



DFS60B-S1EM02500

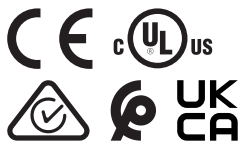
DFS60

INCREMENTAL ENCODERS

SICK
Sensor Intelligence.



Illustration may differ



Ordering information

Type	part no.
DFS60B-S1EM02500	1051220

Other models and accessories → www.sick.com/DFS60

Detailed technical data

Safety-related parameters

MTTF_D (mean time to dangerous failure)	300 years (EN ISO 13849-1) ¹⁾
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¹⁾ This product is a standard product and does not constitute a safety component as defined in the Machinery Directive. Calculation based on nominal load of components, average ambient temperature 40 °C, frequency of use 8760 h/a. All electronic failures are considered hazardous. For more information, see document no. 8015532.

Performance

Pulses per revolution	2,500 ¹⁾
Measuring step	90°, electric/pulses per revolution
Measuring step deviation at non binary number of lines	± 0.01°
Error limits	± 0.05°

¹⁾ See maximum revolution range.

Interfaces

Communication interface	Incremental
Communication Interface detail	HTL / Push pull
Number of signal channels	6-channel
Initialization time	40 ms
Output frequency	≤ 600 kHz
Load current	≤ 30 mA
Power consumption	≤ 0.5 W (without load)

Electronics

Connection type	Cable, 8-wire, universal, 5 m ¹⁾
Supply voltage	10 ... 32 V
Reference signal, number	1
Reference signal, position	90°, electric, logically gated with A and B
Reverse polarity protection	✓

¹⁾ The universal cable connection is positioned so that it is possible to lay it without bends in a radial or axial direction.

²⁾ Short-circuit opposite to another channel, US or GND permissible for maximum 30 s.

Short-circuit protection of the outputs ✓ ²⁾

¹⁾ The universal cable connection is positioned so that it is possible to lay it without bends in a radial or axial direction.

²⁾ Short-circuit opposite to another channel, US or GND permissible for maximum 30 s.

Mechanics

Mechanical design	Solid shaft, Servo flange
Shaft diameter	6 mmWith flat
Shaft length	10 mm
Weight	+ 0.3 kg
Shaft material	Stainless steel
Flange material	Aluminum
Housing material	Aluminum die cast
Start up torque	0.5 Ncm (+20 °C)
Operating torque	0.3 Ncm (+20 °C)
Permissible shaft loading	80 N (radial) 40 N (axial)
Operating speed	≤ 9,000 min ⁻¹ ¹⁾
Moment of inertia of the rotor	6.2 gcm ²
Bearing lifetime	3.6 x 10 ¹⁰ revolutions
Angular acceleration	≤ 500,000 rad/s ²

¹⁾ Allow for self-heating of 3.3 K per 1,000 rpm when designing the operating temperature range.

Ambient data

EMC	According to EN 61000-6-2 and EN 61000-6-4
Enclosure rating	IP67, housing side, cable connection (IEC 60529) IP65, shaft side (IEC 60529)
Permissible relative humidity	90 % (Condensation not permitted)
Operating temperature range	-40 °C ... +100 °C ¹⁾ -30 °C ... +100 °C ²⁾
Storage temperature range	-40 °C ... +100 °C, without package
Resistance to shocks	70 g, 6 ms (EN 60068-2-27)
Resistance to vibration	30 g, 10 Hz ... 2,000 Hz (EN 60068-2-6)

¹⁾ Stationary position of the cable.

²⁾ Flexible position of the cable.

Certificates

EU declaration of conformity	✓
UK declaration of conformity	✓
ACMA declaration of conformity	✓
Moroccan declaration of conformity	✓
China-RoHS	✓
cULus certificate	✓
Information according to Art. 3 of Data Act (Regulation EU 2023/2854)	✓

ECLASS 5.0	27270501
ECLASS 5.1.4	27270501
ECLASS 6.0	27270590
ECLASS 6.2	27270590
ECLASS 7.0	27270501
ECLASS 8.0	27270501
ECLASS 8.1	27270501
ECLASS 9.0	27270501
ECLASS 10.0	27270501
ECLASS 11.0	27270501
ECLASS 12.0	27270501
ETIM 5.0	EC001486
ETIM 6.0	EC001486
ETIM 7.0	EC001486
ETIM 8.0	EC001486
UNSPSC 16.0901	41112113

Technical drawing of a mechanical part, showing side and end views with dimensions and tolerances.

Side View Dimensions:

- Overall length: 58 ± 0.1 (2.28)
- Distance from left face to start of first step: $51.5 - 0.2$ (2.03)
- Distance from left face to start of second step: 50 (1.97) f8
- Distance from left face to start of third step: 9.5 (0.37)
- Distance from left face to start of fourth step: 10 ± 0.3 (0.39)
- Distance from left face to start of fifth step: 43.1 (1.70)
- Distance from left face to start of sixth step: 40 (1.57)
- Distance from left face to start of seventh step: 37 (1.46)
- Distance from left face to start of eighth step: 34 (1.34)
- Distance from left face to start of ninth step: 31 (1.22)
- Distance from left face to start of tenth step: 28 (1.10)
- Distance from left face to start of eleventh step: 25 (0.98)
- Distance from left face to start of twelfth step: 22 (0.87)
- Distance from left face to start of thirteenth step: 19 (0.75)
- Distance from left face to start of fourteenth step: 16 (0.63)
- Distance from left face to start of fifteenth step: 13 (0.51)
- Distance from left face to start of sixteenth step: 10 (0.39)
- Distance from left face to start of seventeenth step: 7 (0.28)
- Distance from left face to start of eighteenth step: 4 (0.16)
- Distance from left face to start of nineteenth step: 1 (0.04)

End View Dimensions:

- Overall diameter: $\varnothing 60$ (2.36)
- Distance from center to first step: 3 (0.12)
- Distance from center to second step: 4 (0.16)
- Distance from center to third step: 5 (0.20)
- Distance from center to fourth step: 6 (0.24)
- Distance from center to fifth step: 7 (0.28)
- Distance from center to sixth step: 8 (0.31)
- Distance from center to seventh step: 9 (0.35)
- Distance from center to eighth step: 10 (0.39)
- Distance from center to ninth step: 11 (0.43)
- Distance from center to tenth step: 12 (0.47)
- Distance from center to eleventh step: 13 (0.51)
- Distance from center to twelfth step: 14 (0.55)
- Distance from center to thirteenth step: 15 (0.59)
- Distance from center to fourteenth step: 16 (0.63)
- Distance from center to fifteenth step: 17 (0.67)
- Distance from center to sixteenth step: 18 (0.71)
- Distance from center to seventeenth step: 19 (0.75)
- Distance from center to eighteenth step: 20 (0.79)
- Distance from center to nineteenth step: 21 (0.83)
- Distance from center to twentieth step: 22 (0.87)
- Distance from center to twenty-first step: 23 (0.91)
- Distance from center to twenty-second step: 24 (0.95)
- Distance from center to twenty-third step: 25 (0.99)
- Distance from center to twenty-fourth step: 26 (1.03)
- Distance from center to twenty-fifth step: 27 (1.07)
- Distance from center to twenty-sixth step: 28 (1.11)
- Distance from center to twenty-seventh step: 29 (1.15)
- Distance from center to twenty-eighth step: 30 (1.19)
- Distance from center to twenty-ninth step: 31 (1.23)
- Distance from center to thirtieth step: 32 (1.27)
- Distance from center to thirty-first step: 33 (1.31)
- Distance from center to thirty-second step: 34 (1.35)
- Distance from center to thirty-third step: 35 (1.39)
- Distance from center to thirty-fourth step: 36 (1.43)
- Distance from center to thirty-fifth step: 37 (1.47)
- Distance from center to thirty-sixth step: 38 (1.51)
- Distance from center to thirty-seventh step: 39 (1.55)
- Distance from center to thirty-eighth step: 40 (1.59)
- Distance from center to thirty-ninth step: 41 (1.63)
- Distance from center to fortieth step: 42 (1.67)
- Distance from center to forty-first step: 43 (1.71)
- Distance from center to forty-second step: 44 (1.75)
- Distance from center to forty-third step: 45 (1.79)
- Distance from center to forty-fourth step: 46 (1.83)
- Distance from center to forty-fifth step: 47 (1.87)
- Distance from center to forty-sixth step: 48 (1.91)
- Distance from center to forty-seventh step: 49 (1.95)
- Distance from center to fiftieth step: 50 (1.99)

Surface Finish and Tolerances:

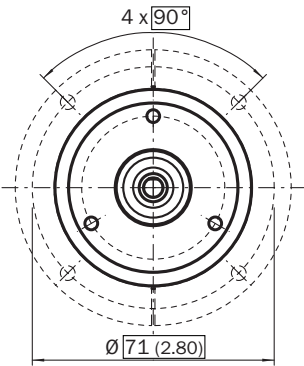
- Surface A: $R_A 0.1$
- Surface B: $R_A 0.05$
- Surface C: $R_A 0.05$

End View Details:

- 3 x 120° (3 x 120 degrees)
- 3 x M4 (6-deep)
- Overall diameter: $\varnothing 42 \pm 0.05$ (1.65)
- Distance from center to first hole: 10 (0.39)
- Distance from center to second hole: 20 (0.79)
- Distance from center to third hole: 30 (1.19)
- Distance from center to fourth hole: 40 (1.59)
- Distance from center to fifth hole: 50 (1.99)
- Distance from center to sixth hole: 60 (2.36)
- Distance from center to seventh hole: 70 (2.76)
- Distance from center to eighth hole: 80 (3.15)
- Distance from center to ninth hole: 90 (3.54)
- Distance from center to tenth hole: 100 (3.94)
- Distance from center to eleventh hole: 110 (4.33)
- Distance from center to twelfth hole: 120 (4.72)
- Distance from center to thirteenth hole: 130 (5.12)
- Distance from center to fourteenth hole: 140 (5.51)
- Distance from center to fifteenth hole: 150 (5.91)
- Distance from center to sixteenth hole: 160 (6.30)
- Distance from center to seventeenth hole: 170 (6.70)
- Distance from center to eighteenth hole: 180 (7.09)
- Distance from center to nineteenth hole: 190 (7.49)
- Distance from center to twentieth hole: 200 (7.87)
- Distance from center to twenty-first hole: 210 (8.27)
- Distance from center to twenty-second hole: 220 (8.66)
- Distance from center to twenty-third hole: 230 (9.06)
- Distance from center to twenty-fourth hole: 240 (9.45)
- Distance from center to twenty-fifth hole: 250 (9.84)
- Distance from center to twenty-sixth hole: 260 (10.24)
- Distance from center to twenty-seventh hole: 270 (10.63)
- Distance from center to twenty-eighth hole: 280 (11.03)
- Distance from center to twenty-ninth hole: 290 (11.42)
- Distance from center to thirtieth hole: 300 (11.81)
- Distance from center to thirty-first hole: 310 (12.21)
- Distance from center to thirty-second hole: 320 (12.60)
- Distance from center to thirty-third hole: 330 (13.00)
- Distance from center to thirty-fourth hole: 340 (13.39)
- Distance from center to thirty-fifth hole: 350 (13.79)
- Distance from center to thirty-sixth hole: 360 (14.18)
- Distance from center to thirty-seventh hole: 370 (14.58)
- Distance from center to thirty-eighth hole: 380 (14.97)
- Distance from center to thirty-ninth hole: 390 (15.37)
- Distance from center to fortieth hole: 400 (15.75)
- Distance from center to forty-first hole: 410 (16.15)
- Distance from center to forty-second hole: 420 (16.54)
- Distance from center to forty-third hole: 430 (16.93)
- Distance from center to forty-fourth hole: 440 (17.33)
- Distance from center to forty-fifth hole: 450 (17.72)
- Distance from center to forty-sixth hole: 460 (18.12)
- Distance from center to forty-seventh hole: 470 (18.51)
- Distance from center to forty-eighth hole: 480 (18.91)
- Distance from center to forty-ninth hole: 490 (19.30)
- Distance from center to fiftieth hole: 500 (19.70)

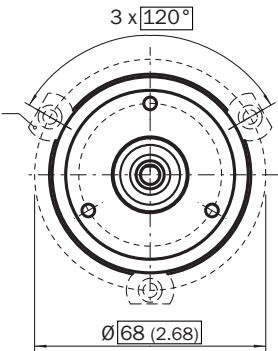
① cable diameter = 5.6 mm +/- 0.2 mm bend radius = 30 mm

Mounting requirements for half-shell servo clamp



All dimensions in mm (inch)
part no. 2029165

Mounting requirements for small servo clamp



All dimensions in mm (inch)
part no. 2029166

PIN assignment



PINMale connector M12, 8-pin	PINMale connector M23, 12-pin	Wire colors (cable connection)	TTL/HTL signal	Sin/Cos 1.0 V _{PP}	Explanation
1	6	Brown	A ⁻	COS-	Signal wire
2	5	White	A	COS+	Signal wire
3	1	Black	B ⁻	SIN-	Signal wire
4	8	Pink	B	SIN+	Signal wire
5	4	Yellow	Z ⁻	Z ⁻	Signal wire

PINMale connector M12, 8-pin	PINMale connector M23, 12-pin	Wire colors (cable connection)	TTL/HTL signal	Sin/Cos 1.0 V _{PP}	Explanation
6	3	Purple	Z	Z	Signal wire
7	10	Blue	GND	GND	Ground connection
8	12	Red	+U _S	+U _S	Supply voltage
-	9	-	N.c.	N.c.	Not assigned
-	2	-	N.c.	N.c.	Not assigned
-	11	-	N.c.	N.c.	Not assigned
-	7 ¹⁾	Orange	0-SET ¹⁾	N.c.	Set zero pulse ¹⁾
Screen	Screen	Screen	Screen	Screen	Screen connected to housing on encoder side. Connected to ground on control side.

¹⁾For electrical interfaces only: M, U, V, W with 0-SET function on PIN 7 on M23 plug. The 0-SET input is used to set the zero pulse to the current shaft position. If the 0-SET input is applied to US for longer than 250 ms after it has previously been open or applied to GND for at least 1,000 ms, the current shaft position is assigned zero pulse signal "Z".

maximum revolution range



signal outputs



CW with view on the encoder shaft in direction “A”, compare dimensional drawing.

Supply voltage	Output
4,5 V ... 5,5 V	TTL
10 V ... 32 V	TTL
10 V ... 32 V	HTL

Recommended accessories

Other models and accessories → www.sick.com/DFS60

	Brief description	Type	part no.
shaft adaptation			
	Product segment: Shaft adaptation Product: Shaft couplings Description: Bellows coupling, shaft diameter 6 mm / 10 mm, maximum shaft offset: radial ± 0.25 mm, axial ± 0.4 mm, angular $\pm 4^\circ$; max. speed 10,000 rpm, -30°C to $+120^\circ\text{C}$, max. torque 120 Ncm; material: stainless steel bellows, aluminum hub	KUP-0610-B	5312982
	Product segment: Shaft adaptation Product: Shaft couplings Description: Double loop coupling, shaft diameter 6 mm / 10 mm, max. shaft offset: radially ± 2.5 mm, axially ± 3 mm, angle ± 10 degrees; max. speed 3,000 rpm, -30 to $+80$ degrees Celsius, torsional spring stiffness of 25 Nm/rad	KUP-0610-D	5326697
	Product segment: Shaft adaptation Product: Shaft couplings Description: Spring washer coupling, shaft diameter 6 mm / 10 mm, Maximum shaft offset: radial ± 0.3 mm, axial ± 0.4 mm, angular $\pm 2.5^\circ$; max. speed 12,000 rpm, -10° to $+80^\circ\text{C}$, max. torque 60 Ncm; material: aluminum flange, glass fiber-reinforced polyamide membrane and hardened steel coupling pin	KUP-0610-F	5312985
	Product segment: Shaft adaptation Product: Shaft couplings Description: Bar coupling, shaft diameter 6 mm / 10 mm, max. shaft offset: radial ± 0.3 mm, axial ± 0.3 mm, angular $\pm 3^\circ$; max. speed 10,000 rpm, -10° to $+80^\circ\text{C}$, max. torque: 80 Ncm, material: fiber-glass reinforced polyamide, aluminum hub	KUP-0610-S	2056407
	Product segment: Shaft adaptation Product: Shaft couplings Description: Claw coupling, shaft diameter 6 mm / 10 mm, damping element 80 shore blue, maximum shaft offset: radial ± 0.22 mm, axial ± 1 mm angular $\pm 1.3^\circ$, max. speed 19,000 rpm, angle of twist max. 10°, -30°C to $+80^\circ\text{C}$, max. torque 800 Ncm, tightening torque of screws: ISO 4029 150 Ncm, material: aluminum flange, damping element: polyurethane	KUP-0610-J	2127056
	Product segment: Shaft adaptation Product: Shaft couplings Description: Bar coupling, shaft diameter 6 mm / 8 mm, maximum shaft offset radial ± 0.3 mm, axial ± 0.2 mm, angle $\pm 3^\circ$, max. speed 10,000 rpm, torsion spring rigidity 38 Nm/wheel; material: fiber-glass reinforced polyamide, aluminum hub	KUP-0608-S	5314179
	Product segment: Shaft adaptation Product: Shaft couplings Description: Cross-slotted coupling, shaft diameter 6 mm / 6 mm, maximum shaft offset: radial ± 0.3 mm, axial ± 0.2 mm, angle $\pm 3^\circ$; max. speed 10,000 rpm, -10° to $+80^\circ\text{C}$, max. torque 80 Ncm; material: fiber-glass reinforced polyamide, aluminum hub	KUP-0606-S	2056406
	Product segment: Shaft adaptation Product: Shaft couplings Description: Bellows coupling, shaft diameter 6 mm / 6 mm, maximum shaft offset: radial ± 0.25 mm, axial ± 0.4 mm, angular $\pm 4^\circ$; max. speed 10,000 rpm, -30°C to $+120^\circ\text{C}$, max. torque 120 Ncm; material: stainless steel bellows, aluminum hub	KUP-0606-B	5312981

	Brief description	Type	part no.
measuring wheels and measuring wheel mechanics			
	Product segment: Measuring wheels and measuring wheel mechanics Product family: Measuring wheels Description: Aluminum measuring wheel with studded polyurethane surface for 6 mm solid shaft, circumference 200 mm	BEF-MR06200APN	4084747
	Product segment: Measuring wheels and measuring wheel mechanics Product family: Measuring wheels Description: Aluminium measuring wheel with O-ring (NBR70) for 6 mm solid shaft, circumference 200 mm	BEF-MR006020R	2055222
	Product segment: Measuring wheels and measuring wheel mechanics Product family: Measuring wheels Description: Measuring wheel with O-ring (NBR70) for 6 mm solid shaft, circumference 300 mm	BEF-MR006030R	2055634
	Product segment: Measuring wheels and measuring wheel mechanics Product family: Measuring wheels Description: Aluminium measuring wheel with O-ring (NBR70) for 6 mm solid shaft, circumference 500 mm	BEF-MR006050R	2055225
	Product segment: Measuring wheels and measuring wheel mechanics Product family: Measuring wheels Description: Aluminum measuring wheel with cross-knurled surface for 6 mm solid shaft, circumference 200 mm	BEF-MR06200AK	4084745
	Product segment: Measuring wheels and measuring wheel mechanics Product family: Measuring wheels Description: Aluminum measuring wheel with smooth polyurethane surface for 6 mm solid shaft, circumference 200 mm	BEF-MR06200AP	4084746
	Product segment: Measuring wheels and measuring wheel mechanics Product family: Measuring wheels Description: Aluminum measuring wheel with ridged polyurethane surface for 6 mm solid shaft, circumference 200 mm	BEF-MR06200APG	4084748

	Brief description	Type	part no.
Mounting systems			
	Description: Bearing block for servo and face mount flange encoder. The heavy-duty bearing block is used to absorb very large radial and axial shaft loads. Particularly when using belt pulleys, chain sprockets, friction wheels. Operating speed max. 4,000 rpm⁻¹, axial shaft load 150 N, radial shaft load 250 N, bearing service life 3.6 x 10⁹ revolutions	BEF-FA-LB1210	2044591
	Description: Mounting kit for servo flange encoder on the bearing block, 1 bar coupling SKPS 1520 06/06 1 hexagon socket wrench SW1.5 DIN 911, 3 mounting eccentric BEMN 1242 49 3 screws M4 x 10 DIN 912, 1 hexagon socket wrench SW3 DIN 911 Items supplied: 1 bar coupling SKPS 1520 06/06 1 hexagon socket wrench SW1.5 DIN 911, 3 mounting eccentric BEMN 1242 49 3 screws M4 x 10 DIN 912, 1 hexagon socket wrench SW3 DIN 911	BEF-MK-LB	5320872
	Description: Servo clamps, large, for servo flange (clamps, eccentric fastener), 3 pcs, without mounting material Items supplied: Without mounting hardware	BEF-WK-SF	2029166
	Description: Mounting bell for encoder with servo flange, 50 mm spigot Items supplied: Mounting kit included	BEF-MG-50	5312987

	Brief description	Type	part no.
connectors and cables			
	Connection type head A: Male connector, M12, 8-pin, straight, A-coded Signal type: Incremental Cable: CAT5, CAT5e Description: Incremental, shielded Connection systems: IDC quick connection Permitted cross-section: 0.14 mm² ... 0.34 mm²	STE-1208-GA01	6044892
	Connection type head A: Female connector, JST, 8-pin, straight Connection type head B: Flying leads Signal type: SSI, Incremental Items supplied: JST including sealing Cable: 3 m, 8-wire, PUR, halogen-free Description: SSI, shielded, Incremental	DOL-0J08-G3M0AA6	2048591
	Connection type head A: Female connector, JST, 8-pin, straight Connection type head B: Flying leads Signal type: SSI, Incremental Items supplied: JST including sealing Cable: 1.5 m, 8-wire, PUR, halogen-free Description: SSI, shielded, Incremental	DOL-0J08-G1M5AA6	2048590
	Connection type head A: Female connector, JST, 8-pin, straight Connection type head B: Flying leads Signal type: Incremental, SSI Items supplied: JST including sealing Cable: 0.5 m, 8-wire, PUR, halogen-free Description: Incremental, shielded, SSI	DOL-0J08-G0M5AA3	2046873
	Connection type head A: Female connector, JST, 8-pin, straight Connection type head B: Flying leads Signal type: Incremental, SSI Items supplied: JST including sealing Cable: 5 m, 8-wire, PUR, halogen-free Description: Incremental, shielded, SSI	DOL-0J08-G05MAA3	2046876
	Connection type head A: Female connector, JST, 8-pin, straight Connection type head B: Flying leads Signal type: Incremental, SSI Items supplied: JST including sealing Cable: 10 m, 8-wire, PUR, halogen-free Description: Incremental, shielded, SSI	DOL-0J08-G10MAA3	2046877
	Connection type head A: Male connector, M23, 12-pin, straight, A-coded Signal type: HIPERFACE[®], SSI, Incremental Description: HIPERFACE[®], shieldedSSIIncremental Connection systems: Solder connection	STE-2312-GX	6028548
	Connection type head A: Male connector, M23, 12-pin, straight, A-coded Signal type: HIPERFACE[®], SSI, Incremental Description: HIPERFACE[®], shieldedSSIIncremental Connection systems: Solder connection	STE-2312-G01	2077273
	Connection type head A: Female connector, JST, 8-pin, straight Connection type head B: Male connector, M23, 12-pin, straight Signal type: Incremental Cable: 0.35 m, 8-wire, PUR, halogen-free Description: Incremental, shielded	STL-2312-GM35AA3	2061621
	Connection type head A: Female connector, JST, 8-pin, straight Connection type head B: Male connector, M23, 12-pin, straight Signal type: Incremental Cable: 1 m, 8-wire, PUR, halogen-free Description: Incremental, shielded	STL-2312-G01MAA3	2061622
	Connection type head A: Female connector, JST, 8-pin, straight Connection type head B: Male connector, M23, 12-pin, straight Signal type: Incremental Cable: 2 m, 8-wire, PUR, halogen-free Description: Incremental, shielded	STL-2312-G02MAA3	2061504

SICK AT A GLANCE

SICK is one of the leading manufacturers of intelligent sensors and sensor solutions for industrial applications. A unique range of products and services creates the perfect basis for controlling processes securely and efficiently, protecting individuals from accidents and preventing damage to the environment.

We have extensive experience in a wide range of industries and understand their processes and requirements. With intelligent sensors, we can deliver exactly what our customers need. In application centers in Europe, Asia and North America, system solutions are tested and optimized in accordance with customer specifications. All this makes us a reliable supplier and development partner.

Comprehensive services complete our offering: SICK LifeTime Services provide support throughout the machine life cycle and ensure safety and productivity.

For us, that is “Sensor Intelligence.”

WORLDWIDE PRESENCE:

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