

# ***ETANI* S - 280**

## TS Parameter Analyzer

### Catalog



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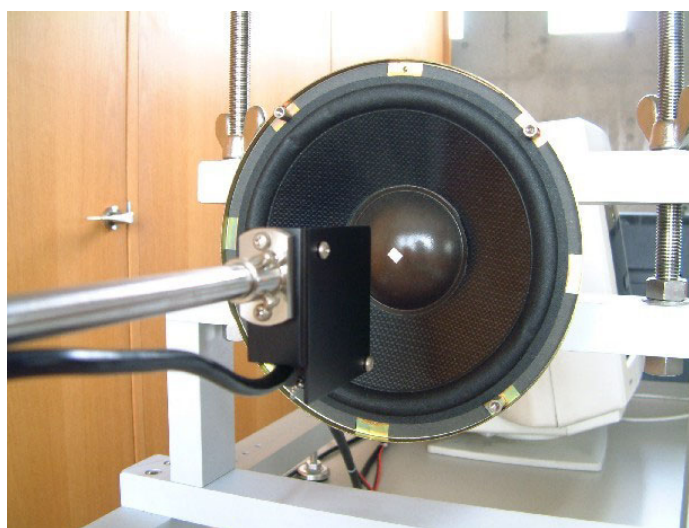
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# S-280 TS Parameter Analyzer Specifications

## 1. Main Features

1. A laser displacement sensor is used to measure the displacement of the cone paper of an under-test loudspeaker in order to gain parameters. There are no need to add mass or to set closed boxes to add stiffness for taking measurements, and the loudspeaker alone is all that is required for obtaining the parameters.
2. The bias displacement is given to the cone paper and this condition allows parameters to be measured. By the function of the software surbo-circuit, the measurement is conducted while maintaining the specified bias.
3. Up to 10 different measurement settings can be set and when a measurement is started, the system continues to measure to the end automatically in the settings set. Measurement settings that can be set are a combination of driving voltage and bias displacement.
4. When a measurement under 1 settings is finished, measured results are read into a file. When all measurements are finished, the calculation and display software [TS GRAPH], automatically starts and the calculation results are shown in lists and graphs.
5. A preliminary measurement is conducted and from these results, the measurement circuit range is automatically set so to have the best resolution. Then the main measurement is conducted.
6. Before starting the main measurement, the under-test speaker can undergo break-in.



Jig and Sensor

## 2. System Composition

### 2-1. Hardware

#### (1) S2801 Thiele Small Measuring Unit

Function

- 1) Changeover function of measuring signals
- 2) Measuring signals & noise rejection of speaker driving signals (low pass filter)
- 3) Direct current (DC) resistance measurement

Dimensions & mass                    132.5(H) x 430(W) x 330(D) mm, 5kg

#### (2) S2802 Speaker Driver

Function                                    Drive of under-test speakers

Performance

Maximum output power    50W(0.5ohm)    100W(1ohm ~ 8ohm)

Maximum output voltage    34V

Dimensions & mass                    177(H) x 430(W) x 430(W) mm, 16.5kg

#### (3) Displacement Sensor

Sensor head LB-080 / Sensor unit LB-110

Measuring range:  $\pm 15$ mm    Standard distance: 80mm    Frequency: 915Hz (-3dB)

#### (4) A/D·D/A Converter Board

A/D converter    500kS/s 12bit

D/A converter    1MS/s 12bit

#### (5) Personal Computer

OS: Windows95/98/NT            1 PCI-slot: 1 space

#### (6) Others

Speaker and sensor-head fittings and printer necessary

### 2-2. Software

#### (1) Sensor Setting.EXE

Used for adjusting sensor and loudspeaker distance

#### (2) TS Parameter no offset.EXE

TS parameter measurement (without bias)

#### (3) TS Parameter with offset.EXE

TS parameter measurement (with bias)

#### (4) Hysteresis Measure.EXE

Hysteresis characteristics measurement

#### (5) TS GRAPH

TS parameter calculation and display

### 3. Flow of Measurement

TS parameters undergo measurements in the following procedure.

1. Preliminary measurement
2. Break-in
3. Main measurement
4. Saving and displaying results

#### 3-1. Preliminary Measurement

Schematic values of items required for calculating the TS parameters are measured. Conditions are determined in such a way so to achieve high precision in the main measurement.

#### 3-2. Break-In

In order to break-in the speaker, fixed voltage and fixed frequency signals are given to the loudspeaker before the main measurement. At the beginning and end of break-in, the break-in signals are smoothly faded-in and faded-out.

#### 3-3. Main Measurement

The main measurement is conducted near the  $f_0$  value obtained in the preliminary measurement, and items required for calculating the TS parameters are measured. For the measuring range, from half to double of the  $f_0$  frequencies are selected as default. To minimize measuring time, the number of measuring points is 40 points per decade, however, frequency points are interpolated in the parameter calculation software [TS GRAPH], so to achieve high calculation precision.

The following items are measured for each frequency in approximately 2 seconds. When the measurement is finished, values are read into files.

- Displacement values of cone paper (rms) and phase in relation to driving voltage
- Electric current values (rms) and phase in relation to driving voltage
- DC values of displacement of cone-paper
- DC resistance of voice coil

Measurements without offset obtain up to 3rd harmonics for displacement and DC values mentioned above.

#### 3-4. Starting TS GRAPH

When the main measurement is finished, [TS GRAPH] automatically started and parameter lists and graphs are displayed.

[TS GRAPH] can start independently and read files consisting of previous measured results to conduct calculation and display of parameters.

#### 4. Calculation and Display Software TS GRAPH

For each driving voltage (with a combination of bias displacement of cone paper), the following parameters are calculated and displayed.

ITEM	DESCRIPTION	UNIT
Voltage	Speaker driving voltage (rms)	v
DCR	DC resistance of voice coil	ohm
mg 10	Amplitude of displacement fundamental wave	mm
Qms	Q by mechanical loss alone in fo resonace frequency	
Qes	Q by electromagnetic damping alone in fo	
Qts	Total Q including all driver instrument loss in fo	
Mms	Mass of all vibration systems	gr
Cms	Compliance of all vibration systems	m/N
Rms	Mechanical resistance of driver suspension system	N·s/m
Bl	Force factor	N/A
Vas	Air volume that has same acoustic compliance as driver suspension system	l (litre)
Eff	Efficiency	%
Ze 0	Impedance in fo	ohm
fo	Resonance frequency of driver alone	Hz
df	Half-value of impedance curve	Hz

The values below are used for calculating the above parameters.

Sound velocity 344m/s

Air density 1.18kg/m<sup>3</sup>

### 4-1. TS GRAPH Display Example Without Bias

[Noof01] TS Parameters Analyzer

File Help

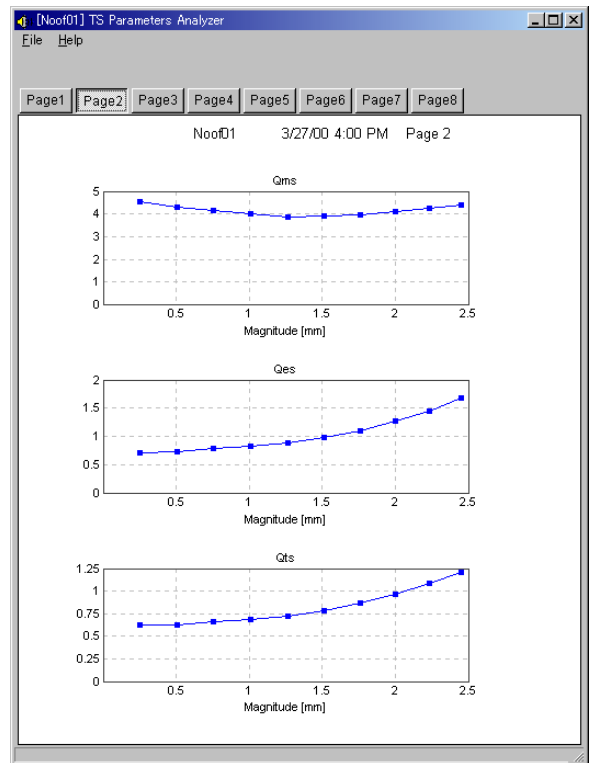
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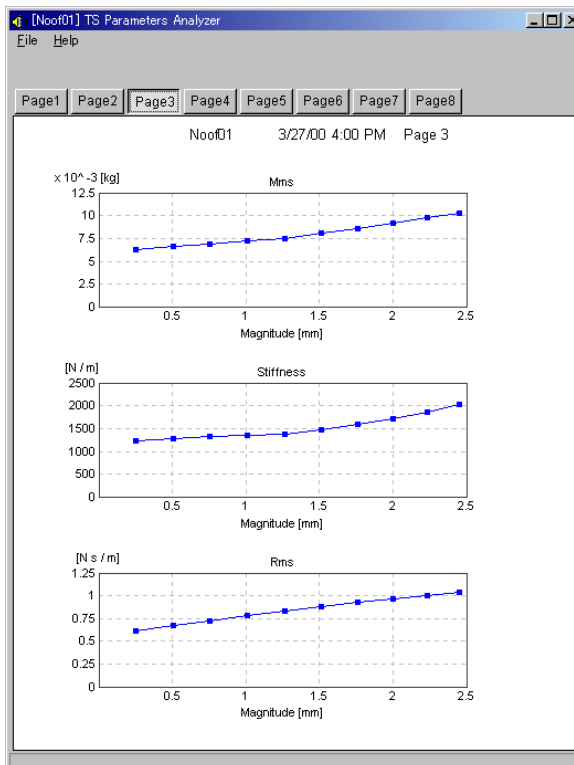
Diameter = 130.0 [mm]

Voltage [V]	0.500	1.000	1.500	2.000	2.500	3.000	3.500	4.000	4.500	5.000
DCR [ohm]	3.821	3.825	3.832	3.861	3.882	3.909	3.942	3.986	4.034	4.087
mg10 [mm]	0.253	0.503	0.753	1.012	1.267	1.511	1.756	1.999	2.233	2.453
Qms	4.550	4.296	4.171	4.012	3.879	3.936	3.983	4.129	4.272	4.410
Qes	0.719	0.739	0.782	0.828	0.881	0.965	1.102	1.269	1.459	1.674
Qts	0.621	0.630	0.658	0.687	0.718	0.788	0.863	0.971	1.088	1.213
Mms [g]	6.243	6.610	6.934	7.271	7.532	8.122	8.593	9.166	9.761	10.313
Cms [mm/N]	0.809	0.787	0.759	0.746	0.728	0.673	0.631	0.581	0.536	0.495
Rms [N*s/m]	0.611	0.674	0.725	0.778	0.829	0.863	0.927	0.962	0.999	1.035
Bl [N/A]	3.843	3.873	3.849	3.815	3.764	3.713	3.634	3.532	3.435	3.338
Vas [l]	20.325	19.779	19.064	18.732	18.265	16.908	15.846	14.593	13.457	12.436
Eff [%]	0.974	0.882	0.790	0.700	0.632	0.525	0.446	0.366	0.302	0.252
Ze0 [ohm]	28.013	26.068	24.276	22.559	20.969	19.526	18.190	16.955	15.842	14.856
f0 [Hz]	70.818	69.768	69.384	68.352	67.976	68.071	68.363	68.975	69.604	70.439
df [Hz]	15.565	16.240	16.636	17.037	17.524	17.294	17.166	16.706	16.292	15.972

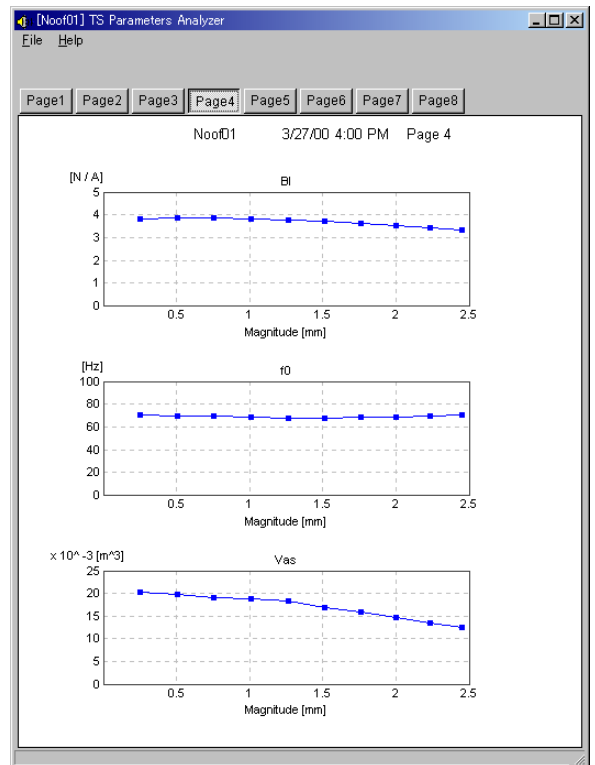
Calculation Parameter List



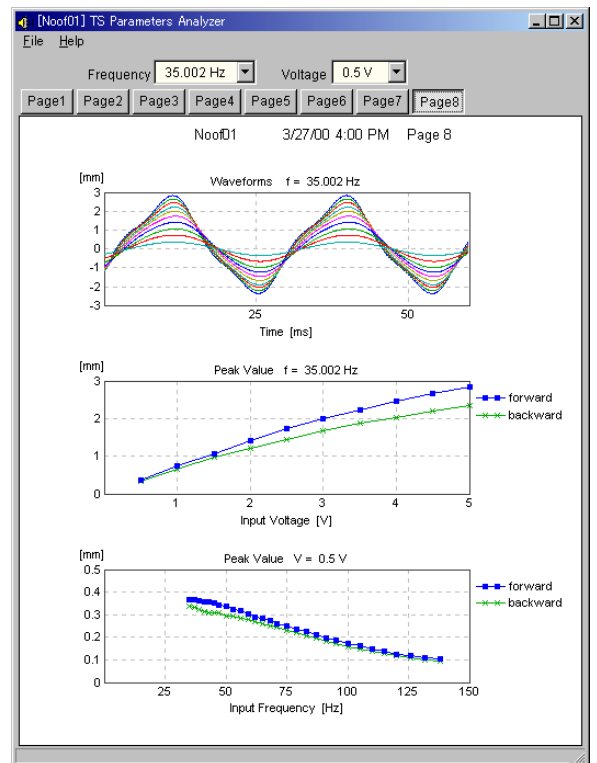
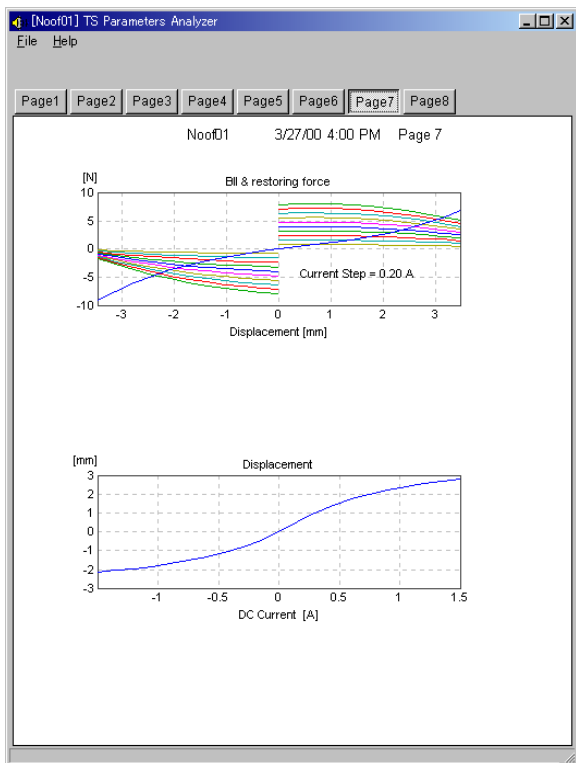
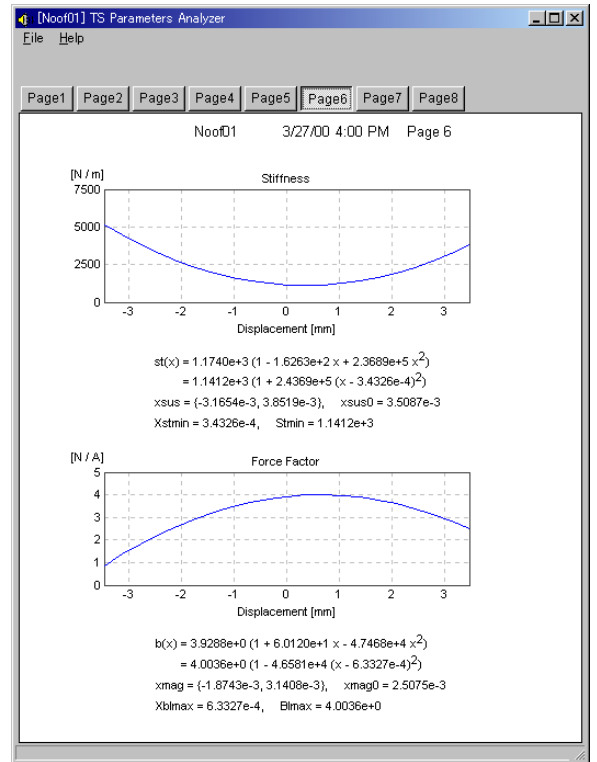
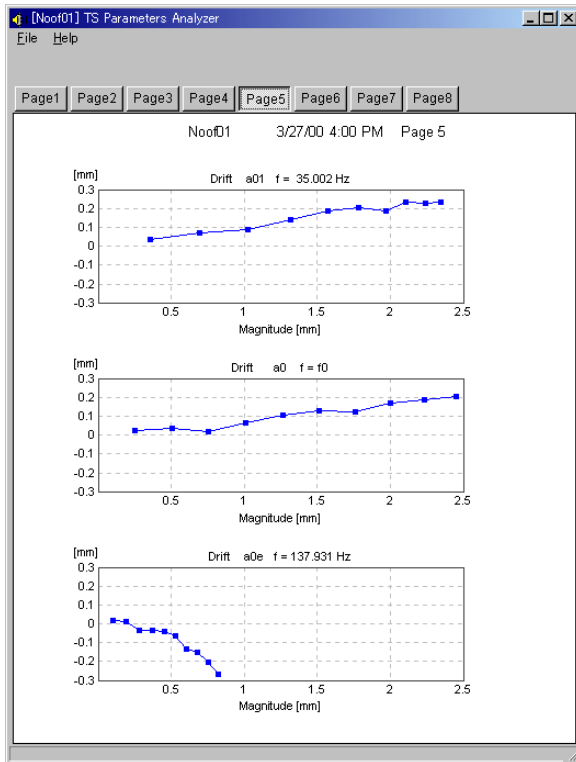
Qms, Qes, Qts vs. Magnitude



Mms, Stiffness, Rms vs. Magnitude



Bl, f0, Vas vs. Magnitude



4-2. TS GRAPH Display Example With Bias

[Off01] TS Parameters Analyzer  
File Help

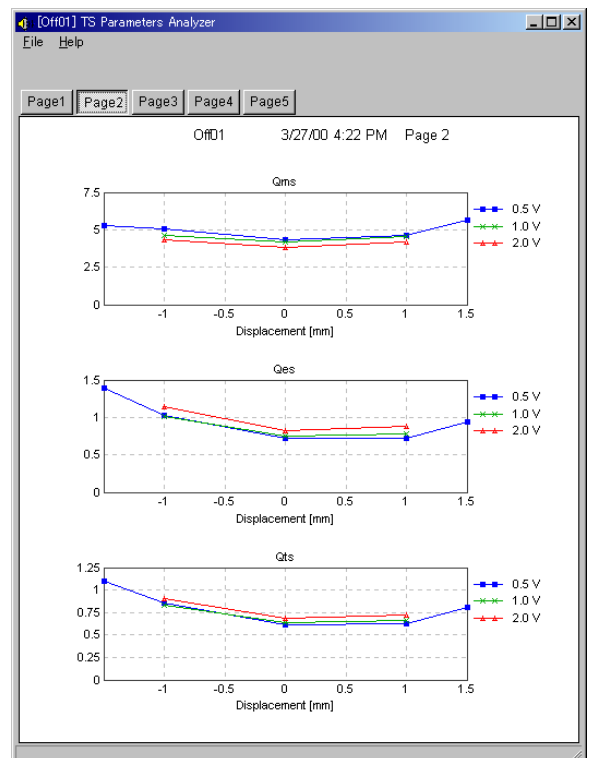
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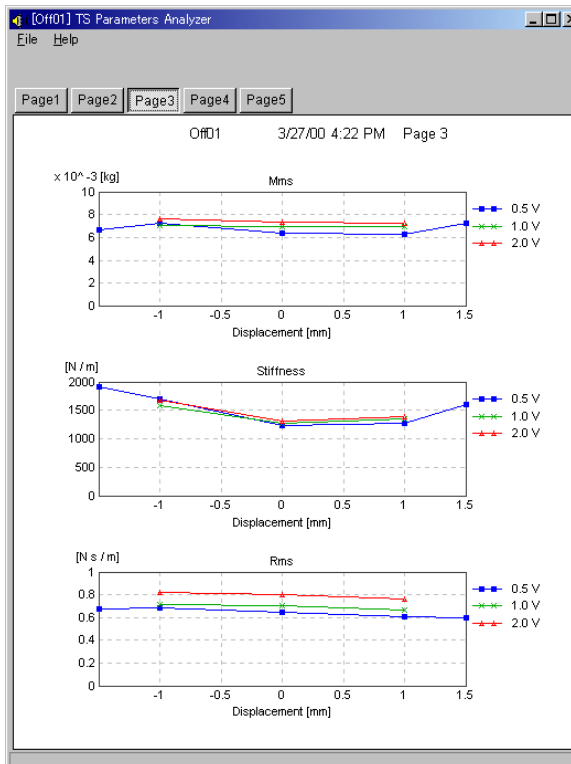
Diameter = 130.0 [mm]

Offset [mm]	-1.500	-1.000	0.000	1.000	1.500	-1.000	0.000	1.000	-1.000	0.000	1.000
Voltage [V]	0.500	0.500	0.500	0.500	0.500	1.000	1.000	1.000	2.000	2.000	2.000
DCR [ohm]	3.963	3.860	3.825	3.836	3.862	3.861	3.830	3.844	3.900	3.865	3.886
mgI0 [mm]	0.232	0.237	0.252	0.249	0.245	0.486	0.508	0.499	0.984	1.023	1.003
Qms	5.333	5.117	4.334	4.677	5.685	4.676	4.243	4.575	4.383	3.841	4.177
Qes	1.394	1.029	0.723	0.729	0.938	1.017	0.759	0.783	1.142	0.830	0.879
Qts	1.105	0.856	0.619	0.631	0.805	0.835	0.644	0.668	0.906	0.682	0.726
Mms [g]	6.723	7.232	6.418	6.319	7.302	7.076	6.957	6.924	7.623	7.314	7.224
Cms [mm/N]	0.520	0.588	0.806	0.782	0.626	0.629	0.779	0.740	0.593	0.763	0.716
Rms [N*s/m]	0.674	0.686	0.651	0.608	0.601	0.717	0.704	0.669	0.818	0.806	0.760
BI [N/A]	3.198	3.628	3.865	3.868	3.749	3.568	3.885	3.876	3.499	3.798	3.748
Vas [l]	13.060	14.766	20.246	19.653	15.732	15.801	19.564	18.595	14.892	19.169	17.989
Eff [%]	0.561	0.640	0.931	0.959	0.670	0.647	0.800	0.801	0.531	0.685	0.681
Ze0 [ohm]	19.129	23.062	26.763	28.454	27.260	21.614	25.253	26.317	18.866	21.760	22.359
f0 [Hz]	85.131	77.196	69.979	71.583	74.429	75.444	68.376	70.301	74.866	67.370	69.980
df [Hz]	15.963	15.087	16.145	15.305	13.093	16.133	16.116	15.366	17.083	17.541	16.756

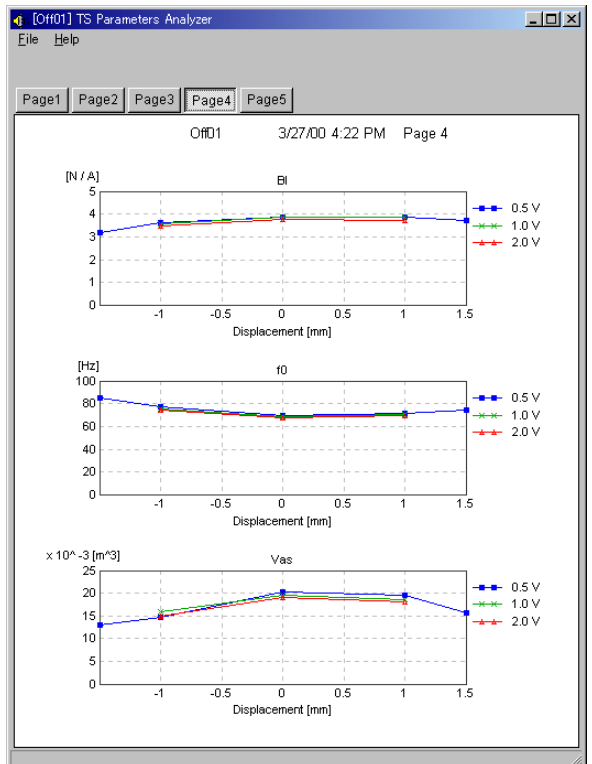
Calculation Parameter List



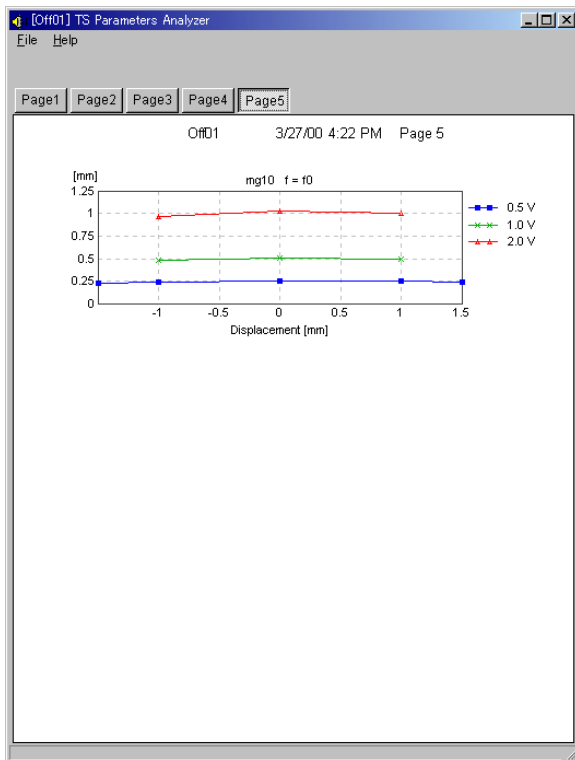
Qms, Qes, Qts vs. Displacement



Mms, Stiffness, Rms vs. Displacement



BI, f0, Vas vs. Displacement



Magnitude vs. Displacement