SONILINE* SERIES

*Sonic Delay Line

COMPUTER CONTROL COMPANY, INC.

FRAMINGHAM, MASS. LOS ANGELES, CALIF.

What is SONILINE?

SONILINE* — 3C's new name for *Sonic Delay Line* — is a *passive electromechanical device* having no moving parts which is capable of *delaying an electrical signal* for a specified time. Typical applications include *information storage, radar target cancellation, generation of precise timing pulses, signal compression or expansion,* etc.

SONILINES PROVIDE:

. . . reduction of wave velocity by a factor of 10^5
. . . delays from 2 μsec to 10,000 μsec
. . . delay-to-rise-time ratio as great as 30,000 to 1
. . . small size and weight
. . . crystal-like stability
. . . ruggedness and reliability

SONILINES, in effect, reduce the velocity of an electrical wave by *converting it into a sound wave* and then *reconverting it back into its electrical form.* Figures 1A and 1B (below) illustrate the principles employed in the *two* basic types of SONILINES. The simplest SONILINE (Figure 1A) consists of an *input transducer coil with magnetostrictive core* attached to a wire sonic wave guide. The far end of the sonic wave guide is attached to an output transducer. At the input transducer, flux change in the coil *creates a mechanical stress* in the magnetostrictive core which travels down the delay line *as a sound wave.* When the wave reaches the output transducer, *it alters the permeability of the magnetostrictive core* which is *polarized* by the permanent magnet. The resulting flux change *induces an electrical signal* in the output coil. Acoustic absorbers at each end of the SONILINE *prevent* signal wave reflections.

The SONILINE shown in Figure 1A makes use of longitudinal sound waves; i.e., *waves in which particle motion is in the same direction as wave motion.* It is useful in *low to medium delay bandwidth* applications and can be readily tapped. The arrangement shown in Figure 1B provides maximum delay bandwidth. It consists of the usual sonic wave guide and transducers. This time, the transducers are *joined to the wave guide at right angles* and are connected so that they produce and respond to a torsion wave in the wire. The torsion wave travels with negligible distortion down the wave guide and *requires about 40% less wire* for a given delay.

**Trademark applied for.*

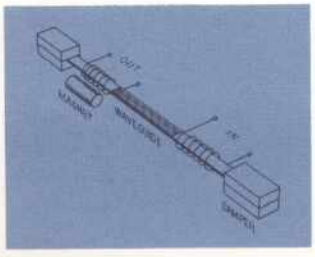


Figure 1A

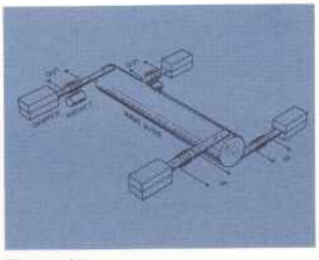


Figure 1B

ADVANTAGES OF SONILINE

3C SONILINES are characterized by:

Reliability: No moving parts — operation is based only on reversible processes — stainless steel construction — all materials are conservatively utilized!

Stability: Critical elements are aged to assure negligible long-term drift!

Low-Cost: SONILINES offer component cost-per-bit as small as pennies! In radar applications, SONILINES can often replace quartz delay lines costing five to ten times more! Further, SONILINES do not require temperature control ovens or troublesome carrier signal circuitry!

Size and Weight: SONILINES generally weigh a fraction of a pound and occupy only a few cubic inches! 3C SONILINE Memories provide storage densities as high as 400 bits per cubic inch!

PARAMETER RANGES OF SONILINE

3C is organized to design and produce SONILINES to exact customer-provided specifications! The following parameter ranges are within 3C's current capabilities:

Delay Range: 2 - 10,000 microseconds

Frequency Range:

Pulse Width (microseconds)	Rep. Rate (megacycles)	Delay (microseconds)
1.0 - 2.0	0 - 0.5	2 - 10,000
0.5 - 2.0	0 - 1	2 - 6,000
0.25 - 0.5	0 - 2	2 - 30

Delay Stability: As low as 0.5 PPM/°C drift over an operating range of 0 - 60°C. Standard delay coefficient is 0 ±10 PPM/°C.

Special Capabilities: Taps can be provided on most models. The arrangement of Figure 1A permits many taps which do not interact or attenuate the signal. Torsional mode SONILINES may be tapped but at the expense of 3db attenuation per tap.

Special **MIL SPEC** packaging can be provided on special order. **MIL SPEC** SONILINES are specially sealed to provide **salt-spray, humidity,** and **water immunity;** construction is designed to withstand **shock** and **vibration.**

3C SONILINES can be manufactured to fit into custom-shaped packages; for example, **doughnut, round, etc. Terminals, mounting arrangement,** and **finish** can be provided to order.

3C has wide experience in the design of input-output amplifiers and logic circuitry both internal and external to the SONILINE package and will gladly design such circuitry to customer specification.

APPLICATIONS OF SONILINE

1. Digital Memory

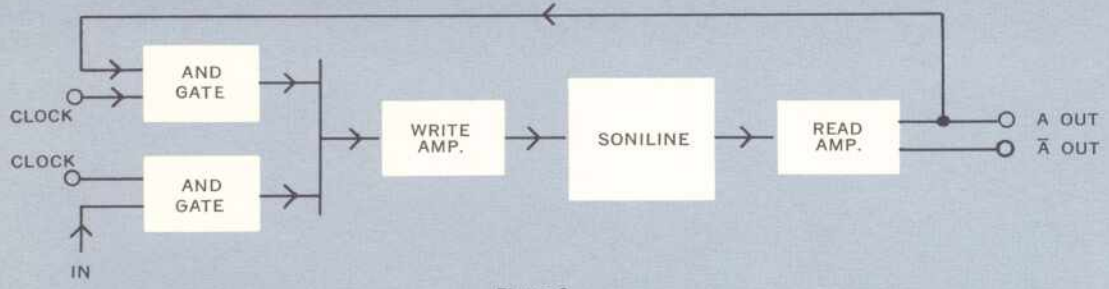


Figure 2

A SONILINE *Digital Memory* is shown in Figure 2. Information is read serially into the delay line from an outside source, e.g., *a shift register*. It is stored in the form of moving sound patterns along the delay element. When the information emerges, it is retimed to the system clock and recirculated.

SONILINE memories are capable of storing *as many as 10,000 bits per memory stage* at bit rates up to 2 mc.

TYPICAL SPECIFICATIONS

Storage Capacity: 4000 bits
Access time: 2.0 ms
Information rate: 2.0 mc max.
Stability: ± 0.1 μs from 0°C to 40°C
Adjustment: ± 2 μs
Input drive: 50 ma
Output level: 15 mv into 4 kΩ
Size: 4½" x 5½" x ¾"

2. Moving Target Indicator

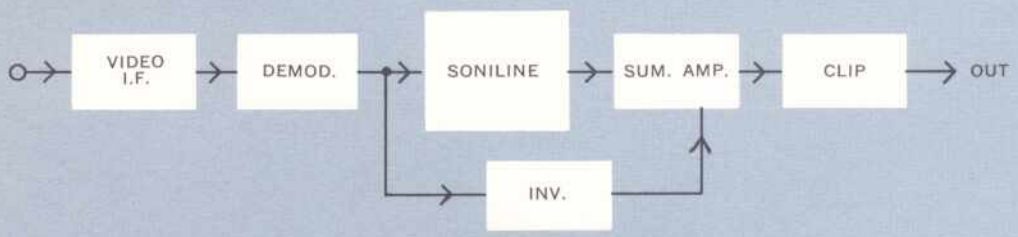
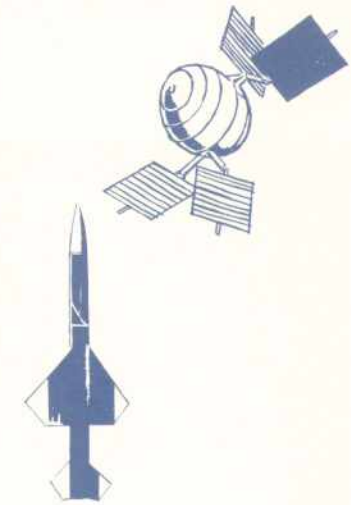


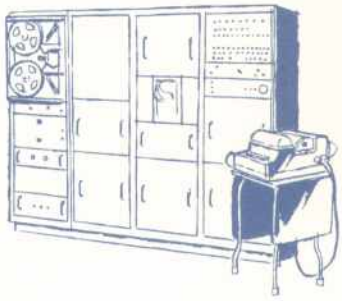
Figure 3

A *Moving Target Indicator* (MTI) is used in radar to remove stationary object "clutter" from radar display of moving objects. The block diagram (Figure 3) shows a typical MTI arrangement using a SONILINE. The radar video signal is demodulated and divided into two paths. Part of the signal is stored in a SONILINE for a time equal to the radar pulse period. The other part of the signal is inverted and sent directly to a summation amplifier. In the amplifier, the direct signal is added to the previous scan. Only signals which do not coincide in time on adjacent scans will leave the amplifier. All other signals will cancel. A clipper following the amplifier removes the moving signal from the previous scan, because it already has been displayed as a result of the previous scan comparison. Unlike quartz delay lines, SONILINES do not require carrier modulation.

TYPICAL SPECIFICATIONS

Delay: 450 μs
Pulse Width: 1.0 μs
Signal to Noise Ratio: 20:1
Adjustment: ± 2 μs
Stability: 1 PPM/°C
Input Drive: 50 ma
Output level: 50 mv into 4 KΩ
Size: 4⅜" x 4⅞" x 7/16"





INFORMATION FROM YOU:

To assist us in providing you with the best possible quotation, the following type of information is requested:

1. Nature of application (if **disclosable —(to aid us in serving you)**.
   - a. Memory _____
   - b. Timing _____
   - c. Correlation _____
   - d. Signal Compression/Expansion _____
   - e. Other _____
2. Approximate delay length or access time: _____
3. Pulse width or maximum information rate: _____
4. Operating temperature range: _____
5. Other environmental requirements (if any): _____
6. Special requirements (**taps, special packaging, associated electronics, etc.**): _____
7. Quantity required: _____
8. When needed. _____

To communicate with 3C

	Eastern Division	Western Division
Mail:	**983 Concord Street Framingham, Mass.**	**2251 Barry Avenue Los Angeles, Calif.**
Telephone:	**CEdar 5-6220 (Boston) TRinity 5-6185 (Fram.)**	**GRanite 8-0481 BRadshaw 2-9135**
TWX:	**FRAM MASS 17**	**W LA CAL 6634**

Western Union: *Direct telegram printer communications with Western Union are maintained for prompt handling of messages.*

Cable Address: **Compcon, Framingham, Mass., U.S.A.**

Shipments

Except when specified otherwise, shipments are generally made as follows:

(a) Under 20 pounds — Parcel Post

(b) 20 to 75 pounds — Railway Express

(c) Over 75 pounds — Truck or Carloading Company

For expedited service we will gladly ship by Air Freight, Air Express, Air Parcel Post, etc., as requested.

Standard warranty

a) Computer Control Co., Inc., warrants all 3C products against defects in workmanship, materials, and construction under normal use and service for a period of ONE YEAR from the date of purchase except that liability for defective vacuum tubes, transistors, and germanium diodes shall conform and be limited to the obligations of the original manufacturer's warranties covering these components.

b) This warranty does not extend to any of our products which have been subjected to misuse, neglect, accident, or improper installation or application. Nor shall it extend to products which have been repaired or altered outside of our factory.

c) For service under this warranty, please advise the factory promptly of all pertinent details. Transportation charges covering return of defective products to our factory shall be at our expense if such products are determined to be defective within the limitations of this warranty. Computer Control Co., Inc. will repair or replace the defective product in accordance with its own best judgment.

d) Computer Control Co., Inc. requests immediate notification for any claims arising from damage in transit in order to determine if carrier responsibility exists.

3C COMPUTER CONTROL COMPANY, INC.

EASTERN DIVISION: 983 Concord Street Framingham, Mass.
WESTERN DIVISION: 2251 Barry Avenue Los Angeles, Calif.

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COMPUTER CONTROL COMPANY, INC.

FRAMINGHAM, MASS.
LOS ANGELES, CALIF.

STANDARD SONILINE* SERIES S66

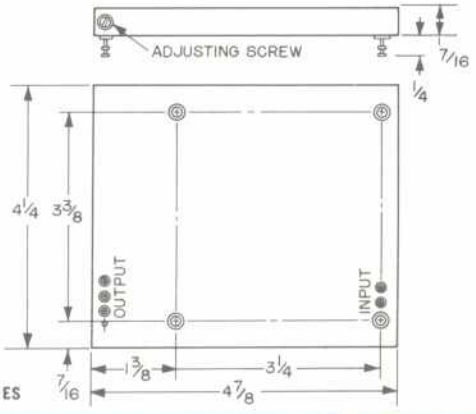
COMPUTER CONTROL COMPANY, INC. (3C) is pleased to announce a new, standard line of *SONILINE* models — the *S66 Series!*

Designed for maximum *reliability* and *utility*, the new *S66 SONILINE Series* are distinguished by top quality construction and precise operating performances — the specific result of 3C's rigid quality control and manufacturing procedures!

Now available for immediate use, the *S66 SONILINE Series* may be used with confidence in a wide range of applications — *information storage, signal compression or expansion, radar target cancellation, precise timing pulse generation, etc.* — or wherever an outstanding technical performance is a positive requirement!

Make a selection to fit your application from the standard *S66 SONILINE* models described below and be assured of small quantity delivery *within 30 days!*

AVAILABLE FOR IMMEDIATE USE!!



S66 STANDARD SONILINE SERIES

*SONILINE — 3C's name for *Sonic Delay Line*—is a passive electromechanical device having no moving parts which is capable of delaying an electrical signal for a specified time.

S66 SONILINE MODEL DESIGNATIONS	S66 SONILINE MODEL DELAY RANGE
S66A-20 to S66A-100	20μsec to 100μsec (20 — 100 binary bits)
S66B-101 to S66B-500	101μsec to 500μsec (101 — 500 binary bits)
S66C-501 to S66C-1000	501μsec to 1000μsec (501 — 1000 binary bits)
S66D-1001 to S66D-1500	1001μsec to 1500μsec (1001 — 1500 binary bits)

HOW TO ORDER . . .

To order S66 SONILINE models, please use the following procedure:

1. Example application: Need to store 573 binary bits . . .
   You would order: **Soniline Model No. S66C-573**
2. Example application: Need 1237.8 μsec delay . . .
   You would order: **Soniline Model No. S66D-1237.8**

PRICES:
On request

DELIVERY:
30 days or as quoted for large quantities

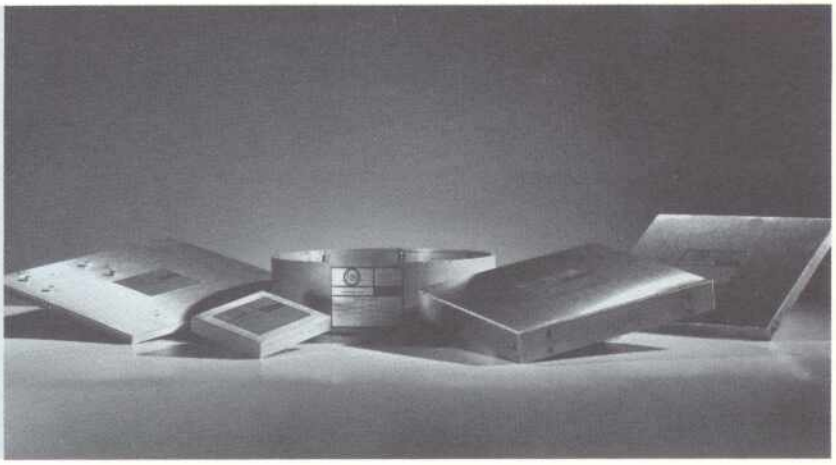
(Please see reverse side for complete S66 Soniline specifications)

SPECIAL SONILINE MODELS

For more highly specialized applications, 3C designs and manufactures *special* SONILINE models to suit specific customer requirements! *(A few of these special SONILINE types are shown at the right).*

Many such *special* SONILINE types (of various sizes and configurations) are already in use in a wide range of customer applications!

Utilize 3C's outstanding SONILINE engineering and design capabilities by specifying a *special* SONILINE model to suit a more exacting technical requirement! Please use the convenient return-addressed form (attached) to describe this *special* SONILINE requirement, and 3C will endeavor to send you delivery and price information promptly!



Specifications

STANDARD SONILINE SERIES S66

DELAY

As specified from 20 μsec to 1500 μsec

DELAY ADJUSTMENT

±2 μsec

INPUT

Pulse Repitition Frequency: 1MC, RZ (return to zero)

Amplitude: 16V at 50 MA

Pulse Width: 0.4 μsec

Rise Time t_r: <0.1 μsec

Fall Time t_f: <0.1 μsec

OUTPUT

Amplitude: 20 MV (minimum) into 3.9 K

Pulse Width: Double dipulse — 1.0 μsec ±0.15 μsec (peak-to-peak)

SIGNAL TO NOISE RATIO

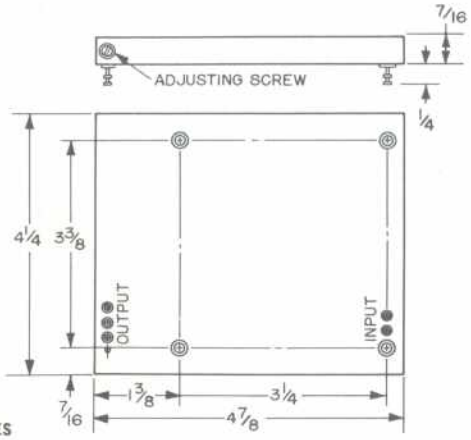
10:1

INSERTION LOSS

55 db

TEMPERATURE COEFFICIENT OF DELAY

±0.1 μsec from 0°C to 50°C



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