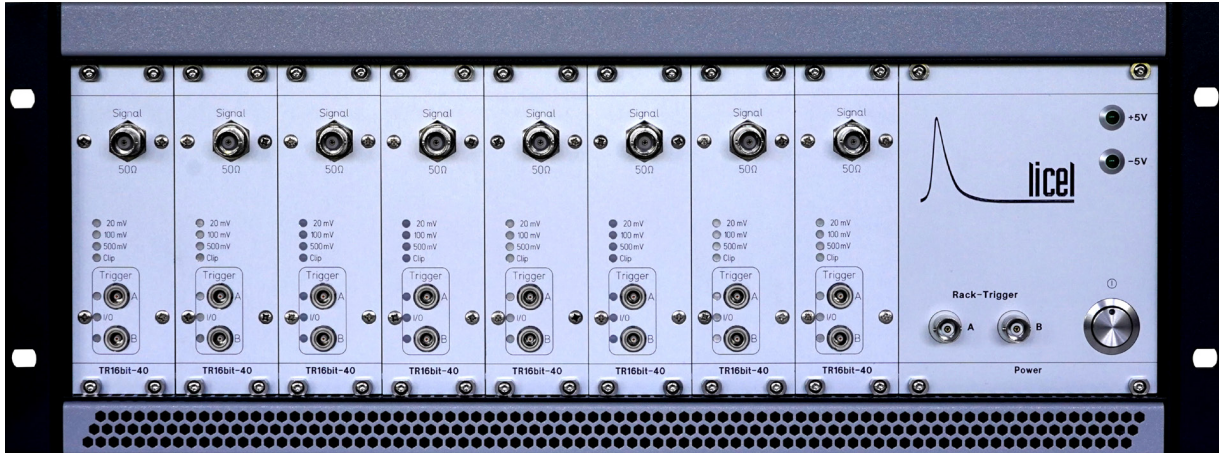
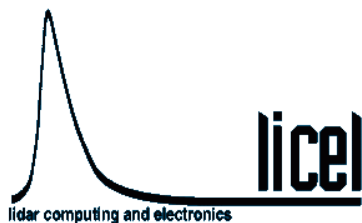


DIFFERENTIAL ABSORPTION LIDAR Optical Transient Recorders & Photodetectors



Photon-Counting PMTs for 160 to 850 nm
Silicon APD Modules <650 to >1064 nm



 **Boston**Electronics

91 Boylston Street, Brookline, MA 02445
tel: (617)566-3821 www.boselec.com
boselec@boselec.com

Optical Transient Recorder

Simultaneous analog and photon counting acquisition
for detection of optical signals

Model TR40-16bit-3U

Concept:

The Licel transient recorder is a powerful data acquisition system, designed especially for optical signal detection. A new concept was developed to reach the best dynamic range together with high temporal resolution at fast signal repetition rates. For the first time, analog detection of the photomultiplier current and single photon counting are integrated into one acquisition system. The licel transient recorder comprises a fast transient digitizer with on-board signal averaging, a discriminator for single photon detection and a multichannel scaler together with preamplifiers for both systems.



Features:

- 16 bit-40 Ms/s ADC
- 800 MHz single photon count rate
- Pretrigger mode
- Integrated preamplifiers
- 10⁵ dynamic range by combination of
Analog and single photon counting acquisition
- 64k shots on board summation
- High repetition rate for kHz lasers

Specifications

Analog acquisition:

Signal input ranges:	+2 mV...-20 mV +5 mV...-100 mV +5 mV...-500mV
A/D resolution:	16 bit
Sampling rate:	40 Ms/s,
Bandwidth:	DC-20 MHz
A/D differential nonlinearity:	typ. 0.5 LSB max. 4 LSB @ 25°C
A/D integral nonlinearity:	typ. ±3.0 LSB @ 25°C
Spurious free dynamic range:	88 dB
S/N single shot:	74 dB @ 100 mV input range (20 µV)
Input impedance:	50 Ω
Coupling:	DC
Protection:	Diode clamped

Photon counting acquisition

Max. count rate:	800 MHz, no deadtime or overlap between range bins
Discriminator threshold:	0...-100mV

Signal averaging:

Signal length:	10 - 32768 range bins
Pretrigger:	128 range bins
Summation memory:	2 (optional 3) channels, 64k acquisitions each
Max. repetition rate:	4,8 kHz for 4 kbin (15.3 km) 19.5 kHz for 1 kbin (3,8 km)

Trigger:

2 trigger inputs to acquire signals into 2 separate summation memories. Optional:3 trigger inputs/memories	
Impedance:	1kΩ
Threshold and slope	2.5V, positive
Trigger jitter:	±12.5 ns

In/Outputs:

Signal input:	BNC, 50Ω front panel
PC input for -AP option:	BNC, 50Ω front panel
Trigger A:	BNC, 1kΩ, front panel
Trigger B:	BNC, 1kΩ, front panel
Rack-6 Global TriggerA :	BNC, 1kΩ, rack front panel
Rack-6 Global TriggerB :	BNC, 1kΩ, rack front panel
Rack-1/-2/-6 Ethernet :	RJ45, rack rear panel

Rack/Power supplies¹:

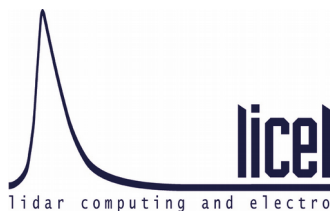
Rack-1:	1 TR + 1 PMT module
Rack-2:	2 TR + 2 PMT modules
Rack-8:	up to 8 TR or up to 4 TR + 4 PMT modules

PC interface ¹:

Ethernet I/O	100/1000 Ethernet interface
--------------	-----------------------------

¹ for a complete system pls. order:
1 pc. rack-1/-2/-8
1 pc. Ethernet I/O
1...8 pcs. transient recorders

order number: **TR40-16bit-3U-xx**
xx= option: for split input version select xx=AP



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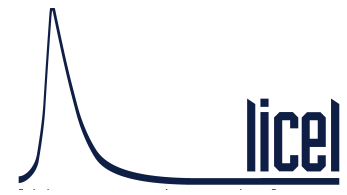
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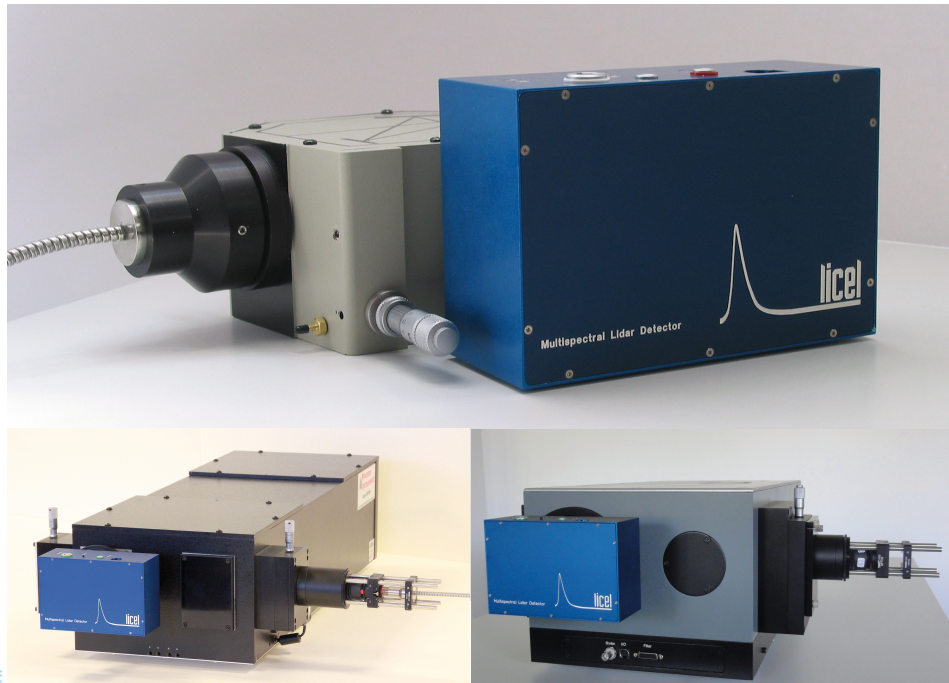
United Kingdom:

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Multispectral Lidar Detector



High time resolution models: Sp32-xx-HR



Applications:

Time resolved multispectral data for

- Raman Lidar
- Fluorescence Lidar
- Temperature Lidar
- Aerosol studies (PM2.5, Pollen, etc.)
- Fluorescence lifetime measurements

Features:

- Multi anode PMT detector
- 32 channel single photon counting
- up to 0.3 nm/channel resolution
- 625 ps time resolution
- 230 MHz sustained photon count rate
- on board signal averaging
- integrated HV supply

System overview:

The Licel multispectral lidar detector allows simultaneous detection of multiple spectrometer wavelengths at high repetition rates.

It is based on a multianode, metal-channel-dynode photomultiplier. 32 photocathode elements together with 32 single photon counting systems provide 2-dimensional, spectral and time resolved data.

The high voltage supply, an adjustable discriminator and fast signal averaging are integrated on the module.

The Ethernet interface is used together with LabView software to control the measurement and readout the acquired data.

The Licel Multispectral Lidar Detector can be used with various flat field spectrographs.

Specifications

Single photon counting system:

Pulse pair resolution: 625 ps, 1/1.6 GHz
 Max. sustained photon count rate: (limited by detector): 230 MHz
 Bin width, select by software: 625 ps to 1 μ s
 No. of range bins: 32000 with 625 ps bins
 16000 with 10 ns-1 μ s bins
 Max. signal range: 3 km @625 ps binwidth
 2400km @1 μ s binwidth
 Max. fast mode trigger summation memory: 255 shots (625 ps binwidth), 4095 shots (10 ns binwidth)
 Max. summation memory: 10⁶ shots
 Max. acquisition rate in fast summation mode: 1/(tracelength + 5 bins)

Anode uniformity, bialkali: 1:1.5 typ., 1:2 max
 multialkali: 1:1.7 typ., 1:2.5 max
 Cross-talk to channel n+1: 3%
 to channel n+2, n+3, n+4: 0.6%, 0.2%, 0.1%
 HV supply: 0... -1000 V
 max. total anode current: 100 μ A (30 sec)
 max. anode current per channel: 6 μ A (30 sec)

Power and dimensions:

SP32 size: 100 x 150 x 70 mm
 Power supply size: 91 x 128 x 220 mm, 3 HU cassette

Detector spectral sensitivity:

Ultra-Bialkali (-200): 300-650nm
 Multialkali (-20): 300-920nm

Connectors:

Trigger input: +2.5V into 1 kOhm
 Computer Interface: 100/1000 Ethernet, RJ45
 AC Power supply: 100/110/230V 50/60 Hz
 DC Power: Lemo 1B307, Lemo 1B304
 Trigger input: Lemo Camac

Detector geometry:

total detector area: 31.8 x 7mm
 single cathode area: 0.8 x 7mm (32 channels)
 inactive area between cathodes: 0.2 x 7mm

order number: SP32-xx-HR

xx = cathode: -200 for bialkali or -20 for multialkali

Spectral range and resolution using different spectrometers:

spectrometer focal length	grating [lines/mm]	monochromator useful spectral range	32 channel detector wavelength span	spectral resolution
125 mm	600	317-850 nm	396 nm	12.4 nm/mm
	1200	317-850 nm	198 nm	6.2 nm/mm
	2400	317-500 nm	99.2 nm	3.1 nm/mm
500 mm	600	300-850 nm	101.4 nm	3.17 nm/mm @355nm
	1200	300-850 nm	48.6 nm	1.52 nm/mm @355nm
	2400	300-707 nm	21.1 nm	0.76 nm/mm @355nm
750 mm	300	300-850 nm	139.2-140 nm	4.35-4.38 nm/mm
	600	300-850 nm	68.8-69.4 nm	2.15-2.17 nm/mm
	2400	300-532 nm	12.2-15.1 nm	0.38-0.47 nm/mm



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Photomultiplier module



High dynamic range detectors for analog + photon counting measurements



The best choice for pulsed dynamic signals

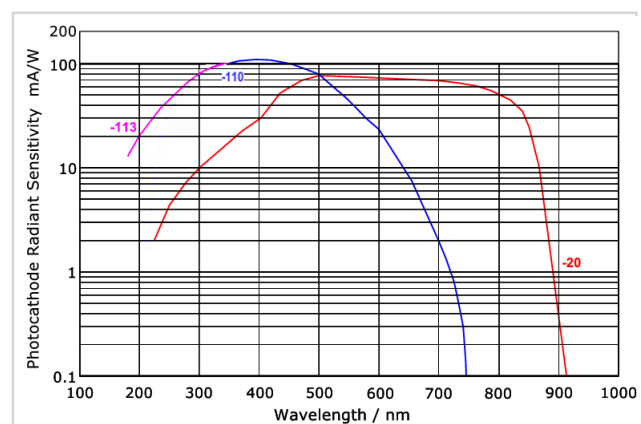
The high dynamic range photomultipliers from Licel have been optimized to enhance the results of your measurements in pulsed applications. The compact design combines a stabilized dynode chain for strong light pulses with fast rise times and narrow pulse widths for high single photon count rates. This combination allows high dynamic range measurements by using both analog and photon counting measurements

together, thus extending the linear dynamic range to 5 orders of magnitude. Additional advantages are reduced space charge effects and higher light levels that can be measured without suffering from nonlinearities. These features make the Licel high dynamic range photomultipliers your ideal detector for applications such as Lidar, fluorescence detection and other pulsed signal methods.

Features:

- stabilized dynode chain
- overcurrent protection
- single photon pulse width <2 ns
- high pulse load stability
- HV remote control option
- interface to lens tube system
- gated versions available

Spectral Sensitivity:



Specifications

Detector:

cathode diameter:	8 mm
cathode types:	
Bialkali UV-glass -113:	185-700 nm
Bialkali borosilicate-glass -110:	350-700 nm
Multialkali -20:	350-920 nm
max. average anode current:	0.1 mA
gain:	2×10^5 - 2×10^6

HV supply:

voltage range:	-100 V...-1 kV
max. current:	2 mA
voltage ripple:	<1mV (DC to 20 MHz)
remote control voltage	0..+1V

Signal specs:

single photon rise time:	< 0.7 ns
single photon width (FWHM):	< 2 ns
pulse load stability @100mV/60µs:	< 0.15%
automatic overcurrent protection:	>0.5mA for 1 second

Mechanics:

PMT module size:	65.4 (gated: 74.7) x 25mm
PMT module weight:	50 g
Optical interface:	O-ring sealed mount and adapter for 1" Thorlabs lens tube system
High voltage supply:	50.5 x 128.4 x 103mm 3 HU, 10 width units cassette

For gated version (-g) only:

Note: The gated PMT cannot be used in ungated mode

Gating type: Active ON

Gate pulse input:	>2.5V into 50Ω
Suppression, Gate OFF :	< 1.2×10^{-3}
Rise time:	<10 ns
Settling time (99%):	<200 ns
Settling time (99.9%):	<5 µs
Max. ON time:	1 ms
Max. duty cycle (ON/OFF):	1/100
Switching noise:	<10mV for <200 ns
High voltage range:	750-850V

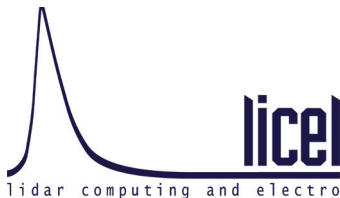
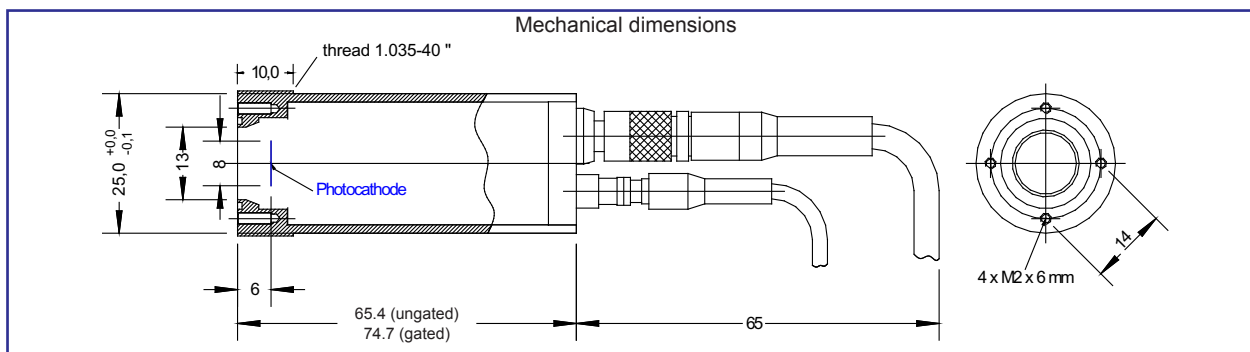
Connectors:

Signal out:	Lemo Minax to BNC
Gate in (-g version only):	Lemo Minax to BNC
HV to PMT:	Lemo Camac
HV power supply:	H11 connector
Power supply:	+15V DC, 250mA

Environmental conditions:

Operating temperature:	0°C to 30°C non condensing
Storage temperature:	-40°C to 70°C

options: -g: gated version



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Si-Avalanche Photodiode module

Low noise - high speed detector @ 400 nm-1100nm



High NIR Quantum Efficiency

Now you can measure optical signals in the near IR with high quantum efficiency, comparable to UV-Vis detectors. Our SI-APD Module consists of a TE-cooled detector, a high-speed low-noise preamplifier and HV supply. Integrated focussing optics and alignment

mechanics allow easy integration into your optical setup. The increased sensitivity in the near infrared is a major advantage compared to photomultipliers.

Enhanced and standard NIR sensitivity versions available.

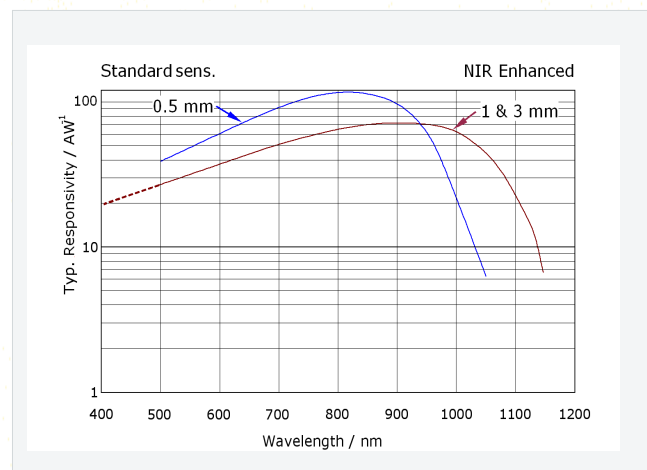
Features:

- 0.5, 1.0 or 3 mm dia. detector size
- thermoelectric cooled
- low noise, high gain preamplifier
- easy system integration with integrated alignment optics and mechanics
- integrated HV- and AC-power supply

Applications:

- LIDAR (Light Detection and Ranging)
- fluorescence detection
- replacement for photomultipliers >800nm

Spectral Sensitivity:



Specifications

Detector:

detector size: 0.5, 1.0, 3.0 mm dia.
 responsivity @650 nm: $>50\text{A/W}^1$, 30A/W^2
 responsivity @ 900 nm: 67A/W^2
 responsivity @ 1060 nm: 42A/W^2 typ., $\text{QE}=38\%^2$
 dark current @22°C: $5/50\text{ nA typ/max}$ (1 mm)²
 $9/90\text{ nA typ/max}$ (3 mm)²
¹ standard sensitivity: 0.5mm, ² NIR enhanced: 1mm, 3mm

Preamplifier for analog detection:

bandwidth: DC-10 MHz
 gain: $11\text{mV}/\mu\text{A}$ into $50\ \Omega$
 spectral noise current:
 DC...1MHz $2\text{ pA}/\sqrt{\text{Hz}}$
 DC...10 MHz $7.2\text{ pA}/\sqrt{\text{Hz}}$
 output polarity: negative
 output signal: $0\text{...}-1\text{V}$ (max), $0\text{...}-100\text{mV}$
 (typ. operation) into $50\ \Omega$

HV supply:

voltage range: $0\text{...}+450\text{V}$
 max. current: 0.6 mA
 voltage ripple: $<0.005\%$

Integrated TE cooler and temp. controller:

Detector temperature: $+0^\circ\text{C}$ (-20°C for 0.5mm APD)
 Temperature stability: $<0.5\text{ K}$

Power supply:

input: 100V, 110V, 230V, 50/60 Hz
 output: $+5\text{V}$, -5V , $+15\text{ V}$, linear regulated.

Environmental conditions:

Operating temperature: 0°C to 30°C (non condens.)
 Storage temperature: -40°C to 70°C

Mechanics:

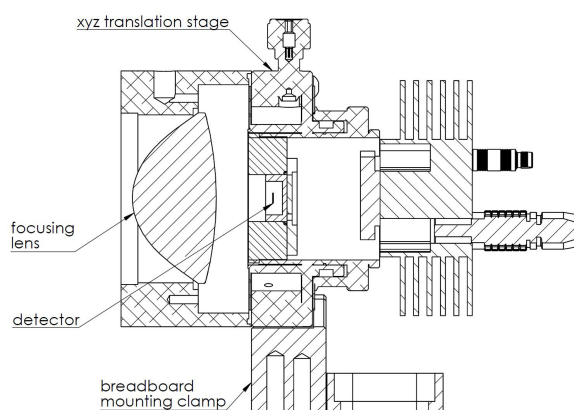
The compact APD/preamp/TEC controller unit is mounted in a XYZ translation stage for easy integration and alignment in detection systems.

XY axis travel: 6 mm
 Z-axis travel: 6 mm
 precision: $4\ \mu\text{m}$

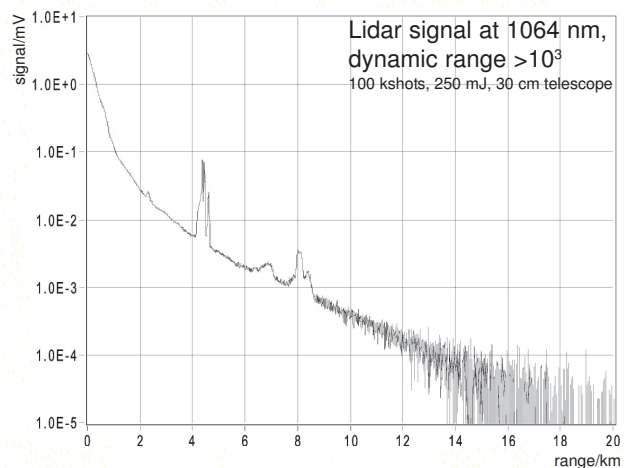
Dimensions and weight

Detector: $92 \times 92 \times 140\text{mm}$, Power: $61 \times 129 \times 220\text{mm}$
 APD detector head: 875 g + cable 350 g
 APD HV-Cassette: 1425 g
 APD total = 2650 g

Detector head



Signals



International distribution:

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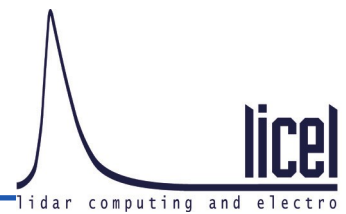
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 www.psplc.com

Other countries: Please contact Licel.

Wind Lidar Acquisition System



Wellenreiter™ Waverider™

The Licel Waverider™ is a powerful data acquisition and data processing system. It is based on a high speed and wide dynamic range A/D converter together with a hardware accelerated FFT processor in a FPGA. FFTs are averaged for a user defined number of shots.

This hardware outperforms PC based post-processing solutions and acquires your wind lidar signals at a duty cycle >95% with up to 6 Mio FFTs/second and a 32 frequency averaged output. It comes with open LabVIEW and C-sources to read the data from the instrument and gives full access to the raw spectral data.



Features:

- 12-bit ADC/400Ms/s
- >95% duty cycle
- hardware accelerated FFTs with full user access:
 - 1.5 Mio FFT/s with 128 frequencies
 - 3.0 Mio FFT/s with 64 frequencies
 - 6.0 Mio FFT/s with 32 frequencies
- Averaged frequency spectrum output for each range bin
- Trigger input (slave mode)
- 100/1000 Ethernet interface
- LabVIEW and C sources
- Price:

International distribution:

Asian Pacific Rim: USA:

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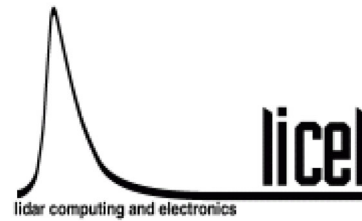
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Licel Euro Price List



Order No.	Description	price, Euro
Transient recorder modules:		
TR80-16bit-3U	Transient recorder, 16 bit-80 MHz A/D and 800 MHz photon counting acquisition, summation up to 64k shots, up to 409 μ s base signal length (6.5ms when down sampling at 5MHz).	10 290.-
TR40-16bit-3U	Transient recorder, 16 bit-40 MHz A/D and 800 MHz photon counting acquisition, summation up to 64k shots, up to 819 μ s base signal length (13ms when down sampling at 2.5MHz).	9 500.-
TR20-12bit-3U	Transient recorder, 12 Bit 20 Ms/s analog acquisition, 800 MHz photon counting, summation up to 64k shots, memory depth 32k bins, up to 1638 μ s base signal length (13ms when down sampling at 2.5MHz).	8 660.-
PR40	Photon Counting system, 800 MHz max. photon count rate, up to 819 μ s base signal length (13ms when down sampling at 2.5MHz).	6 020.-
Options and Accessories:		
Trig-Las	Optical trigger module for passive Q-switched laser	660.-
Multichannel counting systems:		
SP32HR-xx	32-channel Multi-Anode PMT single photon counting system, high voltage supply, Ethernet interface, max. count rate 1.6 GHz, sustained count rate 240 MHz, 625 ps resolution	
xx = 103	Super Bialkali (SBA) photocathode 185-650nm	27 300.-
xx = 200	Ultra Bialkali (UBA) photocathode 300-650nm	27 300.-
xx = 04	Multialkali photocathode 185-880nm	27 670.-
xx = 20	Multialkali photocathode 300-920nm	28 250.-
Sp32HR-Power	External Power for Multispectral Lidar HR detector	720.-
Fiber	Fiber Bundel for Multispectral Lidar detector	2 940.-

MS 125	1/8m spectrograph with 1200 lines/mm grating	4 310.-
Wind speed systems:		
Waverider	Wind speed acquisition system with 12bit 400MHz ADC, user selectable FFTsize, averaged power spectra output, > 95% duty cycle	27 730.-
Rack and power supplies:		
Rack-8-3U	Rack and power supply, 100V-240, 50/60Hz, linear regulated +5.4 V, -5 V for up to 8 pcs. 3HU transient recorders.	1 630.-
Rack-2-3U	Rack and power supply, 100V-240, 50/60Hz, linear regulated +5.4 V, -5 V for up to 2 pcs. 3HU transient recorders.	950.-
Rack-1	Housing and power supply for single transient recorder. AC 230 V-50 Hz / 110V-60 Hz input.	820.-
PMT-Rack3	Rack for up to 3 pmt modules	560.-
PMT-Rack8	Rack for up to 8 pmt modules	1 000.-
Ethernet Remote Control		
Ethernet-IO	Ethernet interface module option for transient recorder rack. Control and readout of up to 16 transient recorders	1 050.-
PM-Remote-8	Ethernet interface for remote control of up to 8 photomultipliers. Remote high voltage setting and high voltage monitor. incl. LabView routines. Mounted in 3 HU cassette.	1 030.-
PM-Remote-4	Ethernet interface for remote control of up to 4 photomultipliers. Remote high voltage setting and high voltage monitor. incl. LabView routines. Mounted in 3 HU cassette.	990.-
Quad-HV	4-channel HV module, 0.-1kV, remote control of HV and readout of HV currents. Display of HV and individual channel names.	3 850.-
Triple-HV	3-channel HV module, 0.-1kV, remote control of HV and readout of HV currents. Display of HV and individual channel names.	3 000.-
APD-Remote-Dig	Ethernet interface for digital opto-isolated remote control of up to 4 APD modules. Remote high voltage setting and TEC on/off control. incl. LabView routines	990.-
APD-Remote-4	Ethernet interface for remote control of up to 4 APD modules. Remote high voltage setting and TEC on/off control. incl. LabView routines. Mounted in 3 HU cassette.	990.-

Trigger generator	Ethernet interface for active laser flashlamp, Q-switch, Gating and transient recorder control. Variable repetition rate and pretrigger delay. Incl. LabView routines. Mounted in 3 HU cassette.	930.-
Laser Sync Module	Ethernet interface for synchronization of up to 3 lasers with different repetition rates. Incl. LabView routines. Mounted in 3 HU cassette.	990.-
Laser Monitor	Ethernet laser monitor. Continuous acquisition of laser pulse energy measured by laser power meter (not. incl.) or photodiode (included).	1 490.-
Detectors:		
	Photomultiplier modules based on Hamamatsu mini PMT's, HV supply, stabilized dynodes, overcurrent protection, cables.	
PM-HV-03	185-650nm Bialkali	3 300.-
PM-HV-R9880-113	185-700nm Super Bialkali	3 800.-
PM-HV-R9880-20	310-920nm Multialkali	4 340.-
gating	optional gating circuit for the PMT modules shown above. The gated PMT version can only be used in gated mode, max. gate ON time = 1ms	add 930.-
Boresite	4-quadrant boresite alignment system, detector, photon counter, Ethernet interface	10 290.-
NIR (1064nm) enhanced Si-APDs for analog detection:		
APD-3.0	Silicon APD detector module detector size 3.0 mm (dia.), features as shown above.	7 610.-
Standard Si sensitivity APDs for analog or p.c. detection:		
APD-C30902	Silicon APD detector module detector size 0.5 mm (dia.), not infrared enhanced, lower dark count rate	8 610.-
InGaAs APD module for eyesafe lidar		
APD-InGaAs50	InGaAs APD detector module, 0.5mm square, sens. 1100-1700 nm, air cooled, incl. AC/DC power supply, HV supply, focussing and alignment optics	8 610.-
Polarization measurements:		
Polarotor	Rotating polarizing beamsplitter for alternating measurements of parallel and perpendicular polarized signals up to 50Hz laser rep. rate.	9 820.-

	Ethernet interface.	
Basic	<hr/> <p style="text-align: center;">Software:</p> <p>Drivers for LabView routines (source code) to perform data acquisitions, display signals, combine analog and photon counting signals, analyze photon counting pulse height distribution. Additional low level C-routines for integration into existing software.</p>	incl.
File	Customized file format and naming convention according to your desired standard.	1 100.-

All Prices are EXW Berlin and excl. VAT and taxes.

Additional costs for shipment, import taxes, banking fees and on site installation (where applicable) will apply

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