BAMBOO SLIDE RULES

MODELO F-686 VECTORLOG

LAFAYETTE RADIO ELECTRONICS CORPORATION

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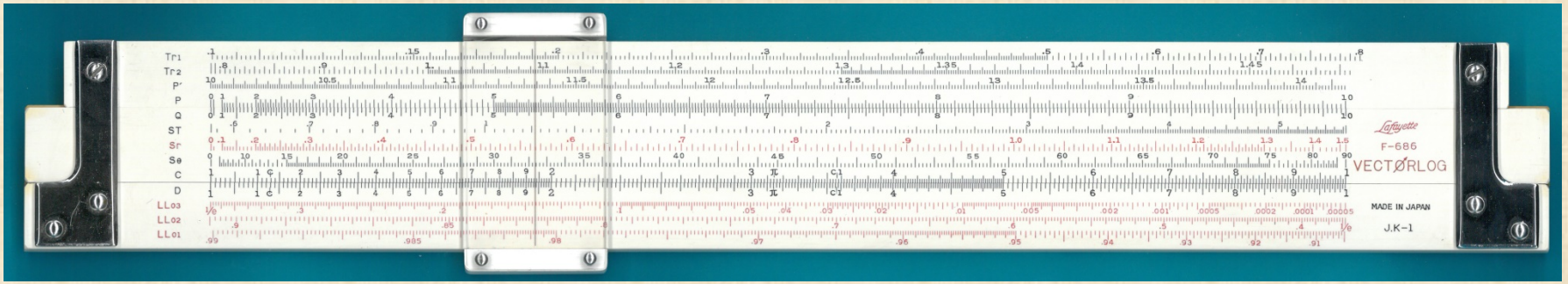
LAFAYETTE F-686 VECTORLOG

DESCRIPTION OF FRONT SCALES



Tr1	Scale of tangents of angles in radians between 0.1 (5.73°) and 0.8 (45.84°).
Tr2	Scale of tangents of angles in radians between 0.8 (45.84°) and 1.472 (84.34°).
P'	Scale for calculating vectors for values between 10.00 and 14.14.
P	Scale for calculating vectors for values between 0.00 and 10.00, main slide rule body.

Q	Scale for calculating vectors for values between 0.00 and 10.00, slide.
ST*	Scale of sines and tangents of small angles (less than 6°).
Sr	Scale of sines of angles in radians. The value of the function is read from the Q scale.
Sθ	Scale of sines of angles in degrees. The value of the function is read from the Q scale.
C*	Basic scale, slide.

D*	Basic scale, main slide rule body.
LL03*	Scale for computing e^x for x values (D scale) from -10 to -1 and results between 0.00005 and 1/e.
LL02*	Scale for computing e^x for x values (D scale) from -1 to -0.1 and results between 1/e and 0.905.
LL01*	Scale for computing e^x for x values (D scale) from -0.1 to -0.01 and results between 0.905 and 0.99.
	These exponential scales are read from right to left.

Descriptions for the scales marked with * are not included in this document because they have the same use and description as in other slide rules.

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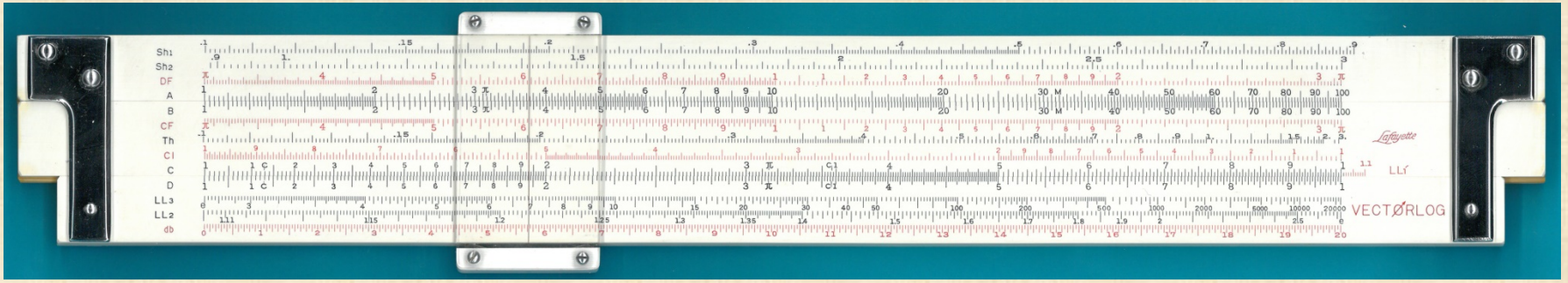
DESCRIPTION OF BACK SCALES



Sh1*	Scale of hyperbolic sines of values between 0.1 and 0.9. The value of the function is read on the D scale.
Sh2*	Scale of hyperbolic sines of values between 0.9 and 3.0. The value of the function is read on the D scale.
DF*	Basic scale shifted by π, main slide rule body.
A*	Scale of squares, main slide rule body.

B*	Scale of squares, slide.
CF*	Basic scale shifted by π, slide.
Th*	Scale of hyperbolic tangents of values between 0.1 and 3.0. The value of the function is read on the C scale.
CI*	Reciprocal of basic C scale.
C*	Basic scale, slide.
LL1'	Scale for calculation of e^x for $x \rightarrow 0$, or ln x for $x \rightarrow 1$, marked as an extension of the C scale.

D*	Basic scale, main slide rule body.
LL3*	Scale representing e^x for x values (D scale) from 1 to 10 and results between e and 22000.
LL2*	Scale representing e^x for x values (D scale) from 0.1 to 1 and results between 1.105 and e.
db	Decibel scale. It can also be used for the calculation of decimal logarithms.

Descriptions for the scales marked with * are not included in this document because they have the same use and description as in other slide rules.

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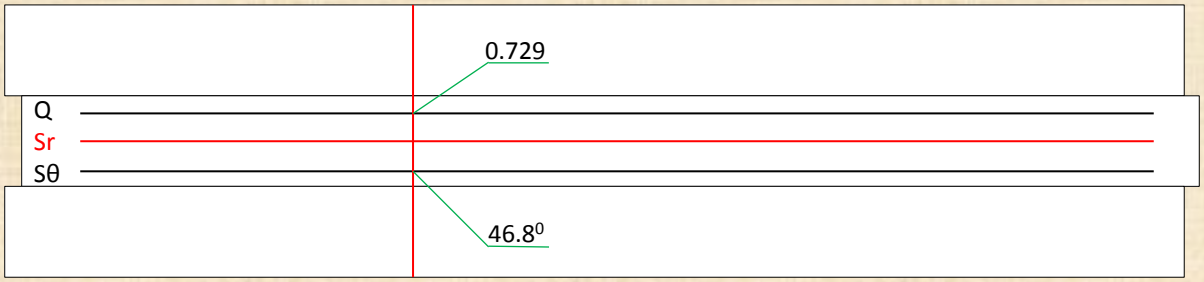
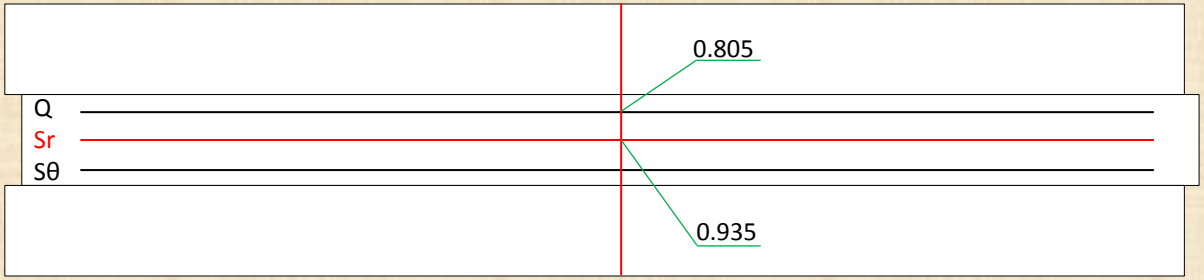
TRIGONOMETRIC SCALES (I) - SINE

The SINE of an angle is obtained directly from the **Q** scale, starting with the value of the angle in degrees on the **Sθ** scale, or the value of the angle in radians on the **Sr** scale.

The **Sθ** and **Sr** scales together also allow the immediate conversion of degrees to radians and vice versa.



EXAMPLE: sin 46.8^0 = 0.729



EXAMPLE: sin 0.935 = 0.805

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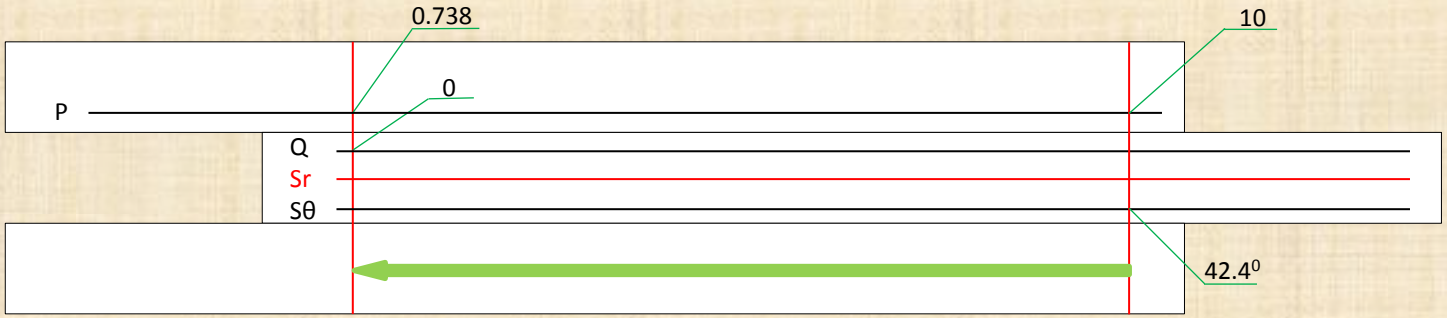
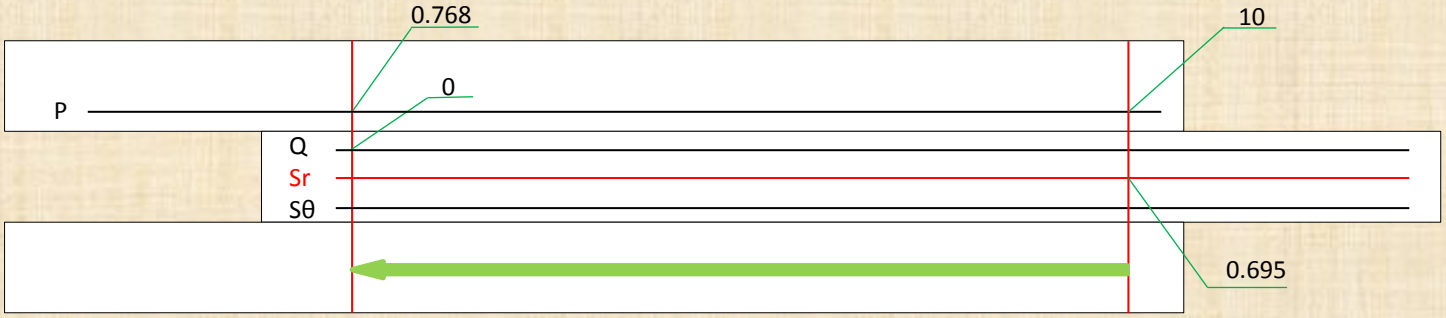
TRIGONOMETRIC FUNCTIONS (II) - COSINE

The COSINE of an angle is obtained by matching, with the help of the cursor, the value of the angle in degrees on the **Sθ** scale, or the value in radians on the **Sr** scale, with the right index of the **P** scale. The value located on the **P** scale aligned with the left index of the **Q** scale is the result.



EXAMPLE: cos 42.4^0 = 0.738



EXAMPLE: cos 0.695 = 0.768

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TRIGONOMETRIC FUNCTIONS (III) - TANGENT

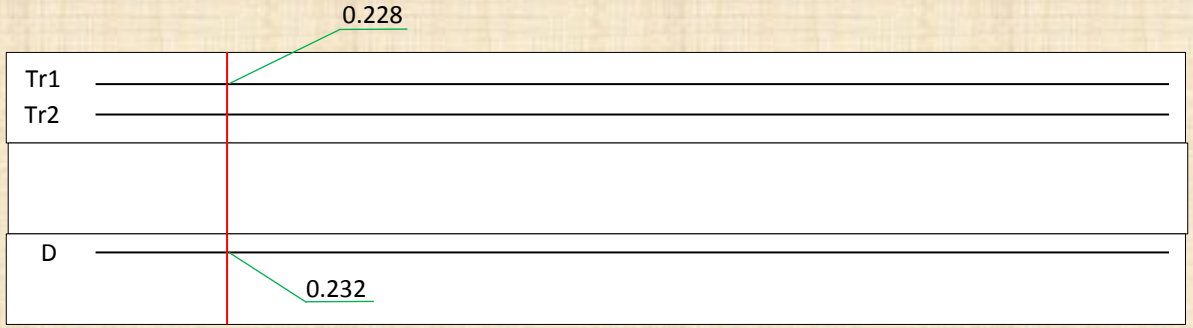
The slide rule has two scales for calculating the tangent of an angle given in radians instead of in degrees as is used typically in other slide rules. The TANGENT of an angle is obtained directly on the **D** scale, starting with the **Tr1** scale for angles between 0.1 and 0.8 radians, or the **Tr2** scale for angles between 0.8 and 1.472 radians.

Tr1: For $\theta < \pi/4$; tg $\theta < 1$
Tr2: For $\theta > \pi/4$; tg $\theta > 1$

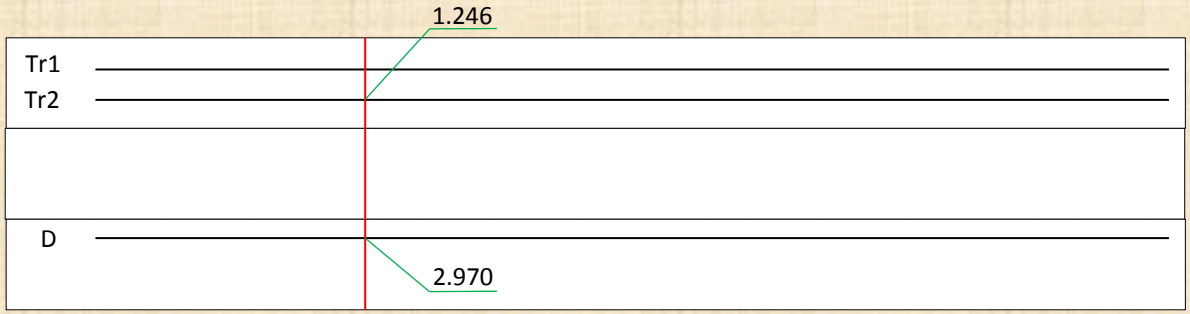
$\pi/2$ [90º] = 1.570
$\pi/4$ [45º] = 0.785

EXAMPLES:

tan 0.228 = 0.232



tan 1.246 = 2.970



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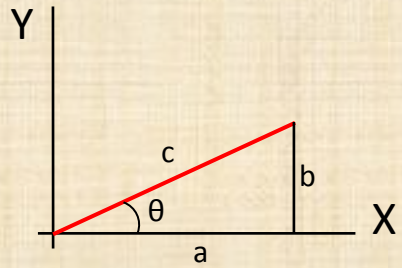
VECTOR CALCULATIONS



Cartesian Coordinates

$a = c \cos\theta$

$b = c \sin\theta$

Polar Coordinates

$c = \sqrt{a^2 + b^2}$

$\theta = \arctan\left(\frac{b}{a}\right)$

The absolute value of the modulus of a Cartesian coordinate vector (a,b) can be easily calculated using the scales **P**, **P'** and **Q**, performed similarly to multiplication and division operations calculated via the basic scales **C** and **D**. Note that he **P'** scale is a continuation of the **P** scale.

EXAMPLES:

A. $\sqrt{3.5^2 + 6.4^2} = 7.30$

B. $\sqrt{8.3^2 + 9.2^2} = 12.39$

The operation can also be performed in reverse.

From the examples above:

A'. $\sqrt{7.3^2 - 6.4^2} = 3.5$

B'. $\sqrt{12.39^2 - 9.2^2} = 8.30$

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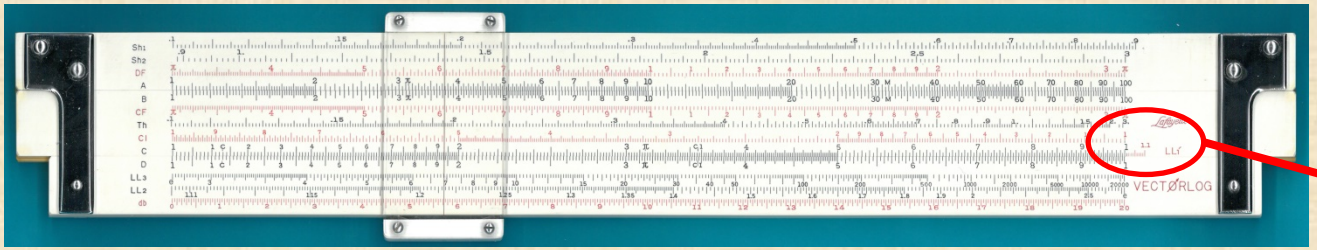
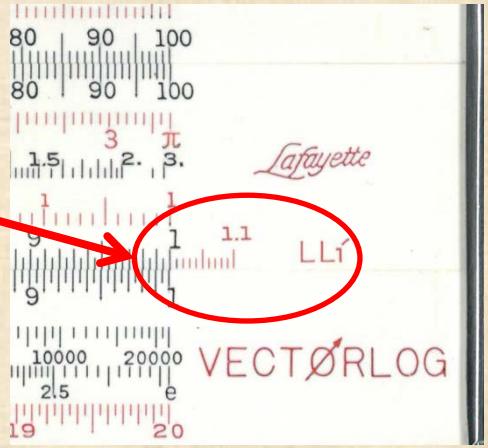
THE LL1' SCALE (I)





The **LL1'** scale is an exponential scale located on the slide as an extension of the **C** scale. It is very short, of red color and with values between 1 and 1.1.

This scale replaces the usual LL1 in other slide rules.

According to the original slide rule Usage Manual, this scale has been developed in the laboratory of the Instrumentation division of LAFAYETTE RADIO ELECTRONICS CORPORATION.

In the calculation of the Napierian (natural) logarithm and the powers of **e**, the following approximations can be made:

When $x \rightarrow 1$: $\ln(x) \approx (x - 1)$
When $x \rightarrow 0$: $e^x \approx (1 + x)$

In the absence of the typical **LL1** scale, the **LL1'** scale refines and improves this approximation as shown in the following examples.

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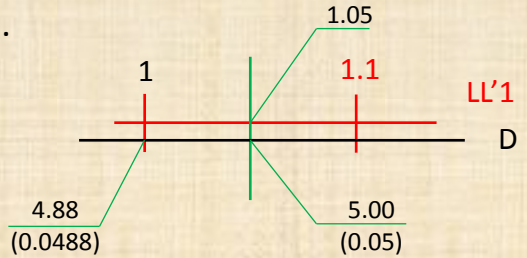
THE LL1' SCALE (II)

Calculating ln x (for x → 1)

The procedure is as follows:

With the help of the cursor, align the value **x** on the **LL1'** scale with the value **(x – 1)** on the **D** scale.
The value of **ln x** is read from the **D** scale under the left index of the **LL1'** scale.

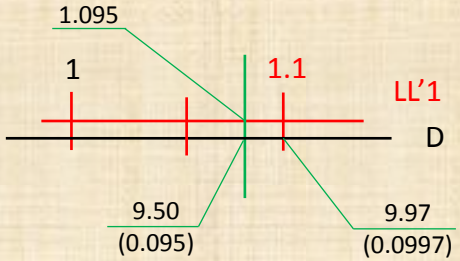


EXAMPLE: **ln (1.05) = 0.0488**
APPROXIMATION: ln (1.05) = 1.05 - 1 = 0.05

Calculating e^x (for x → 0)

The procedure is as follows:

With the help of the cursor, align the value **(1 + x)** on the **LL1'** scale with the **x** value on the **D** scale.
The value of $\mathbf{e^x}$ is read from the **D** scale under the right index of the **LL1'** scale.



EXAMPLE: $\mathbf{e^{0.095} = 1.0997}$
APPROXIMATION: $e^{0.095}$ = 1 + 0.095 = 1.095

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THE db SCALE

In electrical circuit calculations, the decibel is proportional to the log base 10 of the ratio between two voltages or between two current values. It can be computed as follows:

$$dB(V) = 20\log(\frac{V_2}{V_1})$$

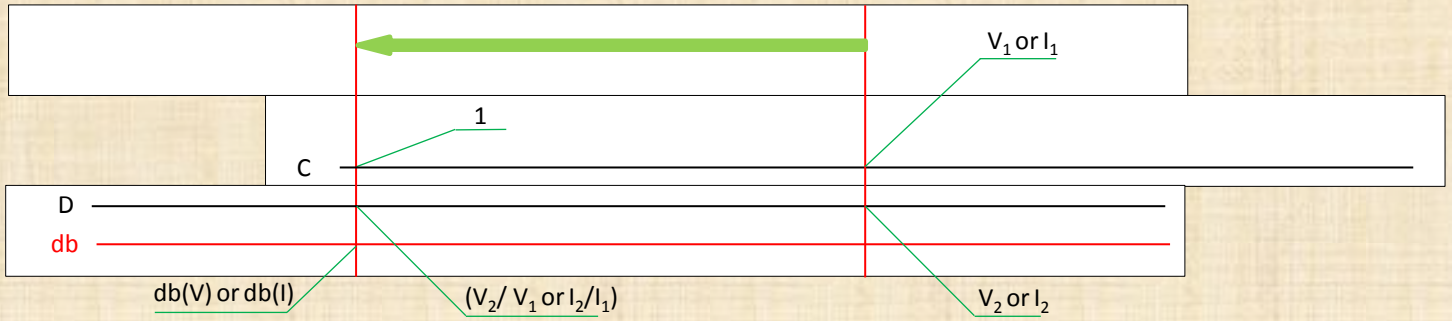
$$dB(I) = 20\log(\frac{I_2}{I_1})$$

The decibel is not a unit of measurement, but expresses the relationship between two voltage or current magnitudes.

The ratio of **V_2** to **V_1** or of **I_2** to **I_1** can be obtained in the usual way using the **C** and **D** scales.

The value of dB(V) or dB(I) is then read directly on the **db** scale.

The intermediate result (**V_2/V_1** or **I_2/I_1**) does not need to be read. It is shown in the illustration below for clarity.



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SAN-AI GROUP

Initially, the Japanese company **Nippon Slide Rule**, founded in 1950, distributed its products under the brand name, "**Nikkei**".

Later the company would be renamed San-Ai, adopting as the brand name of its products "**Relay**".

Later, in 1963, the company changed its name again to **San-Ai Keiki Co. Ltd.**, distributing its products under the brand name, **"Ricoh"**.

Finally, the **Relay/Ricoh** slide rules were exported to the United States where they were marketed by different North American brands.

All these slide rules can be seen on the website of **Bernard RYCKEBUSCH** at the following address:

https://sites.google.com/view/bernard-slide-rules/accueil

Slide rules that have the same scale configuration, including the small LL1':

ALVIN	**ELITE VECTOR Nº 1157**
COMPASS	**Nº 1325**
Lafayette	**F-686 VECTORLOG** **99-7102 VECTORLOG** **99-71029 VECTORLOG**
MICRONTA	**Nº 157**
Relay	**Nº 157**
RICOH	**Nº 157**
SCIENTIFIC INSTRUMENTS COMPANY SIC	**Nº 1570**