



TOE 7711 A

Synthesizers/function generators with sweep, trigger, AM and frequency counter

TOE 7704 to TOE 7711 A

Special features

- Frequency range 1 mHz to 44 MHz
- Sweep, trigger, gate
- Variable symmetry
- Digital display of frequency, sweep, AC, DC
- Amplitude modulation
- Frequency counter up to 50 MHz

The function generators of the TOE 7700 range represent a series of completely novel design.

In addition to the usual standard signal shapes including variable signal symmetry, this range is equipped with a lin/log sweep oscillator which should satisfy the most demanding users.

Continuous or triggered sweeping is selectable, the lower and upper sweep limits are of course separately adjustable, and the sweep frequencies are precisely displayed by an integral frequency counter.

Many details reflect the latest advances in circuit technology: a wear-free spin-wheel for adjusting the output frequency and sweep time, an internally or externally usable frequency counter that employs a reciprocal counting method, and sophisticated new switching techniques allow signal qualities that were previously unattainable.

All inputs and outputs are floating, with the most important ones arranged on the front panel for ease of operation. A wide frequency range, an outstanding processing quality, and the clear and balanced design of the control panel round off the concept of these function generators.

The TOE 7706, TOE 7708 A and TOE 7711/7711 A models also offer signal triggering and gate mode.

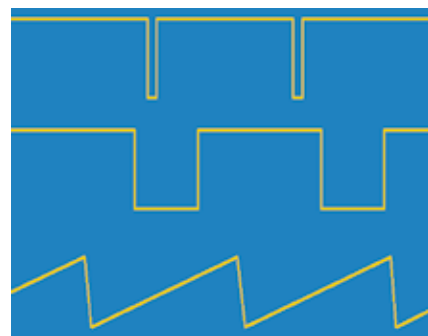
The TOE 7708 A and TOE 7711 A models are additionally able to work in amplitude modulation mode, resulting in a significantly wider range of application.

The TOE 7711/7711 A microprocessor-controlled synthesizers/function generators combine the variety of functions that characterize universal function generators with the stability of modern synthesizers. In PLL mode, the output frequency is controlled with crystal accuracy in the 10 Hz to 44 MHz range. The basic accuracy is 2×10^{-6} of the full-scale value, and the aging rate is only 2 ppm/year.

	TOE 7704	TOE 7706	TOE 7707	TOE 7708 A	TOE 7711	TOE 7711 A
Frequency Min (mHz)	1	1	1	1	1	1
Max (MHz)	12	12	22	22	44	44
Synthesizer					•	•
Frequency counter	•	•	•	•	•	•
Signal waveforms						
~ ^ ^ ^, TTL, ECL	•	•	•	•	•	•
Pos./neg. pulse	•	•	•	•	•	•
Variable symmetry	•	•	•	•	•	•
Output (V_{pp})	> 30 V	> 30 V	> 20 V	> 20 V	> 20 V	> 20 V
Operating modes						
Trigger/gate		•		•	•	•
Lin/log sweep	•	•	•	•	•	•
VCO, external	•	•	•	•	•	•
Amplitude modulation				•		•

Technical specifications

TOE 7704 to TOE 7711 A



Variable symmetry with triangle and square

Technical specifications

Functions and operating modes

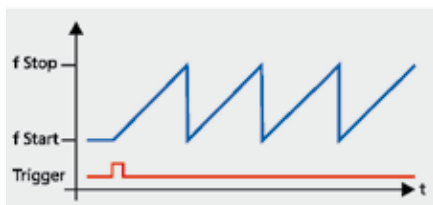
Functions	Sine, triangle, square, pos./neg. pulse, TTL, ECL, variable symmetry, DC	Display	The output voltage is displayed in V_{pp} or in $\pm V$ (for DC). The max. error is $\pm 5\%$ of full-scale
Operating modes	Continuous, internal and external sweep-frequency control, amplifier mode, frequency counter	Reference temperature	Function specification at max. output voltage and $Z_o = Z_L = 50\ \Omega$
Trigger and gate modes	TOE 7706, TOE 7708 A, TOE 7711, TOE 7711 A	Sine	$23\ ^\circ\text{C} \pm 1\ ^\circ\text{C}$
Amplitude modulation	TOE 7708 A, TOE 7711 A	Distortion factor	$\leq 0.5\%$ up to 100 kHz, all harmonics are 26 dB below the fundamental wave up to 12 MHz (TOE 7704, TOE 7706), or up to 22 MHz (TOE 7707, TOE 7708 A, TOE 7711, TOE 7711 A)
Synthesizer mode (PLL)	TOE 7711, TOE 7711 A		Linearity and symmetry error $\leq 1\%$ up to 100 kHz
Frequency characteristics		Triangle	Transition time (10 % to 90 %) typ. 10 ns
Frequency range		Square	Overshoots $< 5\%$
TOE 7704, TOE 7706	1 MHz to 12 MHz (sine, triangle, square, pulse, TTL, ECL)	Pulse	See square
TOE 7707, TOE 7708 A	1 MHz to 22 MHz (sine, triangle, square, pulse, TTL, ECL)	TTL OUT	
TOE 7711, TOE 7711 A	1 MHz to 44 MHz (pulse, TTL, ECL) 1 MHz to 22 MHz (sine, triangle, square)	Output level	0 V/5 V (typ.)
Resolution	3 ½ digits, 4 ½ digits in PLL-mode	t_r/t_f	$\leq 5\ \text{ns}$, $Z_o = 50\ \Omega$, $Z_L \geq 50\ \Omega$
Frequency error	$\pm 1\ \text{LSB}$ 2×10^{-6} in PLL-mode 5 % of full-scale value 1 MHz to 10 Hz	ECL OUT	
Drift	$5 \times 10^{-8}/\text{K}$, 2 ppm/year in PLL mode $10^{-3}/\text{K} < 1\ \text{MHz}$, $3 \times 10^{-3}/\text{K} > 1\ \text{MHz}$, $5 \times 10^{-3}/8\ \text{h}$ free-running; in each case following 30 min warm-up time	Output level	-0.9 V/-1.8 V (typ.)
		t_r/t_f	$\leq 2\ \text{ns}$, $Z_o = 50\ \Omega$, $Z_L \geq 50\ \Omega$
		Variable symmetry	Continuously adjustable from 10 % to 90 %
		All functions	
		f_{max}	1.2 MHz (TOE 7704, TOE 7706)
		f_{max}	2.2 MHz (TOE 7707, TOE 7708 A, TOE 7711, TOE 7711 A)
Function output at OUTPUT		DC voltage	
Output amplitude			3 ranges with $Z_o = 50\ \Omega/600\ \Omega$
TOE 7704, TOE 7706	10 mV _{pp} to 30 V _{pp} , 5 mV _{pp} to 15 V _{pp} in pulse mode (open output)		0 to $\pm 0.1\ \text{V}$, 0 to $\pm 1\ \text{V}$, 0 to $\pm 10\ \text{V}$
TOE 7707, TOE 7708 A, TOE 7711, TOE 7711 A	7 mV _{pp} to 20 V _{pp} , 3 mV _{pp} to 10 V _{pp} in pulse mode (open output)	Operating modes	
Impedance	$Z_o = 50\ \Omega/600\ \Omega$ (switchable), the output is short-circuit and no-load proof	TOE 7704, TOE 7707	Sweep, amplifier mode, frequency counter, VCO
Feedback voltage protection	Up to $\leq 120\ \text{V}$ (optional)	TOE 7706, TOE 7708 A, TOE 7711, TOE 7711 A	Sweep, amplifier mode, trigger and gate modes, AM internal and external (only TOE 7708 A, TOE 7711 A), synthesizer mode (PLL with TOE 7711, TOE 7711 A), frequency counter
DC offset	0 V to $\pm 10\ \text{V}$		All functions, lin/log, rising, falling, continuously adjustable for internal and external trigger, hold, reset
Output attenuator	30 dB continuously adjustable plus 20 dB, 40 dB fixed attenuator (max. 70 dB)	Sweep	
Accuracy	$\pm 5\%$ (at max. amplitude; at 1 kHz for sine and triangle)	Range	
Drift	$\pm 0.05\%$ of full-scale value within 10 min $\pm 0.3\%$ of full-scale value within 8 hours	TOE 7704, TOE 7706	1 MHz to 12 MHz
Frequency response		TOE 7707, TOE 7708 A, TOE 7711, TOE 7711 A	1 MHz to 22 MHz
Sine	$\pm 0.5\ \text{dB}$, $\pm 2\ \text{dB}$ above 1 MHz		
Triangle	$\pm 0.5\ \text{dB}$, $\pm 2.5\ \text{dB}$ above 1 MHz		

Technical specifications

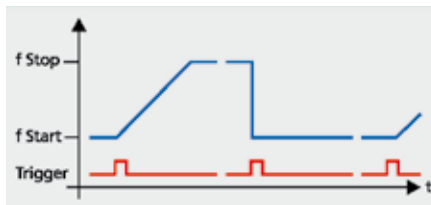
TOE 7704 to TOE 7711 A

Sweep time	1 ms to 1000 s
Resolution	2 digits
Error	5×10^{-5}
Sweep range	3 decades (log), 2 decades (lin)
Frequency output voltage	Approx. 0 V (start frequency) to +5 V (stop frequency)
Pen lift output	TTL level, 0 V (return)
Amplifier mode	
Amplifier TOE 7704, TOE 7706	Approx. 17 dB, DC up to ≥ 12 MHz
TOE 7707, TOE 7708 A, TOE 7711, TOE 7711 A	Approx. 14 dB, DC up to ≥ 12 MHz Distortion factor < 0.2 % up to 100 kHz, input via "EXT IN"
Trigger and gate modes	(TOE 7706, TOE 7708 A, TOE 7711, TOE 7711 A)
Individual triggering	Manual, externally via "EXT IN" or internally with aid of integral sweep oscillator. Max. signal frequency approx. 12 MHz (TOE 7706), approx. 20 MHz (TOE 7708 A, TOE 7711, TOE 7711 A)
Tripping voltage	TTL level
Start phase	-90° to $+90^\circ$, continuously adjustable
Gate mode	Manual, externally via "EXT IN" or internally with aid of integral sweep oscillator. In/out ratio 50 %. Max. signal frequency approx. 12 MHz (TOE 7706), approx. 20 MHz (TOE 7708 A, TOE 7711, TOE 7711 A)
Tripping voltage	TTL level
Start phase	-90° to $+90^\circ$, continuously adjustable
Amplitude modulation	(only TOE 7708 A, TOE 7711 A) internal AM
Frequency range	1 mHz to 22 MHz carrier frequency (TOE 7708A, TOE 7711A)
Modulation frequency	All functions except pulse, TTL, ECL
Modulation factor	1 kHz
External AM	0 % to 100 %
Frequency range	1 mHz to 22 MHz carrier frequency
Modulation frequency	All functions except pulse, TTL, ECL
Modulation factor	DC up to 500 kHz
Modulation voltage	0 % to 200 % 2.5 V _{pp} for 50 % AM

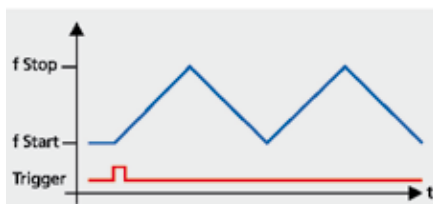
Sweep modes



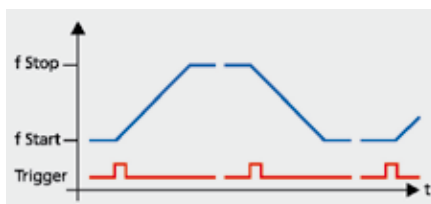
Continuous sweep with reset after the start pulse



Triggered sweep with hold and triggered reset



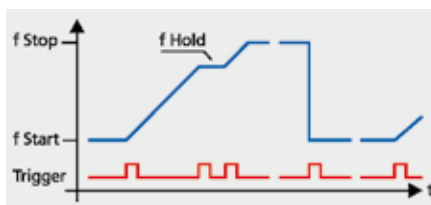
Continuous sweep with reverse after the start pulse



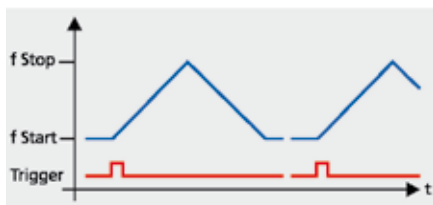
Triggered sweep with hold and triggered reverse



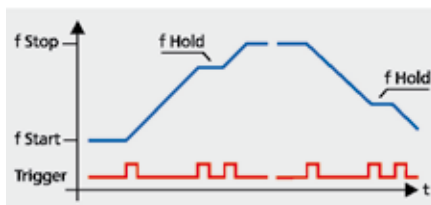
Triggered sweep with reset



Triggered sweep with triggered hold and triggered reset



Triggered sweep with reverse



Triggered sweep with triggered hold and triggered reverse

Trigger, gate, AM

Individual triggering

Manual, externally via "EXT IN" or internally with aid of integral sweep oscillator. Max. signal frequency approx. 12 MHz (TOE 7706), approx. 20 MHz (TOE 7708 A, TOE 7711, TOE 7711 A)

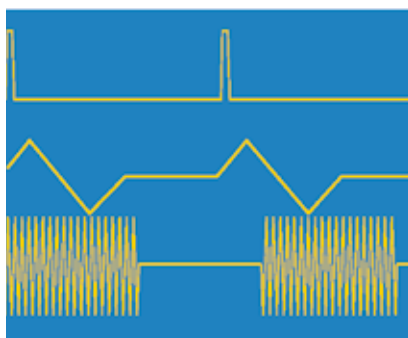
Tripping voltage

TTL level

Start phase: -90° to $+90^\circ$, continuously adjustable.

Gate mode

Manual, externally via "EXT IN" or internally with aid of integral sweep oscillator. In/out ratio 50 %. Max. signal frequency approx. 12 MHz (TOE 7706), approx. 20 MHz (TOE 7708 A, TOE 7711, TOE 7711 A).



Output signals in trigger and gate modes

Tripping voltage

TTL level

Start phase: -90° to $+90^\circ$, continuously adjustable.

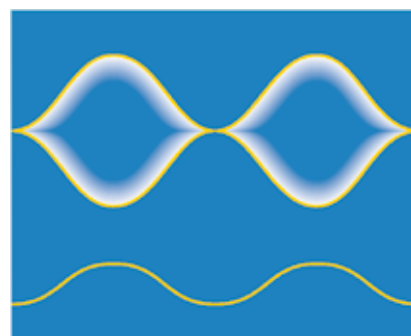
Amplitude modulation

Internal AM

1 mHz to 22 MHz carrier frequency (TOE 7708A, TOE 7711 A), all functions except pulse, TTL, ECL

Modulation frequency: 1 kHz

Modulation factor: 0 to 100 %



Amplitude modulation

External AM

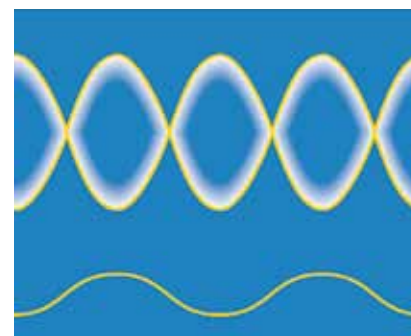
1 mHz to 22 MHz carrier frequency (TOE 7708A, TOE 7711 A), all functions except pulse, TTL, ECL

Modulation frequency:

DC up to 500 kHz

Modulation factor: 0 to 200 %

Modulation voltage: $2.5 V_{pp}$ for 50 % AM



Amplitude modulation with suppressed carrier

General data/ordering data/options

TOE 7704 to TOE 7711 A



TOE 7711 A

Synthesizer mode (PLL)

(only TOE 7711, TOE 7711 A).

In PLL mode, the output frequency is controlled with crystal accuracy. Short-term and long-term errors are negligibly small compared to the display resolution.

Frequency range	10 Hz to 44 MHz
Resolution	4½ digits, autoranging
Frequency error	< 2 ppm
Drift	5 x 10 ⁻⁸ /K
Aging	≤ 2 ppm/year

General data

Line voltage	115/230 V ± 10 % 47 Hz to 63 Hz
Power consumption	40 VA
Operating temperature	0 °C to 50 °C
Reference temperature	23 °C ± 1 °C
Storage temperature	- 20 °C to + 70 °C
Dimensions (WxHxD)	265 x 147 x 330 mm
Weight	5 kg
Housing	Aluminium

Frequency counter mode

Frequency range	10 Hz to 50 MHz, reciprocal counting method
Resolution	4½ digits, autoranging
Input voltage	TTL level
Gate time	0.5 s
Time base error	< 10 ⁻⁵
Aging	< 5 ppm/year
Input impedance	10 kOhm
Input protection	Up to 15 V _{rms}

Ordering data

Function generator	TOE 7704
Function generator	TOE 7706
Function generator	TOE 7707
Function generator	TOE 7708 A
Function generator	TOE 7711
Function generator	TOE 7711 A

Options

TOE 7700/101	Feedback voltage protection
TOE 9008	Carrying handle
TOE 9501	19" adapter, 3 HU
TOE 9503	19" rack module, 4 HU