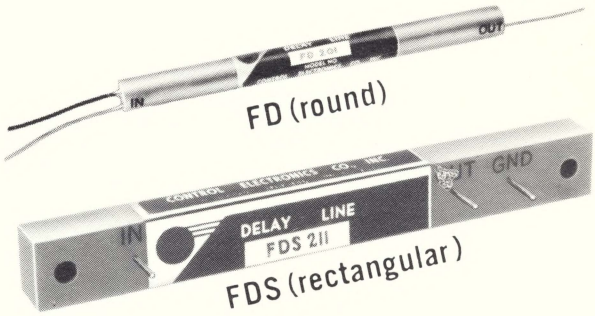
Distributed Constant Delay Lines

GENERAL SPECIFICATIONS

for Standard and Custom Units

Construction	Encapsulated in Epoxy resin Moisture and fungus resistant Made to MIL specifications
Operating Temperature	—55°C to +125°C
Thermal Stability	.50 ppm/°C
Attenuation	0.8 db per μsec. approximate
Test Voltage	500 Vdc



OPTIONAL FEATURES:

All Distributed Constant Delay Lines are offered in a choice of:

Round or Rectangular cross-section sticks
"FD" catalog designation is for Round 13/32" O.D. stick
"FDS" catalog designation is for Rectangular 3/8" x 1/2" stick

Pigtail or pin leads

Stud or insert mounting (FDS line only)

Tap points to your requirements

- **LOWEST COST—RELIABLE PERFORMANCE**
- **SMALL SIZE, LIGHT WEIGHT**
- **IMPEDANCES: 200 TO 4000Ω**
- **BANDWIDTHS TO 20 Mc/s**
- **LINEAR PHASE SHIFT**

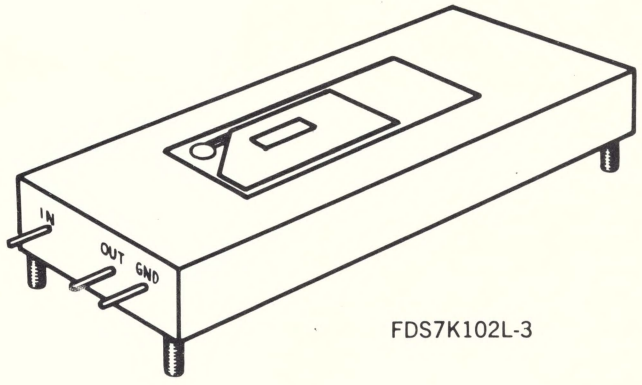
Delay μsec ±5%	Rise Time Less than μsec*	CHARACTERISTIC IMPEDANCE Ω ±10%						
		300 (D)	500 (F)	1000 (K)	1500 (L)	2000 (M)	3000 (N)	4000 (Q)
.1	.014	FD7D101B	FD7F101B	FD7K101B	FD7L101B	FD7M101C	FD7N101C	FD7Q101C
.2	.029	FD7D201C	FD7F201C	FD7K201C	FD7L201C	FD7M201D	FD7N201D	FD7Q201D
.3	.043	FD7D301D	FD7F301D	FD7K301D	FD7L301D	FD7M301E	FD7N301E	FD7Q301E
.4	.057	FD7D401E	FD7F401E	FD7K401E	FD7L401E	FD7M401F	FD7N401F	FD7Q401F
.5	.071	FD7D501F	FD7F501F	FD7K501F	FD7L501F	FD7M501G	FD7N501G	FD7Q501G
.6	.085	FD7D601G	FD7F601G	FD7K601G	FD7L601G	FD7M601H	FD7N601H	FD7Q601H
.7	.10	FD7D701H	FD7F701H	FD7K701H	FD7L701H	FD7M701J	FD7N701J	FD7Q701J
.8	.115	FD7D801J	FD7F801J	FD7K801J	FD7L801J	FD7M801K	FD7N801K	FD7Q801K
.9	.130	FD7D901K	FD7F901K	FD7K901K	FD7L901K	FD7M901L	FD7N901L	FD7Q901L
1.0	.14	FD7D102L	FD7F102L	FD7K102L	FD7L102L	FD7M102M	FD76102M	FD7Q102M
1.5	.21	FD7D152M	FD7F152M	FD7K152M	FD7L152M	FD7M152N	FD7N152N	FD7Q152N
2	.40	FD5D202J	FD5F202J	FD5K202J	FD5L202J	FD5M202K	FD5N202M	FD5Q152Q
4	.80	FD5D402N	FD5F402N	FD5K402N	FD5L402N	FD5M402P		

Longer delays than shown are provided by enclosing several sticks in one case.

e.g. 3 μsec , using FDS7K102L-3, dimensions will be 3/8" x 1½" x 6"

10 μsec , using FDS7K102L-10, dimensions will be ¾" x 2½" x 6"

NOTE: number of sticks is designated by the numeral following the dash at the end of the catalog #. Thus FDS7K102L-3 designates 3 sticks.



FDS7K102L-3

CONTROL ELECTRONICS COMPANY, INC.
153 Florida Street, Farmingdale, L.I., N.Y. 11735 • (516) 694-0125

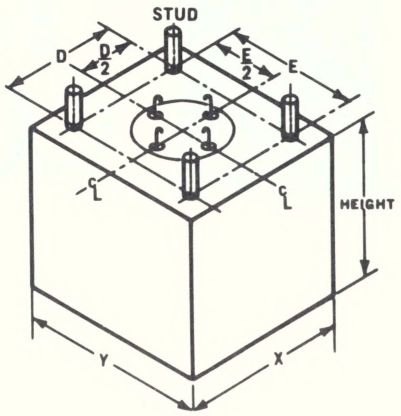
Lumped Constant Delay Lines

STANDARD UNITS

BUILT TO MIL SPECIFICATIONS

Zo in Ω ⟶		50(A)	180(C)	500(F)	1,000(K)	1,500(L)	2000(M)	3000(N)	5000(R)	7500(R)	10000(T)
Time Delay μs	Rise Time μs	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code
.25	.015	F17A251AE	F17C251AE	F17F251AE							
	.025	F10A251AE	F10C251AE	F10F251AE							
	.05	F5A251AA	F5C251AA	F5F251AA			F5M251AE	F5N251AE			
.50	.03	F17A501AE	F17C501AE	F17F501CE							
	.05	F10A501AE	F10C501AE	F10F501AE			F10M501CC				
	.10	F5A501AE	F5C501AA	F5F501AE	F5K501AE	F5L501AE	F5M501AE	F5N501AE			
1.0	.03	F33A102CE	F33C102CE	F33F102CE							
	.05	F20A102CC	F20C102CC	F20F102CE							
	.10	F10A102AE	F10C102AE	F10F102CC	F10K102CC		F10M102CC	F10N102CC			
	.20	F5A102AE	F5C102AE	F5F102AE	F5K102CC	F5L102CC	F5M102AE	F5N102AE	F5P102		
1.5	.05	F30A152CE	F30C152CE	F30F152DE							
	.075	F20A152CC	F20C152CC	F20F152CE			F20M152DE				
	.15	F10A152AE	F10C152AE	F10F152CC	F10K152CC	F10L152DE	F10M152CC	**F10N152CC**	F10P152CC	F10R152CC	
	.30	F5A152AE	F5C152AE	F5F152AE	F5K152CC	F5L152CC	F5M152AE	**F5N152AE**	F5P152AE	F5R152AE	F5T152AE
5.0	.15	F33A502EF	F33C502EE	F33F502GD	F33K502GD						
	.25	F20A502DE	F20C502CE	F20F502DE	F20K502JC		F20M502DE	**F20N502DE**	F20P502DE		F10T502CC
	.50	F10A502CC	F10C502CE	F10F502DE	F10K502CC	F10L502CC	F10M502CC	**F10N502CC**	F10P502CC	F10R502CC	F5T502AE
	1.0	F5A502CE	F5C502CC	F5F502AE	F5K502AE	F5L502AE	F5M502AE	**F5N502AE**	F5P502AE	F5R502AE	
10.0	3	F33A103GE	F33C103GD	F33F103GD	F33K103JD	F33L103JD	F33M103GD	F33N103GD			
	.5	F20A103EE	F20C103DE	F20F103GE	F20K103DE	F20L103DE	F20M203DE	F20N103DE	F20P103DE		
	1.0	F10A103EE	F10C103DE	F10F103CC	F10K103CC	F10L103CC	F10M103CC	F10N103CC	F10P103CC	F10R103CC	F10T103CC
	2.0	F5A103CE	F5C103CC	F5F103AE	F5K103AE	F5L103AE	F5M103AE	F5N103AE	F5P103AE	F5R103AE	F5T103AE
20.0	.6	F33A203GE	F33C203JC	F33F203GD	F33K203GD	F33L203GD	F33M203GD	F33N203GD	F33P203GD		
	1.0	F20A203GF	F10C203GD	F20F203DE	F20K203DE	F20L203DE	F20M203DE	F20N203DE	F20P203DE	F20R203DE	F20T203DE
	2.0	F10A203EF	F10C203DE	F10F203CE	F10K203CE	F10L203CC	F10M203CC	F10N203CC	F10P203CC	F10R203CC	F10T203CC
	4.0	F5A203CE	F5C203CC	F5F203CC	F5K203AE	F5L203AE	F5M203AE	F5N203AE	F5P203AE	F5R203AE	F5T203CC
50.0	1.5	F33A503JF	F33C503JD	F33F503GF	F33K503GD	F33L503GD	F33M503GD	F33N503GD	F33P503GD	F33R503GD	F33T503GD
	2.5	F20A503JC	F20C503JD	F20F503EF	F20K503EF	F20L503DE	F20M503DE	F20N503DE	F20P503DE	F20R503DE	F20T503DE
	5.0	F10A503GE	F10C503DE	F10F503CE	F10K503CE	F10L503CE	F10M503CC	F10N503CC	F10P503CC	F10R503CC	F10T503DE
	10.0	F5A503CE	F5C503CC	F5F503CC	F5K503CC	F5L503AE	F5M503AE	F5N503AE	F5P503AE	F5R503CC	F5T503DE
100	3.0	F33A104JG	F33C104JF	F33F104GF	F33K104GF	F33L104GF	F33M104GD	F33N104GD	F33P104GD	F33R104GD	F33T104GD
	10.0	F10A104GE	F10C104DE	F10F104CE	F10K104CE	F10L104CE	F10M104AE	F10N104AE	F10P104AE	F10R104AE	F10T104DE
200	6.0	F33A204JL	F33C204JF	F33F204JF	F33K204JC	F33L204JC	F33M204GD	F33N204GD	F33P204GD	F33R204GD	F33T204JD
	20.0		F10C204GD	F10F204GD	F10K204EE	F10L204EE					
500	15.0	F33A504JL	F33C504JL	F33F504JF	F33K504JF	F33L504JF	F33M504GF	F33N504JF	F33P504JF		
	50.0		F10C504GD	F10F504GD	F10K504GD	F10L504GD					

TAPPED AS REQUIRED



Height Letter	Code Size
A	1½"
B	2"
C	2½"
D	3"
E	3½"
F	4"
G	4½"
H	5"
J	5½"
K	6"
L	6½"
M	7"

Last letters of the catalog number indicate size.
Example: F10F501AE (here A indicates Base, E indicates Height)

BASE AND MOUNTING CODE

	Base Size		Mounting Dimensions		Stud Size
Letter	X	Y	D	E	
A	1 3/16	1 5/16	1 3/16	1 3/16	6-32 x 3/8
C	2 5/16	2 1/16	1 11/16	1 7/16	6-32 x 3/8
D	2 1/4	2 3/8	2 1/8	1 3/4	6-32 x 3/8
E	3 1/16	2 5/8	2 19/64	1 55/64	8-32 x 3/8
G	3 15/16	3 3/8	3	2 7/16	10-32 x 1/2
J	5 1/2	4 1/2	3 3/4	3	1/4-20 x 5/8

Tolerance ±1/16

DELAY TOLERANCE:
±3% +.01 μsec.

IMPEDANCE TOLERANCE:
±10%

ATTENUATION:
Less than .2 times the delay to rise time ratio

THERMAL STABILITY:
50 parts/million /°C

OPERATING TEMPERATURE RANGE:
—55°C to +125°C

SPURIOUS SIGNALS:
Less than 10%

Delay Lines

Terminology

In order to evaluate and specify your delay line requirements, it is helpful to be familiar with the terminology. The terms most often used to describe and specify delay line characteristics are given below. Where appropriate they're shown on Fig. 1. Dashed lines show common variations in output waveshape.

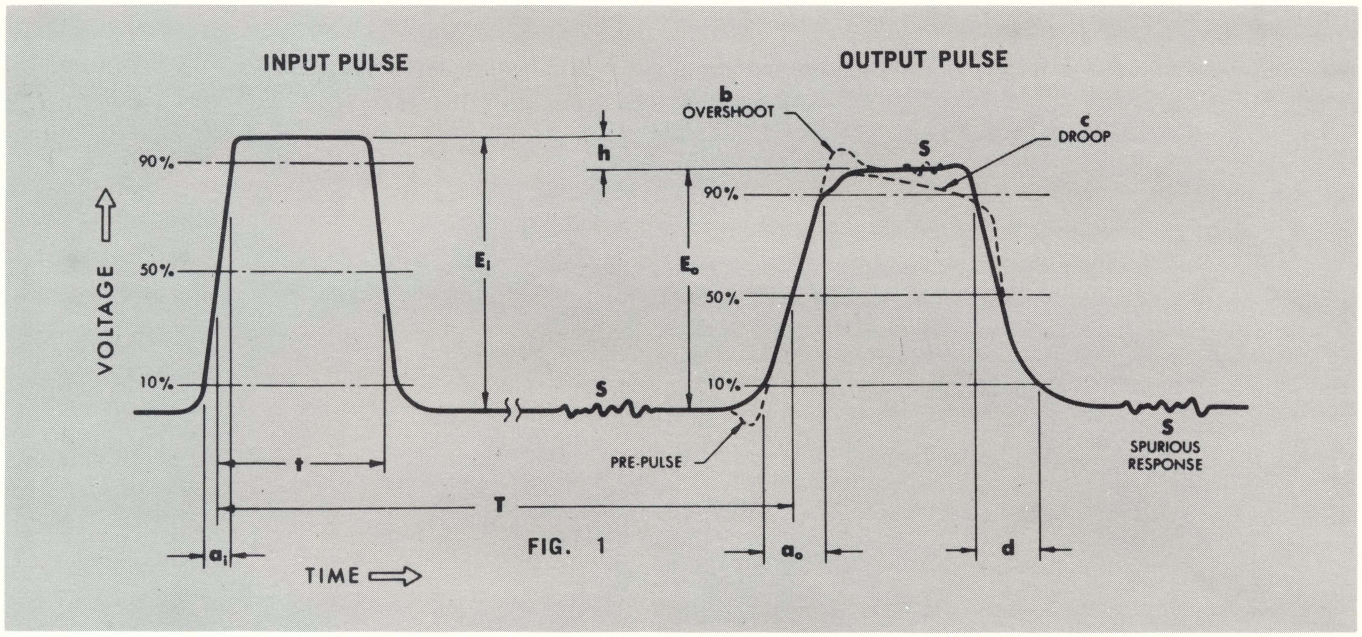


FIG. 1

a RISE TIME...

a_i Input pulse rise time
a_o Output pulse rise time
a_n Network pulse rise time

$$a_n = \sqrt{(a_o)^2 - (a_i)^2} \quad \text{approx.}$$

b OVERSHOOT... A continuation of the leading edge of the pulse

c DROOP... A sloping of the top of the pulse

d FALL TIME...

h ATTENUATION (in db) $= 20 \log \frac{E_i}{E_o}$

S SPURIOUS RESPONSE—Distortion—Ripple . . . Three common terms used to define any irregularities in the signal output of the delay line due to various causes. This may be expressed as db below E_o

t PULSE WIDTH... Usually measured at 50% amplitude points.

T DELAY TIME... The pulse delay is usually measured from the 50% amplitude point of the leading edge of the input pulse to the 50% amplitude point of the leading edge of the output pulse.

CHARACTERISTIC IMPEDANCE, Z_0 . . . Characteristic impedance of the delay line is the impedance presented to an input pulse applied to the delay line. A delay line is usually terminated in a resistance equal to the characteristic impedance.

DELAY/RISE TIME RATIO, T/a_n... The ratio of total delay to the delay line rise time is one measure of the quality of the delay line.

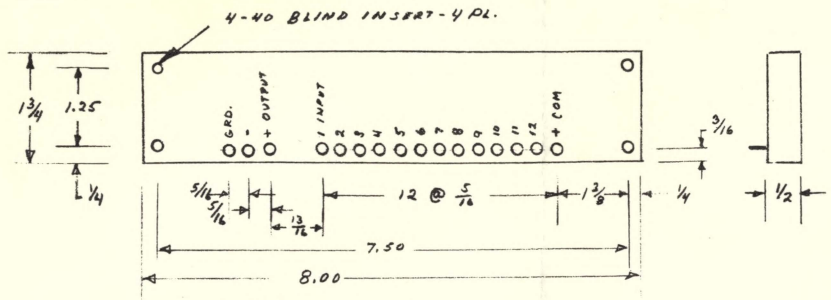
BANDWIDTH . . . Those frequencies which are passed at a useful ampitude (attenuated 3 db or less, for example). This is related to rise time approximately by

bandwidth x rise time = .4

TEMPERATURE COEFFICIENT... Usually expressed as a percent change in delay per degree Centigrade.

PHASE SHIFT... Delay lines may be used as phase shifting devices. A delay line will shift the phase of a sine wave an amount in degrees equal to 360 x delay time x frequency of sine wave. $\theta = 360 \times T \times f$.

CONTROL ELECTRONICS COMPANY, INC.
153 Florida Street, Farmingdale, L.I., N.Y. 11735 • (516) 694-0125



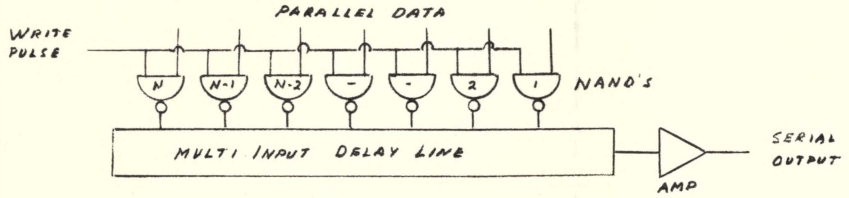


FIG. 1 FUNCTIONAL DIAGRAM

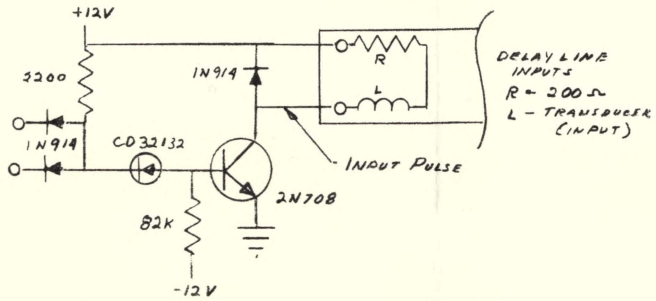


FIG. 2 APPLICATION CIRCUIT (NAND)

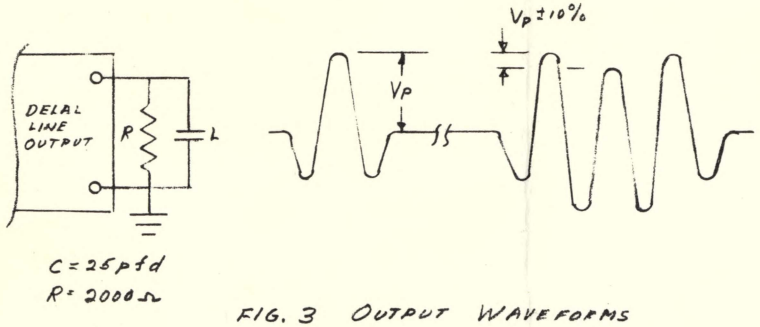


FIG. 3 OUTPUT WAVEFORMS

CODE GENERATOR

Delay Line Model DM718 is representative of a series of multi-tapped Magnetostrictive Delay Lines that are intended for use as word generators, serial to parallel or parallel to serial converters in digital computers or as recognition code train generators in radar systems. A wide choice of tap spacings and number of taps is available with tap spacings from .2 usec to several hundred microseconds being readily achievable. As many as 16 taps at a spacing of 1 usec are provided in the same case size as that of the DM718.

Electronic circuits to restore the signals to input logic level and to match system requirements are also supplied.

Specifications for Delay Line Model DM718

1.0 General Description

Delay Line Model DM718 is a 12 input Magnetostrictive Delay Line intended as a real time parallel to serial converter. Ref. Fig. 1.

2.0 Electrical Specifications

2.1	Input Ref. Fig. 2	
2.2	Input pulse width:	0.40 ±0.05 usec.
2.3	Input rise and fall time:	0.05 usec Max.
2.4	Output Ref. Fig. 3	
2.5	Output amplitude (V_P)	20 mv Min.
2.6	Signal/Noise Ratio:	5:1 Min.
2.7	Amplitude variation:	± 10% Max.
2.8	Crosstalk between inputs and outputs:	Less than 1 to 8

3.0 Delay Specifications:

3.1	Tap Spacing (at 25°C):	1.25 usec ±.05 usec
3.2	Tap #1 to Output	1.75 usec ±.25 usec
3.3	Number of Input taps	12

4.0 Environmental

4.1	Operating Temperature Range:	0 to 50°C
4.2	Storage Temperature Range	-55 to +85°C
4.3	Applicable Mil. specifications	Mil. Std. 202B
4.3.1	Method 102A	Test Condition D
.2	Method 103A	Test Condition B
.3	Method 201A	
.4	Method 202A	50 g 1 blow

5.0 Construction and Marking

5.1	Construction	Solder sealed steel case
5.2	Weight	8 oz.
5.3	All taps shall have a common return	

COMPUTER DEVICES CORP. 6 WEST 18 STREET HUNTINGTON STA., NEW YORK	CODE GENERATOR Delay Line Model DM718	MAT.	DATE
		DWG	REV.

OGILVIE PRESS, INC., BROOKLYN 17, N. Y. STOCK NO. 150 14672

DELAY LINES
TO MILITARY AND COMMERCIAL SPECIFICATIONS

New products for 1965

SUB-MINIATURE VARIABLE DELAY LINE

SIZE: .3 x .3 x .8 in.

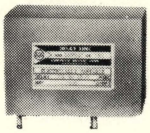
V982	—1	—2	—3	—4
Delay Nanosec.	3-25	3-30	4-50	5-100
Impedance Ohms	1000	500	270	50
Rise Time Nanosec.	20	25	40	90

V982

ELECTRICALLY VARIABLE DELAY LINES • LOW DISTORTION • DELAY LINEAR FUNCTION OF VOLTAGE

Model	Delay Range microsec.	Rise Time microsec.
DEV997	.01-10	0.2
DEV998	1-1000	20
DEV999	10-10000	200 Kc

(See CORRELATION D.L. below)



DEV999

LUMPED CONSTANT DELAY LINES

FIXED AND TAPPED DELAYS

CODING LINES for Radar Recognition Sets — Tap spacing 1.45 μsec. Accuracy up to ±.02 μsec over Mil. specs. Lumped Constant hermetically sealed units — Other special tap spacings are also provided — Lines may be used for encoding or decoding —
*Equalizing Resistors included in package.

TYPICAL LUMPED CONSTANT TYPES — Large variety of performance characteristics available. Delay to rise time ratios of up to 175 to 1 — accuracies up to .1% over Mil. Spec. range. Hermetically sealed in metal containers.

Model	Delay Microsec.	Rise Time Microsec.	Step or Tap Delays μsec.	Imped. Ohms	Attenuation db	Size
D1000	20.3	.5	1.45	330	6	2 x 4 x .31
D389	20.3	.4	1.45	330	4	4 x 4 x .37
D637	20.3	.3	1.45	180	10*	2.37 x 2.75 x 3.18
D203	20.3	.35	1.45	470	3	10 x 2.5 x 2.25
D170	20.3	.60	1.45	510	3	4 x 2 x 1
D231	20.3	.50	1.45	2200	2	4 x 3 x 2
D978	24.65	.45	2.90	180	6*	7.5 x 4 x 2
D297A	24.65	.50	1.45	500	3	2.87 x 2 x 4.25
D298A	25.3	.50	Special	500	3	2.87 x 1.62 4.25
D702	2.5	.075	.05	220	3	3.5 x 5.5 x 1.0
D992	6.0	.3		1000	2	1.37 x 1.37 x 2.5
D148	10.0	.3		1000	3	2.12 x 2.12 x 4
D754	50	1.5	.5	1000	6	4 x 4 x 2
D414	100	3.0	1.0	500	4	6 x 3.5 x 3

AUDIO DELAY AND SONAR LAG LINES

FIXED AND TAPPED DELAYS of low frequency C.W. signals. High accuracy of delay — Temperature stability 40 PPM/°C, VSWR ±½ db.
Phase linearity ±¼%.
*DA921 has VSWR of ±1 db.

VARIABLE DELAYS — Decade insertion type switching — provides low signal distortion and input and output impedance of equal value — Other characteristics same as fixed line.

Model	Delay Microsec.	3 db B.W. Kc	Step or Tap Delays μsec.	Imped. Ohms	Attenuation db	Size
*DA921	420	100		2000	4	14 x 2 x 1
DA563	500	30	25	1000	6	7 x 2.5 x 2
DA301	1000	20	20	600	3	19 x 3.5 x 9
DA261	5000	5	40	500	3	19 x 5.25 x 10
DA607	20000	3.5	80	500	1	19 x 7 x 15
DA177	100000	.2	1000	1000	10	19 x 21 x 12
AV175	0 - 150	30	.1	500	6	9 x 3 x 6
AV287	0 - 500	20	.002	1000	3	19 x 3.5 x 12
AV206	0 - 1000	20	1.0	600	3	19 x 3.5 x 12
AV731	0 - 5000	5	.1	1000	2	19 x 5.25 x 15
AV211	0 - 10000	2.5	.1	600	3	19 x 5.25 x 15

VARIABLE DELAYS

One Turn Movable tap on coil type.
Multi-Turn Movable tap on coil type.
Multi-Turn Movable tap on coil type.
Multi-Turn Movable tap on coil type.
Multi-Turn Movable tap on coil type.
Phase Shifter for up to 200 Kc.
INFINITE RESOLUTION — Inductive pick-off — Distributed Constant.

Model	Delay Range Microsec.	Rise Time Microsec.	Resolution	Imped. Ohms	Attenuation db	Size
DV252	0 - .06	.02	1/300	330	.5	1.5 dia. x .75
V172	0 - .55	.08	1/1000	1000	1	.5 x 1.5 x 4.5
V289	0 - 1.0	.2	1/1000	500	1	.5 x 1.5 x 4.5
DV219	0 - 1.0	.11	1/1000	1000	1	.62 x 1.25 x 6.5
V176	0 - 3	.5	1/1000	330	2	.75 x 1.87 x 7
V649	0 - 10	1.8	1/2000	100	4	2 x 2 x 8
VP162	0 - 7	.3	Infinite	150	30	2 x .75 x 5
VP333	0 - 12	1.2	Infinite	10000	30	1.37 dia. x 10

ULTRA MINIATURE VARIABLES

NANOSECOND RANGE COMPUTER TRIM-DELAYS. Hermetically sealed in metal cases — "O" ring seal on control shaft — for printed circuit board mounting. Can be cascaded with Series D647.

Model	Delay Range Nanosec.	Rise Time Nanosec.	Resolution Nanosec.	Imped. Ohms	Attenuation db	Size
V447-1	0 - 55	15	.5	150	1	1 x .31 x 1.25
V447-2	0 - 100	30	.7	50	1	1 x .31 x 1.25
V447-3	0 - 150	25	.6	150	1	1 x .31 x 2.45
V447-4	0 - 250	30	1.0	50	1.5	1 x .31 x 2.45
V447-5	0 - 300	30	.6	150	1.5	1 x .31 x 3.45
V447-6	0 - 500	60	1.0	50	2	1 x .31 x 3.45
DV875	0 - 100	20	.3	1000	1	1 x .31 x 3.45
DV810	0 - 200	40	.6	1000	1	1 x .31 x 2.45
V975	0 - 40	10	.02	200	1	1 x .31 x 2.45
V887	0 - 300	60	1.0	75	2	1 x .31 x 2.45

D647 SERIES — MINIATURE MODULES

Lumped Constant Printed circuit mounting modules can be cascaded to obtain any desired delay. Case size depends on delay to rise time required. Units are compatible with variable V447 series.
* Tapped each 1.45 μsec. for use in coders.

Delay Choice	Choice Imped.	Delay to Rise Time Ratio	Size
50; 100; 250; 500 and 750 nanosec.	50 ohms		
1.0; 1.45; 2.90* and 4.35* microsec.	150 ohms and 500 ohms	4:1 8:1 12:1	1 x .31 x 1.25 1 x .31 x 2.20 1 x .31 x 3.45

DO IT YOURSELF DELAY ADJUSTMENT

5 completely separate sections in each module. Cascaded modules allow selection of any desired delay in 5 nanosec. increments. Ideal for experimental work. Size of all modules 1 x .31 x 2.25 for printed circuit mounting.

Part No. Imp. 93 Ω	Part No. Imp. 330 Ω	Section Delay — Nanosec.	Tot. Delay Nanosec.	Rise Time Nanosec.
D740	D741	5; 10; 20; 30; 40	105	15
D742	D743	50; 100; 200; 300; 400	1050	150
D744	D745	One Delay	100	15
D746	D747	One Delay	1000	150

ELECTRICALLY VARIABLE

Delay is varied by varying a D.C. control voltage. Both L & C are controlled to minimize mismatch.

Model	Delay μsec.	Rise Time μsec.	Distortion %	Imped. Ohms	Attenuation db	Size
DEV623A	.03 to .04	.008	10	150	2	2 x 1 x .31
DEV350	3 to 7	.25	10	1000	3	3.5 x 4 x 4

COMPUTER DEVICES CORP.
6 W. 18TH STREET, HUNTINGTON STA., L.I., N.Y.
TEL: 516 — AR1—0666, TWX: 516 — 421—4235

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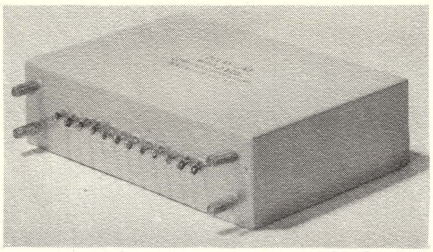
PRINTED IN U.S.A.

LUMPED CONSTANT DELAY LINES

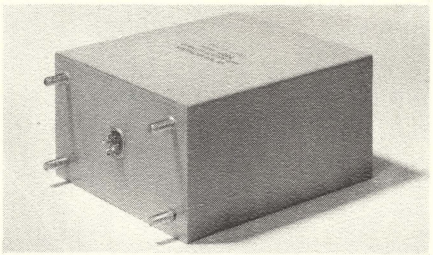
CODING DELAY LINES



MODEL	DELAY in μ secs	RISE TIME in μ secs	IMPEDANCE in ohms	ATT in db	CASE SIZE
D110	24.65	.45	180	6	8 x 4 x 2-1/2
D220	25.3	.70	470	3	4 x 4-1/2 x 1-1/4
D180	25.3	.55	2200	3	4-3/8 x 3-1/4 x 2-1/8
D203	20.3	.35	470	3	10 x 2-1/2 x 2-1/4
D170	20.3	.60	510	3	4 x 2 x 1
D231	20.3	.50	2200	2	4 x 3 x 2

Coding Lines, primarily designed for use in transponders for aircraft identification, are compact, ruggedized, multi-tapped lumped constant delay lines. Although the number and spacing of taps can be modified to meet the requirements of any system, the usual spacing is 1.45 μ secs held to a tolerance of ± .05 μs at 25°C, with an additional ± .05 us over the temperature range -55°C to +85° C (maximum temperature 130°C). For the more critical requirement, the tolerance can be reduced to approximately ± .03 us at room temperature. These delay lines are supplied with delay to rise time ratios of up to 100, and with impedances from 50 to 5000 ohms. The attenuation for air core lines is usually around 6 db. while for iron core approximately 3 db. The attenuation, rise time and delay characteristics are normally measured with a pulse input width of between .5 and 1.0 μs. The lines are capable of operating with any pulse voltage up to 100 volts.

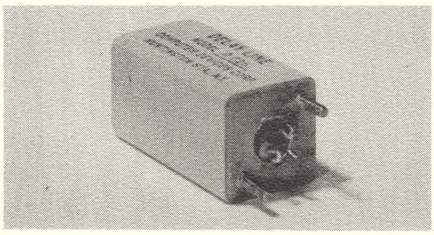
STANDARD DELAY LINES



MODEL	DELAY in μ secs	RISE TIME in μ secs	IMPEDANCE in ohms	ATT in db	CASE SIZE
D260	.05	125 mc	50	.5	4 x 4 x 1
D101	.20	.016	100	1	2 x 2 x 1/2
D121	15.0	.25	1000	2	2-1/4 x 3-3/4 x 4-1/4
D136	200.0	6.0	10000	6	2-1/2 x 3 x 3
D148	10.0	.3	1000	3	2-1/8 x 2-1/8 x 4
D167	1.0	.2	50	2	1-5/16 x 1-5/16 x 3
D214	1000.0	40.0	600	3	15 x 9 x 5

Lumped Constant Delay Lines with delays from 25 nanoseconds to .1 seconds, impedances from 25 to 20,000 ohms and delay to rise time ratios up to 100 are manufactured as standard items by CDC. The following characteristics are for all standard lines: delay tolerances ± 3% ± .01us, impedance ±10%, temperature stability 50 PPM/C°, distortion 10%, attenuation less than .15 x delay to rise time and operating temperature range -55°C to 125°C. These characteristics are indicative of those met at nominal cost. Higher tolerances can be supplied at a slight increase in price. The size of any delay line depends upon the delay, rise time, impedance, and number of taps. But, as a practical guide, the volume for any line up to 100 us is .75 (delay/rise time) cubic inches. This size can be reduced for compact lines or increased for lower cost commercial devices. All lumped lines are hermetically sealed in a metal case or cast in a filled epoxy resin.

MINIATURE DELAY LINES



MODEL	DELAY in μ secs	RISE TIME in μ secs	IMPEDANCE in ohms	ATT in db	CASE SIZE
D277	15.0	.9	500	2.0	5-1/8 x 1 x 1/2
D286	.5	.05	1000	1.0	3-1/2 x 1/2 x 1/2
D226	12.0	1.0	1000	2.0	1-3/4 x 1 x 1
D154	.5	.1	300	.75	1 x 2 x 3/8
D117	1.37	.1	500	1.5	4 x 1-1/4 x 3/8
D129	2.4	.15	300	1.0	5 x 1-1/2 x 3/8

Miniature Lumped Constant Lines are generally cast in a filled epoxy resin capable of withstanding the environmental requirements of missiles and other electronic equipment. This method of sealing makes this series ideally suited for printed circuit and computer applications. The delay lines in this series can be tapped as required and are often supplied with taps every section. Printed circuit leads can be supplied for plug-in applications. The general characteristics of the standard lumped constant series can also be applied to the miniature group.

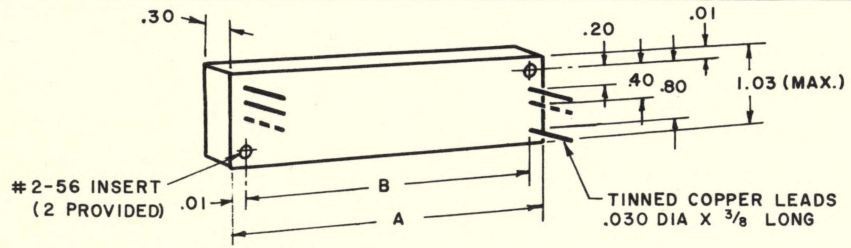
The above is only a partial listing and is typical of the results that can be expected. Generally, lumped constant delay lines are custom made. The delay time, tap spacing, impedance, rise time, distortion, and attenuation are tailored to meet the specific customer's requirement. All CDC delay lines are manufactured to meet the rigid MIL Specs for ship, land, aircraft, and missile equipment.

CDC welcomes the opportunity to serve you - to assist in specifying and solving your delay line problems. We offer prompt response to your inquiries - rapid delivery of samples, usually two to three weeks - and quality assured production units.

COMPUTER DEVICES CORP.

TEL: AR 1-0666

6 WEST 18 STREET HUNTINGTON STATION, N.Y.



GENERAL SPECIFICATIONS:

1. DELAY TOLERANCE: ±5%
2. TEMP. COEFFICIENT: 50 PPM
3. CONSTRUCTION: HERMETICALLY SEALED METAL CASE, GRAY LACQUER FINISH.
4. MILITARY SPECS: DESIGNED TO MEET ALL APPLICABLE MILITARY SPECIFICATIONS FOR WORKMANSHIP AND ENVIRONMENTAL COND'S.

NOTES:

1. MODULES OF 4.35 μSEC ARE TAPPED AT 1.45 AND 2.90 μSEC.
2. DESIGNED FOR CASCADING IN SERIES TO OBTAIN LONGER DELAYS AND WITH THE V447 (VARIABLE) TO OBTAIN A TRIMABLE DELAY.

CASE SIZE NO. 1 (A = 1.25 B = 1.00)

PART NO.	DELAY	T_R	IMPED.	ATTEN.	TAP.
D647-110	50 nSEC	12 nSEC	50 Ω	1 db	NONE
-111	100	25			
-112	250	62			
-113	500	125			
-114	750	187			
-115	1.00 μSEC	.25 μSEC			
-116	1.45	.36			
-117	2.90	.72		2 db	1.45 μS
-118	4.35	1.10		3 db	NOTE 1
D647-120	50 nSEC	12 nSEC	150 Ω	½ db	NONE
-121	100	25			
-122	250	62			
-123	500	125			
-124	750	187			
-125	1.00 μSEC	.25 μSEC			
-126	1.45	.36		1 db	
-127	2.90	.72		1½ db	1.45 μS
-128	4.35	1.10		2 db	NOTE 1
D647-130	50 nSEC	12 nSEC	500 Ω	½ db	NONE
-131	100	25			
-132	250	62			
-133	500	125			
-134	750	187			
-135	1.00 μSEC	.25 μSEC			
-136	1.45	.36		1 db	
-137	2.90	.72		1½ db	1.45 μS
-138	4.35	1.10		2 db	NOTE 1

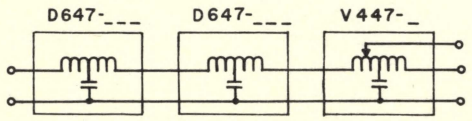
CASE SIZE NO. 2 (A = 2.20 B = 2.00)

PART NO.	DELAY	T_R	IMPED.	ATTEN.	TAP
D647-210	50 nSEC	6.2 nS	50 Ω	1 db	NONE
-211	100	12.5			
-212	250	31.1			
-213	500	62			
-214	750	94			
-215	1.00 μSEC	.12 μSEC			
-216	1.45	.18			
-217	2.90	.36		2 db	1.45 μS
-218	4.35	.54		3 db	NOTE 1
D647-220	50 nSEC	6.2 nS	150 Ω	½ db	NONE
-221	100	12.5			
-222	250	31.1			
-223	500	62			
-224	750	94			
-225	1.00 μSEC	.12 μS			
-226	1.45	.18		1 db	
-227	2.90	.36		1½ db	1.45 μS
-228	4.35	.54		2 db	NOTE 1
D647-230	50 nSEC	6.2 nS	500 Ω	½ db	NONE
-231	100	12.5			
-232	250	31.1			
-233	500	62			
-234	750	94			
-235	1.00 μSEC	.12 μS			
-236	1.45	.18		1 db	
-237	2.90	.36		1½ db	1.45 μS
-238	4.35	.54		2 db	NOTE 1

CASE SIZE NO. 3 (A = 3.45 B = 3.20)

PART NO.	DELAY	T_R	IMPED.	ATTEN.	TAP.
D647-310	50 nSEC	4.2 nS	50 Ω	1 db	NONE
-311	100	8.3			
-312	250	21			
-313	500	42			
-314	750	63			
-315	1.00 μSEC	.08 μSEC			
-316	1.45	.12			
-317	2.90	.24		2 db	1.45 μS
-318	4.35	.36		3 db	NOTE 1
D647-320	50 nSEC	4.2 nS	150 Ω	½ db	NONE
-321	100	8.3			
-322	250	21			
-323	500	42			
-324	750	63			
-325	1.00 μSEC	.08 μS			
-326	1.45	.12		1 db	
-327	2.90	.24		1½ db	1.45 μS
-328	4.35	.36		2 db	NOTE 1
D647-330	50 nSEC	4.2 nS	500 Ω	½ db	NONE
-331	100	8.3			
-332	250	21			
-333	500	42			
-334	750	63			
-335	1.00 μSEC	.08 μS			
-336	1.45	.12		1 db	
-337	2.90	.24		1½ db	1.45 μS
-338	4.35	.36		2 db	NOTE 1

CASE SIZE NO. 1 (A = 1.25 B = 1.00)
CASE SIZE NO. 2 (A = 2.20 B = 2.00)
CASE SIZE NO. 3 (A = 3.45 B = 3.20)



TYPICAL CASCADED GROUP
(WITH V447 TRIM DELAY)

RISE TIME: TO CALCULATE RISE TIME FOR GROUPS CASCADED IN SERIES, USE THE FOLLOWING FORMULA:

$$T_R = \frac{D}{100} + T_{RM}$$

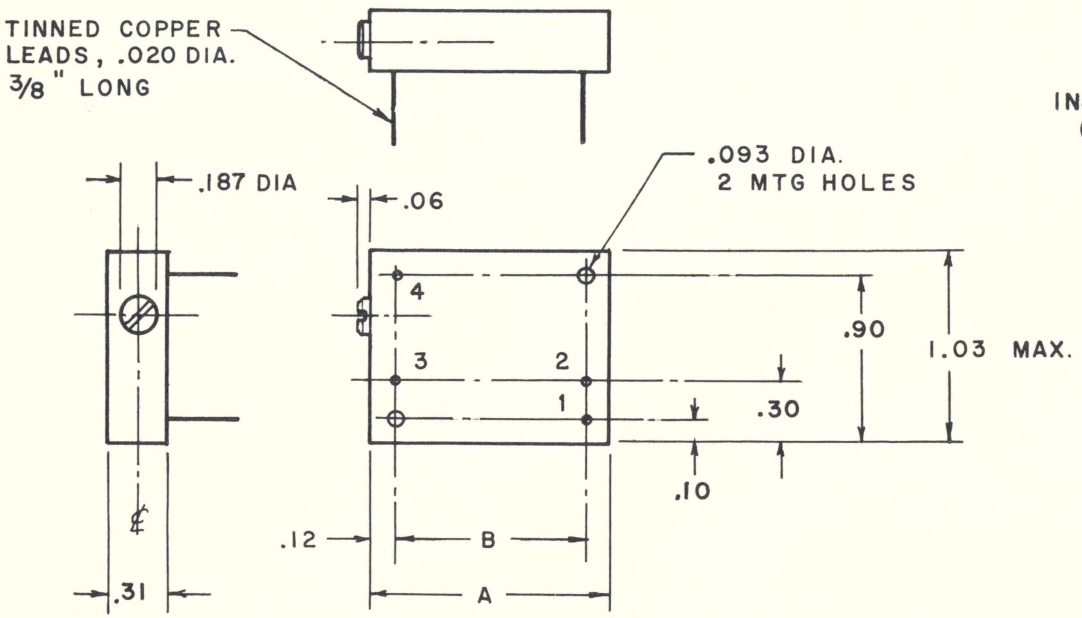
WHERE T_R IS THE RISE TIME FOR THE GROUP, T_{RM} IS THE RISE TIME OF THE MODULE WITH THE HIGHEST RISE TIME OF THOSE USED.

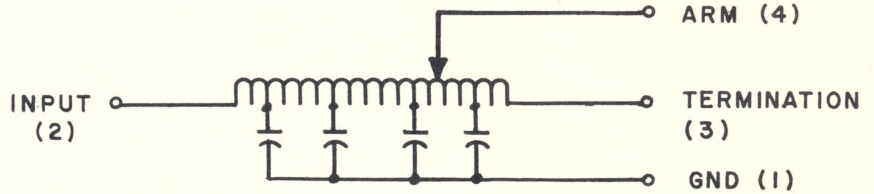
DELAY LINE, ULTRAMINIATURE, FIXED. SERIES D647

COMPUTER DEVICES CORP.
6 WEST 18th ST.
HUNTINGTON STA., N.Y.

SCALE	NONE	DWN	NK 4/6/64
APPVD	E.S.W.	CHKD	K. Dunn

A SIZE | 64701 DWG. NO. | REV.





CIRCUIT DIAGRAM

GENERAL SPECIFICATIONS

TEMP. COEFF:	50 PPM
CONSTRUCTION:	HERMETICALLY SEALED METAL CASE WITH GRAY LACQUER FINISH.
CONTROL:	DELAY IS SET BY MULTI-TURN SCREW DRIVER CONTROL. .125 DIA. SHAFT FOR KNOB APPLICATION PROVIDED ON SPECIAL ORDER
MIL SPECS:	DESIGNED TO MEET ALL APPLICABLE MILITARY SPECIFICATIONS FOR WORKMANSHIP AND ENVIRONMENTAL CONDITIONS.

TABLE OF ELECTRICAL SPECIFICATIONS
(AND CORRESPONDING DIMENSIONS)

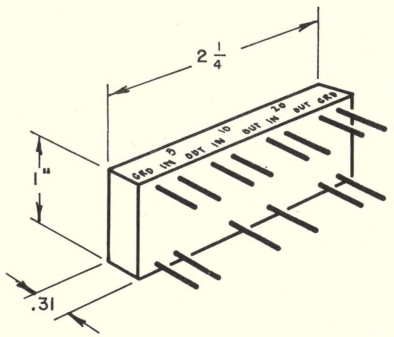
MODEL	V447 -1	V447 -2	V447 -3	V447 -4	V447 -5	V447 -6
DELAY RANGE NANOSECONDS	0 TO 55	0 TO 100	0 TO 150	0 TO 250	0 TO 300	0 TO 500
RISE TIME NANOSEC AT MAX. DELAY	15	30	25	30	30	60
IMPEDANCE OHMS	150	50	150	50	150	50
ATTENUATION DB MAX.	1	1	1	1.5	1.5	2
RESOLUTION	1/110	1/150	1/250	1/250	1/500	1/500
LENGTH (A)	1.25	1.25	2.45	2.45	3.45	3.45
MTG DIM. (B)	1.00	1.00	2.20	2.20	3.20	3.20

DELAY LINE, ULTRAMINIATURE VARIABLE

MODEL V447

COMPUTER DEVICES CORP.
6 WEST 18 TH ST.
HUNTINGTON STA., N.Y.

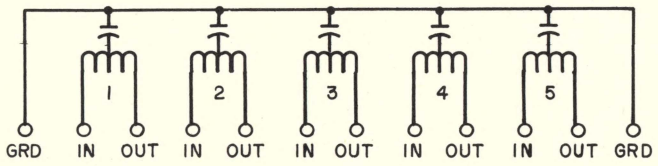
SCALE	DWN	A	44701	
FULL	N.K. 3/4/63	SIZE	DWG. NO.	REV.
APPVD E.W.	CHKD Ken Dunne			



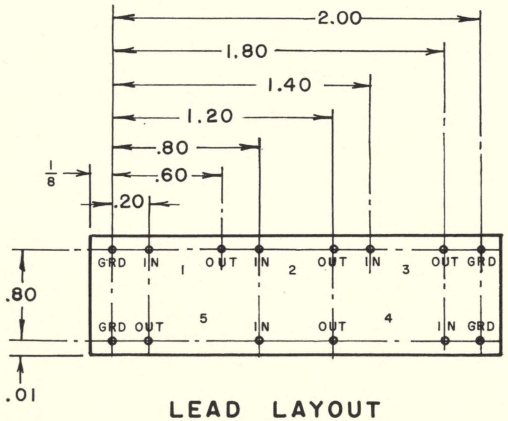
MODELS:
D740
D741
D742
D743

MULTIPLE SECTION DELAY LINES

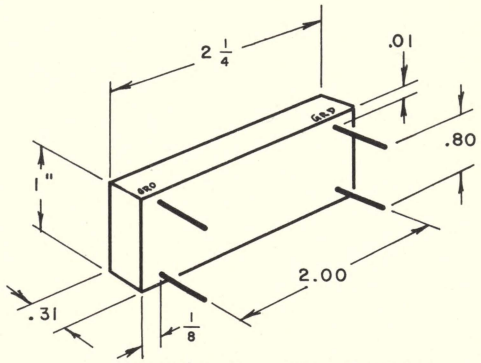
TIME DELAY (PER SECTION) NANOSECONDS					TOTAL TIME DELAY (WITH ALL SECTIONS CONNECTED IN SERIES)	RISE TIME NANOSECS	IMPEDANCE	
1	2	3	4	5			93 Ω MODEL NO.	330 Ω MODEL NO.
5	10	20	30	40	105 NANOSECONDS	15 *	D740	D741
50	100	200	300	400	1050 NANOSECONDS	150 *	D742	D743



SCHEMATIC DIAGRAM



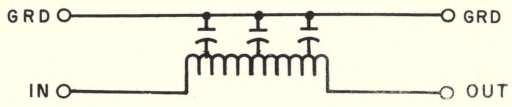
LEAD LAYOUT



MODELS:
D744
D745
D746
D747

SINGLE SECTION DELAY LINES

TIME DELAY NANOSECONDS	RISE TIME NANOSECS	IMPEDANCE	
		93 Ω MODEL NO.	330 Ω MODEL NO.
100	15 *	D744	D745
1000	150 *	D746	D747



SCHEMATIC DIAGRAM

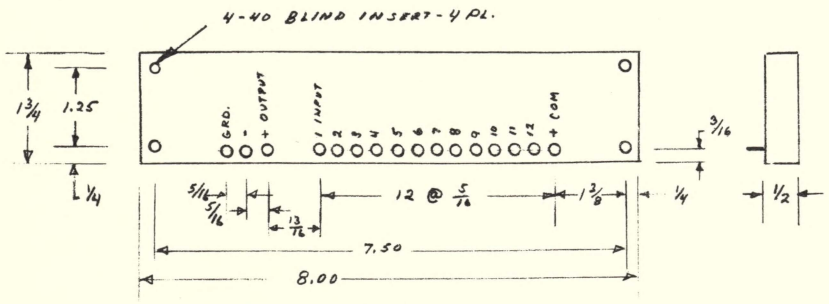
NOTES:

1. RISE TIME, WHEN SEVERAL MODULES ARE CASCADED IN SERIES, CAN BE DETERMINED BY THE FOLLOWING FORMULA: $T_R = \frac{D}{100} + T_{RM}*$. WHERE T_R IS THE RISE TIME OF THE COMBINATION OF MODULES IN MICROSECONDS, $T_{RM}*$ IS THE RISE TIME OF A SINGLE MODULE AS INDICATED. WHEN MODULE TYPES ARE MIXED, USE HIGHER $T_{RM}*$.
2. ATTENUATION = 1/2 DB PER MODULE.
3. DELAY ACCURACY IS BETTER THAN 5%.
4. RIPPLE IS LESS THAN 5%.
5. TERMINALS ARE .025 DIA. DUMET (GOLD PLATED) LEADS, 1/2 LONG.
6. TEMPERATURE COEFFICIENT IS .05% OF TOTAL DELAY PER °C OVER THE TEMPERATURE RANGE OF −60°C TO +125°C.
7. UNITS ARE ENCAPSULATED IN EPOXY RESIN AND HAVE BLACK FINISH.

DELAY LINES, NANOSECOND "DO-IT-YOURSELF"
D740 THRU D747
(LUMPED CONSTANT)

COMPUTER DEVICES CORP.
6 WEST 18th ST
HUNTINGTON STA., N.Y.

SCALE	NONE	DWN	N.K 2/24/64	A	74001	
APPVD	E.W.	CHKD		SIZE	DWG NO.	REV.



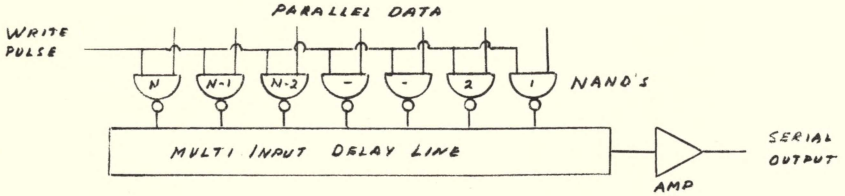


FIG. 1 FUNCTIONAL DIAGRAM

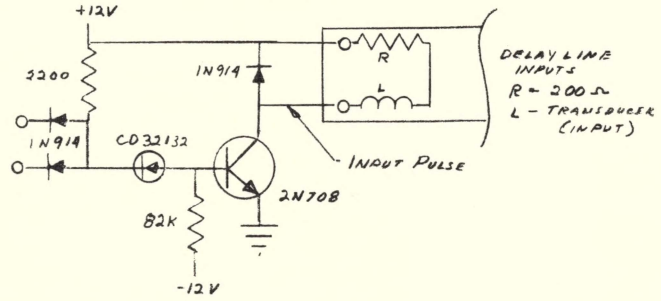


FIG. 2 APPLICATION CIRCUIT (NAND)

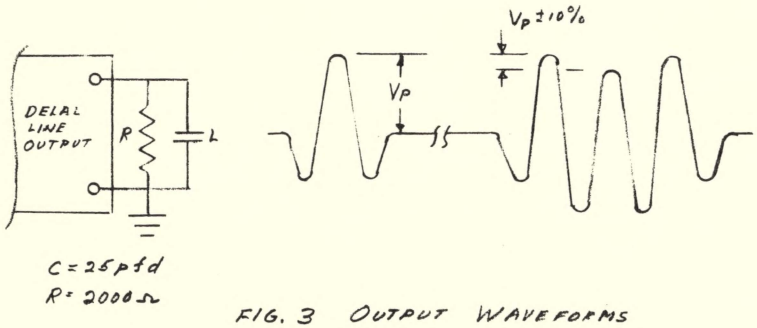


FIG. 3 OUTPUT WAVEFORMS

CODE GENERATOR

Delay Line Model DM718 is representative of a series of multi-tapped Magnetostrictive Delay Lines that are intended for use as word generators, serial to parallel or parallel to serial converters in digital computers or as recognition code train generators in radar systems. A wide choice of tap spacings and number of taps is available with tap spacings from .2 usec to several hundred microseconds being readily achievable. As many as 16 taps at a spacing of 1 usec are provided in the same case size as that of the DM718.

Electronic circuits to restore the signals to input logic level and to match system requirements are also supplied.

Specifications for Delay Line Model DM718

1.0 General Description

Delay Line Model DM718 is a 12 input Magnetostrictive Delay Line intended as a real time parallel to serial converter. Ref. Fig. 1.

2.0 Electrical Specifications

2.1	Input Ref. Fig. 2	
2.2	Input pulse width:	0.40 ±0.05 usec.
2.3	Input rise and fall time:	0.05 usec Max.
2.4	Output Ref. Fig. 3	
2.5	Output amplitude (V_p)	20 mv Min.
2.6	Signal/Noise Ratio:	5:1 Min.
2.7	Amplitude variation:	± 10% Max.
2.8	Crosstalk between inputs and outputs:	Less than 1 to 8

3.0 Delay Specifications:

3.1	Tap Spacing (at 25°C):	1.25 usec ±.05 usec
3.2	Tap #1 to Output	1.75 usec ±.25 usec
3.3	Number of Input taps	12

4.0 Environmental

4.1	Operating Temperature Range:	0 to 50°C
4.2	Storage Temperature Range	-55 to +85°C
4.3	Applicable Mil. specifications	Mil. Std. 202B
4.3.1	Method 102A	Test Condition D
.2	Method 103A	Test Condition B
.3	Method 201A	
.4	Method 202A	50 g 1 blow

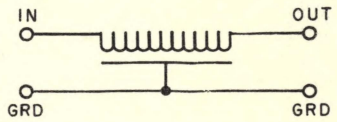
5.0 Construction and Marking

5.1	Construction	Solder sealed steel case
5.2	Weight	8 oz.
5.3	All taps shall have a common return	

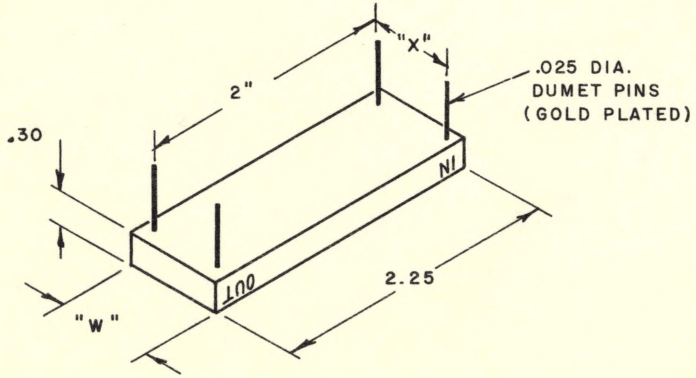
COMPUTER DEVICES CORP. 6 WEST 18 STREET HUNTINGTON STA., NEW YORK	CODE GENERATOR Delay Line Model DM718	MAT.	DATE
		DWG	REV.

OGILVIE PRESS, INC., BROOKLYN 17, N. Y. STOCK NO. 150 14672

CASE SIZE	DELAY NANOSECONDS	RISE TIME NANOSECONDS	IMPEDANCE = 93Ω (PART NUMBER)	IMPEDANCE = 330Ω (PART NUMBER)	IMPEDANCE = 500Ω (PART NUMBER)	IMPEDANCE = 1000Ω (PART NUMBER)
"W" = .50" "X" = .20"	5	1.0	DD680 - 110	DD680 - 120	DD680 - 130	DD680 - 140
	10	2.0	- 111	- 121	- 131	- 141
	20	4.0	- 112	- 122	- 132	- 142
	30	6.0	- 113	- 123	- 133	- 143
	40	8.0	- 114	- 124	- 134	- 144
	50	10.0	- 115	- 125	- 135	- 145
	60	12.0	- 116	- 126	- 136	- 146
	70	14.0	- 117	- 127	- 137	- 147
	80	16.0	- 118	- 128	- 138	- 148
	90	18.0	- 119	- 129	- 139	- 149
	100	20.0	- 11X	- 12X	- 13X	- 14X
"W" = 1.00" "X" = .80"	5	0.5	DD680 - 210	DD680 - 220	DD680 - 230	DD680 - 240
	10	1.0	- 211	- 221	- 231	- 241
	20	2.0	- 212	- 222	- 232	- 242
	30	3.0	- 213	- 223	- 233	- 243
	40	4.0	- 214	- 224	- 234	- 244
	50	5.0	- 215	- 225	- 235	- 245
	60	6.0	- 216	- 226	- 236	- 246
	70	7.0	- 217	- 227	- 237	- 247
	80	8.0	- 218	- 228	- 238	- 248
	90	9.0	- 219	- 229	- 239	- 249
	100	10.0	- 21X	- 22X	- 23X	- 24X



NOTE: FOR SIMILAR TYPE DELAY LINE WITH DELAY IN MICRO-SECONDS, SEE DWG. A67901.



GENERAL SPECIFICATIONS:

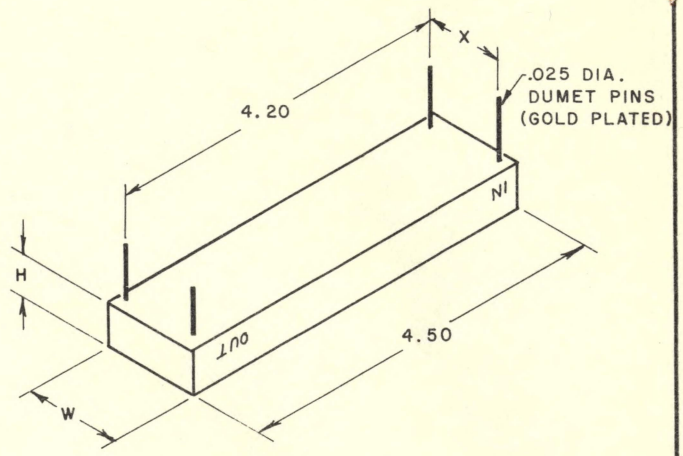
DELAY TOLERANCE: ±5%
ATTENUATION: LESS THAN ½ DB PER 100 NANOSECONDS
RIPPLE: 10% MAXIMUM.
IMPEDANCE TOLERANCE: ± 10%
TEMPERATURE COEFFICIENT: 100 TO 150 PPM/°C
TEMPERATURE RANGE: −50°C TO +125°C
PRINTED CIRCUIT TYPE, LEAD MOUNTING, EPOXY CASE
MEETS APPLICABLE MILITARY SPECIFICATIONS

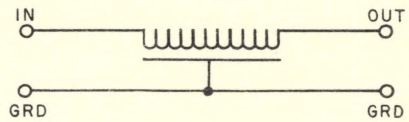
DELAY LINE, NANOSECOND, MODULE
SERIES DD680
(DISTRIBUTED CONSTANT)

COMPUTER DEVICES CORP.
6 WEST 18th ST.
HUNTINGTON STA., N. Y.

SCALE	DWN	SIZE	DWG. NO.	REV.
NONE	NK 2/24/64	A	68001	
APPVD E.W.	CHKD Ken Drumm			

CASE SIZE	DELAY MICROSECONDS	RISE TIME MICROSECONDS	IMPEDANCE 330Ω (MODEL NO.)	IMPEDANCE 500Ω (MODEL NO.)	IMPEDANCE 1000Ω (MODEL NO.)	IMPEDANCE 3900Ω (MODEL NO.)
H = .37 W = .50 X = .20	0.1	.02	DD679-111	DD679-121	DD679-131	
	0.2	.04	-112	-122	-132	
	0.3	.06	-113	-123	-133	
	0.4	.08	-114	-124	-134	
	0.5	.10	-115	-125	-135	
	0.6	.12	-116	-126	-136	
	0.7	.14	-117	-127	-137	
	0.8	.16	-118	-128	-138	
	0.9	.18	-119	-129	-139	
	1.0	.20	-11X	-12X	-13X	
H = .50 W = .50 X = .20	2.0	.4		DD679-222	DD679-232	DD679-242
	4.0	.8		-224	-234	-244
	5.0	1.0		-225	-235	-245
	10.0	2.0		-22X	-23X	-24X
H = .37 W = 1.00 X = .80	0.1	.01	DD679-311	DD679-321	DD679-331	
	0.2	.02	-312	-322	-332	
	0.3	.03	-313	-323	-333	
	0.4	.04	-314	-324	-334	
	0.5	.05	-315	-325	-335	
	0.6	.06	-316	-326	-336	
	0.7	.07	-317	-327	-337	
	0.8	.08	-318	-328	-338	
	0.9	.09	-319	-329	-339	
	1.0	0.1	-31X	-32X	-33X	
H = .50 W = 1.00 X = .80	2.0	0.2		DD679-422	DD679-432	DD679-442
	4.0	0.4		-424	-434	-444
	5.0	0.5		-425	-435	-445
	10.0	1.0		-42X	-43X	-44X





NOTE: FOR SIMILAR TYPE DELAY LINE WITH DELAY IN NANOSECONDS, SEE DWG A68001.

GENERAL SPECIFICATIONS:

DELAY TOLERANCE: ±5%
ATTENUATION: LESS THAN ½ DB PER MICROSECOND
RIPPLE: 10% MAXIMUM
IMPEDANCE TOLERANCE: ±10%
TEMPERATURE COEFFICIENT: 100 TO 150 PPM/°C
TEMPERATURE RANGE: −50°C TO +125°C
PRINTED CIRCUIT TYPE, LEAD MOUNTING, EPOXY CASE
MEETS APPLICABLE MILITARY SPECIFICATIONS

DELAY LINE, MICROSECOND, MODULE
SERIES DD679
(DISTRIBUTED CONSTANT)

COMPUTER DEVICES CORP.
6 WEST 18th ST.
HUNTINGTON STA., N.Y.

SCALE	DWN	A	67901	
NONE	N.K. 4/13/64	SIZE	DWG NO.	REV.
APPVD E.W.	CHKD Ken Bunnell			