

FEATURES & BENEFITS

- High speed sweeping
- High resolution
- Probes of arbitrary length
- Remote sensing capable
- Low-cost probe connection
- No polarization adjustments
- Low Optical Loss
- Standard FC/APC Interfaces
- SMF design reduces cost

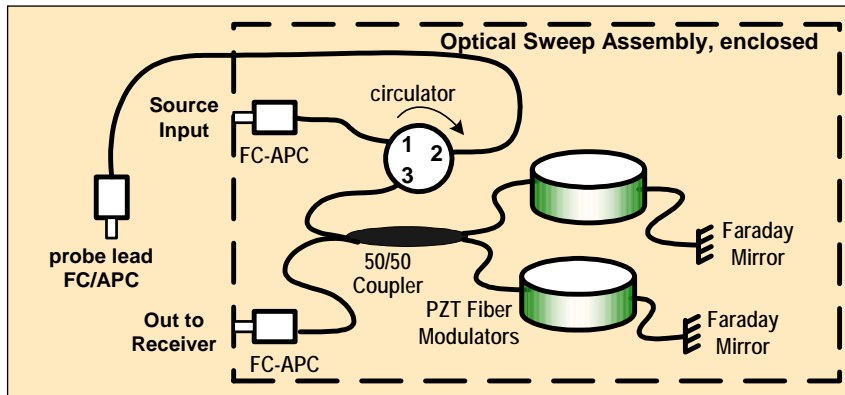
The **OPTIPHASE® AIF-01** Optical Sweep Engine is an industry leading product designed to satisfy the growing needs of Optical Coherence Tomography [OCT] and Optical Coherence Domain Reflectometry [OCDR] applications. The AIF-01 implements an economical high-efficiency optical configuration. Utilizing an all-fiber sweeping mechanism, it enables the host to set sweep ranges from 1 to 7.5 mm and sweep rates up to hundreds of Hertz. The AIF-01 module is rugged and compact, as its design is devoid of bulk optic components making it ideal for applications requiring high reliability, varying temperature ranges and sweeping devoid of ghost images.

Enabling Technology

The AIF-01 Optical Sweep Engine architecture delivers two new enabling capabilities and benefits. First, it removes all restrictions on the length of the probe resulting in the elimination of any path matching requirements. Second, the architecture allows use of Faraday reflectors in the interferometer. This enables and ensures high contrast interference signals and allows the use of Single Mode Fiber [SMF] throughout the entire design (including the probe) reducing costs and increasing reliability.

Field Proven Capabilities

Today, Optiphase technology and expertise supplies numerous OEM partners and users with hundreds of in-the-field units currently on the market. These include Biomedical, Pharmaceutical, Chemical and Film companies as well as major Universities and Medical Research Centers. Optiphase is well-versed in the design, use and manufacture of cost-effective optical modules for OCT / OCDR applications and welcomes the opportunity to discuss your custom application / integration needs.



AIF-01 Design Topology



U.S. Patent No. 6847453

OCT / OCDR APPLICATIONS AND USES

INDUSTRIES	BIOMEDICAL [OCT] USES	INDUSTRIAL [OCDR] USES
• Biomedical	• Coronary catheter guidance	• Reflectometers
• Dental	• Biopsy probe guidance and diagnostics	• Scattering
• Pharmaceutical	• Tissue imaging	• Distinct boundary
• Chemical	- Eye: retina, cornea	• Displacement
• Film	- Cancer: esophageal, bladder, breast, other	• Thickness
• Camera	- Coronary heart disease	• Liquids
• Coatings	- Dental caries and gum disease	• Glass
• Paper	- Organ imaging	• Plastics
• Photonics	- Endoscopy enhancement	• Coatings
	- Skin disease	• Thin Films

SPECIFICATIONS

OPTICAL

Operational Wavelength	1.3 $\mu\text{m} \pm 30 \text{ nm}$
Interfaces	FC/APC [Diamond wide-key connector], SMF-28 mode field match
Loss	
Sweep Assembly [source probe]	2 dB, typical [includes estimated connector loss]
Sweep Assembly [probe return to receiver]	6 dB, typical [includes estimated connector loss]
Return Loss [from source input]	$\geq 50 \text{ dB}$
OCDR Resolution	Optical Source Transform Limited [see note 1]

SWEeper

Drive Interface	Bulkhead connector, both leads floating
Drive Impedance	0.2 μF nominal
Drive Transduction Factor	120 radians per volt at 1.3 μm typical. OCDR [air path] sweep of 12.4 μm per volt
Sweep Signal	Triangle or sine waveforms
Drive Level Limits and Frequency Range	Up to 600V p-p and up to 500 Hz, derated drive exceeds 1 KHz [see note 2]
Maximum Sweep Range	7 mm typical [air path distance from probe end]
Sweep Accuracy	$\leq \pm 2\%$ typical excluding sweep wave reversal for triangle wave drive
Sweep Offset	Set to 3.5 mm $\pm 1 \text{ mm}$ typical unless specified otherwise [see note 3]
Enclosure	7.5" L x 4" W x 3" H

OPTIONS

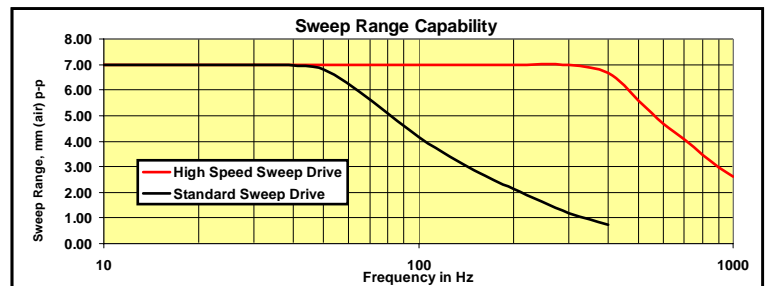
Operational Wavelength	1.5 μm
Enhanced Sweep Range	25+ mm without compromising bandwidth

Note 1: OCDR Resolution

System resolution is optical source spectral-width dependent, roughly following the relationship $\Delta L = \lambda^2 / 2n\Delta\lambda$, where ΔL is the resolution, λ is the source spectral wavelength, $\Delta\lambda$ is the spectral width of the source [Full Width, Half Max] and n is the index of refraction of the medium the measurements are taken.

Note 2: Drive Level and Frequency

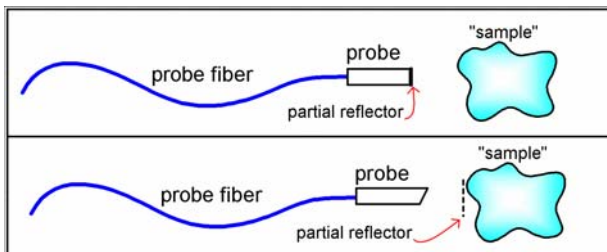
Optiphase manufactures and sells OEM Sweep Drivers for the AIF-01. These are configured as small circuit cards requiring external power. The Standard driver provides full range scans to 50 Hz and the High Speed driver provides full range scans to 300 Hz. Derated drive range performance may exceed 1000 Hz. See performance curves on right.



Note 3: Sweep Offset

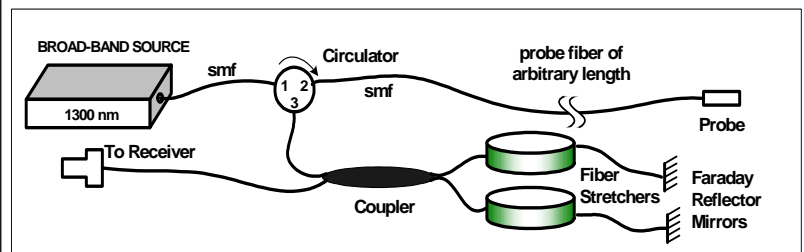
The Autocorrelator reading differs from the Michelson interferometer in that its "transform" is double-sided, where the Michelson is single-sided. In order to make an Autocorrelator behave like a Michelson, it needs to be configured with an offset in optical path. Optiphase typically sets this offset to be half the full scan range to enable single-sided measurements.

Configuration Note



The Autocorrelator does not utilize a reference arm. Therefore a partial reflection is relied on at the end of the fiber probe [or other partial reflection in front of the sample] to provide the reference path. Most probe assembly designs can easily accommodate this.

Application Configuration



Shown with Source and Probe: Not shown are processing electronics and HV driver for fiber stretcher.