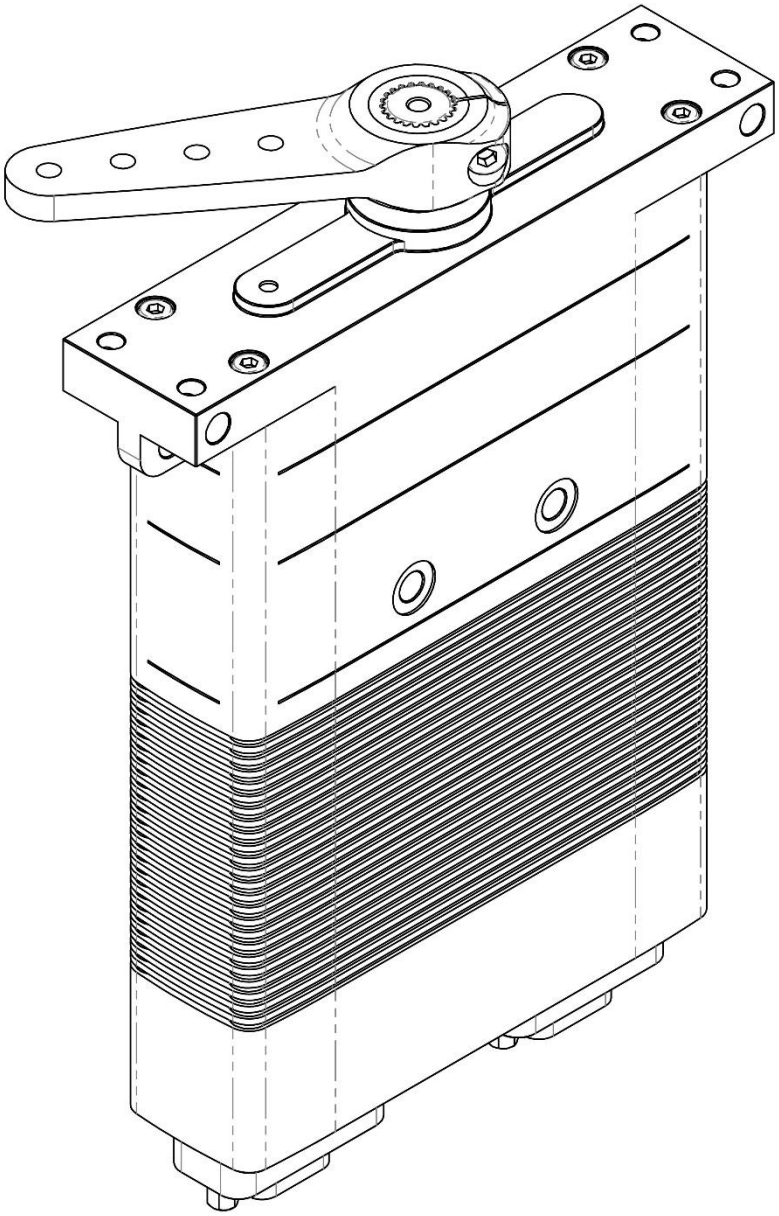
DA 30 Duplex
Technical Specification



DA 30-D-30-5224

Revision: E

Content

1. General Description

The fully redundant DA 30 series has been developed for applications that require a very reliable actuator operation. The redundant – two channel – design of the actuator allows continuing to operate even if one channel of the two channels has failed. All major components such as the electric motors, control and communication electronics and power supply are available twice. The position sensor is even featuring a three channel design (2 out of 3 voting).

1.1 Description of Redundancy Concept

The actuator redundancy concept is based on a so-called “Active-Passive Architecture”. This means that the primary channel of the actuator (communication interface, actuator control electronics, position sensor) is in command of the actuator. Example: The setpoint command is being received by the primary communication interface and will be processed by the primary actuator control electronics (ACE) using the data of the primary position sensor. The result of this processing is used to drive the primary and secondary motor. Therefore, both ACEs are communicating via an internal communication network over which they exchange all required data. Also connected to this network is a voting position sensor. The primary ACE will “hand over” the command to the standby ACE, if a failure is detected. The following failure modes will cause such a failover event:

- Position Sensor Data Mismatch (2 out of 3 voting logic)
- Host Communication Time-Out
- Cyclic-Redundancy-Check-Error of Parameter or Program Memory
- Random-Access Memory failure
- ACE Watch-Dog failure

The standby ACE is in command of the actuator after such a failover. A failover from the primary ACE to the standby ACE can also be forced by the host.

In addition to all automated diagnostic testing, there are tests that can be triggered from the host via specific commands. The brushless motors and the related driver circuits can be fully diagnosed. This is possible as part of a pre and post flight test routine executed by the host. It is also possible to run the BLDC motor diagnostics during mission time.

In case of hardware failure of a BLDC motor or driver circuitry, the actuator will continue to function at degraded performance as only one of the two electric motors will be delivering torque (degraded mode). The remaining performance (torque) is reaching approximately 40% of the nominal rated torque as the gear train of the failed channel is back drivable and will only consume a fraction of the torque that is being produced by the remaining functioning channel.

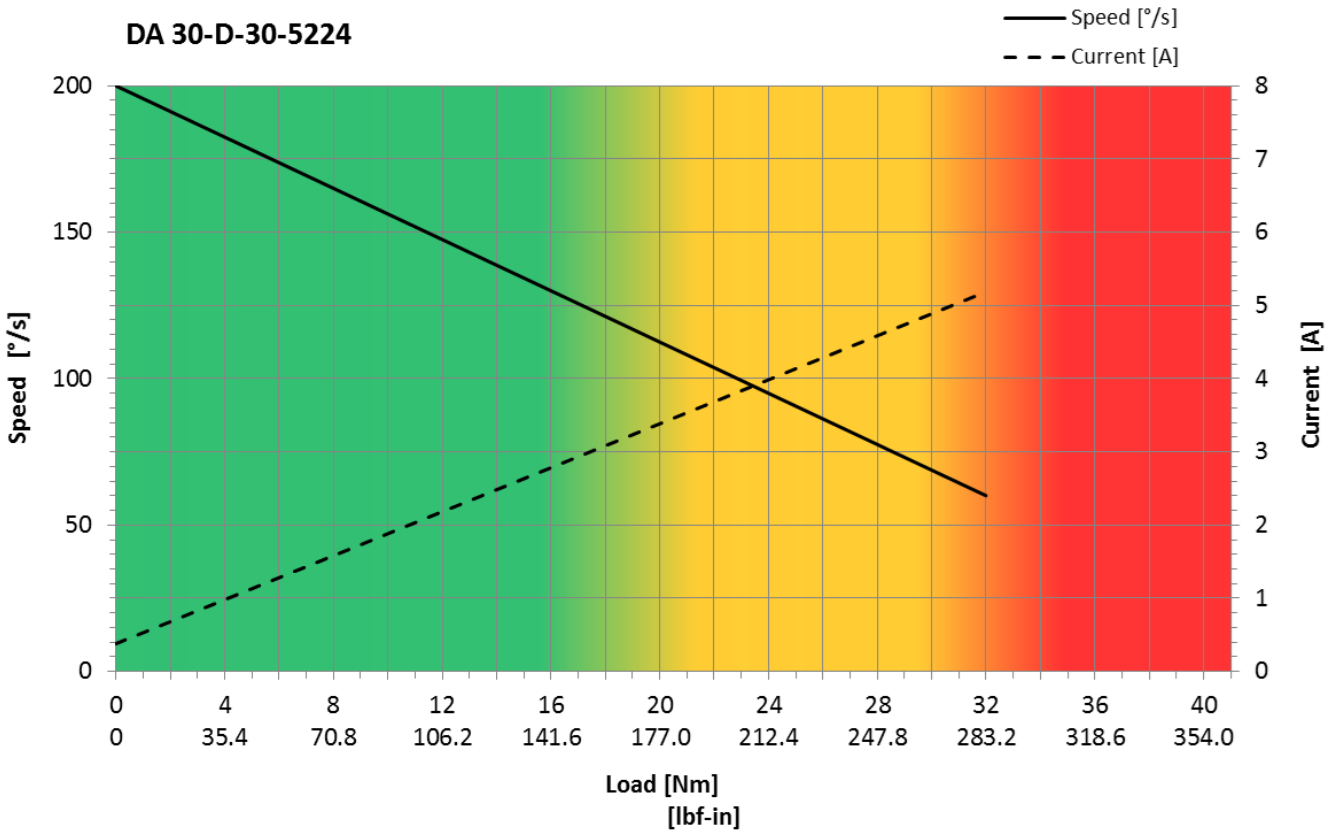
The actuator additionally features a redundant power supply concept. The two power supply inputs are being monitored by both control electronics. The control electronic boards do also have additional diagnostic sensors such as current, motor temperature, electronics temperature and humidity. All this diagnostic data can be read via the communication interface to derive load and health information. In addition, the actuator is counting the time of operation and the time at different load levels.

2. Operating Data

		Standard Mode	Degraded Mode
Supply Voltage (rated)		28 V DC	
Supply Voltage Range		12 … 32 V DC	
Standby Current [1,2]	at rated voltage	0.1 A	0.1 A
Rated Current [1,2]	at rated voltage	3.2 A	1.9 A
Peak Current [1,2]	at rated voltage	5.2 A	N.A.
Rated Torque [1]	at rated speed	20 Nm (177 lbf-in)	8 Nm (70.8 lbf-in)
Peak Torque [1]	at rated voltage	>32 Nm (283.2 lbf-in)	12 Nm (106.2 lbf-in)
No Load Speed [1]	at rated voltage	200 °/s	<120 °/s
Rated Speed [1]	at rated torque	110 °/s	<80 °/s
Default Travel Angle		±45° = 90° total travel	
Max. Travel Angle		±85° = 170° total travel	
Backlash (mechanical)		≤ 0.6°	
Position Error under Temperature [3]		≤ ±1°	
Operating Temperature Range [4]		-30°C … +70°C (-22°F … +158°F)	
Storage Temperature Range		-35°C … +80°C (-31°F … +176°F)	

1) Tolerance ±10%
2) Summarized Current Consumption in Standard Mode
3) -20°C … +50°C , Δt = 70°C (-4°F … +122°F , Δt = 126°F)
4) Low Temperature Modification (-70°C / -94°F) on request

3. Performance



Operation Mode:

Continuous

Short Time
< 10s , 60s cool down

Overload
< 1s , 60s cool down

Degraded Mode: Rated Torque 8 Nm (70.8 lbf-in), <80°/s Peak Torque 12 Nm (106.2 lbf-in), <40°/s

3.1 Degraded Mode

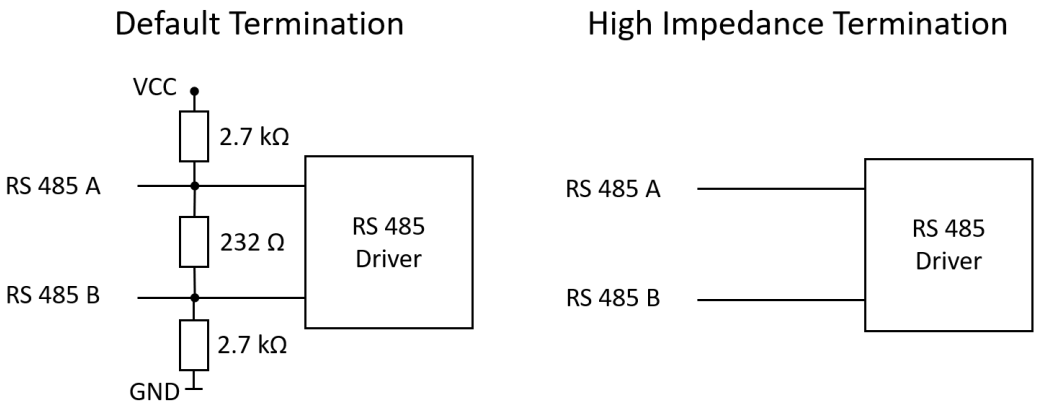
In case one motor and/or the related electronics fail, the output shaft is driven by the remaining motor. This operation mode is called Degraded Mode, as the remaining performance is degraded. The actuator needs to be replaced whenever the actuator switched to Degraded Mode.

4. Redundant Command Interface

Baud-Rate	115200 bit/s ±1.5%
Protocol [5]	6 Byte Command Frame with 16 bit CRC
Resolution	0.1°
Communication Interface Termination	Default or High Impedance (HI)

5) Documentation available

Communication Interface Termination
Per default, the RS485 communication interface is terminated with a 232Ω resistor. Optionally it is possible to order the actuator without termination (high impedance option). This option eliminates the termination and fail-safe resistors as shown in the schematic below. If more than 2 devices shall be connected on the same network, only the first and last device on the bus should feature termination resistors.



RS 485 Redundant Command Interface
The RS 485 compatible communication interface is intended to operate the actuator using a six byte protocol with a baud rate of 115,200 bit/s. All command and reply messages are secured by a 16 bit Cyclic Redundancy Checksum (CRC). Parameters like the actual output shaft position and other diagnostic information can be read from the actuator via this interface.
Detailed information is provided in the RS 485 documentation.

Firmware Adaptation / Non-Recurring Engineering
There are certain rules to be implemented together with the customer to allow best possible integration into the customer's system architecture. This includes the rule for the monitoring motion controller taking over the command from the motion controller currently in command if there is false data coming from the controller in command. This is strongly influenced by the way the customer wants to talk to the servo from the flight control computer or autopilot (e.g. is there one AP or a primary AP and a backup AP, etc.). Volz recommends to discuss all these topics in a workshop to create the specification of the "switching rules" etc. Ideally, there would be staff present from customer's flight control computer/AP team.

5. Materials and Protective Features

Case Material	Saltwater resistant Aluminum Alloy
Splash Water Resistance	IP 67 , waterproof to 1m depth
Case Surface Treatment	HART®-Coat
Salt Water Resistance	>100 hrs.
EMI / RFI Shielding	Case Shielding
Motor Type	Two Brushless DC Motors
Gear Set Material	Hardened Steel
Position Sensor	Triple Sensor, contactless
Position Feedback	Standard
RS 485 Redundant Communication Interface	Standard
Humidity Sensor	Optional
Temperature Sensor	Standard on each Motor and PCB

6. Environmental Compliance

Designed and tested to MIL-STD-810G:

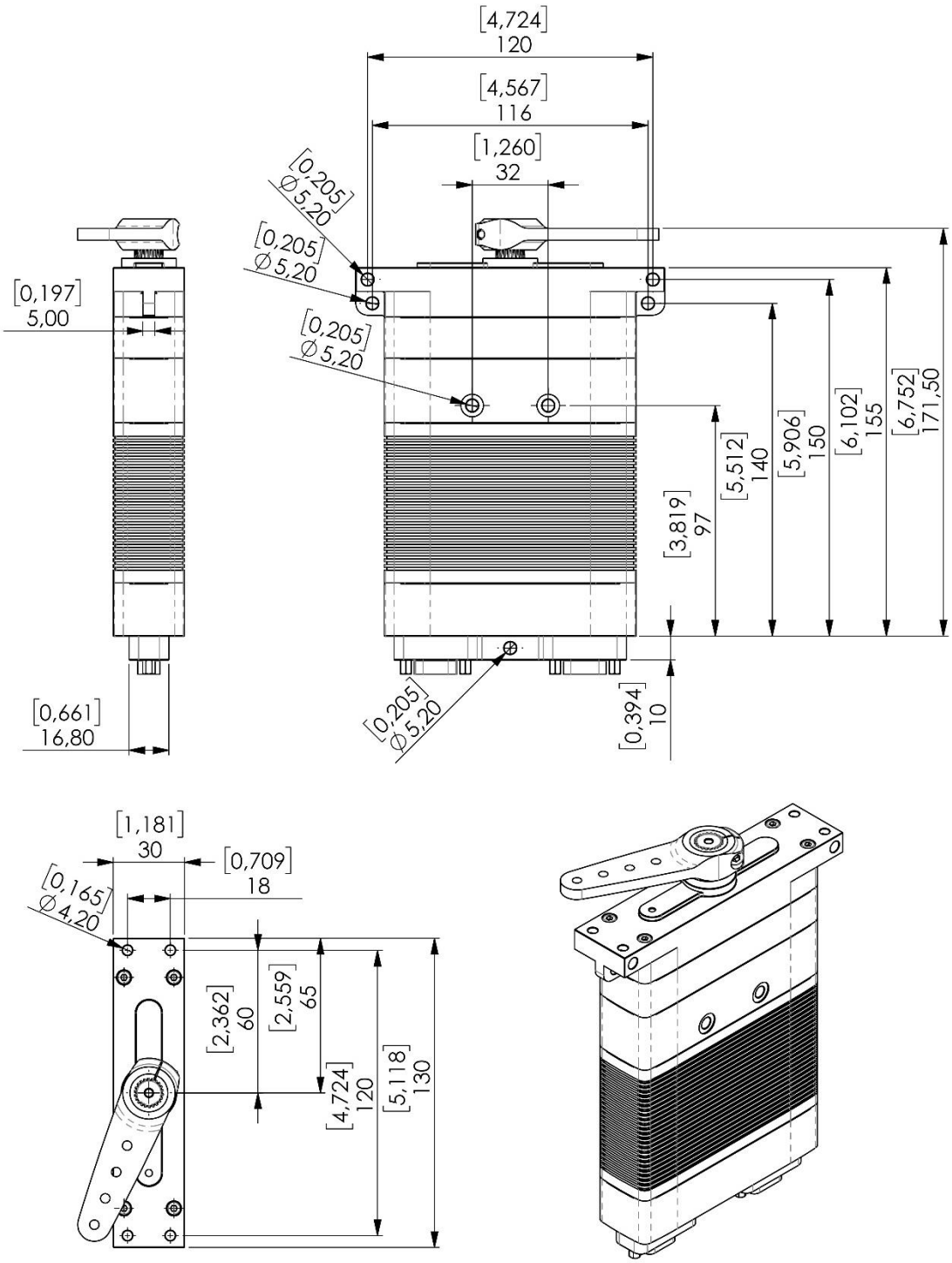
High Temperature	Up to 71 °C
Low Temperature	Down to -55 °C
Altitude	Up to 40000 feet
Humidity	95 % RH
Vibration	different frequencies (total RMS 4.91)
Mechanical Shock	15 G´s

7. Dimensions

Case Dimensions	155.0 mm x 106.0 mm x 30.0 mm 6.10 in x 6.30 in x 1.18 in
Standard Tolerances	Unless otherwise specified according to DIN ISO 2768 - m
Weight (with DE-9m Standard Connectors)	1200g (42.3oz) ±10%
Weight (with MIL Grade D38999 Connectors)	1300g (45.9oz) ±10%

7.1 Installation Dimensions

Valid for version
DA 30-D.30.5848._.ST
DE-9m Standard Connectors



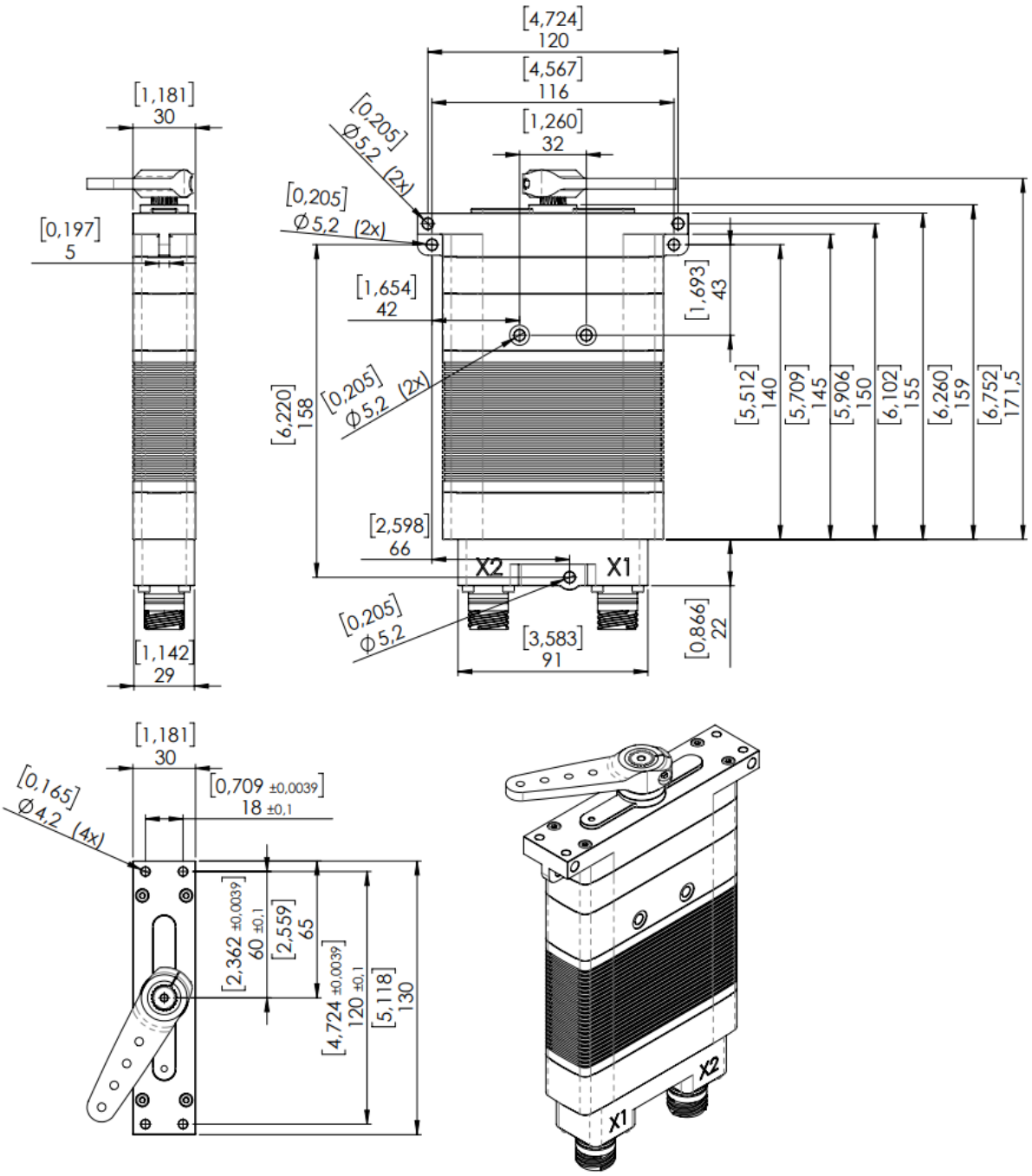
Not to scale

Dimensions: [in], mm

Content is subject to change without notice

Revision: E

Valid for version
DA 30-D.30.5848._.MIL13
MIL Grade D38999 Connectors



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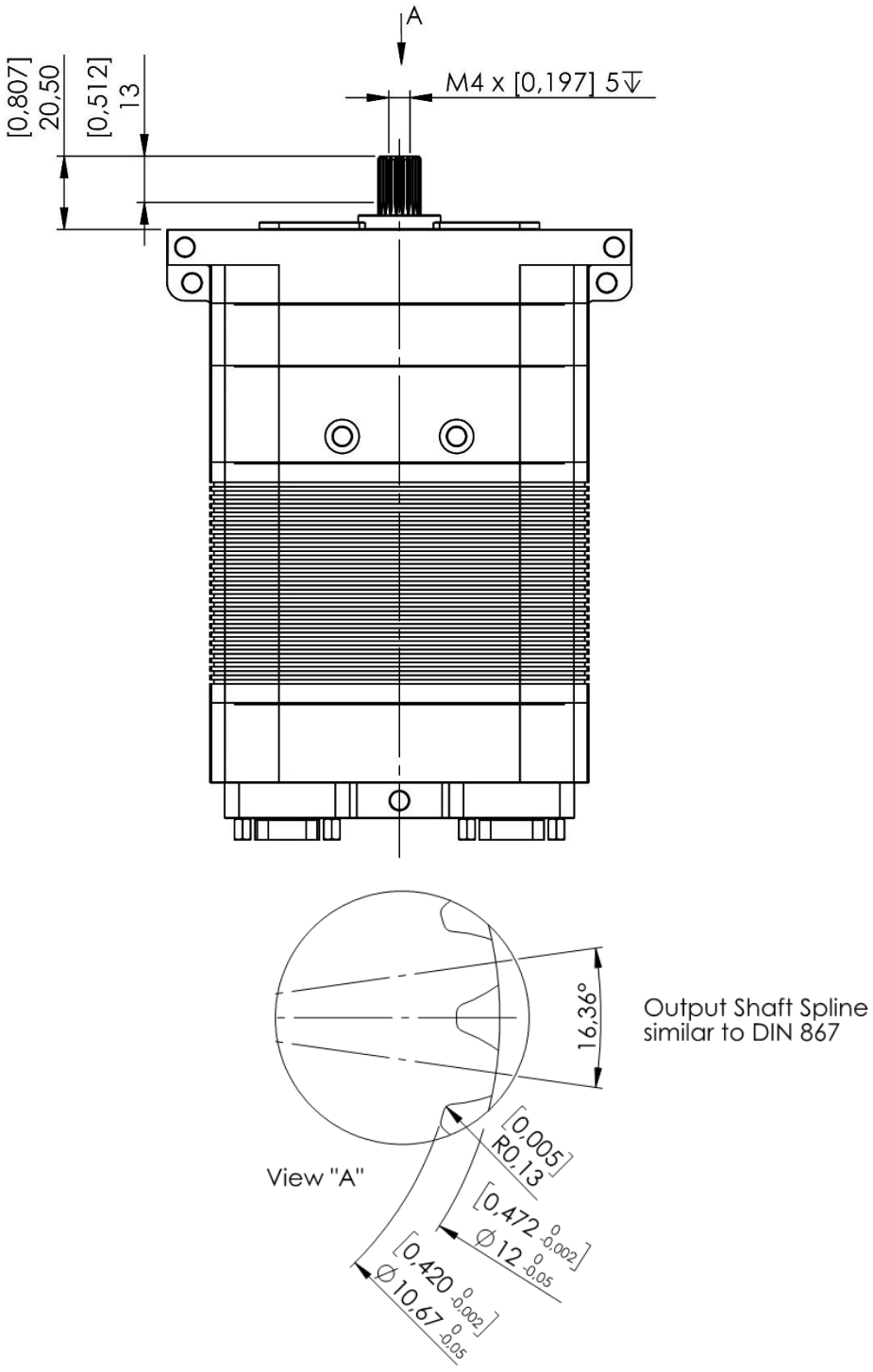
Dimensions: [in], mm

7.2 Output Shaft Spline

Valid for all Versions
DA 30-D-30-5224...



Not to scale

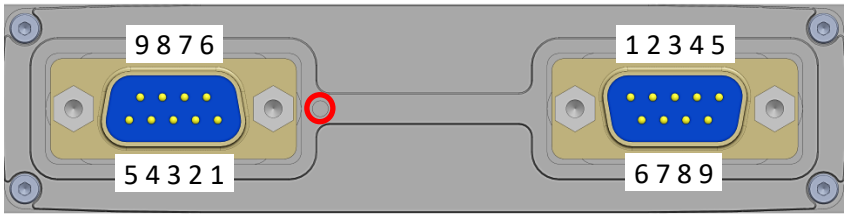
Dimensions: [in], mm

8. Electrical Connection

Two Integrated DE-9m Standard Connectors **Item # DA 30-D.30.5224._.ST**

Standard Connectors			
X1		**X2**	
Manufacturer	ITT Cannon	Manufacturer	ITT Cannon
Type	DEMM-9PE	Type	DEMM-9PE
Mating	DE-9f	Mating	DE-9f
Seal	DE-53750	Seal	DE-53750

X1



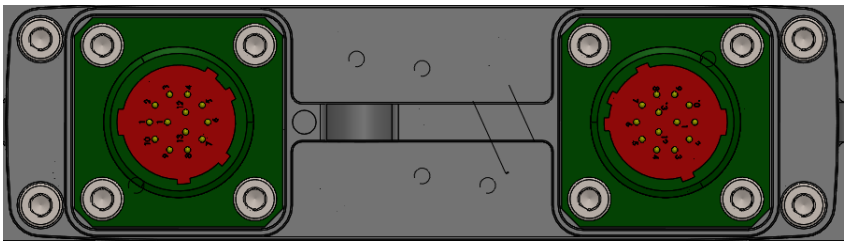
X2

Pin Assignment					
X1 RS 485 Interface 1			**X2** RS 485 Interface 2		
1	**RS 485 A1**	Non-inverting Input / Output	1	**RS 485 A2**	Non-inverting Input / Output
2	**RS 485 B1**	Inverting Input / Output	2	**RS 485 B2**	Inverting Input / Output
3	-	Do not connect	3	-	Do not connect
4	**+V DC (1.2)**	Power + (Backup)	4	**+V DC (2.2)**	Power + (Backup)
5	**Case GND**	Case Ground	5	**Case GND**	Case Ground
6	**+V DC (1.1)**	Power + (Primary)	6	**+V DC (2.1)**	Power + (Primary)
7	**GND (1.1)**	Power Return (Primary)	7	**GND (2.1)**	Power Return (Primary)
8	**GND (1.2)**	Power Return (Backup)	8	**GND (2.2)**	Power Return (Backup)
9	-	Do not connect	9	-	Do not connect

Alternative connectors on request.

Two Integrated MIL Grade D38999 Connectors **Item # DA 30-D.30.5848._.MIL13**

MIL13 D38999 Connectors			
X1		**X2**	
Manufacturer	Amphenol	Manufacturer	Amphenol
Type	D38999-20WB35PN	Type	D38999-20WB35PN
Mating	e.g. D38999-26WB35SN	Mating	e.g. D38999-26WB35SN

X1  **X2**

Pin Assignment

X1 RS 485 Interface 1			**X2** RS 485 Interface 2		
1	**NC**	Do not connect	1	**NC**	Do not connect
2	**PWR_1.1**	Power Supply Input 1.1	2	**PWR_2.1**	Power Supply Input 2.1
3	**NC**	Do not connect	3	**NC**	Do not connect
4	**COM1_1.1**	COM1 A (RS 485)	4	**COM2_2.1**	COM2 A (RS 485)
5	**COM1_1.2**	COM1 B (RS 485)	5	**COM2_2.2**	COM2 A (RS 485)
6	**CASE_GND_1**	Case Ground	6	**CASE_GND_2**	Case Ground
7	**COMI_1.1**	COMi A (RS 485) / Do not connect	7	**COMI_2.1**	COMi A (RS 485) / Do not connect
8	**COMI_1.2**	COMi B (RS 485) / Do not connect	8	**COMI_2.2**	COMi B (RS 485) / Do not connect
9	**NC**	Do not connect	9	**NC**	Do not connect
10	**PWR_1.2**	Power Supply Input 1.2	10	**PWR_2.2**	Power Supply Input 2.2
11	**NC**	Do not connect	11	**NC**	Do not connect
12	**GND_1.1**	Return, Signal Ground 1.1	12	**GND_2.1**	Return, Signal Ground 2.1
13	**GND_1.2**	Return, Signal Ground 1.2	13	**GND_2.2**	Return, Signal Ground 2.2

Alternative connectors on request.

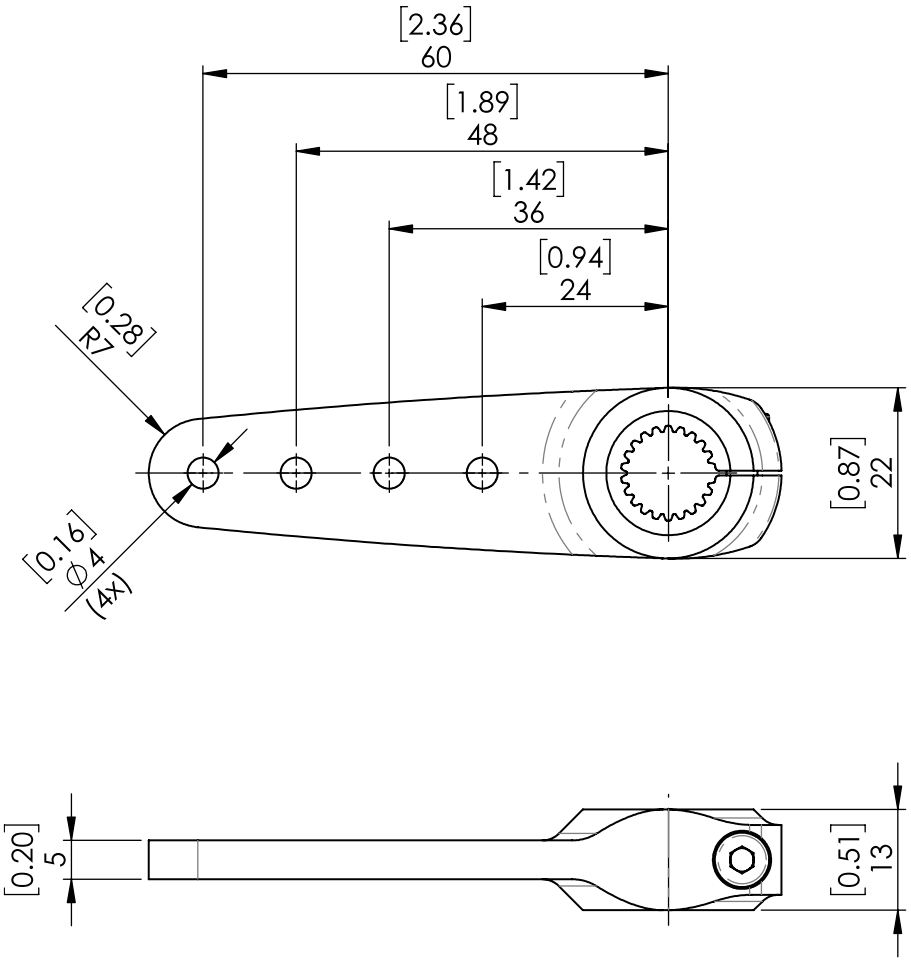
9. Accessories

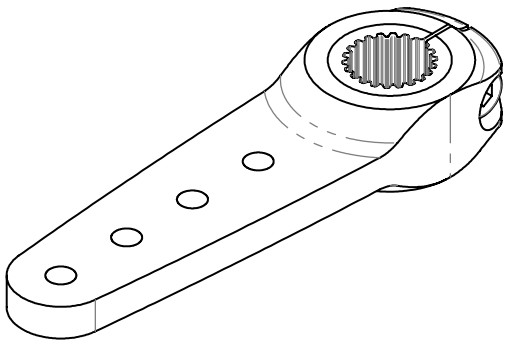
Item	Item-No.
Aluminum Servo Arm	1951.21
Programming Tool RS-485	985.9

All accessories to be purchased separately.

9.1 Servo Arm

Item # 1951.21





Not to scale

Dimensions: [in], mm

10. Item Number System

DA 30 - D . 30 . 5224 . H . ST

Servo Class
30mm Class

Duplex

Supply Voltage
30V DC **30**

Servo Type
5224

Sensor
H Humidity
X without

Electrical Connection
ST Standard D-SUB Connectors
MIL13 MIL Grade Connectors

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