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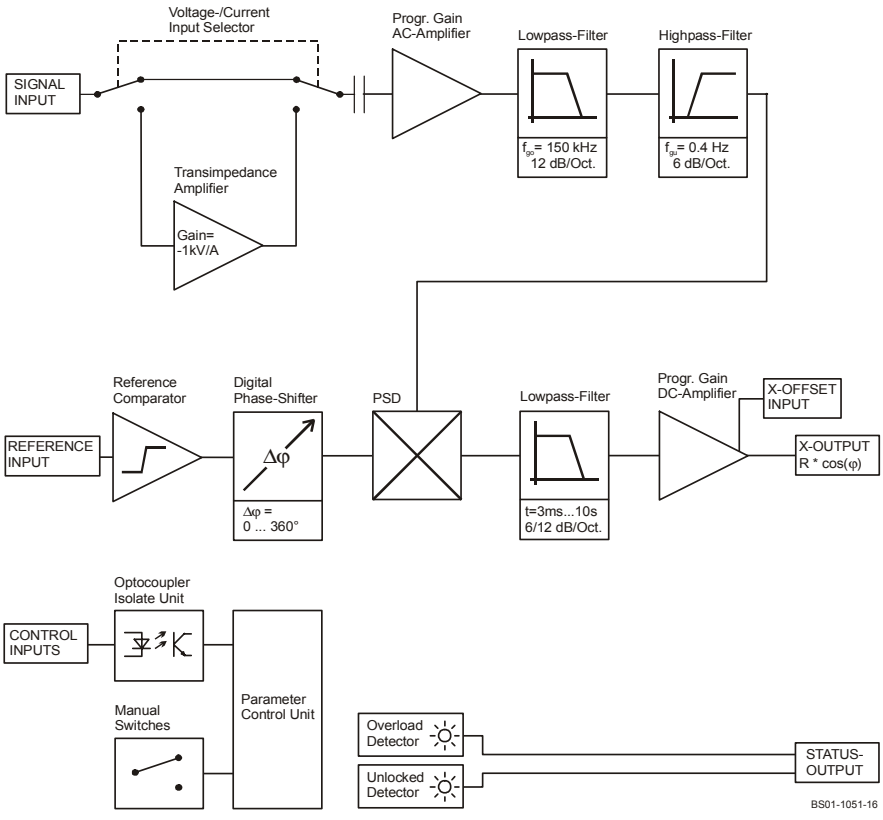
Datasheet LIA-MV-150

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	

Lock-In-Amplifier Module

Specifications	*Test Conditions*	*Vs = ± 15 V, Ta = 25°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 MΩ // 4 pF Model "-D": 2 MΩ // 2 pF differential
	Voltage Input Noise	12 nV/√Hz
	Voltage Input CMRR	Model "-D": 110 dB @ 1 kHz, 100 dB @ 10 kHz
	Voltage Input Gain Drift	100 ppm/K
Current Input	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/√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	± 20 %
Demodulator	Demodulator Dynamic Reserve	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 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	± 10 V (@ 2 kΩ Load)
	Output Current	± 5 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	± 100 % Full Scale by ± 10 V Control @ Low Drift Setting ± 100 % Full Scale by ± 1 V Control @ High Dyn. Setting
	Output Voltage Offset Control-Voltage Impedance	22 kΩ

Lock-In-Amplifier Module

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	± 15 Vdc ... ± 20 Vdc
	Supply Current	- 60 mA, + 100 mA
Case	Weight	370 gr. (0.86 lbs)
	Material	AlMg4.5Mn, nickel-plated
Temperature Range	Storage Temperature	- 40 ... + 100 °C
	Operating Temperature	0 ... + 60 °C

Absolute Maximum Ratings	Signal Input AC Voltage	20 Vpp
	Signal Input DC Voltage	± 30 V
	Reference Input Voltage	± 30 V
	Control Input Voltage	- 5 V, + 30 V
	Power Supply Voltage	± 22 V

Lock-In-Amplifier Module

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)

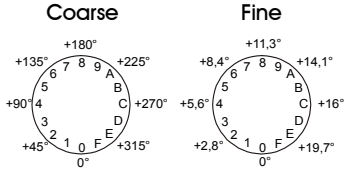
Low Drift Mode			High Dynamic Mode		
Setting	Voltage	Current	Setting	Voltage	Current
0	100 mV	100 µA	8	10 mV	10 µA
1	30 mV	30 µA	9	3 mV	3 µA
2	10 mV	10 µA	A	1 mV	1 µA
3	3 mV	3 µA	B	300 µV	300 nA
4	1 mV	1 µA	C	100 µV	100 nA
5	300 µV	300 nA	D	30 µV	30 nA
6	100 µV	100 nA	E	10 µV	10 nA
7	30 µV	30 nA	F	3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



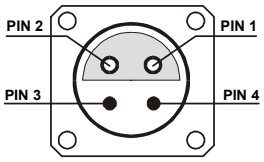
Lock-In-Amplifier Module

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

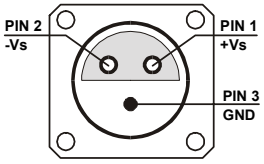
Output

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)

Lock-In-Amplifier Module

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 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

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)

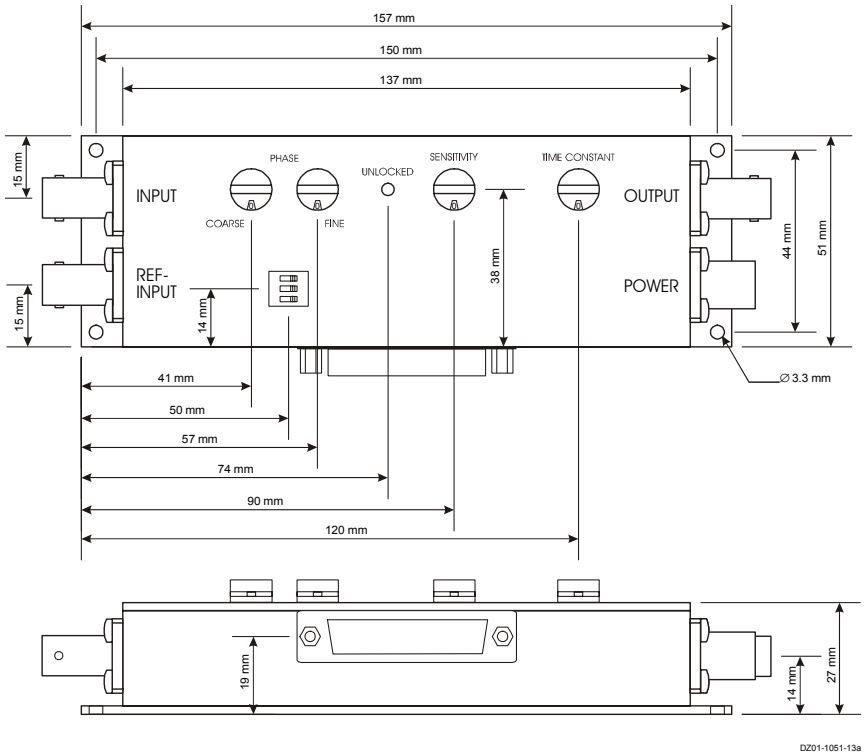
Phase Switch Fine - Corresponding Inputs

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.

Lock-In-Amplifier Module

Dimensions



Ordering Information

Available Models

Model No.: LIA-MV-150-S
- Singe-Ended Input (BNC-Connector Input)

Model No.: LIA-MV-150-D
- True Differential Input (LEMO-Connector Input)

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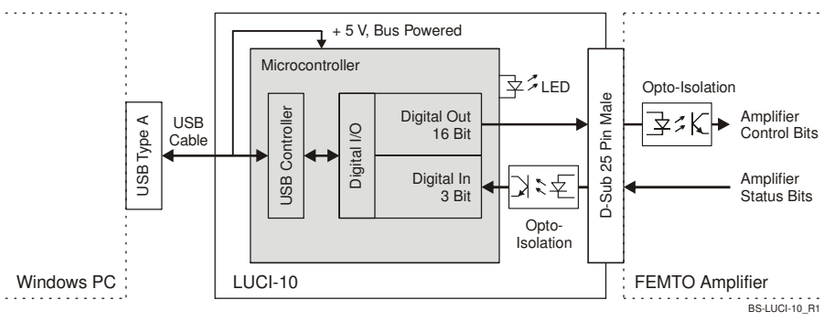
Datasheet LUCI-10

USB to D-Sub Control Interface for FEMTO Amplifiers

Features	• **Compact digital I/O interface for USB remote control of FEMTO amplifiers** • **Supports opto-isolation of amplifier signal path from PC USB port** • **16 digital outputs, 3 opto-isolated digital inputs** • **Bus-powered operation** • **System driver, application software and VI's for use with LabVIEW™ included**
Applications	• **Remote control of FEMTO® amplifiers and photoreceivers directly from a PC**
Block Diagram	

Hardware Specifications

General Characteristics	Bus interface	USB 2.0 (full-speed)
	Digital I/O channels	16 output lines 3 opto-isolated input lines
	Supply	PC USB port, +5 V, typ. 100 mA, bus-powered (no auxiliary power supply required)
	Connectors	USB type A D-Sub, 25 pin, male
	Cable	AWG 28, length 1.8 m
Output	Number of channels	16 output lines, supporting opto-isolation inside FEMTO amplifiers and photoreceivers
	Output voltage range	LOW bit: 0 … +0.5 V (@ 0 … 2 mA output current) HIGH bit: +4 … +5.5 V (@ 0 … 2 mA output current)
	Max. current	6 mA per channel
	Writing rate	max. 600 operations per second

USB to D-Sub Control Interface for FEMTO Amplifiers

Input	Number of channels	3 opto-isolated input lines
	Input voltage range	LOW bit: –20 … +1.5 V HIGH bit: +3 … +20 V
	Switching current	1 mA typ. @ 5 V
	Reading rate	max. 300 operations per second
Power Supply	USB port, bus powered	+4.5 … +5.5 V DC
	Active current	max. 200 mA / typ. 100 mA
	Suspend current	<0.5 mA (standby mode of Windows®)
Case	D-Sub case	metal hood (EMI/RFI shielding), with jack screws
	Weight	130 g (0.3 lb.)
	Material	zinc die-cast, nickel plated
Temperature Range	Storage temperature	–40 … +100 °C
	Operating temperature	0 … +50 °C
Absolute Maximum Ratings	Max. voltage at input	±30 V
	Max. short-circuit output current	±20 mA per channel, 200 mA total
	Max. isolation voltage	±60 V (input ground to output ground)
Connectors	Device port	D-Sub, 25 pin, male Pin 1: NC Pin 2: NC Pin 3: GND (IN) Pin 4: NC Pin 5: Digital IN Pin 6: Digital IN Pin 7: Digital IN Pin 8: NC Pin 9: GND (OUT) Pin 10: Digital OUT Low Byte, LSB Pin 11: Digital OUT Low Byte Pin 12: Digital OUT Low Byte Pin 13: Digital OUT Low Byte Pin 14: Digital OUT Low Byte Pin 15: Digital OUT Low Byte Pin 16: Digital OUT Low Byte Pin 17: Digital OUT Low Byte, MSB Pin 18: Digital OUT High Byte, LSB Pin 19: Digital OUT High Byte Pin 20: Digital OUT High Byte Pin 21: Digital OUT High Byte Pin 22: Digital OUT High Byte Pin 23: Digital OUT High Byte Pin 24: Digital OUT High Byte Pin 25: Digital OUT High Byte, MSB
	PC port	USB type A

USB to D-Sub Control Interface for FEMTO Amplifiers

Software Specifications

Software (included on CD)

Device driver	dynamic link library (DLL) for integration in Microsoft Windows® 32 bit & 64 bit operating system for use with C/C++, LabWindows™ /CVI™ or LabVIEW™
Application software	GUI (graphical user interface) programs for simple remote control of FEMTO amplifiers and photoreceivers provided as executable programs and LabVIEW projects
LabVIEW programs	sample programs to control and test the LUCI-10 hardware (including front panel and block diagram)
LabVIEW library	special VI toolkit for integration in LabVIEW 32 bit & 64 bit development environment

Note: A National Instruments LabVIEW™ license is not included in this software package. For use of the GUI application programs the LabVIEW Run-Time Engine is required. If not detected on the host PC during the installation process the LabVIEW Run-Time Engine will be installed automatically from the CD.

System Requirements

Operating system	Microsoft Windows XP with Service Pack 3, or higher
Processor	Intel Pentium III or AMD Athlon, or better
System memory	1 GB of RAM, or more
Hard disk space	about 5 GB
Interface port	USB 1.1 or USB 2.0
Supported FEMTO modules	any standard FEMTO amplifier or photoreceiver with 25 pin D-Sub socket, except model HLVA-100

Optional Requirements

For development of own application programs an additional development environment like LabVIEW Version 2012 (or higher) or C/C++ is required.

Legal Notice

USB to D-Sub Control Interface for FEMTO Amplifiers

Dimensions