

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

TOE 7704 to TOE 7711 A



- ❖ 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.

Besides the usual standard signal shapes including variable signal symmetry, this range is equipped with a lin/log sweep oscillator that 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 incremental spinwheel 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 unobtainable.

All inputs and outputs are floating, with the most important ones arranged on the front panel for ease of operation. Add to this the wide frequency range, its outstanding finish, and the clear and balanced design of its control panel and you will gain an idea of the possibilities of these function generators.

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

The TOE 7706A, TOE 7708A and TOE 7711A models are additionally able to work in amplitude modulation mode, resulting in a significantly wider range of application.

The TOE 7710 and TOE 7711/7711A 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  $2 \times 10^{-6}$  of the full-scale value, and the aging rate is only 2 ppm/year.

O V E R V I E W									
TOE	7704	7706	7706A	7707	7708	7708A	7710	7711	7711A
Frequency									
Min (mHz)	1	1	1	1	1	1	1	1	1
Max (MHz)	12	12	12	22	22	22	44	44	44
Synthesizer							●	●	●
Frequency counter	●	●	●	●	●	●	●	●	●
Signal waveforms ~ ^ □, TTL, ECL	●	●	●	●	●	●	●	●	●
Pos./neg. pulse	●	●	●	●	●	●	●	●	●
Var. symmetry	●	●	●	●	●	●	●	●	●
Output (V <sub>pp</sub> )	> 30 V	> 30 V	> 30 V	> 20 V	> 20 V	> 20 V	> 20 V	> 20 V	> 20 V
Operating modes									
Trigger/gate		●	●		●	●		●	●
Lin/log sweep	●	●	●	●	●	●		●	●
VCO, ext.	●	●	●	●	●	●	●	●	●
Amplitude modulation			●			●			●

# Specifications

## TOE 7704 to TOE 7711 A

### Specifications

#### Functions and operating modes

**Functions:** sine, triangle, square, pos./neg. pulse, TTL, ECL, variable symmetry, DC.

**Operating modes:** continuously adjustable, internal and external sweep-frequency control, amplifier, frequency counter.

#### Trigger and gate modes:

TOE 7706, TOE 7706 A, TOE 7708, TOE 7708 A, TOE 7711, TOE 7711 A

#### Amplitude modulation:

TOE 7706 A, TOE 7708 A, TOE 7711 A

#### Synthesizer mode (PLL):

TOE 7710, TOE 7711, TOE 7711 A

#### Frequency characteristics

##### Frequency range:

**TOE 7704, TOE 7706, TOE 7706 A:**

1 mHz ... 12 MHz (sine, triangle, square, pulse, TTL, ECL)

**TOE 7707, TOE 7708, TOE 7708 A:**

1 mHz ... 22 MHz (sine, triangle, square, pulse, TTL, ECL)

**TOE 7710, TOE 7711, TOE 7711 A:**

1 mHz ... 44 MHz (pulse, TTL, ECL),  
1 mHz ... 22 MHz (sine, triangle, square)

**Resolution:** 3½ digits,  
4½ digits in PLL mode

##### Frequency error: ± 1 LSD

2 x 10<sup>-6</sup> in PLL mode  
5 % of full-scale value  
1 mHz to 10 Hz

**Drift:** 5 x 10<sup>-8</sup>/K,  
2 ppm/year in PLL mode  
10<sup>-3</sup>/K < 1 MHz,  
3 x 10<sup>-3</sup>/K > 1 MHz,  
5 x 10<sup>-3</sup>/8 h free-running; in  
each case following 30 min  
warm-up time

#### Function output at OUTPUT

##### Output amplitude:

**TOE 7704, TOE 7706, TOE 7706 A:**  
10 mV<sub>pp</sub> to 30 mV<sub>pp</sub>, 5 mV<sub>pp</sub> to 15 mV<sub>pp</sub> in  
pulse mode (open output)

**TOE 7707, TOE 7708, TOE 7708 A,  
TOE 7710, TOE 7711, TOE 7711 A:**  
7 mV<sub>pp</sub> to 20 mV<sub>pp</sub>, 3 mV<sub>pp</sub> to 10 mV<sub>pp</sub> in  
pulse mode (open output)

#### Impedance:

Z<sub>o</sub> = 50 Ohm/600 Ohm (switchable).  
The output is short-circuit and no-load  
proof.

#### Feedback voltage protection:

up to ≤ 120 V (option)  
DC offset: 0 to ± 10 V

#### Output attenuator:

30 dB continuously adjustable plus  
20 dB or 40 dB steps (max. 70 dB)

#### Accuracy:

± 5 % (at max. amplitude; at 1 kHz for  
sine and triangle)

#### Drift:

± 0.05 % of full-scale value within  
10 min ± 0.3 % of full-scale value  
within 8 hours.

#### Frequency response:

Sine ± 0.5 dB,  
± 2 dB above 1 MHz  
Triangle ± 0.5 % dB,  
± 2.5 dB above 1 MHz

#### Display:

The output voltage is displayed in V<sub>pp</sub>  
or in ± V (for DC).

The max. error is ± 5 % of full-scale  
Function specification  
at max. output voltage and  
Z<sub>o</sub> = Z<sub>L</sub> = 50 Ohm

**Reference temperature:** 23 °C ± 1 °C

#### Sine:

Distortion factor ≤ 0.5 % up to  
100 kHz; all harmonics are 26 dB below  
the fundamental wave up to 12 MHz  
(TOE 7704, TOE 7706, TOE 7706 A), or  
up to 22 MHz (TOE 7707, TOE 7708,  
TOE 7708 A, TOE 7710, TOE 7711,  
TOE 7711 A).

#### Triangle:

Linearity and symmetry error  
≤ 1 % up to 100 kHz

#### Square:

Transition time (10 % to 90 %) typ.  
10 ns, overshoots < 5 %

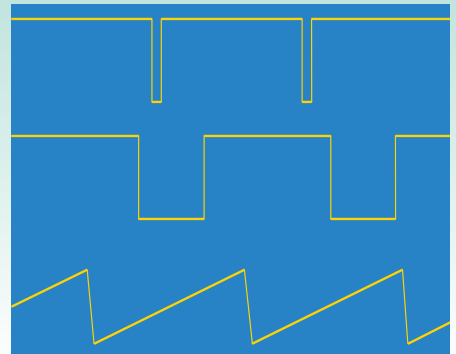
**Pulse:** see square

#### TTL OUT:

Output level: 0 V/5 V (typ.),  
t<sub>r</sub>/t<sub>f</sub>: ≤ 5 ns, Z<sub>o</sub> = 50 Ohm,  
Z<sub>L</sub> ≤ 50 Ohm

#### ECL OUT:

Output level: - 0.9 V/-1.8 V (typ.),  
t<sub>r</sub>/t<sub>f</sub>: ≤ 2 ns, Z<sub>o</sub> = 50 Ohm,  
Z<sub>L</sub> ≤ 50 Ohm



*Variable symmetry for triangle and square*

#### Variable symmetry:

Continuously adjustable from 10% to  
90% for all functions, f<sub>max</sub>: 1.2 MHz  
(TOE 7704, TOE 7706, TOE 7706 A),  
f<sub>max</sub>: 2.2 MHz (TOE 7707, TOE 7708,  
TOE 7708 A, TOE 7710, TOE 7711,  
TOE 7711 A).

#### DC voltage:

3 ranges with Z<sub>o</sub> = 50 Ohm/600 Ohm  
0 to ± 0.1 V, 0 to ± 1 V, 0 to ± 10 V

#### Operating modes:

**TOE 7704, TOE 7707:**

Sweep, amplifier mode, frequency  
counter

**TOE 7710:**

VCO, amplifier mode, PLL, frequency  
counter

**TOE 7706, TOE 7706 A, TOE 7708, TOE  
7708 A, TOE 7711, TOE 7711 A:**

Sweep, amplifier mode, trigger and  
gate modes, internal and (only  
TOE 7706A, TOE 7708A, TOE 7711A)  
external AM mode, synthesizer mode  
(PLL for TOE 7710, TOE 7711  
TOE 7711 A), frequency counter

#### Sweep:

All functions, lin/log, rising, falling,  
continuously adjustable for internal  
and external trigger, hold, reset.

#### Range:

**TOE 7704, TOE 7706, TOE 7706 A:**  
1 mHz to 12 MHz

**TOE 7707, TOE 7708, TOE 7708 A,  
TOE 7711, TOE 7711 A:**  
1 mHz to 22 MHz

# Specifications

## TOE 7704 to TOE 7711 A

**Sweep time:** 1 ms ... 1000 s

**Resolution:** 2 digits

**Error:**  $5 \times 10^{-5}$

**Sweep range:** 3 decades (log),  
2 decades (lin)

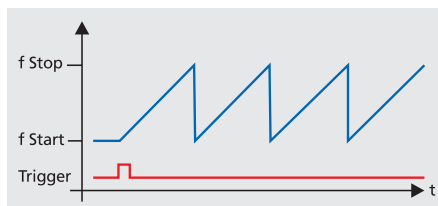
**Frequency output voltage:**

approx. 0 V (start frequency) to +5 V (stop frequency)

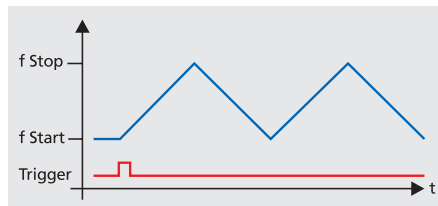
**Pen lift output:**

TTL level, 0 V (return)

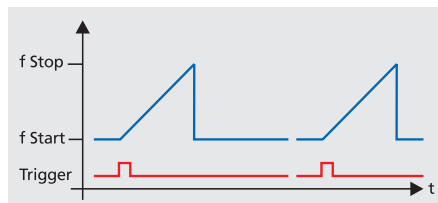
### Sweep modes:



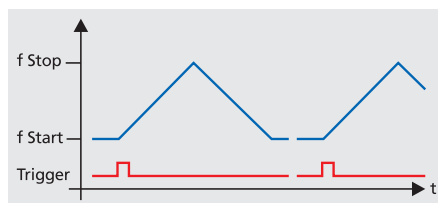
Continuous sweep with reset after the start pulse



Continuous sweep with reverse after the start pulse



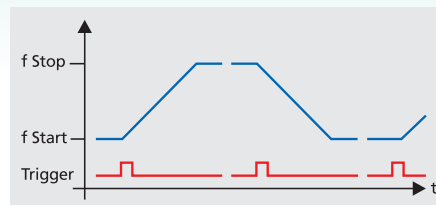
Triggered sweep with reset



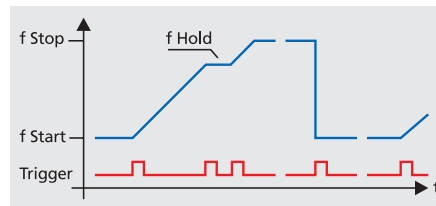
Triggered sweep with reverse



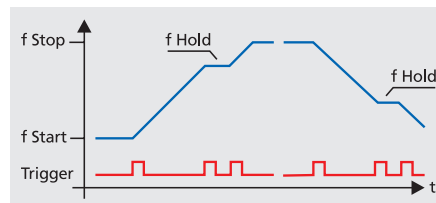
Triggered sweep with hold and triggered reset



Triggered sweep with hold and triggered reverse



Triggered sweep with triggered hold and triggered reset



Triggered sweep with triggered hold and triggered reverse

### Amplifier mode

**Gain:**

**TOE 7704, TOE 7706, TOE 7706 A:**  
approx. 17 dB, DC up to  $\geq 12$  MHz,

**TOE 7707, TOE 7708, TOE 7708 A,  
TOE 7710, TOE 7711, TOE 7711 A:**

approx. 14 dB, DC up to  $\geq 12$  MHz,  
distortion factor  $< 0.2\%$   
up to 100 kHz,  
input via "EXT IN".

**Trigger and gate modes**

(TOE 7706, TOE 7706 A, TOE 7708, TOE 7708 A, TOE 7711, TOE 7711 A)

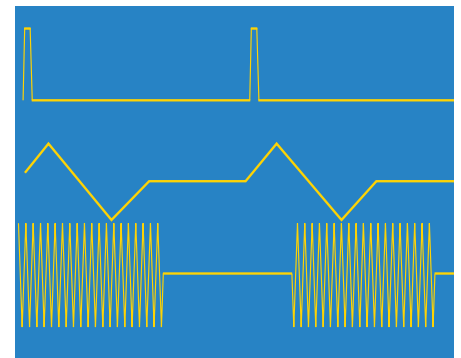
### Individual triggering:

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

**Tripping voltage:** TTL level

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

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



Output signals in trigger and gate modes

**Tripping voltage:** TTL level

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

**Amplitude modulation**

(TOE 7706A, TOE 7708A, TOE 7711A only)

Internal AM

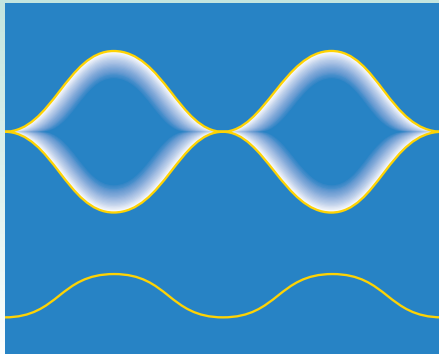
Frequency range: 1 MHz to 12 MHz  
carrier frequency (TOE 7706A) or  
1 MHz to 22 MHz carrier frequency  
(TOE 7708A, TOE 7711A),  
all functions except pulse, TTL, ECL

Modulation frequency: 1 kHz

Modulation factor: 0 to 100 %

## Specifications

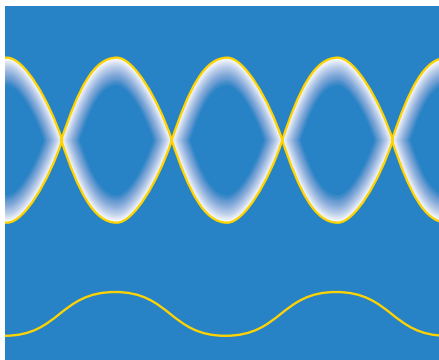
### TOE 7704 to TOE 7711 A



Amplitude modulation

#### External AM

Frequency range: 1 mHz to 12 MHz carrier frequency (TOE 7706A) or 1 mHz to 22 MHz carrier frequency (TOE 7708A, TOE 7711A), 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

#### Synthesizer mode (PLL)

(TOE 7710, TOE 7711, TOE 7711 A only)

In PLL mode, the output frequency is control 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:  $4\frac{1}{2}$  digits  
Frequency error:  $< 2$  ppm  
Drift:  $5 \times 10^{-8}/K$ ,  
Aging:  $\leq 2$  ppm/year

#### Frequency counter mode

Frequency range: 10 Hz to 50 MHz, reciprocal counter method  
Resolution:  $4\frac{1}{2}$  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  $15 V_{rms}$

#### General data

**Mains voltage:** 115/230 V  $\pm 10$  %, 48 ... 60 Hz  
**Power consumption:** 40 VA  
**Operating temperature:** 0 °C ... 50 °C  
**Reference temperature:** 23 °C  $\pm 1$  °C  
**Storage temperature:** - 20 °C ... + 70 °C  
**Dimensions:** 265 x 147 x 330 mm (WxHxD)  
**Weight:** 5 kg  
**Housing:** Aluminium  
**Ordering data:**  
Function generator TOE 7704  
Function generator TOE 7706  
Funktion generator TOE 7706A  
Funktion generator TOE 7707  
Funktion generator TOE 7708  
Funktion generator TOE 7708A  
Funktion generator TOE 7710  
Funktion generator TOE 7711  
Funktion generator TOE 7711A  
**Options:**  
Feedback voltage protection TOE 7700/101  
19" adapter, 3HU TOE 9501  
19" slide-in module, 4HU TOE 9503  
Carrying handle TOE 9008