PHILIPS

Data handbook

PHILIPS

Electronic components and materials

Components and materials

Part 7a January 1979

Assemblies

COMPONENTS AND MATERIALS

Part 7a **January 1979**

Contents

DATA HANDBOOK SYSTEM

Our Data Handbook System is a comprehensive source of information on electronic components, sub-assemblies and materials; it is made up of three series of handbooks each comprising several parts.

ELECTRON TUBES	BLUE
SEMICONDUCTORS AND INTEGRATED CIRCUITS	RED
COMPONENTS AND MATERIALS	GREEN

The several parts contain all pertinent data available at the time of publication, and each is revised and reissued periodically.

Where ratings or specifications differ from those published in the preceding edition they are pointed out by arrows. Where application information is given it is advisory and does not form part of the product specification.

If you need **confirmation** that the published data about any of our products are the latest available, please contact our representative. He is at your service and will be glad to answer your inquiries.

ELECTRON TUBES (BLUE SERIES)

Part 1a	December 1975	ET1a 12-75	**Transmitting tubes for communication, tubes for r.f. heating** Types PE05/25 to TBW15/25
Part 1b	August 1977	ET1b 08-77	**Transmitting tubes for communication, tubes for r.f. heating, amplifier circuit assemblies**
Part 2a	November 1977	ET2a 11-77	**Microwave tubes** Communication magnetrons, magnetrons for microwave heating, klystrons, travelling-wave tubes, diodes, triodes T-R switches
Part 2b	May 1978	ET2b 05-78	**Microwave semiconductors and components** Gunn, Impatt and noise diodes, mixer and detector diodes, backward diodes, varactor diodes, Gunn oscillators, sub-assemblies, circulators and isolators
Part 3	January 1975	ET3 01-75	**Special Quality tubes, miscellaneous devices**
Part 4	March 1975	ET4 03-75	**Receiving tubes**
Part 5a	March 1978	ET5a 03-78	**Cathode-ray tubes** Instrument tubes, monitor and display tubes, C.R. tubes for special applications
Part 5b	December 1978	ET5b 12-78	**Camera tubes and accessories,image intensifiers**
Part 6	January 1977	ET6 01-77	**Products for nuclear technology** Channel electron multipliers, neutron tubes, Geiger-Müller tubes
Part 7a	March 1977	ET7a 03-77	**Gas-filled tubes** Thyratrons, industrial rectifying tubes, ignitrons, high-voltage rectifying tubes
Part 7b	March 1977	ET7b 03-77	**Gas-filled tubes** Segment indicator tubes, indicator tubes, switching diodes, dry reed contact units
Part 8	May 1977	ET8 05-77	**TV picture tubes**
Part 9	March 1978	ET9 03-78	**Photomultiplier tubes; phototubes**

SEMICONDUCTORS AND INTEGRATED CIRCUITS (RED SERIES)

Part 1a	**August 1978**	**SC1a 08-78**	**Rectifier diodes, thyristors, triacs** Rectifier diodes, voltage regulator diodes (> 1,5 W), transient suppressor diodes, rectifier stacks, thyristors, triacs
Part 1b	**May 1977**	**SC1b 05-77**	**Diodes** Small signal germanium diodes, small signal silicon diodes, special diodes, voltage regulator diodes (< 1,5 W), voltage reference diodes, tuner diodes
Part 2	**November 1977**	**SC2 11-77**	**Low-frequency and dual transistors**
Part 3	**January 1978**	**SC3 01-78**	**High-frequency, switching and field-effect transistors**
Part 4a	**December 1978**	**SC4a 12-78**	**Transmitting transistors and modules**
Part 4b	**September 1978**	**SC4b 09-78**	**Devices for optoelectronics** Photosensitive diodes and transistors, light emitting diodes, photocouplers, infrared sensitive devices, photoconductive devices
Part 4c	**July 1978**	**SC4c 07-78**	**Discrete semiconductors for hybrid thick and thin-film circuits**
Part 5a	**November 1976**	**SC5a 11-76**	**Professional analogue integrated circuits**
Part 5b	**March 1977**	**SC5b 03-77**	**Consumer integrated circuits** Radio-audio, television
Part 6	**October 1977**	**SC6 10-77**	**Digital integrated circuits** LOCMOS HE4000B family
Signetics integrated circuits 1978			Bipolar and MOS memories Bipolar and MOS microprocessors Analogue circuits Logic - TTL

COMPONENTS AND MATERIALS (GREEN SERIES)

Part 1	June 1977	CM1 06-77	**Assemblies for industrial use** High noise immunity logic FZ/30-series, counter modules 50-series, NORbits 60-series, 61-series, circuit blocks 90-series, circuit block CSA70(L), PLC modules, input/output devices, hybrid circuits, peripheral devices, ferrite core memory products
Part 2a	October 1977	CM2a 10-77	**Resistors** Fixed resistors, variable resistors, voltage dependent resistors (VDR), light dependent resistors (LDR), negative temperature coefficient thermistors (NTC), positive temperature coefficient thermistors (PTC), test switches
Part 2b	February 1978	CM2b 02-78	**Capacitors** Electrolytic and solid capacitors, film capacitors, ceramic capacitors, variable capacitors
Part 3	January 1977	CM3 01-77	**Radio, audio, television** Components for black and white television, components for colour television
Part 3a	September 1978	CM3a 09-78	**FM tuners, television tuners, surface acoustic wave filters**
Part 3b	October 1978	CM3b 10-78	**Loudspeakers**
Part 4a	November 1978	CM4a 11-78	**Soft ferrites** Ferrites for radio, audio and television, beads and chokes, Ferroxcube potcores and square cores, Ferrocube transformer cores
Part 4b	December 1976	CM4b 12-76	**Piezoelectric ceramics, permanent magnet materials**
Part 6	April 1977	CM6 04-77	**Electric motors and accessories** Small synchonous motors, stepper motors, miniature direct current motors
Part 7	September 1971	CM7 09-71	**Circuit blocks** Circuit blocks 100 kHz-series, circuit blocks 1-series, circuit blocks 10-series, circuit blocks for ferrite core memory drive
Part 7a	January 1979	CM7a 01-79	**Assemblies** Circuit blocks 40-series and CSA70 (L), counter modules 50-series, input/output devices
Part 8	February 1977	CM8 02-77	**Variable mains transformers**
Part 9	March 1976	CM9 03-76	**Piezoelectric quartz devices**
Part 10	April 1978	CM10 04-78	**Connectors**

Circuit blocks
40-Series and CSA70 (L)

INTRODUCTION

In any analogue system for instrumentation and control there are a number of basic functions. The units of the 40- and 70-Series have been developed to perform basic analogue functions, thus to save the system designer considerable time and costs.
Great care has been taken to make them versatile so that a greater part of the required functions in analogue systems can be performed without needing complex external circuitry.
Being capable of handling signals down to d.c. they are very reliable and operate with a high degree of stability.

These units find wide application in, for instance:

signal generating circuits
process and alarm circuits
closed-loop power control systems
A-D and D-A converters
electronic measuring instruments

The 40- and 70-Series comprise the following units:

DOA 40, Operational Amplifier
DZD 40, Differential Zero Detector
PSM 40, Phase Shift Module
CSA 70 (L) Chopper-stabilized operational amplifier.

OPERATIONAL AMPLIFIER

GENERAL

The DOA40 is a high gain, wide band, low drift d.c. differential amplifier. Input voltage offset can be externally corrected.
A 6 dB/octave roll-off network is built-in. Terminals are available to connect an external roll-off network.

This unit is developed for use with power supplies of 15 V. As many control systems use 12 V supplies, some data are given for use at these voltages at the end of the specification.

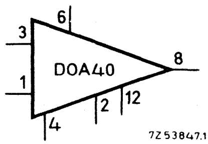


Fig.1. Drawing symbol

Dimensions in mm

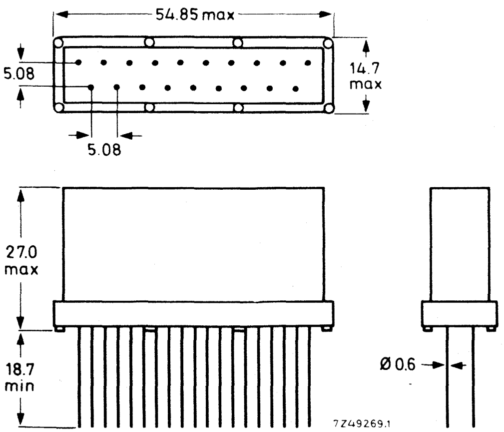


Fig.2.

The complete circuit is potted inside a metal can with 19 wire terminals. The can is internally connected to terminal 10 (0 V)

Circuit diagram and terminal location

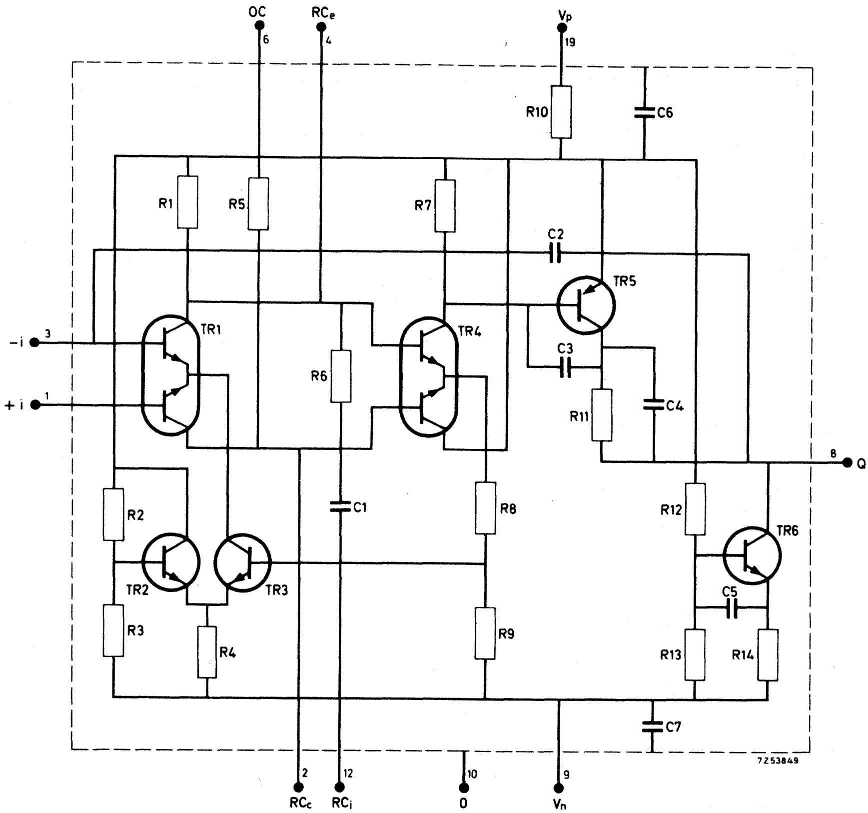


Fig.3. Circuit diagram

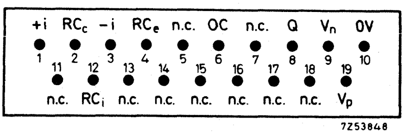


Fig.4. Terminal location

TECHNICAL PERFORMANCE

Ambient temperature range: operating	0 to +85 °C
storage	−40 to +85 °C
Max. case temperature	91 °C

Power supply

Supply voltages	V_P = +15 V ± 3% V_N = −15 V ± 3%
Supply currents	I_P = 10 mA + load current I_N = 10 mA + load current

Input data (ambient temperature +25 °C unless noted otherwise)

Open loop gain	minimum	typical
DC, max. load	25 000	60 000
DC, 100 kΩ load	100 000	150 000

Input voltage offset

Initial offset can be trimmed to zero by means of an external variable resistor of 15 kΩ between terminals OC and V_P

	maximum	typical
drift with temperature change (0 °C to +85 °C)	5 μV/deg C	3 μV/deg C
drift with supply voltage change		
for +15 V supply	7 μV/%	3 μV/%
for −15 V supply	3 μV/%	2 μV/%

Input current	maximum	typical
Each input: bias current	700 nA	300 nA
drift with temperature change (0 °C to +85 °C)	7 nA/deg C	3 nA/deg C
Differential: initial offset	35 nA	6 nA
drift with temperature change (0 °C to +85 °C)	1 nA/deg C	0.3 nA/deg C

Input impedance	minimum	typical
between inputs	75 kΩ	200 kΩ
common mode	60 MΩ	100 MΩ

Input voltage		
max. voltage between inputs	+5 and −5 V	
max. common mode voltage	+10 and −10 V	
common mode rejection	min. 20 000 typ. 60 000	
Voltage noise (16 Hz - 16 kHz)	3 μV (rms)	
<u>Output data</u>		
Output voltage (at a load current of 6 mA)	min. +10 V to −10 V	
Load resistance	min. 1.67 kΩ	
Output resistance	< 5 kΩ	
<u>Frequency response</u>		
Unity gain bandwidth (small signal)	min. 8.5 MHz	typ. 9.5 MHz
Full output response (20 V_{p-p}) with 10 kΩ load with 1.67 kΩ load	 min. 40 kHz min. 33 kHz	 typ. 60 kHz typ. 50 kHz
Slewing rate (R_{load} = 10 kΩ)	min. 2.5 V/μs	typ. 3.7 V/μs

<u>Specifications for the DOA40 used with 12 V supply</u>

If the DOA40 is used with 12 V supply, the specifications remain the same as those given for the 15 V supply, except those listed below.

Power supply voltages	V_P = +12 V ± 5% V_N = −12 V ± 5%
Power supply currents (load current and feedback current to be added)	I_P = 8 mA I_N = 8 mA
Input currents	multiply the data given for 15 V supply by 0.8
Common mode voltage	+8 V, −8 V
Output voltage at a load current of 5 mA	+9 V, −9 V
Load resistance	1.8 kΩ (min.)

APPLICATION INFORMATION

When used in a follower circuit, the DOA40 may exhibit instability. To avoid this, it is good practice to insert a 10 kΩ resistor between the signal source and the amplifier input.

The characteristics of the DOA40 are such that adaption circuitry is unnecessary for most applications. However, three special situations which are sometimes encountered - comparatively small input currents, comparatively large output capability, and the need to adjust input current to zero - can also be handled by the DOA40 with the simple adaption circuits described below.

Reduction of input current and increase of input impedance

The dual transistor BCY87 connected as an emitter-follower in the circuit of Fig.5 can be used to reduce the input current to 40 nA per input and increase the input impedance to 15 MΩ between inputs (typical values).

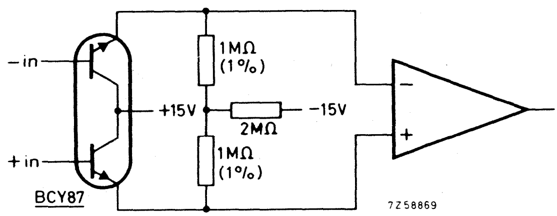


Fig.5. Configuration giving reduced input current and increased input impedance. The component values given are typical.

The characteristics of the circuit are given below. Other characteristics not listed are those of the DOA40 unit alone.

Supply voltage rejection (both supplies)	typical	80 μV/V
Input voltage, drift with temperature change	typical	5 μV/deg C
	maximum	10 μV/deg C
Input current / each input		
bias current	typical	40 nA
	maximum	60 nA
drift with temperature change	typical	0.25 nA/deg C
/ differential		
initial offset	typical	4 nA
	maximum	6 nA
drift with temperature change	typical	0.1 nA/deg C
Input impedance between inputs,	typical	15 MΩ
	minimum	10 MΩ
common mode	typical	600 MΩ
Common mode rejection	typical	10 000
Unity gain bandwidth	typical	6.5 MHz
Full output frequency (20 V_{p-p})	typical	40 kHz

Increase of the output capability

The circuit of Fig.6 is capable of delivering 50 mA at +10 V and −10 V. The output can be short-circuited momentarily without causing damage to the circuit. Feedback networks if used should be connected to the circuit output, not the DOA40 output.

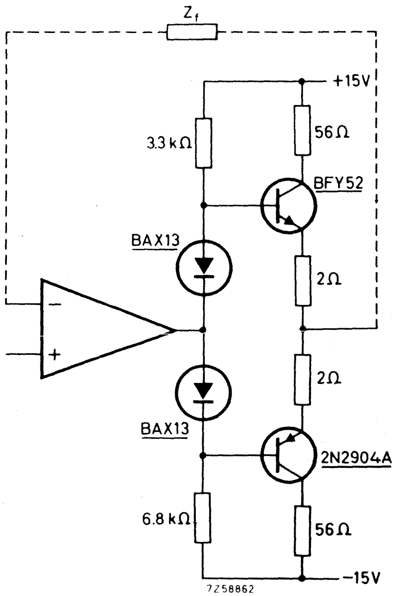


Fig.6. Configuration giving increased output capability.

Zero adjustment of input current

Each DOA40 input requires a bias current of 700 nA to give zero output voltage. By supplying this bias current from an external source, the DOA40 output can be made zero for a driving signal current equal to zero.

In Fig. 7a the negative input (pin 3) is to be so adjusted. A 10 MΩ resistor should be connected between the output and pin 3, and the potentiometer adjusted so that the output voltage of the DOA40 becomes equal to zero. The 10 MΩ resistor should then be removed.

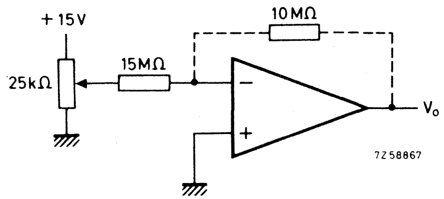


Fig. 7a. External supply of bias current: adjustment of negative input.

The positive input (pin 1) may now be adjusted with the circuit of Fig. 7b. Connect pin 3 to the DOA40 output, and the 10 MΩ resistor between pin 1 and ground. The potentiometer can now be adjusted so that the DOA40 output becomes zero. Disconnect the 10 MΩ resistor.

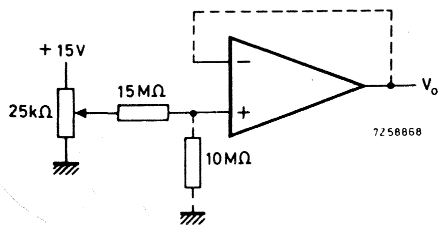


Fig. 7b. External supply of bias current: adjustment of positive input.

DIFFERENTIAL ZERO DETECTOR

GENERAL

This unit can be used as a zero detector, voltage comparator, polarity detector, adjustable discriminator or differential amplifier.
Its feature of offering compatible signals for digital systems (e.g. composed of circuit blocks of the 10- Series) makes this unit a natural interface in hybrid systems.
The DZD 40 has been used succesfully in a wide range of instruments and control systems:

- digital to analogue and analogue to digital converters
- flux meter with digital read out
- automatic pH control system
- electronic potentiometer
- voice or no-voice detector
- automatic frequency characteristic testing
- over and under voltage detection
- over-dissipation switch in transmitter power stage
- servo control
- gas leak detector.

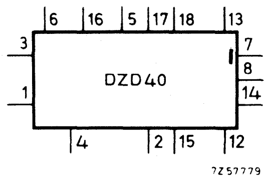
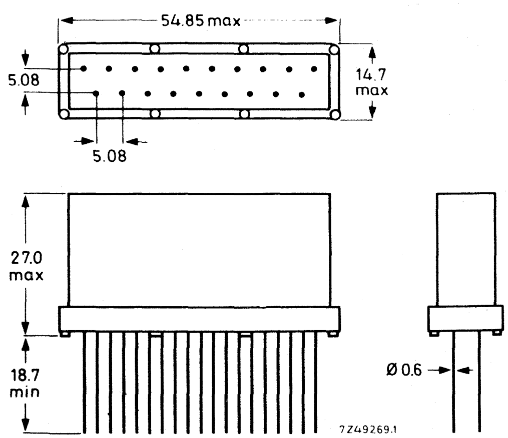


Fig.1 Drawing symbol

Dimensions in mm



The complete circuit is potted inside a metal can with 19 wire terminals.
The can is internally connected to the 0V supply (terminal 10).

Fig.2

Ambient temperature range

	operating	0 to 70 °C
	storage	-40 to +85 °C

Power supply

Supply voltages: $V_P = +12V \pm 5\%$, $V_N = -12V \pm 5\%$ or $V_P = +15V \pm 1\%$, $V_N = -15V \pm 1\%$ ($V_V = V_B = V_{P'}$ = approx. V_P)

Nominal consumed current at nominal values of V_P and V_N: $I_P = 6$ mA, $I_N = 8.3$ mA

CIRCUIT DESCRIPTION

The differential zero detector comprises a two stage d.c. - coupled differential amplifier followed by an OR-gate and an inverting amplifier.
A voltage difference between the input terminals W_1 and W_2 is amplified about 1000 x by the two stage complementary differential amplifier (TR_1, TR_2, TR_3, TR_4). This amplified voltage difference is applied to the bases of TR_6 and TR_7.
As long as $|V_{A1} - V_{A2}|$ is less than a certain voltage, TR_5 is conducting.
If this voltage is exceeded TR_6 or TR_7 becomes conducting, the base current of TR_5 (via R_{10}) diminishes, the voltage across R_{14} goes up and TR_5 is cut off. So if the input voltage difference between W_1 and W_2 has a certain value either TR_6 or TR_7 are conducting (depending upon the polarity of $|V_{W_1} - V_{W_2}|$) and TR_5 is not conducting. From this it can be seen that V_{Q_1} and V_{Q_2} are in phase opposition with regards to V_{W_1} and V_{W_2}.

Truth table

inputs		outputs		
W_1	W_2	Q_1	Q_2	Q_3
high	high	high	high	low
high	low	low	high	high
low	low	high	high	low
low	high	high	low	high

High-high and low-low in the input rows indicate that signals applied to the inputs differ less than the trip value.

High-low and low-high in the input rows indicate that the voltage difference applied to the input exceeds the trip value.

In the output columns, high stands for +12 V and low for 0 V approximately.

It will be noticed that only one output terminal will be low for any input combination.

Current mode switching (no bottoming of transistors) is used to obtain high switching speeds and to reduce loading of the amplifier.
For this reason the terminals Q_1 and Q_2 should be connected to terminal 0 V if not used and they should be clamped with diodes (as for TR_5) if they are used.

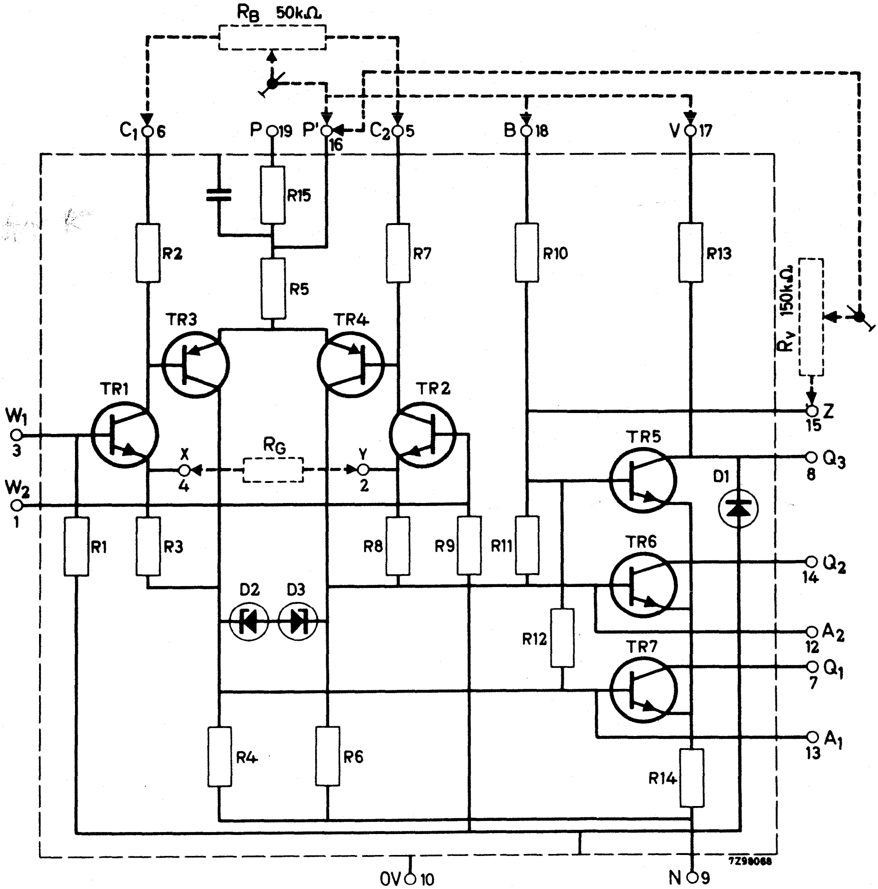


Fig.3. Circuit diagram

Terminal P' should be connected to terminal B for fixed bias or to variable resistor R_V for fine-gain adjustment.

Avoid a shortcircuit between terminals Q_3 and N, as this will damage diode D_1.

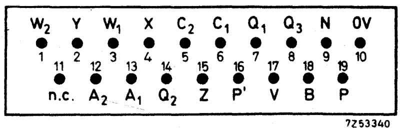


Fig.4. Terminal location

Oscillograms of some voltages with an input voltage of 8 mV_{p-p}, 100 kHz, are shown in the figures below.

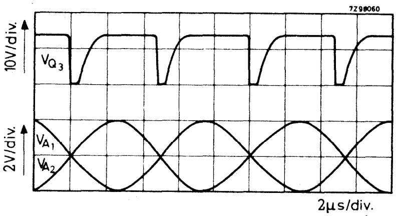


Fig.5

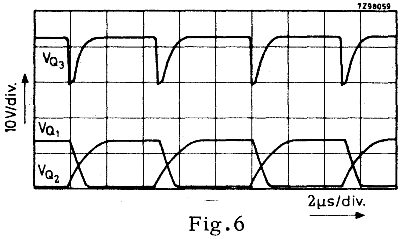


Fig.6

INPUT DATA

Differential off-set voltage after balancing (see "Initial adjustments")	0.1 mV
Voltage drift as a result of a change in temperature, measured at a source impedance of 10 kΩ	
typical value	3 µV / deg C
maximum value	5 µV / deg C
Differential sensitivity ($\|V_{W_1} - V_{W_2}\|$)	adjustable by means of gain control resistor R_G between X and Y; see graphs below.

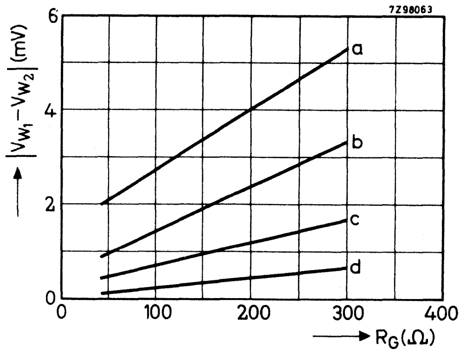


Fig. 7

The curves a and d are worst case limits at T_{amb} = 0 °C.
Curve a applies to the minimum input signal at which TR_5 or TR_6 is conducting (V_{Q1} or V_{Q2} is low) and TR_7 is not conducting (V_{Q3} is high).
Curve d applies to the maximum input signal at which TR_5 or TR_6 is not conducting (V_{Q_1} and V_{Q_2} are high) and TR_7 is conducting (V_{Q_3} is low).
The curves b and c give typical values at T_{amb} = 25 °C.
Curve b : as a.
Curve c : as d.

η = input requirement factor for frequencies over 100 kHz (1.8 at 200 kHz, 1 up to 100 kHz)

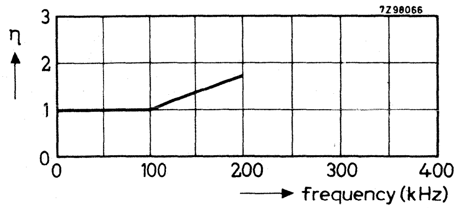


Fig.8

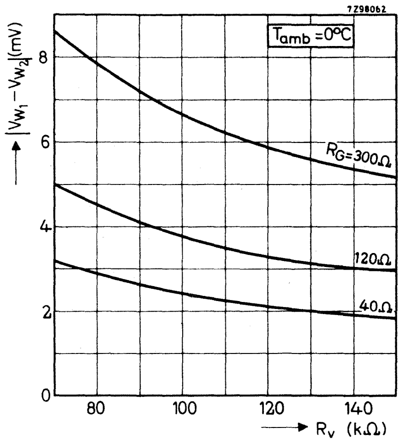


Fig. 9

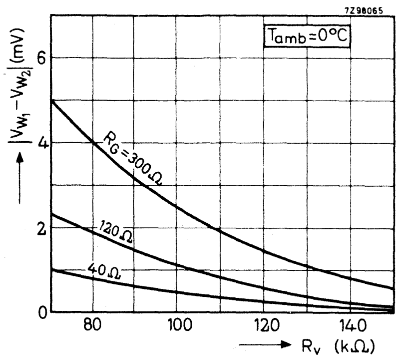


Fig. 10

The curves apply to the minimum input signal at which TR_5 or TR_6 is conducting (V_{Q1} or V_{Q2} is low) and TR_7 is not conducting (V_{Q3} is high).

The curves apply to the maximum input signal at which TR_5 and TR_6 are not conducting (V_{Q1} and V_{Q2} are high) and TR_7 is conducting (V_{Q3} is low).

Maximum value of $\lvert V_{W1} - V_{W2} \rvert$ to avoid extra delays	700 mV
Maximum voltage between input terminals	5 V
Frequency range	0-200 kHz. From 100 to 200 kHz the differential sensitivity reduces; the input voltage must be multiplied by the factor η (see Fig.8)
Maximum common mode voltage	$\pm$ 2V
Common mode rejection $\lvert V_{A1} - V_{A2} \rvert$ (typical value)	80 dB
Differential off-set current	< 30 nA
Current drift as a result of a change in temperature (typical value)	1 nA / deg C

Differential input resistance (R_i)	see Figs.11 and 12
Common mode impedance (typical value)	1.2 MΩ

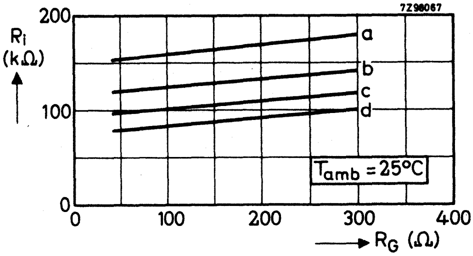


Fig.11

Curve a : typical differential input resistance
Curve b : typical input resistance between each input and 0 V
Curve c : minimum differential input resistance
Curve d : minimum input resistance between each input and 0 V

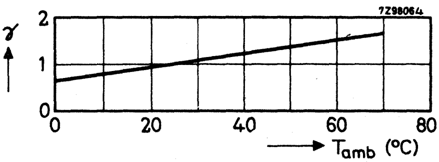


Fig.12. $\gamma = \dfrac{R_i \text{ at } T_{amb}}{R_i \text{ at } T_{amb} = 25\ ^oC}$

OUTPUT DATA

Outputs A_1 and A_2

Voltage gain	see Fig. 13
Maximum undistorted voltage $V_{A_1} = -V_{A_2}$	1 V
Band width at 3 dB	0 - 150 kHz
Minimum load resistance	100 kΩ

Outputs Q_1 and Q_2 *)

Maximum current at $V_Q > 0V$ **)	3.5 mA
Load resistance	3.6 kΩ

Output Q_3

	V and P' interconnected	V and P' not interconnected
Maximum current	2.5 mA	3.5 mA
Load resistance	5 kΩ	3.6 kΩ

*) If the outputs Q_1 and Q_2 are not used these terminals should be connected to terminal 0 V.

**) Clamp diodes (e.g.BAX13, BAY38, 1N4009) must be externally connected to Q_1 and Q_2.

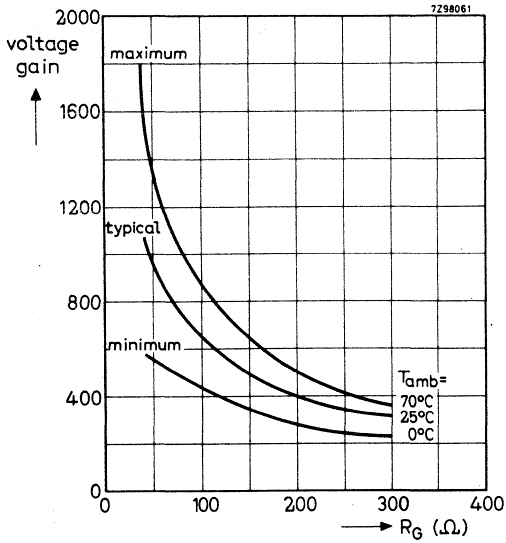


Fig.13

APPLICATION INFORMATION

Application hints

1. Avoid a shortcircuit between the terminals Q_3 and N as diode D_1 (see diagram) will be damaged.
2. In order to avoid instabilities due to transient switching voltages arising on supply lead inductance, the supply terminals N and P should be decoupled directly to terminal 0 V by means of low inductance capacitors.
3. For slowly diminishing voltages below the trip level the dv/dt of the zero going output at Q_3 will be approximately 10000 times as that of the input signal. In case a faster dv/dt is required, the voltage at Q_3 should be applied to a pulse shaper (e.g. PS10, PS20).
4. The terminals Q_1 and Q_2 provide signals that can in most cases directly be used to trigger units of the 10- and 20- Series or logic circuits having similar input requirements.
5. In circuits where high voltages might be detrimental, it is good practice to protect the inputs by an antiparallel diode circuit, thereby limiting the voltage.
6. If possible, arrange the circuit so as to avoid common mode voltage presence on inputs.
7. With a.c. input signals of over 10 kHz a capacitor of 2200 pF should be connected to the terminals Z and 0 V. Then only d.c. common mode voltage is allowed.
8. If terminal V is left unconnected the resistance load on Q_3 can be 3.6 kΩ.

Initial adjustments

Minimum off-set voltage

Connect a trimming potentiometer (R_B, see diagram) of 50 kΩ to the terminals C1 and C_2, slider to terminal P'. Place the slider in the centre position.
Short circuit the input terminals W_1 and W_2.
Connect a resistor to the terminals X and Y to obtain the desired gain (see "Sensitivity", next section).
Connect a d.c. millivoltmeter with high input impedance or an oscilloscope to the terminals A_1 and A_2; the meter or the oscilloscope must be floating.
Apply the supply voltages; allow a few minutes for block temperature distribution to reach a stable value of reading of the amplified off-set voltage on the millivoltmeter.
Correct the off-set voltage by turning the slider of the trimming potentiometer in such a way that minimum reading on the meter or the oscilloscope is obtained. When reading comes below 20% of full-scale value, switch to higher meter sensitivity. A correct adjustment will show a final value of a few millivolts, depending upon the actual gain.
Observe the voltmeter or oscilloscope for some time after balancing has been obtained; the reading should be stable.
Remove the shortcircuit of the input terminals and remove the voltmeter or the oscilloscope. Leave the slider of the potentiometer in optimum position.

Notes - In case no particular requirement for balance is to be met, the trimming potentiometer can be replaced by resistors having the value found during the balance procedure.

Un-balance will give unequal output wave shapes on Q_1 and Q_2 as well as an alternation of two forms on Q_3 with a sinusoidal input voltage.

Sensitivity

Coarse adjustment can be done by connecting a resistor (R_G, see diagram) to the terminals X and Y; if a trimming potentiometer of 500 Ω is used for this purpose the gain can be set over a wide range. The terminals P' and B must be interconnected. For the correct value of R_G, see Fig. 7. After the resistor between the terminals X and Y has been adjusted, fine adjustment can be done by disconnecting terminal P' from terminal B and by connecting a variable resistor (R_V) of 150 kΩ to the terminals Z and P' (without influencing the input impedance).

APPLICATION SUGGESTIONS

Low voltage zero detector giving zero output at zero input

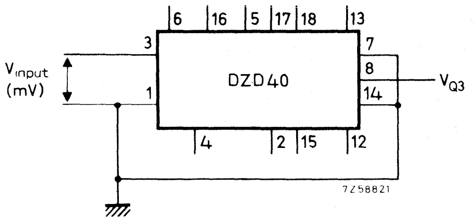


Fig.14

$V_{input} \ll 5\ V_{P-P}$ or $5\ V_{dc}$
$V_{Q3} = +V_{supply}$ as long as V_{input} is higher than the trip level.
$V_{Q3} = 0$ V as V_{input} has reached the trip level.
If V_{input} is an a.c. signal V_{Q3} will be high apart from the zero crossing points i.e. the unit acts as a bidirectional pulse shaper, see Fig.15.

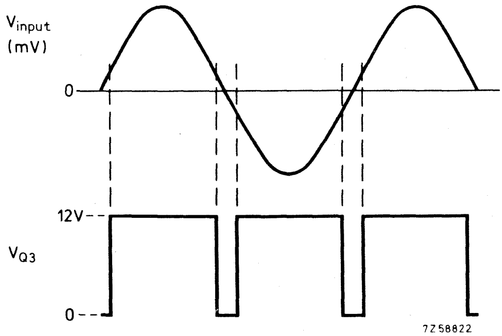


Fig.15

High voltage zero detector giving zero output at zero input

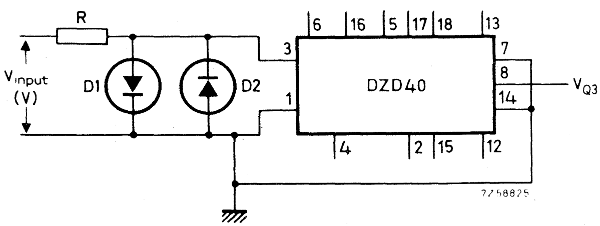


Fig.16

$V_{Q3} = +V_{supply}$ as long as V_{input} is higher than the trip level. $V_{Q3} = 0$ V as V_{input} has reached the trip level. If V_{input} is an a.c. signal V_{Q3} will be high apart from the zero crossing points i.e. the unit acts as a bi-directional pulse shaper (see Fig.15). D_1 and D_2 limit the input voltage. R serves to stay safely within diode current limits and loading of signal source possibilities.
If input frequency exceeds 10 kHz a capacitor of 2200 pF should be connected to the terminals Z and P' (see Figs.3 and 4).

Low voltage zero detector giving complementary outputs

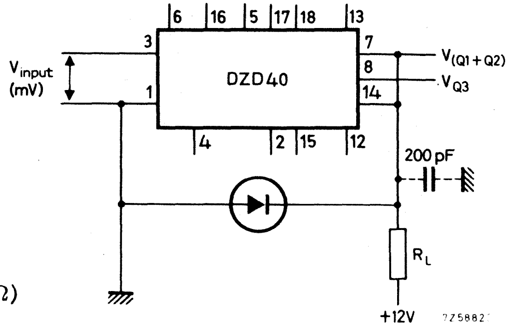


Fig. 17
(R_L = min. 3.6 kΩ)

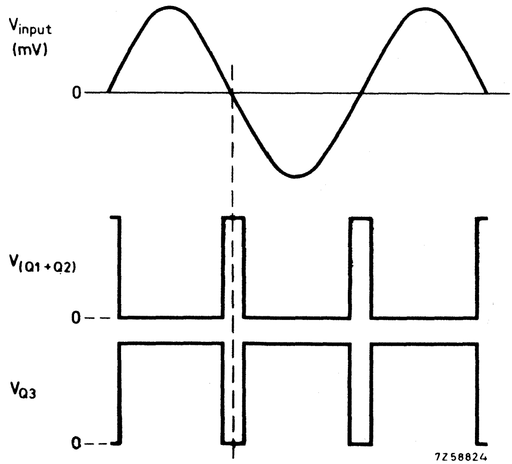


Fig. 18

V_{Q3} may be obtained as well with this circuit, but then it is advisable to give Q_1 and Q_2 a capacitive load of 200 pF or more.

High voltage zero detector giving complementary outputs

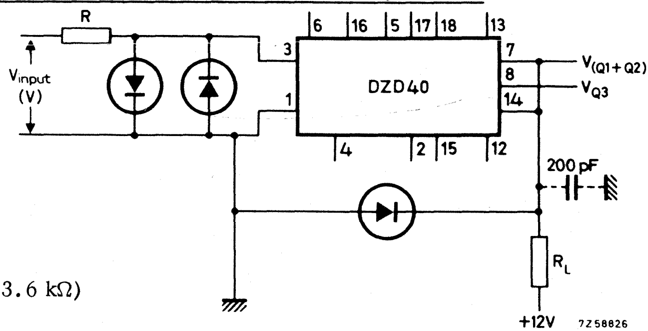


Fig. 19
(R_L = min. 3.6 kΩ)

Low voltage comparator giving zero output at zero difference input

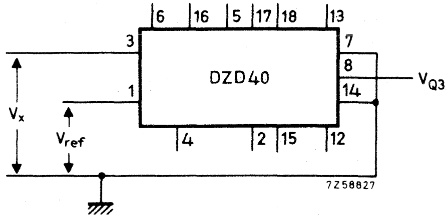


Fig. 20

V_x and $V_{ref} < 1$ V

$V_{Q_3} \approx 0$ V, if $|V_x - V_{ref}| <$ trip level

Low voltage comparator giving high output at zero difference input

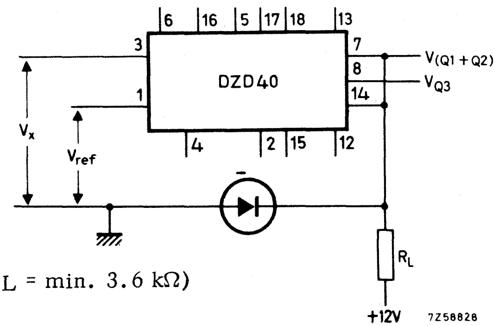


Fig. 21. (R_L = min. 3.6 kΩ)

$V_{(Q1 + Q2)}$ = high if $|V_x - V_{ref}|$ = 0 V.

High voltage comparator for d.c. voltages

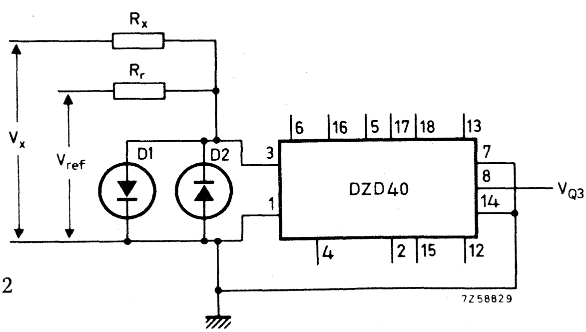


Fig. 22

The outputs can also be arranged as in Fig. 21.

This circuit avoids common mode difficulties. The clamping diodes D_1 and D_2 are to be used if the voltage between 3 and 1 could possibly exceed 5 V.

Note - V_{ref} and V_x are to be operating in series (i.e. not opposition).

Calculation of R_x and R_r.

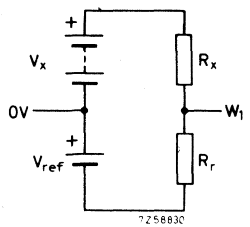


Fig. 23

The voltage between the terminals 0V and W_1 will be zero if

$$\frac{V_x}{V_{ref}} = \frac{R_x}{R_r}$$

R_x and R_r can be selected taking into account the loading of the sources V_r and V_x.

Example - V_x is a potential between + 60 and + 95V with respect to the 0V line. V_r is a properly connected reference source of 5 V. Both sources can be loaded with 1mA max.

It is desired to produce a positive output signal whenever V_x = 80 V. As $V_x$max = 95V, the total voltage across $R_x + R_r$ is max. 100V. To stay within loading $R_x + R_r$ must be approx. 100 kΩ.

Furthermore $\frac{R_x}{R_r} = \frac{80}{5}$ for zero detection at 80 V, so $R_x = 16\ R_r$.

When R_r = 6.8 kΩ a trimming potentiometer of 150 kΩ can be used for R_x. The output can be taken from $(Q_1 + Q_2)$ as in Fig. 21.

Polarity detector

Use is made of the terminals Q_1 and Q_2, if desired terminal Q_3 can be used to indicate zero difference input.

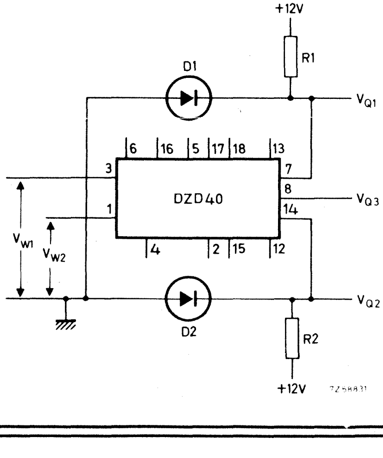


Fig. 24

V_{Q_1} is low, if W_1 (terminal 3) is high.
V_{Q_2} is low, if W_2 (terminal 1) is high.

Clamping diodes across the inputs can be omitted if the input voltages are $< 1\ V_p$.

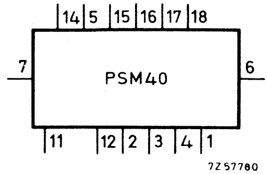
This circuit is extremely useful in servo control, direction determination and tolerance automation.

To avoid common mode influence V_{W_1} and V_{W_2} should be made lower than 2V (resistive step down).

PHASE SHIFT MODULE

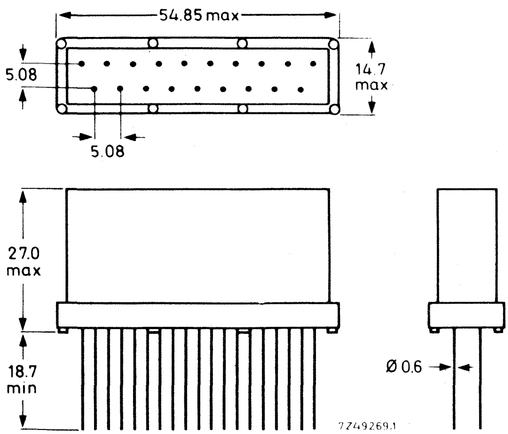
GENERAL

This phase shift module is designed for use in conjunction with a trigger source for the control of the conduction angle of thyristors.
It can be used in single-phase, half- or full-wave applications for control of thyristors operating with an a.c. supply of 15 to 10 000 Hz. The control range is better than 10 to 170°. Three PSM's can be synchronised for 3-phase full-wave control.
An important feature is that one can make a choice between two operation modes, i.e. either linear control of conduction angle by means of a control voltage or linear control of the average voltage across the thyristor load (cosinusoidal control). In the latter case the average thyristor load voltage can be made independent of the a.c. supply voltage (see "CONTROL FACILITIES").



Drawing symbol

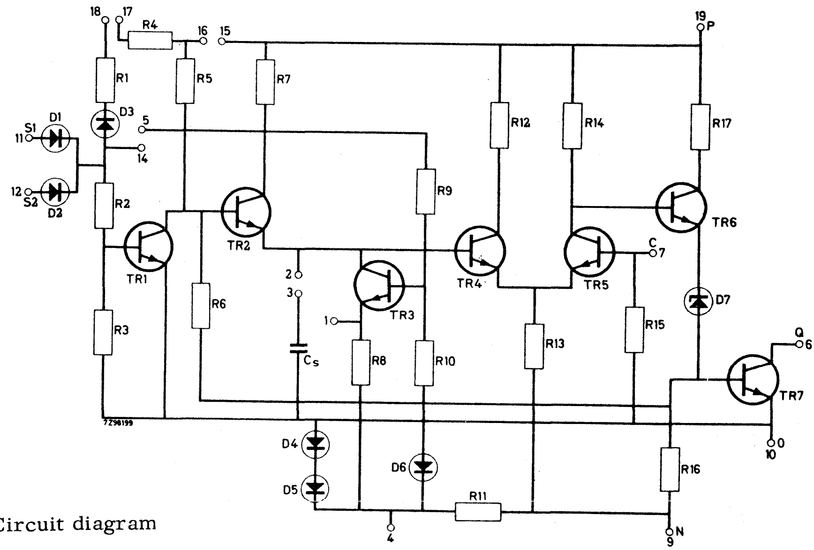
Dimensions in mm



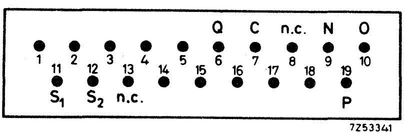
The complete circuit is potted inside a metal can with 19 wire terminals.

CIRCUIT DESCRIPTION

For operation on 50 Hz, terminals 2 and 3 have to be interconnected. Transistor TR_1 is conducting during most of the period that the synchronization voltages are present on S1 and S2. Thereby the collector of TR_1 will be at a low voltage, therefore TR_2 will be non conducting during the time that TR1 conducts. As soon as the value of the synchronization voltage becomes lower than the diode forward voltage drop (around the zero crossing of the synchronization signal) TR_1 ceases to conduct, TR_2 rapidly charges C_s. A few electrical degrees after synchronization zero TR_1 becomes conducting again, TR_2 cuts off.
TR_3 discharges C_s during the half cycle to zero volts. TR_4 and TR_5 constitute a long tailed pair comparator. As long as the voltage to the base of TR_4 exceeds that applied to TR_5, TR_4 is conducting and TR_5 is off. Consequently base current will flow to TR_6 through R_{14} and TR_6 will conduct. The emitter current of TR_6 drives TR_7 into saturation so that the output Q will be at a low potential for the time that the voltage on point 2 is higher than that applied to the control input terminal C.
The discharge of C_s as a function of time can be made linear by means of TR_3 acting as a constant current discharger or cosinusoidal discharger by using different circuit connections.



Circuit diagram



Terminal location

TECHNICAL PERFORMANCE

Operating temperature range	−25 to +85 °C
Storage temperature range	−40 to +85 °C

Power supply

Supply voltage	V_p = + 12 V ± 5%, V_N = −12 V ± 5% or V_p = + 12 V + 10%, V_N = −12 V + 10% or V_p = + 12 V − 10%, V_N = −12 V − 10%
Consumed current	I_p = I_N = approximately 10 mA (excluding load current)

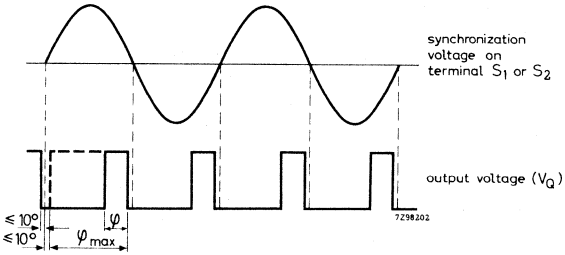
Note - As the output voltage V_Q is dependent upon switch on sequence and rise time of the supply voltages, it is recommended to short circuit terminal Q temporarily to terminal 0 when switching on.

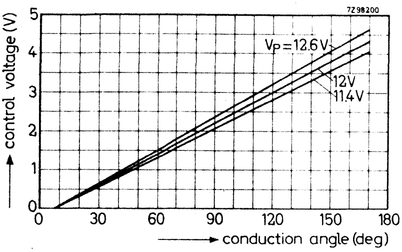
Input data

Control voltage (V_c)	
absolute maximum	5 V
absolute minimum	0 V
Control current (I_c)	0.5 to 0.33 mA
Maximum wiring capacitance at the control input (terminal C)	200 pF

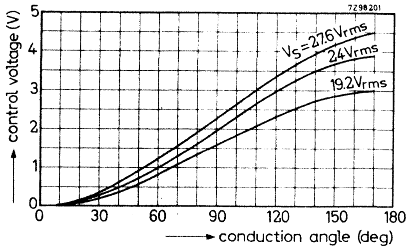
Output data

Output voltage (V_Q)	
high level (TR_7 non conducting)	max. 15 V
low level (TR_7 conducting)	max. 0.5 V min. 0 V
Output current (I_Q)	max. 25 mA at V_Q = max. 0.5 V (T_{amb} = −25 °C)
Minimum control range of conduction angle (φ)	10 − 170°





Linear control



Cosinusoidal control

Synchronization

Synchronization voltage (V_S)	24 V_{rms}, + 15%, -20%
Nominal synchronization current (I_S)	
at linear control	approx. 4 mA
at cosinusoidal control	approx. 8 mA

The synchronization voltage can be supplied by a transformer with or without a center tap and preferably provided with an electrostatic screen between the primary and the synchronization winding to avoid capacitive zero shift.
When a transformer with a center tap is used the outputs of the transformer have to be connected to the terminals S_1 and S_2, whereas the center tap is connected to terminal 0.
When a transformer without a center tap is used the outputs of the transformer have to be connected to the terminals S_1 and S_2. Furthermore two diodes OA200 or an equivalent type, have to be connected with the cathode to the terminals S_1 and S_2, whereas the anodes of these diodes have to be connected to terminal 0.

Synchronization frequency range 15 to 10 000 Hz

When the terminals 2 and 3 are interconnected the unit can be used at a synchronization frequency of 50 Hz.
For frequencies higher or lower than 50 Hz the terminals 2 and 3 have to be left disconnected and an external capacitor has to be connected between the terminals 2 and 10.
Capacitance as a function of the frequency: $C = \frac{11}{f}\ \mu F$

CONTROL FACILITIES

Linear conduction angle control

The conduction angle is proportional to the control voltage. The terminals 5, 15 and 16 have to be interconnected. The terminals 15 and 16 can also be interconnected by means of an adjustable resistor, in case of multi-phase operation.
The conduction angle can be controlled by a voltage level on the control input (terminal C).
When the control voltage is derived by a potentiometer from the d.c. voltage which supplies the conduction angle determining part of the circuit (terminal 16) the variations of the conduction angle, caused by supply voltage variations, are greatly reduced.

Cosinusoidal control of the conduction angle

The course of the conduction angle (φ) as a function of the control voltage (V_C) is given in the formula:

$\varphi = \arccos (1 - aV_C)$, in which

$a = \text{approx.}\ \frac{11}{V_{S_{rms}}}$

At a constant value of the control voltage the variations of the average voltage across the thyristor load, caused by the mains voltage variations, can be greatly reduced as follows.
The conduction angle determining part of the circuit has to be supplied by a full-wave rectified voltage (proportional to the mains voltage) and by a smoothed voltage derived from the mentioned voltage.
Therefore the terminals 14 and 5 have to be interconnected and the terminals 17 and 18 have to be interconnected directly or by means of an adjustable resistor (multi-phase operation). Furthermore an electrolytic capacitor of 100 μF, 40 V has to be connected between terminals 18 and 10.

ADJUSTMENT

1. Single-phase operation

To obtain a conduction angle of 0^o at a control voltage of 0 V, a resistor has to be connected between terminals 1 and 4. For determining its value the following procedure has to be done.
Connect an adjustable resistor with a control range up to 47 kΩ between the terminals 1 and 4, a resistor of 1 kΩ between the terminals Q and P and a d.c. voltmeter between the terminals Q and 0. The control input terminal C has to be connected to terminal 0. Furthermore the necessary interconnections for linear or cosinusoidal control have to be made. Apply the synchronization and d.c. supply voltages.
The output voltage will be about 0 V when the adjustable resistor has its maximum value. This resistor has to be decreased until the moment the output voltage starts to increase. The conduction angle is now close to 0^o at a control voltage of 0 V.
The unit is ready for use after the resistor of 1 kΩ and the voltmeter are removed.

Note - After the resistance value has been determined the variable resistor may be replaced by a fixed resistor of the same value as the inherent stability is such that no readjustment will be required.
Typical value of the resistor for linear control: 10 kΩ, for cosinusoidal control: 33 kΩ.

2. Multi-phase operation

To obtain equal conduction angles of two or more PSM's at a common control voltage within the whole control range the following has to be done.

a. Linear control

Interconnect the terminals 5, 15 and 16. Apply the d.c. supply voltages; the synchronization voltage is not applied. Measure the voltage on terminal 2. This voltage should be equal for all PSM's. If there is a difference between the voltages on terminals 2 a resistor has to be inserted between the terminals 17 and 18 of the unit with the highest voltage on terminal 2. The value of this resistor is approximately 1 Ω per mV voltage difference. For further adjustment, see 2c.

b. Cosinusoidal control

Connect terminal 5 to 15 and terminal 17 to 18. Apply the d.c. supply voltages to the terminals P and N and a d.c. voltage of 30 V to terminal 18; the synchronization voltage is not applied. The same measurements have to be done as for linear control.
If there is a difference between the voltages on terminal 2 of two PSM's a resistor has to be inserted between the terminals 17 and 18 of the unit with the highest voltage on terminal 2. The value of this resistor is approximately 3 Ω per mV voltage difference. For further adjustment, see 2c.

c. With the adjustments described in 2a and 2b the conduction angles of the units will be equal at high values of the control voltage (> 4 V). To obtain equal conduction angles at low values of the control voltage the following has to be done.

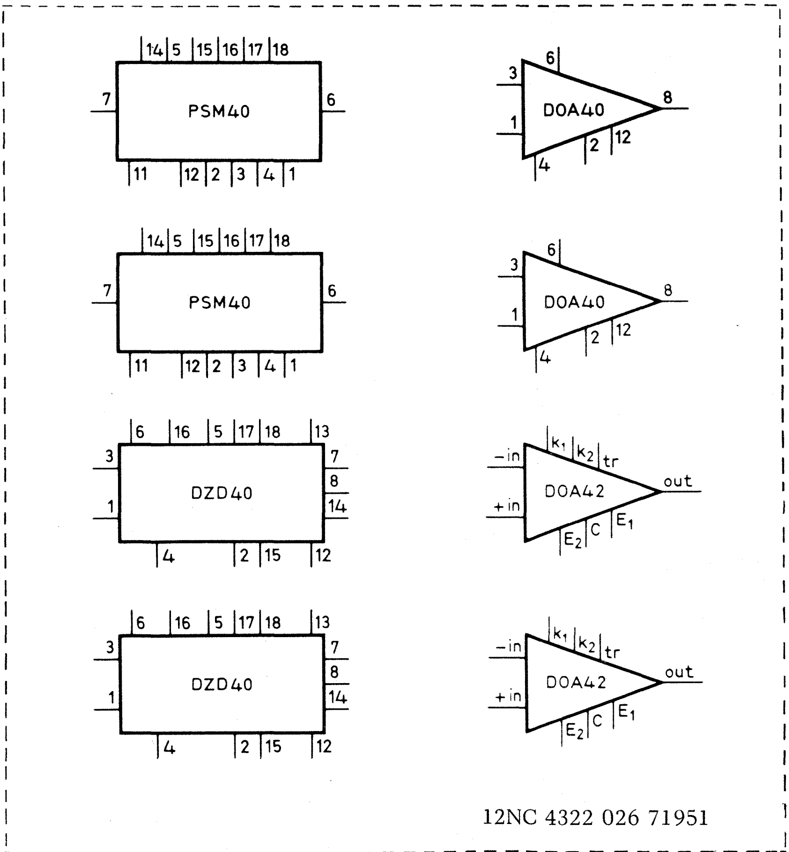
The units have to be connected for the desired mode of operation.

Adjust one unit so that a conduction angle of 0^o at a control voltage of 0 V is obtained (see 1).

Apply a control voltage of 1 V to all units. Connect a d.c. voltmeter between output Q of the unit which has been adjusted and output Q of the unit to be adjusted. These outputs have to be connected via a resistor of 1 kΩ to terminal P. Vary the value of the resistor between the terminals 1 and 4 of the unit to be adjusted, until minimum reading on the voltmeter has been obtained. Now the conduction angles of both units will be equal within the whole control range.

STICKERS

These are drawing symbols of 40-Series circuit blocks printed on self-adhesive, transparent material on which one can write. They can be used for fast preparation of system drawings.
The stickers are available in sheets, each containing the arrangement of drawing symbols shown below. Each sticker can be separately detached from the sheet, without cutting. Catalogue number for 50 sheets: 4322 026 71951.



CHOPPER-STABILIZED OPERATIONAL AMPLIFIER

QUICK REFERENCE DATA	
Open loop gain	min. 10^7
Initial offset voltage	max. ± 10 μV
Average offset voltage drift with temperature	max. 0, 1 μV/degC
Bias current	max. ± 70 pA
Noise voltage (0, 01 to 1 Hz), peak to peak	0, 7 μV

APPLICATION

The component possesses a high current and voltage stability therefore small d.c. and low-frequency signals receive accurate amplified reproduction. Changes due to environmental conditions such as temperature time and power supply voltages have only a minor influence on the circuit performance. Initial offsets are very small, therefore initial adjustments and periodic calibration can be eliminated in many applications.

DESCRIPTION

To obtain a high d.c. stability, the d.c. and low-frequency signals are chopped, amplified (a.c. amplifier) and then demodulated. The higher frequency component of the signal at the common input is fed via a capacitor directly to the wide-band amplifier (see block diagram, Fig. 1). Offset and drift of the wide-band amplifier is reduced by a factor equal to the gain of the a.c. amplifier.

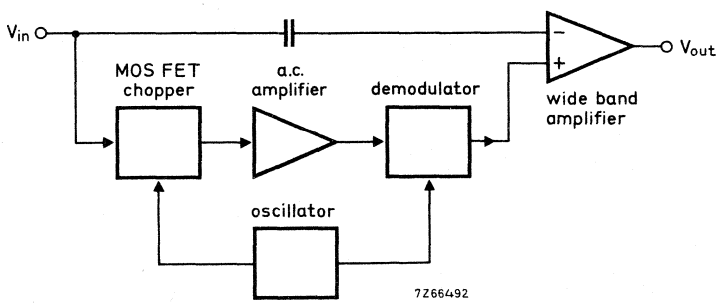
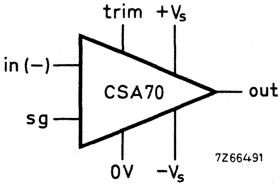


Fig. 1 Block diagram



sg = signal earth
in (-) = inverting input
out = output
$+V_S$ = positive supply voltage
$-V_S$ = negative supply voltage
0 V = common supply voltage
trim = offset voltage adjustment

Fig. 2 Drawing symbol

MECHANICAL DATA

Dimensions (mm) and terminal location

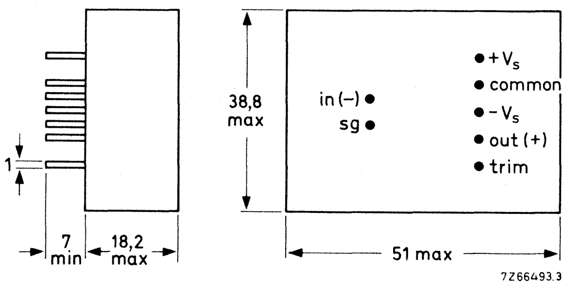


Fig. 3

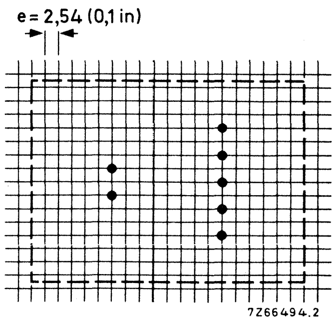


Fig. 4 Terminal location on 0, 1 inch grid.

ELECTRICAL DATA

Ambient temperature +25 °C, supply voltages +15/-15 V, unless stated otherwise.

Ambient temperature range

Operating, rated specification	0 to +60 °C
Storage	-40 to +85 °C

Power supply

Voltage, rated specification	± 15 V ± 3%
derated specification	± 12 V to ± 18 V
Typ. current at +15/−15 V	+7/-7 mA + load current
at +12/−12 V	+4/-5 mA + load current

Open loop gain (R_L = 2 kΩ) min. 10^7

Frequency response

Unity gain bandwidth (small signal)	min. 0,5 MHz (frequency roll-off 6 dB/oct.)
Full power frequency	min. 5 kHz
Slewing rate	min. 0,3 V/µs
Overload recovery time	typ. 3 s, max. 5 s

For method which will substantially reduce recovery time, see circuit of Fig. 5.

Input data

	typical	maximum
Initial offset voltage (adjustable to zero with 100 kΩ potentiom.*))		± 10 µV
Average offset voltage drift with temperature		0,1 µV/degC
Average offset voltage drift with supply voltage		0,1 µV/%
Average offset voltage drift with time	1 µV/month	
Bias current		± 70 pA
Average bias current drift with temperature		0,7 pA/degC
Average bias current drift with supply voltage	0,4 pA/%	
Average bias current drift with time	10 pA/month	

*) Potentiometer to be connected between $+V_S$ and $-V_S$, slider to "trim".

Input voltage range	± 20 V	
Noise voltage		
0,01 Hz to 1 Hz, p-p	0,7 μV	
0,01 Hz to 10 Hz, p-p	5 μV	
10 Hz to 5 kHz, r.m.s.	2,5 μV	
Noise current		
0,01 Hz to 1 Hz, p-p	5 pA	
0,01 Hz to 10 Hz, p-p	40 pA	
Burst noise (popcorn noise) peak voltage of CSA70L, measured across 100 kΩ	< 15 μV	
Input impedance	min. 200 kΩ	
Output data	typical	minimum
Output voltage, R_L = 10 kΩ	± 14 V	± 12 V
R_L = 2 kΩ	± 13 V	± 10 V
Output current	± 12 mA	
Output resistance (without feedback)		max. 200 Ω

Continuous short circuit is allowed between the output and earth, or between the output and supplies.

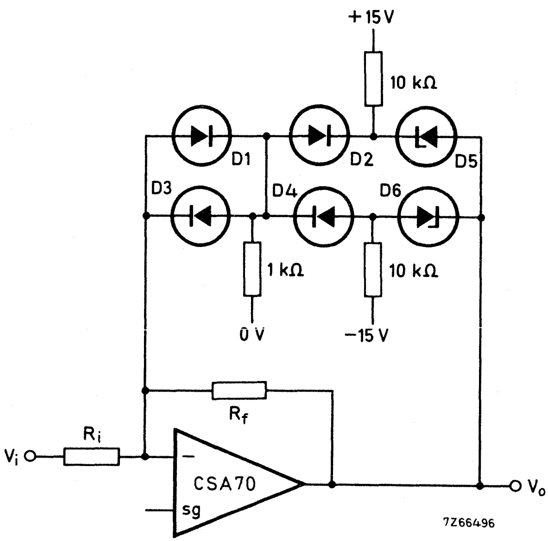


Fig. 5

D1 – D4 = BAW62

D5, D6 = BZX79/C10 or BZY88/C10

The resistors are carbon types, 1/8 W, 5%

APPLICATION INFORMATION

For extensive information on theoretical background and practical applications of operational amplifiers refer to our Application Book: "Measurement and Control using 40-series modules", order number 9399 263 05901.

1. Logarithmic amplifier (6 decade)

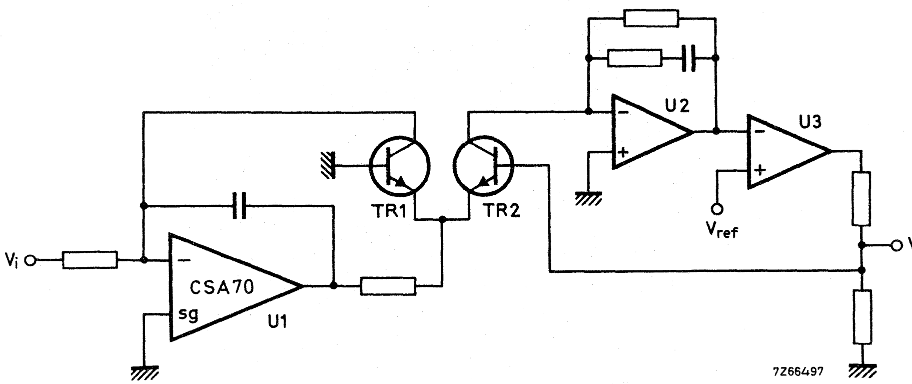


Fig. 6 V_i = 10 μV to 10 V.
TR1, TR2 = matched transistor pair, thermally coupled.
U2, U3 = general purpose amplifiers.

2. Inverting amplifier with very high input impedance

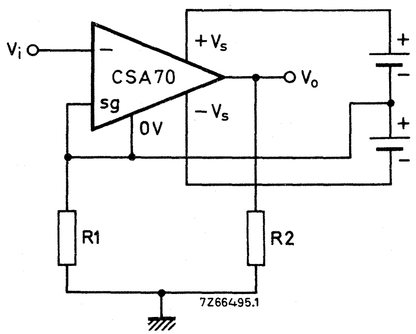


Fig. 7

$+V_S$ and $-V_S$ must be floating.

$$V_O = \frac{R2}{R1} V_i$$

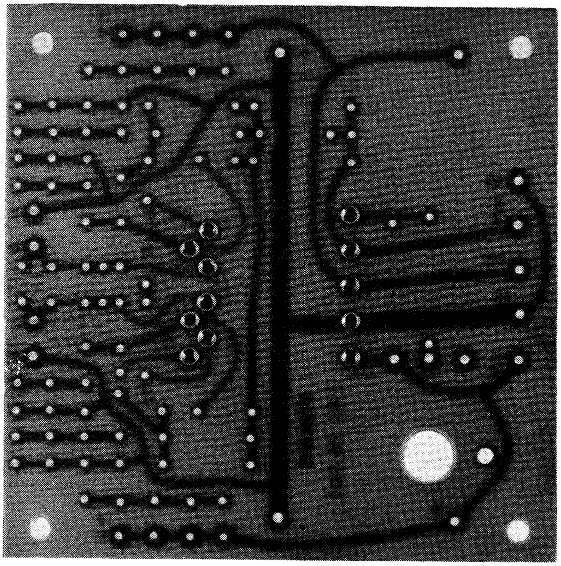
$Z_i > 100\ M\Omega$

(Note that input floats with respect to supplies, and that gain can be chosen less than unity.)

ACCESSORIES

1) A printed-wiring board (see photograph) providing plug-in facilities for the CSA 70 can be ordered separately under catalogue number 4332 000 00501.
This board will also accommodate a trimming potentiometer.

RZ 26423-5



2) Employing the AMP reusable component test receptacles type nr 380 598-2 enables the CSA 70 to be plugged into a printed-wiring board.

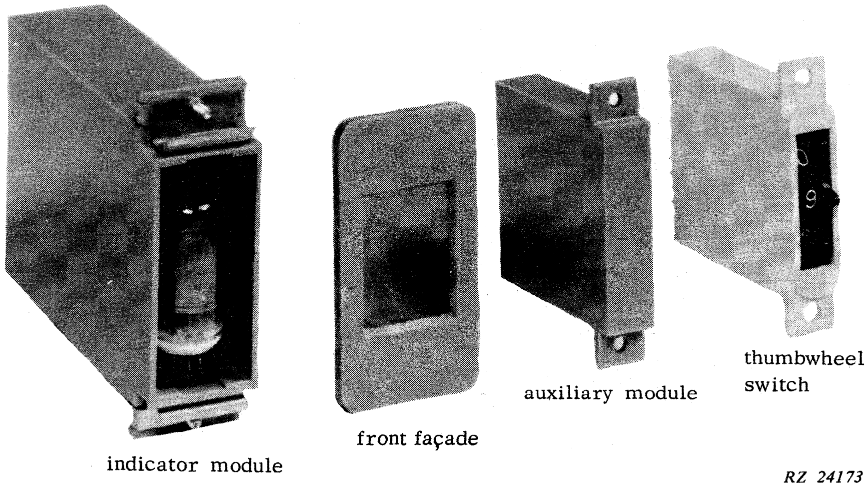
TEST SPECIFICATIONS

The unit has been designed to meet the tests of MIL-STD-202C below. Before and during manufacture samples of modules are regularly subjected to these tests.

1. Shock test according to method 202B; 3 blows 50 g in 3 perpendicular directions.
2. Vibration test according to method 204A; frequency 10-500 Hz 15 min, amplitude 0,75 mm max., 10 g max., 3 x 3 hours.
3. Temperature-cycling test according to method 102A; 5 cycles from −40 to + 85 °C.
4. Moisture resistance according to method 106C; R.H. 90 to 98%, temperature cycling +25 to +65 °C.
5. Solderability according to method 210.
6. Robustness of terminations according to method 211A and B.

Counter modules 50-Series

INTRODUCTION



The 50-Series contains uni-directional and bi-directional decade counters with direct display and a number of auxiliary modules offering a complete range of building modules for industrial automation and control.
The use of silicon semiconductors, including silicon-controlled switches (SCS), ensures reliable operation over a wide temperature range.
The simple rules regarding electrical interconnections, mounting accessories and interwiring of the compact self-contained cases, make the 50-Series ideal for immediate installation and assembly in a large variety of applications. Preset programmed control with the aid of compatible preset switches and input/output devices offer excellent possibilities for:

- industrial batch counting
- automatic winding machines
- sequential control and timing
- numerical control systems
- automatic weighing and dosing
- speed control, etc.

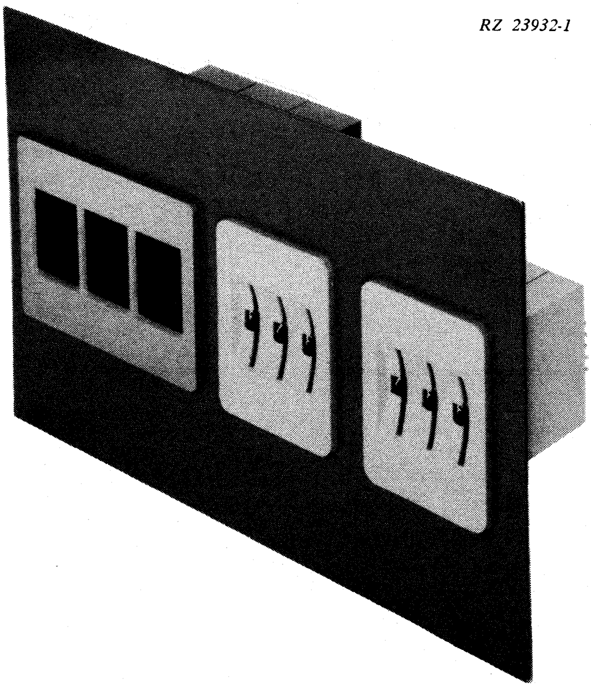
MODULES

The 50-Series comprises the following modules:

type	description	catalogue number
NIC50	Uni-directional decade counter with decimal outputs and direct display. The use of silicon controlled switches allows for direct drive of the numerical indicator tube.	2722 007 03001
RIC50	Bi-directional decade counter with decimal outputs and direct display. The use of silicon controlled switches allows for direct drive of the numerical indicator tube.	2722 007 04001
MID50	Integral buffer memory with direct display. Accepts decimal information from NIC50 and RIC50.	2722 007 05001
SID50	+ and - sign indicator driver with direct display.	2722 007 06001
SU50	10 position thumbwheel switch for preset counting (type 10P1C).	4311 027 82321
3.NOR50	Buffer adaptation stage and double NOR for sequential and combinational logic operations. The latter can be cross connected to form a d.c. memory function.	2722 007 00001
4.NOR51	Quadruple NOR for sequential and/or combinational logic operations. Two d.c. memory functions can be made from the four NOR's.	2722 007 00011
PSR50	Pulse shaper combined with an automatic/manual reset unit.	2722 007 01001
LRD50	300 mA, 30 V output stage for lamp and relay drive.	2722 007 02001
PDU50A and PDU50B	Printer drive units	2722 007 08001 2722 007 08011

type	description	catalogue number
PSU50	Power supply unit Input: 110, 220, 230, 240 V_{ac} ±10%, -15%; 45 to 65 Hz Output: a) 24 V_{dc}, ±5%, 250 mA (logic supply) b) 250 V_{dc}, ±18% (supply for 12 indicator tubes)	2722 151 00061
DCD50	General purpose decade counter and divider	2722 007 07001
ECA50	Empty case assembly	2722 007 89001

For detailed application information the Application Book "Design with 50-series modules", print number 9399 263 06001, should be consulted.



RZ 23932-1

MOUNTING ACCESSORIES

Front façades for indicator modules (NIC50, RIC50, MID50 and SID50)

Front façades are available for one up to and including six indicator modules. They are provided with a coloured polarised screen.

type	number of indicator modules	catalogue number
FIC 1	1	4322 026 70340
FIC 2	2	70350
FIC 3	3	70360
FIC 4	4	70370
FIC 5	5	70380
FIC 6	6	70390

Mounting façades for thumbwheel switches (SU50)

Mounting façades, giving facilities for mounting one up to and including six switches, are available.

type	number of switches	catalogue number
FMF 1	1	4311 027 80598
FMF 2	2	80608
FMF 3	3	80618
FMF 4	4	80628
FMF 5	5	80638
FMF 6	6	80648

Mounting aids for auxiliary modules (3.NOR50, 4.NOR51, PSR50, LRD50, PDU50A, PDU50B and DCD50)

Mounting bar, catalogue number 4322 026 70170
Self tapping screws (2 pieces), 4Nx$\frac{1}{4}$", catalogue number 2522 163 01005
Washer (M3), catalogue number 2522 600 16016

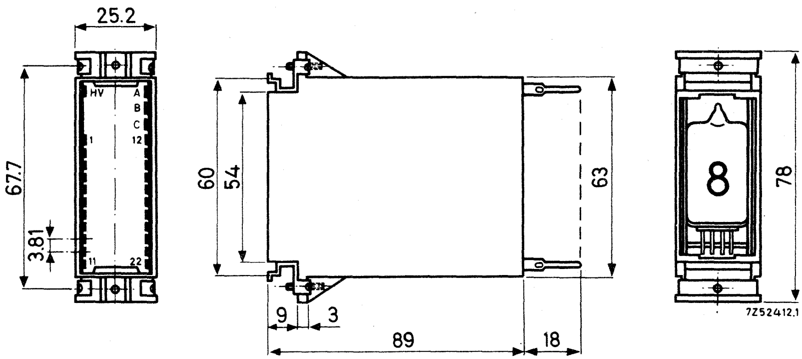
CONSTRUCTION

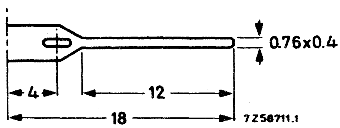
The various functions are housed in plastic cases, of which the dimensions and terminal locations are shown below.
Each module is provided with pins for soldering and wire-wrapping.

DIMENSIONS

The dimensions in the figures are given in mm; for inch values see the tables.

Indicator modules (NIC50, RIC50, MID50 and SID50)



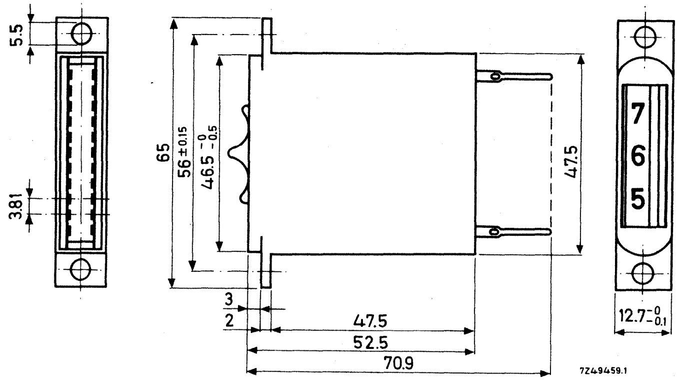


mm	inches
3	0.118
3.81	0.150
4	0.158
9	0.354
12	0.472
18	0.708
25.2	0.992
54	2.126

mm	inches
60	2.362
63	2.480
67.7	2.665
78	3.070
89	3.504

For detailed information on wire-wrapping, see the Application Book "Design with 50-Series modules, print number 9399 263 06001.

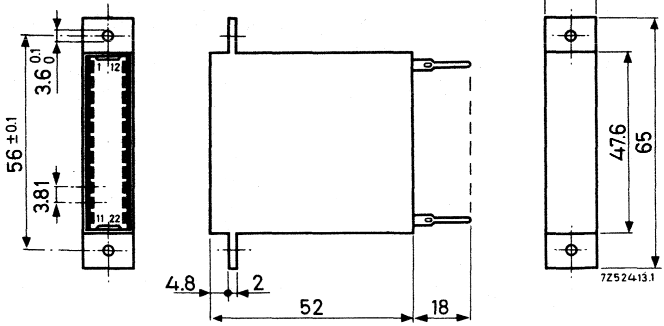
Thumbwheel switch (SU50)



mm	inches
2	0.078
3	0.118
3.81	0.150
5.5	0.216
$12.7^{-0}_{-0.1}$	$0.5^{-0}_{-0.004}$

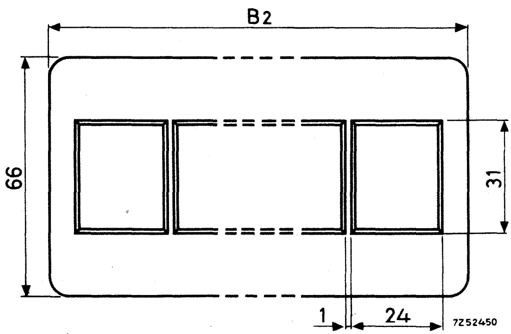
mm	inches
$46.5^{-0}_{-0.5}$	$1.831^{-0}_{-0.02}$
47.5	1.870
52.5	2.067
56 ± 0.15	2.205 ± 0.006
65	2.559
70.9	2.791

Auxiliary modules (3.NOR50, 4.NOR51, PSR50, LRD50, PDU50A, PDU50B and DCD50)

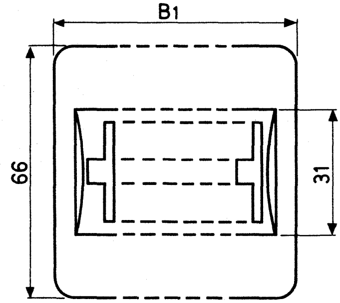


mm	inches	mm	inches
2	0.078	18	0.708
$3.6^{0.1}_{0}$	$0.142^{0.004}_{0}$	47.6	1.874
3.81	0.150	52	2.047
4.8	0.189	56 ± 0.1	2.205 ± 0.004
12.6	0.496	65	2.559

Façades



Front façade for indicator modules
(For B_2 see next page)



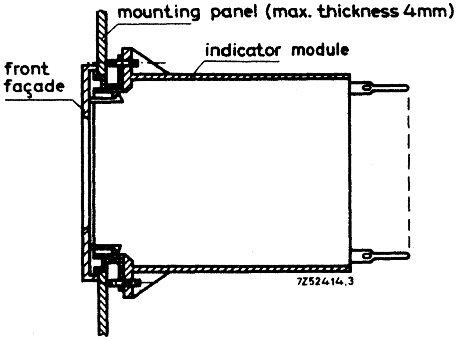
Mounting façade for thumbwheel switches
(For B_1 see next page)

mm	inches
1	0.039
24	0.945
31	1.220
66	2.598

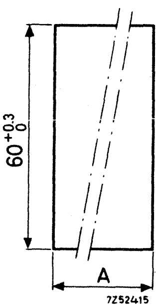
number of modules	indicator modules width B_2		thumbwheel switches width B_1	
	mm	inches	mm	inches
1	35.4	1.394	24	0.945
2	60.8	2.394	36.7	1.445
3	86.2	3.394	49.4	1.945
4	111.6	4.394	62.1	2.445
5	137.0	5.394	74.8	2.945
6	162.4	6.394	87.5	3.445

MOUNTING

Indicator modules (NIC50, RIC50, MID50 and SID50)



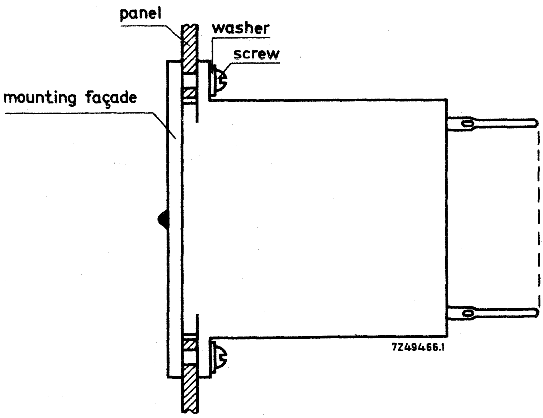
The module is fixed to a mounting panel by means of two screws. The maximum thickness of the mounting panel is 4 mm (0.157 inch). The aperture in the mounting panel is proportional to the number of indicator modules (see table below).
The front façades clip in to the indicator modules.



number of modules	width A	
	mm	inches
1	25.4 + 0.5	1 + 0.02
2	50.8 + 0.5	2 + 0.02
3	76.2 + 0.5	3 + 0.02
4	101.6 + 0.5	4 + 0.02
5	127.0 + 0.5	5 + 0.02
6	152.4 + 0.5	6 + 0.02

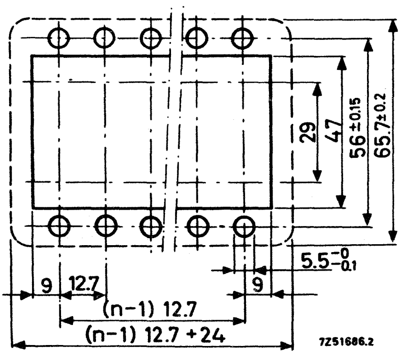
($60^{+0.3}_{0}$ mm = $2.362^{+0.012}_{0}$ inch)

Thumbwheel switches (SU50)



The switches can be mounted in panels with a thickness up to 4 mm by means of mounting façades and the screws and washers supplied. When the panel thickness is less than 4 mm (0.157 inch), additional washers must be used between the panel and the switch.

The dimensions of the necessary apertures in the mounting panel are given in the drawing below; the outline of the mounting façade is indicated by a dash line.

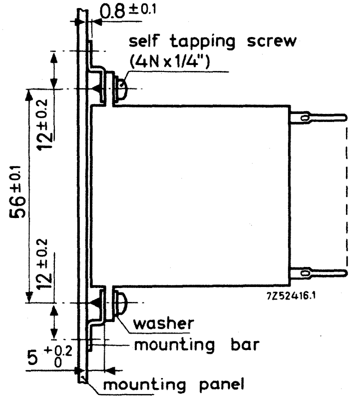


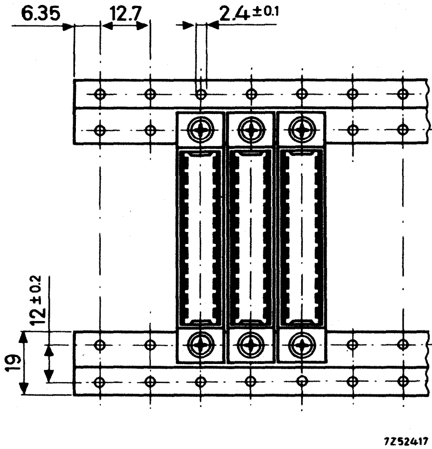
(n = number of switches)

mm	inches
$5.5^{-0}_{-0.1}$	$0.216^{-0}_{-0.004}$
9	0.354
12.7	0.5
24	0.945
29	1.142
47	1.851
56 ± 0.15	2.205 ± 0.004
65.7 ± 0.2	2.587 ± 0.008

Auxiliary modules (3.NOR50, 4.NOR51, PSR50, LRD50, PDU50A, PDU50B and DCD50)

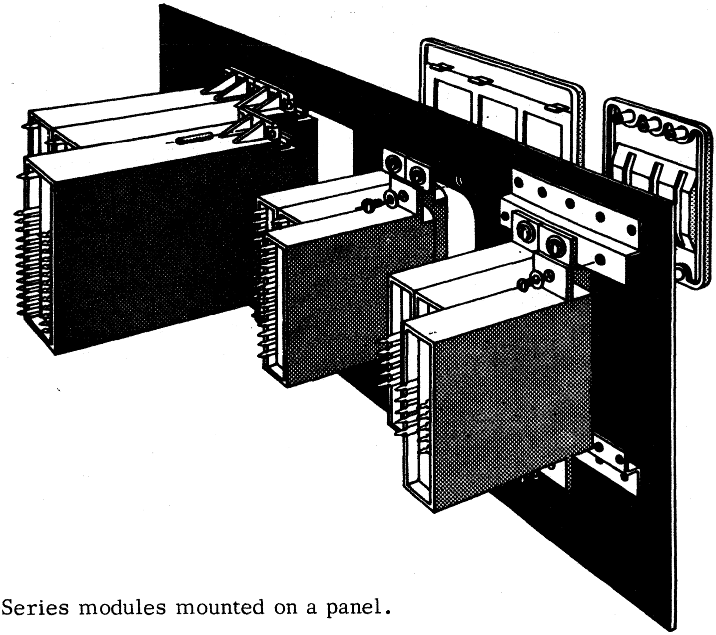
Auxiliary modules are to be fixed to a mounting panel with the aid of two metal bars (available in standard length of 21 positions).
The fixation of each module to the metal bar is done with two self tapping screws (4N x $\frac{1}{4}$inch).



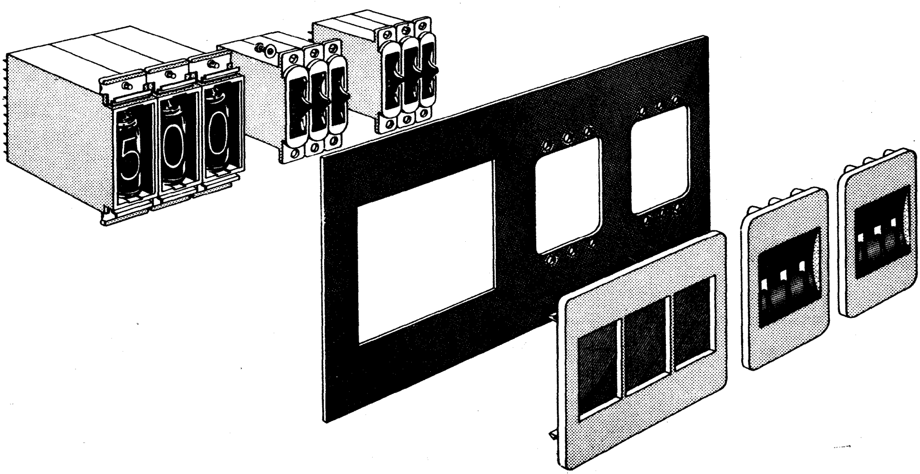


mm	inches
0.8 ± 0.1	0.032 ± 0.004
$5^{+0.2}_{0}$	$0.197^{+0.008}_{0}$
12 ± 0.2	0.472 ± 0.008
56 ± 0.1	2.205 ± 0.004

mm	inches
2.4 ± 0.1	0.094 ± 0.004
6.35	0.25
12 ± 0.2	0.472 ± 0.008
12.7	0.5
19	0.748
56 ± 0.1	2.205 ± 0.004



50-Series modules mounted on a panel.



CHARACTERISTICS

Ambient temperature range

Operating: −25 to +70 °C
−10 to +70 °C, for DCD50 at V_P = +24 V_{dc} ± 25%
Storage : −40 to +85 °C

Counting rate

Uni-directional: max. 50 kHz
Bi-directional : max. 12 kHz

Supply voltage

Logic supply: single rail, +24V_{dc} ± 10% [1)]
Tube supply : high voltage, +250V ± 18%

Fan out

Decade counter: the counter units can be loaded with 6 different programmes.

NOR gate : each output may be loaded with the inputs of six other NOR's. The NOR50 and NOR51 are fully compatible with NOR units of the 60-Series.

1) Note that output units may be operated from a supply voltage of +24V_{dc}, ± 25%.

TEST SPECIFICATIONS

All modules of the 50-Series are designed to meet the tests below. Before and during manufacture samples of modules are regularly subjected to these tests.

1. Shock test according to method 202B of MIL-STD-202C, 3 blows 50 g in 3 perpendicular directions.
2. Vibration test according to method 201A of MIL-STD-202C. Frequency 10-55 Hz, amplitude 0.76 mm max., cycle time 1 min, 2 hours in 3 perpendicular directions.
3. Temperature-cycling test according to method 102A of MIL-STD-202; 5 cycles from -40 to +100 °C.
4. Long-term humidity test according to I.E.C.68, test C. Duration 21 days at 40 °C and R.H. = 90-95%.
5. Solderability according to method 210 of MIL-STD-202.

LOADING TABLE

NOTES

By expressing the input requirements and output capabilities of most modules in "DRIVE UNITS (D.U)", system design is greatly simplified.
Moreover input requirements of all modules are additive.

*) Also suitable for driving 2 x C_F/C_R of RIC50.

**) Two inputs in parallel or one input always floating.

type	function	input		output	
		terminal	required	terminal	available
NIC50	Uni-directional direct display counter	R	To be driven from Q_R of PSR50	Q_0-Q_9	To drive 6 x buffer NOR's + 1 x T-NIC50 + I_0-I_9 of 6 x MID50 + PDU50
		T	To be driven from Q_T of PSR50 or Q_0-Q_9 of NIC50		
RIC50	Bi-directional direct display counter	R	To be driven from Q_R of PSR50	Q_0-Q_9	To drive 6 x buffer NOR's + 1 x T-RIC50 + I_0-I_9 of 6 x MID50 + PDU50
		T_F/T_R	To be driven from Q_T of PSR50 or Q_0-Q_9 of RIC50		
		C_F/C_R	To be driven from Q of LRD50 or Q of NOR50/51		
MID50	Buffer memory with direct display	I_0-I_9	To be driven from Q_0-Q_9 of NIC50, RIC50 or MID50	Q_0-Q_9	To drive decimal input of PDU50 + I_0-I_9 of 3 x MID50
		T_C	To be driven from Q_R or Q_T of PSR50		
SID50	Driver plus and minus indicator tube	+ and - character	1 D.U.	none	Not applicable
3.NOR50	6 Input buffer NOR	G_1-G_6	To be driven from Q_0-Q_9 of NIC50 or RIC50	Q_1	2 D.U.
	Dual 4 input NOR	G_7-G_{14}	1 D.U.	Q_2/Q_3	6 D.U.*)
4.NOR51	Quadruple 4 input NOR	G_1-G_{16}	1 D.U.	Q_1-Q_4	6 D.U.*)

type	function	input		output	
		terminal	required	terminal	available
PSR50	Pulse shaper	B (via R = 39 kΩ)	2 D.U.	Q_T	2 x (T_R + T_F) - RIC50 + 2 D.U. or 4 x T-NIC50 + 2 D.U. or 6 x T_C-MID50
	Reset	T	1 D.U.	Q_R	6 x R-NIC50/RIC50 or 6 x T_C-MID50
		G	1 D.U.	Q_L	4 D.U.
LRD50	Lamp/relay driver	G_1-G_3	1 D.U.	Q	300 mA, 30V (abs.max.) or 6 x C_F/C_R -RIC50
PDU50A	Printer drive unit	I_0-I_9	To be driven from Q_0-Q_9 of NIC50, RIC50 or MID50	Q_0-Q_9	2 D.U.
		L	To be driven from L_1-L_3 of PDU50B		
PDU50B	Printer drive unit	C	To be driven from: -Q_T of PSR50 or -NOR unit**)	L_1-L_3	To drive input L of PDU50A
		S_1-S_3	To be driven from: -Q_0-Q_9 of NIC50 or RIC50 -DCD50 -NOR unit**)		
DCD50	Decade counter and divider	T_A/T_C/T_D T_{B_1}/T_{B_2} S	0 D.U. 1 D.U. 1.5 D.U.	Q_A, $\overline{Q_A}$, Q_B, $\overline{Q_B}$, Q_C, $\overline{Q_C}$, Q_D, $\overline{Q_D}$	To drive 1 x T-NIC50/RIC50
		C_S	6 D.U.	Q_A, Q_B, $\overline{Q_B}$, Q_C, $\overline{Q_C}$	6 D.U. + 1 x T-DCD50 or 4 D.U. + 1 x B-PSR50
				$\overline{Q_A}$, Q_D, $\overline{Q_D}$	see data sheet

Survey of terminal location

terminals	indicator modules (Fig.A)				auxiliary modules (Fig.B)						
	NIC50	RIC50	MID50	SID50	3.NOR50	4.NOR51	PSR50	LRD50	PDU50A	PDU50B	DCD50
HV	V_{p3}	V_{p3}	V_{p3}	V_{p3}	not provided	not provided	not provided	not provided	not provided	not provided	not provided
A	not provided	not provided	LS	X	not provided	not provided	not provided	not provided	not provided	not provided	not provided
B	not provided	not provided	T_C	Y	not provided	not provided	not provided	not provided	not provided	not provided	not provided
C	not provided	not provided	I_0	Z	not provided	not provided	not provided	not provided	not provided	not provided	not provided
1	V_{p1}	V_{p1}	V_{p1}	V_{p1}	V_{p1}	V_{p1}	V_{p1}	not provided	I_1	V_{p1}	V_{p1}
2	0	0	0	0	0	0	0	0	I_2	0	0
3	not provided	C_F	I_1	not provided	G_1	G_1	Q_R	V_{p2}	I_3	K_1	$\overline{Q}_D$
4	not provided	C_R	I_2	not provided	G_2	G_2	Q_L	not provided	I_4	K_2	Q_D
5	F	F	I_3	not provided	G_3	G_3	Q_T	Q	I_5	L_1	Q_C
6	not provided	not provided	I_4	+	G_4	Q_2	i.c.	not provided	L	L_2	$\overline{Q}_C$
7	Q_5	Q_5	Q_5	–	G_5	Q_1	B	not provided	Q_1	L_3	T_{D2}
8	Q_4	Q_4	Q_4	not provided	G_6	G_5	Z	G_1	Q_2	S_1	T_{D1}
9	Q_3	Q_3	Q_3	not provided	D_1	G_6	A	G_2	Q_3	S_2	T_C
10	Q_2	Q_2	Q_2	not provided	D_2	G_7	G	G_3	Q_4	S_3	S_C
11	Q_1	Q_1	Q_1	not provided	Q_1	G_8	T	not provided	Q_5	C	S_D
12	not provided	not provided	I_9	~	G_7	G_9	not provided	not provided	Q_6	not provided	S_B
13	not provided	not provided	I_8	not provided	G_8	G_{10}	not provided	not provided	Q_7	not provided	Q_B
14	R	R	I_7	not provided	G_9	G_{11}	not provided	not provided	Q_8	not provided	$\overline{Q}_B$
15	not provided	T_R	I_6	not provided	G_{10}	G_{12}	not provided	not provided	Q_9	not provided	S_A
16	T	T_F	I_5	not provided	Q_3	Q_4	not provided	not provided	Q_0	not provided	Q_A
17	DP	DP	DP	not provided	Q_2	Q_3	not provided	not provided	L	not provided	$\overline{Q}_A$
18	Q_6	Q_6	Q_6	not provided	G_{11}	G_{13}	not provided	not provided	I_6	not provided	T_{B1}
19	Q_7	Q_7	Q_7	not provided	G_{12}	G_{14}	not provided	not provided	I_7	not provided	T_{B2}
20	Q_8	Q_8	Q_8	not provided	G_{13}	G_{15}	not provided	not provided	I_8	not provided	K
21	Q_9	Q_9	Q_9	not provided	G_{14}	G_{16}	not provided	not provided	I_9	not provided	T_A
22	Q_0	Q_0	Q_0	not provided	R_1	G_4	not provided	not provided	I_0	not provided	C_S

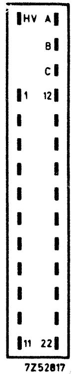


Fig.A.

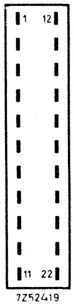
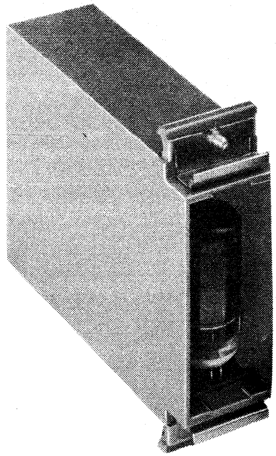


Fig.B.

NUMERICAL INDICATOR COUNTER



RZ 23932-3

Function	Uni-directional decade counter with direct numerical display for preset programmed control systems. Maximum counting rate: 50 kHz.

DESCRIPTION

The NIC50 is a uni-directional decade counter coupled to the numerical indicator tube ZM1000, assembled in one plastic case. The ZM1000 is mounted at the front of the case, the input and output terminals are found at the rear.

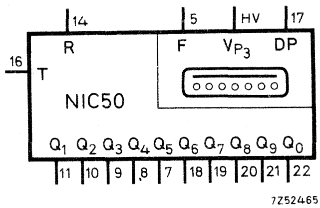
Ten decimal outputs enable connection to other units for active counting operations. There is also a terminal for display of the decimal point in the ZM1000 at the left of any numeral.

Use is made of silicon controlled switches featuring a direct drive of the ZM1000.

Carry pulses to trigger a succeeding counter NIC50 are obtained from output Q_0 (terminal 22) at the nine to zero transition.

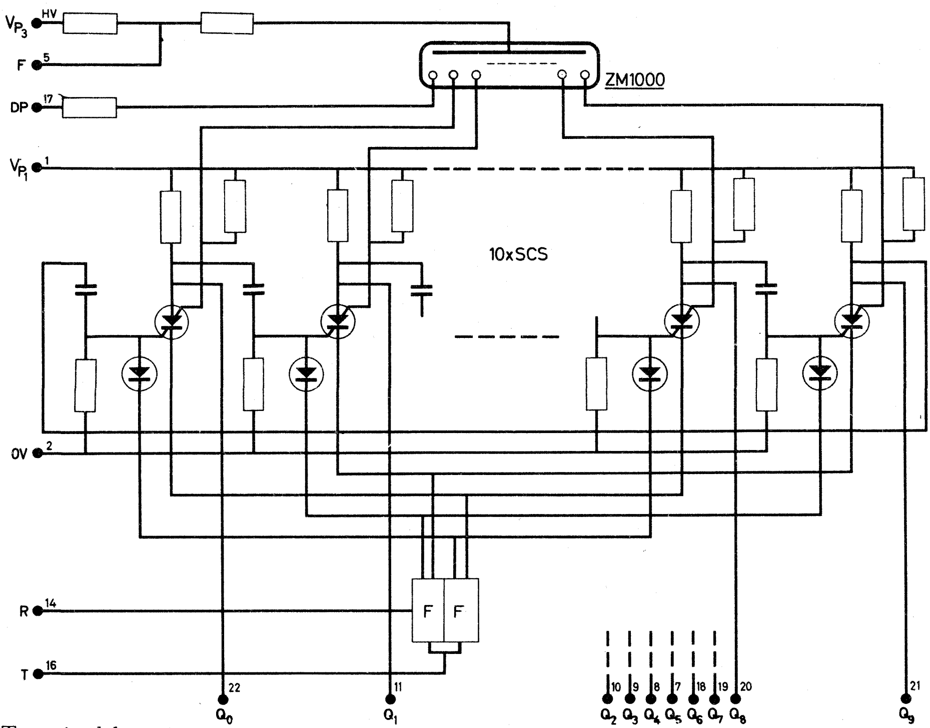
The trigger (counting) pulse and the reset pulse are delivered by the pulse shaper/reset unit PSR50.

Filtering of the high voltage from transients can be obtained by connecting a capacitor of approximately 0.1 μF between terminal F and the central earth point.

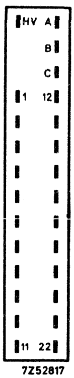


Drawing symbol

CIRCUIT DATA



Terminal location



HV = V_{p3} = +250 V supply for numerical indicator tube
A = not provided
B = not provided
C = not provided
1 = V_{p1} = +24 V supply
2 = 0 = common 0 V
3 = not provided
4 = not provided
5 = F = connection for filtering purposes
6 = not provided
7 = Q_5 = decimal output 5
8 = Q_4 = decimal output 4
9 = Q_3 = decimal output 3
10 = Q_2 = decimal output 2
11 = Q_1 = decimal output 1
12 = not provided
13 = not provided
14 = R = reset input
15 = not provided
16 = T = counting trigger input
17 = DP = input decimal point
18 = Q_6 = decimal output 6
19 = Q_7 = decimal output 7
20 = Q_8 = decimal output 8
21 = Q_9 = decimal output 9
22 = Q_0 = decimal output 0

Power supply

	voltage	current
Tube supply	+250 V ± 18%	3 mA
Logic supply	+ 24 V ± 10%	12 mA

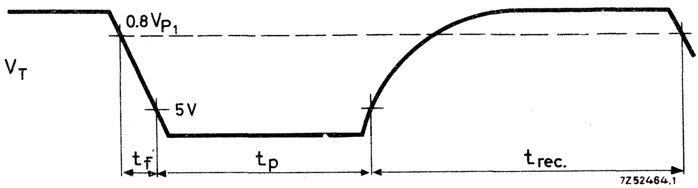
INPUT DATA

Trigger (counting) input T (terminal 16)

This input is to be driven by a negative going pulse, delivered by output Q_T of the unit PSR50, or by a preceding counter unit.

Voltage	V_T = from 0.8 V_{P_1} to 5 V
Required direct current	$-I_T$ = max. 1.5 mA (at V_T = 5 V)
Required transient charge when V_T changes from 0.8 V_{P_1} to 5 V in 1 μs	$-Q_T$ = max. 6.3 nC

Time data



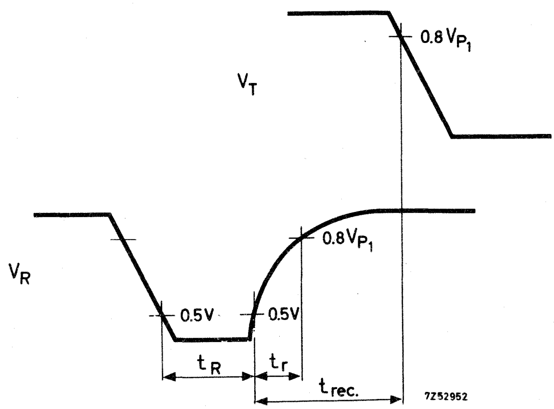
Fall time	t_f = max. 1 μs
Pulse duration	t_p = min. 4 μs
Recovery time	t_{rec} = max. 10 μs

Reset input R (terminal 14)

This input is to be driven by a LOW voltage level, delivered by output Q_R of the unit PSR50.

Required voltage	V_R = max. 0.5 V
Required direct current	I_R = max. 8.5 mA

Time data



Input pulse duration	t_R	= min. 15 μs
Recovery time	t_{rec}	= max. 50 μs
Trailing edge	t_r	= max.1.2 μs

Decimal point input DP (terminal 17)

This input is to be driven by a LOW voltage level with the following requirements:

Decimal point ON

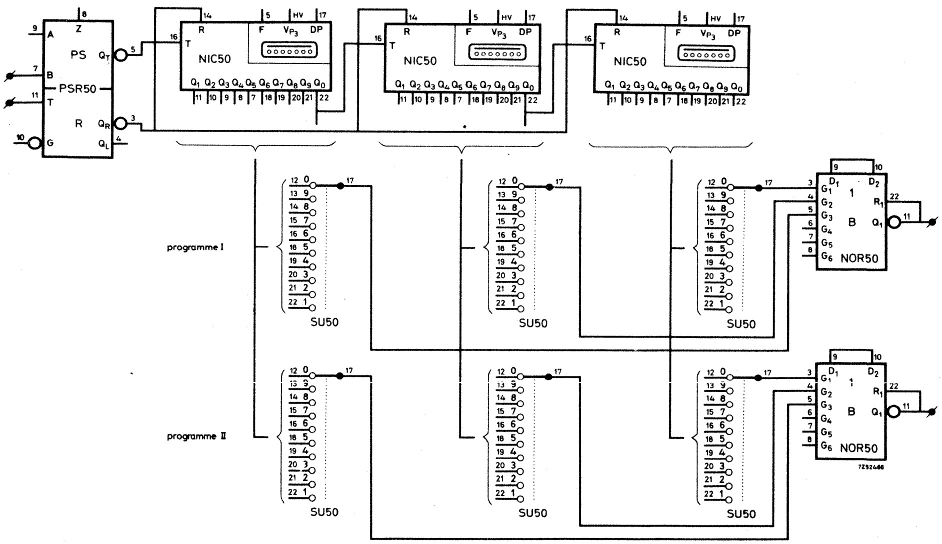
Voltage	V_{DP}	= max. 0.5 V
Direct current	I_{DP}	= 165 μA (typical)

Decimal point OFF

Voltage	V_{DP}	= min. 50 V or terminal 17 floating

OUTPUT DATA

The digits 0-9 are available at the output terminals Q_0-Q_9.
These outputs are primarily intended to drive the buffer NOR in the unit 3.NOR50, in most cases via the 10 position preset switch SU50 as indicated below.



Each Q-output can be loaded with 6 buffer NOR's of the 3.NOR50 units simultaneously in excess of the carry pulse for the succeeding NIC50 counter. This means that 6 preset programmes can be applied as a maximum.

Output voltage LOW (SCS conducting)

Voltage	V_Q	= max. 5 V
Available direct current	I_Q	= max. 1.5 mA
Available transient charge when V_Q changes from 0.8 V_{P1} to 5 V in 1 μs	Q_Q	= max. 9.5 nC

Output voltage HIGH (SCS non conducting)

Voltage	V_Q	= 0.8 V_{P1} to V_{P1}
Available direct current	$-I_Q$	= max. 0.32 mA

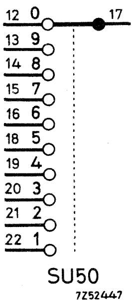
Wiring capacitance C_W = max. 200 pF

Time data

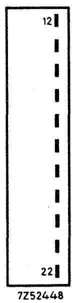
Delay between trigger input and positive going output t_{d_1} = max. 3 μs
Delay between trigger input and negative going output t_{d_2} = max. 4 μs

10 position preset switch

In the 50-Series for preset programmed counting, use is made of the 10 position thumbwheel switch SU50, which is identical to the existing type 10P1C, catalogue number 4311 027 82321.



Drawing symbol

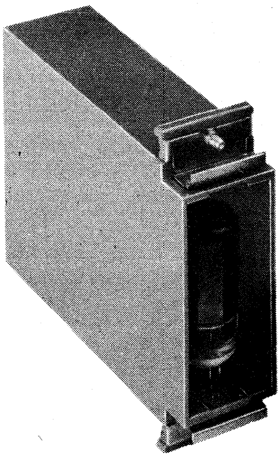


Terminal location

12 = input 0
13 = input 9
14 = input 8
15 = input 7
16 = input 6
17 = output (pole)
18 = input 5
19 = input 4
20 = input 3
21 = input 2
22 = input 1

The ten input terminals 0-9 have to be connected directly to the ten decimal output terminals Q_0-Q_9 of the decade counter NIC50.
The output terminal 17 has to be connected to one of the inputs of the buffer NOR in the unit 3.NOR50.

REVERSIBLE INDICATOR COUNTER

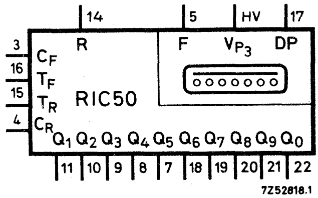


RZ 23932-3

Function — Bi-directional decade counter with direct numerical display for preset programmed control systems.
Maximum counting rate: 12 kHz.

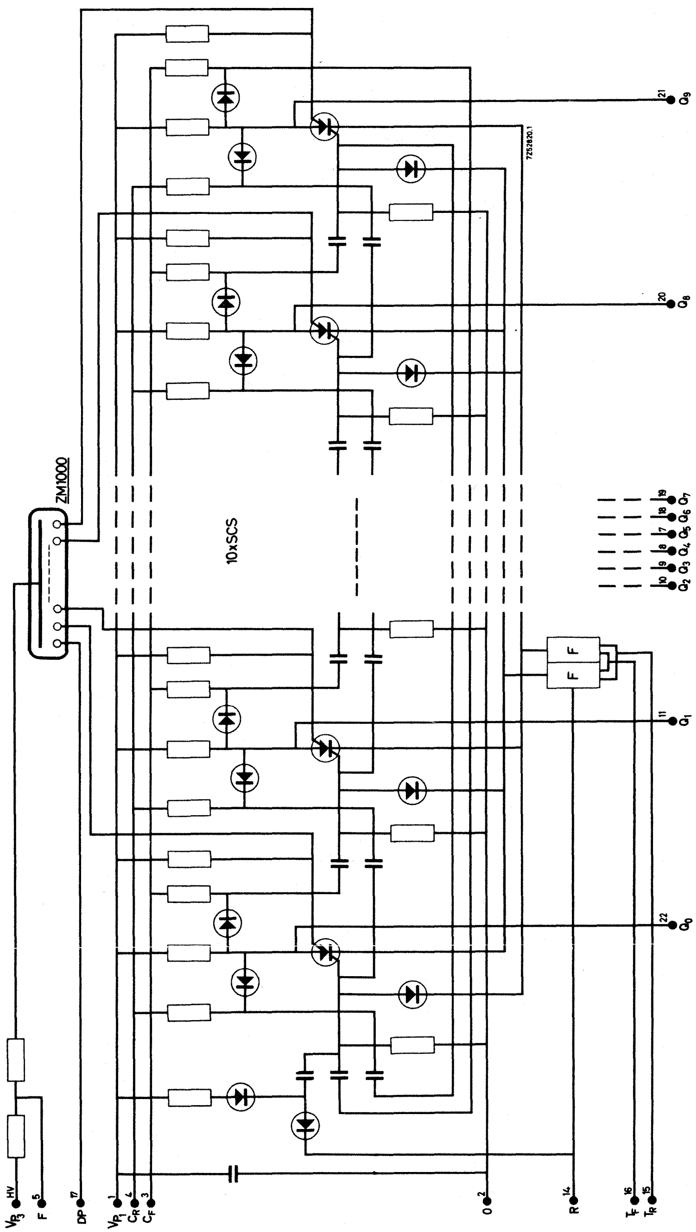
DESCRIPTION

The RIC50 is a bi-directional decade counter coupled to the numerical indicator tube ZM1000, assembled in one plastic case. The ZM1000 is mounted at the front of the case, the input and output terminals are found at the rear.
Ten decimal outputs enable connection to other units for active counting operations.
There is also a terminal for display of the decimal point in the ZM1000 at the left of any numeral.
Use is made of silicon controlled switches featuring a direct drive of the ZM1000.
The trigger (counting) pulses and the reset pulse are delivered by the pulse shaper/ reset unit PSR50.
Filtering of the high voltage from transients can be obtained by connecting a capacitor of approximately 0.1 μF between terminal F and the central earth point.

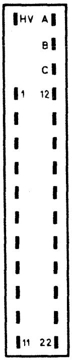


Drawing symbol

CIRCUIT DATA



Terminal location



7Z52817

HV = V_{p3} = +250 V supply for numerical indicator tube
A = not provided
B = not provided
C = not provided
1 = V_{p1} = +24 V supply
2 = 0 = common 0 V
3 = C_F = control forward direction
4 = C_R = control reverse direction
5 = F = connection for filtering purposes
6 = not provided
7 = Q_5 = decimal output 5
8 = Q_4 = decimal output 4
9 = Q_3 = decimal output 3
10 = Q_2 = decimal output 2
11 = Q_1 = decimal output 1
12 = not provided
13 = not provided
14 = R = reset input
15 = T_R = trigger input reverse counting
16 = T_F = trigger input forward counting
17 = DP = input decimal point
18 = Q_6 = decimal output 6
19 = Q_7 = decimal output 7
20 = Q_8 = decimal output 8
21 = Q_9 = decimal output 9
22 = Q_0 = decimal output 0

Power supply

	voltage	current
Tube supply	+250 V ± 18%	3 mA
Logic supply	+ 24 V ± 10%	23 mA

INPUT DATA

Counting conditions

The counting direction is determined by the voltage levels applied to C_F (terminal 3) and C_R (terminal 4).

Forward counting

V_{CF} = max. 1.6 V I_{CF} = max. 7.5 mA
V_{CR} = 0.95 V_{p1} to V_{p1}
} Each input to be driven by LRD50 or NOR unit

Counting pulse from PSR50 - Q_T to be applied to input T_F (terminal 16).

Reverse counting

V_{CR} = max. 1.6 V I_{CR} = max. 7.5 mA
V_{CF} = 0.95 V_{p1} to V_{p1}
} Each input to be driven by LRD50 or NOR unit

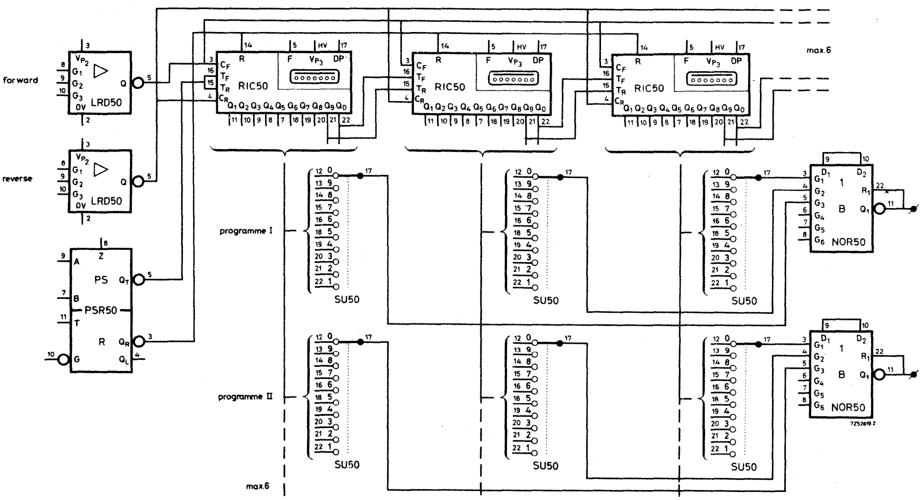
Counting pulse from PSR50 - Q_T to be applied to input T_R (terminal 15).

Note - When both control inputs C_F and C_R are HIGH the RIC50 is blocked for counting pulses.

When two units RIC50 are operating in series the following interconnections have to be made (see figure below).

For forward counting: Q_0 (terminal 22) of the preceding RIC50 has to be connected to T_F (terminal 16) of the succeeding RIC50.

For reverse counting: Q_9 (terminal 21) of the preceding RIC50 has to be connected to T_R (terminal 15) of the succeeding RIC50.



When the levels of the control voltages at C_F or C_R are changed a recovery time t_{rec} = min. 100 μs is to be observed.

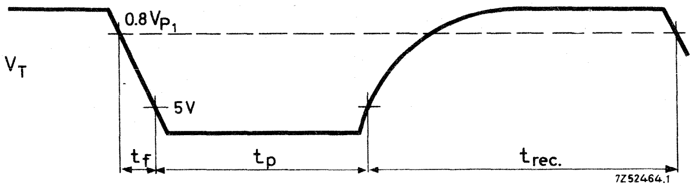
Trigger (counting) inputs T (terminals 16 and 15)

These inputs are to be driven by the negative going pulse, delivered by output Q_T of the unit PSR50 or by the corresponding output Q_0 (forward) or Q_9 (reverse) of the preceding counting decade RIC50.

Triggering edge	V_T = 0.8 V_{p1} to 5 V
Required direct current	I_T = max. 1.5 mA (at V_T = 5 V)
Required transient charge when V_T changes from 0.8 V_{p1} to 5 V in 1 μs	Q_T = max. 6.3 nC

When two trigger inputs are interconnected the above I_T and Q_T requirements have to be doubled.

Time data



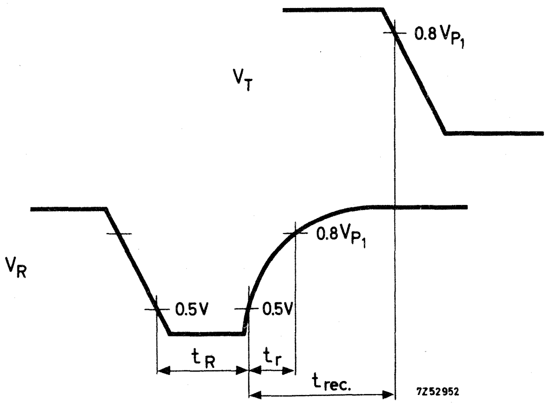
Fall time	t_f	= max. 1 μs
Pulse duration	t_p	= min. 4 μs
Recovery time	t_{rec}	= min. 15 μs
Time between two successive pulses		min. 85 μs

Reset input R (terminal 14)

This input is to be driven by a LOW voltage level, delivered by output Q_R of the unit PSR50.

Required voltage	V_R	= max. 0.5 V
Required direct current	I_R	= max. 8.5 mA

Time data



Pulse duration	t_R	= min. 15 μs
Recovery time	t_{rec}	= max. 80 μs
Trailing edge	t_r	= max. 1.2 μs

Decimal point input DP (terminal 17)

This input is to be driven by a LOW voltage level with the following requirements:

Decimal point ON

Voltage V_{DP} = max. 0.5 V

Direct current I_{DP} = 165 μA (typical)

Decimal point OFF

Voltage V_{DP} = min. 50 V or terminal 17 floating

OUTPUT DATA

The digits 0-9 are available at the output terminals Q_0-Q_9.
These outputs are primarily intended to drive the buffer NOR in the unit 3.NOR50, in most cases via the 10 position preset switch SU50.
Each Q-output can be loaded with 6 buffer NOR's of the 3.NOR50 units simultaneously in excess of the carry pulses for the succeeding RIC50 counter. This means that 6 preset programmes can be applied as a maximum.

Output voltage LOW (SCS conducting)

Voltage V_Q = max. 5 V

Available direct current I_Q = max. 1.5 mA

Available transient charge when V_Q changes from 0.8 V_{P1} to 5 V in 1 μs Q_Q = max. 9.5 nC

Output voltage HIGH (SCS non conducting)

Voltage V_Q = 0.8 V_{P1} to V_{P1}

Available direct current I_Q = max. 0.32 mA

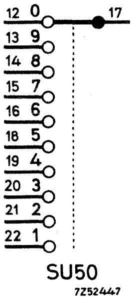
Wiring capacitance C_W = max. 200 pF

Time data

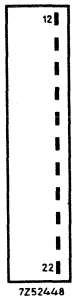
Delay between trigger input and positive going output t_{d1} = max. 3 μs.
Delay between trigger input and negative going output t_{d2} = max. 4 μs.

10 position preset switch

In the 50-Series for preset programmed counting, use is made of the 10 position thumbwheel switch SU50, which is identical to the existing type 10P1C, catalogue number 4311 027 82321.



Drawing symbol

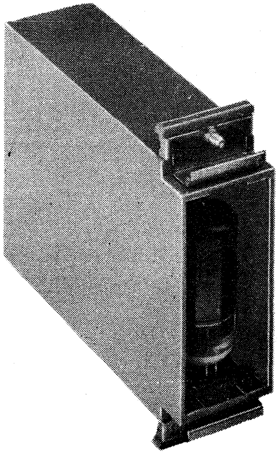


Terminal location

12 = input 0
13 = input 9
14 = input 8
15 = input 7
16 = input 6
17 = output (pole)
18 = input 5
19 = input 4
20 = input 3
21 = input 2
22 = input 1

The ten input terminals 0-9 have to be connected directly to the ten decimal output terminals Q_0-Q_9 of the reversible decade counters RIC50.
The output terminal 17 has to be connected to one of the inputs of the buffer NOR in the unit 3.NOR50.

MEMORY INDICATOR DRIVER

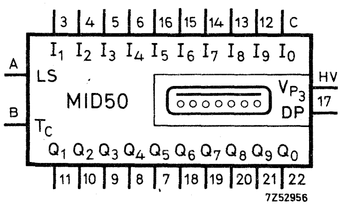


RZ 23932-3

Function — Integral buffer memory with direct numerical display for storage of information from decade counters NIC50 or RIC50.
Apart from numerical display, decimal output is available for e.g. printer drive.

DESCRIPTION

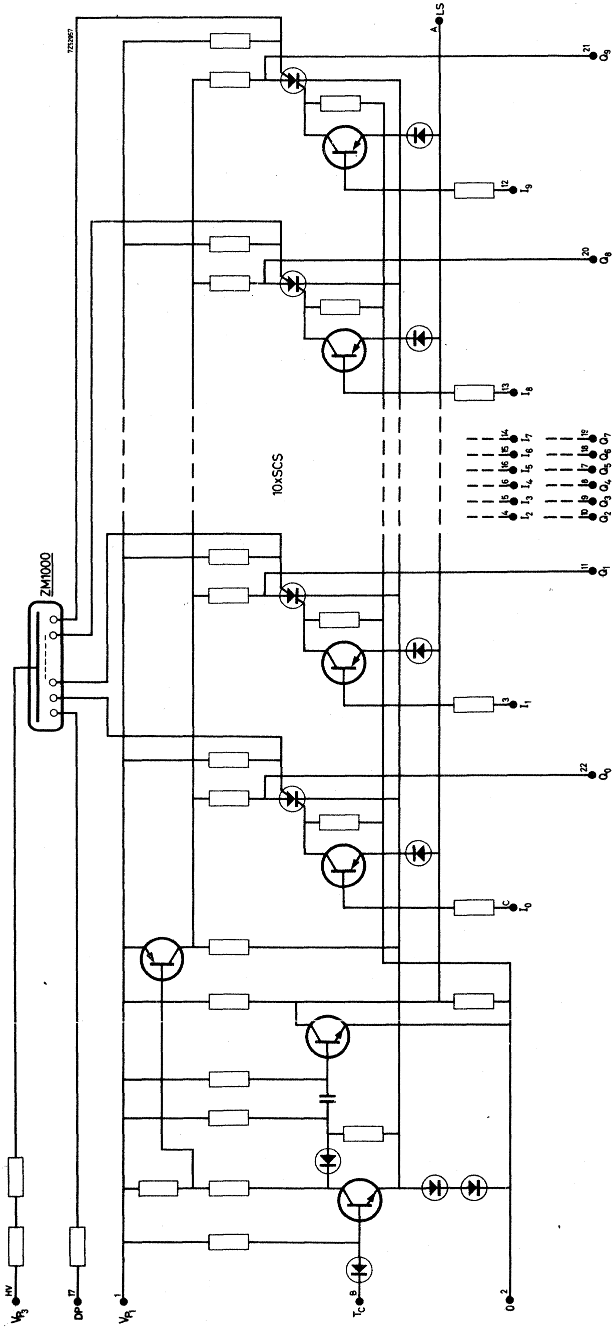
The MID50 is a buffer memory coupled to the numerical indicator tube ZM1000, assembled in one plastic case. The ZM1000 is mounted at the front of the case, the input and output terminals are found at the rear.
Use is made of silicon controlled switches featuring a direct drive of the ZM1000. The ten decimal inputs (I_0-I_9) can be connected directly to the 10 corresponding outputs (Q_0-Q_9) of either the uni-directional decade counter NIC50 or the bi-directional decade counter RIC50, without influencing the output capability (fan out) of both types of counters.
By applying one single pulse to input T_C (terminal B) the decimal information is transferred from the decade counter into the buffer memory MID50 and remains there steadily displayed.
The MID50 is also provided with 10 decimal outputs for e.g. printer read-out *).
There is a terminal for display of the decimal point in the ZM1000 at the left of any numeral.



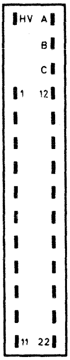
Drawing symbol

*) For this purpose printer drive units PDU50A and PDU50B are available.

CIRCUIT DATA



Terminal location



7Z52817

HV = V_{p3} = +250 V supply for numerical indicator tube
A = LS = level shift facility
B = T_C = shift pulse input
C = I_0 = decimal input 0
1 = V_{p1} = +24 V supply
2 = 0 = common 0 V
3 = I_1 = decimal input 1
4 = I_2 = decimal input 2
5 = I_3 = decimal input 3
6 = I_4 = decimal input 4
7 = Q_5 = decimal output 5
8 = Q_4 = decimal output 4
9 = Q_3 = decimal output 3
10 = Q_2 = decimal output 2
11 = Q_1 = decimal output 1
12 = I_9 = decimal input 9
13 = I_8 = decimal input 8
14 = I_7 = decimal input 7
15 = I_6 = decimal input 6
16 = I_5 = decimal input 5
17 = DP = input decimal point
18 = Q_6 = decimal output 6
19 = Q_7 = decimal output 7
20 = Q_8 = decimal output 8
21 = Q_9 = decimal output 9
22 = Q_0 = decimal output 0

Power supply

	voltage	current
Tube supply	+250 V ± 18%	3 mA
Logic supply	+ 24 V ± 10%	20 mA

INPUT DATA

Decimal inputs I_0-I_9

These inputs are to be fed by the decimal outputs Q_0-Q_9 of either the uni-directional decade counter NIC50 or the bi-directional decade counter RIC50.
One of the ten inputs must be fed with a LOW voltage level, the remaining nine inputs with a HIGH voltage level. By applying one transfer pulse to T_C (terminal B) that output Q becomes LOW of which the corresponding input I carries the LOW voltage, while simultaneously the corresponding figure of the indicator tube is lit. The other nine outputs of the MID50 will be HIGH. The decimal information of a NIC50 or RIC50 is transferred into the MID50 at the positive going edge of the transfer pulse

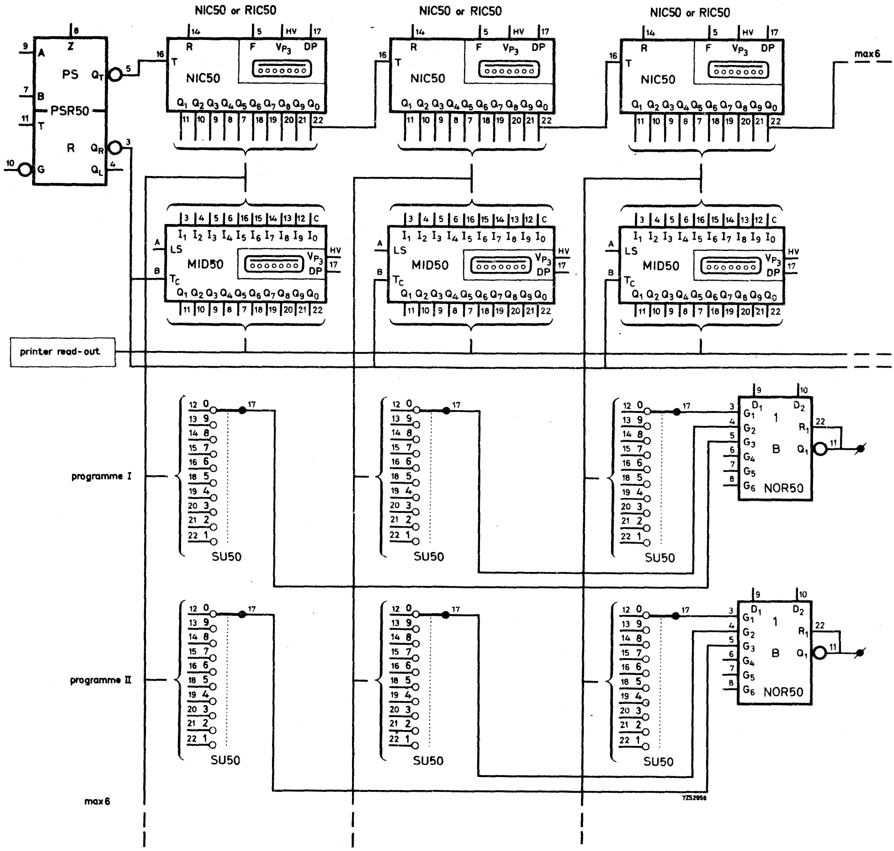
Voltage LOW

V_I = max. 5 V

I_I = max. 0.06 mA

Voltage HIGH

V_I = 0.8 V_{p1} to V_{p1}



Level shift input LS (terminal A)

By connecting a suitable zener diode between LS and 0 V and a resistor between LS and V_{P1}, the correct functional behaviour of the MID50 can be accomplished also when the inputs I_0-I_9 are fed with non-standard voltage levels (not derived from NIC50 or RIC50).

Transfer pulse input T_C (terminal B)

This input is driven by a pulse generated at output Q_R or Q_T of the unit PSR50. The transferring action takes place at the positive going edge. Maximum 6 inputs T_C can be driven simultaneously by output Q_R or Q_T of the PSR50.

Voltage LOW

V_B = max. 0.5 V

I_B = max. 0.5 mA

Voltage HIGH

V_B = 0.62 V_{P1} to V_{P1}

Decimal point input DP (terminal 17)

This input is to be driven by a LOW voltage level with the following requirements:

Decimal point ON

Voltage	V_{DP} = max. 0.5 V
Direct current	I_{DP} = 165 μA (typical)

Decimal point OFF

Voltage	V_{DP} = min. 50 V or terminal 17 floating

OUTPUT DATA

The digits 0-9 are available at the output terminals Q_0-Q_9. These outputs are primarily intended for either printer read-out purposes or shift register configurations.

Output voltage LOW (SCS conducting)

Voltage	V_Q = max. 3.5 V
Available direct current	I_Q = max. 0.2 mA *)

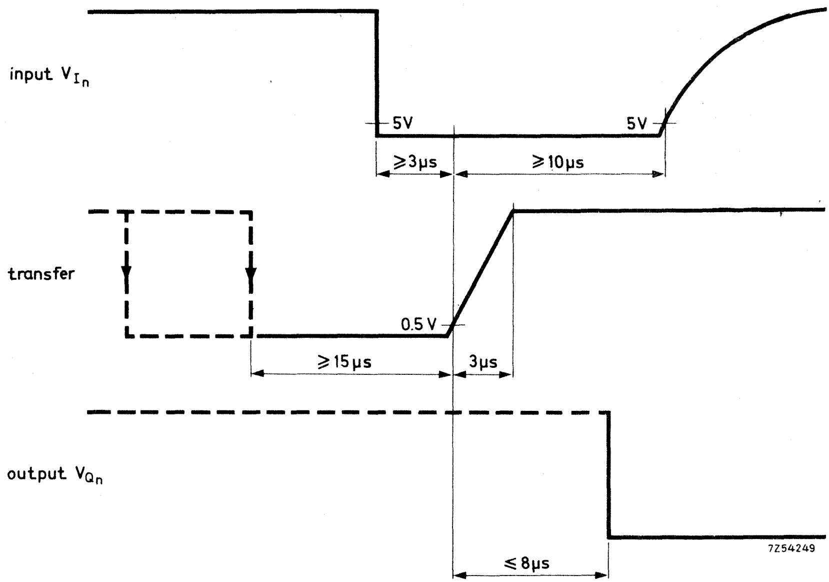
Output voltage HIGH (SCS non conducting)

Voltage	V_Q = 0.8 V_{P1} to V_{P1}
Available direct current	$-I_Q$ = max. 0.84 mA

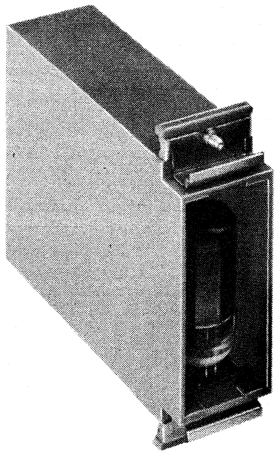
Wiring capacitance	C_W = max. 200 pF

*) The sum of the output currents I_{Q0}-I_{Q9} may not exceed 200 μA.

Time data


input V_{I_n}
5V
5V
≥3μs
≥10μs
transfer
0.5 V
≥15μs
3μs
output V_{Q_n}
7Z54249
≤8μs

SIGN INDICATOR DRIVER

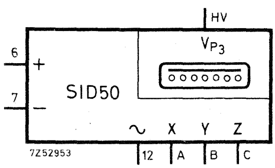


RZ 23932-3

Function — Driver of plus and minus character indicator tube.
Characters ~, X, Y and Z are accessible

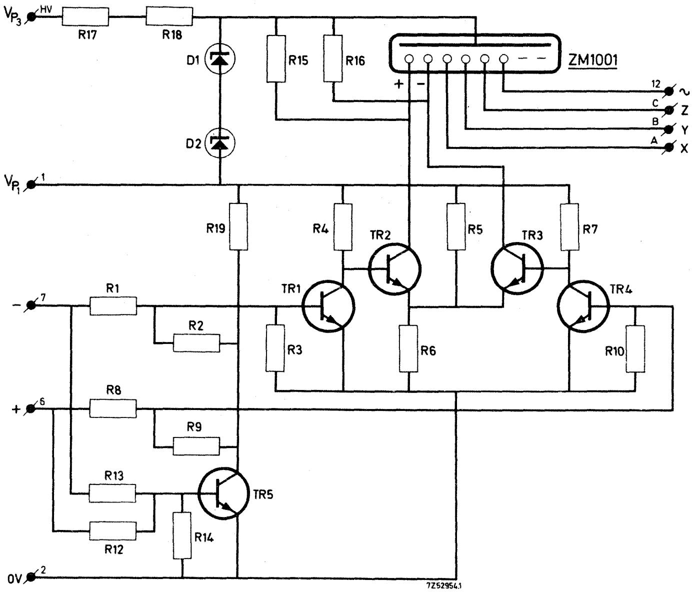
DESCRIPTION

The SID50 contains the plus and minus indicator tube ZM1001 and its driver stages in one plastic case. The ZM1001 is mounted at the front of the case, the connecting terminals are found at the rear.
A dark position of the ZM1001 can be obtained when both plus and minus inputs are driven by equal voltage levels.
The characters ~, X, Y and Z provided in the ZM1001 are also accessible.

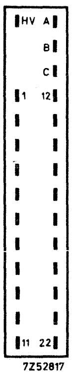


Drawing symbol

CIRCUIT DATA



Terminal location



HV	= V_{p3}	= +250 V supply for numerical indicator tube
A	= X	= X character
B	= Y	= Y character
C	= Z	= Z character
1	= V_{p1}	= +24 V supply
2	= 0	= common 0 V
3	= not provided	
4	= not provided	
5	= not provided	
6	= +	= input driving + character
7	= −	= input driving − character
8 to 11		= not provided
12	= ~	= ~ character
13 to 22		= not provided

Power supply

	voltage	current
Tube supply	+250 V ± 18%	2.8 mA
Logic supply	+ 24 V ± 10%	5.0 mA

INPUT DATA

Input terminals characters + and −

These inputs are to be driven by a HIGH voltage level to illuminate the corresponding character. A LOW level extinguishes the character.

HIGH voltage

V_+/V_- = 0.62 V_{p1} to V_{p1}

I_+/I_- = 0.17 mA (V = 13.4 V); EQUALS ONE D.U.*).

LOW voltage

V_+/V_- = max. 0.3 V

Characters ~, X, Y and Z

Visible : $V_\sim/V_X/V_Y/V_Z$ = 0 to 10 V

Not visible: $V_\sim/V_X/V_Y/V_Z$ = 60 to 120 V or floating

Dark : $V_\sim/V_X/V_Y/V_Z$ = 80 to 120 V or floating

*) See also loading table.

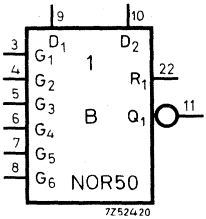
TRIPLE NOR GATE

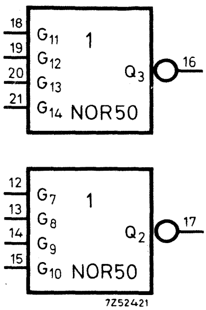
Function

- 6 input buffer NOR for adapting the output levels of the NIC50 and the RIC50 to standard logic levels and
- dual 4 input NOR for logic purposes e.g. to form a memory function.

DESCRIPTION

The 3.NOR50 is intended to be used to memorize the count when the content of the unit(s) NIC50 or RIC50 corresponds with the preset position of the 10 position thumb-wheel switch SU50.





Drawing symbol

6 input buffer NOR

The 6 input buffer NOR is intended to adapt the output levels of the NIC50 or the RIC50 to the standard logic levels of the 4 input NOR's.
To this end each input of the 6 input buffer NOR is to be connected, directly or via the switch SU50, to one of the decimal outputs of the units NIC50 or RIC50.

Simplified truth table:

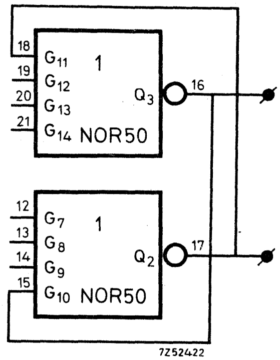
G_1	G_2	Q_1
H	H	L
L	H	L
H	L	L
L	L	H

All inputs (G_1 to G_6) must be LOW or floating for Q_1 is HIGH.

The 6 input buffer NOR can be provided with an intentional delay by interconnecting D_1 (terminal 9) and D2 (terminal 10) (see Time data). This intentional delay cancels hazardous (false) pulses that can occur during e.g. the transition from 499 to 500 at the transit counts 490 and 400, if preset programs have been set at these counts. The maximum delay can be decreased (the maximum counting rate increased) when an external capacitor is connected between D_1 and D_2.

Dual 4 input NOR

The 4 input NOR is intended for logic operations, such as memorizing the preset counts. To this end a memory function can be formed by cross connecting the two NOR's.

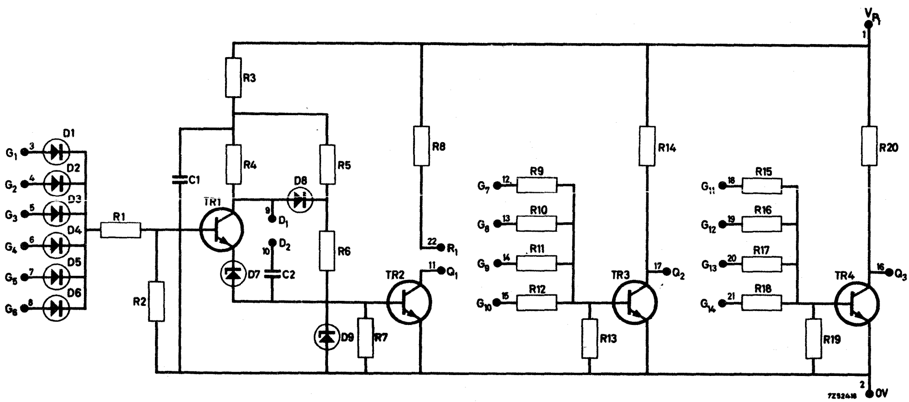


Simplified truth table:

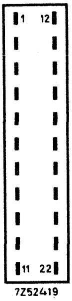
$G_7(G_{11})$	$G_8(G_{12})$	$Q_2(Q_3)$
H	H	L
H	L	L
L	H	L
L	L	H

All inputs G of a NOR must be LOW or floating for Q is HIGH.

CIRCUIT DATA



Terminal location



1 = V_{p_1}	= +24 V supply	12 = G_7	= input NOR2
2 = 0	= common 0 V	13 = G_8	= input NOR2
3 = G_1	= input buffer NOR1	14 = G_9	= input NOR2
4 = G_2	= input buffer NOR1	15 = G_{10}	= input NOR2
5 = G_3	= input buffer NOR1	16 = Q_3	= output NOR3
6 = G_4	= input buffer NOR1	17 = Q_2	= output NOR2
7 = G_5	= input buffer NOR1	18 = G_{11}	= input NOR3
8 = G_6	= input buffer NOR1	19 = G_{12}	= input NOR3
9 = D_1	= } when interconnected	20 = G_{13}	= input NOR3
10 = D_2	= } providing built-in delay	21 = G_{14}	= input NOR3
11 = Q_1	= output buffer NOR1	22 = R_1	= collector resistor buffer NOR1

Power supply

Voltage V_{p_1} = 24 V ±10%

Current I_{p_1} = 10.5 mA

INPUT DATA

6 input buffer NOR

Input HIGH: V_G = 0.8 V_{p_1} to V_{p_1}

I_G = 53 μA (V_G = 18.35 V)

Input LOW: V_G = 0 to 5.5 V

4 input NOR

Input HIGH: V_G = 0.62 V_{p_1} to V_{p_1}

I_G = 0.17 mA (V_G = 13.4 V); EQUALS ONE D.U.*)

Noise immunity: a voltage shift of 2 V on the minimum high level will not cause a change of the output voltage.

Input LOW: V_G = 0 to 0.3 V

Noise immunity: a voltage of +1 V with respect to the 0 V line applied to any one input (the other inputs at low level or floating) will not cause a change of the output voltage. The noise immunity can be increased by connecting unused inputs to 0 V.

*) See also loading table.

OUTPUT DATA

6 input buffer NOR

Output current: I_{Q_1} = 0.35 mA (V_{Q_1} = 13.4 V); EQUALS TWO D.U.*)

4 input NOR

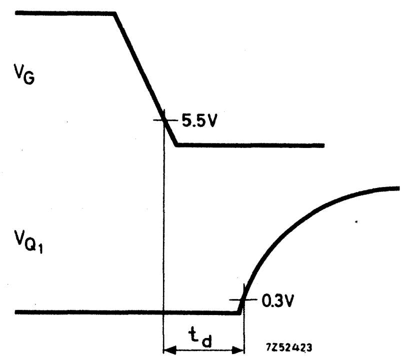
Output current: I_{Q_2/Q_3} = 1.02 mA (V_{Q_2/Q_3} = 13.4 V); EQUALS SIX D.U.*)

Time data

6 input buffer NOR

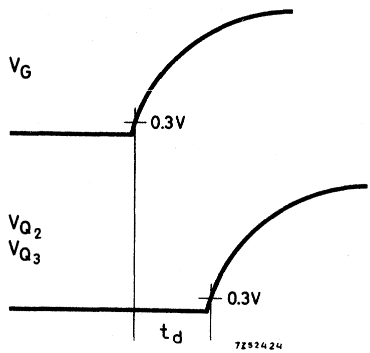
D_1 and D_2 interconnected: t_d = 7-18 μs

D_1 and D_2 not connected : t_d = 4 - 9 μs



4 input NOR

Delay, measured over two stages: t_d = max. 12 μs.
The delay is specified for C_w = 200 pF and worst input and output conditions.



*) See also loading table.

QUADRUPLE NOR GATE

Function

Quadruple 4 input NOR for logic operations e.g. to form memory functions.

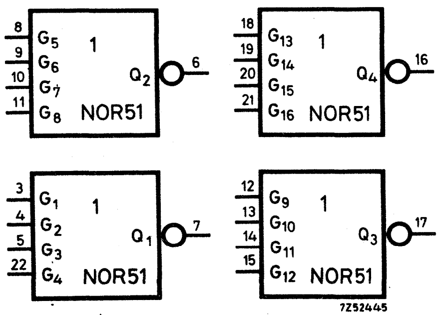
DESCRIPTION

The 4 input NOR is intended for logic operations. A memory function can be formed by cross connecting two NOR's.

Simplified truth table:

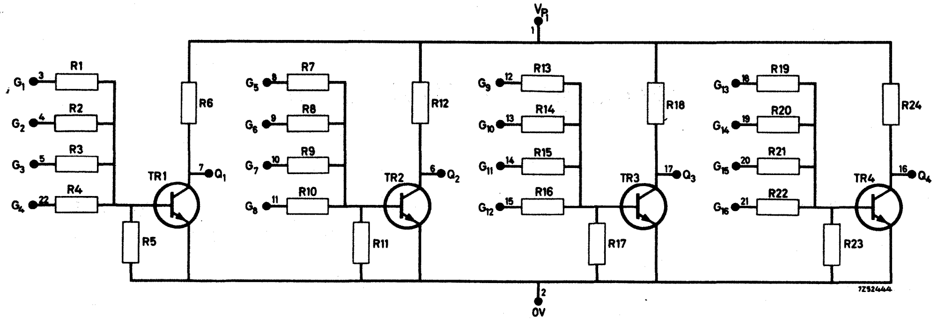
$G_1(G_5, G_9, G_{13})$	$G_2(G_6, G_{10}, G_{14})$	$Q_1(Q_2, Q_3, Q_4)$
H	H	L
H	L	L
L	H	L
L	L	H

All inputs G of a NOR must be LOW or floating for Q is HIGH.

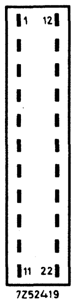


Drawing symbol

CIRCUIT DATA



Terminal location



1 = V_{p1}	= +24V supply	
2 = 0	= common 0 V	
3 = G_1	= input NOR 1	
4 = G_2	= input NOR 1	
5 = G_3	= input NOR 1	
6 = Q_2	= output NOR 2	
7 = Q_1	= output NOR 1	
8 = G_5	= input NOR 2	
9 = G_6	= input NOR 2	
10 = G_7	= input NOR 2	
11 = G_8	= input NOR 2	
12 = G_9	= input NOR 3	
13 = G_{10}	= input NOR 3	
14 = G_{11}	= input NOR 3	
15 = G_{12}	= input NOR 3	
16 = Q_4	= output NOR 4	
17 = Q_3	= output NOR 3	
18 = G_{13}	= input NOR 4	
19 = G_{14}	= input NOR 4	
20 = G_{15}	= input NOR 4	
21 = G_{16}	= input NOR 4	
22 = G_4	= input NOR 1	

Power supply

Voltage V_{p1} = 24 V ± 10%

Current I_{p1} = 8 mA

INPUT DATA

Input HIGH: V_G = 0.62 V_{P1} to V_{P1}

I_G = 0.17 mA (V_G = 13.4 V); EQUALS ONE D.U.*)

Noise immunity: a voltage shift of 2 V on the minimum high level will not cause a change of the output voltage.

Input LOW: V_G = 0 to 0.3 V

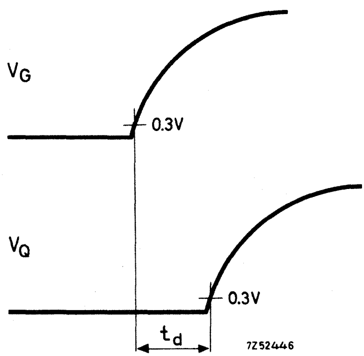
Noise immunity: a voltage of +1 V with respect to the 0 V line applied to any one G input (the other inputs at low level or floating) will not cause a change of the output voltage. The noise immunity can be increased by connecting unused inputs to 0 V.

OUTPUT DATA

Output current: I_Q = 1.02 mA (V_Q = 13.4 V); EQUALS SIX D.U.*)

Time data

Delay, measured over two stages: t_d = max. 12 μs
The delay is specified for Cw = 200 pF and worst input- and output conditions.



*) See also loading table.

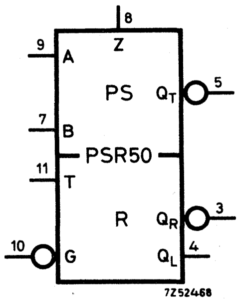
PULSE SHAPER AND RESET UNIT

Function

Pulse shaper for converting input signals into counting pulses for the NIC50 and the RIC50, and
reset unit for generating pulses for resetting the NIC50 and the RIC50,
generating pulses for resetting memories formed by cross-connected 4 input NOR's,
generating transfer pulses for the MID50.

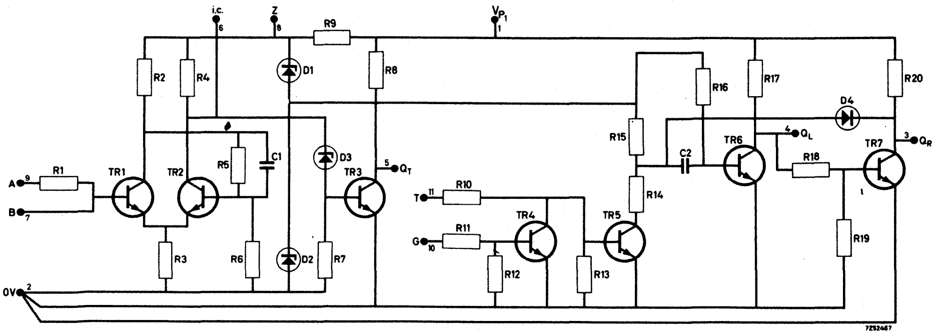
DESCRIPTION

The unit PSR50 contains a pulse shaper and a reset unit. The pulse shaper circuit consists of a Schmitt trigger followed by an inverting amplifier.
The circuit of the reset unit is a monostable multivibrator with one condition input and one trigger input.

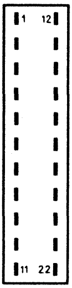


Drawing symbol

CIRCUIT DIAGRAM



Terminal location



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1 = V_{p_1} = +24 V supply
2 = 0 = common 0 V
3 = Q_R = counter reset output
4 = Q_L = logic reset output
5 = Q_T = pulse shaper output
6 = internally connected
7 = B = direct base input pulse shaper
8 = Z = internally connected
9 = A = resistor input pulse shaper
10 = G = gate input reset unit
11 = T = trigger input reset unit
12 to 22 = not provided

Power supply

Voltage	V_{p_1} = +24 V ± 10%
Current	I_{p_1} = 23 mA nominal

PULSE SHAPER

A HIGH level at input B (terminal 7) produces a LOW level at output Q_T (terminal 5), a LOW level at input B produces a HIGH level at output Q_T.

The pulse shaper can be used as follows:

- as a pulse shaper driven by an external source (input transducers)
- as a pulse shaper driven by NOR's of the 50- or 60-Series
- in a relaxation oscillator circuit

INPUT DATA

Pulse shaper driven by an external source

The input voltage has to be applied to B (terminal 7).

HIGH level (operating)

Voltage	V_B = min. 4.0 V
Current	I_B = max. 0.06 mA

LOW level (operating)

Voltage	V_B = max. +1.36 V

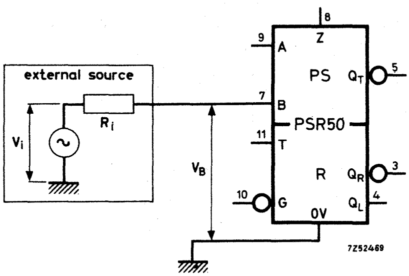
Limiting values

Voltage	V_B = max. +7.0 V min. −2 V
Current	I_B = max. 16 mA

Internal resistance of the driving external source

R_i = max. 33 kΩ

Hysteresis (difference between ON and OFF thresholds)



The hysteresis is affected by the R_i of the external source. The relation is given by the following formula:

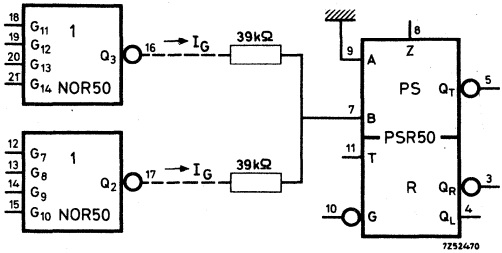
$$\Delta V_i = \text{min. } (1.5 - 0.0455\, R_i)\ \text{V}$$

$$\Delta V_B = \frac{\Delta V_i}{1 + 0.046\, R_i}\ \text{V}$$

R_i in kΩ and V in volt

Pulse shaper driven by a standard NOR

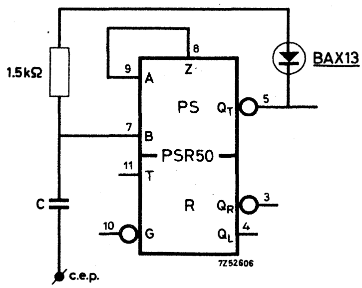
A (terminal 9) has to be connected to 0 (terminal 2).
The input voltage has to be applied to B (terminal 7), via a resistor of 39 kΩ (nominal).
I_G = max. 0.34 mA; EQUALS TWO D.U.*)



The maximum number of driving NOR's is two as shown in the diagram above.

Pulse shaper used in a relaxation oscillator circuit

For this application the connections must be made as shown in the circuitry below.



OUTPUT DATA

Available output suitable for driving three decade counters NIC50 or RIC50 simultaneously

Output voltage LOW

Voltage	V_{QT} = max. 0.5 V
Direct current	I_{QT} = max. 25 mA (V_{QT} = 0.5 V) max. 10 mA (V_{QT} = 0.3 V)
Transient charge	Q_{QT} = max. 30 nC
Wiring capacitance at Q_T	C_w = max. 200 pF

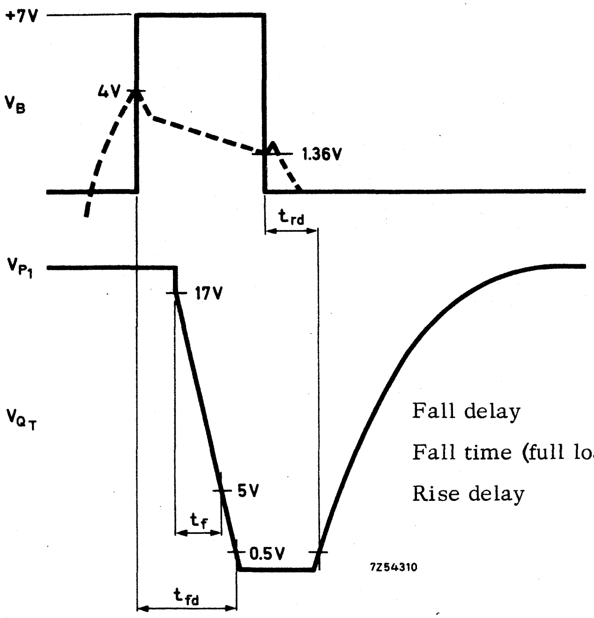
*) See also loading table.

Output voltage HIGH

Voltage	V_{QT} =	0.62 V_{P1} to V_{P1}
Direct current	$-I_{QT}$ = max.	0.34 mA; EQUALS TWO D.U.*)

Wiring capacitance	C_W = max.	200 pF

Time data (when the PSR50 is used in combination with 50-Series units)



Fall delay	t_{fd}	= max.	2 μs
Fall time (full load)	t_f	= max.	1 μs
Rise delay	t_{rd}	= max.	2 μs

RESET UNIT

Reset pulses are only generated when:

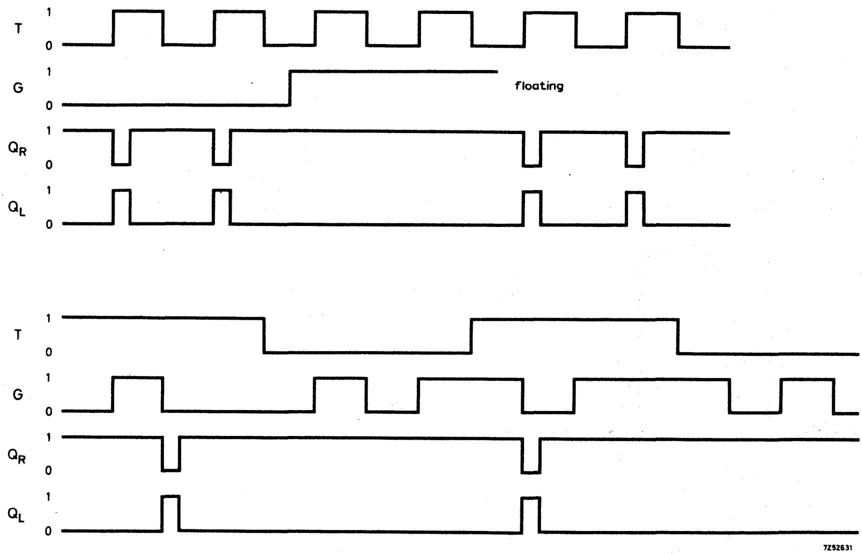
the HIGH level is applied to the trigger input T (terminal 11), and
the gate input G (terminal 10) is kept at the LOW level or left floating.

The unit generates two reset pulses simultaneously, namely:

from the logic reset output Q_L (terminal 4) for resetting d.c. memories built with NOR's
from the counter reset output Q_R (terminal 3) for resetting decade counters NIC50 and RIC50.

Note - A reset pulse is also generated when the G-input changes from the HIGH to the LOW level, whilst the T-input is at the HIGH level.

*) See also loading table.



INPUT DATA

Input HIGH

Voltage $V_{T(G)} = 0.62\ V_{P_1}$ to V_{P_1}

limiting value $V_{T(G)} = +100$ V

Current $I_{T(G)} = 0.17$ mA ($V_{T(G)} = 13.4$ V); EQUALS ONE D.U.*)

Noise immunity: a voltage shift of 2 V on minimum HIGH level will not cause a change of the output voltage.

Input LOW

Voltage $V_{T(G)} =$ max. 0.3 V

limiting value $V_{T(G)} = -15$ V

Noise immunity: a voltage of +1.25 V with respect to the 0 V terminal applied to either the T- or the G-input will not cause a change of the output voltage.

OUTPUT DATA

Output Q_L: capable of driving max. 4NOR's; EQUALS FOUR D.U.*)

Voltage V_{QL} = min. $0.53\ V_{P_1}$

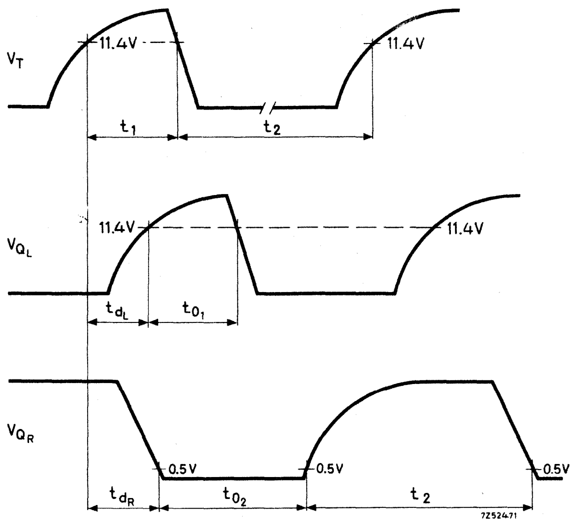
Direct current $-I_{QL}$ = max. 0.55 mA ($V_{QL} = 11.4$ V)

*) See also loading table.

Output Q_R: capable of driving the reset input of 6 decade counters NIC50 or RIC50 simultaneously

Voltage	V_{QR} = max. 0.5 V
Direct current	I_{QR} = max. 51 mA
Wiring capacitance	C_W = max. 200 pF at Q_R and Q_L

Time data



Input pulse duration	t_1	= min. 20 μs
Recovery time *)	t_2	= min. 20 μs
Output pulse duration	t_{0_1}	= min. 15 μs max. 45 μs
	t_{0_2}	= min. 15 μs max. 50 μs
Delay between V_T and V_{Q_L}	t_{d_L}	= max. 3 μs
Delay between V_T and V_{Q_R}	t_{d_R}	= max. 7 μs
Rise time at T	t_r	= max. 100 μs (between 0.5 V and 11.4 V)
Fall time at G	t_f	= max. 100 μs (between 11.4 V and 0.5 V)

*) The recovery time starts at the trailing edge of V_T when $t_1 > t_{0_2}$ or starts at the trailing edge of V_{QR} when $t_{0_2} > t_1$.

LAMP/RELAY DRIVER

Function — Low-power amplifier for driving lamps and relays

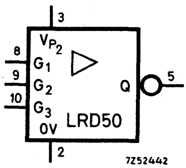
DESCRIPTION

The circuit consists of an inverting amplifier preceded by a 3 input OR-gate.
The load has to be connected between output Q and the unstabilised +24 V supply voltage (abs. max. 30 V).
The load is energised when one or more inputs are HIGH (Q is LOW).
The output transistor is protected against voltage transients which occur when inductive loads are driven.

Simplified truth table:

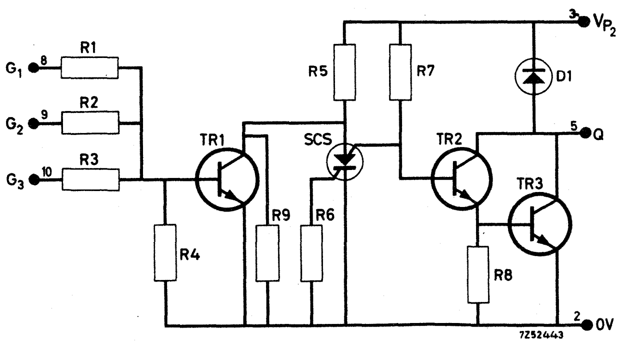
G_1	G_2	Q
H	H	L
H	L	L
L	H	L
L	L	H

All inputs G must be LOW or floating for Q is HIGH.

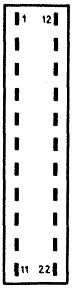


Drawing symbol

CIRCUIT DATA



Terminal location



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1 = not provided
2 = 0 = common 0 V
3 = V_{p_2} = +24 V supply
4 = not provided
5 = Q = output
6 = not provided
7 = not provided
8 = G_1 = input
9 = G_2 = input
10 = G_3 = input
11 = not provided
12 to 22 = not provided

Power supply

Voltage: V_{p_2} = +24 V ±25%

Current: I_{p_2} = (4.4 + I_Q) mA

INPUT DATA

Output transistor ON

Input HIGH: : V_G = 0.62 V_{p_1} to V_{p_1}
I_G = max. 0.17 mA (V_G = 13.4 V); EQUALS ONE D.U.*)

Noise immunity: A voltage shift of 2 V on the minimum high level will not cause a change of the output voltage.

Output transistor OFF

Input LOW : V_G = max. 0.3 V

Noise immunity: A voltage of 1.25 V with respect to the 0 V line applied to any one input (other inputs at low level or floating) will not cause a change of the output voltage. The noise immunity can be increased by connecting unused inputs to 0 V.

OUTPUT DATA

Output transistor ON

I_Q = abs. max. 300 mA ($V_Q \leq 1.6$ V)

Output transistor OFF

I_Q = max. 0.5 mA at V_Q = abs. max. 30 V.

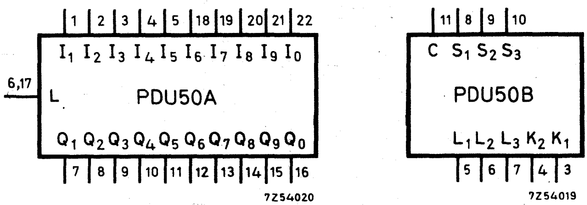
*) See also loading table.

PRINTER DRIVE UNIT

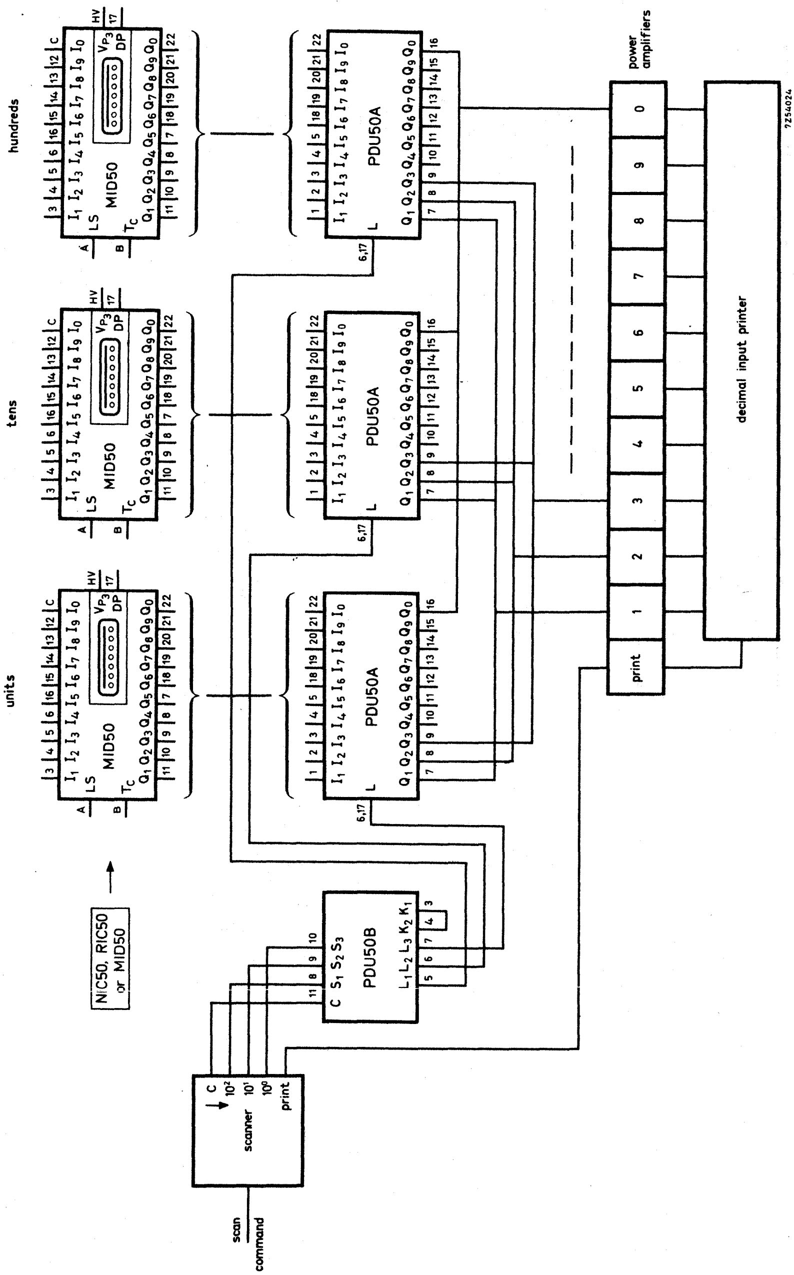
Function — Intermediate stages to drive decimal input printers

DESCRIPTION

With the units PDU50A and PDU50B a complete printer drive circuit is formed. This circuit is intended to be used in combination with the NIC50, RIC50 or MID50 and a printer which requires decimal information at its inputs. A diagram for driving such a printer is given on the next page. One PDU50A unit, which contains ten inverter stages, must be used per decade.
The ten decimal inputs I_0 to I_9 can be connected directly to the ten corresponding outputs Q_0 to Q_9 of either the uni-directional decade counter NIC50 or the bi-directional decade counter RIC50 or the buffer memory MID50.
When a positive voltage is applied to control input L, that particular output Q will become HIGH, which has a LOW level at its input.
The PDU50B contains one clock control and three scan control circuits suitable to operate with a three decade counting system.
When simultaneously both the clock control input C and one of the scan control inputs S_1 to S_3 are at LOW level a positive voltage is available at the corresponding control output L_1 to L_3 of the PDU50B. Each control output of the PDU50B is connected to the control input L of the PDU50A.



Drawing symbols



hundreds
tens
units
MID50
PDU50A
PDU50B
NIC50, RIC50 or MID50
scanner
scan command
print
power amplifiers
decimal input printer
7Z54024

Summarising the functions of the PDU50A and PDU50B it becomes clear that a particular output Q of the PDU50A is at a HIGH level only, when the three following conditions are fulfilled:
- the corresponding input I of the PDU50A at a LOW level,
- the clock control input C of the PDU50B at a LOW level,
- the corresponding scan control input S_1 to S_3 of the PDU50B at a LOW level.

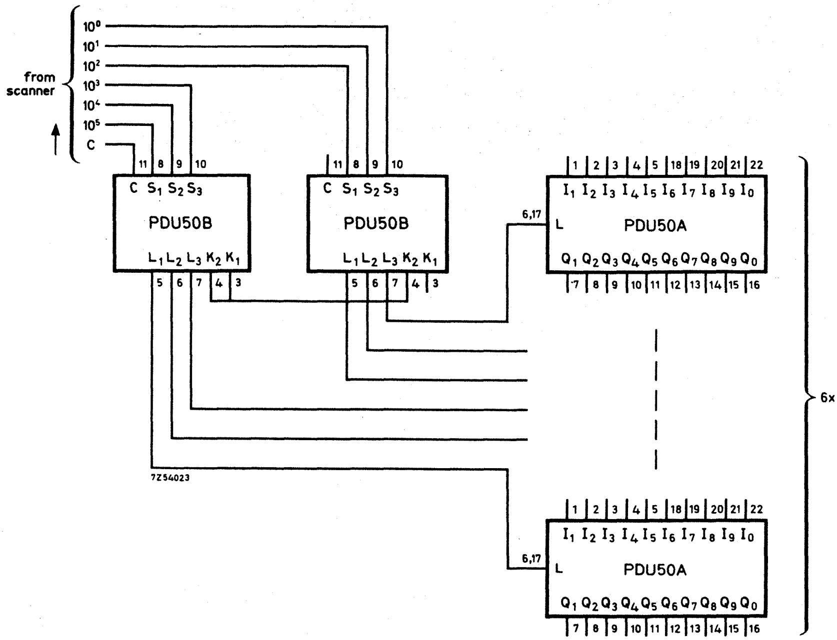
Note that only one output Q of the PDU50A is HIGH at a time as shown in the truth table below.

Truth table:

inputs			output
PDU50B		PDU50A	
C	S	I	Q
H	H	H	L
L	H	H	L
H	L	H	L
L	L	H	L
H	H	L	L
L	H	L	L
H	L	L	L
L	L	L	H

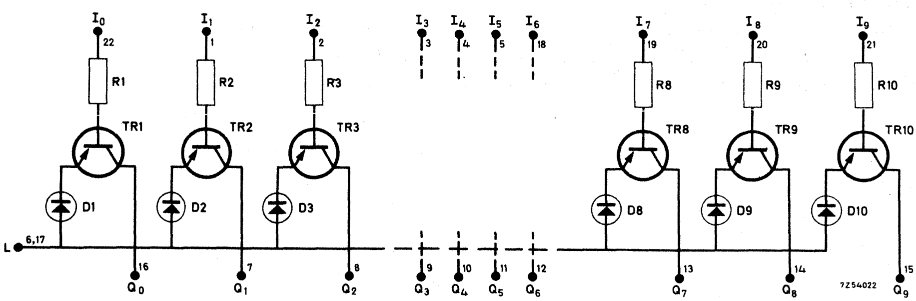
As the positive voltage derived from the PDU50B is fed to terminal L of only one PDU50A at a time it is permissible to common the corresponding outputs of all PDU50A units without any feedback consequences. These ten commoned PDU50A outputs are to be connected to ten power stages, of which the output power depends on the driving input requirements of the decimal input printers, e.g. the LRD50 supplies 300 mA/30V.

The description above holds for systems up to three decades, for which the terminals K_1 and K_2 of the PDU50B have to be interconnected.
When however more than three decades are required another PDU50B unit must be added to the system.
In this case terminals K_1 and K_2 need be interconnected for only one PDU50B.
For the other units PDU50B the terminals K_1 and K_2 are left open.
An interconnection diagram is given on the next page.

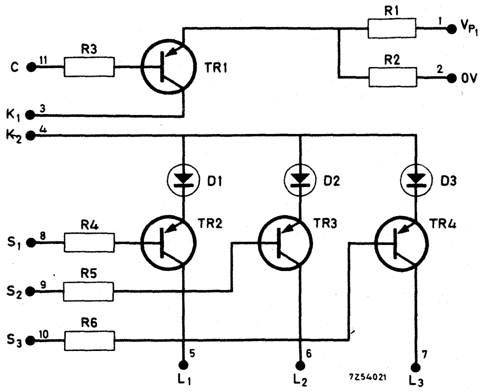


Note - When the input signal for the PDU50A is obtained from a MID50 unit either the clock pulse input C or all the scan inputs of the PDU50B must be at the HIGH level during the time the shift pulse input T_C of the MID50 is at the LOW level.

CIRCUIT DATA



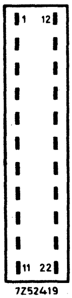
PDU50A



PDU50B

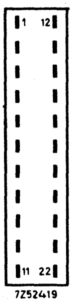
Terminal location

PDU50A



1 = I_1	= decimal input 1	12 = Q_6 = decimal output 6
2 = I_2	= decimal input 2	13 = Q_7 = decimal output 7
3 = I_3	= decimal input 3	14 = Q_8 = decimal output 8
4 = I_4	= decimal input 4	15 = Q_9 = decimal output 9
5 = I_5	= decimal input 5	16 = Q_0 = decimal output 0
6 = L	= control input	17 = L = interconnected with 6
7 = Q_1	= decimal output 1	18 = I_6 = decimal input 6
8 = Q_2	= decimal output 2	19 = I_7 = decimal input 7
9 = Q_3	= decimal output 3	20 = I_8 = decimal input 8
10 = Q_4	= decimal output 4	21 = I_9 = decimal input 9
11 = Q_5	= decimal output 5	22 = I_0 = decimal input 0

PDU50B



1 = V_{P_1}	= +24 V supply	7 = L_3 = control output 3
2 = 0	= common 0 V	8 = S_1 = scan control input 1
3 = K_1	= interconnecting point	9 = S_2 = scan control input 2
4 = K_2	= interconnecting point	10 = S_3 = scan control input 3
5 = L_1	= control output 1	11 = C = clock control input
6 = L_2	= control output 2	12 to 22 = not provided

Power supply PDU50B

Voltage V_{p_1} = 24 V ± 10%

Current I_{p_1} = 1 mA

INPUT DATA

PDU50A

Decimal inputs I_0 to I_9

These inputs are to be driven from decimal outputs Q_0 to Q_9 of either NIC50, RIC50 or MID50.
By applying a suitable, positive voltage to input L derived from output L_1, L_2 or L_3 of the PDU50B, that output Q becomes HIGH which has a LOW level at its input.

Voltage LOW:
V_I = max. 5 V
I_I = max. 35 μA

Voltage HIGH:
V_I = min. 0.8 V_{p_1}

PDU50B

Clock control input C (terminal 11)

Voltage LOW:
V_C = max. 5 V
I_C = max. 35 μA

Voltage HIGH:
V_C = min. 0.9 V_{p_1}

Scan control inputs S_1, S_2, S_3 (terminals 8, 9, 10)

Voltage LOW:
V_S = max. 5 V
I_S = max. 35 μA

Voltage HIGH:
V_S = min. 0.9 V_{p_1}

OUTPUT DATA

PDU50A

Output voltage LOW:
V_Q = max. 0.3 V

Output voltage HIGH:
I_Q = max. 0.34 mA (V_Q = 13.4 V); EQUALS TWO D.U.

PDU50B

Available output at the HIGH and LOW level (terminals L_1 to L_3) are adapted to the input requirements of the input terminal L of units PDU50A.

DECADE COUNTER AND DIVIDER

Function	Divider of 2, 3, 4, 5, 6, 8, 9, 10, 12 and 16
Ambient temperature range	
operating	−25 to +70 °C (at V_P = 24 V ±10%)
	−10 to +70 °C (at V_P = 24 V ±25%)
storage	−40 to +85 °C

DESCRIPTION

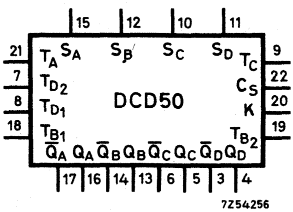
The DCD50 consists of four flip-flops. By correctly interconnecting the terminals a divider of 2, 3, 4, 5, 6, 8, 9, 10, 12 or 16 can be obtained. Each flip-flop is driven by a positive-going pulse. The flip-flops have one common reset input and four separate preset inputs, their condition being governed by a positive-going pulse applied to the appropriate terminal(s). When setting or presetting the DCD50 one sometimes has to apply a HIGH level signal to one of the trigger inputs of the second flip-flop (input K, via a diode).

Truth table (decade counter configuration):

	FF-A	FF-B	FF-C	FF-D
pulse	$\overline{Q_A}$	$\overline{Q_B}$	$\overline{Q_C}$	$\overline{Q_D}$
initial state	1	1	1	1
1	0	1	1	1
2	1	0	1	1
3	0	0	1	1
4	1	1	0	1
5	0	1	0	1
6	1	0	0	1
7	0	0	0	1
8	1	1	1	0
9	0	1	1	0

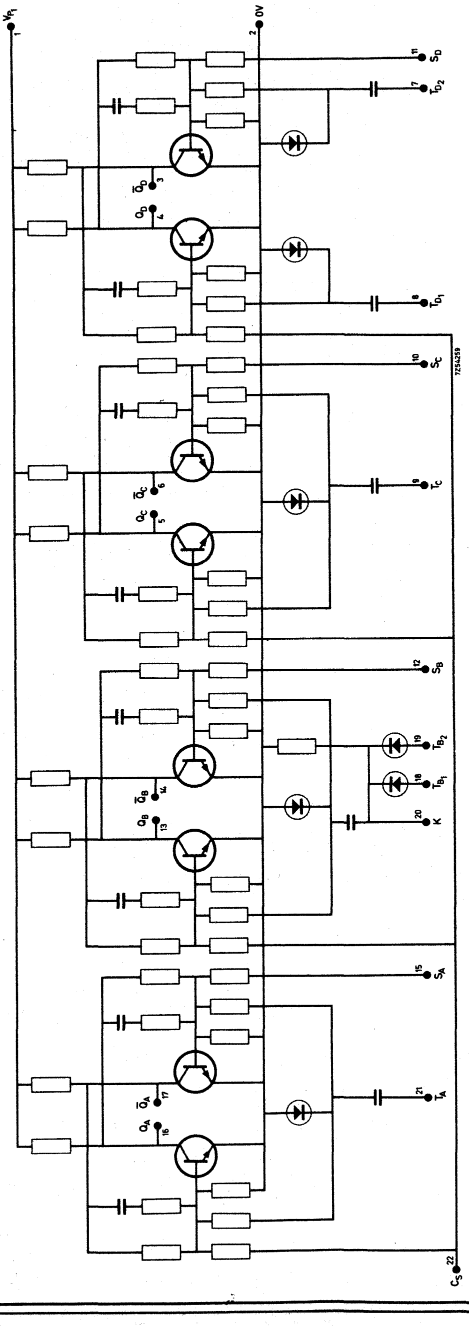
The table below shows the interconnections to be made externally for the various dividers:

divider	input	interconnection	output
2	8	7-8	$\overline{Q_D}$
	9	–	$\overline{Q_C}$
	18	–	$\overline{Q_B}$
	21	–	$\overline{Q_A}$
3	18	4-19, 7-14, 8-18	$\overline{Q_D}$
4	9	6-7-8	$\overline{Q_D}$
	21	17-18	$\overline{Q_B}$
5	18	4-19, 6-7, 8-18, 9-14	$\overline{Q_D}$
6	21	4-19, 7-14, 8-17-18	$\overline{Q_D}$
8	21	6-7-8, 9-17	$\overline{Q_D}$
9	18	4-19, 6-7, 8-18, 9-17, 14-21	$\overline{Q_D}$
10	21	4-19, 6-7, 8-17-18, 9-14	$\overline{Q_D}$
12	9	4-19, 6-21, 7-14, 8-17-18	$\overline{Q_D}$
16	21	6-7-8, 9-14, 17-18	$\overline{Q_D}$

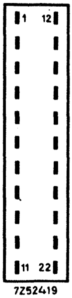


Drawing symbol

CIRCUIT DIAGRAM



Terminal location



1 =	V_{p1}	= +24 V supply
2 =	0	= common 0 V
3 =	$\overline{Q_D}$	= output $\overline{Q}$ of flip-flop D
4 =	Q_D	= output Q of flip-flop D
5 =	Q_C	= output Q of flip-flop C
6 =	$\overline{Q_C}$	= output $\overline{Q}$ of flip-flop C
7 =	T_{D2}	= trigger input T of flip-flop D
8 =	T_{D1}	= trigger input T of flip-flop D
9 =	T_C	= trigger input T of flip-flop C
10 =	S_C	= preset input of flip-flop C
11 =	S_D	= preset input of flip-flop D
12 =	S_B	= preset input of flip-flop B
13 =	Q_B	= output Q of flip-flop B
14 =	$\overline{Q_B}$	= output $\overline{Q}$ of flip-flop B
15 =	S_A	= preset input of flip-flop A
16 =	Q_A	= output Q of flip-flop A
17 =	$\overline{Q_A}$	= output $\overline{Q}$ of flip-flop A
18 =	T_{B1}	= trigger input T of flip-flop B
19 =	T_{B2}	= trigger input T of flip-flop B
20 =	K	= extender input of flip-flop B
21 =	T_A	= trigger input T of flip-flop A
22 =	C_S	= common reset input

Power supply

Voltage	V_{p1} = +24 V ± 10% (at T_{amb} = −25 to +70 °C)
	V_{p1} = +24 V ± 25% (at T_{amb} = −10 to +70 °C)
Current	I_{p1} = 25 mA nominal

INPUT DATA

Trigger inputs T_A, T_{B1}, T_{B2}, T_C, T_{D1} and T_{D2} (terminals 21, 18, 19, 9, 8 and 7)

The trigger inputs require a positive-going pulse.

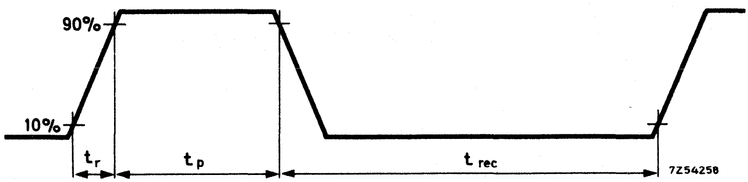
From another DCD50

	V_{p1} = 24 V ± 10%	V_{p1} = 24 V ± 25%
Triggering edge	from 0.3 V to 0.7 V_{p1}	from 0.3 V to 0.8 V_{p1}
Wiring capacitance C_W	C_W = max. 150 pF	

From a PSR50 (output Q_T) or from a NOR unit

	V_{p1} = 24 V ± 10%	V_{p1} = 24 V ± 25%
Triggering edge	from 0.3 V to 0.91 V_{p1}	from 0.3 V to 0.83 V_{p1}
Permissible load at output of driving unit	max. 1 D.U.	max. 2 D.U.
Wiring capacitance C_W	max. 150 pF	max. 50 pF

Time data



Fall time of negative-going input pulse to NOR-unit	t_f	= max.	2 μs	
Rise time of input pulse to trigger input T of DCD50 from another unit than those mentioned above	t_r	= max.	1 μs	
Pulse duration	t_p	= min.	4 μs	
Recovery time for inputs T_A, T_C, T_{D1}, T_{D2}	t_{rec}	= min.	10 μs	
	t_p+t_{rec}	= min.	30 μs	
for inputs T_{B_1}, T_{B2}	t_{rec}	= min.	80 μs,	required at input: 1 D.U.
	t_{rec}	= min.	40 μs,	with external resistor of 82 kΩ between K and 0; required at input: 2 D.U.
	t_{rec}	= min.	27.5 μs,	with external resistor of 43 kΩ between K and 0; required at input: 3 D.U.

Noise margin 1.5 V

Common reset input C_S (terminal 22) and preset inputs S_A, S_B, S_C and S_D (terminals 15, 12, 10 and 11)

Voltage LOW

V_S, V_{CS} = max. 0.3 V

Voltage HIGH

V_S, V_{CS} = min. 0.62 V_{P_1}

I_S = min. 0.24 mA (V_S = 13.4 V); EQUALS 1.5 D.U.

I_{CS} = min. 0.96 mA (V_{CS} = 13.4 V); EQUALS 6 D.U.

Resetting

When a DCD50 is used as a divider of 3, 5 or 9 an inhibit pulse (HIGH level) must be applied to K (terminal 20) via a diode type BAX13 (cathode to K).

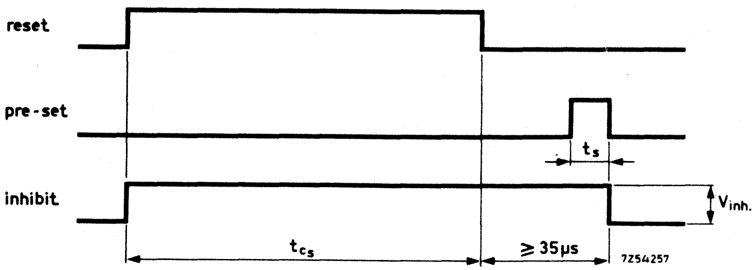
Presetting

When a DCD50 is used as a divider of 3, 5 or 9 and presetting via S_D (terminal 11) is required, an inhibit pulse must be applied to K (terminal 20) via a diode BAX13 (cathode to K).

When a DCD50 is used as divider of 6, 10 and 12 and presetting via S_A and S_D (terminals 15 and 11) is required, an inhibit pulse must be applied to K (terminal 20) via a diode BAX13 (cathode to K).

Time data

The reset pulse and the preset pulse must not be applied at the same time.



Reset pulse duration	t_{c_s}	= min. 20 µs per flip-flop
Preset pulse duration	t_s	= min. 5 µs
Time delay between reset (preset) pulse and trigger input signal	t_{r-t}	= min. 30 µs
Time delay between end of reset pulse and end of preset pulse	t_{r-p}	= min. 35 µs

Inhibit pulse:

Voltage HIGH: $V_{inh} \geq V_{TB1}\ (TB2) - 1.5$ V

When inhibit pulses are applied the total reset time in a chain of dividers, built with the DCD50, can be reduced to $t = (n + 1)\ 20\ \mu s$, where n = maximum number of flip-flops between two inhibited flip-flops.

OUTPUT DATA

The outputs of the four flip-flops are Q_A, $\overline{Q_A}$, Q_B, $\overline{Q_B}$, Q_C, $\overline{Q_C}$, Q_D and $\overline{Q_D}$.

Voltage LOW

V_Q = max. 0.3 V

Voltage HIGH

	V_{P1} = 24 V ±10%	V_{P1} = 24 V ±25%
Loadability	6 D.U.	4 D.U.

Loadability at V_{P1} = 24 V ±10%

- Each output can be loaded with one trigger input of a NIC50.
- The outputs Q_A, Q_B, $\overline{Q_B}$, Q_C and $\overline{Q_C}$ can be loaded with 6 D.U. plus one trigger input of a next DCD50 (except T_{B_1}, and T_{B_2}) or with 4 D.U. plus one base input of a PSR50.
- For further output data and maximum pulse repetition frequency, see table on next page.

Wiring capacitance at each output: C_W = max. 150 pF

Note - For proper inhibiting of the trigger gate of the second flip-flop in the DCD50 the load at the inhibiting output must not exceed the load at the trigger input by more than 2 D.U.

divider of	input terminal	input required (D.U.)	max. p.r.f. (kHz) without resistor *) **)	max. p.r.f. (kHz) with 43 kΩ *) **)	max. p.r.f. (kHz) with 82 kΩ *) **)	available output (D.U.) Q_A	$\overline{Q_A}$	Q_B	$\overline{Q_B}$	Q_C	$\overline{Q_C}$	Q_D	$\overline{Q_D}$
2	21	-	30			6	6						
	9	-	30							6	6		
	7-8	-	30									6	6
	18	3		30 18				6	6				
		2			22 12.5			6	6				
		1	12 6					6	6				
3	8-18	3		30 18				6	6			3	6
		2			22 12.5			6	6			4	6
		1	12 6					6	6			5	6
4	9	-	30							6	6	6	6
	21	-		30		6	3	6	6				
					24	6	4	6	6				
			12			6	5	6	6				
5	8-18	3		30 18				6	6	6	6	3	6
		2			22 12.5			6	6	6	6	4	6
		1	12 6					6	6	6	6	5	6
6	21	-		30		6	3	6	6			3	6
					24	6	4	6	6			4	6
			12			6	5	6	6			5	6
8	21	-	30			6	6			6	6	6	6
9	8-18	3		30 18		6	6	6	6	6	6	3	6
		2			22 12.5	6	6	6	6	6	6	4	6
		1	12 6			6	6	6	6	6	6	5	6
10	21	-		30		6	3	6	6	6	6	3	6
					24	6	4	6	6	6	6	4	6
			12			6	5	6	6	6	6	5	6
12	9	-			30	6	4	6	6	6	6	4	6
			24			6	5	6	6	6	6	5	6
16	21	-	30***)			6	6	6	6	6	6	6	5
				30		6	3	6	6	6	6	6	6
					24	6	4	6	6	6	6	6	6
			12			6	5	6	6	6	6	6	6

*) Input pulses according to "Time data".

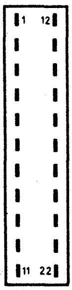
**) Input pulses with $\frac{1}{2}$ T wave form.

***) Second flip-flop (B) is last in chain.

Preset switch

For decoding the DCD50 in preset programmed counting systems use has to be made of the decoding switch 1248N, catalogue number 4311 027 82221.

Note that:
- the outputs of the DCD50 have to be connected to the switch inputs as given below
- the internal resistance of the switch (terminal 12) has to be left floating.

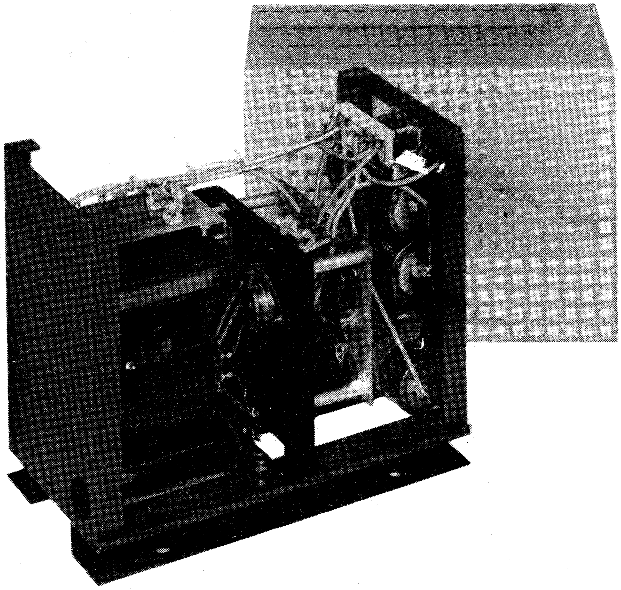


7Z52419

1 = not connected	12 = floating
2 = not connected	13 = not connected
3 = not connected	14 = not connected
4 = $\overline{Q_D}$	15 = $\overline{Q_A}$
5 = Q_D	16 = Q_A
6 = output (pole)	17 = output (pole)
7 = Q_B	18 = Q_C
8 = $\overline{Q_B}$	19 = $\overline{Q_C}$
9 = not connected	20 = not connected
10 = not connected	21 = not connected
11 = not connected	22 = not connected

Note - The output (pole) of the decoding switch may directly be connected to one of the inputs of a NOR in the 4.NOR51 unit.

POWER SUPPLY UNIT
for 50-Series direct display counters



RZ 24599-2

TECHNICAL PERFORMANCE

Operating ambient temperature range	−25 to +65 °C

The unit is provided with a temperature fuse (F1).

Input data

Input voltage	110, 120, 130, 220, 230, 240 V_{ac}, +10%, −15%
Input frequency	45 to 65 Hz

Output data

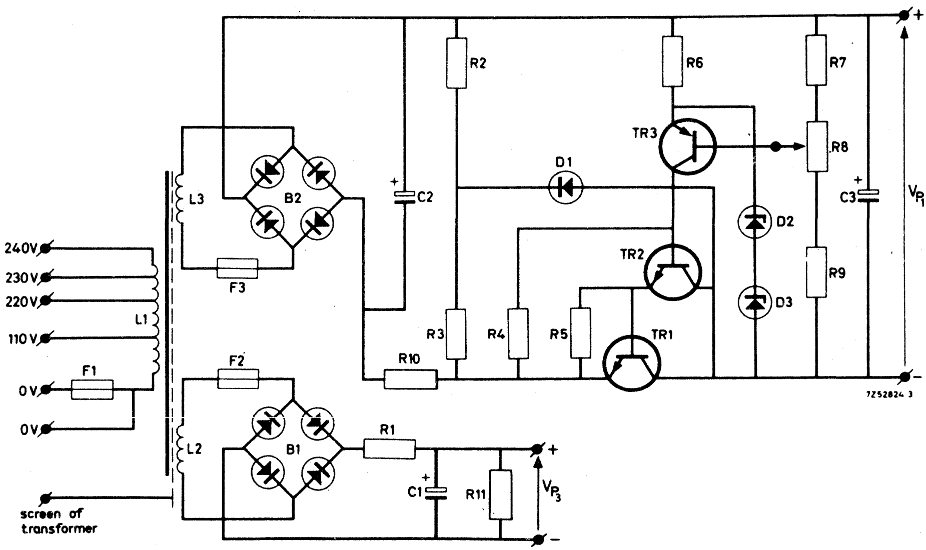
Logic supply (V_{P1})

Output voltage	+24 V ± 5%
Output current	0 to 250 mA
Internal resistance	0.5 Ω
Ripple voltage	10 mV_{rms}
Temperature coefficient	1 mV/deg C (typical value)
Fusing	easy replaceable fuse (630 mA slow, F3)

Provided with automatic short-circuit protection

Numerical indicator tube supply (V_{P3})

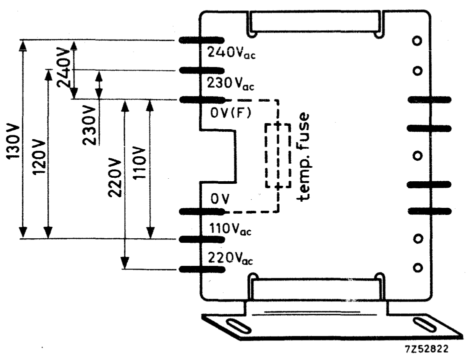
Output voltage	+250 V ± 18%
Output current	max. 40 mA
Fusing	easy replaceable fuse (100 mA slow, F2)



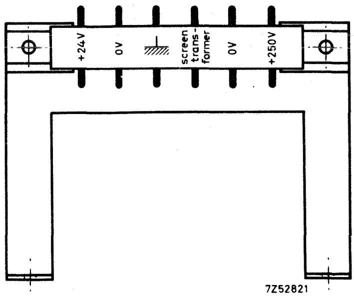
Circuit diagram

Terminal location

mains transformer



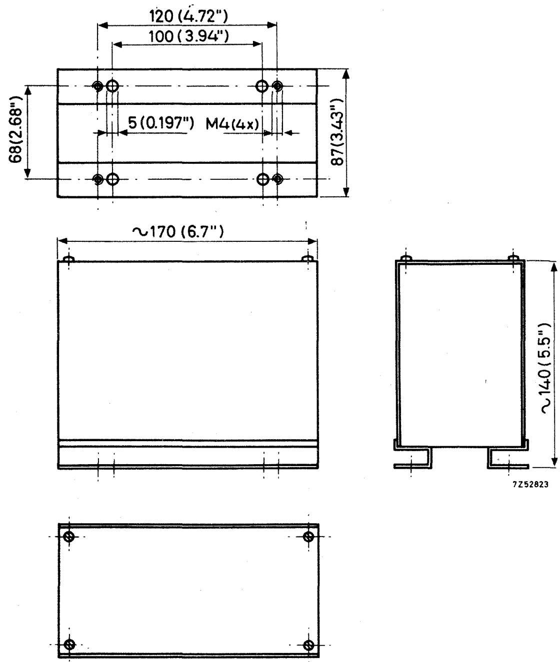
output terminals



Note - Both input and output terminals are suitable for direct soldered connections.

MECHANICAL DATA

Housing	steel
Cover	perforated steel



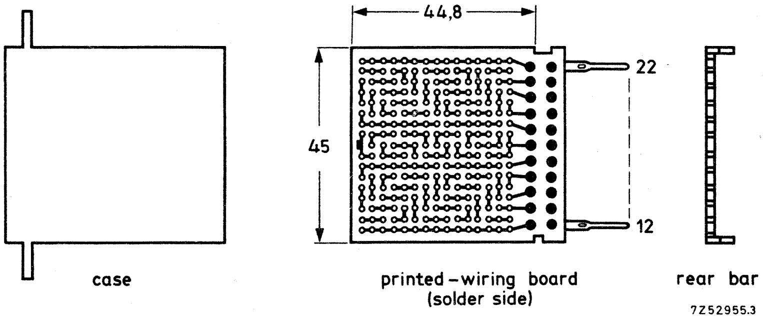
Dimensions in mm, inch values between brackets

EMPTY CASE ASSEMBLY

Function	Empty case assembly for non-standard circuits

DESCRIPTION

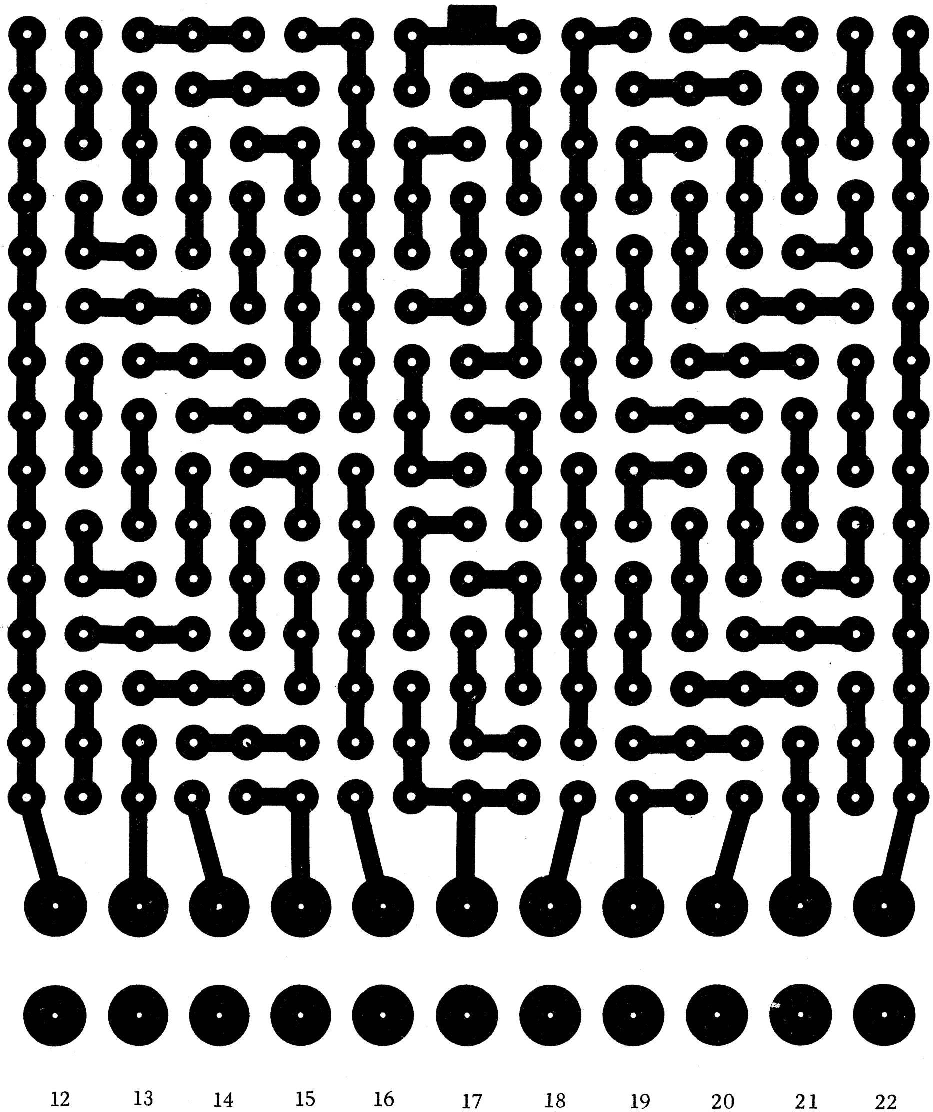
For non-standard circuit configurations an empty case assembly comprising a plastic case, a general purpose printed-wiring board and a rear bar is available in the 50-Series.
With these items non-standard circuits can be built in a technology similar to that of all auxiliary modules in the range.



Dimensions in mm

Printed-wiring board	
material	glass-epoxy with 254 plated-through holes
hole diameter	$0,8\ ^{+0,2}_{-0,05}$ mm
grid pitch	2,54 mm (0, 1 inch)
contacts	11; similar to those of all other 50-Series modules

Note: On the next page the layout of the printed wiring (solder side) is shown on a scale 3:1, which can be used as an aid for the designer.



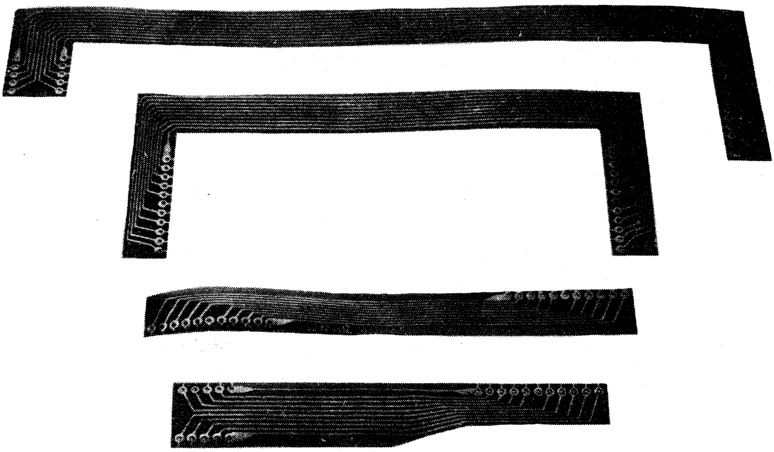
Layout of printed wiring (solder side); scale 3 : 1

Accessories for
counter modules 50-Series

MOUNTING ACCESSORIES

For mounting accessories the sections "INTRODUCTION" and "CONSTRUCTION" of 50-Series, General should be consulted.

FLEXIBLE PRINTED WIRING



RZ 28179-3

The use of flexible printed wiring considerably shortens the time required to wire the modules, while allowing a neat and simple construction. Four types are available:

- Type HCS50, catalogue number 8222 412 10291, for interconnecting the ten output terminals of counters NIC50 or RIC50 to the corresponding terminals of the thumbwheel switches, when the modules are mounted on a horizontal axis
- Type HSS50, catalogue number 8222 412 10301, for interconnection between thumbwheel switches mounted on a horizontal axis
- Type VCS50, catalogue number 8222 412 10310 for interconnecting counters NIC50 and RIC50 and the thumbwheel switches, when these modules are mounted on a vertical axis
- Type VSS50, catalogue number 8222 412 10320 for interconnection between thumbwheel switches mounted on a vertical axis.

More complex installations, with combinations of vertical and horizontal mounting can be covered with the above four types of flexible printed wiring.

STICKERS

Stickers are drawing symbols of 50-Series modules printed on self-adhesive, transparent material. They can be used for fast preparation of system drawings.
The stickers are available in sheets. Each sticker can be separately detached from the sheet, without cutting.

sheet with modules of type	catalogue number for 50 sheets
NIC50 (4x) + SU50 (8x)	4322 026 70260
LRD50 (3x) + PSR50 (2x) + 3.NOR50 (3x)+ 4.NOR51 (2x)	70270
RIC50 (4x) + SU50 (8x)	70430
MID50 (8x) + SID50 (4x)	70440
PDU50A (9x) + PDU50B (3x)	71910
DCD50	71920

Input/output devices

INTRODUCTION

Input devices

Industrial control systems require compatible input devices that are capable of deriving signals representative of controlled or otherwise pertinent conditions. Though the information to be dealt with may take a variety of forms - e.g. presence, position, movement, rotation etc. - many different situations can be covered by a comparitively small selection of input devices.
The requirements of each situation determine the physical principle to be employed in the input device.
For reasons of speed and reliability it is preferable to avoid mechanical contact in deriving the input signal, and often an all-static method of derivation is required. Experience with input devices has made it clear that skilful use of them can greatly improve machine output and reliability.

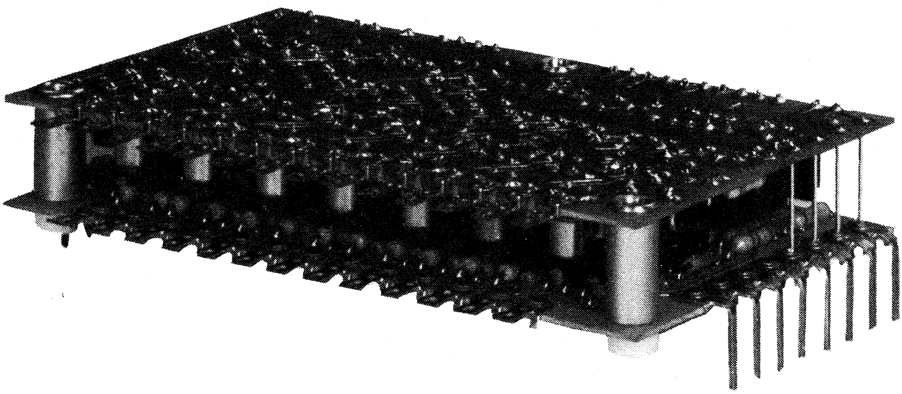
Output devices

It is often necessary to display numerical information concerning situations or values (e.g. position, temperature, time, weight, price, etc.). Our range of numerical display units has been designed to display numbers that are legible at a distance of tens of metres, to be applied in industry, in congress halls, for indoor sports, on platforms, etc.

In this series the following units are available:

DYNAMIC DRIVE MODULE
for indicator tubes

RZ 28657-5



APPLICATION

Dynamic drive of various types of indicator tubes, especially the PANDICON [1]) tubes e.g. ZM 1200 and also a number of single indicator tubes, e.g. ZM 1005 [2]).

[1]) PANDICON - Registered trademark for multiple indicator tubes.

[2]) See Application Information 345 : "Dynamic Drive Module DDM 14 for Cold Cathode Indicator Tubes".

DESCRIPTION

Block diagram of the circuit

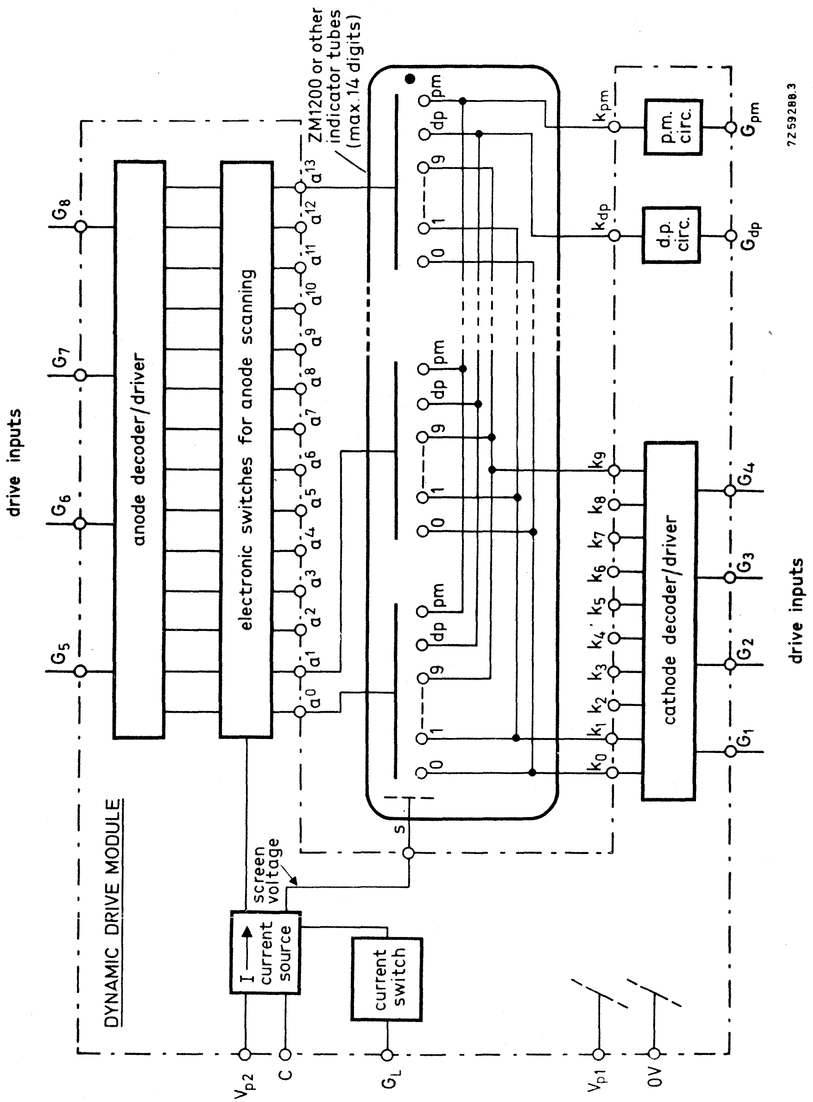


Fig.1

Principle

The identical cathodes of the indicator tubes which are to be driven are connected in parallel. In this way 12 common cathode input lines (numerals 0 to 9, decimal point and punctuation mark) are obtained for all indicator tubes.
A cathode decoder/driver selects one out of the ten cathode lines for the numerals 0 to 9. The input signal for the cathode decoder/driver must be in the 1-2-4-8 code.
The decimal-point cathodes and the punctuation-mark cathodes have their own control circuits (d.p. circuit and p.m. circuit in Block diagram).

The anodes of the various indicator tubes have to be scanned sequentially. For this purpose the 1-2-4-8 code input signal has to be converted into a one-out-of-fourteen code. This is done by means of the anode decoder/driver. Fourteen electronic high voltage switches, connected to the outputs of this decoder, control the anodes of the indicator tubes in sequence.

In other words, the cathode decoder/driver determines what numeral is displayed, while the anode decoder/driver determines where the numeral is displayed.

Operation

Current source

The stabilised current is supplied by a current source, the magnitude of this current being so chosen that the requirements of the PANDICON tube ZM 1200 are met. An external resistor enables the current to be adjusted up to a maximum of 20 mA. Thus, brightness control becomes possible, and in addition a number of single indicator tubes such as the ZM 1005 can be driven.

Current switch (terminal G_L)

The whole display is darkened and consequently the power consumption reduced when the LOW-level is applied to the current switch input G_L. The anode current for the indicator tube(s) is then switched off, resulting in a decrease of power consumption of:

$$\Delta P \approx I_{a\ peak} \times V_{p_2}$$

Blanking

The binary coded signal LHHH(14) or HHHH(15) must be applied to the cathode decoder inputs (G_1 - G_4):

- To blank certain tube positions at will.
- For those positions where the anode switch terminals are left floating.
- When the counter driving the anode decoder/driver does more steps as there are anodes connected (14), but only for the redundant steps.

Moreover, when a sign indicator tube with less than 10 signs (e.g. ZM 1001) is scanned, only the connected cathodes may be selected. In all other cases the blanking code LHHH(14) or HHHH(15) must be applied.

Decimal point circuit and punctuation mark circuit

These circuits drive the decimal point and the punctuation mark separately. When tubes are applied without punctuation mark and decimal point, the outputs of these circuits are left floating.

Circuit protection

The circuit is protected against inadvertent transposition of V_{p_1} and 0V, and V_{p_2} and 0 V, (see also point 6 of next paragraph).
Incidental short-circuits between any of the output terminals or any output terminal and earth (0 V-line) will have no harmful effects on the circuit.

CIRCUIT REQUIREMENTS

Positive logic for all inputs.

1. Cathode decoder/driver

Input conditions: 4 inputs in NBC (1-2-4-8) code
Input voltage levels are compatible with DTL and TTL conditions.

HIGH-level: V_{GH} = 2, 4 to 10 V, I_{GH} = max. 120 μA (3TTL)
V_{GH} = max. 30 V (limiting value)

LOW-level: V_{GL} = 0 to 0, 8 V, $-I_{GL}$ = max. 4, 8 mA at V_{p1} = 5, 25 V, V_{GL} = 0, 4 V
$-I_{GL}$ = max. 5, 4 mA at V_{p1} = 6, 3 V, V_{GL} = 0, 4 V
V_{GL} = min. −4 V (limiting value)

Output conditions: 10 outputs (1 out of 10 "ON")

OFF-state: $V_{k_{off}}$ = min. 70 V, max. 86 V
$\Sigma I_{k_{off}}$ = max. 4 mA (current to non-conducting cathodes)

ON-state: $V_{k_{on}}$ = max. 6 V (at $I_{k_{on}}$ = 20 mA)
$I_{k_{on}}$ = max. 20 mA

2. Anode decoder/driver

Input conditions: 4 input in NBC (1-2-4-8) code
Input voltage levels are compatible with DTL and TTL conditions.

HIGH-level: V_{GH} = 2,4 to 10 V, I_{GH} = max. 80 μA (2 TTL)
V_{GH} = max. 30 V (limiting value)

LOW-level: V_{GL} = 0 to 0,8 V, $-I_{GL}$ = max. 3,2 mA at V_{p1} = 5,25 V, V_{GL} = 0,4 V
$-I_{GL}$ = max. 3,6 mA at V_{p1} = 6,3 V, V_{GL} = 0,4 V
V_{GL} = min. −4 V (limiting value)

Output conditions: 14 outputs (1 out of 14 "ON")

OFF-state: $V_{a_{off}}$ = min. 100 V, max. 120 V
$\Sigma I_{a_{off}}$ = max. 100 μA

ON-state: $V_{a_{on}}$ = V_m of indicator tube + $V_{k_{on}}$
$-I_a$ peak available (C connected to V_{p2}) = 15 to 22 mA
(C not connected to V_{p2}) = 2,5 to 5,5 mA

3. Decimal point and punctuation mark

Input conditions: Input voltage levels are compatible with DTL and TTL conditions.

HIGH-level: V_{dpH}, V_{pmH} = 2,4 to 10 V, I_{iH} = max. 40 μA (1 TTL)
V_{dpH}, V_{pmH} = max. 30 V (limiting value)

LOW-level: V_{dpL}, V_{pmL} = 0 to 0,8 V, $-I_{iL}$ = max. 1,6 mA at V_{p1} = 5,25 V, V_{iL} = 0,4 V
$-I_{iL}$ = max. 1,8 mA at V_{p1} = 6,3 V, V_{iL} = 0,4 V
V_{dpL}, V_{pmL} = min. −4 V (limiting value)

Output conditions:

OFF-state: $V_{kdp_{off}}$, $V_{kpm_{off}}$ = min. 70 V, max. 86 V
$\Sigma I_{k_{off}}$ = 4 mA (current to non-conducting cathodes)

ON-state: $V_{kdp_{on}}$, $V_{kpm_{on}}$ = min. 20 V, max. 25 V (at $I_{kpm_{on}}$ = 2 mA)
$I_{kdp_{on}}$, $I_{kpm_{on}}$ = max. 2 mA

4. Screen

The screen-voltage supply circuit meets the specifications of the screen voltage for the PANDICON tube ZM 1200.

V_{screen} = min. 70 V, max. 86 V
$-I_{screen}$ = max. 0,5 mA

5. Current switch input (G_L)

Input conditions: Input voltage levels are compatible with DTL and TTL conditions. The tube is darkened when the input is at LOW-level.

HIGH-level: V_{GLH} = 2,4 to 10 V, I_{GLH} = max. 40 μA (1TTL)
V_{GLH} = max. 30 V (limiting value)

LOW-level: V_{GLL} = 0 to 0,8 V, $-I_{GLL}$ = max. 1,6 mA at V_{p1} = 5,25 V, V_{GLL} = 0,4 V
$-I_{GLL}$ = max. 1,8 mA at V_{p1} = 6,3 V, V_{GLL} = 0,4 V
V_{GLL} = min. −4 V (limiting value)

6. Power supply

V_{p1} = 4,75 to 6,3 V, I_{p1} = nom. 25 mA at V_{p1} = 5 V
I_{p1} = nom. 30 mA at V_{p1} = 6 V
V_{p1} = max. 10 V (limiting value)
V_{p2} = 200 V ± 5%, I_{p2} = nom. 13 mA
= nom. 25 mA (terminal C connected to V_{p2}), see Note

Note: To maintain the protection against the transposition of V_{p2} and 0 V, a diode (BAX17) has to be connected in series with the current adjusting resistor (anode of the diode to V_{p2}, see also point 8).

7. Ambient temperature range

Operating (T_{amb})	PANDICON ZM 1200	−20° to +70 °C
	single tubes at max. current	−20° to +60 °C
Storage		−30° to +85 °C

8. Tube anode current

The anode current is adjustable up to 20 mA by means of an external resistance between terminal C and V_{p2}, see Figs. 2 and 3.

$I_{a\,peak}$, terminal C not connected 5 mA
terminal C connected to V_{p2} 20 mA

9. Duty cycle

Maximum 1 : 6
Minimum 1 : 14 (if blanked during redundant steps, this can be increased)

10. Scanning frequency

Maximum 50 kHz

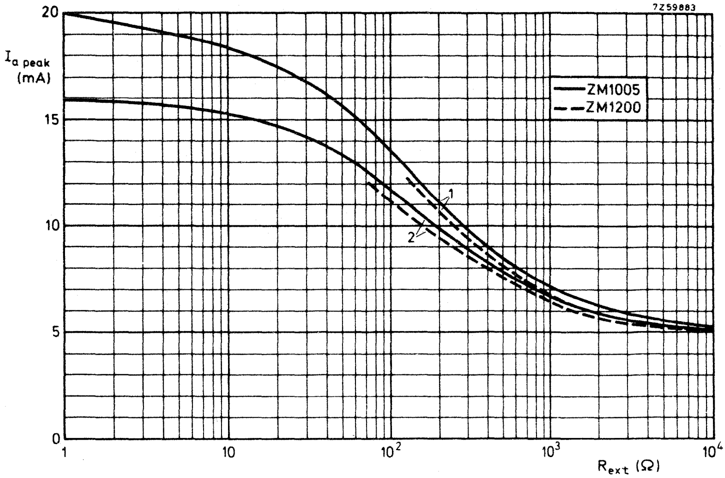


Fig. 2 $I_{a\ peak}$ versus R_{ext} (for measuring circuit, see Fig. 3)
1 = without BAX 17, 2 = with BAX 17
V_{P2} = 200 V, V_{P1} = 5 V, T_{amb} = 25 °C.

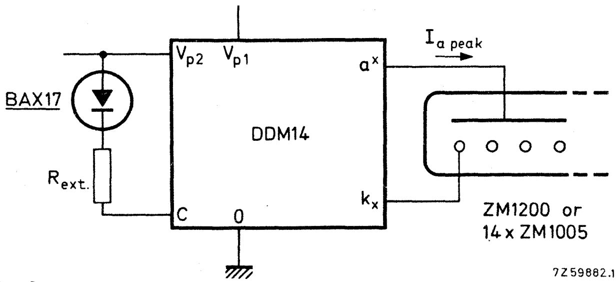


Fig. 3

11. Truth table of anode decoder/driver

G5 1	G6 2	G7 4	G8 8	Anode
L	L	L	L	a^0
H	L	L	L	a^1
L	H	L	L	a^2
H	H	L	L	a^3
L	L	H	L	a^4
H	L	H	L	a^5
L	H	H	L	a^6
H	H	H	L	a^7
L	L	L	H	a^8
H	L	L	H	a^9
L	H	L	H	a^{10}
H	H	L	H	a^{11}
L	L	H	H	a^{12}
H	L	H	H	a^{13}

12. Truth table of cathode decoder/driver

G1 1	G2 2	G3 4	G4 8	Cathode
L	L	L	L	k0
H	L	L	L	k1
L	H	L	L	k2
H	H	L	L	k3
L	L	H	L	k4
H	L	H	L	k5
L	H	H	L	k6
H	H	H	L	k7
L	L	L	H	k8
H	L	L	H	k9
L	H	H	H	blanking codes
H	H	H	H	

MECHANICAL DATA

The circuit is mounted on two printed wiring boards stacked with the component sides facing each other.

Both p.w. boards carry the tags for connecting to the indicator tubes at the same side. These tags enable the tube connections to be made either via a cable directly to the tube or via the "mother" p.w. board.

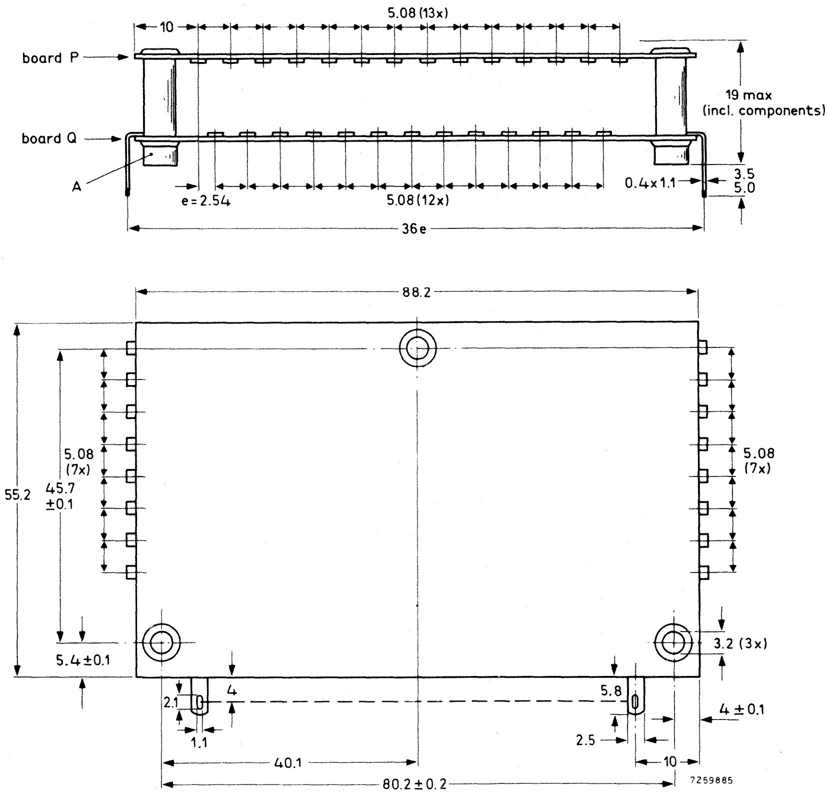
The connections for the supply voltages and the logic signals are made only via the bottom print of the module.

Care is taken that when the module is mounted on a "mother" p.w. board, no short circuits will occur between the bottom print of the module and the "mother" p.w. board.

It is possible to screw the module to, e.g., a front-panel,mounting-holes being provided for the purpose.

The overall dimensions of the module are approx. 91,5 x 61 x 19 mm.

Dimensions in mm



For screw mounting, remove the plastic end-caps A from the studs.

Fig. 4

Terminal configuration

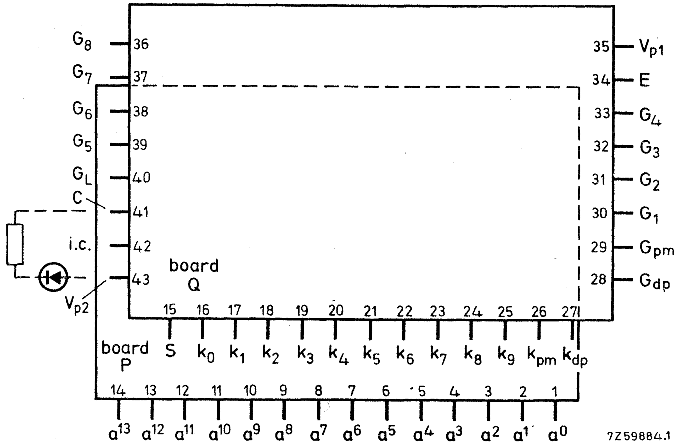


Fig. 5

Terminals:

1	= a^0	= anode ind. tube 1
2	= a^1	= " " " 2
3	= a^2	= " " " 3
4	= a^3	= " " " 4
5	= a^4	= " " " 5
6	= a^5	= " " " 6
7	= a^6	= " " " 7
8	= a^7	= " " " 8
9	= a^8	= " " " 9
10	= a^9	= " " " 10
11	= a^{10}	= " " " 11
12	= a^{11}	= " " " 12
13	= a^{12}	= " " " 13
14	= a^{13}	= " " " 14
15	= s	= screen of ind. tube
16	= k_0	= cathode line 0
17	= k_1	= " " 1
18	= k_2	= " " 2
19	= k_3	= " " 3
20	= k_4	= " " 4
21	= k_5	= " " 5
22	= k_6	= " " 6
23	= k_7	= cathode line 7
24	= k_8	= " " 8
25	= k_9	= " " 9
26	= k_{pm}	= cathode punct. mark
27	= k_{dp}	= cathode dec. point
28	= G_{dp}	= input dec. point
29	= G_{pm}	= input punct. mark
30	= G_1	= 1-input cathode dec.
31	= G_2	= 2-input " "
32	= G_3	= 4-input " "
33	= G_4	= 8-input " "
34	= E	= common supply 0V
35	= V_{p1}	= supply 4.75 to 6.3 V
36	= G_8	= 8-input anode dec.
37	= G_7	= 4-input " "
38	= G_6	= 2-input " "
39	= G_5	= 1-input " "
40	= G_L	= blanking input
41	= C	= current adjusting
42	= i.c.	= internally connected
43	= V_{p2}	= supply (+ 200 V)

TEST SPECIFICATION

The module is designed to meet the tests below.

Shock test according to method 202B of MIL-STD-202C, 3 blows 50 g in 3 perpendicular directions.

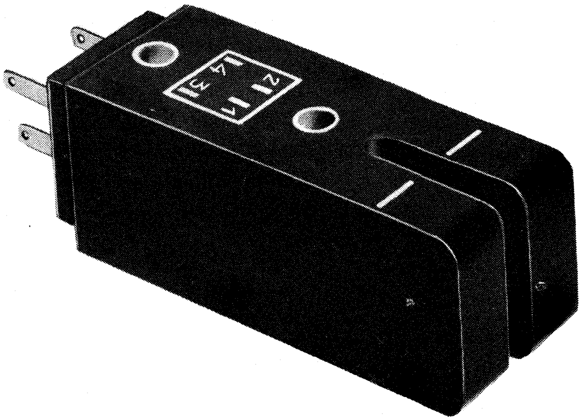
Vibration test according to method 201A of MIL-STD-202C.
Frequency 10-55 Hz, amplitude 0.76 mm max., cycle time 1 min, 2 hours in 3 perpendicular directions.

Temperature-cycling test according to method 102A of MIL-STD-202;
5 cycles from −30 to +100 °C.

Long term humidity test according to I.E.C. 68, test C.
Duration 21 days at 40 °C and R.H. = 90 −95 %.

Solderability according to method 210 of MIL-STD-202.

VANE SWITCHED OSCILLATOR



720809-21-01

Supply voltage	12 V_{dc}
Operating-temperature range	−25 to +85 °C

APPLICATION

The vane switched oscillator can be applied as a static switching device, the switching action being determined by the position of a vane. For the vane any metal can be used.

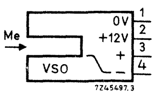
CONSTRUCTION

The vane switched oscillator consists of an oscillator and a diode rectifier. The latter is connected to a separate coupling winding of the oscillator coil, thus providing an isolated d.c. output.
The lay-out of the oscillator is such that upon inserting a suitable piece of metal (vane) in a gap between the oscillator coil windings, the oscillation stops and the d.c. output of the unit will drop to zero.
The complete circuit is encapsulated in epoxy resin.

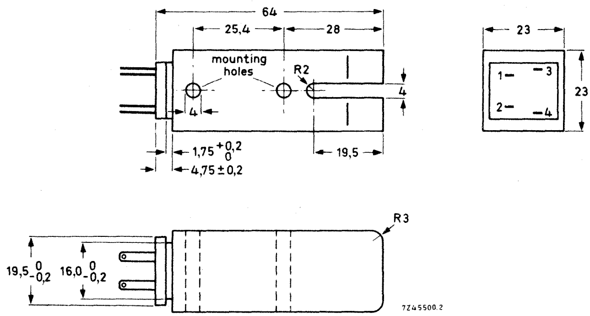
1 = − } supply
2 = +

3 = + } output
4 = −

Terminal location



Drawing symbol



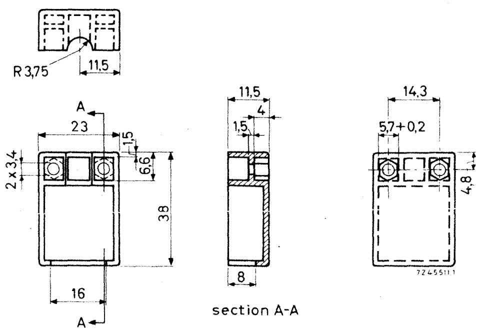
Dimensions (mm)

The weight (without cable anchoring cover) is 42 g.

The unit may be mounted in any position. Two mounting holes allow the use of 4 mm bolts. The bolts should be tightened with a torque of maximum 450 mNm provided that washers are used. Stacking of units is permitted. If two or more units are stacked (gaps in line), they must be placed back to back/front to front.

Connection can be made by 0, 110 inch Fastons or by soldering.
A cable anchoring cover, consisting of two equal caps (as shown in the figure below), is supplied with each VSO.

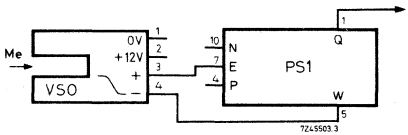
The lines on the arms of the VSO indicate the centre of the oscillator coil windings.

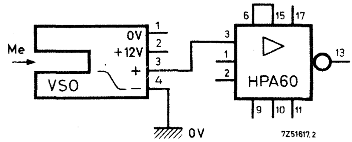


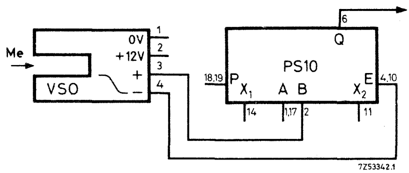
Cable anchoring cover

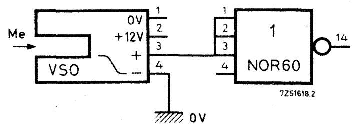
ELECTRICAL DATA

Supply voltage	12 V_{dc} ± 10% or +6 V_{dc} ± 10% and −6 V_{dc} ± 10% (with common 0 V)
Consumed current (in both oscillating and non-oscillating condition)	12 mA ± 10%
Output voltage	5,75 V ± 15% open circuit , isolated from the supply. Maximum permissible voltage between 1-2 and 3-4 is 100 V_p. Suited for driving the pulse shaper types PS 1* and PS 10**, and for driving the Norbit HPA60 and 2.NOR60 if three inputs are connected in parallel.









Output impedance (without vane)	4,1 kΩ ± 10%
Maximum detection frequency	1 kHz
Noise (over supply lines)	< 100 mV_{p-p}
Ambient temperature range	
operating	−25 to +85 °C
storage	−40 to +85 °C

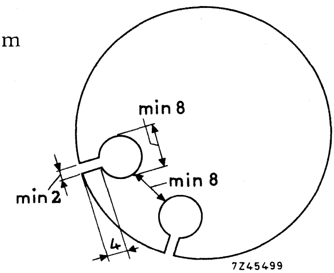
* circuit block 100 kHz series, catalog number 2722 001 11001
** circuit block 10-series , catalog number 2722 004 11001

APPLICATION INFORMATION (typical values)

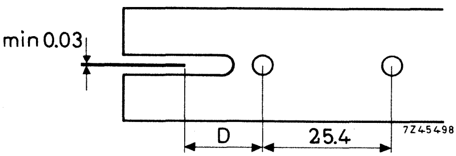
Vane material	any metal
Vane dimensions for aluminium: minimum width for a thickness of 2 mm	8 mm
minimum thickness	0,03 mm

As a rule of thumb the thickness of the vane should be about 10 x the electrical resistivity of the material used.

Instead of a vane a disc with holes of indicated dimensions may be used.



The data given below are based on a movement of an aluminium vane 50 x 50 x 2 mm in longitudinal direction.
The operating distance D (see figure below) is the distance at which the output just drops to zero (measured from the centre of the hole nearest to the gap).
Hysteresis is defined as the distance between the vane position at which oscillation ceases and that at which oscillation starts.

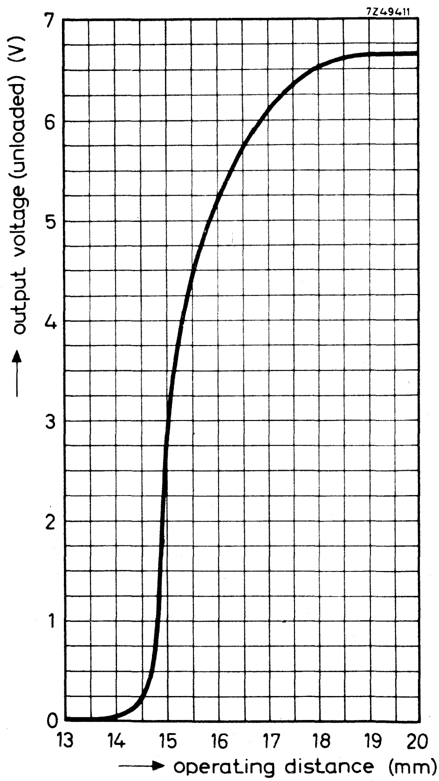


Operating distance D	
open circuit	14,6 ± 1,5 mm
with PS 1 or PS 10 (0 to 1)	15,3 ± 1 mm
Hysteresis	
open circuit	< 1 mm
with PS 1	0,03 mm
with PS 10	0,6 mm

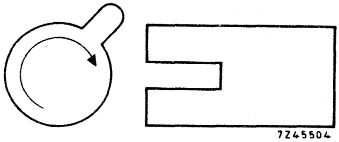
Variation of D with supply voltage

supply voltage	operating distance (mm)
nominal	D
nominal −5%	D +0,06
nominal +5%	D −0,06

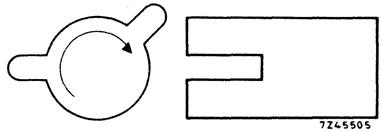
Variation of D with temperature (from −25 to +85 °C)	< 2.7 mm D is maximum at −25 °C
Variation of D with time (at T_{amb} = 25 °C and V_{supply} = 12 V ± 1%, reference point is half the unloaded output voltage of VSO without vane)	< 0.02 mm
Variation of output voltage with D	see typical curve, figure below. From the steep curve it can be seen that a switching point will be kept within very narrow mechanical tolerances.



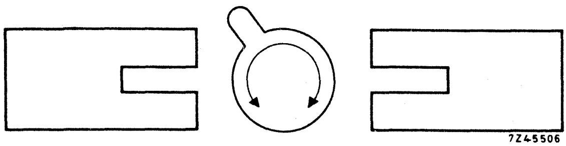
APPLICATION SUGGESTIONS



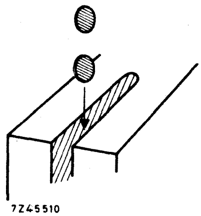
counting of revolutions



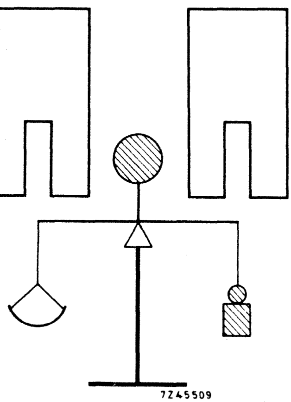
angular position switching (programming)



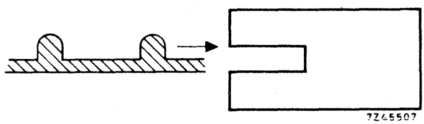
bidirectional counting



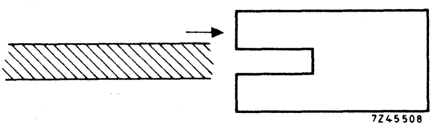
counting of small objects



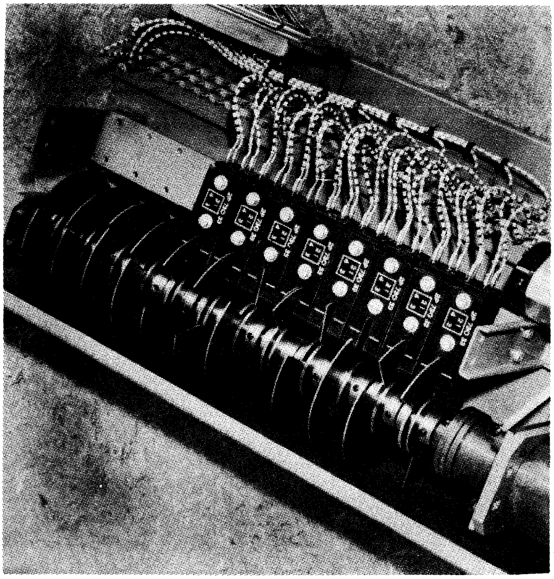
weighing or dosing



linear position switching (programming)

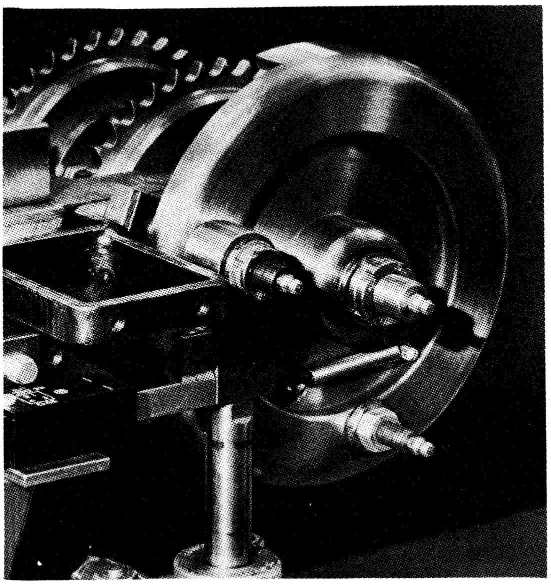


foil continuity check



RK 9230-4

Eight VSO's used in a disc programmer for control of a metal-working machine.

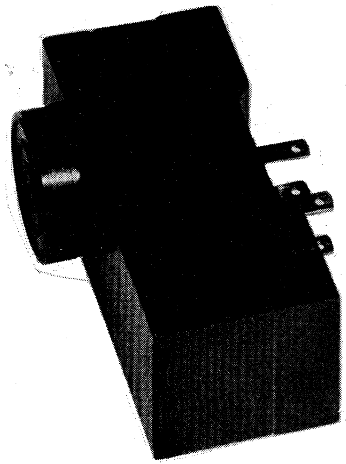


VSO control of pneumatic metal-forming machine.

RK 9230-5

MINIATURE ELECTRONIC PROXIMITY DETECTOR

QUICK REFERENCE DATA	
Supply voltage	24 V (d.c.) ±25%, or 12 V (d.c.) ± 5%
Maximum detection frequency	1 kHz
Operating temperature range	−25 to + 70 °C
Detection range	3 mm



RZ 28513-2

APPLICATION

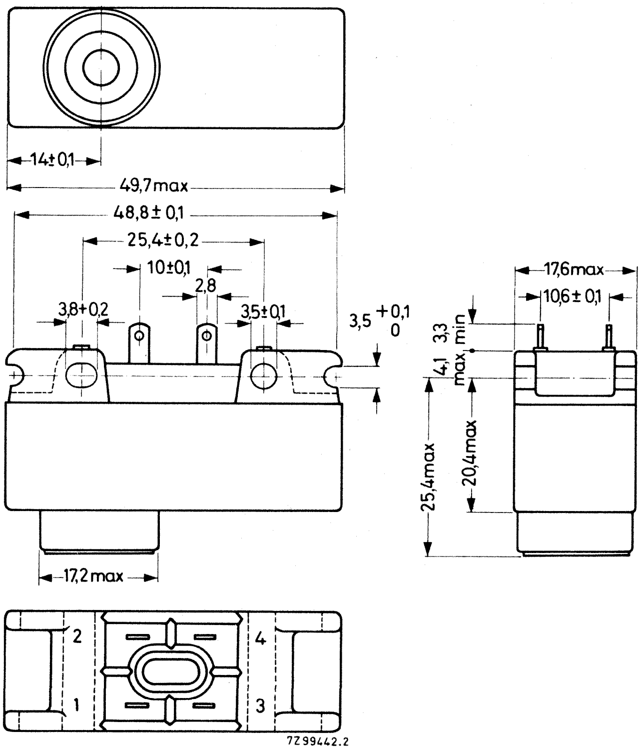
The EPD 60 can be applied as a static switching device, the switching action being determined by the position of a metal object. In this way a static equivalent for the well-known mechanical miniature switch is obtained.

DESCRIPTION

The circuit consists of an oscillator followed by a detector and an amplifier.
The oscillator coil, placed in a potcore half, which is located in the cylindrical part of the housing, sets up a well defined field.
If there is no metal object in the field of the coil the output is low, if a metal object of adequate size is brought far enough into the field, the oscillator will be damped in such a way that the output of the unit goes "high".
The unit is potted in a polydiallylphtalate resin housing, the dimensions of which are compatible with standard mechanical miniature switch housings, see photograph below. Connection to the unit can be made by means of 0.110 inch Fastons or by soldering.

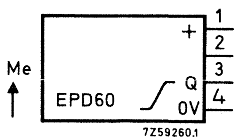
MECHANICAL DATA

Dimensions (mm)



Terminal location

Terminal 1 = +24 V
2 = +12 V (connect 2 and 1)
3 = output (Q)
4 = 0 V common



Drawing symbol

Colour red

Weight 30 g approximately

Mounting

The unit may be mounted in any position. Two mounting holes allow the use of 3 mm bolts. Two grooves in the short sides are provided for bar mounting. Any number of units may be stacked side by side.

ELECTRICAL DATA

Supply voltage (V_S) *)	+24 V ±25%, or +12 V ± 5%
Consumed current (nominal)	15 mA
Limiting value of V_S	
terminal 1	+35 V
terminal 2	+15 V
Ambient temperature range	
operating	−25 to +70 °C
storage	−40 to +70 °C
Maximum detection frequency	1 kHz
Noise on supply lines due to switching	< 5 mV

Output data

			V_S = +24 V		V_S = +12 V	
Output low	at I_Q	=	0	mA	0	mA
	max. V_Q	=	+ 0.3	V	+ 0.3	V
Output resistance		=	3	kΩ	3	kΩ
Output high	at − I_Q	=	0.41	mA	0.20	mA
	and at min. V_S	=	18.0	V	11.4	V
	at loading equivalent	=	3 D.U. in 24 V nom. 60-Series operation		2 D.U. in 12 V nom. 60-Series operation	
	V_Q	=	min.+11.4	V	min.+8.3	V
	max. V_Q	=	max.V_S		max.V_S	
Output resistance		=	15	kΩ	15	kΩ

External short-circuit (from Q to V_S and from Q to 0V common) is not destructive.

APPLICATION INFORMATION

The EPD 60 can be switched by moving either a ferrous or a non-ferrous metal object of any size and form in front of the detection head. If the object is ferrous the resulting damping on the oscillator is proportional to the volume of the object; in the case of a non-ferrous object it is governed by the conductivity of the material. Thus, a perfect conductor cannot be detected unless it is sufficiently thin and brought close to the detection head.

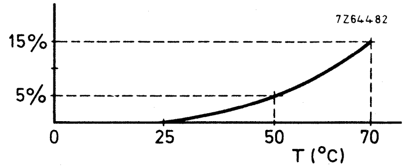
*) Accidental polarity reversal is not destructive.

Operating distance

The operating distance (X) is the distance between the centre of an object and the centre of the detection head at which the output is about to go "high" (measured axially)

For circular steel disc (ϕ15 mm), d = 0, 2 mm in centre of axis, X = 3 mm ± 10%

Influence of temperature in % of X_{nom}



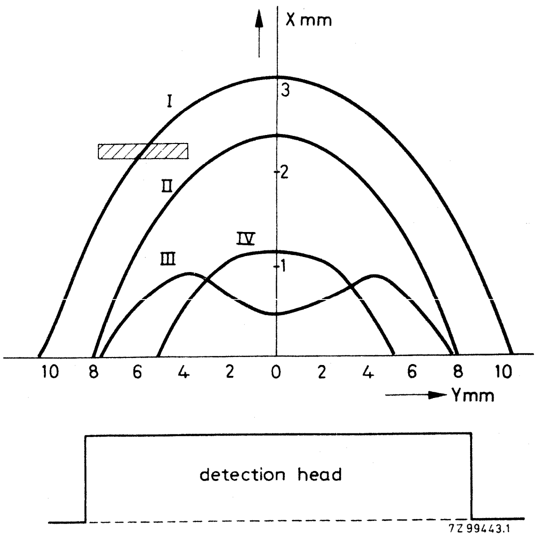
Influence of supply voltage (18 to 30 V) $\Delta X < 20 \mu m$

Hysteresis $< 50 \mu m$

For reference purposes four standard objects are used:

Object I : mild steel, circular disc Ø 15 mm, thickness 0.2 mm
Object II : mild steel, circular disc Ø 10 mm, thickness 0.2 mm
Object III : copper, circular disc Ø 15 mm, thickness 0.04 mm
Object IV : copper, circular disc Ø 10 mm, thickness 0.04 mm

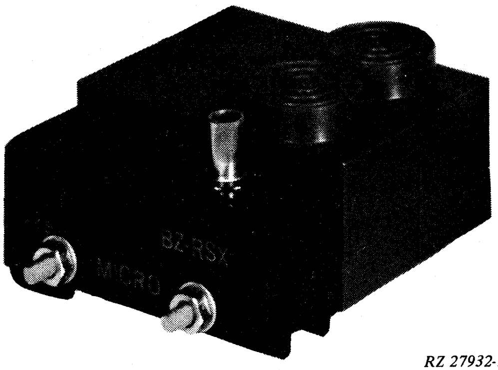
The graph below gives X for each of the four standard objects traversing the sensitive area of the detection head along any straight line parallel to the surface of the head, intersecting the axis of the head.



CLIMATIC TESTS

According to 60-series Norbits

Protection degree according to DIN 40.050 P55 (IP66)



RZ 27932-12

The photograph shows two EPD 60's together with a "Microswitch".

INDUCTIVE PROXIMITY DETECTOR

QUICK REFERENCE DATA	
Supply voltage (d.c.)	10 to 30 V
Maximum detection frequency	min. 1,5 kHz
Operating temperature range	−25 to +70 °C
Operating distance	1 mm
Protection degree	IP67

APPLICATION

The IPD080 can be applied as a detector for the presence, passage or position of metal parts and is a versatile tool in various industrial automation set-ups.

DESCRIPTION

The circuit consists of an oscillator, a detector, and a Schmitt trigger amplifier, housed in a chromium-plated brass tube. Three connecting leads (each having a 0,14 mm^2 cross-section) are brought out at one end and the oscillator coil is mounted at the other end. The oscillator coil sets up a well-defined magnetic field which, when clear, gives the circuit a HIGH output. If a metal object is brought into the magnetic field, the oscillator is damped and the circuit output goes LOW.
The tubular envelope is threaded and provided with two M8 nuts to enable mounting of the unit (see Fig. 1).
Except for the ganging the unit conforms CENELEC publication EN50008.

MECHANICAL DATA

Dimensions in mm

Outlines and connections

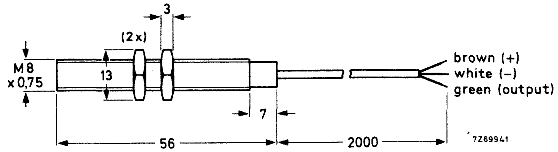


Fig. 1

Mass 45 g approximately

Mounting

The unit may be mounted in any position by means of the two nuts.

Degree of protection (IEC144) IP67

ELECTRICAL DATA

Unless otherwise specified all values apply at an ambient temperature of 25 °C.

Supply voltage V_S (d. c.)		10 to 30 V
current (no load)	V_S = 12 V	4, 5 mA
	V_S = 24 V	9, 2 mA
Ambient temperature range		
operating		−25 to +70 °C
storage		−40 to +85 °C

Output data

Detector activated	
voltage LOW	max. 1 V
minimum load resistance	450 Ω
Detector non-activated	
voltage HIGH	max. V_S
internal resistance	12 kΩ

The output is protected against inductive loads.

OPERATING DATA

The detection sensitivity is dependent on the dimensions and the material of the object in front of the detection head.
The operating distance X (see Fig. 2) is defined as the distance between the centre of the detected object and the surface of the detection head (measured axially), at which the circuit output switches from HIGH to LOW.

For a circular mild steel disc, diameter 6 mm, thickness 0, 2 mm:

Operating distance (X)	1 mm ± 10%
Influence of temperature	2 µm/°C
Influence of supply voltage	1 µm/V
Hysteresis	3 to 10%
Reproducibility	5%
Maximum detection frequency	min. 1, 5 kHz

Reduction factor on X for other metals of the same dimensions:

chromium	0, 9
brass	0, 5
aluminium	0, 45
copper	0, 4

Fig. 2 shows the operating distance curve for the above-mentioned mild steel disc. Y can be considered as any radial axis cutting the axial centre line of the detection head.

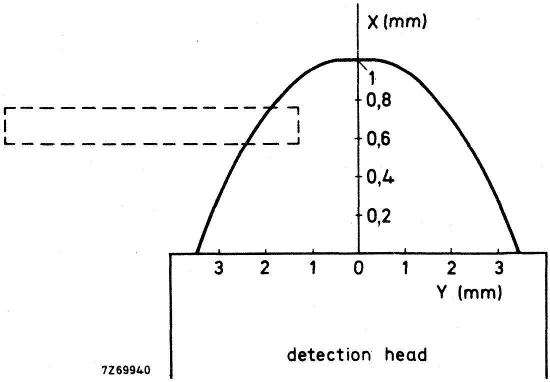


Fig. 2

TEST SPECIFICATIONS

Detector non-operative

1. Shock test according to IEC68-2-27 (test Ea):
   3 blows 50g for 11 ms, in 6 directions.
2. Vibration test according to IEC68-2-6 (test Fc):
   10 to 150 Hz, amplitude 0, 76 mm or 10g maximum; sweep time 1 octave/min; 2 hours in 3 perpendicular directions.
3. Temperature shock test according to IEC68-2-14 (test Na):
   5 cycles from −40 to 85 °C, 1 cycle/2 h.
4. Accelerated damp heat test according to IEC68-2-30 (test Db):
   6 days 25 to 55 °C, R.H. up to 100% without condensation.

INDUCTIVE PROXIMITY DETECTOR

QUICK REFERENCE DATA	
Supply voltage (d.c.)	10 to 30 V
Maximum detection frequency	min. 1 kHz
Operating temperature range	−25 to +70 °C
Operating distance	2 mm
Protection degree	IP67

APPLICATION

The IPD120 can be applied as a detector for the presence, passage or position of metal parts and is a versatile tool in various industrial automation set-ups.

DESCRIPTION

The circuit consists of an oscillator, a detector, and a Schmitt trigger amplifier, housed in a chromium-plated brass tube. Three connecting leads (each having a 0,14 mm^2 cross-section) are brought out at one end and the oscillator coil is mounted at the other end. The oscillator coil sets up a well-defined magnetic field which, when clear, gives the circuit a HIGH output. If a metal object is brought into the magnetic field, the oscillator is damped and the circuit output goes LOW.
The tubular envelope is threaded and provided with two M12 nuts to enable mounting of the unit (see Fig. 1).
Except for the ganging the unit conforms CENELEC publication EN50008.

MECHANICAL DATA

Dimensions in mm

Outlines and connections

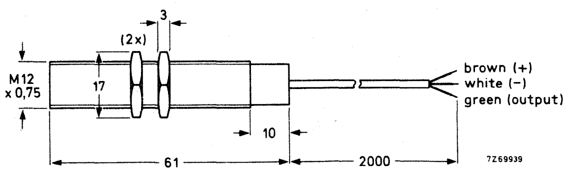


Fig. 1

Mass — 55 g approximately

Mounting

The unit may be mounted in any position by means of the two nuts.

Degree of protection (IEC144) — IP67

ELECTRICAL DATA

Unless otherwise specified all values apply at an ambient temperature of 25 °C.

Supply voltage V_S (d.c.)		10 to 30 V
current (no load)	V_S = 12 V	4, 5 mA
	V_S = 24 V	9, 2 mA
Ambient temperature range		
operating		−25 to +70 °C
storage		−40 to +85 °C

Output data

Detector activated	
voltage LOW	max. 1 V
minimum load resistance	450 Ω
Detector non-activated	
voltage HIGH	max. V_S
internal resistance	12 kΩ

The output is protected against inductive loads.

OPERATING DATA

The detection sensitivity is dependent on the dimensions and the material of the object in front of the detection head.
The operating distance X (see Fig. 2) is defined as the distance between the centre of the detected object and the surface of the detection head (measured axially), at which the circuit output switches from HIGH to LOW.

For a circular mild steel disc, diameter 9 mm, thickness 0, 2 mm:

Operating distance (X)	2 mm ± 10%
Influence of temperature	2 μm/°C
Influence of supply voltage	1 μm/V
Hysteresis	3 to 10%
Reproducibility	5%
Maximum detection frequency	min. 1 kHz

Reduction factor on X for other metals of the same dimensions:

chromium	0, 9
brass	0, 5
aluminium	0, 45
copper	0, 4

Fig. 2 shows the operating distance curve for the above-mentioned mild steel disc. Y can be considered as any radial axis cutting the axial centre line of the detection head.

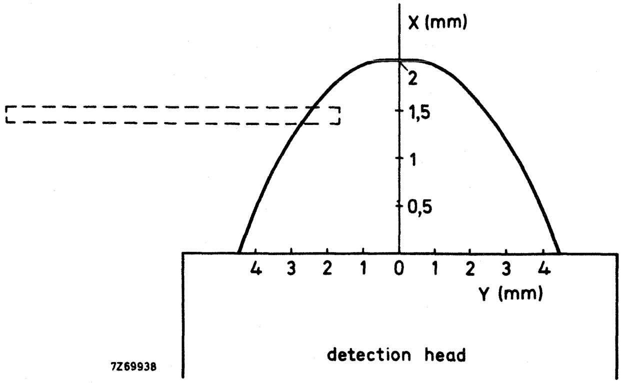


Fig. 2

TEST SPECIFICATIONS

Detector non-operative

1. Shock test according to IEC68-2-27 (test Ea):
   3 blows 50g for 11 ms, in 6 directions.
2. Vibration test according to IEC68-2-6 (test Fc):
   10 to 150 Hz, amplitude 0, 76 mm or 10g maximum; sweep time 1 octave/min; 2 hours in 3 perpendicular directions.
3. Temperature shock test according to IEC68-2-14 (test Na):
   5 cycles from −40 to 85 °C, 1 cycle/2 h.
4. Accelerated damp heat test according to IEC68-2-30 (test Db):
   6 days 25 to 55 °C, R.H. up to 100% without condensation.

INDUCTIVE PROXIMITY DETECTOR

QUICK REFERENCE DATA	
Supply voltage (d.c.)	10 to 30 V
Maximum detection frequency	min. 0,5 kHz
Operating temperature range	−25 to +70 °C
Operating distance	5 mm
Protection degree	IP67

APPLICATION

The IPD180 can be applied as a detector for the presence, passage or position of metal parts and is a versatile tool in various industrial automation set-ups.

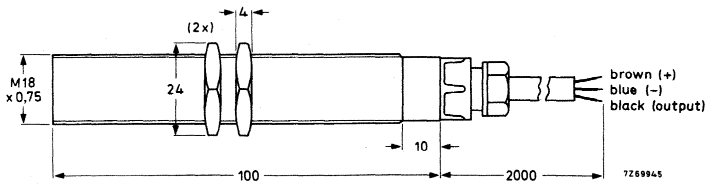
DESCRIPTION

The circuit consists of an oscillator, a detector, and a Schmitt trigger amplifier, housed in a chromium-plated brass tube. Three connecting leads (each having a 0,75 mm^2 cross-section) are brought out at one end and the oscillator coil is mounted at the other end. The oscillator coil sets up a well-defined magnetic field which, when clear, gives the circuit a HIGH output. If a metal object is brought into the magnetic field, the oscillator is damped and the circuit output goes LOW.
The tubular envelope is threaded and provided with two M18 nuts to enable mounting of the unit (see Fig. 1).
Except for the ganging the unit conforms CENELEC publication EN50008.

MECHANICAL DATA

Dimensions in mm

Outlines and connections



The unit is also available with a **screened cable** under type no. **IPD183**, cat. no. 2722 031 00142. The screen is not electrically connected to the housing.

Mass 200 g approximately

Mounting

The unit may be mounted in any position by means of the two nuts.

Degree of protection (IEC144) IP67

ELECTRICAL DATA

Unless otherwise specified all values apply at an ambient temperature of 25 °C.

Supply voltage V_S (d.c.)		10 to 30 V
current (no load)	V_S = 12 V	4,5 mA
	V_S = 24 V	9,2 mA
Ambient temperature range		
operating		−25 to +70 °C
storage		−40 to +85 °C

Output data

Detector activated	
voltage LOW	max. 1 V
minimum load resistance	450 Ω
Detector non-activated	
voltage HIGH	max. V_S
internal resistance	12 kΩ

The output is protected against inductive loads.

OPERATING DATA

The detection sensitivity is dependent on the dimensions and the material of the object in front of the detection head.
The operating distance X (see Fig. 2) is defined as the distance between the centre of the detected object and the surface of the detection head (measured axially), at which the circuit output switches from HIGH to LOW.

For a circular mild steel disc, diameter 14 mm, thickness 0,2 mm:

Operating distance (X)	5 mm ± 10%
Influence of temperature	2 µm/°C
Influence of supply voltage	1 µm/V
Hysteresis	3 to 10%
Reproducibility	5%
Maximum detection frequency	min. 0,5 kHz

Reduction factor on X for other metals of the same dimensions:

chromium	0,9
brass	0,5
aluminium	0,45
copper	0,4

Fig. 2 shows the operating distance curve for the above-mentioned mild steel disc. Y can be considered as any radial axis cutting the axial centre line of the detection head.

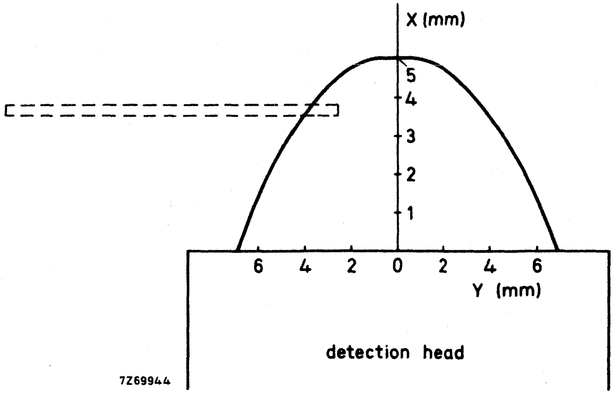


Fig. 2

TEST SPECIFICATIONS

Detector non-operative

1. Shock test according to IEC68-2-27 (test Ea):
   3 blows 50g for 11 ms, in 6 directions.
2. Vibration test according to IEC68-2-6 (test Fc):
   10 to 150 Hz, amplitude 0,76 mm or 10g maximum; sweep time 1 octave/min; 2 hours in 3 perpendicular directions.
3. Temperature shock test according to IEC68-2-14 (test Na):
   5 cycles from −40 to 85 °C, 1 cycle/2 h.
4. Accelerated damp heat test according to IEC68-2-30 (test Db):
   6 days 25 to 55 °C, R.H. up to 100% without condensation.

INDUCTIVE PROXIMITY DETECTOR

QUICK REFERENCE DATA	
Supply voltage	220/240 V +10, −15%; 50 Hz
Maximum detection frequency	min. 25 Hz
Operating temperature range	−25 to +70 °C
Operating distance	5 mm
Protection degree	IP67

APPLICATION

The IPD185 can be applied as a detector for the presence, passage or position of metal parts and is a versatile tool in various industrial automation set-ups.

DESCRIPTION

The circuit consists of an oscillator, a detector, a Schmitt trigger amplifier, and a thyristor, housed in a chromium-plated brass tube. Three connecting leads (each having a 0,75 mm^2 cross-section) are brought out at one end and the oscillator coil is mounted at the other end. The oscillator coil sets up a well-defined magnetic field which, when clear, results in an "open circuit" output. If a metal object is brought into the magnetic field, the oscillator is damped and the circuit acts as a "closed contact".
The tubular envelope is threaded and provided with two M18 nuts to enable mounting of the unit (see Fig. 1), and is connected to the earth lead.
Except for the ganging the unit conforms CENELEC publication EN50008.

MECHANICAL DATA

Dimensions in mm

Outlines and connections

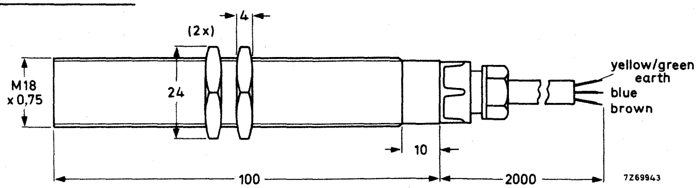


Fig. 1

Mass — 200 g approximately

Mounting

The unit may be mounted in any position by means of the two nuts.

Degree of protection (IEC144) — IP67

ELECTRICAL DATA

Unless otherwise specified all values apply at an ambient temperature of 25 °C.

Supply voltage V_S	220/240 V +10, −15%; 50 Hz
Ambient temperature range	
operating	−25 to +70 °C
storage	−40 to +85 °C

Output data

Detector activated	
voltage LOW	7 V
load current	max. 0,25 A, see Fig. 2
	min. 10 mA
Detector non-activated	
voltage HIGH	V_S
leakage current	4 mA

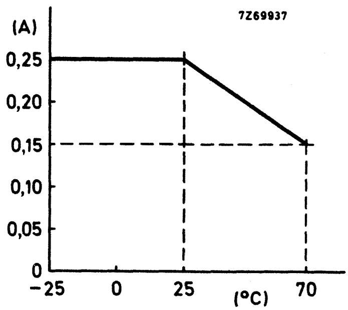


Fig. 2

OPERATING DATA

The detection sensitivity is dependent on the dimensions and the material of the object in front of the detection head.
The operating distance X (see Fig. 2) is defined as the distance between the centre of the detected object and the surface of the detection head (measured axially), at which the circuit output switches from HIGH to LOW.

For a circular mild steel disc, diameter 14 mm, thickness 0,2 mm:

Operating distance (X)		5 mm ± 10%
Influence of temperature		2 μm/°C
Influence of supply voltage		1 μm/V
Hysteresis		3 to 10%
Reproducibility		5%
Maximum detection frequency		min. 25 Hz
Reduction factor on X for other metals of the same dimensions:		
	chromium	0,9
	brass	0,5
	aluminium	0,45
	copper	0,4

Fig. 3 shows the operating distance curve for the above-mentioned mild steel disc. Y can be considered as any radial axis cutting the axial centre line of the detection head.

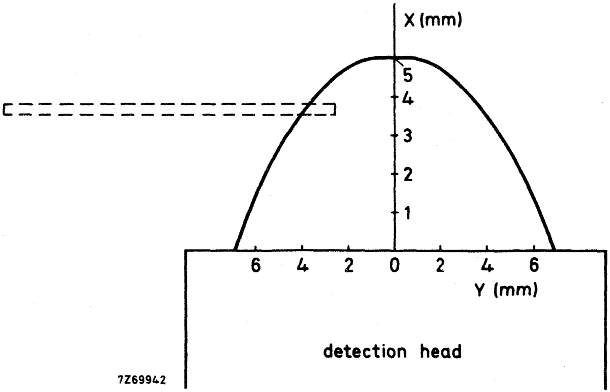


Fig. 3

TEST SPECIFICATIONS

Detector non-operative

1. Shock test according to IEC68-2-27 (test Ea):
   3 blows 50g for 11 ms, in 6 directions.
2. Vibration test according to IEC68-2-6 (test Fc):
   10 to 150 Hz, amplitude 0,76 mm or 10g maximum; sweep time 1 octave/min; 2 hours in 3 perpendicular directions.
3. Temperature shock test according to IEC68-2-14 (test Na):
   5 cycles from −40 to 85 °C, 1 cycle/2 h.
4. Accelerated damp heat test according to IEC68-2-30 (test Db):
   6 days 25 to 55 °C, R.H. up to 100% without condensation.

NUMERICAL DISPLAY UNIT
for direct figure selection

QUICK REFERENCE DATA	
Display figures	0 to 9, in 5 x 7 dot matrix
Type of matrix lamps	6 V, 50 mA; incandescent
Height of figure	140 mm
Legibility	70 m (approximately) within an angle of 120°

APPLICATION

The unit provides a simple and inexpensive means of showing numerical information such as score display for indoor sports, stock exchange rates, and the numbers of departure platforms and quays. Figure selection is direct by means of, say, a switch.

DESCRIPTION

The numerals are formed in a 5 x 7 matrix of 6 V, 50 mA incandescent lamps (E 10 fitting), measuring approximately 140 mm x 100 mm. The lamp holders together with a diode matrix are mounted on a printed-wiring board in a black polystyrene housing.
A spring-mounted white plastic reflector block ensures maximum light intensity, while a translucent red acrylic reflection-free plate acts as the cover of the housing and ensures that a clear red spot is obtained when a lamp is lit. The numerals, 0 to 9, are clearly visible from more than 70 m over an angle of 120°.
The red cover is easily removed for mounting or for lamp replacement.
For electrical connection the module is provided with 0,250 inch pierced tags (in accordance with DIN 46248, Blatt 3) for 0,250 inch receptacles with dimples to ensure correct insertion depth, and rigidity.

MECHANICAL DATA

Dimensions (mm)

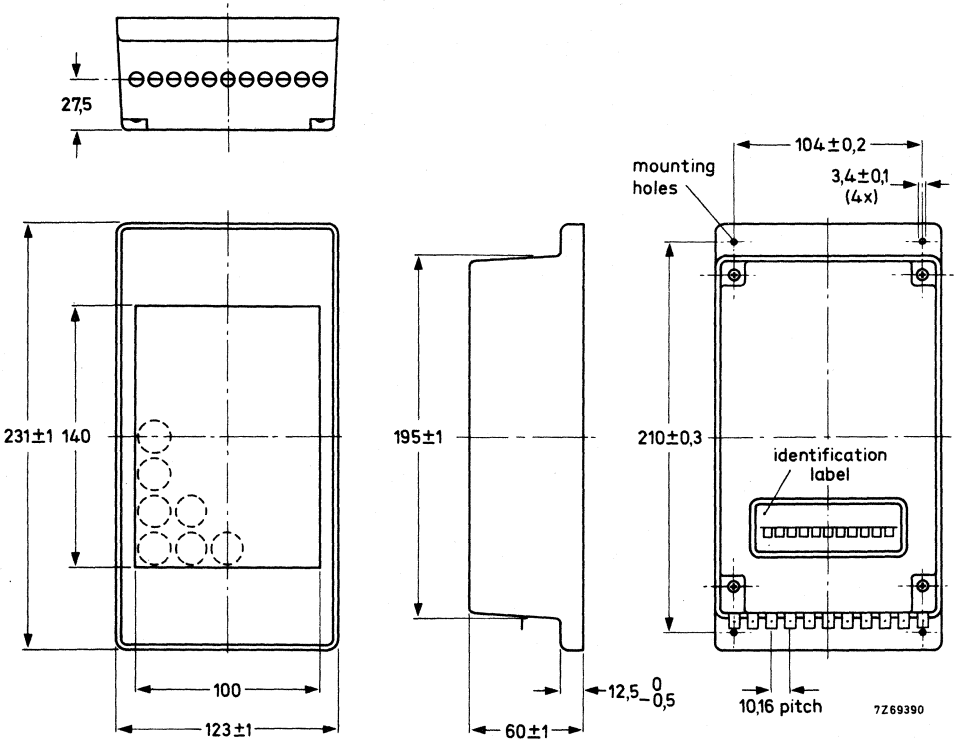


Fig. 1

Terminal location

Terminal location is shown in Fig. 2. To display a numeral, connect + 6 V to the relevant terminal.

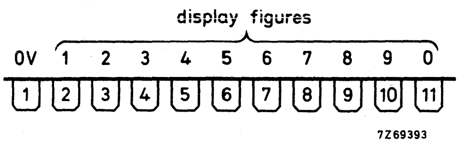


Fig. 2

Mass

510 g (approximately)

Mounting

Access to four mounting holes for M3 screws is achieved after removal of the red cover (see Fig. 1). The cover is removed by pressing both corners on a long side simultaneously. The lock profiles will then disengage. If not, the blade of a knife, screwdriver or similar object can be used with due care to lever out the cover at the corners of one long side.
To avoid damage to housing or cover, never apply a lever to the short sides of the unit where the lock profiles are situated. The cover is replaced (matt side up) by pressing in the middle of both sides until the lock profiles engage.

DISPLAY AND ELECTRICAL DATA

Display figures	0 to 9, in 5 x 7 dot matrix
Type of matrix lamp	6 V, 50 mA; incandescent, E 10 fitting type no 7121D cat. no 9234 406 101..
Height of figure	140 mm
Legibility	70 m (approximately) within an angle of 120°
Supply voltage	+6 V + 10% *)
current	max. 850 mA
peak current	8 A for 10 ms
Ambient temperature range	
operating	−10 to +60 °C
storage	−10 to +70 °C

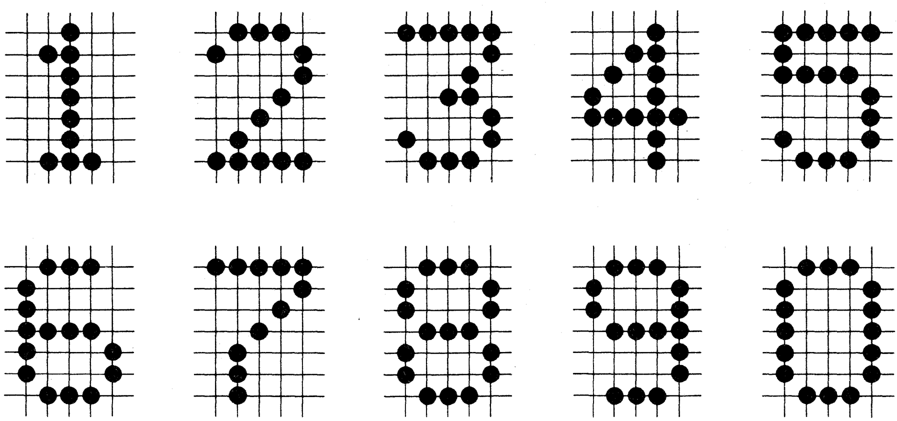


Fig. 3. Numeral make-up

7Z74027

*) At lower voltages the life-time of the lamps is increased, but the light intensity is decreased.

APPLICATION INFORMATION

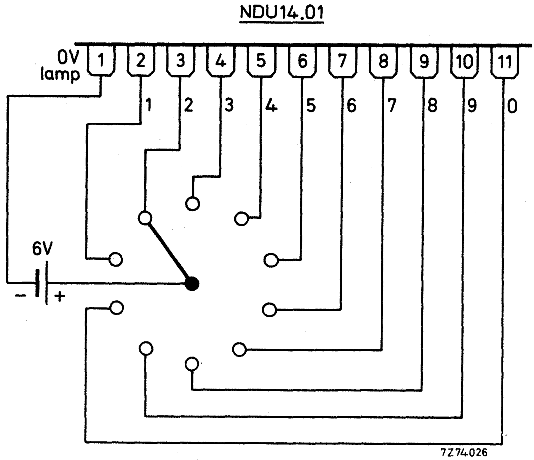


Fig. 4. Connections to the unit when used with a rotary switch

NUMERICAL DISPLAY UNIT
with decimal counter

QUICK REFERENCE DATA	
Display figures	0 to 9, in 5 x 7 dot matrix
Type of matrix lamps	6 V, 50 mA; incandescent
Height of figure	140 mm
Legibility	70 m (approximately) within an angle of 120°
Counter inputs	4 to 30 V

APPLICATION

This unit is very suitable for numerical display in industry (e.g. for counting), at auctions (prices) and congresses (number of votes). It counts the number of pulses supplied to the input terminal.

DESCRIPTION

The numerals are formed in a 5x7 matrix of 6 V, 50 mA incandescent lamps (E 10 fitting), measuring approximately 140 mm x 100 mm. Two printed-wiring boards are mounted in the black polystyrene housing: one board with the lamp holders and a diode matrix, and the other with a decimal counter. A spring-mounted white plastic reflector block ensures maximum light intensity, while a translucent red acrylic reflection-free plate acts as the cover of the housing and ensures that a clear red spot is obtained when a lamp is lit. The numerals 0 to 9 are clearly visible from 70 m over an angle of 120°. The red cover is easily removed for mounting and for lamp replacement.
For electrical connection the modules are provided with 0,250 inch pierced tags (in accordance with DIN 46248, Blatt 3) for 0,250 inch receptacles with dimples to ensure correct insertion depth, and rigidity.
The numeral displayed depends on the number of pulses entered after a reset signal. After every ten pulses a carry signal is available at the clock output terminal CL_o for multi-decade counting. It is connected to the clock input terminal CL_i of the following unit.
Applying the correct signal to the reset input brings the counter and the display to zero. Reset is automatic when switching on the 5 V supply to the logic circuit.
When the display enable output terminal DE_o is connected to the display enable input terminal of the following unit, it permits blanking of a multi-decade counter by a relatively small enable/disable signal.

MECHANICAL DATA

Dimensions (mm)

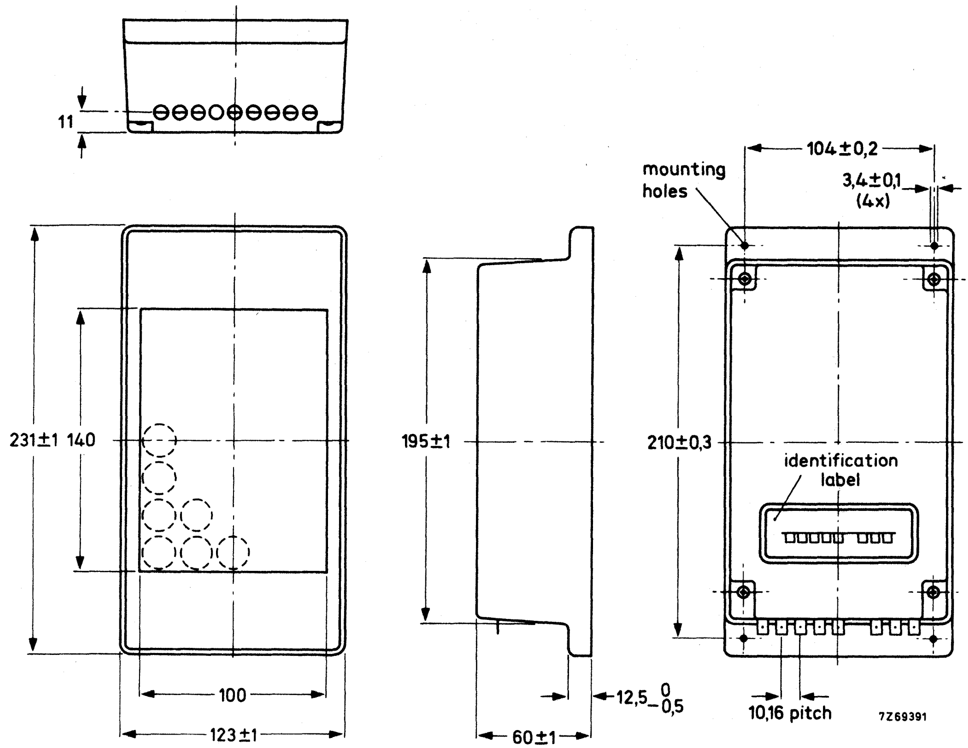


Fig. 1

Terminal location

Terminal 1 = 0 V of lamp
2 = 0 V of logic
3 = 6 V of lamp and 5 V of logic
4 = display enable input
5 = display enable output
6 = not present
7 = clock input
8 = clock output
9 = reset input

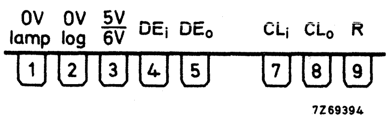


Fig. 2

Mass

580 g (approximately)

Mounting

Access to four mounting holes for M3 screws is achieved after removal of the red cover (see Fig. 1). The cover is removed by pressing both corners on a long side simultaneously. The lock profiles will then disengage. If not, the blade of a knife, screwdriver or similar object can be used with due care to lever out the cover at the corners of one long side.
To avoid damage to housing or cover, never apply a lever to the short sides of the unit where the lock profiles are situated. The cover is replaced (matt side up) by pressing in the middle of both sides until the lock profiles engage.

DISPLAY AND ELECTRICAL DATA

Display figures	0 to 9, in 5 x 7 dot matrix
Type of matrix lamp	6 V, 50 mA; incandescent, E 10 fitting type no 7121D cat. no 9234 406 101..
Height of figure	140 mm
Legibility	70 m (approximately) within an angle of 120°
Supply	
for lamps, voltage (V_{lamp})	+6 V + 10% *)
current	max. 850 mA
peak current	8 A for 10 ms
for logic, voltage (V_{log})	+5 V ± 5%
current	typ. 90 mA
switch-on time (t_s)	max. 250 ms (for automatic reset)
Ambient temperature range	
operating	−10 to +60 °C
storage	−10 to +70 °C
Logic input data	
Voltage level (V_i)	
HIGH	min. +4 V max. +30 V
LOW	min. −15 V max. +1 V
Active level	
DE_i	HIGH **)
CL_i	HIGH
R	HIGH
Resistance (all inputs)	min. 10 kΩ
Time data for clock and reset inputs	see Fig. 3

*) At lower voltages the life-time of the lamps is increased, but the light intensity is decreased.

**) The figure is displayed for as long as the input is floating or LOW. The state of this input has no influence on the counter, only on the display.

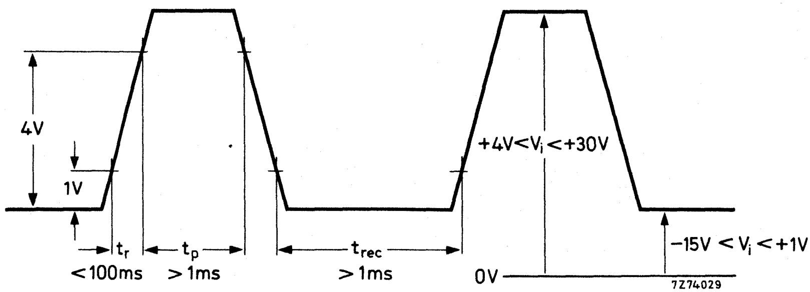


Fig. 3. Timing diagram

Logic output data (fan-out)

Clock output (CL_o)	1 CL_i
Display enable output (DE_o)	1 DE_i

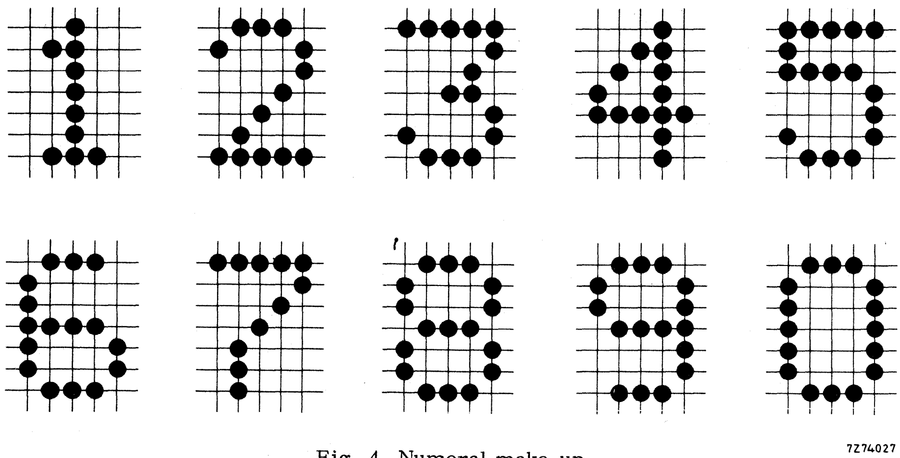


Fig. 4. Numeral make-up

APPLICATION INFORMATION

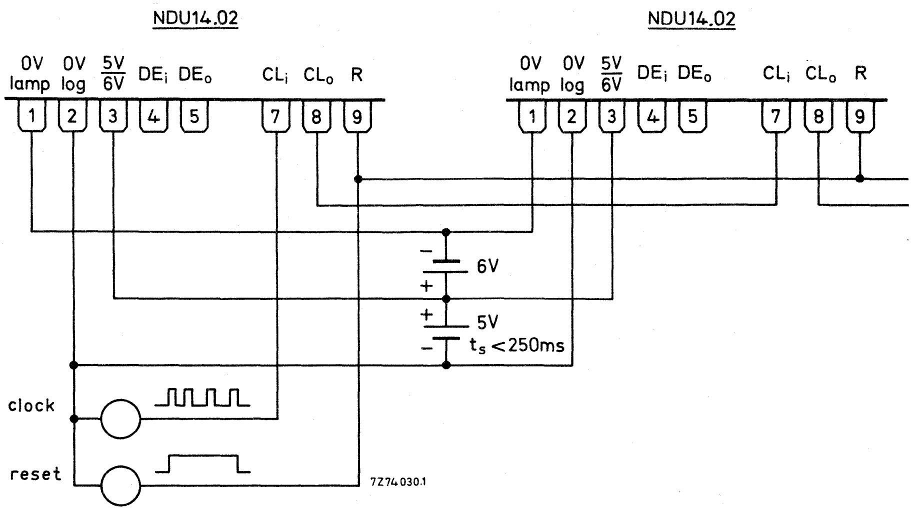


Fig. 5. Connections required when the units are used in multi-decade counters

NUMERICAL DISPLAY UNIT
with BCD-code input

QUICK REFERENCE DATA	
Display figures	0 to 9, in 5x7 dot matrix
Type of matrix lamps	6 V, 50 mA; incandescent
Height of figure	140 mm
Legibility	70 m (approximately) within an angle of 120°
BCD inputs	TTL level

APPLICATION

The NDU 14.03 has been designed to provide the display for binary counters with BCD outputs, e.g. digital clocks and systems in which any number sequence must be displayed (counting back, weighing, computer outputs, binary coding thumbwheel switches).

DESCRIPTION

The numerals are formed in a 5x7 matrix of 6 V, 50 mA incandescent lamps (E 10 fitting), measuring approximately 140 mm x 100 mm. Two printed-wiring boards are mounted in the black polystyrene housing: one board with the lamp holders and a diode matrix, and the other with a decoder. A spring-mounted white plastic reflector block ensures maximum light intensity, while a translucent red acrylic reflection-free plate acts as the cover of the housing and ensures that a clear red spot is obtained when a lamp is lit. The numerals 0 to 9 are clearly visible from 70 m over an angle of 120°.
The red cover is easily removed for mounting and for lamp replacement.
For electrical connection the module is provided with 0,250 inch pierced tags (in accordance with DIN 46248, Blatt 3) for 0,250 inch receptacles with dimples to ensure correct insertion depth, and rigidity.
Input signals in BCD code are required to display a figure. The built-in decoder translates these signals into drive signals for the lamps.
The unit is provided with display enable input and output.

MECHANICAL DATA

Dimensions (mm)

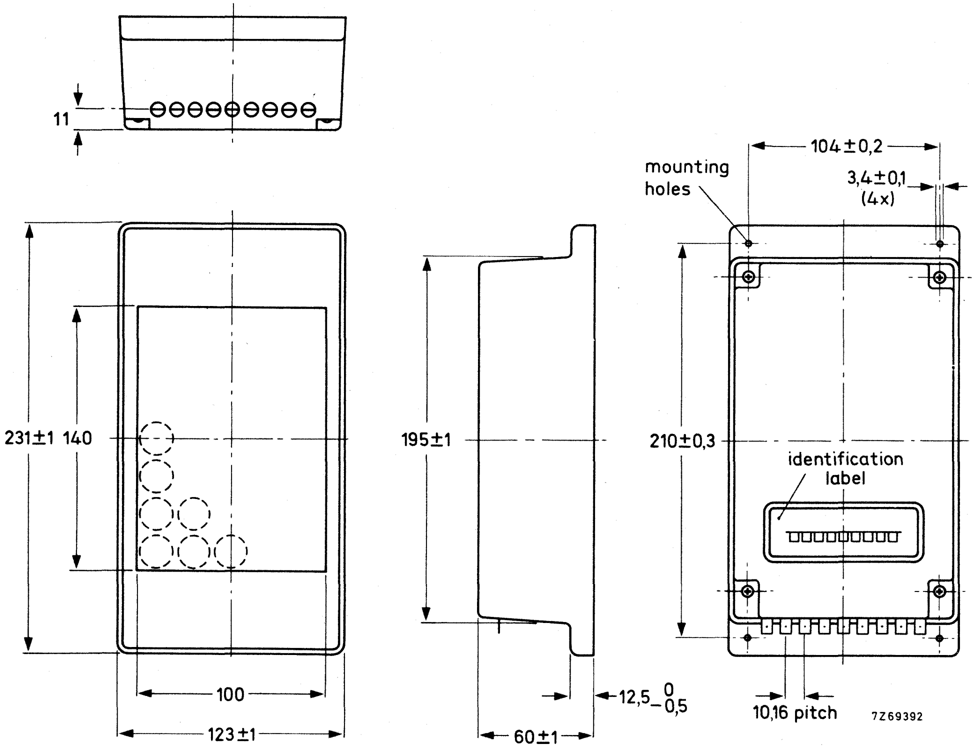


Fig. 1

Terminal location

Terminal 1 = 0 V of lamp
2 = 0 V of logic
3 = 6 V of lamp and 5 V of logic
4 = display enable input
5 = display enable output
6 =
7 =
8 =
9 =
} BCD-input

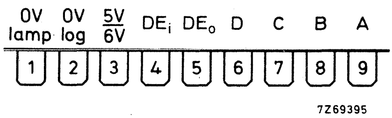


Fig. 2

Mass

580 g (approximately)

Mounting

Access to four mounting holes for M3-screws is achieved after removal of the red cover (see Fig. 1). The cover is removed by pressing both corners on a long side simultaneously. The lock profiles will then disengage. If not, the blade of a knife, screwdriver or similar object can be used with due care to lever out the cover at the corners of one long side.
To avoid damage to housing or cover, never apply a lever to the short sides of the unit where the lock profiles are situated. The cover is replaced (matt side up) by pressing in the middle of both sides until the lock profiles engage.

DISPLAY AND ELECTRICAL DATA

Display figures	0 to 9, in 5x7 dot matrix
Type of matrix lamp	6 V, 50 mA; incandescent, E 10 fitting type no 7121D cat. no 9234 406 101..
Height of figure	140 mm
Legibility	70 m (approximately) within an angle of 120°

Supply

for lamps, voltage (V_{lamp})	+6 V + 10% *)
current	max. 850 mA
peak current	8 A for 10 ms
for logic, voltage (V_{log})	+5 V ±5%
current	typ. 90 mA

Ambient temperature range

operating	−10 to +60 °C
storage	−10 to +70 °C

Logic input data (TTL logic)

A, B, C, D inputs (see truth table)

Level HIGH, voltage	min. 2 V max. 5,5 V
current	max. 40 μA
LOW, voltage	min. 0 V max. 0,8 V
current	−max. 1,6 mA

*) At lower voltage the life-time of the lamps is increased, but the light intensity is decreased.

Display enable input

Voltage level HIGH	min. +4 V
	max. +30 V
LOW	min. −15 V
	max. +1 V
Active (disable) level DE_i	HIGH **)
Resistance	min. 10 kΩ

Truth table

Combinations not included in the table give no display.

display figure	A	B	C	D
0	L	L	L	L
1	H	L	L	L
2	L	H	L	L
3	H	H	L	L
4	L	L	H	L
5	H	L	H	L
6	L	H	H	L
7	H	H	H	L
8	L	L	L	H
9	H	L	L	H

Logic output data (fan-out)

Display enable output (DE_o)	1 DE_i

**) The figure is displayed for as long as the input is floating or LOW.
The state of this input has no influence on the counter, only on the display.

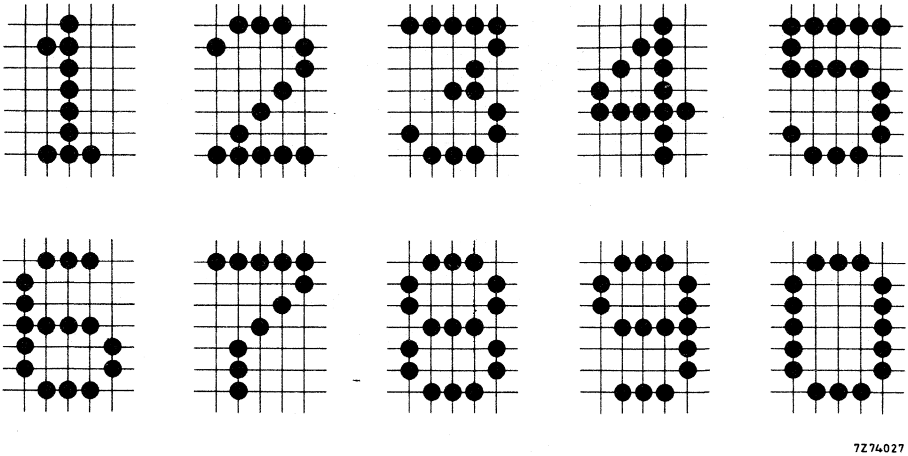


Fig. 3. Numeral make-up

APPLICATION INFORMATION

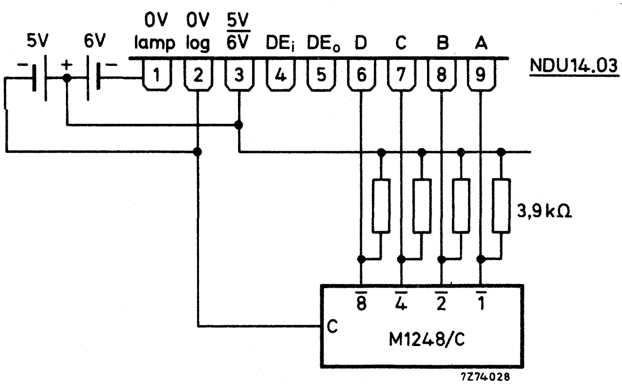


Fig. 4. Connections to the unit when used with the M1248/C thumbwheel switch.

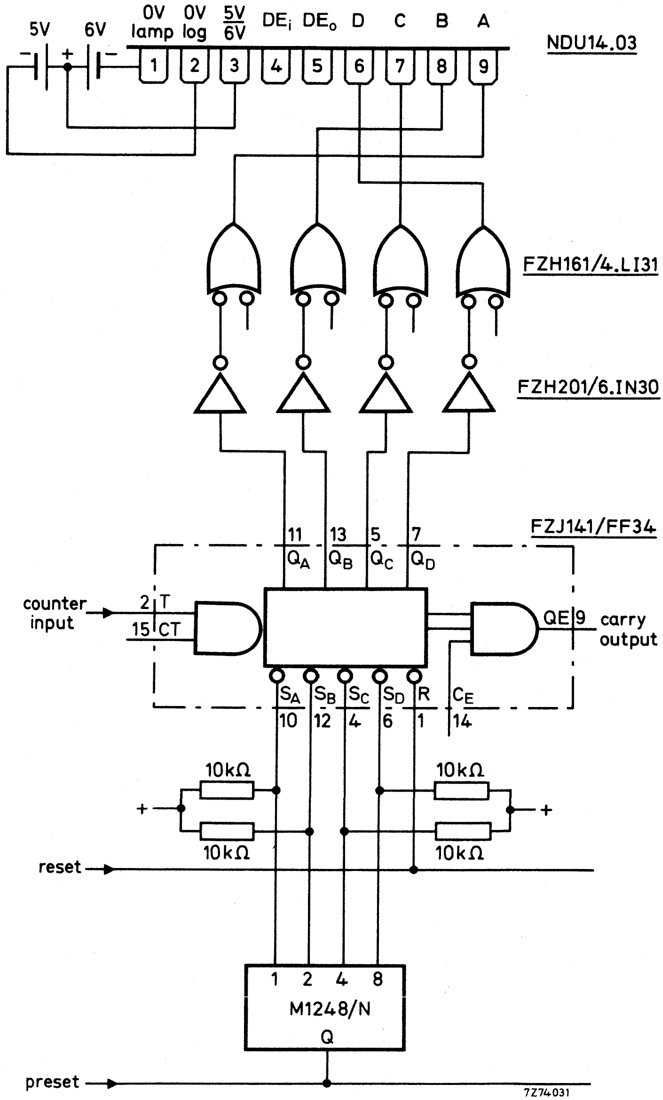


Fig. 5. Decimal counter with preset based on FZ/30 series modules using the NDU 14.03 as the display unit.

TIMERS
electronic time delay-on-relay

QUICK REFERENCE DATA	
Supply voltage	220 V/240 V +10, −15%
frequency	50 Hz ± 10%
Output function	s.p.d.t.
nominal r.m.s. voltage	240 V
nominal r.m.s. current	5 A
Mechanical life expectancy	min. 5 x 10^7 operations
Delay time (adjustable), TX810	5 to 100 s
TX811	10 to 300 s
Dimensions	45 x 70 x 109 mm
Mounting possibilities	rear, front, and rail
Protection degree (DIN 40050)	
terminals	IP20
package	IP40

APPLICATION

These timers have been designed for 220 V and 240 V operation in industrial control.

DESCRIPTION

The modules consist of an electronic timer and an industrial relay which includes a single-pole double-throw switch. The delay-time can be adjusted by a potentiometer, which is provided with a knob on the front of each module. After the module has been connected to the mains, and the delay-time has elapsed, the relay is energized and remains in this condition as long as the mains supply is not interrupted. However, a short interruption (see Fig. 2) neither changes the relay state, nor re-starts the timer.
A delayed turn-on or a delayed turn-off action can be chosen.
The polycarbonate housing has standardized dimensions, and three mounting possibilities are incorporated (see Mounting).
For electrical connection the modules are provided with 0,250 inch pierced tags (in accordance with DIN 46248, Blatt 3) for 0,250 inch receptacles with dimples to ensure correct insertion depth, and rigidity.

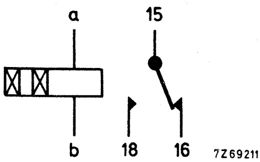


Fig. 1 Drawing symbol

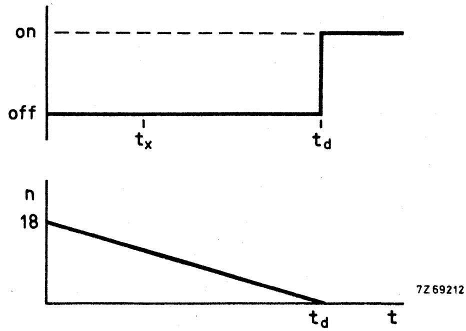


Fig. 2 $$n = 18\left(\frac{t_d - t_x}{t_d}\right)$$

t_d = adjusted delay time
t_x = expired delay time
n = number of cycles of supply that may fall off without noticeable influence. Above n the timer will start again.

MECHANICAL DATA

Dimensions (mm) and terminal location

See Fig. 3.

The terminal configuration and coding are in accordance with DIN 46199, Blatt 5.

Connections

The tags of the timer are in accordance with DIN 46248, Blatt 3, suitable for receptacles to DIN 46247, Blatt 3.
It is recommended that pre-insulated receptacles be used.
Interconnections can be made if receptacles with crimp connection and flexible wire are used.

Mounting

Three ways of mounting are possible:

1. Two holes at the rear permit mounting onto a panel by means of M4 screws (to DIN 43604).
2. Snap-lock mounting on 35 mm "Euro" rail (to DIN 46277, Blatt 3).
3. An adapter is separately available for mounting into a front panel (see Accessories).

Mass

TX810	176 g
TX811	192 g

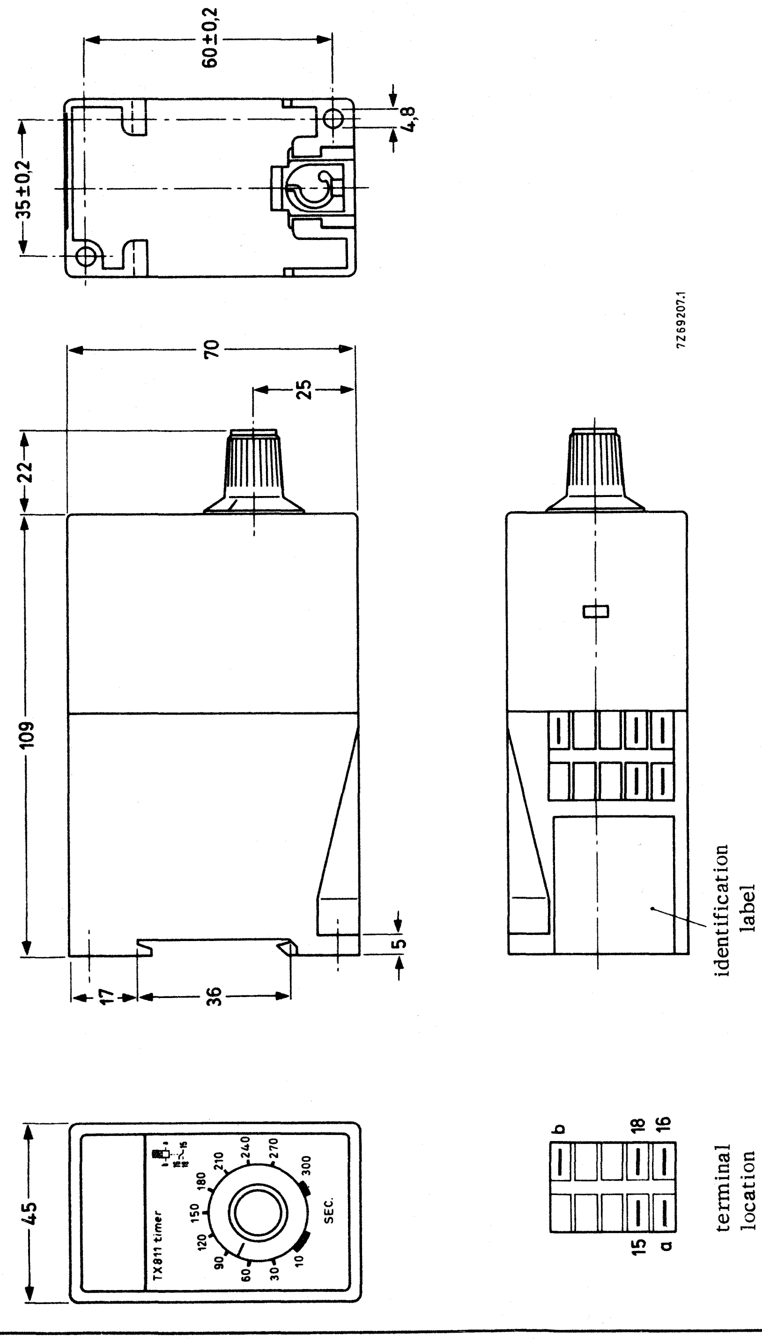

60±0,2
35±0,2
4,8
70
25
22
109
5
17
36
45
7Z69207.1
identification label
terminal location
b
18
16
15
a
TX811 timer
SEC.
10
30
60
90
120
150
180
210
240
270
300

Fig. 3

TECHNICAL PERFORMANCE

Ambient temperature range	
operating	−10 to +60 °C
storage	−25 to +70 °C
Supply	
mains voltage	220 V/240 V +10, −15%
mains frequency	50 Hz ± 10%
power consumption (cos φ = 0, 6)	5 VA
Output	
function	s.p.d.t., break before make
switch contact material	heavy-current silver-cadmium oxide
life expectancy (mechanical)	up to 5 x 10^7 operations, see Figs 5 and 6
Contact ratings *)	
d.c. power	max. 250 W
a.c. power	max. 1000 VA
r.m.s. voltage	max. 264 V
r.m.s. current	max. 5 A
r.m.s. inrush current	max. 16 A
Test voltage between input and output (IEC 348)	2000 V, 50 Hz
Timing data	
delay time (t_d), TX810	5 to 100 s
TX811	10 to 300 s
setting inaccuracy	± max. 2% at 90% of full scale
reproducibility	within ± 1%
temperature coefficient of t_d, between 10 and 40 °C	−0, 1%/°C
change of t_d with supply voltage	max. 0, 02%/%
release time t_{rel}	max. 150 ms
recovery time t_{rec}	min. 1 s

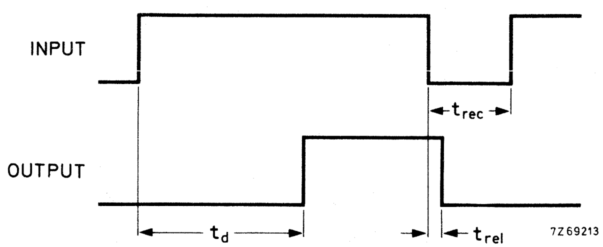


Fig. 4

*) With sufficient spark suppression and for minimum 10^5 operations.

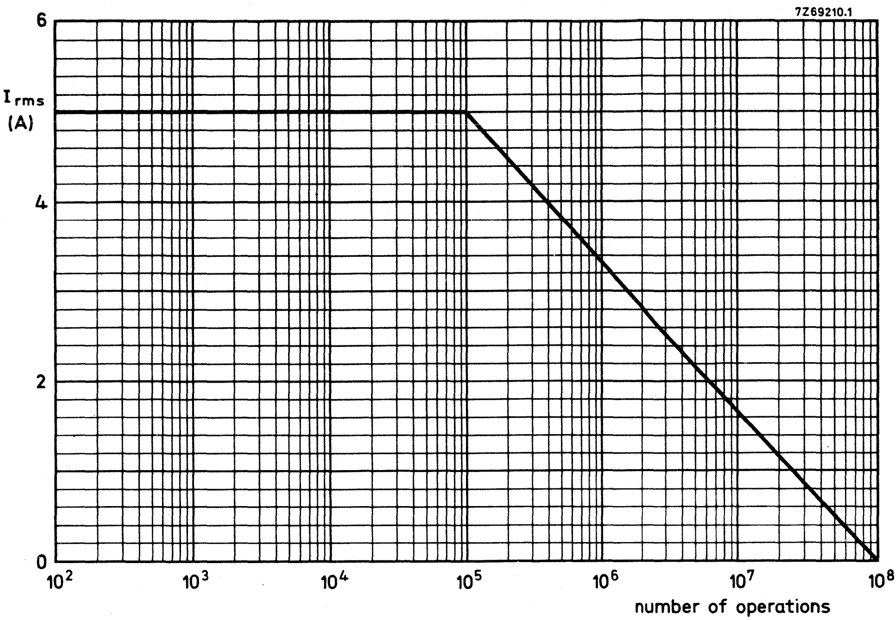


Fig. 5 Continuous current against number of operations at nominal voltage

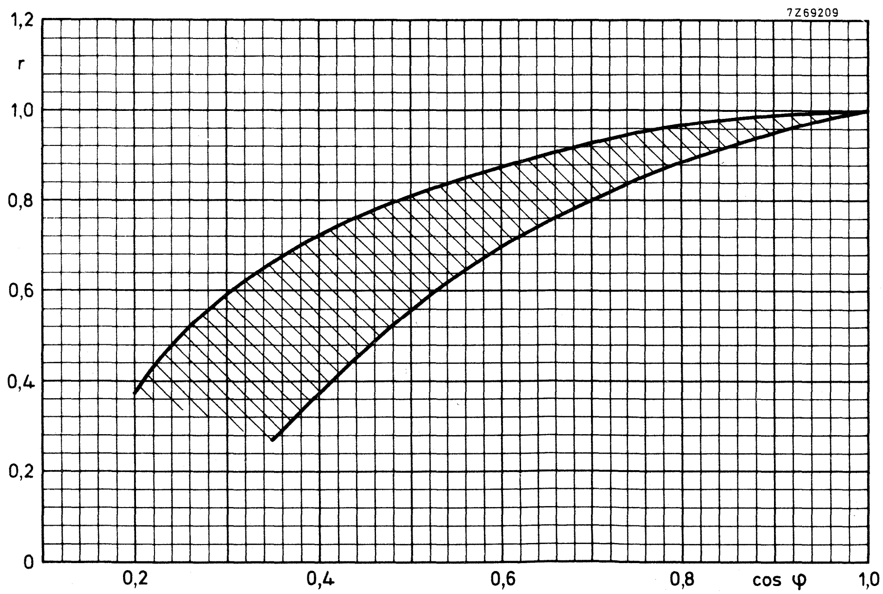


Fig. 6 Reduction factor r for life expectancy as a function of power factor cos φ

MECHANICAL PROTECTION AND ELECTRICAL SAFETY

The design of the timers is based on the following standards:

Test voltage	IEC 348, VDE 0435, VDE 0660 part 2, NLN - D - 97
Creepage and free-air distances	VDE 0110, class C
Protection	DIN 40050, Blatt 1, and IEC 144
terminals *)	class IP 20
package	class IP 40

*) In combination with receptacles the following classes are met:

non-insulated receptacle	class IP 00
pre-insulated receptacle	class IP 20
non-insulated receptacle with post-insulating boot	class IP 30
non-insulated receptacle with a cold crimp insulating sleeve	class IP 40

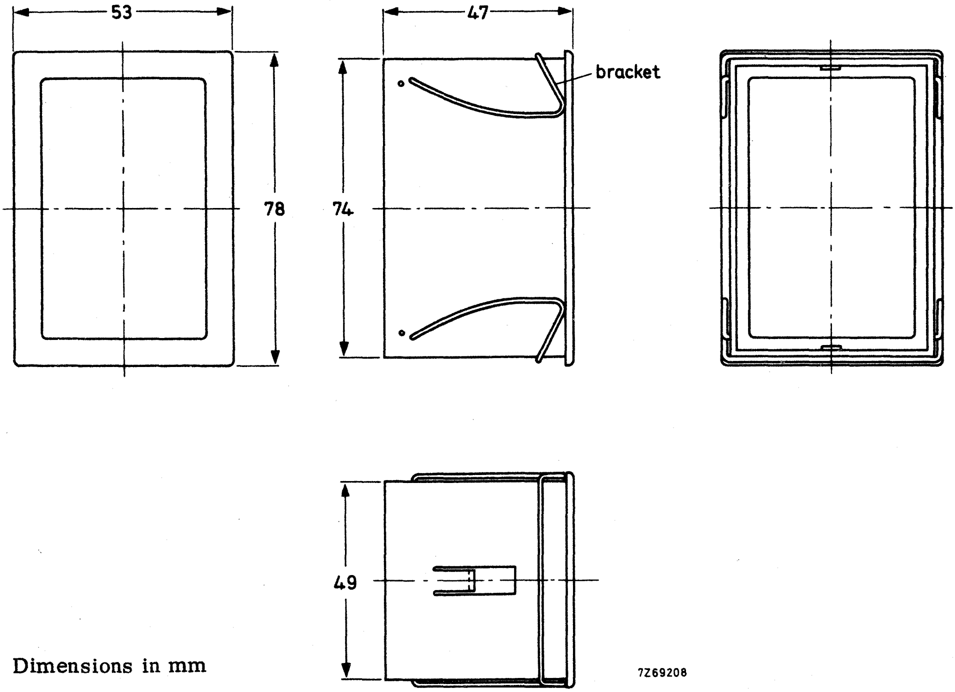
TEST SPECIFICATIONS

1. Shock test according to IEC68-2-27 (test Ea):
   3 blows 50g for 11 ms, in 6 directions.
2. Vibration test according to IEC68-2-6 (test Fc):
   10 to 55 Hz, max. amplitude 0, 76 mm, sweep time 1 octave/min;
   2 hours in 3 perpendicular directions.
3. Temperature shock test according to IEC68-2-14 (test Na):
   5 cycles from −25 to 70 °C, 1 cycle/h.
4. Damp heat test according to IEC68-2-3 (test Ca):
   21 days at 40 °C, R.H. 90 to 95%.

ACCESSORIES

The timer can be equipped with a LED to indicate the energized state (relay on), on request.

For front-panel mounting a polycarbonate **adapter**, catalogue number 4322 026 79651, and brackets, catalogue number 4322 026 79642, are available. Two brackets are required per **adapter**. Fig. 7 shows the **adapter** with the brackets mounted.
Required aperture in panel 49,5 (+0,5) x 74,5 (+0,5) mm, maximum panel thickness 6 mm.



Dimensions in mm

Fig. 7

TIMER
electronic time delay-on-relay

QUICK REFERENCE DATA	
Supply voltage	220 V/240 V +10, −15%
frequency	50 Hz ± 10%
Output function	s.p.d.t.
nominal r.m.s. voltage	240 V
nominal r.m.s. current	5 A
Mechanical life expectancy	min. 5 x 10^7 operations
Delay time (adjustable)	1 to 99 s
Dimensions	45 x 70 x 109 mm
Mounting possibilities	rear, front and rail
Protection degree (DIN 40050)	
terminals	IP20
package	IP40

APPLICATION

This timer has been designed for 220 V and 240 V operation in industrial control.

DESCRIPTION

The module consists of an electronic timer and an industrial relay which includes a single-pole double-throw switch. The delay-time can be adjusted by two thumbwheel switches on the front of the module. After the module has been connected to the mains, and the delay-time has elapsed, the relay is energized and remains in this condition as long as the mains supply is not interrupted. However, a short interruption (see Fig. 2) neither changes the relay state, nor re-starts the timer.

A delayed turn-on or a delayed turn-off action can be chosen.

The polycarbonate housing has standardized dimensions, and three mounting possibilities are incorporated (see Mounting).

For electrical connection the module is provided with 0,250 inch pierced tags (in accordance with DIN 46248, Blatt 3) for 0,250 inch receptacles with dimples to ensure correct insertion depth, and rigidity.

The timer is provided with a LED which indicates the energized state (relay on).

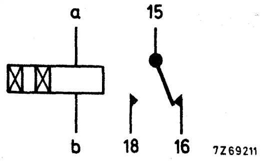


Fig. 1 Drawing symbol

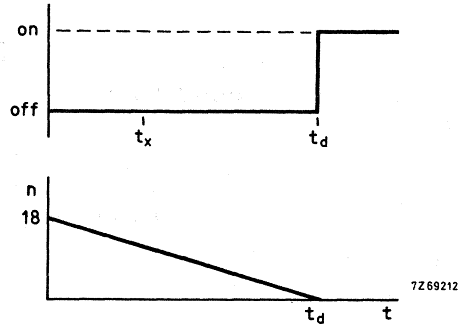


Fig. 2 $$n = 18 \left(\frac{t_d - t_x}{t_d} \right)$$

t_d = adjusted delay time
t_x = expired delay time
n = number of cycles of supply that may fall off without noticeable influence. Above n the timer will start again.

MECHANICAL DATA

Dimensions (mm) and terminal location

See Fig. 3.

The terminal configuration and coding are in accordance with DIN 46199, Blatt 5.

Connections

The tags of the timer are in accordance with DIN 46248, Blatt 3, suitable for receptacles to DIN 46247, Blatt 3.
It is recommended that pre-insulated receptacles be used.
Interconnections can be made if receptacles with crimp connection and flexible wire are used.

Mounting

Three ways of mounting are possible:

1. Two holes at the rear permit mounting onto a panel by means of M4 screws (to DIN 43604).
2. Snap-lock mounting on 35 mm "Euro" rail (to DIN 46277, Blatt 3).
3. An adapter is separately available for mounting into a front panel (see Accessories).

Mass 170 g

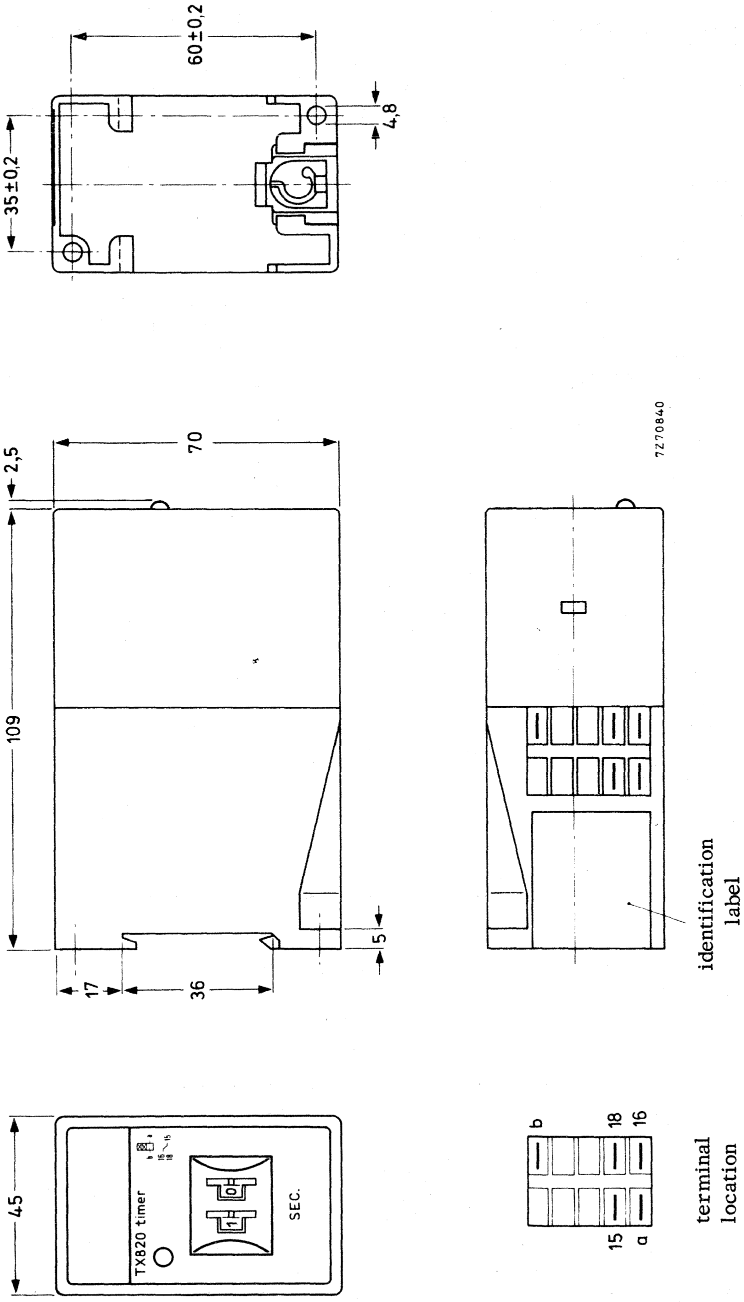

60±0,2
35±0,2
4,8
70
2,5
109
5
17
36
7Z70840
identification label
45
TX820 timer
SEC.
b
18
16
15
a
terminal location

Fig. 3

TECHNICAL PERFORMANCE

Ambient temperature range	
operating	−10 to +60 °C
storage	−25 to +70 °C
Supply	
mains voltage	220 V/240 V +10, −15%
mains frequency	50 Hz ± 10%
power consumption ($\cos\varphi = 0,6$)	5 VA
Output	
function	s.p.d.t., break before make
switch contact material	heavy-current silver-cadmium oxide
life expectancy (mechanical)	up to 5 x 10^7 operations, see Figs 5 and 6
Contact ratings *)	
d.c. power	max. 250 W
a.c. power	max. 1000 VA
r.m.s. voltage	max. 264 V
r.m.s. current	max. 5 A
r.m.s. inrush current	max. 16 A
Test voltage between input and output (IEC 348)	2000 V, 50 Hz
Timing data	
delay time (t_d)	1 to 99 s
setting inaccuracy	± max. 1%, or ± max. 0,5 s
reproducibility	within ± 0,4%
temperature coefficient of t_d, between 10 and 40 °C	0,02%/°C
change of t_d with supply voltage	max. 0,02%/%
release time t_{rel}	max. 150 ms
recovery time t_{rec}	min. 1 s

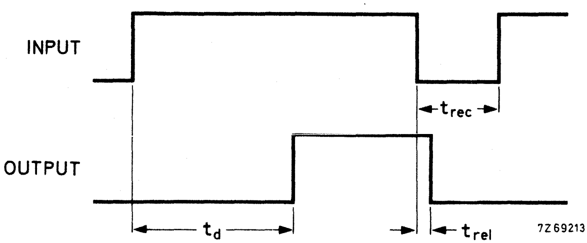


Fig. 4

*) With sufficient spark suppression and for minimum 10^5 operations.

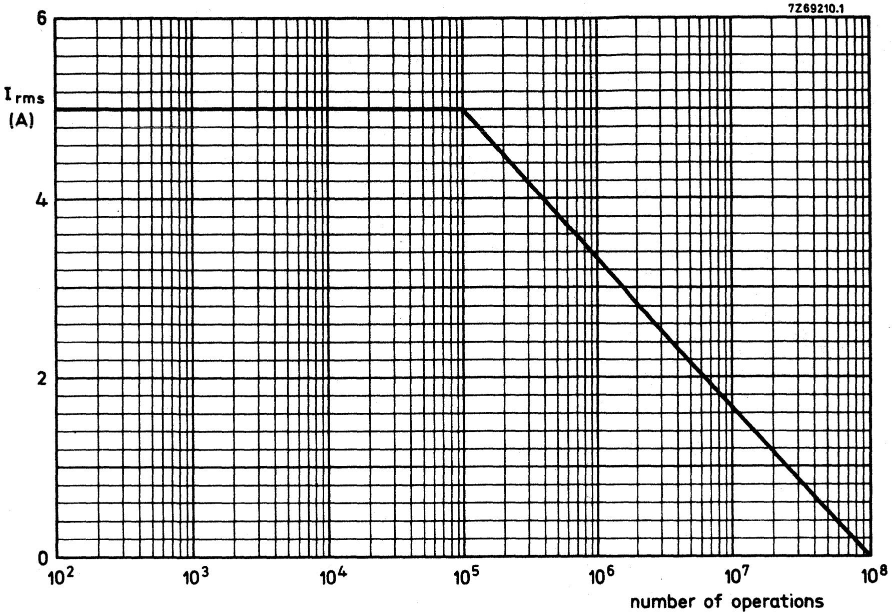


Fig. 5 Continuous current against number of operations at nominal voltage

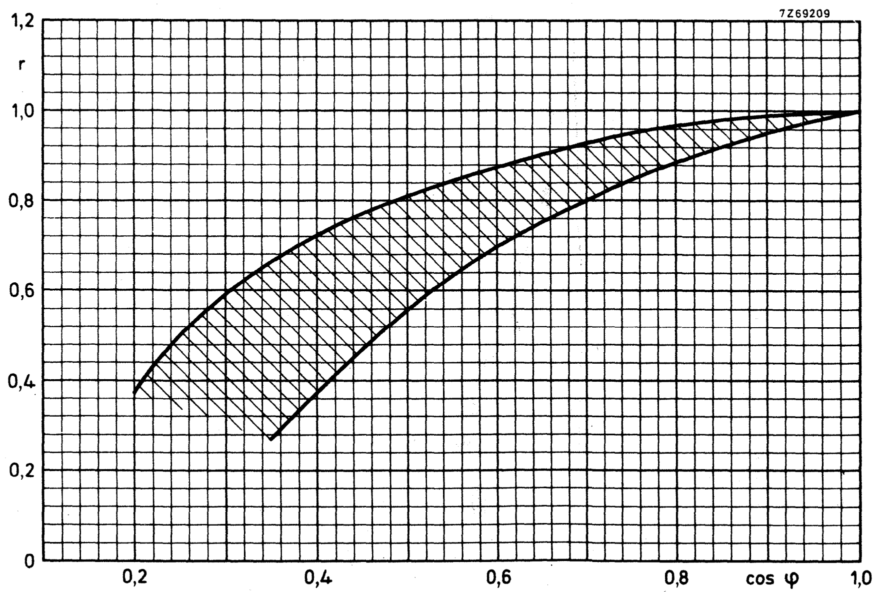


Fig. 6 Reduction factor r for life expectancy as a function of power factor cos φ

MECHANICAL PROTECTION AND ELECTRICAL SAFETY

The design of the timer is based on the following standards:

Test voltage	IEC 348, VDE 0435, VDE 0660 part 2, NLN - D - 97
Creepage and free-air distances	VDE 0110, class C
Protection	DIN 40050, Blatt 1, and IEC 144
terminals *)	class IP 20
package	class IP 40

*) In combination with receptacles the following classes are met:

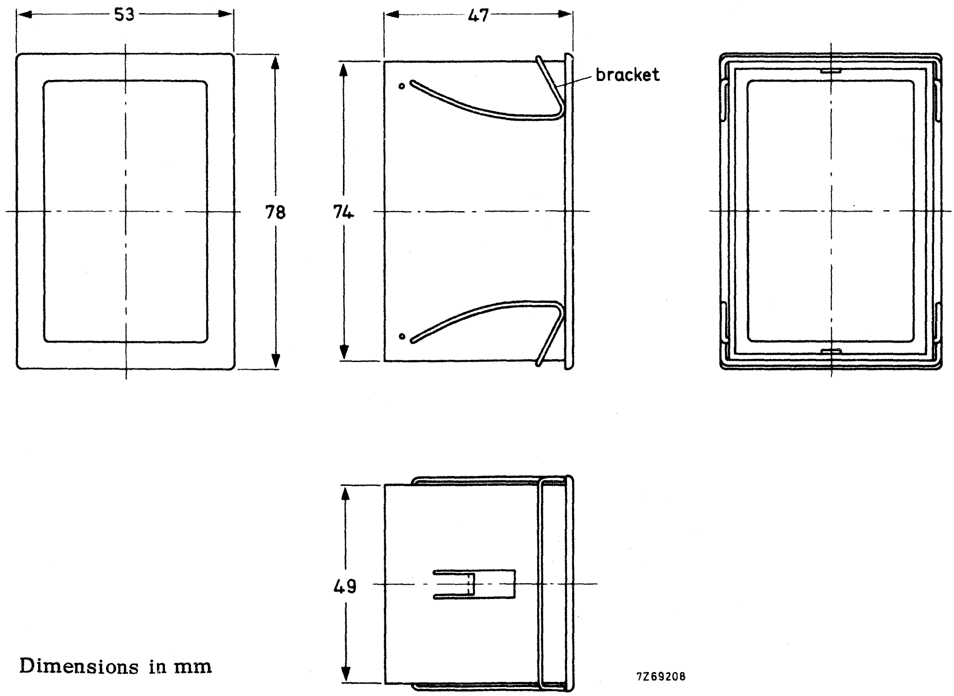
non-insulated receptacle	class IP 00
pre-insulated receptacle	class IP 20
non-insulated receptacle with post-insulating boot	class IP 30
non-insulated receptacle with a cold crimp insulating sleeve	class IP 40

TEST SPECIFICATIONS

1. Shock test according to IEC68-2-27 (test Ea):
   3 blows 50g for 11 ms, in 6 directions.
2. Vibration test according to IEC68-2-6 (test Fc):
   10 to 55 Hz, max. amplitude 0,76 mm, sweep time 1 octave/min;
   2 hours in 3 perpendicular directions.
3. Temperature shock test according to IEC68-2-14 (test Na):
   5 cycles from −25 to 70 °C, 1 cycle/h.
4. Damp heat test according to IEC68-2-3 (test Ca):
   21 days at 40 °C, R.H. 90 to 95%.

ACCESSORIES

For front-panel mounting a polycarbonate adapter, catalogue number 4322 026 79651, and brackets, catalogue number 4322 026 79642, are available. Two brackets are required per adapter. Fig. 7 shows the adapter with the brackets mounted.
Required aperture in panel 49, 5 (+0, 5) x 74, 5 (+0, 5) mm, maximum panel thickness 6 mm.



Dimensions in mm

Fig. 7

FLASHER

QUICK REFERENCE DATA	
Supply voltage	220 V/240 V +10, −15%
frequency	50 Hz ± 10%
Output function	s.p.d.t.
nominal r.m.s. voltage	240 V
nominal r.m.s. current	5 A
Mechanical life expectancy	min. 5 x 10^7 operations
Number of pulses	30/min to 120/min
Dimensions	45 x 70 x 109 mm
Mounting possibilities	rear, front and rail
Protection degree (DIN 40050)	
terminals	IP20
package	IP40

APPLICATION

This flasher has been designed for 220 V and 240 V operation as an intermittent switch for signal lamps and as a clock pulse generator.

DESCRIPTION

The item consists of an electronic low frequency pulse generator and an industrial relay which includes a single-pole double-throw switch. The module operates as soon as its power supply is switched on. The output pulse has a duty cycle of 50%. The pulse rate can be adjusted by a potentiometer, which is provided with a knob on the front of the module.

The polycarbonate housing has standardized dimensions, and three mounting possibilities are incorporated (see Mounting).
For electrical connection the module is provided with 0, 250 inch pierced tags (in accordance with DIN 46248, Blatt 3) for 0, 250 inch receptacles with dimples to ensure correct insertion depth, and rigidity.

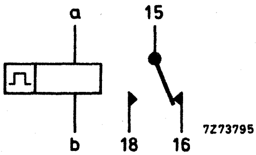


Fig. 1 Drawing symbol

MECHANICAL DATA

Dimensions (mm) and terminal location

See Fig. 2.

The terminal configuration and coding are in accordance with DIN 46199, Blatt 5.

Connections

The tags of the flasher are in accordance with DIN 46248, Blatt 3, suitable for receptacles to DIN 46247, Blatt 3.
It is recommended that pre-insulated receptacles be used.
Interconnections can be made if receptacles with crimp connection and flexible wire are used.

Mounting

Three ways of mounting are possible:

1. Two holes at the rear permit mounting into a panel by means of M4 screws (to DIN 43604).
2. Snap-lock mounting on 35 mm "Euro" rail (to DIN 46277, Blatt 3).
3. An adapter is separately available for mounting into a front panel (see Accessories).

Mass 173 g

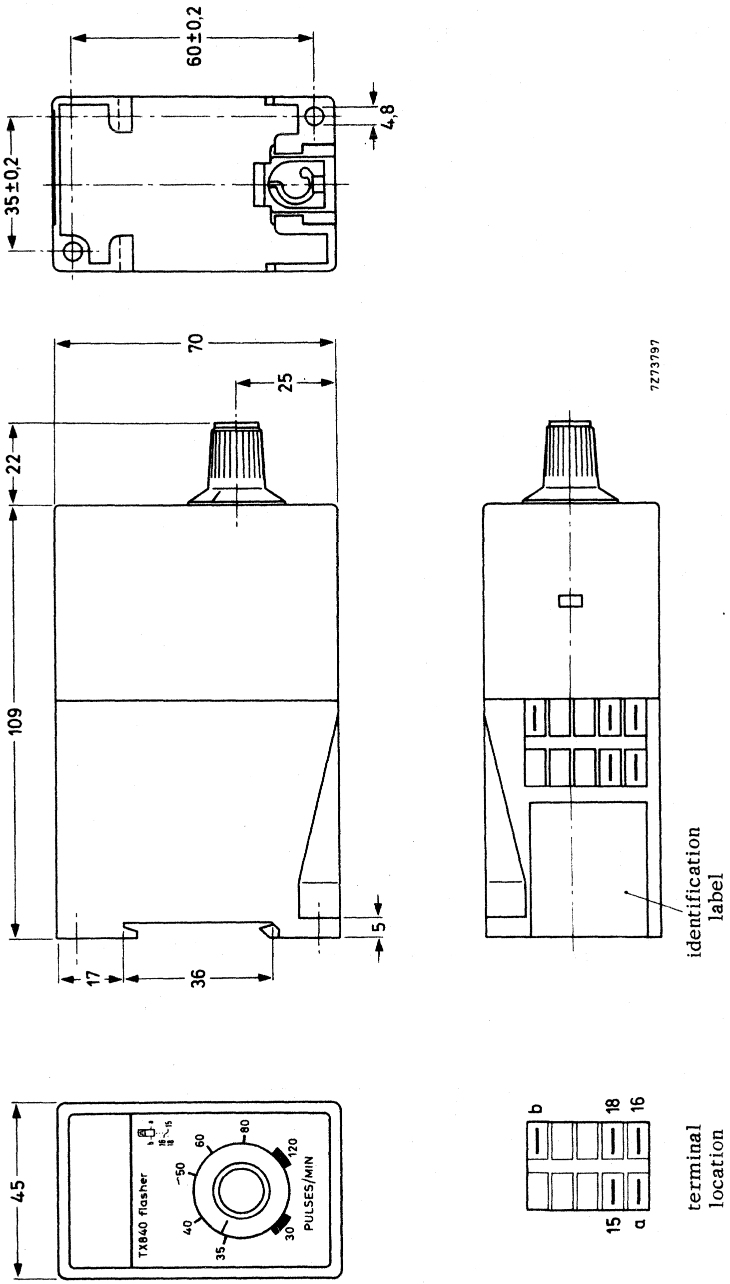

60±0,2
4,8
35±0,2
70
25
22
109
5
17
36
7Z73797
identification label
45
TX840 flasher
PULSES/MIN
30
35
40
50
60
80
120
b
18
16
15
a
terminal location

Fig. 2

TECHNICAL PERFORMANCE

Ambient temperature range	
operating	−10 to +60 °C
storage	−25 to +70 °C
Supply	
mains voltage	220 V/240 V +10, −15%
mains frequency	50 Hz ± 10%
power consumption (cos φ = 0, 6)	5 VA
Output	
function	s.p.d.t., break before make
switch contact material	heavy-current silver-cadmium oxide
life expectancy (mechanical)	up to 5 x 10^7 operations, see Figs 4 and 5
Contact ratings *)	
d.c. power	max. 250 W
a.c. power	max. 1000 VA
r.m.s. voltage	max. 264 V
r.m.s. current	max. 5 A
r.m.s. inrush current	max. 16 A
Test voltage between input and output (IEC 348)	2000 V, 50 Hz
Timing data	
number of pulses (f)	30/min to 120/min
duty cycle	50%
setting inaccuracy at 40 cycles/min	± max. 5%
stability of cycle time	within ± 1%
temperature coefficient of f, between 10 and 40 °C	−0, 2%/°C
change of f with supply voltage	max. 0, 02%/%

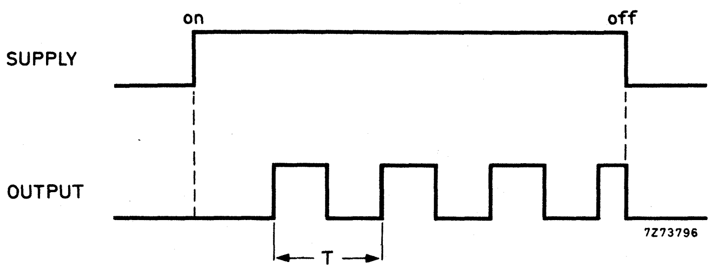


Fig. 3. T = cycle time.

*) With sufficient spark suppression and for minimum 10^5 operations.

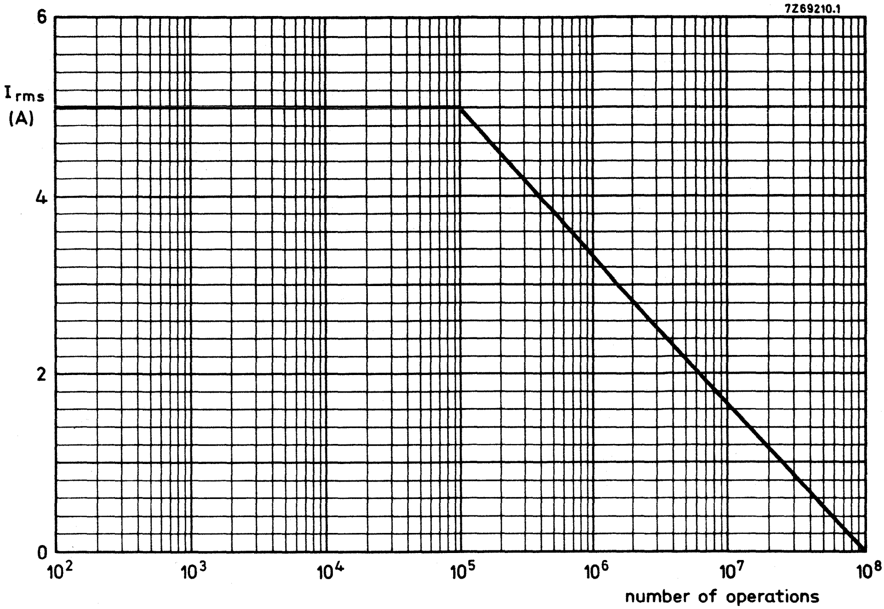


Fig. 4 Continuous current against number of operations at nominal voltage

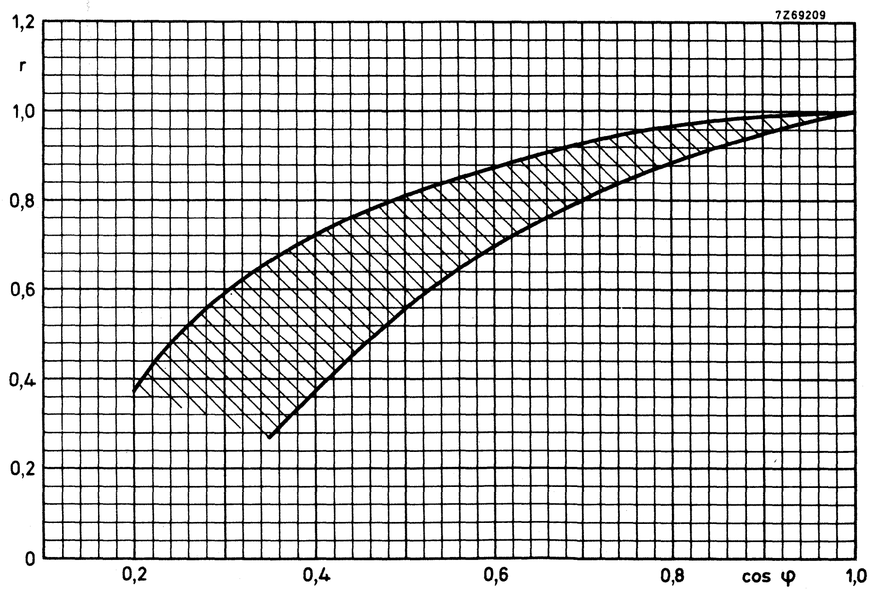


Fig. 5 Reduction factor r for life expectancy as a function of power factor cos φ

MECHANICAL PROTECTION AND ELECTRICAL SAFETY

The design of the flasher is based on the following standards:

Test voltage	IEC 348, VDE 0435, VDE 0660 part 2, NLN - D - 97
Creepage and free-air distances	VDE 0110, class C
Protection	DIN 40050, Blatt 1, and IEC 144
terminals*)	class IP20
package	class IP40

*) In combination with receptacles the following classes are met:

non-insulated receptacle	class IP00
pre-insulated receptacle	class IP20
non-insulated receptacle with post-insulating boot	class IP30
non-insulated receptacle with a cold crimp insulating sleeve	class IP40

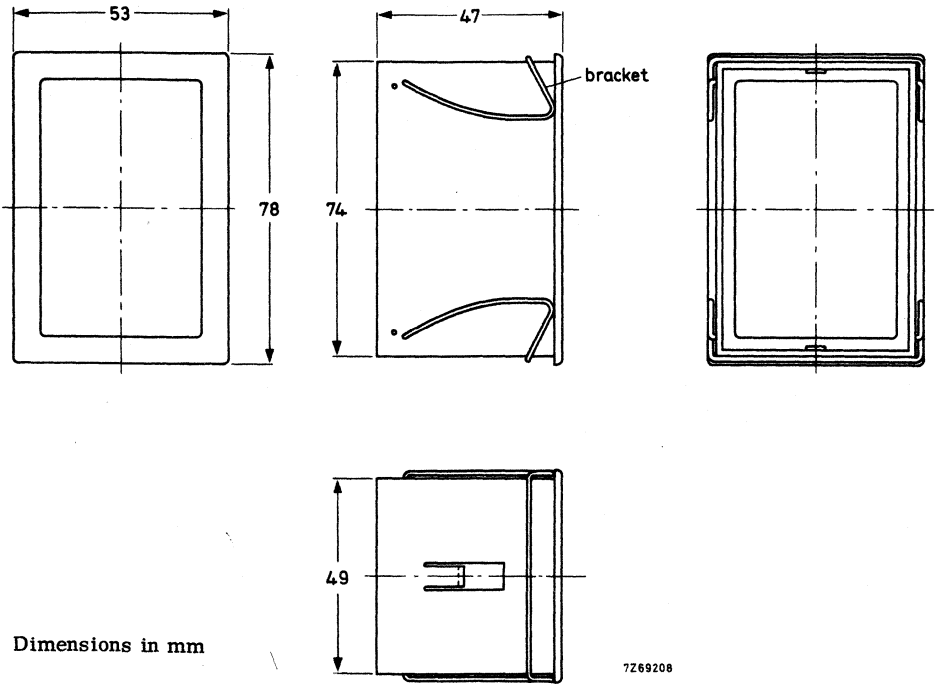
TEST SPECIFICATIONS

1. Shock test according to IEC68-2-27 (test Ea):
   3 blows 50g for 11 ms, in 6 directions.
2. Vibration test according to IEC68-2-6 (test Fc):
   10 to 55 Hz, max. amplitude 0,76 mm, sweep time 1 octave/min, 2 hours in 3 perpendicular directions.
3. Temperature shock test according to IEC68-2-14 (test Na):
   5 cycles from −25 to 70 °C, 1 cycle/h.
4. Damp heat test according to IEC68-2-3 (test Ca):
   21 days at 40 °C, R.H. 90 to 95%.

ACCESSORIES

The flasher can be equipped with a LED to indicate the energized state (relay on), on request.

For front-panel mounting a polycarbonate adapter, catalogue number 4322 026 79651, and brackets, catalogue number 4322 026 79642, are available. Two brackets are required per adapter. Fig. 6 shows the adapter with the brackets mounted.
Required aperture in panel 49,5 (+0,5) x 74,5 (+0,5) mm, maximum panel thickness 6 mm.



Dimensions in mm

Fig. 6

Contents

A Circuit blocks 40-Series and CSA70(L)

B Counter modules 50-Series

C Input/output devices

Contents

Argentina: FAPESA I.y.C., Av. Crovara 2550, Tablada, Prov. de BUENOS AIRES, Tel. 652-7438/7478.
Australia: PHILIPS INDUSTRIES HOLDINGS LTD., Elcoma Division, 67 Mars Road, LANE COVE, 2066, N.S.W., Tel. 427 08 88.
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Printed in The Netherlands

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