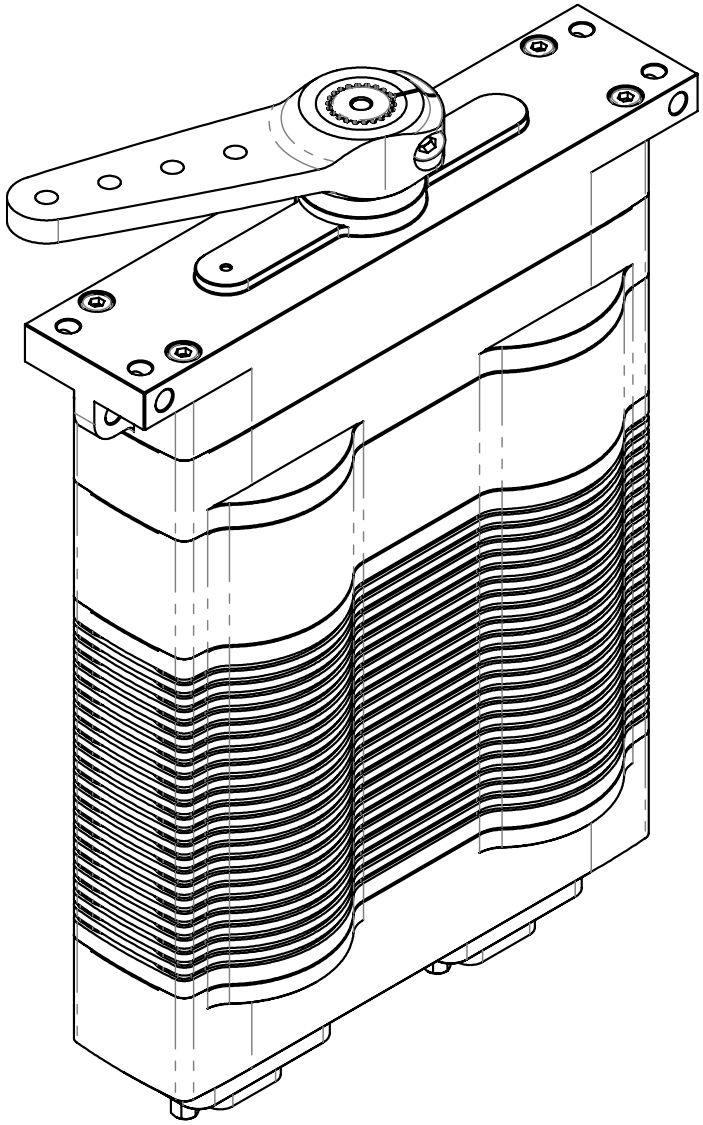
DA 30-HT-D
Technical Specification



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1. General Description

The fully redundant DA 30-HT-D high torque 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 of the actuator control electronics (ACE) has failed. All major components such as the electric motors, control and communication electronics as well as power supply are available twice. The position sensor is even featuring a three-channel design for 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 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 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 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 and electronics temperature. 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.

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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	4.5 A	2 A
Peak Current[1] [2]	at rated voltage	7.8 A	---
Rated Torque[1]	at rated speed	36 Nm [318.6 lbf-in]	14 Nm [123.9 lbf-in]
Peak Torque[1]	at rated voltage	64 Nm [566.4 lbf-in]	26 Nm [230.1 lbf-in]
No Load Speed[1]	at rated voltage	165 °/s	<100 °/s
Rated Speed[1]	at rated torque	115 °/s	<75 °/s
Default Travel Angle		±170° = 340° total travel	
Backlash (mechanical)		≤ 0.6°	
No-load 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]	

Values applicable at 20°C

[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

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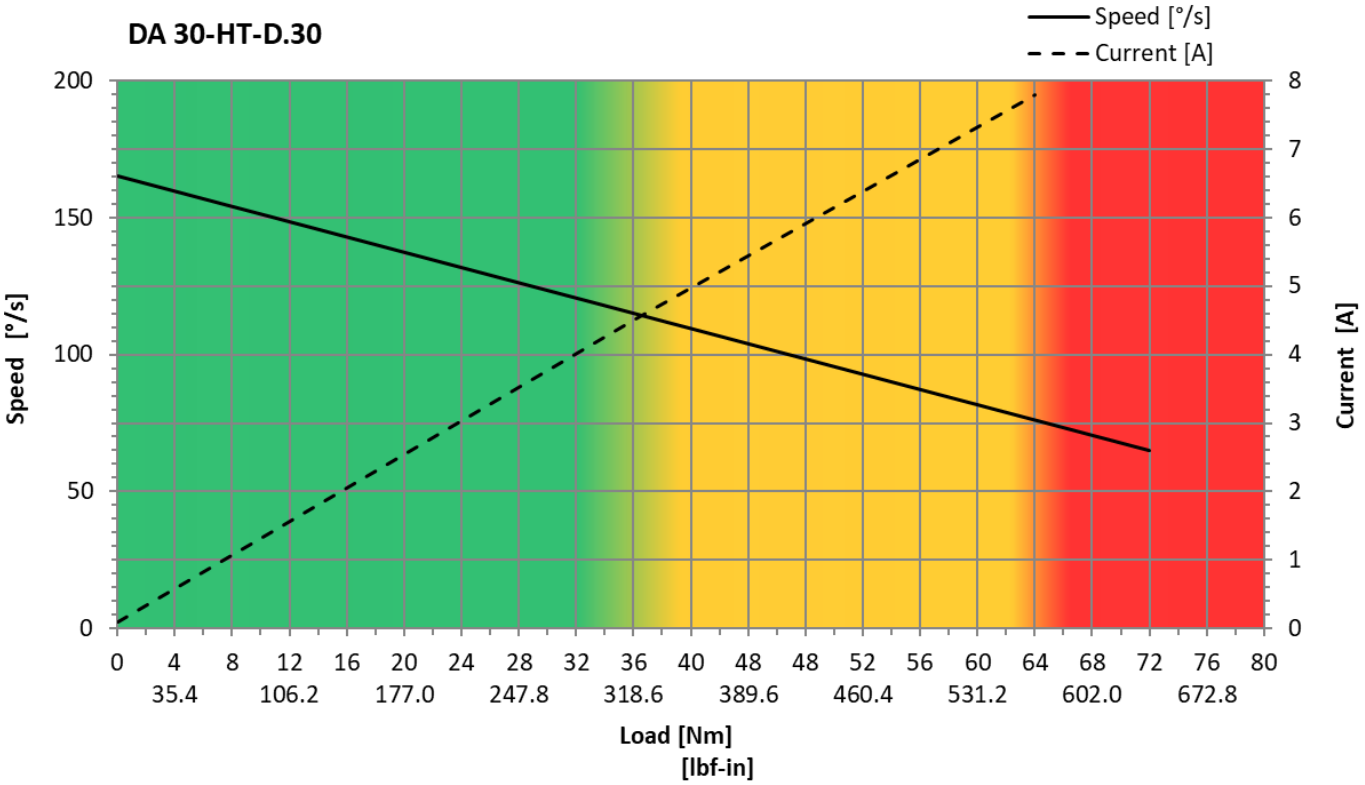
3. Performance



Operation Mode:

Continuous

Short Time
< 10 s, 60 s cool down

Overload
< 1 s, 60 s cool down

Degraded Mode: see Operating Data

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.

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4. Command Signal

4.1. RS 485 Command Signal

Baud-Rate	115200 ±1.5% baud/s
Protocol (Documentation available)	6 Byte (incl. 2 byte CRC)
Number of Data Bits	8
Number of Stop Bits	1
Parity	None

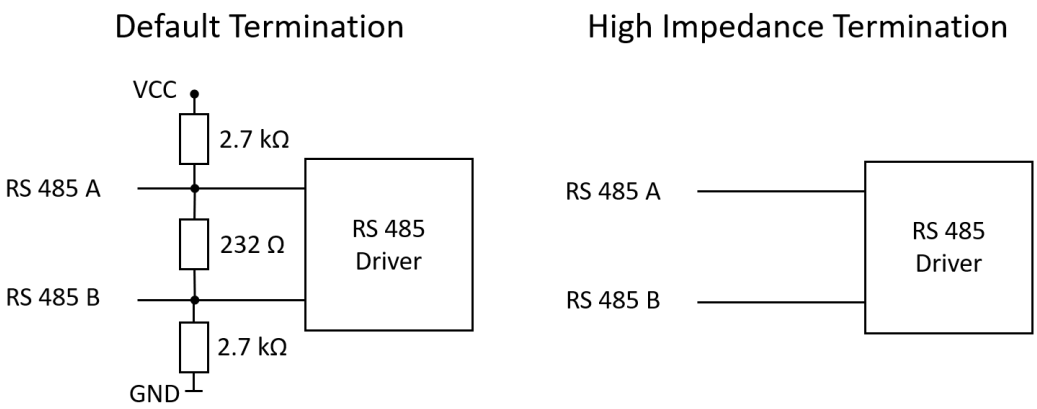
Command / Response Frame

Byte #	Description
1	Command / Response-Code
2	Actuator ID
3	Argument 1
4	Argument 2
5	CRC High Byte
6	CRC Low Byte

RS-485 position feedback
Integrated in the RS-485 protocol a Position Feedback Value is available, representing the output shaft's angular position. Value readout by sending a request command. Detailed information is provided in the RS-485 documentation.

Detailed information is provided in the RS-485 ICD.

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 two devices shall be connected on the same BUS, only the first and last device on the BUS should feature termination resistors.



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Firmware Adaptation / Non-Recurring Engineering

There are certain integration aspects that should be jointly reviewed with the customer to ensure optimal integration into the overall system architecture. This includes, for example, the definition of switching rules in case the monitoring motion controller needs to take over from the active motion controller due to invalid or implausible data.

The specific implementation of such switching logic depends on how the customer interfaces the servo from the flight control computer or autopilot, for example whether a single autopilot or a primary and backup autopilot architecture is used.

In principle, the standard firmware already supports typical architectures. However, if project specific requirements arise, adaptations to the firmware can be evaluated and implemented if necessary.

Volz recommends discussing these topics in a dedicated workshop in order to jointly define the switching logic and interface behavior. Ideally, representatives from the customer's flight control computer or autopilot team should participate.

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5. Materials and Protective Features

Case Material	Saltwater resistant aluminum alloy
Splash Water Resistance	IP 67, waterproof up to 1m depth for 30 minutes
Case Surface Treatment	HART®-Coat
Salt Water Resistance	> 100 h. Saltwater Spray
EMI / RFI Shielding	Case Shielding
Motor Type	Brushless DC Motors
Gear Set Material	Hardened Steel
Position Sensor	Triple Contactless Hall sensor
Position Feedback	Standard
RS 485 Communication Interface	Standard
Temperature Sensor	Motor and PCBA

6. Environmental Specifications

Operating Temperature	-55°C [-67°F][5]	MIL 810G Method 502.5
	+70°C [158°F]	MIL 810G Method 501.5
Altitude	40.000 ft [12.192 m]	MIL 810G Method 500.5
Humidity	95% at 30°C -60°C for 240 h	MIL 810G Method 507.5
Vibration	Vibration Profile: Cat. 13, Figure 514.6D-2	MIL 810G Method 514.6
Mechanical Shock	Procedure 1 – Functional shock 15 g, 11 ms, half sine	MIL 810G Method 516.6
Dust and water	IP 67 - Dust tight and Immersion, up to 1 m depth for 30 minutes	DIN EN 60529

Test reports on request

[5] Low Temperature Modification on request.

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7. Dimensions

Envelope dimensions for servo with D-Sub connector (.S9)	195,5mm x 138,0 mm x 45.0 mm 7.697 in x 5.433 in x 1.772 in
Envelope dimensions for servo MIL Grade D38999 connectors (.MIL13)	222,29mm x 138,0 mm x 45.0 mm
	8.752 in x 5.433 in x 1.772 in
Standard Tolerances	Unless otherwise specified according to DIN ISO 2768 - m
Weight with D-Sub connectors (.S9)	1850 g [65.3 oz] ±10%
Weight with MIL Grade D38999 connectors (.MIL13)	1950 g [68.8 oz] ±10%

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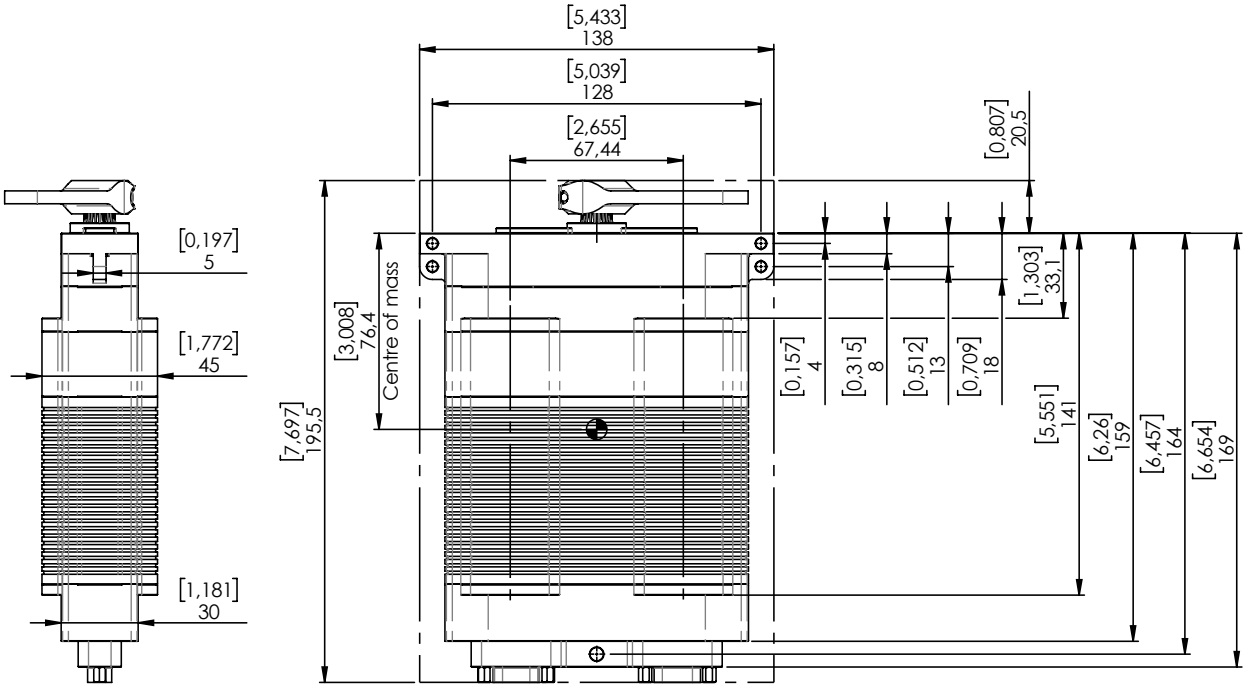
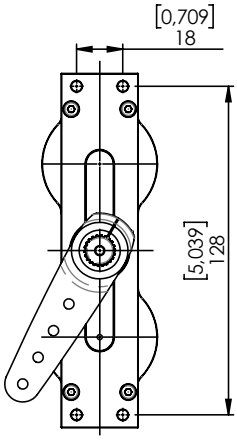
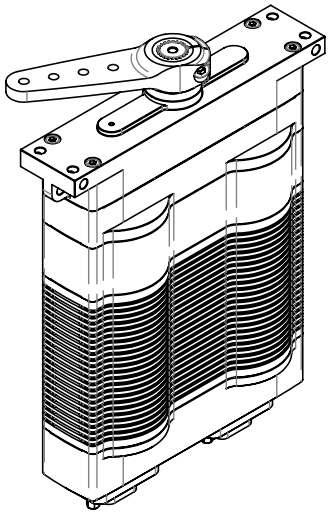
7.1. Installation Dimensions .S9.U

D-Sub connector (.S9), bottom sided (.U)







Not to scale | Tolerances: Unless otherwise specified according to DIN ISO 2768- m | Dimensions: [in], mm

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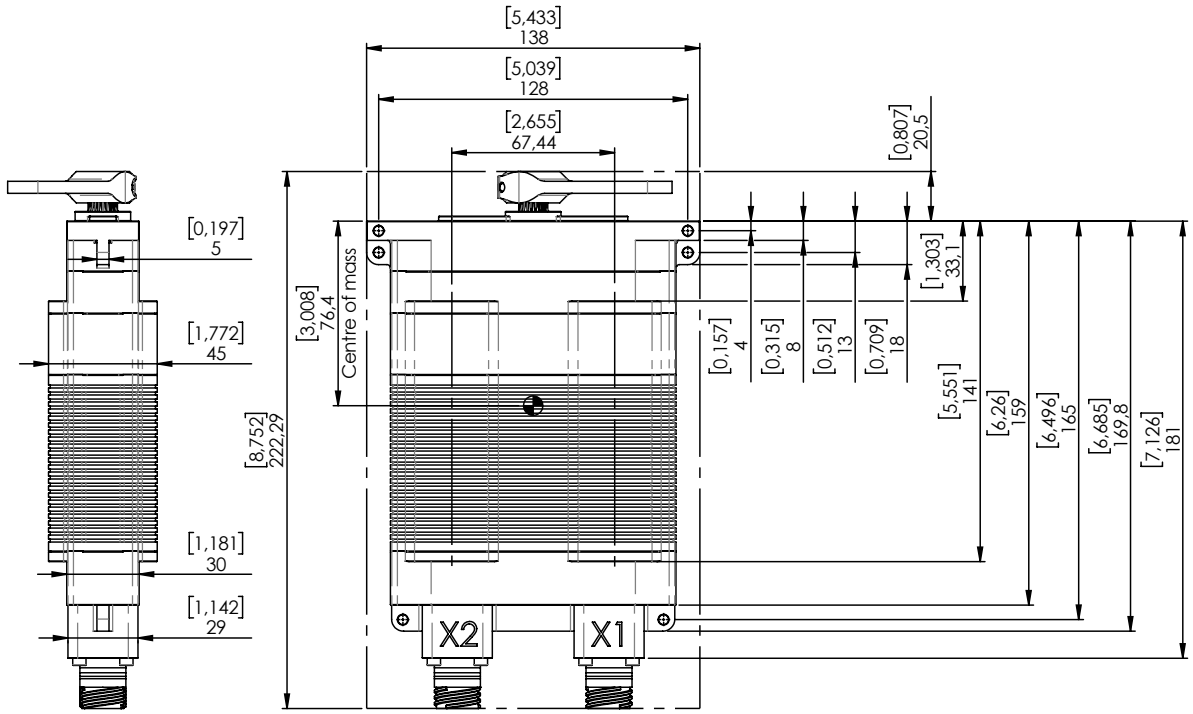
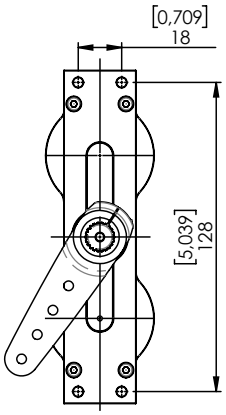
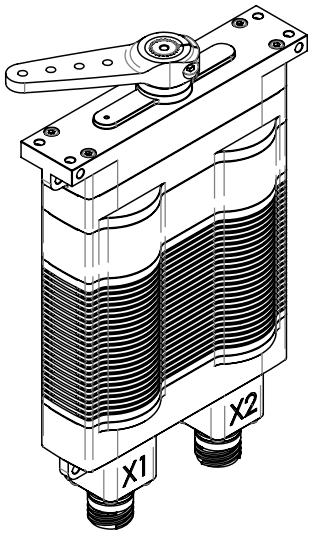
7.2. Installation Dimensions .MIL13.U

MIL graded D38999 connector (.MIL13), bottom sided (.U)







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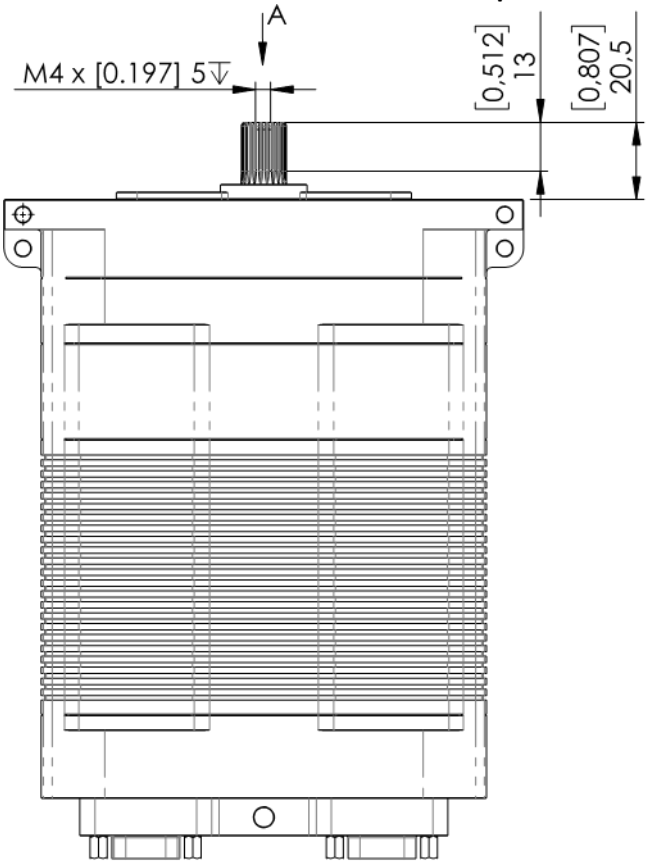
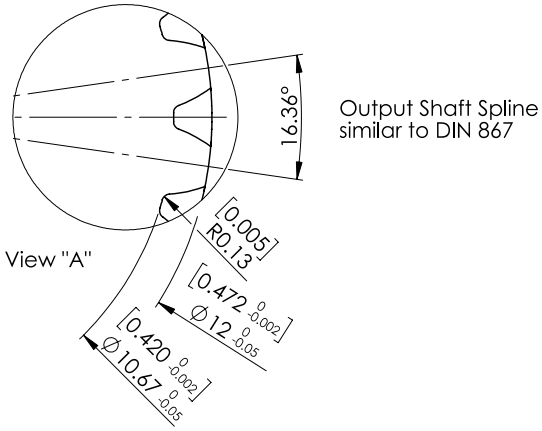
7.3. Output Shaft Spline

Valid for all Versions with standard spline shaft





Not to scale Tolerances: Unless otherwise specified according to DIN ISO 2768- m Dimensions: [in], mm

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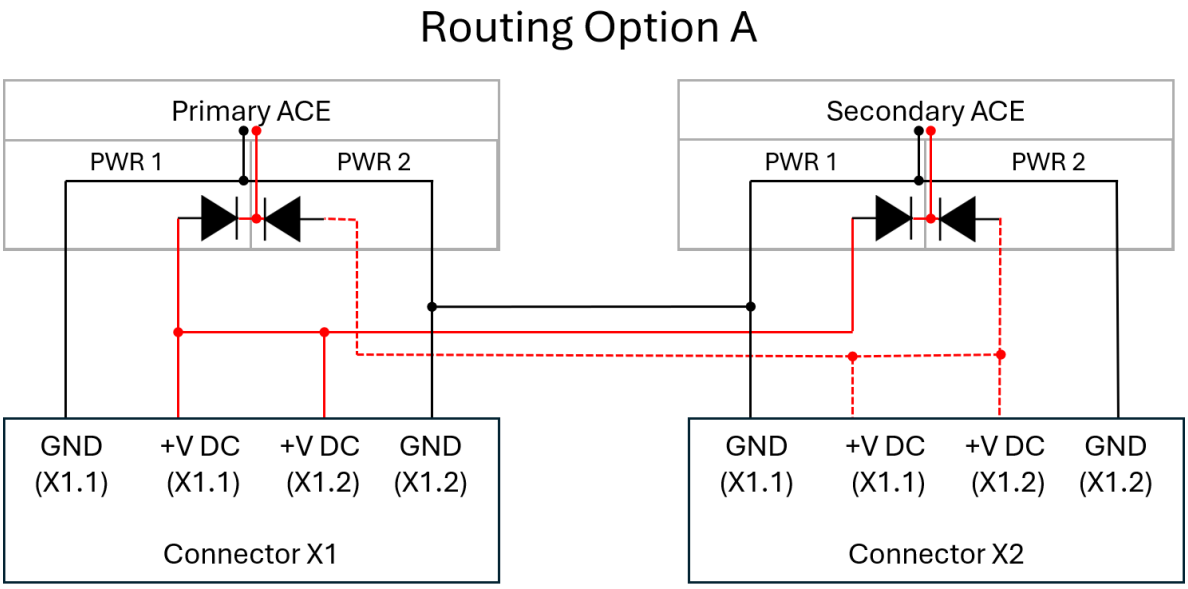
8. Routing Options

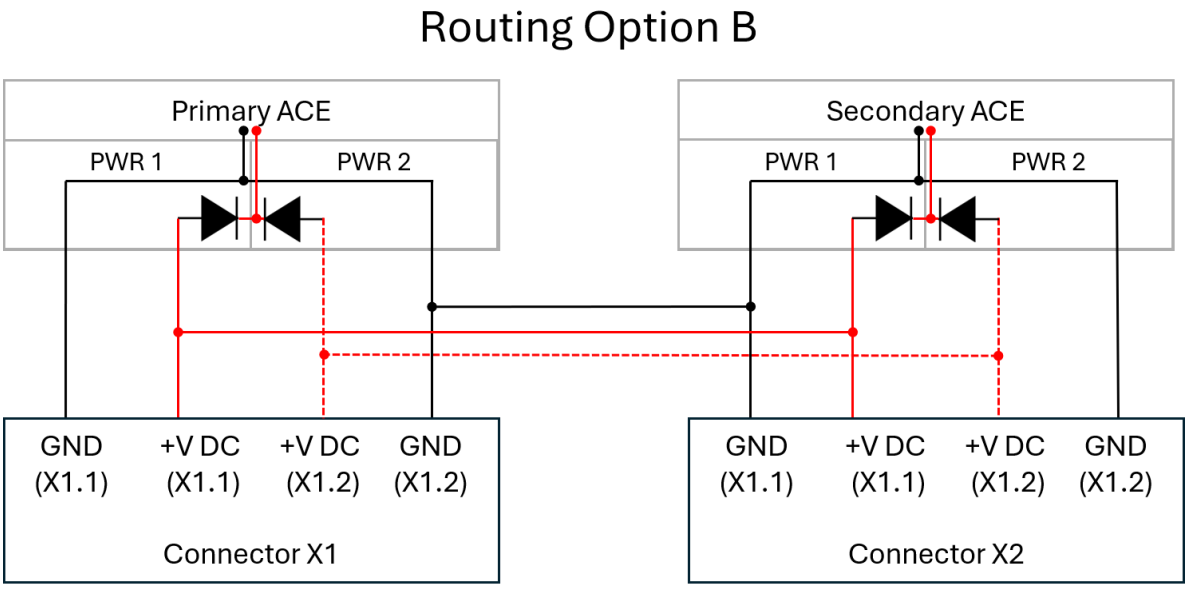
Two Actuator Control Electronics (ACE) units are installed in each duplex servo. Both connectors, X1 and X2, provide redundant power inputs. Each power input is internally connected in accordance with the applicable routing option shown below.

On each ACE PCBA, the two power inputs, PWR1 and PWR2, are connected through a wired-OR configuration. For all routing options, the corresponding ground returns are interconnected within each ACE PCBA.

8.1. Routing Option A (.RA)



8.2. Routing Option B (.RB)



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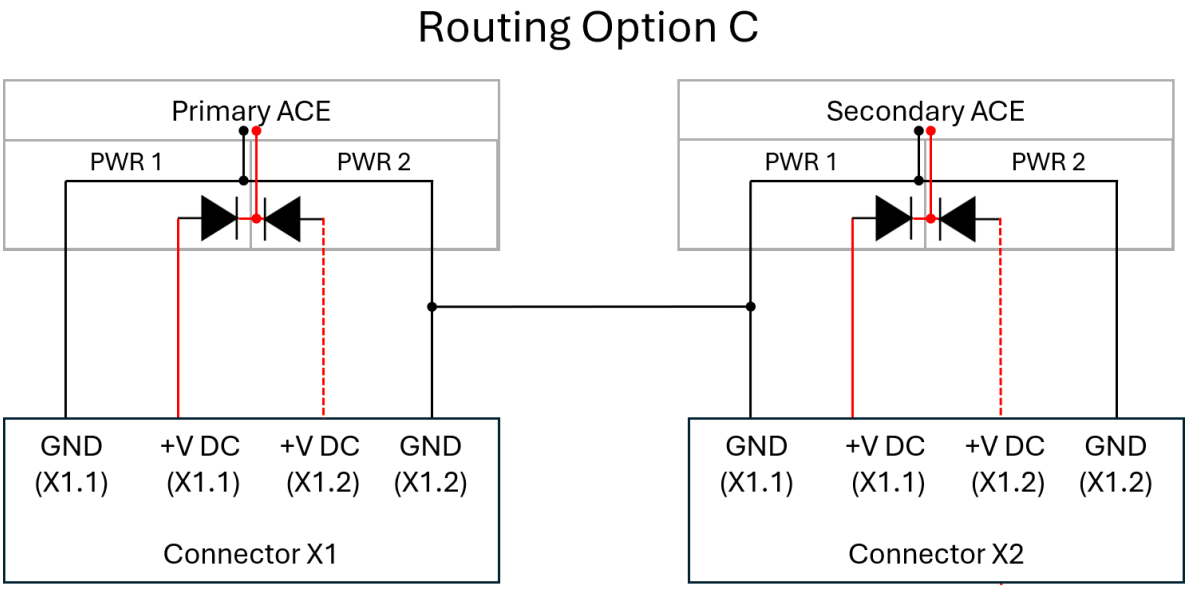
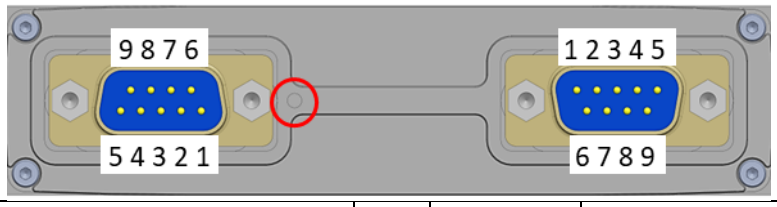
8.3. Routing Option C (.RC)



9. Electrical Connection

9.1. RS-485 Interface (.3)

RS-485 two-wire interface (.3) with two integrated D-Sub connectors (.S9)

X1			X2		
Manufacturer		ITT Cannon	Manufacturer		ITT Cannon
Type		DEMM-9PE	Type		DEMM-9PE
Mating		DE-9f	Mating		DE-9f
X1					**X2**
1	RS-485 A (X1.1)	Non-Inverted Input/Output (Rx/Tx)	1	RS-485 A (X2.1)	Non-Inverted Input/Output (Rx/Tx)
2	RS-485 B (X1.1)	Inverted Input/Output (Rx/Tx)	2	RS-485 B (X2.1)	Inverted Input/Output (Rx/Tx)
3	NC	Do not connect / Non-Inverted internal interface	3	NC	Do not connect / Non-Inverted internal interface
4	+V DC (X1.2)	Supply Voltage (Secondary)	4	+V DC (X2.2)	Supply Voltage (Secondary)
5	Case	Case (Not connected to GND)	5	Case	Case (Not connected to GND)
6	+V DC (X1.1)	Supply Voltage (Primary)	6	+V DC (X2.1)	Supply Voltage (Primary)
7	GND (X1.1)	Supply and Signal Ground (Primary)	7	GND (X2.1)	Supply and Signal Ground (Primary)
8	GND (X1.2)	Supply and Signal Ground (Secondary)	8	GND (X2.2)	Supply and Signal Ground (Secondary)
9	NC	Do not connect / Inverted internal interface	9	NC	Do not connect / Inverted internal interface

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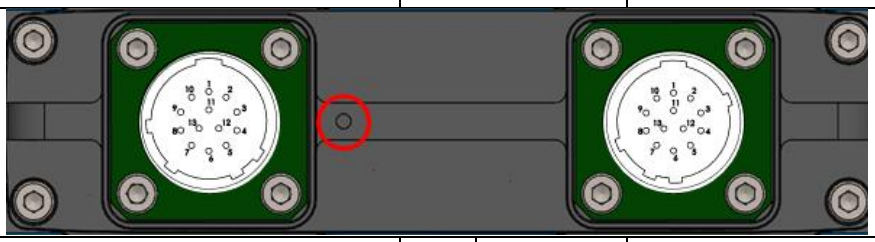
RS 485 two-wire interface (.3) with two MIL specified connectors (.MIL13)

X1			X2		
Manufacturer	Amphenol		Manufacturer	Amphenol	
Type	D38999-20WB35PN		Type	D38999-20WB35PA	
Mating	e.g. D38999-26WB35SN		Mating	e.g. D38999-26WB35SA	
X1					**X2**
1	NC	Not connected	1	NC	Not connected
2	+V DC (X1.1)	Supply Voltage (Primary)	2	+V DC (X2.1)	Supply Voltage (Primary)
3	NC	Not connected	3	NC	Not connected
4	RS-485 A (X1.1)	Non-Inverted Input/Output (Rx/Tx)	4	RS-485 A (X2.1)	Non-Inverted Input/Output (Rx/Tx)
5	RS-485 B (X1.1)	Inverted Input/Output (Rx/Tx)	5	RS-485 B (X2.1)	Inverted Input/Output (Rx/Tx)
6	Case	Case (Not connected to GND)	6	Case	Case (Not connected to GND)
7	NC	Do not connect / Non-Inverted internal interface	7	NC	Do not connect / Non-Inverted internal interface
8	NC	Do not connect / Inverted internal interface	8	NC	Do not connect / Inverted internal interface
9	NC	Not connected	9	NC	Not connected
10	+V DC (X1.2)	Supply Voltage (Secondary)	10	+V DC (X2.2)	Supply Voltage (Secondary)
11	NC	Not connected	11	NC	Not connected
12	GND (X1.1)	Supply and Signal Ground (Primary)	12	GND (X2.1)	Supply and Signal Ground (Primary)
13	GND (X1.2)	Supply and Signal Ground (Secondary)	13	GND (X2.2)	Supply and Signal Ground (Secondary)

Alternative connectors on request!

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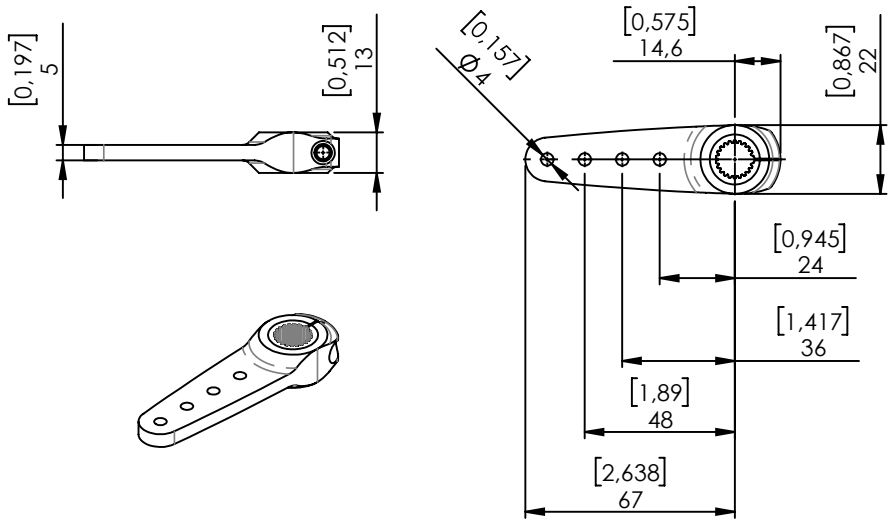
10. Accessories

Item	Item-No.
Aluminium servo arm, single sided	1951.21
Aluminium servo arm, double sided	1951.20
Aluminium servo disc	1951.23
Programming Tool Duplex Servos - RS 485	#985.9

All accessories to be purchased separately.

10.1. Aluminium servo arm, single sided

1951.21



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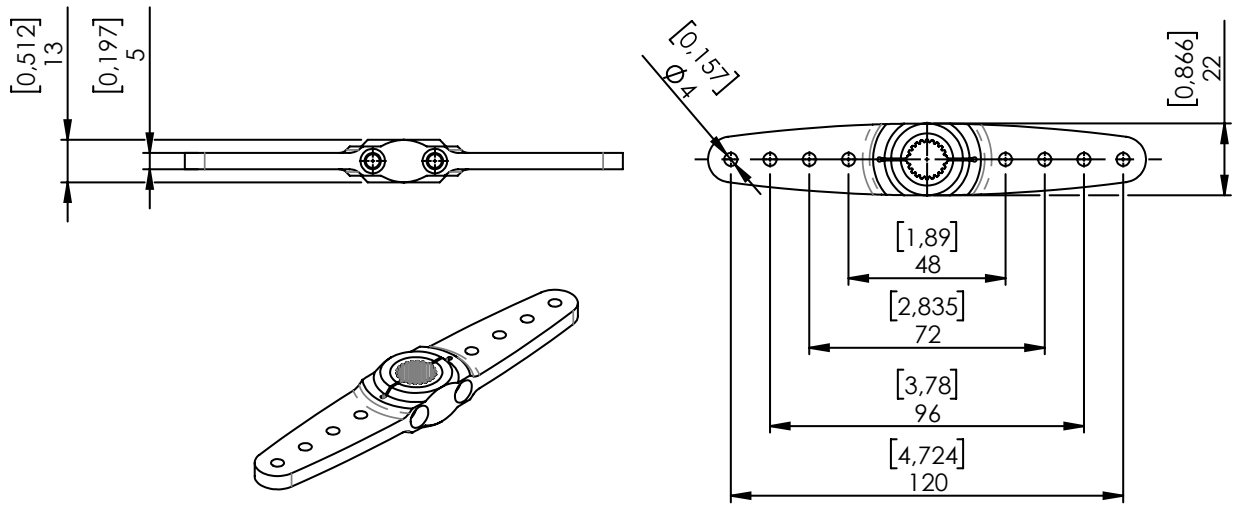
10.2. Aluminium servo arm, double sided

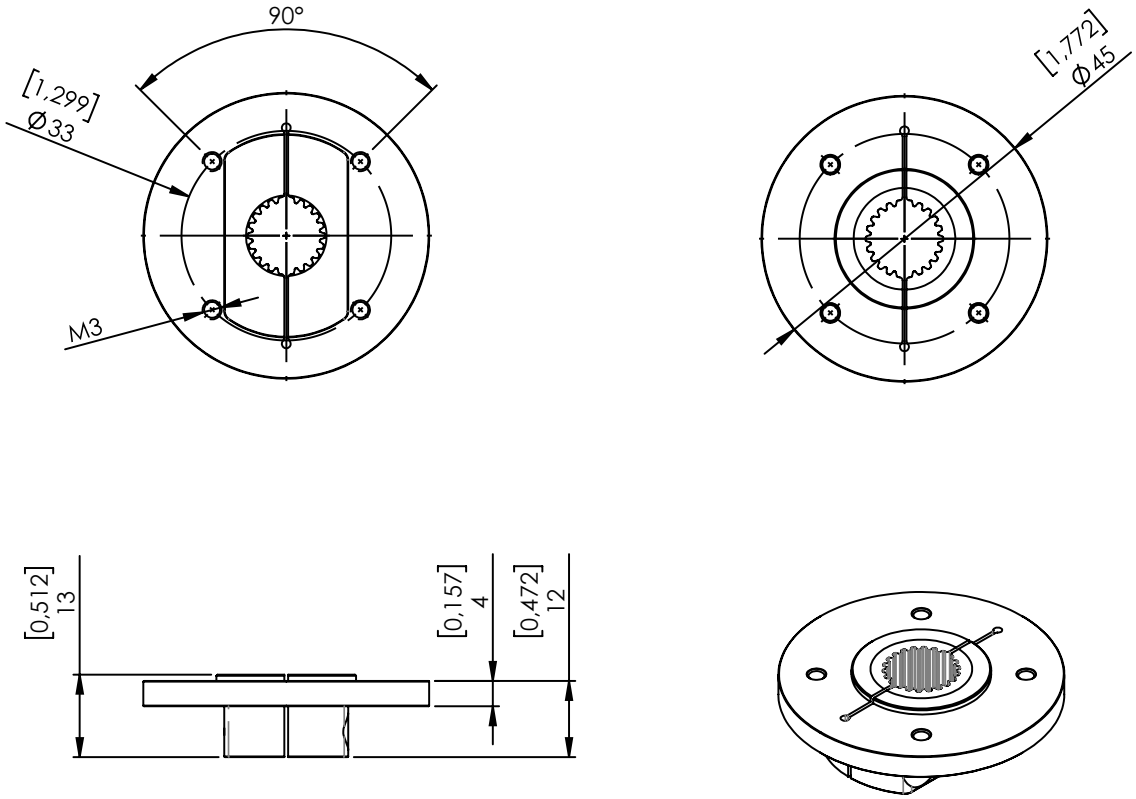
1951.20



Not to scale Tolerances: Unless otherwise specified according to DIN ISO 2768- m Dimensions: [in], mm

10.3. Aluminium servo disc

1951.23



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11. Item Number System

DA 30-HT-D		
1	Type of Actuator	
	DA 30-HT-D	30 mm Class high torque duplex Actuator with brushless motors
2	Internal Servo Saver (ISS)	
	Empty field	Without Internal Servo Saver
3	Supply Voltage	
	30	30 V Supply Voltage
4	Gear Set	
	Empty field	Standard Gear Train
5	Interface	
	3	RS 485 two-wire (Digital interface)
6	Routing Option	Only for Duplex
	RA	Routing Option A
	RB	Routing Option B
	RC	Routing Option C
7	Case	
	Empty field	Standard Case
8	Analog Feedback	Only for PWM
	Empty field	Without Analog Feedback
9	Extended Travel Angle	
	Empty Field	Standard Travel Angle
10	Electrical Connection	
	S9	Integrated connector D-SUB DE 9f, 9 pin
	MIL13	MIL spec D38999, 13 pin
11	Orientation Electrical Connection	
	U	Bottom sided
12	Output Shaft	
	Empty field	Standard Spline
13	High Impedance Option	Only for RS 485
	Empty field	With BUS termination resistor
	HI	Without BUS termination resistor
14	Temperature Range	
	Empty field	Standard Range (-30 °C …. 70 °C)
	LT	Low temperature modification
15	Baud Rate	Only for RS 485
	115	Baud rate of 115.200 bauds/s (Standard RS 485)
	038	Baud rate of 38.400 baud/s
	057	Baud rate of 57.600 baud/s
	250	Baud rate of 250.000 baud/s

Part Number Example:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
DA 30-HT-D		.30		.3					.S9					115

DA 30-HT-D with 30 V supply voltage, RS-485 two-fire interface, a Baud rate of 115.200 baud/s and integrated D-SUB connector

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