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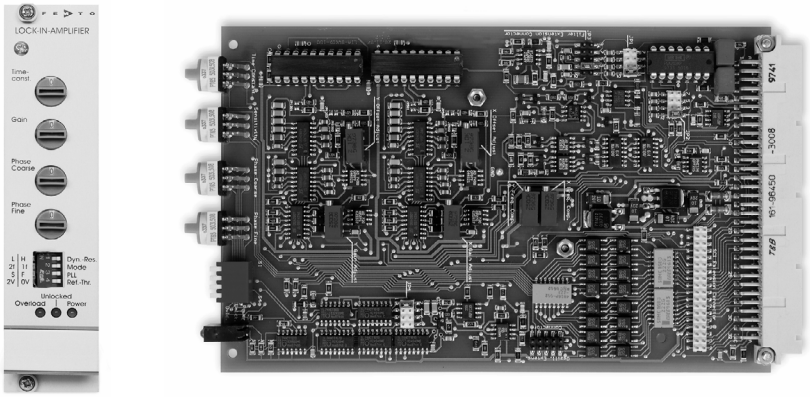
Datasheet LIA-BV-150-H

Single-Board Lock-In-Amplifier



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

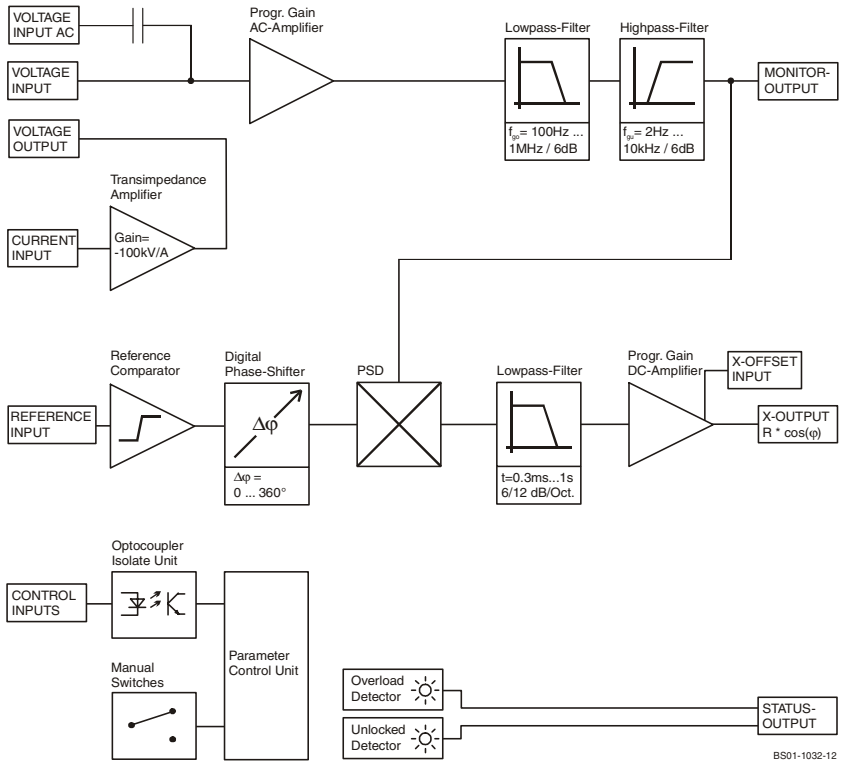
Features

- **Single Phase Detection with X Output**
- **Working Frequency 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



Single-Board Lock-In-Amplifier

Specifications		*Test Conditions*	*Vs = ± 15 V, Ta = 25°C*
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	Cs	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 °
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 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	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.
	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 ... ± 18 Vdc
	Supply Current	- 60 mA, + 120 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	Low Drift Mode Setting	Voltage	Current
0	1 V	10 µA	8	100 mV	1 µA
1	300 mV	3 µA	9	30 mV	300 nA
2	100 mV	1 µA	A	10 mV	100 nA
3	30 mV	300 nA	B	3 mV	30 nA
4	10 mV	100 nA	C	1 mV	10 nA
5	3 mV	30 nA	D	300 µV	3 nA
6	1 mV	10 nA	E	100 µV	1 nA
7	300 µV	3 nA	F	30 µV	300 pA

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

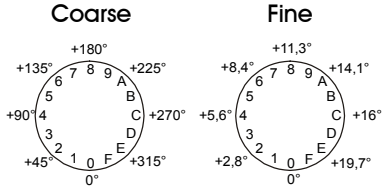
Low Drift Mode Setting	Voltage	Current	High Dynamic Mode Setting	Voltage	Current
0	100 mV	1 µA	8	10 mV	100 nA
1	30 mV	300 nA	9	3 mV	30 nA
2	10 mV	100 nA	A	1 mV	10 nA
3	3 mV	30 nA	B	300 µV	3 nA
4	1 mV	10 nA	C	100 µV	1 nA
5	300 µV	3 nA	D	30 µV	300 pA
6	100 µV	1 nA	E	10 µV	100 pA
7	30 µV	300 pA	F	3 µV	30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

Time Constant Setting

6 dB/Oct.	12 dB/Oct.	Time Constant
0	8	300 µs
1	9	1 ms
2	A	3 ms
3	B	10 ms
4	C	30 ms
5	D	100 ms
6	E	300 ms
7	F	1 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 Frequency Range f > 60 kHz or 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:

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 *

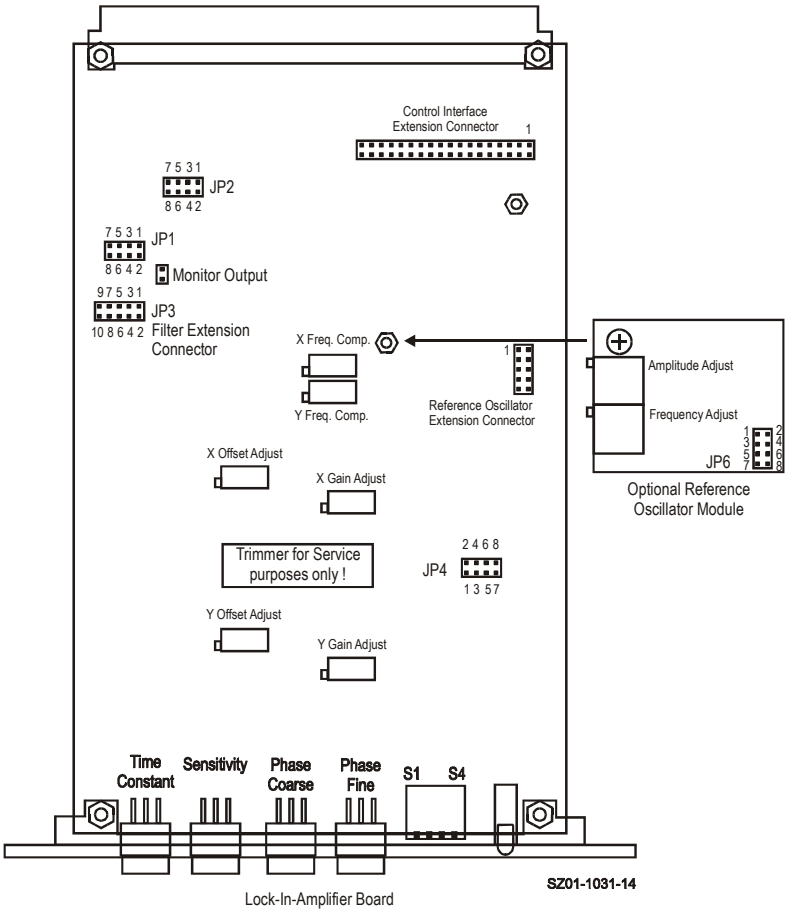
* (At Sensitivity Settings 6,7 & E,F max. 200 kHz)

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 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 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 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

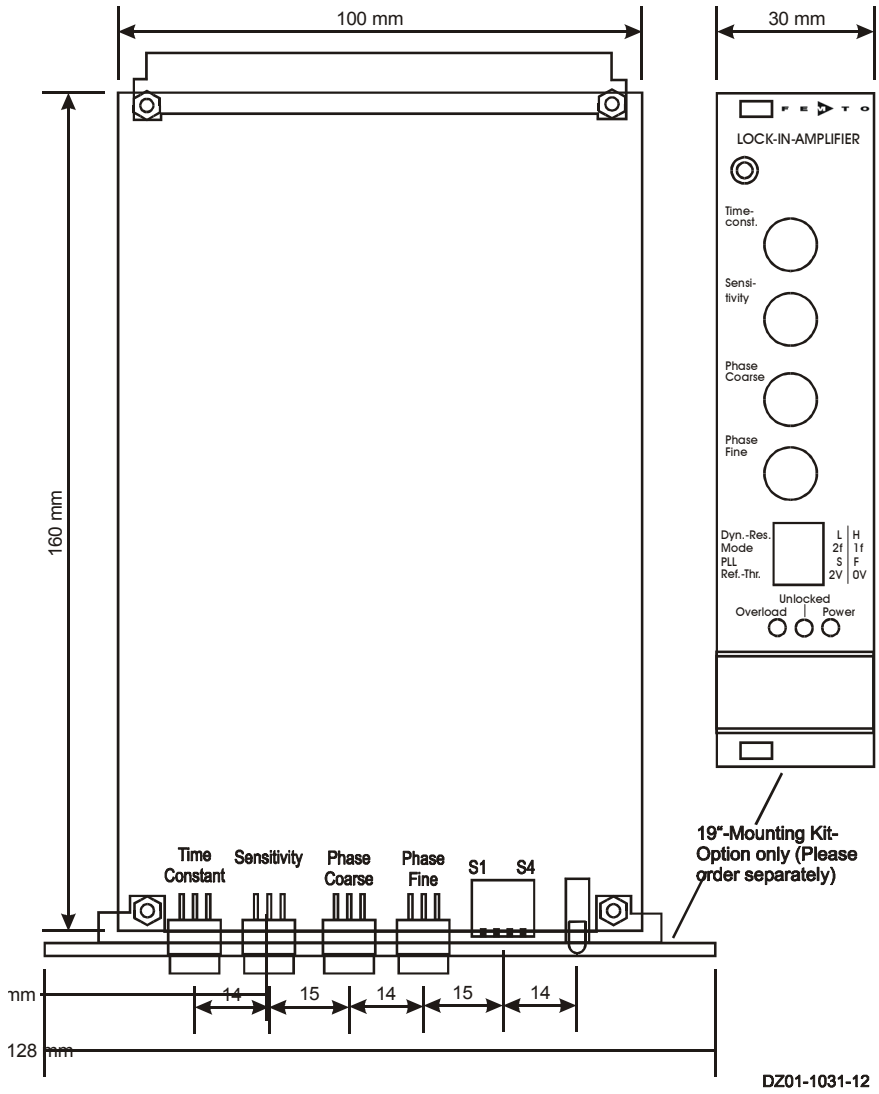
Bit	Corresponding Control Port Input	
Bit 0	PH0	(Pin A28)
Bit 1	PH1	(Pin C28)
Bit 2	PH2	(Pin A27)
Bit 3	PH3	(Pin C27)

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



Single-Board Lock-In-Amplifier

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

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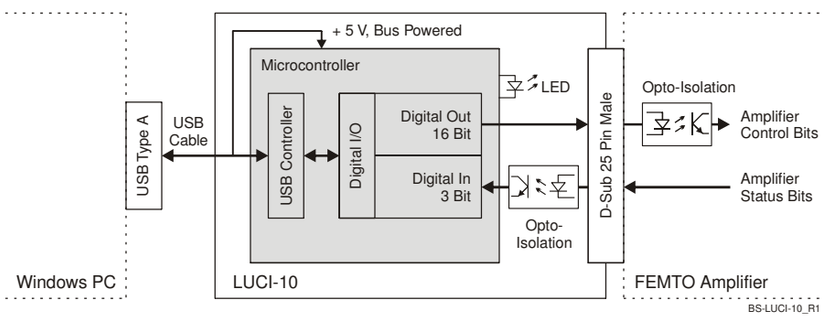
Datasheet LUCI-10

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