



type 2425

## Electronic Voltmeter

### FEATURES:

- True RMS detector with 40 dB range and 5:1 (14 dB) crest factor capability
- Average detector with vu response
- Positive, Negative and Max. Peak detector with 50  $\mu$ s rise time
- Peak Hold function
- Linear frequency response from 0,5 Hz to 0,5 MHz
- Indication of volts, dBV and dBm
- "Fast" and "Slow" meter time constants
- Sensitivities from 1 mV to 300 V FSD

- Calibrated Amplifier with line-level output
- Input for external meter time constants
- Mains or external battery operation

### USES:

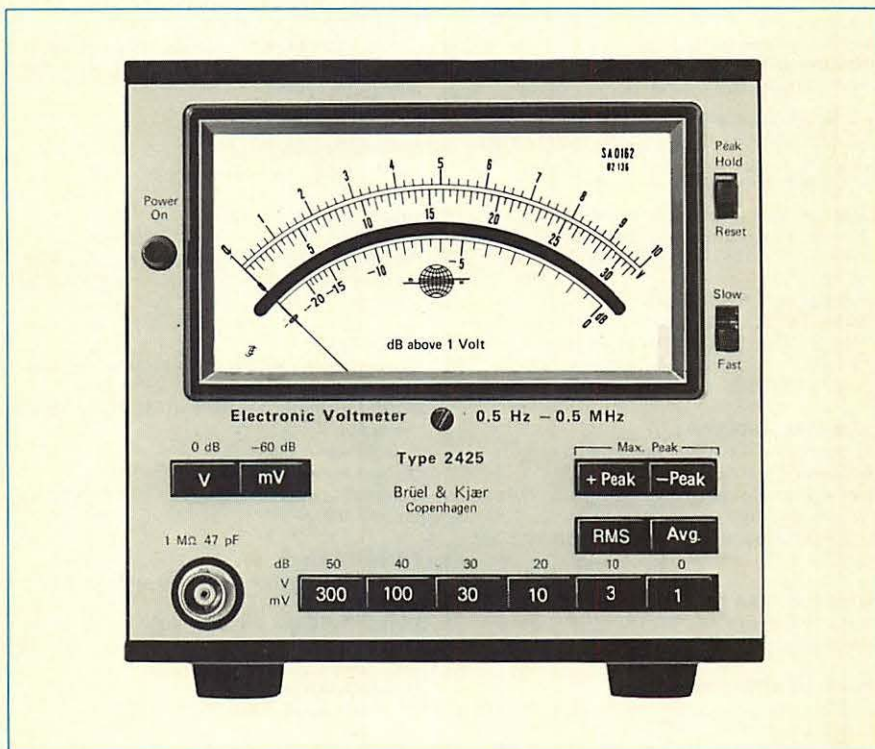
- Measurement of true RMS, -Peak, +Peak, Max. Peak and Average voltage
- Calibrated amplifier
- General purpose voltmeter
- vu measurements

The Type 2425 Electronic Voltmeter is a versatile general purpose voltmeter. It has a full-scale measurement range of 110 dB from 1 mV to 300 V full-scale, manually switched in steps of 10 dB. The linear scale (fitted as standard) can be replaced by scales calibrated for dBm and vu measurements. The voltmeter can be powered from an AC mains supply or by two batteries of 22V to 35 V each.

The 2425's true RMS rectifier has a dynamic range of 40 dB and can handle signals with a crest factor of 5:1 (14 dB). The Average detector, when used with the meter response set to "Fast", conforms to standards for vu measurements. The Peak detector has a rise-time constant of 50  $\mu$ s with the "Fast" response selected (500  $\mu$ s with "Slow" response) and can be switched to capture positive peak voltage, negative peak voltage or maximum voltage irrespective of polarity. A Peak Hold facility can be used to capture very short transient signals. The Peak Hold facility has a decay rate of 0,05 dB/s with the meter "Fast" response selected and 0,005 dB/s with "Slow" selected.

### Calibrated Amplifier

The AC Output on the rear panel of the 2425 provides a line-level signal



for connection to other recording or signal processing equipment, with 1 V RMS at the output corresponding to full-scale meter deflection. The characteristics of the 2425's fixed gain amplifiers and attenuators ensure consistent phase response throughout the

range of the Voltmeter for accurate reproduction of the input signal. The 2425 has a frequency response which is linear to within  $\pm 0,5$  dB from 0,5 Hz, "Slow" meter response; 20 Hz, "Fast" response, up to 0,5 MHz.

## DC Output

A 7-pin DIN socket on the rear panel of the 2425 provides a DC output voltage which is proportional to the input signal. An output level of 1V is equivalent to full scale deflection on the meter; the output range is from +10dB to -30dB referenced to 1V. The output impedance of less than 10Ω allows the DC Output to be used

with chart recorders and other data recording equipment.

## Meter Time Constants

The rear panel DIN socket also incorporates connections to the meter time constant circuit. By placing a resistor or capacitor between the Ext. Time Constant connector and Ground, the RMS averaging time and

the Peak decay time can be modified. For every 2,5μF of capacitance connected to the Ext. Time Constant connector, the RMS averaging time and the Peak decay time are increased by 10s. The Peak decay time can also be modified by adding a resistor to the Ext. Time Constant connector.

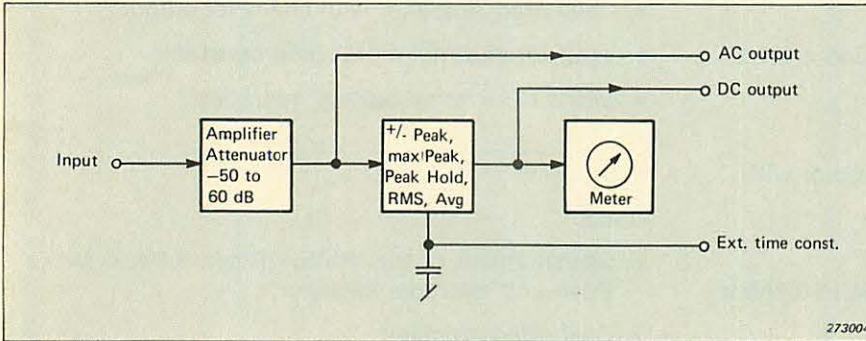


Fig. 1. Block diagram of the Type 2425 Electronic Voltmeter

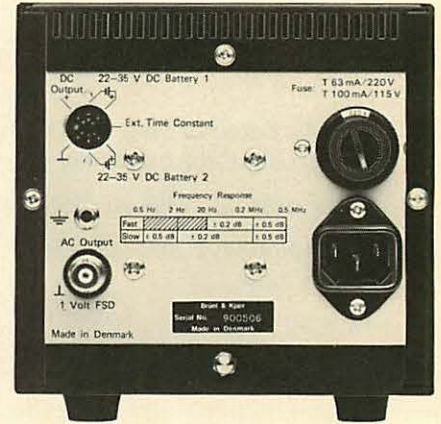


Fig. 2. Rear panel of the Type 2425

# Specifications 2425

### INPUT:

Standard BNC socket, mating plug JP 0035  
**Input Impedance:** 1 MΩ // 47 pF  
**Max. Input Voltage:** 250V DC; 110V peak in "mV" ranges, 600V peak in "V" ranges

**Amplifier/Attenuator Range:** -50 dB (300 V full-scale) to +60 dB (1 mV full-scale) in steps of 10 dB

**Accuracy:** better than 1%

**Rectifier Dynamic Range:** >40 dB

**Accuracy:** ± 0,5 dB, +10 dB to -20 dB  
 ± 1 dB, -20 dB to -30 dB

### FREQUENCY RESPONSE:

**"Fast":** ± 0,2 dB, 20 Hz to 0,2 MHz  
 ± 0,5 dB, 0,2 MHz to 0,5 MHz  
**"Slow":** ± 0,2 dB, 2 Hz to 0,2 MHz  
 ± 0,5 dB, 0,5 Hz to 0,5 MHz

### RMS MEASUREMENT:

**Accuracy:** ± 0,5 dB for signals with crest factor up to 5:1 (14 dB)  
**Averaging time:** "Fast", approx. 270 ms; "Slow", approx. 3 s  
**External capacitor time constant:** 10 s per 2,5 μF

### AVERAGE MEASUREMENT:

"Fast" response for standard vu measurements, and "Slow" response

### PEAK MEASUREMENT:

+ Peak, -Peak and Max. Peak measurement selected by front-panel switches  
**Input time constant:** "Fast", 50 μs; "Slow", 500 μs  
**"Hold" leakage rate:** "Fast", <0,05 dB/s; "Slow", <0,005 dB/s

**"Reset" discharge time:** "Fast", 2,7 s; "Slow", 30 s from full-scale deflection  
 "Reset" can be activated by the front-panel switch or by a remote switch via the rear panel DIN socket

### SIGNAL-TO-NOISE RATIO:

300 kHz bandwidth  
**1 mV Range:** >40 dB  
**3 mV Range:** >50 dB  
**Other Ranges:** >60 dB

**INHERENT NOISE:** typically 31,6 μV with maximum amplification and input short-circuited

### AC OUTPUT:

Standard BNC socket on rear panel; mating plug JP 0035  
**Output Voltage:** 1 V RMS ± 2% at full-scale deflection  
**Max. Output:** 5,6 V peak  
**Output Impedance:** 100 Ω  
**Minimum Load:** Resistance >10 kΩ; Capacitance <200 pF

### DC OUTPUT:

Via 7-pin DIN socket on rear panel; mating plug JP 0703  
**Output Voltage:** 1 V DC ± 2% at full-scale deflection  
**Max. Output:** 5,6 V  
**Output Resistance:** <10 Ω  
**Minimum Load:** 1 kΩ

### ENVIRONMENTAL LIMITS:

**Temperature Range:** +5°C to +40°C (41°F to 114°F)

**Humidity:** Up to 90% RH non-condensing at 30°C

**External Magnetic Field:** Up to 80 A/m at 50 Hz

### MAINS POWER SUPPLY:

100; 115; 127; 200; 220; 240 V AC, 50-60 Hz, 9 VA  
 Complies with Safety Class I of IEC Publication 348

### BATTERY POWER SUPPLY:

External battery connections to rear panel DIN socket; requires 2 batteries, 22V to 35V each

### DIMENSIONS:

Metal cabinet, excluding connectors and feet  
**Height:** 133 mm (5,2 ins)  
**Width:** 140 mm (5,5 ins)  
**Depth:** 200 mm (7,9 ins)

### WEIGHT:

2,1 kg (4,63 lb)

### ACCESSORIES INCLUDED:

Mains Cable..... AN 0010  
 BNC Plugs (2)..... JP 0035  
 7-pin DIN plug..... JP 0703  
 Fuses T100 mA (3)..... VF 0026  
 Fuses T63 mA (2)..... VF 0047  
 Scale Lamps (2)..... VS 1273

### ACCESSORIES AVAILABLE:

Meter Scale, dBm..... SA 0163  
 Meter Scale, vu..... SA 0168  
 BNC-BNC Cables..... AO 0087, AO 0135

# Service Instructions

## Voltmeter/Amplifier

valid from serial no. 605 642

2425

### Trouble Shooting

If any faults should occur please check the instrument according to the Adjustment Procedure.

When a fault has been traced and corrected, the voltages and adjustments influenced by the correction must be rechecked. The complete instrument should then be tested to make sure that all basic functions are operative.

The tolerances given in these notes are intended for use as guide for adjustments.

Before correcting any apparent deviation make sure that the measuring instrument has tolerances small enough not to affect the measurement.

### Modifications

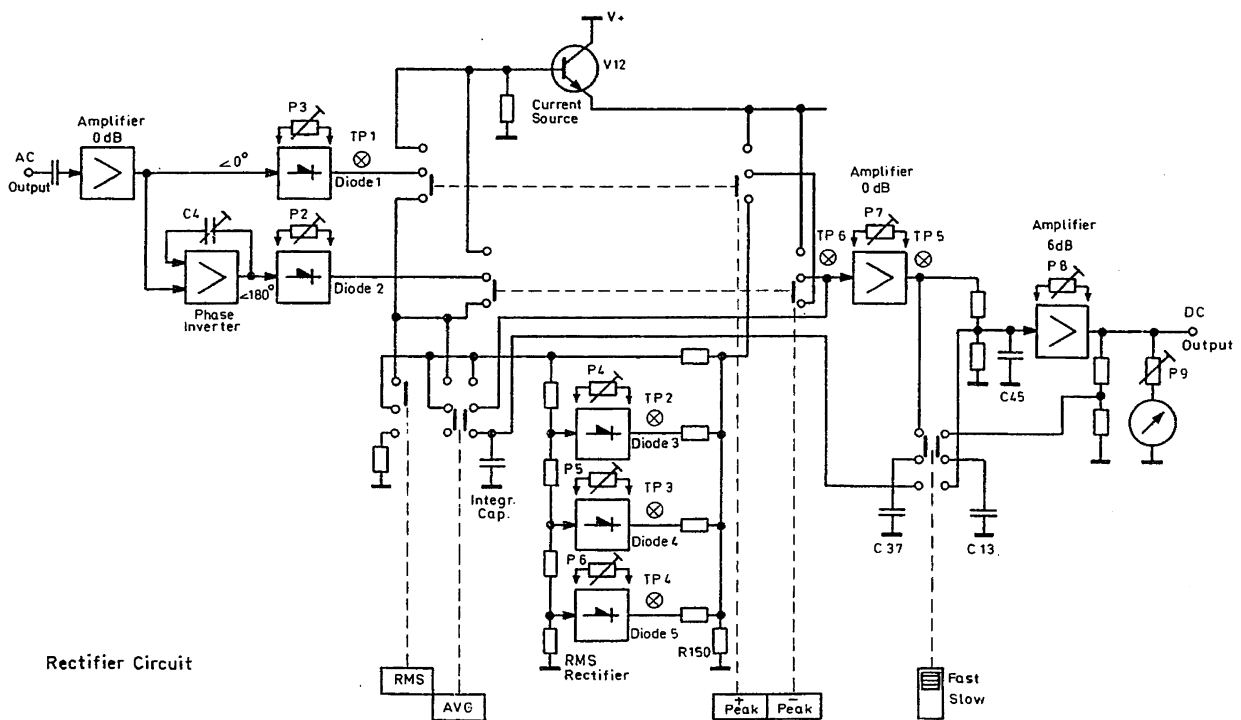
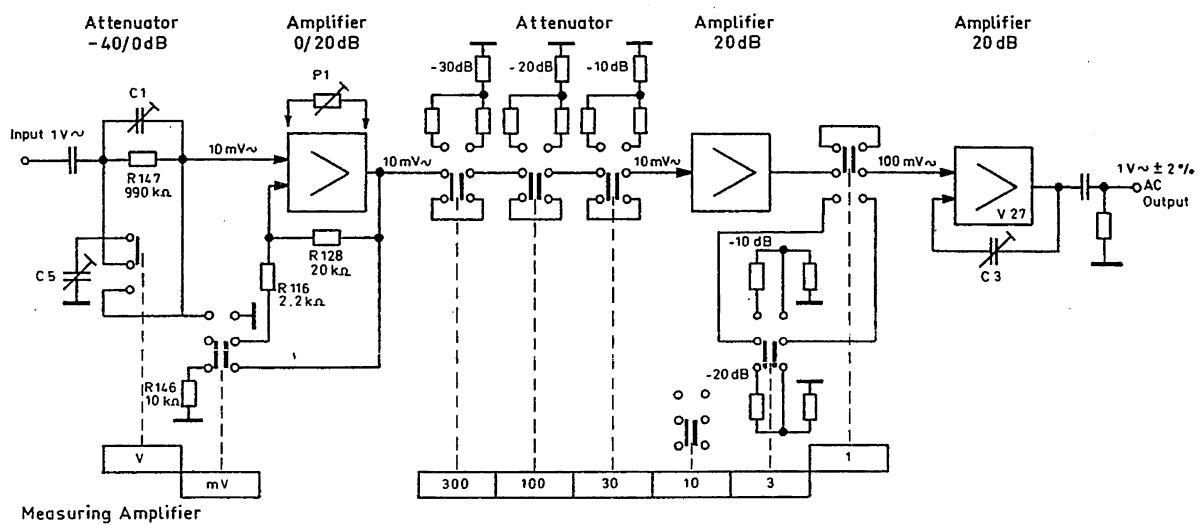
Due to the constant technical progress the instrument will be modified from time to time in order to provide continuously improved performance.

For this reason there may be small differences between the instrument and the Service Instruction.

However, the local Representative Service is in possession of all information regarding the modifications that have been made.

### Spare Parts

Please state type and serial number of the instrument when ordering spare parts.



## Adjustment

### Measuring Amplifier

a. DC balance

RANGE: "1 mV"  
"RMS"  
"Fast"

**Note:** Before any adjustments, check the power supply:  $\pm 18\text{ V}$

Short circuit the input to ground.  
Measure the DC voltage on V 27 pin 6:  $0\text{ V} \pm 0,5\text{ V}$ .  
If necessary adjust P 1.

b. Attenuator

RANGE to "100 mV"

Input signal: 100 mV, 1 kHz.

Change the input voltage stepwise 10 dB and check the meter deflection for all "mV" and "1 V" ranges  $\pm 1\%$ .

c. Frequency Response

RANGE to "100 mV"

Input signal: 1 kHz. Adjust the input voltage for a  $-1\text{ dB}$  deflection on the meter.

Check the frequency response from 0,5 Hz to 500 kHz.

Tolerance: at 0,5 Hz:  $\pm 0,5\text{ dB}$  (Time constant to "Slow")  
20 Hz to 200 kHz:  $\pm 0,2\text{ dB}$   
at 500 kHz:  $\pm 0,5\text{ dB}$ . If necessary adjust C 3.

RANGE to "1 V"

Check as above but adjust C 1 at 500 kHz if the deflection is out of tolerance.

Input Impedance: Adjustment is only necessary if the instrument is used with an input probe. C 5 is factory adjusted to give the same input impedance for both "mV" and "V" ranges.

### Rectifier Circuit

a. DC balance

Range: "Avg."

Short circuit C 45.  
Measure the DC voltage on "DC Output":  $0\text{ V} \pm 1\text{ mV}$ .  
If necessary adjust P 8.

b. Sensitivity

RANGE to "100 mV"  
"RMS"  
"Fast"

Input signal: Exactly 100 mV, frequency approx. 1 kHz.  
Meter deflection: 1 V.  
If necessary adjust P 9.

c. Peak Adjustment

RANGE to "100 mV"  
"+ Peak"  
"Fast"  
"Reset"

Input signal: Exactly 100 mV, frequency approx. 1 kHz.

**Note:** Max. Distortion on the input signal: 0,1%.

Check the DC voltage on "DC Output":  $141,4\text{ mV} \pm 20\text{ mV}$ .

Change input signal to 10 mV and check again the voltage:  $141,1\text{ mV} \pm 3\text{ mV}$ .  
If necessary adjust P 2.

RANGE to "-Peak"

Check the DC voltage on "DC Output":  $141,4\text{ mV} \pm 3\text{ mV}$ .  
If necessary adjust P 3.

Set the signal frequency to 500 kHz and check that the meter deflection is equal at FSD for "+ Peak" and "-Peak".  
If necessary adjust C 4.

d. RMS Adjustment

It should be noticed that the instrument even with out input signal will give a deflection of approx. 1,5% of FSD due to leak current in RMS diodes and linearity compensation.

Disconnect the input signal.

RANGE to "300V"  
"RMS"  
"Fast"

Short circuit TP6 to ground.  
Measure the DC voltage on "DC Output":  $0\text{ V} \pm 1\text{ mV}$ .  
If necessary adjust P 7.

Turn P 4 fully clockwise and P 5 and P 6 fully counterclockwise.

Measure the DC voltage on "DC Output": approx. 5 mV.

Turn P 4 counterclockwise until the pointer just start moving.

Adjust P 5 and P 6 as above.

e. Linearity

RANGE to "100 mV"

Adjust the input voltage to FSD (correspond to 1000 mV on "DC Output").  
Decrease the input voltage 20 dB and check the meter deflection:  $-20\text{ dB}$  (correspond to 100 mV on "DC Output").  
If necessary adjust P 7.

Repeat item e since P 7 have influence on FSD.

Measure the DC voltage without input signal on "DC Output": approx. 15 mV.

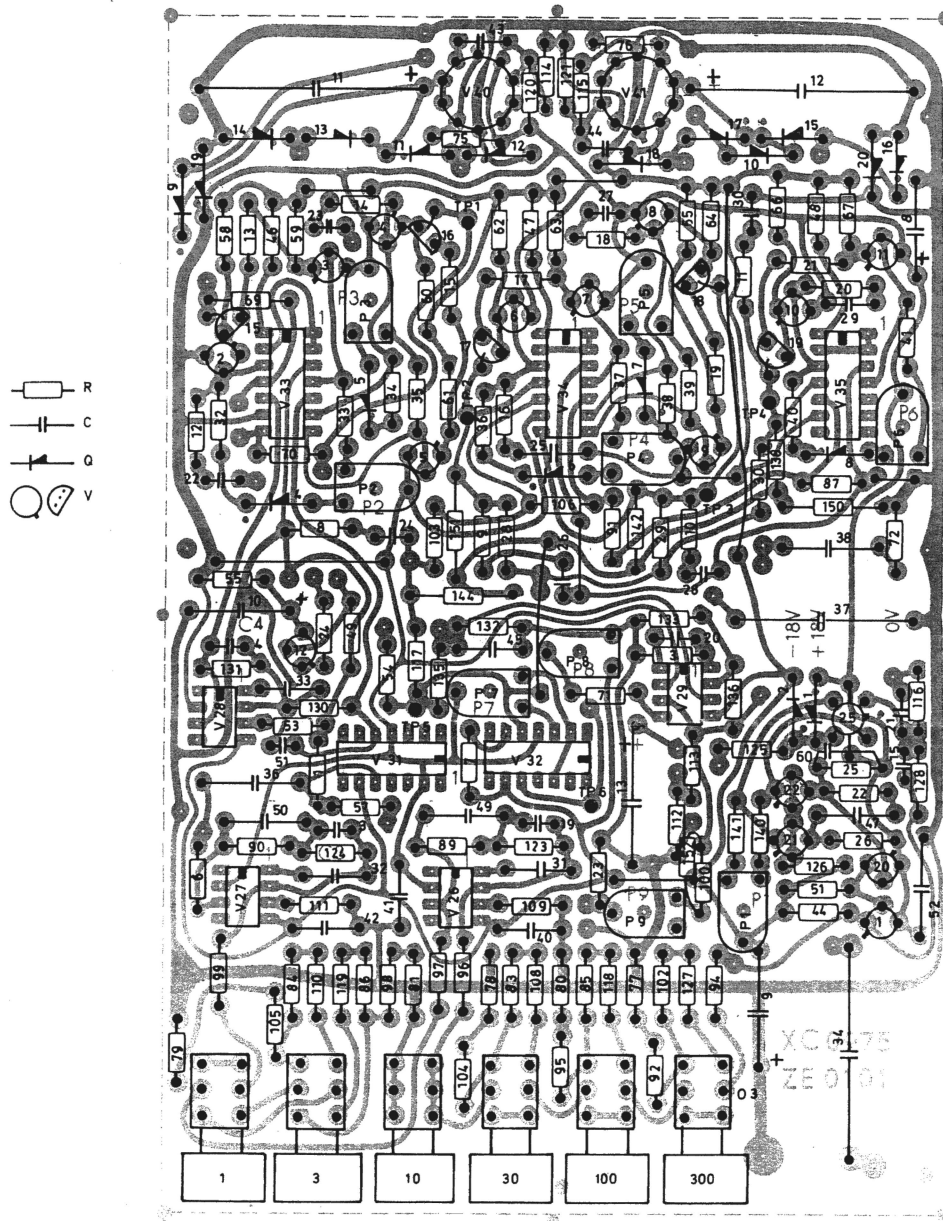
**Note:** The instrument should be mounted with side- top- and bottom plates.

### Hum — Noise

RANGE: "1 mV"  
"RMS"  
"Fast"

Short circuit input to ground.  
Check the meter deflection: max.  $35\text{ }\mu\text{V}$ .

# Layout Diagram and Parts List



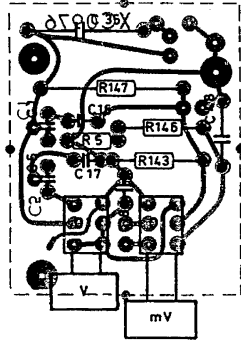
Measuring Amplifier ZE 0101

ZE 0101

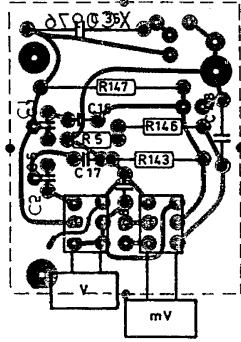
CIRCUIT DIAGRAM REF.	COMPONENT TYPE		STOCK REF.	CIRCUIT DIAGRAM REF.	COMPONENT TYPE		STOCK REF.
C 3,4	Ceramic	3-8 pF/ 63 V	CV 0027	C 36	Polycarbonate	1 μF/100 V	CS 0384
C 8-10	Electrolytic	12.5 μF/ 25 V	CE 0416	C 37	-	6.8 μF/100 V	CS 0385
C 11,12	-	400 μF/ 40 V	CE 0417	C 38	-	0.68 μF/100 V	CS 0388
C 13	-	100 μF/ 15 V	CE 0310	C 40, 41	Tantalum	6.8 μF/35 v	GF 0009
C 15	Ceramic	4.7 pF/400 V	CK 0470	C 42	Polyester	47 nF/250 V	CS 0401
C 19	-	3.9 pF/400 V	CK 0390	C 43,44	Ceramic	120 pF/400 V	CK 2122
C 20	-	27 pF/400 V	CK 1270	C 45	Polyester	100 nF/250 V	CS 0402
C 21	-	33 pF/400 V	CK 1330	C 47	Polystyrene	200 pF/100 V	CT 1118
C 22-30	-	120 pF/400 V	CK 2122	C 49,50	-	1.2 nF/ 63 V	CT 1149
C 31-33	-	150 pF/400 V	CK 2151	C 51	Ceramic	5.6 pF/250 V	CK 0561
C 34	Polyester	2 μF/250 V	CS 0028	C 52	Polyester	0.22 μF/250 V	CS 0405
				C 60	Ceramic	5.6 pF/250 V	CK 0560

2425-5.76

# Layout Diagram and Parts List

CIRCUIT DIAGRAM REF.	COMPONENT TYPE			STOCK REF.	CIRCUIT DIAGRAM REF.	COMPONENT TYPE			STOCK REF.
O 3	Push button switch			OJ 0033	R 150	Carbon	0.33 W	10%	560 kΩ
P 1	Pot. meter	Cermet	10 kΩ	PG 3109	R 151	-	-	-	768 kΩ
P 2-7	-	Carbon	1 kΩ	PG 2101	R 152	NTC	-	-	15 kΩ
P 8	-	-	30 kΩ	PG 3301	V 1-12	Si. trans.	NPN	BC 107	VB 0032
P 9	-	Cermet	470 Ω	PG 1504	V 15-19	-	PNP	2 N 3702	VB 0038
Q 1,2	Silicon trans SF 115 NPN			VB 0533	V 20	-	PNP	BC 177	VB 0071
Q 4-20	1 N 4004 400 V/ 1 A			QV 0237	V 21,22	-	NPN	BF 199	VB 0515
R 1	Carbon	0.25 W	10%	2.2MΩ	RB 6220	V 25	-	dual	2 N 3956
R 3	-	-	-	10MΩ	RB 7100	V 26	Op. Amp.	301AN	VE 0044
R 6,7	-	-	5%	100 Ω	RB 2100	V 27-29	-	301 AN	VE 0017
R 8-11	-	-	-	120 Ω	RB 2120	V 31,32	-	310 D	VE 0023
R 12-21	-	-	-	220 Ω	RB 2220	V 33-35	-	3051	VE 0032
R 22	-	-	-	270 Ω	RB 2270	V 40,41	Volt. reg.	723 CH	VE 0039
R 23,24	-	-	-	820 Ω	RB 2820	Printed Circuit Board			XC 0975
R 25,26	-	-	-	1 kΩ	RB 3100				
R 28-30	-	-	-	1.2 kΩ	RB 3120				
R 32-41	-	-	-	1.5 kΩ	RB 3150				
R 44	-	-	-	2.2 kΩ	RB 3220				
R 46,47	-	-	-	2.7 kΩ	RB 3270				
R 48	-	-	-	4.7 kΩ	RB 3470				
R 49	-	-	-	8.2 kΩ	RB 3820				
R 51	-	-	-	10 kΩ	RB 4100				
R 53,54	-	-	-	15 kΩ	RB 4150				
R 55	-	-	-	27 kΩ	RB 4270				
R 57-67	-	-	-	100 kΩ	RB 5100				
R 69,70	-	-	-	1MΩ	RB 6100				
R 71	-	-	-	4.7MΩ	RB 6470				
R 72	Metal	-	1%	4.99 Ω	RF 0499				
R 75,76	-	-	-	6.04 Ω	RF 0604				
R 77	-	-	-	28.7 Ω	RF 1287				
R 78,79	-	-	-	30.1 Ω	RF 1301				
R 80,81	-	-	-	54.9 Ω	RF 1549				
R 83,84	-	-	-	78.7 Ω	RF 1787				
R 85,86	-	-	-	274 Ω	RF 2274				
R 87	-	-	-	422 Ω	RF 2422				
R 89,90	-	-	-	453 Ω	RF 2453				
R 91	-	-	-	464 Ω	RF 2464				
R 92	-	-	-	487 Ω	RF 2487				
R 94-100	-	-	-	499 Ω	RF 2499				
R 102	-	-	-	590 Ω	RF 2590				
R 103	-	-	-	619 Ω	RF 2619				
R 104,105	-	-	-	698 Ω	RF 2698				
R 106	-	-	-	732 Ω	RF 2732				
R 108-112	-	-	-	1 kΩ	RF 3100				
R 113	-	-	-	1.13 kΩ	RF 3113				
R 114,115	-	-	-	7.15 kΩ	RF 3715				
R 116	-	-	-	2.21 kΩ	RF 3221				
R 117	-	-	-	2.55 kΩ	RF 3255				
R 118,119	-	-	-	4.22 kΩ	RF 3422				
R 120,121	-	-	-	10.2 kΩ	RF 4102				
R 123,124	-	-	-	9.53 kΩ	RF 3953				
R 125	-	-	-	10 kΩ	RF 4100				
R 126,127	-	-	-	14.7 kΩ	RF 4147				
R 128	-	-	-	20 kΩ	RF 4200				
R 130,131	-	-	-	30.1 kΩ	RF 4301				
R 132,133	-	-	-	31.6 kΩ	RF 4316				
R 135,136	-	-	-	35.7 kΩ	RF 4357				
R 138	-	-	-	39.2 kΩ	RF 4392				
R 140,141	-	-	-	68.1 kΩ	RF 4681				
R 142	-	-	-	221 kΩ	RF 5221				
R 144	-	-	-	1MΩ	RF 6010				
					<b>ZF 0015</b>				
					CIRCUIT DIAGRAM REF.	COMPONENT TYPE			STOCK REF.
					C 1,5	Ceramic	3.5-13 pF/250 V		CV 0047
					C 16,17	-	6.8 pF/250 V		CK 0680
					C 18	-	5.6 pF/250 V		CK 0561
					C 35	Polyester	68 nF/400 V		CS 0111
					C 48	Polystyrene	390 pF/100 V		CT 1120
					O 1	Push button switch			OJ 0031
					R 5	Carbon	0.25 W	5%	150 Ω
					R 143	Metal	-	1%	1MΩ
					R 146	-	-	-	10 kΩ
					R 147	-	-	-	990 kΩ
					Printed Circuit Board			XC 0976	

*No longer available.*



Attenuator ZF 0015  
Printed Circuit Board XC 0976

*NOT AVAILABLE*

# Parts List

2425

CIRCUIT DIAGRAM REF.	COMPONENT TYPE			STOCK REF.
C 7	Electrolytic		22 $\mu$ F/35 V	CE 0428
C 14	Tantalum		33 $\mu$ F/ 10 V	CF 0034
N 1	Peak Hold -- Reset switch			NN 0031
N 2	Slow-Fast switch			NN 0035
N 3	Power switch			NN 0036
O 2	Switch $\pm$ Peak			OJ 0032
O 4	RMS -- Av. switch			OJ 0036
R 4	Carbon	0.25 W	10% 3.9M $\Omega$	RB 6390
R 45	-	-	5% 2.7 k $\Omega$	RB 3270
R 68	-	-	100k $\Omega$	RB 5100
T 1	Power Transformer			TN 0068
V 50	Fuse		0.1 A/220 V	VF 0026
	-		0.2 A/110 V	VF 0012
V 51.52	Scale lamp		7 V/0.25 A	VS 1273
	Power Input Socket			OA 0037
	Power Cord			AN 0010
	Fuse socket			JS 0001
	Socket BNC			JJ 0130
	Socket DIN			JJ 0709
	Moving Coil Instrument			IM 0046
	Front Plate			FA 0382
	Rear Plate			FB 0297
	Side Plate			GV 0673
	Top Plate			GV 0932
	Bottom Plate			GV 1095
	Printed Circuit Board			with comp.
	Amplifier	XC 0975		ZE 0101
	Attenuator	XC 0976		ZF 0015

