

Datasheet

LIA-MV-150

Lock-In-Amplifier Module



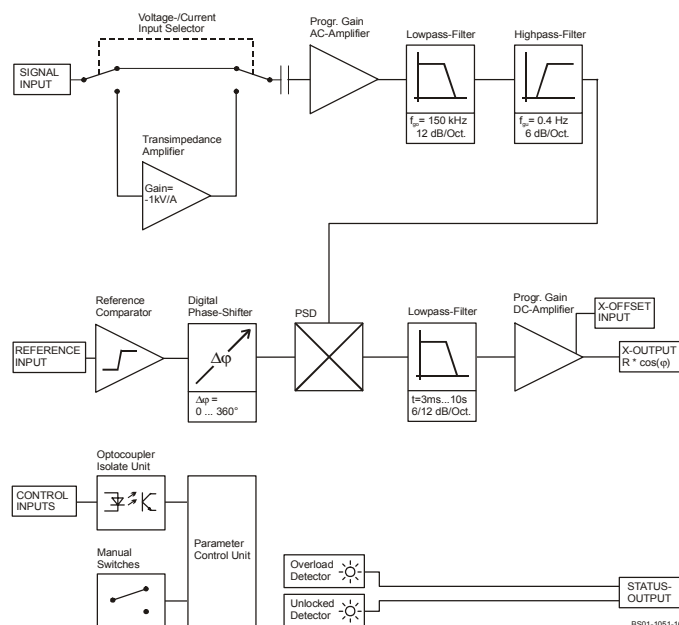
Features

- Working Frequency 10 Hz ... 45 kHz
- Digital Phase Shifter 0 ... 360°
- Current and Voltage Input
- Parameter Control by local Switches and opto-isolated digital Inputs
- Compact and EMI-Shielded Case

Applications

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

Block Diagram



SOPHISTICATED TOOLS FOR SIGNAL RECOVERY

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Specifications	Test Conditions	$V_s = \pm 15 \text{ V}$, $T_a = 25^\circ\text{C}$
Voltage Input	Voltage Input Characteristic	Model "-S": Single-Ended Instrumentation-Amplifier Model "-D": True Differential Instrumentation-Amplifier
	Voltage Input Range	3 μV ... 100 mV in 1-3-10 steps (for Full Scale Output)
	Voltage Input Coupling	AC, 0.015 Hz
	Voltage Input Impedance	Model "-S": 1 M Ω // 4 pF Model "-D": 2 M Ω // 2 pF differential
	Voltage Input Noise	12 nV/ $\sqrt{\text{Hz}}$
	Voltage Input CMRR	Model "-D": 110 dB @ 1 kHz, 100 dB @ 10 kHz
Current Input	Voltage Input Gain Drift	100 ppm/K
	Current Input Characteristic	Transimpedance-Amplifier, -1 kV/A (inverting)
	Current Input Range	3 nA ... 100 μA in 1-3-10 steps (for Full Scale Output)
	Current Input Noise	13 pA/ $\sqrt{\text{Hz}}$
	Current Input Source- Capacit.	10 pF – 1 nF (recommended)
	Current Input Gain Error vs. Source Capacitance	Cs f < 20 kHz 10 pF < 1 % 100 pF < 1 % 1 nF < 2 %
Signal Filter	Signal Filter Lowpass (-3 dB BW)	150 kHz; 12 dB/Oct.
	Signal Filter Highpass (-3 dB BW)	0.4 Hz; 6 dB/Oct.
	Signal Filter Cutoff accuracy	$\pm 20 \%$
Demodulator	Demodulator Dynamic Reserve	35 dB @ Low Drift Setting 55 dB @ High Dynamic Setting
	Reference Input	Reference Input Voltage Range $\pm 100 \text{ mV}$... $\pm 5 \text{ V}$ @ bip. Mode (0 V Comparator Threshold) - 5 V / +10 V @ TTL Mode (2 V Comparator Threshold)
Reference Input	Reference Input Impedance	1 M Ω
	Reference Acquisition Time	max. 2 s @ Fast Setting max. 4 s @ Slow Setting
Phase Shifter	Phase Shifter Type	Digital, Working Frequency 10 Hz ... 45 kHz
	Phase Shifter Range	0 ... + 360 °
	Phase Shifter Resolution	1.4 °
	Phase Shifter Drift	< 100 ppm/K
	Phase Shifter Accuracy	< 0.3 °
Time Constants	Time Constant Range	3 ms ... 10 s in 1-3-10 steps
	Time Const. Filter Characteristic	6 dB/Oct. or 12 dB/Oct. switchable
Output	Output Channels	X = In Phase
	Output Voltage Range	$\pm 10 \text{ V}$ (@ 2 k Ω Load)
	Output Current	$\pm 5 \text{ mA}$ max.
	Output Impedance	50 Ω
	Output DC-Stability	50 ppm/K @ Low Drift Setting 500 ppm/K @ High Dynamic Setting
	Output Basic Accuracy	2 %, Frequency > 30 kHz 5 % @ sinusoidal input signal
	Output Voltage Offset Range	$\pm 100 \%$ Full Scale by $\pm 10 \text{ V}$ Control @ Low Drift Setting $\pm 100 \%$ Full Scale by $\pm 1 \text{ V}$ Control @ High Dyn. Setting
	Output Voltage Offset Control-	
	Voltage Impedance	22 k Ω

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Specifications (continued)

Status Indicator LED

Functions

Amplifier Overload Status
Reference PLL Unlocked Status

Digital Control

Control Input Voltage

Low: - 0.8 V ... + 0.8 V
High: + 1.8 V ... + 12 V, TTL / CMOS compatible
Control Input Current
0 mA @ 0V, 1.5 mA @ + 5 V, 4.5 mA @ + 12V typ.
Digital Status Output Voltage
Active: + 4.5 V typ.
Non Active: 0 V typ.
Digital Status Output Current
10 mA max.

Power Supply

Supply Voltage
Supply Current

± 15 Vdc ... ± 20 Vdc
- 60 mA, + 100 mA

Case

Weight
Material

370 gr. (0.86 lbs)
AlMg4.5Mn, nickel-plated

Temperature Range

Storage Temperature
Operating Temperature

- 40 ... + 100 °C
0 ... + 60 °C

Absolute Maximum Ratings

Signal Input AC Voltage
Signal Input DC Voltage
Reference Input Voltage
Control Input Voltage
Power Supply Voltage

20 Vpp
± 30 V
± 30 V
- 5 V, + 30 V
± 22 V

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Switch Settings

3 Dip Switch - Presettings

Switch	OFF	ON
S1	Reference-Input-Threshold = 0 V	Reference-Input-Threshold = 2 V
S2	Fast PLL-Locking	Slow PLL-Locking
S3	Current Input	Voltage Input

Sensitivity Setting, General

8 steps of input AC-gain are selectable. Output DC-gain is selectable in 2 settings. The DC-gain settings are marked as "Low Drift" and "High Dynamic" mode:

Mode	DC-Gain	Dyn. Reserve	DC-Stability
Low Drift	100	Low	High
High Dynamic	1000	High	Low

Select mode by sensitivity switch settings 0–7 or 8–F. If only low dynamic reserve is required, select the high DC-stability settings ("Low Drift" mode).

Sensitivity Setting for Full Scale (= 10 V Output)

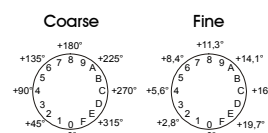
Low Drift Mode			High Dynamic Mode		
Setting	Voltage	Current	Setting	Voltage	Current
0	100 mV	100 μ A	8	10 mV	10 μ A
1	30 mV	30 μ A	9	3 mV	3 μ A
2	10 mV	10 μ A	A	1 mV	1 μ A
3	3 mV	3 μ A	B	300 μ V	300 nA
4	1 mV	1 μ A	C	100 μ V	100 nA
5	300 μ V	300 nA	D	30 μ V	30 nA
6	100 μ V	100 nA	E	10 μ V	10 nA
7	30 μ V	30 nA	F	3 μ V	3 nA

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:


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Connectors

Signal Input

Model "-S": BNC

Model "-D": LEMO Series 1S, 4-pin fixed Socket

Voltage Input: Pin 1: Non Inverting Input

Pin 2: Inverting Input

Pin 3: GND

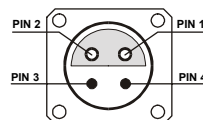
Pin 4: N.C.

Current Input: Pin 1: Current Amplifier Input

Pin 2: If Current Input is used,
connect to Pin 3 (GND)

Pin 3: GND

Pin 4: N.C.



Reference Input

BNC

Output

BNC

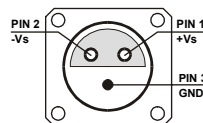
Power Supply

LEMO Series 1S, 3-pin fixed Socket

Pin 1: +15V

Pin 2: -15V

Pin 3: GND



Control Port

Sub-D 25-pin, female, Qual. Class 2

Pin 1: +12V (Stabilized Power Supply Output)

Pin 2: -12V (Stabilized Power Supply Output)

Pin 3: AGND (Analog Ground)

Pin 4: +5V (Stabilized Power Supply Output)

Pin 5: X-Output

Pin 6: Overload Status Output

Pin 7: Unlocked Status Output

Pin 8: X-Output Offset Control Input

Pin 9: DGND (Ground f. Digital Control Pin 10 - 25)

Pin 10: Dynamic Mode (DYN0)

Pin 11: Sensitivity (SEN0)

Pin 12: Sensitivity (SEN1)

Pin 13: Sensitivity (SEN2)

Pin 14: Time Constant Slope (TCSL)

Pin 15: Time Constant (TC0)

Pin 16: Time Constant (TC1)

Pin 17: Time Constant (TC2)

Pin 18: Phase Shift (PH0)

Pin 19: Phase Shift (PH1)

Pin 20: Phase Shift (PH2)

Pin 21: Phase Shift (PH3)

Pin 22: Phase Shift (PH4)

Pin 23: Phase Shift (PH5)

Pin 24: Phase Shift (PH6)

Pin 25: Phase Shift (PH7)

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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 Lock-In-Amplifier switch setting, set the local switch to "0" and select the wanted setting via a 4-bit-code at the corresponding digital inputs:

Sensitivity Switch - Corresponding Inputs

Bit	Corresponding Control Port Input	
Bit 0	SEN0	(Pin 11)
Bit 1	SEN1	(Pin 12)
Bit 2	SEN2	(Pin 13)
Bit 3	DYN0	(Pin 10)

Time Constant Switch - Corresponding Inputs

Bit	Corresponding Control Port Input	
Bit 0	TC0	(Pin 15)
Bit 1	TC1	(Pin 16)
Bit 2	TC2	(Pin 17)
Bit 3	TCSL	(Pin 14)

Phase Switch Coarse - Corresponding Inputs

Bit	Corresponding Control Port Input	
Bit 0	PH4	(Pin 22)
Bit 1	PH5	(Pin 23)
Bit 2	PH6	(Pin 24)
Bit 3	PH7	(Pin 25)

Phase Switch Fine - Corresponding Inputs

Bit	Corresponding Control Port Input	
Bit 0	PH0	(Pin 18)
Bit 1	PH1	(Pin 19)
Bit 2	PH2	(Pin 20)
Bit 3	PH3	(Pin 21)

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 setting and remote controlled sensitivity setting, is also possible.

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