BROADBAND LINEAR AMPLIFIER

Model F70PV

HIGH OUTPUT CURRENT
+70 V 2 A

VARIABLE GAIN
0-10x

HIGH SLEW RATE
500 V/µs

BROADBAND
DC to ca 5 MHz
GENERAL DESCRIPTION

The F70PV is a broadband, high output current, general purpose linear amplifier designed for laboratory use. It is based on a fast operational amplifier with a feedback network chosen to give a voltage amplification of 10 times. Any function or arbitrary waveform generator can be used as an input device. The output is unipolar.

The amplifier combines very high speed with high output current. It is, thus, of the outmost importance for the safe operation that the user understands the possibilities as well as the limitations of the instrument. A functional diagram of the instrument is shown below:

![Functional diagram of the F70PV amplifier](image)

INPUT AMPLITUDE

The amplifier has an attenuator at the input. At the knob position “10” the amplification is equal to 10x. Standard value is 500 ohm, but 50 ohm, 1kohm or other values can be fitted in on request.

The amplitude of the input signal should normally be kept within the range from zero to +7 V. The input protection network limits the amplitude of the input signal to a safe value (between -1 V and +11 V). It also effectively cuts accidental spikes and overshoots. However, large and prolonged overvoltage at the input may blow the microfuse in the input protection circuit. (A spare fuse is provided inside the instrument. If possible, contact flce@flce.se for advice before opening the instrument case.)

*Keep input signal positive and below +7 V. Avoid negative input voltage!*

*Never connect the output to the input of the amplifier!*
**LOAD**

The amplifier is intended to drive resistive and capacitive loads. It can also be used to drive an inductance in series with resistance. The maximum load that can be safely connected depends on the slew rate of the amplifier. Unless agreed otherwise, this is normally set at the factory to ca 500 V/µs which yields a capacitive load limit of about 1 nF. This limit includes the capacitance of the connection cable (ca 100 pF/m for a standard coaxial cable). Increasing the capacitive load causes overshoot and may cause instability of the amplifier. If a larger capacitive load is required then the slew rate should be reduced accordingly (see the Load vs. Frequency plot below). Such an adjustment (within a limited load range) may be performed by qualified personnel and the factory should be contacted for advice, since opening the instrument voids the warranty. Inside the cabinet exist hazardous voltage levels and the amplifier circuit is extremely sensitive to static discharge.

*Overloading the output may cause instability.*

The frequency response to 1 V$_{pp}$ input amplitude and with 50 ohm load is shown in the following diagram:

![Frequency Response Diagram](image)

The output current limit is set to ca 2 A. The output is equipped with a current limiting circuit that withstands accidental short-circuits and with a protective 1 Ω resistance. However, prolonged short-circuiting or overload should be avoided.
The amplifier may be overheated and enter thermal shutoff if its output is short-circuited for a long time.

The amplifier cannot be used to drive an inductive load.

Maximum frequency depends on the load capacitance. For safe operation with high loads the slew rate has to be reduced by adjusting internal trim capacitor. The slew rate is roughly equal to the max current (2 A) divided by the load capacitance:

\[
SR \ [V/\mu s] \approx \frac{I_{\text{MAX}} [A]}{C_L [\mu F]}
\]

The diagram below shows the possible adjustment range. It does not mean that higher loads can be driven just by lowering the frequency. The slew rate adjustment is necessary!

Total noise at the output with short-circuited input is:

<table>
<thead>
<tr>
<th>frequency [kHz]</th>
<th>0,5</th>
<th>1</th>
<th>10</th>
<th>50</th>
</tr>
</thead>
<tbody>
<tr>
<td>(U_{\text{NOISE}} [\mu V/\sqrt{Hz}])</td>
<td>&lt;1.3</td>
<td>&lt;0.32</td>
<td>&lt;0.06</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>
SUMMARY OF TECHNICAL DATA

Bandwidth: DC to about 5 MHz at 70 V and 50 ohm load
Amplification: 10 times fixed; variable with input attenuator
Load: type resistive || capacitive, factory adjusted for 1nF max load unless requested otherwise
Impedance: input 500 \( \Omega \) || 30 pF, custom values possible
          output 2 \( \Omega \) in the linear mode
Voltage: input nominal from 0 to +7 V
         maximum -5V…+11 V peak
Current: output maximum 2 A
Slew Rate: output ca 500 V/\( \mu \text{s} \) at 50 \( \Omega \) load
Input protection fuse 15 mA (Littelfuse, part number 272.015)
one spare fuse provided inside the instrument,
additional fuses available from Littelfuse resellers
or from FLC Electronics AB.

Operating Ambient Temperature: 0°C to 30°C
Storage Temperature: 0°C to 60°C
Relative Humidity: up to 90% (operation)
                  30% to 50% (storage)
Power Requirements: 100/110 V or 220/230 V, 50/60 Hz
Fuse: 100/110 V: 3.15 A (slow), 220/230 V: 2 A (slow)
Dimensions (H/W/L): 112 x 255 x 316 (mm)
Weight: 4.5 kg
Country of Origin: Sweden

Note: Specifications apply to instruments operating at 23°C \( \pm \) 5°C ambient temperature after 15 min. warm-up time. Due to ongoing product development, specifications are subject to change without notice.

WARNING It is not allowed to connect the 100...230V AC line power input of the amplifier to DC-AC converters or solid state AC generators with non-sinusoidal output.

Data sheet revision date: 13 August 2019
**WARRANTY**

FLC Electronics warrants that this product will be free from defects in materials and workmanship for a period of **two years** from the date of the shipment.

If any such product proves defective during this warranty period, FLC Electronics, at its option, either will repair the defective product without charge for parts and labour, or will provide a replacement for the defective product. In order to obtain service under this warranty, Customer must notify FLC Electronics of the defect before the expiration of the warranty period and make suitable arrangements for the performance of the service. Customer shall be responsible for packing and shipping the defective product to the service center designed by FLC Electronics, with shipping charges prepaid. FLC Electronics shall pay for the return of the product to the Customer if the shipment is to a location within the country in which the FLC Electronics service center is located. Customer shall be responsible for paying all shipping charges, duties, taxes, and any other charges for products returned to any other locations.

This warranty shall not apply to any defect, failure or damage caused by improper use or inadequate maintenance and care. FLC Electronics shall not be obligated to furnish service under this warranty:

- to repair damage resulting from attempts by personnel other than FLC Electronics representatives to install, repair or service the product;
- to repair damage resulting from improper use or connection to incompatible equipment;
- to service a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product.

This warranty is given by the FLC Electronics with respect to this product in lieu of any other warranties, expressed or implied. FLC Electronics and its vendors disclaim any implied warranties of merchantability or fitness for a particular purpose. FLC Electronics’ responsibility to repair or replace defective products is sole and exclusive remedy provided to the customer for breach of this warranty. FLC Electronics and its vendors will not be liable for any indirect, special, advance notice of the possibility of such damages.

The instrument may generate hazardous voltage levels! It should be operated by qualified personnel only. The instrument is to be used in normal room temperature and humidity.

The manufacturer cannot be held responsible for damage to any device connected to the instrument. It is recommended that samples or equipment sensitive to voltage spikes are disconnected from the high-voltage outputs when turning the power to the instrument ON or OFF.
IMPORTANT

Inside the amplifier case exist dangerous voltage levels.

The amplifier cannot be used to drive an inductive load.

The instrument cannot be powered from a DC-AC converter nor from a solid-state AC generator with non-sinusoidal output.

Loads sensitive to voltage transients should be disconnected from the amplifier during power-up and power-down.

Never connect the output to the input of the amplifier!

The amplifier may be overheated if the output is short-circuited for a long time.

It is recommended to monitor the output signal of the amplifier on the oscilloscope.
EC Declaration of Conformity

We

FLC Electronics AB
Sippetalsvägen 8
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Sweden

declare under sole responsibility that the

Voltage Amplifier F70PV

meets the intent of Directive 89/336/EEC for Electromagnetic Compatibility (EMC) and Low Voltage Directive 73/23/EEC (LVD). Compliance was demonstrated to the following standards as listed in the official Journal of the European Communities:

- **EN 50081-1** Generic Emissions
  - EN 55022 Conducted emission (interference voltage), class B
  - EN 55022 Radiated emission (electric field), class B

- **EN 50082-1** Generic Immunity
  - EN 61000-4-4 Electrical fast transient/burst
  - EN 61000-4-2 Electrostatic discharge
  - EN 61000-4-3 Radiated E-fields (radio frequency)

- **EN 61010-1:2010** Electrical Safety

Tomasz Matuszczyk, PhD
Technical Director
FLC Electronics AB

May 8, 2014