

# Automotive Transient Generator



## 1. Automotive Transient Generator Specifications

Parameter	Specification	
<b>Power Supply Details</b>		
Output voltage	0V to + 60V	
Output current	0A - 50A, continuous	
Peak current	100A for max. 500ms	
Frequency range	DC to 100kHz *	
Supply voltage	3x400V (US-type 3x480V)	
<b>MICROPULSES</b>		
Test voltage	U = 20V - 600V $\pm$ 10% (peak voltage and polarity as per selected standard)	
Repetition rate	0.2s - 99.0s	
<b>ISO PULSE 1</b>		
Rise time	1 $\mu$ s, +0 $\mu$ s/-0.5 $\mu$ s & 3 $\mu$ s +0 $\mu$ s/-1.5 $\mu$ s  Please note: 10% _ 90% is settings in Oscilloscope horizontal cursor for measuring Tr.	
Pulse duration	1ms and 2 ms $\pm$ 20%	
Int. resistor	10ohm and 50ohm $\pm$ 10%	
<b>ISO PULSE 2a (Need to mention about the 2b pulse)</b>		
Rise time	1 $\mu$ s +0 $\mu$ s/-0.5 $\mu$ s	
Pulse duration	50 $\mu$ s $\pm$ 20%	
Int. resistor	2 $\Omega$ $\pm$ 10%	
<b>ISO PULSE 2b</b>		
Rise time	1ms +/-0.5ms	
Pulse duration	0.2s to 2s	
Int. resistor	0 $\Omega$ to 0.05 $\Omega$	
	As per ISO 7637-2 standard we need cover Pulse 2B also	
<b>ISO PULSE 3a (test requirement should meet as per ISO 7637-2 pulse 3a and 3b)</b>		
Rise time	5ns +/- 1.5ns  Peak voltage $V_p$ shall be adjusted to the test levels specified in Annex A with a tolerance of $\left(\frac{+10}{-0}\right)\%$ . The timing (t) tolerances and internal resistance (R <sub>i</sub> ) tolerance shall be $\pm 20\%$ unless otherwise specified.  It is 20% only, if they are no mentioned any tolarances.since they given tolarances no need 20%. As per 7637-2_2004 Standard P.g no 13.	

Pulse duration	0.1us, +0.1us\ -0us _as per 2004 standard And 150ns +\ - 45ns as per 2011. Above comment is applicable	
Int. resistor	50 ohm ± 10%	
Burst duration	t4= 10ms	
Burst repetition rate	t5 =90ms	
Spike frequency	f = 0.1kHz - 200kHz t1 = 5µs - 10ms	
<b>ISO PULSE 3b</b>		
Rise time	5ns +/- 1.5ns <small>Peak voltage <math>V_p</math> shall be adjusted to the test levels specified in Annex A with a tolerance of <math>\left(\frac{+10}{-10}\right)\%</math>. The timing (t) tolerances and internal resistance (R) tolerance shall be ± 20% unless otherwise specified.</small>	
Pulse duration	0.1us, +0.1us\ -0us _as per 2004 standard And 150ns +\ - 45ns as per 2011.	
Int. resistor	50 ohm ± 10%	
Voltage (Open circuit )	25V – 1000V ± 10 %	
At 50 Ohms	U = 13V – 500V ± 10 %	
Rise time	5ns +/- 1.5ns	
Burst duration	t4= 10ms	
Burst repetition rate	t5 =90m	
Spike frequency	f = 0.1kHz - 200kHz t1 = 5µs - 10ms	
<b>ISO PULSE 4</b>		
tf [Vb-Va1]	< 5ms	
Vb	0.0V – 30.0V (60.0V)	
Va1	-30.0V(-60.0V)- 30.0V(+60.0V)	
Va2	-30.0V(-60.0V)- 30.0V(+60.0V)	
t1	0.1S – 99.9S	
t7	15ms to 100ms	
t8	5ms to 50ms	
t9	0.1s to 20 s	
t11	5ms to 100ms	
Va	0V-60V	
<b>ISO PULSE 5a and 5b (test requirement should meet as per ISO 7637-2 and 16750-2)</b>		
Rise time	10ms,-5ms\+0ms	
Pulse duration	400ms	
Int. resistor	0.5 ohm to 8 ohm ± 10%	

## 2. Conducted Transient Emission

Parameter	Specification	
<b>Test voltage</b>		
Operating voltage	Max. 60 V	
Operating current	Max. 100 A continuous	
Peak current protection	500 A	
Inrush current	400 A for 200ms	
Voltage drops	Less than 1V @ 25 A U <sub>max</sub> =400V @25A I <sub>max</sub> = 25 A continuously,100 A for t ≤ 1 s. switching time, Δt <sub>s</sub> = 300 ns ± 20 % with DUT;	

Overvoltage protection	By Varistor	
Overload protection	Short – circuit over temperature protected switch off after approx. 2 min with 120 A; switch on after approx. 45 s cooling time.	
Inverse polarity protection	Protected with an additional acoustic signal in case of inverse polarity	

### 3. Electronic Switch

Parameter	Specification	
<b>Test voltage</b>		
Switching time	300 ns $\pm$ 20% (240 ns – 360 ns) into test load 50 $\mu$ H/0.6 $\Omega$	
On/Off duration	Min. 10ms to 500ms continuously selectable by potentiometer $\pm$ 5%	
On/Off repetition	Min. 1 s to 10 s continuously selectable by potentiometer $\pm$ 5%	
Operation	Switch closed indicated by LED	
<b>Trigger</b>		
Auto	Automatic trigger with min. $\sim$ 0.1 Hz to max. 1 Hz repetition, continuously selectable by potentiometer	
Extern	External trigger $\downarrow$ 0V, BNC input (Umax. +15 V)	
External LV124 Mode	Active when Manual Trigger button is pressed during "Power ON"	
Trigger delay typical	Switch off: approx. 10.5 $\mu$ s Switch on: approx. 94ms	
Manual	Manual trigger of a single event	
<b>Requirement of Power Supply adapter : It is necessary if, external supply is required to turn on the switch</b>		

### 4. Single Line Artificial Network

DUT Supply	Specification	
Max operating voltage	1000V DC / 250V AC (up to 1kHz)	
Max. operating current	50A continuous	
Max. peak current	100A	
Max operating voltage	1000V DC / 250V AC (up to 1kHz)	
<b>Artificial Network</b>		
<b>Specification</b>		
Impedance	50 $\Omega$    5 $\mu$ H + 1 $\Omega$ +/- 10%	
Frequency range	100 kHz to 108 MHz	
Inductance	5 $\mu$ H (Air core)	
Insertion loss	< 3 dB DUT to receiver output	
Coupling capacitor	0,1 $\mu$ F	
Connector	Multi Contact 6mm High-current connector up to 100A 4mm banana safety lab connector up to 32A	
BNC plug	for 50 $\Omega$ terminating resistor or measuring device (in parallel with 22k $\Omega$ )	

## Electrical transient transmission by capacitive and inductive coupling via lines other than supply lines

### a) capacitive coupling clamp (CCC) method:

Parameters	12 V system	24 V system	42 V system
$U_s$ in V	See Table B.1	See Table B.2	See Table B.3
$t_r$ in ns	5	5	5
$t_d$ in $\mu$ s	0,1	0,1	0,1
$t_1$ in $\mu$ s	100	100	100
$t_4$ in ms	10	10	10
$t_5$ in ms	90	90	90
$R_i$ in $\Omega$	50	50	50

Figure 8 — Fast transient test pulse b

Parameters	12 V system	24 V system	42 V system
$U_s$ in V	See Table B.1	See Table B.2	See Table B.3
$t_r$ in ns	5	5	5
$t_d$ in $\mu$ s	0,1	0,1	0,1
$t_1$ in $\mu$ s	100	100	100
$t_4$ in ms	10	10	10
$t_5$ in ms	90	90	90
$R_i$ in $\Omega$	50	50	50

Figure 7 — Fast transient test pulse a

### b) Direct capacitive coupling (DCC) method:

Table 3 — Capacitor values for DCC test method

Test pulse	Capacitor value
Fast transient test pulse	100 pF
Slow transient test pulse	0,1 $\mu$ F

### c) Inductive coupling clamp (ICC) method:

Table 4 — ICC — Characteristics of the coupled pulses

Parameters	12 V system	24 V system	42 V system
$t_d$ in $\mu$ s	(7 $\pm$ 30) %	(7 $\pm$ 30) %	(7 $\pm$ 30) %
$t_r$ in $\mu$ s	$\leq$ 1,2	$\leq$ 1,2	$\leq$ 1,2

## Additional Items with Automotive Transients (But not limited to):

- Calibration kit and Calibration Fixture for Transients:
- Software for equipment operation:
- Batteries 6 numbers (4 numbers of 12V DC,90AH. 2 numbers of 12V DC 150AH):
- Battery Charger as required to charge above batteries:
- BNC cables (As required for using with test instrument):
- Insulation Support \_50mm thickness(Length = 1.2m width :0.5m (Styrofoam):
- Capacitive Coupling Clamp (CCC method) (1 number):
- Injection Probe (ICC method) along with calibration jig and accessories:
- DCC method Capacitor value 100pF and 0.1uf and 470pF:
- Two numbers of High Voltage LISN acc. To CISPR 25 Ed. 4 or BMW GS 95025-1 to measure the conducted disturbance voltage on shielded lines for (hybrid) electric vehicles (HEV, EV), can be used for BCI with an external dummy load, impedance (5 $\mu$ H) || 50 Ohm. 70 (100) A, 1000 V DC:
- Shielded housing for 2 HV-LISN, 2 paths with cable feed troughs for HV+ and HV-, shield can be connected to the housing, 2 measurement ports N, 2 monitor ports N, with connecting cables between inside measurement ports and outside N-connectors:

Description	Specification	Quantity
Metallic Table	Table of size H:0.9mXW:1.2mXL:2m	3
Ground reference plane	2.44m (Length) X 4m (Width) min 0.25mm to 0.65mm thickness (Aluminum or copper) - Checked Plates	3
Ground reference plane	2.0m (Length) X 4m (Width) min 0.25mm to 0.65mm thickness (Aluminum or copper) - Checked Plates	1
MULTIMETER	Voltage up to 1000V AC and DC; Current rating up to 10A, with Acc. calibration certificate.	1
CLAMP METER	Voltage up to 1000V AC and DC; Current rating up to 100A, with Acc. calibration certificate.	1
RC Network	Capacitor = 220pF $\pm$ 20%, Resistor 510 $\Omega$ $\pm$ 10%	1
Test Rack	Net-rack Table 1.5mL x 0.7mWx2mH with accessories	2
Insulation Support	Styrofoam Table (0.8mX1.0mX0.8m) (H*L*W)	1
Wooden Insulation Support	Wooden Support, (0.1m*1.5m*1.2m) (H*W*L) Wooden Support, (0.1m*0.6m*0.6m) (H*W*L)	1 each
ESD Target	Target as per IEC 61000-4-2 (Only target & Fixture not required)	1
ESD Target accessories	Calibration adopter, 20db SMA Attenuator (additionally), SMA cable, SMA to BNC adopter (For cable chain)	As required for target
Oscilloscope	2GHz Bandwidth	1

## Supported Standards

ISO 7637-1
ISO 7637-2
ISO 7637-3
ISO 16750-2
AIS 004 part 3
ECE R10 Rev 5