NON-LINEAR POTENTIOMETER

(Precision 1-turn, Wirewound & Conductive Plastic Element)

A precise detection of Sine-Cosine and other Non-Linear function voltage can be obtained through the shaft revolution of **SAKAE Non-Linear Potentiometer Series.** There are 2 kinds of resistive element in this series: traditional wirewound with high stability and newest conductive plastic featuring long life expectancy and high speed tracking ability.

THE NOMENCLATURE OF SAKAE NON-LINEAR POT. SERIES

S FSCB 30 A G - ○○○○

●Special Specifications
S means the potentiometer with special mechanical specifications not applicable to our standard.

●Type
FSCB means a conductive plastic type potentiometer with continuous, sine-cosine function and the following types are available according to the kinds of resistive elements incorporated and functional characteristics.
SCB.....Sine-Cosine function, wirewound resistive element type.
FP.....Special functional curves, wirewound resistive element type.
FSCB-A.....Sine-Cosine function, conductive plastic resistive element type.
FFP-A.....Special functional curves, conductive plastic resistive element type.

●4 digits branch number
to be used for specific requirements.

●Number of Gangs
G means 2 ganged potentiometer on the same axle. The potentiometer consists of one single section unless G is given.
(e.g. G3...3 ganged, G4...4 ganged.)

●Characteristics
A means a conductive plastic resistive element type. (A is not given to wirewound type.)

●Diameter
30 means approximate outer diameter of the potentiometer in metric system. The 4 standard diameters are available, namely, 12mm, 22mm, 30mm and 50mm.

■Examples of Non-Linear Function Curves

SELECTION GUIDE

Function Characteristics	Kind of Element	Model No.	Features
Sine-Cosine	Wirewound	**SCB50**	Most popular precision pot. with sine-cosine output.
	Conductive Plastic	**FSCB22A, FSCB30A, FSCB50A**	Conductive plastic resistive element pot. with essentially infinite resolution and long life expectancy, using a patented multifinger contact.
Special Functional Curves	Wirewound	**FP50**	Various kinds of special functions are available in this series.
	Conductive Plastic	**FFP12A, FFP22A**	Various kinds of special functions are available in this series with smaller diameter.

●General Performances

Kind of Element	Model No.	Function Characteristics	Standard Total Resistance Range (Ω)	Special Resistance Values (Ω)	Conformity Tolerance (Peak-Peak) (%)	Special Specifications					
						With Stopper	Front and Rear Shaft Extension	Extra Taps	Simple Sealing Type	With-Switch	Multi-ganged
Wirewound	**SCB50**	Sin-Cos	500～10k	—	±1.0～±0.5	—	○	—	○	—	○
	FP50	X^2, $\frac{1}{X}$, etc.	500～10k	—	±5.0～±0.5	○	○	○	○	○	○
Conductive Plastic	**FSCB22A**	Sin-Cos	1k～10k	500, 20k, 50k	±2.0～±1.0	—	○	—	○	—	○
	FSCB30A	Sin-Cos	1k～10k	500, 20k, 50k	±1.0～±0.7	—	○	—	○	—	○
	FSCB50A	Sin-Cos	1k～10k	20k, 50k, 100k	±0.5～±0.2	—	○	—	○	—	○
	FFP12A	Sin 360° X^2, $\frac{1}{X}$, etc.	1k～10k	—	±5.0～±2.0	—	○	○	○	—	—
	FFP22A	Sin 180° X^2, $\frac{1}{X}$, etc.	1k～10k	—	±5.0～±1.0	○	○	○	○	—	○

Note: 1. For detailed performances, please refer to specifications of each model in this catalog.

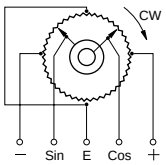
●Environmental Performances

Parameters \ Model Nos.	SCB50, FP50	FSCB22A, FSCB30A, FSCB50A, FFP12A, FFP22A
Operating Temperature Range	-55℃～+105℃	-55℃～+105℃
Temperature Cycle	5 cycles under -55℃～+105℃ Total resistance value variation: below ±5% No mechanical damage	5 cycles under -55℃～+105℃ Total resistance value variation: below ±10% No mechanical damage
Exposure at Low Temperature	24 hours at -55℃ Total resistance value variation: below ±5% No mechanical damage	24 hours at -55℃ Total resistance value variation: below ±5% No mechanical damage
Exposure at High Temperature	1,000 hours at 105℃ Total resistance value variation: below ±5% No mechanical damage	1,000 hours at 105℃ Total resistance value variation: below ±10% No mechanical damage
Vibration	10Hz to 2,000Hz 147m/s² 12 hours Total resistance value variation: below ±5% No mechanical and electrical damage	10Hz to 2,000Hz 147m/s² 12 hours Total resistance value variation: below ±2% No mechanical and electrical damage
Shock	490m/s² 11ms 18 times Total resistance value variation: below ±1% No mechanical and electrical damage	490m/s² 11ms 18 times Total resistance value variation: below ±1% No mechanical and electrical damage
Moisture Resistance	40℃ 95%RH 240 hours Total resistance value variation: below ±10% Insulation resistance: over 10MΩ	40℃ 95%RH 120 hours Total resistance value variation: below ±10% Insulation resistance: over 10MΩ
Rotational Life Expectancy (at 25℃)	No load at 40 r.p.m. 1,000,000 shaft revolutions Total resistance value variation: below ±5% against initial value Conformity tolerance: below 150% of specified value Noise: below 500Ω E.N.R.	No load at 400 r.p.m., inverting every 15 minutes FSCB-A...50,000,000 shaft revolutions FFP-A...10,000,000 shaft revolutions Total resistance value variation: below ±10% against initial value Conformity tolerance: below 150% of specified value Output smoothness: below 150% of specified value

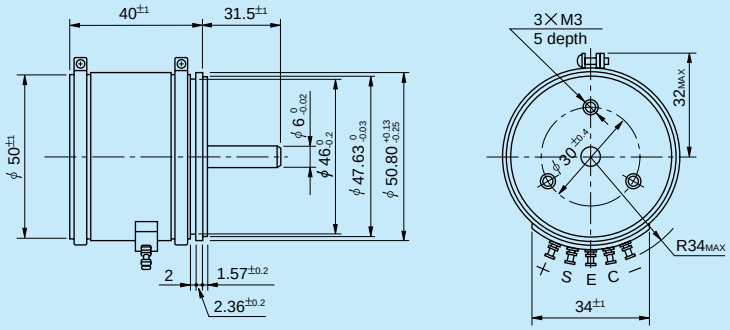
Note: 2. In case of the potentiometer with special resistance values and special specifications, the above performances may change and therefore, please consult us in advance, separately.
3. As for operating temperature range, we can not guarantee that all values of performances can satisfy within this operating temperature range. (Please see page 24 in this catalog for further details.)
4. The above values of performances based on each testings were measured after each testings completed, respectively, under standard conditions. As for the values during testings and other values not mentioning in the above table, please ask us separately.

Model SCB50

●Terminal Connection Diagram



●Standard Dimensions



●General Specifications

Standard Resistance Range:	500Ω to 10kΩ
Max. Practical Resistance Value:	20kΩ
Total Resistance Tolerance:	Standard Class ±5% (J) Precision Class ±3% (H)
Conformity Tolerance: (Peak-Peak)	Standard Class ±1.0% Precision Class ±0.5%
Power Rating:	2.0W
Noise:	Below 100Ω E.N.R.
Electrical Travel:	360° (Endless)
Mechanical Travel:	360° (Endless)
Insulation Resistance:	Over 1,000MΩ at 1,000V.D.C.
Dielectric Strength:	1 minute at 1,000V.A.C.
Starting Torque:	Below 11mN•m (110gf•cm)
Max. Working Voltage:	250V
Resist. Temperature Coefficient of Wire:	±20p.p.m./℃
Mass:	Approx. 160g

●Standard Resistance Values ■No. of Wire Turns ■Resistance Wire Used

Resist. Value (Ω)	500	1k	2k	5k	10k	※ 20k
No. of Wire Turns	1,000	1,400	1,800	1,800	2,000	2,500
Resist. Wire Used	Cu-Ni System			Ni-Cr System		

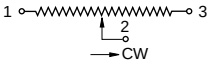
Note: Mark ※ shows value at special higher practical resistance.

●Special Specifications Available

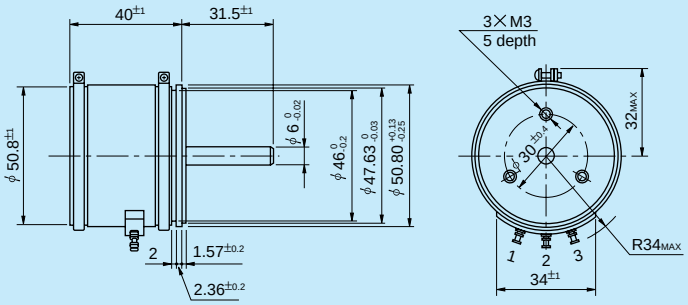
Multi-ganged (Available up to 3 gangs. Housing length is extended by 30mm per 1 gang), Shaft with front and rear extension (Rear shaft with 6mm dia. and 15mm length), Bushingmount type, Shaft dia. (∅6.35mm) with inch dimensions, Special machining on the shaft, Oil-filled type.

Model FP50

●Terminal Connection Diagram



●Standard Dimensions



●General Specifications

Standard Resistance Range:	500Ω to 10kΩ
Total Resistance Tolerance:	Standard Class ±10% (K) Precision Class ±5% (J)
Function Characteristics: (Examples)	20dB log, Sine 90°, Sine 180°, Tan 45° X^2 $(0 \leqq X \leqq 1)$ $1/X$ $(1 \leqq X \leqq 10)$
Power Rating:	1.5W
Conformity Tolerance: (Peak-Peak)	Standard Class ±5% Precision Class ±3% Super-precision Class ±1%
Noise:	Below 100Ω E.N.R.
Electrical Travel:	300° ±3°
Mechanical Travel:	360° (Endless)
Insulation Resistance:	Over 1,000MΩ at 1,000V.D.C.
Dielectric Strength:	1 minute at 1,000V.A.C.
Starting Torque:	Below 8mN•m (80gf•cm)
Max. Working Voltage:	250V
Resist. Temperature Coefficient of Wire:	±20p.p.m./℃
Mass:	Approx. 160g

●Special Specifications Available

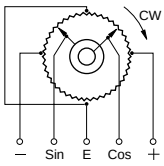
Extra taps (Available up to 5 taps), Multi-ganged (Available up to 3 gangs. Housing length is extended by 30mm per 1 gang), Shaft with front and rear extension (Rear shaft with 6mm dia. and 15mm length), Bushingmount type, With stopper (Rotating angle becomes 330° and stopper strength is 0.9N•m [9kgf•cm]), Special electrical travel, Shaft dia. (∅6.35mm) with inch dimensions, Special machining on the shaft, Oil-filled type.

Conductive Plastic

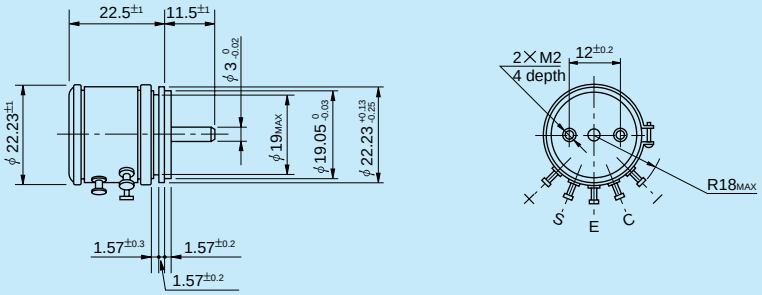
MODEL FSCB22A (Servomount)

Model FSCB22A

●Terminal Connection Diagram



●Standard Dimensions



●General Specifications

Standard Resistance Values:	1k, 2k, 5k, 10k (Ω)
Special Practical Resistance Values:	500, 20k, 50k (Ω)
Total Resistance Tolerance:	Standard Class ±15% (L) Precision Class ±10% (K)
Conformity Tolerance:	Standard Class ±2.0%
(Peak-Peak)	Precision Class ±1.0%
Resolution:	Essentially infinite
Output Smoothness:	Below 0.1% against input voltage
Contact Resistance Variation:	Below 8% C.R.V.
Power Rating:	0.5W
Electrical Travel:	360° (Endless)
Mechanical Travel:	360° (Endless)
Insulation Resistance:	Over 1,000MΩ at 500V.D.C.
Dielectric Strength:	1 minute at 500V.A.C.
Starting Torque:	Below 3mN•m (30gf•cm)
Max. Working Voltage:	250V
Resist. Temperature Coefficient:	±400p.p.m./℃
Mass:	Approx. 20g

●Special Specifications Available

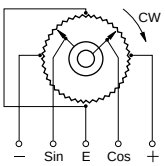
Multi-ganged (Available up to 3 gangs. Housing length is extended by 16mm per 1 gang), Shaft with front and rear extension (Rear shaft with 3mm dia. and 10mm length), Shaft dia. (∅3.175mm) with inch dimensions, Special machining on the shaft, Oil-filled type.

Conductive Plastic

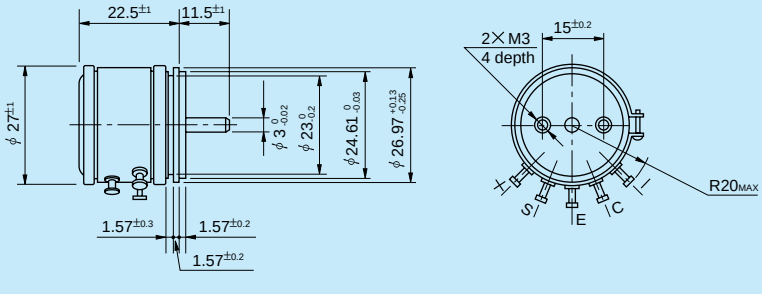
MODEL FSCB30A (Servomount)

Model FSCB30A

●Terminal Connection Diagram



●Standard Dimensions



●General Specifications

Standard Resistance Values:	1k, 2k, 5k, 10k (Ω)	**Contact Resistance Variation:**	Below 8% C.R.V.
Special Practical Resistance Values:	500, 20k, 50k (Ω)	**Power Rating:**	0.75W
Total Resistance Tolerance:	Standard Class ±15% (L) Precision Class ±10% (K)	**Electrical Travel:**	360° (Endless)
		Mechanical Travel:	360° (Endless)
		Insulation Resistance:	Over 1,000MΩ at 500V.D.C.
Conformity Tolerance: (Peak-Peak)	Standard Class ±1.0% Precision Class ±0.7%	**Dielectric Strength:**	1 minute at 500V.A.C.
		Starting Torque:	Below 3mN•m (30gf•cm)
Resolution:	Essentially infinite	**Max. Working Voltage:**	250V
Output Smoothness:	Below 0.1% against input voltage	**Resist. Temperature Coefficient:**	±400p.p.m./℃
		Mass:	Approx. 30g

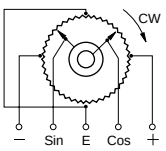
●Special Specifications Available

Multi-ganged (Available up to 3 gangs. Housing length is extended by 16mm per 1 gang), Shaft with front and rear extension (Rear shaft with 3mm dia. and 10mm length), Shaft dia. (∅3.175mm) with inch dimensions, Special machining on the shaft.

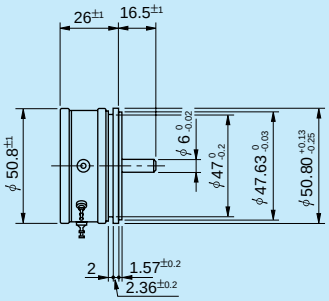
Conductive Plastic — MODEL FSCB50A (Servomount)

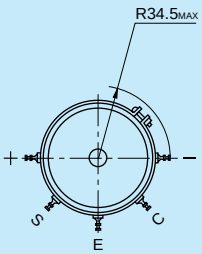
Model FSCB50A

●Terminal Connection Diagram



●Standard Dimensions





●General Specifications

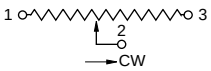
Standard Resistance Values:	1k, 2k, 5k, 10k (Ω)		**Output Smoothness:**	Below 0.1% against input voltage	
Special Higher Practical Resistance Values:	20k, 50k, 100k (Ω)		**Contact Resistance Variation:**	Below 8% C.R.V.	
			Power Rating:	1.25W	
Total Resistance Tolerance:	Standard Class ±15% (L) Precision Class ±10% (K)		**Electrical Travel:**	360° (Endless)	
			Mechanical Travel:	360° (Endless)	
			Insulation Resistance:	Over 1,000MΩ at 1,000V.D.C.	
Conformity Tolerance: (Peak-Peak)	Standard Class	±0.5%	**Dielectric Strength:**	1 minute at 1,000V.A.C.	
	Precision Class	±0.3%	**Starting Torque:**	Below 5mN•m (50gf•cm)	
	Super Precision Class	±0.2%	**Max. Working Voltage:**	250V	
Resolution:	Essentially infinite		**Resist. Temperature Coefficient:**	±400p.p.m./℃	
			Mass:	Approx. 120g	

●Special Specifications Available

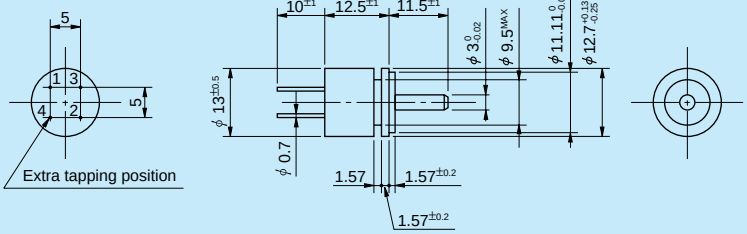
Multi-ganged (Available up to 3 gangs. Housing length is extended by 17mm per 1 gang), Shaft with front and rear extension (Rear shaft with 6mm dia. and 15mm length), Bushingmount type, Shaft dia. (∅6.35mm) with inch dimensions, Special machining on the shaft, Oil-filled type.

Model FFP12A

Terminal Connection Diagram



Standard Dimensions



General Specifications

Standard Resistance Values:	1k, 2k, 5k, 10k (Ω)
Total Resistance Tolerance:	Standard Class ±15% (L) Precision Class ±10% (K)
Function Characteristics:	Sine 360° , 20dB log, X^2 ($0 \leqq X \leqq 1$) $1/X$ ($1 \leqq X \leqq 10$)
Conformity Tolerance:	Standard Class ±10%
(Peak-Peak)	Precision Class ±5%
Resolution:	Essentially infinite
Output Smoothness:	Below 0.1% against input voltage
Power Rating:	0.2W
Electrical Travel:	300° ±5° (360° in case of Sine 360°)
Mechanical Travel:	360° (Endless)
Insulation Resistance:	Over 1,000MΩ at 500V.D.C.
Dielectric Strength:	1 minute at 500V.A.C.
Starting Torque:	Below 1mN•m (10gf•cm)
Resistance Temperature Coefficient:	±400p.p.m./℃
Mass:	Approx. 5g

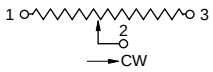
Special Specifications Available

Extra taps (Available up to 1 tap), Shaft with front and rear extension (Rear shaft with 1mm dia. and 10mm length), With stopper (Rotating angle becomes 310° and stopper strength is 0.3N•m [3kgf•cm]), Special electrical travel, Shaft dia. (∅3.175mm) with inch dimensions, Special machining on the shaft, Special functions, Bushingmount type (Same dimensions as FCP12AC).

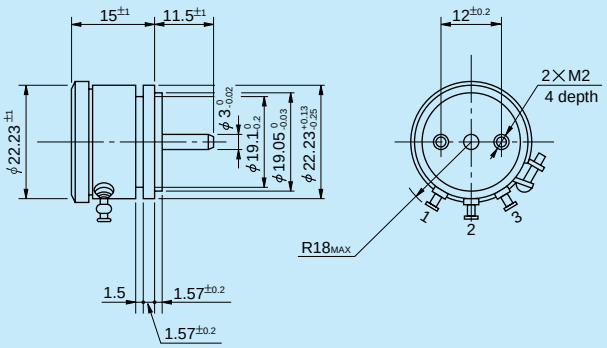
MODEL FFP22A (Servomount)

Model FFP22A

●Terminal Connection Diagram



●Standard Dimensions



●General Specifications

Standard Resistance Values:	1k, 2k, 5k, 10k (Ω)
Total Resistance Tolerance:	Standard Class ±15% (L) Precision Class ±10% (K)
Function Characteristics:	Sine 90°, Sine 180°, 20dB log, X^2 ($0 \leqq X \leqq 1$) 1/X ($1 \leqq X \leqq 10$)
Conformity Tolerance:	Standard Class ±5%
(Peak-Peak)	Precision Class ±2%
Resolution:	Essentially infinite
Output Smoothness:	Below 0.1% against input voltage
Power Rating:	0.5W
Electrical Travel:	300° ±5°
Mechanical Travel:	360° (Endless)
Insulation Resistance:	Over 1,000MΩ at 500V.D.C.
Dielectric Strength:	1 minute at 500V.A.C.
Starting Torque:	Below 3mN•m (30gf•cm)
Resistance Temperature Coefficient:	±400p.p.m./℃
Mass:	Approx. 20g

●Special Specifications Available

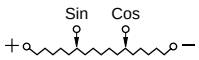
Extra taps (Available up to 1 tap), Shaft with front and rear extension (Rear shaft with 3mm dia. and 10mm length), With stopper (Rotating angle becomes 300° and stopper strength is 0.3N•m [3kgf•cm]), Special electrical travel, Shaft dia. (∅3.175mm) with inch dimensions, Special machining on the shaft, Special functions.

SPECIALLY ORDERED ITEM

The following item discontinues to manufacture as our standard items and however, we can manufacture them as specially ordered items.

Model SCA30 (Wirewound)

(1-turn Sine-Cosine Pot.)



Standard Resistance Range	:	50Ω～20kΩ
Total Resistance Tolerance	:	±10% (K)
Conformity tolerance (Peak-Peak)	:	±3.0%
Power Rating	:	1W
Noise	:	Below 100Ω E.N.R.
Electrical travel	:	360° (Endless)
Mechanical travel	:	360° (Endless)
Mass	:	Approx. 25g