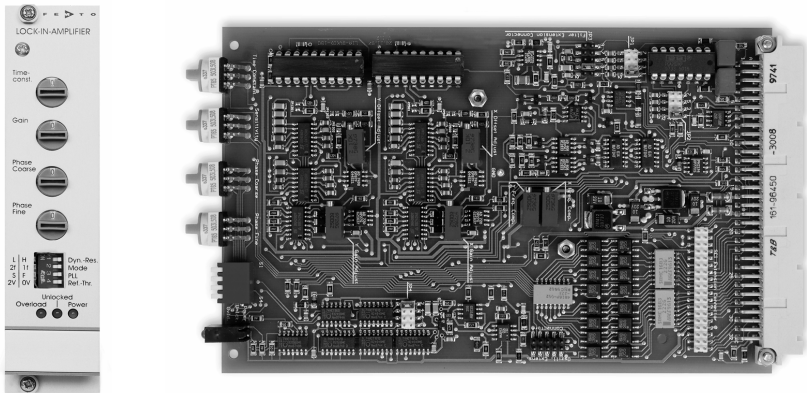


Datasheet

LIA-BV-150-L

Single-Board
Lock-In-Amplifier



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

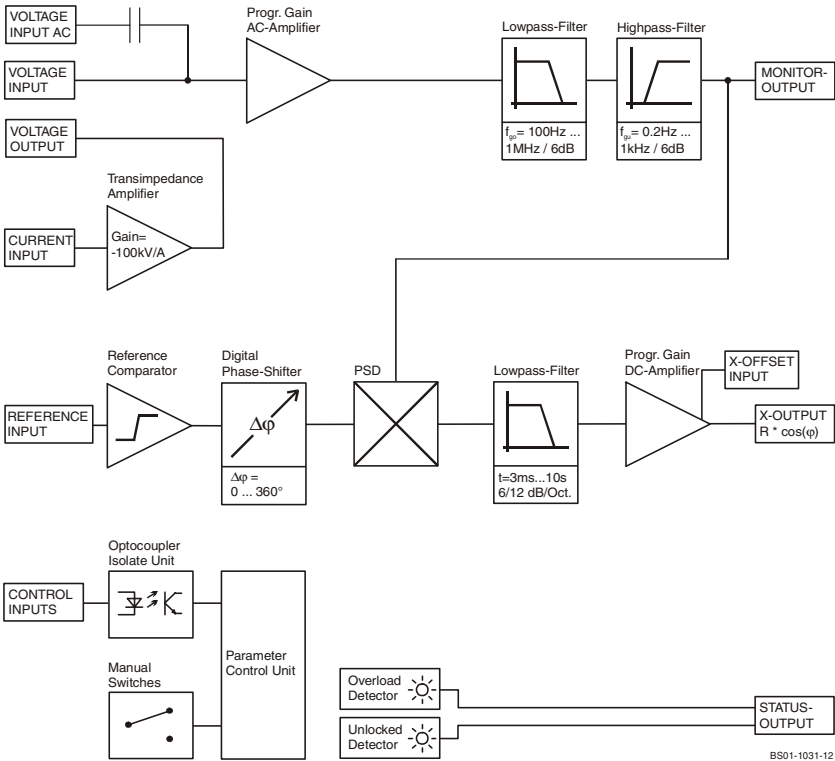
Features

- Single Phase Detection with X Output
- Working Frequency 5 Hz ... 10 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



Single-Board Lock-In-Amplifier

Specifications	Test Conditions	$V_s = \pm 15\text{ V}$, $T_a = 25^\circ\text{C}$
Voltage Input	Voltage Input Characteristic Voltage Input Range Voltage Input Coupling Voltage Input Impedance Voltage Input Noise Voltage Input CMRR Voltage Input Gain Drift	True Differential Instrumentation-Amplifier 3 μV ... 1V in 1-3-10 steps (for Full Scale Output) AC or DC (selectable at Connector) 1 $\text{M}\Omega$ // 4 pF 12 nV/ $\sqrt{\text{Hz}}$ 110 dB @ 1 kHz, 100 dB @ 10 kHz 100 ppm/K
Current Input	Current Input Characteristic Current Input Range Current Input Noise Current Input Source- Capacit. Current Input Gain Error vs. Source Capacitance	Transimpedance-Amplifier, -100 kV/A (inverting) 30 pA ... 10 μA in 1-3-10 steps (for Full Scale Output) 0.4 pA/ $\sqrt{\text{Hz}}$ 10 pF – 500 pF (recommended) Cs f < 10 kHz 10 pF < 1 % 100 pF < 1 % 1 nF < 2 %
Signal Filter	Signal Filter Lowpass (-3 dB BW) Signal Filter Highpass (-3 dB BW) Signal Filter Cutoff accuracy Max. Dynamic Reserve	1 MHz, 100 kHz, 10 kHz, 1 kHz, 100 Hz; 6 dB/Oct. selectable per jumper 0.2 Hz, 1 Hz, 10 Hz, 100 Hz, 1 kHz; 6 dB/Oct. selectable per jumper $\pm 20\%$ 80 dB
Signal Monitor Output	Signal Monitor Output Gain Signal Monitor Output Voltage Signal Monitor Output Impedance Signal Monitor Output Current Note	1 ... 3333 (depends on Gain-Setting) $\pm 8\text{ V}$ max. 100 Ω $\pm 10\text{ mA}$ max. 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 Reference Input Impedance Reference Acquisition Time	$\pm 100\text{ mV}$... $\pm 5\text{ V}$ @ bip. Mode (0 V Comparator Threshold) - 5 V / +10 V @ TTL Mode (+2 V Comparator Threshold) 1 $\text{M}\Omega$ max. 2 s @ Fast Setting max. 4 s @ Slow Setting
Phase Shifter	Phase Shifter Type Phase Shifter Range Phase Shifter Resolution Phase Shifter Drift Phase Shifter Accuracy	Digital, Working Frequency 5 Hz ... 10 kHz 0 ... + 360 ° 1.4 ° < 100 ppm/K < 0.3 °
Time Constants	Time Constant Range Time Const. Filter Characteristic	3 ms ... 10 s in 1-3-10 steps 6 dB/Oct. or 12 dB/Oct. switchable

Single-Board Lock-In-Amplifier

Specifications (continued) Output	Output Channels	X = In Phase			
	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 % @ sinusoidal input signal			
	Output Voltage Offset Range	± 100 % Full Scale by ± 10 V Control Voltage			
	Output Voltage Offset Control-Voltage Impedance	> 2 kΩ			
	Status Indicator LED	Functions	Amplifier Overload Status Reference PLL Unlocked Status		
		Digital Control	Control Input Voltage Control Input Current Digital Status Output Voltage Digital Status Output Current		
Power Supply	Control Input Voltage	Low: - 0.8 V ... + 0.8 V, High: + 1.8 V ... + 12 V			
	Control Input Current	0 mA @ 0V, 1.5 mA @ + 5 V, 4.5 mA @ + 12V typ.			
Case	Digital Status Output Voltage	Active: + 4.5 V typ., Non Active: 0 V typ.			
	Digital Status Output Current	10 mA max.			
Temperature Range	Supply Voltage	± 15 Vdc ... ± 18 Vdc			
	Supply Current	- 60 mA, + 100 mA			
Case	Board	19" Euro-Card, (100 mm x 160 mm Board)			
	Weight	100 gr. (0.22 lbs)			
Temperature Range	Storage Temperature	- 40 ... + 100 °C			
	Operating Temperature	0 ... + 60 °C			
Absolute Maximum Ratings	Signal Input AC Voltage	50 Vpp			
	Signal Input DC Voltage	± 70 V			
	Reference Input Voltage	± 15 V			
	Control Input Voltage	- 5 V, + 15 V			
	Power Supply Voltage	± 22 V			
Switch Settings	4 Dip Switch - Presettings	Switch	OFF	ON	
		S1	Low Drift & High Dynamic	Ultra Stable & Low Drift	
		S2	1-f Mode	2-f Mode	
		S3	Fast PLL-Locking	Slow PLL-Locking	
		S4	Reference-Input-Threshold = 0 V	Reference-Input-Threshold = +2 V	
	Sensitivity Setting, Output DC-Gain Modes	3 Output DC-Gain Modes are selectable:			
		Mode	DC-Gain	Dyn. Reserve	DC-Stability
		Ultra Stable	10	Low	High
		Low Drift	100	Medium	Medium
		High Dynamic	1000	High	Low
If only low dynamic reserve is required, select the higher DC-Stability settings. Use Dip switch S1 to preselect either the two upper or the two lower DC-Gain modes, then select best mode by Sensitivity switch settings 0–7 or 8–F.					

Single-Board Lock-In-Amplifier

Switch Settings (continued)

S1 = ON: Sensitivity Setting
for Full Scale (= 10 V Output)

Ultra Stable Mode

Setting Voltage Current

0	1 V	10 μ A
1	300 mV	3 μ A
2	100 mV	1 μ A
3	30 mV	300 nA
4	10 mV	100 nA
5	3 mV	30 nA
6	1 mV	10 nA
7	300 μ V	3 nA

Low Drift Mode

Setting Voltage Current

8	100 mV	1 μ A
9	30 mV	300 nA
A	10 mV	100 nA
B	3 mV	30 nA
C	1 mV	10 nA
D	300 μ V	3 nA
E	100 μ V	1 nA
F	30 μ V	300 pA

S1 = OFF: Sensitivity Setting
for Full Scale (= 10 V Output)

Low Drift Mode

Setting Voltage Current

0	100 mV	1 μ A
1	30 mV	300 nA
2	10 mV	100 nA
3	3 mV	30 nA
4	1 mV	10 nA
5	300 μ V	3 nA
6	100 μ V	1 nA
7	30 μ V	300 pA

High Dynamic Mode

Setting Voltage Current

8	10 mV	100 nA
9	3 mV	30 nA
A	1 mV	10 nA
B	300 μ V	3 nA
C	100 μ V	1 nA
D	30 μ V	300 pA
E	10 μ V	100 pA
F	3 μ V	30 pA

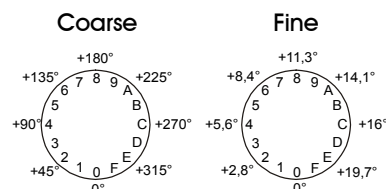
Time Constant Setting

6 dB/Oct. 12 dB/Oct. Time Constant

0	8	3 ms
1	9	10 ms
2	A	30 ms
3	B	100 ms
4	C	300 ms
5	D	1 s
6	E	3 s
7	F	10 s

Phase Shift Setting

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 °. One step with switch marked "Coarse" changes phase shift by 22.5 °. The "Fine"-switch changes phase shift by 1.4 ° - steps:



If 2-f Mode is selected,
the resolution of digital phase control changes to 2.8 °
and the phase shift range doubles to 0 ... + 720 °.

Jumper Settings

Input Signal Filter

Set Cut-Off Frequency of Input Lowpass Filter

Single-Board
Lock-In-Amplifier

	Setting	with JP1 + JP2 (always same position) and Highpass Filter with JP3:			
		Highpass		Lowpass	
	JP3	-3 dB Cut-Off	JP1, JP2	-3 dB Cut-Off	
	3 – 4	0.2 Hz	1 – 2	100 Hz	
	1 – 3	1 Hz	3 – 4	1 kHz	
	2 – 4	10 Hz	5 – 6	10 kHz	
	3 – 5	100 Hz	7 – 8	100 kHz	
	4 – 6	1 kHz	none	1 MHz	
	Frequency Range Selection	JP4	Frequency Range		
		1 – 2	normal operation		
	3, 4, 5, 6, 7, 8	test pins, do not use			

Jumper Position Diagram

The diagram illustrates the physical layout of the Lock-In-Amplifier Board (SZ01-1031-14). Key components and jumper positions are labeled:

- Control Interface Extension Connector:** Located at the top right.
- JP2:** Jumper with pins 7 5 3 1 and 8 6 4 2.
- JP1:** Jumper with pins 7 5 3 1 and 8 6 4 2, labeled "Monitor Output".
- JP3:** Jumper with pins 9 7 5 3 1 and 10 8 6 4 2, labeled "Filter Extension Connector".
- Reference Oscillator Extension Connector:** A 1-pin connector.
- Optional Reference Oscillator Module:** Includes "Amplitude Adjust" and "Frequency Adjust" controls, with a 2x4 pin header labeled JP6 (pins 1 2 3 4 and 5 6 7 8).
- JP4:** Jumper with pins 2 4 6 8 and 1 3 5 7.
- Adjusters:** X Freq. Comp., Y Freq. Comp., X Offset Adjust, X Gain Adjust, Y Offset Adjust, and Y Gain Adjust.
- Trimmer:** "Trimmer for Service purposes only!".
- Bottom Panel:** Features "Time Constant", "Sensitivity", "Phase Coarse", "Phase Fine", switches S1 and S4, and a "Lock-In-Amplifier Board" label.

Single-Board 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 C14:	X-Signal Output
		Pin C15:	Output GND
	Offset Input	Pin A10:	X-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 (DYN0)
		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 Lock-In-Amplifier

Remote Control Operation

General

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:

Switch Code	MSB		LSB	
	Bit 3	Bit 2	Bit 1	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

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.

Disable Local Switches

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.

Sensitivity Switch - Corresponding Inputs

Bit	Corresponding Control Port Input	
Bit 0	SEN0	(Pin A22)
Bit 1	SEN1	(Pin C21)
Bit 2	SEN2	(Pin A21)
Bit 3	DYN0	(Pin C22)

Time Constant Switch - Corresponding Inputs

Bit	Corresponding Control Port Input	
Bit 0	TC0	(Pin C19)
Bit 1	TC1	(Pin A19)
Bit 2	TC2	(Pin C20)
Bit 3	TCSL	(Pin A20)

Phase Switch Coarse - Corresponding Inputs

Bit	Corresponding Control Port Input	
Bit 0	PH4	(Pin A26)
Bit 1	PH5	(Pin C26)
Bit 2	PH6	(Pin A25)
Bit 3	PH7	(Pin C25)

Phase Switch Fine - Corresponding Inputs

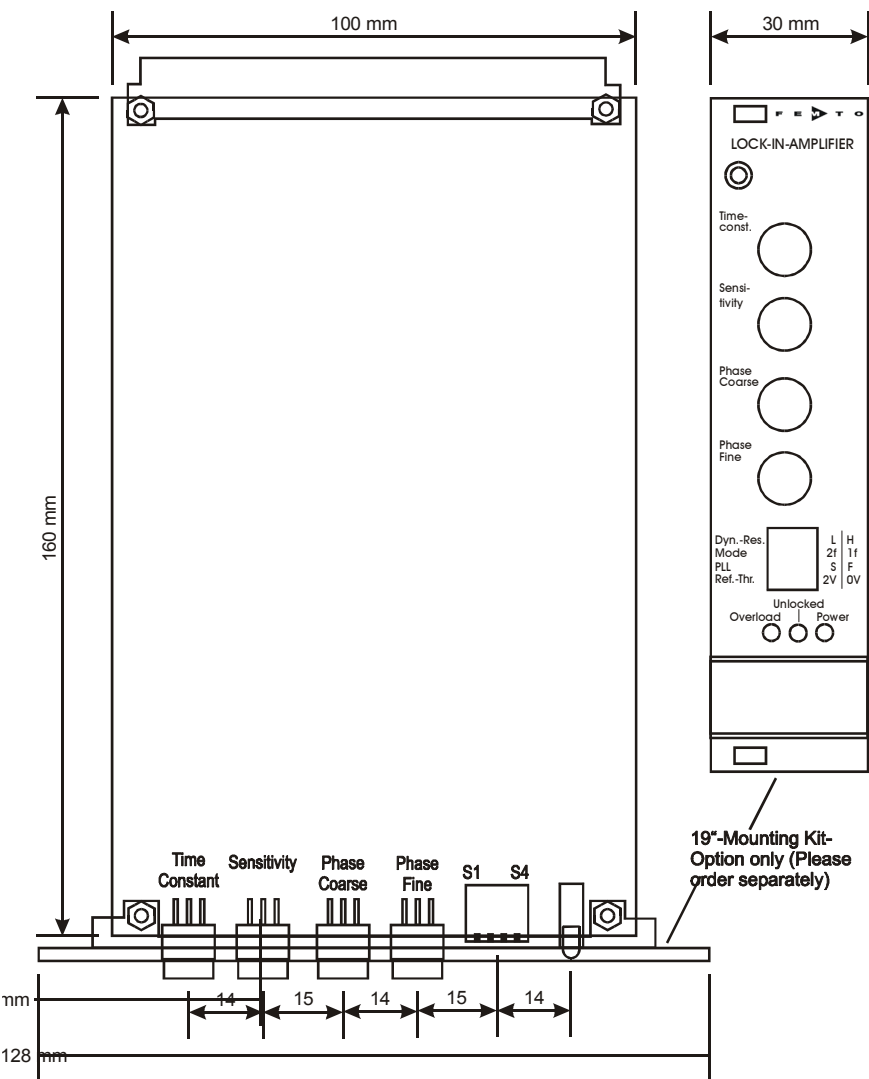
Bit	Corresponding Control Port Input	
Bit 0	PH0	(Pin A28)
Bit 1	PH1	(Pin C28)
Bit 2	PH2	(Pin A27)
Bit 3	PH3	(Pin C27)

Single-Board
Lock-In-Amplifier

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



Datasheet

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

FEMTO Messtechnik GmbH
Klosterstr. 64
D-10179 Berlin • Germany
Tel.: +49-(0)30-280 4711-0
Fax: +49-(0)30-280 4711-11
e-mail: info@femto.de
<http://www.femto.de>

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