

# M Precision Laboratories ECAT Lightning Test System (LTS)

Modular LTS platform for multiple avionic standards

The M Precision Labs ECAT Lightning Test System (LTS) is a modular test platform which tests to the lightning simulator requirements of RTCA DO-160, Section 22 and Section 17. The system is expandable to meet Boeing, Airbus, EUROCAE and other avionic standards.

- Safe
- Quick test set-up
- Simple user interface
- Waveforms: 1, 2, 3, 4, 5A, 5B and 6
- Levels 1, 2, 3, 4 and 5+
- Single Stroke, Multiple Stroke, Multiple Burst and Pin Injection from the same front panel
- Modular architecture
- Voltage spikes



## When failure is not an option

With its fully-automated test operation, the M Precision Labs ECAT Lightning Test System (LTS) yields reliable, repeatable and accurate test results to avionics lightning simulation requirements of RTCA DO 160 Section 22 and 17. It is easily expandable to meet most Boeing, Airbus, EUROCAE and other requirements.

Building on the legacy of the proven ECAT platform, it provides field-upgradeable modular technology featuring fast test set-up, intuitive programming, and front panel control. On-site calibration and field service is available worldwide.

## System description

The ECAT LTS is configured as a basic test system available as a Level 3, Level 4, or Level 5 tester. All test systems feature Single stroke, Multiple Stroke, Pin Injection and Multiple Burst test capability integral to the system controls without any external connections.

The system is composed of a frame that houses power and control functions for the system. Waveforms are produced from the modules inserted into the frame. Both the frame and modules can be purchased separately. Owning multiple frames allows increased capability by "swapping" modules between frames, and testing with each frame simultaneously.

## The Total System

The ECAT LTS provides a modular test platform based on the requirements of RTCA DO-160G Section 17 (Voltage Spikes) and Section 22 (Lightning Induced Transient Susceptibility), EUROCAE, Boeing, Airbus and others. The LTS can perform Pin Injection, Cable Bundle and Ground Injection testing with Single Stroke, Multiple Stroke and Multiple Burst modes from the same module. The system can be expanded as test requirements evolve or to allow the operator to double his capacity using existing modules without purchasing another system.

## Turn-key Testing

With the advent of the ECAT LTS, lightning testing of avionics comes of age with an easy to use, turn-key solution for test engineers and technicians. Until recently, the availability of commercial equipment for testing to lightning standards for avionics, such as RTCA DO-160G, has been limited. Most test equipment used in the industry was home-made: difficult and time consuming to set-up and awkward to use, often unsafe and requiring skilled engineers for their operation and maintenance.

Testing with the ECAT LTS insures repeatable, reproducible test results while virtually eliminating tester set-up time. Waveforms and functions are selected with the push of a button rather than by reconfiguring test equipment and moving around bulky generator boxes and wiring. The ECAT LTS can significantly reduce total test time resulting in significant cost savings.

## Versatile, Modular Architecture

ECAT LTS modular systems are totally open-ended to protect you as industry standards evolve. Built upon the proven modular construction of the M Precision Labs ECAT System, ECAT LTS waveform simulators use plug-in modules that can be added or replaced by the operator at any time without a field service engineer or shipping to the factory, at considerably less expense than purchasing new instruments.

## Currently Available LTS Modules<sup>1</sup>:

Waveform	Pin Injection	Single Stroke	Multiple Stroke	Multiple Burst	Description	Plug-in Module
WF1		•	•		6.4µs X 69µs Current Wave	D561, D566
WF2	•	•	•		≤100ns x 6.4µs Voltage Wave	D562
WF3- 1 MHz	•	•	•	•	1 MHz Oscillatory Voltage Wave	D563
WF3- 10 MHz		•	•	•	10 MHz Oscillatory Voltage Wave	D563
WF4	•	•	•		6.4µs X 69µs Voltage Wave	D561, D566
WF5A	•	•	•		40µs X 120µs Current Wave	D561, D567
WF5A Airbus/Boeing		•	•		40µs X 120µs Voltage & Current Wave	D568
WF5B	•	•	•		50µs X 500µs Current Impulse	D564
WF6				•	0.25µs X 4.0µs Current Impulse	D569
Voltage Spikes				2	≤2µs X ≥10µs, ≤2µs X ≥50µs, ≤2µs X ≥100µs, ≤2µs X ≥200µs, ≤2µs X ≥400µs	D570

<sup>1</sup>See specifications

<sup>2</sup>Up to 50 pulses in 60 seconds

## One example of the multiple standards supported for WF3 Multiple Burst Test Mode:

LTS Display	Standards Compliance	Min. Applic. Time	Max # Trans	Max # Bursts	Time Between Bursts	Time Between Transients
DO160	DO160 Boeing D6-16050-5 Airbus ABD0100.1.2-F Airbus ABD0100.1.2-G	3 sec	20	3	30-300ms	50-10,000µs
Airbus/E	Airbus ABD0100.1.2-E	15 sec	500	1	-----	10-10,000µs

Boeing-4	Boeing D6-16050-4 NH-90	3 sec	20	24	10-200ms	10-50 $\mu$ s
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Example test setup for WF3 Single Stroke, Multiple Stroke, Multiple Burst and Pin Injection from the same module front panel



DCHV-1 Coupler

Cable Induction

- Single Stroke
- Multiple Stroke
- Multiple Burst

Pin Injection

Controller front panel programming for above example



1. Select Test Type: Pin Injection, Single Stroke, Multiple Stroke or Multiple Burst

2. Select waveform type, voltage levels and timing



It doesn't get any easier than this!

<b>Model: F-LTS-X</b>	(x indicates level 3, 4 or 5)
LTS Frame/Controller for the operation of individual modules	
System Voltage	190-230 VAC, 50/60 Hz, 3Ø Wye, 30 Amax (Optional 190-230 VAC, 50/60 Hz, 1Ø 50 Amax)
Test Types	Single Stroke Multiple Stroke: 1-24 pulses; 10–200 ms fixed, random or irregular 1st pulse and subsequent pulse spacing Multiple Burst: 1-500 pulses; 50–1000 us fixed, random or irregular pulse spacing; 1-24 bursts; 30–300 ms fixed, random or irregular burst spacing Pin Injection Voltage Spikes
Number of Tests	1 to 999
Test Repetition Rate	3 s to 255 s (at maximum level, min rep rate may be >3 s)
Control Interface	Display 8x40 character LCD; Remote USB, RS232, Fiber-optic (future feature)
Safety Features	Emergency off switch, external interlock for users (mats, Lexan barrier, etc); lockout/tag out capability
Module Bays	3 full-width / 4 half-width plug-in module capability
Operating Temperature	+15°C to +35°C
Humidity	10-75%, non-condensing
Physical Specifications	Height 160 cm (66.6 in); Width 107 cm (42 in); Depth 69 cm (27 in); Weight 360 kg (800 lb) fully configured
Options	LTS-1PHASE: Adds a power converter to accept 190-230 VAC, 50/60 Hz, 1Ø 50 Amax to power the LTS
CE Marking	Safety and EMC Directives

<b>Model: D561-Lx</b>	(x indicates level 3, 4 or 5)
LTS Module for WF1, WF4, WF5A, full-width ECAT plug-in module	
WF1 (CI <sup>1</sup> , GI)	Single Stroke, 6.4/69 µs, 50-3800 A, 2000 Voc Multiple Strokes, 6.4/69 µs, 25-1200 A
WF4 (GI)	Single Stroke, 6.4/69 µs, 25-2000V, 2100 Asc Multiple Strokes, 6.4/69 µs, 10-600 V
WF4 Pin Injection	6.4/69 µs, 50-2000 Voc / 10-400 Asc = 5 Ohm
WF5A (CI <sup>1</sup> , GI)	Single Stroke, 40/120 µs, 50-10000 A, 1300 Voc Multiple Strokes, 40/120 µs, 30-1500 A
WF5A Pin Injection	40/120 µs, 50-1800 Voc / 50-1800 Asc = 1 Ohm
Safety Features	Door interlocks, safety sockets, outputs only connected during transient, active module indicator LED, voltage present indicator LED
Operating Temperature	+15°C to +35°C
Humidity	10-75%, non-condensing
CE Marking	Safety and EMC directives

<sup>1</sup>(For Cable Induction use Model DCI-1 Cable Induction Coupler)

<b>Model: D562-Lx</b>	(x indicates level 3, 4 or 5)
LTS Module for WF2, half-width ECAT plug-in module	
WF2 (CI <sup>1</sup> , GI <sup>2</sup> )	Single Stroke, 0.1/6.4 µs, 25-1920 V, 1700 Asc Multiple Strokes, 0.1/6.4 µs, 25-1200 V
Safety Features	Door interlocks, safety sockets, outputs only connected during transient, active module indicator LED, voltage present indicator LED
Operating Temperature	+15°C to +35°C
Humidity	10-75%, non-condensing
CE Marking	Safety and EMC directives

<sup>1</sup>(For Cable Induction use Model DCV-1 Cable Induction Coupler and use 2 for Level 5)

<sup>2</sup>(Add wire to clamp between ground planes)

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**Model: D563-Lx** (x indicates level 3, 4 or 5)

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LTSM module for WF3, 1 MHz and 10 MHz, full-width ECAT plug-in module

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WF3 (CI <sup>1</sup> , GI)	Single Stroke, 1 MHz, 25-4000 V, 160 Asc Multiple Strokes, 1 MHz, 25-2400V Multiple Burst, 1 MHz, 25-2300V Single Stroke, 10 MHz, 25-4000 V, 60 Asc Multiple Strokes, 10MHz, 25-2400V Multiple Burst, 10MHz, 25-2300V
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WF3 Pin Injection	1 MHz, 30-4000 Voc /1.2-160 Asc = 25 Ohm
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Safety Features	Door interlocks, safety sockets, outputs only connected during transient, active module indicator LED, voltage present indicator LED
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Operating temperature	+15°C to +35°C
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Humidity	10-75%, non-condensing
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CE Marking	Safety and EMC directives
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<sup>1</sup>(For Cable Induction use Model DCHV-1 Cable Induction Coupler)

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**Model: D564-Lx** (x indicates level 3, 4 or 5)

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LTSM module for WF5B, full-width ECAT plug-in module

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WF5B (CI <sup>1</sup> , GI <sup>2</sup> )	Single Stroke, 50/500 µs, 150-6000 A, 900 Voc Multiple Strokes, 50/500 µs, 30-1500 V
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WF5B Pin Injection	50/500 µs, 50-1800 Voc /50-1800 Asc = 1 Ohm
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Safety Features	Door interlocks, safety sockets, outputs only connected during transient, active module indicator LED, voltage present indicator LED
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Operating temperature	+15°C to +35°C
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Humidity	10-75%, non-condensing
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CE Marking	Safety and EMC directives
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<sup>1</sup>(For Cable Induction use Model DCI-1 Cable Induction Coupler)<sup>2</sup>(DCI-1 clamp cal loop)

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**Model: D566-Lx** (x indicates level 3, 4 or 5)

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LTSM module for WF1, 4, full-width ECAT plug-in module

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WF1 (CI <sup>1</sup> , GI)	Single Stroke, 6.4/69 µs, 50-3800 A, 2000 Voc Multiple Strokes, 6.4/69 µs, 25-1200 A
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WF4 (GI)	Single Stroke, 6.4/69 µs, 25-2000V, 2100 Asc Multiple Strokes, 6.4/69 µs, 10-600 V
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WF4 Pin Injection	6.4/69 µs, 50-2000 Voc /10-400 Asc = 5 Ohm
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Safety Features	Door interlocks, safety sockets, outputs only connected during transient, active module indicator LED, voltage present indicator LED
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Operating Temperature	+15°C to +35°C
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Humidity	10-75%, non-condensing
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CE Marking	Safety and EMC directives
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<sup>1</sup>(For Cable Induction use Model DCI-1 Cable Induction Coupler)

<b>Model: D567-Lx</b>	(x indicates level 3, 4 or 5)
LTS Module for WF5A, full-width ECAT plug-in module	
WF5A(CI <sup>1</sup> , GI <sup>2</sup> )	Single Stroke, 40/120 $\mu$ s, 50-10000 A, 1300 Voc; Multiple Strokes, 40/120 $\mu$ s, 30-1500 A
WF5APin Injection	40/120 $\mu$ s, 50-1800 Voc /50-1800 Asc = 1 Ohm
Safety Features	Door interlocks, safety sockets, outputs only connected during transient, active module indicator LED, voltage present indicator LED
Operating Temperature	+15°C to +35°C
Humidity	10-75%, non-condensing
CE Marking	Safety and EMC directives

<sup>1</sup>(For Cable Induction use Model DCI-1 Cable Induction Coupler)

<sup>2</sup>(For Ground Injection take from cal loop on DCI-1)

<b>Model: D568-L5</b>	(x indicates level 3, 4 or 5)
LTS Module for WF5A for Airbus/Boeing specifications, full-width ECAT plug-in module	
WF5A(SS, MS)	40/120 $\mu$ s, 50-2000 voltage & current, output impedance =1 Ohm
Safety Features	Door interlocks, safety sockets, outputs only connected during transient, active module indicator LED, voltage present indicator LED
Operating Temperature	+15°C to +35°C
Humidity	10-75%, non-condensing
CE Marking	Safety and EMC directives

<sup>1</sup>(For Cable Induction up to 1500V/1500A use Model DCVI-1 Cable Induction Coupler and use 2 for Level 5, use 3 for 2000V/2000A)

<b>Model: D569-Lx</b>	(x indicates level 3, 4 or 5)
LTS Module for WF6, full-width ECAT plug-in module	
WF6(CI <sup>1</sup> , GI)	Multiple Burst, 0.25/4.0 $\mu$ s, 5-160 A, 4500 Voc
Safety Features	Door interlocks, safety sockets, outputs only connected during transient, active module indicator LED, voltage present indicator LED
Operating Temperature	+15°C to +35°C
Humidity	10-75%, non-condensing
CE Marking	Safety and EMC directives

<sup>1</sup> (For Cable Induction use Model DCHV-1 Cable Induction Coupler)

<b>Model: D570</b>	(x indicates level 3, 4 or 5)
LTS Module for RTCA DO-160G, Section 17, Voltage Spikes, full-width ECAT plug-in module	
$\leq 2\mu$ s X $\geq 10\mu$ s	50 $\Omega$ or 100 $\Omega$
$\leq 2\mu$ s X $\geq 50\mu$ s	5 $\Omega$ or 10 $\Omega$
$\leq 2\mu$ s X $\geq 100\mu$ s	5 $\Omega$ or 10 $\Omega$
$\leq 2\mu$ s X $\geq 200\mu$ s	5 $\Omega$
$\leq 2\mu$ s X $\geq 400\mu$ s	5 $\Omega$ or 10 $\Omega$
Safety Features	Door interlocks, safety sockets, outputs only connected during transient, active module indicator LED, voltage present indicator LED
Operating Temperature	+15°C to +35°C
Humidity	10-75%, non-condensing
CE Marking	Safety and EMC directives

## Accessories

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### Option: DCI-1

Cable Induction Coupler for WF1, 4, 5A, 5B

WF1	6.4/69 $\mu$ s, >2000 VLimit, >5000 A Test
WF4	See Technical Note #201
WF5A	40/120 $\mu$ s, >1200 VLimit, >10,000 A Test
WF5B	50/500 $\mu$ s, >900 VLimit, >6000 A Test
Safety Features	Double insulated, safety sockets
Dimensions	Height 21.6 cm (8.5 in); Width 28.3 cm (11.1 in); Depth 34.3 cm (13.5 in)
Aperture	3.8 cm x 7.6 cm (1.5 in x 3 in)
Weight	48 kg (106 lb)
CE Marking	Safety and EMC directives

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### Option: DCV-1

Cable Induction Coupler for WF2 (use 2 for Level 5)

WF2	0.1/6.4 $\mu$ s, >2000 VTest, >1700 A Limit
Safety Features	Double insulated, safety sockets
Dimensions	Height 14.2 cm (5.6 in); Width 12.7 cm (5.0 in); Depth 31.8 cm (12.5 in)
Aperture	3.8 cm x 5.1 cm (1.5 in x 2 in)
Weight	13 kg (29 lb)
CE Marking	Safety and EMC directives

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### Option: DCHV-1

Cable Induction Coupler for WF3, 6

WF3/1 MHz	1 MHz, >4000 VTest, >300 A Limit
WF3/10 MHz	10 MHz, >4000 VTest, >20 A Limit
WF6	0.2/4 $\mu$ s, >4000 VLimit, >160 A Test
Safety Features	Double insulated, safety sockets
Dimensions	Height 14.2 cm (5.6 in); Width 12.7 cm (5.0 in); Depth 31.8 cm (12.5 in)
Aperture	3.8 cm x 5.1 cm (1.5 in x 2 in)
Weight	13 kg (29 lb)
CE Marking	Safety and EMC directives

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### Model: D591

Powered Pin Decoupler Module for Powered Pin Injection, half-width ECAT plug-in module

Operating AC Voltage	0-244 VAC, 20 A
Operating DC Voltage	0-285DC, 10 A
Operating Frequency	0-400 Hz
Safety Features	Safety sockets
CE Marking	Safety and EMC directives



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**Option: DCVI-1**

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D568-L5 Cable Induction Coupler for Airbus/ Boeing WF5A specifications. Includes lift and ground plane.  
Top is removable to allow cable bundle insertion within the coupler. Top section weight is 180lb.  
Ground Plane is 0.06 AL sheet, 1" perforated overhangs for attachment to adjacent ground planes if needed.  
Calibration loop contains 1 turn.

2 DCVI-1 clamps required for obtaining waveforms up to 1500V/ 1500A

3 DCVI-1 clamps required for obtaining waveforms at 2000V/2000A

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WF5A(SS, MS)	40/120 $\mu$ s, 50-2000 voltage & current
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Safety Features	Double insulated, safety sockets
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**Transformer**

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Dimensions	Height 34.3 cm (13.5 in); Width 41.9 cm (16.5 in); Depth 45.7 cm (18 in) cable length
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Aperture	6.4 cm x 10.9 cm (2.5 in x 4.3 in)
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Weight	362 kg (800 lbs)
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**Cart**

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Lowered Height	29.8 cm (11.75 in)
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Raised Height	92.7 cm (36.5 in)
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Length	90.1 cm (35.5 in)
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Width	59.69 (23.5 in)
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Lift Time	25 strokes
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Capacity	498.9 kg (1100 lbs)
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Weight	130.2 kg (287 lb)
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DCVI-1 total weight = 493kg 1087 lb)

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CE Marking	Safety and EMC directives
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**Option: D111-1**

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5 KA Current Probe suitable for all waveforms except WF5B

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Sensitivity	0.1 Volt/Ampere +1/-0%
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Output Resistance	50 Ohms
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Scope Coupling	1 M $\Omega$ DC/AC
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Maximum Peak Current	5,000 Amperes
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Useable Rise Time	25 nanoseconds
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Low Frequency 3dB Point	5 Hz
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High Frequency 3dB Point	15 MHz
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Operating Temperature	0°C to +65°C
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Output Connector	BNC
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Weight	1.7 kg (3.7 lb)
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**Option: D301X**

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50KA Current Probe suitable for WF5A, 5B

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Sensitivity	0.01 Volt/Ampere +1/-0%
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Output Resistance	50 Ohms Scope Coupling, 1 M $\Omega$ DC/AC
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Scope Coupling	1 M $\Omega$ DC/AC
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Maximum Peak Current	50,000 Amperes
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Useable Rise Time	200 nanoseconds
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Low Frequency 3dB Cut-off	5 Hz
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High Frequency 3dB Cut-off	2 MHz
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Operating Temperature	0°C to +65°C
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Output connector	UHF (SO-239)
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Weight	7.9 kg (17.5 lb)
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**Option: D5KV**

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Voltage Probe suitable for all Waveforms to 5KV

Max. Input Voltage	5 kV
Scope Coupling	1 MΩ DC/AC
System Attenuation	100:1, +/-2%
System Input Resistance	50 MΩ Input
Capacitance	< 6 pF
System BW (-3 dB)	400 MHz
Operating Temperature	0 °C to +50 °C
Output Connector	BNC

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**Option: DPI-1**

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Probe accessory kit suitable for all Waveforms to 5KV

Safety Socket Dolphin Clips
Safety Socket Crocodile Clips
Safety Socket Pointed Probes
Safety Socket Grabber Probes
Safety Socket Lug Terminals
Safety Socket Clip-On
Safety Socket Cables
Safety Socket Leads
Safety Socket Plugs

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**Option: E000**

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ECAT Half-width module bay blank for unused module bay locations (required if no module is present in the bay). Cannot be used in lowest module bays. Half-width ECAT plug-in module.

CE Marking	Safety and EMC directives
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**Option: E002**

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ECAT Full-width module bay blank for unused module bay locations (required if no module is present in the bay). Full-width ECAT plug-in module,

CE Marking	Safety and EMC directives
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**Option: LTS-1PHASE**

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AC converter that allows LTS to operate from a single phase instead of a 3 phase AC source.

Input	1Ø 208VAC +/-10%, 50/60 Hz, 50Amax
Output	3Ø 208VAC +/-10% 50/60 Hz, 30 Amax
Dimensions	Height 50.8 cm (20 in); Width 38.1 cm (15 in); Depth 33 cm (13 in)
Weight	34 kg (75 lb)
CE Marking	Safety, EMC Directives and UL listed

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**Option: LTS-CASTERS**

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Add-on base for LTS with larger 5" casters to facilitate high threshold and/or aggressive ramp installations. Increases LTS caster ground clearance from 1.5" to 5"

Dimensions	Height 25 cm (9.8 in); Width 107 cm (42 in); Depth 69 cm (27 in)
Weight	34 kg (75 lb)

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**Option: LTS**

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Kit of commonly used components for Section 22 setups

Qty = 1                      39000µF, 100V bypass capacitor for DC Supply upto 50V, i.a.w. Fig. 22-17

Qty = 1 ea of the following block Varistors:

EPCOS B40K130 130VAC/170VDC<sup>1</sup>, 40kA<sup>2</sup>

EPCOS B40K150 150VAC/200VDC<sup>1</sup>, 40kA<sup>2</sup>

EPCOS B40K275 275VAC/350VDC<sup>1</sup>, 40kA<sup>2</sup>

EPCOS B40K550 550VAC/745VDC<sup>1</sup>, 40kA<sup>2</sup>

Qty = 1 ea of following Bidirectional TVS diodes:

Littlefuse AK10-058C 64-70V<sup>3</sup>, 10kA<sup>2</sup>

Littlefuse AK10-076C 85-95V<sup>3</sup>, 10kA<sup>2</sup>

Littlefuse AK10-170C 180-220V<sup>3</sup>, 10kA<sup>2</sup>

Littlefuse AK10-240C 2250-285V<sup>3</sup>, 10kA<sup>2</sup>

<sup>1</sup>Operating voltage. See EPCOS datasheet for complete specs

<sup>2</sup>Peak Pulse Current with 8.20µs impulse

<sup>3</sup>Reverse Breakdown Voltage. See Littlefuse datasheet for complete specs

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**Option: LTS-100 A-LISN**

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Line Impedance Stabilization Network

Frequency                      10kHz – 400MHz

SupplyLines                    Single Conductor

Current Rating:                100A

Max Voltage Rating:        DC – 1200V, 60Hz – 800V, 400Hz – 400V, 800Hz – 230V; Includes 10µF by-pass capacitor

Power Connector              Superior Con Socket

RF Output Connector        Type N

Chassis Size                  15" X 9" X 7"

Manufacturer                 Fischer Custom Communications, Model: FCC-LISN-5-100-02-DO-160F

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**Option: LTS-50 A-LISN**

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Line Impedance Stabilization Network

Frequency                      10kHz – 400MHz

SupplyLines                    Single Conductor

Current Rating:                50A

Max Voltage Rating:        DC – 1200V, 60Hz – 800V, 400Hz – 400V, 800Hz – 230V; Includes 10µF by-pass capacitor

Power Connector              Multi-Contact Safety Socket

RF Output Connector        Type N

Chassis Size                  9" X 6" X 5"

Manufacturer                 Fischer Custom Communications, Model: FCC-LISN-5-50-1-01-DO-160F

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