Annex A1 - Frontal Panel of the Distortion Meter

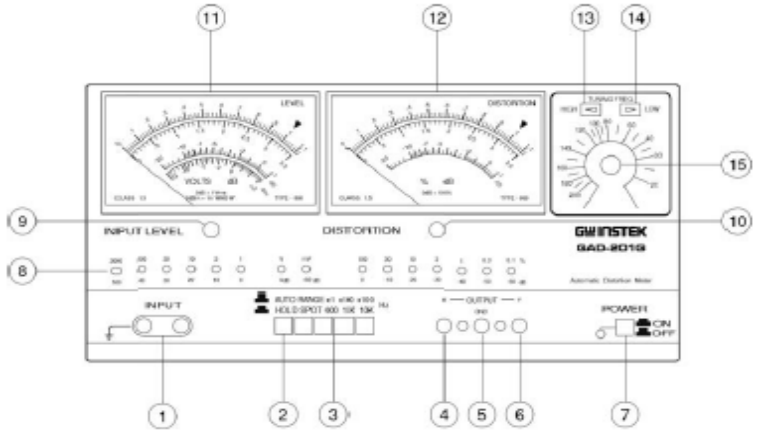

Figure A1. Frontal Panel of the Distortion Meter

1. A.C. input.
2. **AUTO** / **HOLD** function control: it sets the automatic mode of measurement / it preserves the scale selected when effectuating the operations.
3. The selector of frequency ranges in order to set the frequency for the rejection of the fundamental component.
   Frequency ranges are: **x1** →{20Hz÷200Hz},
   x10 →{200Hz÷2kHz},
   x100 →{2kHz÷20kHz}
4. The output of the amplifier input to the Distortion Meter. From here one obtains the signal applied to the Distortion Meter, scaled at the value $U_{RMS} \approx 1V$ ($U_{RMS} \approx 0dB$).
5. "Electrical GND" for connecting terminal X, and connecting terminal Y, respectively.
6. Input signal, after the rejection of the fundamental component, which has no more fundamental component, but only noise and distortions (harmonics), as components.
7. ON / OFF knob.
8. The indicator of the scale for the A.C. voltmeter of the input signal, respectively, the indicator for the scale of the Distortion Meter.
9. Zero adjustment of the voltmeter.
10. Zero adjustment of the distortion indicator.
11. The voltmeter which indicates the level (U_{RMS}) of the input signal.
12. The indicator of the distortion factor.

13, 14. LEDs indicating the sense for adjustment of the frequency of the notch filter, so that it is tuned on the frequency of the fundamental of the input signal. *Remark: When neither LED is lit, the manual adjustment of the filter is completed. The Distortion Meter is in its tracking mode (capture bandwidth) and the exact adjustment of notch filter is automatically done.*

15. Knob for manual adjustment of the notch filter.

Annex A2 - FFT (Fast Fourier Transform) Application of the scope TDS1001

In FFT operating mode, the scope outputs the magnitude spectrum of the input signal, so that on horizontal axis the frequency is read, and on vertical axis, the magnitude of the spectral components at a given frequency, scaled at $\sqrt{2}V$ ($\sqrt{2}V \leftrightarrow 0dB$), can be read. The horizontal sweep scale (Hz/div) and the vertical sweep scale (dB/div) can be adjusted from the same knobs as they are adjusted in the time domain (equivalent value of C_y, C_x, respectively. The image on the display corresponds to the semi-log graph in Figure 1.b.

As postulated by the Sampling Theorem the sampling frequency must be greater than the double of the maximum frequency of the signal, $f_{sampling}/2 > f_{\max}$, and the maximum range of frequencies is between $0Hz$ (left side of the screen) and $f_{sampling}/2$ (right side of the screen). The currently display range (in frequency) is set by placing the given frequency in the center of the screen (f_{centr}), then adjusting C_x at one of the 4 possible values. The viewed range of frequencies will now be $f_{centr} - 5div \cdot C_x ... f_{centr} + 5div \cdot C_x$.

Attention ! If the maximum frequency from the spectrum of the signal is greater than half of the sampling frequency, $f_{sampling}/2 < f_{\max}$, aliasing phenomenon will appear. Its effect is the display, in the $(0; f_{sampling}/2)$ interval, of some spectral components that are, in fact, at frequencies greater than $f_{sampling}/2$. The behavior is equivalent to the signal exceeding the full scale of the device. This can be solved (as for any other device) by switching to a superior range (greater $f_{sampling}$) using C_x adjustment.

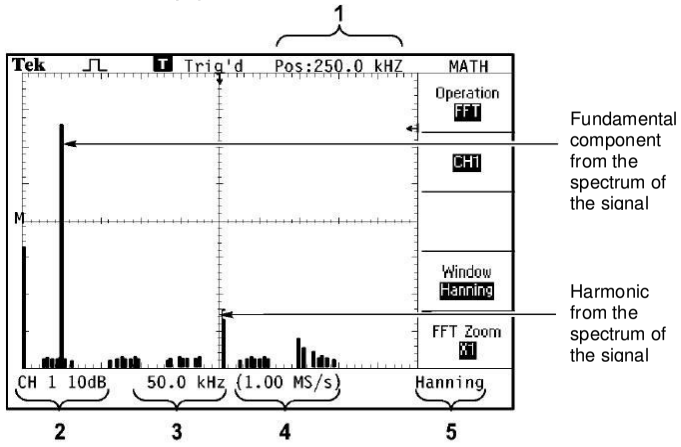

Figure A2: The display of the scope in FFT Mode

Legend to Figure A2:
(1) central frequency (from the center of the display),
(2) vertical sweep scale, in dB/div,
(3) horizontal sweep scale, in Hz/div,
(4) sampling frequency,
(5) used FFT Window.
Sampling frequency is indicated in S/s (*samples/second)* instead of Hz.

ANNEX A 3.1. Instek GFC2110 signal generator

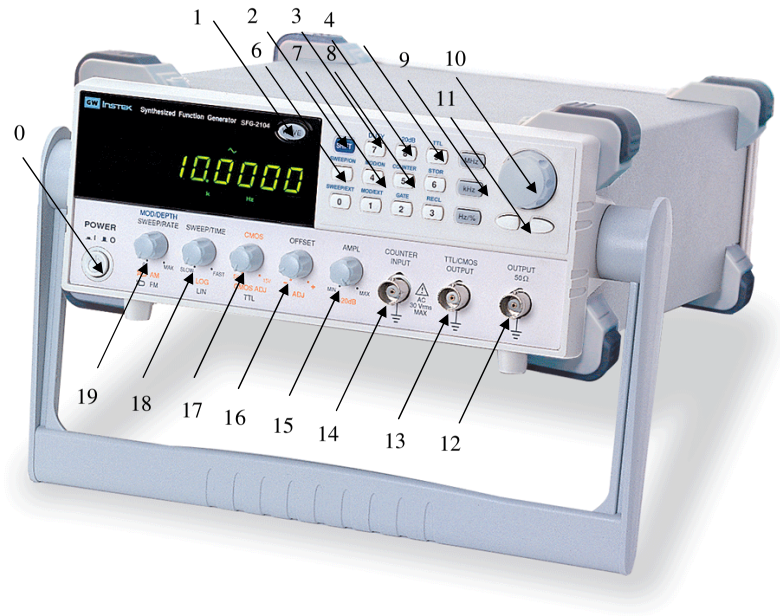

Figure A5: GFC2110 signal generator

0. **ON** / **OFF** knob.
1. **WAVE -** waveform selection: sinusoidal, rectangular, triangular
2. **SHIFT –** switches between key functions**.** The keys have the function to enter the value marked on. When the SHIFT knob is enabled (it is displayed on the screen) the key has the function marked with blue.
3. **7/DUTY** – alternative function: setting of the duty factor for rectangular signal.
4. **8/-20dB** – alternative function: attenuates the signal with 20dB.
5. **9/TTL** – alternative function: command of the generation of a TTL signal on the TTL/CMOS output.
6. **./AM** – alternative function: command of the generation of an amplitude-modulated signal.
7. **4/FM** – alternative function: command of the generation of a frequency-modulated signal.
8. **5/SWEEP** – alternative function: command of the generation of a signal whose frequency varies with a linear/logarithmic step (selectable from 18 knob).
9. **MHz/kHz/Hz** – selects the scale of signal frequency.
10. rotative knob for continuous adjustment of the frequency.
11. keys that select the digit from the display, whose value can be changed by rotating the knob 10. The selected digit blinks.
12. **OUTPUT -** main output of the signal.
13. **TTL/CMOS OUTPUT -** alternative output for TTL/CMOS level (5-15V) signals.
14. **COUNTER INPUT -** input for frequencemeter function.
15. **AMPL** – knob for continuous adjustment of the amplitude.

16. **OFFSET** – knob for CC adjustment. The knob must be pulled in order to be enabled. When it is pushed CC is equal to zero (CC = 0 V).
17. **TTL/CMOS** – when it is pulled it allows the adjustment of the TTL/CMOS signal level
18. **SWEEP TIME** – for the variable frequency generation it selects the rate of change. When it is pushed the variation is linear, and if it is pulled the variation is logarithmic.
19. **SWEEP SPAN** – selects the maximum limit for the signal frequency to be changed.

Annex A3.2. - SFG-2110 signal generator

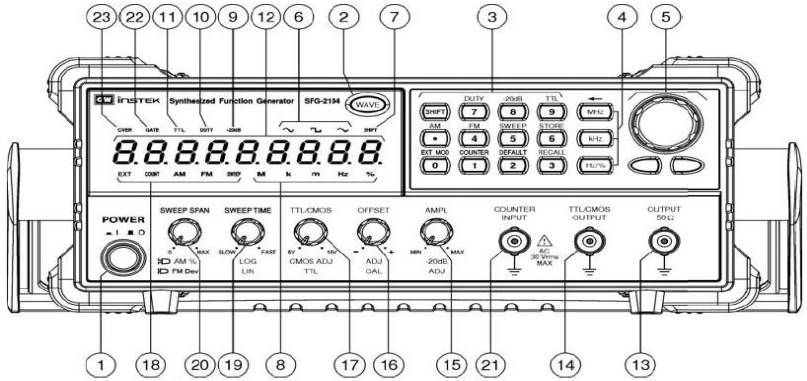

Figure A3. Frontal Panel of the SFG-2110 generator

2, 6. The selector, and the indicator, of the waveform (sine, triangle, rectangle).

3. Numeric keyboard for frequency adjustment and duty factor adjustment (when pressed SHIFT 7). **You can not adjust the amplitude and the offset with this keyboard!**

4. Unit of measurement for frequency.

5. Continuous adjustment of the frequency. The rotary knob, implicitly sets the last digit. You can choose another digit by using the two arrow-knobs.

7. Indicator that points out that the SHIFT key is pressed. Pressing a softkey now, it has the alternative function written above the softkey.

8. Selected unit of measurement.

9. Indicator shows the additional attenuation of 20dB (**SHIFT + 8**)

10. Indicator that points out the command, from softkey, for the adjustment of the duty factor

(SHIFT + 7). Now, you can introduce the value you want for the duty factor, followed by the Hz / % softkey.

11. Indicator that points out that the output 14 is enabled (**SHIFT + 9**).

13. The main output of the device.

14. TTL Output, with rectangular waveform, at the same frequency as the Main Output, 13, regardless of the waveform selected for the main output.

15. The adjustment of the amplitude for the waveform at output 13. When the knob is pulled, the signal is attenuated with 20dB.

16. Offset adjustment of the output signal, 13. It is enabled when pulled. When pressed, the offset is equal to 0V (calibrated value), regardless of the knob rotation.

17. The adjustment of the amplitude for the waveform at the output 14. It does not alter the waveform at the main output, 13.

19,20. Adjustments for the „sweep" operating mode (output frequency sweep).

21,22,23. Input and display for operating mode "Frequencemeter" (**SHIFT + 1**)

ANNEX 4. AC millivoltmeter

1. Analog display of scale:
   a) 0 ÷ 1 (extension 1.1), in V.
   b) 0 ÷ 3 (extension 3.5), in V.
   c) -20dB ÷ 0dB (extension +2dB)
   d) -20dBm ÷ 0dBm (extension +3dBm).
2. Zero adjustment.
3. Scale selection switch – selects the maximum of that scale.
   a) when selecting values of 1mV, 10mV, 100mV, 1V, 10V, 100V, read on scale (a).
   b) when selecting values of 300μV, 3mV, 30mV, 300mV, 3V, 30V, read on scale (b).
   c) To read in dB (U_{ref} = 1V) or dBm (U_{ref}=0,775V), sum the value of the indication with the indication of the switch (3).
   d) $U\big|_{dB} = 20 \cdot \lg\left(\frac{U}{U_{\mathrm{Ref}}}\right)$
4. Input connector (for the measured signal).
5. Output connector.
6,7. Operating switch and indicator.

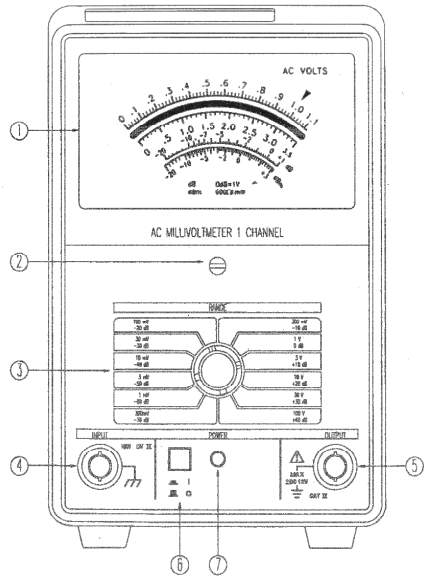

Figure A4. AC millivoltmeter

Pay attention ! *The AC milivoltmeter indicates the* ***RMS voltage*** *of the signal and it is calibrated for* ***sinusoidal*** *signals. For other waveforms, the device will commit a systematic error.*