

Lock-in Amplifier

The compact lock-in amplifier SU-1, developed by Tydex, is designed to amplify high-noise signals. It is a homodyne detector with a low pass filter. An external reference signal is required to operate SU-1. All operating parameters (amplification, time constant and phase) are manually adjustable. Also SU-1 is used to measure phase shift of the signal.



Schematic diagram of SU-1 is provided in fig. 1.

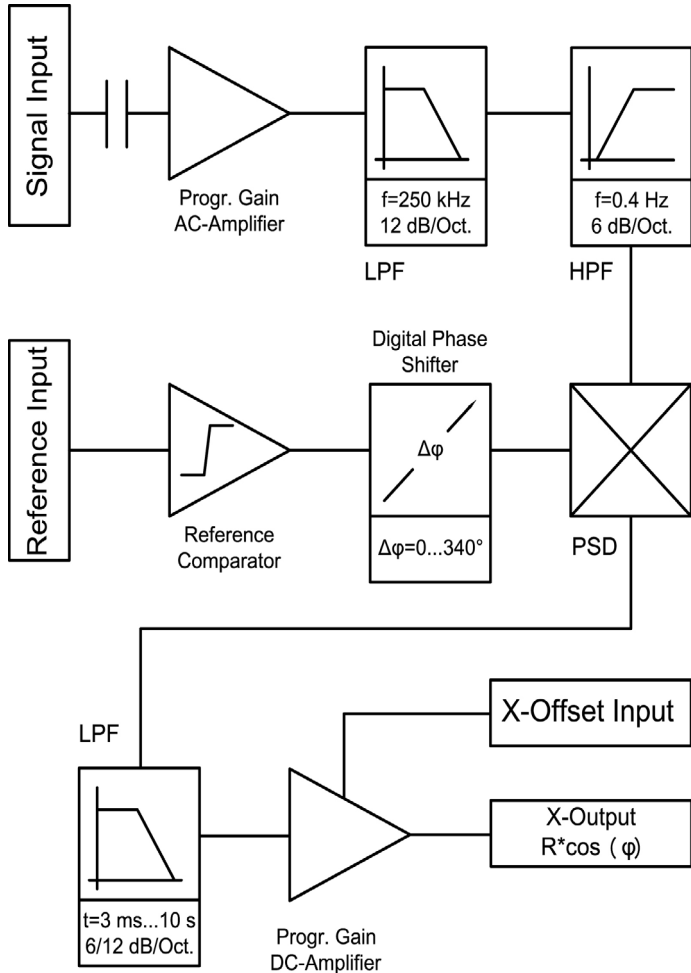


Fig. 1. SU-1 schematic diagram

The principle of operation of SU-1 is based on orthogonality of two sinusoidal functions. When a product of two sinusoidal functions with non-matching frequencies f_1 and f_2 is integrated over time well above their periods, the result is zero. On the other hand, when $f_1 = f_2$, and both functions are in phase, integrated average is equal to half of the product of the functions' amplitudes.

SU-1 multiplies input signal to reference signal (from built-in generator or external source) and integrates the product over specified time (usually from milliseconds to a few seconds). The result is a DC signal, and the effect of any other signal not matched by frequency to the reference is dampened to almost zero. Same-frequency component that is not in phase with the reference signal is attenuated too (since same-frequency sinusoidal and cosinusoidal waves are orthogonal).

SU-1 is to be used to amplify high-noise signal produced by the following means of detecting of THz radiation: electro-optical detection of pulsed THz radiation and of detection of THz radiation using the following detectors: Golay detectors, cooled bolometers, pyro-electric THz radiation detectors, semiconductor THz radiation detectors, novel THz radiation detectors.

The figures 2 and 3 respectively show the signal dependence on SU-1 gain factor and time constant. This signal is a temporal shape of THz impulse obtained by EOD.

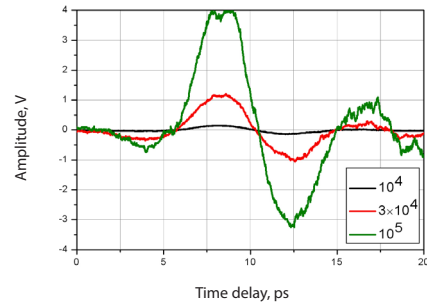


Fig. 2. Signal level at various gain factor settings

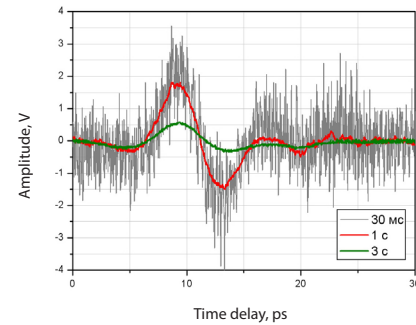


Fig. 3. Signal level at various time constant settings

Specifications:

Absolute Maximum Ratings	
Signal input AC voltage, V	20
Signal input DC voltage, V	± 30
Reference input voltage, V	± 15
Power supply voltage, V	± 15
Key Specifications	
Frequency range	0,01 ÷ 250 kHz
Reference Input	
Signal range: Bipolar	± 0,01 ÷ ± 5 V
TTL	-5 B / +10 V
Input impedance	1 MΩ
Reference acquisition time	4 s
Phase	
Range	0 ÷ 340°
Resolution	8 bit
Drift	0,01° / K
Accuracy	±1 bit



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Voltage Input	
Maximum input voltage	± 15 V
Range: low drift	30 μ V - 100 mV RMS
high dynamic	3 μ V - 100 mV RMS
Input impedance	1 M Ω
Input voltage noise	12 nV / $\sqrt{\text{Hz}}$ @ 1 kHz
Gain drift	< 100 ppm / K
Dynamic reserve	
Low drift	26 dB (min)
High dynamic	46 dB (min)
Maximum dynamic	50 dB
Output	
Voltage range	± 10 V
Impedance	50 Ω
DC drift: low drift	< 50 ppm / K
high dynamic	< 500 ppm / K
Basic accuracy: ≤ 30 kHz	2 %
≥ 30 kHz	5 %
Time constants	
Range	3 ms - 10 s
Filter characteristics	6 dB / octave
	12 dB / octave
Dimensions and weight	
Dimensions (LxHxW), mm	194x115x35
Weight, kg	5,0

Following accessories for the SU-1 can be supplied separately:

- Golya Detector GC-1P/T/D;
- BPF (band-pass filters) for a specified wavelength within 0.1-15 THz range ;
- LPF (low pass filters) to filter out IR radiation, with the following cut-off frequencies: 23.4 THz, 23.3 THz, 23.1 THz, 14.3 THz, 10.9 THz, 8.8 THz, 5.5 THz, 4.3 THz, 4 THz, 3.2 THz ;
- a set of attenuators with 1%, 3%, 10% and 30% transmittance ;
- TPX and HRFZ-Si lenses.

For price quotation and delivery please fill in our request form at the web site or send us a letter.

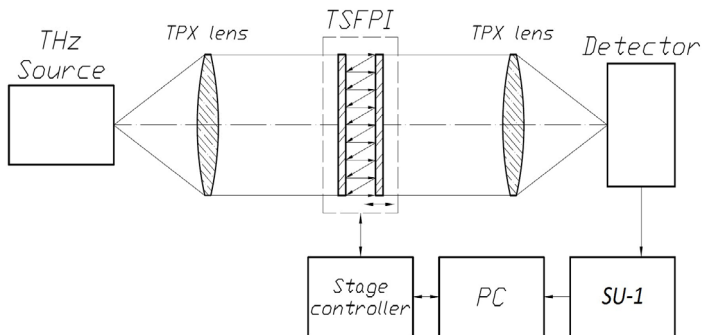


Fig. 4. Sample application of SU-1 within THz radiation detector based on THz scanning Fabry-Perot interferometer with Golya Detector

Key features:

- Operating frequency up to 250 KHz;
- Adjustable sensitivity, time constant and phase;
- Compact and electromagnetic interference shielded enclosure.

SU-1 package includes:

- electronic unit,
- power supply,
- three RF-connector cables (1.5 m each),
- operating manual.