

# **Pulse Amplifier DIV 20**

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## **Instruction Manual**

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## 1. Safety remarks

In order to avoid unwanted damage or hazards, please read this instruction manual carefully before operation.

**The DIV 20 has to be operated by trained personnel only !**

The pulse amplifier DIV 20 is specially designed to drive capacitive loads with an extremely fast rise-time and high repetition rate. A high voltage of up to 600V can be present at output sockets (Pulsausgang) and (Offsetausgang) of the driver and the maximum current may be as high as 8 A. Never touch any plugs when the modulator cable is connected to the DIV 20. A voltage up to 600 V may be accessible in case of a damage.

**The connection to and operation of the protective ground has to be ensured always !**

Switch on the DIV 20 only after the cable connection between modulator and driver is established. Before connecting the cable, make sure that the line switch (S4) is off. Before disconnecting the cable, the DIV 20 must be in the off position for at least 5 minutes, in order to guarantee that the grounding capacitors are completely discharged.

For safety reasons we recommend establishing the following settings prior to switching on:

- 1) control knob DC-Offset (PO) to minimum (fully counter clock-wise)
- 2) mode switch (S2) to LOW.

**Any contact with water has to be avoided (IP20-class product)!**

**Do never operate the DIV 20 with opened housing !**

**Repairs have to be done by qualified representatives of the manufacturer only !**

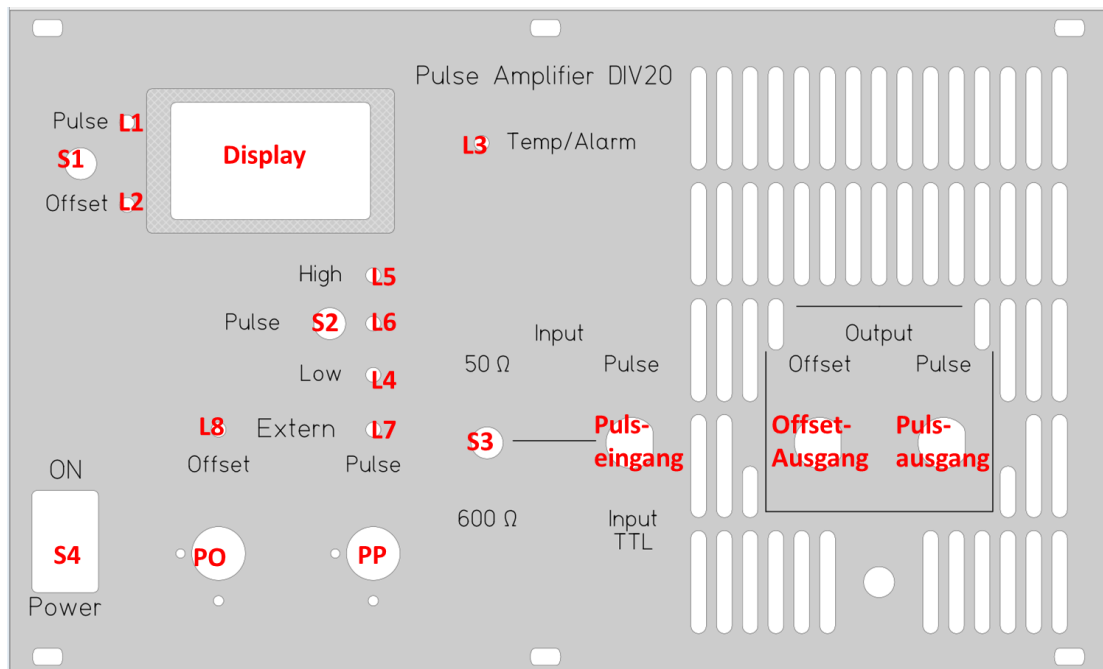
## 2. General remarks

The pulse amplifier DIV 20 is a digital driver for electro-optic modulators (EOM). It transforms a low voltage (TTL) input signal into a high voltage output with an extremely fast rise-time. The amplitude of the high voltage pulses is user-controllable. A variable offset voltage permits selection of the optimum working point. Signal voltage and offset voltage work on separate electrodes of the modulator. User controllable functions cable connectors and adapters are designed for use of the DIV 20 with the laser modulators LM 0202 and LM 13.

Other loads can be switched by the addition of the DIV 20, if the maximum load (as specified under section 6 of this manual) will not be exceeded.

### 3. Description of the control and display elements

Legend	Description
Display	Display for pulse or offset voltage
S1	Switch DIV 20 Display to show pulse or offset voltage the green LEDs L1,L2 indicate the displayed voltage
S2	Mode switch: green LED L5/L6/L4 indicates the operation mode
S3	Impedance switch for the input signal (50/600)
S4	Main Power Switch
L3	Temp/Alarm Red LED on: thermal overload Red LED flashing: current overload
L7	Indication of external pulse voltage control Red LED on: only external control using the 25-pin Sub-D-Connector
L8	Indication of external offset voltage control Red LED on: only external control using the 25-pin Sub-D-Connector
PO	Control knob: DC-offset voltage
PP	Control knob: pulse voltage
Pulseingang	“Input TTL” socket: signal
Pulsausgang	Output socket: pulse voltage
Offsetausgang	Output socket: offset voltage



**Fig. 1:** Front panel of DIV 20 with control and display elements

## 4. Operation

This description explains operation of the DIV 20 as driver for the laser modulator series LM 0202 or LM 13 in the light chopper mode. For these modulators a special cable and an adapter are included with the DIV 20. Operation of the DIV 20 with other modulators or in other modes is similar.

The DIV20 has to be switched off for any connecting procedures. Begin setup (see Appendix A) by connecting the special adapter with the modulator, such that the banana plugs are fully inserted (step 1). For the completion of the adapter connection, the two housing screws of the plug have to be screwed into the modulator housing (step 2). Then connect the special plug of the cable's modulator-side to the adapter (step 3) and finally the cable's input side (2 triaxial plugs) to the output sockets (Offset) and (Pulse) of the DIV 20 as depicted in Appendix B. Also connect the ground Banana-plug to the corresponding Banana-plug at the DIV 20.

If you want to use another cable instead of the included special cable, please note that cable length must be less than 0.5 m with a capacity of less than 40 pF/m. Otherwise reduction of the specifications is possible. The connected system (including the cable) must have a sufficient isolation strength to withstand the maximum output voltage. Also EMC-qualities of the new cables would have to be proven by the applicant to justify a CE-certification.

Connect your TTL-signal generator with "Input TTL" socket and attach the Ferrite (delivered with the DIV 20) to the cable used for the connection. For best EMC-performance also use Ferrites on the modulator-cable (Appendix C).

Switch on the DIV 20 using the power switch (S4): the line control LED indicates power on.

The DC-Offset knob (PO) controls the offset voltage within the range 0 V to +600 V. This permits compensating possible double refraction induced birefringence of the modulator and choosing the optimum working point.

Before setting the offset voltage, the modulator should have reached thermal equilibrium with the environment. The offset voltage chosen is such that minimum light intensity is achieved behind the modulator. Make sure that the mode switch (S1) is set to the LOW position. In order to reach optimum conditions, the modulator must be correctly aligned as well. Please refer to the manual *laser modulator LM 0202*.

Finally, by optimizing the setting of offset and pulse voltage, the light intensity will be minimum in the LOW position of the mode switch (S2) and maximum in the HIGH position. Further increase of the pulse voltage will only reduce the maximum light intensity. Once correctly adjusted, the pulse voltage does not need any further readjustment. Changing temperatures, on the other hand, might require readjustment of the offset voltage.

Once correct values for pulse and offset voltages are found, set the mode switch (S2) to the PULSE position. Set the output voltage of your signal generator such that the DIV 20 is reliably triggered according to +5 V TTL-

signal. The output impedance of the signal generator must be sufficiently low to drive the input of the DIV 20 (see section 7. *specifications*). The input impedance of the DIV 20 can be switched to 50  $\Omega$  or to 600  $\Omega$ . In the case of narrow pulses combined with high repetition rates, we recommend choosing 50  $\Omega$  for the input impedance. Make sure that the function generator also provides 50  $\Omega$  output impedance. With the 50  $\Omega$  connection, reflections in the connector cable are avoided. Such reflections in the connector cable can cause faults in the signal trigger. For the special version DIV 20 (600 Ohm) the input impedance is fixed at 600 Ohm and the impedance switch is missing.

### **Additional important remarks**

Mistakes in the handling of the DIV 20 are preserved by the display of nearly all operation modes via LEDs on the front panel. The red LEDs are of premium importance. If the TEMP is on, then an overload condition or a fault in connection is indicated. The red LEDs EXTERN indicate that the DIV 20 is set for external control of the offset voltage (LED above the DC-offset knob is on ) and/or of the pulse voltage (LED above the pulse voltage knob is on).

The TEMP LED indicates an overload condition of the DIV 20. The flashing LED indicates a current overload. To re-receive a signal voltage at the output socket, either the pulse voltage has to be set to the minimum value or the frequency has to be reduced. The frequency has to be reduced until the current overload is switched off. Instead of the reduction of the pulse voltage, another possible way to switch off the current overload, is to set the mode switch (S2) to the LOW position. After switching the mode switch again to the HIGH position, the signal voltage is again available on the output socket.

The constant shining TEMP LED indicates an thermal overload of the DIV 20 amplifier. If the LED is on, no voltage is supplied to the output socket for the pulse voltage. After a recovery time of ~20 seconds, the output pulse voltage is re-received automatically.

In the PULSE position of the mode switch (S2), the light intensity follows the pattern of the input signal. Intermediate intensity levels (grey scales) cannot be switched: the DIV 20 is a pure digital (on/off) driver.

The safety of the complete measurement system in which the DIV20 is integrated, is the responsibility of the installer of the system.

## **5. Remote control**

Pulse voltage and offset voltage can be controlled externally. This permits, for instance, installing automatic temperature drift compensation or laser power drift compensation. For external control, the 25-pin Sub-D Connector on the back panel of the DIV 20 should be used (see chapter 10).

## **6. Inverted intensity pattern**

It is extremely easy to invert the generated pulse pattern: Set the mode switch (S2) to the LOW position and adjust the offset, such that maximum light intensity is given. Then set the mode switch (S2) to the HIGH position and adjust pulse voltage, such that minimum intensity is given. In the PULSE position of the mode switch (S2), now the light intensity pattern is inverted.

## **7. Maintenance**

Replace the fuse only with the correct rating:

2x 250V/4A 5x20mm SLO-BLO

Replace the power cord:

The power cord specification must match the power requirements of the DIV20.

## **8. Ventilation**

For proper operation and protection of the Device it is important that the ventilation passages located at the front and rear of the device are not obstructed from free airflow.

## **9. Specifications of the DIV 20**

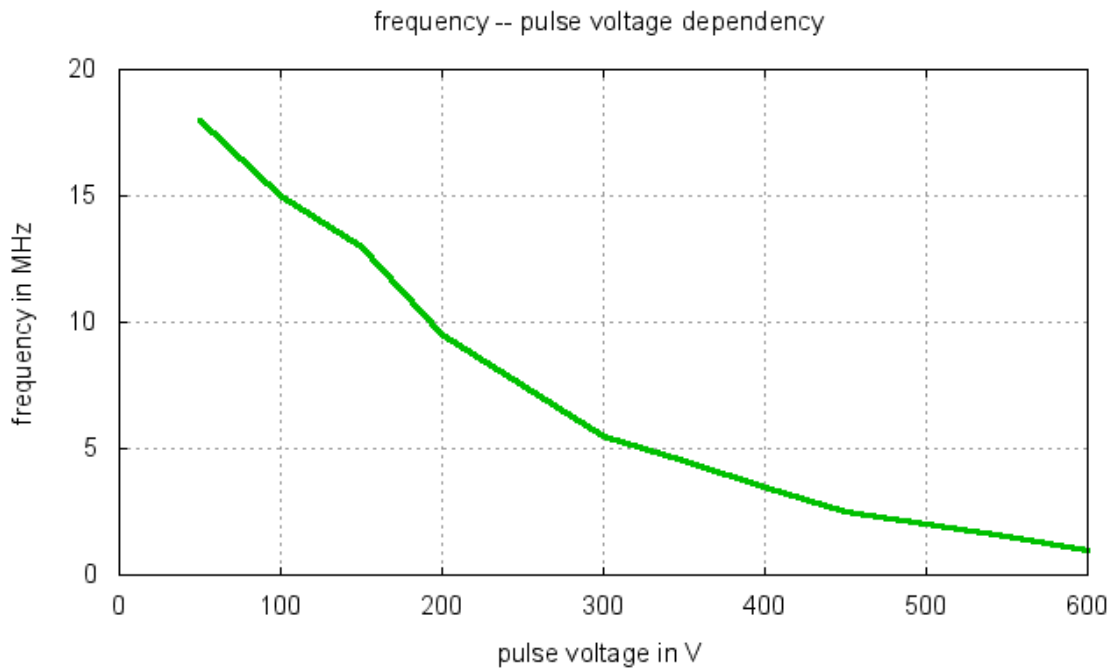
The DIV20 is intended for in-door use at maximum altitude of 2000m only in a dry and clean environment (pollution degree <2). A special cable with connectors suitable for the LM 0202 or LM 13 series modulators is included.

The technical specifications of the DIV 20 listed below are obtainable for a connected capacity of 80 pF, using the delivered special cable for connection.

Specification	Description
<b>Signal Input</b>	
Input Impedance	50 $\Omega$ / 600 $\Omega$ adjustable
Input voltage Low	0V .. 0.4V
Input voltage High	2.4V .. 5.5V
Pulse width	>30 ns
AC Power	115V/230V ( $\pm$ 15%), 50/60Hz, 400W overvoltage category II,
<b>Output voltage</b>	
Pulse output voltage	0V .. 590V
Maximum pulse output current	<8A
Output impedance	50 $\Omega$
Rise time (10% - 90%)	Typ. 23-27ns (@ 590V) Typ. 20-25ns (@ 350V)
Voltage stability	< 6%
Input-output delay	<150 ns
Offset output voltage	0V .. 590V
Maximum offset output current	<1.5 mA
<b>Operation environment</b>	
Temperature	10 .. 35°C
Humidity	< 80%RH
<b>Physical Features</b>	
Dimensions	260 (W) x 155 (H) x 330 (D) (dimensions in mm)
Weight	9.5 kg
<b>Connectors</b>	
Pulse output Voltage	SHV- BNC 50 $\Omega$
Offset output Voltage	SHV- BNC 50 $\Omega$
Pulse input Voltage	BNC 50 $\Omega$
External Control	SubD 25p female



## Load diagram



**Fig. 2:** Dependence of the maximum frequency on the applied pulse voltage

## 10. Interface for external control

The external control is possible using the 25-Pin-Sub-D connector in the rear panel of the DIV 20. The trigger signal is TTL.

### Pin assignment

Pin	Description
1	GND
2	Input control voltage for the pulse voltage 0 -10 V DC = 0 - 600 V pulse voltage input resistance ca. 50 k $\Omega$
3	adjustment of pulse voltage 0 = internal 1 = external via PIN 2
4	output for offset voltage measurement (0 - 4 V $\Rightarrow$ 0 - 600 V)
5	output for pulse voltage measurement (0 - 4 V $\Rightarrow$ 0 - 600 V)

6	+15 V															
7	NC															
8	GND															
9	temperature control 0 = normal 1 = thermal overload alternate 0/1 = output current overload															
10	+5 V (< 100 mA)															
11	input control voltage for the offset voltage 0 - 10 V DC $\Rightarrow$ 0 - 600 V pulse voltage input resistance ca. 50 k $\Omega$															
12	adjustment of offset voltage 0 = internal 1 = external via PIN 11															
13	NC															
14	<table border="1"> <thead> <tr> <th>PIN 14</th> <th>PIN 15</th> <th></th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>internal control</td> </tr> <tr> <td>0</td> <td>1</td> <td>external control: signal</td> </tr> <tr> <td>1</td> <td>0</td> <td>external control: low</td> </tr> <tr> <td>1</td> <td>1</td> <td>external control: high</td> </tr> </tbody> </table>	PIN 14	PIN 15		0	0	internal control	0	1	external control: signal	1	0	external control: low	1	1	external control: high
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16	NC															
17	NC															
18	GND															
19	GND															
20	GND															
21	GND															
22	GND															
23	connection with PIN 10 for external control															
24	GND															
25	GND															

## 11 Waste treatment



This Qioptiq product may not be disposed in the normal waste disposal!

If this Qioptiq product is no longer used and should be disposed, please contact Qioptiq or your nearest dealer for further information

Appendix A:

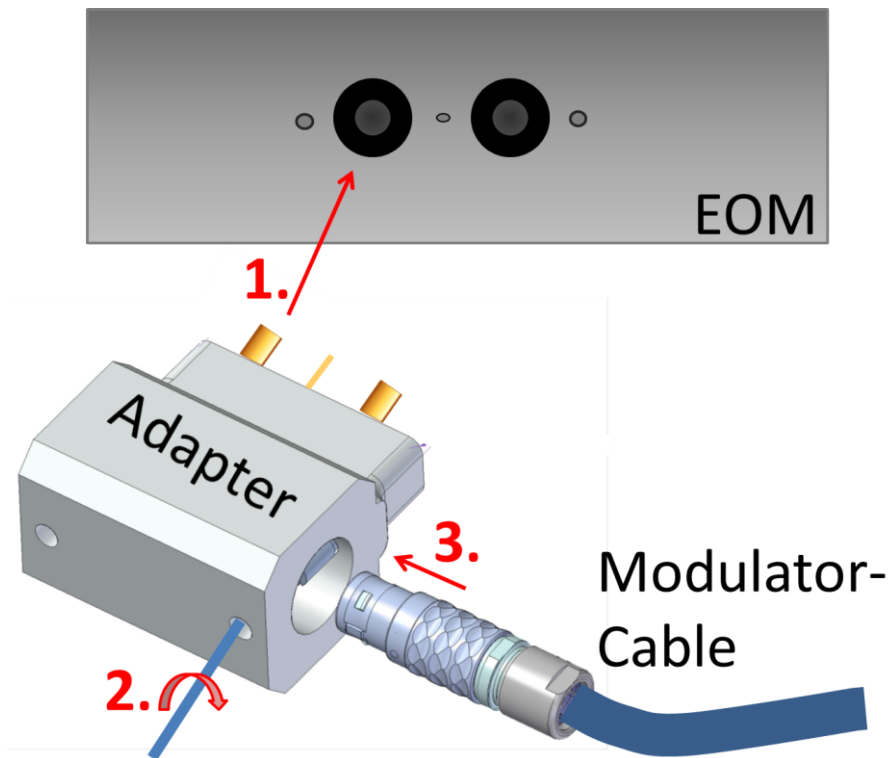


Fig. 3: Connecting the Adapter

## Appendix B:

### Connecting the special cable to the DIV 20 Output Socket:

1. Plug 1 marked as “Pulse” has to be connected to the Pulse-Output Socket. See Fig.4 below.
2. Plug 2 marked as “Offset” has to be connected to the Offset-Output Socket. See Fig.4 below.
3. The Banana-plug of the cable has to be connected to the Banana-Socket at the DIV 20 front-side. See Fig. 4 below.



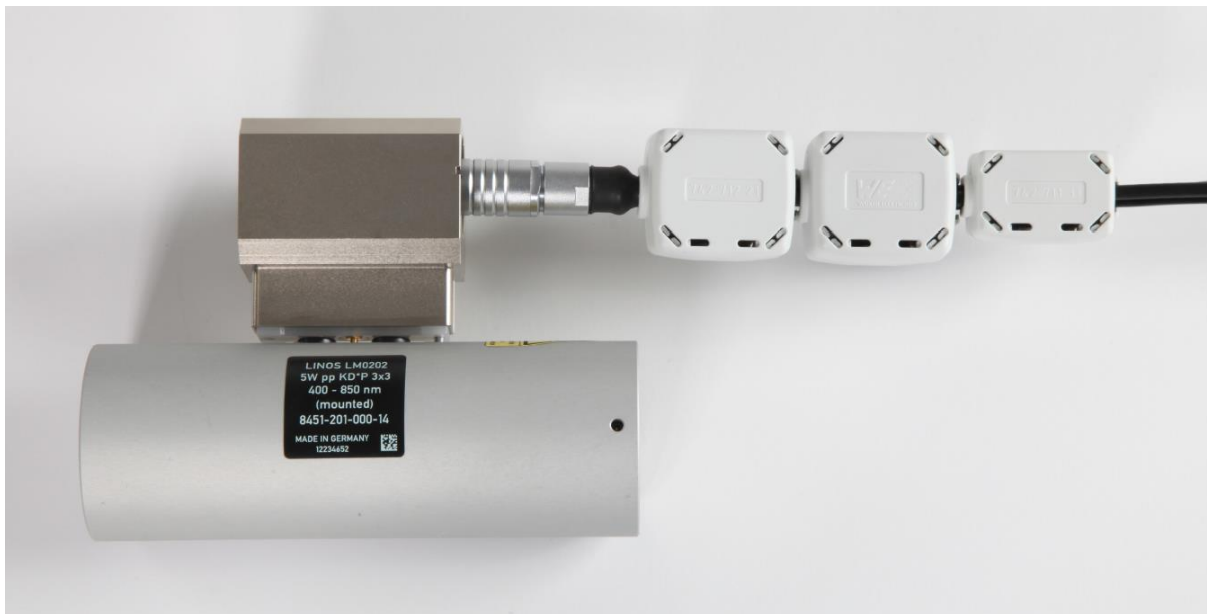
**Fig. 4:** Connecting the Modulator-cable to the DIV 20 and ferrite to Pulse-Input

## Appendix C:

### Using the Bulk-Ferrite:

4 pcs Ferrite are shipped with the DIV 20 driver. Please assemble them to the cables in the following way:

1. Ferrite No. 7427154 has to be mounted to the cable plugged to the Pulse-Input-TTL of the DIV 20. The Ferrite should be placed close to the “Pulse”-Input-TTL (max. 30cm distance). In case a thin cable is used there may be a loop (loop diameter <10cm) to fix the Ferrite-position (see Fig.4).
2. For best EMC-performance please mount the 2 Ferrites No. 74271221 and 1 Ferrite No. 74271131 to the special (3-wire) cable close to the output-side of the DIV 20 special cable (distance from the output-plug should be less than 35 cm). Although their order is not relevant, we suggest arranging them as depicted on Fig.5. Then the Ferrites maximum distance from the load (here a LM0202 type modulator) is fixed by the small Ferrite.



**Fig. 5:** Connecting Ferrites to the Modulator-cable