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Modular Electronics (NIM) for Cellular Physiology

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Electronic instruments for "patch-clamp" measurements

Manufactured by

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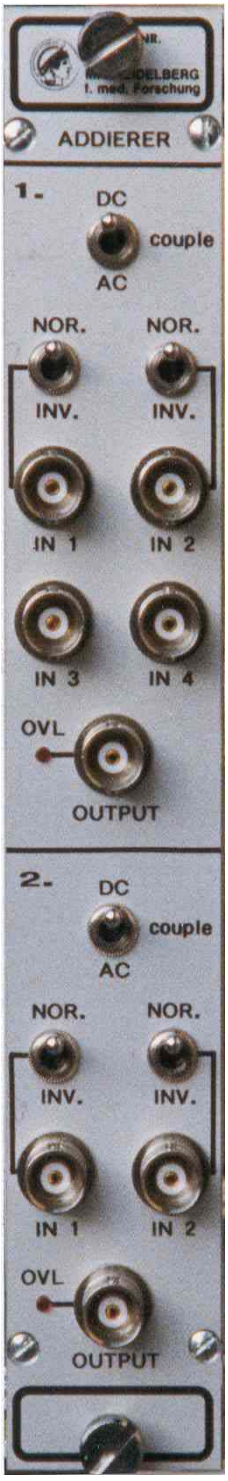
INDEX

ADDER

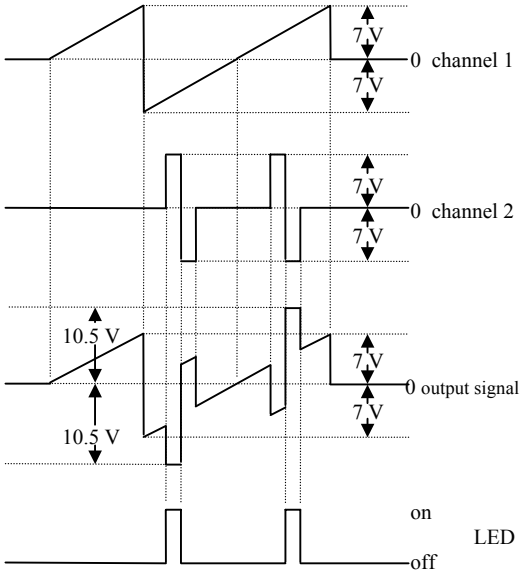
ADDER permits the electronic addition of voltages. It operates in either two-channel or four-channel mode. The output signal of ADDER cannot exceed 10.5V.



ADDER

DESCRIPTION

ADDER allows the addition of voltage signals. This model contains both a four-input channel and a two-input channel ADDER. The output signal of the four-input channel ADDER represents the added 4 input signals whereas the output signal of the two-input channel ADDER represents the addition of its 2 input signals.
You may choose between AC or DC coupling and between inverting or non-inverting operation mode.
Only two input channels of the four-input channel ADDER can be inverted. If the output signal of any ADDER exceeds the range of ±10.5 V a warning LED is switched on.



Pict. 1) Example of a 2 channel adder (channel 2 inverted)

PERFORMANCE

INPUT VOLTAGES
±1mV min., ±10.5V max. for each input channel. The sum of all input voltages of one adder should not exceed ±10.5V.
OUTPUT VOLTAGE
±10.5V max. for each adder.
INPUT IMPEDANCE
100 kΩ for each input.
OUTPUT IMPEDANCE
50Ω for each output.
CUT-OFF FREQUENCY
800kHz (-3dB).
RISING TIME/FALLING TIME
output signal needs 700ns to rise/fall by 10V.

ANALOGUE INPUTS

IN 1, IN 2, IN 3, IN 4 (upper region)
Front panel BNC connectors for the inputs of the 4-channel adder.
IN 1, IN 2 (lower region)
Front panel BNC connectors for the inputs of the 2-channel adder.

ANALOGUE OUTPUTS

OUTPUT (upper region)
Front panel BNC connector for the output of the 4-channel adder.
OUTPUT (lower region)
Front panel BNC connector for the output of the 2-channel adder.

DISPLAY

OVL
The LED is switched on if one of the output signals exceeds the ±10.5 V range.

CONTROLS

NOR./INV
Selects either non-inverting (normal) or inverting operation mode. Note that inputs IN 3 and IN 4 of the 4-channel ADDER cannot be inverted.

DC/AC
Selects either DC or AC coupling of all input signals of one ADDER.

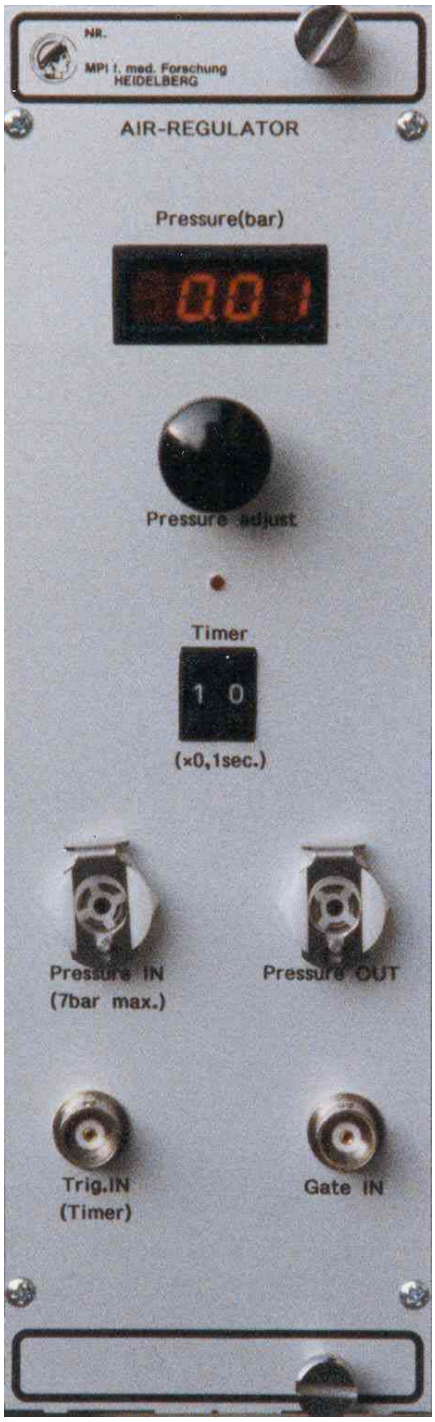
ELECTRICAL AND MECHANICAL

POWER SPECIFICATIONS
+24V, 135mA; -24V, 135mA; +6V, 60mA

DIMENSIONS
NIM-standard single-width module, 3.43 x 22.13 cm front panel.

AIR-REGULATOR

AIR-REGULATOR can be used to create compressed air pulses by quickly opening and closing a valve. The duration and amplitude of the pulses can be adjusted.



AIR-REGULATOR

DESCRIPTION

AIR-REGULATOR transforms a constant current of compressed air into pulses by quickly opening and closing a valve. Both duration and amplitude of the pulses can be adjusted. The valve can be opened by applying either a gate or a trigger signal.

When applying a gate signal, the valve remains open for as long as the signal is zero (i.e. connected to ground). Setting the signal to +5V closes the valve. This can be achieved by simply disconnecting the gate input from ground since it is connected internally to +5V via a pull-up resistor.

By applying a trigger signal, the can be opened for a predefined period of time: The length of this period can be adjusted in steps of 100ms from zero to 9.9 seconds by two 10-position switches. When the trigger signal falls from +5V to zero the valve is opened for the selected period of time. Like the gate input, the trigger input is also connected internally to +5V by a pull-up resistor. The output pressure can be adjusted continuously from the zero to the value of the input pressure (7bar max.). The display shows the output pressure in the format ##.#.

PERFORMANCE

MAX. INPUT PRESSURE 7bar
OUTPUT PRESSURE RANGE
from zero to input pressure.
ACCURACY
±0.04% of maximum ±1digit.
RESOLUTION OF DISPLAY 10mbar.
TRIGGER SIGNAL
High=+5V; low=zero. System reacts on negative slope.
GATE SIGNAL
High=+5V; low=zero. System reacts on low level.

INPUTS

PRESSURE IN
Front panel quick connector to connect the system to the pressure source, e.g. a compressor. Unless connected an internal safety valve is closed.
TRIG. IN
Front panel BNC connector. A negative slope (falling from +5V to zero) opens the valve for a predefined period of time.
GATE IN
Front panel BNC connector. If the signal is low (zero) the valve is opened and closed if it is high (+5V).

OUTPUT

PRESSURE OUT
Front panel quick connector to connect the system to the output. Unless connected an internal safety valve is closed and there is no output pressure.

DISPLAY

PRESSURE (bar)
A 3½-digit, 7-segment LED display with leading zero suppression; 2 digits to the right and one to the left of the decimal point.
LED is on if valve is open.

CONTROLS

TIMER
The two 10-position switches define how long the valve remains open for if opened by a trigger signal. The total time period corresponds to the selected value times 100 ms.
PRESSURE ADJUST
Control to adjust the output pressure continuously between the input pressure and zero.

ELECTRICAL AND MECHANICAL

POWER REQUIRED

+24V, 14mA; -24V, 11mA; +12V, 140mA; +6V, 130mA.

DIMENSIONS

NIM-standard double-width module, 6.90 x 22.13 cm front panel.

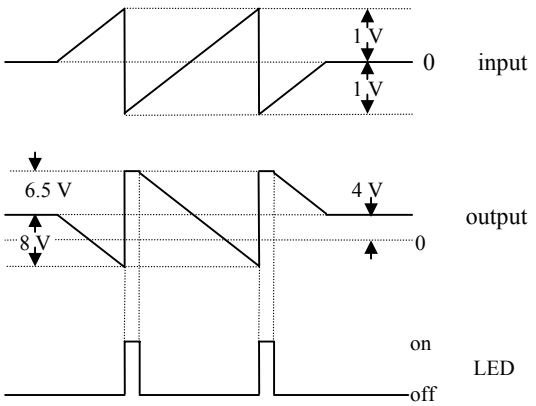
AMPLIFIER

AMPLIFIER permits the amplification of an input voltage. Voltage gain is adjustable continuously between 0 and 50. AMPLIFIER can operate in inverting and non-inverting modes, and with either AC or DC coupling. An offset voltage (±10V) can be added to the output signal.

AMPLIFIER

DESCRIPTION

The voltage gain of **AMPLIFIER** is continuously adjustable between 0 and 50. You may choose between AC and DC coupling and between inverting and non-inverting operation modes. An offset (±10V, continuously adjustable) may be added to the output signal. The offset is displayed in 4 figures. Both gain and offset can be adjusted coarsely by multi-position switches and tuned finely with potentiometers. If the output signal exceeds the ±10.5 V range, a warning LED is switched on.



Pict. 1) Example of input and output signals (gain= 8, offset= 4, operation mode: inverting)

PERFORMANCE

NOMINAL VOLTAGE GAIN
Continuously adjustable between 50 and -50.
INPUT VOLTAGE
±1mV min., ±10.5V max.
OUTPUT VOLTAGE
±10.5V max.
INPUT IMPEDANCE 100 kΩ.
OUTPUT IMPEDANCE 50 Ω.
CUT-OFF FREQUENCY 1 MHz.
RISING TIME/FALLING TIME
output signal needs 700ns to rise/fall by 10V.
OFFSET
Continuously adjustable in the range of ±10V
RESOLUTION OF OFFSET DISPLAY
±1mV (1V range) or ±10mV (10V range)

ANALOGUE INPUT

Front panel BNC connector.

ANALOGUE OUTPUT

Front panel BNC connector.

DISPLAY

OFFSET
A 3½-digit, 7-digit LED display with leading zero suppression; 1 digit to the left and 3 to the right of the decimal point (1V range) or 2 digits to the left and 2 to the right of the decimal point (10V range).
OVL
LED is switched on if the output signal exceeds the ±10.5V range.

CONTROLS

GAIN
6-position switch for coarse adjustment of voltage gain. The selected value corresponds to the real gain if the potentiometer above it (used for fine tuning) is fully turned to the right.
AMPLITUDE 0-100%
A 10-turn precision potentiometer to finely tune the gain. If it is turned fully to the right the gain corresponds to the value of the coarse gain control below it; if it is turned fully to the left, the gain is zero.
OFFSET ±10V, 0V, ±1V
A 3-position switch to select the range of the offset that can be added to the output; Top position: offset adjustable in the range of ±10V; bottom position: offset adjustable in the range of ±1V; mid position: no offset.

OFFSET
A 10-turn precision potentiometer to finely tune the offset. If it is fully turned to the right the maximum offset (dependent on the range selected above) is added. If it is fully turned to the left the minimum offset is added. Additionally, the actual offset value is displayed above.

DC/AC
to select either DC or AC coupling

NOR./INV
to select either non- inverting (normal) or inverting operation mode.

ELECTRICAL AND MECHANICAL

POWER REQUIRED
+24V, 70mA; -24V, 70mA; +6V, 130mA.

DIMENSIONS NIM-standard single-width module, 3.43 x 22.13 cm front panel.

DIGITAL MANOMETER

DIGITAL MANOMETER can be used to measure pressures in the range of ±1000mbar. Two ranges can be selected, either ±200mbar or ±1000mbar. The measured pressure is proportional to the voltage output (resolution: 1mV is equal to 1mbar). This output can be connected to a voltmeter or to an analogue input port of a computer.

DIGITAL MANOMETER

DESCRIPTION

DIGITAL MANOMETER can be used to accurately measure pressures (±1mbar). The value is displayed in 4 figures. There are two ranges that can be selected: either ±200mbar (last figure after the decimal point) or ±1000mbar (all figures in front of the decimal point). The voltage output is proportional to the measured pressure and can be connected to e.g. a voltmeter or the analogue input port of a computer (1mV corresponds to 1mbar).

PERFORMANCE

PRESSURE RANGES
±200mbar or ±1000mbar (selectable).
ACCURACY
±1% of full scale ±1 Digit.
RESOLUTION OF DISPLAY
0.1mbar (200mbar range) or 1mbar (1000mbar range).

INPUT

The input is fed into the pressure sensor box (20 x 42 x 63 mm) which can be connected to the front panel. Any kind of flexible tubing (internal diameter about 4.5 mm) may be used to connect the sensor to the pressure to be measured.

ANALOGUE OUTPUT

Front panel BNC connector (1mV = 1mbar). Output impedance 50Ω.

DISPLAY

A 3½-digit, 7-segment LED display; 3 digits to the left and if the ±200 mbar range is used one to the right of the decimal point.

CONTROL

A toggle switch to select the two measuring ranges (±200mbar or ±1000mbar).

ELECTRICAL AND MECHANICAL

POWER REQUIRED
+24V, 15mA; -24V, 9mA; +6V, 100mA.
DIMENSIONS
NIM-standard single-width module, 3.43 x 22.13 cm front panel.
DIMENSIONS OF SENSOR BOX
9,5 x 5,5 x 3,5 cm

DIGITAL THERMOMETER

DIGITAL THERMOMETER can be used to measure temperatures between 30°C and 50°C by a micro-thermistor. The voltage output can be connected to a voltmeter or the analogue input port of a computer (resolution: 10mV is equal to 1 degree centigrade).

DIGITAL THERMOMETER

DESCRIPTION

DIGITAL THERMOMETER can be used to measure temperatures between 0°C and 50°C. The measured value is displayed in 3 figures, one after the decimal point. The voltage output may be connected to e.g. a computer or a voltmeter (10mV correspond to 1 degree centigrade).

PERFORMANCE

TEMPERATURE RANGE
from 0°C to 50°C
ACCURACY
± 0.5°C ± 1 Digit
RESOLUTION
0.1°C

INPUT

The micro-thermistor (3.5 x 0.5 mm) acts as the temperature sensor and can be connected on the front panel.

ANALOGUE OUTPUT

Front panel BNC connector (10mV = 1°C). Output impedance 50Ω.

DISPLAY

A 3½-digit, 7-segment LED display with leading zero suppression; 2 digits to the left and one to the right of the decimal point.

ELECTRICAL AND MECHANICAL SPECIFICATIONS

POWER REQUIRED
+12V, 6mA; -12V, 7mA; +6V, 130mA;
DIMENSIONS
NIM-standard single-width module, 3.43 x 22.13 cm front panel.

DUAL-PIEZO-AMPLIFIER

DUAL-PIEZO-AMPLIFIER boosted the input signal 0-10V to an output signal 0-60V with an adjustable gain.

DUAL-PIEZO-AMPLIFIER

DESCRIPTION

The DUAL-PIEZO-AMPLIFIER boosted the input signal 0-10V to an output signal 0-60V with an adjustable gain.

PERFORMANCE

NOMINAL VOLTAGE GAIN
Continuously adjustable between 0 and 60 V.
INPUT VOLTAGE
0-10 V
OUTPUT VOLTAGE
0-60 V
INPUT IMPEDANCE
100 kΩ
OUTPUT IMPEDANCE
10 Ω
OUTPUT CURRENT
550 mA
RISE TIME
0,35ms by CL 1,8µF

ANALOGUE INPUT

Front panel BNC connector.

ANALOGUE OUTPUT

Front panel plug connection.

CONTROLS

AMPLITUDE
A 10-turn precision potentiometer to finely tune the gain.

ELECTRICAL AND MECHANICAL

POWER REQUIRED
+24V, 10mA; -24V, 36mA; 110VAC, 400mA
DIMENSIONS NIM-standard double-width module, 6.90 x 22.13 cm front panel.

MANUAL-SEAL-SUCKER

MANUAL-SEAL-SUCKER can be used to increase the number of SUCTION PULSER outputs from one to three.

MANUAL-SEAL-SUCKER

DESCRIPTION

MANUAL-SEAL-SUCKER can be used to increase the number of SUCTION PULSER outputs from one to three. SUCTION PULSER has one vacuum output. Connecting SUCTION PULSER to MANUAL-SEAL-SUCKER increases the number of outputs to three, each of which can be opened seperately by a remote control. Additionally, a low and a high press can be connected to the MANUAL-SEAL-SUCKER.
MANUAL-SEAL-SUCKER can also multiplex three inputs on three outputs.
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PERFORMANCE

PRESSURE RANGE
from –1000 to 1000mbar.
ACCURACY
±1% of full scale ±1 Digit.
RESOLUTION OF DISPLAY 1mbar.

INPUTS

VACUUM / PRESSURE
Front panel quick connector to intput the pressure.

DISPLAY

VACUUM (mbar)
A 3½-digit, 7-segment LED display.

OUTPUT

VACUUM / PRESSURE OUT
Front panel quick connector to output the pressure.

CONTROLS

With the REMOTE-CONTROL you can choose the inputs to the outputs.
The output can toggle between flow and hold function.

ELECTRICAL AND MECHANICAL

POWER REQUIRED
+24V, 31mA; -24V, 28mA; +12V, 265mA; +6V, 490mA.
DIMENSIONS
FRONT PANEL: NIM-standard double-width module, 6.90 x 22.13 cm front panel.
REMOTE CONTROL: 15 x 8 x 5,5 cm

PIEZO-FILTER-AMPLIFIER

PIEZO-FILTER-AMPLIFIER modified an input square pulse in the amplitude and the rise time.

PIEZO-FILTER-AMPLIFIER

DESCRIPTION

The PIEZO-FILTER-AMPLIFIER modified an input square pulse in the amplitude and the rise time.

PERFORMANCE

NOMINAL VOLTAGE GAIN
Continuously adjustable between 1 and 10
INPUT VOLTAGE
±10V
OUTPUT VOLTAGE
±12V
INPUT IMPEDANCE
20 kΩ.
OUTPUT IMPEDANCE
50 Ω.

ANALOGUE INPUT

Front panel BNC connector.

ANALOGUE OUTPUT

Front panel BNC connector.

CONTROLS

GAIN
4-position switch for coarse adjustment of voltage gain. The selected value corresponds to the real gain if the potentiometer above it (used for fine tuning) is fully turned to the right. The steps are 1, 2, 5, 10.
AMPLITUDE 0-100%
A 10-turn precision potentiometer to finely tune the gain. If it is turned fully to the right the gain corresponds to the value of the coarse gain control below it; if it is turned fully to the left, the output is zero.

TRANSITION TIME / ms
A 5-position switch to select the time base for the rise time in ms. The selected value corresponds to the real time if the potentiometer above it (used for fine tuning) is fully turned to the left. The timebase are 0.01, 0.1, 1, 10, 100.
x1 – x11
A 10-turn precision potentiometer to finely tune the time. If it is turned fully to the left the time corresponds to the value of the coarse time control below it; if it is turned fully to the right, the time multiplicator is 11.

ELECTRICAL AND MECHANICAL

POWER REQUIRED
+24V, 10mA; -24V, 11mA;
DIMENSIONS
NIM-standard single-width module, 3.43 x 22.13 cm front panel.

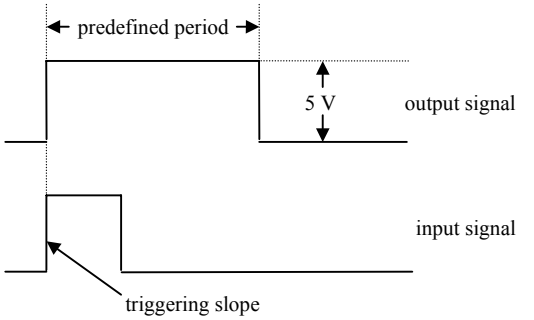
PROGRAMMABLE TIMER

PROGRAMMABLE TIMER can either generate voltage pulses of a predefined length or generate 10µs pulses delayed by a predefined period of time. The period can be adjusted from zero to 9999µs or from zero to 9999ms.

PROGRAMMABLE TIMER

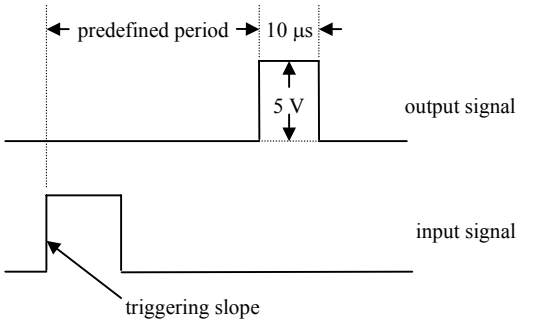
DESCRIPTION

PROGRAMMABLE TIMER can either generate pulses of a predefined length (gate mode) or delay pulses by a predefined period of time (pulse mode). An internal jumper is used to switch between these two modes. In both cases, every trigger slope generates one output pulse. One of two inputs can be selected: one is for positive trigger slopes and the other one is for negative slopes trigger slopes. There are two outputs: one for positive and one for negative pulses. In the gate mode, pulses start at the beginning of the trigger slope and remain active for the predefined period.



Pict. 1) Example for gate mode operation (output/input positive)

In pulse mode, the system waits for a predefined period after the onset of the trigger slope and generates one pulse of 10µs length at the end of the delay period:



Pict. 2) Example of pulse mode operation (output/input positive)

The time period (i.e. either the pulse width or the delay, according to the selected operation mode) can be adjusted either from zero to 9999ms or from zero to 9999µs.
Whenever a pulse is generated, an LED is switched on for at least 10µs.

PERFORMANCE

PERIOD
Adjustable either from zero to 9999µs in steps of 1µs or from zero to 9999ms in steps of 1ms.
TRIGGER SIGNAL
High=+5V; low=zero. System reacts on eitherpositive or negative slope according to which input is chosen.
PULSE OUTPUT SIGNAL
High=+5V; low=zero. System generates positive and negative pulses simultaneously.
OUTPUT IMPEDANCE
250Ω for each output.
INPUT IMPEDANCES
POSITIVE INPUT 1kΩ.
NEGATIVE INPUT 5kΩ.

INPUTS

TRIG. IN TTL
Front panel BNC connector. If the trigger signal is connected to this connector the system will trigger on positive slopes.
TRIG. IN (TTL)´
Front panel BNC connector. If the trigger signal is connected to this connector the system will trigger on negative slopes.

DISPLAY

LED
is switched on for at least 10µs when the system reacts to a trigger slope irrespective of the operation mode.

OUTPUTS

PULSE OUT TTL
Front panel BNC connector. Pulses are high (+5V) and pauses are low (zero).
PULSE OUT (TTL)´
Front panel BNC connector. Pulses are low (zero) and pauses are high (+5V).

CONTROLS

PULSE WIDTH
Four 10-position switches to define the pulse width. If the system operates in pulse mode, 'pulse width' refers to the delay between a trigger slope and the resulting pulse.

RANGE ms/μs
A 2-position toggle switch to select if the pulse width or the delay is to be adjusted in ms or in μs respectively.

INTERNAL JUMPER

PULSE/GATE
to select pulse mode or gate mode.

ELECTRICAL AND MECHANICAL

POWER REQUIRED
+6 V, 150 mA.

DIMENSIONS
NIM-standard single-width module, 3.43 x 22.13 cm front panel.

PULSER

PULSER generates single or periodical voltage pulses. There are three adjustable parameters: pulse amplitude, pulse width and repetition rate. Additionally, positive or negative pulses and different trigger modes (internally, manually or externally) can be selected.

PULSER

DESCRIPTION

PULSER generates either single or periodically repetitive pulses. There are three continuously adjustable pulse parameters: pulse amplitude, pulse width and repetition rate. Positive and negative pulses can be generated and a TTL trigger signal is derived from the pulse signal.
Pulser can be triggered internally, manually or by an external signal. In the 'internal' mode the system triggers itself so that the pulse signal is periodic. The signal frequency can be adjusted within the range of 0.1Hz to 1kHz.
In 'manual' mode the system generates one pulse whenever an "unlocking" switch is pressed.
In 'external' mode a pulse is generated whenever the external trigger signal changes from +5V to zero or vice versa. Internal jumpers select whether the system reacts on positive or negative slopes.
To keep the system pulsing for a certain period of time, select gate mode. In this mode the system works just like in the internal mode (see above) for as long as the gate signal is active. If the gate signal is passive then the output signal is zero. Internal jumpers may be used to define if 'active' corresponds to +5V and 'passive' corresponds to zero or vice versa. While in gate mode, it is not possible to generate pulses manually because the trigger select switch is inactivated.
In addition to the real output signal a trigger output signal is also produced. This signal is identical to the output signal in terms of pulse width and frequency, but it just toggles between zero and +5V. Using an internal jumper you may select whether a positive or a negative slope of the pulse output signal corresponds to a positive or a negative slope of the trigger output signal.

PERFORMANCE

OUTPUT VOLTAGE
Continuously adjustable in the range of ±10V.
REPETITION RATE
Continuously adjustable from 0.1Hz to 1kHz.
PULSE WIDTH
Continuously adjustable from 10µs to 1.1s.
TRIGGER SIGNAL
High=+5V; low= zero. System reacts on either
positive or negative slope (internally selectable).
GATE SIGNAL
High=+5V; low=zero. System reacts on either high or low level (internally selectable).
OUTPUT IMPEDANCES
PULSE OUTPUT 50Ω;
TRIGGER OUTPUT 250Ω.
RISING TIME/FALLING TIME
Output signal needs 700ns to rise/fall by 10V.

INPUT

TRIG. IN / GATE IN
Front panel BNC connector. If the gate select switch (see below) is in the 'down' position, this connector is used as a gate input and pulses are generated for as long as the gate signal is active. If the switch is in the 'up' position, the connector is used as a trigger input. Every active slope of the trigger signal results in one pulse. See paragraph 'JUMPERS' on what 'active' means in this case.

OUTPUTS

PULSE OUT
Front panel BNC connector.
TRIG. OUT
Front panel BNC connector. The signal pattern is the same as that of the pulse output signal with regards to repetition rate and pulse width. However, the amplitude is always on TTL level (i.e. zero or +5V) and does not depend on the adjusted amplitude.

Display

AMPLITUDE/mV/V
A 3½-digit, 7-segment LED display that shows the actual pulse amplitude. If the 10V range is selected by the control below it, the amplitude is shown in V with two digits to the right and one to the left of the decimal point. Thus the resolution is 10 mV in this mode. If any other range is selected the amplitude is shown in mV.

REPETITION RATE/Hz
A 3½-digit, 7-segment LED display that shows how many pulses per second are generated (i.e. the signal frequency). The value is displayed in Hz. Thus the resolution is between 1mHz and 1Hz according to which range is selected with the control below it.

LED
is switched on when a pulse is generated, i.e. when the pulse output signal is not equal to zero.

CONTROLS

AMPLITUDE/V
A 6-position turning switch for coarse adjustment of the amplitude. The selected value corresponds to the actual amplitude if the potentiometer to its right is turned fully to the right.

0-100%
A 10-turn precision potentiometer for fine control of the amplitude. If it is turned to the right stop, the actual amplitude corresponds to that adjusted by the control (AMPLITUDE/V) on its left; if it is turned fully to the left, the amplitude is zero.

REPETITION RATE/Hz
A 4-position turning switch for coarse adjustment of the repetition rate. The selected value corresponds to the actual repetition rate if the potentiometer to its right is turned fully to the left.

x1-x10
A 10-turn precision potentiometer for fine control of the repetition rate. If it is turned fully to the left, the repetition rate corresponds to that adjusted by the 'REPETITION RATE/Hz' control on its left; if it is turned fully to the right, the repetition rate is multiplied by ten.

WIDTH/ms
A 5-position turning switch for coarse selection of the pulse width. The selected value corresponds to the actual pulse width if the potentiometer on its right is turned to the left stop.

x1-x11
A 10-turn precision potentiometer for fine control of the pulse width. If it is turned to the left stop, the pulse width corresponds to that adjusted by the control on its left; if it is turned fully to the right, the repetition rate is multiplied by eleven.

INT. TRIG./EXT./MAN.
A 3-position toggle switch. Pressing it down generates a pulse. If it is locked in the top position, the system triggers itself, i.e. generates a periodical signal. In the mid position the system is triggered by an external trigger signal which must be connected to the left BNC connector.
This switch is only active if the gate switch (see below) is in the 'up' position.

GATE/NON
A 2-position toggle switch to select whether the system is responding to a trigger signal ('up' position) or to a gate signal ('down' position).

PULSE POS./NEG.
A 2-position toggle switch to select whether output pulses are positive (toggling between zero and the amplitude adjusted above) or negative (toggling between zero and the negative amplitude).

JUMPERS (internal)

N/P T. IN
Two jumpers to select if 'active' means positive or negative with regards to the input signal. If the jumpers are in the 'p'-position, the system responds to a positive slope (rising from zero to +5V) or to a high-level signal (+5V) if in gate mode. In the 'n'-position, the system responds to a negative slope (falling from +5V to zero) or to a low level signal (zero) respectively.

P/N TRIG. OUT
to select whether the output trigger signal has the same or opposite polarity compared with the pulse output signal. If the jumper is in the 'p'-position (non-inverting), a pulse output signal of zero means a low trigger output signal whereas a pulse output signal not equal to zero corresponds to a high trigger output signal. Similarly, if the jumper is in the 'n'-position (inverting) a pulse output signal of zero means a high trigger output signal whereas a pulse output signal not equal to zero corresponds to a low trigger output signal. Note that the trigger output signal just toggles between high (+5V) and low (zero) whereas a pulse output signal not equal to zero may mean any value in the range of ±10V.

ELECTRICAL AND MECHANICAL

POWER REQUIRED
+24V, 80mA; -24V, 70mA; +6V, 250mA; -6V, 25 mA.

DIMENSIONS
NIM-standard double-width module, 6.90 x 22.13 cm front panel.

SLICER

The Slicer HR 2 is very good for cutting fresh cells. The cell probes must not longer be frozen or packed in paraffin. With the used oscillation blade you can make cell cuts with a thickness in the µm-area. The tolerance is under 5µm (typical height oscillation 3-4µm).

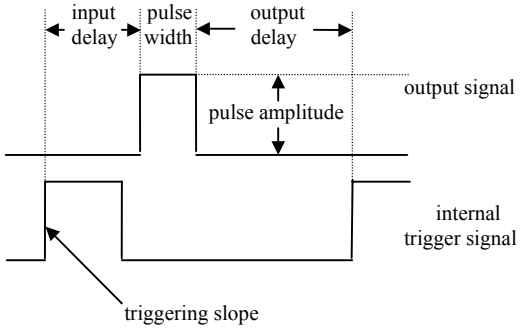
STIMULUS GENERATOR

STIMULUS GENERATOR generates single or periodical pulses. There are four adjustable parameters: pulse amplitude, pulse width, input delay and output delay. Positive or negative pulses can be selected. There are three different trigger modes: internally, manually or externally. STIMULUS GENERATOR can be used to stimulate a cell in a “patch-clamp“application.

STIMULUS GENERATOR

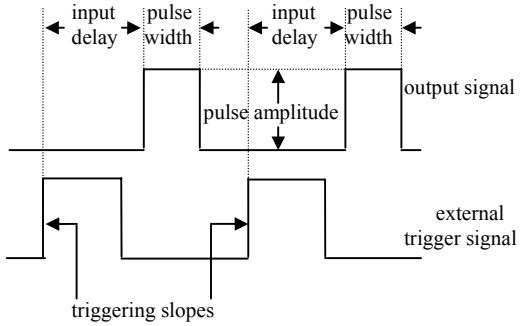
DESCRIPTION

STIMULUS GENERATOR can generate single or periodical pulses. There are four pulse parameters that can be adjusted continuously by the user: pulse amplitude, pulse width, input delay and output delay. Additionally, positive or negative pulses may be selected, and pulses and several internal signals are lead out on TTL level.
The system can be triggered internally, manually or by an external signal:
In the internal-trigger mode, the system triggers itself so that the pulse signal is periodic.
In the manual mode the system generates a pulse when an unlocking switch is pressed down.
In the external mode, a pulse is generated whenever the external trigger signal changes from +5V to zero or vice versa. Internal switches can be used to select whether the system reacts on either positive or negative slopes.
To make the system pulsing for a defined period of time, choose gate mode. In this mode the system works like in the internal mode (see above) for as long as the gate signal is 'active'. If the gate signal is 'passive' the output signal is zero. Two internal switches are used to define whether 'active' means +5V and 'passive' means 0V or vice versa. When working in the gate mode, it is not possible to generate pulses manually because the trigger select switch is inactivated.
Four parameters can be adjusted to define the pulse output signal: pulse width, pulse amplitude, input delay and output delay. Input delay refers to the time that elapses between a trigger signal and the resulting pulse; output delay refers to the time that has to pass before the system may trigger itself again. The output delay is only active if the system is triggering internally i.e. when in internal or gate mode.



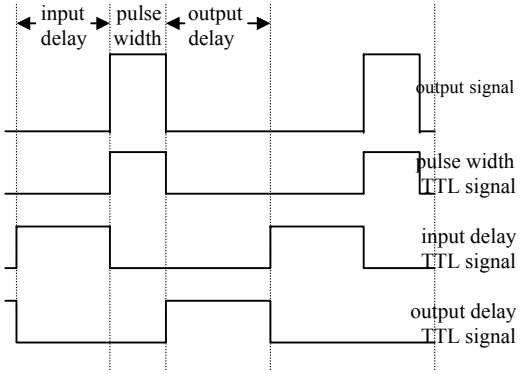
Pict. 1) Example of working in internal mode

When the system is in external or manual mode, the selected output delay is ignored and after each pulse the system waits for the next external trigger slope. However, this slope will not generate a pulse if it is applied too early i.e. before the output signal has returned to zero.



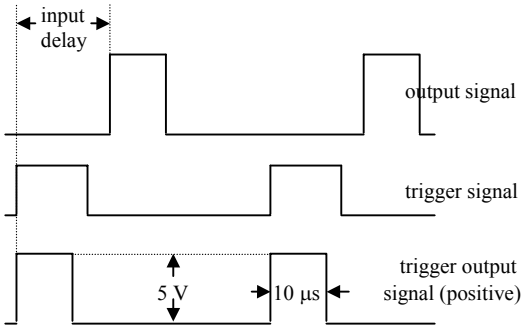
Pict. 2) Example of working in external mode

Both output and input delay can be adjusted either from zero to 9999ms or from zero to 9999µs. The pulse width can be adjusted either from zero to 999ms or from zero to 999µs.
The three parameters that determine the pulse frequency (i.e. input delay, pulse width and output delay) are also lead out as TTL signals. Thus it is possible to monitor which of these parameters is active at any time.



Pict. 3) Example of the three TTL signals

In addition to the output signal, a trigger output signal is lead out which is derived from the signal that triggers the pulse generator (internally or externally). This signal is generated whenever the system is triggered, and is not influenced by the selected input and output delays. It toggles between zero and +5V and its pulse width is fixed to 10µs. Thus, a 'permanent trigger output pulse' is generated if the frequency of the source signal is higher than 100kHz. An internal switch is used to select whether the trigger output signal is 'positive' or 'negative': If 'positive' is selected, the pulses are positive (+5V) and intervals are zero; the reverse applies if 'negative' is selected.



Pict. 4) Example of a trigger output signal (positive)

PERFORMANCE

OUTPUT VOLTAGE
Adjustable in the range of ±1.99V in steps of 10mV.
PULSE WIDTH
Adjustable either from zero to 999µs in steps of 1µs or from zero to 999ms in steps of 1ms.
INPUT DELAY
Adjustable either from zero to 9999µs in steps of 1µs or from zero to 9999ms in steps of 1ms.
OUTPUT DELAY
Adjustable either from zero to 9999µs in steps of 1µs or from zero to 9999ms in steps of 1ms.
TRIGGER SIGNAL
High=+5V; low=zero. System reacts on either positive or negative slopes (internally selectable).
GATE SIGNAL
High=+5V; low=zero. System reacts on either high or low level (internally selectable).
OUTPUT IMPEDANCES
PULSE OUTPUT 50Ω;
ALL OTHER OUTPUTS 100Ω.
RISING TIME/FALLING TIME
Output signal needs 70 ns to rise/fall by 1V.

INPUT

TRIG. IN/GATE IN
Front panel and rear panel BNC connector. If the gate select switch (see below) is in the lower position this connector is used as a gate input and pulses are generated for as long as the gate signal is active. If the switch is in the upper position the connector is used as a trigger input. Every active slope of the trigger signal generates one pulse. For the definition of 'active'/'passive' in this case see section 'INTERNAL SWITCHES' below.

OUTPUTS

PULSE OUT
Front panel and rear panel BNC connector.
TRIG. OUT
Front panel and rear panel BNC connector.
IN-DELAY TTL
Rear panel BNC connector. Signal is high (+5V) if input delay is active and low (zero) otherwise.

IN-DELAY (TTL)´
Rear panel BNC connector. Signal is low (zero) if input delay is active and high (+5V) otherwise.

OUT-DELAY TTL
Rear panel BNC connector. Signal is high (+5V) if output delay is active and low (zero) otherwise.

OUT-DELAY (TTL)´
Rear panel BNC connector. Signal is low (zero) if output delay is active and high (+5V) otherwise.

PULSE WIDTH TTL
Rear panel BNC connector. Signal is synchronous with the pulse output signal: If the output signal is equal to zero it is low (zero) and if the output signal is not equal to zero it is high (+5V).

PULSE WIDTH (TTL)´
Rear panel BNC connector. Signal is synchronous with the pulse output signal: If the output signal is equal to zero it is high (+5V) and if the output signal is not equal to zero it is low (zero).

DISPLAY

AMPLITUDE/mV
A 3½-digit, 7-segment LED display that shows the actual pulse amplitude directly in mV. The resolution is 1mV.

LED
is on when a pulse is generated i. e. when the pulse output signal is not equal to zero at the moment.

CONTROLS

INT. TRIG./EXT./MAN.
A 3-position toggle switch. When it is pressed down, a pulse is generated. In the top position the system triggers itself i.e. a periodic signal is generated. In the mid position, the system must be triggered by an external trigger signal connected to the 'Trig. IN' BNC connector.
This switch is only active if the gate switch (see below) is in the top position.

GATE/NON
A 2-position toggle switch to select whether the system is to be controlled by a trigger signal (up position) or by a gate signal (down position).

PULSE POS./NEG./OFF
A 3-position toggle switch to select whether output pulses are either positive (toggling between zero and the amplitude adjusted above) or negative (toggling between zero and the negative amplitude) or zero.

AMPLITUDE [mV]
Two 10-position turning switches to select the pulse amplitude.

1000mV/0mV
A 2-position toggle switch to select whether 1V is to be added ('up' position) to the value adjusted by the two controls on its right or not ('down' position, 0mV).

INPUT DELAY [ms/µs]
Two 10-position switches to define the input delay.

INPUT DELAY RANGE ms/µs
A 2-position toggle switch to select if the input delay is to be adjusted in ms or in µs.

PULSE WIDTH [ms/µs]
Three 10-position turning switches to define the pulse width.

PULSE WIDTH RANGE ms/µs
A 2-position toggle switch to select if the pulse width is to be adjusted in ms or in µs.

OUTPUT DELAY [ms/µs]
Two 10-position switches to define the output delay.

OUTPUT DELAY RANGE ms/µs
A 2-position toggle switch to select if the output delay is to be adjusted in ms or in µs.

INTERNAL SWITCHES

N/P TRIG. GATE

Two switches to select if 'active' means positive or negative with regards to the input signal. In the 'p'-position with the system in trigger mode, pulses are generated by positive slopes (rising from zero to +5V) or by a high level signal (+5V) if the system is in gate mode. In the 'n'-position, pulses are generated by negative slopes (falling from +5V to zero) or by a low level signal (zero).

P/N TRIG. OUT

To select if the output trigger signal has the same sign as the pulse signal. In the 'p'-position, a pulse signal equal to zero results in a low trigger output signal whereas a pulse signal not equal to zero gives a high trigger output signal.

In the 'n'-position a pulse signal of zero results in a high trigger output signal whereas a pulse signal not equal to zero gives a low trigger output signal.

Note that the trigger output signal toggles between high (+5V) and low (zero) whereas a pulse signal not equal to zero may mean any value in the range of ±1.99V.

ELECTRICAL AND MECHANICAL

POWER REQUIRED

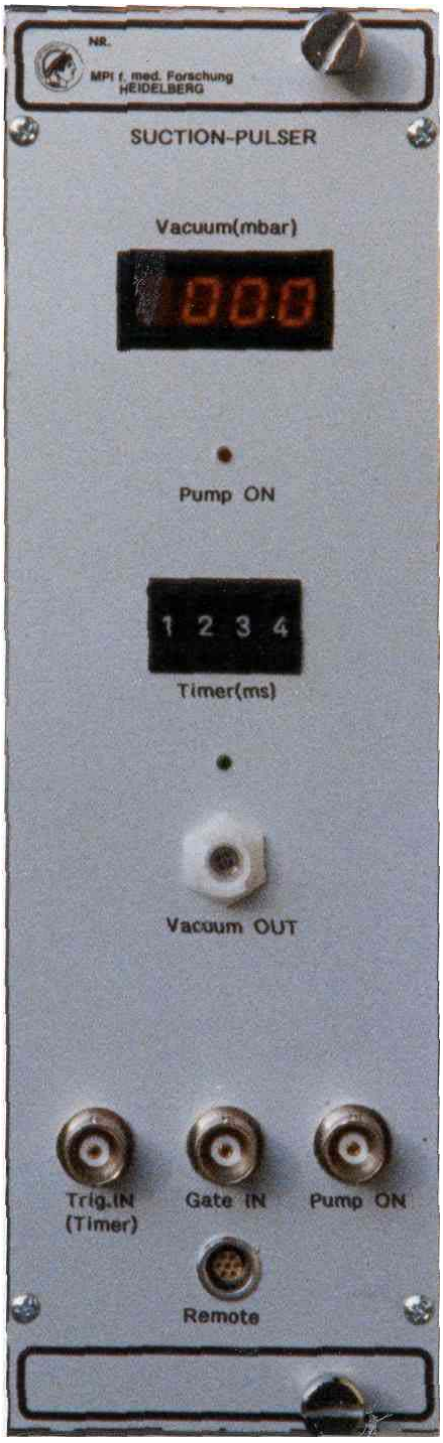
+24V, 50mA; -24V, 60mA; +6V, 170mA.

DIMENSIONS

NIM-standard triple-width module, 10.23 x 22.13 cm front panel.

SUCTION-PULSER

SUCTION-PULSER generates pulses of negative pressure by quickly opening and closing a valve. SUCTION-PULSER includes a suction-pump. There are two adjustable parameters: length and strength of the pulses.



SUCTION-PULSER

DESCRIPTION

SUCTION-PULSER is a combination of a suction pump and a valve that generates pulses of negative pressure by quickly opening and closing the valve. Both duration and amplitude of the pulses can be adjusted.
There are two ways to open the valve: either by a gate signal or by a trigger signal. In the first case the valve remains open for as long as the gate signal is zero (i.e. connected to ground). When the signal becomes +5V, the valve closes. This is achieved by simply disconnecting the gate input from ground, since the input is connected internally to +5V via a pull-up resistor.
To open the valve for a predefined period a trigger signal can be used: The duration can be adjusted in steps of 1ms from zero to 9.999 seconds by four 10-position switches. When the trigger signal falls from +5V to zero the valve is opened for the pre-defined period. Like the gate input, the trigger input is also connected internally to +5V via a pull-up resistor to keep it on a positive level unless connected to ground.
To create a negative pressure, the internal suction pump must be switched on. This requires the system to be connected to its power supply and the pump signal to be zero (i.e. connected to ground). Like the other two inputs mentioned above the pump signal is also connected internally to +5V via a pull-up resistor. When the pump signal is set to +5V, the pump stops after a period of about 2 minutes unless restarted.
Additionally, the included remote control can be used to change the three input signals described above. Thus, the user can switch off the pump manually before the 2 minutes have passed and adjust the speed of the pump i. e. the magnitude of the negative output pressure. The remote control can be attached to any kind of magnetic material.

PERFORMANCE

NEGATIVE PRESSURE RANGE
from 0 to 800mbar.
ACCURACY
±0.75% of full scale ±1 Digit.
RESOLUTION OF DISPLAY 1mbar.
TRIGGER SIGNAL
High=+5V; low= zero. System reacts on negative slope.
GATE SIGNAL
High=+5V; low=zero. System reacts on low level.
PUMP SIGNAL
High=+5V; low=zero. System reacts on negative slope.

INPUTS

TRIG. IN
Front panel BNC connector. A negative slope (falling from +5V to zero) makes the valve open for a predefined period of time.
GATE IN
Front panel BNC connector. If the signal is low (zero) the valve is open and if it is high (+5V) the valve is closed.
PUMP ON
Front panel BNC connector. A negative slope (falling from +5V to zero) makes the pump run for about 2 minutes.
REMOTE
to connect the included remote control.

DISPLAY

VACUUM (mbar)
A 3½-digit, 7-segment LED display.
GREEN LED is on if the valve is open.
RED LED is on if the pump is running.

OUTPUT

VACUUM OUT
Front panel quick connector to output the negative pressure. Unless it is connected an internal safety valve is closed.

CONTROLS

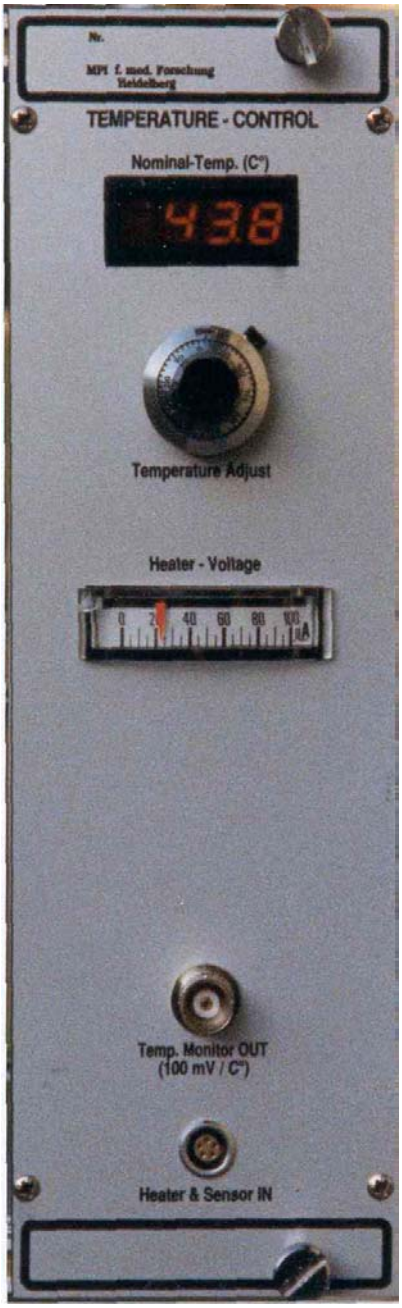
TIMER
Four 10-position switches to define how many milliseconds the valve should stay open if opened by a trigger signal.
RED PUSHBUTTON SWITCH
(REMOTE) to generate a gate signal: low when pushed down, high when released. This switch corresponds to the connection and disconnection of gate input and ground (see above).
BLACK PUSHBUTTON SWITCH
(REMOTE) to generate a trigger signal: low when pushed down, high when released. This switch corresponds to the connection and disconnection of trigger input and ground (see above).
POTENTIOMETER
(REMOTE) to adjust the speed of the pump and thus the output pressure.
3 POSITION TOGGLE SWITCH
(REMOTE)
right position: to switch off the pump.
mid position: no function;
left position: to switch on the pump by generating a pump signal: low when pushed down, high when released. This switch corresponds to the connection and disconnection of pump input and ground (see above).

ELECTRICAL AND MECHANICAL

POWER REQUIRED
+24V, 22mA; -24V, 13mA; +12V, 250mA; -12V, 250mA; +6V, 170mA.
DIMENSIONS
FRONT PANEL: NIM-standard double-width module, 6.90 x 22.13 cm front panel.
REMOTE CONTROL: 8.5 x 5,5 x 5 cm (without projecting parts).

TEMPERATURE CONTROLLER

TEMPERATURE CONTROLLER can be used to accurately control the temperature of a medium. The actual temperature of the medium is measured by an included micro thermistor. This temperature is compared with the nominal temperature and voltage dependent heater switched on if it is less than the nominal temperature. In addition, the voltage output can be connected to a voltmeter or the analogue port of a computer (resolution: 10mV is equal to 1 degree centigrad of the nominal temperature).



TEMPERATURE CONTROLLER

DESCRIPTION

TEMPERATURE CONTROLLER consists of a voltage-dependent heater which compares the actual temperature with the nominal temperature. This is an excellent way to control temperature of a medium accurately. The actual temperature is measured by an included micro thermistor and the nominal temperature can be adjusted by a potentiometer. Its value is displayed in 3 figures, two in front of and one after the decimal point. Besides, a voltage is lead out which may be connected to e.g. a writer or a voltmeter (100mV correspond to 1 centigrade of nominal temperature).
The greater the difference between the nominal and the actual temperature is, the higher the heater voltage becomes. The actual voltage is displayed on a panel meter. If the actual temperature becomes greater than the nominal one the heater voltage decreases to zero.
Both the thermistor and the heater are connected by the same connector.

PERFORMANCE

NOMINAL TEMPERATURE RANGE
Continously adjustable from 0°C to 60°C.
ACCURACY
±0,5°C ±1 Digit.
RESOLUTION OF DISPLAY
0,1°C.
OUTPUT VOLTAGE
from zero to 12V
MAX. HEATING POWER
6 W

INPUT

By the included micro thermistor (3.5 x 0.5 mm) which can be connected on the front panel.

OUTPUTS

TEMP. MONITOR OUT
Front panel BNC connector (100mV = 1°C). Output impedance 1 kΩ.
HEATER
By the included heater line.

DISPLAY

NOMINAL TEMPERATURE
A 3½-digit, 7-segment LED display; 2 digits to the left and 1 to the right of the decimal point.
HEATER VOLTAGE
analogue panel meter.

CONTROL

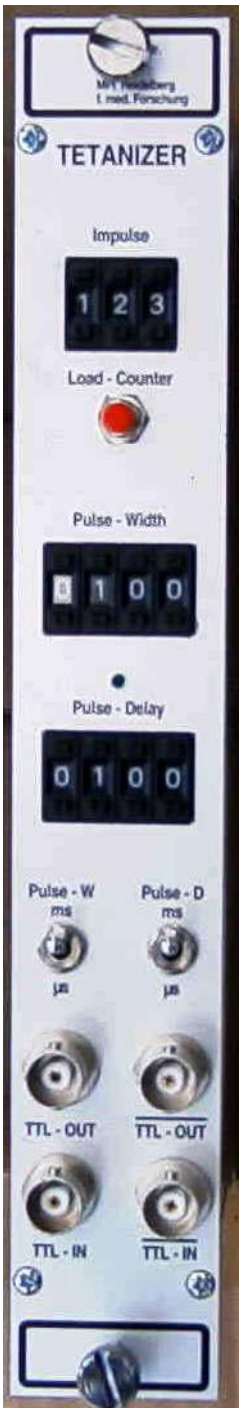
A 10-turn precision potentiometer to adjust the nominal temperature.

ELECTRICAL AND MECHANICAL

POWER REQUIRED
+24V, 40mA; -24V, 20mA; +6V, 110mA; -6 V, 20 mA.
DIMENSIONS
NIM-standard double-width module, 6.90 x 22.13 cm front panel.

TETANIZER

TETANIZER creates preselection number of TTL pulses with adjustable pulse-width and pulse-delay.



TETANIZER

DESCRIPTION

TETANIZER creates preselection number of TTL pulses with adjustable pulse-width and pulse-delay. With the impulse programmable counter, the number of pulses are select from 1 to 999 pulses. The push button load the internal counter with the number of preselected pulses. The pulse-width-time and the pulse-delay-time is adjustable with two time programmable switches. The timebase can be select between ms and μs.

PERFORMANCE

IMPULSE
adjustable between 1 and 999
PULSE-WIDTH
adjustable between 1μs and 9999ms
PULSE-DELAY
adjustable between 1μs and 9999ms
INPUT IMPEDANCE.
positive 1kΩ
negative 5kΩ
OUTPUT
TTL
/TTL

DISPLAY

LED
LED is switched on if the output signal is high

ELECTRICAL AND MECHANICAL

POWER REQUIRED
+6V, 150mA;
DIMENSIONS
NIM-standard single-width module, 3.43 x 22.13 cm front panel.