

LIVE VALVE INTRODUCTION

October 2018



WHAT IS LIVE VALVE?

FAST-ACTING AUTOMATED ELECTRONIC SUSPENSION SYSTEM

LIVE VALVE



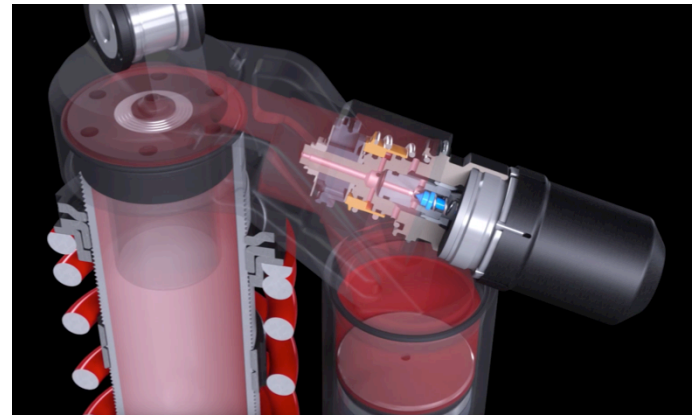
The controller automatically switches the fork and shock independently as the terrain changes. It uses ultra-fast reacting sensors and the fastest valve ever created by FOX.

System is complex, but what you get is simple.
It's doing the work for you.

LIVE VALVE – OEM VEHICLES



Polaris Dynamix



LIVE VALVE – OEM VEHICLES



FRONT - 3.0 Live Valve Internal Bypass Coil-Over IFP



REAR - 3.0 Live Valve Internal Bypass Piggyback

Electronics allow us to do things we can't do otherwise mechanically

- The “Human Engine” is able to focus on the trail
- Handle bar / cockpit setup is clean
- Does everything for you (without compromise)
- Seamless activation
- Consumer friendly



Live Valve is a suspension system that improves the efficiency of human and machine while increasing mass consumer user friendliness of suspension setup.

WHY BUILD IT?



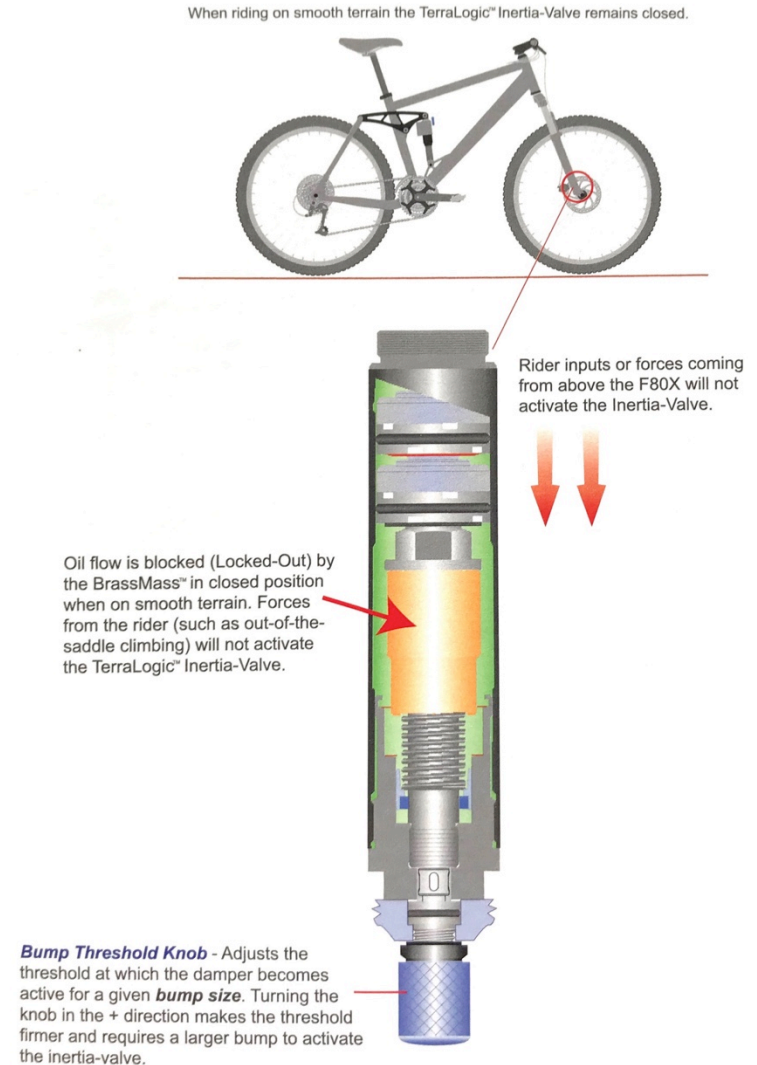
HISTORY

We wanted automatic suspension system.

Terralogic – 2004

We were looking to increase a bike's efficiency and control.

We were looking for hardtail efficiency.



HISTORY - Why did we look to electronics?

iRD Umbrella – faster, more efficient than remote or Terralogic, a bridge to electronics

- Easier for the rider
- iRD - Data from RAD team show that racers adjust iCD suspension up to 90 times during an XC race (**more than doubled compared to cable remote**)
- iCTD - added additional setting to iCD

RAD
RACING APPLICATIONS DEVELOPMENT


iRD
INTELLIGENT
RIDE DYNAMICS

FLOATiCD

iCTD

WHY BUILD IT?



Live Valve Today

- 480 times per hour (720 times per 1.5hr XC race)
- Sensors – 1000 times per second (1kHz)
- Mode change – 3 milliseconds (100 times faster than blink of an eye). Allows to sense a bump at the front wheel and open the fork before the rider feels it



System is complex, but what
you get is simple.

It's doing the work for you.

- No rider input is needed
- Ultra-efficient full suspension bike
- Seamless to the rider
- Provides a natural feel over wide variety of terrain and riding styles
- Focus on the ride
- Simplicity of cockpit
- Covers all segments – race/play/ride/fun
(**XC / Marathon / Trail / Enduro / DH**)
- Less errors – no descending in lock/firm mode, reduced pinch flats

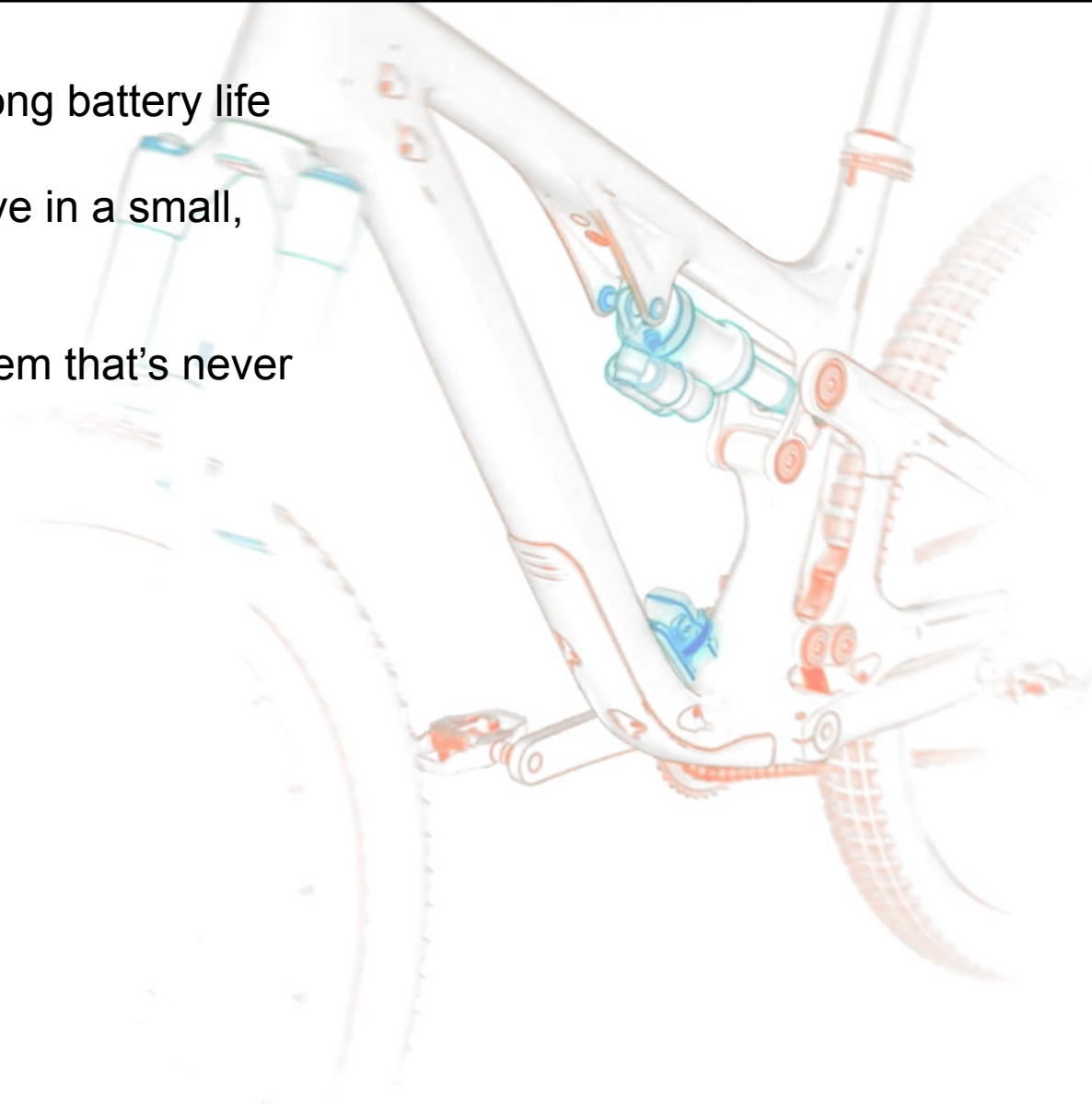
LIVE VALVE DESIGN



DESIGN CONSIDERATIONS



- Low power consumption / long battery life
- Developing a really fast valve in a small, power-efficient package
- Building an electronics system that's never been done before
- Light weight
- Water bottle clearance
- Frame clearance
- User Simplicity



Fork applications:

- 32 Step-Cast
- 34
- 34 Step-Cast
- 36 up to 160 (29) / 180 (27.5)

Shock applications:

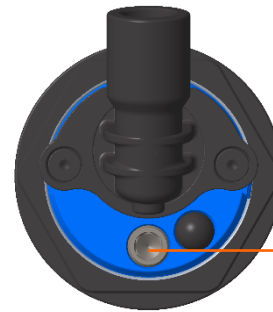
- Standard, metric, trunnion
- LV eyelet / EVOL air sleeve only
- Reservoir flips 180 degrees depending on frame fitment



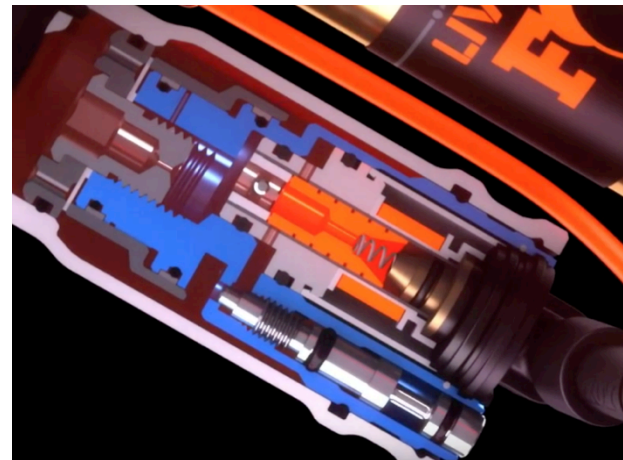


- With the Controller off, set sag and rebound (initial set-up only) in the normal manner
- Turn Controller on... GO RIDE
- Use adjusters to fine-tune as needed
 - Open mode compression
 - Rebound
 - Bump sensitivity (Controller settings 1-5)

- **Air spring pressure and rebound** adjustment are the same as non-Live Valve suspension.
- **Open Mode** – The rider can fine-tune compression damping via the 3mm hex on the fork top cap (or the shock resi end cap)
- **Firm mode** – Factory set. The OEM decides the Firm Mode damping setting
- **Controller settings (1-5)**
Determines bump sensitivity to activate solenoid



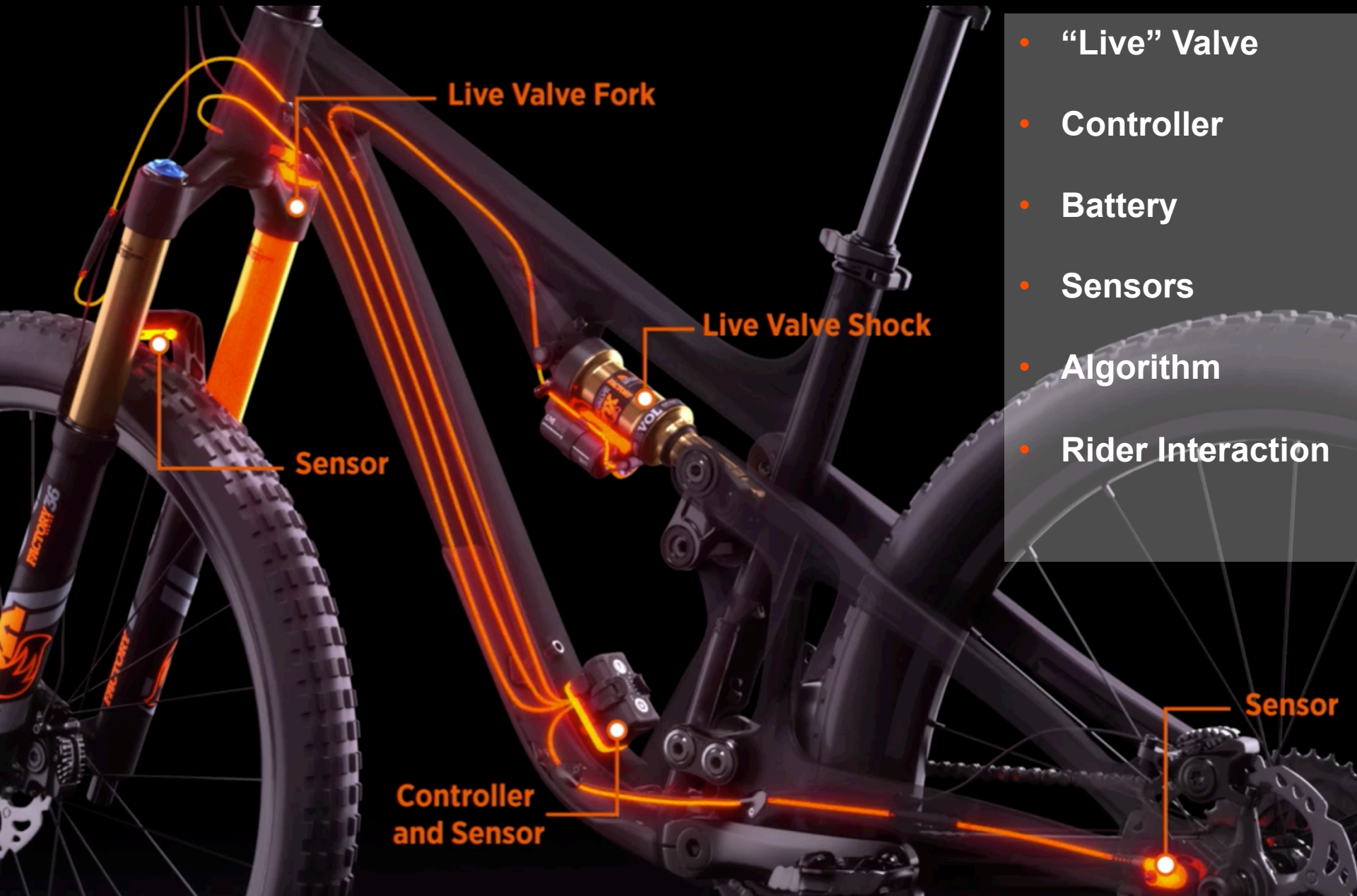
**OPEN MODE
COMPRESSION
ADJUSTER**
(same on fork
and shock)



- When the rider first presses the power button, 1 of 5 green LEDs light up as a battery level indicator
- Pressing the power button again opens the suspension and then turns off the controller. The red off LED will flash. If you want regular passive suspension, just turn off the Controller.
- The other button is the settings selector button which allows the rider to select between 5 Controller settings. Press & release once and the green LEDs will light to indicate which setting is selected. Immediately press again to go to the next setting. When the LED goes out, that settings has been selected.
- When the rider plugs in the battery for charging, the red charging LED will turn on. Charging is complete when the LED turns off.
- After 1.5 hours of no bumps detected by the controller, the system assumes that the bike has been put away for storage. The controller opens the suspension and then shuts down for battery life. **The rider must turn the system on for the next ride.**

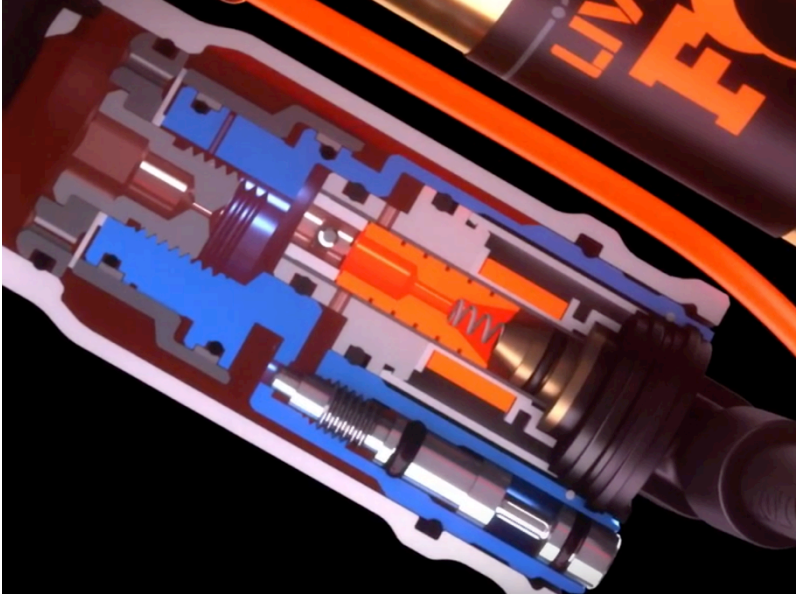


BASICS OF LIVE VALVE SYSTEM

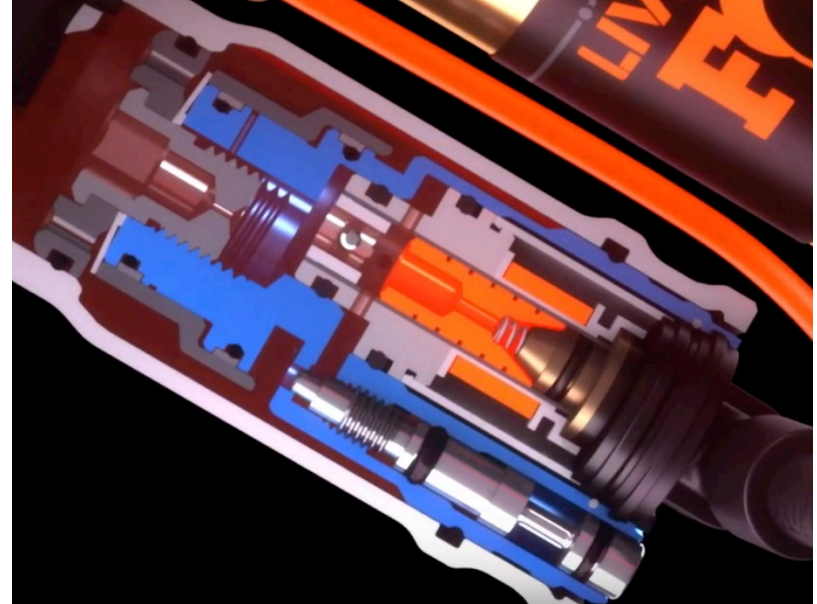


- “Live” Valve
- Controller
- Battery
- Sensors
- Algorithm
- Rider Interaction

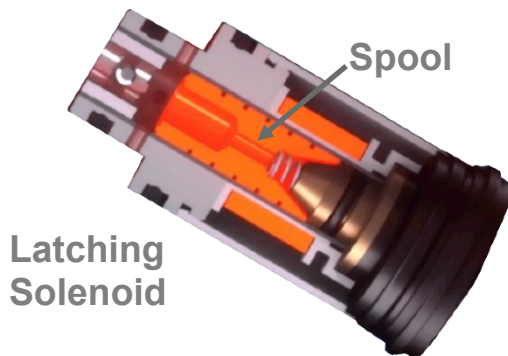
A proprietary latching solenoid is the heart of the Live Valve. It opens and closes a fluid flow path.



CLOSED



OPEN



The latching characteristic of the solenoid means that it doesn't require power to be either open or closed. It only requires a 25msec pulse from the battery to toggle it between open and closed.

This is KEY for power efficiency.

BASICS OF LIVE VALVE SYSTEM // PITCH DETECTION



Using the sensor in the Controller, we know if the bike is going **uphill**, **downhill**, or on **flat** ground.

The algorithm is optimized for these three states.



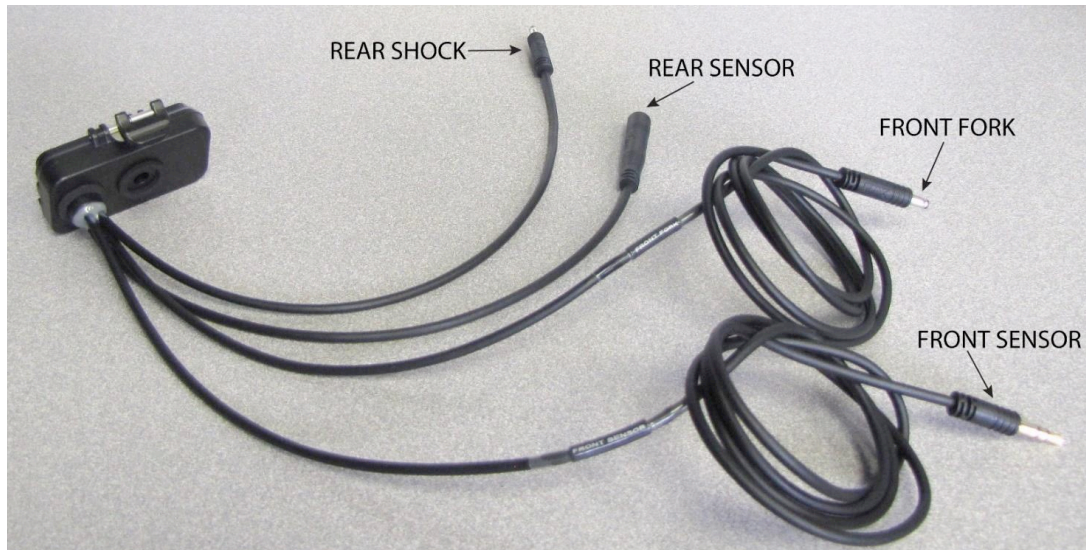
Sensors on front and rear wheels

- Single-axis accelerometers (vertical wheel movement)
- Reads acceleration coming from bumps
- Sensor signals are read at 1000 samples/second (Hz)



The controller is the part that is attached to the frame

- Contains the microprocessor and the firmware code
- Battery mount
- Has a 3-axis accelerometer (Controller sensor)



- 2-Cell Lithium Ion, 7.4V, 800 mAh
- Charging circuitry on-board: all that is needed to charge is a micro-USB cord (included) and a USB power source
- Battery can be charged on the bike or removed for charging
- Contains the on/off and settings selector buttons as well as LEDs
- The settings selector button allows the rider to select between 5 Controller settings



Battery Life/Range

- Low battery detection - the system sets the suspension to Open mode and then shuts down.
- It's ok to still ride the bike with Live Valve turned off.
- Full charge time is 1.5 to 2 hours depending on power source.
- Battery life? Highly depends on setting and terrain.
16 to 20 hours average.
- The Live Valve system can charge for 15 minutes for a 2hr ride.





What does Live Valve know?

- Pitch detection (Controller sensor) - If the bike is going:
 - Uphill
 - Downhill
 - Flat/traversing
- If the bike is jumping or free falling (Controller sensor)
- If the terrain is bumpy or smooth (Wheel sensors)

All this data is collected into the algorithm, optimal suspension settings are determined. (all this happens at 1000 times per second)



Simplified algorithm description:

- Smooth terrain → Suspension is in Firm Mode
- Front sensor detects a bump of a certain magnitude → Opens front and rear suspension (Open Mode) and start a timer
- Timer expires and no more bumps → Closes suspension (Firm Mode)
- Front sensor detects another bump before timer expires → Reset Timer
- **Example number one: Rider goes over a tree root:**
 - Suspension opens, bike goes over root, suspension closes and waits for the next bump
- **Example number two: Rider goes down a rough 2-minute descent**
 - The suspension opens at the first bump. Because the bumps are coming quickly, the timer constantly resets keeping the suspension open the whole way. At the bottom, when the terrain smooths out, the suspension closes. In this example, the solenoid opened and closed only once → MINIMAL POWER CONSUMPTION

System weight / comparison (example: 2018 Scott Genius)

- Battery: 72g
- Controller + sensors: 104g
- Live Valve shock: 466g (185x55 Trunnion)
- Live Valve fork damper: 249g (36 29" 160)

Compared to stock 2018 Scott Genius cable-actuated remote suspension: 144g increase

Allows the OEMs to customize the 5 settings to suit their vision for the bicycle performance.

File
Exit
About LIVE Valve Configurator

OM Port
Firmware Download
Ride Settings
Admin

FLAT

UPHILL

DOWNHILL

Setting 1

Bump Thresholds (g)

Front
Rear

40
30

Timer (sec)

Front and Rear

25

Bump Thresholds (g)

Front
Rear

35
30

Timers (sec)

Front
Rear

25
25

Incline Angle (°)

On

40

Bump Threshold (g)

Front and Rear

25

Timer (sec)

Front and Rear

25

Decline Angle (°)

On

25

Setting 2

Bump Thresholds (g)

Front
Rear

45
34

Timer (sec)

Front and Rear

25

Bump Thresholds (g)

Front
Rear

40
34

Timers (sec)

Front
Rear

25
25

Incline Angle (°)

On

40

Bump Threshold (g)

Front and Rear

25

Timer (sec)

Front and Rear

25

Decline Angle (°)

On

25

Setting 3

Bump Thresholds (g)

Front
Rear

50
30

Timer (sec)

Front and Rear

25

Bump Thresholds (g)

Front
Rear

45
30

Timers (sec)

Front
Rear

25
25

Incline Angle (°)

On

40

Bump Threshold (g)

Front and Rear

25

Timer (sec)

Front and Rear

25

Decline Angle (°)

On

25

Setting 4

Bump Thresholds (g)

Front
Rear

55
45

Timer (sec)

Front and Rear

25

Bump Thresholds (g)

Front
Rear

55
45

Timers (sec)

Front
Rear

25
25

Incline Angle (°)

On

40

Bump Threshold (g)

Front and Rear

25

Timer (sec)

Front and Rear

25

Decline Angle (°)

On

25

Setting 5

Bump Thresholds (g)

Front
Rear

60
60

Timer (sec)

Front and Rear

25

Bump Thresholds (g)

Front
Rear

75
60

Timers (sec)

Front
Rear

25
25

Incline Angle (°)

On

40

Bump Threshold (g)

Front and Rear

25

Timer (sec)

Front and Rear

25

Decline Angle (°)

On

25

GET Ride Settings from Controller

SEND Ride Settings to Controller

STATUS

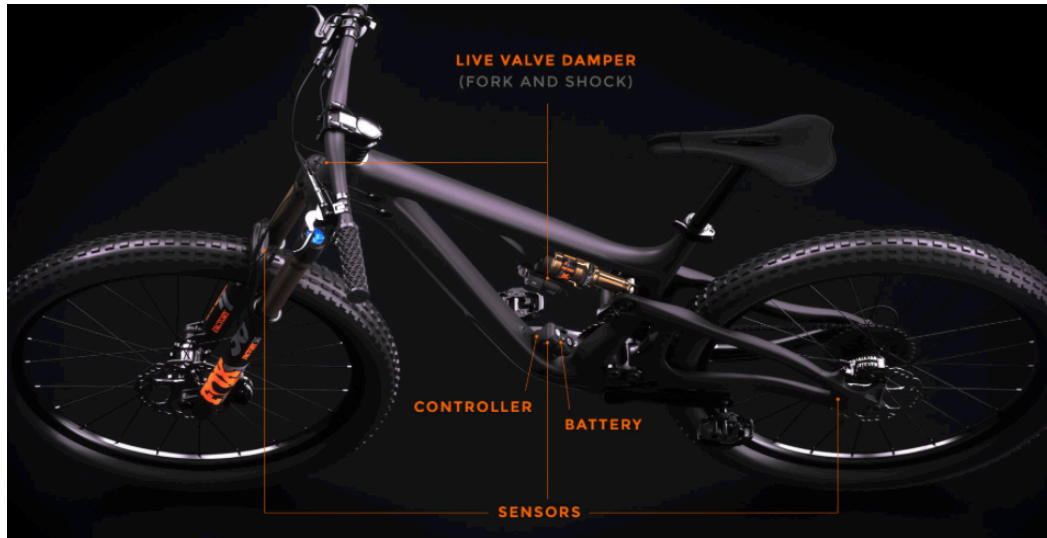
www.ridefox.com/livevalve

Video tutorials

- Controller
- Battery
- Calibration
- Set-up

Information

- Q & A
- Manual
- Tuning Guide
- Quick Start
- Media reviews



LIVE VALVE DAMPER (FORK AND SHOCK)

CONTROLLER

BATTERY

SENSORS

CONTROLLER | **BATTERY** | **CALIBRATION** | **SET-UP**

The brains behind the system is the suspension Controller, monitoring the terrain at a rate of a thousand times per second and making suspension adjustments in just three milliseconds – that's one hundred times faster than the blink of an eye.

With strategically placed sensors on the frame and both wheels, the Controller processes data from the terrain to constantly adjust the suspension for maximum efficiency and control no matter what the trail throws at you.

01:06



QUICK START GUIDE



OWNER'S

- Warning and safe
- Maintenance info

DOWNLOAD NOW



TUNING GUIDE

- Live Valve System overview
- Battery charging
- Setting selection
- Sag setup
- Compression and rebound setup
- How the system works
- Basic troubleshooting

DOWNLOAD NOW

THANK YOU

