VID69 Car Clock Motor

DESCREIPTION

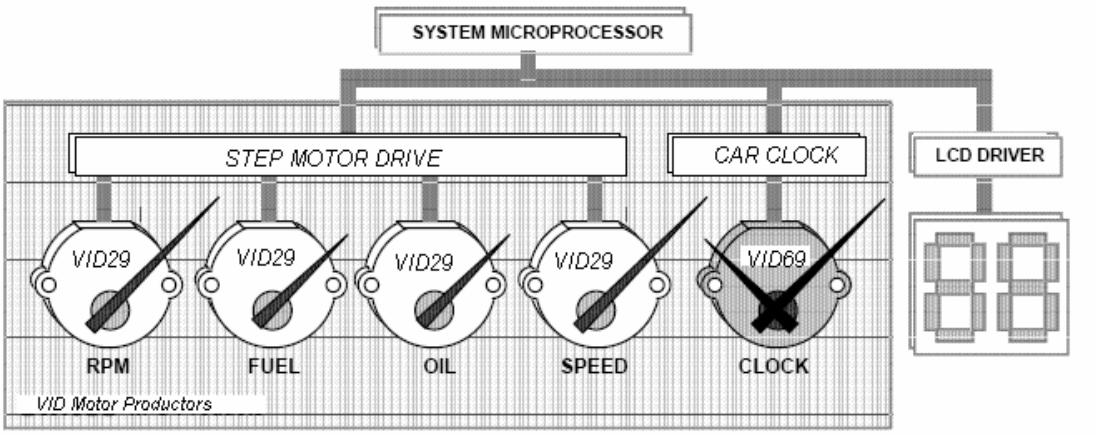
VID69 Car Clock Stepper Motor is a precision stepping motor design, with reduction gear ratio 1/60 for minute shaft and 1/12 for hour shaft, mainly used in automotive instrumentation or other equipments, to display time. VID69 stepper motor can be driven by 2 sequent logic pulse signals in partial step mode with 3.5V ~ 10V power.

The 6 step gears design constructs high efficiency, high position accuracy and extremely robust gear system. special gear shape and selected materials for each component are helpful to decrease mechanical friction and noise, enhance product liability.

FEATURES

- Wide working voltage: 3.5~10V.
- Wide working temperature: -40~105℃.
- Low current consumption: 18mA, 5V, 2X90mW.
- Small dimension: Φ30mm X 8.3mm.
- Directly driven by a μ-controller.
- Large static torque.
- Qualified for automotive applications.

TYPICAL APPLICATION



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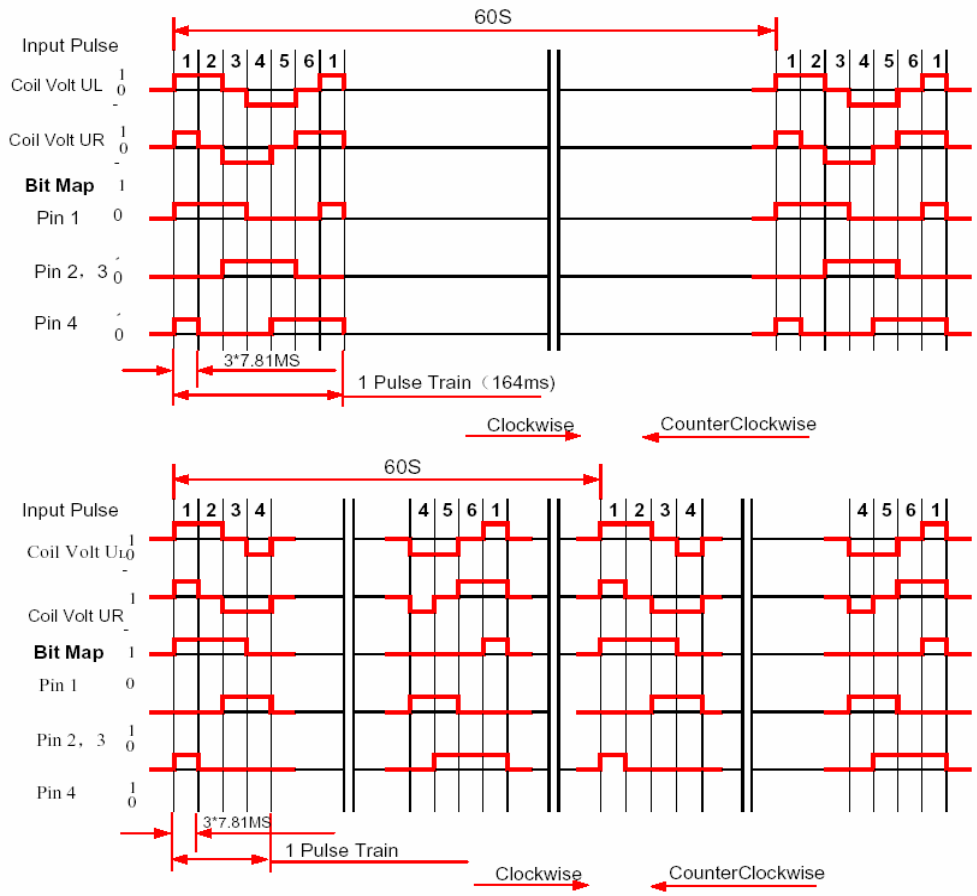
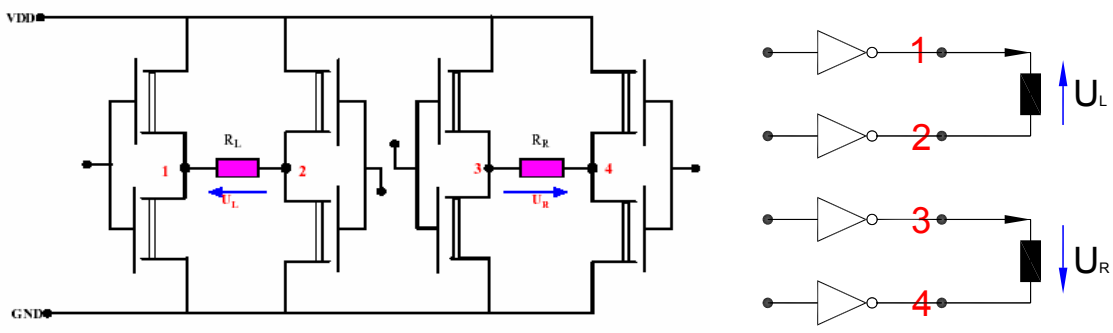
DRIVER PULSE AND CONTROL CIRCUIT

VID69 motor can be directly driven by a standard logic voltage level with 18mA current output capacity in partial-step driving mode. Each pulse can make 60° revolution of rotor (minute shaft rotate 1°). The bit-time sequence determines the turning direction of the motor. If the input pulse of coil voltage U_L prior to the one of U_R, VID-69XXP series clock motor will rotate clockwise, while VID-69XX series clock motor will rotate counterclockwise .The time sequence diagram is as following:



Driving control circuit of partial step mode



ABSOLUTE MAXIMUM VALUES

Parameter	Symbol	Conditions
Driving Voltage	U_b	10V
ESD Tolerance	U_{ESD}	10000V
EMI Tolerance (1 kHz;AM 80%; 100 kHz - 2 GHz)	E	80V/m
Storage Temperature	T_{stg}	95ºC
Solder Temperature(≤ 5 sec)	T_s	380ºC

ELECTRICAL AND MECHANICAL CHARACTERISTICS

Symbol Definition : fa – full-step testing frequency, Ub – Driving Voltage

T_{amb}=25ºC, in partial step mode @ Max. voltage 5V, unless other specified.

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Operating Temperature	T_a		-40		105	ºC
Coil Resistance	R_b		235	260	285	Ω
Operating Peak Current	I_m	f_a=16Hz(50º/s)		19.3	21.3	mA
Dynamic Torque	M50 M200	f_a=16Hz(50º/s) f_a=66Hz(200º/s)	0.4	0.5 0.4		mNm
Static Torque	M_s M_0	U_b=5V U_b=0V	1 0.16	1.2 0.25		mNm
Gear Play				±0.5	±1	Degree
Noise Level	SPL	Back ground:35dBA f_a =16Hz		40	50	dBA

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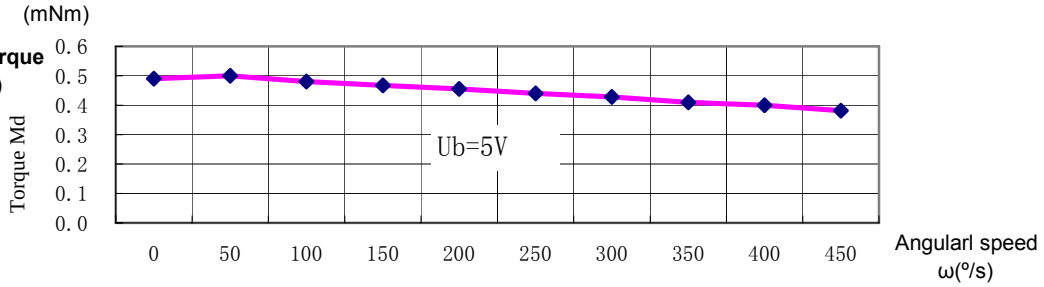
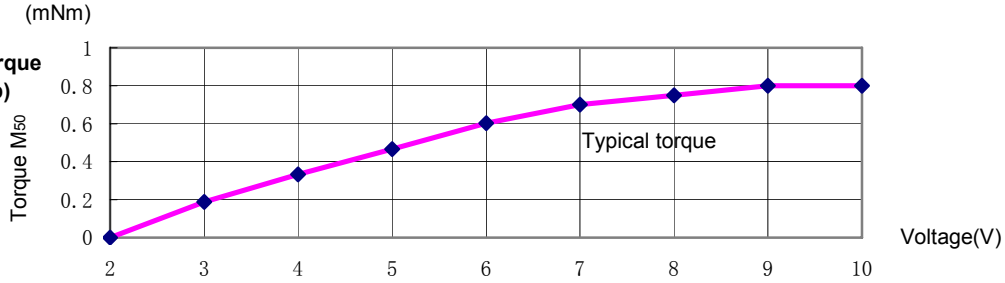
TYPICAL PERFORMANCE CHARACTER OF CLOCK

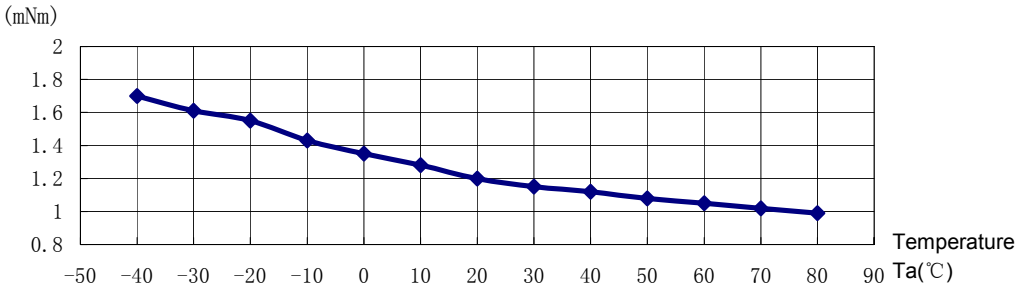
Dynamic Torque
Md=f(ω)



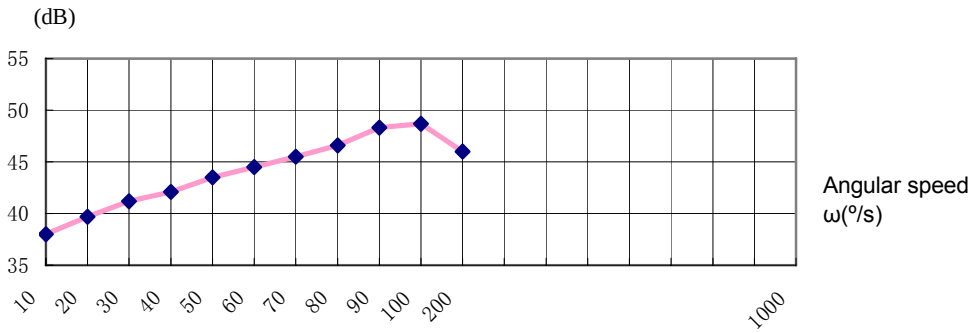
Dynamic Torque
M50=f(Ub)



Static Torque
Ms=f(Ta)



Sound Emission
SPL=f(ω)



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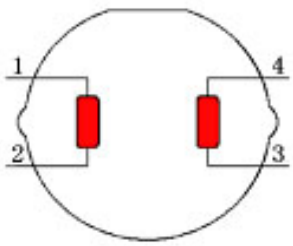
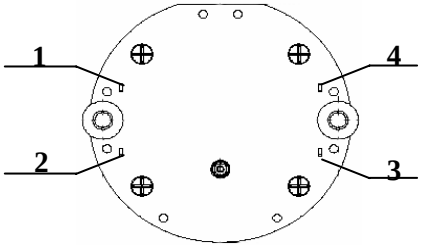
PIN CONNECTION DEFINITION

VID69-XX PIN CONNECTION

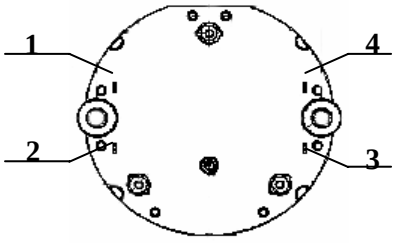
Schematic



VID69-02

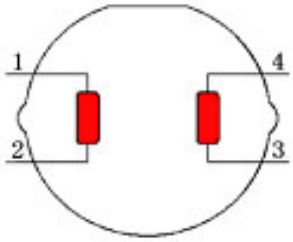


VID69-05

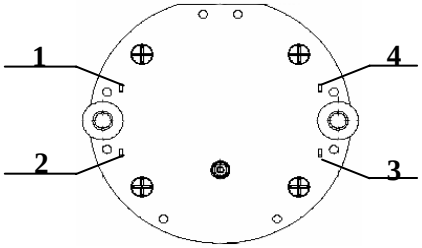


VID69-XXP PIN CONNECTION

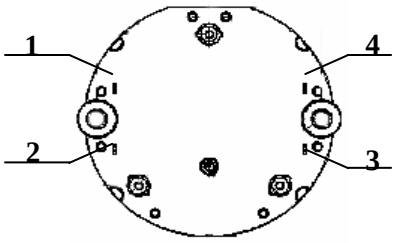
Schematic



VID69-02(P)

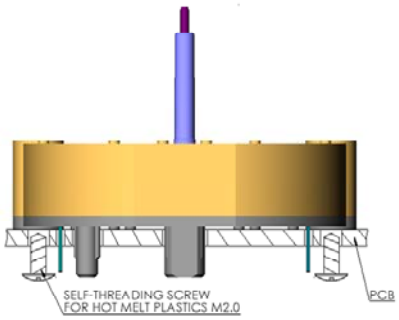


VID69-05(P)



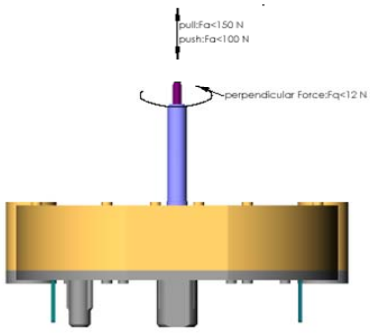
INSTALLATION

The VID69 can be easily installed. The four contact pins can be soldered on PCB circuits. If the application is subject to very strong vibrations, screws might be necessary.



ASSEMBLING POINTER ON SHAFTS

The pointers assembly on the minute shaft and protrusion of the hour wheel are usually done in the factory. All operations should be done carefully within the values of forces (***Fa*** and ***Fq***). During the assembly of pointers, the rotor has to be in a static position.



Caution:

The axial force including pull force and push force can not exceed the values as shown in next figure. The perpendicular force is also. Excessive acceleration should not be imposed onto the pointer shaft (minute shaft and hour shaft). A resistless concussion on the mounting pointer might damage the gear or gear assembly, or even cause permanent damage to Clock motor.

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CONTROL CIRCUIT (VK11, VK12)

VK11 chip is a clock driver designed for VID69-XX (without built-in PCB) clock motors.VK12 chip is a clock driver designed for VID69-XXP clock motors. In normal operating mode a pulse train is sent to the motor every 60 seconds to obtain a 6° rotation of clock minute shaft. Two push-buttons are put to correct the time in both directions. A calibration circuit allows to adjust the Quartz in the range of ± 50 ppm, this assures an accuracy of less than ± 1 s per Month at 25°C.

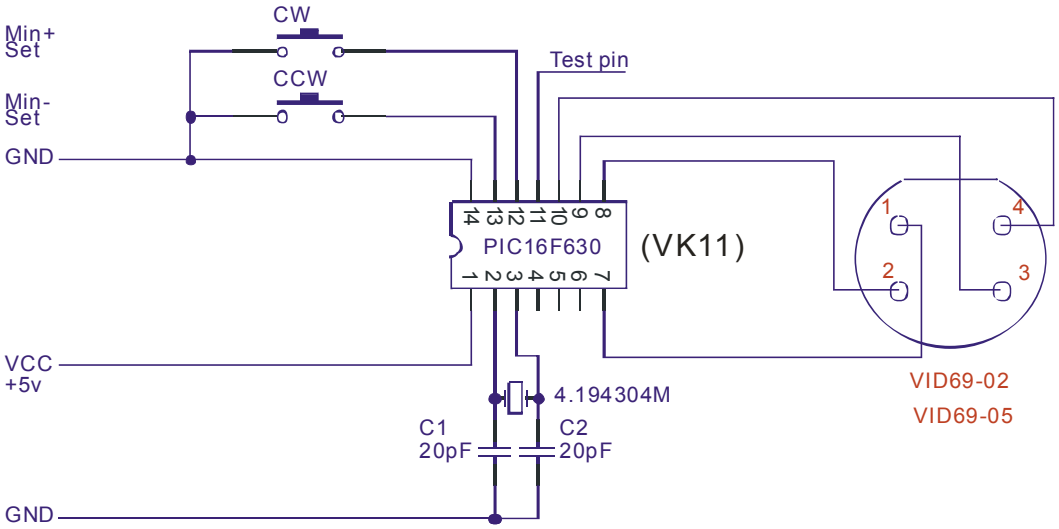

Fig. 1 Schematic for VK11 and VID69-02, VID69-05

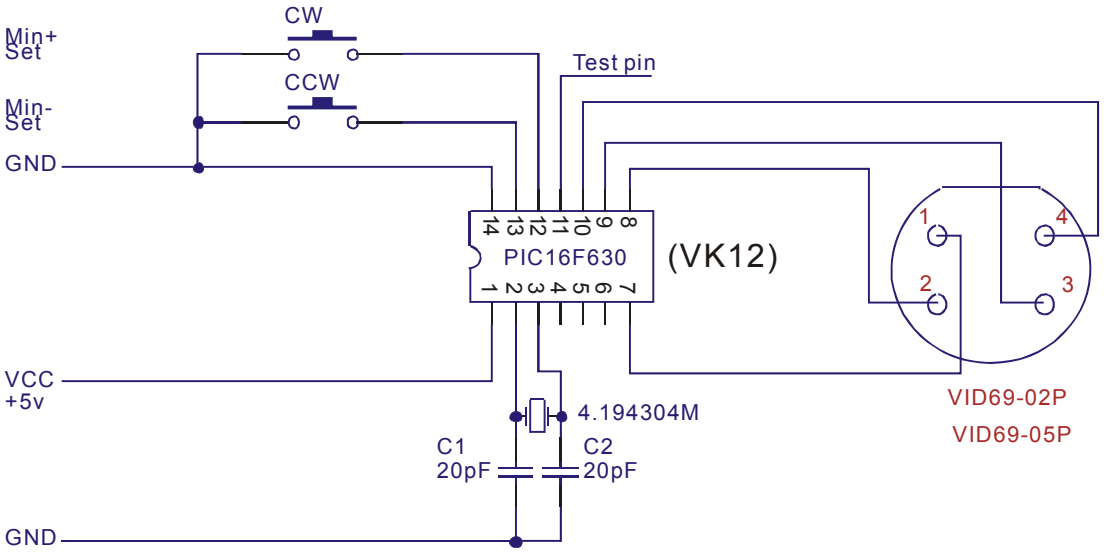

Fig. 2 Schematic for VK12 and VID69-02P,VID69-05P

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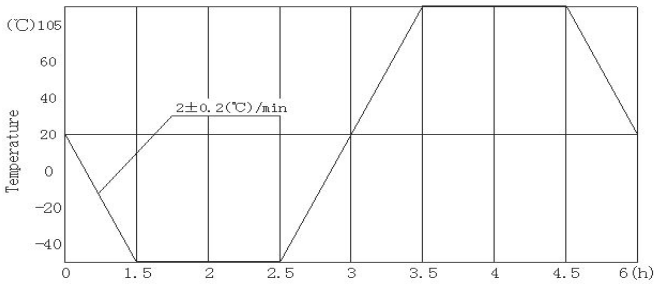
RELIABILITY TEST

Temperature Cycle Test

- Low Temperature: -40°C±2°C
- High Temperature: +105°C±2°C
- Dwell time: each for 1 Hrs
- Transfer Time: 1 hrs
- Cycle times: 50 times
- Cycle mode: see right graph..
- Motor Status: running
- Reference standard: IEC60068-2-14.



Thermal Shock Test

- Low Temperature: -40°C±2°C
- High Temperature: +105°C±2°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.

Humidity Test

- Temperature:+65°C±2°C
- Humidity:95±2%RH
- Duration:144 Hrs
- Motor Status: non-running
- Reference standard: IEC68-2-3.

High Temperature Test

- Temperature: +105°C±2°C
- Duration:168 Hrs
- Motor Status: running
- Reference standard: IEC60068-2-2.

Low Temperature Test

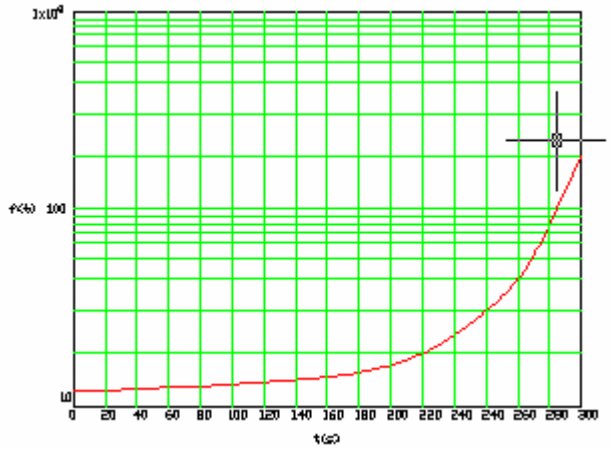
- Temperature: -40°C±2°C
- Duration: 48 Hrs
- Motor Status: running
- Reference standard: IEC60068-2-1.

Life Test

- Running Time :176Hrs
- Environment Temperature:20-25°C
- Running Estate: f_a=16Hz(50º/s)

Mechanical Vibration Test

- Pulse shape: sine pulse form
- Range of frequency: 5Hz～200Hz(logarithm sweep)
- Sweep cycle: 315 sec.
- Direction: X,Y axis
- Duration:8 hrs /each Direction
- Acceleration: 6 g
- Motor Status: running
- Reference standard: IEC68-2-6



Mechanical Shocking Test

- Height: 1 m
- Direction: X/Y
- Motor Status: non-running
- Reference standard: IEC68-2-62
- Load: natural load

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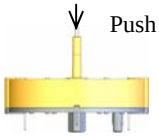
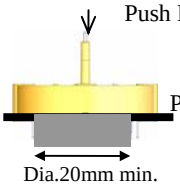
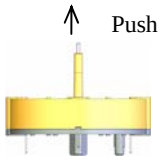
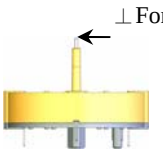
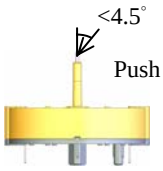
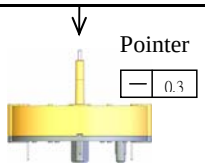
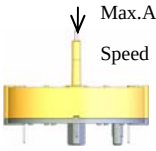
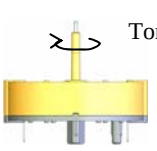
VID69 Precaution of Clock Hands Assembly

Description	Diagram	Specification Limit			Possible problems when over limit	Remarks
		Metal Shaft	Outer Shaft	Unit		
Maximum Push On Force		<100	<60	N	Wire damaged/ Wirebroken/ Gear damage/ Abnormal Noise/ Gear & shaft mounting is damaged	Proper fixing motor on PCB. Proper supporting during assembly.
Minimum Assembly Support		Dia. 20 min.		mm	Wire damaged/ Wire broken/ Gear damage/ Abnormal Noise/ Gear & shaft mounting is damaged	Concrete base support should be located within +/- 0.5mm concentricity to the motor
Maximum Pull Out Force		<70	<60	N	Wire damaged/ Wire broken/ Gear damage/ Abnormal Noise/ Gear & shaft overmoulding damage/ Low pull out force	Repetivitive push & pull force should also be avoided. This could weaken overmoulding force between gear and shaft, then it induce low pull out foce.
Maximum Perpendicular Force		5		N	Output shaft bend/ Non-concentric rotation of output shaft	Excess perpendicular force should be avoided to bend the shaft.
Maximum Force Inclination		< 4.5		degree	Output shaft bend/ Non-concentric rotation of output shaft	Excess inclination of applied force should be avoided to bend the shaft.
Maximum Pointer Straightness Deviation		0.3		mm	Output shaft bend/ Non-concentric rotation of output shaft	Assembly force should be maintained within 0.3mm straightness. Excess inclined assembly force could induce excess perpendicular force and bend the shaft.
Maximum Assembly Speed		2	1.5	mm/sec	Gear damage/ Gear & shaft mounting is damaged	Excess assembly speed could induce excess force on gears.
Maximum External Torque		<40	<35	mNm	Gear damage/ Gear & shaft overmoulding damage / Low pull out force / Stopper damage (360 Degree Rotate)	Excess external torque (> 40 mNm) applied on shaft would weaken overmoulding force between gear and shaft. It induce low pull out force.Repetivtive external torque, even less than 40mNm, could also damage the overmoulding force, it should be avoided.

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