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INSTRUCTION MANUAL

FE 281 LINEAR GATE

Valid for serial No : 500...

Approved : Si

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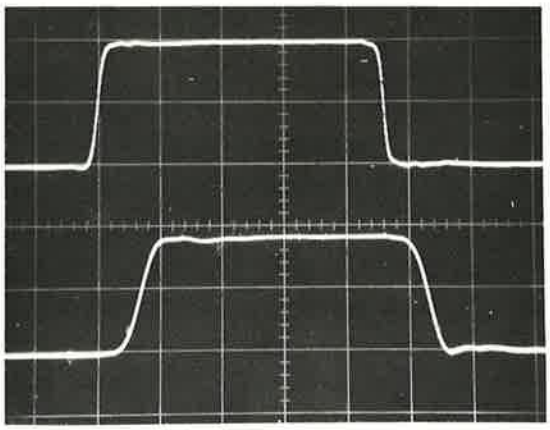
Linear Input and Output Signals

(measured with Sampling Scope, tr=0,35ns, 5ns/cm, 200 mV/cm, Gate Switch open)



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Purpose

This Linear Gate is intended to select and transmit linearly photo-multiplier pulses or other short pulses. It can also be used to sample voltage levels.

General Features

The gate, which is built in a single-width NIM-module, is entirely DC-coupled and can transmit linear signals of either polarity with a minimum of distortion.

There is no pulse shaping and the pedestal is practically zero.

The output is a current source which must be terminated by a resistance of less than a few hundred ohms.

The gate is opened by a NIM-Standard Logic signal, not shorter than 10ns, and is kept open as long as this signal is applied. It can also be kept permanently open by a switch on the front panel.

A recessed potentiometer on the front panel allows adjustments of transients.

Timing adjustments are facilitated by a push-button, which introduces, as long as the gate is open, a pedestal easily visible on an oscilloscope.

Brief Circuit Description

The input is transformed into a current pulse and, if too large, amplitude limited in the input limiter T4–T7 before being applied to the gating diodes D4–D7.

The gating diodes are controlled, via two emitter-followers T8–T9, by the gating signal shaper T12–T15, which provides the necessary symmetrical signal.

The DC level at the input is stabilized to zero by an input stabilizer T1–T3, since an offset voltage there would cause an undesirable pedestal on the output.

To avoid a pedestal it is also necessary to balance the collector currents of the transistors T5 and T7. This is done with the help of the output stabilizer T10–T11.

Both these stabilizers have a slow response, since they only are required to correct for slowly varying conditions.

SPECIFICATIONS

Linear Input	Impedance 50 ohms with less than 5% reflections below ± 1 V, less than 10% below ± 10 V from a signal with a rise-time of 1 ns. Maximum continuous input current 75 mA.
Linearity	0,25% over a range of ± 16 mA (= ± 800 mV).
Transmission Attenuation	Approximately 5%. Output limited to ± 22 mA.
Rise-Time	Less than 3 ns.
Output	Current source, which must have a DC return to ground of not more than 125 ohms.
Gating Signal Input	Impedance 50 ohms. Requires a negative signal between −400 mV and −3 V to open the gate. Minimum length is 10 ns, but there is no maximum limitation.
Repetition Rate	Higher than 50 Mc/s.
Pedestal	Adjustable to zero and stabilized to better than ± 0,5 mV over 50 ohms.
Signal Feed-Through	Less than 50 mV, capacitively differentiated, for an input signal of 10 V and 1 ns rise-time. Net charge is zero.
Power Consumption	+24 V / 80 mA −24 V / 80 mA

Specifications subject to minor changes without notice.

Adjustment Procedure

A. Instruments Required

1) Power supply ± 24V, min 100mA.
   Variable ± 0, 5V around nominal voltage.

2) Pulse generator HP 215 A or equivalent.

3) Attenuator HP 355 D (0 ÷ 120 dB).

4) Sampling oscilloscope.

5) VTVM HP 412 A or equivalent.

6) 50 ohm Termination, Lemo.

B. DC Adjustment Procedure

1) Put the two small potentiometers marked (C) and (D) and the front panel potentiometer to their middle positions.

2) Terminate the output with 50 ohm and connect supply voltages.

3) Adjust voltage at input to zero ± 0, 1mV with potentiometer marked (A).

4) Vary both supply voltages ± 0, 5V and check that input remains at zero ± 0, 5mV.

5) With the switch in position "GATED", check that output is at zero ± 0, 5mV. If not, the unit is faulty.

6) Put switch in position "OPEN" and adjust output DC level to zero ± 0, 1mV with potentiometer marked (B).

7) Vary both supply voltages ± 0, 5V and check that output remains at zero ± 1mV.

8) Press button marked "PEDESTAL". Output level should then be - 50mV ± 20%.

C. Pulse Adjustment Procedure

1) Connect gate output to oscilloscope input (50 ohm).

2) Put switch in position "GATED" and apply a pulse of - 700 mV 50 ns to GATE connector.

3) Minimize transients with the potentiometer marked (C). If leading and trailing edge transients have different amplitudes, they should be adjusted to be symmetrical around zero.

4) Minimize with potentiometer (D) as far as possible the two transients.

5) Repeat steps 3 and 4 until the transients are as small as possible (less than 50 mV, base line to worst peak).

Checks

1) Vary "GATE" signal amplitude between -400mV and -1, 6V and check that switching transients remain smaller than 50mV.

2) Vary supply voltages ± 0, 5V and check that transients remain smaller than 50mV.

3) Press the "PEDESTAL" button and verify that a negative pedestal of about 50mV amplitude is produced.

4) Remove the signal from the "GATE" connector and apply a pulse of approximately 700mV amplitude to "IN". With the switch in position "OPEN", check that output rise and fall times are shorter than 3ns (when input pulse has approximately 1ns rise and fall times). Check with both positive and negative pulses.

5) Put the switch to "GATED" and check that feed-through signals are smaller than 50mV (base-line to worst peak) when signal applied to "IN" is ± 10V (rise time 1ns).

6) Check power consumption

Supply Polarity	Switch Position	
	OPEN	GATED
+ 24 V	75 - 80 mA	80 - 85 mA
- 24 V	60 - 65 mA	75 - 80 mA

Part List

	Component		Value	Manuf.
R1 - 2	5%	1/4 W	10 K	AB
R3	"	"	1 K2	"
R4 - 5	"	"	3 K9	"
R6	"	"	1 K	"
R7	"	"	10 K	"
R8	"	"	4 K7	"
R9 - 10	"	"	10	"
R11 - 12	2%	"	2 K7	Metallux
R13 - 14	"	"	56	"
R15 - 16	"	"	47	"
R17	5%	"	47	AB
R18	"	"	330	"
R19 - 20	"	"	10	"
R21	"	"	18 K	"
R22 - 23	"	"	100	"
R24 - 25	2%	1/2 W	470	Metallux
R26	5%	1/4 W	100	AB
R27	"	"	68	"
R28 - 29	"	"	3 K9	"
R30	"	"	680	"
R31	"	"	470	"
R32 - 33	"	"	10	"
R35	"	"	270	"
R36 - 37	"	1/2 W	2 K2	"
R38 - 39	2%	1/4 W	5 K6	Metallux
R40 - 41	5%	"	12 K	AB
R42	"	"	12 K	"
R43	"	"	1 K	"
R44	"	"	10	"
R45 - 46	2%	"	5 K6	Metallux
R47	5%	"	560	AB
R48	"	"	470	"
R49	"	"	27	"
R50	"	"	56	"
R51	"	1/2 W	2 K7	"
R52	"	1/4 W	27	"
R53	"	"	5 K6	"
R54 - 55	"	"	10	"
R56 - 57	"	"	100	"
R58	"	1/2 W	1 K2	"
L1	2 turns of 0,6mm wire on a M6 x 6 Plexiglas Former (≃ 50 nH)			

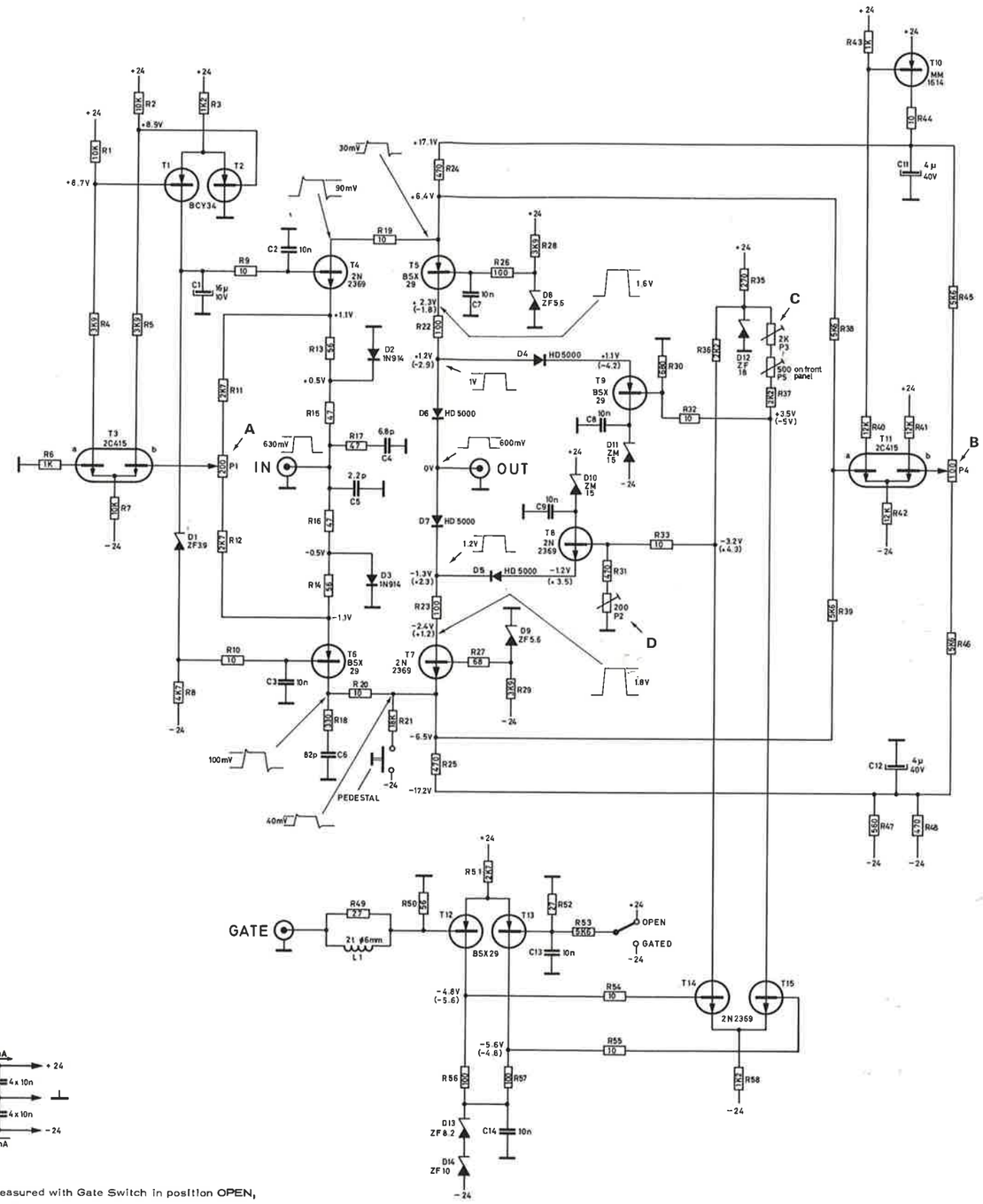
	Component	Value	Manuf.
P1	3/4W Helitrim	78P 200	Beckman
P2	1/2 W "	62PR 200	"
P3	1/2 W "	" 2K	"
P4	3/4W "	78P 100	"
P5	" "	78P 500	"
C1	Electrolyt.	16µ-10V	Phil.
C2 - 3	Ceram.	10n	LCC
C4	" mini.	6,8p	Phil.
C5	" "	2,2p	"
C6	" "	82p	"
C7	"	10n	LCC
C8 - 9	"	10n	"
C11	Electrolyt.	4µ - 40V	"
C12	"	4µ - 40V	"
C13	Ceram.	10n	LCC
C14	"	10n	"
C15 - 22	"	10n	"
D1	Zener	ZF 3,9	ITT
D2 - 3	Si Diode	1N 914	Hug.
D4 - 7	Si Diode	HD 5000	"
D8 - 9	Zener	ZF 5,6	ITT
D10 - 11	Zener	ZM 15	ITT
D12	Zener	ZF 18	"
D13	Zener	ZF 8,2	"
D14	Zener	ZF 10	"
T1 - 2	PNP Si	BCY34	Phil.
T3	Dual NPN Si	2C 415	SGS
T4	NPN Si	2N 2369	"
T5	PNP Si	BSX 29	"
T6	PNP Si	BSX 29	"
T7	NPN Si	2N 2369	"
T8	NPN Si	2N 2369	"
T9	PNP Si	BSX 29	"
T10	PNP Si	MM 1614	Mot.
T11	Dual NPN Si	2C 415	SGS
T12 - 13	PNP Si	BSX 29	"
T14 - 15	NPN Si	2N 2369	"

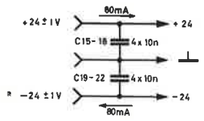
INPUT STABILIZER

INPUT SIGNAL LIMITER & GATE

GATING SIGNAL SHAPER

OUTPUT STABILIZER





Voltages are measured with Gate Switch in position **OPEN**,
Output terminated by 50 ohms.
Values in brackets : Switch in position GATED,

LINEAR GATE

FE 281

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DRAWING NO FE53

DEC 9 69 BERAGNUS