# Air Shock Manual

Version 28072016


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# 1. Overview

**“Custom Axis Pro Air Shock” built by Penske Racing Shocks**

DynAccess monoskis, such as the Torque 1, Torque 2 and Tensor, are equipped with a specially designed and developed **Custom Axis Pro Air shock** for monoski applications. The Pro Air is a Custom Axis brand, a Division of Penske Racing Shocks, specializing in off-road shocks for vehicles such as ATV, snowmobiles, motocross bikes, UTV’s, and monoskis.  DynAccess is the sole source for this monoski shock.

Please read the following information to understand how to adjust the shock to your riding style and your preferences. There is quite a range of adjustment possibilities. Some people prefer a smooth and soft ride, as in a "cruiser", while others want to shred the mountain with a stiff and responsive feel. Dialing in the shock to your liking is a very rewarding exercise.

The shock has a **dual chamber air spring** (Chambers 1 and 2) and **hydraulic damping**, making our monoskis fit for skiers with a wide variety of weights and skills. Spring stiffness (spring rate), ride height, and compression and rebound dampings can be easily and quickly adjusted by an air pump and easy-to-turn knobs.

In essence, **spring stiffness** is controlled by the air pressure in the both chambers (Chamber 1 & 2) whereas **ride height** is controlled by the air pressure in the upper chamber (Chamber 2). The air pressure of both chambers can be changed by the enclosed air pump (bicycle shock pump). The **compression and rebound dampings** are adjusted with two or three knobs (depending on whether a double-adjustable or triple-adjustable shock is used).

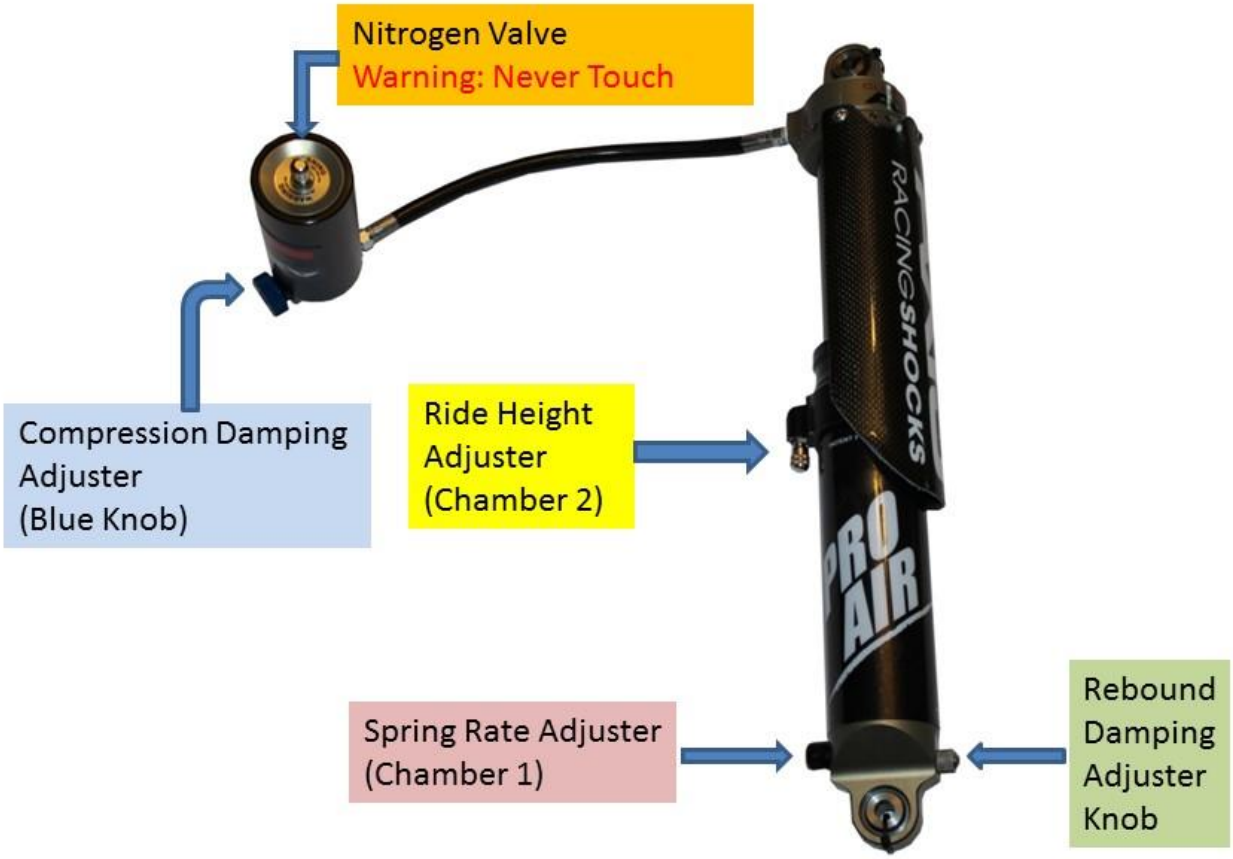


**Fig. 1 Locations of shock adjusters**

# 2. Adjusting the Shock

When adjusting the spring and shock for the first time, release all air pressure from the upper chamber (chamber 2). Then start by setting the pressure in the lower chamber (chamber 1) as described below.

When you unscrew the hand pump, the air in the hose of the pump will leak out, but not the air in the shock. Please make sure that you screw on the pump sufficiently far. The hose will first seal to the valve, then as you keep screwing it on the valve stem will be depressed and you can pump in air. If you don't screw it on sufficiently far, the valve stem won't open and you are just compressing air in the hose of the pump.

## 2.1 Adjusting Air Pressure in Chamber 1

Spring rate can be simply stated as the amount of force required for a certain deflection of a spring. The lower the rate, the softer the spring. The softer the spring, the smoother the ride; however, the more likely it is to bottom out. Spring rates are selected based on body weight, ride style, personal preference, etc. Heavy riders need higher spring rates than light riders. The spring rate of our shock is controlled by air pressure in both chambers (chamber 1 & 2). Since spring rate is controlled by air there is infinite adjustability. The air spring is progressive, which means that the spring rate increases as the spring is compressed. This reduces the risk for bottoming out. There further is an internal rubber bumper which makes bottoming-out less harsh.

**The spring stiffness (spring rate) towards the end of the stroke of the shock is tuned by changing the air pressure in the lower chamber (Chamber 1) with the enclosed air pump (a shock pump). The higher the air pressure, the higher the spring rate.** It is suggested to start with fairly high air pressures and then reduce the pressures gradually as desired. **Higher spring rates should be accompanied by higher damping (in particular rebound).** It is impossible to give exact pressures and damper settings since it varies with speed, snow condition, course, rider style, aggressiveness, bumpiness, personal preference, etc.

 Warning!

Never use air pressure above 150 psi.

**Adjust the air pressure with the shock unloaded** (i.e., while not sitting in the monoski). A starting point for a 120 lbs rider of average aggressiveness is 40-50 psi in the lower chamber. A 200 lbs rider of average aggressiveness may start with 80-100 psi in the lower chamber. Again, these are pressures in the lower chamber (chamber 1) when the shock is unloaded.

## 2.2 Ride Height and Initial Spring Rate - Chamber 2

The ride height as well as the initial spring rate are set with air pressure in the upper chamber (chamber 2). In general you sit higher in a DynAccess monoski than in other monoskis. This allows for steeper bank angles for high G turns. It also helps getting on chairlifts. However, if you prefer sitting lower this can be accomplished by decreasing the air pressure in the upper chamber as described in this section.

**When unloaded the pressure in chamber 2 should always be lower than in chamber 1**. In general the pressure in chamber 2 should not be vastly different from the pressure in chamber 1. An exception is for beginner riders who may want a quite low ride height, in which case the air pressure in chamber 2 may be considerably less than in chamber 1.

**Adjust the air pressure with the shock unloaded** (i.e., while not sitting in the monoski). Using the examples above, a starting point for a 120 lbs rider of average aggressiveness may be 25 psi in the upper chamber. A 200 lbs rider of average aggressiveness may start with 55 psi in the upper chamber. Again, these are pressures in the upper chamber (chamber 2) when the shock is unloaded.

The pressure should not be so high that the shock does not compress when the rider sits still in the monoski. A good starting point is to have 1"-1.5" static compression when sitting in the monoski. Please have an assistant help when setting this up. Using a pair of outriggers the rider can lift himself/herself until the ski barely touches the ground. The assistant can now measure the length of the unloaded shock. Then the rider can relax and sit still in the monoski on the ground while the assistant again measures the shock length. The difference in length should be 1"-1.5" to start with.

A beginner who wants a lower ride height can reduce the air pressure in camber 2 further. The static compression will then be considerably more (e.g., 3").

**A lower ride height leads to less shock stroke remaining and thus a larger risk for bottoming out the shock. Thus, a low ride height combined with jumps or high speed in bumpy terrain should be avoided.**

## 2.3 Rebound Damping

The next parameter to set is the rebound damping. When the spring is compressed it stores energy. If there is no rebound damping the shock will quickly extend after a bump, releasing its stored energy and it may throw the rider "over the handlebars". In less extreme situations the shock may just extend too quickly, possibly bouncing the ski off the ground, throwing the skier off balance, providing poor traction, and/or leading to a few oscillations after hitting a single bump.

On the other hand, very high rebound damping leads to a slower response, and if running over many successive bumps the shock may not extend fast enough to respond to the next impact which will give a harsh ride. It may further lead to the shock "packing". Packing is when the shock gets shorter and shorter, resulting in lower and lower ride height. The shock does not have time to extend much between successive bumps. Edge grip also suffers with too high rebound damping.

You can get a starting point for rebound damping by strapping into the monoski, lifting yourself and the ski off the ground (perhaps 3"-6") using outriggers, and dropping down. **The response should be that the shock is compressed and then partially extend.** With too low rebound damping (too fast response) the shock will extend quickly and the monoski may oscillate one or a few times before it settles. With too much rebound damping the shock may feel "dead" and hardly extend at all after the initial compression.

Using the examples above, a starting point for a 120 lbs rider of average aggressiveness may be 15-20 clicks out on the rebound (turn the rebound knob all the way in clockwise to the slowest response (without turning it very hard), then back it out 15-20 clicks). A 200 lbs rider of average aggressiveness may start with 5-10 clicks out on the rebound. The rebound damping can be adjusted with the rider strapped in the monoski.

During successive runs, **try to adjust the rebound knob so that the rebound is as fast as possible (low rebound damping) without feeling uncontrolled.** Further, you may want an assistant to watch you riding off a 4"-6" jump and adjust the rebound so that the monoski bounces no more than once.


**Fig.2.** Rebound damping adjuster (Left: knob model, Right: New adjuster, needing a 5/32 ball hex wrench)

**Turning it clockwise will increase damping and make the response slower.**

Warning!

Never use any tools other than a 5/32 ball hex wrench on the shock. Never back out the knob more than 25 clicks.

When a tool is used on the rebound knob, for example, it can be backed out too far, which would allow the metering rod to slide down and block the rebound knob from threading back in. If the O-ring on the rebound knob is seen, that is beyond the maximum that it should be turned out (at that point you will feel it getting harder to turn out). If the rebound knob is turned out too far the shock may need to be serviced. The shock should only be serviced by Penske Racing Shocks, or Penske approved shops.

## 2.4 Compression Damping

The last shock parameter to adjust is compression damping. Compression damping is a means to alter the dynamic force-displacement curve and to dissipate energy while the shock compresses. Too little compression damping and the shock may go through all its travel on smaller sized bumps and bottom out. Too much compression damping and the shock may feel harsh and not achieve full travel.

**Compression damping needs to be adjusted on the snow while paying attention to the response to bumps**. The general principle is that mentioned above: too little compression damping and the shock may go through all its travel on smaller sized bumps; too much compression damping and the shock may feel harsh and not achieve full travel. Test different settings in different terrain and try to develop a feel for the effect of different compression damping.

**DynAccess shocks have either a single compression knob, or two knobs.** The latter allows the high-speed and the low-speed compression to be essentially independently adjusted. In either case the shocks have regressive compression response.

## How to Adjust Compression Damping with a Single Compression Knob (for a Double Adjustable Shock):

A double adjustable shock is equipped with a rebound adjuster and a single compression adjuster. For adjusting compression, turn the (blue) knob all the way in (turning it clockwise), then count the clicks coming out. There are about 25 clicks in total. Never click it out too far or the shock will be damaged (it will need to be sent in for a rebuild). The more the knob is turned counter-clockwise, the less the damping and the faster the response. If your shock has a compression knob with 8 numbers (previous model), the lowest number corresponds to the lowest damping.

Using the examples above, a starting point for a 120 lbs rider of average aggressiveness may be 10-25 for compression damping (using a double adjustable shock). A 200 lbs rider of average aggressiveness may start with 20 clicks for compression damping. The compression damping can be adjusted with the rider strapped in the monoski.

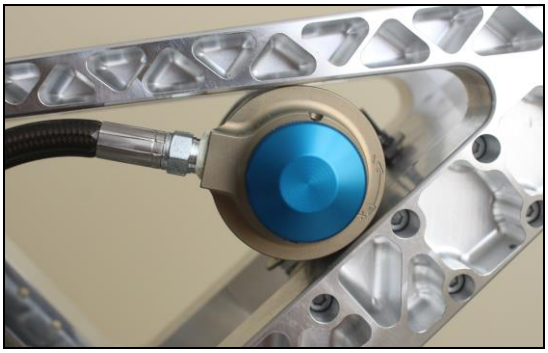

**Fig. 3** The blue knob for adjusting compression damping is located on the remote reservoir.

## Warning!

There is a Schrader valve on the opposite side of the remote reservoir. Do not touch this. The remote reservoir is charged with dry nitrogen (not air) that could leak out.

## How to Adjust Compression Damping with Two Compression Knobs (for a Triple Adjustable Shock):

**Fig. 4** The knobs for adjusting high speed and low speed compression damping are located on the remote reservoir. The big black knob is for adjusting high speed compression damping and the small blue one is for low speed compression damping

A triple adjustable shock is equipped with a rebound adjuster plus a high speed and a low speed compression knob. **The large black knob is for adjusting high speed compression damping and the smaller blue one is for low speed compression damping.** High and low speed here means “shaft speed”, i.e., how fast the shock is compressed. It has nothing to do with how fast you ski. For example, landing after a jump compresses the

shock quickly and the response will be governed by the high speed compression knob. Skiing at high speed over “rollers” compresses the shock slowly and the low speed compression knob governs this range.

There are no numbers on the compression knobs of a triple adjustable shock. Rather, you count clicks as you turn the knobs.

Turning the compressions knobs may appear confusing but there is a reason for it. This is the right way to do it:

- For low speed compression, turn the blue knob all the way in (turning it clockwise), then count the clicks coming out. There are about 25 clicks in total. Never click it out too far or the shock will be damaged (it will need to be sent in for a rebuild). The more the knob is turned counter-clockwise, the less the damping and the faster the response. A good starting point may be 20 clicks out,
- For high speed compression, turn the black knob all the way out (turning it counter-clockwise), then count clicks going in. There are about 17 clicks in total. The more the knob is turned clockwise, the higher the damping and the slower the response. A good starting point is 2-4 clicks in.

If you have a dyno chart for your shock, you will see markings like “HSC +4, LSC -20, REB -8”. This means that the High Speed Compression was turned all the way OUT and then turned 4 clicks IN, that the Low Speed Compression was turned all the way IN and then turned 20 clicks OUT, and that the rebound was turned all the way IN and then turned 8 clicks OUT. Confusing? Perhaps, but this way of counting clicks leads to the most consistent settings, and it is the standard practice of any professional race team (including monoskis). However, all dampings (high speed compression, low speed compression, and rebound) always INCRESE when you turn the knob CLOCKWISE.

## 2.5 Further Adjustments, Fine Tuning

As mentioned previously, it is impossible to give exact spring rates and damping settings. Learning to tune the shock to your preference is a challenging and very rewarding process. With a well tuned shock you can smoothly "fly" over somewhat rough terrain, hang on to your ski's edge in long carving turns over bumps, and retain control in a wide range of situations.

By all means **experiment with many different shock settings, but do it slowly and carefully.** You can reduce the air pressure to 20 psi or even lower in the main (lower) chamber, and even further in the upper chamber, **BUT remember that it will be easier to bottom out**. You may want to use different settings for different events, different snow conditions, different slopes, etc.

If you have any questions about shock setting, please feel free to contact DynAccess. DynAccess engineers are very often on snow and are always glad to help.

# 3. Lock-Out Mechanism

DynAccess has a patent pending system to hydraulically lock out the shock when getting on the chair lift. This mechanism is available as a special order. You can locate the red knob for the lock-out function on the remote reservoir. The blue knob is for adjusting compression damping.

You can lock your position by turning the red lock-out knob clockwise by the fingers ¼ turn (see Fig. 5) and lift up using outriggers (or by your ski buddy). The sled then stops at the top position.

**Fig. 5** Lock-out (Lift riding) position

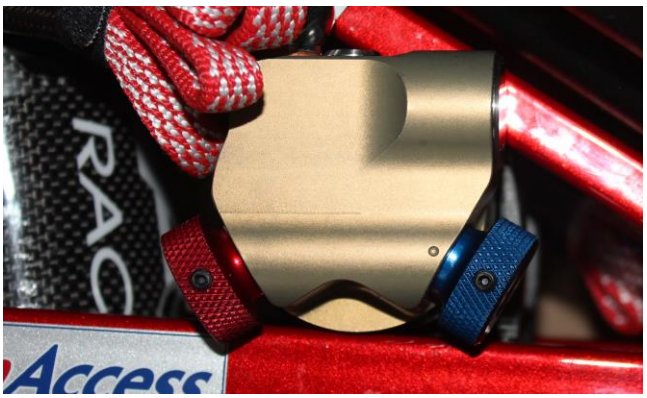

**Fig.6** Up and Go (skiing) Position

When on the lift the red knob can be turned back (up –counterclockwise) ¼ turn. In case the skier forgets, there is a blow-off bypass valve to reduce the pressure if you jump off the lift. However, make sure to turn the knob to the skiing position before you ski.

Compared to mechanical lock-out systems available on the market, our hydraulic system is more reliable. This lightweight system is quite fail-safe and hardly affected by snow and ice.

# 4. Trouble Shooting and Set-up Tips

Below are common handling conditions and some suggestions for shock adjustments.

## Bottoming Out

Cause 1: not enough air pressure in chamber 1

Solutions 1: add air pressure to chamber 1. Make sure your monoski is unloaded when air is added. On the slope, you can lie on your side on the snow and let your buddy pump up the air pressure in chamber 1.

Cause 2: not enough compression damping

Solutions 2: increase compression damping (LSC and HSC) a few clicks at a time

## Ride Height Too High

Cause : too high air pressure in chamber 2

Solution : reduce chamber 2 air pressure by 2-4 psi at a time

## Monoski Feels Harsh or Too Rigid

Cause 1: too high air pressure in both chamber 1 and 2

Solution 1: gradually reduce air pressure, for example 2 psi at a time. Make sure that the pressure in chamber 2 is always lower then in chamber 1 when the shock is unloaded

Cause 2: compression damping too high

Solutions 2: turn compression adjuster(s) to reduce damping a few clicks at a time

Cause 3: rebound damping too high

Solution 3: turn rebound adjuster knob out (counterclockwise) 2-3 clicks at a time

# 5. Maintenance and Service

DynAccess recommends having your monoski and shock professionally serviced once a year, as well as after any hard impact or other issue.

We can check the complete monoski, replace worn hardware (bearings, rod ends, nuts and bolts, etc), repair any damage, service the shock, and other service if necessary.

Penske services and rebuilds the shocks for us. This includes disassembling the shock, cleaning and checking all parts, replacing ice scrapers, seals, O-rings, worn valves, etc., re-assembling the shock, filling new oil and vacuum degassing it. If desired the shock can be re-valved (for example, if you're skiing with the rebound almost all the way in, then the shock can be re-valved such that your desired setting is near the middle of the range of the rebound adjuster).

# 6. Shock Setup Charts for Pro Air Monoski Shock

The tables below show some examples of shock settings. Please note that it is impossible to give exact pressures and damper settings since they vary with speed, snow condition, course, rider style, aggressiveness, bumpiness, personal preference, etc. If your shock has a compression knob with 8 numbers (1-8), please refer to the number in brackets. The lowest number corresponds to the lowest damping.

## Beginner Monoskier

| **Skier's weight** | **120 lb** | **160 lb** | **200 lb** |
|---|---|---|---|
| **Spring Rate (Chamber 1) [psi]** | 40 | 60 | 80 |
| **Ride Height (Chamber 2) [psi]** | 20 | 30 | 40 |
| **Rebound Damping knob [click out]** | 12 | 8 | 6 |
| **Compression Damping [click out] Single Compression only** | 22<br>(#1 ) | 21<br>(#1) | 20<br>(#1) |

## Intermediate Monoskier

| **Skier's weight** | **120 lb** | **160 lb** | **200 lb** |
|---|---|---|---|
| **Spring Rate (Chamber 1) [psi]** | 50 | 70 | 100 |
| **Ride Height (Chamber 2) [psi]** | 25 | 35 | 50 |
| **Rebound Damping [click out]** | 15 | 12 | 9 |
| **Compression Damping [click out] Single Compression only** | 22<br>(#1) | 21<br>(#1) | 20<br>(#1) |

## Advanced Monoskier

| **Skier's weight** | **120 lb** | **160 lb** | **200 lb** |
|---|---|---|---|
| **Spring Rate (Chamber 1) [psi]** | 60 | 85 | 110 |
| **Ride Height (Chamber 2) [psi]** | 30 | 42 | 55 |
| **Rebound Damping [click out]** | 15 | 12 | 10 |
| **Compression Damping [click out]**<br>**Single Compression only** | 22<br>(#1) | 20<br>(#1) | 18<br>(#2) |

 Caution!

Pressure in Chamber 1 > Pressure in Chamber 2

When you increase air pressure, start with Chamber 1, and then Chamber 2.

When you decrease air pressure, start with Chamber 2 and then Chamber 1.