

Assembly Instruction (V 1.0) for **Powerlock Differential 2**

For the assembly of the Powerlock 2 Differentials (**PL2**) please take a look to the exploded drawing and part list. You can also have a look to our video tutorials on YouTube or Facebook.

The differential has been assembled at SCS M2 Engineering factory. You just have to fill up the PL2 with our special diff oil (**order no: M10111**). All parts which you add or exchange in the differential have to be smooth and free of burrs.

PL2 - the concept

The PL2 is the logical consequence out of the successful Powerlock 1, a perfect revolution. The advantages of the new PL2 is a reduction of mass-rotation, optimized and smooth rolling resistance, disengagement of acceleration, rolling- & braking stage and all of this could be adjusted from outside without taking the dif apart. Patent applied for Powerlock 2.

The three external adjustment allows the driver to modify the locking effect and this would take only a few seconds to do. The external adjustment gives the driver more setup options to tune the car to adapt best possible on the track grip level. If the racetrack continuously changes over the weekend, the locking effect is the perfect setup option to improve laptime. The preload screw still remains and is mainly there to balance the internal tolerances.

Setup configuration

There are 2 basic configurations: Low Grip & High Grip option.

The parts for both options are included in the PL2 package.

For the Low Grip option you exchange the disc package set (34) of the right housing (7) with a filler piece (44). The disc package set (34), which has a package height of 5,8 to 6,0mm contains 4x diff shim ring (10), 2x diff-shim carbon (3) and 2x outer disc (17) (**Fig. 1**). With the filler piece (44) you reduce the locking effect by 50% in comparison to the High Grip option. Generally the filler piece (44) is design to fit as well into the left housing (6), hence with an additionally filler piece (44) you are able to eliminate the locking effect of the differential almost complete.

The adjustability of the locking effect is set by the activation or deactivation of friction pairings. A friction pairing is defined with an outer disc (17) and a diff-shim carbon (3), these two surfaces generate a frictional torque due to their relative movement to each other. On each side of a disc package set (34) there are diff shim rings (10) implemented to reduce the unwanted friction.

Low Grip Option
 #1 = 0 friction pairing
 #2 = 2 friction pairing
 #3 = 3 friction pairing

High Grip Option
 #1 = 0 friction pairing
 #2 = 3 friction pairing
 #3 = 6 friction pairing

Switch position

The PL2 offers 3 switch positions, which are set by the adjuster screw (37). You have to loosen the adjuster screw (37), which is located in holes (**Fig. 2**) on the left differential housing (6). With a smooth movement of the adjuster screw (37) to the relevant switch position you can modify the locking effect. If you reach your preferred switch position #1 #2 or #3 then retighten the adjuster screw (37). **Tip:** Use thread locker for the adjuster screw.

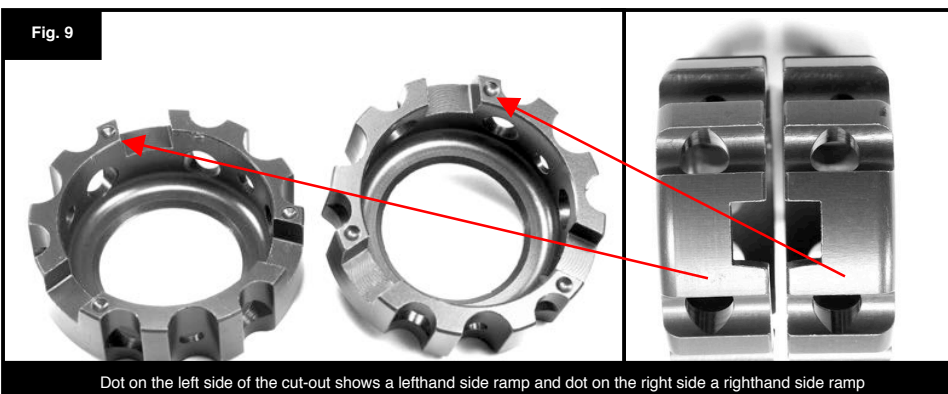
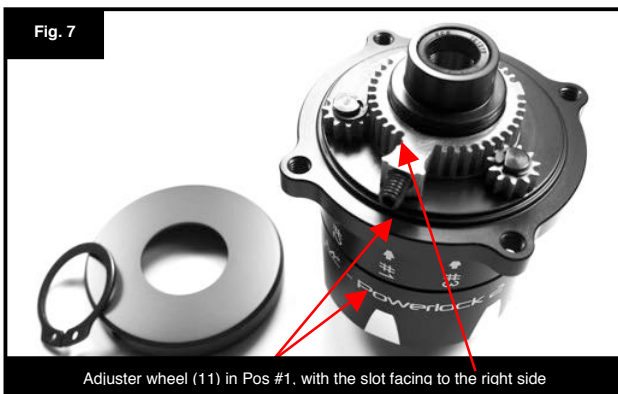
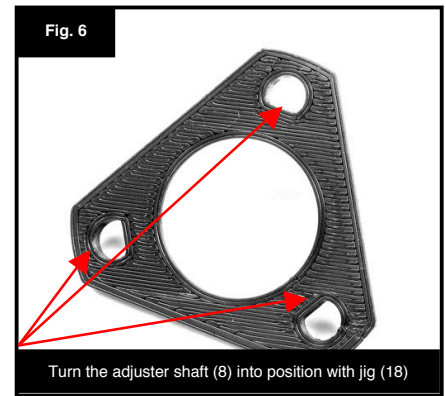
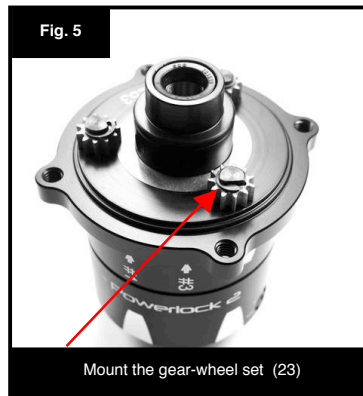
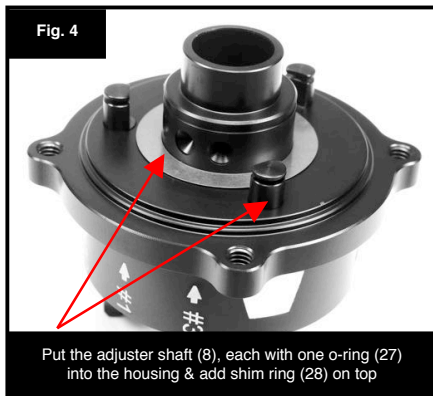


Configuration change

- Drain the oil via drain screw (14) or ball diff axle (41).
- Change to position #3.
- Rotate the differential onto the left ball diff axle (41), open the 3 cylinder heat bolts (35) and remove carefully the right diff housing (7) (**Fig. 3**).
- Remove the preload compensator (21).
- Exchange the disc package set (34) with the relevant filler piece (44) or vice versa. Be aware that the collar of the filler piece (44) is facing to the outside, not to the ramps. Please take care of the disc package sequence (34), see relevant order in exploded drawing.
- Add the preload compensator (21) back on top of the filler piece (44) or disc package set (34).
- Put over the right on top of the left diff housing. Take care of the correct position of the o-ring (12).
- If you have troubles with the ramps (33/40) or ramp angle blocks (43), please read the section „Merge both halves of the diff housing“.

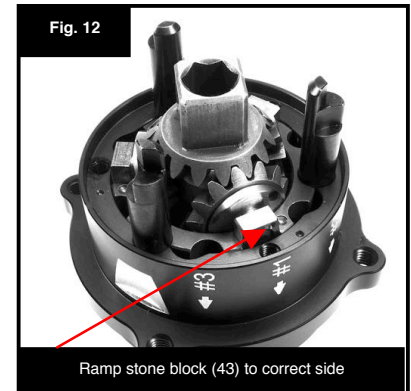
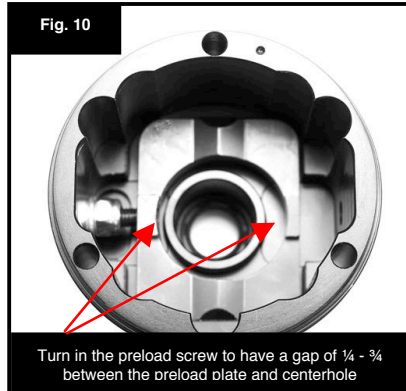
Pre-assembly of left diff housing

- Fit the main gear to left diff housing (6). Please use thread locker.
- Fit the flange sleeve (4), ball bearing inner (19) & shaft sealing ring (26) into the housing.
- Fit the o-ring (27) into the lower groove of the adjuster shaft (8) and place them into the diff housing (**Fig. 4**).
- **Tip: Use therefore teflon grease (order nr. M80700) and turn the shafts a few times in their position.**
- Place a shim ring f. adjuster wheel (28) onto the left housing (6) (**Fig. 4**).
- Fit another o-ring (27) on all adjuster shafts (8), after that the gear-wheel set (23) and secure them with the c-clips (16) (**Fig. 5**).
- Use the jig (18) to turn the adjuster shaft (8) into correct position (**Fig. 6**).
- Secure the adjuster screw (37) with thread locker into the adjuster wheel (11).
- Adjuster wheel (11) must be placed in position #1 with the slot facing to the right side (**Fig. 7**).
- Check for free movement of the gear-wheel set unit (24).
- Afterwards add the cap (25) on top with relevant lock ring (20). Check safely the fixation of the lock ring (20).
- Turn around the housing upside down to add the disc package set (34) according the order shown in **Fig. 8**:
2x diff shim ring (10) – 1x outer disc (17) – 1x diff shim carbon (3) - 1x outer disc (17) – 1x diff shim carbon (3) - 2x diff shim ring (10)
- Place the left ramp (40) into the housing (6), add the diff output drive gear (30) and the ball diff axle (41) and align all parts.
- **Tip 1:** To check if the the correct ramp is fitted in the correct housing you can compare the alignment of the dots in the housing/ramps (**Fig. 9**). Left ramp has the dots on the left side of the cut-outs for the ramp angle blocks (43), right ramp has the dots on the right side of the cut-outs.
- **Tip 2:** The ramp (40) has to be flush with the diff housing (6), maximum tolerance +/-0,1mm. Otherwise you have to add more shim rings (10) to th disc package set (34) or you have to machine down the diff-shim carbon (3). **Attention:** the disc package set (34) has to have always 2 shim rings on each side of it (see exploded drawing).
- **Tip 3:** The ramps (40/33) must run smoothly up & down without sticking between the adjuster shafts (8). Please check this frequently.
- Last but not least set the switch position to #3.



Pre-assembly of right diff housing

- Fit the flange sleeve (4), ball bearing inner (19) & shaft sealing ring (26) into the housing.
- Mount the preload screw (13) with a shim (42) and o-ring (27) from outside, plus a shim (42) and counter nut (39) from inside. Additionally add the preload plate (22) and make sure the preload screw (13) fits into the thread of the preload plate (22). Insert the preload screw (13) marginally into the preload plate (22) to guarantee that there is no preload on the system when assembling the housing (**Fig. 10**).
- Tip:** Add oil to the o-ring (27) before you tighten up the preload screw (13) and the counter nut (39) to avoid damaging the o-ring. Make sure that the preload screw is tighten strong enough to seal up the diff and ensure the screw is still turnable.
- Place the o-ring f. housing (12) into the slot of the right housing (7).



Merge both halves of the diff housing

- Place the left diff housing (6) onto its ball diff axle (41) in switch position #3.
- Equip the bevel gear carrier assy (47) with the diff bevel gear (31) and the ramp angle blocks (43), see **Fig. 11**.
- Use a small longnose plier (**order no: X106502**) to place the prepared bevel gear carrier assy (47) into the left ramp (40). Take care of the correct direction of the ramp angle blocks (43), that all dots are matching (**Fig. 12**).
- Add the diff output drive gear (30) & right ramp (33) on top.
- Insert the disc package set (34) or optional filler piece (44) in following order (**Fig. 8.1**):
2x diff shim ring (10) – 1x diff shim carbon (3) – 1x outer disc (17) – 1x diff shim carbon (3) – 1x outer disc (17) – 2x diff shim ring (10)
- Put the preload compensator (21) according **Fig. 3** onto the disc package set (34) or respectively the filler piece (44)
- Put over the right diff housing (7) and secure it with the cylinder heat bolts (35).
- Tip 1:** Screws must be hand-tight and ball diff axle must turn smoothly.
- Tip 2:** Differential should run smoothly when turning the ball diff axles. Simultaneously turn the preload screw (13) to find correct preload setting. With the preload screw (13) it is **not** possible to increase or decrease the locking effect. The screw is there to balance the tolerances.
- Fill up the diff with our special differential oil by adding it via the right ball diff axle (41). Remove the drain screw (14) and put the diff in an upright position. Put as much oil into it until the oil comes out by the drain screw (14). Stick in the right ball diff axle (41) and tight up the drain screw with the relevant o-ring (27).