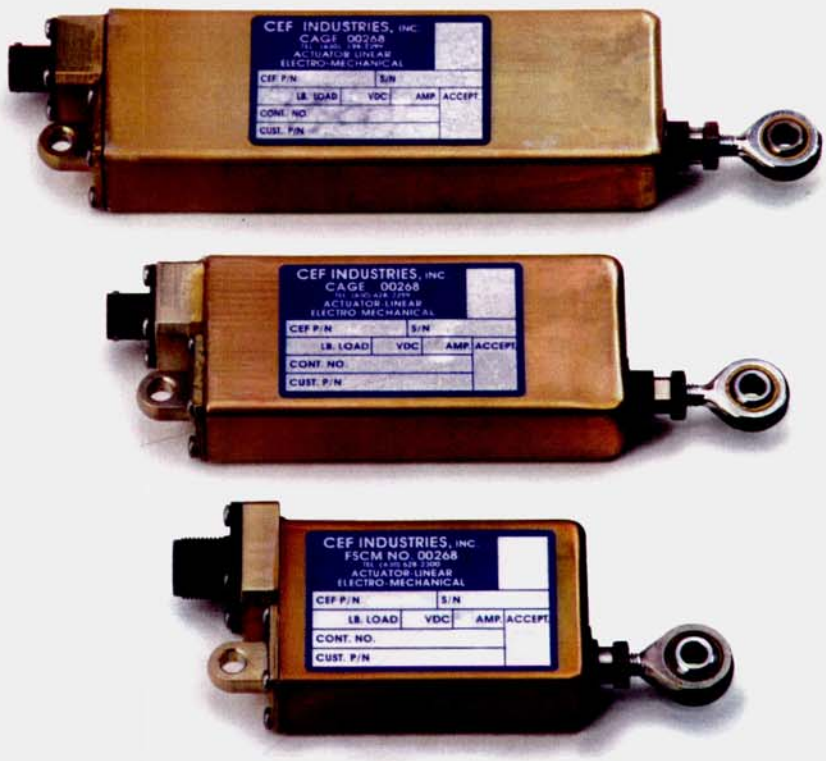
ACTUATORS

MODEL 20
LINEAR ACTUATOR

Small, reliable, lightweight and versatile.



Applications

- *Aircraft utility actuation*
- *Rotor-wing and fixed-wing trim-tab actuation*
- *Ground based vehicle utility actuation*
- *Bomb rack safety lockout*
- *Industrial automation*
- *Robotics*

Design Features and Benefits

- ***Operating temperature range: -67°F to +160°F (-55°C to +71°C)***
  Suitable for extreme environmental conditions
- ***EMI, RFI Tested***
  Aerospace qualified
- ***Solid state (electrical) limit switches***
  Accurate, repeatable extended and retracted positions (with indication)
- ***Non-jamming mechanical stops***
  Protects system from overtravel
- ***Optional electrical interfaces and mounting configuration***
  Adaptable to customer installation constraints
- ***Each unit functionally tested***
  Assured performance

CEF Industries is an Aerospace qualified manufacturing company including marketing/sales, customer service, design engineering, assembly and test and customer support.

Our experience spans fifty years of designing and building of electromechanical products and systems to customer specifications. Capabilities include flap, gear and utility actuation, pumps/compressors for potable water and avionics cooling, gearboxes for actuation drive systems and electronic controls as well as low cost license manufacturing and build to print support.

One result has been a series of high performance electromechanical actuation products each designed, qualified, produced, tested and delivered to meet the unique applications specified by our customers.

We now offer this capability in a new line of standard actuators – the Model 20. Each Model 20 employs the same basic components in a modular design approach that spans a stroke/speed/load operating envelope – making it easy and affordable for the customer to select a model that matches the application. This data sheet has been developed to enable the customer to specify a Model 20 Actuator that best fits the application. Should the application fall outside the performance envelope of the Model 20, we encourage the customer to consult CEF Applications Engineering.

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ISO9001 Registered with conformance to AS9100

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NOTE ON ORDERING

In order to properly select an actuator, we suggest the customer review the Model 20 operational description presented below. Once these are understood, a specific model can be created using the Model Number Selection Chart on page 6.
We encourage you to contact CEF Applications Engineering with any questions or should your specific requirements fall outside the performance charts.

Model 20 Operational Description

Basic Elements of Construction
The Model 20 converts the torque and speed of an electric motor to linear motion. Three main components are involved:

1. Electric Motor
2. Gearing (Gears & Screw)
3. Power and Command

Electric Motor

The Model 20 employs a commercial-off-the-shelf, 28VDC, permanent magnet, fractional horsepower motor. This motor was chosen for its optimal performance and cost over the envelope specified. Motor speed and therefore rate of linear movement will vary as a function of voltage (and load). All Model 20 actuator performance charts are based upon 28VDC input.

Gear Set and Screw

Motor rotational torque and speed are converted to linear force and speed using a gear reduction set and acme screw. For a given voltage, Model 20 output shaft linear speed and operating load carrying capability will be determined by the gear set ratio, screw lead and their mechanical efficiencies.

By selecting different combinations, a range of standard performance curves can be generated. The performance envelope shown for the Model 20 (Chart 1) was bounded by maximum motor efficiency and specific application constraints such as limit loads on the output shaft.

Power and Command

Application of 28VDC to pin A relative to common (pin C) will initiate actuator extension (Reference Interface Schematic, Figure 3). Upon full extension, power to the motor is internally cut off, stopping motion. Removal of 28VDC from pin A and applying it to pin B will cause retraction. Annunciation is available in two options. Reference Schematic B and C in Figure 2. Select the desired interface and corresponding connector as indicated in the Model Number Selection Chart.

Speed/Operating Load

Actuator output shaft speed and load carrying capability are inversely related. For a given voltage, motor, gear/screw reduction set and system mechanical efficiencies, an actuator's output speed/load performance can be plotted. Due to variation in mechanical efficiencies from one actuator to another, the performance is really a series of curves resulting in an envelope of capability.

The Model 20 uses six (6) spur gear and acme screw combinations: three (3) single and three (3) double-lead screws.

Model 20 actuators using single lead screws will not back drive. While double lead screws provide increased speed of linear movement they are susceptible to back drive. If back drive is not desired, consult CEF Applications Engineering for alternative approaches.

The speed/load output performance for each combination is depicted in Chart 1. Select the envelope which covers the speed/load output performance required and enter this in the model number.

Load

Operating load is the load at which the actuator is normally expected to operate and the design load upon which the life and speed requirements of the actuator are generally based.

Structural load limit is the applied load which the actuator will withstand without failure or permanent deformation of a structural member. This is a function of stroke length and is shown in Chart 3.

Back drive

Back drive is the ability of an actuator to be reversed by a load applied to its output end. Generally, the more efficient the gearing/screw combination, the more susceptible that combination is to back drive. While double lead screws are commonly used to provide increased speed of linear movement, they are more susceptible to back drive. If back drive is not desirable, select a single lead screw or consult CEF Applications Engineering.

Braking

Braking can be applied to ensure more accurate positioning, load holding and overall repeatability. The Model 20 employs dynamic braking which removes kinetic energy from the system by shorting the motor. For applications where more accurate extend and retract position limits are required, consult CEF Applications Engineering.

Stroke

Electrical stroke is the working stroke and is determined by limit switch settings. The Model 20 uses Hall sensors as limit switches at either end of the stroke for extend and retract control. Hall sensors are used for their high accuracy and reliability. Electrical stroke is individually calibrated and tested for each unit at the extend and retract positions to within ±0.030 inches for an overall stroke accuracy of ±0.060 inches.

Mechanical stroke is the travel determined by the actuator's mechanical stops which are employed as back-up to the electrical stops. Model 20 mechanical stops are typically positioned 0.090 inches beyond each of the electrical switch positions.

The Model 20 offers electrical stroke ranges from 0.59 inches to 5.00 inches in 0.01 increments. Select the stroke length required and enter this in the model number as shown on the Model Number Selection Chart. Maximum load limits as a function of stroke length are shown in Chart 3.

Refer to Figure 1 for resultant outline dimensional drawings for the stroke range selected.

Repeatability

Repeatability is the ability of the actuator to stop at the same point in its travel each time when de-energized by its limit switches. Model 20 repeatability at no-load is typically 0.005 inches.

Current Draw

Current draw will be a function of mechanical load and the particular gear reduction set chosen to drive it. Chart 2 depicts the maximum current computed for each reduction set.

Duty Cycle

Actuator life will be a function of duty cycle, power input, operating temperature and load conditions. The Model 20 was designed to provide optimal life at a 25% duty cycle, 0.6 amps and 72°F, with a maximum continuous operation less than sixty seconds. For the effects on life in applications beyond this, contact CEF Applications Engineering.

Mount and Output Shaft Fittings

The Model 20 offers optional mount and output shaft fittings. Refer to the Model Number Selection Chart and drawings for details.

End Play

End play is limited to 0.010 inches maximum under a 10 pound reversing load.

Model 20 Qualifications

Power
28VDC nominal, 18-32 VDC operating (Refer to Chart 2 for current draw.)

Environmental Qualification
All Model 20 actuators meet the environmental qualification requirements of MIL-A-85046

Temperature
-67°F to +160°F (-55°C to +71°C)

Vibration
Per MIL-STD-810, Method 514, Procedure I

Shock
Per MIL-STD-810, Method 517, Procedures I & II

EMI/RFI
RFI per MIL-STD-461, paragraphs CE01, RE02 and CE03 (within allowed limitations of 10db from 20-200KHz)

Humidity
Per MIL-STD-810, Method 507, Procedure II

Salt Fog
Per MIL-STD-810, Method 509, Procedure I

Chart 2 - Model 20 Maximum Current Draw

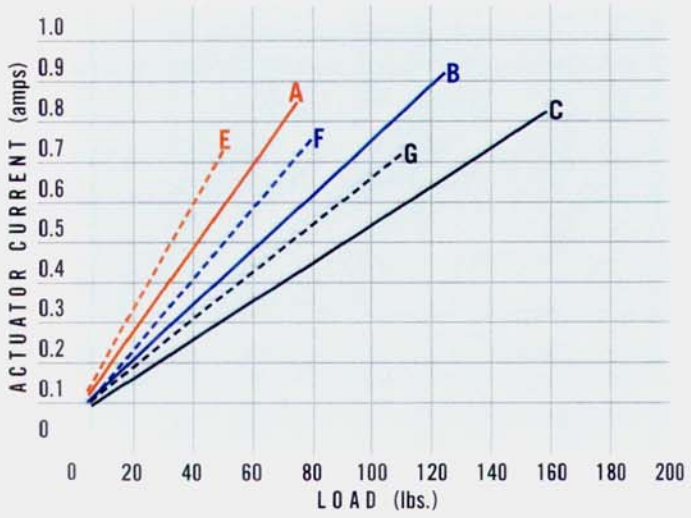
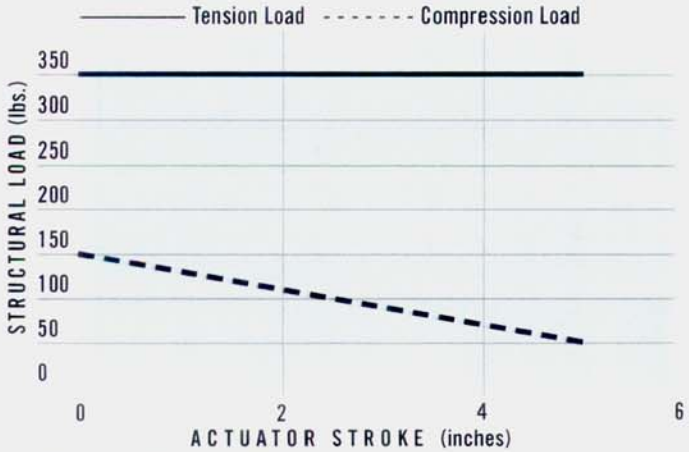


Chart 3 - Model 20 Structural Load



Note: For structural loads exceeding those shown consult CEF Applications Engineering.

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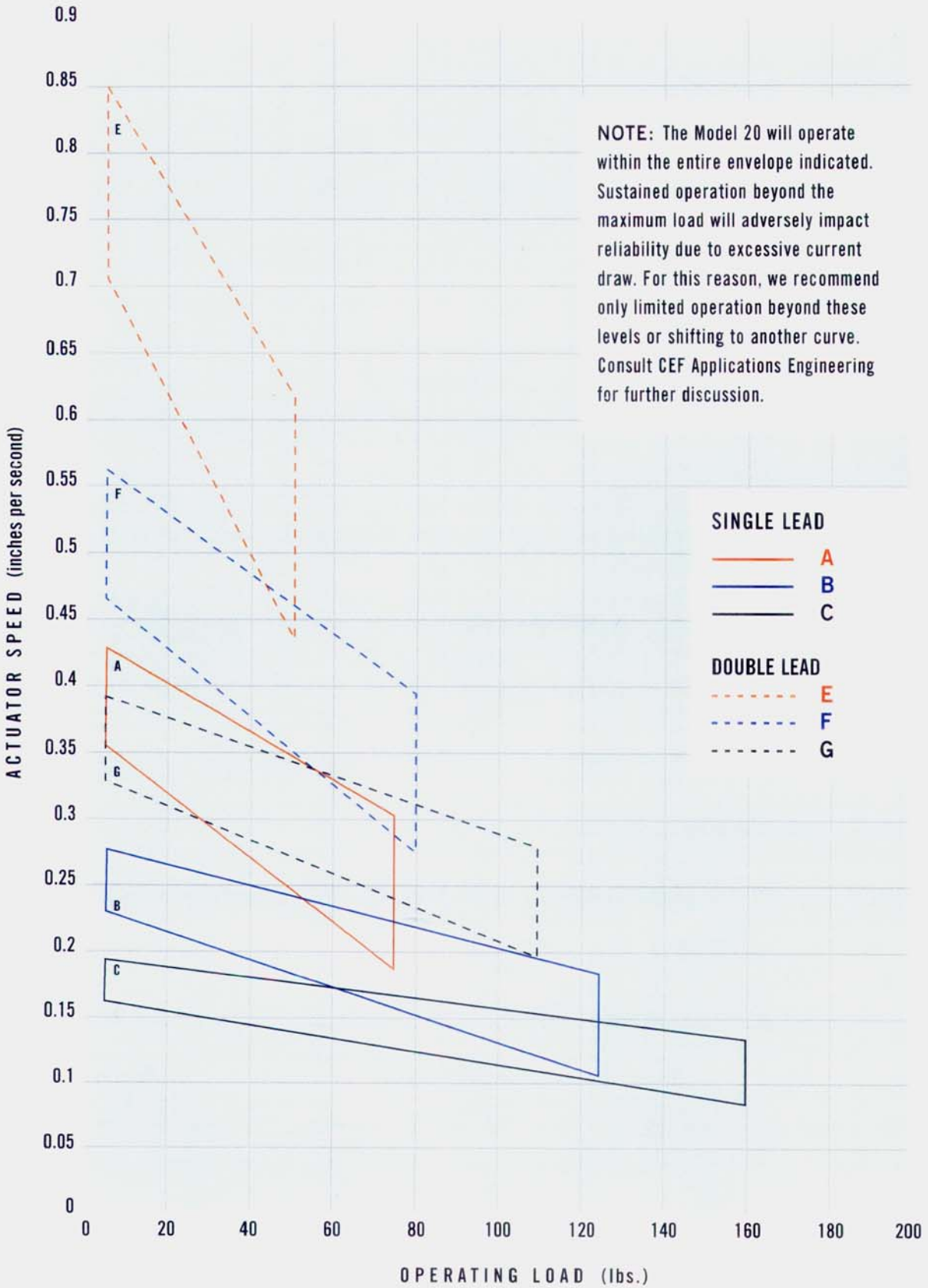
Chart 1 – Model 20 Speed vs. Load Envelope, 28 VDC Standard Ambient Temperature



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NOTE: All dimensions are subject to change. Consult CEF Industries for certified engineering drawings.

DIMENSION A Electrical Stroke Range *(Available in 0.01 Increments)*	DIMENSION B Retracted Length *(Nominal)*	DIMENSION C Case Length *(Nominal)*
Strokes from 0.59 to 0.69	4.58	3.38
Strokes from 0.70 to 1.00	4.89	3.67
Strokes from 1.01 to 2.00	5.89	4.67
Strokes from 2.01 to 3.50	7.39	6.17
Strokes from 3.51 to 5.00	8.89	7.67

Figure 1 – Standard Connector and Rear Attach Fitting

Standard configuration shown, all dimensions in inches.

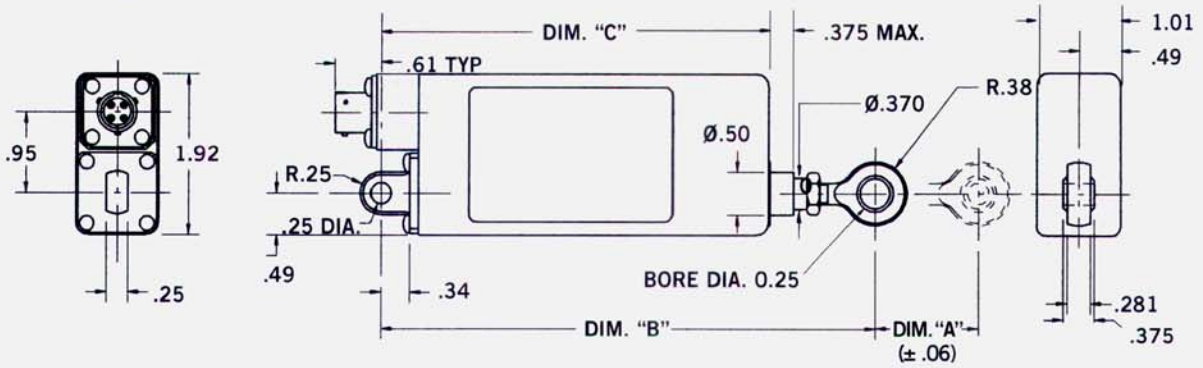
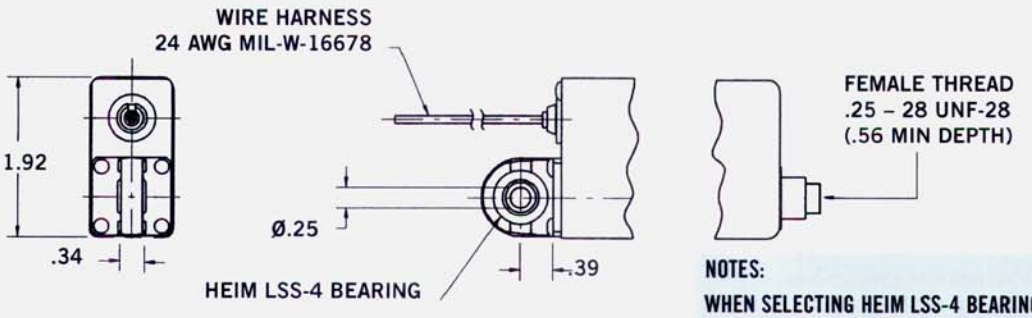
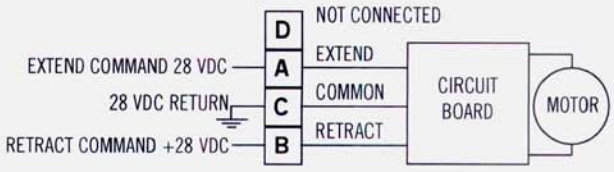


Figure 2 – Optional Connector, Rear Attach Fitting and Output Shaft

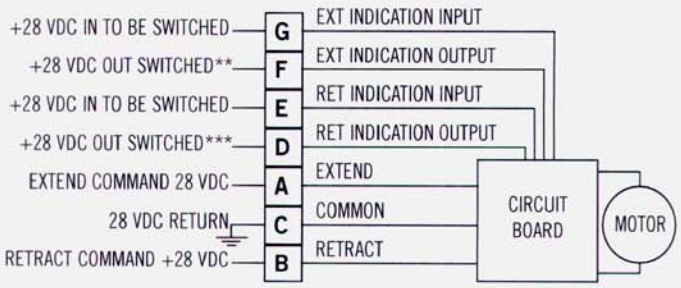


NOTES:
WHEN SELECTING HEIM LSS-4 BEARING ON REAR MOUNT, MUST ADD .05 INCHES TO DIMENSIONS B AND C

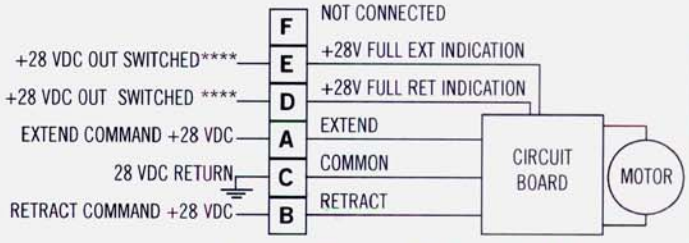
Figure 3 – Interface Schematics



Standard Electrical Schematic A*



Optional Electrical Schematic C*



Optional Electrical Schematic B*

NOTES:
*** ALL VOLTAGES 18 TO 30 VDC (28 VDC NOMINAL)**
**** AT FULL EXTENDED POSITION, 28VDC IN SUPPLIED EXTERNALLY**
***** AT FULL RETRACTED POSITION, 28VDC IN SUPPLIED EXTERNALLY**
****** 28 VDC SUPPLIED BY COMMAND**

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MODEL 20 LINEAR ACTUATOR

Model Number Selection Chart

Base	Stroke	Screw/Gear Reduction Set	Mounting	Output Tube Fitting	Electrical Connector
20	075	C	S	S	A

Stroke (inches) in 0.01 increments

(See Figure 1 for dimensions)

0.59 - 0.69 note 1
0.70 - 1.00 note 1
1.01 - 2.00 note 1
2.01 - 3.50 note 1
3.51 - 5.00 note 1

Screw/Gear Reduction Set

See discussion on speed/operating load.

A
B
C
E note 2
F note 2
G note 2

Mounting

S Standard
H Heim LSS-4 Spherical Bearing

Output Shaft Fitting

S Heim HM-4 Spherical Rod End Bearing
B 0.250-28UNF-2B Female thread (0.45 minimum depth)

Electrical Connector

A MS3112E-8-4P, Schematic A
B MS3112E10-6P, Schematic B
C MS27499E10F99P, Schematic C

Optional, wire harness 24 AWG MIL-W-16678 with silicon varnished fiberglass sleeving (standard length 1 ft.)

D 3 wire
E 5 wire
F 7 wire

Note 1: Structural load limit per Chart 3.
Note 2: Susceptible to back drive under load and/or vibration. Consult CEF Applications Engineering.

Ordering Information

Now that you have familiarized yourself with Model 20 Actuators, we have developed an easy way for you to order. The Model Number Selection Chart takes advantage of the modular design to guide you through the process of establishing a model number.

Reminder

Prior to selecting an actuator, the user must identify ultimate loads present in order to avoid damage. Note that constraints on load/stroke/speed/repeatability combinations arise from material properties of actuator construction. See the discussion of terminology in the Model 20 operational description section. Should your application not fall within the performance envelope indicated, please consult CEF Applications Engineering for a review of your requirement.

Example:

Building a model number for the following Model 20 Actuator

Base: Model 20 – Enter 20
Stroke: 0.75" stroke – Enter 075
Screw Gear Reduction Set: Load & speed requirement associated with Curve E from Chart 1 – Enter E
Mounting: Standard Mounting Scheme – Enter S
Output Shaft Fitting: Heim HM-4 Spherical Rod End Bearing – Enter S
Electrical Connection – Enter A for MS3112E-8-4P

20 075 E S S A

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