

SUM-40

OPERATING MANUAL

DYNAMIC STRUCTURES AND MATERIALS, LLC
REV. 171011



Please review the following points for both personal and equipment safety while operating the SUM-40 motor.

HIGH ENERGY/VOLTAGE WARNINGS

DO NOT attempt to open the SUM-40 motor. High voltages exist in the internal power circuitry, and may persist for some time with the power removed.



OPERATING AND SERVICES PRECAUTIONS

Operate the motor in an environment free of flammable gases or fumes. Do not attempt to open, modify, or repair the motor in any way. There are no user-serviceable parts inside the SUM-40 motor. Contact DSM for service and repair assistance.

INCLUDED POWER SUPPLY INFORMATION

Your SUM-40 may include an optional power supply module to convert AC (line) power into the 12 V/1.5 A power required for the SUM-40 to operate. If your order includes a separate power supply, please refer to manufacturer documentation for safety information before using it to power your SUM-40 motor.

If you are using the Mean Well MDR-20-12, use the outputs labeled “+V” and “-V” as your +12 V and GND connections, respectively. See the table below for more information on the SUM-40 connector pinout.

Introduction

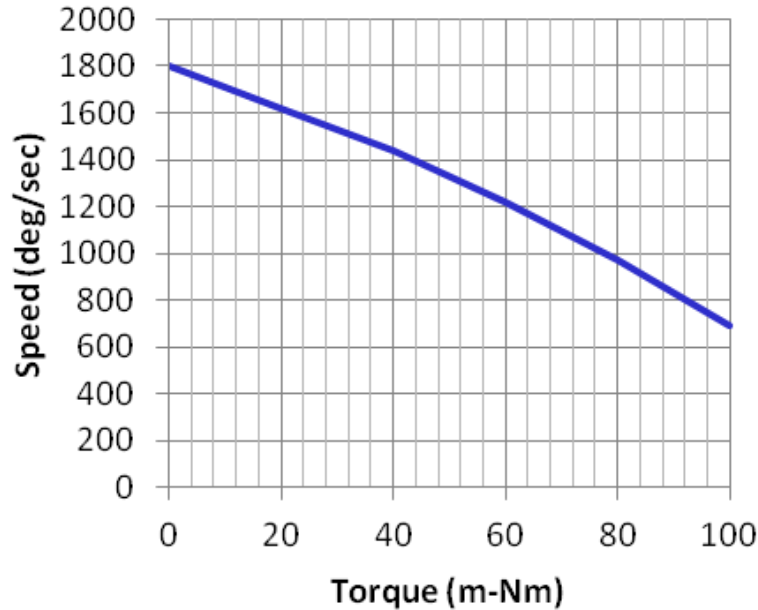
The SUM-40 is an all-in-one motor and controller system featuring high-resolution closed-loop control, zero-power hold, high direct drive torque, and quiet operation. The SUM-40 only needs an external power supply and a communications connection to operate; no external feedback devices are required. This document describes the setup and operating specifications of the SUM-40 motor. A separate document (“SUM-40 Communication Protocol”) describes how to communicate with the SUM-40 from a host. Note that the RS-232 level is full voltage and is not TTL compatible. A level converter must be used to connect the RS-232 port to a microcontroller.

Specifications

Property	Value	Notes
Mechanical		
Mounting pattern	3.4mm through holes on 31mm square	<i>NEMA 17 hole pattern</i>
Output shaft diameter	4 mm	<i>With flat</i>
Output shaft length	11 mm	<i>Nominal length</i>
Overall size	40 mm x 40 mm x 34.4 mm	
Mass	82 g	
Operating temperature	-10 C – 55 C	
Shaft maximum radial load	20 N	
Shaft maximum axial load	20 N away from motor, 10 N towards motor	
Performance		
Maximum speed	1800 deg/sec	<i>No load</i>
Maximum torque @ 700 deg/sec	100 mNm	<i>See torque-speed information below</i>
Zero power hold torque	140 mNm	
Feedback type	Optical encoder	
Feedback resolution	46,592 counts/rev 0.0077 counts/degree 130 μ rad	
Range of motion	Continuous	
Backlash	Zero	<i>System is direct drive with no gearing</i>
Lifetime	2000 hours	
Electrical/communications		
Input voltage	12 V	
Required power (max)	12 W	
Idle power	<1 W	
Baud rate	921600	

Torque-speed performance

The SUM-40 uses a unique internal drive mechanism that features high direct drive torque and true zero-power hold. The motor does not have a traditional “stall torque” in that the maximum torque does not increase linearly as the max speed goes to zero. The full torque-speed plot is shown below.



External torque loads above 100 mNm should not be applied to the system, as this may cause backdriving. Backdriving the motor may reduce the overall life of the motor. A backdriving load is distinguished from a frictional load in that a backdriving load attempts to cause motion on the motor output shaft, whereas a frictional load simply resists motion on the motor output shaft.

Temperature limitations

The SUM-40 motor is designed as a precision positioning device. As such, it is not capable of running at a 100% duty cycle. An internal temperature sensor in the control electronics monitors the internal device temperature, and will not allow operation if the internal temperature exceeds 80 C. The external case does not have an integrated temperature sensor, but should not be allowed to exceed 55 C. Refer to the programming documentation for information on querying the internal temperature of the SUM-40. Many factors determine the temperature of the SUM-40, including duty cycle, mounting conditions, torque load, and external environmental temperature. The maximum duty cycle for a particular application is best determined experimentally by monitoring the internal and external temperature of the SUM-40 during operation in a representative environment.

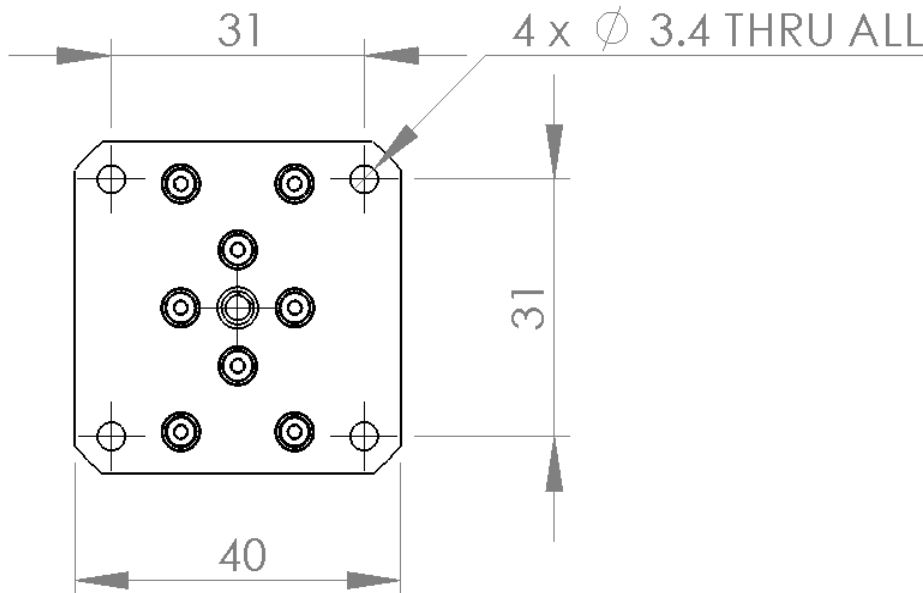
The table below gives approximate maximum continuous run-times at various rotation speeds for an unmounted SUM-40. The table assumes no load operation. This data is provided for reference only, and should not be considered as a specification. Actual run times before cooling down must be determined in a specific application.

Motor speed (deg/sec)	Max continuous runtime (minutes)
100	10
400	7
800	6
1200	5

Connections and installation

The motor mounts via four 3.4mm clearance holes arranged in a 31 mm pattern. These clearance holes can be used with either M3 or #4 screws. The output is a 4 mm diameter D-profile shaft extending approximately 11.2 mm out of the face of the motor. DSM recommends the use of flexible shaft couplers when installing the motor to avoid placing off-axis loads onto the motor output shaft.

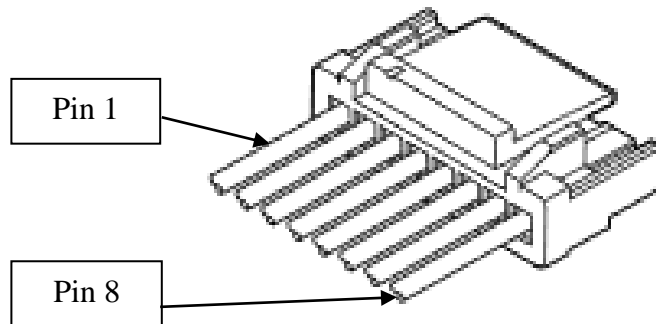
The motor has an internal bearing capable of supporting up to 20 N pulling away from the motor or 10 N pushing into the motor. The bearing can also support a maximum of 20 N of radial load applied to the tip of the output shaft. Motor performance may be degraded slightly when fully loaded in this way. DSM recommends isolating the SUM-40 motor with external bearings and couplers designed for correcting shaft misalignments.



The SUM-40 motor has two connections on it; one multi-function connector, and one USB type C connector. The multi-function connector has one digital input, one digital output, RS-232 connections, a 12 V input, and a Ground connection. The USB type C connector is for communication only. The SUM-40 must be powered by the multi-function connector, but communication is possible either by the RS-232 pins on the multi-function connector or the USB type C connector.

The multi-function connector on the SUM-40 mates with a GHR-08V-S connector. DSM includes one such connector with flying lead wires with the purchase of each SUM-40 motor. The pinout of this connector is given below.

Pin number	Color	Function	Notes
1,2	Red	+12 V/1.5 A Power In	Both pins should be connected together to the 12 V power supply.
3,4	Black	Ground	Both ground pins should be connected together.
5	Blue	SUM-40 RS-232 Rx	Messages are sent TO the SUM-40 on this pin.
6	Purple	SUM-40 RS-232 Tx	Messages are sent FROM the SUM-40 on this pin.
7	Orange	Digital Input (0-12V)	Contact DSM for customization options.
8	Yellow	Digital Output (0-12 V)	Contact DSM for customization options.



On the GHR-08V-S connector, the pins are numbered such that with the disconnect tab facing UP, pin number 1 is on the far LEFT of the connector.

For more information on communicating with the SUM-40, refer to the “SUM-40 Communication Protocol” document. That document includes command methods and specific commands used to control the SUM-40.