

UGO BASILE

BIOLOGICAL RESEARCH APPARATUS

Via G. Borghi 43,
21025 Comerio (VA), ITALY

Phone +39 0332 744574

Fax +39 0332 745488

e-mail (sales) sales@ugobasile.com

e-mail (service) service@ugobasile.com

URL <http://www.ugobasile.com>

**MULTIPLEXING PULSE
BOOSTER**

Cat. No. **3 1 6 5**



INSTRUCTION MANUAL

UGO BASILE
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Via G. Borghi 43
21025 COMERIO - Varese, ITALY

INSTRUCTION MANUAL

MULTIPLEXING PULSE BOOSTER

Cat. No. **3 1 6 5**

Series No. _____ Mfg. date _____

THIS INSTRUMENT IS WIRED FOR

- | | | |
|--------------------------|-------------------|-----------|
| <input type="checkbox"/> | 115 Volts - 60 Hz | OPERATION |
| <input type="checkbox"/> | 115 Volts - 50 Hz | |
| <input type="checkbox"/> | 230 Volts - 50 Hz | |
| <input type="checkbox"/> | 230 Volts - 60 Hz | |

SAFETY CONSIDERATION

ALTHOUGH THIS INSTRUMENT HAS BEEN DESIGNED WITH INTERNATIONAL SAFETY STANDARD, THIS MANUAL CONTAINS INFORMATION, CAUTIONS AND WARNINGS WHICH MUST BE FOLLOWED TO ENSURE SAFE OPERATION AND TO RETAIN THE INSTRUMENT IN SAFE CONDITIONS.

SERVICE AND ADJUSTMENTS SHOULD BE CARRIED OUT BY QUALIFIED PERSONNEL, AUTHORIZED BY UGO BASILE ORGANIZATION.

ANY ADJUSTMENT, MAINTENANCE AND REPAIR OF THE OPENED INSTRUMENT UNDER VOLTAGE SHOULD BE AVOIDED AS MUCH AS POSSIBLE AND, WHEN INEVITABLE, SHOULD BE CARRIED OUT BY A SKILLED PERSON WHO IS AWARE OF THE HAZARD INVOLVED.

CAPACITORS INSIDE THE INSTRUMENT MAY STILL BE CHARGED EVEN IF THE INSTRUMENT HAS BEEN DISCONNECTED FROM ITS SOURCE OF SUPPLY.

Instruction Manual dated February 1996
Revision 0



MULTIPLEXING PULSE BOOSTER

Cat. No. 3 1 6 5

Enables four in-vitro preparations to be driven by a single one-channel stimulator

- *High Power (up to 800 mA) digitally adjustable constant current*
- *Adequate Voltage (45V) enabling stimulation by field electrodes of most in-vitro preparations*
- *Unipolar or Bipolar Mode*
- *Independent Isolated Circuits to eliminate interference*
- *Continuous Monitoring of the preset current flowing through each preparation*





UGO BASILE S.R.L.
BIOLOGICAL RESEARCH
APPARATUS

CHECK-LIST

☐ **CAT. 3165 MULTIPLEXING PULSE BOOSTER**

CLIENTE / CUSTOMER _____

Ordine No. / Order No. _____ Data / Date ____/____/____

UB code	CAT.No.	✓	Q.ty	DESCRIPTION	DESCRIZIONE
	3165		1	INSTRUCTION MANUAL	MANUALE DI ISTRUZIONE
E-WP 008			1	EUROPA	EUROPA
E-WP 008-1				U.S.A.	U.S.A.
E-WP 008-2				U.K.	U.K.
M-LM 133	7562		1	DUST COVER	COPERTINA
E-FT 008-1			2	FUSES FOR 115V (T 800 mA)	FUSIBILI PER 115 V (T 800 mA)
E-FT 005-1			2	FUSES FOR 230 V (T400 mA)	FUSIBILI PER 230 V (T 400 mA)
E-PE 015			2	CONNECTION CABLE TO STIMULATOR	CAVO COLLEGAMENTO STIMOLATORE
OPTIONAL					
3175			1	TIMER	TIMER

DATE / /	3165 Serial No. 3175 Serial No.	PREPARATO DA / PACKED BY
Set for		
<input type="checkbox"/> 115V 50 Hz	<input type="checkbox"/> 230V 50 Hz	<input type="checkbox"/> 115V 60 Hz <input type="checkbox"/> 230V 60 Hz

IMPORTANT/IMPORTANTE:

Check the shipment for completeness immediately after receipt: should you find any discrepancy, please fill in the following part and transmit it to our fax no. +39 0332 745488

Al ricevimento della merce controllate che la spedizione sia completa: in caso di discrepanza, completate il formulario di seguito riportato ed inviatelo al nostro fax no. 0332 745488

FROM: Name	Company/Institution
DATE	REF.

NOTES



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MULTIPLEXING PULSE BOOSTER

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Cat. 3 1 6 5

1.0 GENERAL

The typical one-channel stimulator lacks the independent output connections and the individual adjustment capability to deliver pulses of preset intensity to more than one preparation.

It also lacks the power, in particular when "field electrodes" and other low impedance stimulation arrangements are used.

The Multiplexing Pulse Booster Cat. 3165 has been designed to obviate these shortcomings, performing as a useful complement to any stimulator, to energize up to four in-vitro electrode pairs at the same time.

The multiplexing mode supplies all available power to each channel and ensures optimum isolation among preparations, which are energized one at a time.

The 3165 features:

- High Power (up to 800 mA) digitally adjustable constant current
- Adequate Voltage (45V) which enables stimulation by field electrodes of most in-vitro preparations described in the literature
- Unipolar or Bipolar Mode
- Independent Isolated Circuits to eliminate interferences
- Continuous Monitoring of the preset current flow through each preparation

2.0 INSTALLATION

2.1 Unpacking

Check the contents of the shipment for completeness, packing list to hand, and visually inspect the Instrument as soon you take it out of the packaging.

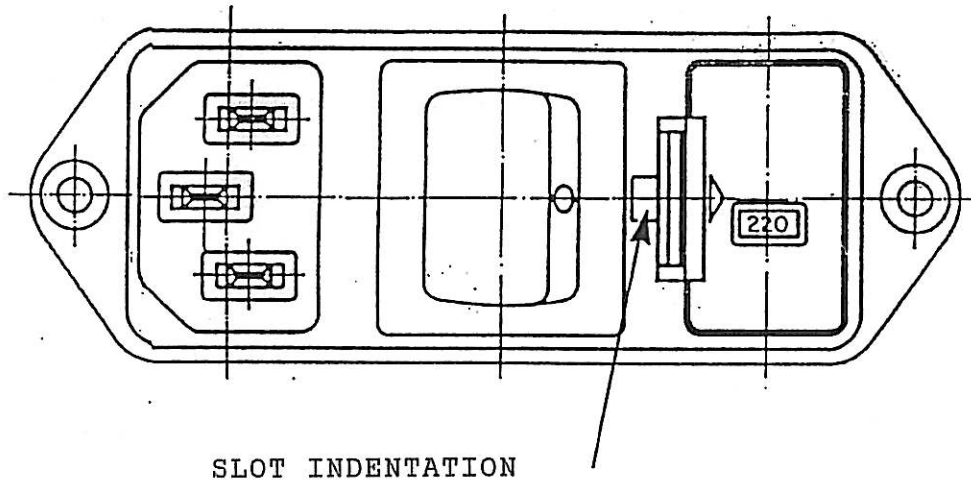
If the instrument is damaged or, after having tested it, fails to meet rated performances, notify the carrier and our company immediately.

2.2 Before Applying Power

Consider the Power Module on the back panel of the Pulse Booster, which includes the fuse holders, the mains switch & the inlet connector of the mains cord.

2.2.1 Fuse Holder

Insert a miniature screwdriver in the slot indentation, see sketch



and snap out the slide which houses the fuses.

For operation at 220-240 Volts, we recommend 400 mA timed fuses (type T 400). Use 800 mA fuses (type T 800) for operation at 115 Volts.

2.2.2 Voltage Selector

Remove the mains cord. Having extracted the fuse slide, the voltage selector becomes accessible.

The same miniature screwdriver will help you to pry out the cross jumper on which the operation voltage is engraved. Place the jumper upside down if you have to shift from 115 to 220V or viceversa.

Snap in the fuse slide: the "click" assures you that it is locked. Check the flag before giving power.

2.2.3 Mains Switch

This two-pole toggle switch, which complies with international safety standards, provides a visual cue, to signal the:

- OFF position by a 0
- ON position by a I

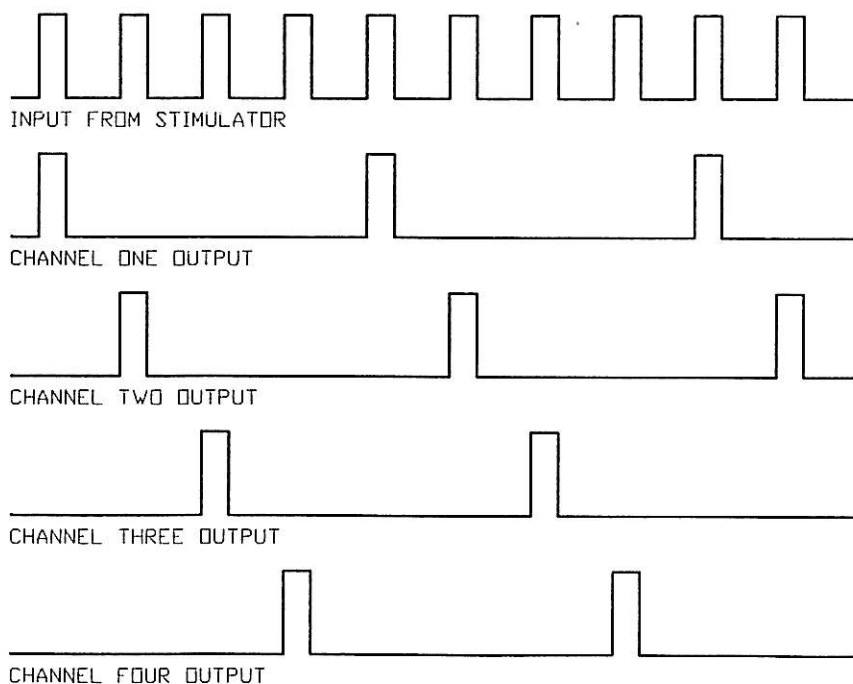
Connect the Instrument to a suitable power outtake, provided with a reliable earth connection.

3.0 OPERATION

3.1 Stimulator/Pulse Booster Set-up

Be sure the Stimulator is set as follows:-

- 3.1.1 The frequency (see NOTE) is 4 times the rate the operator requires for each channel output, irrespective of the output channels in operation.



The instrument in fact, as its name suggests, leads the input pulses sequentially to the four channel, see sketch above.

At this point we stress again the basic advantages of multiplexing:

- it ensures optimum isolation among preparations, which are energized one at a time
- it supplies all available power to each channel

N O T E :

in some stimulators, the operator is required to set the INTERVAL (T), instead of the FREQUENCY (f).

We remind you that:

$$f = \frac{1}{T}$$

In our case T would be 4 times shorter

- 3.1.2 The square wave output voltage of the Stimulator is set at about 10 Volts
- 3.1.3 Pulse width and delay are set as for the usual direct (i.e., with no Pulse Booster) operation
- 3.1.4 When pulse trains are delivered, either by the Stimulator or by the Timer Cat. 3175, to the Pulse Booster, the preset train duration should be somewhat longer than in the case of direct operation, as explained with the help of the graphics, see sketch on facing page.

For example, the operator wishes 10 Hz (100 ms) and train duration of 400 ms, i.e., 5 pulses, on each output of his/ her Multiplexing Pulse Booster.

He/she will set the Stimulator at 40 Hz (period 25 ms) and train duration at 485 or 490 ms. In fact, the first pulse occurs at time 0 (zero) on channel 1, at 25 ms delay on channel 2, at 50 on channel 3 and at 75 on channel 4.

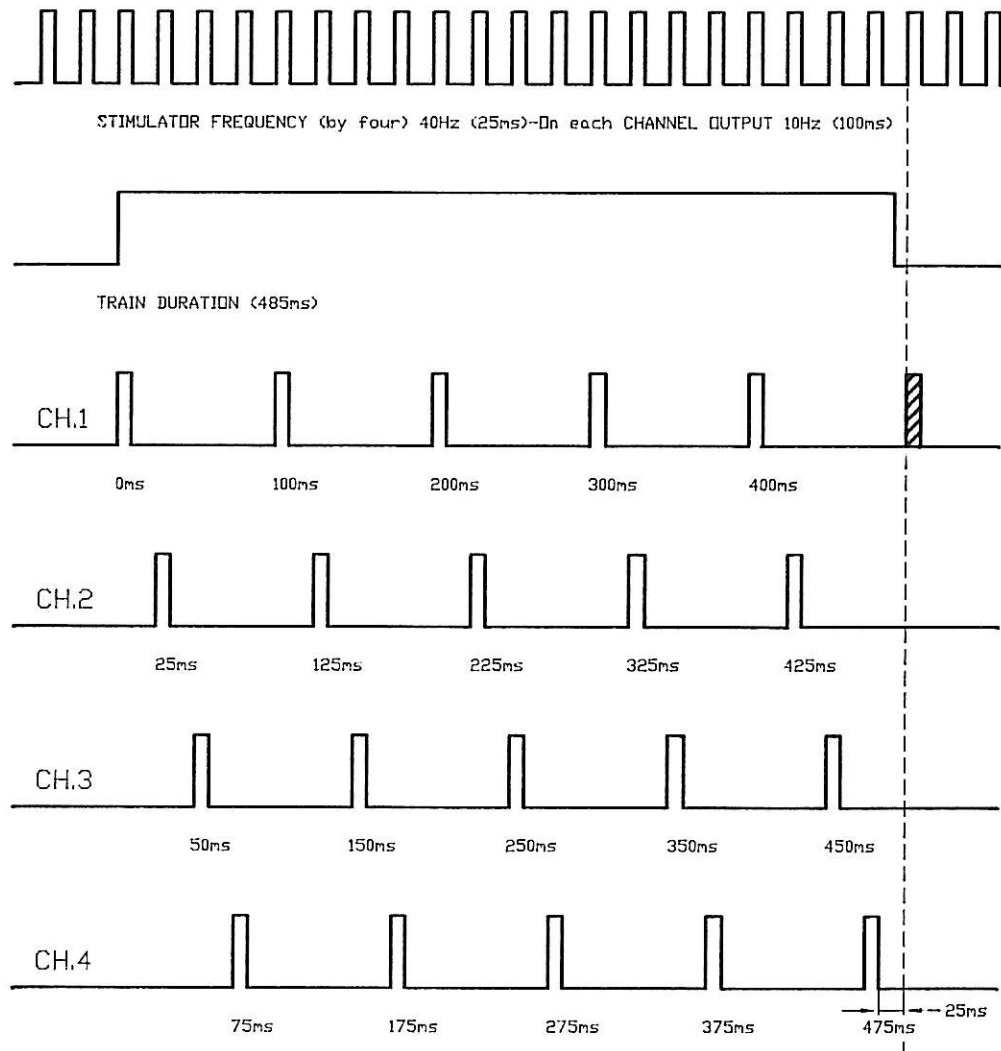
The graph clearly shows that the 5th pulse on channel 4 will take place at 475 ms delay.

To prevent the following pulse (delay = 500 ms, broken line pulse on channel 1 line) to trigger again the channel 1, the train duration preset on the Timer or on the Stimulator should be between 475 and 500 ms.

A simple formula will help to resolve each individual schedule, without the need to visualize the pulse pattern as shown in the previous example:

$$\text{MULTIPLEXER t.d.} = \text{Stimulator t.d.} + \left(3T + \frac{1}{2}T\right)$$

where: t.d. = desired train duration
 T = period = $\frac{1}{f}$



3.2 Connection of the Pulse Booster

The Stimulator output (10 Volts) goes to the two binding posts (RED & BLACK) placed on the back panel of the instrument, respecting polarity (PLUS-RED).

The input circuit forgives the wrong polarity connection because a protection diode has been wired ad hoc in the input circuit. In other words, wrong polarity does not lead to a damage, but inhibits the operation.

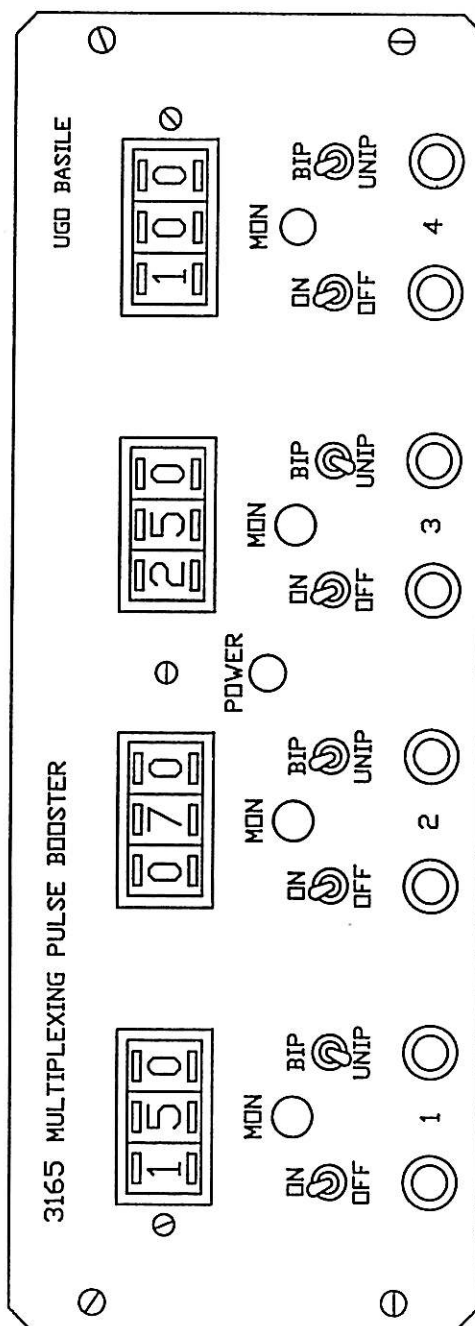


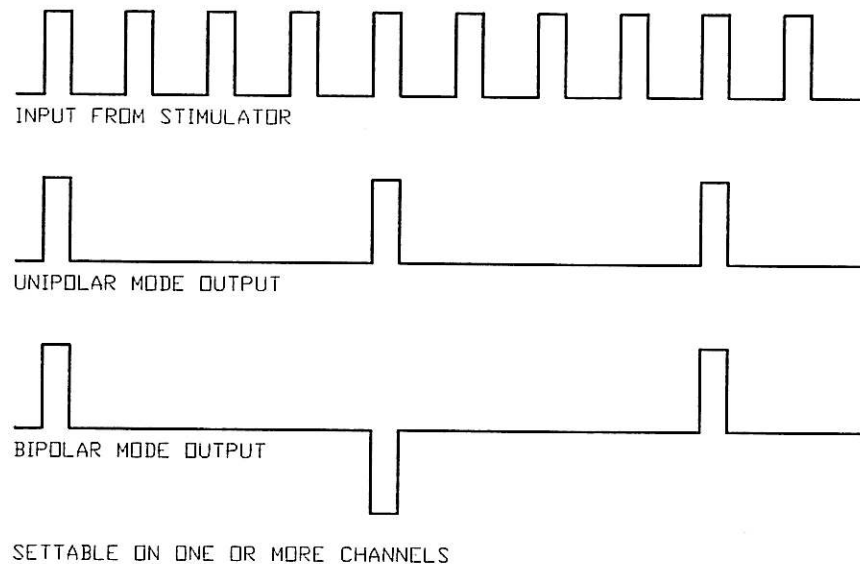
Fig. 1

DATE		12/01/93		SCALE	Q.TY	MACROING	UGO BASILE 21025 CONERIO VA - ITALY
DEATH		ZAGONEL M.		TOL	MATZGUL	FRONT	
REF	DATE	REF.	APPROD	FRONT PANEL			
A							
B							
C							
D							
E				MULTIPLEXING PULSE BOOSTER			

3.3 Setting the Pulse Booster

Set the current level of each channel via its individual 3-digit thumb-wheel switch.

The current output is adjustable in each channel to equal or different levels in the range 0-799 mA in 1 mA steps. These current levels are independent on the Stimulator output voltage.



Select the pulse mode, either unipolar or bipolar, see sketch. When operating on unipolar, the red binding post is PLUS.

The binding posts of each channel should be connected to their electrode pairs.

Each channel is provided with an ON-OFF switch.

3.4 Switching-On & Preliminary Check

Switch on both the Stimulator and the Pulse Booster. A green LED on the Pulse Booster front panel indicates that the power is ON.

If the current running through each electrode circuit corresponds to the set value, its LED "Monitor" lights.

A pulse shaping circuit has been provided to supply each LED with a longer pulse (about 1 s) when it monitors a pulse in the millisecond range, to make the light flash clearly visible. It

follows that in case of high pulse rate (over 1 Hz) the LED light is steady.

Pulse widths shorter than, say, 0.1 ms are in general not suitable for field stimulation: the combination of R-L-C (resistance-inductance-capacity) of the electrode circuit makes the waveform hard to reproduce, as they become dependent upon the length and loops of the connecting wires, the electrode distance, etc.

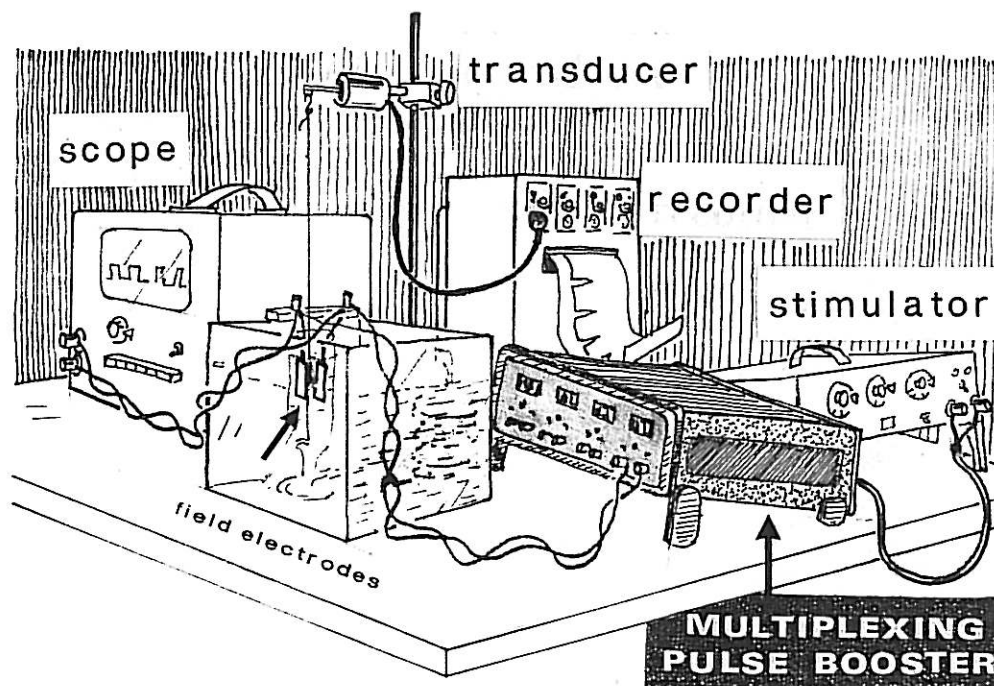
For lower rates (below 1 Hz) the 4 LEDs blink in sequence and the multiplexing is visualized.

In case one or more Monitoring LEDs do not light:

- 3.4.1 Check that the corresponding channel switch is ON.
- 3.4.2 Check the circuit continuity to clear a possible oversight, disconnected wire, etc.
- 3.4.3 Make sure that the circuit impedance is low enough to enable the Booster to perform its duty!

Example: you preset 100 mA; the Booster provides 45 V. If the LED does not light, it means the circuit impedance is over $45/0.1 = 450 \text{ Ohm}$.

3.5 Monitoring the Operation by the Oscilloscope



The attentive experimenter knows that, on what concerns Stimulator output, the proof that the pulses are actually delivered to

the electrodes and from the electrodes transmitted to the preparations, is given only by the pulses appearing on the "tube".

Connect the Oscilloscope (the job will be more comfortable if a storage model is available) across the electrodes and measure the voltage.

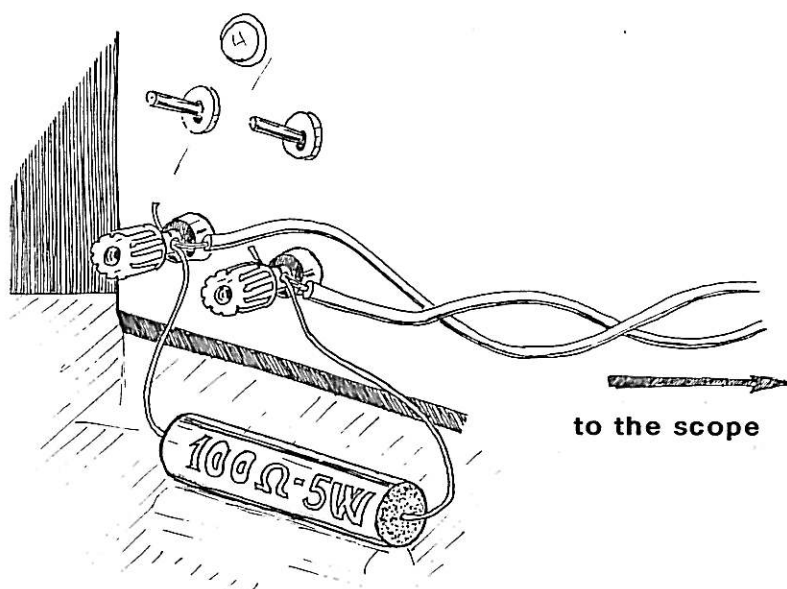
The pulses appearing on the tube ensure that the electrodes are not shorted (short circuit = zero voltage) and tell the experimenter the impedance (Z) of the preparation:

$$Z = \frac{V^*}{i}$$

V^* = amplitude in Volts of the pulses displayed by the oscilloscope

i = preset current

To check the calibration of the BOOSTER channel, disconnect the electrode wires (if any) and connect a non inductive resistance, say, 100 Ohm - 5 W, in parallel to its output binding post.



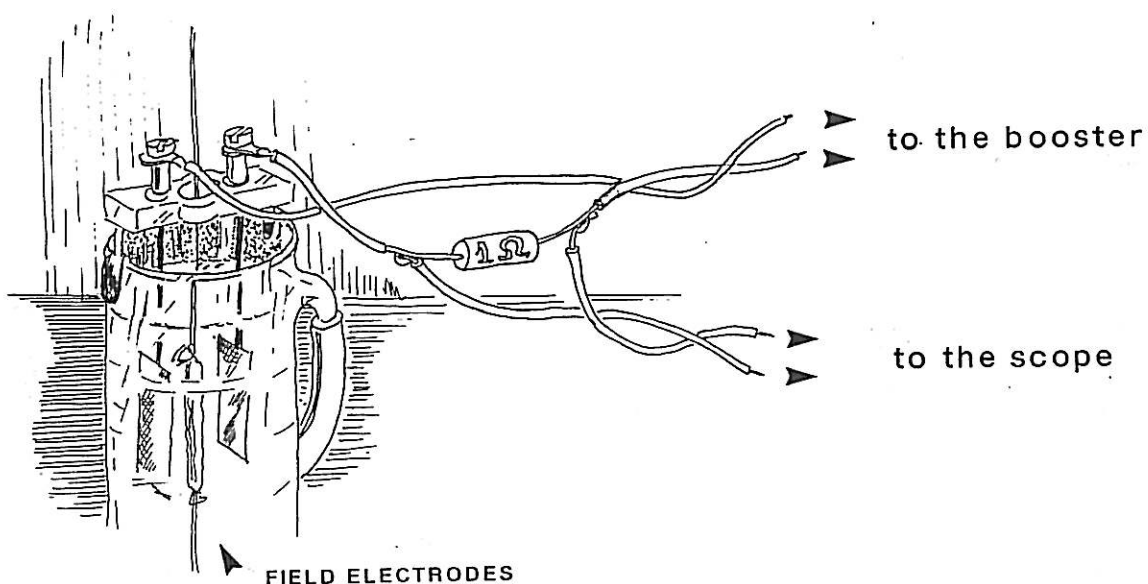
Preset a current of 100 mA. According to the Ohm's law, the voltage amplitude, on the Oscilloscope must be:

$$100 \text{ Ohm} \times 0.1 \text{ A} = 10 \text{ Volts}$$

It is also possible to monitor the current flowing through the preparation, by placing a small resistor (*), say, 1 Ohm - 1 W, in series to the electrodes.

* not inductive, hence a metal film, not a wire-wound type

Measure (by the Oscilloscope!) the voltage across it and calculate the current according to the Ohm's law.



4.0 ORDERING INFORMATION

3165 MULTIPLEXING PULSE BOOSTER, complete

7562 Dust Cover

3170 Power Cord

3135 Instruction Manual

4.1 Physical

Power Requirement : 110/220 V 50/60 Hz 50 VA max.

Dimensions : cm 26 (width) x 30 (depth) x 12 (height)

Weight : kg. 4.2

Shipping Weight : kg. 6.5 approx.

4.2 Options

4.2.1 Timer Cat. 3175

The Ugo Basile TIMER 3175 enables the researcher to pre-set "timed operation" to all instruments in which this feature is not provided.

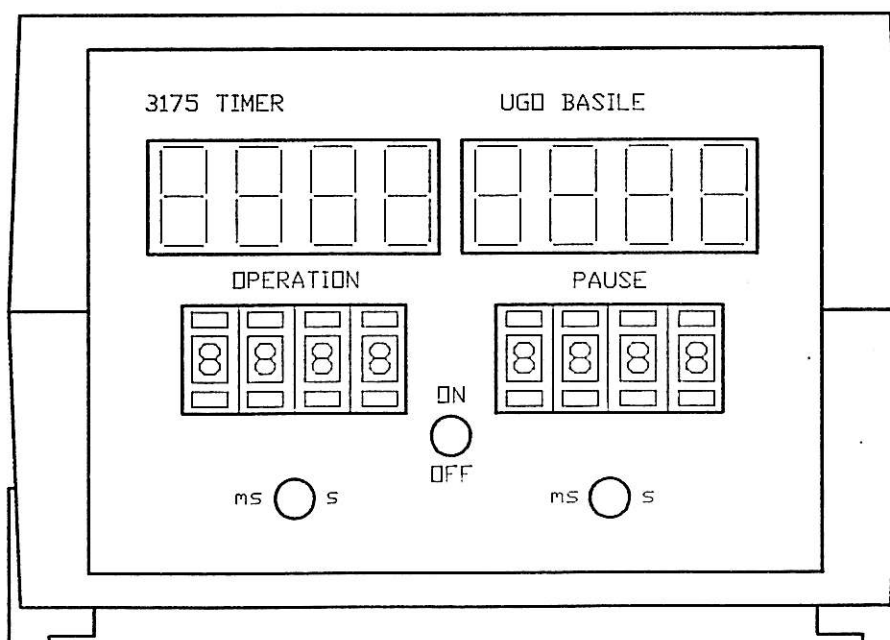
The 3175 can, for instance, time a single session of the Hole Board 6650 or of a behavioral cage (Skinner or Shuttle Box).

The 3175 can also generate repetitive operation periods each followed by a pause (TRAINS) in experiments involving an electric stimulation or the like, for example coupled to Cat. 3165 Multiplexing Pulse Booster.

The 3175 is linked to the instrument which has to be timed via a cable provided with a 3-pin Connei Connector: this cable supplies excitation voltage to the Timer and leads the timing signal to the instruments.

An ON-OFF switch located on the front panel activates the Timer: when in OFF position, the Timer is not operating but the displays remain on stand-by, indicating the preset time.

The OPERATION and PAUSE durations can both be set on the digital thumb-wheels, adjustable from 0000 to 9999 in steps of 1 second or millisecond, according to the position of the s/ms switches.



For single TIMED operation (non repetitive) it is advisable to set the desired OPERATION time on the corresponding thumb-wheels in s or ms and leave the PAUSE on the 9999 s value (9999s = 2h46'39").

The count-down displays show in real time the status of OPERATION and PAUSE durations.

Each time the ON/OFF switch is operated even momentarily, the Timer is reset and the OPERATION period starts from the beginning. In case different figures are set on the thumb-wheels, the fresh values are loaded in the memory. They will be shown on the display and become operative as soon a reset command is entered.

- 4.2.2 A Standard Field Electrode Pair (Cat. 3160) can be supplied. Special electrodes can be designed and manufactured on request. Please ask for details!

5.0 BIBLIOGRAPHY

- Marco Cosentino et alia: "Tonic Modulation of Neurotransmitter Release in the Guinea-pig Myenteric Plexus: Effect of μ and K Opioid Receptor Blockade and of Chronic Sympathetic Denervation" Neuroscience Letters 194: 185-188, 1995



WIRING DIAGRAMS

3165/01 (sh 1 of 2)	Wiring Diagram
3165/01 (sh 2 of 2)	Wiring Diagram
E-AM 114 (sh 1 of 5)	Electronic List
E-AM 114 (sh 2 of 5)	Electronic List
E-AM 114 (sh 3 of 5)	Electronic List
E-AM 114 (sh 4 of 5)	Electronic List
E-AM 114 (sh 5 of 5)	Electronic List
3165-001EC01	Board Component Layout
3165/04	Wiring Diagram
E-AM 115 (sh 1 of 2)	Electronic List
E-AM 115 (sh 2 of 2)	Electronic List
3165-001EC02	Board Component Layout
3165-001EA01	Wiring Layout
E-AM 214	Electronic List, <i>External components</i>
3175-175ES01	Wiring Diagram
3175-175EL01	Electronic List
3175-175EC01	Board Component Layout
3175-175ES02 (sh 1 of 2)	Wiring Diagram
3175-175ES02 (sh 2 of 2)	Wiring Diagram
3175-175EL02 (sh 1 of 2)	Electronic List
3175-175EL02 (sh 2 of 2)	Electronic List
3175-175EC02 (sh 1 of 2)	Board Component Layout
3175-175EC02 (sh 2 of 2)	Board Component Layout
3175-175EA02	Interconnection Diagram
3175-175EX01	Electronic List – <i>External Components</i>

checked on 23/12/2004



Customer Support

WIRING DIAGRAMS ARE NOT INCLUDED IN THE MANUAL, BUT ARE AVAILABLE ON REQUEST.

PLEASE ADDRESS TO OUR AFTER SALES SERVICE OR WITH OUR LOCAL DISTRIBUTOR, FOR ANY FURTHER INFORMATION YOU MAY DESIRE CONCERNING THE USE AND/OR MAINTENANCE OF THE MULTIPLEXING PULSE BOOSTER



UGO BASILE s.r.l.

Viale G. Borghi 43
21025 COMERIO – Varese, ITALY



Phone : +39 0332 744574



Fax : +39 0332 745488



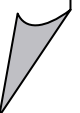
e-mail : service@ugobasile.com

Before sending any instrument to our factory for repair, we recommend you to get in touch with our service department to obtain a return authorization number (R.A.N.) and shipping/packing instructions.

We may not be held responsible for damages during transport due to poor packing. Whenever possible, please use the original packing.

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Notes

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**UGO BASILE S.r.l.**

BIOLOGICAL RESEARCH APPARATUS

Comerio - VA - ITALY

**DICHIARAZIONE CE DI CONFORMITA'
CE CONFORMITY STATEMENT****UGO BASILE S.R.L.****Produttore
Manufacturer**

Società / company

Via G. Borghi, 43 - 21025 Comerio, VA, ITALY

Indirizzo / address

+39 0332 744574 -+39 0332 745488

Telefono / phone

fax

SI DICHIARA CHE / WE HEREBY STATE THAT**Apparecchiatura
Instrument****MULTIPLEXING PULSE BOOSTER****Cat. No. 3165**

- È costruita in conformità alle DIRETTIVE DEL CONSIGLIO DELLE COMUNITÀ EUROPEE concernente il ravvicinamento delle legislazioni degli Stati Membri relative alla Bassa Tensione (73/23/CEE) e alla Compatibilità Elettromagnetica (89/336/CEE). *Is manufactured in conformity with the provisions of the EUROPEAN COMMUNITY COUNCIL directives for Low Voltage (73/23/CEE) and Electromagnetic Compatibility (89/336/CEE).*
- È costruita in conformità alle seguenti norme e specifiche tecniche armonizzate / *Conform the following directives and harmonized technical specifications:* EN 292, EN 1050, EN 60204-1, EN 61010-1, EN 61000-3-2, EN 61000-3-3, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-6-1, EN 61000-6-2, EN 61000-6-3, EN 61000-6-4.

Direttore Generale / DirectorUgo BasileResponsabile del Prodotto / Product ManagerNome / NameGennaio 2003Data / DateFirma / Signature

