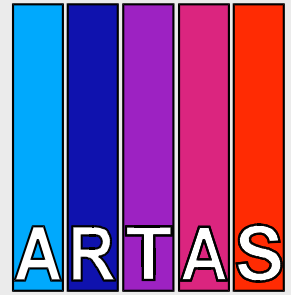
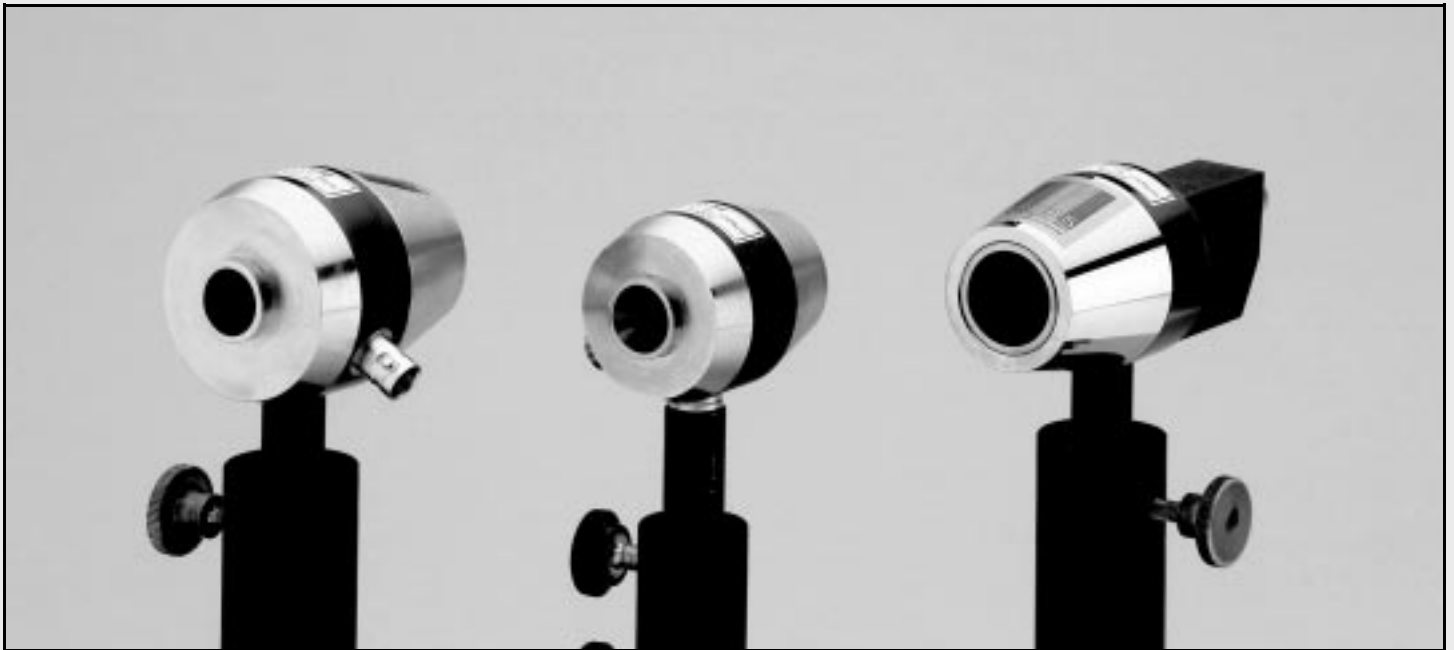


**ARTAS Advanced Research Technology and Systems
Vertriebsgesellschaft mbH**



**Fast Detectors for Pulsed Radiation
for
 $\lambda = 2 \dots 1200 \mu\text{m}$**



**Photon Drag Detectors
Photovoltaic Detectors
Photoconductivity Detectors
Signal Amplifiers**

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INTRODUCTION

High time resolution, wide dynamic and spectral range, high radiation resistance, operation at room temperature are the main requirements for photodetectors of pulsed laser IR and FIR radiation. Photodetectors based on photon drag, photovoltaic and intraband photoconductivity phenomena are ideal for meeting these requirements.

This generation of photodetectors has been developed at A.F. Ioffe Institute, St.Petersburg, with full regard of the demands to exploit these photodetectors as reliable and convenient devices for measuring the parameters of pulsed laser IR and FIR radiation. These detectors of pulsed laser radiation are capable of measuring power and time characteristics of practically all modern pulsed IR and FIR lasers, operating in both single and pulsed periodical modes.

FEATURES

- Wide spectral range of photosensitivity
- High time resolution (up to 100 ps)
- Output impedance 50Ω at standard BNC connector
- Operation at room temperature
- High radiation resistance (up to 20 MW/cm^2)
- Wide dynamic range (10 mW to 500 MW)
- High protection against external electromagnetic fields
- High long term stability of the device characteristics
- Simplicity and reliability

APPLICATIONS

- Development and production of IR and FIR lasers
- Quantum electronics research
- Semiconductor physics research
- Plasma physics research
- Material laser treatment
- Biology and medicine technology

DESCRIPTION

Eleven detector series and three amplifier variants differing in operation and structure provide the possibility to solve a wide range of problems in laser photometry. The series are as follows:

NEAR INFRARED RANGE



PV5N & PV3N mit Polarisator

PV series (**P**hoto **V**oltaic) detectors are based on the photovoltaic effect in semiconductors and are intended for the measuring the parameters of high power near infrared radiation pulses with sub nanosecond time resolution. The detectors of this series do not require a bias voltage.

PVA series (**P**hoto **V**oltaic with **A**mplifier) detectors are intended for measuring the parameters of weak near infrared radiation pulses with nanosecond time resolution. They use wide band amplifiers with the sensitive elements of the PV-detectors.

MID- AND FAR- INFRARED RANGES

PD series (**Photon Drag**) detectors are based on the photon drag effect in semiconductors and are intended for measuring the parameters of high-power middle- and far-infrared radiation pulses with sub nanosecond time resolution.



PD-10M

PDA series (**Photon Drag with Amplifier**) detectors are intended for measuring the parameters of weak middle- and far-infrared radiation pulses with nanosecond time resolution by using wide band signal amplifiers together with the sensitive elements of PD detectors. Two different signal amplifiers are available with 50 MHz and 300 MHz bandwidth, respectively. A special noise protected amplifier circuit and double screening of the devices provide a highly efficient protection against external electromagnetic high frequency interferences.



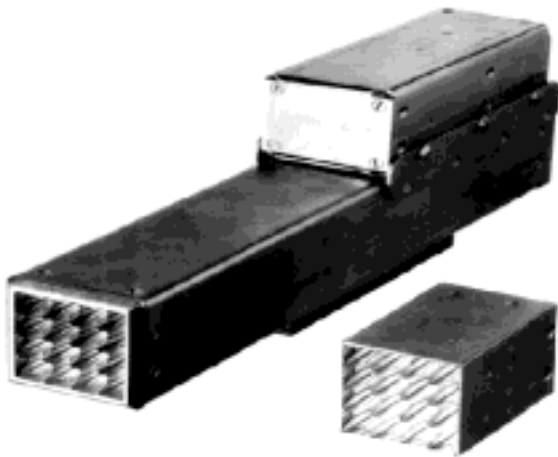
IP-2F

IPA series (**Intraband Photoconductivity with Amplifier**) detectors are based on the interband photoconductivity effect and are intended for measuring the parameters of very weak far infrared radiation pulses. Detectors of this series have two orders of magnitude higher sensitivity than PDA

detectors. IPA detectors include external signal amplifiers (models with 50 MHz and 300 MHz bandwidth are available). IPA detectors have a high protection against external electromagnetic high frequency interference.

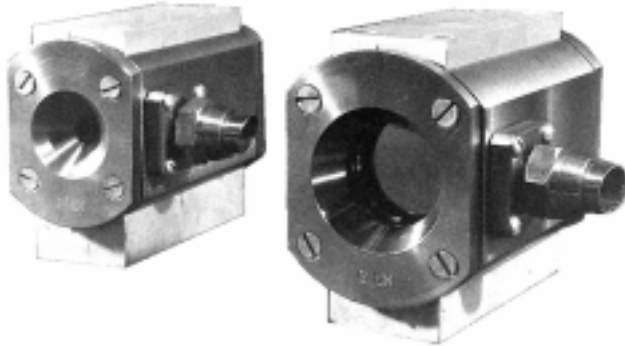
IPA-SF series (**S**uper **F**ast modification of **IPA**) detectors are intended for measuring the parameters of picosecond and nanosecond far infrared radiation pulses. The other features are identical with the IPA detector series.

MD, MDA series (**M**atrix of photon drag **D**etectors without and with **A**mplifiers) detectors are intended for studying the spatial-temporal distribution of wide laser beams using a detectors matrix with any number and arrangement of elements. They feature all advantages of the PD and PDA series devices.



MDA5x16M50 & MD5x16M

CD, CDA series (**C**ooled photon drag **D**etectors without and with **A**mplifier) are intended for the direct detection of the radiation from high power industrial lasers. Special design and application of liquid cooling provide operation at high average power of the radiation being measured (up to 1 kW). These devices allow direct observation of the radiation parameters (power, time characteristics) of such lasers.



CD-10M & CD-30M

HAD series (**H**igh **A**perture photon drag **D**etectors) are intended for direct registration of large diameter high power middle and far infrared beams and measuring the parameters of radiation pulses with nanosecond time resolution. They feature all the advantages of the PDA series devices.

AMPLIFIERS

A, **AD** series (wideband **A**mplifiers and **A**mplifiers with **D**ifferential input) amplifiers are intended for the amplification with gain coefficient of more than 100 (20dB) of any pulse signal with bandwidth of 300 MHz and 50 MHz, respectively. A special noise protected amplifier circuit and double screening of the devices provide a highly efficient protection against external electromagnetic high frequency interferences.



AD50 & A300

EF series (wideband **E**mitter **F**ollower) amplifiers are intended for impedance matching in the bandwidth of 50 or 100 MHz. They feature all the advantages of the A and AD series amplifiers.

NAME OF THE SERIES

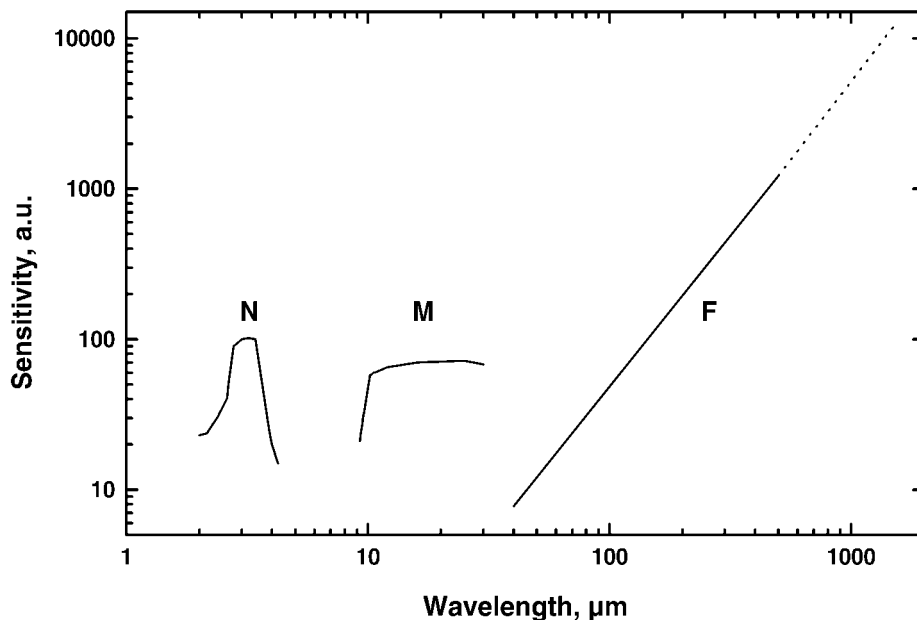
The names of the series reflect the physical principle, presence of amplifiers, the sensing element size and the desired spectral range of operation.

SPECTRAL RANGE AND SENSITIVITY

The spectral range from 2-1200 μm is covered by three groups of detectors.

- N** - Near infrared range 2 ... 4 μm
- M** - Mid infrared range 5 ... 30 μm
- F** - Far infrared range 40 ... 1200 μm

A photodetector's sensitivity S is determined by the physical principle used for detection, diameter of the detecting element, amplifier gain and varies with wavelength. The spectral dependence of the sensitivity, shown in relative units, is presented in the figure. Absolute values are given in the tables below.



TIME RESOLUTION

The physical principles used for detection have characteristic times less than 10^{-11} s and thus do not limit the measurement of longer pulses.

The time resolution of real devices is determined by the design and bandwidth of the amplifiers, if present. The model IPA300-SF has the best time resolution of less than 100 ps. The time resolution for each model is given in the tables.

DETECTORS FOR THE NEAR IR, TECHNICAL DATA

<i>PV & PVA Detector Series for the Near IR</i>						
Model	PV3N	PV5N	PVA3N50	PVA5N50	PVA3N300	PVA5N300
spectral range, μm	2 ... 4					
sensitive area \emptyset , mm	3	5	3	5	3	5
input cone \emptyset , mm	10	15	10	15	10	15
sensitivity @ 2.6 μm , V/MW	1.5	1	150	100	250	170
NEP @ 2.6 μm , W	20	25	25	40	10	15
time resolution, ns	<0.5	<0.5	<7	<7	<1	<1

Application examples: pulse analysis of HF lasers, Er:YAG lasers, Ho:YAG lasers ...

DETECTORS FOR THE MID IR, TECHNICAL DATA

<i>PD & PDA Detector Series for the Mid IR</i>						
Model	PD5M	PD10M	PD20M	PDA5M50	PDA5M300	PDA10M300
spectral range, μm	5 ... 30					
sensitive area \emptyset , mm	5	10	20	5	5	10
input cone \emptyset , mm	15	15	30	15	15	15
sensitivity @ 10.6 μm , V/MW	0.5	0.2	0.07	100	100	40
NEP @ 10.6 μm , W	50	100	300	50	25	50
time resolution, ns	<0.5	<0.5	<0.5	<7	<1	<1

Application examples: pulse analysis of TEA-CO₂-lasers, Q-switched CO₂-lasers, ...

CD & CDA Detector Series for the Mid IR						
Model	CD10M	CD20M	CD30M	CDA10M50	CDA20M50	CDA30M50
spectral range, μm	5 ... 30					
sensitive area \emptyset , mm	10	20	30	10	20	30
input cone \emptyset , mm	-	-	-	-	-	-
sensitivity @ 10.6 μm , V/MW	0.2	0.1	0.05	20	10	5
NEP @ 10.6 μm , W	100	300	900	100	300	900
time resolution, ns	0.5	1	1	10	10	10
maximum average power, kW	2	2	2	1	1	1
water consumption, l/min	1	2	4	1	2	4

HAD, MD & MDA Detector Series for the Mid IR			
Model	HAD70M50	MD5x16M	MDA5x16M50
spectral range, μm	5 ... 30		
input area, mm x mm	70 x 70	60 x 60	60 x 60
number of sensing elements	1	16	16
sensitive element size, mm	70 x 70	5	5
sensitivity @ 10.6 μm , V/MW	20	0.5	100
NEP @ 10.6 μm , W		50	50
time resolution, ns	<7	<1	<7

Application examples: temporal and spatial pulse analysis of TEA-CO₂-lasers, Q-switched CO₂-lasers, Free-Electron-Lasers, etc., with high repetition rates and high average output powers.

DETECTORS FOR THE FAR IR, TECHNICAL DATA

PD & PDA Detector Series for the Far IR						
Model	PD3F	PD5F	PD10F	PDA5F50	PDA5F300	PDA10F300
spectral range, μm	40 ... 1200*					
sensitive area \emptyset , mm	3	5	10	5	5	10
input cone \emptyset , mm	10	15	15	15	15	15
sensitivity @ 90.5 μm , V/MW	0.5	0.1	0.07	40	20	15
NEP @ 90.5 μm , W	100	200	300	100	100	150
time resolution, ns	<0.5	<0.5	<0.5	<7	<1	<1

* calibrated 40..500 μm , tested 40..1200 μm

IPA Detector Series for the Far IR				
Model	IPA300F1	IPA300F2	IPA300F1-SF	IPA300F2-SF
spectral range, μm	40 ... 1200*			
sensitive area \varnothing , mm	1	2	1	2
input cone \varnothing , mm	20	20	20	20
in operating mode with amplifier				
sensitivity @ 90.5 μm , V/MW	4000	2000	4000	2000
NEP @ 90.5 μm , W	0.5	1	0.5	1
time resolution, ns	1	1	1	1
in operating mode without amplifier				
sensitivity @ 90.5 μm , V/MW	20	10	20	10
time resolution, ns	<0.5	<0.5	<0.1	<0.1

HAD, MD & MDA Detector Series for the Far IR			
Model	HAD70F50	MD5x16F	MDA5x16F50
spectral range, μm	40 ... 1200*		
input area, mm x mm	70 x 70	60 x 60	60 x 60
number of sensing elements	1	16	16
sensitive element size, mm	70 x 70	5	5
sensitivity @ 90.5 μm , V/MW	10	0.3	60
NEP @ 90.5 μm , W			
time resolution, ns	<7	<1	<7

Application examples: pulse analysis of FIR molecular optically pumped lasers, FIR free electron lasers, ...

* calibrated 40..500 μm , tested 40..1200 μm

SPECIAL PURPOSE DETECTORS

Modifications of the detectors described above could be made on special request. For instance: polarization dependent detectors, fast polarization analyzers, other amplifier configurations. Please do not hesitate to contact us.



SIGNAL AMPLIFIERS, TECHNICAL DATA

<i>EF, AD & A Series Amplifiers</i>				
Model	EF50	EF100	AD50	A300
gain	1	1	100	170
bandwidth, MHz	0.1 .. 50	0.1 .. 100	0.5 .. 50	1 .. 300
input impedance, Ω	3000	3000	700	50
output impedance, Ω	50	50	50	50
output noise, peak-peak, mV	0.05	0.05	4	2
rise time, ns	7	3	7	1
output voltage, linear range, V	-0.1 ... +1.8	-0.1 ... +1.8	-0.1 ... +1.8	-2.5 ... +2.5

POWER SUPPLIES

Each detector which needs a bias and each amplifier are designed to operate with a 12 V DC, 400 mA power supply. If not otherwise stated, a power supply module for 230 V, 50 Hz will be supplied together with the detector or amplifier, respectively.

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