

**Volume**

**1**

**PE RACING PRODUCTS**

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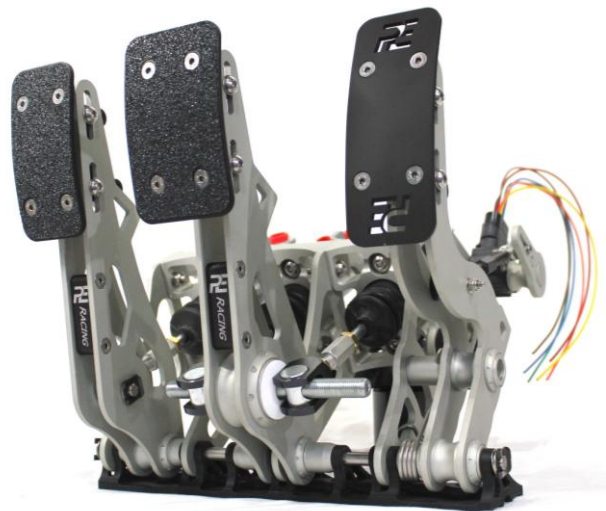
**ENGINEERING DESIGNS AND SOLUTIONS**

(edit September 2019)

**PEDAL ASSEMBLY MODELS**

**FABRICATED**  
PE-001-1001  
PE-002-1001  
PE-003-1001  
PE-004-1001

**BILLET**  
PE-005-1001  
PE-006-1001  
PE-007-1001  
PE-008-1001



**Pedal Assemblies Manual  
&  
Installation Instructions**

A PE RACING PRODUCT

# Pedal Assembly Manual – Installation Instructions

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We require that all products come back to us for inspection and testing prior to shipping out any replacement. Prior authorization must be obtained before returning any product for warranty.

The customer is responsible for all return shipping and insurance charges. If your product is under warranty, it will shipped back to you at our cost. Warranty will be void if failure results from misuse of product or damage caused by some other improper action. Warranty will be void for misdiagnosis or customer error.

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Use of this Product in the Vehicle on public highways, streets, and other roads may violate applicable federal, state, or local clean air, emission, noise, and other environmental laws, or applicable motor vehicle, traffic, and other laws. The User must review and comply, and is solely responsible for reviewing and complying with, all applicable clean air, emission, noise, other environmental laws, as well as all applicable motor vehicle, traffic, safety, and other laws, in connection with User's installation and use of this Product with the Vehicle. Use of this Product may violate warranties from the manufacturer of the Vehicle or from others. The User must review and comply, and is solely responsible for reviewing and complying, with the terms and conditions of any such warranty. Use of this Product may make the Vehicle non-compliant with applicable laws, make the Vehicle capable of generating unsafe driving speeds, make the Vehicle capable of exceeding tire speed ratings, make the Vehicle capable of exceeding RPM ratings of the engine, exceed stress limits of the engine, transmission, chassis, body, and other components of the Vehicle, destroy or damage mechanical, electrical, structural, or other components of the Vehicle, may require superior driving skills and techniques to handle the Vehicle, may make the Vehicle unsafe, and may lead to personal injury or property damage. The User must ensure, and is solely responsible for ensuring, the proper installation of this Product in the Vehicle in a professional manner, adhere to any written instruction of Perusic Engineering, in accordance with industry standards and in a good and workmanlike manner, and in accordance with applicable law. The User must ensure, and is solely responsible for ensuring, the proper, legal, and safe use of the Vehicle. Use of the Product in the Vehicle is at the sole risk and discretion of the User. The User acknowledges that motorsports, racing, and other competitions are dangerous and may cause death, other personal injury, or property damage. Except as expressly provided in the written Limited Warranty from PE Racing issued for this Product, and to the greatest extent provided by applicable law, this Product is sold on an AS IS, WHERE AS, and WITH ALL FAULTS basis, and PE Racing disclaims any and all warranties of any kind, whether express or implied, relating to this Product, including without limitation any implied warranty of merchantability, any implied warranty of fitness for a particular purpose, any warranty as to success in races or other competition, or any warranty made by any distributor or other third party. Any such Limited Warranty is conditioned upon the User's compliance with the terms and conditions of this Disclaimer.

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 **Warning**

“During installation, make sure that no interfere is present with any hoses, cables or wiring when each of the pedals are moved all the way in either direction. Also make sure, through the full range of adjustments made that the master cylinders and bias assembly do not bind, or exceed the stroke limit and bottom out. Ensure the throttle linkages do not approach an over centre position as this may lead to the throttle jamming. The improper installation of this kit and related components could result in serious injury or death.”

 **Caution**

This product should be regularly inspected, cleaned, adjusted as necessary, and maintained by replacing any damaged items to ensure reliability and function.

# Kit's Contents, FITTINGS & ACCESSORIES

This manual covers the following models from the Fabricated and Billet product line.

Fabricated Model	Transmission	Drive Type
PE-001-1001	3 Pedal / Manual	Cable Throttle
PE-002-1001	3 Pedal / Manual	Drive/Fly by wire
PE-003-1001	2 Pedal / Auto	Cable Throttle
PE-004-1001	2 Pedal / Auto	Drive/Fly by wire

Billet Type	Transmission	Drive Type
PE-005-1001	3 Pedal / Manual	Cable Throttle
PE-006-1001	3 Pedal / Manual	Drive/Fly by wire
PE-007-1001	2 Pedal / Auto	Cable Throttle
PE-008-1001	2 Pedal / Auto	Drive/Fly by wire

- Assembly contents and Part No.

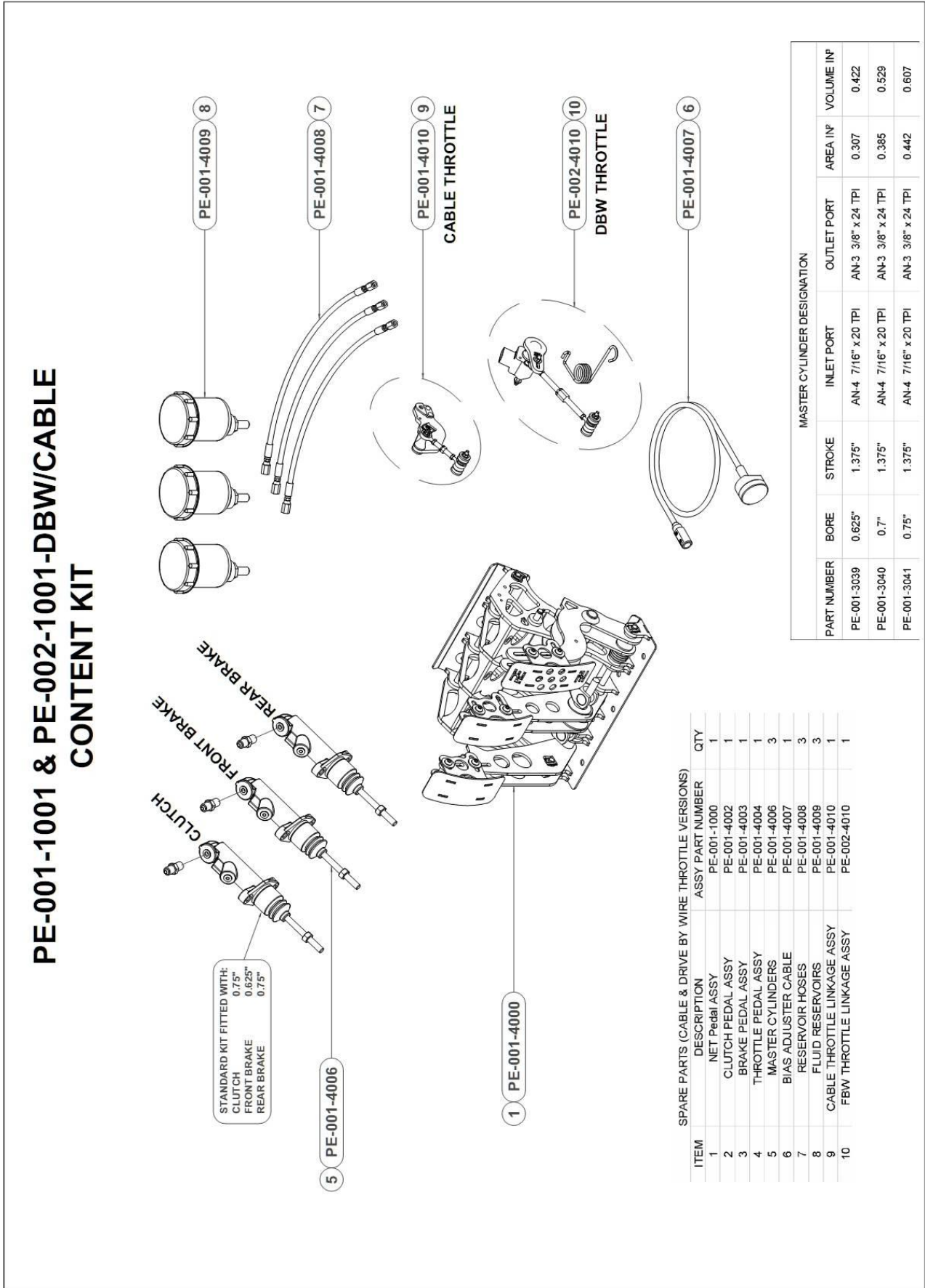
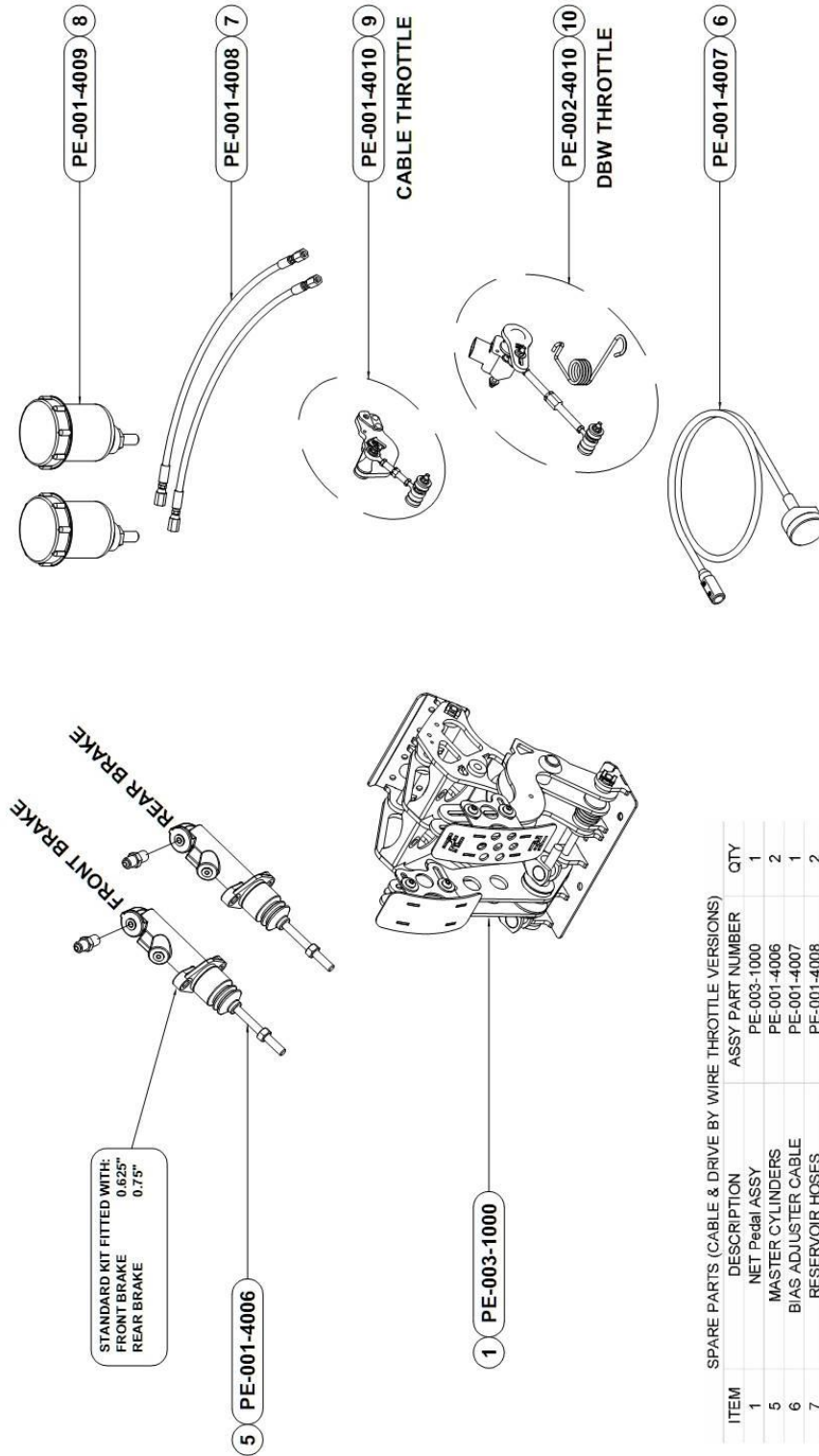


Figure 1 Standard Fabricated 3-pedal assembly (PE-001-1001 + PE-002-1001)



# PE-003-1001 & PE-004-1001 -DBW/CABLE CONTENT KIT



SPARE PARTS (CABLE & DRIVE BY WIRE THROTTLE VERSIONS)

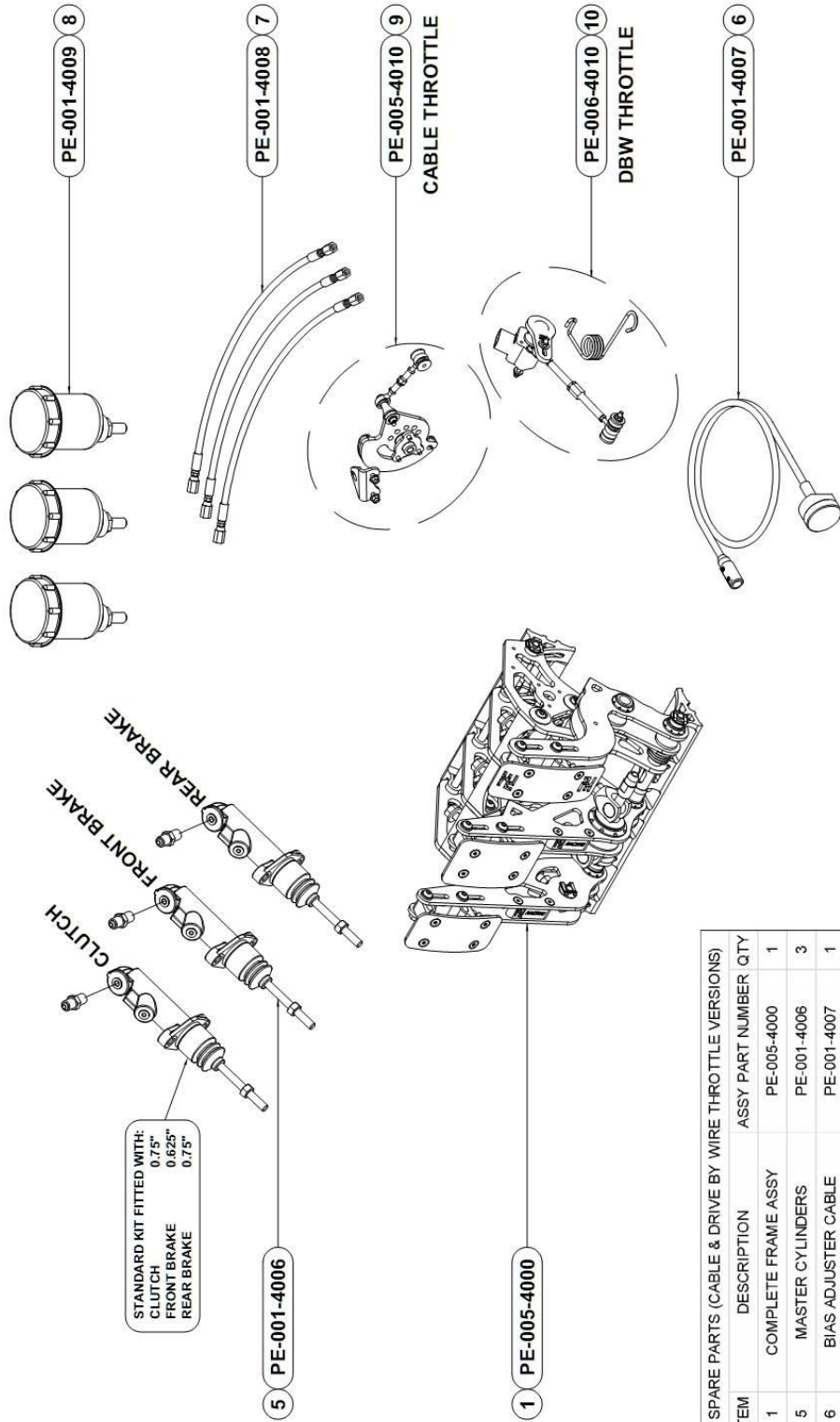
ITEM	DESCRIPTION	ASSY PART NUMBER	QTY
1	NET Pedal ASSY	PE-003-1000	1
5	MASTER CYLINDERS	PE-001-4006	2
6	BIAS ADJUSTER CABLE	PE-001-4007	1
7	RESERVOIR HOSES	PE-001-4008	2
8	FLUID RESERVOIRS	PE-001-4009	2
9	CABLE THROTTLE LINKAGE ASSY	PE-001-4010	1
10	FBW THROTTLE LINKAGE ASSY	PE-002-4010	1

MASTER CYLINDER DESIGNATION

PART NUMBER	BORE	STROKE	INLET PORT	OUTLET PORT	AREA IN <sup>2</sup>	VOLUME IN <sup>3</sup>
PE-001-3039	0.625"	1.375"	AN-4 7/16" x 20 TPI	AN-3 3/8" x 24 TPI	0.307	0.422
PE-001-3040	0.7"	1.375"	AN-4 7/16" x 20 TPI	AN-3 3/8" x 24 TPI	0.385	0.529
PE-001-3041	0.75"	1.375"	AN-4 7/16" x 20 TPI	AN-3 3/8" x 24 TPI	0.442	0.607

Figure 2 Standard Fabricated 2-pedal assembly (PE-003-1001 + PE-004-1001)

# PE-005-1001 & PE-006-1001 -DBW/CABLE CONTENT KIT



SPARE PARTS (CABLE & DRIVE BY WIRE THROTTLE VERSIONS)

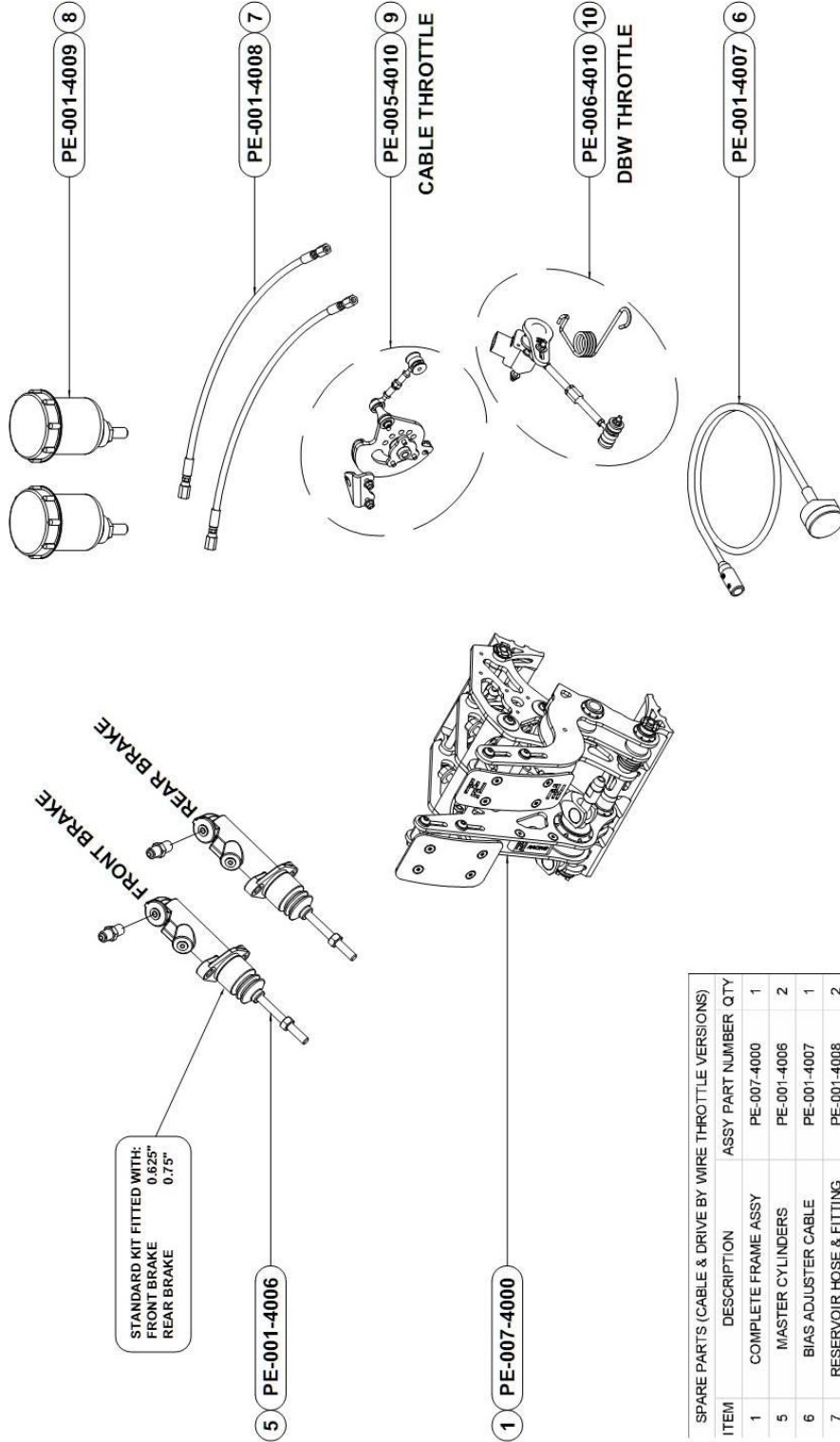
ITEM	DESCRIPTION	ASSY PART NUMBER	QTY
1	COMPLETE FRAME ASSY	PE-005-4000	1
5	MASTER CYLINDERS	PE-001-4006	3
6	BIAS ADJUSTER CABLE	PE-001-4007	1
7	RESERVOIR HOSE & FITTING	PE-001-4008	3
8	FLUID RESERVOIRS	PE-001-4009	3
9	CABLE THROTTLE LINKAGE ASSY	PE-005-4010	1
10	FBW THROTTLE LINKAGE ASSY	PE-006-4010	1

MASTER CYLINDER DESIGNATION

PART NUMBER	BORE	STROKE	INLET PORT	OUTLET PORT	AREA IN <sup>2</sup>	VOLUME IN <sup>3</sup>
PE-001-3039	0.625"	1.375"	AN-4 7/16" x 20 TPI	AN-3 3/8" x 24 TPI	0.307	0.422
PE-001-3040	0.7"	1.375"	AN-4 7/16" x 20 TPI	AN-3 3/8" x 24 TPI	0.385	0.529
PE-001-3041	0.75"	1.375"	AN-4 7/16" x 20 TPI	AN-3 3/8" x 24 TPI	0.442	0.607

Figure 3 Standard Billet 3-pedal assembly (PE-005-1001 + PE-006-1001)

# PE-007-1001 & PE-008-1001 -DBW/CABLE CONTENT KIT



SPARE PARTS (CABLE & DRIVE BY WIRE THROTTLE VERSIONS)

ITEM	DESCRIPTION	ASSY PART NUMBER	QTY
1	COMPLETE FRAME ASSY	PE-007-4000	1
5	MASTER CYLINDERS	PE-001-4006	2
6	BIAS ADJUSTER CABLE	PE-001-4007	1
7	RESERVOIR HOSE & FITTING	PE-001-4008	2
8	FLUID RESERVOIRS	PE-001-4009	2
9	CABLE THROTTLE LINKAGE ASSY	PE-005-4010	1
10	FBW THROTTLE LINKAGE ASSY	PE-006-4010	1

MASTER CYLINDER DESIGNATION

PART NUMBER	BORE	STROKE	INLET PORT	OUTLET PORT	AREA IN <sup>2</sup>	VOLUME IN <sup>3</sup>
PE-001-3039	0.625"	1.375"	AN-4 7/16" x 20 TPI	AN-3 3/8" x 24 TPI	0.307	0.422
PE-001-3040	0.7"	1.375"	AN-4 7/16" x 20 TPI	AN-3 3/8" x 24 TPI	0.385	0.529
PE-001-3041	0.75"	1.375"	AN-4 7/16" x 20 TPI	AN-3 3/8" x 24 TPI	0.442	0.607

Figure 4 Standard Billet 2-pedal assembly (PE-007-1001 + PE-008-1001)

# 1. Trial Fitting and Pre-Adjustments

**Refer to notes and illustrations provided in following sections of this instruction manual.**

Trial fitting the assembly in place before drilling any holes is highly recommended. Following the steps below will ensure your successful installation and compliment the overall operation, comfort and usefulness of your pedal box.

## 1.1. Recommended Trial Fitting Order

- Set throttle linkage stroke
- Set throttle motion ratio
- Assembly positioning options in your vehicle
- Fit a Full Throttle Stop to your vehicle (not provided)
- Fit Throttle cable (if applicable)
- Fit Remote Reservoirs and Hoses
- Set Clutch lever position, stroke adjustment and stop position
- Set Brake bias bar
- Set Brake lever position, stroke adjustment and stop position
- Fit plumbing to master cylinders
- Fit remote bias cable
- Pedal faces adjustment
- Ensure comfort
- Ensure no clearance problems exist
- Once satisfied, Remove master cylinders
- Mark mounting holes and drill to suit fasteners
- Fix assembly and ensure no twisting is induced (shim as necessary)
- Disconnect cables and hoses
- On completion of trial fitting with all connections and adjustments, remove the assembly.
- Re-Assemble pedal box on workbench

## 2. Final Fitting & Adjustments

**Refer notes and illustrations provided in following sections of this instruction manual.**

Final fitting would typically be a replicate of the trial fitting. Care should be taken to ensure all services are mounted safely.

- Where cables and hoses pass through panels, ensure no chaffing is present by using appropriate bushings/bulkhead fittings or glands/grommets.
- Fasten all loose lines and cables appropriately to allow sufficient pedal operation without interference to drivers' feet and pedals through full operation of all pedals.

### 2.1. Recommended Final Fitting Order

- Fix pedal box to your vehicle
- Fit Full Throttle Stop to your vehicle
- Fit reservoirs
- Fit plumbing
- Fit throttle cable (if applicable)
- Fit Remote bias cable
- Final adjustments
- Bleed the Brake System
- Bleed the Clutch System
- Apply full pressure
- Check for leaks
- Check all operational clearances and adjust as necessary
- Final inspection
- Test, inspect and adjust as necessary
- Regularly inspect, clean, maintain and adjust as necessary

### 3. Mounting Position Options

It is very important that the pedal assembly is mounted securely to an adequate frame or panel. Increased rigidity provides increased accuracy, control and pedal feel to the driver. The mounting is required to resist the loads of a driver's legs in panic situations, typically 130-200kg combined on the clutch and brake pedals. Together these loads are required to be withstood by the vehicle floor and the method of attachment to your vehicle. Seek professional advice if you are not confident with the mounting.

See Diagrams below for the position options.

- When installing, check that no interferences are present by temporarily mounting the assembly in place and have the driver trial the position by operating all the pedals.
- Initial adjustments to the pedal levers, pedal faces and pushrods may be completed in order to achieve a comfortable position while selecting your preferred mounting location and incline angle.
- If additional adjustments are required, temporarily complete the adjustments prior to moving on with permanent mounting. Follow the directions outlined in the previous section, and then return to this section to continue.

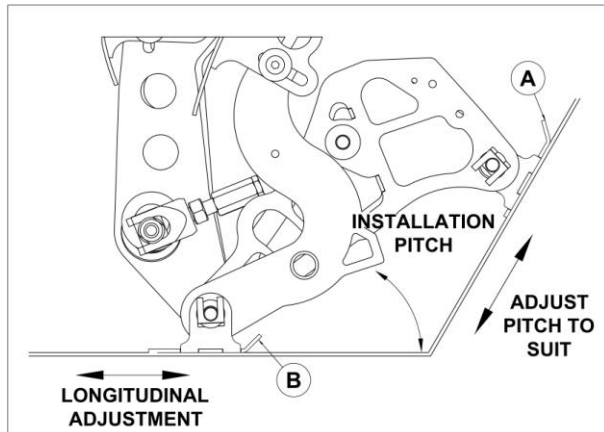


Diagram 1 Floor & Firewall Positioning

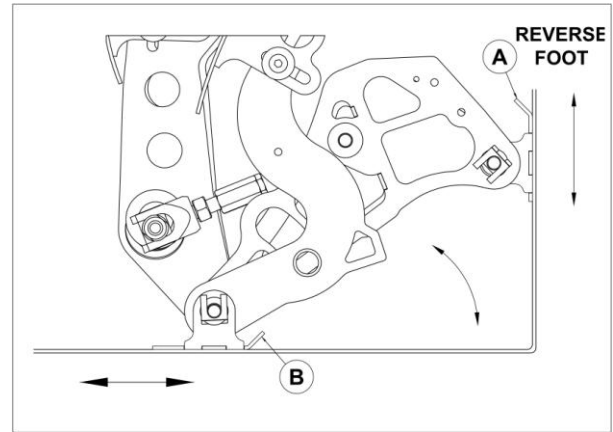


Diagram 2 Bulkhead Positioning

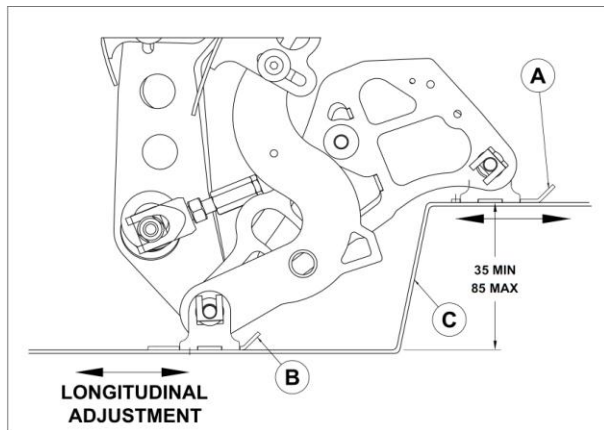


Diagram 3 Parallel Positioning

**Important Note:**

- The lower foot (B) and upper foot (A) support the pedal assembly, spread the loads and

**decrease any concentrated loads to your vehicle panels when installed.** When mounting through sheet metal panels, ensure a large mud guard washer (or equivalent) is used under all fixing heads to provide a larger clamping area to reduce localised stresses.

- If you are mounting the pedal box assembly on two parallel platforms (C), putting multiple mounting holes will enable longitudinal adjustments – see Diagram 3. Thus, allowing the entire pedal assembly to be moved fore and aft to suit different drivers.
- When the final position is selected, continue with the next step.

## 4. Mounting the Pedal Box

Proper mounting is achieved by providing an adequate spread of fasteners to both mounting flanges. Be sure to use high quality fine thread self locking fasteners at the suggested locations with large diameter washers to both sides.

Minimum suggested hardware – refer to Fig. 5 on Page 16:

### **PE-001-1001, PE-002-1001 (fabricated manual 3-pedal assembly)**

- Lower flange (B) – 4 x M8 fasteners.
- Upper flange (A) – 3 x M6 fasteners.

### **PE-003-1001, PE-002-1001 (fabricated auto 2-pedal assembly)**

- Lower Flange (B)- 3 x M8 fasteners
- Upper Flange (A)- 3x M6 fasteners

### **PE-004-1001, PE-005-1001 (Billet manual 3-pedal assembly)**

- Lower Flange (B)- 4 x M6 Countersunk fasteners
- Upper Flange (A)- 4x M6 Countersunk fasteners

### **PE-006-1001, PE-007-1001 (Billet auto 2-pedal assembly)**

- Lower Flange (B)- 3 x M6 Countersunk fasteners
- Upper Flange (A)- 3x M6 Countersunk fasteners

An increase in size of hardware would increase the factor of safety. Consider your mounting options and consult a professional as required before commencing any drilling for the fastening of your pedal box assembly.

Foot Mounting – refer to Fig. 5 on Page 16:

- **To access the upper foot mounting holes (A), remove the master cylinders.**
- **To access the lower foot mounting holes (B), depress the clutch and throttle arms and retract the brake lever arm.**

On completion, temporarily fix the pedal assembly in place and check that no twisting is induced when tightened. If twisting is present, shim the appropriate locations to eliminate the twisting. This will contribute to the smooth operation of your pedal box.

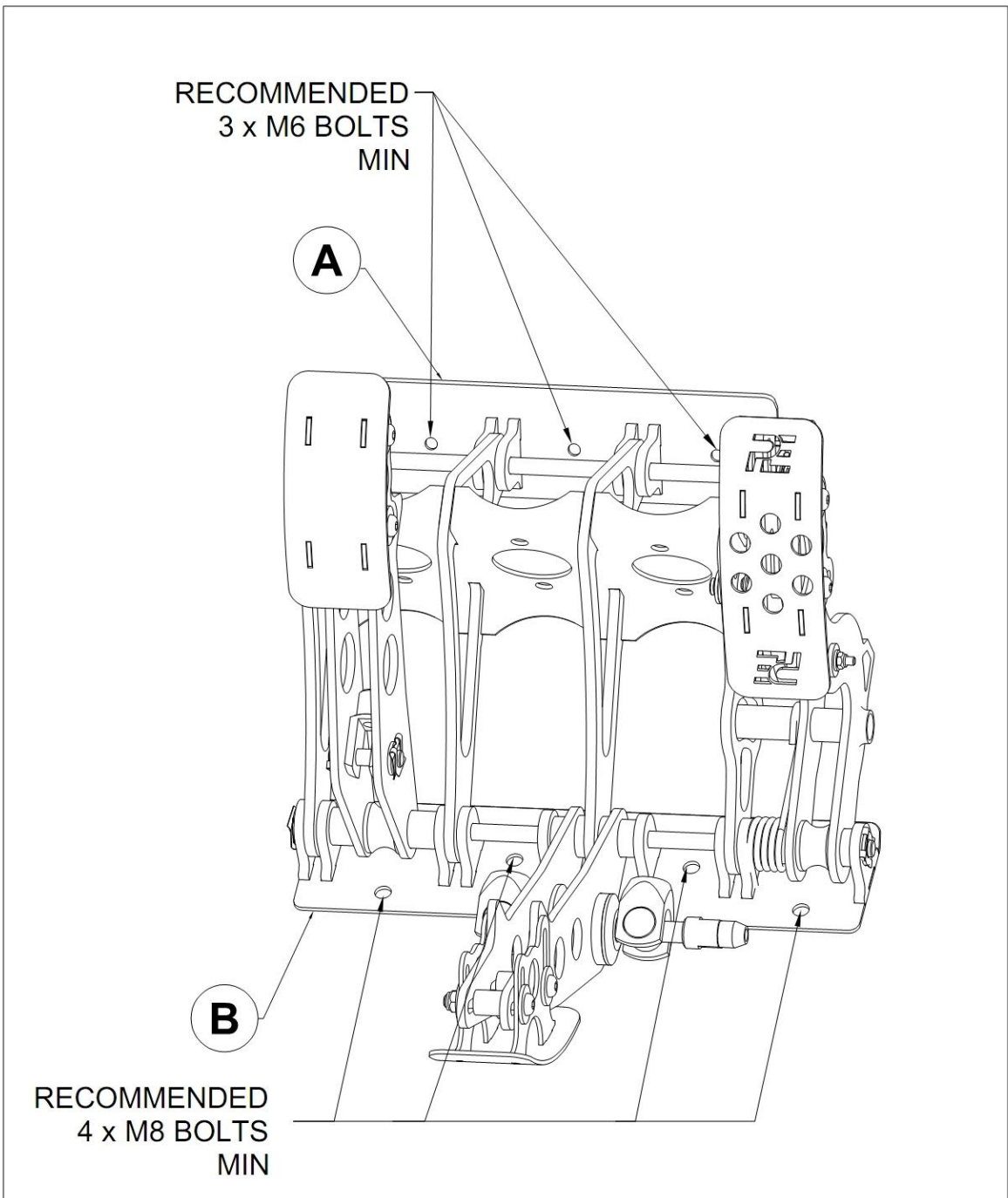


Figure 5: Pedal Mounting Bolt Location



# 5. Throttle Install & Stroke Adjustment

This pedal box assembly features inbuilt adjustments for throttle linkage geometry to allow you to set the desired throttle cable stroke and motion ratio and a spring return mechanism.

## 5.1 Cable Install (Cable models Only)

With your own throttle cable, route the cable through your own cable tension and the supporting flange as marked in Diagram 4 and/or 5. Carefully install the cable end through the slot provided on the inside face. With the cable attached, tension it as necessary without straining it in the relaxed position. Test for smooth operation by pressing and depressing the throttle pedal and if applicable, ensure cable sits within cable guide.

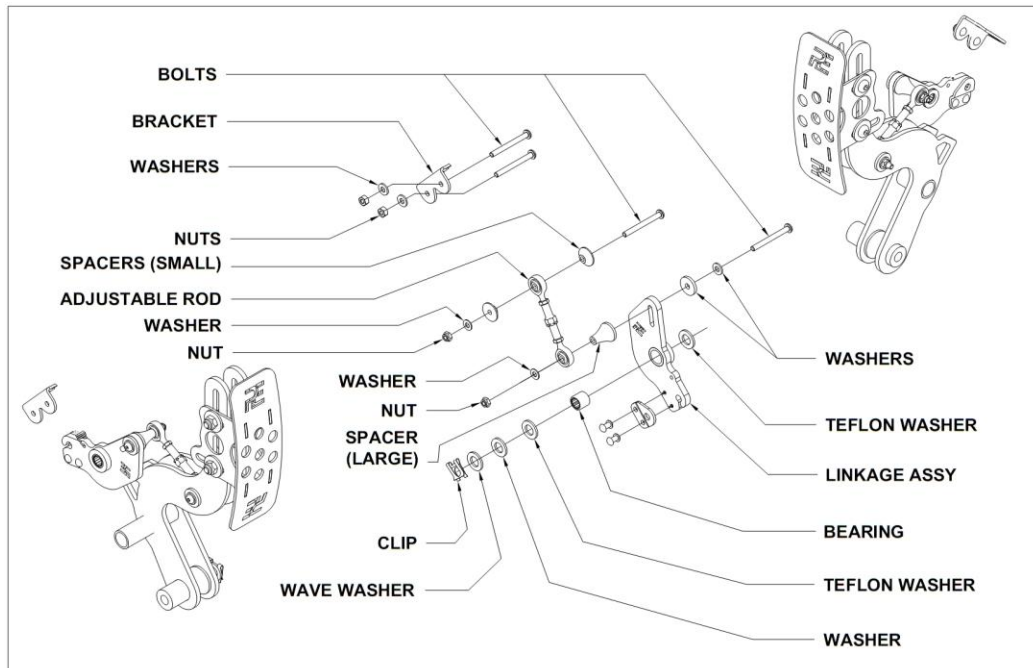


Figure 6 Throttle Cable Parts (PE-001-1001 & PE-003-1001)

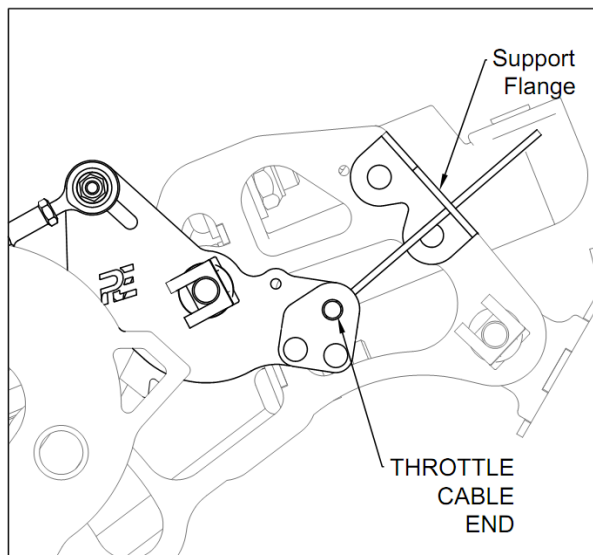


Diagram 4 Throttle Cable Assembly (PE-001-4010)

Note: A Cable tension is required to be fitted at the support flange. The throttle cable and cable tension is **NOT** supplied with the Pedal Assembly Kit and will need to be supplied by the USER.

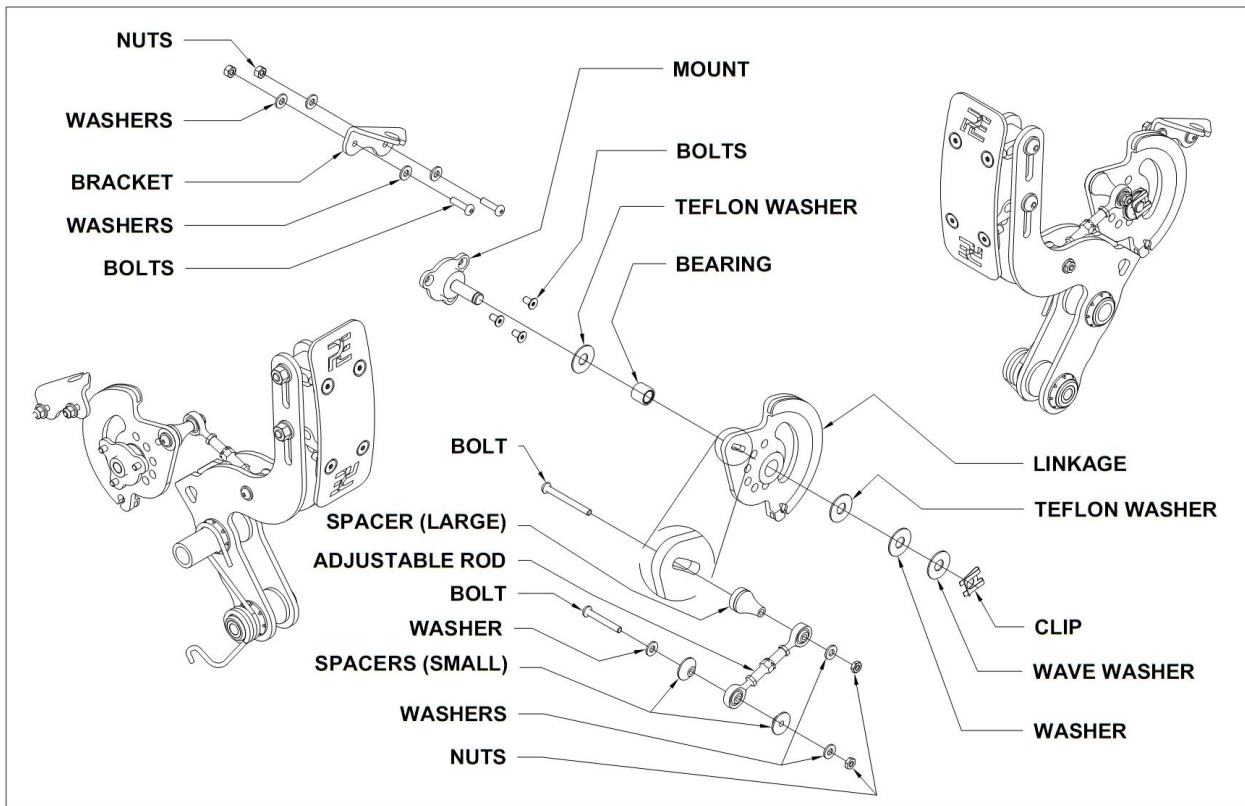


Figure 7 Throttle Cable Parts (PE-005-1001 & PE-007-1001)

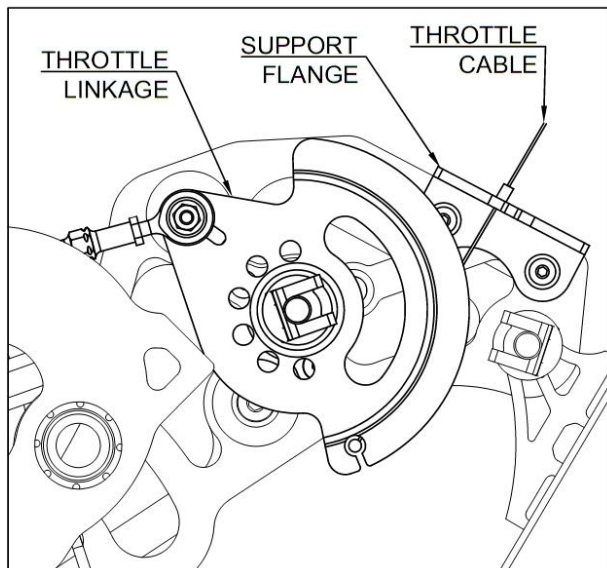


Diagram 5 Throttle Cable Assembly (PE-005-4010)

Note : A Cable tension is required to be fitted at the support flange. The throttle cable and cable tension is NOT supplied with the Pedal Assembly Kit and will need to be supplied by the USER.

## 5.2 Throttle Sensor (DBW/FBW models only)

DBW pedal assemblies are fitted with dial output, non-contact potentiometer. This will need to be wired to your ECU. (Please refer to the sensor data sheet below, page 20. The sensor has a 180° operating range. Operating outside this range will not produce any result. To ensure the sensor is within the correct range, refer to Diagram 6. The throttle linkage has a tip and/or screw which, when lines up vertically with the PINOUT connection is the zero point (middle of operating range).

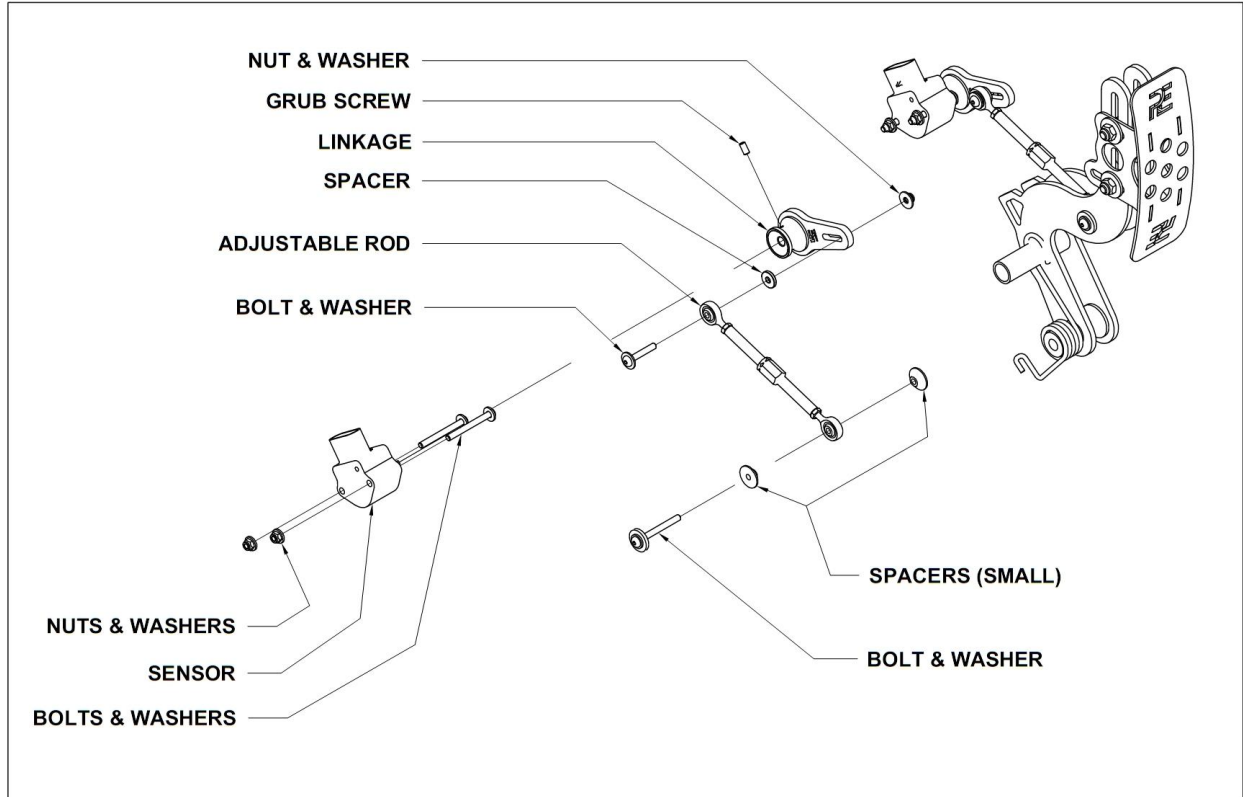


Figure 8 DBW Throttle Parts (applicable to PE-002-1001, PE-004-1001, PE-006-1001, PE-008-1001)

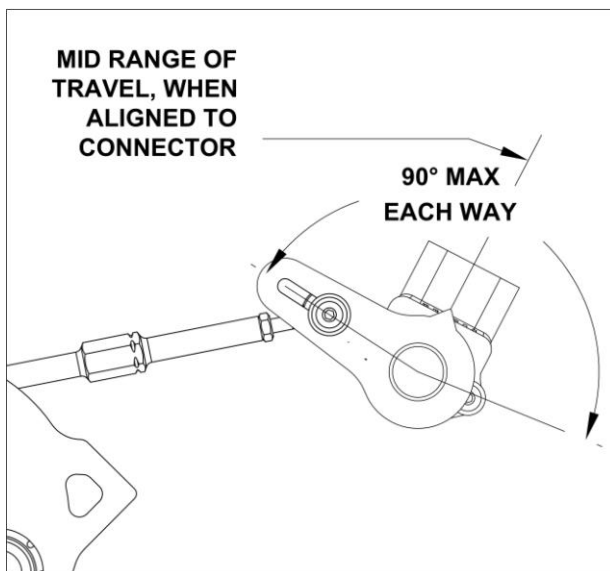


Diagram 6 DBW operating range

NOTE: Ensure pin connections are correct before powering up the unit. Check that the pedal motion is within the operating range of the throttle position sensor.

**DUAL OUTPUT, NON-CONTACT POTENTIOMETER - DATA SHEET**

**PART NUMBER PE-002-3001**

**Mechanical Specifications**

Mechanical travel 0° to +180° with stops  
 Frequency response 1,000Hz minimum  
 Rotational torque 0.025 – 0.110 N-m  
 Weight 35 grams (approx.)

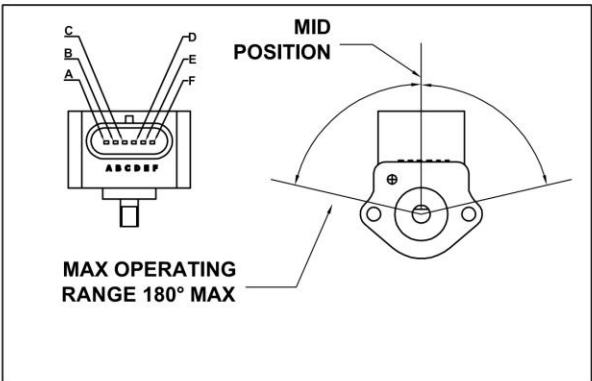
**Electrical Specifications**

Mechanical input range 0° to +180°  
 Input voltage 5.0 V±0.25V DC  
 Input current 18mA maximum per output  
 36mA maximum total (both channels)  
 Sensor 0.25V – 4.75V for Analog at 5.0V input  
 5% – 95% duty cycle for PWM  
 Accuracy ±0.6% of full scale at room temperature  
 ±0.9% of full scale over operating temperature range  
 Resolution Analog (continuous)

**Environmental Specifications**

Electromagnetic compatibility 100V/meter, 14kHz – 1GHz range  
 Vibration 10G peak, 20 – 2,000 Hz  
 Shock 50Gs, half sine pulse, 5 m sec duration  
 Side load 1kg for 1 million cycles  
 Operating temperature range -40°C to +85°C  
 Storage temperature range -55°C to +105°C

**Note: All dimensions are shown in millimeters  
 Note 1 : Shaft is positioned at 50% voltage output**



<b><u>CONNECTOR PIN OUTPUT</u></b>		
	<b><u>SENSOR 1</u></b>	<b><u>SENSOR 2</u></b>
<b>Vs (INPUT)</b>	<b>F</b>	<b>B</b>
<b>GROUND</b>	<b>E</b>	<b>A</b>
<b>OUTPUT</b>	<b>C</b>	<b>D</b>

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 Specifications subject to change without notice.



### 5.3 Throttle Travel Adjustment

Setting the correct throttle travel is vital to the performance of your engine. It is just as important to achieve the correct motion ratio to suit your intake linkage system.

- Install a permanent Full Throttle Stop (to suit) as shown in Figure 9. This will eliminate twisting of the throttle lever in the depressed position.
- With your throttle cable attached, adjust the throttle travel so that the engine throttle fully opens without straining the cable or linkage. The adjustable link provides throttle adjustments(see chapter 5.4). **The pedal positive stop must stop pedal movement, not the linkage, which could bend or break if movement range is exceeded.**

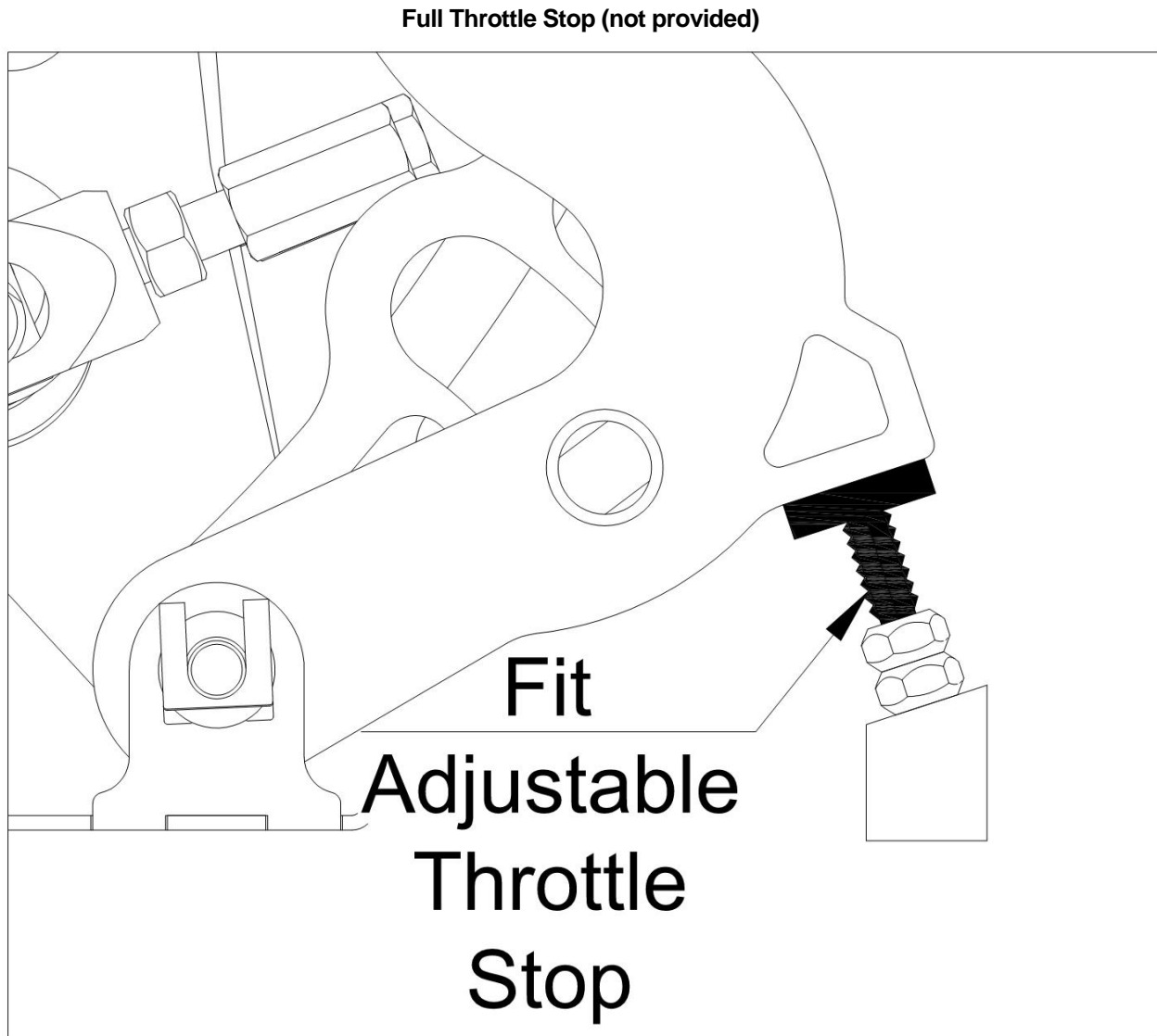


Figure 9 Throttle Stop placement

## 5.4 Throttle Stroke Adjustment – see Diagram 7,8,9,10,11,12

1. The throttle stroke length is achieved by moving the adjustable rod connection along the slot in the linkage.
2. Clamp the adjustable rod (A) to the required position in the slot provided in linkage (B). The outer portion of the slot (B) will provide a decreased stroke length, and the inner position will provide an increased stroke length.
3. Measure what your throttle stroke requirement is.
4. Set the travel required, including any linkage adjustments at your throttle body/bodies.
5. Check the throttle lever travel and ensure the inbuilt stops engage at both ends, alternatively, the full throttle stop could be utilised as a minimum requirement. Adjust and tighten jam nuts and all related hardware as necessary.
6. Once the correct travel length is achieved, you may proceed to check the motion ratio (chapter 6).

Note: Very fine settings can be achieved ranging from 30mm to 55mm stroke.

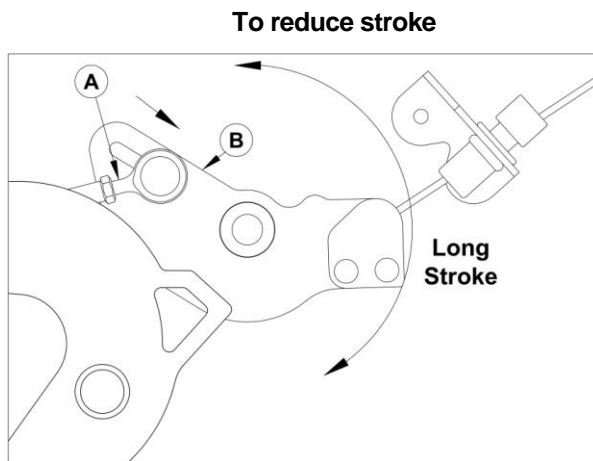


Diagram 7 Short Stroke.

(models: PE-001-1001 & PE-003-1001)

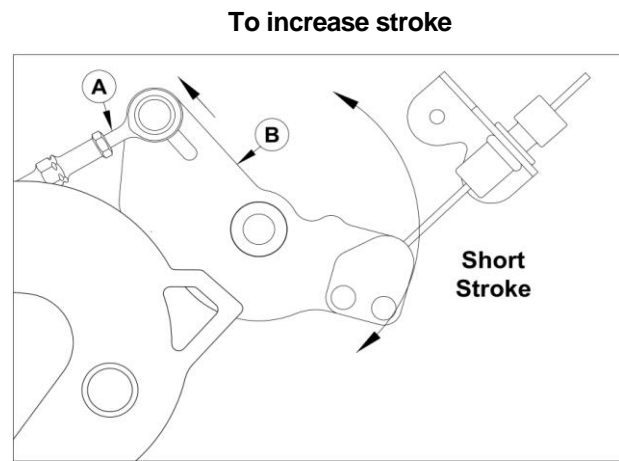


Diagram 8 Long Stroke.

(models: PE-001-1001 & PE-003-1001)

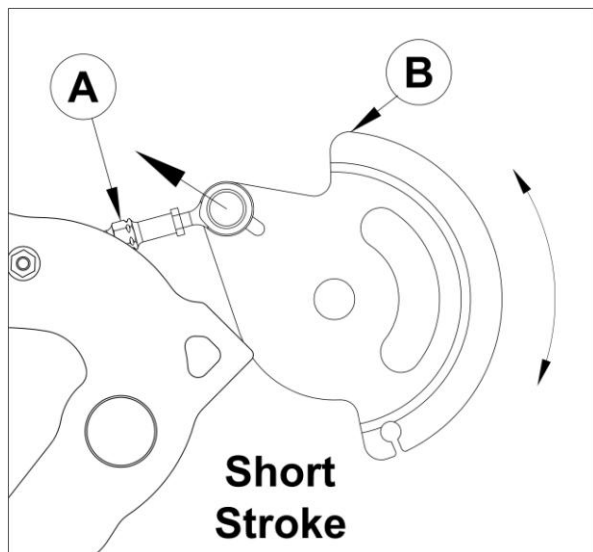


Diagram 9 Short Stroke

(models: PE-005-1001 & PE-007-1001)

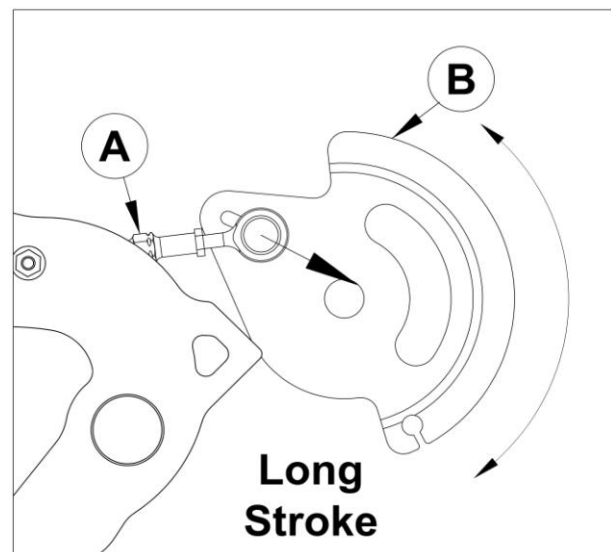


Diagram 10 Long Stroke

(models: PE-005-1001 & PE-004-1001)

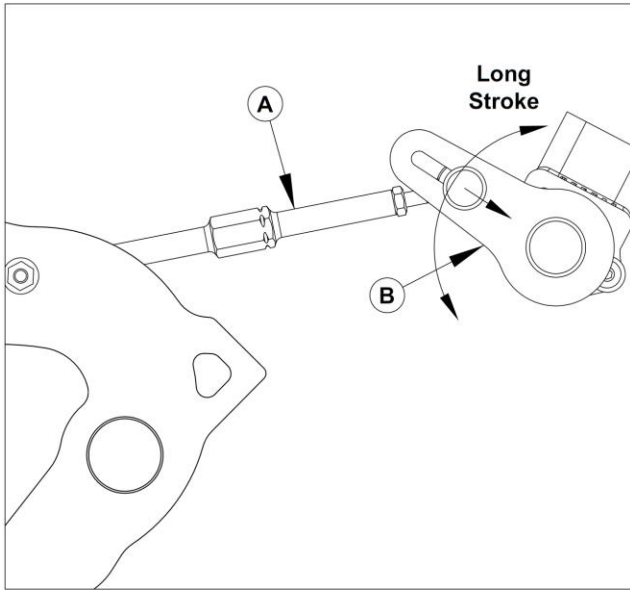


Diagram 11 Short Stroke  
 (models: PE-002-1001, PE-004-1001, PE-006-1001, PE-008-1001)

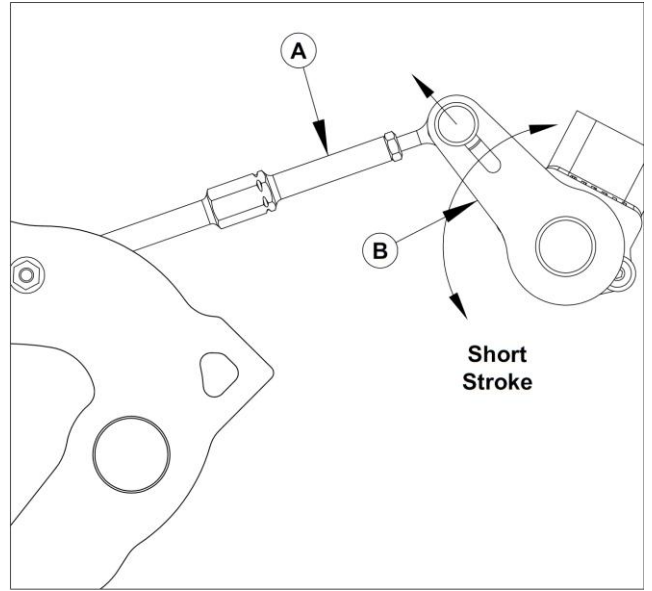


Diagram 12 Long Stroke  
 (models: PE-002-1001, PE-004-1001, PE-006-1001, PE-008-1001)

## 6. Throttle Motion Ratio Adjustment

The length of the adjustable rod with spherical ends will determine the motion ratio of your throttle. Thus, adjusting the length slightly will change the responsiveness at low or high throttle percentages.

### 6.1. Motion Ratio Adjustment (Fabricated model)

- The motion ratio can be set to correct the motion of your throttle butterfly (or slide) to give a more consistent area opening rate. **Do not allow the link to get close to an over centre position at any time.**
- A maximum of 160 degrees should be maintained between the adjustable rod (A) & link (B), also a maximum of 160 degrees should be maintained between the adjustable rod (A) & throttle lever (C) at both no throttle & full throttle positions – see diagrams below. **Exceeding 160° will cause the cable guide to over centre which will affect the return operation of the pedal**

**No Throttle Position (Max Stroke)**

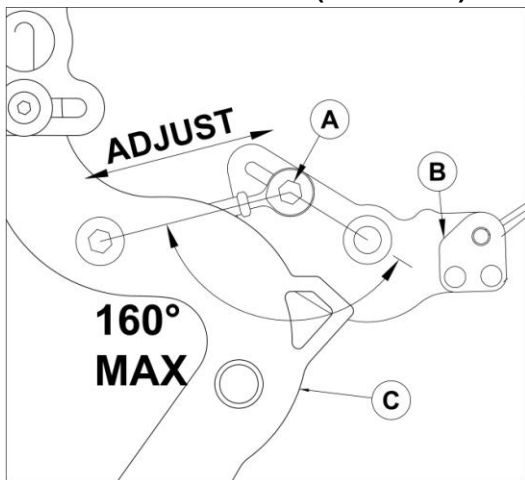


Diagram 13 Throttle Position

**Full Throttle Position (Max Stroke)**

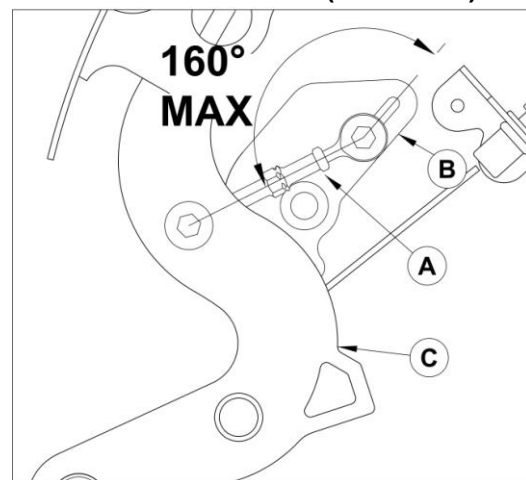


Diagram 14 Full Throttle Position-Max

**Full Throttle Position (Min Stroke)**

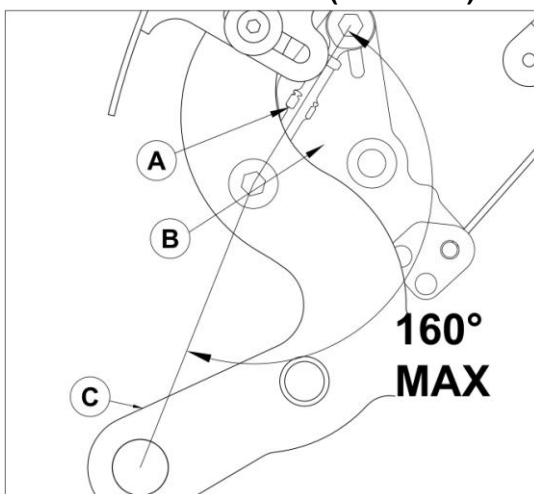


Diagram 15 Full Throttle Position - Min

- On completion, check the stroke length, and re-adjust as necessary.

#### **Important Notes:**

Since, the adjustable rod with spherical ends allows fine motion ratios to be set to suit your throttle rate requirements.

- Ensure the throttle contacts the lever travel stops in either direction (or, full throttle as a minimum requirement) without straining the throttle cable.
- Ensure no binding takes place during full operation
- Ensure all connections are tight on completion after any adjustments.



## 6.2 Motion Ratio Adjustment (Billet Model)

- The motion ratio can be set to correct the motion of your throttle butterfly (or slide) to give a more consistent area opening rate. **Do not allow the link to get close to an over centre position at any time.**
- A maximum of 160 degrees should be maintained between the adjustable rod (A) & link (B), also a maximum of 160 degrees should be maintained between the adjustable rod (A) & throttle lever (C) at both no throttle & full throttle positions – see diagrams below.

No Throttle Position (MAX Stroke)

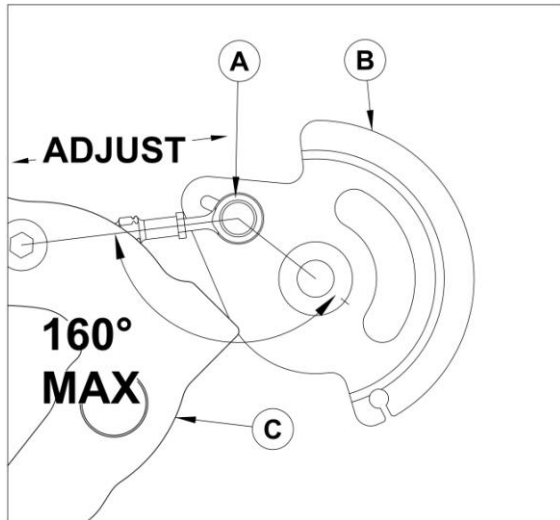


Diagram 16 Throttle Position

Full Throttle Position (MAX Stroke)

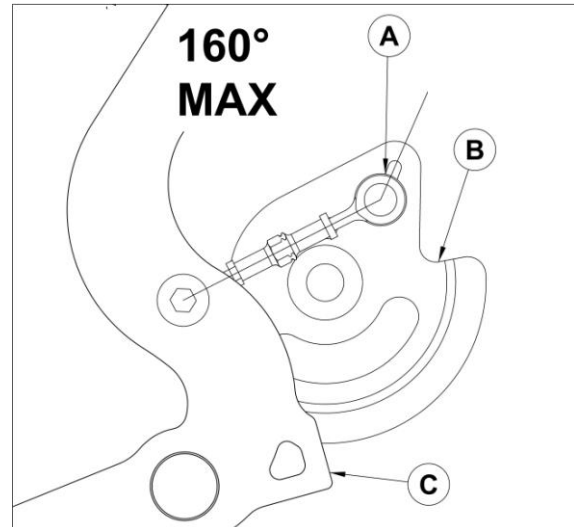


Diagram 17 Throttle Position - Max

Full Throttle Position (MIN Stroke)

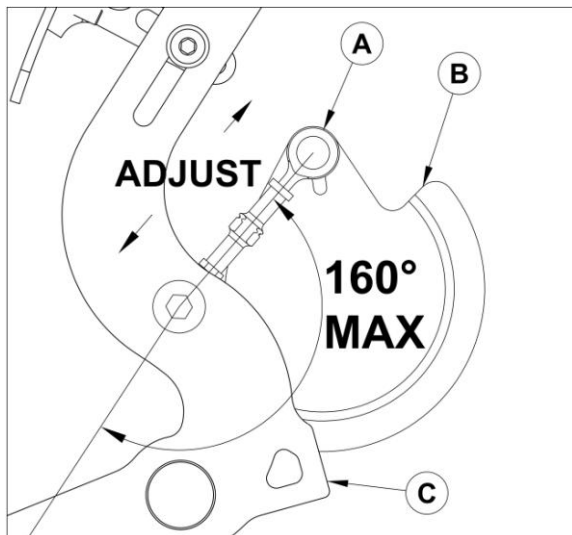


Diagram 18 Throttle Position - Min

- On completion, check the stroke length, and re-adjust as necessary.

### Important Notes:

Since, the adjustable rod with spherical ends allows fine motion ratios to be set to suit your throttle rate requirements.

- Ensure the throttle contacts the lever travel stops in either direction (or, full throttle as a minimum requirement) without straining the throttle cable.
- Ensure no binding takes place during full operation
- Ensure all connections are tight on completion after any adjustments.

### 6.3 Motion Ratio Adjustment (DBW)

- The motion ratio can be set to correct the motion of your throttle butterfly (or slide) to give a more consistent area opening rate. **Do not allow the link to get close to an over centre position at any time.**
- A maximum of 160 degrees should be maintained between the adjustable rod (A) & link (B), also a maximum of 160 degrees should be maintained between the adjustable rod (A) & throttle lever (C) at both no throttle & full throttle positions – see diagrams below.

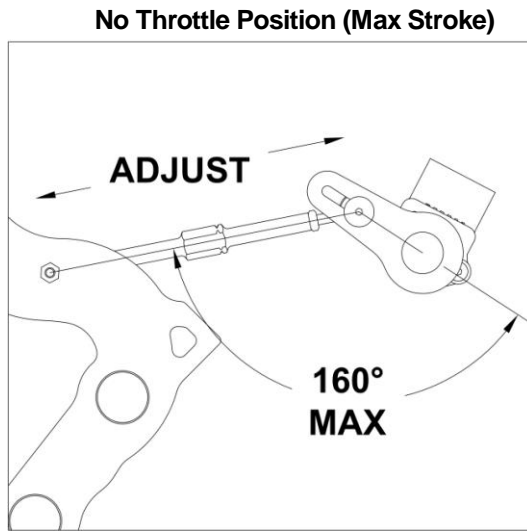


Diagram 19 Throttle Position

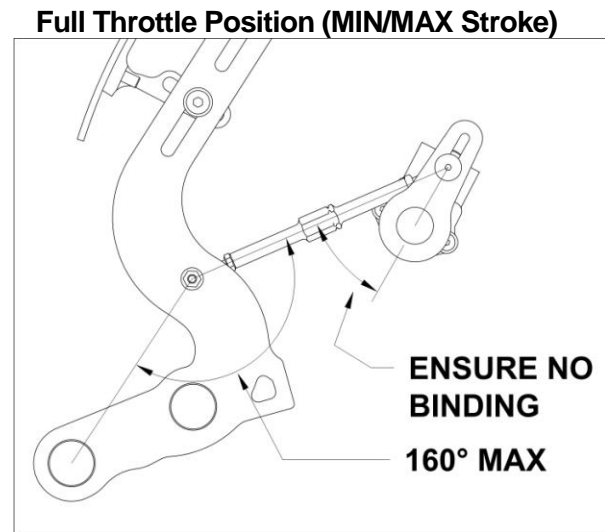


Diagram 20 Throttle Position-MIN/MAX

#### **Important Notes:**

Since, the adjustable rod with spherical ends allows fine motion ratios to be set to suit your throttle rate requirements.

- Ensure the throttle contacts the lever travel stops in either direction (or, full throttle as a minimum requirement) without straining the throttle cable.
- Ensure no binding takes place during full operation.
- Ensure throttle movement is within operating range of the throttle sensor (refer to Diagram 6 ,page 20)
- Ensure all connections are tight on completion after any adjustments.

# 7. Master Cylinder & Plumbing

## 7.1. Master Cylinders Overview – see Figure. 10.

- The PE Racing Pedal Box is designed to accept the Girling-type universal master cylinders in a variety of cylinders bore sizes (5/8", 0.7", 3/4" or 13/16") with a maximum stroke of 34.9mm (1.375").
- The clutch and brake pedal levers are conservatively designed to travel through 30°, resulting in 30mm cylinder stroke (allowing 5mm piston clearance in the cylinder).

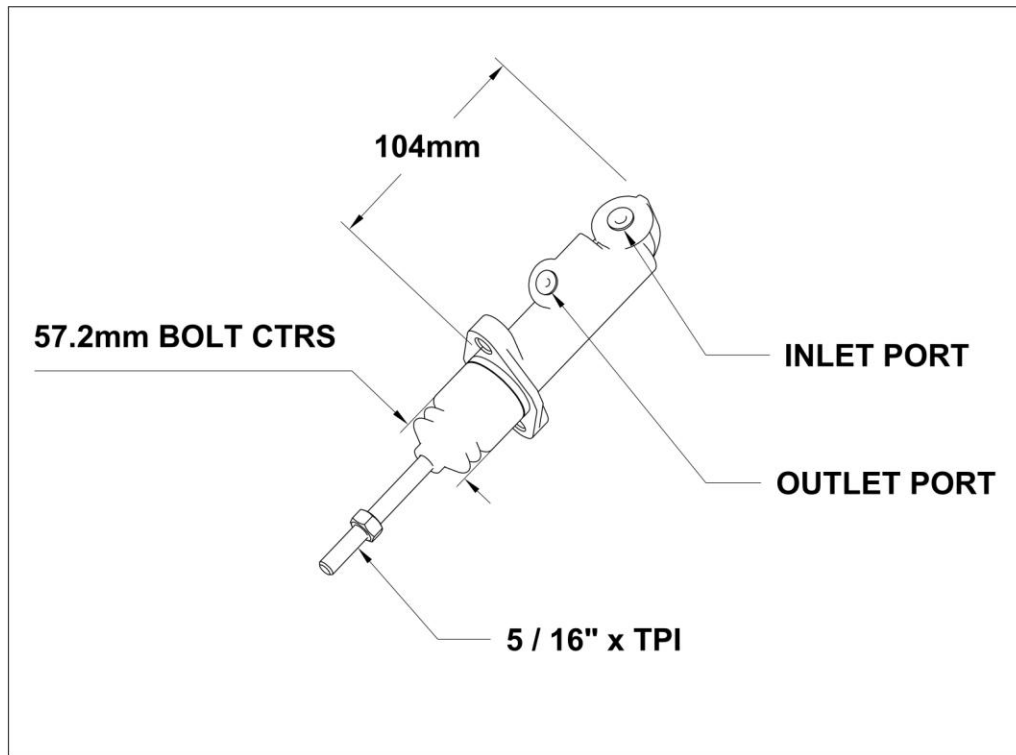


Figure 10 Master Cylinder

## 7.2. Pedal Adjustments

- The pedal travel can be varied by pushrod length adjustments.
- The pedal levers can be adjusted for minimised stroke (shortening the pushrod) or maximum travel of 35° for increased travel. For high pedal travel, ensure no binding occurs within the master cylinders.
- Increasing pedal travel increases cylinder stroke improving an overall mechanical advantage on the clutch lever.
- Decreasing master cylinder bore sizes further increases the overall mechanical advantage for both clutch and brake levers.
- For additional information, refer to the “How it works” section of this manual. It is good practice to match your brake components i.e, callipers to your master cylinder sizes or vice versa for optimal braking performance. If you are unsure, seek professional advice.

### 7.3. Master Cylinder Assembly

The standard manual pedal box kit includes 3 master cylinders, 3 reservoir bottles and 3 braided hoses (for reservoirs to cylinders). The standard auto box includes 2 master cylinders, 2 reservoir bottles and 2 braided hoses. Fix the master cylinders in the appropriate location on the frame with high tensile M8 bolts, washers and self locking (or nyloc) nuts.

- The master cylinder pushrods may be too long for shorter stroke applications. You may need to shorten the pushrods to obtain the desired pedal starting position. If you do shorten the pushrods for any reason, chamfer the end of the threads after cutting to remove sharp edges.

### 7.4. Master Cylinders Plumbing

- Attach the hydraulic feed lines to the master cylinders.
- Locate your reservoirs as high as possible using the lines provided.
- Connect your brake and clutch lines to the outlets of each master cylinder using banjo fittings. A Banjo type fitting provides a more convenient fitting/removing access and increases the available clearances from the pedal movements. The table below indicates the thread types for your master cylinder inlet and outlet ports.

#### Important Notes:

- The clutch and brake system is gravity fed by the reservoirs which need to maintain a head of fluid.
- Mounting the reservoirs at a level above the brake callipers and master cylinders is extremely important for maintaining a firm pedal, easy bleeding and, is more reliable than using a residual pressure valve.

### 7.4. Bleeding the System

1. To bleed the system, (as per any balance bar system) always bleed the front and rear calliper at the same time to allow full master cylinder stroke.
2. Bleed the clutch system and check that the lever stop is set correctly.
3. On completion, apply full pedal pressure and check for leaks.

### 7.5. Master Cylinder Data

- All cylinders in the table below have a maximum stroke of 34.9mm (1.375").
- The values for volume displacement are calculated at the maximum stroke.

CYLINDER DESIGNATION				CYLINDER BORE		MAX DISPLACEMENT	
BORE Inches	BORE cm	INLET PORT THREAD TYPE	OUTLET PORT THREAD TYPE	AREA IN <sup>2</sup>	AREA cm <sup>2</sup>	VOLUME IN <sup>3</sup>	VOLUME cm <sup>3</sup>
5/8" 0.6250"	1.59	7/16" x 20 TPI	3/8" x 24 TPI	0.31	2.0	0.4	6.9
0.700"	1.78	7/16" x 20 TPI	3/8" x 24 TPI	0.38	2.5	0.5	8.7
3/4" 0.75"	1.91	7/16" x 20 TPI	3/8" x 24 TPI	0.44	2.9	0.6	9.9

Table 1: Master Cylinder Data.

# 8. Pedal Positioning & Adjustments

## 8.1. Pedal Comfort Position

Adjustable pedal geometry is incorporated for driver feel and comfort. The pedal positions can be adjusted using the adjustment slots provided. The proper pedal positioning is highly dependent on driver preferences. Hence, set the pedals so that the driver is comfortable and safe.

- The stroke of the clutch and brake levers is set by adjusting the length of the master cylinder pushrods. **The brake lever should act on the maximum possible comfortable stroke to increase the available mechanical advantage and travel in emergencies.**
- In all cases, **ensure the cylinders do not bottom out before their respective inbuilt pedal stop positions. (refer to Figure 11 & 12)**
- Ensure the pushrods engage at least 12mm into the clevises.

### Important Notes:

- Mechanical advantage, commonly known as Pedal Ratios, on this assembly can be adjusted by moving the pedal face up or down using the slots provided. (refer to Figure 13 & 14)
- Overall mechanical advantage also relies on cylinder bore and effective stroke used.

## 8.2. Clutch Pedal

Most racing clutches and release bearings require the use of a clutch stop to eliminate over travel. Setting this stop correctly will prevent any unnecessary damage to the clutch and allow the clutch to release as intended.

- With the system properly bled, set the desired stroke by adjusting the pushrod length.
- Setup the clutch stop, the setting should be 4-8mm (as measured at the pedal face) past the point of clear clutch release.
- The clutch lever arm has an inbuilt stop position. Adjust the rod length to correct the fluid displacement. Alternatively, you may change to a different master cylinder bore size to achieve the correct fluid displacement for your desired pedal travel – see Table 1 on Page 17, to view alternative master cylinders bore sizes and their fluid displacement rates.

### Important Notes:

- Precautions should be taken to set up the clutch pedal correctly, as clutch over travel may damage your clutch cylinder. (refer to figure 11 & 12)
- The Table on Page 28 should be used to select the correct master cylinder bore and travel rate required to suit your clutch slave cylinder fluid displacement.
- The greater the effective stroke used, the greater the mechanical advantage.
- If your desired stroke length is shorter than the available cylinder stroke, it would be advisable to reduce the cylinder bore size to one that meets the correct fluid displacement at your desired pedal stroke setting.

### Pedal Depressed Position

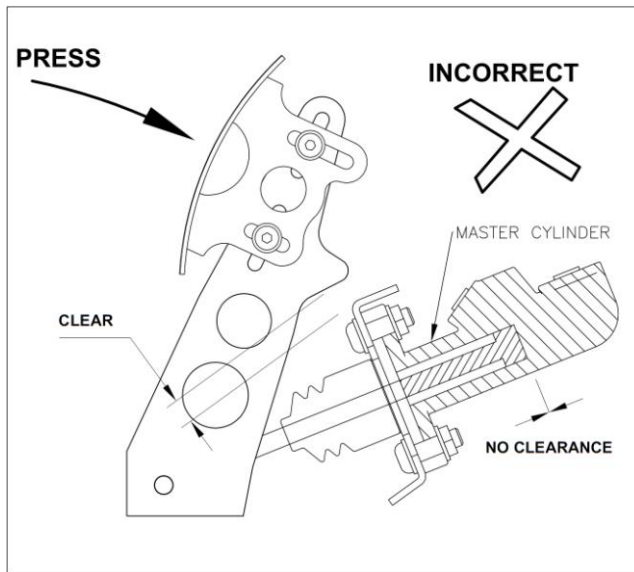


Figure 11 Incorrect Position

### Pedal Depressed Position

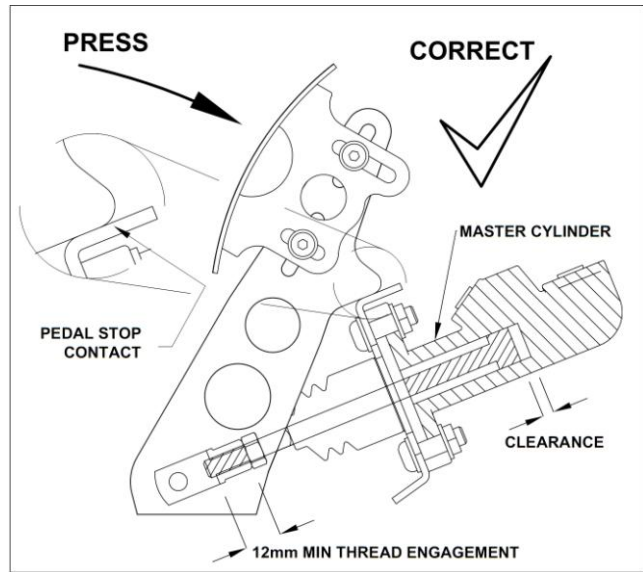


Figure 12 Correct Position

The position of the clutch pedal face is mostly a matter of driver preference. Thus, adjust the pedal face position to suit using the slots provided and ensure hardware is tightened.

### 8.3. Brake Pedal

- With the system properly bled, and the pedal depressed – the pedal face should be vertical or leaning slightly towards the driver.
- Tighten all pushrod lock nuts after the pedal lever positioning is set.
- On completion, adjust the pedal face position to suit using the slots provided and ensure hardware is tightened.

#### Important Notes:

- **The driver should not be stretching their toes to reach this pedal position, and their knees should be slightly bent.**
- Keep in mind, as a typical race progresses, any problems with pad knock back or fade will only increase the pedal travel distance. Thus, ensure that the full pedal travel can be reached in an emergency.

### 8.4. Throttle Pedal

A good starting point for the throttle pedal position is to have it even with the brake pedal while the brake pedal is in the depressed position – this allows a driver to quickly change back to the throttle after braking.

- Set the throttle pedal face accordingly and check that all fasteners are tightened. Note: The throttle lever has fixed travel limits.
- Adjust the pedal face position to suit using the slots provided and ensure hardware is tightened.

## 8.5. Pedal Face Adjustments

- The pedal face position is adjusted to suit using the slots provided. **The adjustment bolts should always have large diameter washers at both faces and have the crush tubes in place.**
- The pedal face may be moved up/down, in/out, flipped over or pitched about the vertical position using the slots provided to suit your installation – see Figures 13 & 14 below.
- On completion, ensure hardware is tightened.

### Pitch Adjustment Slots – Lever Arms & Pedal Faces

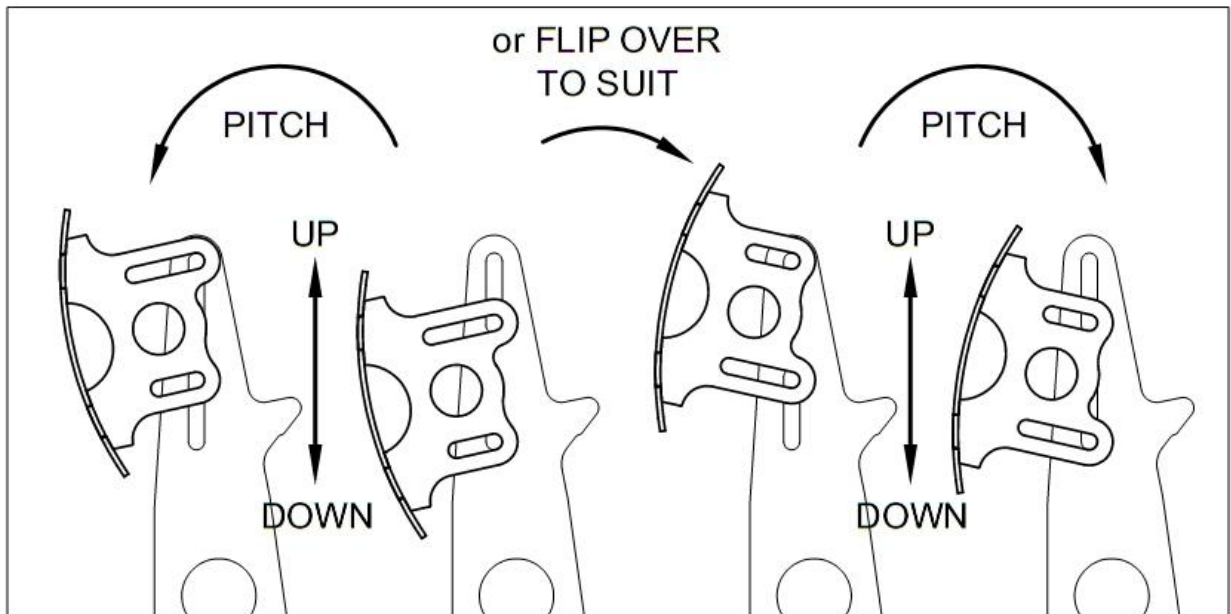


Figure 13 Pedal Face Adjustment (Pitch)

### Horizontal & Vertical Adjustment Slots – Lever Arms & Pedal Faces

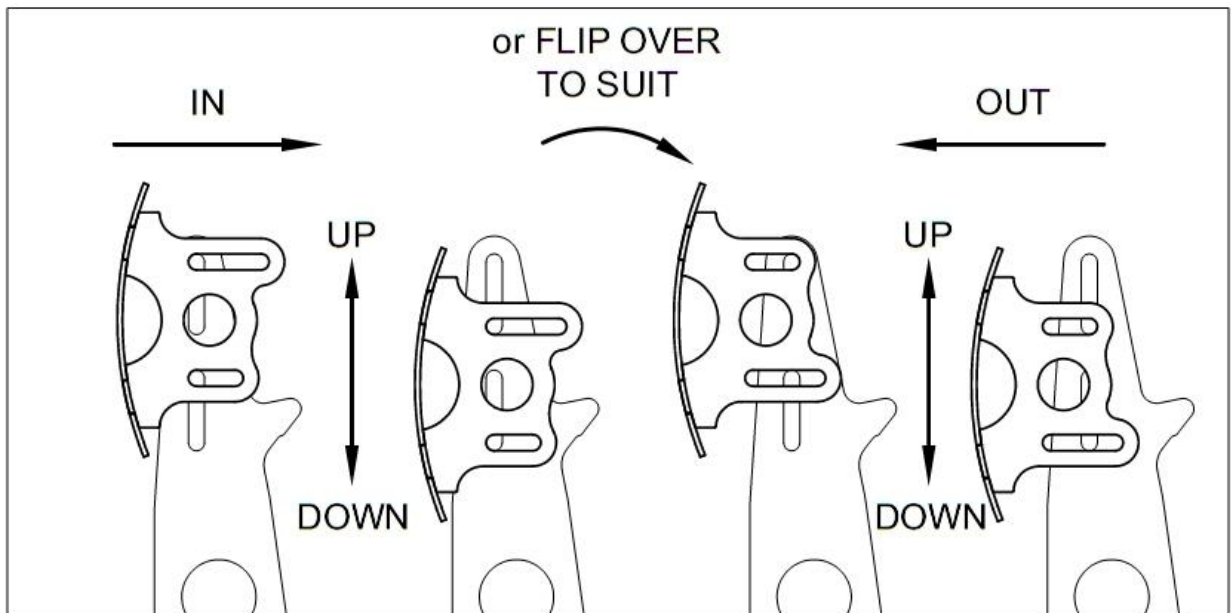


Figure 14 Pedal Face Adjustment (Horizontal and Vertical)

# 9. Balance Bar

## 9.1. How it works

Initially, there are several variables which, when understood enable you to refine your brake balance settings effectively. The variables include:

- Master cylinder bore sizes for front and rear
- Balance bar position
- Calliper pistons total bore areas for front and rear
- Brake pad material and area
- Brake rotor diameter and pad area

All of these elements are important and understanding the relationship between them is helpful. Consult a professional as necessary prior to committing to brake callipers, brake rotors and brake pads. Any homework done early in the design stage of your braking system will reduce any unnecessary expense.

Generally, under heavy braking, many vehicles transfer majority of its weight to the front, up to 80% of braking effort is required by the front brakes – leaving 20% for the rear brakes. For example, your vehicle may only transfer 65% to the front and 35% to the rear, thus, doing a little homework at the early design stages is vital to obtaining the correct brake components.

Also, **keep in mind the operating temperature of your braking system is vital.** It is important that both front and rear brakes have the same temperature gradient at all times. This will ensure no irregular front to rear braking forces are present. A poorly designed braking system will lock the fronts at some times and lock the rears at others.

This would typically be a result of mismatched operating temperatures relative to each other. Seek professional advice as required. Most modern vehicle scales have the ability to determine the centre of gravity and weight distribution, which is used for the calculation of the front and rear braking efforts required.

## 9.2. Remote Bias Cable

- Fit the remote bias adjuster knob in a location that is convenient to reach and see while driving.
- The Adjustment knob should be mounted through a panel or supported by a bracket at a location which allows the flexible cable to reach to the balance bar from the throttle side only.
- Fix the cable to the remote adjuster knob and the balance bar threaded section using the provided set screws. Should you wish to shorten the cable, ensure all ends are de-burred and long enough to operate correctly. Trim outer skin labelled in Figure 15 so that the core wire 'B' is long enough to be inserted into the threaded adaptor. Once inserted, tighten the set screw 'C' to clamp onto the cable. Next, wind the adaptor onto the threaded balance bar until the set screw hole 'D' lines up with the hole in the balance bar. Tighten set screw 'D' to prevent the adaptor coming loose during operation.
- – NOTE: The bias adjustment is only to be used when the brake lever is in the relaxed position.

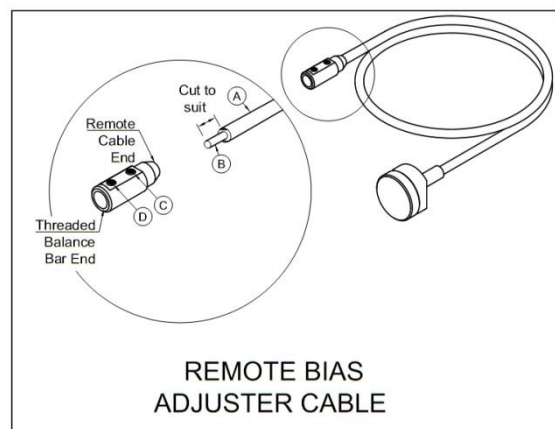


Figure 15 Remote Bias Kit (PE001-4007)



### **Important Notes:**

- The throttle lever is shaped to provide full clearance to the remote cable under the condition that the brake lever is in the fully depressed position. **Under no circumstances should you reverse the cable and balance bar to approach to be from the clutch lever side.**
- **Never operate the bias adjustment while the brake pedal is in the depressed position, or under braking. Only adjust when the brake lever is in the relaxed position.**

### **9.3. Adjustment and Operation**

When driving on a consistent surface, you may ideally want the front tires to lock-up with a slightly less pedal effort than the rears. This will assist to keep the vehicle stable while entering a corner under braking conditions and prevent unnecessary spinning out. With the pedal in the relaxed position, turn the adjusting nut on remote cable so that it advances the spherical bearing closer to the selected master cylinder, increasing the braking force produced by that master cylinder.

The spherical bearing in the balance bar has a wide range of adjustment. If you find that after testing, that you are at the edge of the adjustment range, you will need to make a change to the master cylinder bore sizes, or possibly changes to the front/rear calipers, pads or rotors.

Refer to Section 9.1 – How it works. Should you choose to correct the balance issue by changing the master cylinder bore sizes, there are three possible changes that you can make (See Figures below). Each change is aimed at moving the spherical joint towards the ideal centre position.

- **Option 1:** Decrease the master cylinder bore size closest to the spherical joint to a few sizes down (typically by  $-1/8$ " ). This will reduce the braking force required to that circuit, but increase pedal travel. The spherical bearing will be re-adjusted towards the centre position.
- **Option 2:** Increase the master cylinder bore size furthest to the spherical joint to a few sizes up (typically by  $+1/8$ " ). This will increase the braking force required to that circuit, but decrease pedal travel. The spherical bearing will be re-adjusted towards the centre position.
- **Option 3:** Increase the master cylinder bore size farthest from to the spherical joint by one size up ( $+1/16$ " ). Decrease the master cylinder bore size closest from to the spherical joint by one size down ( $-1/16$ " ). This will maintain the same amount of brake force and pedal travel. The spherical bearing will be re-adjusted towards the centre position.
- After testing and refining your brake balance, note your ideal settings by recording the number of turns in or out from a referenced location or by recording the line pressure distribution. Fine adjustment during driving will maintain your ideal balance to suit varying conditions such as changes in weather, fuel usage, weight distribution, tyre wear, road surface and your driving style.

**Depressed Pedal Position**

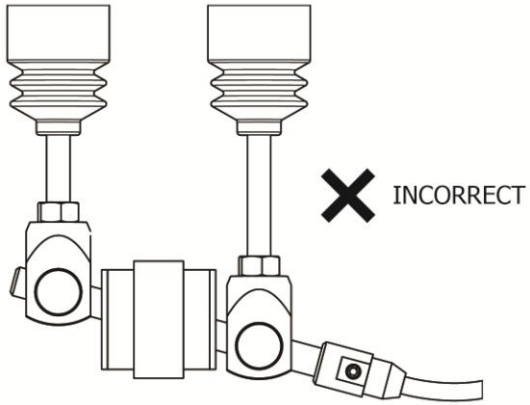


Figure 16 Incorrect Position

**Depressed Pedal Position**

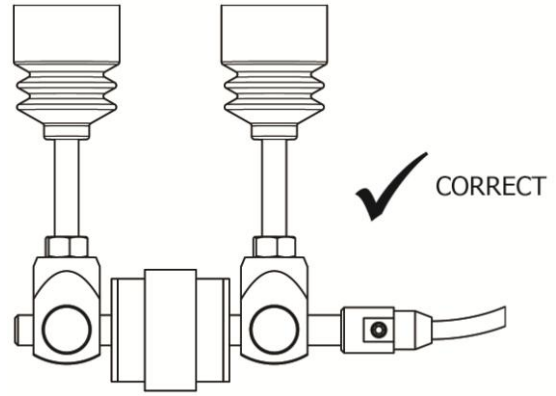
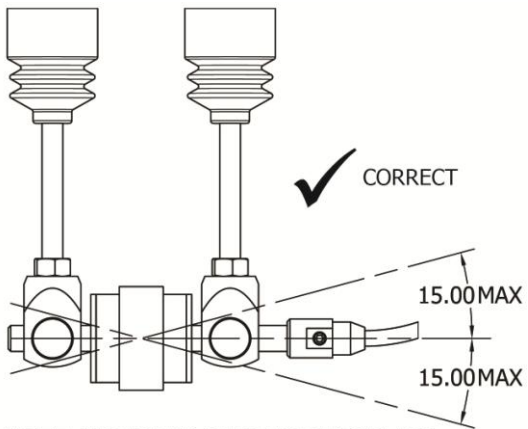


Figure 17 Correct Position

**Relaxed Pedal Position**



**NOTE: ENSURE NO BINDING TAKES PLACE**

Figure 18 Correct Unloaded Position

## 10. Post-Installation Checks

- Care should be taken to ensure all services are correctly and safely mounted.
- Check all fixings and locknuts are tight.
- Ensure the permanent Full Throttle Stop is set correctly & tight.
- Ensure the throttle cable connections are tight and return springs are fitted at both ends.
- Ensure the throttle linkages do not approach an over centre position as this may lead to the throttle jamming.
- Fasten all loose lines and cables appropriately to allow any freedom of movement required, but not allowing interference to drivers' feet and pedals during the full operation of all pedals.
- Where cables and hoses pass through panels, check for chaffing and correct as necessary.
- Ensure the reservoirs have the correct fluid and level.
- Ensure the system is fully bled.
- Check for leaks while you have an assistant holding full pedal pressure.
- Check all clearances and make any necessary adjustments.
- Test, inspect and adjust as necessary.
- This product should be regularly inspected, cleaned, adjusted as necessary, and maintained for endured reliability and function.

**“The improper installation of this kit and related components could result in serious injury or death”.**

# 11. Spec Sheet

## PE Racing Pedal Box

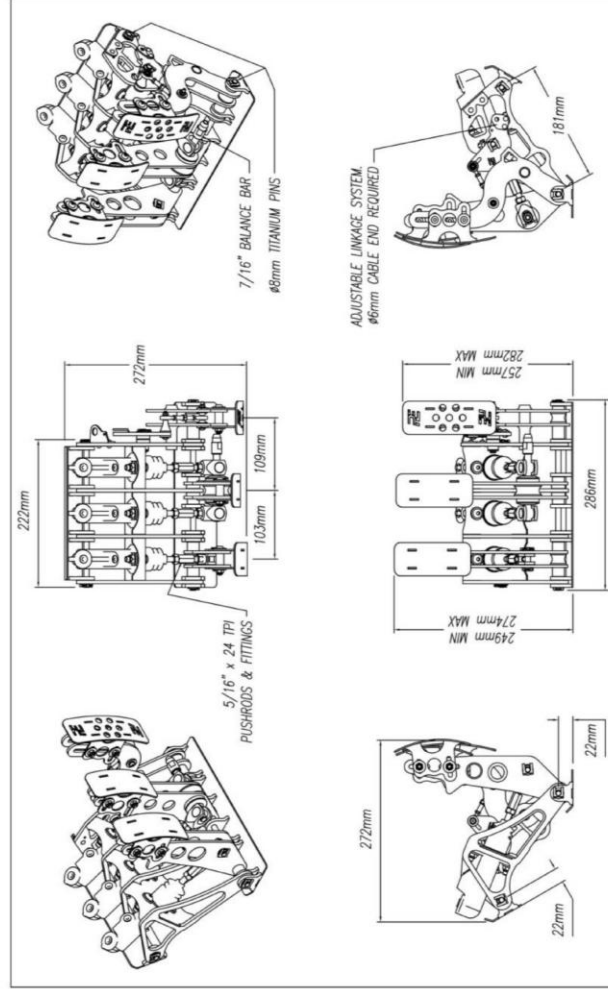
PE-001-1001

## Dimensions & Specifications

## Cable Throttle Version

### SPECIFICATIONS

- Materials : 6061-T6 & 5005-H34 Alloys, Tig Welded Alloy Construction
- Finish: Anodised in Black & Clear
- Master Cylinders: Alloy Construction with 34.9mm stroke (1.375")
- Mounting Location: Floor and Firewall, or Floor and Bulkhead
- Reservoir Capacity: 3 off Remote mounted Plastic with 105cc Fluid Capacity each
- Reservoir Dimensions: 76.2mm (3") diameter and 88.9mm (3.5") high
- Hydraulic Feed Lines: Teflon lined Stainless Braided Hose AN-4 Fittings
- Fixings: Stainless Steel
- Pins : Titanium Gr2
- Net Weight: 4lb 7oz (2.02kg)
- Incl. Throttle Linkage Kit
- Gross Weight: 7lb 11oz (3.45kg)
- Incl. Master Cylinders, Balance Bar & Fittings
- Pedal Ratio: Adjustable 3.5:1 to 3.9:1



### Safe Working Loads

- Clutch Pedal Force 90kg (138 Lb Or 883 N)
- Brake Pedal Force 160kg (352 Lb Or 1570 N)
- Throttle Pedal Force 50kg (110 Lb Or 490 N)
- Throttle Cable Force 10kg (22 Lb Or 98 N)
- Return Spring Force 5kg (11 Lb Or 50 N)

## PE Racing Auto Pedal Box

PE-002-1001

## Dimensions & Specifications

Cable Throttle Version

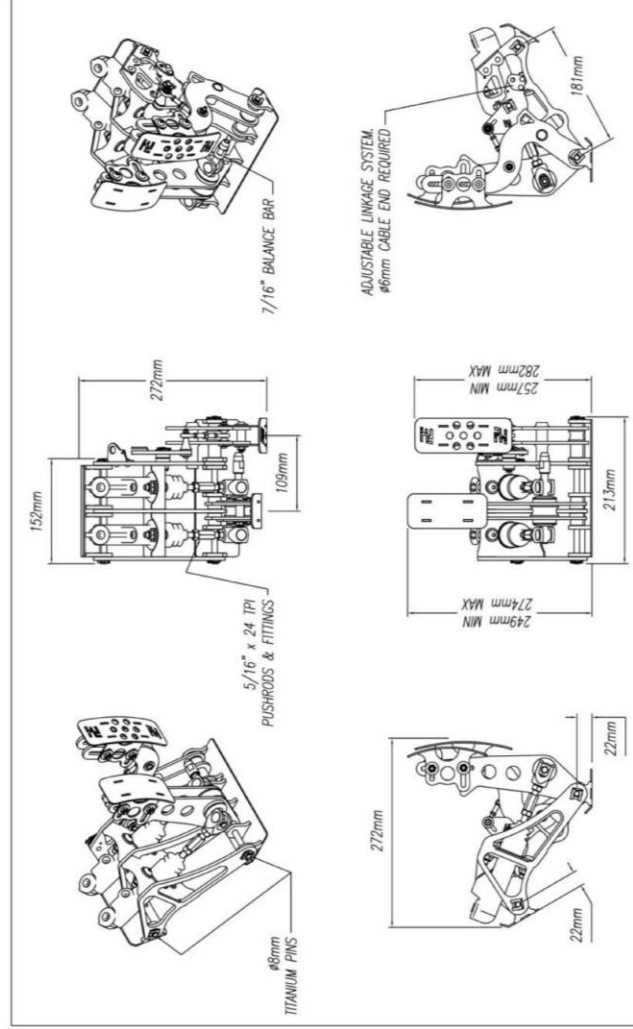
### SPECIFICATIONS

- Materials : 6061-T6 & 5005-H34 Alloys, Tig Welded Alloy Construction
- Finish: Anodised in Black & Clear
- Master Cylinders: Alloy Construction with 34.9mm stroke (1.375")
- Mounting Location: Floor and Firewall, or Floor and Bulkhead
- Reservoir Capacity: 2 off Remote mounted Plastic with 105cc Fluid Capacity each
- Reservoir Dimensions: 76.2mm (3") diameter and 88.9mm (3.5") high
- Hydraulic Feed Lines: Teflon lined Stainless Braided Hose AN-4 Fittings
- Fixings: Stainless Steel
- Pins : Titanium Gr2
- Net Weight: 3lb 8oz (1.6kg) Incl. Throttle Linkage Kit
- Gross Weight: 5lb 8oz (2.5kg) Incl. Master Cylinders, Balance Bar & Fittings
- Pedal Ratio: Adjustable 3.5:1 to 3.9:1

### Safe Working Loads

- Brake Pedal Force 160kg (352 Lb Or 1570 N)
- Throttle Pedal Force 50kg (110 Lb Or 490 N)
- Throttle Cable Force 10kg (22 Lb Or 98 N)
- Return Spring Force 5kg (11 Lb Or 50 N)

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## PE Racing Pedal Box

PE-003-1001

## Dimensions & Specifications

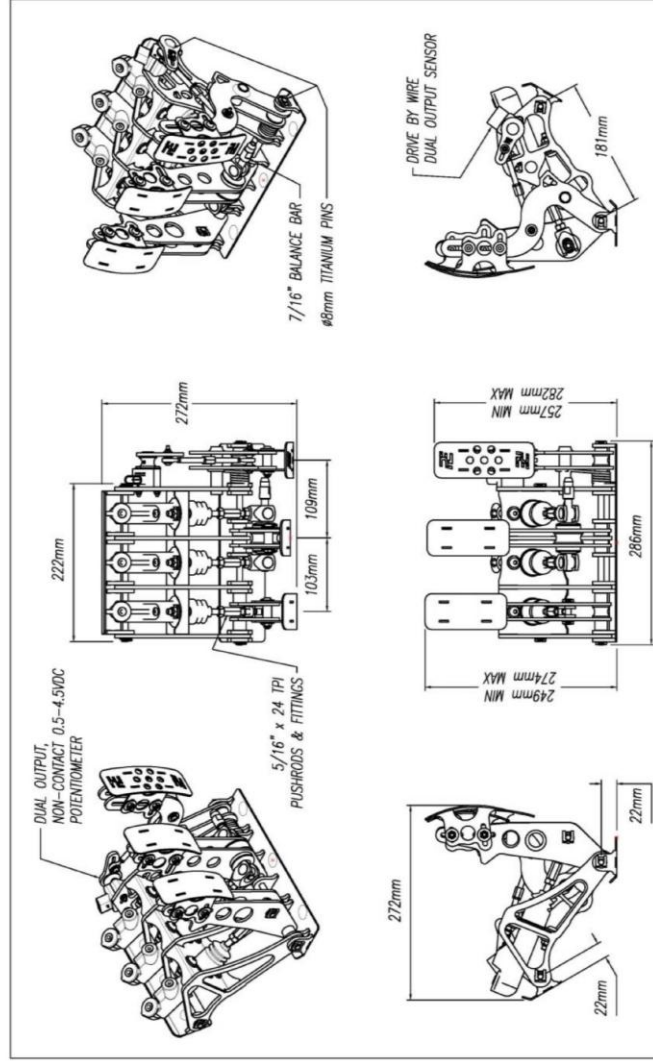
Drive by Wire Throttle Version

### SPECIFICATIONS

- Materials : 6061-T6 & 5005-H34 Alloys, Tig Welded Alloy Construction
- Finish: Anodised in Black & Clear
- Master Cylinders: Alloy Construction with 34,9mm stroke (1.375")
- Mounting Location: Floor and Firewall, or Floor and Bulkhead
- Reservoir Capacity: 3 off Remote mounted Plastic with 105cc Fluid Capacity each
- Reservoir Dimensions: 76.2mm (3") diameter and 88.9mm (3.5") high
- Hydraulic Feed Lines: Teflon lined Stainless Braided Hose AN-4 Fittings
- Fixings: Stainless Steel
- Throttle Torsion Spring: stainless Steel
- Pins : Titanium Gr2
- Net Weight: 4lb 7oz (2.07kg)  
Incl. Throttle Linkage Kit
- Gross Weight: 7lb 11oz (3.5kg)  
Incl. Master Cylinders, Balance Bar & Fittings
- Pedal Ratio: Adjustable 3.5:1 to 3.9:1
- Dual Output Throttle Position Sensor, Non-Contact 180°, Input 5V±0.25V DC, Output 0.5 V - 4.5V DC

### Safe Working Loads

- Clutch Pedal Force 90kg (138 Lb Or 883 N)
- Brake Pedal Force 160kg (352 Lb Or 1570 N)
- Throttle Pedal Force 50kg (110 Lb Or 490 N)
- Return Spring Force 5kg (11 Lb Or 50 N)



## PE Racing Auto Pedal Box

PE-004-1001

## Dimensions & Specifications

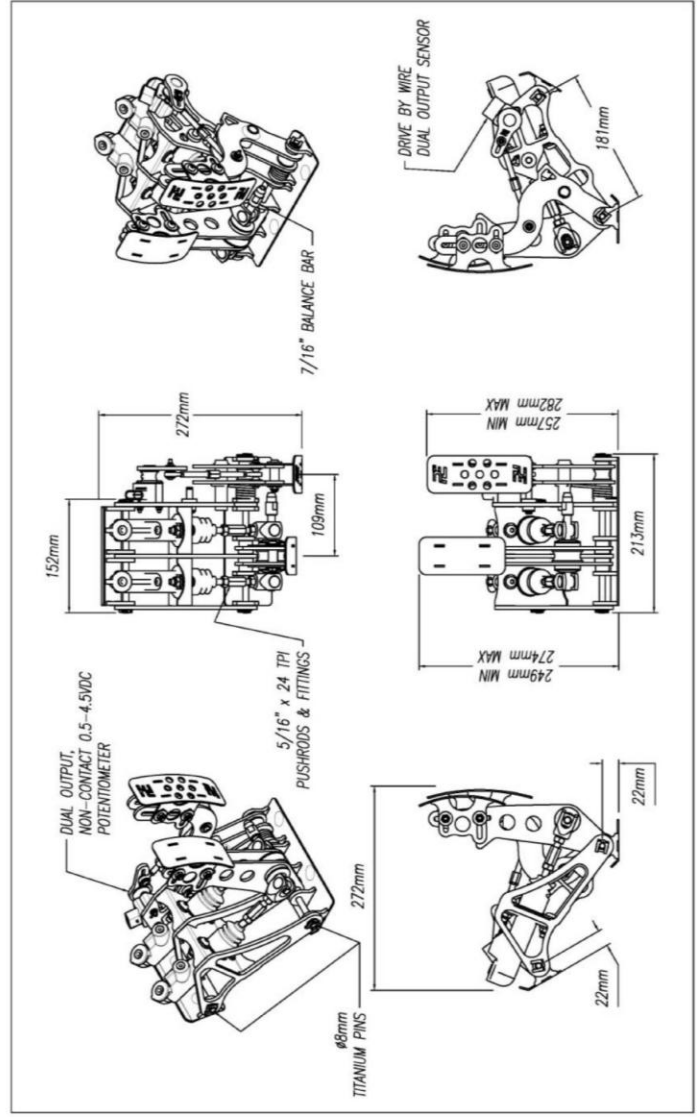
Drive by Wire Throttle Version

### SPECIFICATIONS

- Materials : 6061-T6 & 5005-H34 Alloys, Tig Welded Alloy Construction
- Finish: Anodised in Black & Clear
- Master Cylinders: Alloy Construction with 34.9mm stroke (1.375")
- Mounting Location: Floor and Firewall, or Floor and Bulkhead
- Reservoir Capacity: 2 off Remote mounted Plastic with 105cc Fluid Capacity each
- Reservoir Dimensions: 76.2mm (3") diameter and 88.9mm (3.5") high
- Hydraulic Feed Lines: Teflon lined Stainless Braided Hose AN-4 Fittings
- Fixings: Stainless Steel
- Pins : Titanium Gr2
- Net Weight: 3lb 8oz (1.6kg) Incl. Throttle Linkage Kit
- Gross Weight: 5lb 8oz (2.5kg) Incl. Master Cylinders, Balance Bar & Fittings
- Pedal Ratio: Adjustable 3.5:1 to 3.9:1

### Safe Working Loads

- Brake Pedal Force 160kg (352 Lb Or 1570 N)
- Throttle Pedal Force 50kg (110 Lb Or 490 N)
- Return Spring Force 5kg (11 Lb Or 50 N)



## PE Racing 3 Pedal Billet Pedal Box

PE-005-1001

### Dimensions & Specifications

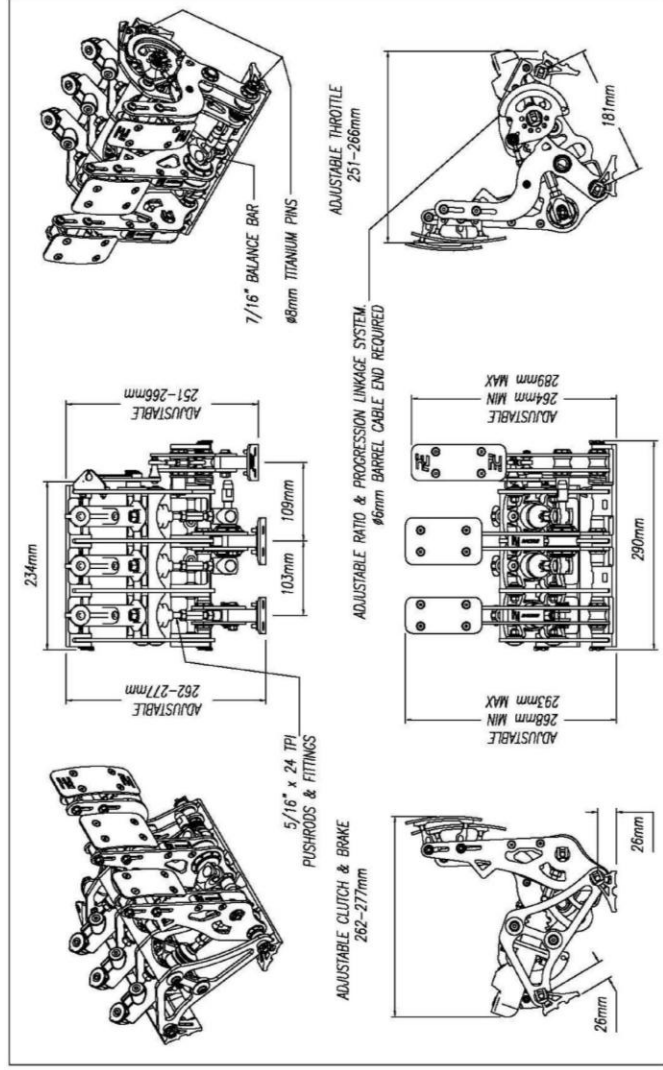
### Cable Throttle Version

#### SPECIFICATIONS

- Materials : 6061-T6 Billet Construction
- Finish: Anodised in Black & Clear
- Master Cylinders: Alloy Construction with 34.9mm stroke (1.375")
- Mounting Location: Floor and Firewall, or Floor and Bulkhead
- Reservoir Capacity: 3 off Remote mounted Plastic with 105cc Fluid Capacity each
- Reservoir Dimensions: 76.2mm (3") diameter and 88.9mm (3.5") high
- Hydraulic Feed Lines: Teflon lined Stainless Braided Hose AN-4 Fittings
- Fixings: Stainless Steel
- Throttle Torsion Spring: Stainless Steel
- Pins : Titanium Gr2
- Net Weight: 6lb 2oz (2.79kg)
- Gross Weight: 9lb 9oz (4.3kg)
- Including Master Cylinders, Balance Bar, Throttle Linkage Kit & Fittings
- Pedal Ratio: Adjustable 3.93:1 to 4.46:1

#### Safe Working Loads

- Clutch Pedal Force 90kg (138 Lb or 883 N)
- Brake Pedal Force 160kg (352 Lb or 1570 N)
- Throttle Pedal Force 50kg (110 Lb or 490 N)
- Throttle Cable Force 10kg (22 Lb or 98 N)
- Return Spring Force 5kg (11 Lb or 50 N)





## PE Racing 3 Pedal Billet Pedal Box

PE-006-1001

### Dimensions & Specifications

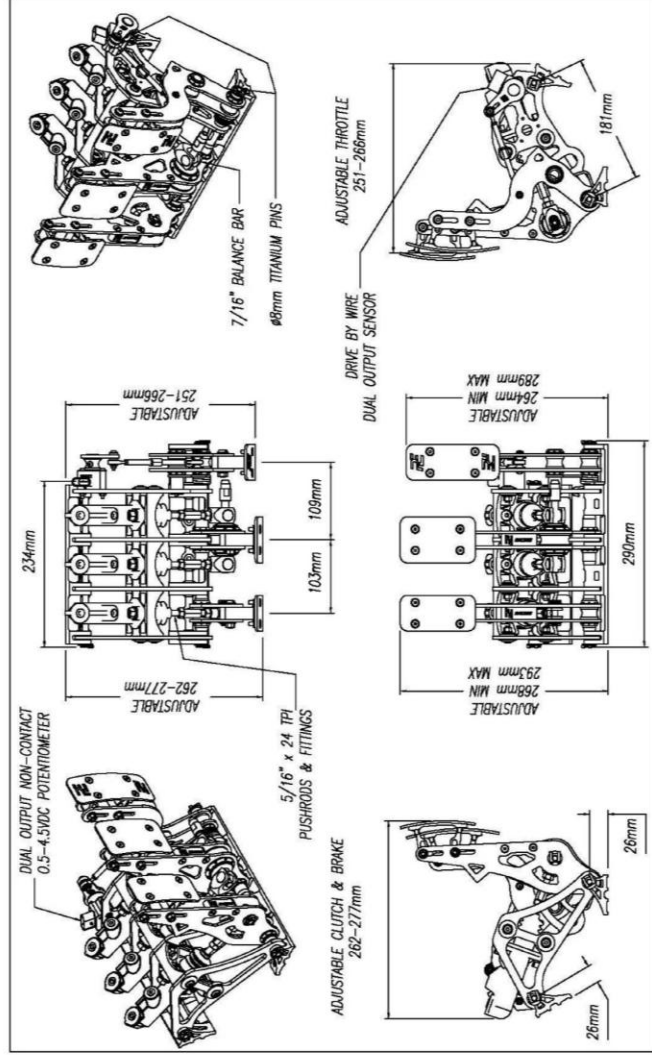
### Drive by Wire Throttle Version

#### SPECIFICATIONS

- Materials : 6061-T6 Billet Construction
- Finish: Anodised in Black & Clear
- Master Cylinders: Alloy Construction with 34.9mm stroke (1.375")
- Mounting Location: Floor and Firewall, or Floor and Bulkhead
- Reservoir Capacity: 3 off Remote mounted Plastic with 105cc Fluid Capacity each
- Reservoir Dimensions: 76.2mm (3") diameter and 88.9mm (3.5") high
- Hydraulic Feed Lines: Teflon lined Stainless Braided Hose AN-4 Fittings
- Fixings: Stainless Steel
- Throttle Torsion Spring: Stainless Steel
- Pins : Titanium Gr2
- Net Weight: 6lb 2oz (2.79kg)
- Gross Weight: 9lb 9oz (4.3kg) Including Master Cylinders, Balance Bar, DBW Linkage Kit & Fittings
- Pedal Ratio: Adjustable 3.93:1 to 4.46:1
- Dual Output Throttle Position Sensor, Non-Contact 180°, Input 5V±0.25V DC, Output 0.5 V - 4.5V DC

#### Safe Working Loads

- Clutch Pedal Force 90kg (138 Lb or 883 N)
- Brake Pedal Force 160kg (352 Lb or 1570 N)
- Throttle Pedal Force 50kg (110 Lb or 490 N)
- Return Spring Force 5kg (11 Lb or 50 N)



## PE Racing 2 Pedal Billet Pedal Box

PE-007-1001

### Dimensions & Specifications

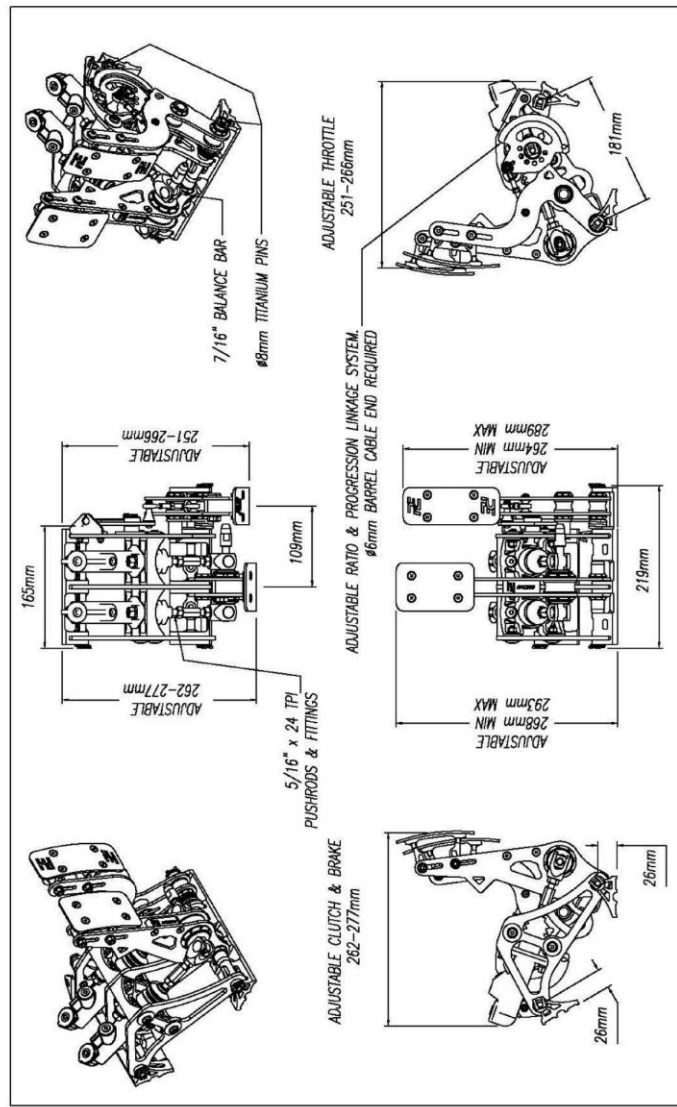
### Cable Throttle Version

#### SPECIFICATIONS

- Materials : 6061-T6 Billet Construction
- Finish: Anodised in Black & Clear
- Master Cylinders: Alloy Construction with 34.9mm stroke (1.375")
- Mounting Location: Floor and Firewall, or Floor and Bulkhead
- Reservoir Capacity: 2 off Remote mounted Plastic with 105cc Fluid Capacity each
- Reservoir Dimensions: 76.2mm (3") diameter and 88.9mm (3.5") high
- Hydraulic Feed Lines: Teflon lined Stainless Braided Hose AN-4 Fittings
- Fixings: Stainless Steel
- Throttle Torsion Spring: Stainless Steel
- Pins : Titanium Gr2
- Net Weight: 4lb 4oz (1.92kg)
- Gross Weight: 6lb 12oz (3.06kg) Including Master Cylinders, Balance Bar, Throttle Linkage Kit & Fittings
- Pedal Ratio: Adjustable 3.93:1 to 4.46:1

#### Safe Working Loads

- Brake Pedal Force 160kg (352 Lb or 1570 N)
- Throttle Pedal Force 50kg (110 Lb or 490 N)
- Throttle Cable Force 10kg (22 Lb or 98 N)
- Return Spring Force 5kg (11 Lb or 50 N)



## PE Racing 2 Pedal Billet Pedal Box

PE-008-1001

### Dimensions & Specifications

Drive by Wire Throttle Version

#### SPECIFICATIONS

- Materials : 6061-T6 Billet Construction
- Finish: Anodised in Black & Clear
- Master Cylinders: Alloy Construction with 34.9mm stroke (1.375")
- Mounting Location: Floor and Firewall, or Floor and Bulkhead
- Reservoir Capacity: 2 off Remote mounted Plastic with 105cc Fluid Capacity each
- Reservoir Dimensions: 76.2mm (3") diameter and 88.9mm (3.5") high
- Hydraulic Feed Lines: Teflon lined Stainless Braided Hose AN-4 Fittings
- Fixings: Stainless Steel
- Throttle Torsion Spring: Stainless Steel
- Pins : Titanium Gr2
- Net Weight: 4lb 4oz (1.92kg)
- Gross Weight: 6lb 12oz (3.06kg) Incl. Master Cylinders, Balance Bar, DBW Linkage Kit & Fittings
- Pedal Ratio: Adjustable 3.93:1 to 4.46:1

#### Safe Working Loads

- Brake Pedal Force 160kg (352 Lb or 1570 N)
- Throttle Pedal Force 50kg (110 Lb or 490 N)
- Return Spring Force 5kg (11 Lb or 50 N)

