HELICALOHM® MULTI-TURN POTENTIOMETER

(Precision Multi-turn, Wirewound & Hybrid Element)

There are two kinds in **SAKAE** Helicalohm Potentiometers with a wirewound resistive element. One is Model HD Series which are an original device consisting of a resistive element wound helically on a drum surface and a slider of which contact is made around the resistance drum and the other is Model HP Series which are formed with a slider travelling along the interior surface of a resistive element helically wound inside a sealed pipe.
Both of them equally offer high resolution, excellent reliability and long life. **SAKAE** has expanded to the production of hybrid resistive element potentiometers and this element has now been incorporated into Model HP Series with small size.

THE NOMENCLATURE OF SAKAE HELICALOHM POT. SERIES

S 46 HD S - 10 L G - ○○○○

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

Diameter
46 means the approximate outer diameter of the potentiometer in metric system. The 8 standard diameters are available, namely, 10mm, 12mm, 20mm, 22mm, 25mm, 30mm, 46mm and 50mm.

Type and Internal Construction
H means helicalohm, multi-turn, linear potentiometer. There are 4 kinds of HP, HHP, HD and HDS.
HP, HPC ·····Wirewound type with resistive element helically wound inside the pipe-shaped housing.
HHP·····Hybrid type with same construction as HP type.
HD·····Wirewound type with resistive element helically wound on the drum-shaped base.
HDS·····Super-precision type with same construction as HD type.

4 digits branch number
to be used for specific requirements.

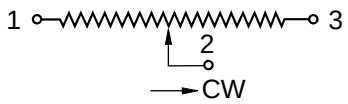
Number of Gangs
G means 2 ganged potentiometer on the same axle. The potentiometer consists of one single section unless G is given.(e.g. G3···3 ganged, G4...4 ganged.)

Application
L means for semi-fixed purpose. **P** means for p.c. terminals. **W** means for lug terminals at rear end. **S** means shortened body type (only for use on 20HP-ns). **E** means inch dimensional bushing and shaft type.

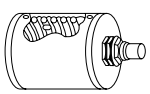
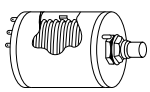
Number of Turns
10 means 10-turn. There are 5 kinds in the number of our standard multi-turn potentiometers. They are 3, 5, 10, 15 and 20, but subject to models.

Mounting Method
S means servomount type(in case of bushingmount type, S is deleted.)

Terminal Connection Diagram



SELECTION GUIDE

Internal Constraction	Type	Kind of Element	Diameter (mm)	Model No.	Features
Pipe type 	HP	Wirewound	∅10.5	10HP	World's smallest multi-turn pot. since 1965.
			∅13	12HP, 12HP-P, 12HPS, 12HPC, 12HPC-P, 12HPC-W	Low-cost multi-turn pot. of outer dia. of 13mm. Terminals for p.c. board and rear terminals are also available.
			∅20	20HP, 20HPS	Precision multi-turn pot. of outer dia. of 20mm. Servomount type is also available.
			∅22	22HP	Low-cost multi-turn pot. of outer dia. of 22mm.Most popular items for general applications. Two kinds of bushing in 22HP series are available : plastic and metal.
			∅25	25HP, 25HPS	Precision multi-turn pot. of outer dia. of 25mm. Various specials based on this item are also available.
	HHP	Hybrid	∅13	12HHP, 12HHP-P, 12HHPS	World's smallest multi-turn precision hybrid pot. of outer dia. of 13mm. Servomount type is also available.
			∅20	20HHP, 20HHPS	Precision multi-turn hybrid pot. of outer dia. of 20mm. Servomount type is also available.
			∅22	22HHP, 22HHPS	Low-cost precision multi-turn hybrid pot. of outer dia. of 22mm. Servomount type is also available.
Drum type 	HD	Wirewound	∅46	46HD, 46HDS	Traditional item being manufactured continuously over 45 years. Slide wire resistive element type which brings infinite resolution is available as standard version against the standard resistance values below 20Ω in this series, but subject to models.
	HDS	Wirewound	∅30	30HDS	This series has the highest performances, especially in resolution and in linearity tolerance, which are almost at the upper practical limits in wirewound type pot. You can also use this pot. as a standard potentiometer.
			∅50	50HDS	

●General Performances

Kind of Element	Model No.	Standard Total Resistance Range (Ω)	Special Lower Resistance Values (Ω)	Special Higher Resistance Values (Ω)	Independent linearity Tolerance (%)	Special Specifications						
						Servo-mount Type	Front and Rear Shaft Extension	Extra Taps	Simple Sealing Type	With Limit-Switch Adaptor	Multi-ganged	Semi-fixed Setting Type
Wirewound	**10HP**	100～50k	20,50	100k	±0.25～±0.1	—	○	—	—	—	—	—
	12HP	100～100k	20,50	150k	±0.25～±0.1	○	○	—	○	—	—	○
	12HPC	100～100k	—	—	±0.25～±0.1	—	○	—	○	—	—	○
	20HP	100～50k	10,20,50	150k	±0.2 ～±0.1	○	○	○	○	○ (with adaptor)	○	○
	22HP	100～100k	—	—	±0.25～±0.1	○	○	—	○	—	○	○
	25HP	100～100k	10,20,50	200k	±0.25～±0.1	—	○	○	—	○ (with adaptor)	○	—
Hybrid	**12HHP**	1k～50k	—	100k	±0.4 ～±0.1	○	○	—	○	—	—	○
	20HHP	2k～100k	—	—	±0.25～±0.1	○	○	○	○	○ (with adaptor)	○	○
	22HHP	2k～100k	—	—	±0.25～±0.1	○	○	—	○	—	○	○
Wirewound	**46HD**	0.5～100k	—	200k	±0.3 ～±0.1	○	○	—	○	○ (Incorporated)	○	—
Wirewound	**30HDS**	2k～50k	—	—	±0.05～±0.025	○	○	—	—	—	—	—
	50HDS	5k～100k	—	—	±0.02～±0.01	○	○	○	—	—	—	—

Note: 1. Above-mentioned data are applied for our standard 10-turn models per each series and for further technical details, please see each articles of the models in question mentioned in this catalog.

●Environmental Performances

Parameters \ Model Nos.	10HP, 12HP, 20HP, 25HP, 46HD	12HPC, 22HP, 30HDS, 50HDS	12HHP, 20HHP (22HHP) ※
Operating Temperature Range	-55℃ ～ +105 ℃	-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 ±5% No mechanical damage	5 cycles under -55 ℃ ～+105 ℃ Total resistance value variation: below ±5% 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	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 ±5% No mechanical damage	1,000 hours at 105 ℃ Total resistance value variation: below ±5% 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 ±5% No mechanical and electrical damage	10Hz to 2,000Hz 147m/s² 12 hours Total resistance value variation: below ±5% 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	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	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. 3-turn ·····600,000 shaft revolutions 5-turn ·····1,000,000 shaft revolutions 10-turn, 15-turn, 20-turn ·····2,000,000 shaft revolutions Total resistance value variation: below ±5% against initial value Independent linearity tolerance: below 150% of specified value Noise: below 500Ω E.N.R.	No load at 40 r.p.m. 3-turn ·····300,000 shaft revolutions 5-turn ·····500,000 shaft revolutions 10-turn ·····1,000,000 shaft revolutions Total resistance value variation: below ±5 ℃ against initial value Independent linearity tolerance: below 150% of specified value Noise: below 500Ω E.N.R.	No load at 40 r.p.m. 5-turn·····5,000,000 (2,500,000) ※ shaft revolutions 10-turn·····10,000,000 (5,000,000) ※ shaft revolutions Total resistance value variation: below ±5% against initial value Independent linearity tolerance: below 150% of specified value Output smoothness: 5-turn·····0.2% against input voltage 10-turn·····0.1% against input voltage

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 25 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.
5. Mark ※ applies only for model 22HHP series.

Wirewound

MODEL 22HP

(Bushingmount)

Model 22HP-10

●Standard Model Nos.

5-turn models:

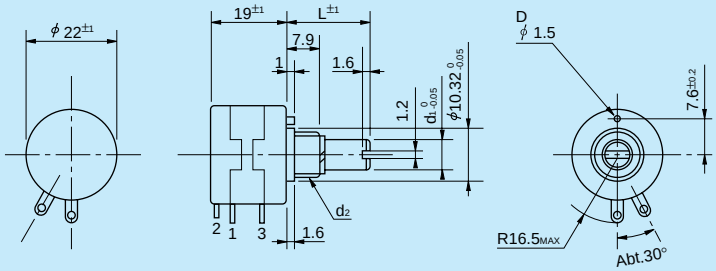
22HP-5	22HP-5M
22HP-5E	22HP-5N

10-turn models:

22HP-10	22HP-10M
22HP-10E	22HP-10N

Note: Please select the exact model number from the right-side table, because each model number has different shaft dia. and bushing dimensions.

●Standard Dimensions



Model No.	Shaft Dimensions		Mounting Screw	Anti-rotation
	d1	L	d2	D
22HP-10	Ø6	20.6	3/8-32UNEF	Yes
22HP-10M	Ø6	25.0	M9 P=0.75	No
22HP-10E	Ø6.35	20.6	3/8-32UNEF	Yes
22HP-10N	Ø6	20.6	M9 P=0.75	No

Note: 1. 1 pc. each inner teeth washer and hex nut are attached.
2. Outer dimensions of 5-turn version are same as those of 10-turn.
3. Housing length of 2 ganged version is extended by 19mm.
4. Please process the mounting hole on the panel to be mounted with this potentiometer by the diameter of 10.32mm $^{+0.05}_{0}$.

●General Specifications

Standard Resistance Range: 100Ω to 50kΩ (5-turn)
100Ω to 100kΩ (10-turn)

Total Resistance Tolerance: Standard Class ±5% (J)
Precision Class ±1% (F)

Independent Linearity Tolerance:

	5-turn	10-turn
Standard Class	±0.3%	±0.25%
Precision Class	±0.2%	±0.1%
(Below 5kΩ)	(±0.25%)	(±0.15%)

Power Rating: 1.0W (5-turn)
2.0W (10-turn)

Noise: Below 100Ω E.N.R.

Electrical Travel: 360°×n ±5°(n: No. of turns)

Mechanical Travel: 360°×n $^{+10°}_{0°}$(n: No. of turns)

InsulationResistance: Over 1,000MΩ at 500V.D.C.

Dielectric Strength: 1 minute at 1,000V.A.C.

Starting Torque: Below 10mN•m (100gf•cm)

Stopper Strength: Approx. 0.35N•m (3.5kgf•cm)

Max. Torque exerted on fastening the mounting nut to the bushing: Below 1.0N•m (10kgf•cm)
(In case of panel thickness with over 2.5mm., the rotating torque may become heavier.)

Max. Working Voltage: 250V

Resist. Temperature Coefficient of Wire: ±20p.p.m./℃

Materials:
Shaft: Stainless steel
Housing case: Glass-filled nylon
Bushing: Glass-filled nylon
(For ganged version, the bushing is metal-brass without plating.)
Terminals: Gold-plated brass
(All terminals can be fitted with the AMP 110 series faston receptacle (2.8×0.5mm) or equivalents.)

Mass: Approx. 20g (Both 5-turn and 10-turn)

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

Resist. Value (Ω)	100	200	500	1k	2k	5k	10k	20k	50k	100k
22HP-5	1,240	1,560	2,000	2,510	2,400	3,200	3,900	4,800	5,500	–
22HP-10	2,100	2,480	3,300	4,000	5,020	5,000	6,400	7,800	10,100	11,000
Resist. Wire Used	Cu-Ni System					Ni-Cr System				

●Special Specifications Available

Shaft with front and rear extension (Rear shaft with 6mm dia. and 15mm length), Multi-ganged (Available up to 10 gangs), With high torque, Special shaft dia. (Ø3mm, Ø3.175mm, Ø4mm, Ø5mm), Special machining on the shaft, With plastic shaft, Metal bushing type (22HPM-n with anti-rotation pin), 1, 2, 3, 4, 6, 7 and 8-turn versions are available (These versions have same outer dimensions, but general specifications are please request us for details), Simple sealed housing, Slipping-clutch incorporated type, Extra taps (Available up to 1 tap only for 10-turn model), Servomount type (Same dimensions as 22HHPS-10).

TURNS-COUNTING DIAL

(for use with Helicaiohm Pots. and Multi-turn Pots.)

SAKAE Turns-counting Dials are designed for use with Helicalohm Potentiometers and multi-turn potentiometers and have an elegant appearance and rigid construction offering an easy reading, smooth rotation and accurate counting. There are a plenty of models: **MA, MB, MF, MG** in analog type and **DA, DB, DC** in digital type. In particular, **MF** and **DB** dials have a unique internal mechanism with a special flexible coupling incorporated, which we developed (several patents obtained and designs registered) and adopted first of all in the world to solve the traditional troubles such as irregular rotation and uneven torque resulting from inaccurate mounting of the potentiometer on dial.

THE NOMENCLATURE OF SAKAE TURNS-COUNTING DIAL

S MB 10 - 25 B 6 - ○○○○

●Special Specifications
S means the turns-counting dial with special mechanical specifications of graduation not applicable to our standard. (Model **MA** is only available to special specifications.)

●Type
MB means a kind of model among our 7 models of turns-counting dial. The 8 models are **MA, MB, MF, MG, DA, DB** and **DC**.

●Number of Turns
10 means 10 full turns-counting type. The 6 standard numbers of turns are available, namely, 3, 5, 10, 15, 20 and 100, but subject to a limit from each model, It is convenient to use the dial with same number of turns as that of multi-turn potentiometer to be combined.

●Diameter
25 means the approximate outer diameter of the dial body in metric system. The 9 standard diameters are available, namely, 15mm, 22mm, 24mm, 25mm, 26mm, 27mm, 30mm, 46mm and 55mm.

●Lock
B means that the lock lever is fitted to lock the dial rotation at any desired position. No lock lever is fitted unless **B** is given.

●Fitting Shaft Diameter
6 means the mounting hole of 6mm dia. to be suitable for the pot, with 6mm dia. shaft. The 5 standard mounting holes are available, namely, 3mm, 3.175mm, 4mm, 6mm and 6.35mm, but a single model is not always furnished with all of these 5 sizes of holes. (Model **MA** has always 6mm dia. hole and therefore, this indication is not necessary.)

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

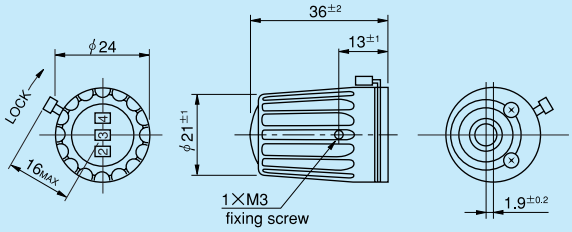
SELECTION GUIDE

Kind of Reading	Type	Diameter (mm)	Model No.	Features
Analog	**MA**	∅55	**MA-55**	You can read the number of turns-counting precisely in outer graduations which rotate continuously relating to the shaft rotation without any intervals. Special graduations are available in this series.
	MB	∅26, ∅31	**MB-25, MB-30**	Popular sized dials with rigid construction for general use.
	MF	15×18.5 25×29 ∅22, ∅46	**MF-15, MF-25, MF-22, MF-46**	Most advanced dials in the world. Even the unskilled can easily mount it with the potentiometer on the panel because this dial has a special flexible coupling inside, of which device is patented. (U.S.A. PAT. No. 4197765)
		15×18.5	**MF-15D**	Popular low-cost item without flexible coupling.
	MG	∅22	**MG-22**	This low-cost popular type dial can be mounted on every kind of pots. and 2 kinds of lock mechanism are available.
Digital	**DA**	∅24	**DA-24**	Smallest digital dial with easiness to operate. 3 digits of figures give you precise indication of number of turns-counting of the pot. mounted.
	DB	26×43.5	**DB-26**	Rectangular digital dial with flexible coupling incorporated as in MF dial.
		26×43.5	**DB-26D**	Popular low-cost item without flexible coupling.
	DC	∅27×31.5	**DC10-27**	Low-cost round-shaped digital dial.
		∅30.5×31.5	**DC10-27F**	Same as above, but recessed mounting type.

MODEL DA10-24B

Model DA10-24B

●Standard Dimensions



Note: 1. The dimensions of mark ※ are determind by the pot. to be mounted.
2. 1 pc. each of mounting adaptor and the hexagonal wrench are attached.

●General Specifications

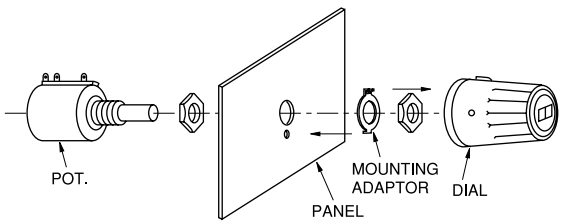
Model No	Number of Turns-Counting.	Matching Shaft Dia. (mm)		Combinable Helicalohm Pot. (Matching shaft length of 25mm)	Lock Device	Operating Temperature Range	Mass (Approx. g)
		Standard	Special				
DA10-24B	10	6	6.35	20HP 46HD 22HP 20HHP 25HP 22HHP	YES	-30℃～+85℃	40

Note: 1. Standard color of knob is black.
2. In case of using the combination of model 46HD, please specify the shaft length of model 46HD as 25mm. (Standard shaft length of model 46HD is 28mm.).

●Special Specifications Available

Knob in white color, Specially marked in face plate such as with a decimal point, comma, etc., DA dial without lock device.

How to mount DA Series



The mounting adaptor of Model DA Series Digital Counting Dial and the Helicalohm pot. are fixed on the panel according to the illustration given left. The shaft of the Helicalohm pot. is turned anticlockwise to its limit and is put into the mounting hole of the dial which was already set at "000". The shaft of the Helicalohm pot. is secured by the screw positioned at the knob of the dial with the attached hexagonal wrench. With this, the mounting is completed.

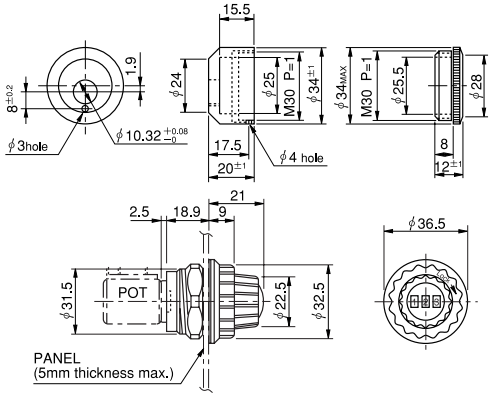
CAUTION:
Do not rotate the fixing screw over 180°with the hexagonal wrench when removing Helicalohm pot. from Model DA Series Digital Counting Dial. Otherwise, inner neighbouring plastic gear may be damaged.

Recessed Mounting Adaptor

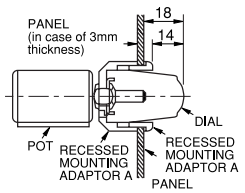
The following 2 kinds of Recessed Mounting Adaptors are available on option in Model DA dial.
When using this recessed mounting adaptor, please place an order for the potentiometer, digital turns-counting dial and recessed mounting adaptor in one set for assembling them at SAKAE and we will be supplied in one unit.

Adaptor A (without lock device)

Adaptor B (with lock device)



How to mount



Note: 1 pc. each of mounting nut and rubber washer are attached.

POTENTIOMETER SPECIFICATIONS

1. Model No.	**22HPM-10E, SDA10-24-6.5 with dust proof special adapter**
2. Mechanism	**Wirewound resistive element, 10 - turn potentiometer with digital multi-turns counting dial (adapter)**

MECHANICAL PERFORMANCES

3. Outer appearance and dimensions	**As per attached drawing No. 242-10504-2**
4. Mechanical rotating angle	**3,600° $^{+10°}_{0°}$**
5. Starting torque	**Below 36mN·m(360gf·cm)[After mounting dial]**
6. Stopper strength	**0.35N·m (3.5kgf·cm)**

ELECTRICAL PERFORMANCES (Specs. of potentiometer)

7. Total resistance value	**2kΩ ±5%**
8. Independent linearity tolerance	**±0.25** %
9. Electrical rotating angle	**3,600° ± 5°**
10. Power rating	**2 W**
11. Noise	**Below 100Ω E. N. R.**
12. Insulation resistance	**Over 1,000 MΩ at 500 V. D. C.**
13. Dielectric strength	**1 minute at 1,000 V. A. C.**
14. Resistance temperature coefficient of wire	**±20 p. p. m. / °C**
15. Terminal connection diagram	**As per attached drawing No. 242-10504-2**

OTHERS

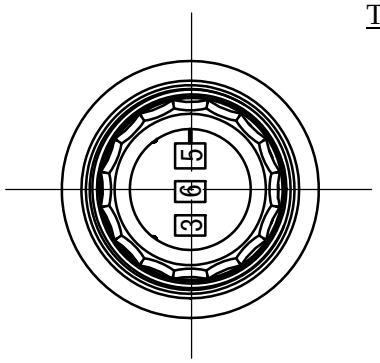
16. Operating temperature range	**−30°C~+85°C**
17. Rotational life expectancy	**1,000,000 shaft revolutions**

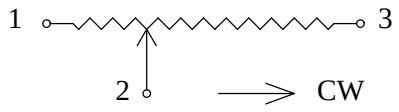
(***This item shows life expectancy shall be based on test conditions under which shaft shall be turned at the speed of 40 r.p.m. in normal room temperature.***)

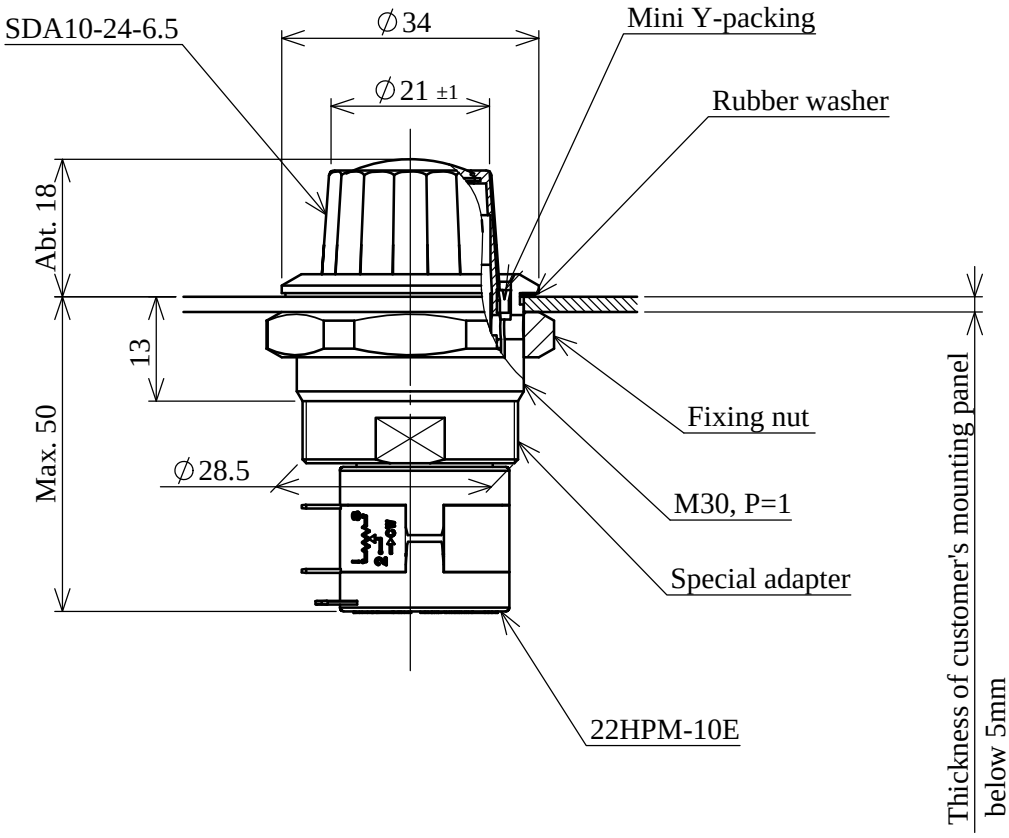
18. SDA10-24-6.5 wit dust proof special adapter

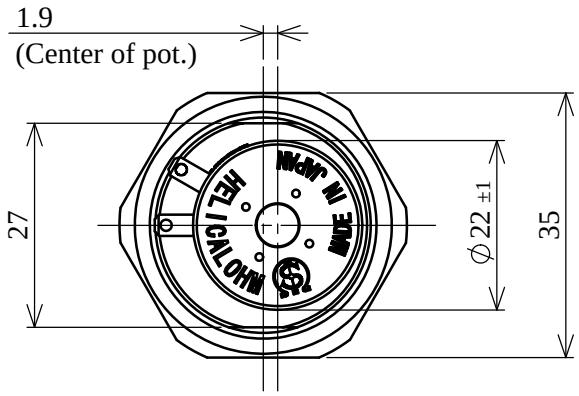
SYM.	DATE	DESCRIPTION	APPD.	DESIGNED	DRAWN	CHECKED	APPROVED	TITLE
				S.R	J.T	M.Y	M.Y	
								MODEL NO. SDA10-24-6.5+22HPM-10E
				DATE DEC. 13, 2013		3RD ANGLE PROJECTION		DWG. NO. 242-10504-1
				SAKAE TSUSHIN KOGYO CO., LTD. KANAGAWA JAPAN				SCALE / NTS. UNITS mm SHEET 1 OF 2

TERMINAL CONNECTION DIAGRAM









SYM.	DATE	DESCRIPTION	APPD.	DESIGNED	DRAWN	CHECKED	APPROVED	TITLE
				S.R	J.T	M.Y	M.Y	
								MODEL NO. SDA10-24-6.5+22HPM-10E
				DATE DEC. 13, 2013		3RD ANGLE PROJECTION		DWG. NO. 242-10504-2
				SAKAE TSUSHIN KOGYO CO., LTD. KANAGAWA JAPAN				SCALE 1 / 1 NTS. UNITS mm SHEET 2 OF 2