



OM358
eight channel
oscilloscope multiplexer

INSTRUCTION MANUAL

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1. INTRODUCTION

The OM358 enables up to eight signal inputs to be displayed simultaneously using just one trace of a conventional oscilloscope.

The OM358 has a bandwidth of 35MHz and a calibration accuracy of $\pm 3\%$. Each channel has an input impedance of $1M\Omega // 20pF$ and accepts input signals of up to $\pm 6V$. This can be extended to $\pm 60V$ using a standard X10 oscilloscope probe.

All inputs and outputs are via standard BNC sockets. The multiplexer is connected to the oscilloscope's Y input and external trigger input with the cables provided. A mode switch provides for an 8 channel, 4 channel or single channel display, and the trigger can be selected to come from any input.

The ability to observe a large number of waveforms simultaneously can be an important aid in analysing complex equipment. Analogue or digital signals can be displayed, typical application areas include microprocessor based products, data transmission systems, phased locked loops, analogue to digital converters, etc.

2. PRINCIPLES OF OPERATION

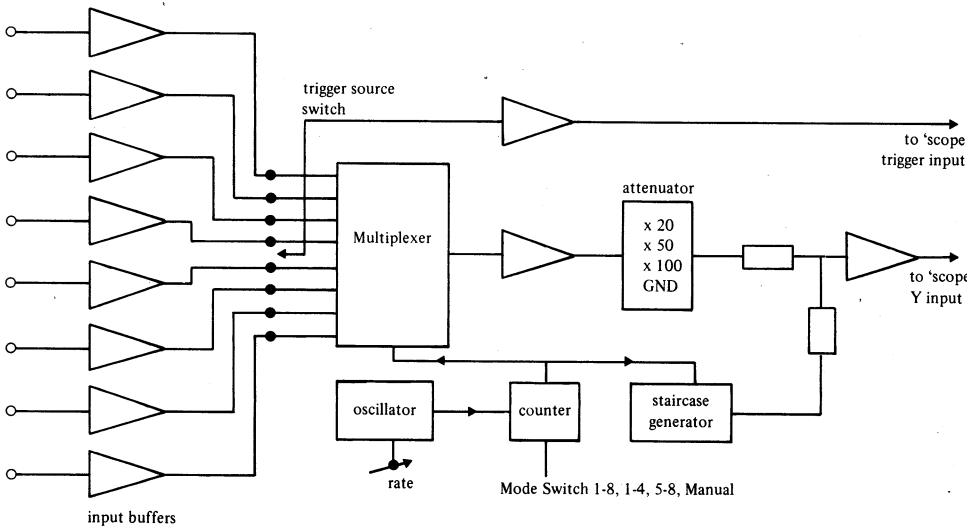
The multiplexer combines the signals from eight input channels in such a way that they can be displayed on one trace of an oscilloscope.

It does this by generating a staircase waveform and superimposing one channel of signal information on each step of the staircase. The oscilloscope is triggered from one of the eight signal inputs and, by setting the staircase repetition rate to be asynchronous with the oscilloscope sweep rate, the eye perceives eight separate signal waveforms separated by the staircase step voltage. This is an extension of the principle used by a dual-trace oscilloscope in chop mode but, since the multiplexing rate is variable over a wide range, asynchronism can be achieved at any sweep rate.

The inputs are all DC coupled. A single attenuator operates on all input channels simultaneously and provides attenuation levels of 20, 50, or 100 as well as a ground position. The staircase generator has a 100mV step level. The multiplexer can be set to display all eight channels, the upper or lower four channels, or any single channel.

The trigger is selected from any one of the signal inputs and buffered before being passed to the external trigger input of the oscilloscope. Triggering is then achieved using the oscilloscope's trigger controls in the normal way.

Fig 1 Block Diagram



3. PREPARATION FOR USE

3.1 Operating Power

The OM358 is operated from AC line power, either 220V, 240V $\pm 10\%$ 48-63Hz or 110, 120V $\pm 10\%$ 48-63Hz. The voltage range to which the instrument is set is marked on the rear panel and should be checked before power is connected.

The IEC standard cable supplied should be connected to a captive plug with an integral earth connection and wired as follows:- brown to Live, blue to Neutral, green/yellow to Earth.

3.2 Power On/Off Switch

The power switch is mounted on the rear panel of the instrument. A front panel mounted LED indicates that the power is on.

3.3 Tilt Stand

A tilt stand is provided which enables the instrument to be angled upwards. The stand must be pressed inwards firmly with both hands before trying to move it.

3.4 Connecting to an Oscilloscope

The oscilloscope controls should be set as follows:-

Mode	—	Single Trace
Volts/Division	—	100mV
Input Coupling	—	DC
Trace Position	—	Mid Screen
Trigger Source	—	External
Trigger Mode	—	Bright Line or Auto
Time/Division	—	50usec

The OM358 is supplied complete with two BNC to BNC cables. One of these should be used to connect the socket on the multiplexer marked 'vertical output' to the vertical (Y) input of the oscilloscope. The other cable should be used to connect the socket on the multiplexer marked 'trigger output' to the oscilloscope's external trigger input.

The OM358 controls should be set as follows:-

Trigger Source	—	1
Multiplexing Mode	—	1-8
Multiplexing Rate	—	Slow
Attenuator	—	Ground

With the multiplexer connected to the oscilloscope and the oscilloscope set to produce a trace in the absence of a trigger signal, 8 lines should appear on the screen. Most 'scopes have a graticule with 8 vertical divisions, and it should be possible to set the traces to be coincident with the graticule lines by using the Y shift control. The multiplexer is now ready for use.

4. OPERATING THE MULTIPLEXER

4.1 Basic Operating

With the multiplexer and oscilloscope set-up as described already, connect a signal of around 5V pk-pk (centred on 0V) and approximately 20KHz to the CH1 input socket. Move the attenuator switch to the X50 position, and adjust the oscilloscope's trigger control until a stable trace is displayed. The multiplexing rate control should be set to avoid any flicker or break-up of the display. The signal should be now displayed on the top trace at an amplitude of about 1 division pk-pk.

Connecting further signal inputs will result in them being displayed on each corresponding trace (channel one appears on the top trace and channel eight on the bottom trace). The trigger can be selected from any input by moving the trigger source control.

Moving the mode switch to 1-4 or 5-8 will result in a display of the upper or lower four channels only. Moving it to manual will result in a display of channel 1 only. In this mode pressing the advance button will cause CH2 to be displayed pressing it again will cause CH3 to be displayed, and so on. Triggering is unaffected by the mode switch.

The attenuator enables three levels of input sensitivity to be achieved. With the 'scope set to 100mV/div these are 2V/div (X20), 5V/div (X50) or 10V/div (X100). The ground positions allows the DC reference level to be observed.

4.2 Input Characteristics

Each channel has an input impedance of $1\text{M}\Omega // 20\text{pF}$, is DC coupled and accepts input signals up to at least $\pm 6\text{V}$. Above $\pm 6.5\text{V}$ the input impedance reduces to 100K. The inputs are protected against accidental overload up to 250V rms or DC (max. $10^6 \text{ volt} \times \text{Hz}$).

Where it is required to observe signals above $\pm 6\text{V}$, this can be done by connecting a standard X10 'scope probe which enables signals up to $\pm 60\text{V}$ to be observed.

4.3 Four-Channel Mode

When it is required to observe only four signals or less, the mode switch should be moved to one of the four channel positions (1-4 or 5-8). This has two advantages, firstly the trace brightness will increase and secondly the signals can be observed in more detail.

By increasing the oscilloscope's vertical sensitivity to 50mV/div the traces will appear at 2 division intervals, and input sensitivity will be doubled to 1V/div, $2\frac{1}{2}\text{V/div}$ or 5V/div depending on attenuator position.

Triggering is unaffected and can still be selected from any of the eight channels.

4.4 Single-Channel Mode

Where it is required to observe one signal in particular detail, manual mode can be used. This allows the oscilloscope's Y sensitivity to be increased further since only one trace is displayed.

When the mode switch is moved to manual it is automatically set to display CH1. Pressing the advance button will then step through the channels in order. Thus to observe CH6, move the mode switch and return it to manual, then press the advance button five times.

Triggering is unaffected and can still be selected from any of the eight channels.

4.5 Triggering

The trigger source control allows any one of the input channels to be connected to the oscilloscope's trigger input via a buffer amplifier. Triggering is then achieved using the oscilloscope's trigger controls in the normal way.

When observing several synchronous waveforms with different repetition rates, it will normally be necessary to trigger from the lowest frequency signal.

4.6 Setting the Multiplexing Rate

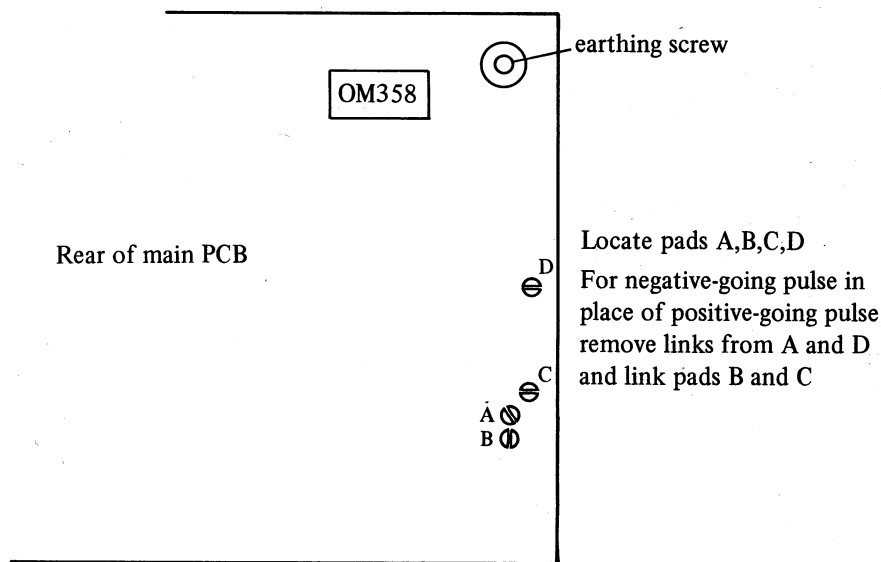
The multiplexing rate must be set to be asynchronous with respect to the oscilloscope sweep rate. If the two approach synchronism the multiplexer staircase waveform will start to become visible and the display will appear to flicker or break-up. When changing timebase speed it will sometimes be necessary to reset the multiplexing rate to avoid these effects.

4.7 Blanking Output (need not be used)

When using the fastest multiplexing rates there will be a slight reduction in trace sharpness and contrast caused by the finite rise-time of the multiplexing waveform. This effect can be eliminated if the oscilloscope has a blanking or Z modulation input since the trace can be suppressed on each edge of the multiplexer waveform.

The blanking output from the OM358 is a positive-going pulse which is suitable for most oscilloscopes. An internal adjustment is available when using an oscilloscope which requires a negative-going blanking pulse.

Fig 2 modifying blanking output to negative-going pulse



4.8 Using a Dual-Trace Oscilloscope

With a dual-trace oscilloscope, up to nine traces can be displayed since the second channel can be used as an additional input. By using 200mV/div sensitivity in 8 channel mode, or 100mV/div sensitivity in 4 channel mode the multiplexer display is compressed into half the screen area leaving the other half available for the additional channel. This system is particularly useful when one signal needs to be examined in detail whilst still observing several others.

Another use of the second input channel is as an alternative to the external trigger input should the external trigger sensitivity prove to be inadequate.

5. SPECIFICATIONS

Eight channels with specifications as follows:-

Input impedance	—	1M Ω //20pF
Max. working voltage	—	$\pm 6V$
Max. overload voltage	—	250V for 10 secs.
Input coupling	—	D.C.

Attenuator (operates on all channels simultaneously)

Four position	—	X100, X50, X20, Ground
Accuracy	—	typically better than $\pm 3\%$

Multiplexer

Modes	—	8 channels; upper 4 channels; lower 4 channels; any single channel.
DC separation	—	100mV/channel in 8 channel and 4 channel modes.
Separation accuracy	—	typically better than $\pm 3\%$
Multiplexing rate	—	20kHz to 1.2MHz fully variable

Vertical output

Through bandwidth	—	35MHz ($-3db$) at 1V pk-pk input
Max. slew rate	—	+300V/ μ sec, -200V/ μ sec referred to input
Output impedance	—	50 Ω

Trigger output

Source	—	switch selectable from any input
Level	—	equal to input level
Output impedance	—	50 Ω

Blanking output (need not be used)

Pulse width	—	300nsec typical
Polarity	—	positive, internally adjustable to negative.
Level	—	>10V
Output impedance	—	600 Ω typical

Power requirements

Voltage	—	110, 120, 220, 240V $\pm 10\%$ 48-63Hz
Safety	—	IEC class 1

Mechanical details

Dimensions	—	230 x 230 x 90mm(9 x 9 x 3½")
Weight	—	1.3kg (2.8lb)

6. GENERAL SAFETY CONSIDERATIONS

The instrument is safety class 1 by IEC classification. All exposed metal parts are connected to the protective earth (ground) conductor of the AC line cord.

Ensure that an appropriate AC line plug is connected to the IEC standard cable supplied, and that a secure earth connection is made. Connections are brown = live, blue = neutral, green/yellow = earth.

Ensure that the line cord is disconnected before attempting to dismantle the instrument.

7. MAINTENANCE AND REPAIR

The manufacturers or their agents overseas will provide repair for any unit developing a fault. Where owners wish to undertake their own maintenance work, this should only be done by skilled personnel in conjunction with the service manual which may be purchased directly from the manufacturers or their agents overseas.

In the UK, defective instruments should be returned, carriage paid, to the manufacturers service department. Careful and substantial packing is essential - no responsibility can be accepted for damage caused in transit to the manufacturer - if possible, retain the original packing material. If the guarantee has expired or if the fault is the result of misuse, the repair will be carried out and charged unless other instructions are received. Customers outside the UK should contact the dealer from whom the unit was purchased to ascertain service arrangements for that country.

8. GUARANTEE

The instrument is guaranteed as free from defects in workmanship or materials. The terms of the guarantee will vary dependent upon the country in which it is sold. Information concerning the guarantee can be obtained from the agent from whom the instrument was purchased.

In the UK the guarantee period is 12 months.

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