

COARSE POINTING ASSEMBLY: CPA 70



CPA 70 DUAL-MIRROR POINTING MECHANISM

CPA 70

The CPA 70 is a dual-mirror pointing mechanism for 70 mm beam diameter designed for full hemispherical pointing capability. It is typically used in lasercom terminals for data relay applications between spacecraft in LEO/MEO and GEO or for Direct-to-Earth (DTE) links at medium data rates. The usable beam diameter can be modified upon customer request.

The CPA 70 is a lower cost derivative of Synopta's high performance CPA 135 providing 135 mm beam diameter.

The CPA 70 combines well proven functional modules and technologies, which were developed/qualified by Synopta and operate successfully in orbit in frame of several European space programs such as EDRS and the Sentinels.

In its standard version the CPA 70 supports both wavelength ranges currently used for laser communications; 1'064 nm and 1'530 to 1'565 nm. With special mirror coatings it is possible to handle also other wavelengths (e.g. 700 to 850 nm).

The dual-mirror configuration of the CPA 70 ensures lowest Tx/Rx laser beam polarization change which is kept constant over the entire pointing range.

Combining high optical quality (induced wavefront error < 30 nm rms with SiC mirrors,) and agility (angular speed $\geq 25^\circ/\text{sec}$) with excellent pointing precision (pointing error $\leq 25 \mu\text{rad rms}$) and low tracking jitter, the CPA 70 offers top class technical features; it is designed to operate over a wide temperature range and under stressing environmental conditions during a long in-orbit lifetime. Thus, it combines the performance and functionality needed for advanced data relay and DTE applications. It is designed for medium volume production quantities and meets most rigorous industrial quality standards.

Developed and produced in Switzerland by Synopta and its industrial partners the CPA 70 combines traditional Swiss workmanship and advanced technologies in a high performance industrial space product at very competitive price level.

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CPA 70 Main Functional and Performance Features

MAIN FUNCTIONAL CHARACTERISTICS

Beam diameter	70 mm (free of vignetting)
Beam angular range	± 5 mrad
Operating wavelength ranges	1'530 nm to 1'565 nm (optionally 1'050 nm $\pm$ 25 nm)
Azimuth pointing range	$\pm 160^\circ$
Elevation pointing range	-20° to $+200^\circ$

PERFORMANCE FEATURES

Angular resolution	2 μ rad
Angular velocity	$\geq 5^\circ/\text{sec}$
Angular acceleration	up to $\pm 5^\circ/\text{sec}^2$
Angular position jitter	≤ 3.5 μ rad @ $0.05^\circ/\text{sec}$
Line-of-sight pointing error (with pointing model)	≤ 25 μ rad rms (500 μ rad maximum over operational temperature)
Induced wavefront error	≤ 30 nm rms (with SiC mirrors)
Rel. spectral transmission	≥ 0.96
Polarization change	$< 1\%$ @ 1'064 nm (over entire pointing range)

ENVIRONMENTAL CONDITIONS

Operating temperature range	-25°C to $+55^\circ\text{C}$ (at interface plate)
Mechanical loads	Overall 17.6 g rms
Radiation load, ionizing	100 krad (Si) @ 5 mm 4π Al-equivalent
Lifetime	in-orbit operations: 54'000 on/off cycles, 20 min/cycle up to 5 years on ground, 1'000 hrs. operation

INTERFACE CHARACTERISTICS

Dimensions	305 mm x 180 mm, 215 mm height
Mass	5 kg (without MLI and S/C connector harness)
Power	< 6 W mean (without heaters)
Electrical interface	Analog & digital lines
Connectors	2 x MDM, 2 x D-Sub, grounding stud