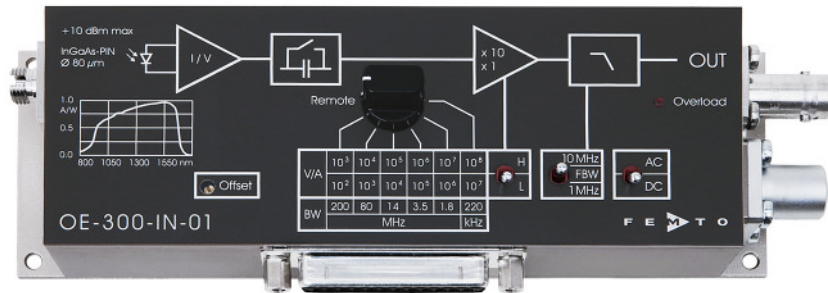


200 MHz Variable Gain Photoreceiver



The image shows model OE-300-IN-01-FC.

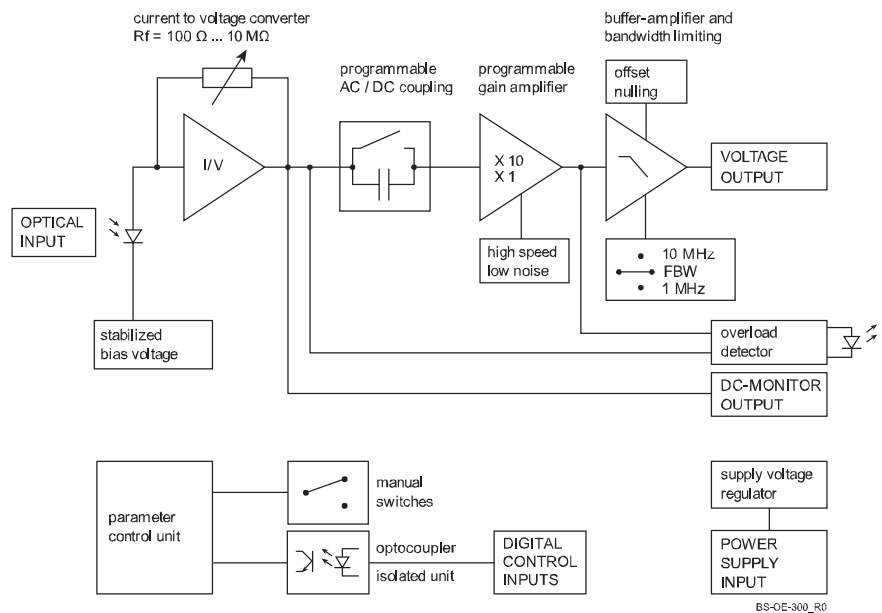
Features

- Adjustable transimpedance gain from 10^2 to 10^8 V/A
- Wide bandwidth up to 200 MHz
- InGaAs-PIN photodiode covering the 900 to 1,700 nm wavelength range
- FC fiber optic input
- High dynamic input range up to 10 mW optical power
- Very low noise, NEP down to 88 fW/√Hz
- Switchable low pass filters for minimizing wideband noise
- Full manual and remote control capability

Applications

- All purpose low-noise photoreceiver (O/E converter) for the MHz range
- Time resolved optical pulse and power measurements
- Laser intensity noise measurements (RIN)
- Optical front-end for oscilloscopes, spectrum analyzers, A/D converters and RF lock-in amplifiers

Block Diagram



200 MHz Variable Gain Photoreceiver

Available Versions

OE-300-IN-01-FC

FC fiber optic input

Related OE-300 Models

See separate datasheets for following models on www.femto.de:

OE-300-SI-10-FST

Si-PIN, 1 mm x 1 mm, 400 - 1000 nm
1.035"-40 threaded flange

OE-300-SI-10-FS

Si-PIN, 1 mm x 1 mm, 400 - 1000 nm
25 mm dia. unthreaded flange

OE-300-SI-30-FST

Si-PIN, \varnothing 3 mm, 320 - 1000 nm
1.035"-40 threaded flange

OE-300-SI-30-FS

Si-PIN, \varnothing 3 mm, 320 - 1000 nm
25 mm dia. unthreaded flange

OE-300-IN-03-FST

InGaAs-PIN, \varnothing 300 μ m, 800 - 1700 nm
1.035"-40 threaded flange

OE-300-IN-03-FS

InGaAs-PIN, \varnothing 300 μ m, 800 - 1700 nm
25 mm dia. unthreaded flange

OE-300-S

customized versions available on request

Available Accessories

PRA-PAP



post adapter plate,
easy to mount on
FEMTO photoreceiver series
OE, FWPR, HCA-S and LCA-S

PS-15



power supply,
input: 100 - 240 VAC,
output: \pm 15 VDC, +400/-250 mA

LUCI-10



compact digital I/O interface for USB remote control,
supports opto-isolation of amplifier signal path from PC
USB port, 16 digital outputs, 3 opto-isolated digital inputs,
bus-powered operation

200 MHz Variable Gain Photoreceiver

| Specifications | <p>Test conditions $V_s = \pm 15\text{ V}$, $T_A = 25\text{ }^\circ\text{C}$, system impedance = $50\ \Omega$</p> <p>Gain Transimpedance gain $1 \times 10^2 \dots 1 \times 10^8\ \text{V/A}$ Gain accuracy $\pm 1\ \%$</p> <p>Frequency Response Lower cut-off frequency DC/100 Hz, switchable Upper cut-off frequency up to 200 MHz (see table below), switchable to 1 MHz or 10 MHz</p> <p>Input Noise equivalent power (NEP) see table below Max. CW saturation power see table below</p> <p>Detector Detector InGaAs-PIN photodiode Active area $80\ \mu\text{m}$ dia. Spectral response 900 - 1700 nm Sensitivity R 0.95 A/W typ. @ 1550 nm Dark current 0.02 nA typ.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------------------------------|---|--------------------------------|-------------------|-------------------|-------------------|-------------------|--------|--------|---------------------------------|---------|--------|--------|---------|---------|---------|------------------------------|--------|--------|-------|-------------------|-------------------|-------------------|---------------------------------------|--------|-------|--------|--------|--------|-------|-------------|--------|-------|---------|---------|---------|--------|-------------------------------|-------------------|--------|-------|--------|---------|-------|---------------------------|-------|--------|-------------------|------------------|-------------------|--------|---------------------------------|--------|--------|--------|--------|--------|--------|---------------------------------|---------|--------|--------|---------|---------|---------|------------------------------|------|--------|-------|-------------------|-------------------|-------------------|---------------------------------------|--------|--------|--------|--------|--------|-------|-------------|--------|-------|---------|---------|---------|--------|-------------------------------|-------------------|--------|-------|--------|---------|-------|---------------------------|--------|-------------------|------------------|-------------------|--------|-------|
| Performance Depending on Gain Setting | <table border="1"> <thead> <tr> <th>Gain setting (low noise) (V/A)</th> <th>10^2</th> <th>10^3</th> <th>10^4</th> <th>10^5</th> <th>10^6</th> <th>10^7</th> </tr> </thead> <tbody> <tr> <td>Upper cut-off frequency (-3 dB)</td> <td>200 MHz</td> <td>80 MHz</td> <td>14 MHz</td> <td>3.5 MHz</td> <td>1.8 MHz</td> <td>220 kHz</td> </tr> <tr> <td>Rise/fall time (10 % - 90 %)</td> <td>1.8 ns</td> <td>4.4 ns</td> <td>25 ns</td> <td>0.1 μs</td> <td>0.2 μs</td> <td>1.6 μs</td> </tr> <tr> <td>NEP ($\sqrt{\text{Hz}}$, @ 1550 nm)</td> <td>217 pW</td> <td>17 pW</td> <td>6.3 pW</td> <td>1.7 pW</td> <td>363 fW</td> <td>96 fW</td> </tr> <tr> <td>Measured at</td> <td>20 MHz</td> <td>8 MHz</td> <td>1.4 MHz</td> <td>350 kHz</td> <td>180 kHz</td> <td>22 kHz</td> </tr> <tr> <td>Integrated input noise (rms)*</td> <td>4.9 μW</td> <td>380 nW</td> <td>23 nW</td> <td>3.3 nW</td> <td>0.84 nW</td> <td>71 pW</td> </tr> <tr> <td>CW sat. power (@ 1550 nm)</td> <td>10 mW</td> <td>1.0 mW</td> <td>100 μW</td> <td>10 μW</td> <td>1.0 μW</td> <td>100 nW</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Gain setting (high speed) (V/A)</th> <th>10^3</th> <th>10^4</th> <th>10^5</th> <th>10^6</th> <th>10^7</th> <th>10^8</th> </tr> </thead> <tbody> <tr> <td>Upper cut-off frequency (-3 dB)</td> <td>175 MHz</td> <td>80 MHz</td> <td>14 MHz</td> <td>3.5 MHz</td> <td>1.8 MHz</td> <td>220 kHz</td> </tr> <tr> <td>Rise/fall time (10 % - 90 %)</td> <td>2 ns</td> <td>4.4 ns</td> <td>25 ns</td> <td>0.1 μs</td> <td>0.2 μs</td> <td>1.6 μs</td> </tr> <tr> <td>NEP ($\sqrt{\text{Hz}}$, @ 1550 nm)</td> <td>151 pW</td> <td>7.2 pW</td> <td>1.7 pW</td> <td>549 fW</td> <td>339 fW</td> <td>88 fW</td> </tr> <tr> <td>Measured at</td> <td>18 MHz</td> <td>8 MHz</td> <td>1.4 MHz</td> <td>350 kHz</td> <td>180 kHz</td> <td>22 kHz</td> </tr> <tr> <td>Integrated input noise (rms)*</td> <td>3.0 μW</td> <td>285 nW</td> <td>21 nW</td> <td>3.2 nW</td> <td>0.84 nW</td> <td>71 pW</td> </tr> <tr> <td>CW sat. power (@ 1550 nm)</td> <td>1.0 mW</td> <td>100 μW</td> <td>10 μW</td> <td>1.0 μW</td> <td>100 nW</td> <td>10 nW</td> </tr> </tbody> </table> <p>* The integrated input noise is measured with a shaded input in the full bandwidth ("FBW") setting (referred to 1550 nm). The measurement bandwidth is 3 x the upper cut-off frequency at the specific gain setting; filter slope is a 1st order roll-off.</p> <p>The input referred peak-peak noise can be calculated from the rms noise as follows: $P_{\text{Input noise peak-to-peak}} = P_{\text{Input noise rms}} \times 6$</p> <p>The output noise is given by: $U_{\text{Output noise rms}} = P_{\text{Input noise rms}} \times \text{gain} \times R$ $U_{\text{Output noise peak-to-peak}} = U_{\text{Output noise rms}} \times 6 = P_{\text{Input noise rms}} \times \text{gain} \times 6 \times R$</p> <p>The integrated noise will be reduced considerably by setting the low pass filter to "1 MHz" or "10 MHz" instead of "FBW". This is especially useful for continuous wave (CW) measurements.</p> | Gain setting (low noise) (V/A) | 10^2 | 10^3 | 10^4 | 10^5 | 10^6 | 10^7 | Upper cut-off frequency (-3 dB) | 200 MHz | 80 MHz | 14 MHz | 3.5 MHz | 1.8 MHz | 220 kHz | Rise/fall time (10 % - 90 %) | 1.8 ns | 4.4 ns | 25 ns | 0.1 μs | 0.2 μs | 1.6 μs | NEP ($\sqrt{\text{Hz}}$, @ 1550 nm) | 217 pW | 17 pW | 6.3 pW | 1.7 pW | 363 fW | 96 fW | Measured at | 20 MHz | 8 MHz | 1.4 MHz | 350 kHz | 180 kHz | 22 kHz | Integrated input noise (rms)* | 4.9 μW | 380 nW | 23 nW | 3.3 nW | 0.84 nW | 71 pW | CW sat. power (@ 1550 nm) | 10 mW | 1.0 mW | 100 μW | 10 μW | 1.0 μW | 100 nW | Gain setting (high speed) (V/A) | 10^3 | 10^4 | 10^5 | 10^6 | 10^7 | 10^8 | Upper cut-off frequency (-3 dB) | 175 MHz | 80 MHz | 14 MHz | 3.5 MHz | 1.8 MHz | 220 kHz | Rise/fall time (10 % - 90 %) | 2 ns | 4.4 ns | 25 ns | 0.1 μs | 0.2 μs | 1.6 μs | NEP ($\sqrt{\text{Hz}}$, @ 1550 nm) | 151 pW | 7.2 pW | 1.7 pW | 549 fW | 339 fW | 88 fW | Measured at | 18 MHz | 8 MHz | 1.4 MHz | 350 kHz | 180 kHz | 22 kHz | Integrated input noise (rms)* | 3.0 μW | 285 nW | 21 nW | 3.2 nW | 0.84 nW | 71 pW | CW sat. power (@ 1550 nm) | 1.0 mW | 100 μW | 10 μW | 1.0 μW | 100 nW | 10 nW |
| Gain setting (low noise) (V/A) | 10^2 | 10^3 | 10^4 | 10^5 | 10^6 | 10^7 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Upper cut-off frequency (-3 dB) | 200 MHz | 80 MHz | 14 MHz | 3.5 MHz | 1.8 MHz | 220 kHz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Rise/fall time (10 % - 90 %) | 1.8 ns | 4.4 ns | 25 ns | 0.1 μs | 0.2 μs | 1.6 μs | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| Measured at | 20 MHz | 8 MHz | 1.4 MHz | 350 kHz | 180 kHz | 22 kHz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Integrated input noise (rms)* | 4.9 μW | 380 nW | 23 nW | 3.3 nW | 0.84 nW | 71 pW | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CW sat. power (@ 1550 nm) | 10 mW | 1.0 mW | 100 μW | 10 μW | 1.0 μW | 100 nW | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Gain setting (high speed) (V/A) | 10^3 | 10^4 | 10^5 | 10^6 | 10^7 | 10^8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Upper cut-off frequency (-3 dB) | 175 MHz | 80 MHz | 14 MHz | 3.5 MHz | 1.8 MHz | 220 kHz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Rise/fall time (10 % - 90 %) | 2 ns | 4.4 ns | 25 ns | 0.1 μs | 0.2 μs | 1.6 μs | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| Measured at | 18 MHz | 8 MHz | 1.4 MHz | 350 kHz | 180 kHz | 22 kHz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Integrated input noise (rms)* | 3.0 μW | 285 nW | 21 nW | 3.2 nW | 0.84 nW | 71 pW | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CW sat. power (@ 1550 nm) | 1.0 mW | 100 μW | 10 μW | 1.0 μW | 100 nW | 10 nW | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

200 MHz Variable Gain Photoreceiver

Specifications (continued)

| | | | |
|--------------------------|--------------------------------|--|-----------------------------|
| Output | Output voltage range | ±1 V (@ 50 Ω load), for linear amplification | |
| | Output impedance | 50 Ω (designed for 50 Ω load) | |
| Ext. Offset Control | Slew rate | 1,000 V/μs | |
| | Max. output current | ±40 mA | |
| | Output offset compensation | adjustable by offset potentiometer and external control voltage, output offset compensation range min. ±100 mV | |
| | Control voltage range | ±10 V | |
| | Offset control input impedance | 15 kΩ | |
| Indicator LED | Function | overload | |
| Digital Control | Control input voltage range | LOW bit: -0.8 ... +1.2 V, HIGH bit: +2.3 ... +12 V | |
| | Control input current | 0 mA @ 0 V, 1.5 mA @ +5 V, 4.5 mA @ +12 V | |
| | Overload output | non active: <0.4 V @ 0 ... -1 mA active: typ. 5 ... 5.1 V @ 0 ... 2 mA | |
| Power Supply | Supply voltage | ±15 V | |
| | Supply current | +110/-90 mA (depends on operating conditions, recommended power supply capability min ±200 mA) | |
| Case | Stabilized power supply output | ±12 V, max. 20 mA, +5 V, max. 150 mA | |
| | Weight | 320 g (0.74 lb.) | |
| DC Monitor Output | Material | AlMg4.5Mn, nickel-plated | |
| | Monitor output gain | Mode | Monitor gain |
| Temperature Range | Monitor output polarity | Low noise | Gain setting divided by -1 |
| | Monitor output voltage range | High speed | Gain setting divided by -10 |
| | Monitor output bandwidth | inverting | |
| | Monitor output impedance | ±1 V (@ ≥1 MΩ load) | |
| | Storage temperature | DC ... 1 kHz | |
| | Operating temperature | 1 kΩ (designed for ≥1 MΩ load) | |
| Absolute Maximum Ratings | Max. CW power (averaged) | -40 ... +80 °C | |
| | Digital control input voltage | 0 ... +60 °C | |
| | Analog control input voltage | 12 mW | |
| | Power supply voltage | -5 V/+16 V relative to digital ground DGND (pin 9) | |

200 MHz Variable Gain Photoreceiver

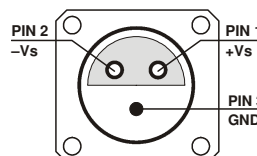
Connectors

Input
Output

FC fiber optic receptacle
BNC jack (female)

Power supply

Lemo® series 1S, 3-pin fixed socket
(mating plug type: FFA.1S.303.CLAC52)
Pin 1: +15 V
Pin 2: -15 V
Pin 3: GND



Control port

Sub-D 25-pin, female, qual. class 2
Pin 1: +12 V (stabilized power supply output)
Pin 2: -12 V (stabilized power supply output)
Pin 3: AGND (analog ground for pins 1 - 8)
Pin 4: +5 V (stabilized power supply output)
Pin 5: digital output: overload (referred to pin 3)
Pin 6: DC Monitor output
Pin 7: NC (= not connected)
Pin 8: output offset control voltage input
Pin 9: DGND (ground for digital control pins 10 - 14)
Pin 10: digital control input: gain, LSB
Pin 11: digital control input: gain
Pin 12: digital control input: gain, MSB
Pin 13: digital control input: AC/DC
Pin 14: digital control input: high speed / low noise
Pin 15: upper cut-off frequency limit 10 MHz
Pin 16: upper cut-off frequency limit 1 MHz
Pin 17 - 25: NC (= not connected)

Scope of Delivery

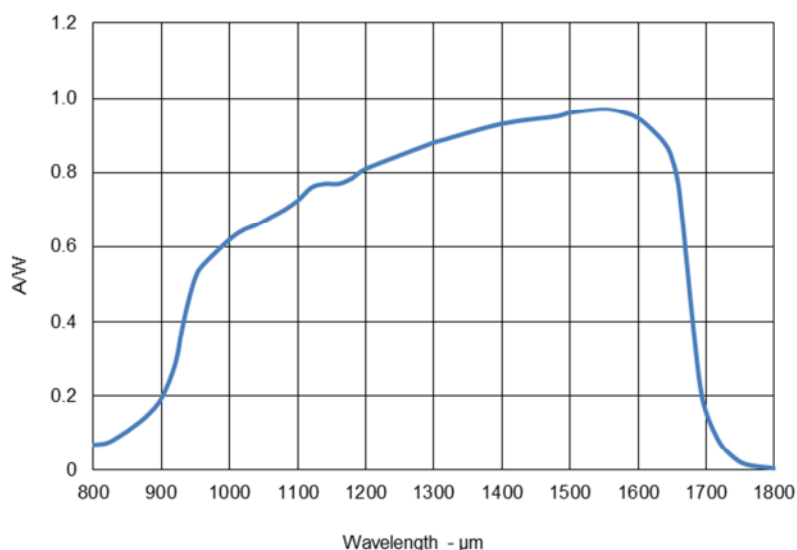
OE-300-IN-01-FC, Lemo® 3-pin connector, datasheet, transport package

200 MHz Variable Gain Photoreceiver

Remote Control Operation

| | | | | | |
|--------------------------------|---|--|---------------|--------|---------------|
| General | Remote control input bits are opto-isolated and connected by a logical OR function to the local switch settings. For remote control set the corresponding local switches to "Remote", "AC" and "H" and select the desired setting via a bit code at the corresponding digital inputs. Mixed operation, e.g. local AC/DC setting and remote controlled gain setting, is also possible. | | | | |
| Gain setting | Low noise Gain (V/A) Pin 14=HIGH | High speed Gain (V/A) Pin 14=LOW | Pin 12 MSB | Pin 11 | Pin 10 LSB |
| | 10^2 | 10^3 | LOW | LOW | LOW |
| | 10^3 | 10^4 | LOW | LOW | HIGH |
| | 10^4 | 10^5 | LOW | HIGH | LOW |
| | 10^5 | 10^6 | LOW | HIGH | HIGH |
| | 10^6 | 10^7 | HIGH | LOW | LOW |
| | 10^7 | 10^8 | HIGH | LOW | HIGH |
| AC/DC setting | Coupling | Pin 13 | | | |
| | DC | LOW | | | |
| | AC | HIGH | | | |
| Low pass filter setting | Upper cut-off frequ. limit | | Pin 15 | Pin 16 | |
| | full bandwidth | | LOW | LOW | |
| | 10 MHz | | HIGH | LOW | |
| | 1 MHz | | LOW | HIGH | |
| High speed / low noise setting | Mode | | Pin 14 | | |
| | low noise mode | | LOW | | |
| | high speed mode | | HIGH | | |

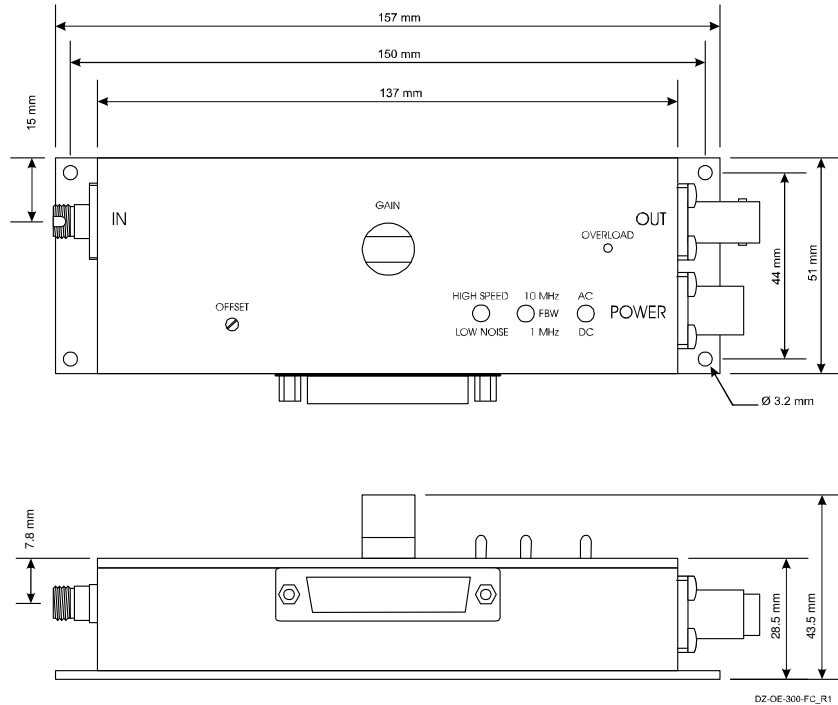
Spectral Responsivity



200 MHz Variable Gain Photoreceiver

Dimensions

Fiber optic input OE-300-IN-01-FC:



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 Fax: +49 30 280 4711-11
 Email: info@femto.de
 www.femto.de

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