<sup>′</sup> Scan by Zenith





CUSTOMER SERVICES SUPPORT

## **178 COMMON MODE CALIBRATION FIXTURE**

(Part No. 067-0756-00)



This Calibration Fixture is used to verify/adjust the Common Mode Rejection Ratio of the  $178\ {\rm Instrument}.$ 

The LM725 has been selected by Tektronix, Inc. to meet or exceed 120dB Common Mode Rejection. The Diagrams below show the exact CMRR of the Op-Amp Included.



Compensation Diagram for  $10\,\mu V$  attenuation range





NO.	062-1828-00
DATE	April 1975
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## CHECK COMMON-MODE REJECTION RATIO

<ul> <li>Var Collector % 0</li> <li>Coll Polarity +DC</li> <li>a. Set controls as indicated on the chart to the left.</li> <li>Series Resistors</li> <li>Step Family OFF</li> <li>Step/Offset Amp</li> <li>Step/Offset Pol</li> <li>No of Steps</li> <li>Offset Aud</li> <li>Ourne Step X.1</li> <li>Display Filter</li> <li>OUT</li> <li>Step X.1</li> <li>Display Filter</li> <li>OUT</li> <li>Horiz Volts/Div</li> <li>Collector Volts</li> <li>X10 Vert Mag</li> <li>OUT</li> <li>Vert Position</li> <li>Vert Position</li> <li>Vert Position</li> <li>Vert Position</li> <li>Vert Position</li> <li>Sweep Amp1</li> <li>Fully CCW</li> <li>Sweep Amp1</li> <li>Fully CCW</li> <li>Sweep Amp1</li> <li>Fully CCW</li> <li>Sweep Freq</li> <li>INZ</li> <li>Max Max Max</li> <li>Supply Limit</li> <li>Supply Limit</li> <li>Supply Limit</li> <li>Supply Limit</li> <li>Supply Limit</li> <li>CHECK-Vertical deflection of the horizons and constraint are should not exceed ±3 divisions, the DISPLAY ZERO button.</li> </ul>	<u>†</u>	Storage	OUT			
Max Peak Volts25Series ResistorsStep FamilyStep FamilyOFFStep/Offset AmpStep/Offset PolNo of StepsOffset MultOffset AidPulsed 300 usOffset AidPulsed 300 usStep X.1Display invertDisplay FilterOUTHoriz Volts/DivX10 Horiz MagNo dr Z positionVert PositionVert PositionVert PositionVert PositionVert PositionSurce RSource RSource RSource RSource RSupplyH2Display ZeroFunctionFunctionVert Units/DivVert Units/DivAmplifier SWAmplifier SWEXT FBA SW <td></td> <td>Var Collector %</td> <td>0</td> <td>į</td> <td></td>		Var Collector %	0	į		
Series Resistors Step FamilyOFF Step RateStep Kate Step/Offset Amp Step/Offset Polb. Using patch cords, connect the LM725 Op Amp on the Standard Op Amp card as shown in Figure 1.No of StepsC. Set the DUT SUPPLIES switch to ON. Press the DISPLAY ZERO button and center the DISPLAY ZERO button and center the DISPLAY ZERO reference point.Offset Aid Pulsed 300 us Step X.1C. Set the SWEEP AMPLITUDE control for ten divisions of horizontal display.Display invert Step X.1OUT Step X.1Display filter OUT Horiz Volts/Div X10 Horiz Mag Horiz PositionCollector Volts IN Collector VoltsVert PositionF Set the VERT UNITS/DIV switch to 100V (magnified). Press the DISPLAY ZERO button.DUT Supplies Sweep Ampl Fully CCW Sweep Ampl <b< td=""><td></td><td>Coll Polarity</td><td>+DC</td><td>а.</td><td>Set controls as indicated on the</td></b<>		Coll Polarity	+DC	а.	Set controls as indicated on the	
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<ul> <li>Offset Zero IN</li> <li>Offset Zero IN</li> <li>Offset Aid</li> <li>Pulsed 300 us OUT</li> <li>Step X.1</li> <li>Display invert IN</li> <li>Display Filter OUT</li> <li>Horiz Volts/Div 2 Collector Volts</li> <li>X10 Vert Mag IN</li> <li>Horiz Position</li> <li>Vert Position</li> <li>DUT Supplies OFF</li> <li>Load R</li> <li>Source R 50 0hm</li> <li>+ Supply +15V</li> <li>Sweep Ampl Fully CCW</li> <li>Sweep Ampl Fully CCW</li> <li>Sweep Freq .1HZ</li> <li>Display Zero</li> <li>Function CMRR</li> <li>Vert Units/Div .1mV</li> <li>Vert Units/Div .1mV</li> <li>Vert Units/Div .1mV</li> <li>Wert Fas SW</li> <li>NORM</li> <li>Supply Limit</li> <li>Supply Limit</li> <li>CHECK-Vertical deflection of the horizontal trace should not exceed ±3 divisions,</li> <li>the LM725's CMRR to be flat. Set the VERT</li> <li>WITS/DIV switch to luV (magnified). Press the DISPLAY ZERO button.</li> </ul>				с.		
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Pulsed 300 usOUTStep X.1Display invertINDisplay FilterOUTHoriz Volts/Div2 Collector VoltsX10 Horiz MagINX10 Vert MagOUTHoriz PositionE. CHECK-Vertical deflection of the horizontal trace should not exceed ±3 divisions.Vert Positionf. Set the VERT UNITS/DIV switch to louV (magnified). Press the DISPLAY ZERO button.Source R50 Ohm + SupplySweep AmplFully CCWSweep Freq.HZ Display ZeroFunctionCMRRVert Units/Div.lmV .lmVVert Units/Div.lmV .lmVAmplifier SW EXT FBA SWNORM + Supply LimitCHECK-Vertical deflection of the horizontal trace should not exceed ±3 divisions, + the	<u>ر</u> ،		IN			
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Horiz Position Vert Positionf. Set the VERT UNITS/DIV switch to 10uV (magnified). Press the DISPLAY ZERO button.DUT Supplies Load R Source R - SupplyOFF 15V Track + Supply Sweep Ampl Sweep Ampl Sweep Freq Fully CCW Functionf. Set the VERT UNITS/DIV switch to 10uV (magnified). Press the DISPLAY ZERO button.Market Supply Sweep Freq Display Zero Functionfully CCW CMRRCHECK-Vertical deflection of the horiz- ontal trace should not exceed ±3 divisions, + the LM725's CMRR slope on the 10uV/Div range. If no diagram is supplied for the 10uV/Div range with the LM725, consider the LM725's CMRR to be flat. Set the VERT UNITS/DIV switch to 1uV (magnified). Press the DISPLAY ZERO button.Vert Units/Div Amplifier SW EXT FBA SW H Supply LimitNORM CHECK-Vertical deflection of the horizontal trace should not exceed ±3 divisions, + the		0				
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DUT SuppliesOFF10uV (magnified). Press the DISPLAYLoad RSource R50 Ohm+ Supply+15V- SupplyTrack + SupplySweep AmplFully CCWSweep Freq.1HZDisplay ZeroIntFunctionCMRRVert Units/Div.1mVMaplifier SWNORM+ Supply LimitCHECK-Vertical deflection. of the horiz-Ontal trace should not exceed ±3 divisions,+ Supply LimitCHECK-Vertical deflection. of the horiz-Ontal trace should not exceed ±3 divisions,+ Check - Vertical deflection. of the horiz-Ontal trace should not exceed ±3 divisions,+ Supply LimitCHECK-Vertical deflection.	ľ			£	Sot the NEPT INITE DIV suite to	
Load RZERO button.Source R50 0hm+ Supply+15V- SupplyTrack + SupplySweep AmplFully CCWSweep Freq.1HZDisplay Zero10uV/Div range with the LM725's CMRR slope on the 10uV/DivFunctionCMRRVert Units/Div.1mVAmplifier SWLXT FBA SWEXT FBA SWNORM+ Supply LimitCHECK-Vertical deflection of the horizontaltrace should not exceed ±3 divisions, + the			0.55	1.		
Source R50 Ohm+ Supply+15V- SupplyTrack + SupplySweep AmplFully CCWSweep Freq.1HZDisplay ZeroIf no diagram is supplied for the 10uV/Div range with the LM725's CMRR to be flat. Set the VERTVert Units/Div.1mVAmplifier SWUNITS/DIV switch to luV (magnified). Press the DISPLAY ZERO button.EXT FBA SWNORM+ Supply LimitCHECK-Vertical deflection of the horizontal trace should not exceed ±3 divisions, + the			OFF			
<ul> <li>+ Supply +15V</li> <li>Supply Track + Supply</li> <li>Sweep Ampl Fully CCW</li> <li>Sweep Freq .1HZ</li> <li>Display Zero</li> <li>Function CMRR</li> <li>Vert Units/Div .1mV</li> <li>Amplifier SW</li> <li>EXT FBA SW</li> <li>NORM</li> <li>+ Supply Limit</li> <li>Supply Limit</li> </ul>	ľ		50 Ohm	1	bhio baccon.	
<ul> <li>Supply Track + Supply ontal trace should not exceed ±3 divisions, + the LM725's CMRR slope on the 10uV/Div range. If no diagram is supplied for the 10uV/Div range. If no diagram is supplied for the 10uV/Div range. If no diagram is supplied for the 10uV/Div range. If no diagram is supplied for the 10uV/Div range with the LM725, consider the LM725's CMRR to be flat. Set the VERT</li> <li>Vert Units/Div . 1mV</li> <li>Vert Units/Div . 1mV</li> <li>Amplifier SW</li> <li>EXT FBA SW</li> <li>Hord the the DISPLAY ZERO button.</li> <li>CHECK-Vertical deflection of the horizontal trace should not exceed ±3 divisions, + the</li> </ul>			-	CHE	CK-Vertical deflection of the boriz-	
Sweep Amp1Fully CCW+ the LM/25's CMRR slope on the l0uV/DivSweep Freq.1HZrange. If no diagram is supplied for theDisplay Zerol0uV/Div range with the LM/25, consider theFunctionCMRRLMZ/Div range with the LM/25, consider theVert Units/Div.1mVUNITS/DIV switch to luV (magnified). PressAmplifier SWEXT FBA SWNORM+ Supply LimitCHECK-Vertical deflection of the horizontal- Supply Limittrace should not exceed ±3 divisions, + the	78		Track + Supply			
Sweep Freq Display Zero.1HZrange. If no diagram is supplied for the 10uV/Div range with the LM725, consider the LM725's CMRR to be flat. Set the VERTVert Units/Div.1mVUNITS/DIV switch to luV (magnified). Press the DISPLAY ZERO button.Mmplifier SWEXT FBA SWNORM + Supply LimitSupply LimitCHECK-Vertical deflection of the horizontal trace should not exceed ±3 divisions, + the						
Display Zero10uV/Div range with the LM725, consider the LM725's CMRR to be flat. Set the VERTVert Units/Div.1mVUNITS/DIV switch to luV (magnified). Press the DISPLAY ZERO button.Amplifier SWEXT FBA SWNORM + Supply LimitSupply LimitCHECK-Vertical deflection of the horizontal trace should not exceed ±3 divisions, + the				ran	ge. If no diagram is supplied for the	
FunctionCMRRLM725's CMRR to be flat. Set the VERTVert Units/Div.lmVUNITS/DIV switch to luV (magnified). PressAmplifier SWthe DISPLAY ZERO button.EXT FBA SWNORM+ Supply LimitCHECK-Vertical deflection of the horizontaltrace should not exceed ±3 divisions, + the						
Amplifier SWthe DISPLAY ZERO button.EXT FBA SWNORM+ Supply LimitCHECK-Vertical deflection of the horizontal- Supply Limittrace should not exceed ±3 divisions, + the			CMRR	LM7		
Amplifier SWthe DISPLAY ZERO button.EXT FBA SWNORM+ Supply LimitCHECK-Vertical deflection of the horizontal- Supply Limittrace should not exceed ±3 divisions, + the	4		.lmV	UNI		
EXT FBA SW       NORM         + Supply Limit       CHECK-Vertical deflection of the horizontal         - Supply Limit       trace should not exceed ±3 divisions, + the         LM725's CMRR slope on the luV/Div range.	ģ			the	DISPLAY ZERO button.	
+ Supply LimitCHECK-Vertical deflection of the horizontal+ Supply Limittrace should not exceed ±3 divisions, + theLM725's CMRR slope on the luV/Div range.	CAF		NORM			
Trace should not exceed ±3 divisions, + the LM725's CMRR slope on the luV/Div range.	ບ ພ					
LM725's CMRR slope on the luV/Div range.	ENC	- Supply Limit				
	ī			LM7	25's CMRR slope on the luV/Div range.	

LM725

Supplies +15V



Figure 1. LM725 connection and compensation diagram

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## ADJUST COMMON-MODE REJECTION RATIO

t	Storage	OUT		
i i	Var Collector %	0	а.	Set controls as indicated on the chart
	Coll Polarity	+DC		to the left.
	Max Peak Volts	25		
	Series Resistor		b.	Using patch cords, patch the LM725 and
	Step Family	OFF	ļ	compensation network to the standard
	Step Rate			Op Amp card as shown in figure 1.
	Step/Offset Amp			Place the LM725 Op Amp in the test
	Step/Offset Pol			socket. Set the DUT SUPPLIES switch to
	No of Steps			ON. Press the DISPLAY ZERO button and
-	Offset Mult			center the display.
57	Offset Zero	IN		tested the display.
	Offset Aid		с.	ADJUST-R267, X10 CMRR, for no vertical
	Pulsed 300 us	OUT		deflection of the horizontal trace.
	Step X.1			deriverenten of the horizontal trace.
	Display Invert	IN	d.	Set the VERT UNITS/DIV switch to 10uV
	Display Filter	OUT		(MAG ON) and press the DISPLAY ZERO
	Horiz Volts/Div	2 Collector Volts	1	button.
	X10 Horiz Mag	IN		Saccon,
	X10 Vert Mag	OUT	e.	ADJUST-R265, X100 CMRR, for the known
	Horiz Position			vertical deflection of the horizontal
	Vert Position			trace. If no diagram is supplied for
t	DUT Supplies	OFF		the 10uV/Div range with the LM725, the
	Load R			vertical deflection is flat.
	Source R	50 Ohm		in a second to reat.
	+ Supply	+15V	f.	Set the VERT UNITS/DIV to 1mV (MAG ON)
178-	- Supply	TRACK + SUPPLY		and press the DISPLAY ZERO button and
E.	Sweep Ampl	FULLY CCW		repeat parts C through F until there is
	Sweep Freq	.lHZ		no vertical variation of the horizontal
	Display Zero			trace from the known CMRR for the LM725.
	Function	CMRR		orable from the known onkk for the LM725.
. ↓	Vert Units/Div	1mV	g.	Set the VERT UNITS/DIV to luV (MAG ON)
1	Amplifier SW		8.	and press the DISPLAY ZERO button.
ģ	EXT FBA SW	NORM		Frees the profiling also bullon.
DUT CARD	+ Supply Limit		h.	ADJUST-R262, X1000 CMRR, for the known
0	- Supply Limit			vertical deflection of the horizontal
UT				display as shown by the diagram for
<u>п</u> -				luV/Div.
<u> </u>				