joysteer

a product of the company Bozzio AG

Toyota Sienna Hybrid

Vehicle Specific Installation Manual

Valid for Model 2020 (XL40)

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1 General

This document describes the installation of the joysteer® system and to take place by trained personnel **exclusively**, whereby all points need to be carried out as described.

This document is in addition to the "Universal System Manual".

The electrical connections can be found in the electrical cabling diagram.

This document applies to the joysteer® system generation 2.0.

2 Disclaimer

Bozzio AG refuses their product liability if one or more of the following facts are given:

- Driving the system by users who do not possess an appropriate driving licence
  Exception: driving accompanied by an authorized driving instructor
- Driving with accompanying driving instructor without installation of an Instructor switch
- Installation/ maintenance/ repairs by companies not trained by Bozzio AG
- Installation/ maintenance/ repairs by personnel not trained by Bozzio AG
- Installation/ maintenance/ repairs not according to the manuals
- Installation/ maintenance/ repairs of components/ modules, which are not mentioned in the part list
- Weld and install brackets which are not welded by certified welders according to the American welding society
- Installation/ maintenance/ repairs of any MMI (Man Machine Interface), which has not been released by Bozzio AG in written form
- Usage of parameter-sets which do not correspond to the “rules” of the Servicemanager
- Any modifications to the cable harness

Important:

- By opening the modules any warranty of the manufacturer is omitted
  (Exception: EnergyAlarm module)

3 Preparation and order of Installation

Choose a sensible order to install: The correct order of installing each component of the joysteer® system is depending on which components have to be installed.

Example: If you first install the steering actuator, it is harder to reach the brake pedal and the gear shifter.

Preparation:

- Any floor/B-pillar modification (welding) must be done before installing any electronic equipment.
- Check if a newer SW Version is released. The downloads are available in the login domain of www.joysteer.ch.

Order of installation:

The proposed order of installation for this car type is the following:

1. Secondary controls (see specific manuals)
2. Digital gear shifter
3. CAN box
4. Backup battery
5. SmartGas 2 (see specific manuals)
6. Electronics with Module Rack
7. Cable Harness
8. Brake pressure sensors.
   To be done while the original pedal is still in place so it's possible to purge the system immediately after mounting the sensors.
9. Brake actuator BAM
10. Steering actuator SAM
11. Park Switch

Important countermeasure for screw locking:

Always use Loctite 243 to assure unintended loose of fixation.
Always use the recommended tightening torque as shown below

TIGHTENING TORQUE **REFERENCE CHART** FOR SAE AND METRIC **BOLTS**

NL = Not Lubricated
L = Lubricated
1 lbs ft = 1.356 N*M

TIGHTENING TORQUE FOR SAE BOLTS (80% of yield strength Sy) in lbs ft

MATERIAL	UNC	1/4"-20	5/16"-18	3/8"-16	7/16"-14	1/2"-13	9/16"-12	5/8"-11	3/4"-10	7/8"-9	1"-8	1 1/8"-7	1 1/4"-7	1 3/8"-6	1 1/2"-6
GRADE 1	NL	4	8	14	22	34	49	68	120	194	291	412	581	762	1012
	L	3	6	10	17	26	37	51	90	145	218	309	436	572	759
GRADE 2	NL	6	12	22	35	54	78	107	191	194	291	412	581	762	1012
	L	5	9	17	27	40	58	81	143	145	218	309	436	572	759
GRADE 5/5.2	NL	10	20	36	57	87	126	173	308	496	743	1053	1486	1948	2586
	L	7	15	27	43	65	94	130	231	372	557	790	1114	1461	1939
GRADE 8	NL	14	28	50	81	123	177	245	435	700	1050	1488	2100	2752	3654
	L	10	21	38	60	92	133	184	326	525	787	1116	1575	2064	2740
MATERIAL	UNF	1/4"-28	5/16"-24	3/8"-24	7/16"-20	1/2"-20	9/16"-18	5/8"-18	3/4"-16	7/8"-14	1"-14	1 1/8"-12	1 1/4"-12	1 3/8"-12	1 1/2"-12
GRADE 1	NL	4	9	16	25	38	55	77	134	214	326	462	644	868	1138
	L	3	7	12	19	29	41	58	101	160	245	347	483	651	854
GRADE 2	NL	7	14	25	39	61	87	122	213	214	326	462	644	868	1138
	L	5	10	19	30	46	65	91	159	160	245	347	483	651	854
GRADE 5/5.2	NL	11	22	40	64	98	140	196	343	547	834	1181	1645	2217	2909
	L	8	17	30	48	74	105	147	257	410	625	886	1234	1663	2182
GRADE 8	NL	16	31	57	90	139	198	277	485	773	1178	1669	2325	3133	4111
	L	12	24	43	68	104	148	208	364	580	884	1251	1744	2350	3083

TIGHTENING TORQUE FOR METRIC BOLTS (80% of yield strength Sy) in lbs ft

MATERIAL	ST. PITCH	M6-1	M8-1.25	M10-1.5	M12-1.75	M14-2	M16-2	M18-2.5	M20-2.5	M22-2.5	M24-3	M27-3	M30-3.5	M33-3.5	M36-4
CLASS 4.6	NL	3	8	16	29	46	71	98	139	189	240	351	477	649	833
	L	3	6	12	21	34	53	74	104	142	180	263	357	486	625
CLASS 8.8	NL	9	22	44	76	122	190	262	370	503	640	936	1271	1730	2221
	L	7	17	33	57	91	142	197	278	378	480	702	953	1297	1666
CLASS 10.9	NL	13	32	64	112	179	279	385	544	739	940	1375	1867	2540	3263
	L	10	24	48	84	134	209	289	408	555	705	1031	1400	1905	2447
CLASS 12.9	NL	16	38	75	131	209	326	451	636	865	1100	1609	2185	2973	3818
	L	12	29	56	98	157	245	338	477	649	825	1207	1639	2230	2863
MATERIAL	FINE PITCH	M6-0.75	M8-1	M10-1	M12-1.25	M14-1.5	M16-1.5	M18-1.5	M20-1.5	M22-1.5	M24-1.5	M27-1.5	M30-1.5	M33-1.5	M36-1.5
CLASS 4.6	NL	4	9	18	31	50	76	110	154	207	273	393	545	733	958
	L	3	7	14	23	37	57	83	116	156	204	295	409	550	719
CLASS 8.8	NL	10	24	49	83	132	202	294	411	553	727	1048	1455	1954	2556
	L	7	18	37	63	99	151	220	308	415	545	786	1091	1466	1917
CLASS 10.9	NL	15	35	72	123	194	296	431	603	813	1068	1539	2136	2870	3754
	L	11	26	54	92	146	222	323	453	610	801	1155	1602	2152	2815
CLASS 12.9	NL	17	41	84	143	227	347	505	706	951	1249	1802	2500	3358	4393
	L	13	31	63	108	170	260	379	530	713	937	1351	1875	2519	3295

WRENCH INTERCHANGE

SAE	Metric
5/64	2
3/32	2.5
7/64	3
1/8	3.5
5/32	4
3/16	5
7/32	6
1/4	7
5/16	8
3/8	10

4 All wire connections for primary control

WIRE NUMBER		*NOTES*	*CONNECTION TYPE*
		O = WIRE CONNECTIONS TO VAN	
X10		STEERING INPUT DEVICE	PLUG
X21		STEERING DRIVE MOTORS	PLUG
X22		STEERING DRIVE MOTORS	PLUG
X23		STEERING DRIVE MOTORS	PLUG
X24		STEERING DRIVE MOTORS	PLUG
X25		STEERING DRIVE MOTORS	PLUG
X26		STEERING DRIVE MOTORS	PLUG
X31		STEERING MODULE 1	PLUG
X32		STEERING MODULE 1	PLUG
X41		STEERING MODULE 2	PLUG
X42		STEERING MODULE 2	PLUG
X51		GAS / BRAKE INPUT	PLUG
X52		GAS / BRAKE INPUT	PLUG
X53		GAS / BRAKE INPUT	PLUG
X54		GAS / BRAKE INPUT	PLUG
X61		BRAKE ACTUATOR	PLUG
X62		BRAKE ACTUATOR	PLUG
X71		BRAKE PRESSURE SENSOR 1	PLUG PIN INSTALL
X72		BRAKE PRESSURE SENSOR 2	PLUG PIN INSTALL
X81		BRAKE MODULE 1	PLUG
X82		BRAKE MODULE 1	PLUG
X91		BRAKE MODULE 2	PLUG
X92		BRAKE MODULE 2	PLUG
X101	O	PIN 3 GOES TO THE CAN MODULE GREEN WIRE	HARD WIRE

X102	O	PIN 3 GOES TO THE CAN MODULE GREEN WIRE	HARD WIRE
X111	O	GROUND	RING TERMINAL
X112	O	GROUND	RING TERMINAL
X122	O	GREEN WIRE TO TRUE IGNITION POWER OR PURPLE ON THE CAN MODULE	HARD WIRE
X123	O	PARK SIGNAL BLUE WIRE TO THE PINK WIRE ON CAN MODULE	HARD WIRE
X124		PARK SIGNAL FROM SWITCH INSTALLED AT SHIFTER	SPADE CONNECTOR
X301		PROGRAMMING PORT	SUB-D TO USB
X321		SYSTEM ON / OFF SWITCH	SPADE CONNECTOR
X322		CONVENTIONAL / JPAS SWITCH	SPADE CONNECTOR
X331		BATTERY PULSE BOX	PLUG PIN INSTALL
X341		SMART GAS PWMA	PLUG
X342		SMART GAS PWMB	PLUG
X351		BRAKE HOLD SWITCH USED TO HOLD BRAKE WIHEN SHIFTING	SPADE CONNECTOR

4.1 CAN Module connections

WIRE COLOUR		***NOTES***	***CONNECTION TYPE***
BLACK	O	GROUND	RING TERMINAL
RED	O	12 VOLT CONTINUOUS	HARD WIRE
WHITE	O	CAN LOW PIN 21 CONNECTION AT LOWER A_COLUMN	HARD WIRE
BLUE	O	CAN HIGH PIN 8 CONNECTION AT LOWER A_COLUMN	HARD WIRE
GREEN		PIN 3 ON CONNECTORS X101 AND X102	2 PLUGS PIN INSTALL
PURPLE	O	INGNITION OUTPUT CAN BE USED FOR X122 GREEN WIRE	HARD WIRE
PINK		PARK SIGNAL BLUE WIRE ON X123 BLACK NOT USED TAPE OFF	PLUG PIN INSTALL

4.2 Smart Gas connections

WIRE COLOUR		***NOTES***	***CONNECTION TYPE***
GREEN	O	PIN 5 BRAKE SWITCH CONNECTOR PINK	HARD WIRE
GREEN/BLACK	O	PIN 1 BRAKE SWITCH CONNECTOR BLUE	HARD WIRE
BLACK	O	12 VOLT IGNITION 5 AMP FUSE MARKED +15 ON WIRE	HARD WIRE
BROWN	O	GROUND MARKED GROUND ON WIRE	RING TERMINAL
RED	O	12 VOLT SUPPLY 5 AMP FUSE MARKED +30 ON WIRE	HARD WIRE
PEDAL	O	PLUG AND PLAY HARNESS FOR THIS VAN	HARD WIRE

4.3 Notes for connections

NOTE 0	***X***	***WIRES TO EXTERIOR TROUGH THE FIRE WALL WIRE GROMMET***
	X	X71
	X	X72
	X	BOARD POWER BATTERY 1
	X	BACKUP BATTERY- BATTERY 2

	X	BATTERY PULSE GRAY WIRE HARNESS CONNECTOR X331

NOTE 1		***RED AND BLACK BATTERY CABLES FROM PULSE BOX TO BATTERY 2***

NOTE 2		***DO NOT CONNECT THE BATTERIES WITH ANY OTHER EQUIPMENT***
		I.E. JUMP START WITH IGNITION FEED FOR CHARGING

NOTE 3		***SWITCHES NOT SUPPLIED FOR JPAS , SYSTEM, BRAKE HOLD***
		CAN BE CONNECTED WITH SOLINOID AND SWITCH FOR EGRESS

NOTE 4		***SYSTEM AND JPAS SWITCHES MARINE ROCKER STYLE***
		BRAKE HOLD MOMENTARY SWITCH (IF NEEDED FOR THE CUSTOMER)
		PARK SWITCH BRAUN 919 LIFT TOWER SWITCH NEW SEALED STYLE

NOTE 5		***MAKE WIRE CONNECTIONS FOR GAS BRAKE AND SECONDARIES BEFORE MOUNTING ACTUATOR MOUNTS***

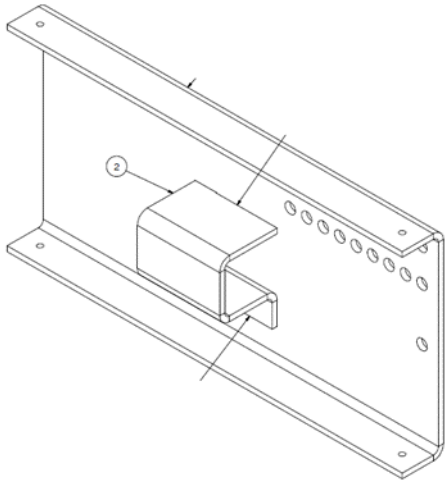
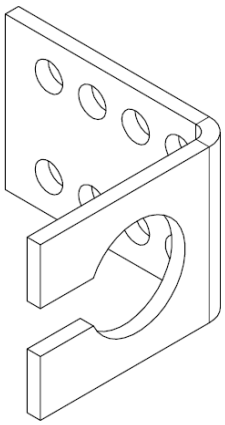
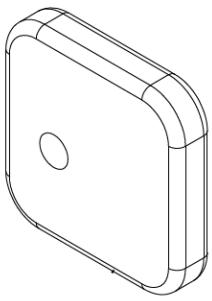
NOTE 6		***PARK SWITCHES NOW INCLUDED***
		MAIN SYSTEM SWITCH, JPAS SWITCH, UNDER HOOD 2ND BATTERY MOUNTS ARE AVAILABLE SEE BELOW
		TOYOTA MOUNTS 1 RED TOP OPTIMA ABOVE THE ENGINE. WELD OR DRILL TRAY

5 Installation of Modules

5.1 Installation Digital Gear Shifter

5.1.1 Part list

(Images are not to scale)

Image	*Description*	*Pcs*
	MAIN SHIFTER MOUNT SAM053117	1
	HONDA TOYOTA CABLE MOUNT PFHTCM111417	1
	SWITCH ACTIVATOR SP0427021	1
	SWITCH DK2552041ND	2

5.1.2 Hardware kit for shifter brackets

Component/ Part Number	***Description***	***Quantity/ BOM***	***Image (Images not to scale)***
694034M	1/4-20 X 2 1/2" HEX HEAD BOLT	1	
13SP227	1/4" ID X 1/2" OD X 3/8" LONG NYLON BUSHING	1	
	1/4-20 NUT	4	
	1/4" WASHER	1	
	1/4" X 1 1/2" FENDER WASHER 1/8"THICK	1	
	1/4-20 X 1 1/2" BUTTON HEAD	1	
	4-40 X 1 1/4"	2	
	4-40 NYLOCK NUT	2	
	1/4-20 NYLOCK NUT	1	

5.2 Installation backup-battery

5.2.1 Hardware kit for Backup Battery

Component/ Part Number	***Description***	***Quantity/ BOM***	***Image (Images not to scale)***
	1" -5/16" bolt	2	
	5/16" nylock nut	2	
	5/16 washers	4	
	1" 1/4-20 bolt	2	
	1/4 lock washers	2	
	1/4" washers	2	
	1/4" steel nut inserts	2	
PFTHSTB051622-1	Battery tray	1	
	Battery strap	1	

Important:

Ensure the following

- Cable cross section 7AWG
- Cable protected against chafing
- Place the Pulse test box close to the backup battery (without extending the cables)

1. Any separately placed relays should be removed.

2. The mass cable of the backup-battery should not be connected to the vehicles body. It needs to be connected to the EnergyAlarm module using a cable.
3. All consumers such as ramp door, lift etc. need to be connected to the vehicle's primary battery.
4. **For safety reasons the backup-battery must always be as specified in the Universal System Manual.**

Next installation steps

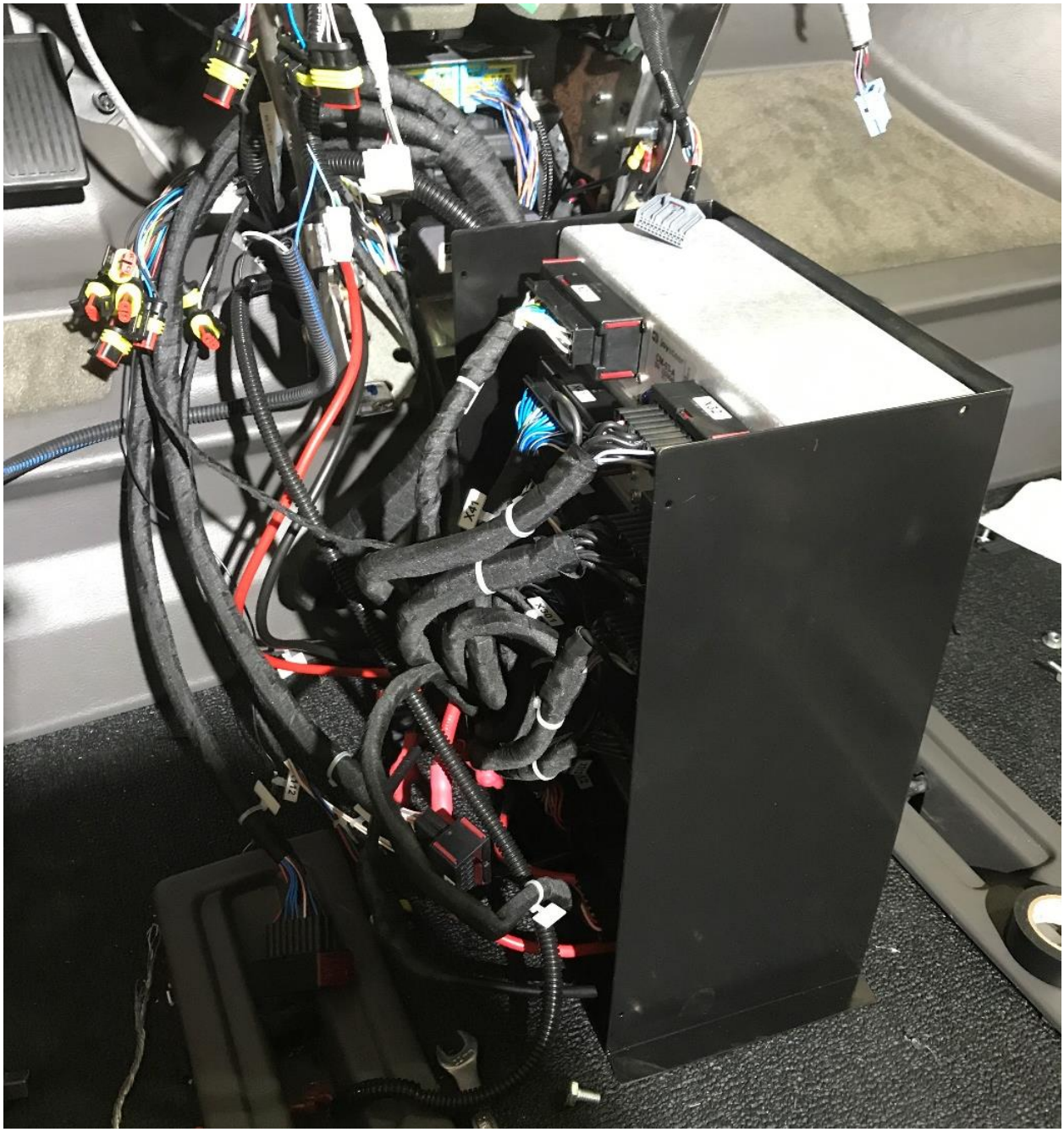
5. Place ring cable shoes to the backup-battery (4AWG/M8).
6. Place fuse near the backup-battery 125A (adapter included in the delivery).
7. Apply battery clamp on the backup-battery (positive and negative pole).
8. Apply vent hose on the backup-battery.

   Make sure that the gases are led out of the vehicle (If required; drill a hole and make a tulle).
9. Connect both 10mm^2 cables to the EnergyAlarm module.

   Use ring cable shoes (8AWG/M6).
10. Connect the EnergyAlarm module to the backup- battery.

11. Place ring cable shoes on the original battery (8AWG/M8).
12. Place fuse 125A near the original battery (adapter included in the delivery).
13. Apply ring cable shoes (8AWG/M8) to the positive and negative pole of the battery.
14. Mount them to the original battery clamps.

5.3 Installation of Electronics



The installation order of modules from top to bottom is always:

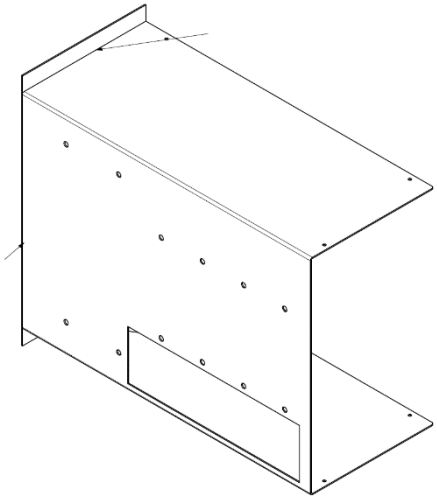
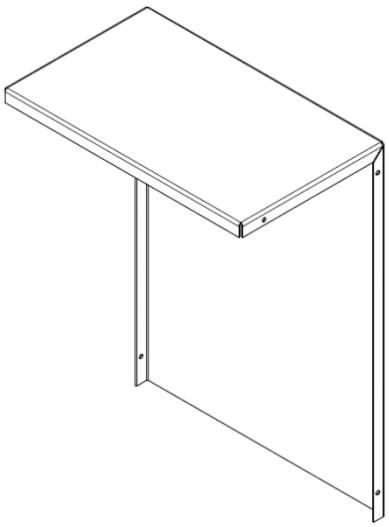
L1	=	Steering converter module 1
L2	=	Steering converter module 2
B1	=	Braking converter module 1
B2	=	Braking converter module 2
EAM	=	EnergyAlarm module

The modules and, if available, the module rack (optional item) have to be grounded well. In case this is done with a cable, the cables cross section must be at least 2.5mm^2.

If the module rack is installed all modules are to be connected to it.

5.3.1 Part list

(Images not to scale)

Image	*Description*	*Pcs*
	Module rack PFHB6135	1
	Module rack cover PFHB6137	1

5.3.2 Hardware kit for Module Rack

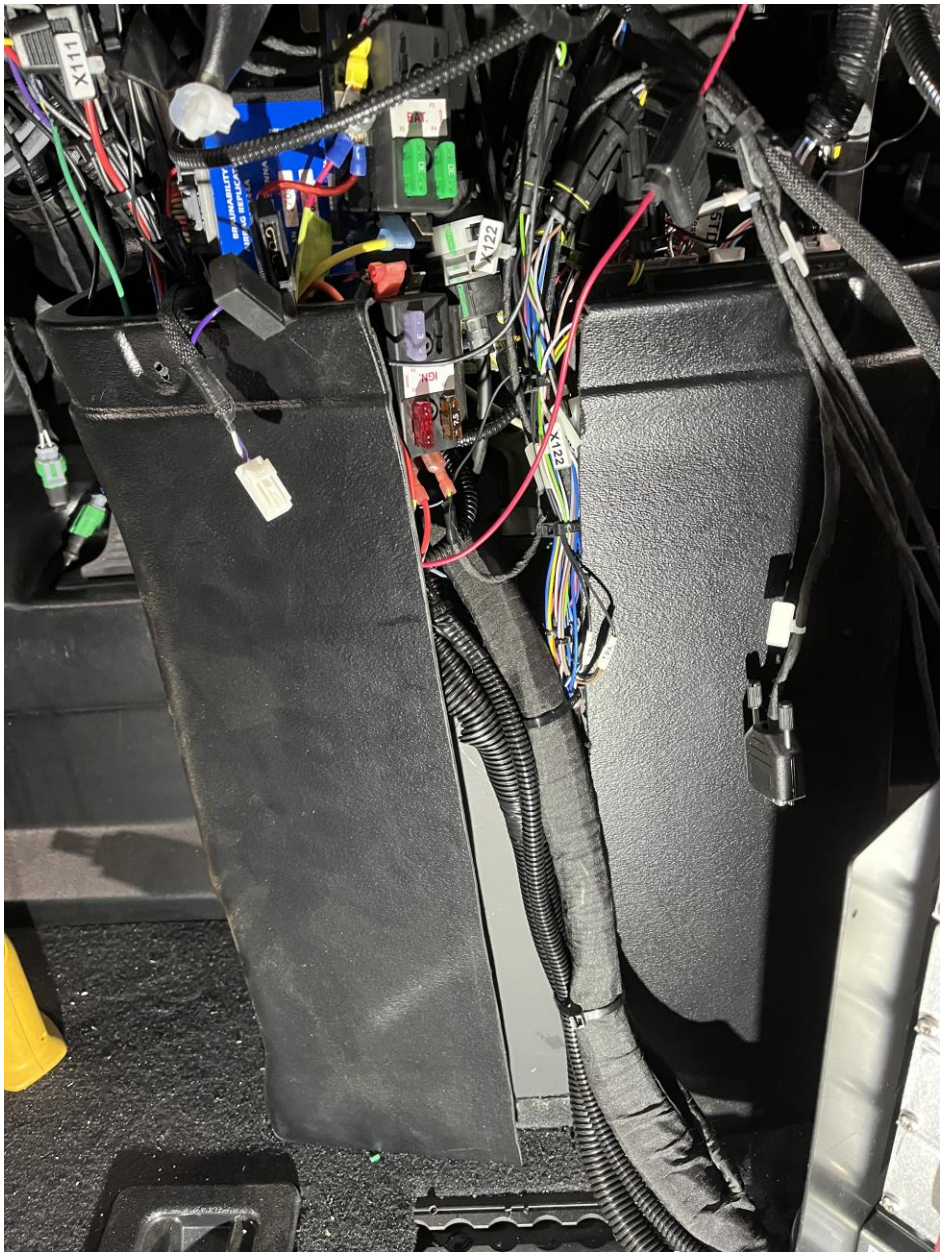
Component/ Part Number	***Description***	***Quantity/ BOM***	***Image (Images not to scale)***
500-26209	M4-0.7 X 10MM BUTTON HD SOC CA Controller Mounting Bolts	12.00	
102-00748	M4 F/W TRIV ZINC DIN125A - M4. Controller mounting	12.00	
9600K128	3 ¼ RUBBER PUSH IN GROMMET Controller Tower grommet	1.0	

Important:

Assure that the modules are not affected by the hot air stream of the foot heating as this can result in overheated modules. If so, a heat shield has to be mounted accordingly (heat shield not within delivery).

5.4 Installation of Cable Harness

The Cable Harness can be laid in the car as showed on the pictures below:

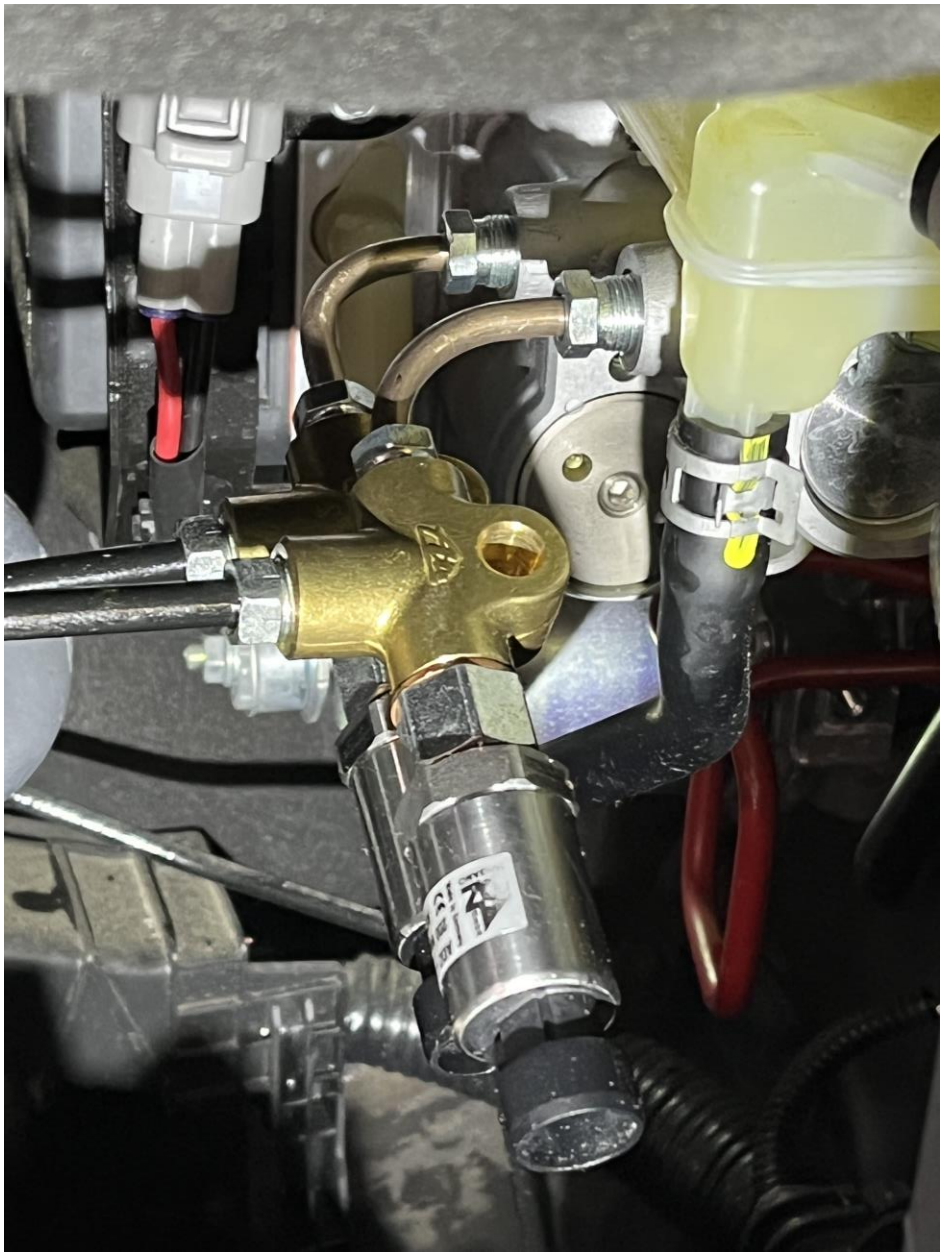


5.5 Installation brake pressure sensors

5.5.1 Hardware kit for brake pressure sensors

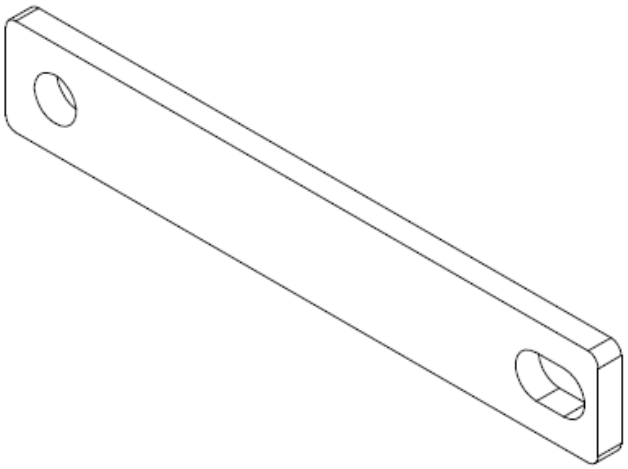
Component/ Part Number	***Description***	***Quantity/ BOM***	***Image (Images not to scale)***
	Brake pressure sensors	2	
	Copper washers	2	
	Sensor adapters	2	
	Lines M12x1.0 Fitting with double flare as short as possible. 3-3.5 inches, then bent 90 °	2	

1. Install the brake pressure sensors as shown in the picture



2. Purge the brake lines to remove air and connect the sensors to X71 / X72.

3. Optional, this brake press sensor mount can be used to stabilize the position of the sensors.



5.6 Installation brake actuator (BAM)

After removing the dash panels and Airbag Assembly remove the four nuts holding the booster and pedal assembly in place. Remove the upper dash support bolt.

Remove the pedal assembly and place the pedal mount into its location shown in the photos. It should align with the bottom of the switch plate and flat onto the top of the pedal arm as shown. Then clamp it into place and weld it.

Note:

The pedal mount can be tacked into place and fit before welding to confirm that the pin slides through it by installing the pedal assembly and the main mount using just two of the mounting nuts and the dash support bolt attach the motors. Then fit the pin.

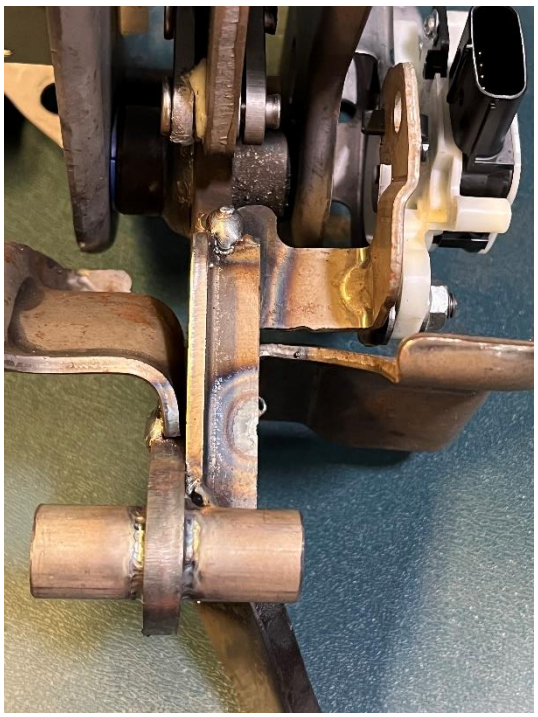
Once confirmed then finish welding.

When welding the brake mount to the pedal its recommended aligning it and tack welding it in place.

Then fitting the brake assembly back into the car mount the upper mount and actuator. Align the pin so that it has no binding

Then removing and welding solid. This will prevent having to cut and start over and only adds about 15-20 minutes of work but could save hours if welded incorrectly

Install the pedal assembly back into the car and work the main brake actuator mount into the location shown. The front will have to start at the lower section of the factory assembly and push over the flange then up into its location. Then install the factory nuts.



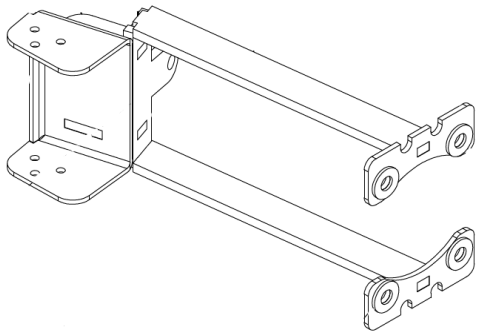
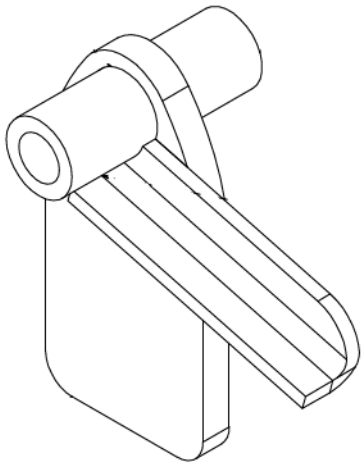
Note:
This symbol indicates the usage of Loctite.
Always use Loctite 243 unless otherwise mentioned.
Apply the required torque.

Check the fit. If correct, the motors should have between 4 and 8 mm between the tube and the main body and the pin should slide through without any force needed.

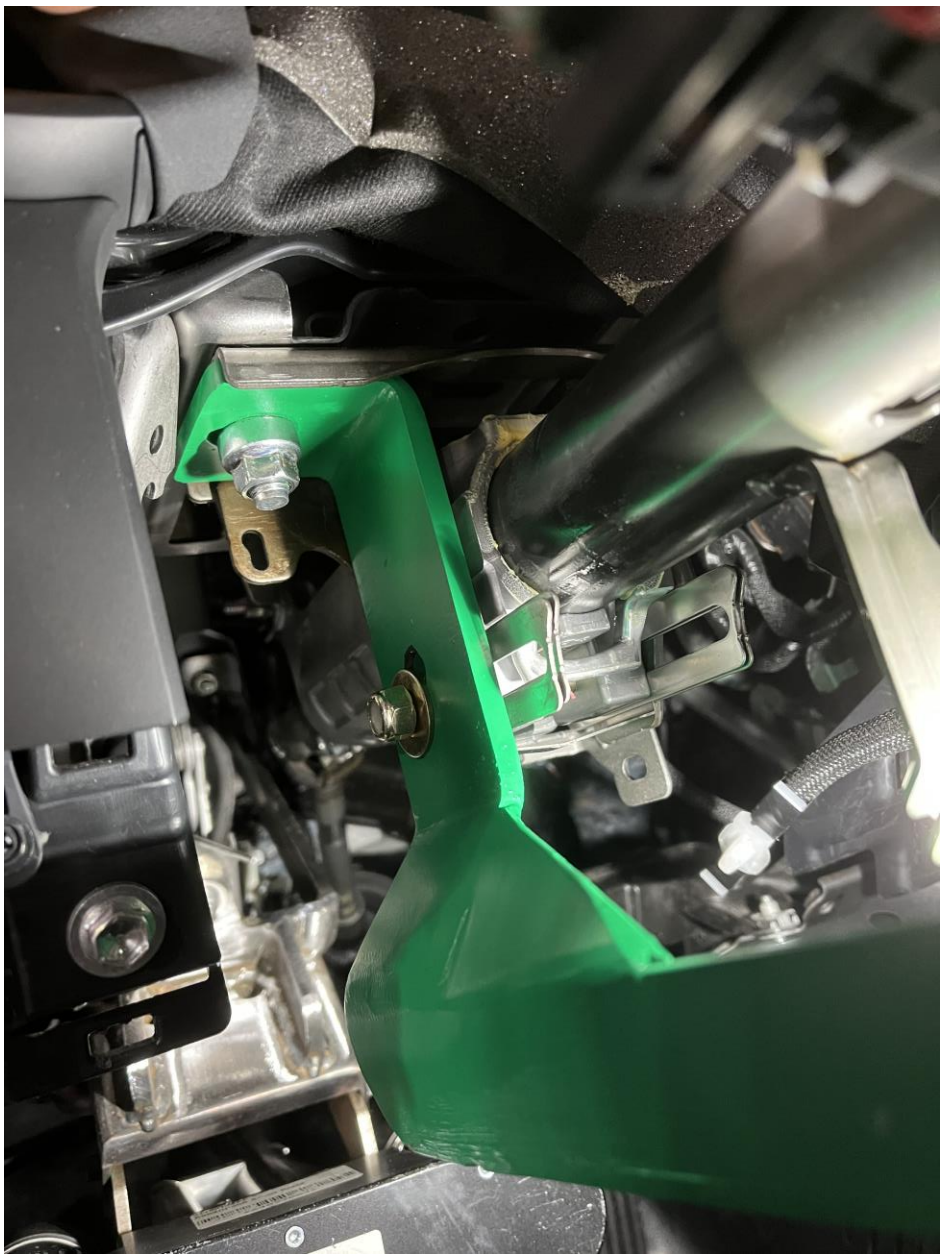
Always check that the pin is not under tension and that the locking clip is attached properly.

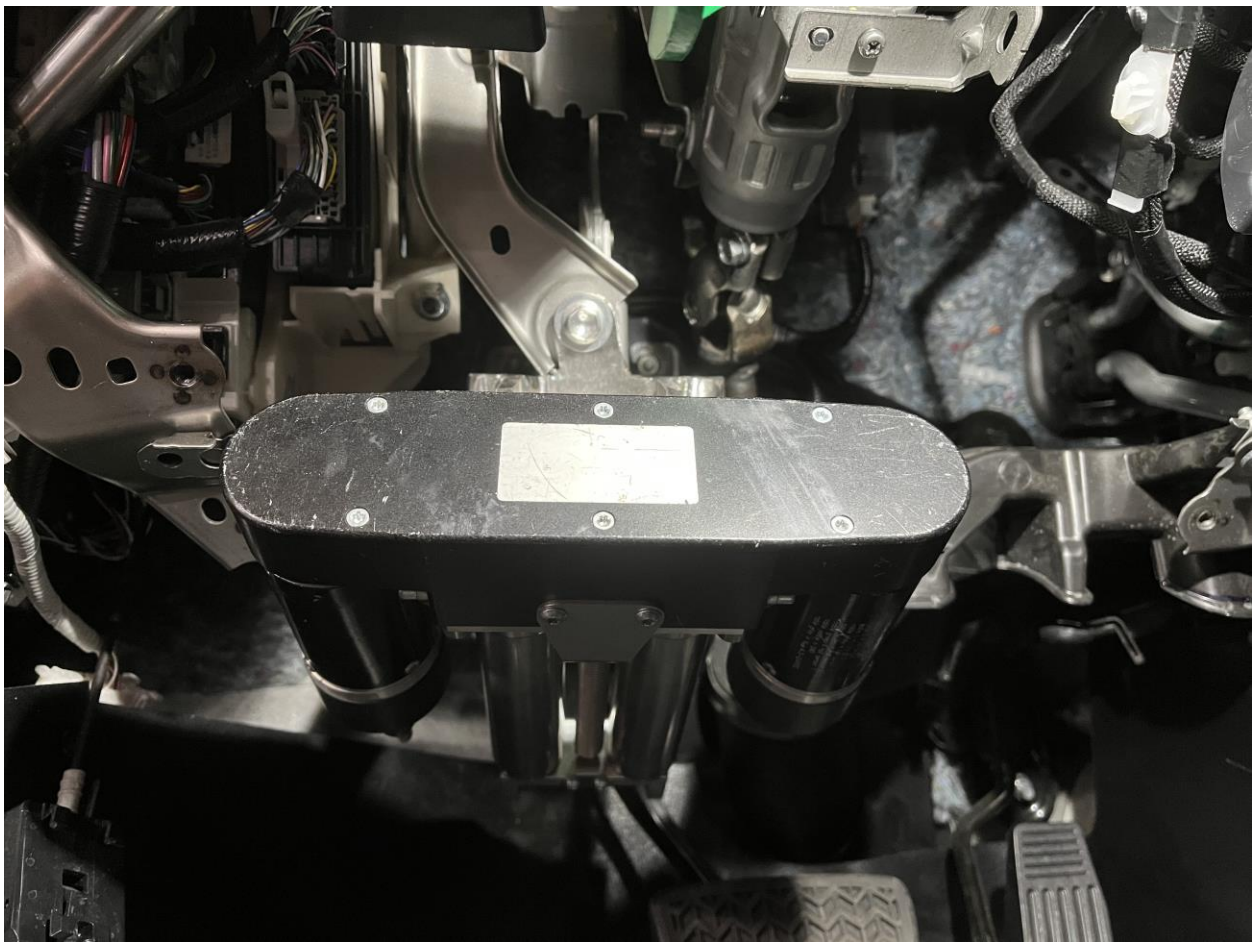
5.6.1 Part list

(Images not to scale)

Image	***Description***	***Pcs***
	Upper Main Mount	1
	Lower Main mount THLBM09233	

5.6.2 Installation steps





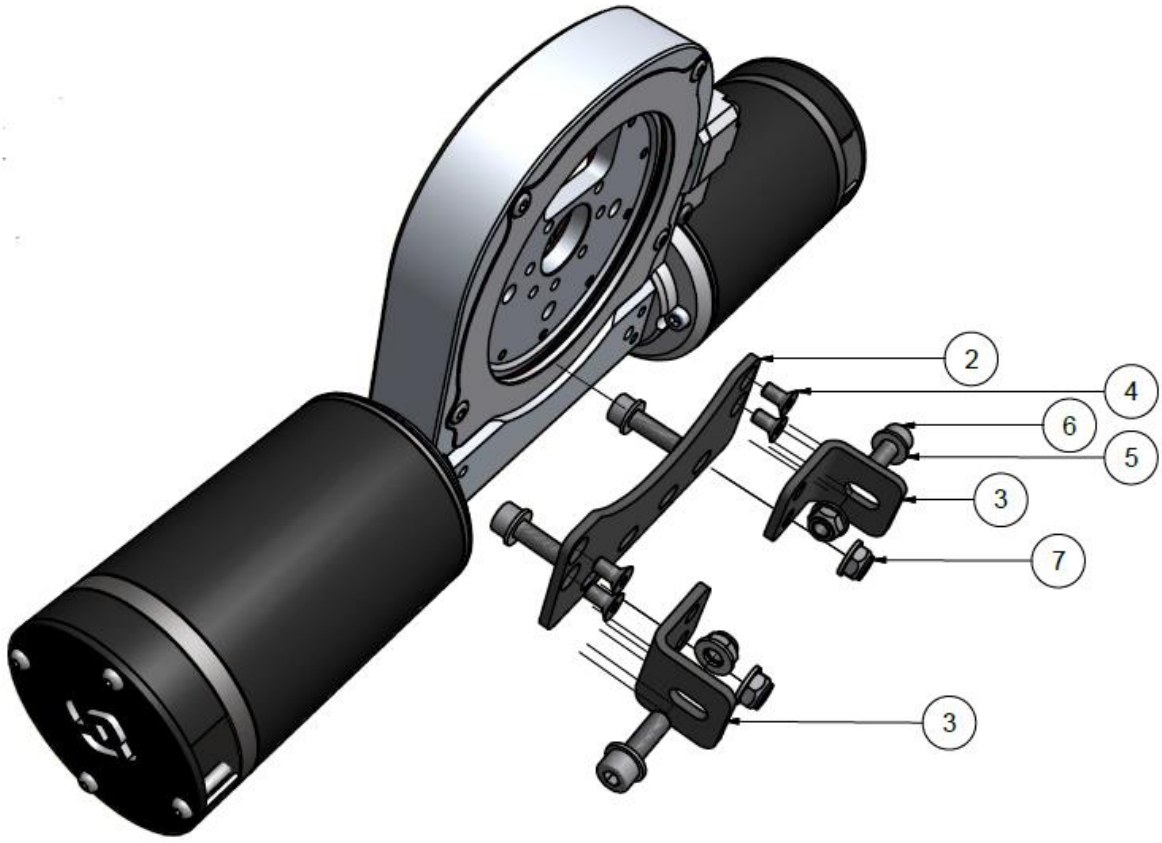
Assure that the modules are not affected by the hot air stream of the foot heating as this can result in overheated modules. If so, a heat shield has to be mounted accordingly (heat shield not included in the delivery).

5.7 Installation steering actuator (SAM)

The steering actuator is placed between the steering wheel and the steering column. There is no need to detach the steering column.

In case of an adjustable steering column the steering column needs to be fixed permanently.

Ensure the steering wheel is always in the middle position (straight-ahead position).



In addition, the following needs to be ensured:

- the airbag-ring is in its middle position when installing.
- the catch pin of the airbag-ring is placed correctly.

Note:

Before starting with this, start the car and feel the force needed to turn so that you can compare to assembled force.

The force needed will be greater, but it should not feel tight.

5.7.1 Part list

(Images are not to scale)

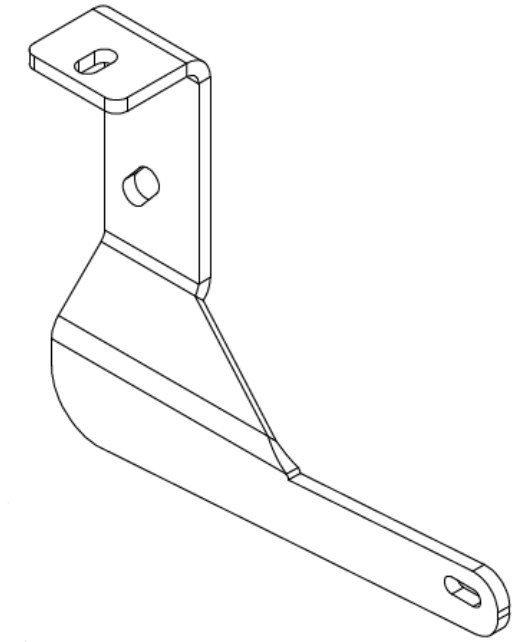
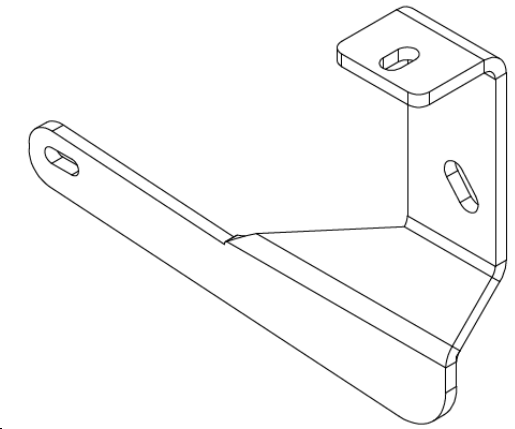
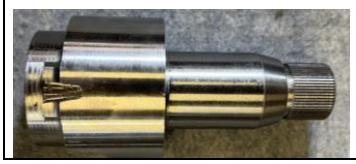
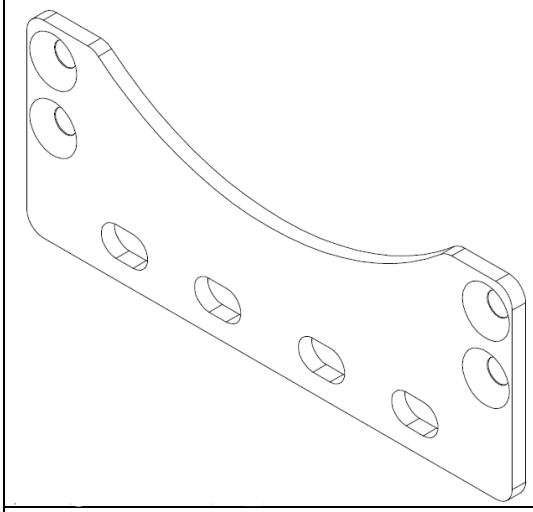
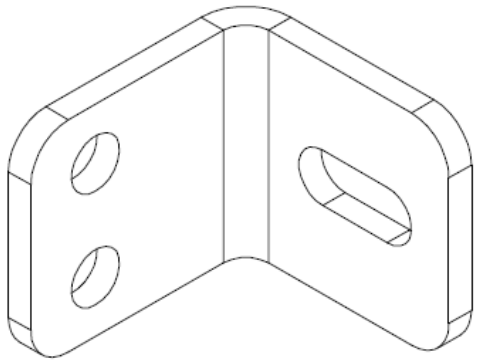
Image	*Description*	*Pcs*
	Left Mount	1
	Right Mount	1
	Wheel Adapter	1

Image	***Description***	***Pcs***
	Steer plate PF 3637	1
	Angle Bracket PF 3636	2
	M6x8 Full Tread Flat Head Screw	4
	M18x1.5 90mm Long Hex	1
	M8 Nylock Nut	4
	M8 Washer	8
	M8x20 mm Hex head	2
	M8x25 mm Hex head	2
	5/16'' x 3.5 Grade 8 Hex Bolt	1
	5/16' Washer	2
	5/16' Nylock nut	1

Note:

This symbol indicates the usage of Loctite.
Always use Loctite 243 unless otherwise mentioned.
Apply the required torque as per table

5.7.2 Installation steps

1. Remove the plastic surrounding the wheel if not already done for secondaries.
2. Remove the steering adjustor as shown in picture below, Slide a 5/16” bolt with a washer through the mount and column assembly.

3. Then repeat to the right-side mount. Snug the adjustor bolt enough to pull the mounts to the column and then tighten the main column nuts.

Note:
This symbol indicates the usage of Loctite.

Always use Loctite 243 unless otherwise mentioned.
Apply the required torque.

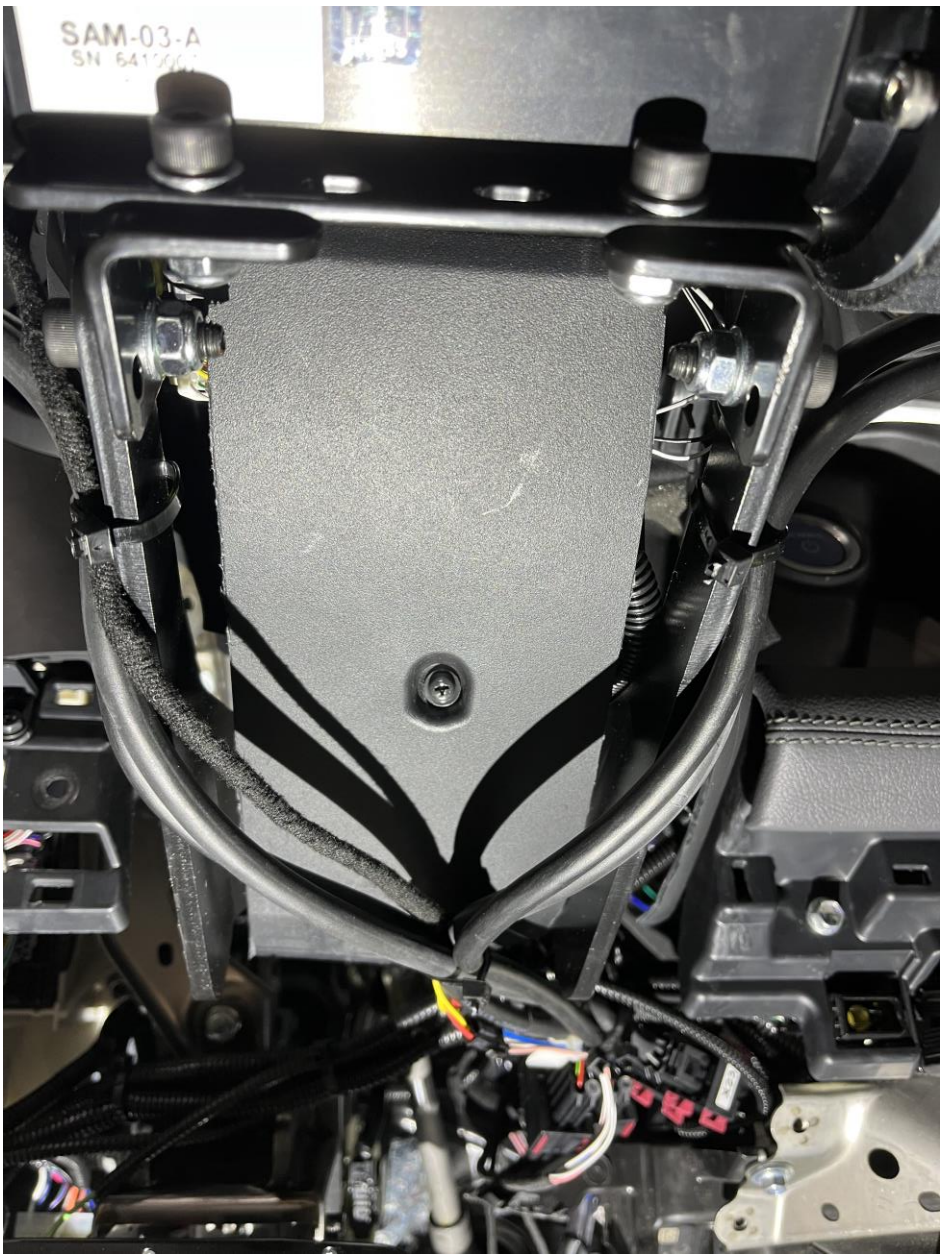
4. Make sure the wheel are pointing straight
5. Remove the steering wheel
6. Being carefully not to let the clock spring turn by locking it into place. The wires will have to be extended a couple of inches.
7. Install the steering adapter and then the plastic covers.

The lower cover will have to be cut as shown below.

8. This is the starting point. The rear facing part will have to be cut enough to get to the bolts and the angle mounts which can be loosely fit into place to confirm enough has been cut away.
9. Once the plastic is in place and the wires are extended the steer actuator can be installed

Note:
This symbol indicates the usage of Loctite.
Always use Loctite 243 unless otherwise mentioned.
Apply the required torque.

10. The column should be moved into the correct alignment to prevent binding of the gear assembly. Then the column adjustment bolt can be tightened.

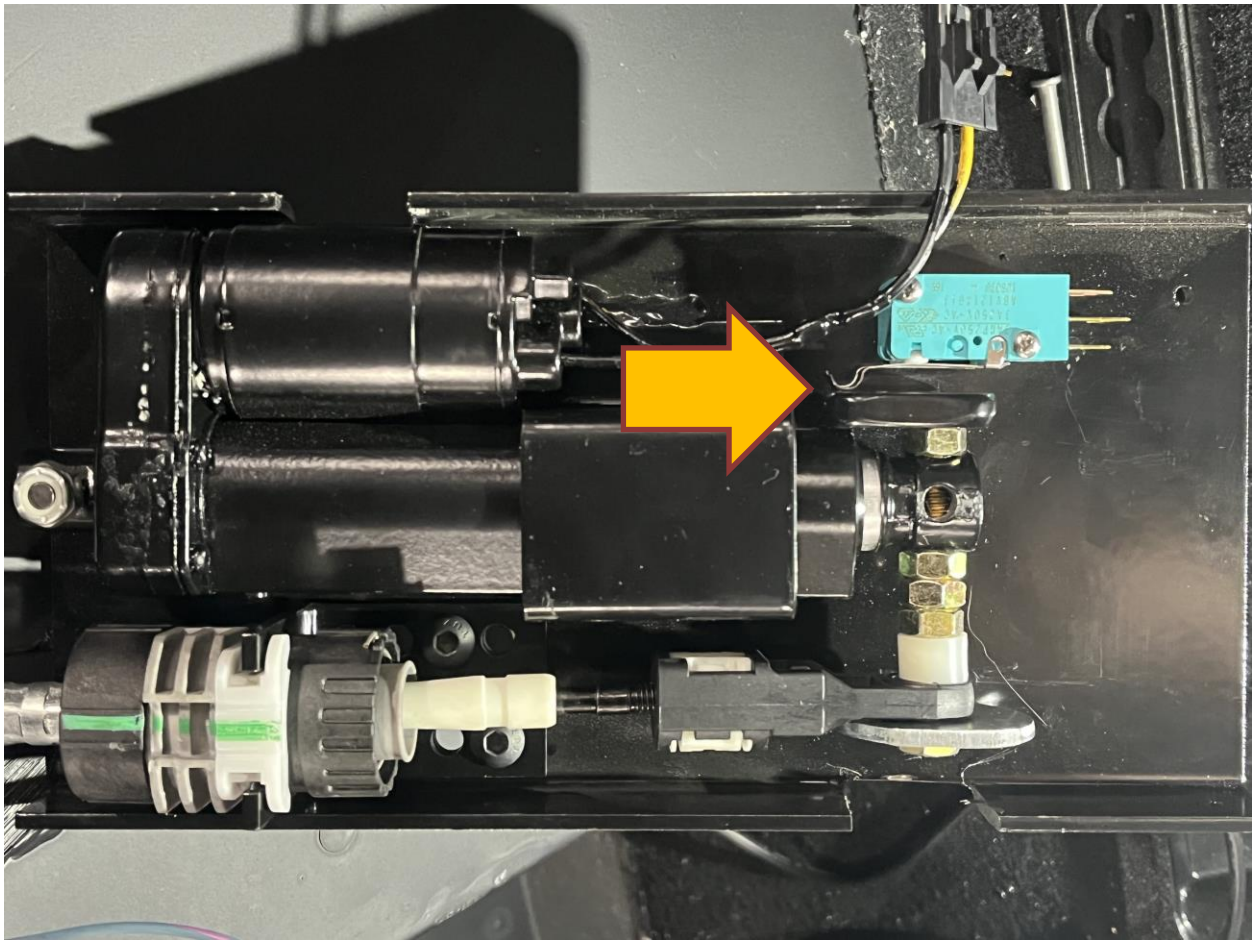


11. After tightening the bolt, test the friction of the gear assembly again. If the friction feels to great, then loosen the two bolts holding the steer actuator and the angle mount. If should remain flat to the amount. Remove the two bolts and the hole should remain aligned. If either does not, then the column adjustment is needed.

Important:

Check if the installation is correct by driving the car conventionally after having installed the steering actuator. As the worm wheel and the motors are rotated passively, there is an increase of friction. Whilst the joysteer® system is turned off the friction of the steering actuator should **not increase significantly**. If this is the case, the steering actuator is misaligned, and the screws of the brackets need to be loosened slightly. By sequential tightening of the screws, the alignment of the steering column to the steering actuator is ensured and thus the friction can be minimized.

5.8 Park Switch

The Park Position is safety critical and is recognised by the joysteer® system.

There can be found 2 installation methods to detect the safe Park Position. Either with a CAN Adapter or with P-switches. The Installation of the CAN Adapter is universal and shown in the System manual. However, the installation of the P-switches is car specific as following: