

made to measure

OPERATING INSTRUCTIONS AND SYSTEM DESCRIPTION FOR THE

PDES-01LP

PNEUMATIC DRUG EJECTION SYSTEM

Special version: low pressure, analog pressure control



VERSION 1.0
npi 2025

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1. Safety Regulations

VERY IMPORTANT: Instruments and components supplied by npí electronic are NOT intended for clinical use or medical purposes (e.g. for diagnosis or treatment of humans), or for any other life-supporting system. npí electronic disclaims any warranties for such purpose. Equipment supplied by npí electronic must be operated only by selected, trained and adequately instructed personnel. For details please consult the **GENERAL TERMS OF DELIVERY AND CONDITIONS OF BUSINESS** of npí electronic, D-71732 Tamm, Germany.

- 1) **GENERAL:** This system is designed for use in scientific laboratories and must be operated by trained staff only. General safety regulations for operating electrical devices should be followed.
- 2) **AC MAINS CONNECTION:** While working with the npí systems, always adhere to the appropriate safety measures for handling electronic devices. Before using any device please read manuals and instructions carefully.
The device is to be operated only at 115/230 Volt 60/50 Hz AC. Please check for appropriate line voltage before connecting any system to mains.
Always use a three-wire line cord and a mains power-plug with a protection contact connected to ground (protective earth).
Before opening the cabinet, unplug the instrument.
Unplug the instrument when replacing the fuse or changing line voltage. Replace fuse only with an appropriate specified type.
- 3) **STATIC ELECTRICITY:** Electronic equipment is sensitive to static discharges. Some devices such as sensor inputs are equipped with very sensitive FET amplifiers, which can be damaged by electrostatic charge and must therefore be handled with care. Electrostatic discharge can be avoided by touching a grounded metal surface when changing or adjusting sensors. **Always turn power off when adding or removing modules, connecting or disconnecting sensors, headstages or other components from the instrument or 19" cabinet.**
- 4) **TEMPERATURE DRIFT / WARM-UP TIME:** All analog electronic systems are sensitive to temperature changes. Therefore, all electronic instruments containing analog circuits should be used only in a warmed-up condition (i.e. after internal temperature has reached steady-state values). In most cases a warm-up period of 20-30 minutes is sufficient.
- 5) **HANDLING:** Please protect the device from moisture, heat, radiation and corrosive chemicals.

HIGH PRESSURE PRECAUTIONS: While working with PDES systems and components, always adhere to the appropriate safety measures for handling high pressure pneumatic systems. Before using the PDES or any external pneumatic device please read the manual and instructions carefully.

- Always turn off pressure source before connecting or disconnecting the PDES system.
- Any component used (tubes, fittings etc.) must be specified for the maximum possible pressure.
- Do not use any aggressive, combustible or explosive gases. Only gases such as air, nitrogen, carbon dioxide, helium, etc. are allowed.
- Use only dry, oil free, filtered gases (max. 5 µm filter is allowed).
- Maximum input pressure must be below 5 bar (1 bar = 100,000 Pa). npí recommends an input pressure of 1 bar more than the maximum output pressure.

2. PDES-2DX System

2.1. System Description

Pressure ejection is a convenient method for applying both ionic and non-ionic solutions from micropipettes. This method is popular for two reasons. First, it can apply to almost all solutions. Second, the amount of solution ejected can be monitored by viewing the tip of the micropipette under a microscope.

The PDES-01LP is designed for pressure ejection of drugs in physiological and pharmacological studies. This special PDES systems is equipped with a low-pressure output ($P_{\max} = 200$ mbar). A Digital timer and analog control of the output pressure facilitate the use of these instruments.

The pressure connectors (quick connect type) are located at the front panel of the instrument. It is equipped with an INPUT coupling (6 mm OD) where the pressure source is connected, an OUTPUT coupling (4 mm OD) where the external valve (PDES-01-BOX) is connected.

The injection pressure is preset by a precision pressure regulator. The pressure is displayed on a digital manometer. Additional pneumatic devices (tubes, fittings connectors, filters etc.) are available. Please contact npi electronic for details.

2.2. Description of the Front Panel

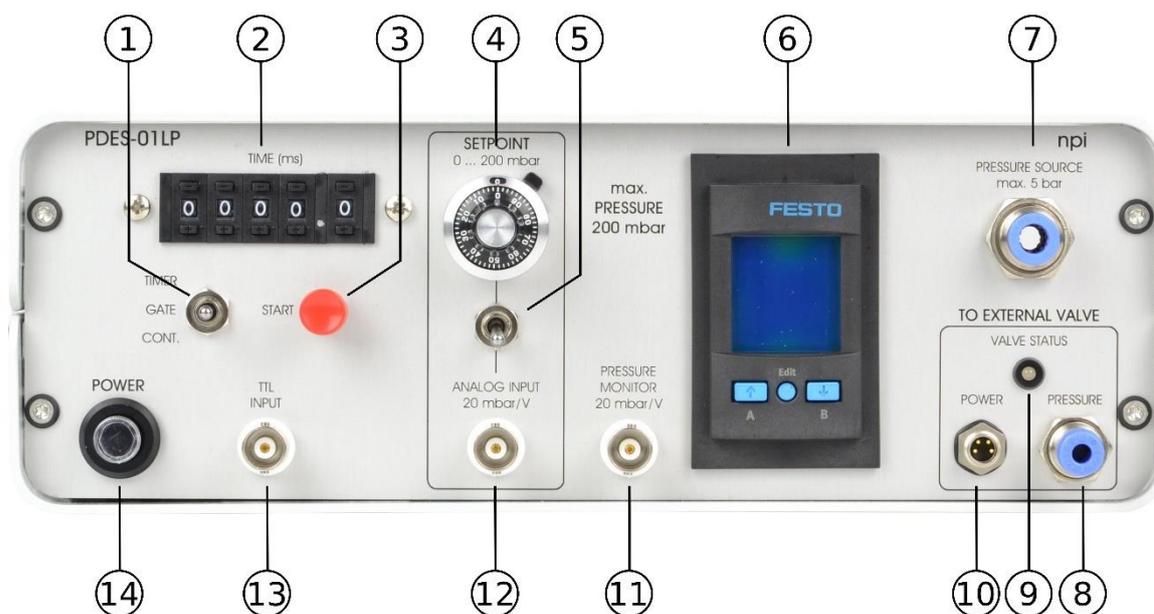


Figure 1: PDES-01LP front panel view (the numbers are related to those in the text below)

In the following description of the front panel elements, each element has a number that is related to that in Figure 1. The number is followed by the name (in uppercase letters) written on the front panel and the type of the element (in lowercase letters). Then, a short description of the element is given.

(1) TIMER, GATE, CONT. switch

Switch to set the operation mode (see also chapter 0)

- In CONT. position (continuous) the application can be controlled manually, i.e. as long as the CONT. position is set, pressure is applied to the pipette.
- In GATE position the duration of the application is determined directly by the duration of the TTL pulse at the TTL INPUT connector (#13).
- In TIMER position the duration is preset by the TIME control (#2)

(2) TIME (ms) tumble-wheel switch

Five digit tumble-wheel switch to set the ejection time (XXXX.X ms) in TIMER mode

(3) START button

Push button to start operation. The START button can be used to start ejection in TIMER or GATE. mode.

In TIMER mode pressing the START button opens the valve for the time set by #2.

In GATE. mode pressing the START button opens the valve as long as the button is pressed

(4) SETPOINT 0...200 mbar potentiometer

This 10-turn potentiometer is used to set the pressure of the internal pressure controller. One rotation corresponds to 20 mbar. Maximum is 200 mbar.

(5) SETPOINT selector switch

This switch selects how the set point is set:

Upper position: using the SETPOINT potentiometer

Lower position: using the ANALOG INPUT connector (#12)

(6) Manometer

Digital display for the pressure (X.XXXX bar). The pushbuttons under the display are without function.

(7) PRESSURE SOURCE connector

Connector for connecting the filtered, dry and oil-free gas source (5 bar max.). This is a quick connector type for 6 mm OD pressure tubing.

Note: npf recommends an input pressure of 1 bar more than the maximum output pressure.

(8) PRESSURE connector

Connector for connecting the pressure tubing of the external valve on the remote valve plate. The EJECT pressure is supplied to this connector. This is a quick connector type for 4 mm OD pressure tubing.

(9) VALVE STATUS LED

This LED indicates the operational status

red light: valve is closed

green light: valve is open

(10) POWER connector

Connector for the electrical connection of the PDES-01-BOX or *microJECT* (see chapter 2.5)

(11) PRESSURE MONITOR 20 mbar/V connector

BNC connector monitoring the pressure output. Scaling is 20 mbar/V.

Important: This pressure monitor needs an input pressure to work correctly. If no input pressure is present at the PRESSURE SOURCE connector (#7), this output will give a false reading of -200 mV.

(12) ANALOG INPUT 20 mbar/V connector

BNC connector for monitoring the pressure output. Scaling is 20 mbar/V.

(13) TTL INPUT connector

BNC connector for TTL triggering.

In TIMER mode a TTL HIGH (+5V) signal opens the valve for the time set by #2.

In GATE mode a TTL HIGH (+5V) signal opens the valve as long as the signal level is HIGH.

(14) POWER push button

Push button to turn POWER on or off

2.3. Connecting the pressure tubing

The tubing for input pressure (6 mm OD) and valve pressure (4 mm OD) can be directly connected to the respective quick connectors on the front panel (see #7 and #8, Figure 1).

Since the pressure tubing is quite sturdy, two 90° adapters are supplied. They can be inserted into the quick connector on the front panel, and the respective tubing is connected to these adapters (see Figure 2).



Figure 2: Pressure tubing connection. Left: direct connection; right: connection with a 90° adapter.

2.4. Description of the Rear Panel

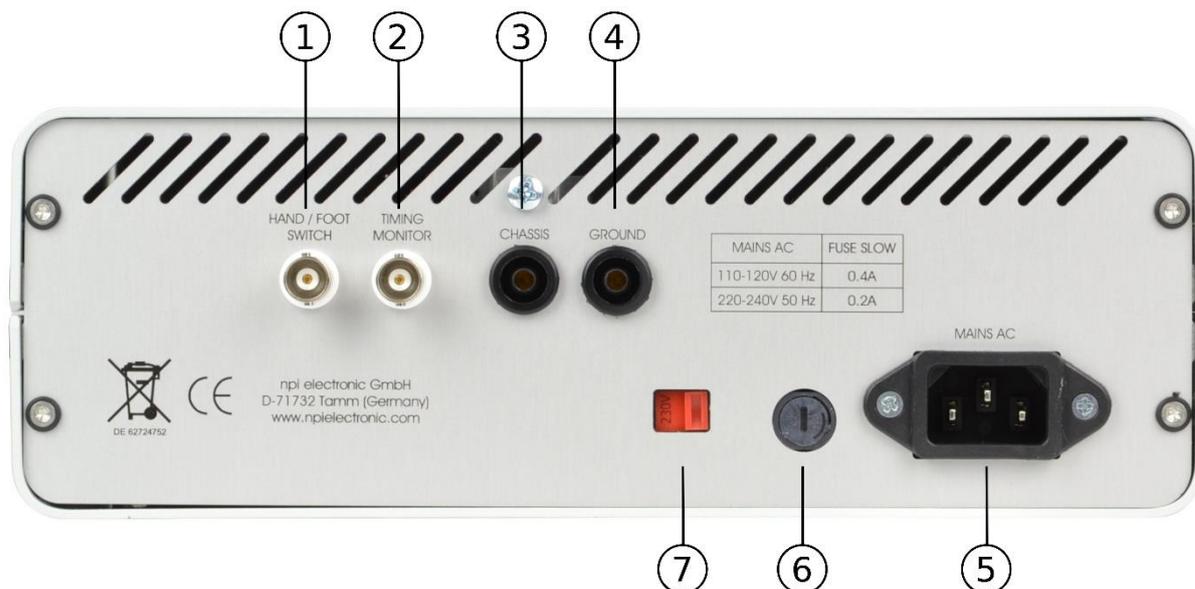


Figure 3: PDES-01LP rear panel view (the numbers are related to those in the text below)

Note: npi recommends an input pressure of 1 bar more than the maximum output pressure.

- (1) **HAND / FOOT SWITCH** connector
An optional hand or foot switch for remote triggering can be connected here.
- (2) **TIMING MONITOR** connector
This output provides a TTL signal monitoring the valve state:
HIGH = open, LOW = closed.
- (3) **CHASSIS** connector
This connector is linked to mains ground (green/yellow wire, protective earth).
- (4) **GROUND** connector
This connector is linked to the internal system ground which has no connection to the cabinet (CHASSIS) and the mains ground to avoid ground loops.
- (5) **MAINS AC** connector
The power cable is connected here.
- (6) **FUSE**
Unplug the instrument when replacing the fuse or changing line voltage. Turn the knob to open. Replace fuse only with an appropriate specified type (see chapter 3)
- (7) **VOLTAGE SELECTOR**
Rotary switch for selecting the operating voltage (115 V / 230 V).

Caution: Always switch to the appropriate voltage before connecting the PDES to power.

2.5. External Valves

External valve(s) for the PDES system are either mounted on a remote valve plate or in the *microJECT* micro valve pipette holder.

PDES-01-BOX

The valve which is controlled by the PDES-01LP is located on the remote valve plate (see Figure 4). Tubing and cable of the external valves are connected at the front panel of the PDES system (refer to chapter 2.5). Exhaust is usually not connected.

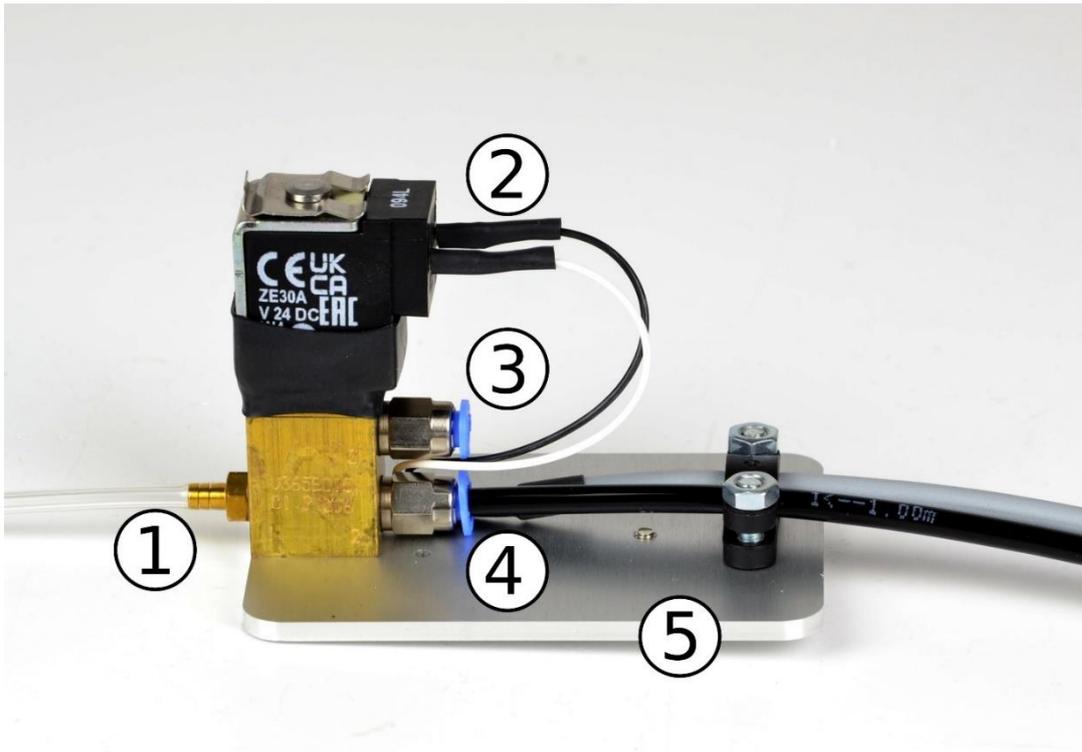


Figure 4: PDES-01-BOX: external valve on remote valve plate

- 1: connector with tubing to pipette holder
- 2: electrical connection
- 3: connector for EXHAUST (usually left open)
- 4: connector for EJECT pressure (marked with black tubing)
- 5: mounting plate, with magnet installed on bottom side

microJECT micro Valve Pipette Holder (optional accessory)

This special valve which is controlled by the PDES-01LP is located in the micro valve pipette holder, called *microJECT* (see Figure 5). Tubing and cable of the *microJECT* are connected at the front panel of the PDES system (refer to chapter 0). Exhaust is usually not connected.

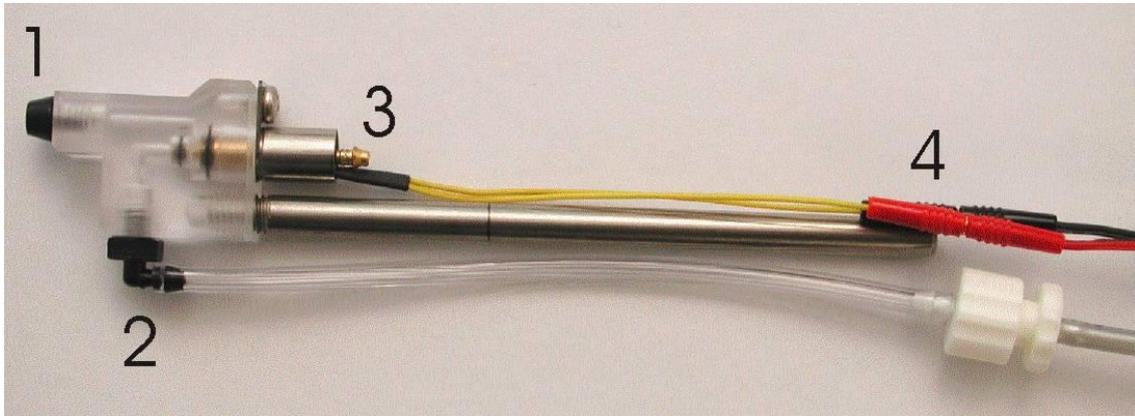


Figure 5: *microJECT*

- 1: pipette connector
- 2: connector for EJECT pressure
- 3: connector for EXHAUST pressure (usually left open)
- 4: electrical connection

Important: In experiments with high pressures (> 1 bar) it might be necessary to insert 2 seals into the pipette connector in order to prevent the pipette from moving.

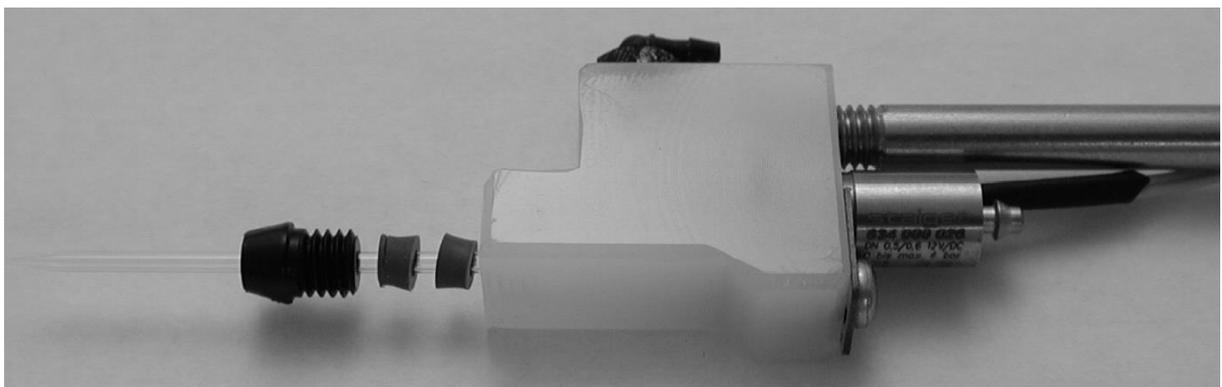


Figure 6: *microJECT* – pipette insertion

Caution: Pipettes that are not rigidly fixed in the pipette connector might be pressed out of the connector by high pressure. Always adhere to the appropriate safety measures.

2.6. Operation

- o Connect the gas source to the PRESSURE SOURCE connector at the front panel, using 6 mm OD pressure tubing. The gas source must be dry and clean. It should be filtered by a 5 μ m filter element.

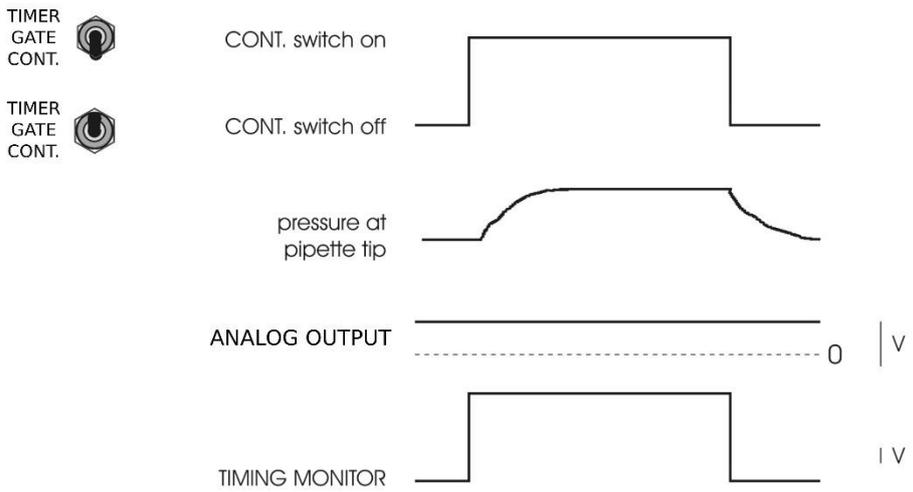
Important: Do not connect sources of OXYGEN or COMBUSTIBLE or EXPLOSIVE gases!!

- o Connect the PDES-01-BOX or *microJECT* holder to the PRESSURE (TO EXTERNAL VALVE) connector and POWER connector at the front panel.
- o Connect your ejection pipettes to the PDES-01-BOX (#1, Figure 4) or *microJECT*s (#1, Figure 5).
- o Turn on pressure and adjust the SETPOINT pressure to the desired value using the SETPOINT potentiometer (#4, Figure 1) or the ANALOG INPUT (#12, Figure 1).
- o Connect a TTL signal source (function generator or data acquisition system) to the TTL INPUT BNC connector at the front panel.
- o Set an application time with the TIME (ms) tumblewheel switches (#2, Figure 1).
- o The VALVE STATUS LED is red when no ejection happens, and green when the pressure is applied to the pipette.
- o Select the operation mode using the respective toggle switch at the front panel (#1, Figure 1).
 - * In the TIMER position the duration is preset by the TIME (ms) tumblewheel switches (#2, Figure 1).
 - * In the GATE position the duration of the application is determined directly by the duration of the TTL pulse.
 - * In the CONT. position the application can be controlled manually, i.e. as long as the CONT. position is set, pressure is applied to the pipette.
- o Use the START button to test the system. The START button can be used to start ejection in TIMER or GATE mode. In TIMER mode pushing the START button starts ejection for the time set by the timer control (#5, Figure 1). In GATE mode the ejection lasts as long as the START button is pushed.
- o The actual application pressure can be monitored at the display (#6, Figure 1) or as an analog signal with 20 mbar/V at the PRESSURE MONITOR output (#1, Figure 1).
- o Optional: Connect the hand or foot switch (see Figure 7) to the HAND/FOOT SWITCH connector at the rear panel (#1, Figure 3). The switch works as described above for the START button (#3, Figure 1).

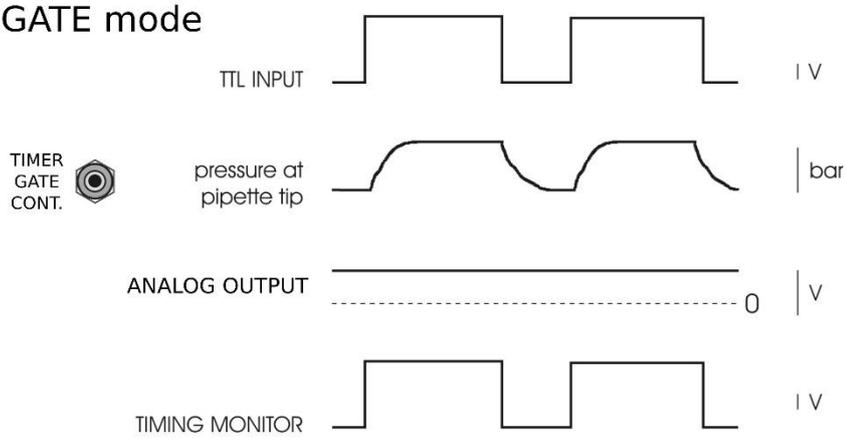


Figure 7: Left: PDES remote control foot switch as 2-channel or single channel version. (single channel version may look different). Right: PDES remote control hand switch.

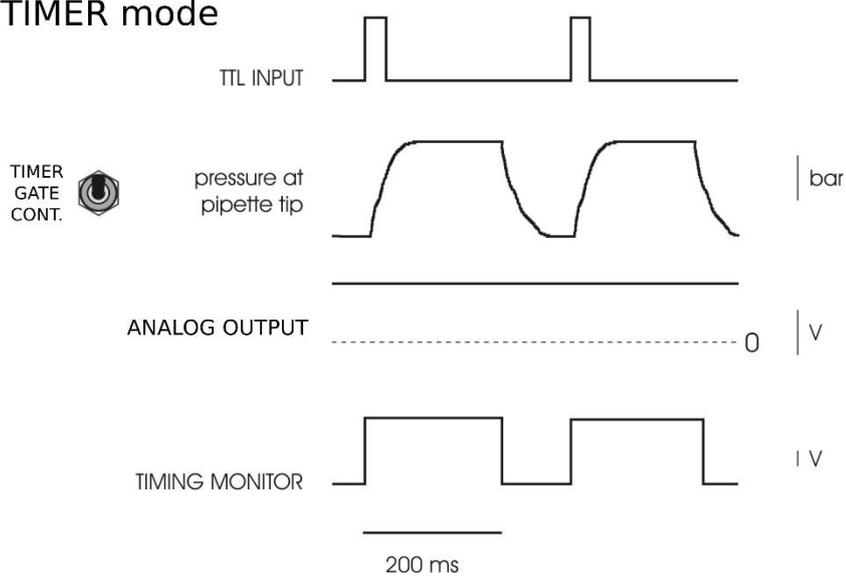
Manual (CONT.) mode



GATE mode



TIMER mode



if the internal timer is set to 200 ms

Figure 8: operation modes of the PDES-01LP

3. Technical Data

Source gas:

air, nitrogen, helium etc. no aggressive, combustible or explosive gases, filtered by a 5 μm filter element.

Pressure range:

input pressure: max. 5 bar (1 bar = 10^5 Pa = 14.5 psi)
pressure control range: 0 - 200 mbar,

Input and output couplings:

quick connect type

Tubes:

input: 6 mm OD
output: 4 mm OD

Status / EJECT time indicator:

red/green LED

red light: channel has been turned on, valve is closed

green light: valve is open or valve not connected

Mode selection:

three position toggle switch, (TIMER, GATE, CONT.)

<u>Typical minimum valve switch time:</u>	PDES-01-BOX:	~ 20 ms
	EHM <i>micro</i> JECT:	< 5 ms

Digital timer:

100 μs – 9.9 s set by five-digit tumble-wheel switch (0000.0-9999.9)

Inputs:

TTL INPUT: standard BNC connector, TTL (LO = 0-2.5 V, HI = 2.5-12 V),
input impedance 10 k Ω

ANALOG INPUT: standard BNC connector, scaling: 20 mbar/V,
input impedance 10 k Ω

Pulse output:

PRESSURE MONITOR: standard BNC connector, sensitivity: 20 mbar/V,
output impedance 249 Ω

TIMING MONITOR: standard BNC connector, TTL (LO = +0-1 V, HI = +5 V),
output impedance 249 Ω

Dimensions:

Desktop cabinet, 245 x 260 x 90 mm³

Power requirements:

115/230 V AC, 20-40 W, Fuse: 0.2 A / 230V; 0.4 A / 115V