

410 DUAL PHASE, SINGLE BOARD LOCK-IN AMPLIFIER

DL Instruments, LLC

The Model 410 is a Dual Phase Lock-In Amplifier for applications where fixed reference frequencies as well as presettable values for sensitivity, time constant and phase setting are applicable. It is intended primarily for OEM applications or for installations requiring a multiplicity of lock-in amplifiers.

Due to the use of highly integrated circuitry and modern filter techniques, the Model 410 offers a data

quality which is comparable with today's laboratory type instruments. The small size of only 3.93 x 8.70 x .59 inches (100 x 221 x 15mm) and low cost now allow the advantages of lock-in detection in application areas where cost and size of laboratory grade instruments were previously infeasible.

MODEL 410 FEATURES

- integrated voltage and current input amplifiers
- overload capability up to 100 dB
- outputs for $A \cos$ and $A \sin$ or A and Phase
- f and $2f$, external and internal reference mode
- integrated internal oscillator
- optional log output as well as X/Y ratio output

SPECIFICATIONS

WORKING FREQUENCY: factory set within the range from 1 Hz to 100 kHz per customer requirements. Tuning range of pre-set frequency is $\pm 5\%$

VOLTAGE INPUT: differential and single ended

OVERVOLTAGE PROTECTION: maximum 25 V rms, ± 100 V dc

SENSITIVITY: 10 mV rms to 1 μ V rms, presettable in 1–10–100 steps and continuously variable

INPUT IMPEDANCE: 20 M Ω differential

10 M Ω single ended

GAIN DRIFT: < 50 ppm/ $^{\circ}$ C

INPUT NOISE: typically 20 nV rms/ $\sqrt{\text{Hz}}$ at 1 kHz

COMMON MODE REJECTION: typ 100 dB at 1 kHz, typ 60 dB at 50 kHz

CURRENT INPUT SENSITIVITY: 10^{-7} to 10^{-11} A rms or 10^{-6} to 10^{-10} A rms

CURRENT NOISE: typically < 1 pA rms/ $\sqrt{\text{Hz}}$ at 1 kHz

OVERLOAD CAPABILITY FOR THE REFERENCE

FREQUENCY RANGE FROM 50 HZ TO 10 KHZ: 100 dB at $f_i/f_s \leq 0.25$ and ≥ 4 ; 80 dB at $f_i/f_s \leq 0.6$ and ≥ 1.7 ; 60 dB at $f_i/f_s \leq 0.8$ and ≥ 1.2 ; minimum 40 dB at $f_i/f_s \approx 1$. Max 80 dB for the ranges 1 to 50 Hz and 10 kHz to 50 kHz.

From 10 kHz to 50 kHz, the filter Q values are decreased by a factor of 3, tripling the f_i/f_s ratios given above.

f_i = frequency of sinusoidal interference

f_s = signal frequency

HARMONIC REJECTION: Minimum 85 dB for the 2nd; minimum 65 dB for the 3rd for frequency range 50 Hz to 10 kHz. 10 dB less in the ranges from 1 Hz to 50 Hz and 10 kHz to 50 kHz.

OUTPUTS: ± 10 V, at 330 ohm impedance for $A \cos$ and $A \sin$ outputs, switchable to 0 to 10 V for A and ± 10 V for $\pm 180^{\circ}$.

OUTPUT TIME CONSTANT LP FILTER ROLLOFF: presettable 6 or 12 dB/octave

TIME CONSTANT RANGE: 10 ms to 3.16 s in 1–3.16–10 steps, presettable. Other ranges such as 1 ms to 316 ms or 100 ms to 31.6 s available.

OUTPUT OFFSET DRIFT: < 20 ppm/ $^{\circ}$ C for 1 Hz–10 kHz versions < 50 ppm/ $^{\circ}$ C for 10 kHz–50 kHz versions

PHASE ADJUSTMENT: 45° step switch from 0 to 360° and 45° continuous trimpot range

PHASE DRIFT: < $0.02^{\circ}/^{\circ}$ C, 50 Hz to 10 kHz. < $0.05^{\circ}/^{\circ}$ C for 1 Hz to 10 Hz and 10 kHz–50 kHz ranges.

AUTOPHASING: $\pm 90^{\circ}$ capture range, $\pm 180^{\circ}$ hold-in range for vector sum A and ϕ outputs

REFERENCE FREQUENCY INPUT: 100 mV to 10 V, $R_i = 100$ K, for all signal shapes with only one pos. going edge per cycle. Overvoltage protection maximum 25 V rms, ± 100 V dc

REFERENCE MODES: f and $2f$ mode, external and internal mode.

INTERNAL OSCILLATOR

FREQUENCY RANGE: factory set to customer specific requirements within the range from 1 Hz to 100 kHz. Trimpot tuning range $\pm 5\%$. Switchable to $0.5 f_s$ for 2f mode. (0.5 Hz to 50 kHz).

FREQUENCY DRIFT: $<30\text{ppm}/^\circ\text{C}$

OUTPUT WAVEFORMS: Sine, 0.5% maximum distortion, and square wave.

OUTPUT AMPLITUDE: sine: from 10 mV rms to 10 V rms in 1–10–10 steps and continuously at 600 ohm impedance. Square: +15 V fixed at 600 ohm impedance, open emitter.

AMPLITUDE DRIFT: $<100\text{ppm}/^\circ\text{C}$ for sine

OPTIONS

LOG OUTPUT: 4 decades, log 10 V = 0 V, log 1 mV = +4 V. $\text{Log} = -2[\log_{10}(\text{voltage}) - 1]$

X/Y RATIO OUTPUT: for pos. X and Y inputs 0 to +10V. 10 Vdc for $R = X/Y = 1$

X INPUT: wired to the A, $\text{Acos}\phi$ output

Y INPUT: pin 14C of 64 pin main connector. Level trim provided.

RATIO ACCURACY: at levels for X and Y $\geq 1\text{ V}$ $\leq 10\text{ V}$, better than 0.03%; for X and Y $\geq 100\text{ mV}$, better than 0.3%

POWER AND MECHANICAL

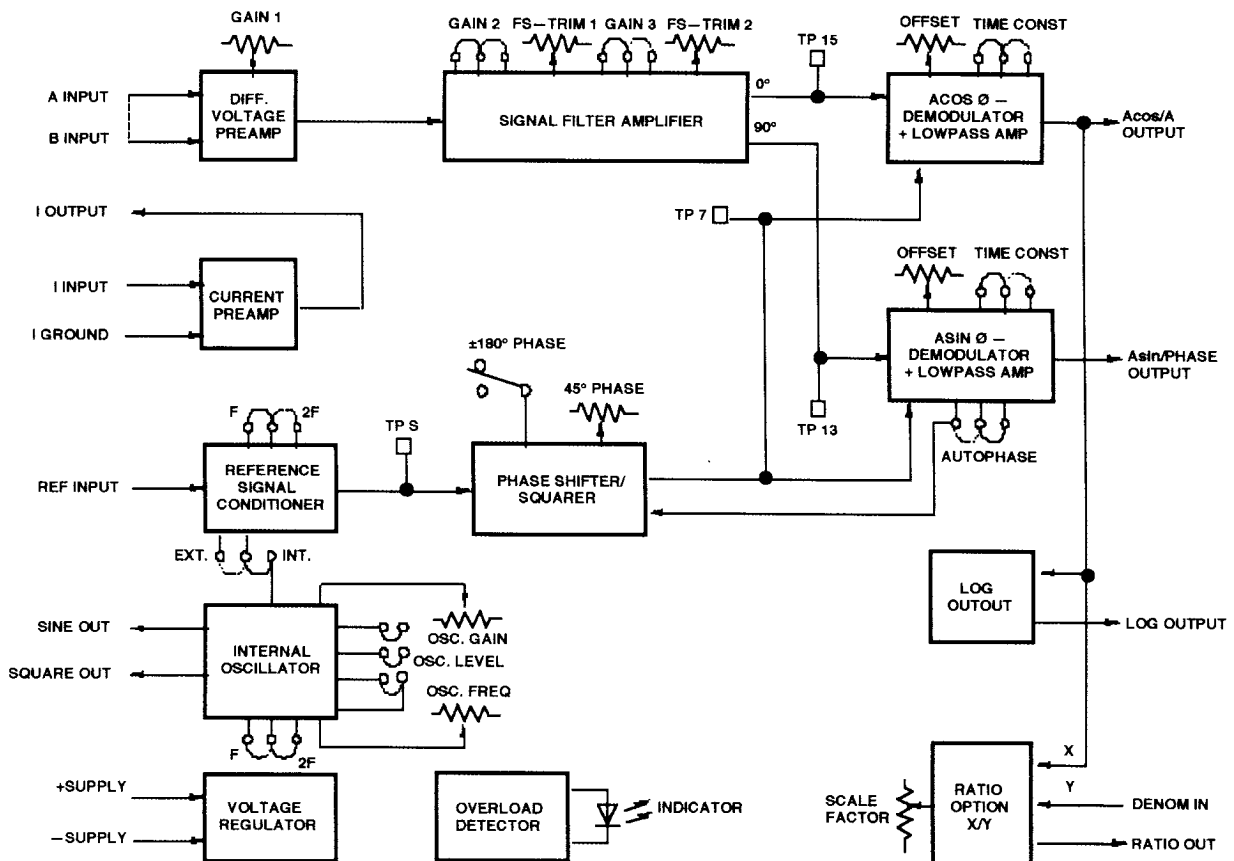
ELECTRICAL CONNECTIONS: 64 pin connector, DIN 41612

POWER REQUIREMENTS: +17 to 20 V, 175 to 200 mA –17 to 20 V, 150 to 175 mA. Protected against misconnection. All outputs are short circuit protected.

DIMENSIONS: single printed circuit board 3.93" x 8.70" x .59" (100 x 221 x 15 mm) Euroformat

WEIGHT: with options and 64 pin mating connector 8 oz (225 grams)

Model 410 fits in standard 19", 3HE racks and can be delivered as open frame or in sealed aluminum housings. The Model 511 Power Supply can be used for 1 to 5 channels. Consult factory for details.



410 Block Diagram

For more information contact

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