DIGITAL / ANALOG TRAINER

MODEL XK-550

A COMPLETE MINI-LAB FOR BUILDING, TESTING AND PROTOTYPING ANALOG AND DIGITAL CIRCUITS

Tools and meter not included.

Instruction Manual

For Trainer with Organizer Case

ELENCO®

 Revised 2011 REV-J 753550

GENERAL SPECIFICATIONS FOR MODEL XK-550

Power Supplies:

- 0V to 20VDC @ .5 amp (0V to 15V @ 1 amp)
- 0V to –20VDC @ .5 amp (0V to –15V @ 1 amp)
- +12V ±5% @ 1 amp
- –12V ±5% @ 1 amp
- +5V ±5% @ 1 amp
- 30V AC center-tapped at 15VAC @ 1 amp.
- Load regulation all DC supplies less than .2V no load to .5A
- Line regulation all DC supplies less than .2V 105 to 135V
- Hum and ripple all DC supplies less than .01V rms
- Short protection all DC supplies - Internal IC thermal cutoff
- Fuse - 1.25A, 250V

Function Generator Analog Section:

- Waveforms sine, square, triangle, complimentary square
- Frequency - 1Hz to 100kHz in 5 steps continuously variable
- Fine frequency adjust - 10:1 approximate
- Amplitude variable 0-15Vpp
- Output impedance 330Ω: short protected
- DC offset change ±10V from zero crossing

Digital Section:

- Data switches, eight DPDT, Hi 5V, low 0V
- Logic switches, two no bounce with complimentary output
  "On" voltage level 2.8V min., "Off" voltage level 1V max.
  Input impedance 100kΩ.
- Eight LED readouts, 100kΩ input impedance
- Clock frequency, 1Hz to 100kHz in 5 steps continuously variable
- Clock amplitude, 5Vpp squarewave
- Clock rise time, better than 100nsec.

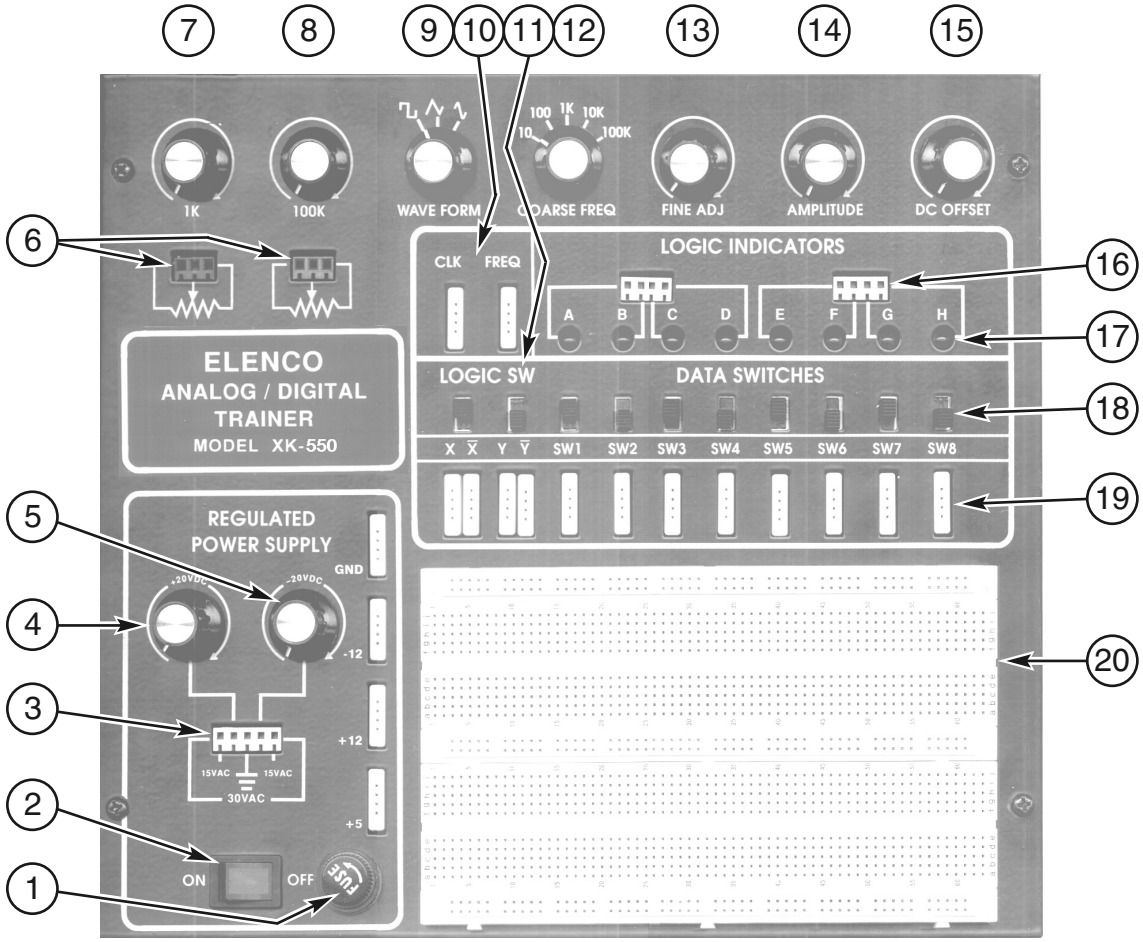
Bredboards Section:

- Two bredboards containing 830 tie points each (total 1,660 pins)
- 6 independent power bus lines for common connections

Variable Resistance (undedicated):

- 1kΩ Potentiometer
- 100kΩ Potentiometer

USERS DESCRIPTION OF FRONT PANEL CONTROL



1) **Fuse holder** - Easy access for replacement of 1.25A 250V fuse.

2) **On-Off switch** - Allows power to be applied to all outputs. Switch will light when on.

3) **Power output terminals** - This provides 30VAC center tapped at 15VAC - also provides output terminal for positive and negative variable voltages.

4) **Variable positive voltage control** - Varies positive voltage from 0 to 20V at indicated output terminal.

5) **Variable negative voltage control** - Varies negative voltage from 0 to –20V at indicated output connector pin.

6) **Output terminals** for 1kΩ and 100kΩ undedicated potentiometers.

7) 1kΩ undedicated potentiometer.

8) 100kΩ undedicated potentiometer.

9) **Waveform selection control**, square, triangle or sine generator waveforms.

10) **Output terminals** for all functions as stated, 4 pins per block.

11) **Two logic switches** - These are no bounce logic switches. Give one signal state change per movement of switch.

12) Selects five ranges of frequencies from 10 to 100,000 hertz.

13) **Fine frequency control** - allows easy selection of desired function generator frequency.

14) **Amplitude control** - Controls the function generation output amplitude, 0-15Vpp.

15) **DC offset control** - controls the DC level of the generator output. DC may be varied ±10 volts from zero level.

16) **Input points for logic indicator LEDs.** "A" input corresponds with A lamp, etc.

17) **Logic indicators LEDs**, total eight.

18) **Eight data switches** - Output 5V or 0V depending on position.

19) Output terminals for all functions as stated, 4 pins per block.

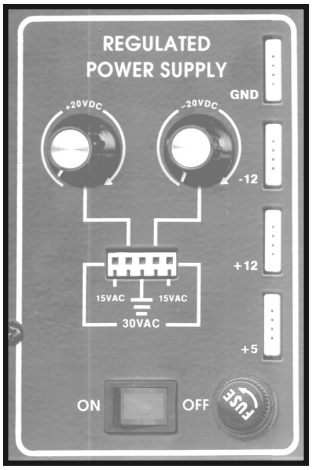
20) **Two breadboards** containing a total of 1,660 tie points including 6 independent bus lines.

INTRODUCTION

Congratulations on your purchase of the Elenco® Model XK-550 Digital / Analog Trainer. This trainer is designed to simplify designing of digital and analog circuits. It contains most of the necessary test equipment needed to build and test these circuits. Your XK-550 has four basic trainers in a single package. They are, 5 independent power supplies, an analog trainer, a digital and a bredblock assembly trainer. We shall proceed in describing each trainer in the following sections.

POWER SUPPLY

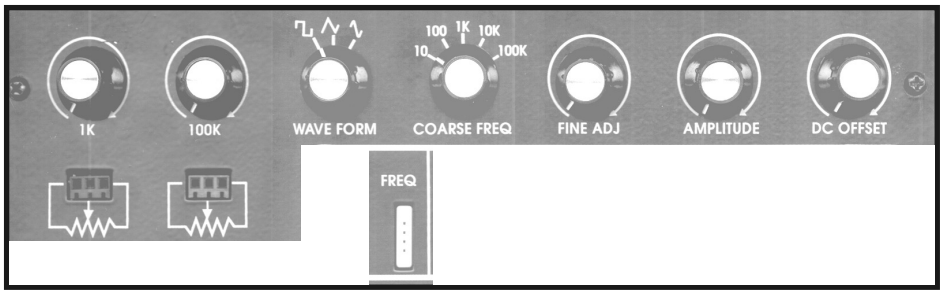
Model XK-550 has five built-in power supplies which will satisfy most design needs. This includes two variable power supplies giving up to +20 volts and –20 volts at .5 amp. Below 15V the current available is over 1 amp. Three fixed power supplies give you +12VDC, –12VDC or +5VDC at 1 amp each. These fixed voltages are the most commonly used voltages for design work. All supplies are regulated to within 150mV. This means that you can increase the current draw from no load to .5 amp and the voltage will change less than 150 millivolts. All supplies are also short circuit protected by using integrated circuit regulator devices.



ANALOG TRAINER SECTION

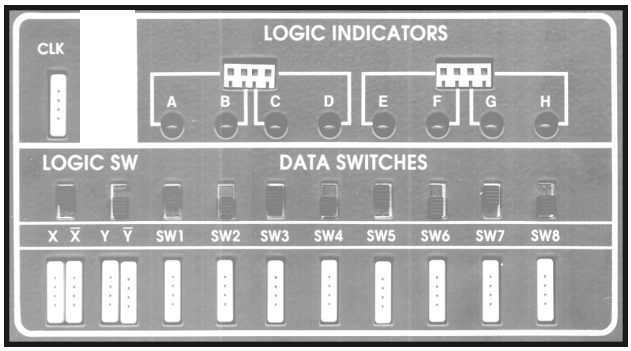
FUNCTION GENERATOR

The analog trainer contain a complete function generator capable of producing sine, square and triangle waveform. The frequency of this generator is continuously variable from one hertz to over 100,000 hertz in five steps. A fine tuning control makes selection of any frequency easy. The output voltage amplitude is variable between 0 to 15Vpp. The output impedance is approximately 330 ohms.



DIGITAL TRAINER SECTION

The digital trainer has the necessary functions to do your digital designs. They consist of a clock generator, two no bounce logic switches, 8 LED indicator lamps and 8 data switches. These functions will make it easy to do your digital experiments.



TESTING THE XK-550 DIGITAL ANALOG TRAINER

The following paragraphs give detailed instructions on testing the digital / analog trainer.

Note that in the XK-550 trainer there are five major functions, (1) Power Supply (2) Logic Indicators (3) Function Generator (4) Logic Switches and (5) Data Switches. We shall proceed in testing out each section. If any test fails, refer to the schematic diagram and check the wiring and soldering of the section involved.

POWER SUPPLY TESTING

Plug the trainer into a 120VAC outlet and switch to the "**ON**" position (the power switch should light). With a digital voltmeter, measure the voltage outputs at the power blocks. The +12V should measure between 11.4 and 12.6 volts. The 5V supply should read between 4.75 and 5.25 volts. The –12V supply should read between –11.4 and 12.6 volts.

Do not short the 15VAC output to ground.

Short the +12V, –12V and +5V supply to ground. They should turn off and recover when the short is removed. If you have a 25Ω 10 watt resistor, place it across the output terminal (2 watt resistor will work, but use it only for a few seconds). The output of the 12V supply should not change more than 0.20 volts. Do the same on the 5V supply using a 10Ω 5 watt resistor. Again, the output should not change more than 0.20 volts. In making this test, the voltmeter leads should be clipped to the terminal directly and no to the load leads. This is to prevent errors due to voltage drop from contact resistance of the load.

Check the variable voltage supplies in the same manner. Set the output voltage between 10-15 volts. Place the 25Ω 10 watt resistor across the output terminal. The voltage should stay within 0.20 volts of the no load voltage.

TESTING THE FUNCTION GENERATOR

To test the function generator, you will need an oscilloscope. Connect the scope to the terminal marked FREQ., and the ground clip to the terminal marked GND. Adjust the waveform switch to sine, the coarse frequency switch to 1k and the amplitude control to maximum. Your scope should show a sine wave with an output of about 15Vpp. If the sinewave is clipped on top or bottom, adjust the DC offset control for the most linear reading. Turn the FINE ADJ control and the frequency should vary between 100 and 1000 hertz. Check the other coarse frequency positions.

Now, check the CLK output terminal. You should see a square wave of about 5Vpp. If the scope is a dual trace, connect one input to the CLK and the other FREQ terminal. Set the waveform switch to squarewave. You will note the two frequencies are 180^{O} out of phase. If no scope is available, connect a wire to the CLK terminal and input to "A" of the logic indicators. Connect another wire to the FREQ terminal and input "B". Set the coarse frequency switch to 10 hertz and the fine freq control to minimum position. The two LEDs should blink alternately.

TESTING THE LOGIC INDICATOR FUNCTION

There are eight logic indicators which you will be checking out. Place a wire to the 5V power supply and touch the "A" logic indicator test pin. The "A" LED should light up. Remove the wire and the LED should go out. Do the same for the B, C, D, E, F, G and H test pins.

TESTING THE LOGIC SWITCHES
There are two logic switches and four conditions to be checked out. Connect a wire from the "$\overline{X}$" test pin to the "A" logic indicator test pin. Connect another from the "X" test pin to the "B" test pin.

Apply power and note that the "A" LED indicator should be lit when the logic switch is in the "X" positions and the "B" LED is not lit. Moving the logic switch to "$\overline{X}$" should reverse the indicator LEDs, that is, the "B" LED should light and the "A" LED not light. Check the Y logic switch in the same manner.

TESTING THE DATA SWITCHES
There are eight data switches to be checked. The output of the switches are at 5V or ground depending on position. Connect a wire to SW1 terminal and the "A" test pin, the "A" LED should light when the switch is placed toward the top case. Repeat the same test on SW2, SW3, SW4, SW5, SW6, SW7 and SW8.

This completes the testing of the trainer.

CIRCUIT DESCRIPTION

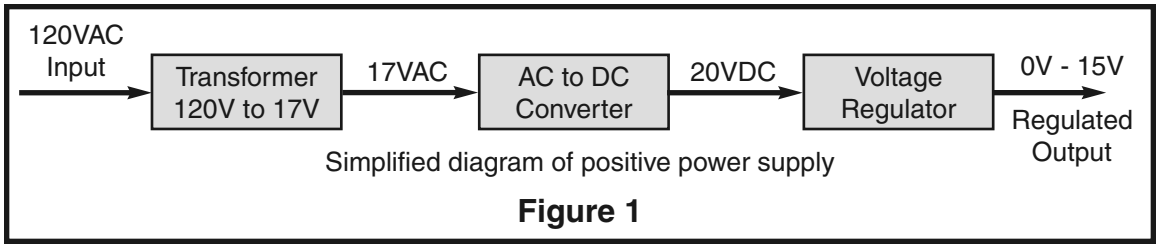
The XK-550 power supply features two variable output voltages and three fixed 12V, –12V and 5V, variable output voltages are 0V to 20V and 0V to –20V at up to 1 ampere maximum current. All supplies are regulated to better than .2V when going from no load to full load. Varying the input AC voltage from 105 to 135V will have practically no effect on the output voltages. This is because of the specially designed IC circuits used in the XK-550 circuits. Severe overloading or even shorting the output circuits will not damage the supplies. Special turn-off circuits in the IC sense the overload and turn off the output.

THE POSITIVE 0V TO 20V POWER SUPPLY
Figure 1 shows a simplified circuit diagram of the positive supply. It consists of a power transformer, a DC rectifier stage and the regulator stage.

TRANSFORMER
The transformer T1 serves two purposes. First, it reduces the 120VAC input to 17VAC to allow the proper voltage to enter the rectifier stages. Second, it isolates the power supply output from the 120VAC line. This prevents the user from dangerous voltage shock should he or she be standing in a grounded area.

AC TO DC CONVERTER
The AC to DC converter consists of diodes D1, D3 and capacitor C1. Transformer T1 has two secondary windings which are 180^{O} out of phase. The AC output at each winding is shown in Figure 2A and 2B.

Diodes are semiconductor devices that allow current to flow in one direction. The arrow in Figure 3 points to the direction current will flow. Only when the transformer voltage is positive will current flow through the diodes. Figure 3 shows the simplest possible rectifier circuit. This circuit is known as a half-wave rectifier. Here the diode conducts only half of the time when the AC wave is positive as shown in 2C. Use of this circuit is simple but inefficient. The big gap between cycles require much more filtering to obtain a smooth DC voltage.



Simplified diagram of positive power supply

Figure 1

By the addition of a second diode and transformer winding we can fill in the gap between cycles as shown in Figure 4. This circuit is called full-wave rectification. Each diode conducts when the voltage is positive. By adding the two outputs, the voltage presented to capacitor C1 is more complete, thus easier to filter, as shown in Figure 2E. When used in 60 cycles AC input power, the output of a full wave rectifier will be 120 cycles.

Capacitor C1 is used to store the current charges, thus smoothing the DC voltage. The larger the capacitor, the more current is stored. In this design 1000μF capacitors are used, which allows about 5 volts AC ripple when one amp is drawn.

In practice, the current through the diodes is not as shown in Figure 2C. Because capacitor C1 has a charge after the first cycle, the diode will not conduct until the positive AC voltage exceeds the positive charge in the capacitor. Figure 5 shows a better picture of what the current flow looks like assuming no loss in the diode.

It takes a few cycles for the voltage to build up on the capacitor. This depends on the resistance of the winding and diode. After the initial start-up, there will be a charge and discharge on the capacitor depending on the current drawn by the output load. Remember, current only flows through the diodes when the anode is more positive than the cathode. Thus, current will flow in short bursts as shown in Figure 5.

The DC load current may be one ampere but the peak diode current may be three times that. Therefore, the diode rating must be sufficient to handle the peak current. The 1N4001 has peak current rating of 10 amps.

REGULATOR CIRCUIT

The regulator circuit in the Model XK-550 power supply consists of a LM-317 integrated circuit. This IC is specially designed to perform the regulation function. Figure 6 shows a simplified circuit of how the LM-317 IC works.

Transistors Q1 and Q2 form a circuit known as a differential amplifier. Transistor Q1 base is connected to a stable 1.5V reference voltage. The base of Q2 is connected to the regulator output circuit through a voltage divider network. The collector of transistor Q2 is connected to a current source. This basically is a PNP transistor biased to draw about 1mA current. Transistor Q2 sees the current source as a very high resistor of about 1 meg ohms. Thus, the gain of transistor Q2 is extremely high.

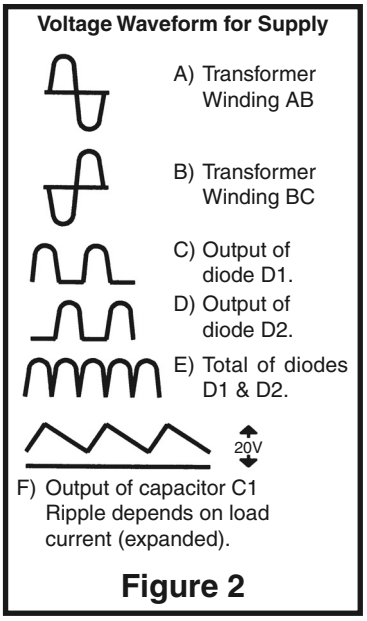


Figure 2

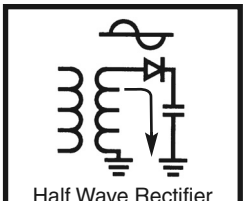


Figure 3

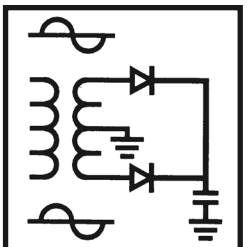


Figure 4

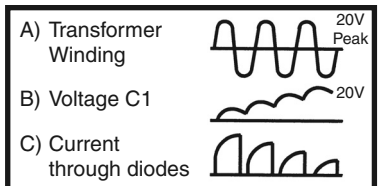


Figure 5

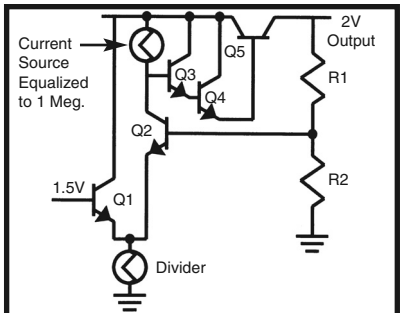
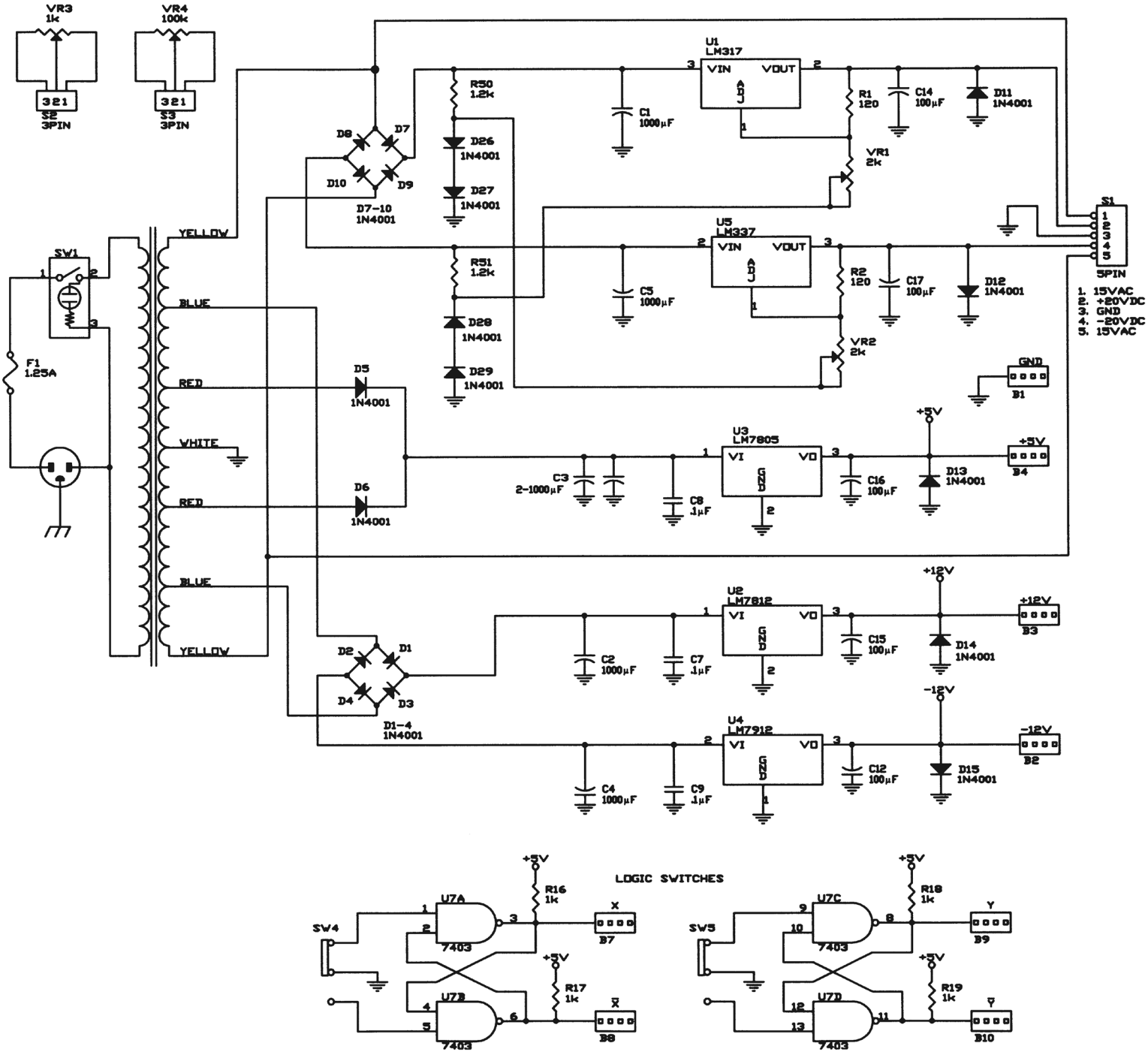
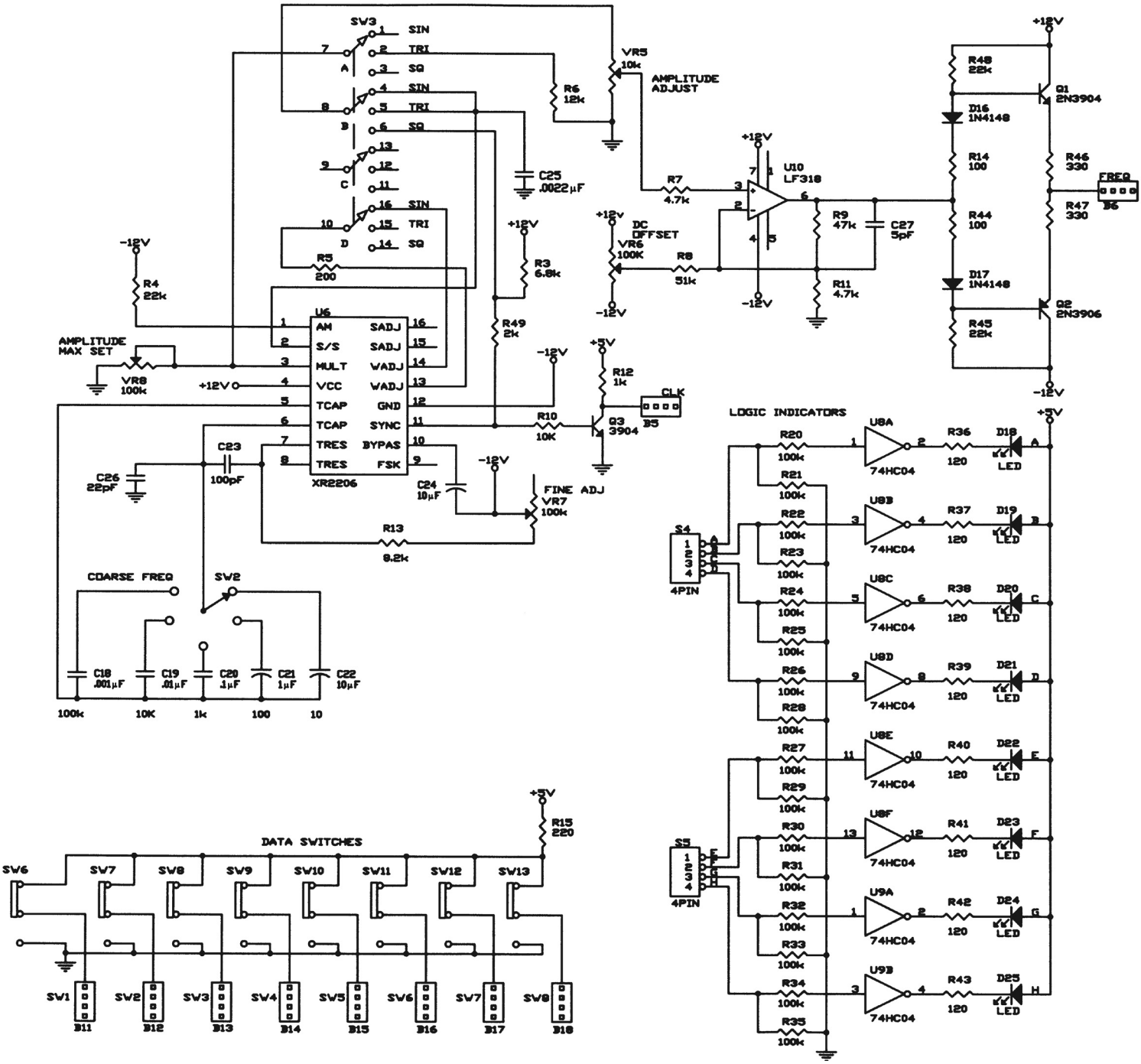


Figure 6

SCHEMATIC DIAGRAM



SCHEMATIC DIAGRAM



Transistor Q5 is called the pass transistor. It controls the current reaching the output. Transistor Q3 and Q4 are emitter followers. Their function is to raise the impedance of the pass transistor. Note that transistor Q2, Q3, Q4, Q5 and resistor R1 form a close loop. Also note that the feedback to the base of Q2 is negative, that is, when the base of Q2 goes positive, the output at emitter Q5 goes negative. Now if the 2V output voltage goes down because of current drain at the output, the base of Q2 will drop forcing the the collector voltage of Q2 to go higher. This will bring the output voltage back to 2V. This is the basis of all negative feedback regulators.

Another feature of the LM-317 regulator is to protect the IC against overload and output shorts. If the IC is overloaded, the junction of an overload transistor will overheat. A transistor will sense this overheating and shut down transistor Q5.

The LM-317 IC basically is a 1.25 volt regulator. To be able to vary the output from 0 to 20V, you stack the IC on the negative 1.25VDC voltage as shown in Figure 6A. When VR1 equals 0, the output voltage is 0 volts.

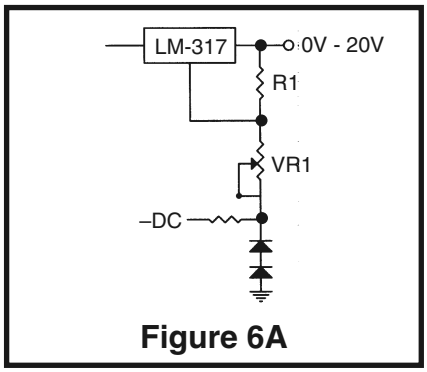


Figure 6A

THE NEGATIVE VOLTAGE REGULATOR

The theory of the voltage regulator is the same as the previously discussed positive regulator. The basic difference is that diodes D1 and D3 are reversed producing a negative voltage across capacitor C1. The LM-337 IC is designed to operate from a negative supply.

THE DATA SWITCHES

There are eight data switches labeled SW1 to SW8. The circuit is very simple. To perform the desired functions there is a double throw-double pole switch. One end is connected to the 5V, the other to ground and the center lug is connected to the output.

THE LOGIC SWITCHES

The logic switches perform the same function as the data switch, that is, they produce high or low states. But there is one big difference. When switching the data switches, many pulses may be produced due to bouncing of the contacts.

In the logic switches, only one pulse is produced, no matter how many times the contacts bounce. This is extremely important if you are producing pulses for counting circuits. Figure 7 shows the wiring of the logic switch. The two NAND gates are connected so that when X input is grounded the output X goes high. Opening and closing the ground at X will not change the output. Only when X is grounded will the output change to low. Thus, only one output change is produced with one movement of the X switch. There are two outputs from logic switch, X and X or Y and Y.

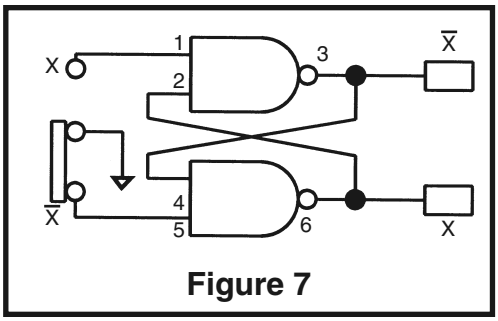


Figure 7

THE FUNCTION GENERATOR

The function generator frequencies are produced by an XR-2206 integrated circuit. This IC is capable of producing high quality sine, square, and triangle waveform of high stability and accuracy. Figure 8 shows the block diagram of the XR-2206 IC.

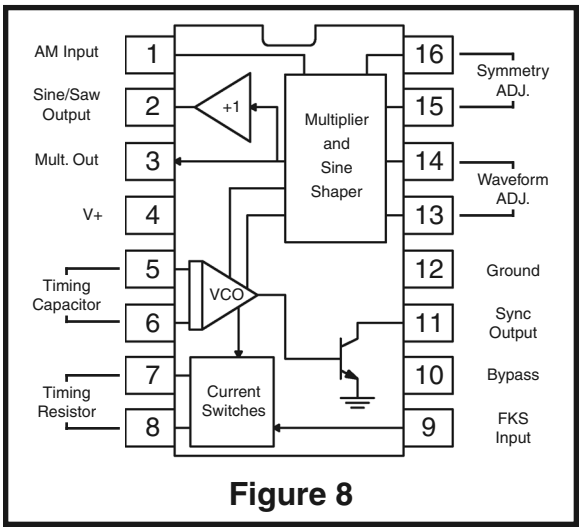


Figure 8

The XR-2206 is comprised of four functional blocks, a voltage controlled oscillator (VCO), an analog multiplier & sine shaper, a unity gain buffer amplifier and a set of current switches.

The VCO actually produces an output frequency proportional to an input current. Across pins 5 and 6, a timing capacitor, is switched on to give 5 different ranges of frequencies via COARSE FREQ. switch. On pin 7, the FINE FREQ. ADJ. variable resistor controls the actual frequency output. These two components form the RC time constants for the oscillator frequency.

The VCO produces a squarewave signal. This squarewave is sent to a shaper and converted into a sine wave.

THE LOGIC INDICATORS

There are eight logic indicators. Figure 9 shows the circuit. It consists of a 74HC04 IC. When the input is over 2.8V, the output of the IC will be low, drawing current through the LED indicator. The 120 ohm resistor limits the current in the LED to about 30mA.

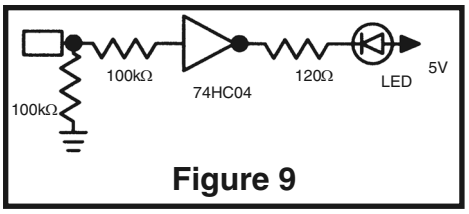


Figure 9

PARTS LIST

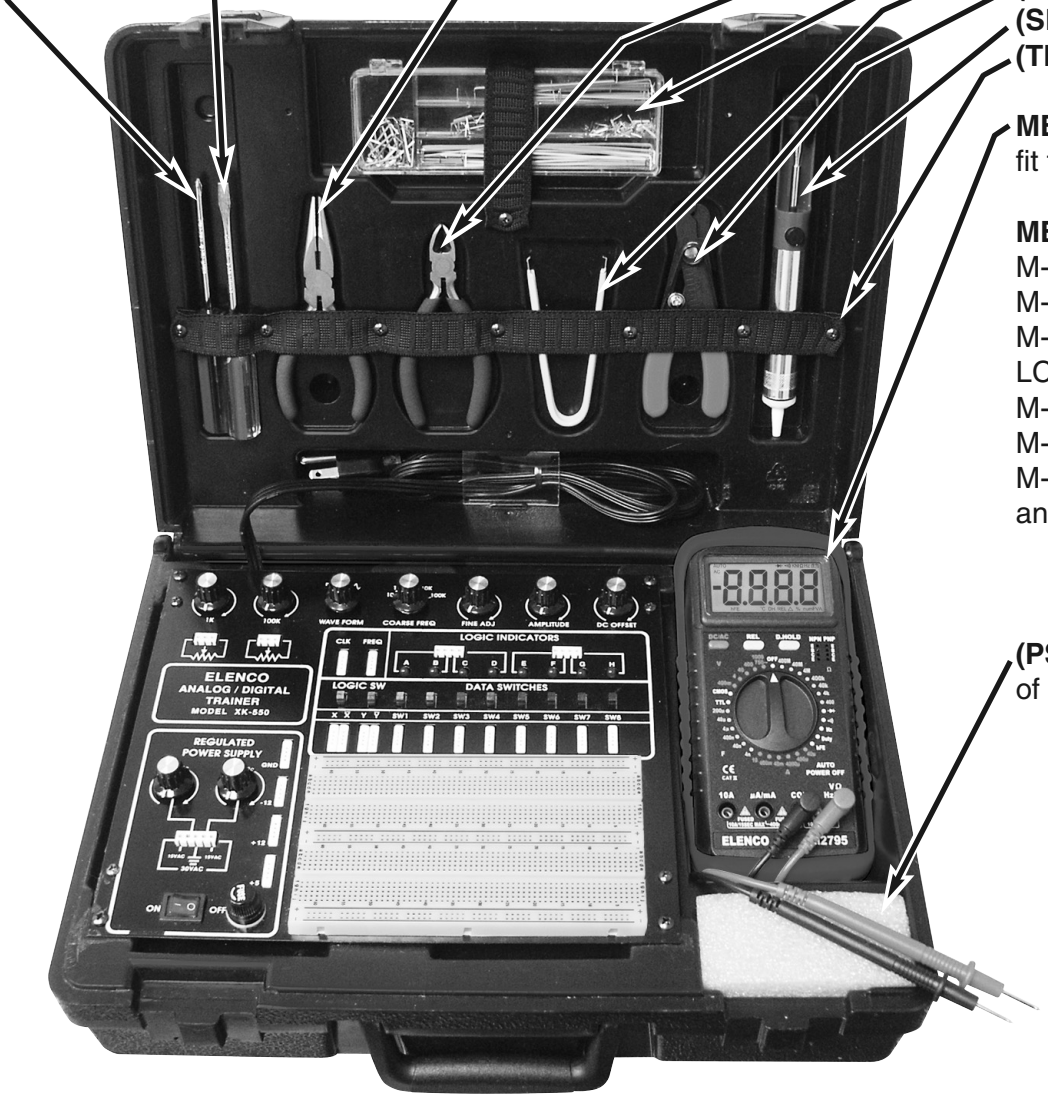
Qty.	Description	Part#
	Resistors	
❒ 4	100Ω 1/4W 5% brn-blk-brn-gold	131000
❒ 10	120Ω 1/4W 5% brn-red-brn-gold	131200
❒ 1	200Ω 1/4W 5% red-blk-brn-gold	132000
❒ 1	220Ω 1/4W 5% red-red-brn-gold	132200
❒ 2	330Ω 1/4W 5% org-org-brn-gold	133300
❒ 5	1kΩ 1/4W 5% brn-blk-red-gold	141000
❒ 2	1.2kΩ 1W 5% brn-red-red-gold	141202
❒ 1	2kΩ 1/4W 5% red-blk-red-gold	142000
❒ 2	4.7kΩ 1/4W 5% yel-vio-red-gold	144700
❒ 1	6.8kΩ 1/4W 5% blu-gry-red-gold	146800
❒ 1	8.2kΩ 1/4W 5% gry-red-red-gold	148200
❒ 1	10kΩ 1/4W 5% brn-blk-org-gold	151000
❒ 1	12kΩ 1/4W 5% brn-red-org-gold	151200
❒ 3	22kΩ 1/4W 5% red-red-org-gold	152200
❒ 1	47kΩ 1/4W 5% yel-vio-org-gold	154700
❒ 1	51kΩ 1/4W 5% grn-brn-org-gold	155100
❒ 16	100kΩ 1/4W 5% brn-blk-yel-gold	161000
❒ 1	100kΩ Pot Trim	191610
❒ 1	1kΩ Pot PC Mount	192412
❒ 2	2kΩ Pot PC Mount	192421
❒ 1	10kΩ Pot PC Mount	192531
❒ 3	100kΩ Pot PC Mount	192612
	Capacitors	
❒ 1	5pF 10% 50V Disc	205010
❒ 1	22pF 10% 50V Disc	212210
❒ 1	100pF 10% 50V Disc	221017
❒ 1	0.001μF 10% 100V Mylar	231017
❒ 1	0.0022μF 10% 50V Disc	232216
❒ 1	0.01μF 10% 100V Mylar	241017
❒ 4	0.1μF 10% 100V Mylar	251017
❒ 1	1μF 50V Lytic Radial	261047
❒ 2	10μF 25V Lytic Radial	271045
❒ 5	100μF 25V Lytic Radial	281045
❒ 2	1000μF 25V Lytic Radial	291045
❒ 4	1000μF 35V Lytic Radial	291046
	Semiconductors	
❒ 19	1N4001	314001
❒ 2	1N4148	314148
❒ 2	2N3904 NPN Transistor	323904
❒ 1	2N3906 PNP Transistor	323906
❒ 1	LM317 Regulator	330317
❒ 1	LM337 Regulator	330337
❒ 1	LF357 Integrated Circuit	330357
❒ 1	XR2206 Integrated Circuit	332206
❒ 1	SN7403 Integrated Circuit	337403
❒ 1	LM7805 Regulator	337805
❒ 1	LM7812 Regulator	337812
❒ 1	LM7912 Regulator	337912
❒ 8	LED Red	350002
❒ 2	74HC04 Integrated Circuit	39HC04

Qty.	Description	Part#
	Miscellaneous	
❒ 1	Transformer	44K500
❒ 1	PC Board	514550
❒ 1	Fuse 1.25A	530125
❒ 10	Switch Slide PC Mount DPDT	541009
❒ 1	Switch Rotary 2P5POS	542206
❒ 1	Switch Rotary 4P3POS	542405
❒ 1	Switch Rocker Illuminated	541204
❒ 2	Connector 3-pin	591032
❒ 2	Connector 4-pin	591042
❒ 1	Connector 5-pin	591052
❒ 1	Bracket	613003
❒ 4	Bracket L 4-40 Tap	613008
❒ 1	Top Panel	614108
❒ 1	Panel Side Right	614551
❒ 1	Panel Side Left	614554
❒ 9	Knob Push On	622009
❒ 1	Plastic Case	623002
❒ 1	Bushing Insulated	624009
❒ 1	Spacer Nylon 7/16” 4-40 Tap	624013
❒ 8	Spacer 1/4” #8 Plastic	624124
❒ 1	Cord Retainer	628003
❒ 2	Screw #10-32 x 3/8” Hex	641158
❒ 1	Screw #4-40 x 1/4” Phil Flat	641431
❒ 9	Screw #4-40 x 1/4” Phil Truss	641438
❒ 6	Screw #6-32 x 3/8” Phil Pan	641640
❒ 2	Screw #6-32 x 5/16” Sltd Bndr	641641
❒ 4	Screw #4 x 1/4” AB Phil Blk	642430
❒ 6	Screw #6 x 3/8” AB Phil Blk	642660
❒ 4	Screw #8 x 1/2” A Phil Blk	642862
❒ 7	Nut Pot 7mm	644101
❒ 2	Nut Pot 9mm	644102
❒ 8	Nut #6-32 Hex	644601
❒ 2	Nut #10-32 Hex	644810
❒ 7	Washer Flat 8mm ID x 14mm OD	645101
❒ 2	Washer Flat 9mm ID x 15mm OD	645103
❒ 2	Washer flat black #6	645400
❒ 5	Washer Fiber #4	645404
❒ 2	Lockwasher #6 Internal	646600
❒ 2	Lockwasher #10 External	646910
❒ 1	Fuse Holder	663000
❒ 1	IC Socket 8-Pin	664008
❒ 3	IC Socket 14-Pin	664014
❒ 1	IC Socket 16-Pin	664016
❒ 18	Bredblox 4-Pin	665204
❒ 1	Label XK-550 Case	723501
❒ 5	Insulator Mica	780002
❒ 5	Insulator Washer	780101
❒ 5”	Wire 20GA Red Topcoat	813120
❒ 2’	Wire 22GA Jumper	845000
❒ 1	Line Cord	862105
❒ 2”	Shrink Tubing 1/2” Dia	891101-2
❒ 1½”	Shrink Tubing 3/4” Dia	899110-2
❒ 1	9426 Bredboard	99426
❒ 1	9830 Bredboard	99830

ORGANIZER CARRYING CASE

The carrying case for the XK-550 Digital/Analog Trainer has been designed to hold a meter and many of the most important tools. The layout below shows a suggestive layout for equipment and tools. The sloped side pocket of the case next to the trainer can accommodate a wide range of different meters.

(ST-2) 5" Long Nose Pliers
(ST-6) #1 Phillips Screwdriver
(ST-5) 3/16" Blade Screwdriver



(ST-1) 4 1/2" Side Cutter
(JW-140) Wire Jumper Kit
(ST-7) IC Puller
(ST-3) Wire Stripper
(SP-4) Desoldering Pump
(TM-30) Tool MTG Kit

METERS - ANY of the following will fit the special slope cavity

METERS AVAILABLE:
M-2795
M-2666K
M-1700
LCM-1950
M-2625
M-1750
M-1000D
and others in catalog

(PSV-50) Anti-static foam for storage of ICs and velcro for mounting meter

When ordering a meter to be used with the XK-550 trainer, specify a PSV-50 kit which will provide you with velcro hold the meter in place and an anti-static foam pad that fits below the meter for storage of ICs. This is supplied **FREE** with meter order.

When ordering tools, specify a TM-30 tool MTG kit. When four or more tools are ordered, the tool MTG kit is supplied **FREE!**

POPULAR METERS THAT CAN BE USED WITH THE XK-550 TRAINER

Model M-2795

Features

- 3 ¾ digit, 4,000 count display
- Audible continuity test
- Data hold / rel. value
- Frequency to 15MHz
- Capacitance to 200µF
- Transistor / diode / logic test
- AC/DC current to 10A
- Auto power off
- Holster included

Specifications

AC volts Accuracy	400mV, 4V, 40V, 400V, 750V 4V, 40V, 400V: ±(0.8% + 3) 400mV, 750V: ±(1.2% + 3)	
DC volts Accuracy	400mV, 4V, 40V, 400V, 1000V 400mV, 4V, 40V, 400V: ±(0.5% + 3) 1000V: ±(0.8% + 3)	
AC current Accuracy	40µA, 400µA, 4000µA, 40mA, 400mA, 10A 40µA, 400µA, 4000µA: ±(1.5% + 5) 40mA, 400mA: ±(2% + 5) 10A: ±(2.5% + 5)	
DC current Accuracy	40µA, 400µA, 4000µA, 40mA, 400mA, 10A 40µA, 400µA, 4000µA: ±(1.2% + 3) 40mA, 400mA: ±(1.5% + 3) 10A: ±(2% + 5)	
Resistance Accuracy	400Ω, 4kΩ, 40kΩ, 400kΩ, 4MΩ, 40MΩ, 400MΩ 400Ω, 4kΩ, 40kΩ, 400kΩ, 4MΩ: ±(1%+3) 40MΩ: ±(2%+3) 400MΩ: ±(3%+10)	
Capacitance Accuracy	4nF, 40nF, 400nF, 4µF, 40µF, 200µF 4nF: ±(5%+10) 40nF: ±(3%+10) 400nF, 4µF, 40µF: ±(2%+5) 200µF: ±(4%+5)	
Frequency Sensitivity	10Hz - 15MHz ±(0.1% + 5) Sine wave 0.6Vrms	
Accessories	Heavy-duty test leads, holster, manual, & 9V battery included	
Dimensions / weight	7 1/2" (H) x 3 1/2" (W) x 1 3/4" (D) (without holster) / 10.56 oz. (without holster)	

Model M-1700

Features

- 3 ½ digit, 2,000 count display
- Frequency to 15MHz
- Capacitance to 20µF
- Diode and transistor test
- Audible continuity
- AC/DC current to 10A
- 3-way overload protection
- Low cost
- Holster included

Specifications

AC + DC volts Accuracy	200mV, 2V, 20V, 200V, 600V ±(0.5% rdg +1 dgt) DC, ±(1% rdg +4 dgts) AC	Resolution 100µV
AC + DC current Accuracy	2mA, 20mA, 200mA, 10A ±3.5%	Resolution 100µA
Resistance Accuracy	200Ω, 2kΩ, 20kΩ, 200kΩ, 2MΩ, 20MΩ ±(0.8% rdg +3 dgts) 200Ω, ±(3.0% +3 dgts) 20MΩ	Resolution 0.1Ω
Capacitance Accuracy	2nF, 20nF, 200nF, 2µF, 20µF ±5%	Resolution 1pF
Frequency Accuracy	10Hz - 20MHz autoranging ±0.5%	Resolution 1Hz
Accessories	Test leads, manual, 9V battery included	
Dimensions	6" (H) x 2 1/2" (W) x 1 1/4" (D)	
Weight	11.2 oz. (including holster and battery)	

Model M-1750

Features

- 3 ¾ digit, 4,000 count display
- Frequency to 10MHz
- Capacitance to 200µF
- Diode and transistor test
- Audible continuity
- AC/DC current to 10A
- 3-Way overload protection
- Holster included
- Relative measurement

Specifications

AC + DC volts Accuracy	400mV, 4V, 40V, 400V, 600V ±0.5% DC, ±0.8% AC	Resolution 100µV
AC + DC current Accuracy	400µA, 4000µA, 40mA, 400mA, 10A ±1.5%	Resolution 0.1µA
Resistance Accuracy	400Ω, 4kΩ, 40kΩ, 400kΩ, 4MΩ, 40MΩ ±1Ω	Resolution 0.1Ω
Capacitance Accuracy	1pf- 20µF autoranging ±2%	Resolution 1pF
Frequency Accuracy	10Hz - 10MHz autoranging ±0.5%	Resolution 1Hz
Accessories	Test leads, manual, holster, and two (2) "AAA" batteries included	
Dimensions	6" (H) x 2 1/2" (W) x 2 1/4" (D)	
Weight	9.6 oz. (including holster and batteries)	

Compact Multimeter
Model M-1000D

Features

- 3 ½ digit, 2,000 count display
- Transistor test
- Audible continuity
- Diode test
- Relative measurement
- 3-way overload protection
- Pocket-size
- Low cost

Available as a kit (M-1007K)

Specifications

AC + DC volts Accuracy Input impedance	200mV, 2V, 20V, 200V, 1,000V, 220VAC, 750VAC DC ±0.5%, AC ±1.2% 1MΩ	Resolution 0.1mV
DC current Accuracy	200µA, 2mA, 20mA, 200mA, 10A ±1.2%	Resolution 0.1µA
Resistance Accuracy	200Ω, 2kΩ, 20kΩ, 200kΩ, 2MΩ ±1.2%	Resolution 0.1Ω
Accessories	Test leads, manual, 9V battery included	
Dimensions	5" (H) x 2 7/8" (W) x 1" (D)	
Weight	4.5 oz. (including battery)	

WARRANTY POLICY

Your XK-550 Digital / Analog Trainer has been tested and conforms to our rigid requirements on performance and durability. It is guaranteed to be free of defects in workmanship, materials and construction for a period of 2 years. If this product should fail during normal use within the first 3 months from the date of purchase, Elenco® will repair or replace the unit at no cost. For the remainder of the warranty period, a nominal service charge is required to cover shipping and handling.

When returning merchandise for repair, please include proof of purchase, a brief letter of explanation of problem and sufficient packing material. Before returning any merchandise, please call our service department at (847) 541-3800 to obtain a return merchandise authorization number (RMA).

ELENCO® Service Department
150 Carpenter Avenue Wheeling, IL 60090

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