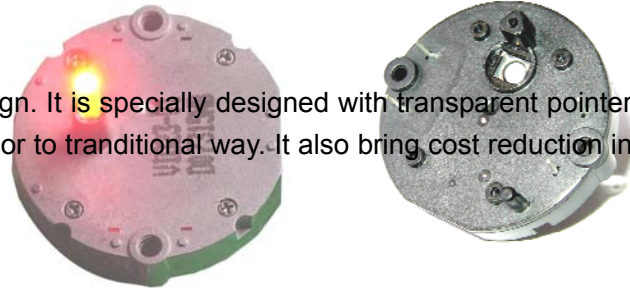


VID23-xx Transparent Shaft Stepper Motor

Description

VID23 - XX

Is a precise stepping motor of patent design. It is specially designed with transparent pointer shaft, pointer lumination intensity is superior to traditional way. It also bring cost reduction in saving number of LEDs.



VID23 - XX

with a gear reduction ratio of 1/180. It's mainly used in dashboard instrumentation or other digital indicator equipments, to transfer digital signals directly and accurately to analog display output.

VID23 - XX

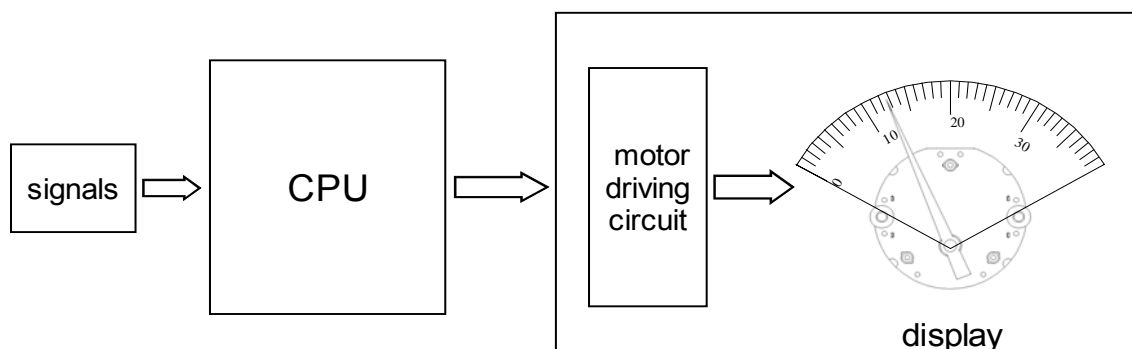
Is driven by 2 sequent logic pulse signals. It can be driven in 3.5V ~ 10V providing shaft stepping angle resolution 1/12°. The pointer can move with a speed more than 400Hz.

The main features are:

- Transparent Pointer Shaft
- Superior illumination intensity
- Compatible with LED PLCC-2 Package
- High speed rotation: 400Hz.
- High μ -step resolution: 1/12°.
- Wide working temperature: - 40 ~ 105°C.
- Low current consumption: less than 20mA, 5V, 2X100mW.
- Extremely robust construction: Φ 30mm X 7.6mm.
- Long lifetime: longtime design for ten work lifetime.



Typical application:

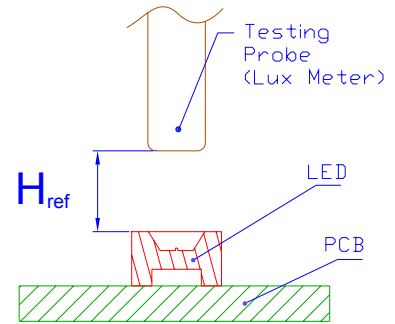


perfect combination of digital accuracy and analog facility

Illumination

Reference Setup

Parameters	Red LED	White LED
H _{ref} (Probe apart from LED surface)	1mm	1mm
Chromaticity Coordinates (x,y)	(0.7,0.27) (630~635nm)	(0.35,0.35)
Luminous Intensity	46,000 Lux	55,000 Lux
Forward voltage	2 V	3.3 V
Forward Current	20mA	20mA
View Angle	120 °	120 °
Package	PLCC-2	PLCC-2



Reference Setup

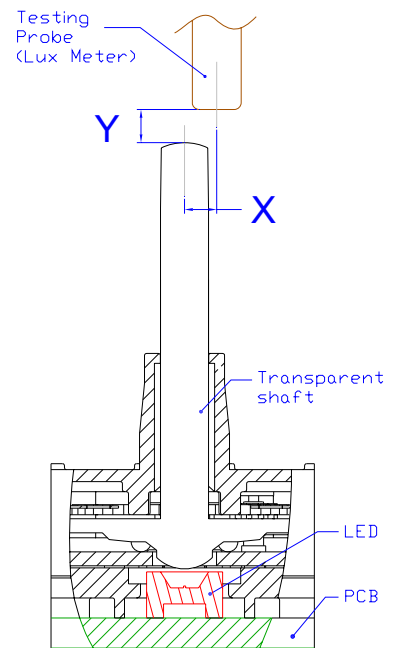
Relative Intensity

Red LED Relative Intensity

Y (mm)	X (mm)			
	0.00	0.25	0.50	0.75
1.40	118%	114%	84%	46%
1.00	146%	134%	94%	48%
0.60	138%	151%	101%	53%

White LED Relative Intensity

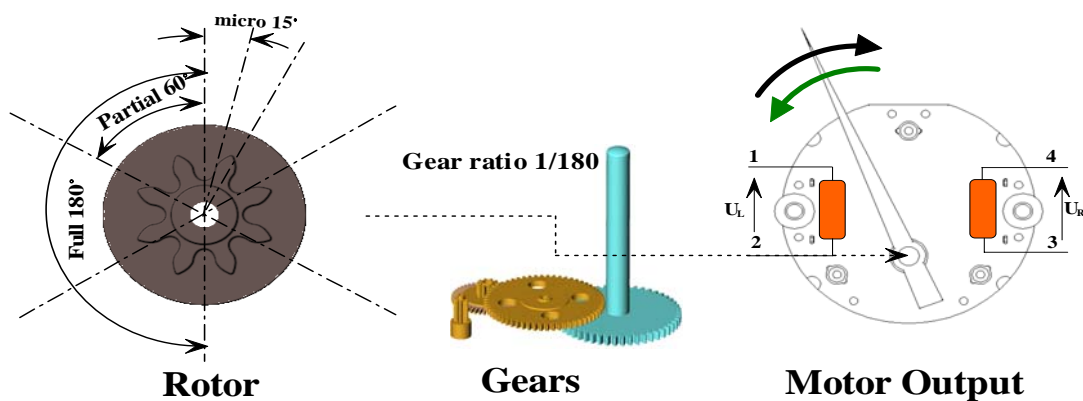
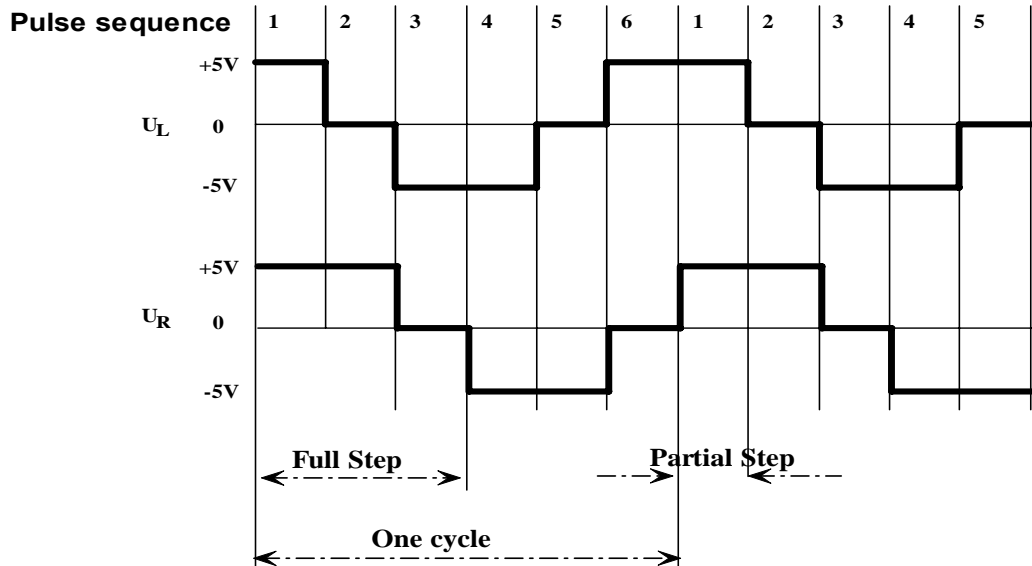
Y (mm)	X (mm)			
	0.00	0.25	0.50	0.75
1.40	94%	93%	78%	54%
1.00	100%	98%	79%	59%
0.60	92%	93%	82%	63%



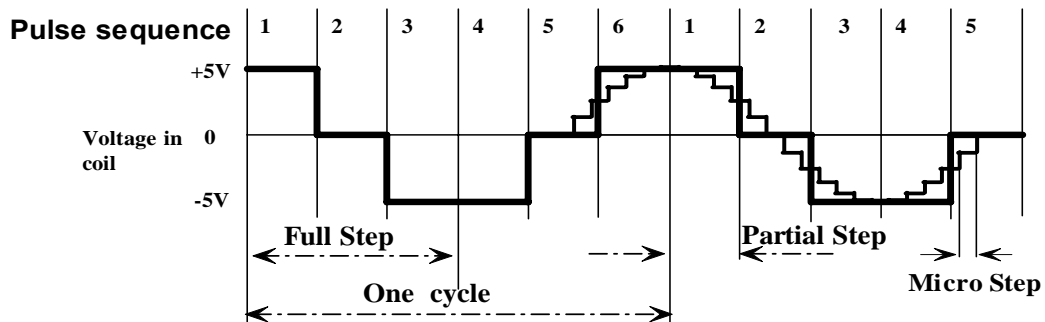
Relative Intensity

Step Definition and Rotor Movement

VID23 - XX series is driven by 2 sequent logic pulse signals and has 3 gears design to construct high efficiency. Its work diagram is as following:



In order to make the motor run more stably and reduce its noise, micro stepping technology is recommended. The micro pulse sequence which is more precise and near to sine wave, which could drive motor with $1/12^\circ$ micro step of the pointer. The diagram is as following:



For more details about the micro stepping driving signals, please see specified files.

Absolute Maximum Ratings

Driving voltage (Ub) 10V
 EMI tolerance (1 kHz;AM 80%; 100 kHz - 2 GHz) 80 V/m
 Soldering temperature (≤ 5 sec) 380°C

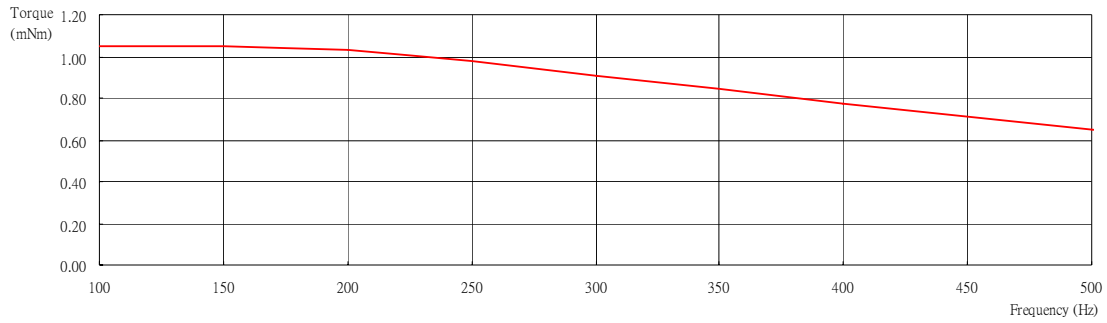
Electrical and Mechanical Characteristics

Symbol Definition : f_a – testing frequency, J_L – testing pointer inertia, Ub – Driving Voltage
 Testing Conditions : $T_{amb}=25^\circ\text{C}$, In micro step mode @ Max. voltage 4.2V, unless other specified.

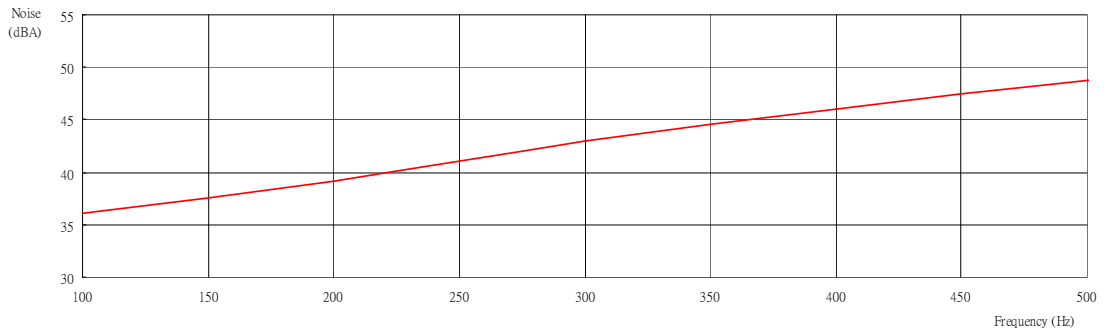
Parameter	Symbol	Test Conditions	Min.	Typ.	Max	Units
Electrical Characteristics						
Operating Temperature	T_a		-40		105	°C
Coil Resistance	R_b		260	280	300	Ω
Operating Current	I_m	$f_a=200\text{Hz}$		15	20	mA
Start-Stop Frequency	f_{ss}	$J_L=0.2 \times 10^{-6} \text{kgm}^2$	125			Hz
Maximum Driving Frequency	f_{mm}	$J_L=0.2 \times 10^{-6} \text{kgm}^2$	400			Hz
Mechanical Characteristics						
Dynamic Torque	M200	$f_a=200\text{Hz}$	08	1.0	1.2	MNm
	M400	$f_a=400\text{Hz}$	0.6	0.7	0.9	mNm
Static Torque	M_s	$U_b=5\text{V}$	3.5	4.5		mNm
Equivalent Motor Inertia @ Output	J_m			4.225 E-7		Kgm^2
Gear ratio				180 :1		
Step size in full step mode				1		Degree
Step size in partial step mode				1/3		Degree
Step size in micro step mode				1/12		Degree
Backlash				0.5	1.0	Degree
Angle of Rotation	f_i	Motors with internal Stop			315	Degree
Noise						
Noise Level	SPL	@ 100 °/sec		34		dBA
		@ 200 °/sec		41		dBA

Typical torque and noise

Dynamic Torque - testing in micro step driving mode, @ Max voltage $U_b = 4.2V$

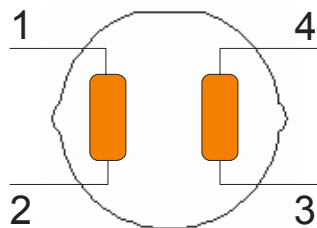


Noise - testing in micro step driving mode, @ Max voltage $U_b = 4.2V$

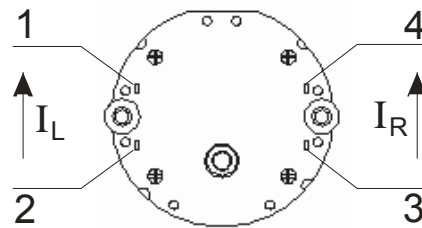


Pin Connection

VID23-03 Series Pin Connection



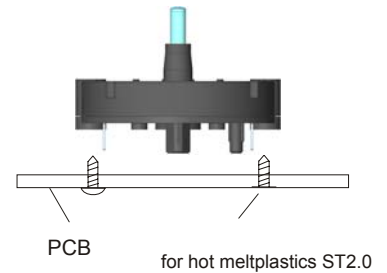
Schematic



Front Mount

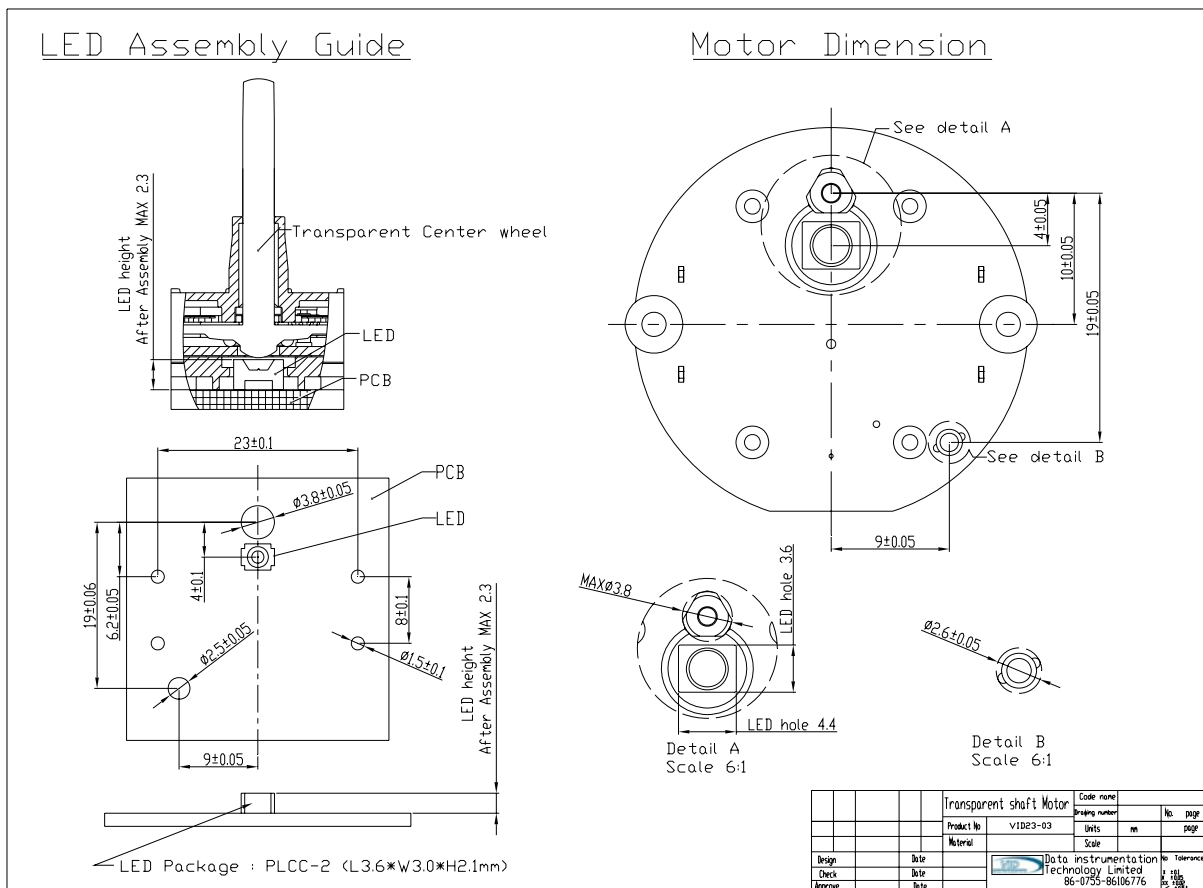
Suggested Installation

The VID23 can be easily installed. The four contact pins can be soldered on PCB circuits. If the application is subject in very strong vibrations, screws might be necessary.



Compatible with LED PLCC-2 Package

The VID23-03 is designed compatible with LED PLCC-2 Package to obtain the optimum light intensity. Light is captured by the lower lens of transparent shaft. VID23-03 motor and LED corresponding position is recommended on the following LED Assembly Guide.



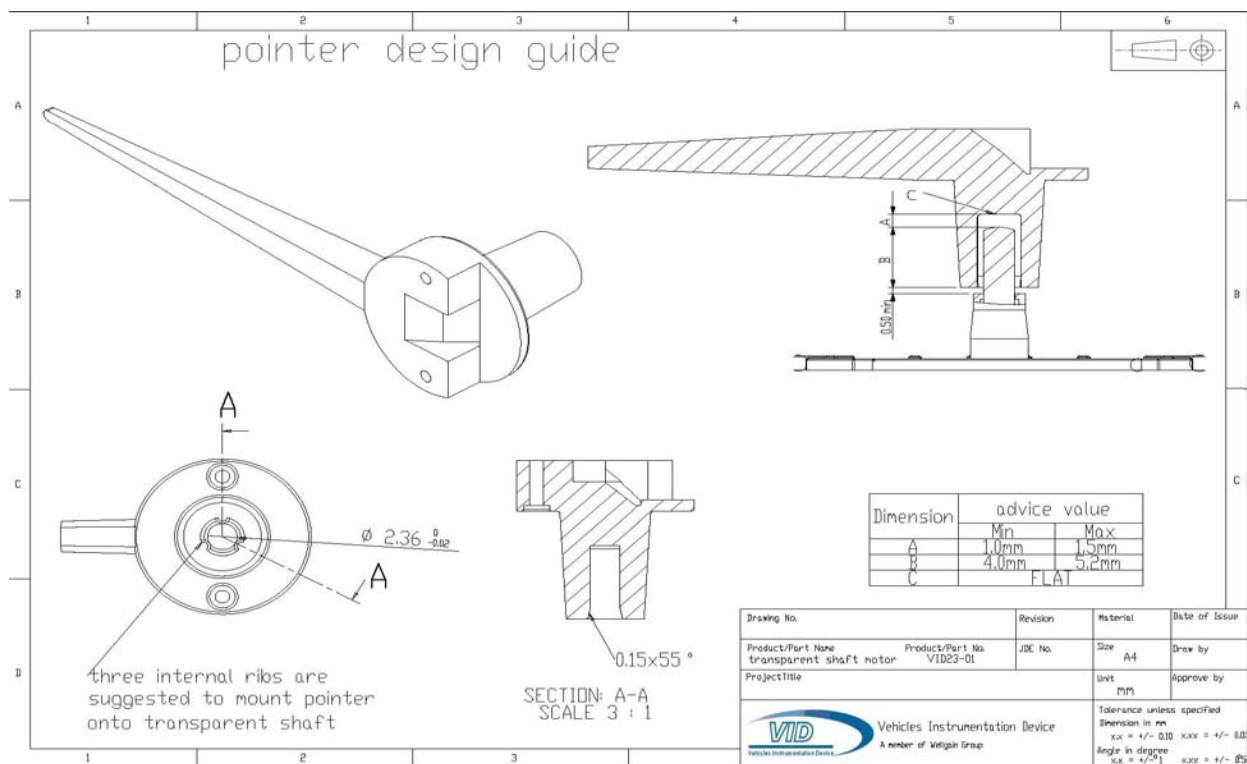
Pointer Design Reference

The parameter of the pointer

	Min	Typical	Suggested MaxValue(*)
Size:		50mm	80mm
Weight:		2.5g	10g
Inertia moment:		$2 \times 10^{-7} \text{ kgm}^2$	$20 \times 10^{-7} \text{ kgm}^2$
Unbalance:		0.01mNm	0.025mNm

Structure Design

Pointer design can influence the final illumination result of VID23-03. Following Pointer Design Guide is recommended to obtain the optimum illumination result.

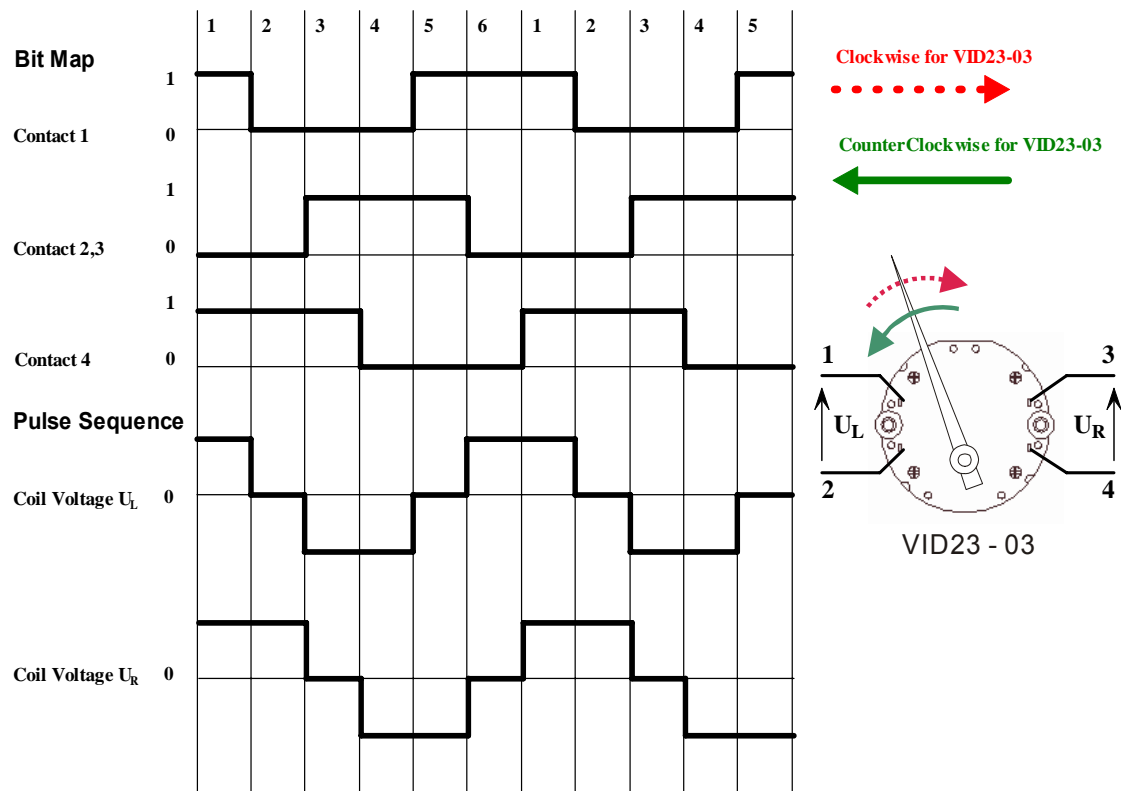


Driving Pulse and Control Circuit

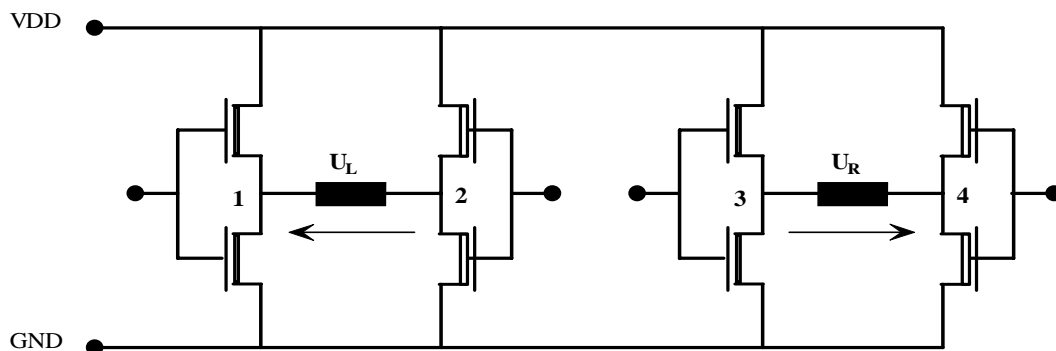
1. Partial-Step Driving Mode

In partial-step driving mode, the motor can be directly driven by a standard logic voltage level with less than 20mA current consumption. The bit-time sequence determines the turning direction of the motor. The time sequence diagram is as following:

Driving Pulse in Partial Mode



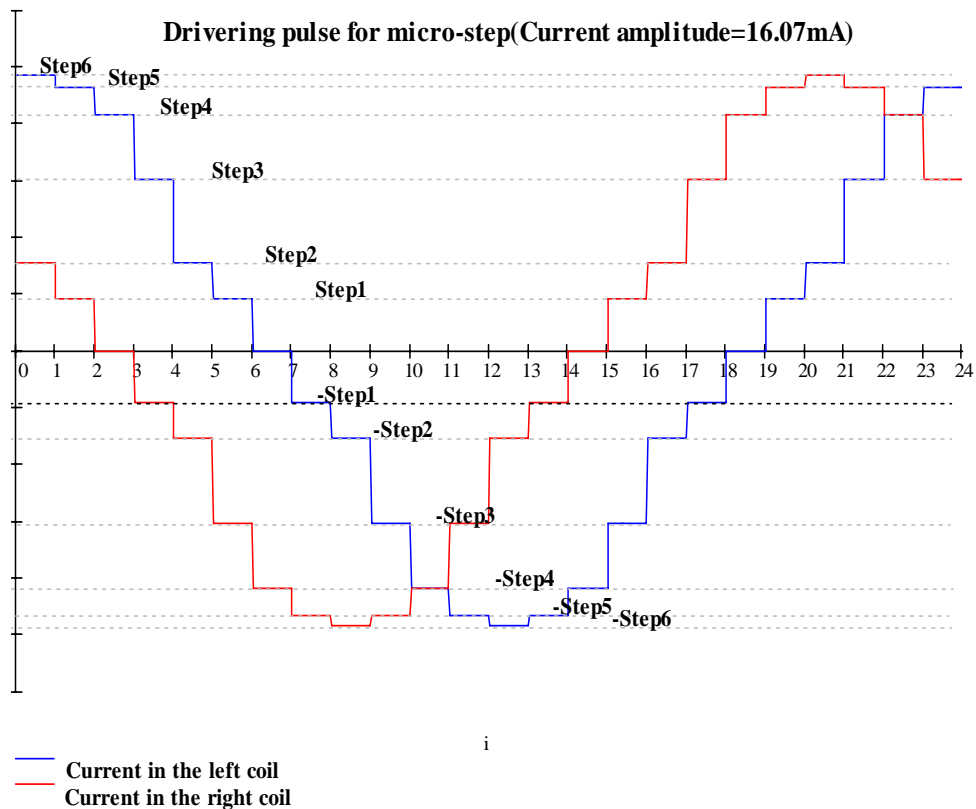
Driving Diagram in Partial Mode



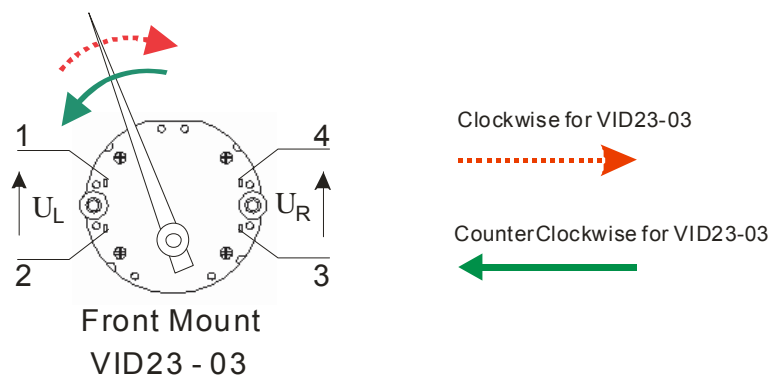
2. μ -Step Driving Mode

In μ -step driving mode, the motor can be driven by a current-level sequence. A μ -step is a 0.083° of pointer. The driving pulses consist of many different current level pulse sequences. The μ -step provides the pointer shaft continuous, smooth movement.

Example of driving Pulses in μ -step Mode



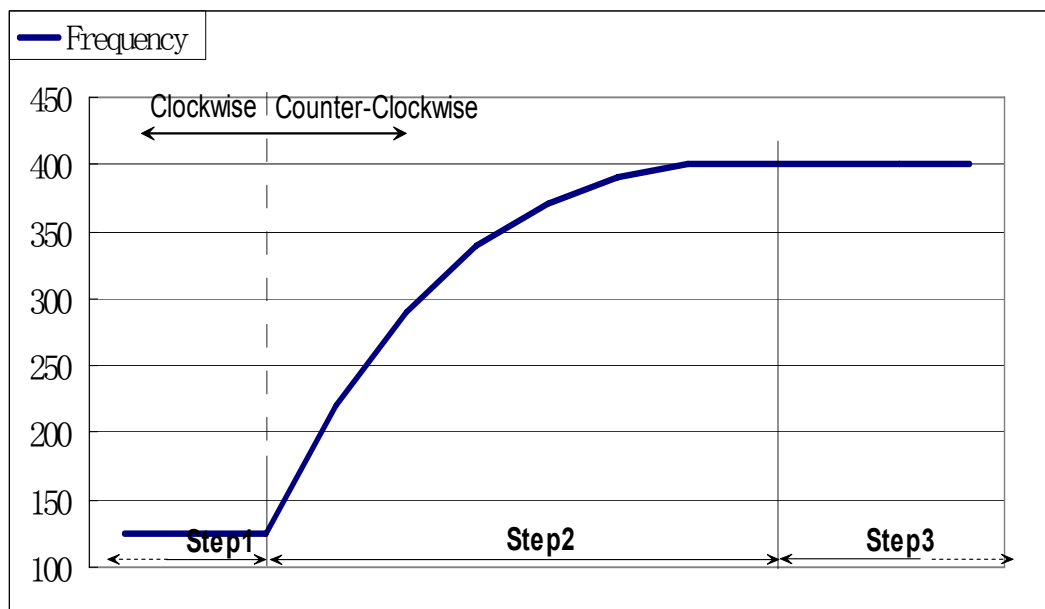
In general, the *peak amplitude* should be between $12.9\text{mA} \geq I_{\text{max.}} \geq 16.07\text{mA}$.



Suggested Reseting Process

In most of the VID23-03 applications, the angular range of the instrument dial is less than 300°. This allows use of a mechanical stop to define the zero position. Generally the pointer will be reset to the zero position at each power-up of the instrument.

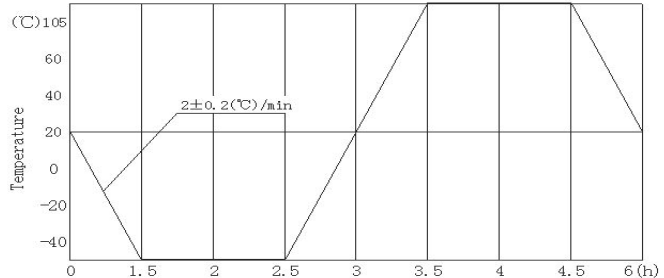
During the power-up of instrument, to bring the pointer at his initial stop position without creating any visible and audible jitter of the pointer, we suggest frequency acceleration process to speed up VID23-03 step motor till a high speed. Below is an example:



Reliability Test

Temperature Cycle Test

- Low Temperature: $-40^{\circ}\text{C}\pm 2^{\circ}\text{C}$
- High Temperature: $+105^{\circ}\text{C}\pm 2^{\circ}\text{C}$
- Dwell time: each for 1 Hrs
- Transfer Time: 1.5 hrs
- Cycle times: 50 cycles total 300hrs
- Cycle mode: see right graph..
- Motor Status: running
- Reference standard: IEC60068-2-1



Thermal Shock Test

- Low Temperature: $-40^{\circ}\text{C}\pm 2^{\circ}\text{C}$
- High Temperature: $+105^{\circ}\text{C}\pm 2^{\circ}\text{C}$
- Dwell time: each for 0.5hrs
- Transfer Time: within 30s
- Cycle:100 Cycles total 100hrs
- Motor Status: non-running
- Reference standard: IEC60068-2-14.

High Temperature Test

- Temperature: $+105^{\circ}\text{C}\pm 2^{\circ}\text{C}$
- Duration:168 Hrs
- Motor Status: running
- Reference standard: IEC60068-2-2.

Low Temperature Test

- Temperature: $-40^{\circ}\text{C}\pm 2^{\circ}\text{C}$
- Duration: 48 Hrs
- Motor Status: running
- Reference standard: IEC60068-2-1.

Humidity Test

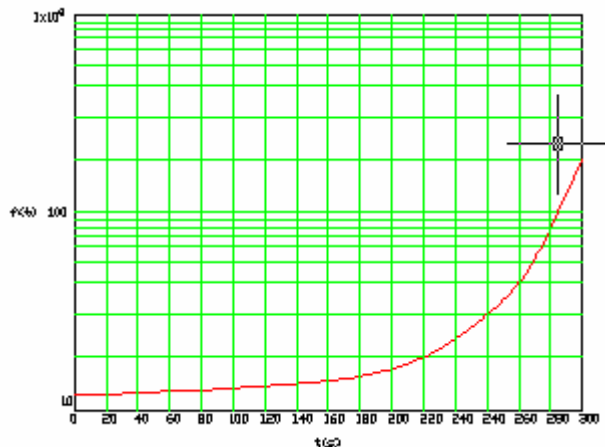
- Temperature: $+65^{\circ}\text{C}\pm 2^{\circ}\text{C}$
- Humidity: $95\pm 2\%$ RH
- Duration:144 Hrs
- Motor Status: non-running
- Reference standard: IEC68-2-3.

Mechanical Shocking Test

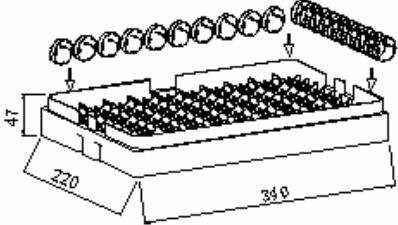
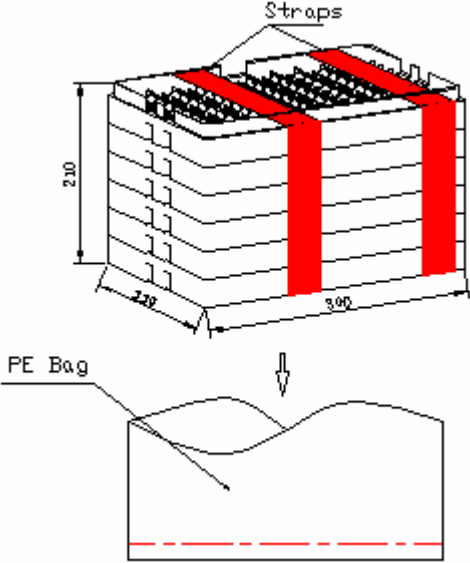
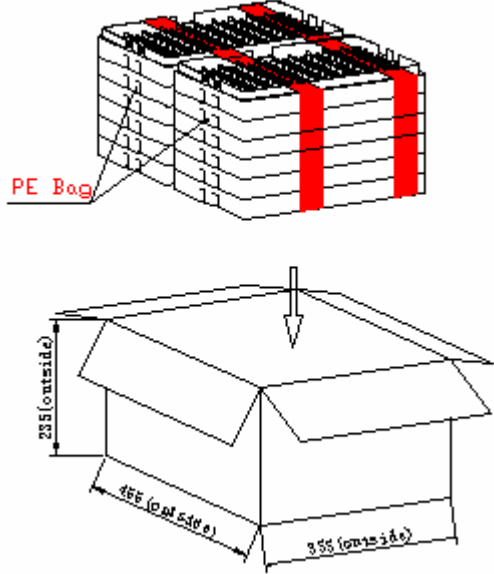
- Height: 1.2 m
- Direction: X/Y
- Motor Status: non-running
- Reference standard: IEC68-2-62

Mechanical Vibration Test

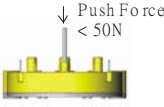
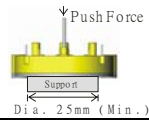
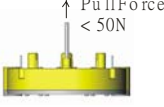
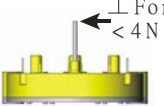
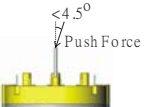
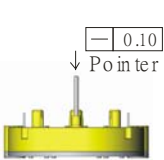
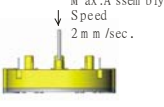
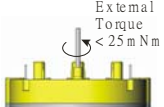
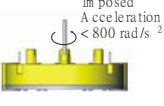
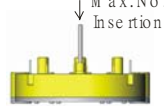
- Pulse shape: sine pulse form
- Range of frequency: 5Hz~200Hz(logarithm sweep)
- Sweep cycle: 300 sec.
- Direction: X,Y axis
- Duration:8 hrs /each Direction
- Acceleration: 6 g
- Motor Status: running
- Reference standard: IEC68-2-6



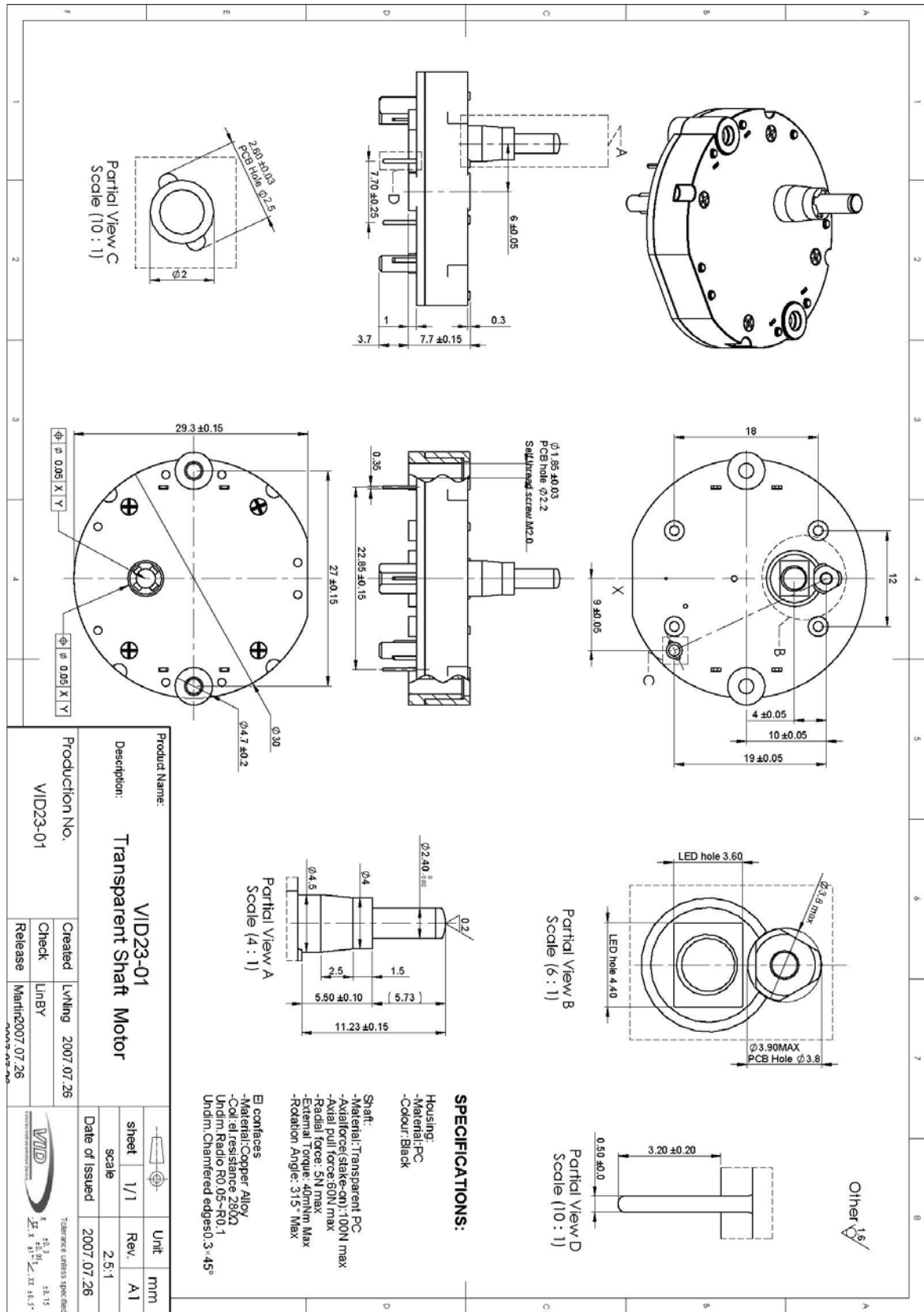
Packing Sketch Map

<p>Tray for 100 stepper motor VID23-XX :</p> <p>Material : PP</p> <p>Weight : Tray 1x210g=210g Motors 100x7g=700g Total = 910g</p>	
<p>Stack for 500 motors VID23-XX :</p> <p>Material : 6 Trays (including Cover) strapped together with plastic band</p> <p>Weight : Trays 5x910g=4550g Cover tray 1x210g=210g Plastic strap 2x15g=30g Total = 4790g</p>	
<p>Master-carton for 1000 motors VID23-XX :</p> <p>Material : cardboard 710g/m2</p> <p>Weight : Master-carton 1x820g=820g PE bag 2x50g=100g Stacks 2x4790g=9580g Total = 10500g</p>	

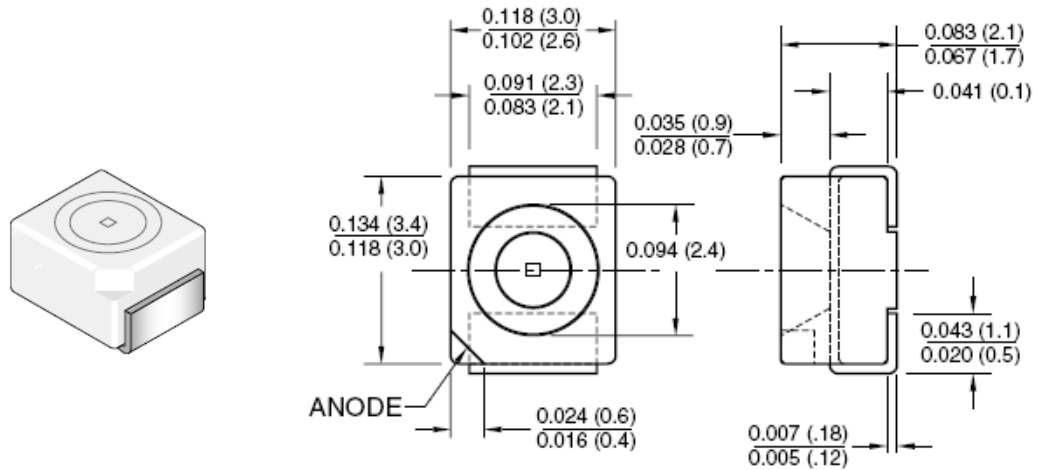
VID23-xx Limits and Precaution of Pointer Assembly

Description	Diagram	Specification		Possible problems when over limit	Remarks
		Limit	Unit		
Maximum Push On Force		50 max.	N	Wire damaged/ Wire broken/ Gear damage/ Abnormal Noise	Proper fixing motor on PCB. Proper supporting during assembly.
Minimum Assembly Support		Dia. 25 min.	mm	Wire damaged/ Wire broken/ Gear damage/ Abnormal Noise	Concrete base support should be located within +/- 1.0mm concentricity to the motor.
Maximum Pull Out Force		50 max.	N	Wire damaged/ Wire broken/ Gear damage/ Abnormal Noise/	Repetitive push & pull force should also be avoided. This could deform gear and shaf.
Maximum Perpendicular Force		4 max.	N	Output shaft bend/ Non-concentric rotation	Excess perpendicular force should be avoided to bend the shaft.
Maximum Force Inclination		4.5 max.	degree	Output shaft bend/ Non-concentric rotation	Excess inclination of applied force should be avoided to bend the shaft.
Maximum Pointer Straightness Deviation		0.10 max.	mm	Output shaft bend/ Non-concentric rotation of output shaft.	Pointer straightness should be maintained within 0.1mm during assembly. Excess inclination could induce excess perpendicular force and bend the shaft.
Maximum Assembly Speed		2 max.	mm/sec	Gear damage/ Gear & shaft deform	Excess assembly speed could induce excess force on gears.
Maximum External Torque		25 max.	mNm	Gear damage/ Gear & shaft deform / Stopper damage (360 Degree Rotate)	Excess external torque (>25 mNm) applied on shaft would damage stopper , gear and shaft. Repetitive external torque, even less than 25mNm, could also induce gears and shaft deformation, it should be avoided. Zero reset should be done before assembly, then pointer is assembled while pointing to zero. Zero reset manually should be avoided..
Maximum Imposed Acceleration		800 max.	rad/s ²	Gear damage	Excessive imposed acceleration would induce excessive force on gears, it must be avoided.
Maximum Number of Pointer Insertion		1 max.	time	Pointer loose out from pointer shaft / Pointer loose out from pointer shaft when temperature changes	Repetitive assembly and disassembly pointer would cause pointer shaft surface wearing. It induce loose matching between pointer and pointer shaft.

VID23-xx Outside Dimension



LED PLCC-2 Package Reference



Chromaticity Coordinates

