



# **ANEXOS**



# **ANEXO A**

## **PLATAFORMA MOOG 6DOF2000E**

## **Series 6DOF2000E**

Electric Motion Platform



- **6 Degrees of Freedom**
- **1000 Kg Payload / 2200 lbs**
- **Integrated Design**
- **Electric Actuation**



Cabin images courtesy of AITEC GmbH & SimEx Inc.

### **Worldwide Support**

#### **North & South America:**

Moog Inc., East Aurora, New York 14052-0018 • Telephone: 716/687-4000 • Fax: 716/687-4467

#### **Europe:**

Moog Controls Ltd., Tewkesbury, England • Telephone: +44(0)1684-296600 • Fax: +44(0)1684-296760

Moog GmbH, Böblingen, Germany • Telephone: +49(0)7031-622-0 • Fax: +49(0)7031-622-100

Moog Sarl, Cedex, France • Telephone: +33(0)1 45607000 • Fax: +33(0)1 45607001

Moog Sarl Sucursal En España, Orio, Spain • Telephone: +34(0)9 43133240 • Fax: +34(0)9 43133180

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Moog Australia Pty. Ltd., Mulgrave, Australia • Telephone: +61(0)3 9561-6044 • Fax: +61(0)3 9562-0246

Moog Japan Ltd., Hiratsuka, Japan • Telephone: +81(0)463-55-3615 • Fax: +81(0)463-54-4709

# Series 6DOF2000E

## Moog Inc.

Moog Motion Systems offer high performance solutions to motion simulator requirements. Fifty years of experience and a proven track record makes Moog the world's leading supplier of motion system components and integrated platforms in both the training and entertainment markets.

Moog produces both 4 degree and 6 degree of freedom (DOF) motion bases, with actuator strokes ranging from 12 to 62 inches and load capacities up to 14,600 Kg (32,200 lbs).

## Specifications: 6DOF2000E Size:

Settled Height .....0.71 m (28")  
Foot Print .....≈1.84 m (w) x 1.84 m  
(≈72.5" (w) x 72.5")  
Std. Flying Floor  
Structural Triangle .....≈1.5 m (59") per side  
System Weight .....650 Kg (1433 lbs)

## Facility:

Average Floor Loading  
Compression .....1900 Kg/m<sup>2</sup>  
(380 lb/ft<sup>2</sup>)  
Power  
Control .....1φ, 100-120 vac.  
50-60 Hz  
10 Amp service  
Main.....1φ, 100-120 vac.  
50-60 Hz  
20/30 Amp service

## Load:

Max. Customer Payload..1000 Kg (2205 lbs)  
CG Location  
Horizontal.....≤ 0.06 m (2.5")  
(from centroid)  
Vertical.....≤ 0.6 m (24")  
(above the top of flying platform)  
Motion Centroid.....0.13m (5.1")  
(below the top of flying platform)  
Mass Moment of Inertia (relative to centroid)  
Pitch Axis.....650 Kg-m<sup>2</sup>  
(5750 in-lb-sec<sup>2</sup>)  
Roll Axis .....400 Kg-m<sup>2</sup>  
(3540 in-lb-sec<sup>2</sup>)  
Yaw Axis .....650 Kg-m<sup>2</sup>  
(5750 in-lb-sec<sup>2</sup>)

## Actuator Features:

- DC Servomotor
- Fold-back design for low boarding height and efficient field service
- Low friction actuator using precision ballscrew design
- Internal hydraulic snubbers for end of stroke cushioning
- Encoder feedback
- End of stroke limit switches
- Actuator brakes available for "freeze mode"/E-stop circuit

## Documentation:

- Facility Requirements
- Installation Instructions
- Operation/Maintenance Manual

## Reliability:

- Custom high efficiency drives and actuators optimized for performance and long life in demanding applications. Designed for a minimum 5 year life.
- Detailed fault tree analysis for all single point and multiple failure modes has been performed.
- Drives have been life cycle tested and have proven field history.

## Field Service and Repair:

- One (1) year part warranty from the date of shipment
- Worldwide support
- Installation and training support provided

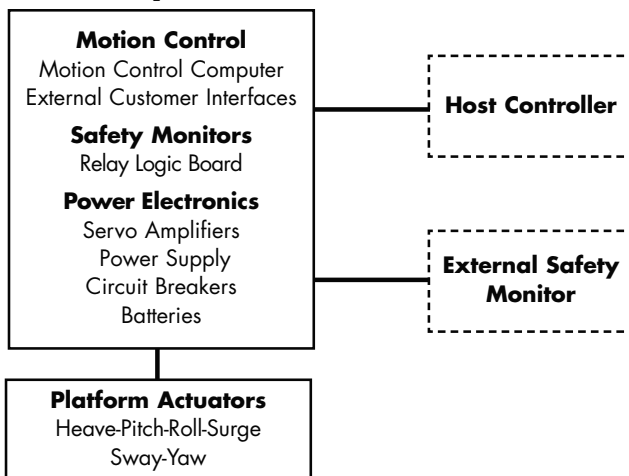
## Compliance:

- The system is designed to U.S. and European electrical codes.
- The system utilizes UL and CE compliant components.
- Designed to meet the AFGS-87241A requirement to egress to home position in event of major single point failures.
- Electronics are CE marked

## Interface Options:

Serial Interface (RS-485)  
• Ride Storage  
• Real Time (non-ride storage)  
Ethernet Interface  
• Real Time  
• Real Time with Motion Cueing (Motion Dynamics Algorithm)

## Motion System Interfaces:



## Motion:

Degree of Freedom	Displacement Comb. Motion	Displacement Single DOF	Velocity	Acceleration
Pitch	+25/-23 deg	±22 deg	±30 deg/s	±500 deg/s <sup>2</sup>
Roll	±22 deg	±21 deg	±30 deg/s	±500 deg/s <sup>2</sup>
Yaw	±23 deg	±22 deg	±40 deg/s	±400 deg/s <sup>2</sup>
Heave	±0.18 m (±7.0 in)	±0.18 m (±7.0 in)	±0.30 m/s (±11.8 in/s)	+0.5 g
Surge	±0.27 m (±11.1 in)	±0.25 m (+102/9.5in)	±0.50 m/s (±19.7 in/s)	±0.6 g
Sway	±0.26 m (±11.7in)	±0.25 m (±10.2 in)	±0.50 m/s (±19.7 in/s)	±0.6 g

Specifications are subject to change without notice.

# MOOG

Moog Inc. East Aurora, New York 14052-0018 • 716/687-4000 • Fax 716/687-4467 • www.moog.com

500-395 1102



**3.5 DOF MODE COMMAND (SCC to MB)**

Figure 3-7 shows the format for the 8 word DOF Mode command. For the DOF mode, DOF commands (words 1 through 6) are all 32 bit float values. Values for the platform angles / position are defined in radians (rad) or meters (m). The values given in Figure 3-7 are assumed to be in host byte order (LSB first).

Software Limits for Degrees of Freedom: Refer to section 6.2.

#	Data	Description	Unit	Type
0	MCW	Motion Command Word	-	32 bit unsigned long
1	roll	Roll Command	rad	32 bit float
2	pitch	Pitch Command	rad	32 bit float
3	position_z	Heave Command	m	32 bit float
4	position_x	Surge Command	m	32 bit float
5	yaw	Yaw Command	rad	32 bit float
6	position_y	Lateral Command	m	32 bit float
7	-	Spare	-	32 bit tbd

**Figure 3-2: DOF Mode Command**

WORD	DESCRIPTION	FORMAT																																																				
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5	YAW COMMAND	x x x x x x x x																																																				
6	LATERAL COMMAND	x x x x x x x x																																																				
7	SPARE	0 0 0 0 0 0 0 0																																																				

X = AS REQUIRED

**X = AS REQUIRED**





### 3.7 **COMMANDS (SCC to MBC)**

Command values are all 8 bit unsigned long values sent to the MB computer in byte  $\phi$  of word 0 of the command datapacket data area. The decimal value assigned to each command is placed in the LSB of the command word.

**WARNING: THE SYSTEM INTEGRATOR OF THE MOTION BASE IS RESPONSIBLE FOR CONNECTING THE MOTION BASE E-STOP CIRCUIT DESCRIBED IN THE 6DOF2000E USER'S MANUAL. THE COMMUNICATIONS E-STOP COMMAND IS NOT INTENDED TO REPLACE THIS SAFETY FEATURE.**

#### 3.7.1 **220: DISABLE (Valid in any state)**

- 1) The MB disables Ethernet communications, ignoring further commands;
- 2) removes power from the motor controllers;
- 3) returns to HOME position under battery power.

Reset is manual (remove & re-apply power to MB).

#### 3.7.2 **210: PARK (Valid only in ENGAGED, STANDBY states)**

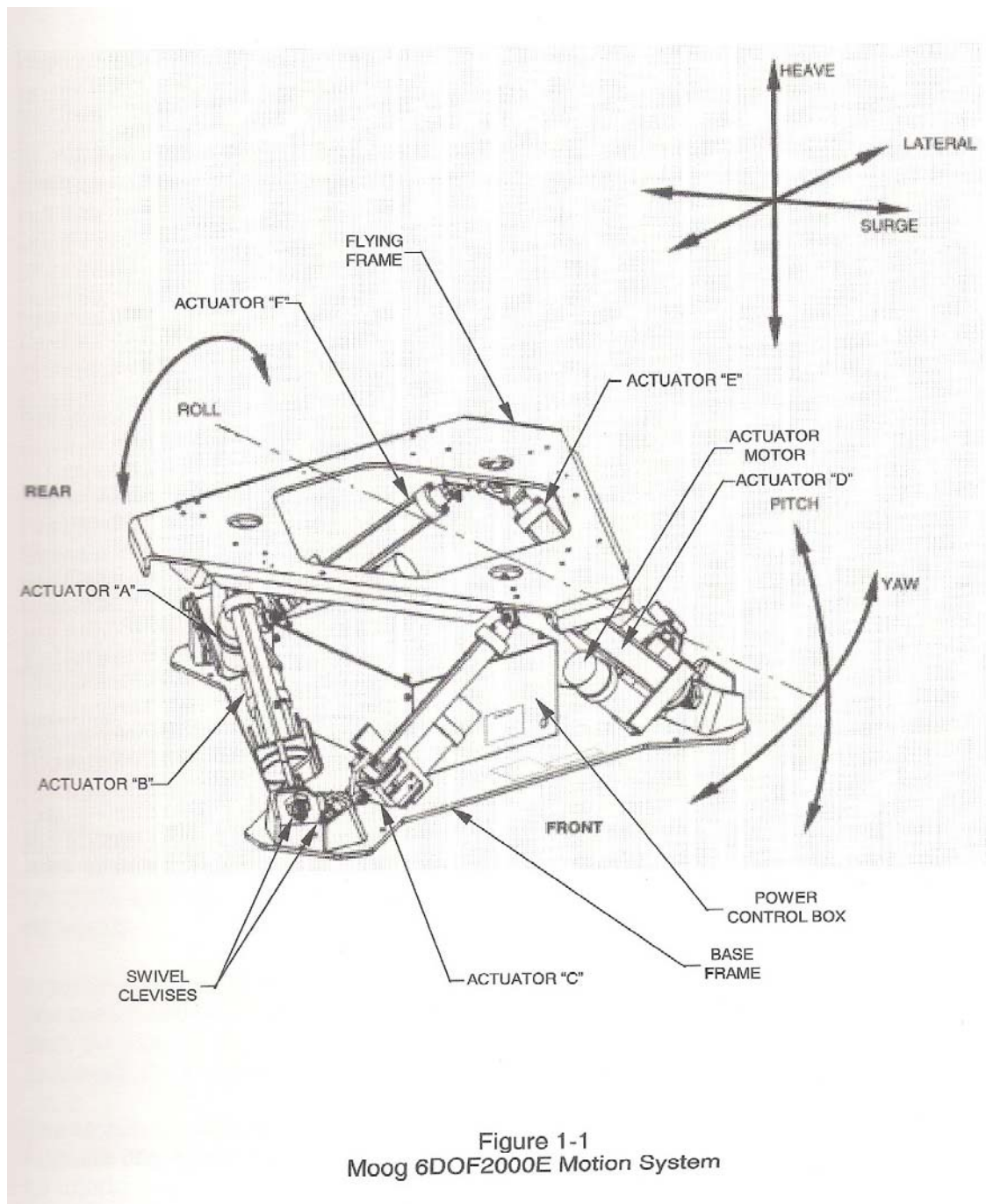
MB returns to PARK position under power, then removes power from the motors.

#### 3.7.3 **200: LOW LIMIT ENABLE (Valid in all states)**

Tells MB software to remove the low limit shunt (see next command description). The SCC does not need this command in normal operation.

#### 3.7.4 **190: LOW LIMIT DISABLE (Valid in all states)**

Shunts the limit switches so that limit faults and amplifier faults cannot be detected. The MB software controls the shunt automatically at ride startup and when parking, so the SCC should not need to use this command except possibly in a maintenance mode. The shunt is removed automatically by the MB software after 2 seconds in the ENGAGED state (refer to later sections on MB operation).







**3.7.5 180: ENGAGE (Valid only in the IDLE state)**

Makes MB ready to run (applies power to the motor controllers). To engage, communications must be OK, machine state must be idle, and the base must be "at home".

Actuator commands must be:

- Length mode - all lengths at 0.03048m
- DOF mode - all DOFs must be = 0.0 m or 0.0 rad
- MDA mode - all command data must = 0.0

The MBC software powers and enables the amplifiers, then moves the base up to the starting position listed above. At this point the machine state becomes ENGAGED, and the customer's SCC can control the actuator movement. The SCC must keep the command data at these values until the base is ENGAGED to avoid abrupt motions.

**3.7.6 175: START (Valid only in the IDLE state)**

Same as ENGAGE, except the customer may define the starting position of the base. Valid start positions ranges are:

- Length mode - lengths from 0.03048m to 0.30988m
- DOF mode - all commands must be at neutral = 0.0m or 0.0 rad, except for heave, which may range from 0.0m to -0.4572m
- MDA mode – START command not valid in MDA mode

In the Length and DOF modes, words 1 through 6 indicate the start position. These words must not change until after the base has reached the ENGAGED state to avoid abrupt motions when the base becomes ENGAGED.

**3.7.7 172: LENGTH MODE (Valid only in the IDLE, POWERUP states)**

Commands MB to interpret the actuator command data as actuator lengths from 0.03048m to 0.30988m.

**3.7.8 170: DOF MODE (Valid only in the IDLE, POWERUP states)**

Advises MB to interpret the actuator command data as degrees of freedom. Data is ordered as roll, pitch, heave, surge, yaw, sway, in the command frame. For the DOF mode, DOF commands are all 32 bit float values. Values for the platform angles / position are defined in radians (rad) or meter (m). DOF mode is the default mode of MB operation.



**160: RESET (Valid in FAULT & INHIBIT states)**

Used to recover a MB from FAULT\_2 state; also restores normal operation after INHIBIT command is received.

**150: INHIBIT (Valid in POWER\_UP, IDLE states)**

Temporary means of de-activating the MB. The MB ignores further commands until the RESET command is received.

**140: MDA MODE (Valid only in the IDLE, POWERUP states)**

Asks MB to interpret the acceleration and angular rate data. For the MDA mode, DOF commands are all 32 bit float values. Values for the accelerations, defined in radians per (second x second) ( $\text{rad/s}^2$ ) or meters per (second x second) ( $\text{m/s}^2$ ). Values for the velocities are defined in radians per second ( $\text{rad/s}$ ) or meters per second ( $\text{m/s}$ ). Values for the lengths or angles, are defined in radians ( $\text{rad}$ ) or meters ( $\text{m}$ ). The MB must be purchased with MDA mode option in order to enter MDA mode.

**130: NEW POSITION (may be sent in any state)**

Sends position command data (lengths or DOFs) to the MB. The MB in the AGED state will update its position loops with the data provided in the command frame. Not valid in MDA mode.

**128: NEW MDA (may be sent in any state) (MDA mode only)**

Sends acceleration and specific force command data to the MB. The MB in the AGED state will update its position loops with the data provided in the command datapacket. Not valid in DOF or Length modes.

**155: NEW MDA FILE (Valid only in IDLE, POWERUP states)**

Requests the MB to change the MDA tuning file from the default value (which is 1). The tuning file will be changed if the requested file exists. The MDA response datagram will indicate which MDA file number is being used.





## CHAPTER 6.0

### 6DOF2000E PHYSICAL DATA

#### 6.1 PURPOSE

The purpose of this chapter is to provide excursion limits of the MB in terms of linear measurement, 32-bit float values and degrees of freedom.

#### 6.2 6DOF2000 PHYSICAL DATA

All length measurements are referenced from the actuator full-retracted position.

- Maximum physical actuator stroke ..... 0 to 0.34036m (0 to 13.4 in.)
- Extend limit switch position ..... 0.32385m (12.75 in.)
- Retract limit switch position ..... 0.01905m (0.75 in.)
- Software extend limit (max useable stroke) ..... 0.30988m (12.2 in.)
- Software retract limit (min useable stroke) ..... 0.03048m (1.2 in.)

Software Limits for Degrees of Freedom:

**NOTE:** THESE DOF LIMITS ARE USED TO SCALE INCOMING COMMANDS, AND DO NOT IMPLY THAT THE 6DOF2000E MOTION BASE IS CAPABLE OF MOVING TO THESE VALUES. REFER TO THE 6DOF2000E SPECIFICATIONS FOR ACTUAL MOTION CAPABILITIES.

	<u>MIN</u>	<u>MAX</u>
• Roll (rad) . . . . .	- 0.50605	+0.50605
• Pitch (rad) . . . . .	- 0.57585	+0.57585
• Heave (m) . . . . .	0.0	-0.4572
• Surge (m) . . . . .	- 0.38100	+0.38100
• Yaw (rad) . . . . .	- 0.50605	+0.50605
• Lateral (m) . . . . .	- 0.38100	+0.38100

DOF orientations are defined from the perspective of a rider seated on the base facing forward, refer to Figure 6-1, Moog 6DOF2000E Motion System DOF's :

- ROLL: positive means right edge of platform goes down, left edge moves up.
- PITCH: positive, front edge of platform moves up, rear edge moves down.
- HEAVE: positive means entire platform moves down.
- SURGE: positive means entire platform moves forward.
- YAW: positive means platform rotates clockwise as viewed from above.
- LATERAL: positive means platform moves to the right.



# **ANEXO B**

## **ORDENADOR Y JOYSTICK**



## **Características**

- Procesador Intel Core 2 Duo E6750 @ 2.66 GHz
- 3 GB de Memoria RAM
- GeForce 8800 GT 512 Mb
- Joystick de 8 botones y throttle analógico Microsoft Sidewinder



Figura B.1 Microsoft Sidewinder Joystick

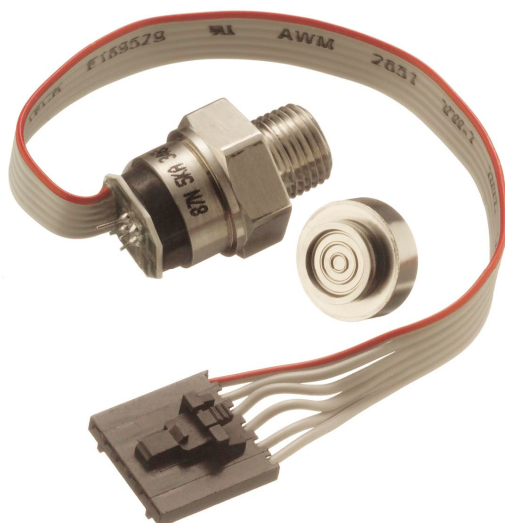




# **ANEXO C**

## **SENSORES**

## Model 87N UltraStable™



- 316L SS Pressure Sensor
- High Pressure
- 0 - 100mV Output
- Absolute and Sealed Gage
- Temperature Compensated

### DESCRIPTION

The Model 87N UltraStable™ is a small profile, media compatible, piezoresistive silicon pressure sensor packaged in a 316L stainless steel housing. The Model 87N UltraStable™ is offered in a weldable package or with a variety of threaded fittings such as 1/4 and 1/8NPT, 1/4BSP as well as custom process fittings.

The Model 87N UltraStable™ is designed for high pressure OEM applications where compatibility with corrosive media is required. The sensing package utilizes silicon oil to transfer pressure from the 316L stainless steel diaphragm to the sensing element. A ceramic substrate is attached to the package that contains laser-trimmed resistors for temperature compensation and offset correction. An additional laser trimmed resistor is included which can be used to adjust an external differential amplifier and provide span interchangeability to within  $\pm 1\%$ .

### FEATURES

- Weldable and Threaded Process Fittings
- -20°C to +85°C Compensated Temperature Range
- $\pm 0.25\%$  Pressure Non Linearity
- 1.0% Interchangeable Span (provided by gain set resistor)
- Solid State Reliability

### APPLICATIONS

- Hydraulic Controls
- Process Control
- Pressure Calibrators
- Refrigeration/Compressors

### STANDARD RANGES

Range	psia	psis
0 to 1000	•	•
0 to 3000	•	•
0 to 5000	•	•

# Model 87N UltraStable™

## PERFORMANCE SPECIFICATIONS

Supply Current: 1.5mA

Ambient Temperature: 25 °C (unless otherwise specified)

Parameters are specified for the compensated versions only

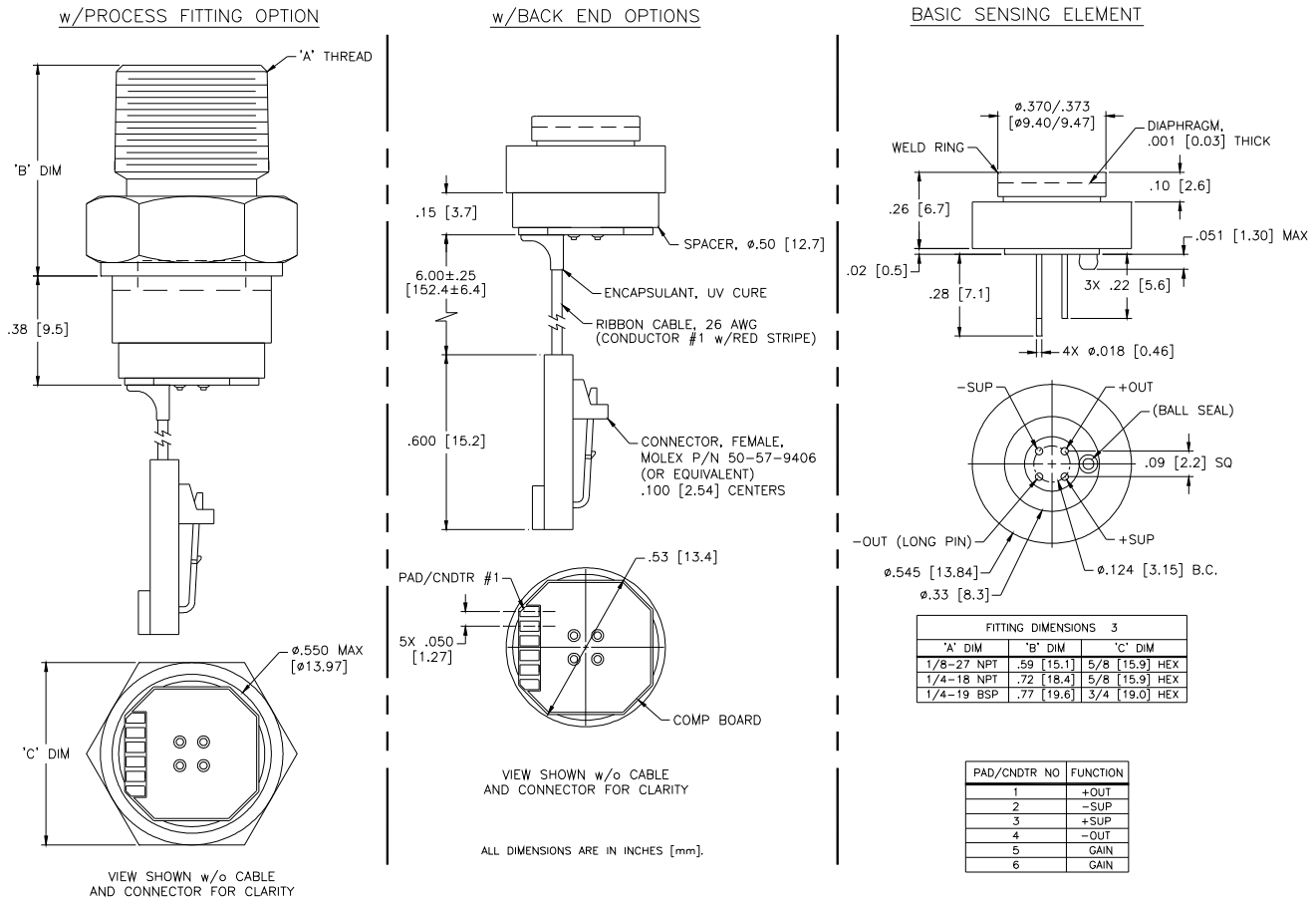
PARAMETERS	MIN	TYP	MAX	UNITS	NOTES
Span	75	100	150	mV	1
Zero Pressure Output	-1		1	mV	
Pressure Non Linearity	-0.25		0.25	%Span	2
Pressure Hysteresis		±0.05		%Span	
Repeatability		±0.02		%Span	
Input Resistance	2000	2750	4000	Ω	
Output Resistance	4000		25k	Ω	
Temperature Error – Span	-0.75		0.75	%Span	3
Temperature Error – Offset	-0.75		0.75	%Span	3
Thermal Hysteresis – Span		±0.05		%Span	3
Thermal Hysteresis – Offset		±0.05		%Span	3
Long Term Stability – Span		±0.1		%Span	4
Long Term Stability – Offset		±0.1		%Span	4
Supply Current	0.5	1.5	2.0	mA	
Insulation Resistance (50Vdc)	50			MΩ	5
Pressure Overload			3X	Rated	6
Compensated Temperature	-20		+85	°C	
Operating Temperature	-40		+125	°C	7
Storage Temperature	-50		+125	°C	7
Weight			9	grams	
Media – Pressure Port	Liquids and Gases compatible with 316L Stainless Steel				

### Notes

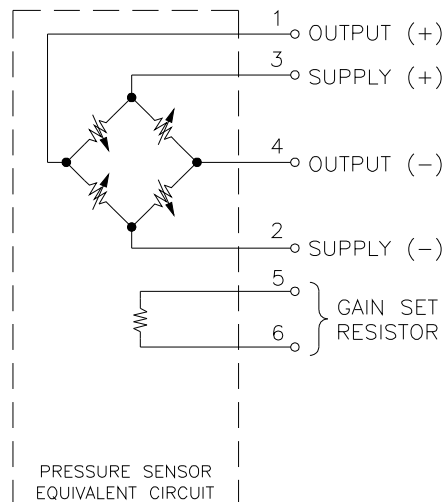
1. Ratiometric to supply current.
2. Best fit straight line.
3. Maximum temperature error between -20 °C and +85 °C with respect to 25 °C.
4. Long term stability over a one year period with constant current and temperature.
5. Minimum resistance between case and pins.
6. 2X maximum for 5000 psi devices.
7. Maximum temperature range for product with standard cable and connector is -20 °C to +105 °C.

# Model 87N UltraStable™

## DIMENSIONS

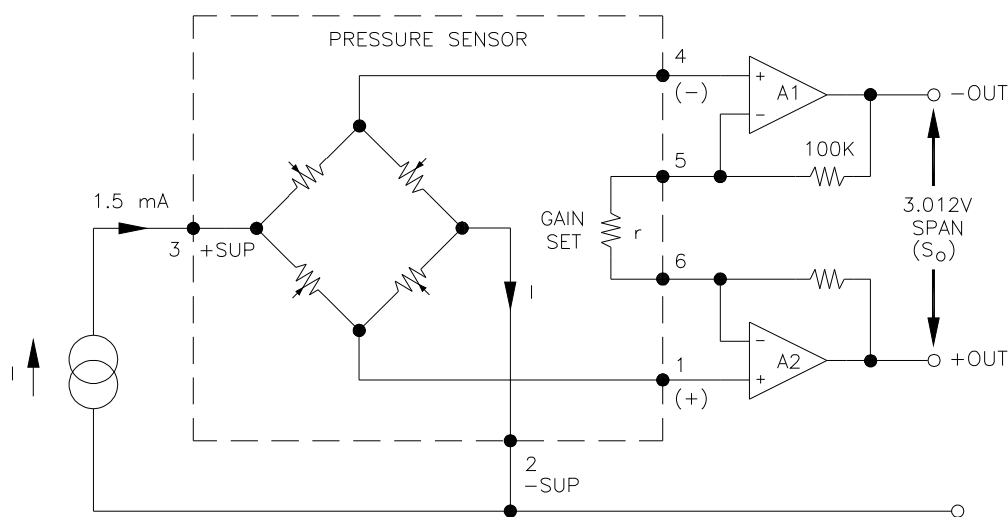


## CONNECTIONS



# Model 87N UltraStable™

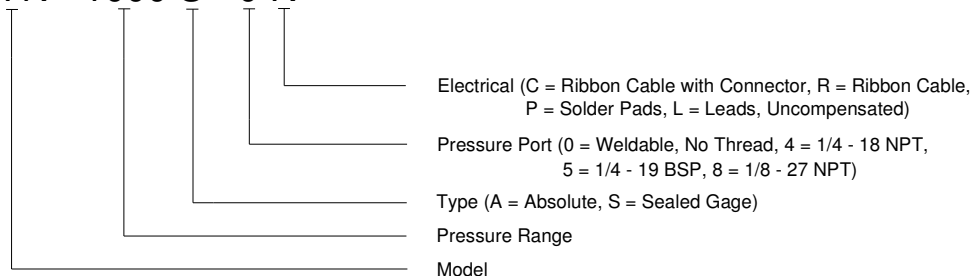
## APPLICATION SCHEMATIC



APPLICATION SCHEMATIC

## ORDERING INFORMATION

87N - 1000 S - 0 R



### NORTH AMERICA

Measurement Specialties  
45738 Northport Loop West  
Fremont, CA 94538  
Tel: 1-800-767-1888  
Fax: 1-510-498-1578  
Sales: [pfg.cs.amer@meas-spec.com](mailto:pfg.cs.amer@meas-spec.com)

### EUROPE

Measurement Specialties  
(Europe), Ltd.  
26 Rue des Dames  
78340 Les Clayes-sous-Bois, France  
Tel: +33 (0) 130 79 33 00  
Fax: +33 (0) 134 81 03 59  
Sales: [pfg.cs.emea@meas-spec.com](mailto:pfg.cs.emea@meas-spec.com)

### ASIA

Measurement Specialties  
(China), Ltd.  
F1.6-4D, Tian An Development  
Compound  
Shenzhen, China 518048  
Tel: +86 755 8330 1004  
Fax: +86 755 8330 6797  
Sales: [pfg.cs.asia@meas-spec.com](mailto:pfg.cs.asia@meas-spec.com)

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### 9 mm Square Rotary Potentiometers with Insulated Shaft

Japan  
Malaysia

Type: **EVUE/EVUF**

#### ■ Features

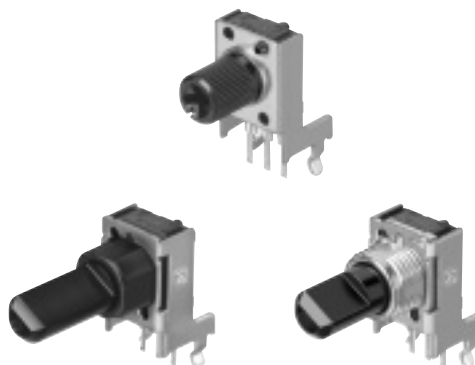
- Multi-gang block can be provided upon request
- DC voltage available
- Rigid rectangular shape suited for automatic insertion

#### ■ Recommended Applications

- Audio Equipment
- Video Equipment
- Electronic Musical Instruments
- Audio Mixers

#### ■ Explanation of Part Numbers

1	2	3	4	5	6	7	8	9	10	11	12
<b>E</b>	<b>V</b>	<b>U</b>	<b>E/F</b>								
Product Code			Specifications			Shaft Trims & Dimensions			Taper & Resistance		



#### ■ Product Chart

Construction	Style	Height (H=mm)	Detent	Type
Horizontal	Without bushing	6.5	Without detent	EVUE20
			Midpoint	EVUE30
		10.0	Without detent	EVUE2A
			Midpoint	EVUE3A
		12.5	Without detent	EVUE21
			Midpoint	EVUE31
	With bushing	6.5	Without detent	EVUE25
			Midpoint	EVUE35
		10.0	Without detent	EVUE2J
			Midpoint	EVUE3J
	With sleeve	6.5	Without detent	EVUE27
			Midpoint	EVUE37
		10.0	Without detent	EVUE2K
			Midpoint	EVUE3K
Vertical	Without bushing	—	Without detent	EVUF2A
			Midpoint	EVUF3A
	With bushing	7.5	Without detent	EVUF2J
			Midpoint	EVUF3J
		8.5	Without detent	EVUF2M
			Midpoint	EVUF3M
	With sleeve	7.5	Without detent	EVUF2K
			Midpoint	EVUF3K
		8.5	Without detent	EVUF2L
			Midpoint	EVUF3L

Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use.  
Should a safety concern arise regarding this product, please be sure to contact us immediately.

## ■ Specifications

Classification	Item	Type without bushing	Type with bushing	Type with sleeve														
Mechanical Specifications	Rotation Angle	300 °																
	Rotation Torque	1 mN·m to 8 mN·m (after rotation started)	1 mN·m to 20 mN·m (after rotation started)	1 mN·m to 20 mN·m (after rotation started)														
	Shaft Stopper Strength	300 mN·m																
	Shaft wobble	● Shaft bend and shaft wobble shall be $0.8 \times \frac{L}{20}$ (mm) max. (for one side)  ( When moment of 25 mN·m is applied. )  ● L=Distance between mounting surface and measuring point	● Shaft bend and shaft wobble shall be $0.5 \times \frac{L}{30}$ (mm) max. (for one side)  ( When moment of 50 mN·m is applied. )  ● L=Distance between mounting surface and measuring point	● Shaft bend and shaft wobble shall be $0.7 \times \frac{L}{30}$ (mm) max. (for one side)  ( When moment of 50 mN·m is applied. )  ● L=Distance between mounting surface and measuring point														
	Shaft Pull/Push Strength	Push strength 100 N min.	Pull strength 100 N min.	Push strength 100 N min.	Pull strength 100 N min.													
	Nut Tightening Torque	—		1 N·m max.	—													
	Electrical Specifications	Nominal Total Resistance	1 kΩ to 1 MΩ, 300 kΩ to 2 MΩ for taper B (Tolerance ±20 %)															
Taper		A, B, C, D, G																
Power Rating		0.05 W (0 °C to 50 °C) For potentiometers operating in ambient temperatures above 50 °C, Rating should be derated in accordance with the figure on the right. <div><p>Power Derating Curve</p><table><caption>Power Derating Curve Data</caption><thead><tr><th>Ambient Temperature (°C)</th><th>Rated Load (%)</th></tr></thead><tbody><tr><td>0</td><td>100</td></tr><tr><td>20</td><td>100</td></tr><tr><td>40</td><td>100</td></tr><tr><td>50</td><td>100</td></tr><tr><td>60</td><td>66.7</td></tr><tr><td>70</td><td>33.3</td></tr></tbody></table></div>			Ambient Temperature (°C)	Rated Load (%)	0	100	20	100	40	100	50	100	60	66.7	70	33.3
Ambient Temperature (°C)		Rated Load (%)																
0		100																
20		100																
40		100																
50		100																
60		66.7																
70	33.3																	
Residual Resistance	Standard	R < 50 kΩ		50 Ω max.														
		50 kΩ < R < 1 MΩ		100 Ω max.														
		1 MΩ < R < 2 MΩ		200 Ω max.														
	Semi-standard	A, B, D, G T1 & T2	B, C, G T2 & T3	A, D T2 & T3	C T1 & T2													
		R < 2 kΩ		20 Ω max.														
		2 kΩ < R < 50 kΩ		25 Ω max.														
		50 kΩ < R < 250 kΩ		50 Ω max.														
R >250 kΩ		100 Ω max.																
Insulation Resistance	50 MΩ min. at 250 Vdc																	
Dielectric Withstand Voltage	250 Vac for 1 minute																	
Noise Level	100 mV max. Apply 20 V (When Voltage Rating < 20 V, use the rated voltage.) Rotate shaft at 30 r/min.																	
Endurance	Operating Life	10000 cycles min.																
Minimum Quantity/Packing Unit		EVUE/EVUF : 200 pcs. Polyethylene Bag (Bulk)																
Quantity/Carton		EVUE/EVUF : 2000 pcs.																

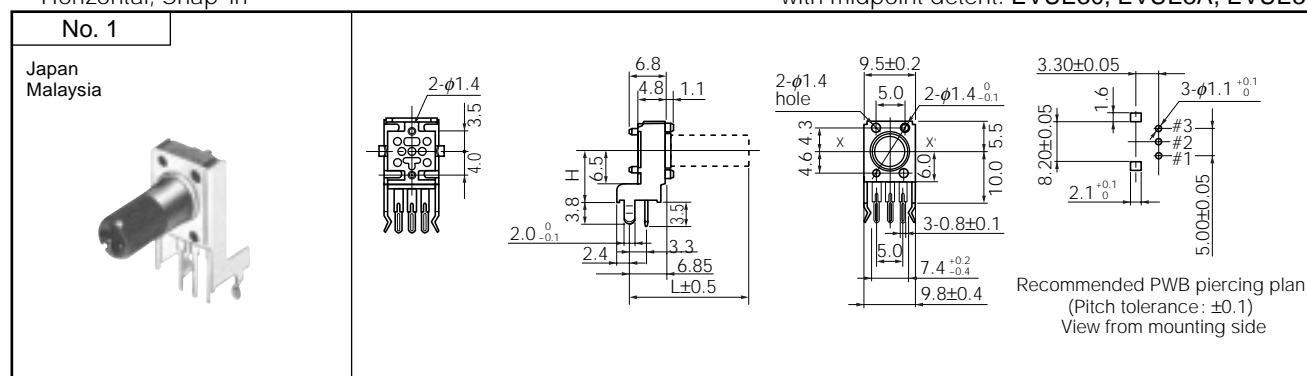
### ■ Dimensions in mm (not to scale)

#### ● Single Type without Bushing

Horizontal, Snap-in

without midpoint detent: EVUE20, EVUE2A, EVUE21

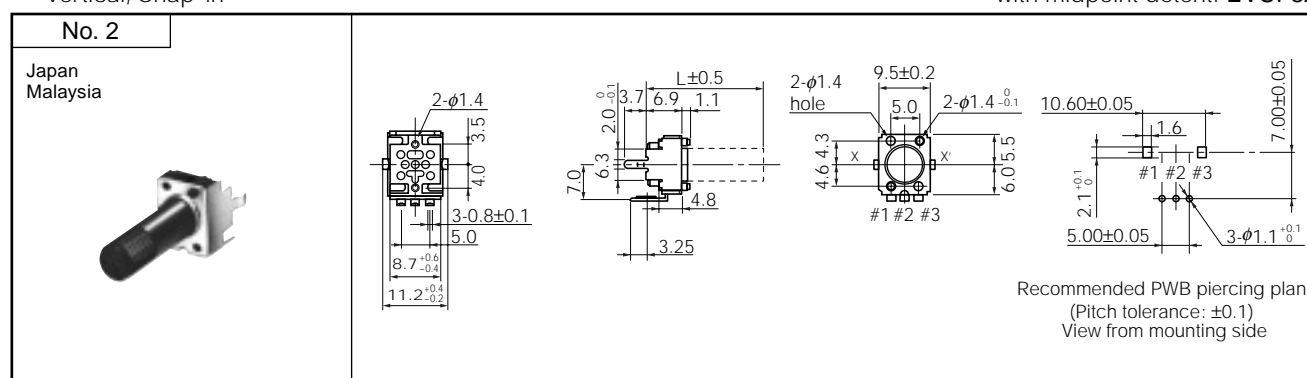
with midpoint detent: EVUE30, EVUE3A, EVUE31



Vertical, Snap-in

without midpoint detent: EVUF2A

with midpoint detent: EVUF3A

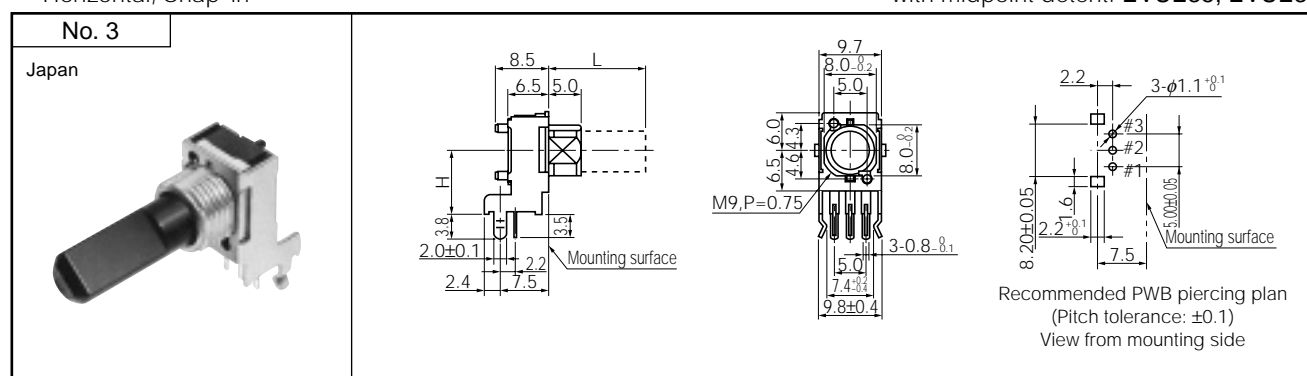


#### ● Single Type with Bushing

Horizontal, Snap-in

without midpoint detent: EVUE25, EVUE2J

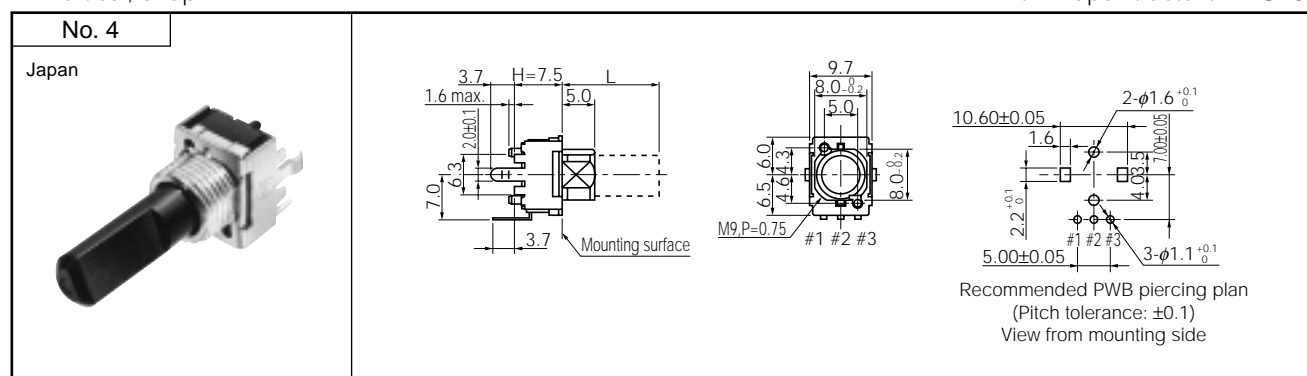
with midpoint detent: EVUE35, EVUE3J



Vertical, Snap-in

without midpoint detent: EVUF2J

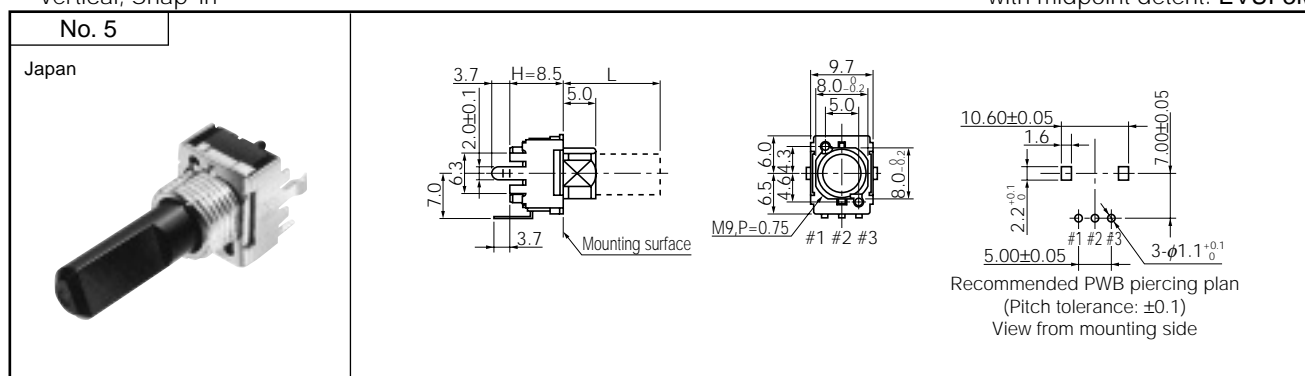
with midpoint detent: EVUF3J



Vertical, Snap-in

without midpoint detent: EVUF2M

with midpoint detent: EVUF3M

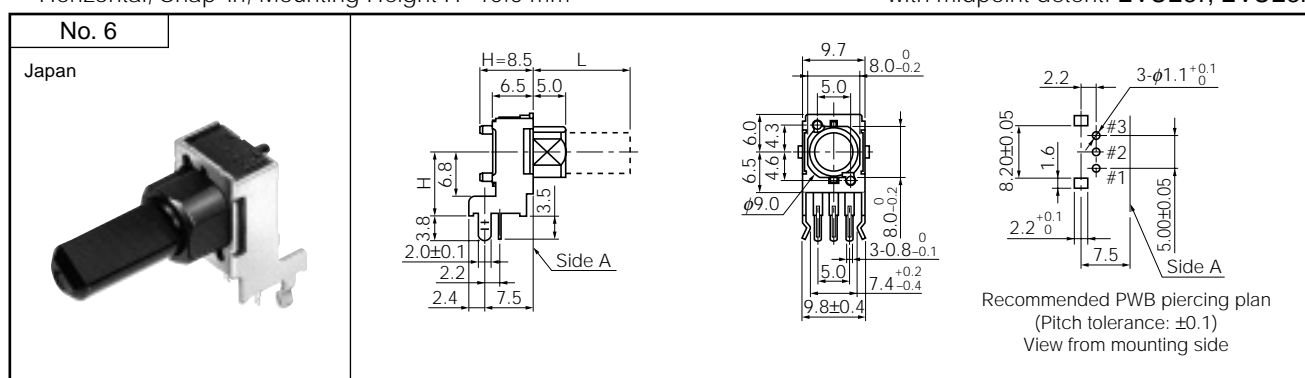


● Single Type with Sleeve

Horizontal, Snap-in, Mounting Height H=10.0 mm

without midpoint detent: EVUE27, EVUE2K

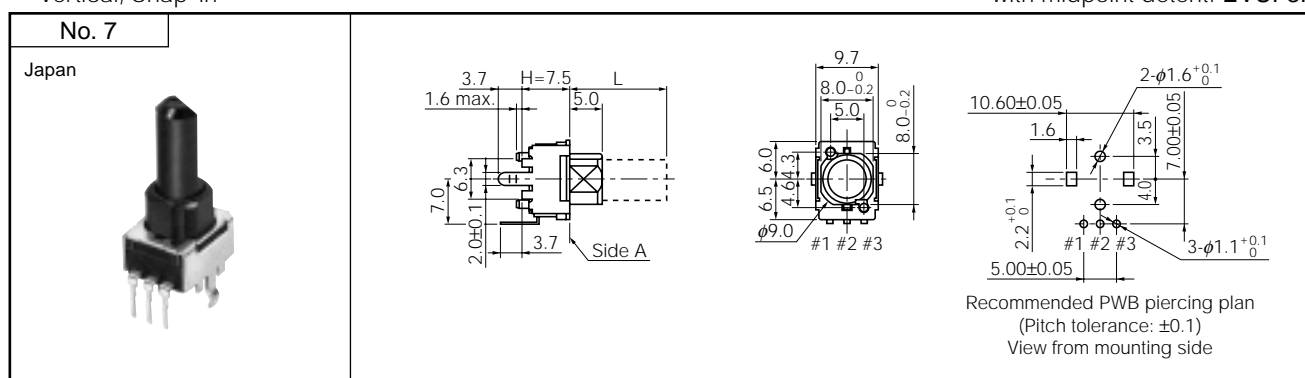
with midpoint detent: EVUE37, EVUE3K



Vertical, Snap-in

without midpoint detent: EVUF2K

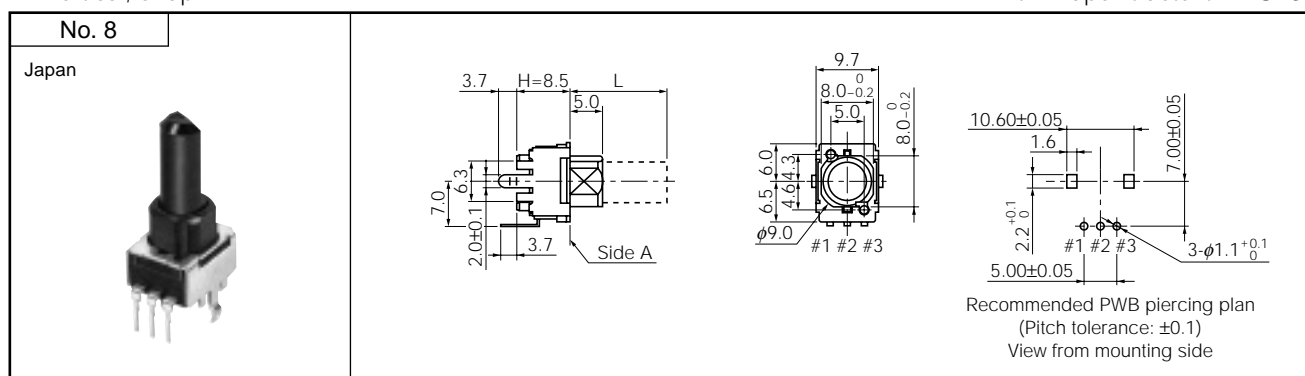
with midpoint detent: EVUF3K



Vertical, Snap-in

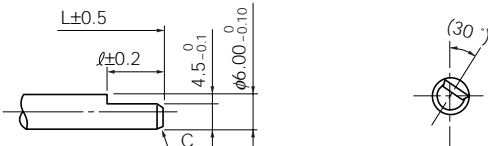
without midpoint detent: EVUF2L

with midpoint detent: EVUF3L

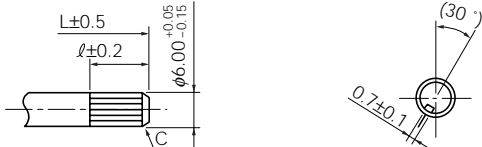


● Shaft Trims and Dimensions in mm for Type without Bushing (Drawings are at full CCW position.)

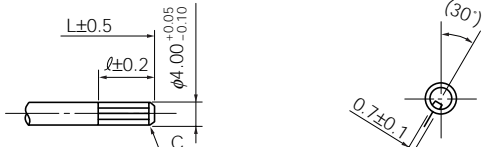
Type F (Flat)

Product No. 7-8-9 th	F15	F20	F25	F30	
L	15.0	20.0	25.0	30.0	
ℓ	6.0	7.0	12.0	12.0	

Type E (40 teeth serrations)

Product No. 7-8-9 th	E15	E17	E20	E25	E30	E35	
L	15.0	(17.0)	20.0	25.0	30.0	35.0	
ℓ	6.0	7.0	7.0	7.0	7.0	7.0	

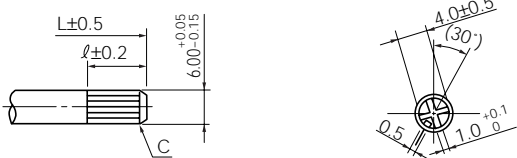
Type M (24 teeth serrations)

Product No. 7-8-9 th	M20	M25	M30	M35	
L	20.0	25.0	30.0	35.0	
ℓ	7.0	7.0	7.0	7.0	

Type S (with screw slot)

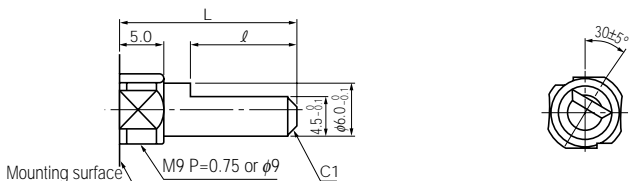
Product No. 7-8-9 th	S01	
L	9.5	
ℓ	—	

Type H (40 teeth serrations, with screw slot)

Product No. 7-8-9 th	H15	H20	H25	
L	15.0	20.0	25.0	
ℓ	6.0	7.0	7.0	

● Shaft Trims and Dimensions in mm for Types with Bushing or Sleeve (Drawings are at full CCW position.)

Type F (Flat)

Product No. 7-8-9 th	FK1	FK3	FK4	FK5	FL3	FK6	
L	12.5	15.0	17.5	20.0	21.5	22.5	
ℓ	7.0	7.0	12.0	12.0	12.0	12.0	

Note: When you have special requirements other than the above, consult our salesmen.

Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use.  
Should a safety concern arise regarding this product, please be sure to contact us immediately.



### Standard Type Slide Potentiometers

Japan  
Malaysia

Type: **EWAK/EWAM/EWAN**  
**EWAP/EWAQ**

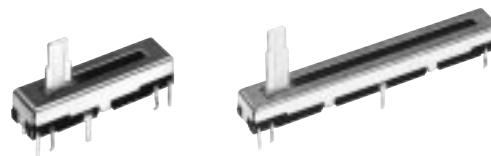
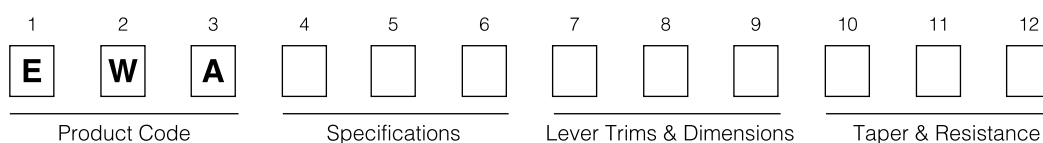
#### ■ Features

- Compact size and wave-soldering available
- A large variety: 15.0, 20.0, 30.0, 45.0 and 60.0 mm travel

#### ■ Recommended Applications

- Audio Equipment
- Video Equipment
- Home Electrical Appliances
- Electronic Musical Instruments

#### ■ Explanation of Part Numbers



#### ■ Product Chart

Classification		Standard part numbers	Functions				Remarks
Travel	Single/Dual		Metal lever	Mounting screw hole	Midpoint detent	Midpoint tap	
15.0 mm	Single	EWAKF	○	○	○	○	
	Dual	EWAKA	○	○	○	○	
20.0 mm	Single	EWAMF	○	○	○	○	
	Dual	EWAMA	○	○	○	○	
30.0 mm	Single	EWANF	○	○	○	○	
	Dual	EWANA	○	○	○	○	
45.0 mm	Single	EWAPF	○	○	○	○	
	Dual	EWAPA	○	○	○	○	
60.0 mm	Single	EWAQF	○	○	○	○	
	Dual	EWAQA	○	○	○	○	

Notes:

- Standard part numbers are insulated lever types.
- =available

#### ■ Minimum Quantity/Packing Unit

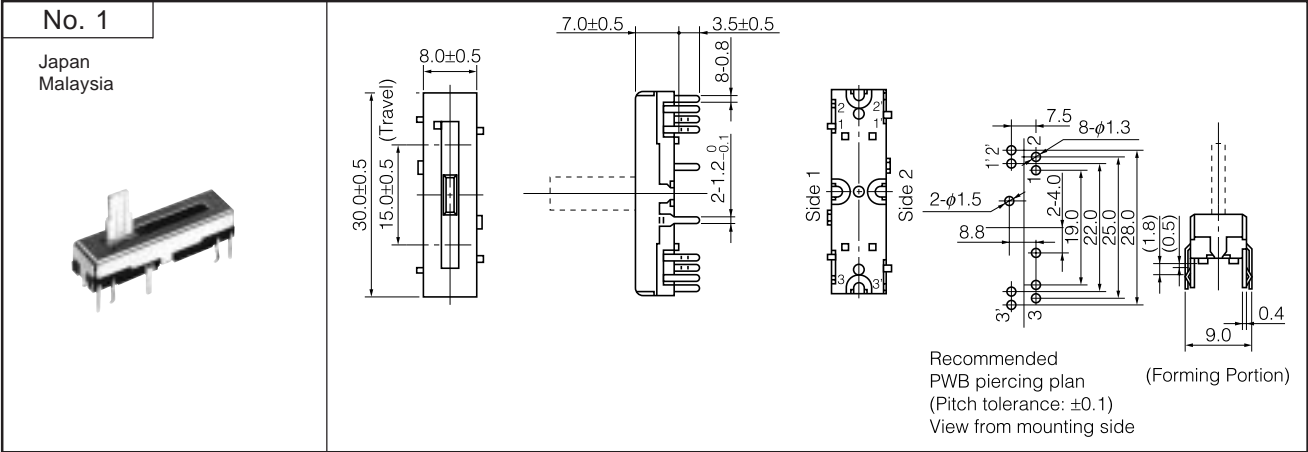
Minimum Quantity/ Packing Unit	EWAK	100 pcs. (Tray Pack)	
	EWAM	100 pcs. (Tray Pack)	Lever length ≤ 20.0 mm
		50 pcs. (Tray Pack)	Lever length ≥ 21.0 mm
	EWAN	100 pcs. (Tray Pack)	
	EWAP	50 pcs. (Tray Pack)	
	EWAQ	50 pcs. (Tray Pack)	Lever length ≤ 20.0 mm
		25 pcs. (Tray Pack)	Lever length ≥ 21.0 mm
Quantity/Carton	EWAK	1000 pcs.	
	EWAM	1000 pcs.	Lever length ≤ 20.0 mm
		500 pcs.	Lever length ≥ 21.0 mm
	EWAN	1000 pcs.	
	EWAP	500 pcs.	
	EWAQ	500 pcs.	Lever length ≤ 20.0 mm
		250 pcs.	Lever length ≥ 21.0 mm

Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use.  
Should a safety concern arise regarding this product, please be sure to contact us immediately.

■ Dimensions in mm (not to scale)

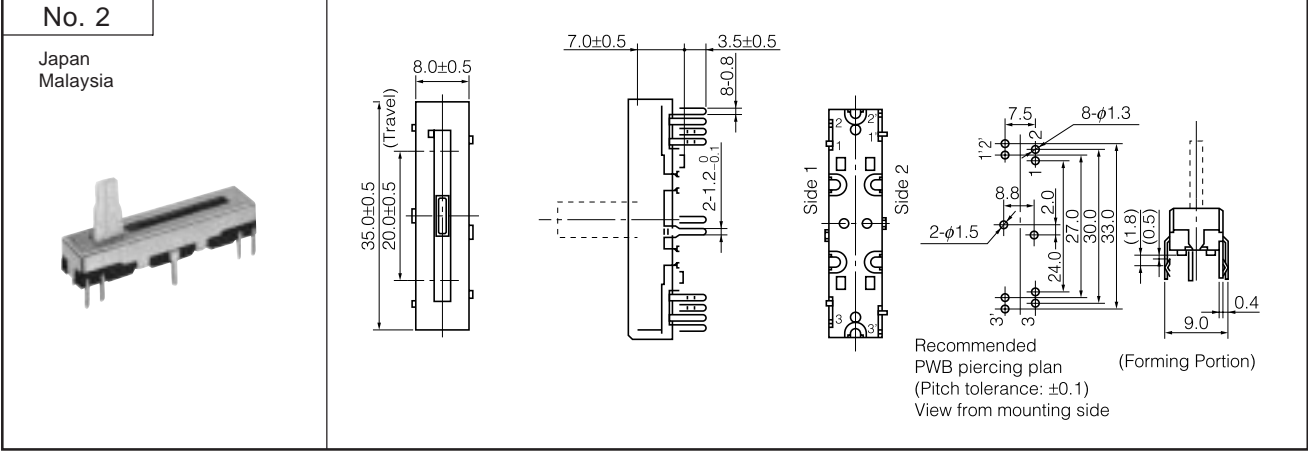
● 15.0 mm Travel Series

- Single ..... EWAKF
- Dual ..... EWAKA



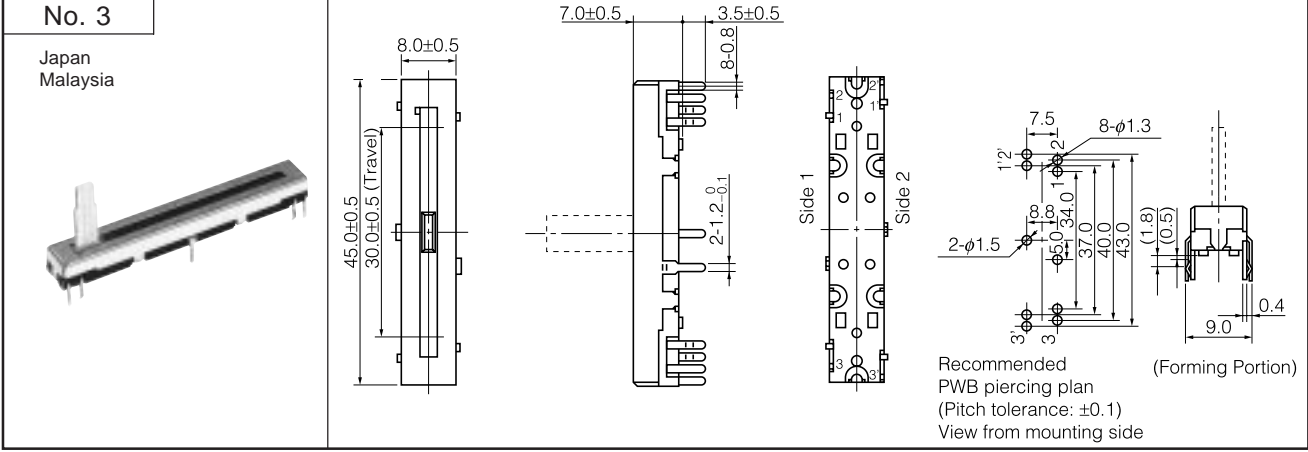
● 20.0 mm Travel Series

- Single ..... EWAMF
- Dual ..... EWAMA

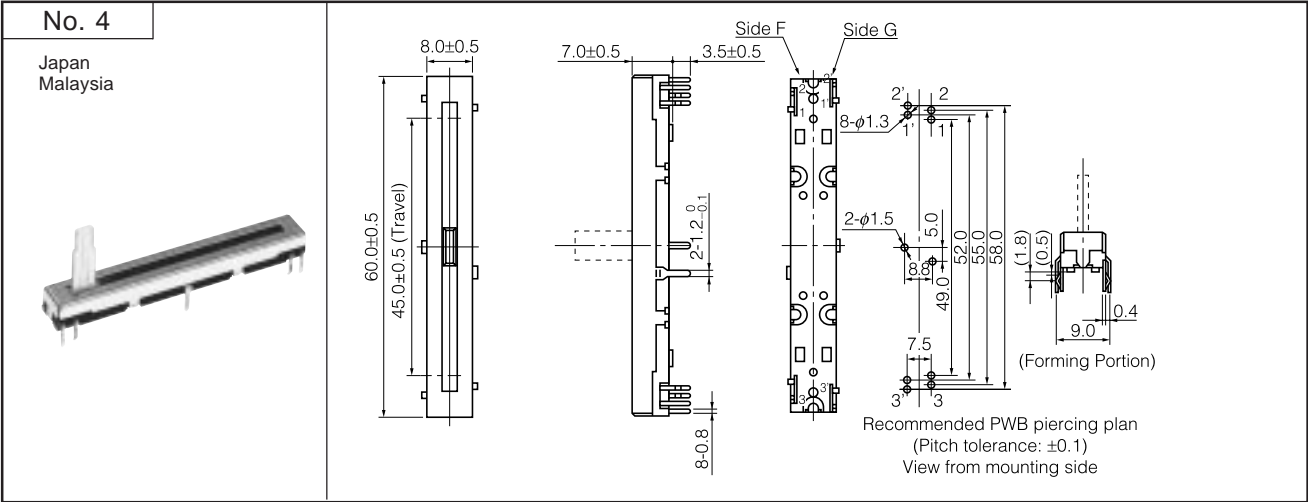


● 30.0 mm Travel Series

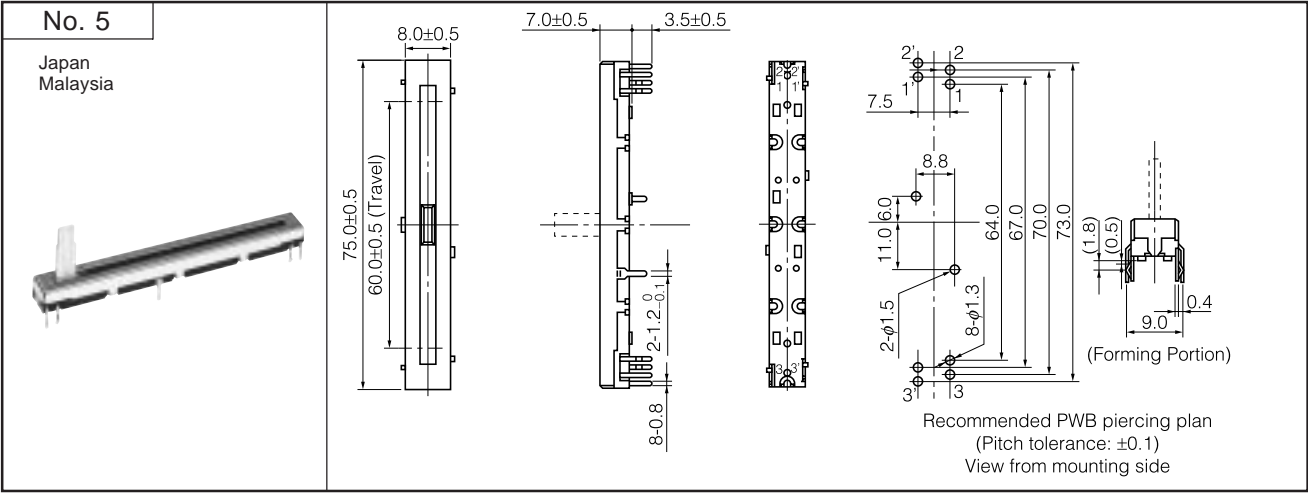
- Single ..... EWANF
- Dual ..... EWANA



- 45.0 mm Travel Series
- Single ..... EWAPF
- Dual ..... EWAPA

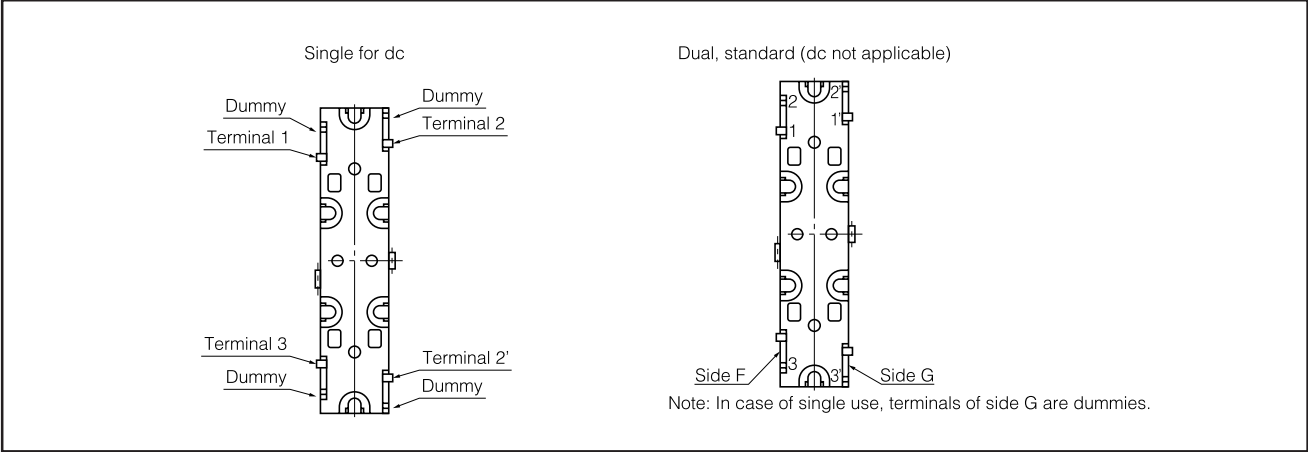


- 60.0 mm Travel Series
- Single ..... EWAQF
- Dual ..... EWAQA



- Notes:
1. Refer to the drawing below for terminal alignment of single slide potentiometers.
  2. Slide Potentiometers with no Midpoint Tap  
Terminals 3-3' and the next inner terminals are connected together as a common terminal.
  3. Slide Potentiometers with Midpoint Tap  
The next inner terminals to Terminal 3-3' shall be used for midpoint taps.

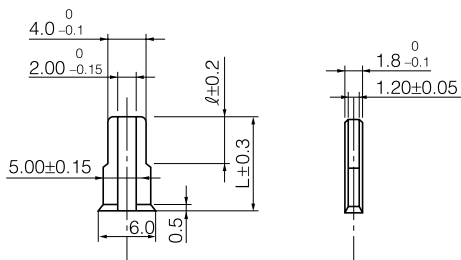
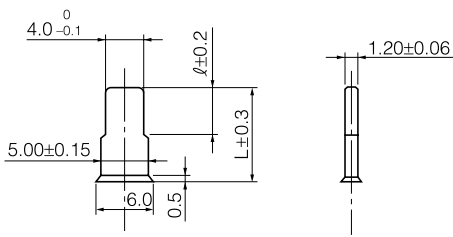
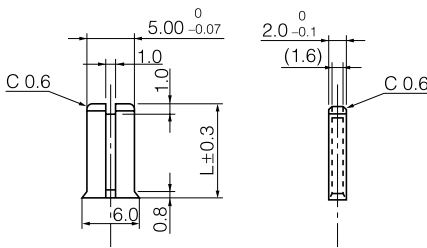
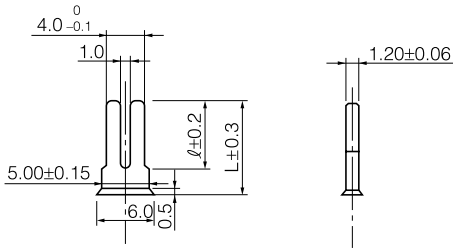
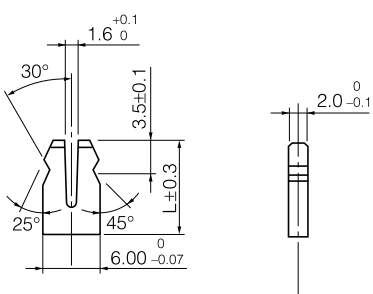
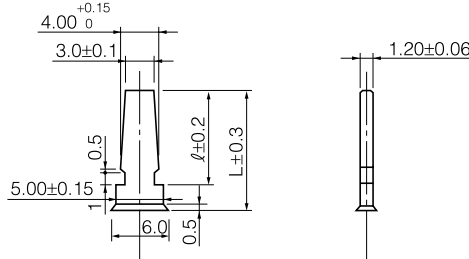
Terminal Numbers of Single, dc Version



■ Lever Trims and Dimensions in mm

1. Insulated lever (15.0, 20.0, 30.0, 45.0, 60.0)

2. Metal lever (15.0, 20.0, 30.0, 45.0, 60.0)

Type	Insulated lever	Type	Metal lever																																	
C	<table><tr><th>Part No.</th><th colspan="2">Length</th></tr><tr><th>7th to 9th</th><th>L</th><th>ℓ</th></tr><tr><td>C10</td><td>10.0</td><td>5.0</td></tr><tr><td>C15</td><td>15.0</td><td>5.0</td></tr></table> 	Part No.	Length		7th to 9th	L	ℓ	C10	10.0	5.0	C15	15.0	5.0	C	<table><tr><th>Part No.</th><th colspan="2">Length</th></tr><tr><th>7th to 9th</th><th>L</th><th>ℓ</th></tr><tr><td>C10</td><td>10.0</td><td>5.0</td></tr><tr><td>C15</td><td>15.0</td><td>10.0</td></tr><tr><td>C20</td><td>20.0</td><td>10.0</td></tr></table> 	Part No.	Length		7th to 9th	L	ℓ	C10	10.0	5.0	C15	15.0	10.0	C20	20.0	10.0						
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X	<table><tr><th>Part No.</th><th colspan="2">Length</th></tr><tr><th>7th to 9th</th><th>L</th><th>ℓ</th></tr><tr><td>X05</td><td>5.0</td><td>—</td></tr><tr><td>X10</td><td>10.0</td><td>—</td></tr><tr><td>X15</td><td>15.0</td><td>—</td></tr><tr><td>X20</td><td>20.0</td><td>—</td></tr></table> 	Part No.	Length		7th to 9th	L	ℓ	X05	5.0	—	X10	10.0	—	X15	15.0	—	X20	20.0	—	S	<table><tr><th>Part No.</th><th colspan="2">Length</th></tr><tr><th>7th to 9th</th><th>L</th><th>ℓ</th></tr><tr><td>S10</td><td>10.0</td><td>7.0</td></tr><tr><td>S15</td><td>15.0</td><td>8.0</td></tr><tr><td>S20</td><td>20.0</td><td>8.0</td></tr></table> 	Part No.	Length		7th to 9th	L	ℓ	S10	10.0	7.0	S15	15.0	8.0	S20	20.0	8.0
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Part No.	Length																																			
7th to 9th	L	ℓ																																		
D15	15.0	10.0																																		
D20	20.0	10.0																																		

# SSI Technologies – Application Note PS-AN2

## MediaSensor™ Absolute, Sealed, Gage Pressure Sensors

### Family Product Overview

#### Product Description

The MediaSensor™ (P51) family of bulk micro-machined, absolute, sealed and gage pressure sensors are for both harsh and benign media with superior *accuracy over an operating temperature of -40°C to 105°C*. These compact, robust sensors measure pressures from 3 PSI to 5,000 PSI and are well suited for a variety of automotive, industrial and commercial applications.

#### Product Features

- **Superb Accuracy:**
  - +/- 0.5% Full Scale for 75 PSI to 5000 PSI
  - +/- 1% Full Scale for 15 PSI to 60 PSI
  - +/- 2% Full Scale for 3 PSI to 10 PSI
- **Pressure Ranges:** 3 PSI to 5,000 PSI
- **Electronics:**
  - 0.5 – 4.5 Volt output (with 5V input)
  - 0.5 – 4.5 Volt output with overvoltage protection (with 5V input)
  - 1-5 Volt non output (with 8 - 30V input)
  - 4 – 20 mA output (with 8 - 30V input)
- **Temperature Range:** -40°C to 105°C
- **Maximum Flexibility:** Custom ASIC provides signal conditioning for calibration and temperature compensation.
- **Standard and custom options available for OEM quantities**
- **Excellent price/performance ratio**
- **Compact, Robust Package:** All laser-welded stainless steel design for optimal media isolation in compact size
- **Chemical Compatibilities:** Any gas or liquid compatible with 304L & 316L Stainless Steel. For example, Motor Oil, Diesel, Hydraulic fluid, brake fluid, water, waste water, Hydrogen, Nitrogen, and Air.
- **Typical Applications:** Refrigeration; Fuel Cells; Pumps; Hydraulics; Process Control; Spraying Systems; Pneumatics; Compressors; Flow; Robotics; Agriculture; Hydrogen Storage

Call us at 1- 888 - 477- 4320

or visit our

Website: <http://ssitechnologies.com>



MediaSensor™ Family of Pressure Sensors with integrated signal conditioning



# SSI Technologies – Application Note PS-AN2

## MediaSensor™ Absolute, Sealed, Gage Pressure Sensors

### Family Product Overview

#### Standard Full Scale Pressure Ranges

- **Gage:** 3, 5, 10, 15, 25, 30, 50, 60, 75, 100, 120, 130, 200, 225, 250 and 300 PSIG
- **Sealed:** 50, 100, 150, 200, 300, 400, 500, 750, 1000, 1500, 2000, 3000 and 5000 PSIS
- **Absolute:** 15, 30, 50, 65, 75, 100, 150, 200, 250, 300, 500, 750, 1000, 1500, 2000, and 3000 PSIA

#### Measurement Technology

In general, pressure measurement technology translates force from an induced pressure into an electrical quantity. The MediaSensor™ family of pressure transducers and transmitters use piezoresistive technology for its sensor signal processing to measure pressure.

A micro-machined stainless steel convoluted diaphragm with a silicon crystal semiconductor is used. Strain gauges (resistive elements) in the silicon crystal are used in a Wheatstone Bridge circuit. When pressure is applied, the resistivity of the strain gauges changes proportional to the pressure applied. Since a single silicon crystal is used it has a low mechanical hysteresis with good linearity.

One leg of the bridge measures the input pressures port. The other leg of the bridge is connected to the reference port the input pressure port is compared to. The connection to this reference port determines the pressure sensing convention used.

The MediaSensor™ family comes in a choice of three pressure sensing type conventions: absolute, gauge (vented or sealed).

Absolute MediaSensors™ measure pressure relative to perfect Vacuum pressure (0 PSI) which remains unchanged regardless of temperature, location or other ambient conditions such as weather. Absolute MediaSensors™ are calibrated to have 0.5 Vdc, 1 Vdc, or 4 mA respectively at 0 PSIA.

There are two different gauge pressure conventions – Vented Gauge and Sealed Gauge. Gauge MediaSensors™ measure pressure relative to ambient room pressure through a port that is vented (open) to the atmosphere. Gauge MediaSensors™ are calibrated to have 0.5 Vdc, 1 Vdc, or 4 mA respectively at 0 PSIG.

Sealed MediaSensors™ measure pressure relative to a port that is connected to a sealed perfect vacuum chamber. Sealed MediaSensors™ are calibrated to 14.5 PSI absolute. Sealed MediaSensors™ are calibrated to have 0.5Vdc, 1 Vdc, or 4 mA respectively at 14.5 PSIA.

The MediaSensor™ takes the two voltage output ports of the Wheatstone bridge and amplifies the signal. Piezoresistive pressure sensors are sensitive to changes in temperature. The MediaSensor™ uses signal conditioning to compensate for temperature and calibration. The output signal is then converted into one of four forms:

- 1) 0.5 – 4.5 Volt ratiometric output (transducer)
- 2) 0.5 – 4.5 V ratiometric output with Overvoltage protection (transducer)
- 3) 1 – 5 volt output (transducer)
- 4) 4 – 20 mA output (transmitters)

# SSI Technologies – Application Note PS-AN2

## MediaSensor™ Absolute, Sealed, Gage Pressure Sensors

### Family Product Overview

Ratiometric outputs vary as a ratio of the supply voltage.

Transmitters are very suitable in applications that use long cables. There is virtually no error from voltage drop introduced from the wire resistance when sending the signal as a current. They are also less sensitive to electromagnetic interference.

Some piezoresistive pressure transducers use only an unprotected silicon sensing element. Silicon is a brittle crystalline material, which can sometimes crack under severe cold transient environments. The MediaSensor™ pressure transducer uses an additional 316L stainless steel convoluted diaphragm with a protective non-silicone oil to protect the sensitive silicon sensing element from the harsh media and environmental conditions. The 316L stainless steel diaphragm not only provides for optimal water and chemical media isolation for the silicon crystal sensing element but can handle cold temperature transients without sustaining damage.

Under cold transient conditions and within our operating temperature range, the oil does not gel and acts as a buffer for the silicon sensing element from the extreme temperature transients found in certain applications such as refrigeration.

#### MediaSensor™ Compensations Features

All the compensation circuitry is internal to the MediaSensor™ pressure transducer. No external compensation modules are needed.

##### 1) Zero balancing (Null Offset) Calibration

During manufacturing the Wheatstone Bridge resistive elements are closely matched and compensated, however an offset voltage (due to resistance differences) may still exist. SSI MediaSensor™ compensates for this offset over operating temperature range (refer to Table 1).

##### 2) Span Calibration

The resistance of silicon gauges is temperature dependent. The span will shift with temperature to a final stabilized value as it warms up. SSI MediaSensor™ compensates for this span variation over operating temperature range.

# SSI Technologies – Application Note PS-AN2

## MediaSensor™ Absolute, Sealed, Gage Pressure Sensors

### Family Product Overview

#### Typical Connections

The following torque limits should be used when mounting the MediaSensor™ pressure port.

Straight Thread w/O-Ring:	Recommended Torque
High Pressure (> 750 PSI)	300 in lb
All others with out Port types T, U, Y	150 in lb
Parts with Ports T,U, Y	120 in lb
<b>NPTF Thread:</b>	2 T.F.F.T. (Turns From Finger Tight)

#### MediaSensor™ 4 -20mA Output connections:

- 1) Connect the Power Lead (Red) to the + terminal of the supply voltage.
- 2) Connect the Return Lead (White) to the + terminal of the current measuring device
- 3) Connect the – terminal of the current measuring device to the – terminal of the supply voltage.

#### MediaSensor™ Voltage Output connections:

- 1) Connect the Power Lead (Red) to the + terminal of the supply voltage.
- 2) Connect the Ground Lead (Black) and the – terminal of the supply voltage to – input of your voltage measurement equipment.
- 3) Connect the Vout Lead (White) to the + input of your voltage measurement equipment.

# SSI Technologies – Application Note PS-AN2

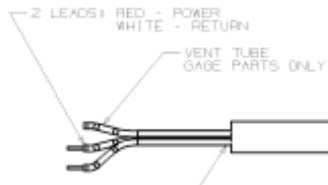
## MediaSensor™ Absolute, Sealed, Gage Pressure Sensors

### Family Product Overview

#### Packaging

MediaSensor™ is readily available in a large selection of standard packaging options. MediaSensor™ offers an integral harness with 6 standard lengths and four standard readily available connectors (Packard, Deutsch, M12 and Mini DIN). In addition, SSI will work with the customer to meet their needs with custom options for large volumes orders. (I.e... special fittings & connectors; special pressure ranges; operating temperature; and increased accuracy).

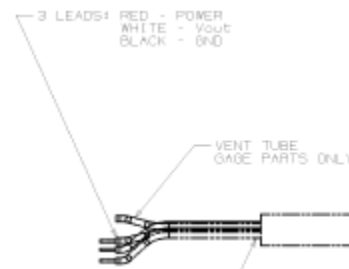
**Integral Harness** (Standard lengths of 6", 12", 18", 24", 36" and 72"). The Harness can be constructed of either PVC Jacketed 18 or 24 AWG Wire.



Wire Color

Red - Power  
White - Return

#### Integral Harness Transmitter (4 to 20 mA)



Wire Color  
Red - Power  
White - Vout  
Black - Ground

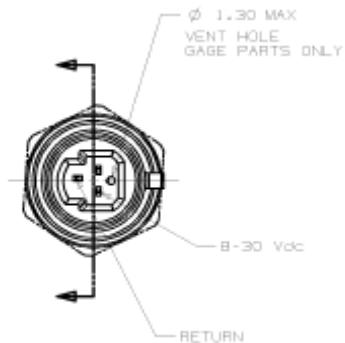
#### Integral Harness Transducer(1 to 5 Vdc or 0.5 to 4.5Vdc)

# SSI Technologies – Application Note PS-AN2

## MediaSensor™ Absolute, Sealed, Gage Pressure Sensors

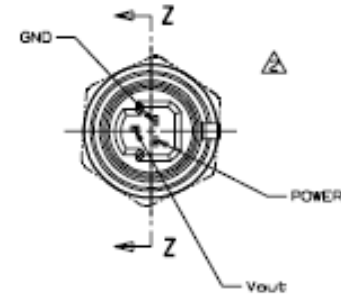
### Family Product Overview

#### Standard Connector Options



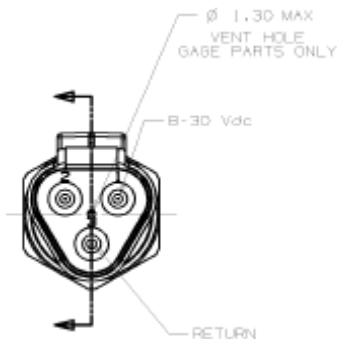
- Pin 1 - Power  
2 - Not Used  
3 - Return

**Packard Connector Transmitter (4 to 20 mA)**



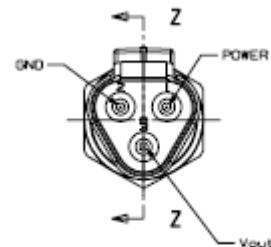
- Pin 1 - Power  
2 - Ground  
3 - Vout

**Packard Connector Transducer (1 to 5 Vdc or 0.5 to 4.5Vdc)**



- Pin 1 - Power  
2 - Not Used  
3 - Return

**Deutsch Connector Transmitter (4 to 20 mA)**



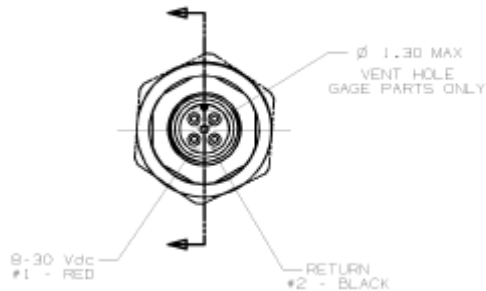
- Pin 1 - Power  
2 - Ground  
3 - Vout

**Deutsch Connector Transducer (1 to 5 Vdc or 0.5 to 4.5Vdc)**

# SSI Technologies – Application Note PS-AN2

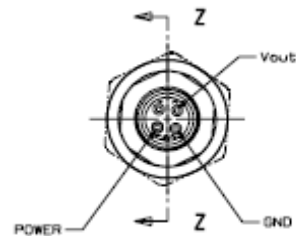
## MediaSensor™ Absolute, Sealed, Gage Pressure Sensors

### Family Product Overview



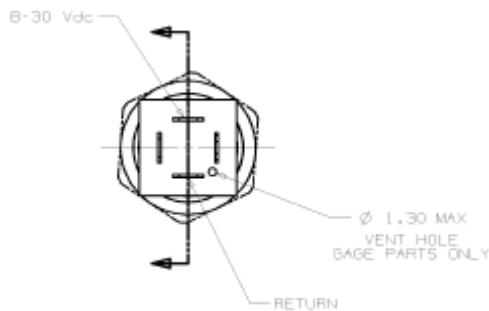
- Pin 1 - Power
- 2 - Return
- 3 - Not Used
- 4 - Not Used

**M12 Connector Transmitter (4 to 20 mA)**



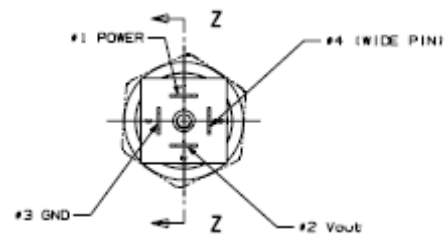
- Pin 1 - Power
- 2 - Ground
- 3 - Vout
- 4 - Not Used

**M12 Connector Transducer (1 to 5 Vdc or 0.5 to 4.5Vdc)**



- Pin 1 - Power
- 2 - Return
- 3 - Not Used
- 4 - Not Used

**DIN 43650 Transmitter Connector**



- Pin 1 - Power
- 2 - Vout
- 3 - Ground
- 4 - Not Used

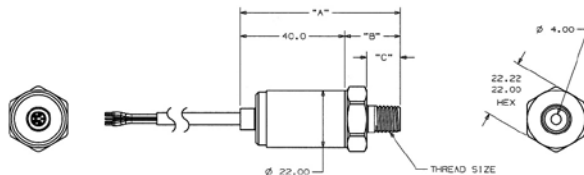
**DIN 43650 Transducer Connector**

# SSI Technologies – Application Note PS-AN2

## MediaSensor™ Absolute, Sealed, Gage Pressure Sensors

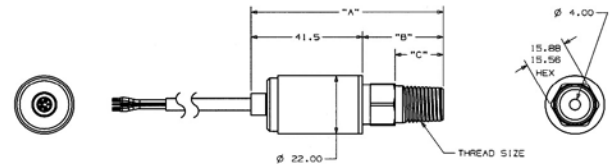
### Family Product Overview

#### Standard Packaging Options



THREAD SIZE	LENGTH "A"	LENGTH "B"	LENGTH "C"
1/4-18 NPT	66.6	26.0	18.0
1/8-27 NPT	61.6	21.0	13.0
M12-1.5 6g	59.6	19.0	11.0
7/16-20 UNF	59.6	19.0	11.0
3/8-24 UNF	58.1	17.5	9.5

#### Integral Harness with 22mm Hex



THREAD SIZE	LENGTH "A"	LENGTH "B"	LENGTH "C"
1/4-18 NPT	72.0	30.5	18.0
1/8-27 NPT	67.0	25.5	13.0
M12-1.5 6g	65.0	23.5	11.0
7/16-20 UNF	65.0	23.5	11.0
3/8-24 UNF	63.5	22.0	9.5

#### Integral Harness with 5/8" Hex

Harness Construction: PVC Jacketed 18 or 24 AWG Wire

Please visit our website at <http://www.ssitechnologies.com> for a more information and a listing of all the series of pressure sensors in the MediaSensor™ family or call SSI toll-free at **1- 888- 477- 4320**







## **ANEXO D**

# **PLANOS**



# **ANEXO D**

## **PLANOS**



## **Planos**

Plano 1.00 → Conjunto

Plano 1.01 → Lista de elementos

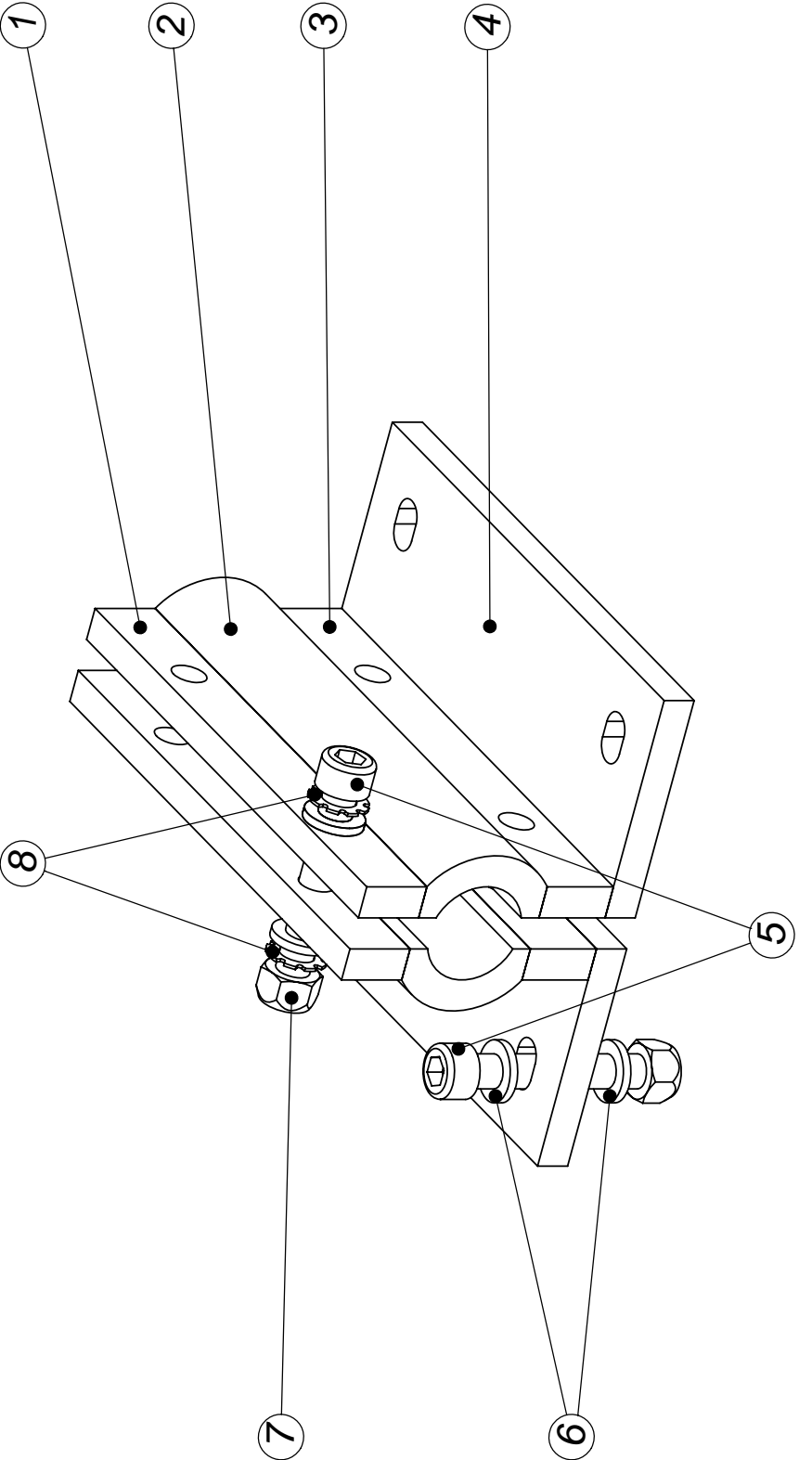
Plano 1.02 → Medio conjunto

Plano 1.03 → Pletina superior

Plano 1.04 → Pletina inferior

Plano 1.05 → Pletina base

Plano 1.06 → Zapata

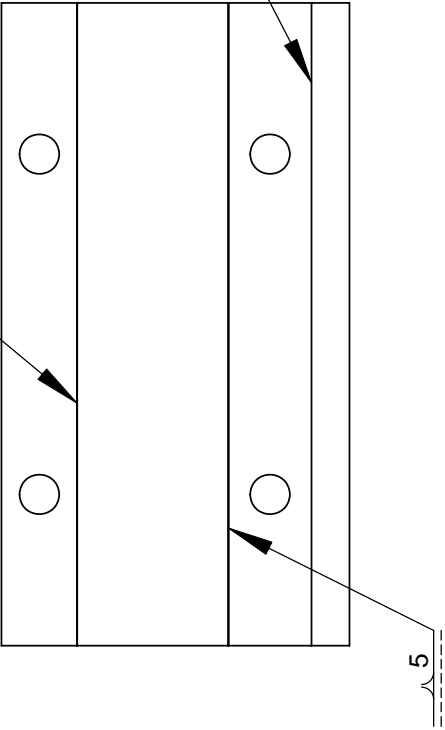
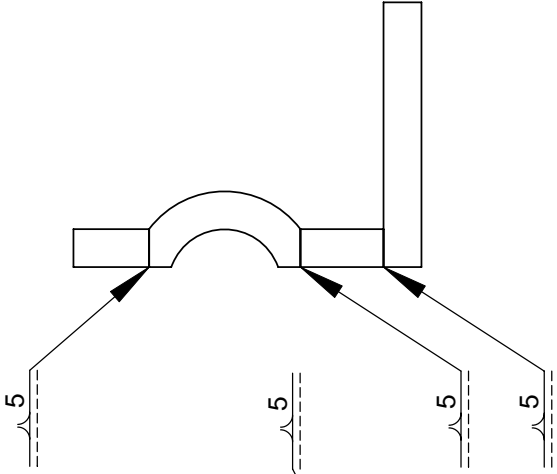
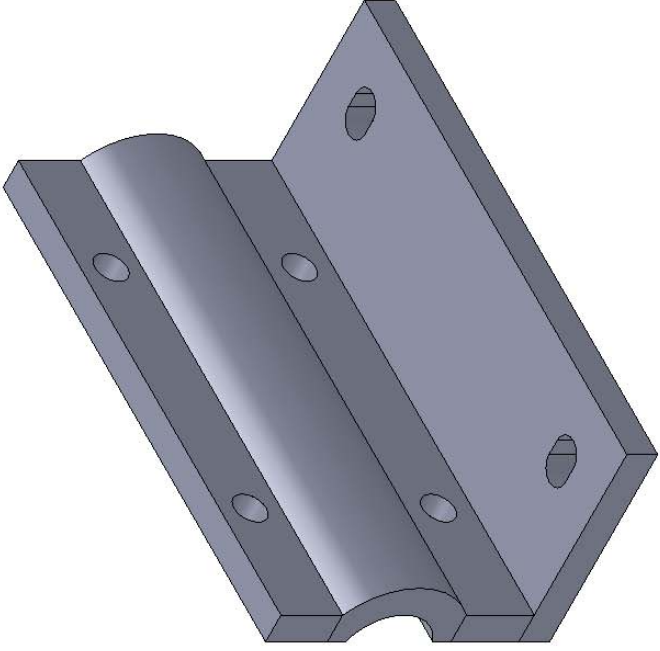
1	2	3	4	5	6
A	B	C			
					
A	B	C			
D					

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Dibujado	01-06-2010	Nombre	J. Puértolas y A. Romea
Comprob			
Escala: 1:2		CONJUNTO	
Plano nº: 1.00			
Acondicionamiento de plataforma Stewart para simulador de motocicleta			

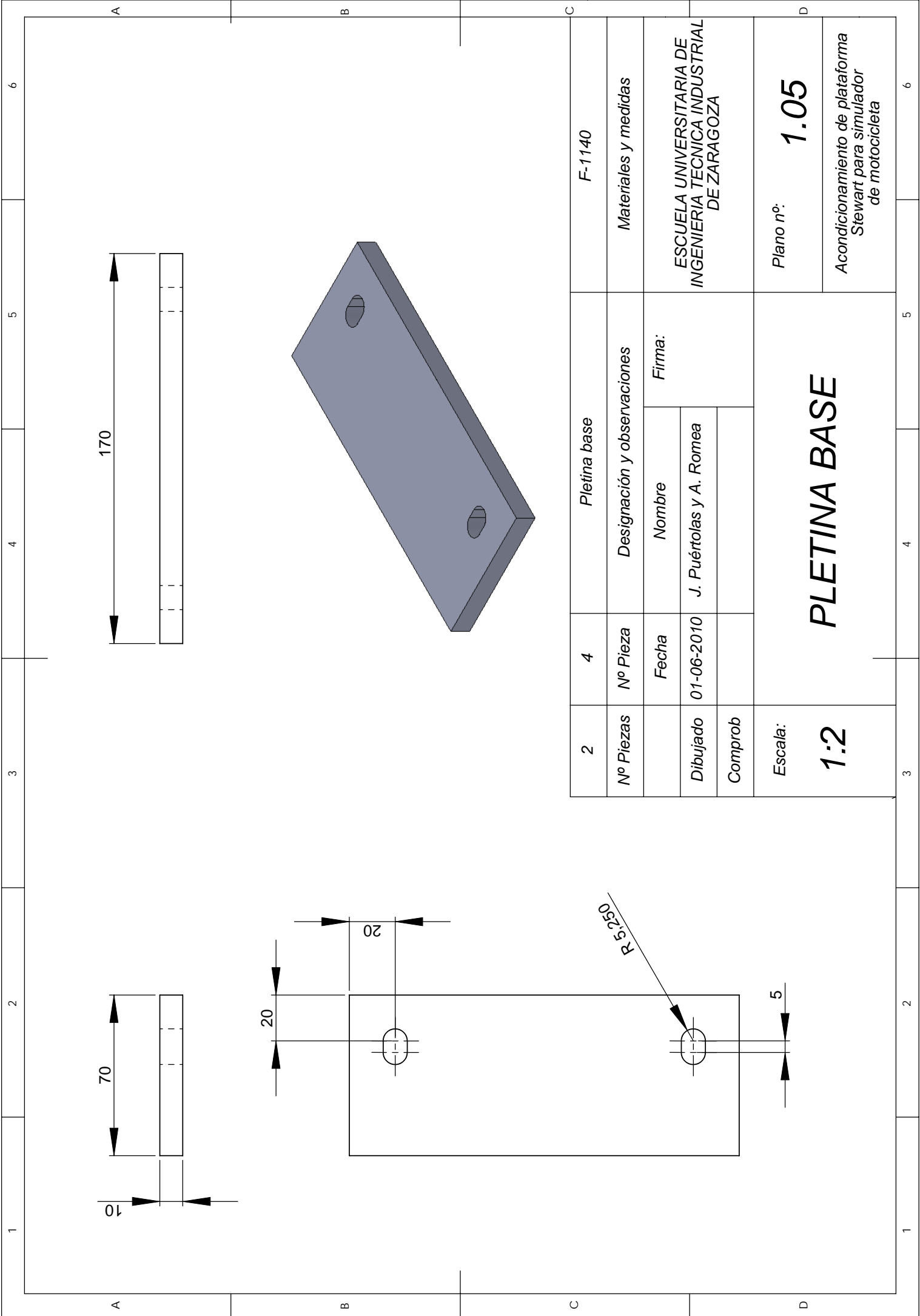
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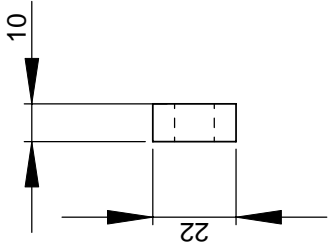
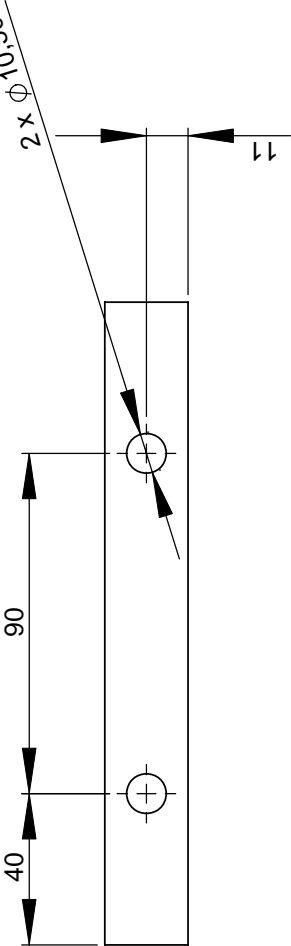

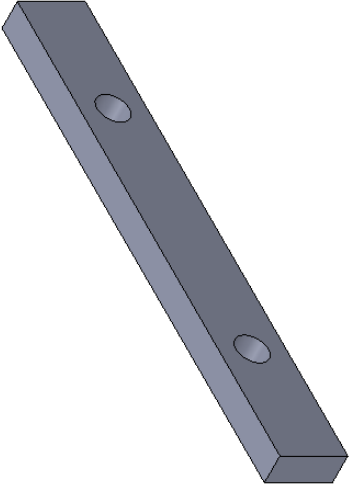
	1	2	3	4	
A					A
B					B
C					C
D					D
E					E
F					F

8	8	Arandela estriada DIN 6797		Comercial $\phi$ 10.5
8	7	Tuerca ISO 10513		Comercial M10 X 1.25 calidad 8
16	6	Arandela plana ISO 8738		Comercial $\phi$ 10
8	5	Tornillo ISO 4762		Comercial M10 X 60 calidad 12.9
2	4	Pletina base		F-1140
2	3	Pletina inferior		F-1140
2	2	Zapata		F-1140
2	1	Pletina superior		F-1140
Nº Piezas	Nº Pieza	Designación y observaciones		Materiales y medidas
	Fecha	Nombre	Firma:	ESCUELA UNIVERSITARIA DE INGENIERIA TECNICA INDUSTRIAL DE ZARAGOZA
Dibujado	01-06-2010	J. Puértolas y A. Romea		
Comprob				
Escala:  S/E	LISTA DE ELEMENTOS			Plano nº:  1.01
				Acondicionamiento de plataforma Stewart para simulador de motocicleta

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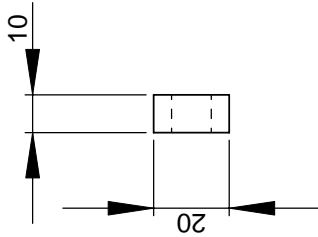
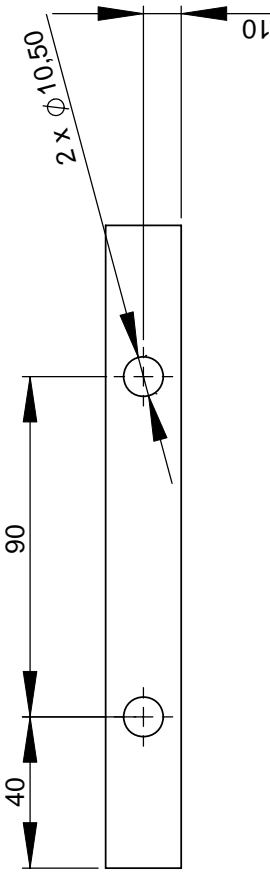

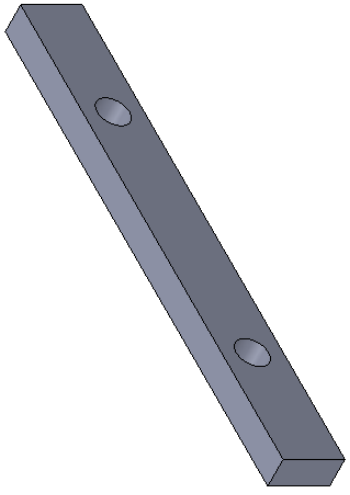




1	2	3	4	5	6
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B					
C					
D					

2	3	Pletina inferior		F-1140
Nº Piezas	Nº Pieza	Designación y observaciones		Materiales y medidas
	Fecha	Firma:		ESCUELA UNIVERSITARIA DE INGENIERIA TECNICA INDUSTRIAL DE ZARAGOZA
Dibujado	01-06-2010	J. Puértolas y A. Romea		
Comprob				
Escala:	PLETINA INFERIOR			Plano nº: 1.04
1:2				Acondicionamiento de plataforma Stewart para simulador de motocicleta

1	2	3	4	5	6
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1	2	3	4	5	6	
A						
B						
C	2		1		Pletina superior	F-1140
D	Nº Piezas		Nº Pieza		Designación y observaciones	Material y medidas
			Fecha		Nombre	Firma:
	Dibujado		01-06-2010		J. Puértolas y A. Romea	
	Comprob					
Escala:		1:2		PLETINA SUPERIOR		Plano nº: 1.03
						Acondicionamiento de plataforma Stewart para simulador de motocicleta
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