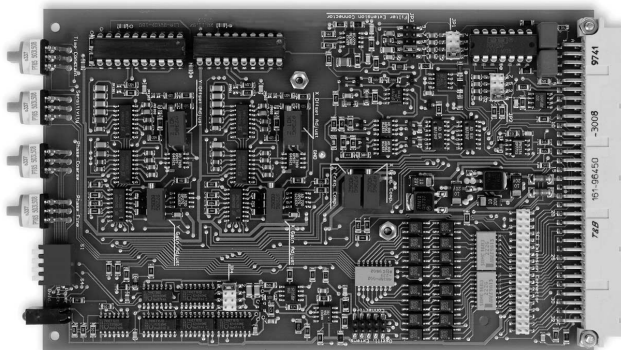


Single-Board Dual Phase Lock-In Amplifier



Picture shows Lock-in Amplifier card with optional Mounting Kit LIA- MK- 2 (to be ordered separately)

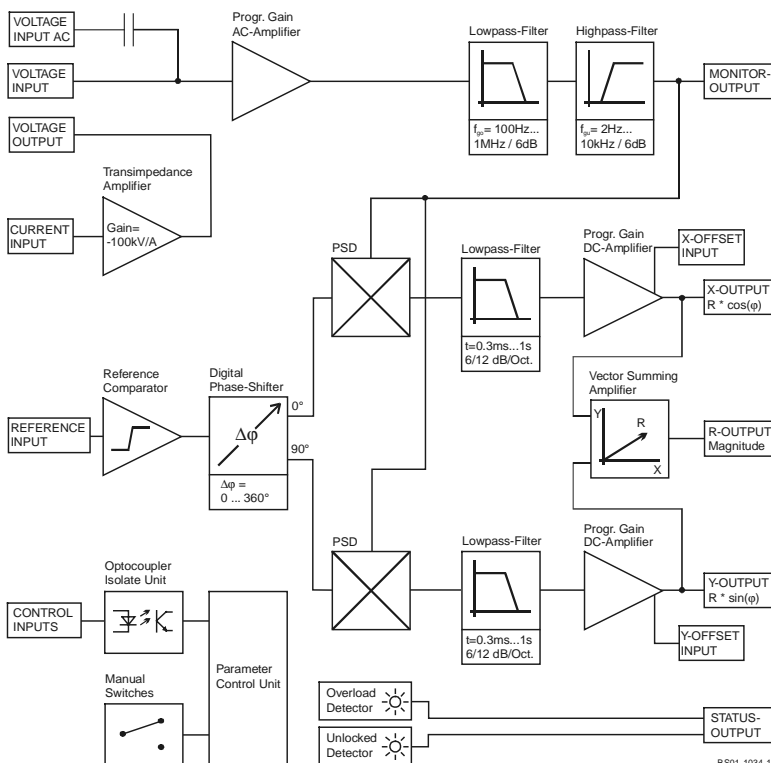
Features

- Dual Phase Detection with X, Y and Magnitude Output
- Working Frequency 50 Hz ... 120 kHz
- Digital Phase Shifter 0 ... 360°
- Current and Voltage Input
- Parameter Control by local Switches and opto-isolated digital Inputs
- Optional Mounting Kit and Reference Oscillator Modules available

Applications

- Spectroscopy
- Luminescence, Fluorescence, Phosphorescence Measurements
- Light Scattering Measurements
- Opto-electronical Quality Control
- Integration in Industrial and Scientific Measurement-Systems
- Multi-Channel-Systems at moderate Costs

Block Diagram



BS01-1034-12

**Single-Board
Dual Phase Lock-In-Amplifier**

Specifications	<i>Test Conditions</i>	<i>V_s = ± 15 V, T_a = 25°C</i>			
Voltage Input	Voltage Input Characteristic	True Differential Instrumentation-Amplifier			
	Voltage Input Range	3 μV ... 1V in 1-3-10 steps (for Full Scale Output)			
	Voltage Input Coupling	AC or DC (selectable at Connector)			
	Voltage Input Impedance	1 MΩ // 4 pF			
	Voltage Input Noise	12 nV/√Hz			
	Voltage Input CMRR	110 dB @ 1 kHz, 100 dB @ 10 kHz			
	Voltage Input Gain Drift	100 ppm/K			
Current Input	Current Input Characteristic	Transimpedance-Amplifier, -100 kV/A (inverting)			
	Current Input Range	30 pA ... 10 μA in 1-3-10 steps (for Full Scale Output)			
	Current Input Noise	0.4 pA/√Hz			
	Current Input Source- Capacit.	10 pF – 500 pF (recommended)			
	Current Input Gain Error vs. Source Capacitance	C _s	f < 20 kHz	f = 50 kHz	f = 100 kHz
	10 pF	< 1 %	1 %	4 %	
	100 pF	< 1 %	1 %	3 %	
	500 pF	< 1 %	4 %	3 %	
Signal Filter	Signal Filter Lowpass (-3 dB BW)	1 MHz, 100 kHz, 10 kHz, 1 kHz, 100 Hz; 6 dB/Oct. Selectable per jumper			
	Signal Filter Highpass (-3 dB BW)	2 Hz, 10 Hz, 100 Hz, 1 kHz, 10 kHz; 6 dB/Oct. selectable per jumper			
	Signal Filter Cutoff accuracy	± 20 %			
	Max. Dynamic Reserve	80 dB			
Signal Monitor Output	Signal Monitor Output Gain	1 ... 3333 (depends on Gain-Setting)			
	Signal Monitor Output Voltage	± 8 V max.			
	Signal Monitor Output Impedance	100 Ω			
	Signal Monitor Output Current	± 10 mA max.			
Note	When using Current Input with low Input Ranges, the Monitor Output may be disabled by opening the soldering jumper at the Board (near JP1) to prevent from recoupling.				
Demodulator	Demodulator Dynamic Reserve	15 dB @ Ultra Stable Setting 35 dB @ Low Drift Setting 55 dB @ High Dynamic Setting			
Reference Input	Reference Input Voltage Range	± 100 mV ... ± 5 V @ bip. Mode (0 V Comparator Threshold) - 5 V / +10 V @ TTL Mode (+2 V Comparator Threshold)			
	Reference Input Impedance	1 MΩ			
	Reference Acquisition Time	max. 2 s @ Fast Setting max. 4 s @ Slow Setting			
Phase Shifter	Phase Shifter Type	Digital, Working Frequency 50 Hz ... 120 kHz			
	Phase Shifter Range	0 ... + 360 °			
	Phase Shifter Resolution	1.4 ° @ f < 60 kHz, 2.8 ° @ f > 60 kHz			
	Phase Shifter Drift	< 100 ppm/K			
	Phase Shifter Accuracy	< 0.3 °			
	Phase Shifter Orthogonality	< 0.1 °			
Time Constants	Time Constant Range	300 μs ... 1 s in 1-3-10 steps			
	Time Const. Filter Characteristic	6 dB/Oct. or 12 dB/Oct. switchable			

Single-Board Dual Phase Lock-In-Amplifier

Specifications (continued) Output	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">Output Channels</td> <td>X = In Phase, Y = Quadrature, R = Magnitude</td> </tr> <tr> <td>Output Voltage Range</td> <td>± 10 V (@ 2 kΩ Load)</td> </tr> <tr> <td>Output Current</td> <td>± 5 mA max.</td> </tr> <tr> <td>Output Impedance</td> <td>50 Ω</td> </tr> <tr> <td>Output DC-Stability</td> <td>5 ppm/K @ Ultra Stable Setting 50 ppm/K @ Low Drift Setting 500 ppm/K @ High Dynamic Setting</td> </tr> <tr> <td>Output Basic Accuracy</td> <td>2 % (X and Y-Output) @ sinusoidal input signal 4 % (R-Output) @ sinusoidal input signal</td> </tr> <tr> <td>Output Voltage Offset Range</td> <td>± 100 % Full Scale by ± 10 V Control Voltage</td> </tr> <tr> <td>Output Voltage Offset Control-Voltage Impedance</td> <td>> 2 kΩ</td> </tr> </table>	Output Channels	X = In Phase, Y = Quadrature, R = Magnitude	Output Voltage Range	± 10 V (@ 2 kΩ Load)	Output Current	± 5 mA max.	Output Impedance	50 Ω	Output DC-Stability	5 ppm/K @ Ultra Stable Setting 50 ppm/K @ Low Drift Setting 500 ppm/K @ High Dynamic Setting	Output Basic Accuracy	2 % (X and Y-Output) @ sinusoidal input signal 4 % (R-Output) @ sinusoidal input signal	Output Voltage Offset Range	± 100 % Full Scale by ± 10 V Control Voltage	Output Voltage Offset Control-Voltage Impedance	> 2 kΩ																																								
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Single-Board Dual Phase Lock-In-Amplifier

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Phase Shift Setting	<p>Phase shift is adjusted by 2 phase switches with 8 Bit resolution. Values 0 ... 255 (Hex 00 ... FF) correspond to phase shift setting 0 ... +360 $^{\circ}$. One step with switch marked "Coarse" changes phase shift by 22.5 $^{\circ}$. The "Fine"-switch changes phase shift by 1.4 $^{\circ}$ - steps:</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>Coarse</p> </div> <div style="text-align: center;"> <p>Fine</p> </div> </div> <p>If Frequency Range $f > 60$ kHz or 2-f Mode is selected, the resolution of digital phase control changes to 2.8 $^{\circ}$ and the phase shift range doubles to 0 ... + 720 $^{\circ}$.</p>																																																													

Single-Board Dual Phase Lock-In-Amplifier

Jumper Settings

Input Signal Filter Setting

Set Cut-Off Frequency of Input Lowpass Filter with JP1 + JP2 (always same position) and Highpass Filter with JP3:

JP3	Highpass -3 dB Cut-Off	JP1, JP2	Lowpass -3 dB Cut-Off
3 – 4	2 Hz	1 – 2	100 Hz
1 – 3	10 Hz	3 – 4	1 kHz
2 – 4	100 Hz	5 – 6	10 kHz
3 – 5	1 kHz	7 – 8	100 kHz
4 – 6	10 kHz	none	1 MHz *

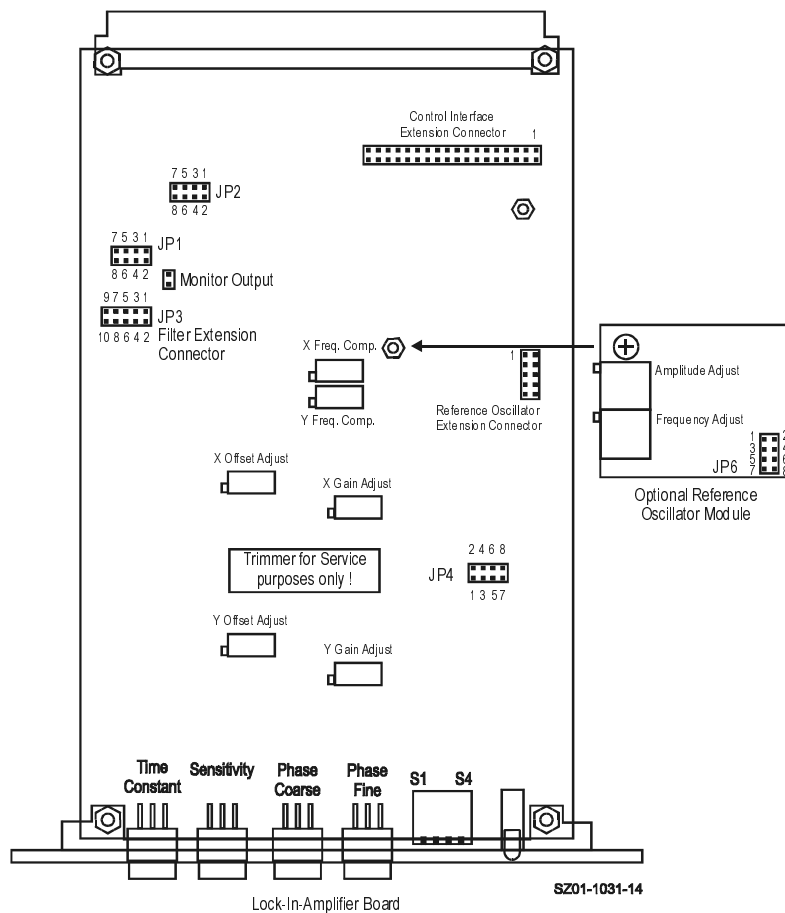
* (At Sensitivity Settings 6,7 & E,F max. 200 kHz)

Frequency Range Selection

JP4	Frequency Range
1 – 2	f < 60 kHz
3 – 4 & 5 – 6	f > 60 kHz
7, 8	test pins, do not use

(if 2-f mode is used, position is always 1-2)

Jumper Position Diagram



Single-Board Dual Phase Lock-In-Amplifier

Connector	Connector Type	Euro-Card DIN 41612 Connector, 64 pin male, (a+c)	
	Input	Pin C2:	Voltage Input, Non Inverting, DC-Coupled
		Pin C3:	Voltage Input, Non Inverting, AC-Coupled
		Pin C4:	Voltage Input, Inverting, AC-Coupled
		Pin C5:	Voltage Input, Inverting, DC-Coupled
		Pin C7:	Current Input
		Pin C6:	Current Amplifier Voltage Output
		Pin A2- A6:	Input GND
	Monitor Output	Pin C9:	Monitor Output
		Pin A9:	Monitor GND
	Output	Pin A12:	R-Signal Output
		Pin C14:	X-Signal Output
		Pin A14:	Y-Signal Output
		Pin C15:	Output GND
	Offset Input	Pin A10:	X-Offset Input
		Pin A11:	Y-Offset Input
		Pin A13:	Offset GND
	Status Output	Pin C10:	Unlocked Status Output
		Pin C11:	Overload Status Output
		Pin C17:	Status Output GND (=Power Supply GND)
	Power Supply	Pin A16+C16:	Power Supply – 15V
		Pin A18+C18:	Power Supply + 15V
		Pin A17+C17:	Power Supply GND
	Remote Control Inputs (Opto-Isolated)	Pin C19:	Time Constant (TC0)
		Pin A19:	Time Constant (TC1)
		Pin C20:	Time Constant (TC2)
		Pin A20:	Time Constant Slope (TCSL)
		Pin A22:	Sensitivity (SEN0)
		Pin C21:	Sensitivity (SEN1)
		Pin A21:	Sensitivity (SEN2)
		Pin C22:	Dynamic Mode (DYNO)
		Pin A28:	Phase Shift (PH0)
		Pin C28:	Phase Shift (PH1)
		Pin A27:	Phase Shift (PH2)
		Pin C27:	Phase Shift (PH3)
		Pin A26:	Phase Shift (PH4)
		Pin C26:	Phase Shift (PH5)
		Pin A25:	Phase Shift (PH6)
		Pin C25:	Phase Shift (PH7)
		Pin C24:	Disable Local Switch Control
		Pin A23+A24:	Remote Control GND (Common Optocoupler Cathode)
	Reference Input	Pin A32:	Reference Input
		Pin A31:	Reference Input Ground
	Reference Output (Connected only if optional Oscillator Module is installed)	Pin A30:	Reference Output
		Pin A17:	Refer. Output GND (=Power Supply GND)
		Pin A29:	Reference Synchronization Input
	Standard Control Interface (Connected only if optional Control Interface Module (future product) is installed)	Pin C29:	Interface 0
		Pin C30:	Interface 1
		Pin C31:	Interface 2
		Pin C32:	Interface 3

Single-Board Dual Phase Lock-In-Amplifier

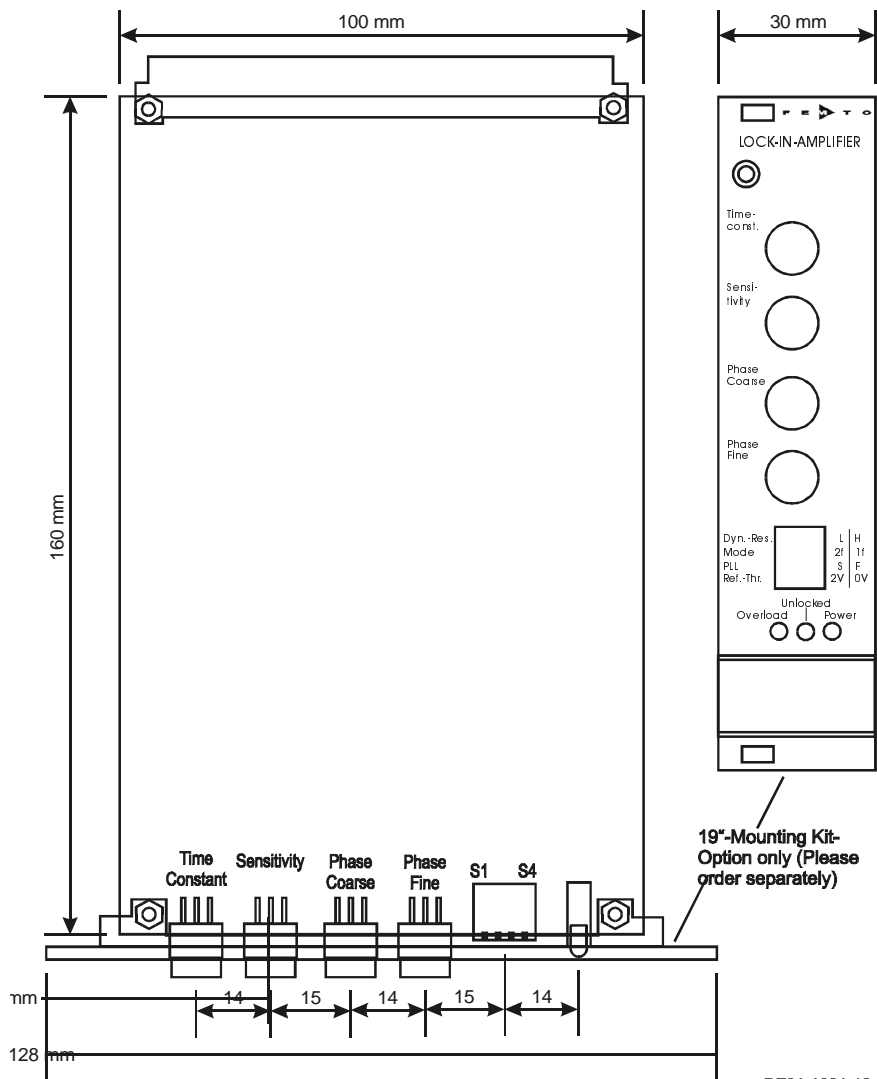
Remote Control Operation	General	<p>Remote Control Input Bits are opto-isolated and connected by logical OR to local switch setting. The 4 hexadecimal switches are 4 Bit-coded as shown in the following table:</p> <table style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <thead> <tr> <th style="border-bottom: 1px solid black;">Switch Code</th> <th style="border-bottom: 1px solid black;">MSB Bit 3</th> <th style="border-bottom: 1px solid black;">Bit 2</th> <th style="border-bottom: 1px solid black;">Bit 1</th> <th style="border-bottom: 1px solid black;">LSB Bit 0</th> </tr> </thead> <tbody> <tr><td>0</td><td>Low</td><td>Low</td><td>Low</td><td>Low</td></tr> <tr><td>1</td><td>Low</td><td>Low</td><td>Low</td><td>High</td></tr> <tr><td>2</td><td>Low</td><td>Low</td><td>High</td><td>Low</td></tr> <tr><td>3</td><td>Low</td><td>Low</td><td>High</td><td>High</td></tr> <tr><td>4</td><td>Low</td><td>High</td><td>Low</td><td>Low</td></tr> <tr><td>5</td><td>Low</td><td>High</td><td>Low</td><td>High</td></tr> <tr><td>6</td><td>Low</td><td>High</td><td>High</td><td>Low</td></tr> <tr><td>7</td><td>Low</td><td>High</td><td>High</td><td>High</td></tr> <tr><td>8</td><td>High</td><td>Low</td><td>Low</td><td>Low</td></tr> <tr><td>9</td><td>High</td><td>Low</td><td>Low</td><td>High</td></tr> <tr><td>A</td><td>High</td><td>Low</td><td>High</td><td>Low</td></tr> <tr><td>B</td><td>High</td><td>Low</td><td>High</td><td>High</td></tr> <tr><td>C</td><td>High</td><td>High</td><td>Low</td><td>Low</td></tr> <tr><td>D</td><td>High</td><td>High</td><td>Low</td><td>High</td></tr> <tr><td>E</td><td>High</td><td>High</td><td>High</td><td>Low</td></tr> <tr><td>F</td><td>High</td><td>High</td><td>High</td><td>High</td></tr> </tbody> </table> <p>For remote control a switch setting, set the local switch to "0" and select the wanted setting via the 4-Bit-code at the corresponding digital inputs.</p>	Switch Code	MSB Bit 3	Bit 2	Bit 1	LSB Bit 0	0	Low	Low	Low	Low	1	Low	Low	Low	High	2	Low	Low	High	Low	3	Low	Low	High	High	4	Low	High	Low	Low	5	Low	High	Low	High	6	Low	High	High	Low	7	Low	High	High	High	8	High	Low	Low	Low	9	High	Low	Low	High	A	High	Low	High	Low	B	High	Low	High	High	C	High	High	Low	Low	D	High	High	Low	High	E	High	High	High	Low	F	High	High	High	High
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	Disable Local Switches	<p>By forcing Input Bit "Disable Local Switch Control" (Pin C24) to "High", the LIA is set to exclusively remote control operation and the manual switches are out of function.</p>																																																																																					
	Sensitivity Switch - Corresponding Inputs	<table style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <thead> <tr> <th style="border-bottom: 1px solid black;">Bit</th> <th style="border-bottom: 1px solid black;">Corresponding Control Port Input</th> </tr> </thead> <tbody> <tr><td>Bit 0</td><td>SEN0 (Pin A22)</td></tr> <tr><td>Bit 1</td><td>SEN1 (Pin C21)</td></tr> <tr><td>Bit 2</td><td>SEN2 (Pin A21)</td></tr> <tr><td>Bit 3</td><td>DYNO (Pin C22)</td></tr> </tbody> </table>	Bit	Corresponding Control Port Input	Bit 0	SEN0 (Pin A22)	Bit 1	SEN1 (Pin C21)	Bit 2	SEN2 (Pin A21)	Bit 3	DYNO (Pin C22)																																																																											
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Remote Control Example

For example, to select a switch setting code "6", you have to connect a "High"- level signal to the corresponding control input pins Bit 1 & Bit 2. Mixed operation, e.g. local phase settings and remote controlled sensitivity setting, is also possible when "Disable Local Switch Control" (Pin C24) is not active ("Low" or just not connected).

Dimensions



DZ01-1031-12

**Single-Board
Dual Phase Lock-In-Amplifier**

<p>Optional Extensions</p>	<p>Mounting Kit</p>	<p>Model No.: MK-LIA-2 - 19" – Frontpanel, printed - EMI – shielding Board-Backplane</p>
	<p>Reference Oscillator Module</p>	<p>Model No.: SOM-1 - Frequency Range 5 Hz ... 130 kHz, User adjustable - Output Voltage 0 ... 2 Vrms, User adjustable - 100 ppm/K Amplitude Accuracy</p>

12/07 / V1 / HW / femto/lock-in/lia-bvb-150-h.pdf

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