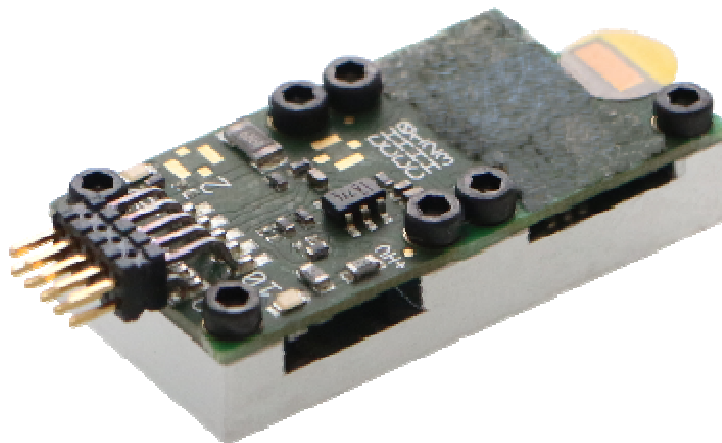




# User Manual

LDP-AV 4N55-90



PicoLAS GmbH  
Burgstr. 2  
52146 Würselen  
Germany

Phone: +49 (0) 2405-64594-60  
Fax: +49 (0) 2405-64594-61  
E-mail: [info@picolas.de](mailto:info@picolas.de)  
Web: [www.picolas.de](http://www.picolas.de)

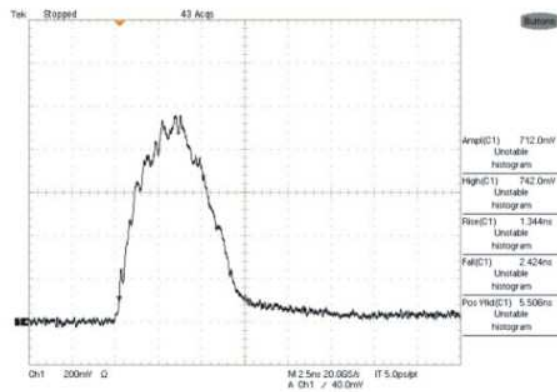
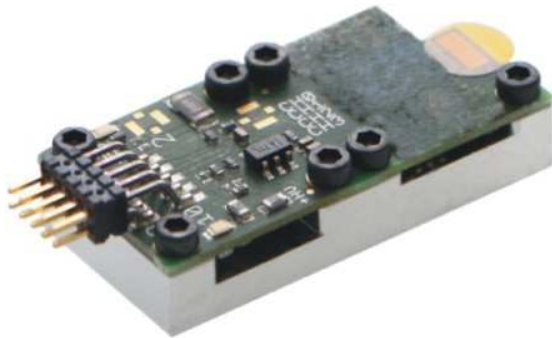
## Table of Contents

Product Overview .....	3
How to use the Manual .....	4
Dos and Don'ts .....	5
How to get started.....	6
Connection of the Laser Diode.....	7
How to connect the Driver .....	8
Pulse Input .....	9
Channel Selection .....	9
Power Supply Requirements .....	10
Trigger Output Monitor .....	10
Current Consumption .....	11
Cooling .....	11
Power Losses .....	11
Recommended Operating Conditions.....	12
Absolute maximum Ratings (destroying limits).....	12
Output Power.....	13
Mechanical Dimensions .....	14

## LDP-AV 4N55-90

Rev. 2004

### LIDAR - Sequential controlled Laser Diode Driver



Typical optical output signal, driver designed for 5.5 ns pulses (time scaling 2.5 ns/div).

### Product Description

The LDP-AV 4N55-90 is a nanosecond driver especially designed for multi-channel LIDAR applications. It is a 4-channel high side driver which is capable for driving more than 360 A in total with fixed pulse durations of ~ 5.5 ns. The exact pulse duration can be adjusted by PicoLAS to your demands. The laser diode can be mounted directly on top of the driver.

With the compact and small design the driver achieves a high power density. The output of 360 A is accomplished by 4 separate channels. Each channel can be controlled independently and provides a maximal output current of up to 90 A.

- Ultra compact driver 30 x 15 mm<sup>2</sup>
- 4 independent channels
- 4 x 90 A or 1 x 360 A output current \*\*
- Fixed pulse duration e.g. 5.5 ns
- Rep. rates from single shot to 200 kHz
- Easy settings of output current via an external high voltage
- Applications: LIDAR, Measurements, Ignition, Rangefinding, Biochemistry, ...
- Flexible platform to install and test laser diodes
- Advanced minimal inductance layout
- High power density

### Technical Data

Output current Each channel	0 .. 40 A* 0 .. 90 A **
Flash	360 A
Pulse duration	Fixed e.g. 5.5 ns
Repetition rate	Single shot to 200 kHz **
Max. duty cycle	0.1 %
Trigger input	+5 V into 50 Ω
Supply voltage	+5 V 0.05 A
Charging voltage	HV 0 .. 95 V / 0 .. 0.5 A
Dimensions	30 mm x 15 mm
Weight	16 g
Operating temperature	TBD

\* Tested with OSRAM SPL PL90\_3 laser diode

\*\* See manual for detailed information.

## How to use the Manual



**Notice:** Depending on the final application and operation regime, this unit must be assembled onto a heat sink or may stay non-cooled. Improper cooling may cause damage to the electronic components.



Before powering on your driver unit read this manual thoroughly and make sure you have understood everything.



**Caution:** High voltages up to 100 V are present at several PCB components. Do not touch during operation.

Please pay attention to all safety warnings.

If you have any doubts or suggestions, please do not hesitate to contact us!

## Dos and Don'ts

**Never** ground any output connector.

**Never** use any grounded probes at the output.

**Do not** connect your oscilloscope to the output!  
This will immediately destroy the driver and the probe!

**Do not** connect voltages in reverse polarity to the device as there is no built-in protection circuit.

**Do** use power-up sequencing: Allow the +5 V supply voltage to fully ramp up before applying any other voltages (HV; Trigger Input).

**Do not** use mechanical force on the PCB components as they are fragile. Resulting damages are not covered by warranty.

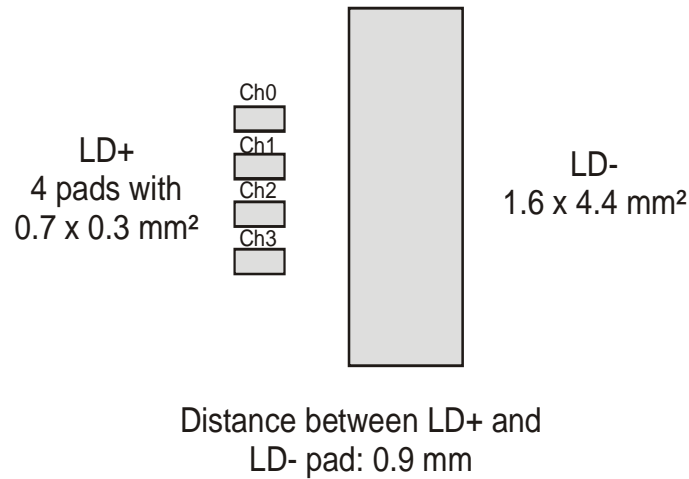
**Beware:** Some lab power supplies cause excessive ringing during powering on and off. These may damage the unit!

**Do** keep connecting cables between power supply and driver as short as possible.

## How to get started

Step	What to do	Check
1	Unpack your device.	
2	Attach the laser diode to the driver.	Please see section “Connection of the Laser Diode” for further details.
3	Assemble the driver onto an appropriate heat sink. This step may only be omitted if the stress to the driver is kept very low.	See section “Power Losses” for further information on thermal dissipation.
4	Connect GND, +5 V and +HV to the 10 pin Micro-Match connector. Keep the power supply off.	Please see section “How to connect the Driver” for further details.
5	Connect the pulse generator to the SMA trigger input jack.	Ensure that no pulse is fed before powering up the unit.
6	Carry out the power-up sequence as follows: 1) Fully ramp up the +5 V rail 2) Enable the +HV supply Then, feed a pulse signal to the input terminal. For example 5 V amplitude, 100 $\mu$ s pulse width and 1 kHz repetition rate.	<b>Security advice:</b> Do not touch the PCB components near the laser diode since they may carry high voltages up to 100 V. Note: Observe the drivers limits as in section “Power Losses” to avoid overloading the driver.
7	Check the optical output of your laser diode.	
8	Turn off sequence: Disable the pulse generator and then turn off all power sources (+5 V and +HV).	

## Connection of the Laser Diode



**Figure 1: Dimensions of bonding pads for the laser diode**

The LD- and LD+ pads are located in the upper edge of the driver. For the standard dimensions please refer to the dimensions in Figure 1.

Many elements and parasitic “stray” components may affect the performance of the driver unit. The stray inductance of the load connected to the driver is very important. The term “load” not only includes the diode itself but also the packaging (bond wires!) and the connection between the driver and the diode. However, PicoLAS has no influence on these parts.

→ Refer to the PicoLAS Application Notes “Impedance of Diodes” and “LD-Connections” for more information on parasitic elements and their effect on the pulse shape.



If you need different pad sizes for your laser diode, please do not hesitate to contact us. Customized pad layouts are possible for adapting the dimensions of your load.

## How to connect the Driver

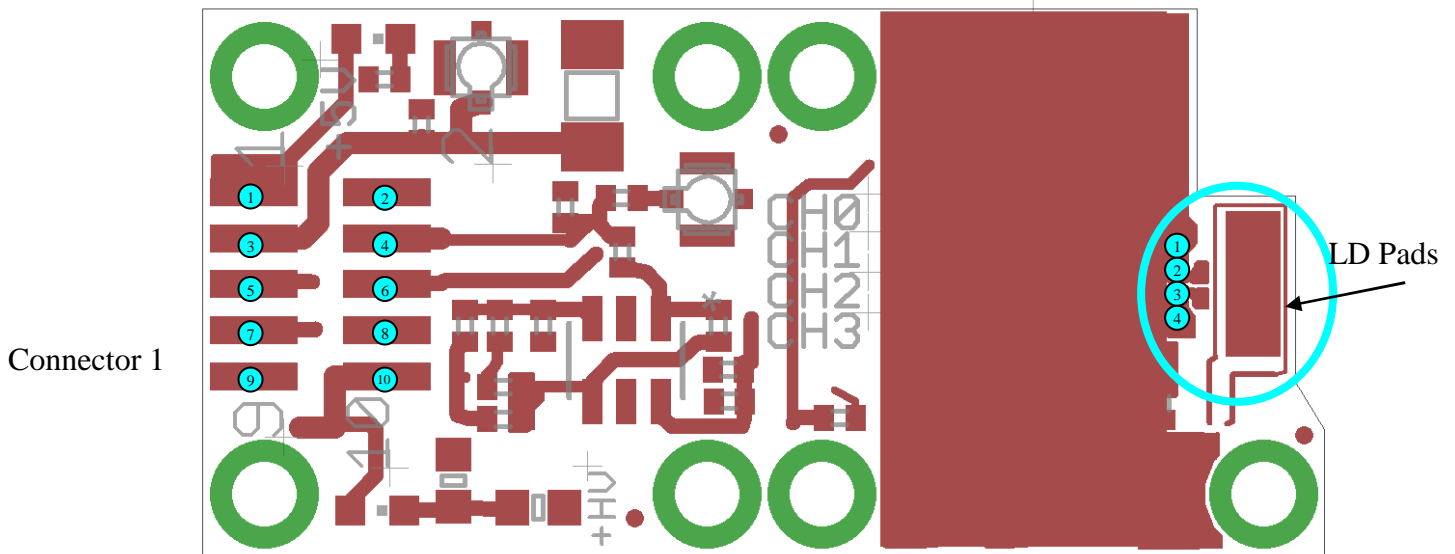


Figure 2: Layout of the LDP-AV 4N55-90

Signals of the 10 pin Micro-Match header (connector 1):

Pin	Name	Description
1	+5 V	+5 V supply voltage, connect to a stabilized power supply.
2	GND	Ground return
3	Trigger input	The trigger input requires a signal of 5 V and is terminated with 50 Ohms.
4	Sync out	Sync out signal; Rogowski coil
5	/INH	Leave this pin floatend for normal operation. Connect to logic level high to turn all channels off.
6	BIT0	Binary channel selection A.
7	BIT1	Binary channel selection B.
8	GND	Ground return
9	GND	Ground return
10	HV	External high voltage supply input (0 .. 95 V)

### **Security Advice:**

Do not touch any leads of the output or the output capacitors as they can carry high voltages of up to 100 V.



## Pulse Input

The trigger generator must be capable of delivering 5 V into 50 Ohms and at least 1  $\mu$ s in pulse width. The internal Schmitt-Trigger prevents unstable trigger response.

**Note:** It is recommended to keep the trigger pulse width within the range of 1  $\mu$ s .. 100  $\mu$ s. The LDP-AV 4N55-90 has an internal short pulse sharpener included. This feature assures a constant pulse width.

## Channel Selection

This driver includes an internal multiplexer which allows to select a specific channel thus a laser diode. For the selection of one specific laser diode see following table:

BIT1	BIT0	Channel / laser diode
0	0	0
0	1	1
1	0	2
1	1	3

Table 1: Description – How to select a specific channel

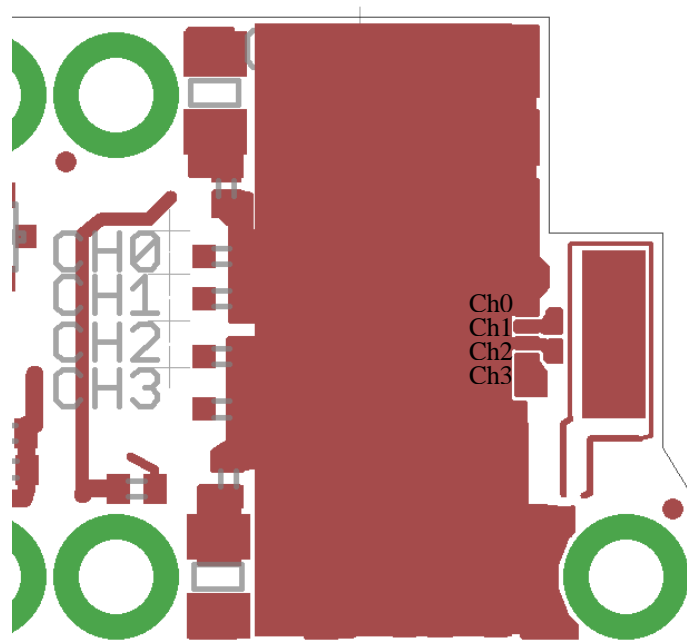


Figure 3: Close up of the laser diode footprint and their indicators

This driver is capable for individual coding methods. Therefore the LDP-AV 4N55-90 features the ability of fast channel selection up to 1 MHz.



If you need a flash driver instead of a sequential driver, please do not hesitate to contact us. Customized driver topologies are possible.

## Power Supply Requirements

The driver requires a stabilized +5 V supply (used by control logic).

### Adhere to the power-up sequence as follows:

- 1) Fully ramp up the +5 V rail
- 2) Enable the HV supply
- 3) Apply trigger signal

Should you aim to connect a large number of driver units to a single power supply the high start-up current spikes can be taken care of by using an additional capacitor bank and hard power switching at its output. Failure to meet this requirement may cause the gate driver circuitry to stay in a faulty state.

To reveal that you have to feed the power supply +5 V or +HV in, there are two blue LEDs included. They indicate that the power supply is turned on.

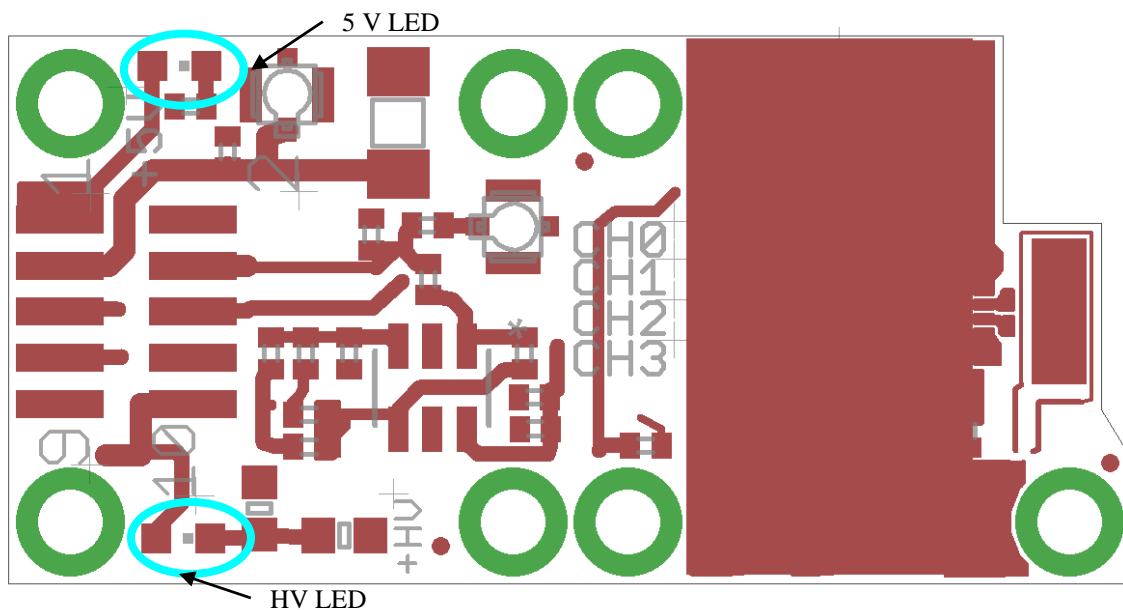


Figure 4: Close up of the laser diode driver and LEDs

**Note:** The +HV laser diode supply can be interrupted at any time e.g. for safety reasons by the customer.

## Trigger Output Monitor

The trigger output signal is generated with an integrated, isolated Rogowski coil and provides an ultra fast galvanically isolated signal. The signal shape is proportional to the derivative of the load current. It can be used for a current response triggering signal and has no delay to the load current. Combined with an integrator it is possible to use this signal for a galvanically isolated current monitor. The isolation barrier is suitable for voltages up to 100 V and prevents unwanted ground loops.

## Current Consumption

Quiescent currents

Supply input	Conditions	Min.	Max.	Unit
+5 V	4.8 V .. 5.2 V	TBD	TBD	mA
HV	0 V .. 95 V	5	500	mA

Trigger signal present

Supply input	Conditions	Typ.	Max.	Unit
+5 V	4.8 V .. 5.2V	0.3	25	mA

## Cooling

The driver is base plate cooled only. Please assemble the entire unit to a heat-sink which is capable to take out the heat.

The heat-sink is suitable if the system temperature does not exceed the maximum operating limits.

## Power Losses

Due the structure of this driver the power losses of this driver can be approximately estimated with following equation

$$P_{LOSS} \approx V_{HV+} \cdot f_{rep} \cdot t_{pw} \cdot I_{out} + V_{HV+} \cdot 0.05W / A$$

Where

$P_{LOSS}$  Total average power consumption [W]

$V_{HV+}$  High voltage supply [V]

$f_{rep}$  Repetition frequency [Hz]

$t_{pw}$  Optical pulse width [s]

$I_{out}$  Output current [A]

## Recommended Operating Conditions

Supply voltages	Min.	Typ.	Max.	Unit
HV+	0	-	+95	V
+5 V	+4.75	+5.0	+5.2	V

Trigger input	Min.	Typ.	Max.	Unit
HIGH level input voltage @ $Z_{in}=50\ \Omega$	4.8	5	+5.2	V
LOW level input voltage @ $Z_{in}=50\ \Omega$	0	-	+0.8	V
Pulse width	1	2	100	$\mu\text{s}$
Repetition rate	-	-	200	kHz

Channel selection	Min.	Typ.	Max.	Unit
BIT0 / BIT1 input logic high	+2.0	+5.0	+5.2	V
BIT0 / BIT1 input logic low	+0.8	-	+0	V
Address transition time	-	-	1.0	MHz

## Absolute maximum Ratings (destroying limits)

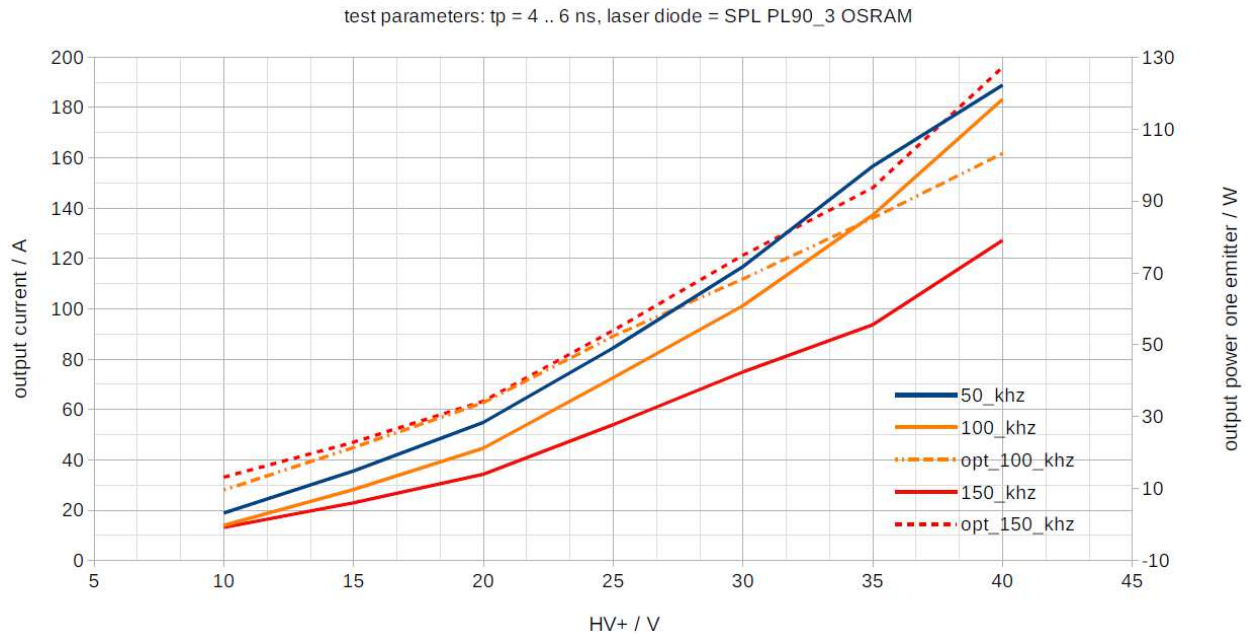
Supply voltages	Min.	Max.	Unit
HV+	0	+95	V
+5 V	0	+5.2	V

Trigger input	Min.	Max.	Unit
Trigger signal voltage, unterminated	0	+5.2	V

- **Trigger Signal:**

Note that the maximum ratings for both **pulse width** and **repetition rate** depend on the actual high voltage supply (HV). See section “Power Losses” for guidance.

## Output Power



**Figure 5: Output power of the LDP-AV 4N55-90 in relationship to the HV voltage; measured with the SPL PL90\_3**

The LDP-AV 4N55-90 was tested with the SPL PL90\_3 from OSRAM. The maximum current of this laser diode is 40 A. In total we expected that this driver can reach an output current up to 360 A or 90 A each channel.

Many elements and parasitic “stray” components may affect the performance of the driver unit. The stray inductance of the load connected to the driver is very important. The term “load” not only includes the diode itself but also the packaging (bond wires!) and the connection between the driver and the diode. However, PicoLAS has no influence on these parts.

→ Refer to the PicoLAS Application Notes “Impedance of Diodes” and “LD-Connections” for more information on parasitic elements and their effect on the pulse shape.

# Mechanical Dimensions

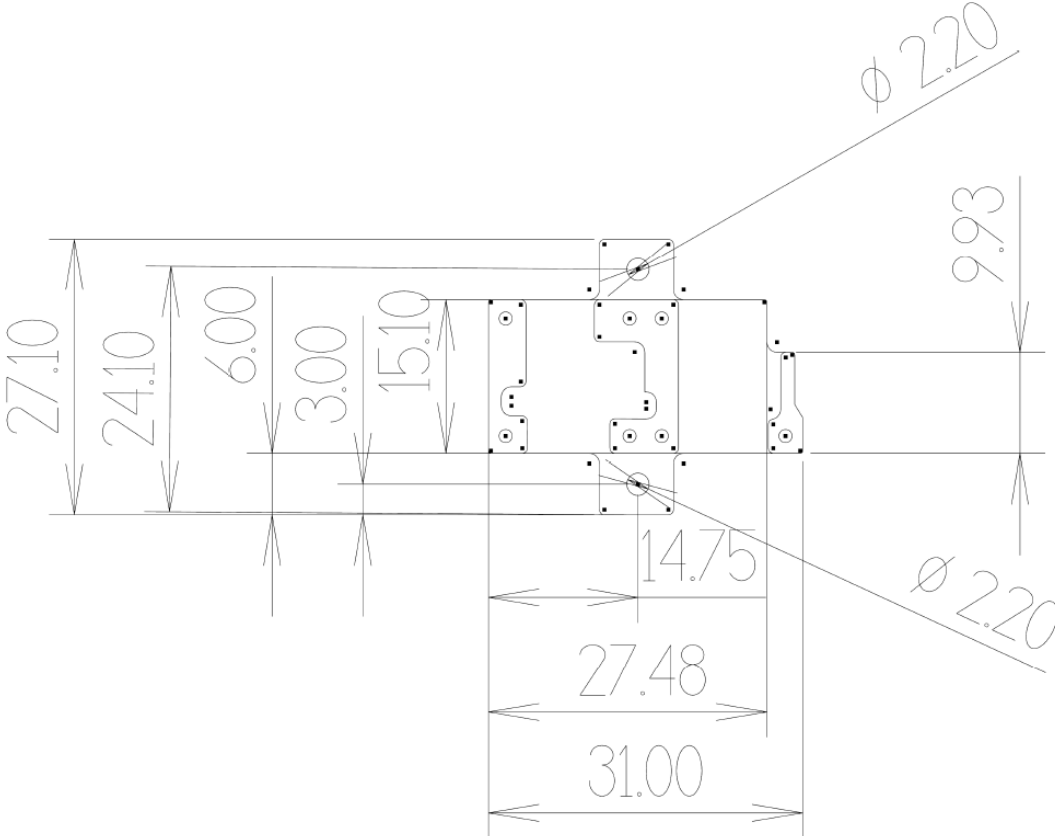


Figure 6: Mechanical dimensions of LDP-AV 4N55-90