on a budget, it may be difficult to justify the expense and value of a peripheral that may otherwise not get much use.

The lack of an equivalent CSL Elite shifter option combined with the apparent simplicity of a Logitech shifter and a two week break between the FIA Gran Turismo Championship seasons gave rise to this idea of a more affordable H-pattern shifter. Hopefully sharing the knowledge and experiences acquired from this project will facilitate an increase in the number of H-pattern users and result in a more competitive and skilful player base.

SUMMARY

This document outlines the steps required to convert a Logitech Driving Force Shifter into a Fanatec wheelbase compatible shifter with 6, 7 or 8 gears including reverse. It is intended to be used as a guide by modders who already have some experience and competence working with basic hand and power tools.

The instructions provided are meant to explain some relevant details and do not include step-by-step descriptions for beginners. Performing the tasks in this guide will void the warranty of the Logitech shifter and are done at your own risk. Mods relating to the selection of gears will likely not be compatible with any other brand of wheelbase, including Logitech.

It may take a few hours to a few day to complete this project, depending on how many of the mods are attempted. Some optional steps and the theory behind how these mods work are also included towards the end of the document.

CONTENTS

INTRODUCTION

The current Fanatec racing peripheral ecosystem includes one option that combines a sequential shifter and H-pattern shifter into one package – the ClubSport Shifter SQ V1.5. It is an excellent product that provides satisfyingly solid feeling shifts with its almost all-metal construction. Although it can be considered reasonably priced with its excellent build quality and features, it is still around 4 to 6 times more expensive than the shifter currently on offer from Logitech.

This guide aims to provide an alternative shifter for Fanatec wheelbase owners who either want a low cost H-pattern shifter or want to make use of an existing Logitech shifter (e.g. G25, G27). It should also be possible to use a converted Logitech shifter in conjunction with Fanatec's ClubSport USB Adapter to enable standalone PC compatibility, although there are other options available that can also provide that function without modifications to the shifter (e.g. Leo Bodnar Shifter Interface USB adapter, Basherboards FL2, etc.).

To keep this project a low-cost solution the only required expenses, other than the shifter itself, is a suitable cable (available from the Fanatec Webshop) to replace the original D-sub connector and some consumables (tape, solder, grease, etc.). However the other mods covered can also be considered low-cost and the materials required are generally available at hardware, fastener and electronic parts stores.

It is assumed that access is available to the basic hand and power tools listed for each section, so the cost of using these tools are not considered. The Logitech shifter used in this guide is sold as the Driving Force Shifter for G29 and G920 steering wheel.

DISASSEMBLING THE SHIFTER

Required tools:

- Phillips #1 screwdriver
- 2.5mm hex key
- 10mm spanner

There already exists guides that go into the detail of taking the shifter apart, they are linked here:

- **Logitech G27 Shifter Potentiometer Replacement by Nicholas Gholdoian and others.** ***https://www.ifixit.com/Guide/Logitech+G27+Shifter+Potentiometer+Replacement/42378***
- **Logitech Driving Force Shifter Review by Barry Rowland.** ***http://simracinggarage.com/logitech-driving-force-shifter-review/*** or ***https://youtu.be/d7qCn308K98?t=458***

The original shifter cable fitted with the 9-pin D-sub connector and the small PCB it is attached to can be completely removed as it is not required.

REWIRING THE SHIFTER

Recommended tools:

- 1mm flat blade screwdriver
- tweezer

Optional tools:

- Side cutter
- Soldering iron

This section can be competed without completely taking out the shifter assembly (stop at Step 8 of the ifixit guide), but if being able to select reverse gear is desired then continue to the end of Step 12 of the ifixit guide.

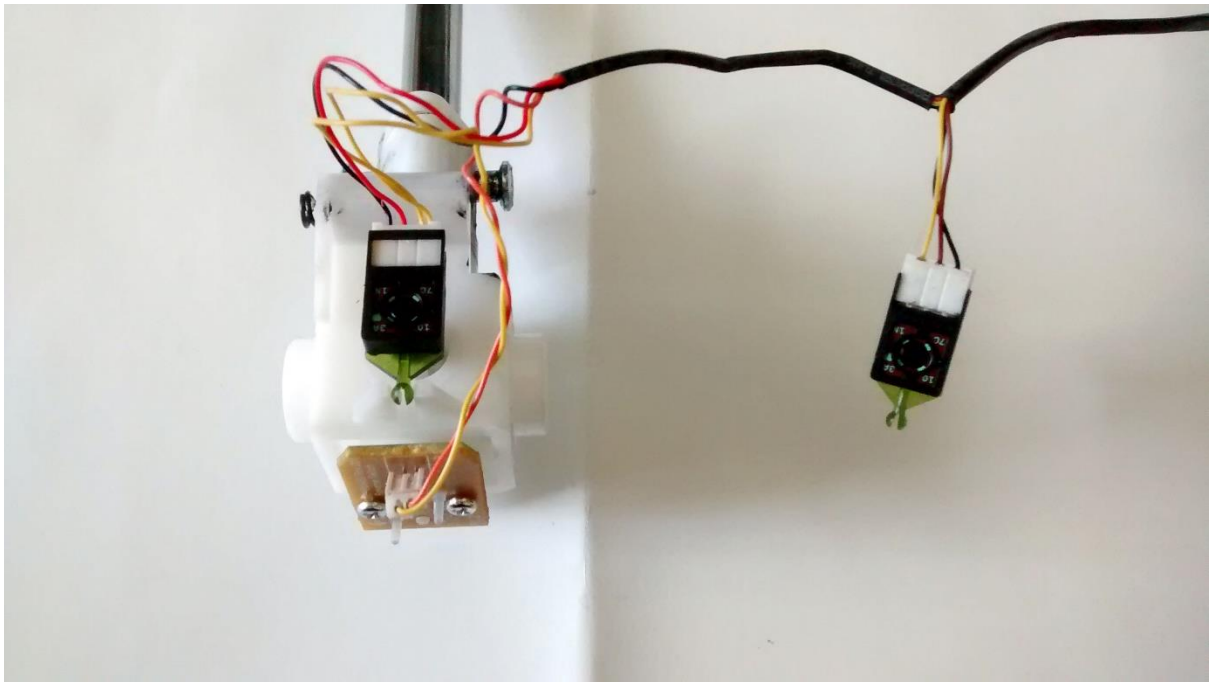

Figure 1 – Rewired shifter potentiometer

A partially disassembled shifter assembly is shown in Figure 1 where the left potentiometer is used to determine the lateral position of the gear selector and the right potentiometer determines the longitudinal position (it's not necessary to take it out as shown). Both pots were originally wired like the one on the right, where the yellow coloured wires were connected on the left-hand side and the black wires were connected on the right-hand side. Rewiring the left potentiometer so that the yellow and black wires are swapped around makes it consistent with the wiring used in Fanatec's Porsche/CSR H-pattern shifter and allows the switch at the bottom of the unit to be used for the reverse gear selection (shown on page 7).

Figure 2 – Potentiometer pin

If you do pull out the potentiometer from the white plastic body, please be aware that there should be a small metal pin, similar to the one shown above, located through its shaft axis which helps prevent it from falling out on its own. It must be present when reinserting the potentiometer into the shifter assembly.

REWIRING FOR A PS/2 CONNECTION (BACKWARDS COMPATIBLE)

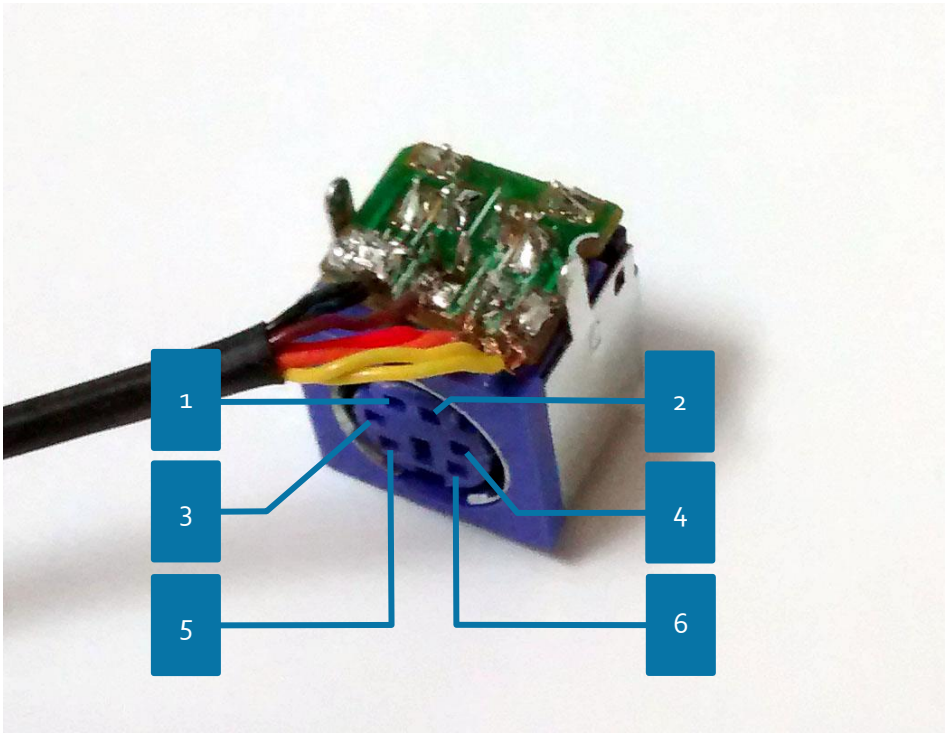

Figure 3 – Potentiometer wires connected to female PS/2 port

In the figure above, the original 5-pin PHR-5 JST connector at the other end of the potentiometer wires has been replaced with a female PS/2 port connector. Although this step is not necessary, soldered connections may offer more robustness in the connection between the potentiometer wires and the replacement cable.

The wires and their corresponding pin number are shown in the table below:

Table 1 - Pots to Fanatec PS/2 shifter wiring pinout

PS/2 Pin	**1**	**2**	**3**	**4**	**5**	**6**
Wire Colour[1]	Brown	Red, Orange	Black	Yellow	See below	Not used

Please note that pins 3 and 5 are connected together through the small PCB above the PS/2 port so that the Fanatec wheelbase can determine the shifter plugged into it is an H-pattern. When pins 3 and 5 are unconnected, it will think a sequential shifter has been plugged in.

SUITABLE PS/2 CABLES FROM THE FANATEC WEBSHOP

Reasonably priced cables can be found in the Pedals and Shifter Accessories categories.

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REWIRING FOR AN RJ12 CONNECTION (CURRENT GENERATION)

Although the example above used a PS/2 cable and connector for backwards compatibility with older Fanatec wheelbases, an alternative RJ12 connector and cable may be used instead for the current generation wheelbases. Please refer to the figure and table below for the RJ12 pinout:

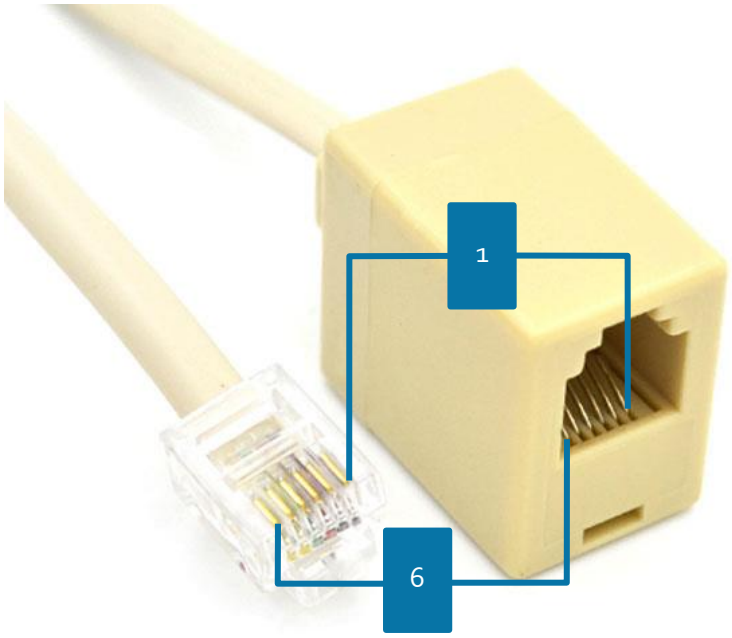

Figure 4 – RJ12 6P6C plug and socket

Table 2 - Pots to Fanatec RJ12 shifter wiring pinout

RJ12 Pin	1	2	3	4	5	6
Wire Colour[1]	Black	Not used	See below	Red, Orange	Brown	Yellow

Please note that pins 1 and 3 are connected together so that the Fanatec wheelbase can determine the shifter plugged into it is an H-pattern, or a sequential shifter when pins 1 and 3 are unconnected. Make sure the RJ12 cable you use is also of 6P6C specification as not all cables contain 6 wires.

SUITABLE RJ12 CABLES FROM THE FANATEC WEBSHOP

Reasonably priced cables can be found in the Pedals Accessories category.

[1] Wire colours may differ between different models or even batches. Please refer to Figure 1 – Rewired shifter potentiometer and section FANATEC COMPATIBLE LOGITECH SHIFTER WIRING DIAGRAM to determine the correct wiring.

ENABLING REVERSE GEAR SELECTION

This section covers the modifications required to enable reverse gear selection. It is not required if simply being able to use gears 1 through 6 is adequate.

Required tools:

- Drill
- 5.5mm drill bit
- 9mm drill bit
- Mini metal files

Recommended tools:

- Centre punch
- Drill press
- Clamps
- Vice

Figure 5 – RHS shifter plate with masking tape

The RHS shifter plate shown above has been removed from the shifter assembly (not necessary) and has had the grease cleaned off so that masking tape can be stuck onto its surface. However unlike Figure 5, it is actually better to place the masking tape onto the outer surface (opposite side) which does not have the rounded off edges, so that a more accurate outline of the cut-out can be traced onto the tape with a pencil.

The LHS shifter plate should also be free of grease so that this masking tape can be carefully reapplied onto its outer surface. The upper section of the outline should match up with the existing cut-out in the LHS plate, while the lower section forms the basis of the area that needs to be removed.

Figure 6 – LHS shifter plate with masking tape

Note that in Figure 6, the lower section of the outline has been slightly modified so as to not interfere with the three holes used by the spring and ball bearing from the shifter assembly. For this reason, the centre of the 9mm hole has been marked 0.5mm to the left of what could be considered the axis of symmetry of the cut-out.

It is recommended that the centre of the 5.5mm hole be marked such that it is at least 8mm away from the centre of the upper left hole (used to select 1st gear). Drilling this hole accurately is critical to ensuring the switch at the bottom of the shifter assembly is completely activated when pushing the shifter knob into the shifter body. The finished plate should look similar to the one below after some filing.

Figure 7 – LHS shifter plate with completed modification

ENABLING 7TH GEAR SELECTION

This section covers the modifications required to enable 7th gear selection. It is not required if simply being able to use gears 1 through 6 is adequate.

Required tools:

- Centre punch
- Drill press
- 2mm drill bit
- 5.5mm drill bit
- Countersink drill bit
- Mini metal files
- Soldering iron

Recommended tools:

- Clamps
- Vice

Required items:

- Sub-miniature microswitch with lever
- 2 x M2x10 countersunk screws
- 2 x M2 nuts and washers

Figure 8 – Modified RHS shifter plate with masking tape and microswitch

Complete similar modifications from section ENABLING REVERSE GEAR SELECTION for the RHS shifter plate as shown above and mark out the mounting holes for the microswitch. The microswitch body should have dimensions of approximately 6mm x 6mm x 13mm (not including lever, etc.) and must have the following terminals:

- Common (COM)
- Normally Open (NO)
- Normally closed (NC)

For reference, the two Ø2mm hole centres shown in Figure 8 are approximately collinear with the shifter assembly pivot hole centre and about 50° counter clockwise from horizontal. This was the lowest possible mounting location for this particular microswitch, which is activated by the shift lever when it is in the 7th gear position. Mounting holes for other microswitch models may differ and their required mounting locations and orientation will depend on the microswitch lever's open and close position.

Figure 9 – Modified RHS shifter plate with countersunk holes and screws

Figure 9 shows the inner side of the RHS plate with 2mm countersunk holes. This allows the M2 fastener heads to sit flush with the side of the plate so as to not impede the movement of the shifter assembly.

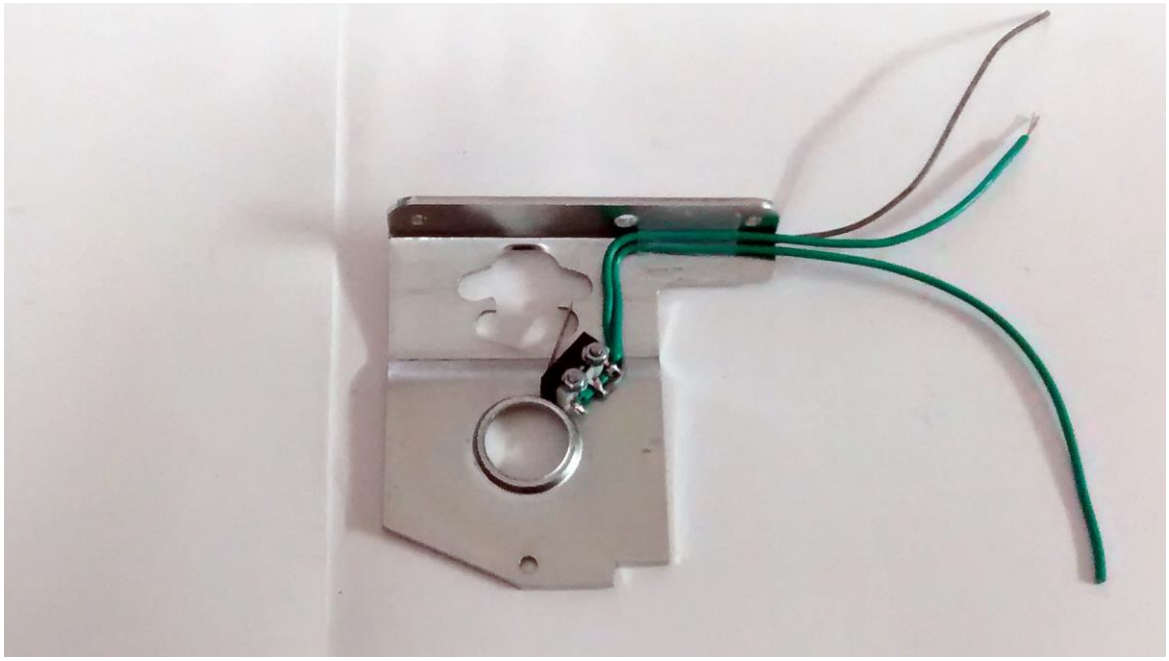

Figure 10 – Modified RHS shifter plate with mounted switch and attached wires

Mount the microswitch to the outer side of the RHS shifter plate as shown above and solder enough wire (about 150mm) to each terminal. Tape the wires to the plate as shown to simplify the reassembly process.

The microswitch terminals and their relevant potentiometer wire and/or Fanatec connector pin number are shown in the table below:

Table 3 – Pots to microswitch to Fanatec PS/2 and RJ12 shifter wiring pinout for 7th gear

Microswitch	COM	NO	NC
Wire Colour[1]	N/A	Black	Red, Orange
PS/2 Pin No.	2	3	N/A
RJ12 Pin No.	4	1	N/A

Please note that the Red and Orange potentiometer wires are no longer directly connected to the Fanatec connector pins as they have been replaced with the wire from the microswitch COM terminal.

INCREASING THE REQUIRED SHIFTING FORCE

This optional section can be completed as part of the reassembly procedure.

Figure 11 – Shifter spring with M3 cap head screw

If a stronger shifting force between the odd and even gears is desired, then simply inserting an M3 cap head screw into one end of the spring (or any other similarly sized object, e.g. M5 grub screw) before reinserting it into the shifter assembly will increase the spring's preload force. The result is that a stronger shifting force is required to overcome the preload of the spring, before the ball bearing is able to pop out of and back into one of the three holes of the LHS shifter plate.

The length of the insert should not exceed 5mm to avoid overpowering the return spring of the shifter assembly. It is recommended that this mod should be done in conjunction with the INCREASING GEAR LEVER CENTRING FORCE mod to reduce the possibility of miss-shifts.

INCREASING GEAR LEVER CENTRING FORCE

This optional section requires the fabrication of a pair of steel plates and can be completed as part of the reassembly procedure.

Required tools:

- Hacksaw
- Centre punch
- Drill press
- 2.5mm drill bit
- 3.2mm or 3.5mm drill bit
- Mini metal files
- M3 tap
- Phillips #2 screwdriver
- 5.5mm spanner or pliers

Recommended tools:

- Clamps
- Vice
- Side cutter

Required items:

- 2 x 61x10x1mm steel plates
- 2 x CSC C-1 extension springs
- 4 x M3x6 countersunk screws
- 4 x M3 nuts

Figure 12 – Century Spring Corp C-1 extension spring

Due to the minimal volume available for this mod to fit in, the only suitable extension spring from the CSC range is the C-1 which is Ø3.175mm in diameter and has a closed end-to-end length of 38.1mm.

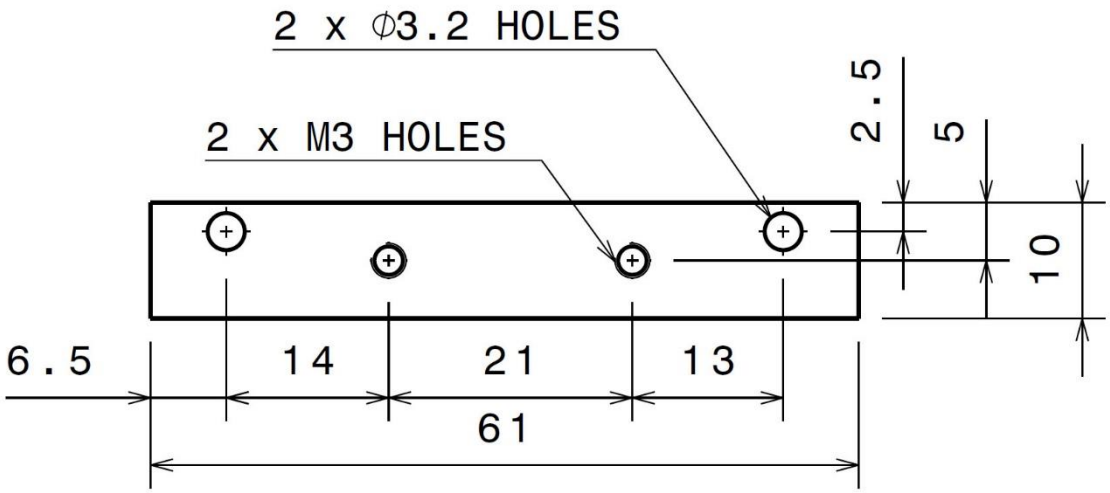

Figure 13 – Bridge plate dimensions and features

Use the dimensions shown in Figure 13 to drill and tap the appropriate holes in each steel plate. The thickness of the plate should ideally be between 0.5 and 1mm. Please note that these bridge plates are not meant to be symmetrical and the pair of M3 holes should be shifted horizontally to be symmetric about the shift lever in its neutral position (±0.5mm only), but do not change the dimension between their centres (21mm).

Figure 14 – Fabricated bridge plates: assembled and its components

Assemble both bridge plates such that they are the mirror image of each other. The M3 countersunk screws are wound down such that the top of their heads are 3mm above the surface of the plate and the nuts are used to tighten them in position from underneath the plate.

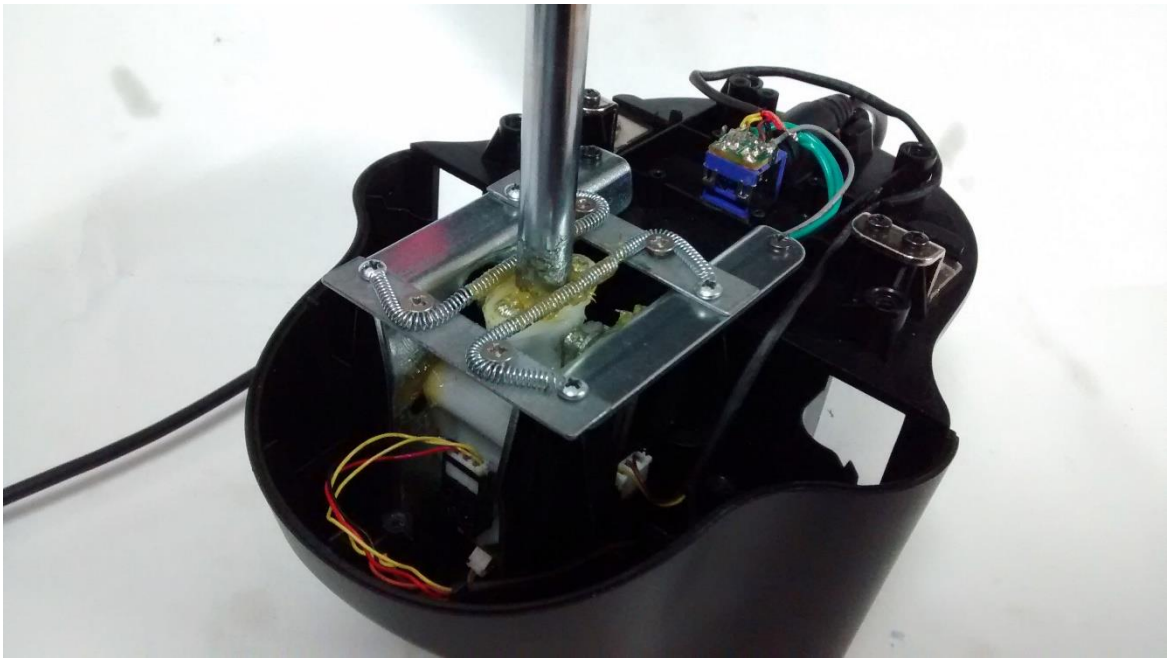

Figure 15 – Bridge plates and springs assembled in shifter

Assemble the completed bridge plates with the springs onto the top of the shifter plates as shown in Figure 15. Check that the shift lever is able to move into all gear positions unimpeded by the addition of the bridge plates. If required, readjust the position of the plates accordingly before fastening the screws tightly.

Figure 16 – Shifter body with cavity modification

Partially remove the stiffeners from the front underside of the shifter's top half body as shown in Figure 16 and make a shallow cavity in the same area to make enough clearance room for the bridge plate and springs. Test fit, remove material and repeat this process until both halves of the shifter body fit together again.

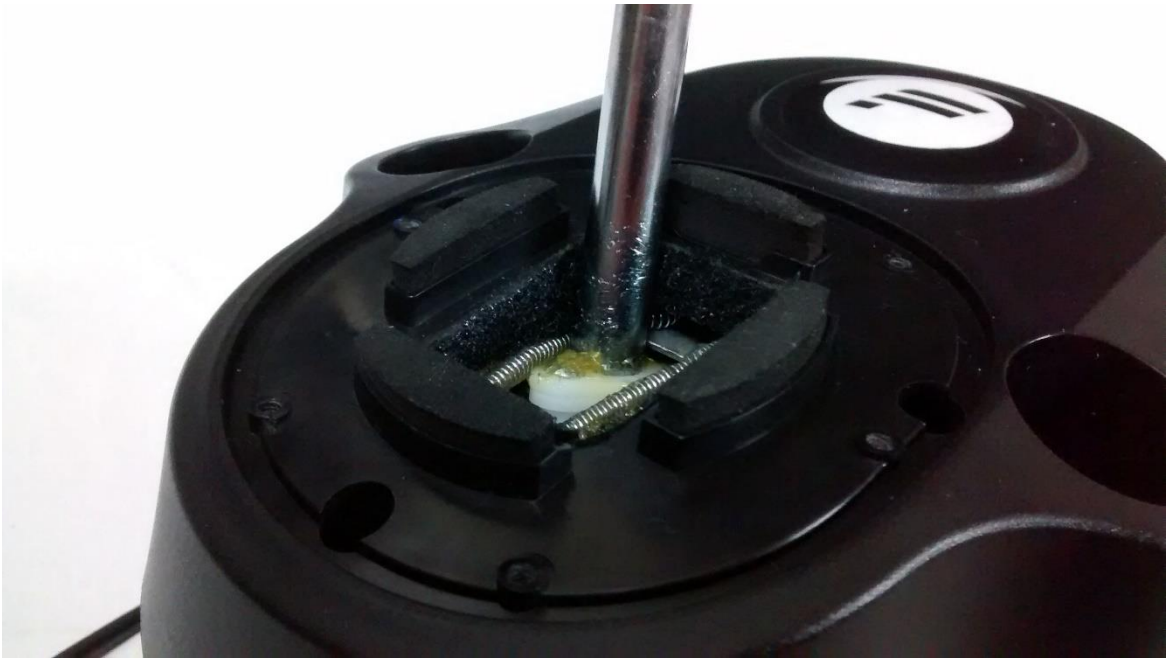

Figure 17 - Small tolerances between bridge plates, springs and shifter body

The shifter assembly should be able to operate with the springs moving in and out of the available gaps between the shifter body's opening perimeter and the bridge plate.

OTHER SHIFTER FEELING MODS

The metal-on-plastic noise that occurs when shifting can be dampened slightly with the application of some self-adhesive loop tape (one half of the hook-&-loop fastener tape aka Velcro). An example is linked below:

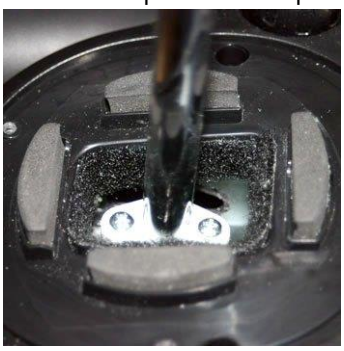

Figure 18 – Loop tape applied to the shifter opening perimeter

- **IMPROVE THE FEEL OF THE LOGITECH G27 SHIFTER BY FRANK RICO**
  http://www.ricmotech.info/?p=56 or
  https://youtu.be/HvQzbeRpLWQ

It is possible to neatly line the sides with 4 trimmed pieces from a strip no larger than 60mm x 25mm. This can be achieved by marking out the required amount with some masking tape beforehand. A few mm of overlap in the corners should work just fine. When the rectangular perimeter is lined with loop tape, some extra friction is introduced when shifting between gears 1-2 and 5-6, which may improve the feeling of the shifts. Considering the original application of the loop tape, the robustness of this mod should not be of concern.

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CHECKLIST FOR REASSEMBLING THE SHIFTER ASSEMBLY

When reassembling the shifter, check the following items to ensure satisfactory functionality:

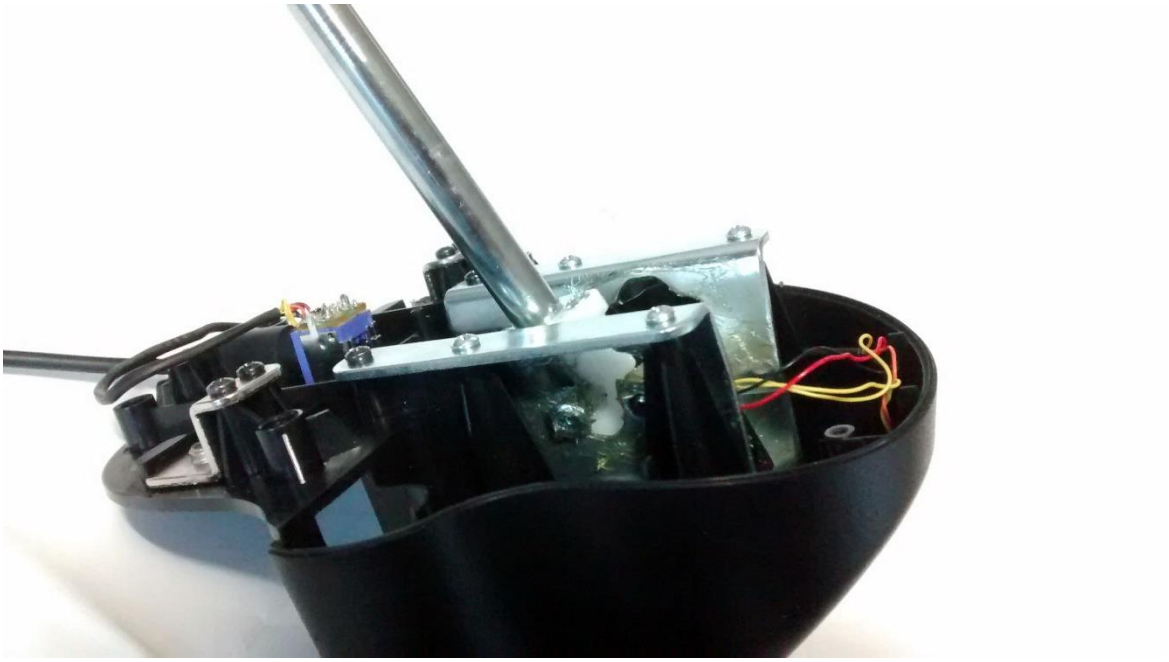

Figure 19 – Reassembled shifter assembly in reverse gear location

- Both shifter plates should be parallel for smooth shifting, especially with the increased spring preload.
- When the gear lever is in the Fanatec reverse gear position, as shown in Figure 19, the metal rod should not be able to move up or down, otherwise the reverse gear capability may become impaired.
- Ensure that the tip of the 7th gear switch lever, as marked in Figure 20, can move smoothly and doesn't get caught on the side of the RHS shifter plate.

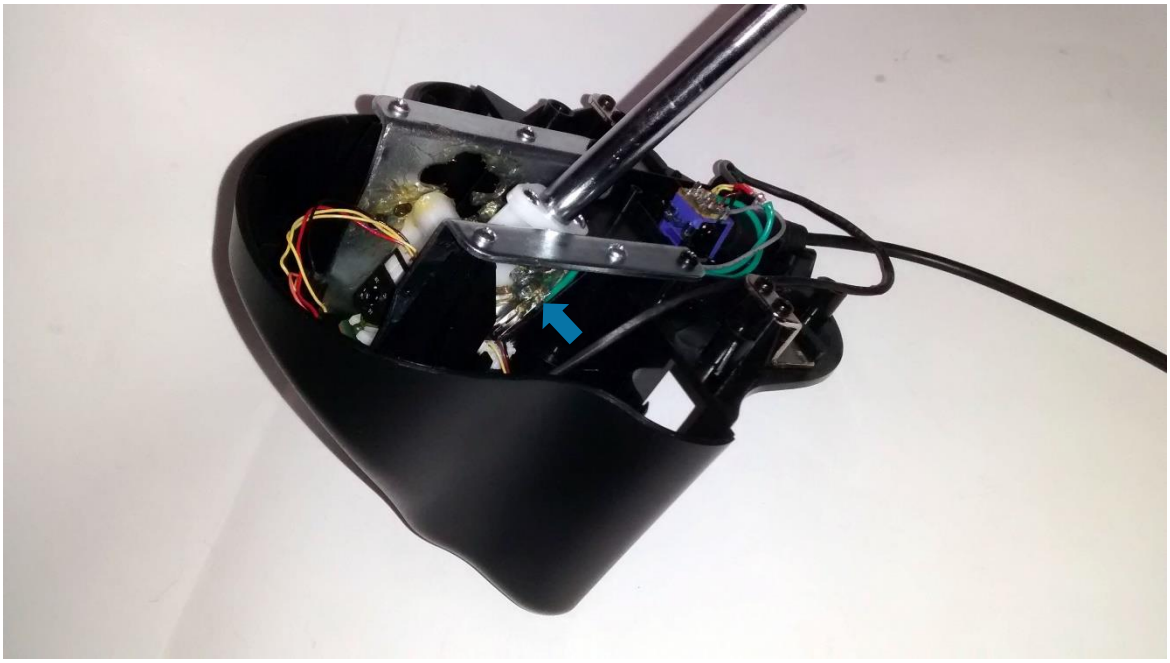

Figure 20 – Reassembled shifter assembly in 7th gear location

SECURING THE REPLACEMENT CABLE AND COMPLETING REASSEMBLY

Required tools:

- Mini metal files

Optional tools:

- Side cutter

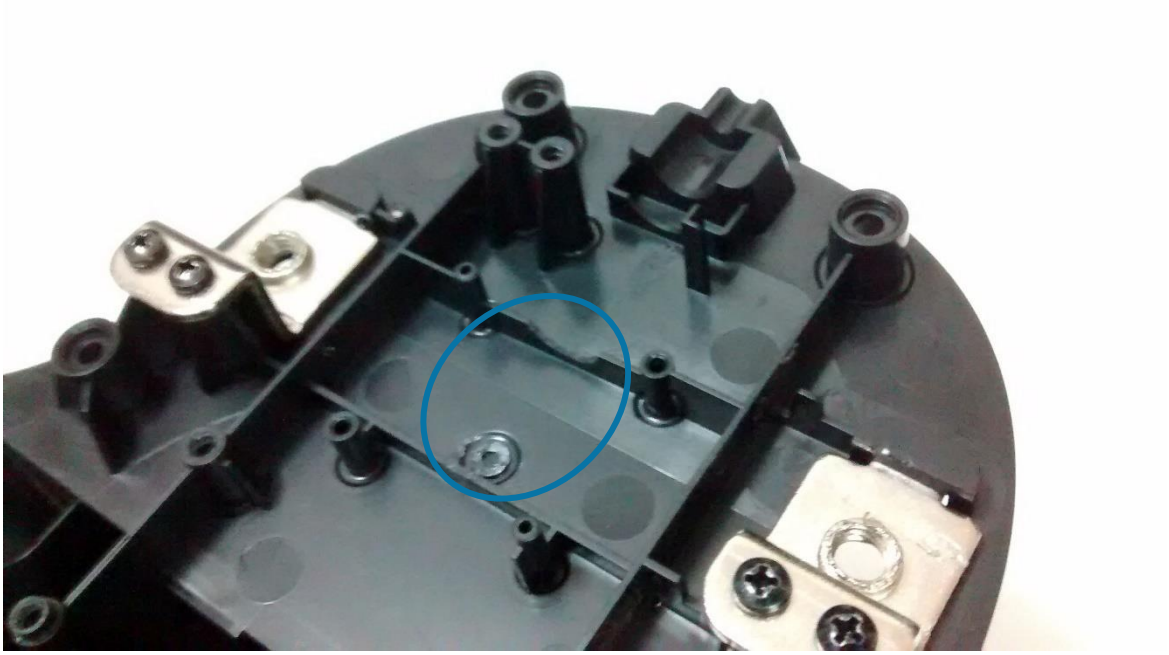

Figure 21 – Shifter body with internal modifications

Figure 21 shows the inside of the shifter body with some material removed from an internal rib and what remains of a stem that was previously used to secure the small PCB with a screw. This step may be slightly different depending on the spatial requirements of the chosen replacement cable and also on which shifter model is being modified. Cables with a PS/2 plug can simply be stuck down with double-sided mounting tape.

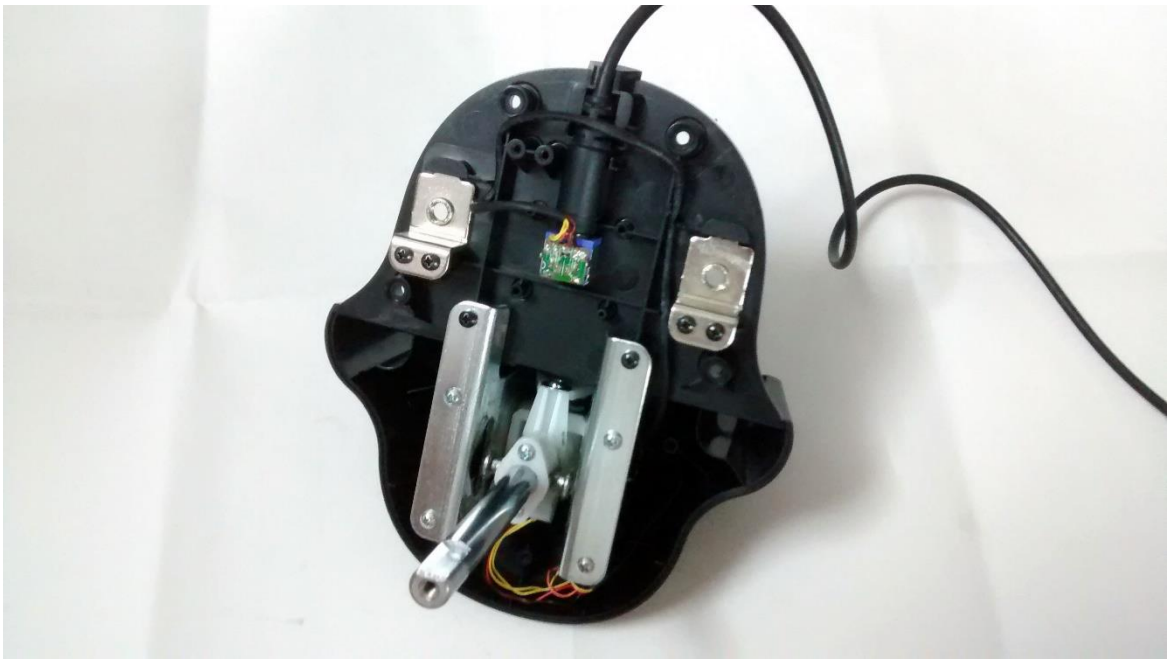

Figure 22 – Partially reassembled shifter with attached replacement cable

Connect the shifter to a wheelbase and check its calibration through the Fanatec PC driver – Function Test.

Figure 23 – Fully reassembled shifter with Fanatec compatible PS/2 plug

Follow the disassembly steps in reverse order to completely reassemble the shifter and take care not to pinch the internal wiring during this process. The shifter should now be ready for use with Fanatec wheelbases.

REPOSITIONING THE SHIFTER KNOB CAP

This optional section shows how the shifter knob cap can be remounted to reflect the Fanatec reverse gear position.

Required tools:

- Drill
- 2.5mm drill bit
- Hot glue gun
- Pen knife

Recommended tools:

- Centre punch
- Drill press
- 2mm flat blade screwdriver

Figure 24 – Shifter knob with cap removed

Mark out hole centres on the opposite side of each rectangular hole as shown in Figure 24.

Figure 25 – Shifter knob with centre piece removed

Pop out the black knob centre by inserting a screwdriver into one of the rectangular holes and levering it out.

Figure 26 – Modified shifter knob centre with cap

Drill 2.5mm holes at the three previously marked locations so that the shifter knob cap can be reinserted as shown in Figure 26. To create flexible ledges for the cap's retention clips, apply hot glue onto the black centre piece, at the base of each clip while they are inserted and then quickly remove the cap while the glue is still cooling (it may be easier to do them one at a time).

Figure 27 – Fully reassembled shifter with rotated knob cap

Trim off any excess hot glue around the edges that prevent the black centre piece from being reinserted into the knob and complete the reassembly of the shifter knob.

OTHER SHIFTER KNOB MODS

Alternatively the metal gear lever rod may be filed down or the shifter assembly reassembled such that the keyway in the rod (visible in Figure 22) is on the opposite side, allowing the knob to be reinstalled at 180 degrees of rotation from the original position. However the stitched leather seam would also be rotated around and may not feel as comfortable to hold.

Another option is to replace the original knob altogether with an aftermarket solution. One method to achieve this is to use a thread die to cut an M10 thread into the tip of the gear lever rod itself, which should allow compatibility with gear knobs of multiple thread sizes through the use of adapters.

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APPENDIX A: WIRING DIAGRAMS

The wiring diagrams in this section show the differences and similarities between the electrical componentry of the Logitech and Fanatec devices. These diagrams are drawn to look similar to the layout of their physical counterparts. They also show what effect the changes made to the wiring were in the section REWIRING THE SHIFTER and how the wiring pinouts were determined in its subsections.

FANATEC SHIFTER WIRING DIAGRAM

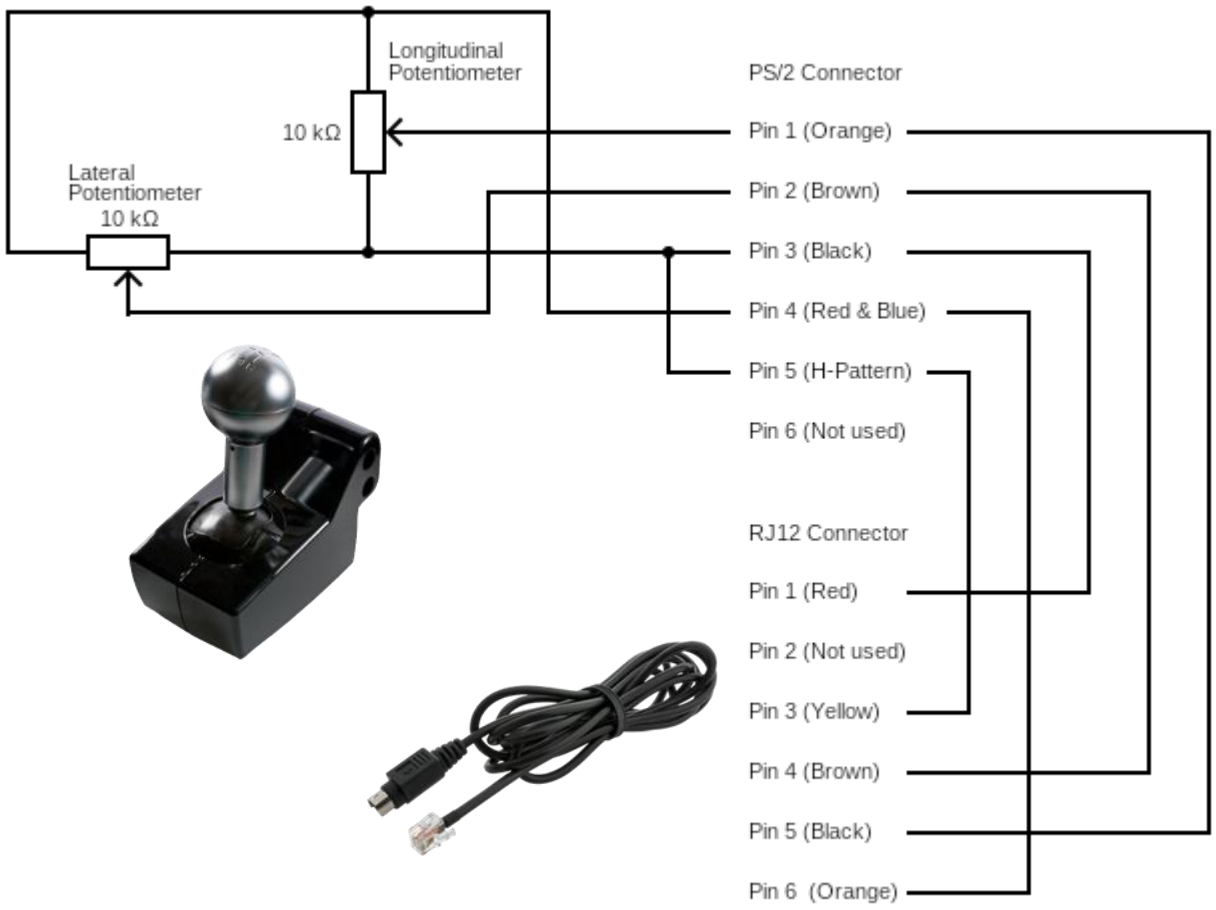

Figure 28 – Fanatec Porsche/CSR H-Pattern wiring diagram with PS/2 to RJ12 adapter

The simplistic design of the Fanatec shifter is what allows the conversion of the Logitech shifter to be fairly straightforward. Two 10 kiloohm (kΩ) pots are used to track the position of the gear lever, where the lateral potentiometer tracks the left and right movements while the longitudinal potentiometer tracks the fore and aft movements.

Electric current is provided to the pots through Pin 4 in the PS/2 connector. The variable output voltages of both longitudinal and lateral pots are measured through Pins 1 and 2 respectively. Pin 3 completes the wiring by connecting the negative terminals together. As previously mentioned, Pins 3 and 5 are connected together so that the Fanatec wheelbase knows an H-Pattern shifter is plugged in.

LOGITECH SHIFTER WIRING DIAGRAM

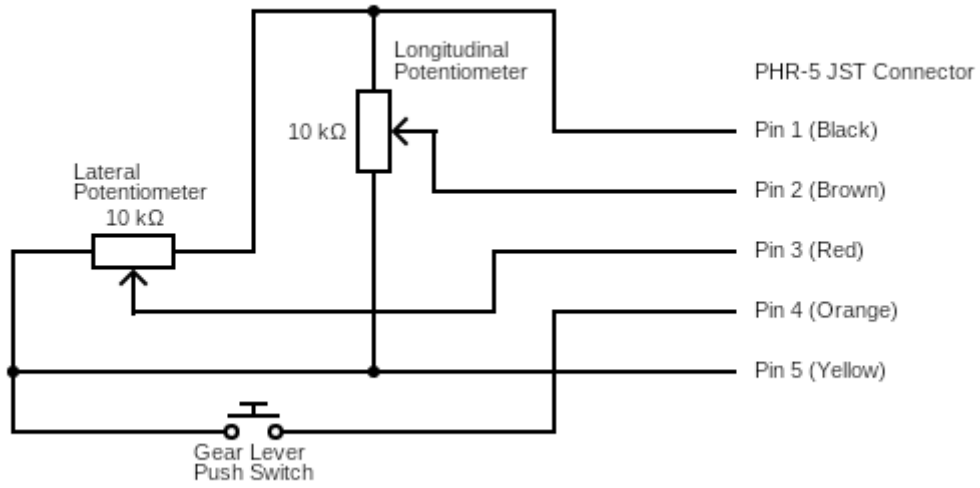

Figure 29 – Logitech wiring diagram (not including extra PCB and D-sub connector wiring)

The main differences between the Logitech and Fanatec wiring is that the connections of the lateral potentiometer have been swapped and a push switch has been introduced. The relative physical installation of the pots are also flipped. Current flows from Pin 5 of the PHR-5 JST connector, Pin 4 detects whether the push switch has been activated and the other pins perform the same respective functions as in the Fanatec.

FANATEC COMPATIBLE LOGITECH SHIFTER WIRING DIAGRAM

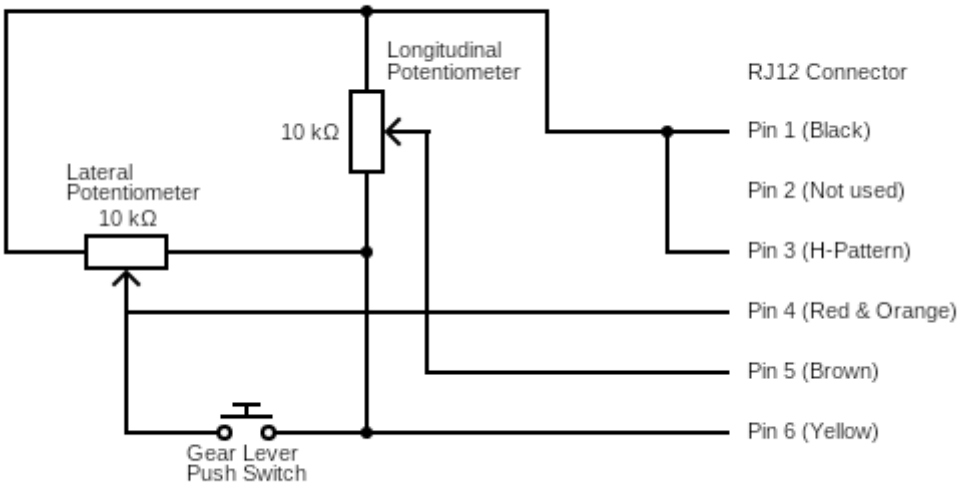

Figure 30 – Logitech wiring diagram modified to be compatible with Fanatec wheelbases

The wiring diagram above would look almost identical to Figure 28 with the exception that current from Pin 6 appears to flow in the opposite direction through the flipped-around pots, there is an additional push switch and the PS/2 connection has been removed. The usage of the push switch is discussed in the section below.

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APPENDIX B: ALTERING POTENTIOMETER OUTPUT VOLTAGES

The two pots used in both the Fanatec and Logitech shifters behave as adjustable voltage dividers, where the output voltage measured at the middle terminal of each potentiometer is some fraction of the input voltage. The two output voltages can be interpreted as positional coordinates for corresponding physical locations.

Fanatec wheelbases recognise the H-pattern's reverse gear location as being to the left of the 1st gear position. Fanatec shifters achieve this by having a unique physical location for reverse gear and hence a corresponding positional coordinate. However the Logitech shifter design does not allow for an equivalent physical location to be possible. Simply modifying the left shifter plate as shown in the section ENABLING REVERSE GEAR SELECTION is not enough. Without altering the output voltage of the lateral potentiometer, Fanatec wheelbases would still interpret the physical 'push-down into reverse gear' location of the Logitech shifter as the positional coordinate for 1st gear.

The output voltage can be determined with Ohm's law, where the relationship between voltage V, resistance R and current I is defined by the formula: $V = I \times R$. Since both pots in Figure 30 are wired in parallel, the voltage drop across both are identical. Because voltage and resistance are directly proportional to each other, the varying resistance of the pots can be used to define equivalent positional coordinates that are proportional to the coordinates composed of their output voltages.

The following is an explanation of how the push switch can be used to alter the equivalent resistance of the lateral potentiometer and thus its output voltage, to provide a positional coordinate for reverse gear.

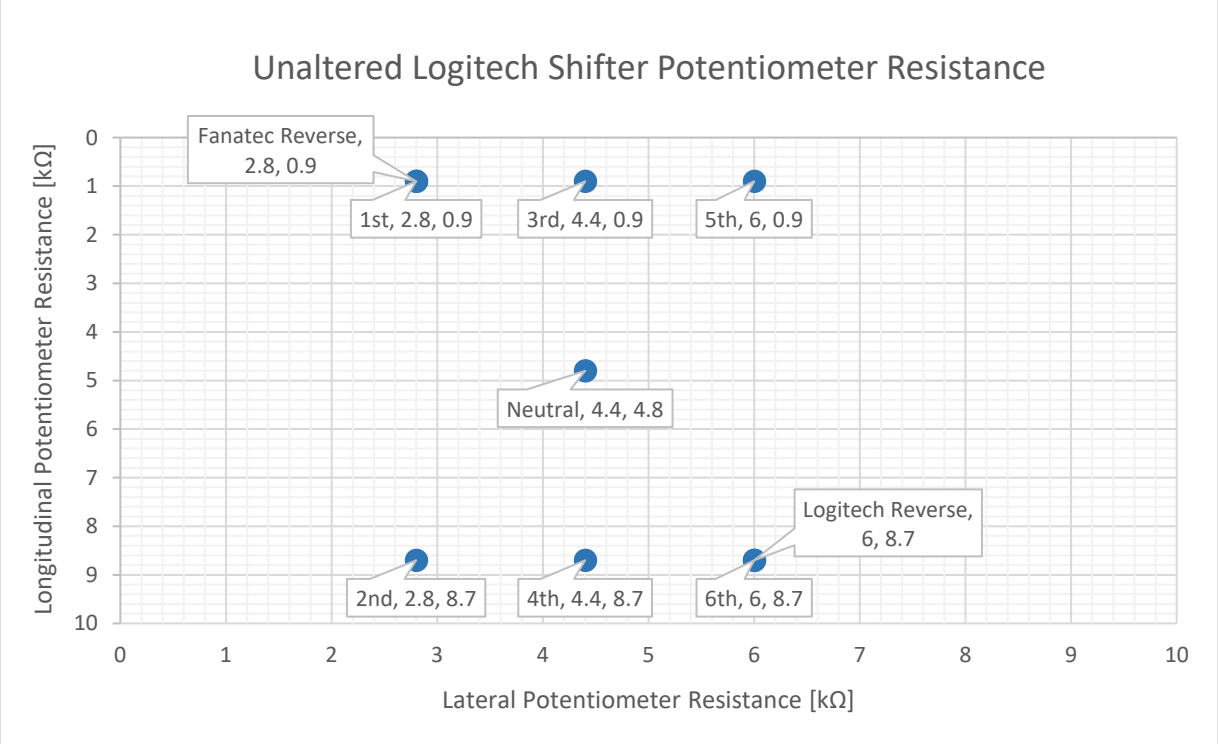

Figure 31 – Unaltered Logitech shifter potentiometer resistance

Figure 31 shows the unaltered positional coordinates for neutral and all gear selections when the gear lever is in their respective physical location. When the push switch in the FANATEC COMPATIBLE LOGITECH SHIFTER WIRING DIAGRAM is closed, the equivalent resistance of the lateral potentiometer can be calculated with the formulae:

Equation 1 – Total resistance for N number of parallel resistors OR for two parallel resistors

$$\frac{1}{R_{Total}} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots + \frac{1}{R_N} \quad or \quad R_{Total} = \frac{R_1 \times R_2}{R_1 + R_2}$$

So when the gear lever is in the 'push-down into reverse' location where R_1 = 2.8kΩ = 2800Ω and the resistance of the push switch is R_2 = 1Ω, then the equivalent resistance of the lateral potentiometer becomes:

$$R_{Total} = \frac{2800 \times 1}{2800 + 1} \cong 0.999\ \Omega < 0.001\ \text{k}\Omega$$

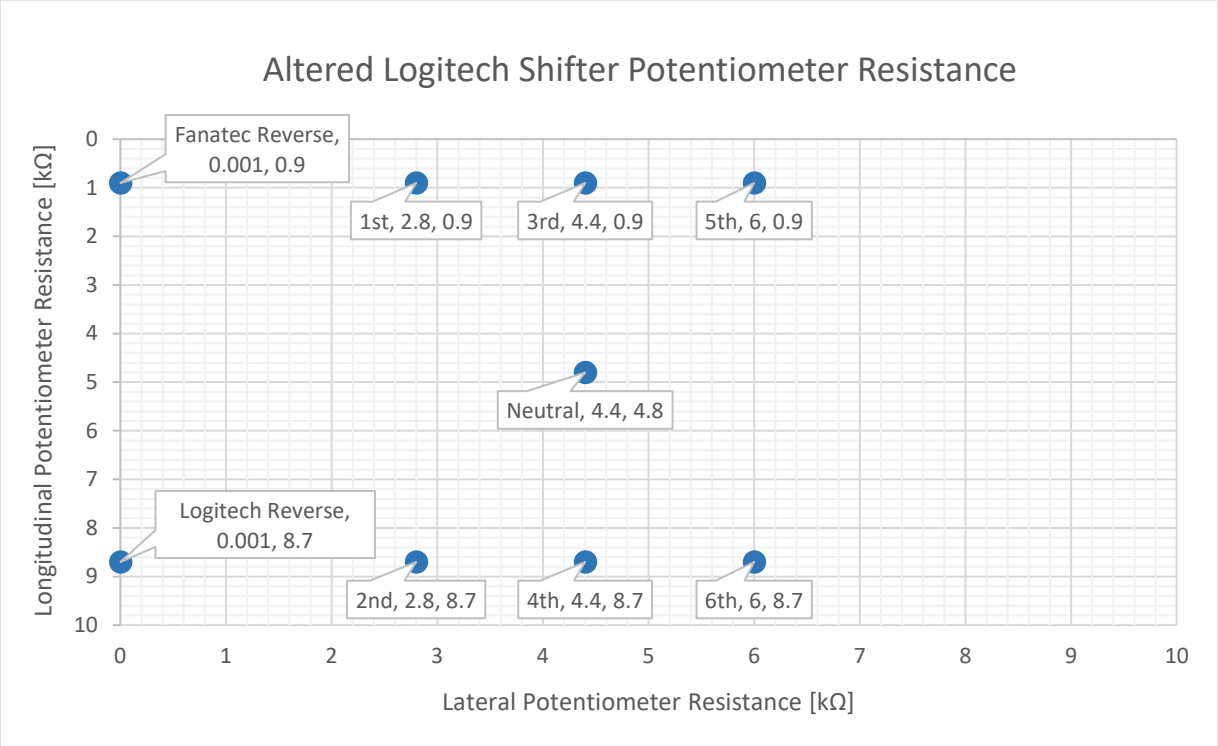

Figure 32 – Altered Logitech shifter potentiometer resistance

The new coordinate for the Fanatec reverse gear location places it to the left of 1st gear as required. The original Logitech reverse gear is similarly affected but is only interpreted as 2nd gear by Fanatec wheelbases.

ALTERNATIVE WIRING TO USE THE LOGITECH REVERSE GEAR POSITION

To be able to use the original Logitech reverse gear position, a similar method to alter the equivalent resistance of the longitudinal potentiometer may be implemented to achieve a suitable positional coordinate of approximately (0.001kΩ, 0.001kΩ). However this can only be achieved with an extra switch or by replacing the existing push switch (which is actually a membrane switch and not a microswitch in the G29/G920 compatible shifter) with a double-action switch or similar.

Such a switch is required to connect Pins 4, 5 and 6 of an RJ12 connector or Pins 1, 2 and 4 of a PS/2 connector together when the gear knob is pushed down. This switch must then completely disconnect these pins from each other when the gear knob is returned to its normal extended position so that the 6-speed function can resume properly. An example wiring diagram based on the FANATEC COMPATIBLE LOGITECH SHIFTER WIRING DIAGRAM that enables this is provided below.

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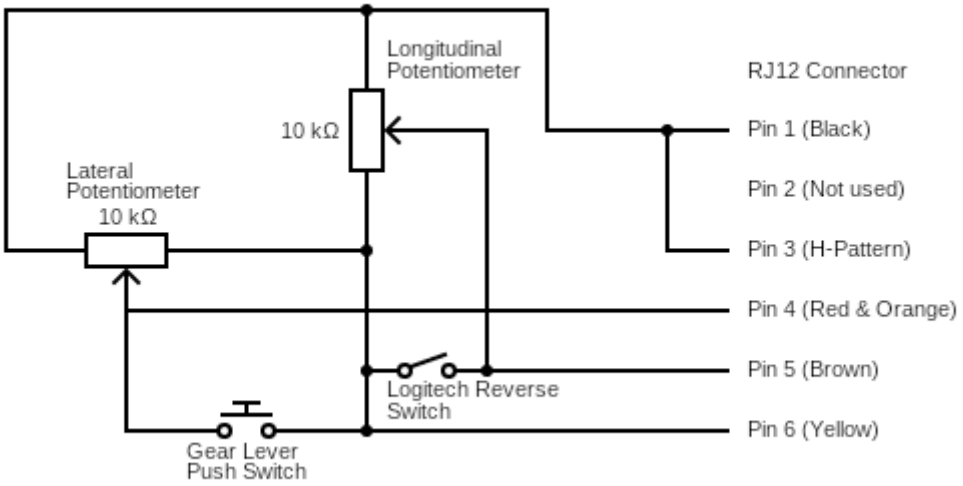

Figure 33 – Wiring diagram to enable the Logitech reverse gear position

ALTERNATIVE WIRING TO ENABLE THE FANATEC 7TH GEAR POSITION

Similar to the reverse gear position, Fanatec wheelbases recognise the H-pattern's 7th gear location as being to the right of the 5th gear position, so their CSS SQ V1.5 shifter has a unique physical location to enable this. To achieve a suitable positional coordinate for 7th gear, the equivalent resistance of the lateral potentiometer should be at least 7.6kΩ or greater. Additionally, in order to mirror the 'push-down into 7th gear' location of the Fanatec shifter, the closed push switch must not contribute to the equivalent resistance.

The figure below shows how the addition of a crossover switch can be used to disconnect the effects of the push switch, while reconnecting Pin 4 from the middle terminal of the lateral potentiometer to the output terminal of both pots. The output voltage measured at Pin 4 is now effectively the same as at Pin 1.

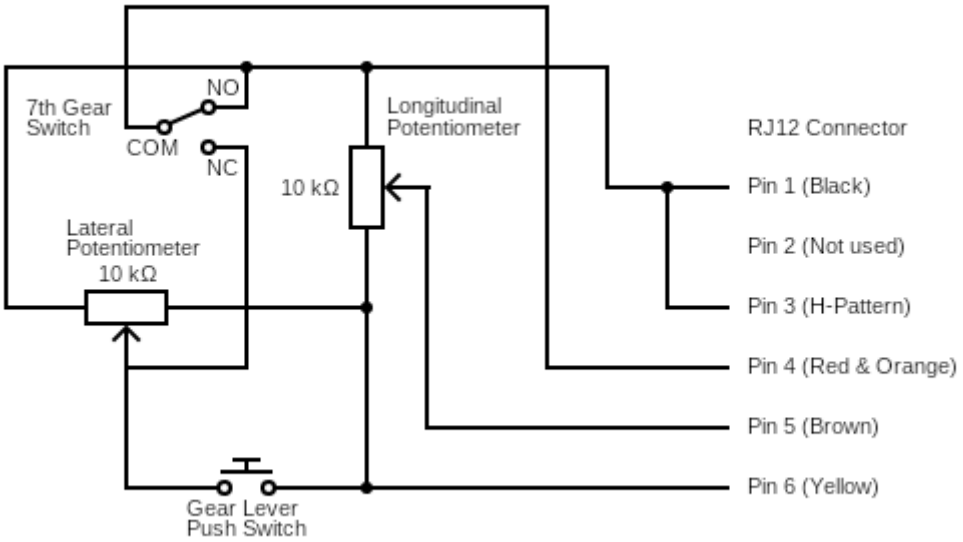

Figure 34 – Wiring diagram to enable the Fanatec 7th gear position

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Although according to Equation 1, the total resistance of both pots in parallel is halved at 5kΩ, the voltage drop across both are still identical. Because both pots have the same total resistance, the current flowing through them are also identical. Thus the equivalent resistance in relation to the positional coordinates as defined on page 23, can be evaluated with Ohm's law:

Equation 2 - Ohm's law

$$V = I \times R$$

$$\therefore 2I \times 5k\Omega = I \times 10k\Omega$$

The resulting equivalent resistance and corresponding positional coordinate for the Fanatec 7th gear can be approximated as (10kΩ, 0.9kΩ). This new coordinate places the corresponding gear location to the right of 5th gear as required and is shown in the figure below.

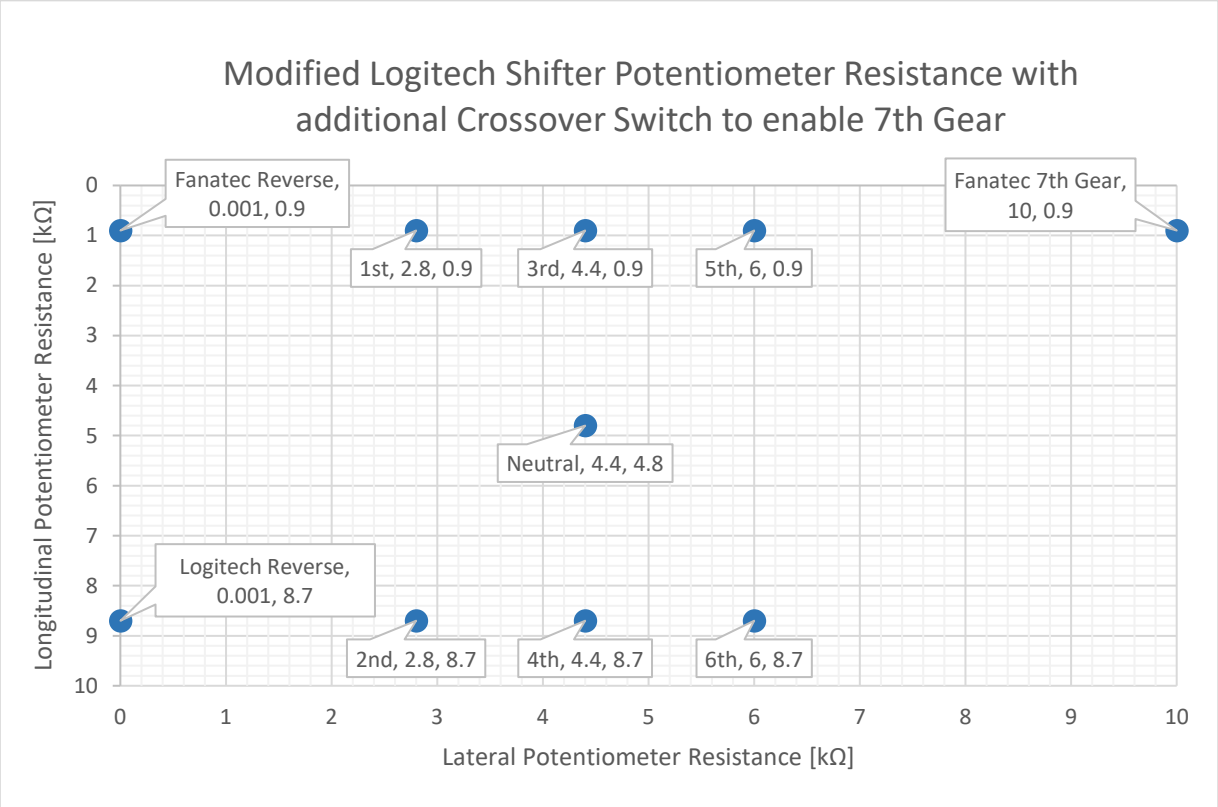

Figure 35 – Addition of Fanatec 7th gear coordinate to Figure 32