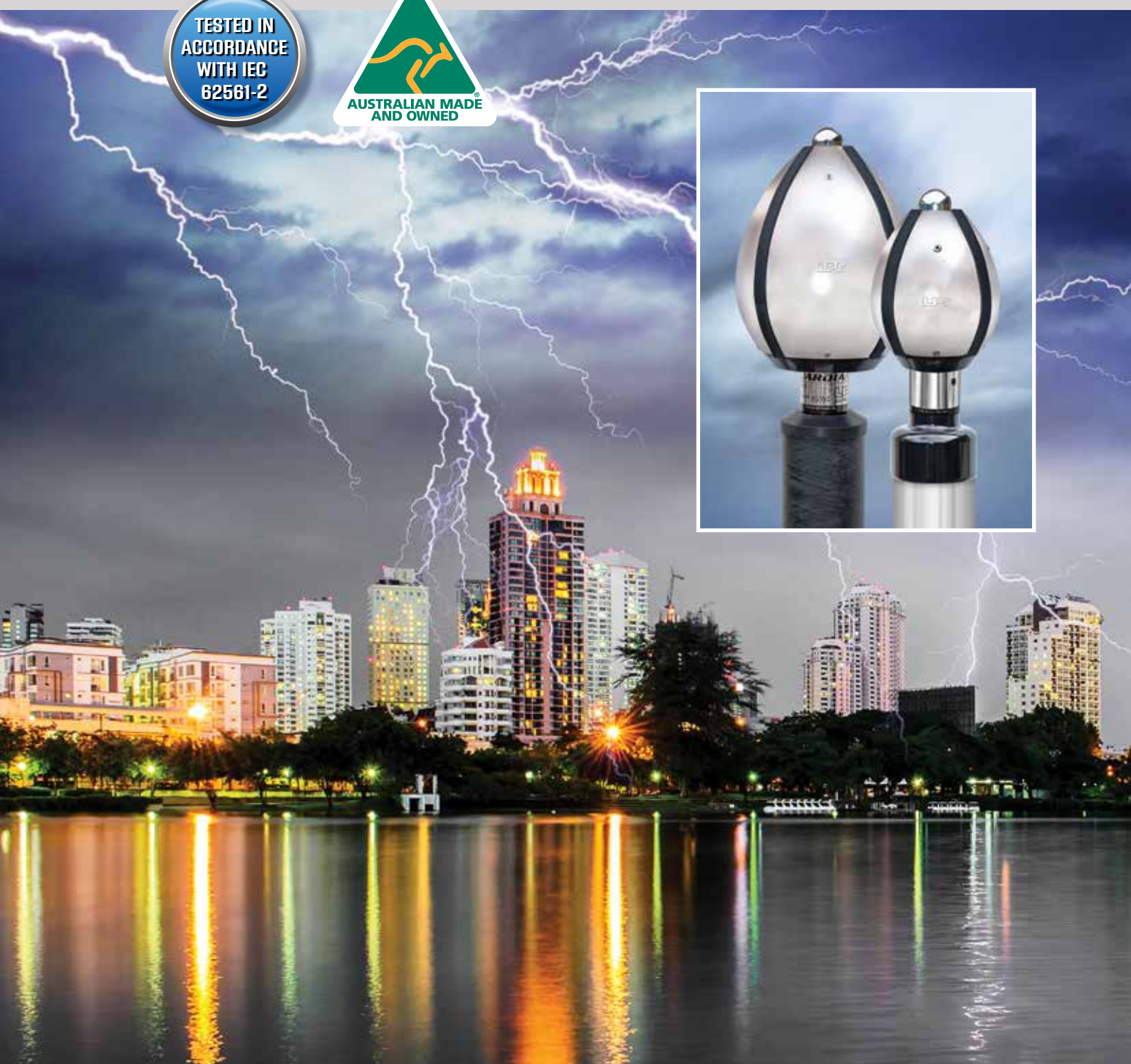


LIGHTNING PROTECTION INTERNATIONAL PTY LTD



# GUARDIAN Lightning Protection System 5





## The LPI story

Lightning Protection International Pty Ltd (LPI) is a fully Australian owned manufacturer and supplier of direct strike lightning protection, surge and transient protection, and earthing / grounding solutions.

LPI has provided specialist lightning protection advice to customers for many years in some of the most lightning-prone areas of the world. LPI personnel have extensive experience in risk management, system design, training, installation, certification, and commissioning of lightning protection systems in a wide variety of industry groups.

LPI maintains a third party Quality Management System to AS/NZS ISO 9001:2015.

LPI's range of products and services are exported from its head office, research and manufacturing facility in Tasmania, Australia as well as via regional offices worldwide.

The company has been recognised within Australia for its outstanding export successes and has been awarded several prestigious export awards.

## LPI's 4-Step Approach to Lightning Protection

It is the strategic aim of our company to be able to provide a complete packaged solution. LPI has identified 4 key steps when considering the complete approach to lightning protection. Ask for our 4-Step approach to lightning protection.

### OUR SYSTEM DESIGN APPROACH INCLUDES

- 1 Definition and provision of area protection
- 2 Creation of a bonded earthing system
- 3 Protection of mains power lines
- 4 Protection of signal, data and communication lines

## Active in Industry



# GUARDIAN LIGHTNING PROTECTION SYSTEM 5

## LPI's Guardian™ CAT System 5

LPI's award-winning families of enhanced air terminals have the following key characteristics:

- First company to introduce corona-minimising terminals with optimised blunt design and four independent panels;
- Extensive field experience with more than 50,000 installations over 15+ years in more than 75 countries around the world;
- Air terminal families designed to meet direct-strike placement methodologies in compliance with various international standards; and
- Proven technology based on international research findings, modelling and field testing.

LPI's Guardian™ System 5 provides a purpose-designed package for direct-strike lightning protection.



1. A Family of LPI CAT [Controlled Advanced Triggering] series air terminals.
2. A Fibreglass Reinforced Plastic [FRP] mast which provides an insulated mast for mounting of LPI CAT series air terminals.
3. A purpose designed LPI High Voltage Shielded Cable [HVSC Plus] specifically designed for the conveying of lightning energy to ground. Alternatively, depending

on the local codes and applications, other materials such as flat copper or aluminium tape, smooth weave conductor or stranded conductor may be used.

4. LPI Lightning Strike Recorder [LSR2] which confirms system efficiency and effectiveness.

5. An earthing system consisting of earth rods, clamps, copper tapes and earth enhancing compounds such as LPI RESLO, SRIM PLUS or GRIP.

## Guardian CAT Range

LPI offers Guardian CAT Terminal in high-quality Stainless Steel.

### CAT X SS - ZZ

**X:** CAT terminal model. Model I, II and III

**ZZ:** Blank for standard version, **GI** for 2 inch BSP GI Pipe adaptor

## How does the LPI Guardian™ CAT Terminal operate?

A Guardian CAT terminal consists of a blunt, earthed lightning rod surrounded by electrically floating metal panels. Rounded or blunt tips have been demonstrated to be more efficient than sharp points because of a reduced space charge effect. This principle has been proven in tests conducted at South Baldy Peak in central New Mexico, USA.

[Source: "The Measurement of Lightning Rod Responses to Nearby Strikes" by C.B. Moore, G.D. Aulich and W. Rison / 2001.]

During the static thunderstorm phase, when the electric fields are steady at 5-15 kV/m, the panels present as a relatively low field intensification surface aided by the blunt configuration of the rod tip.

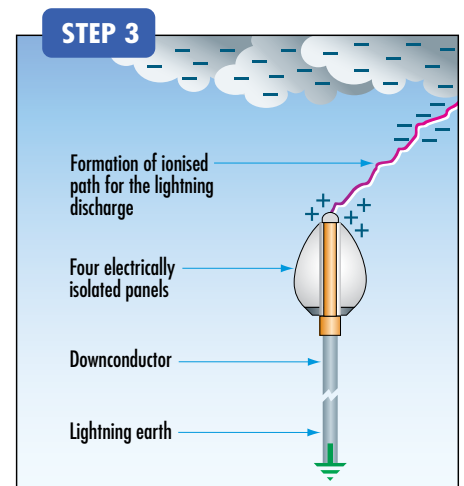
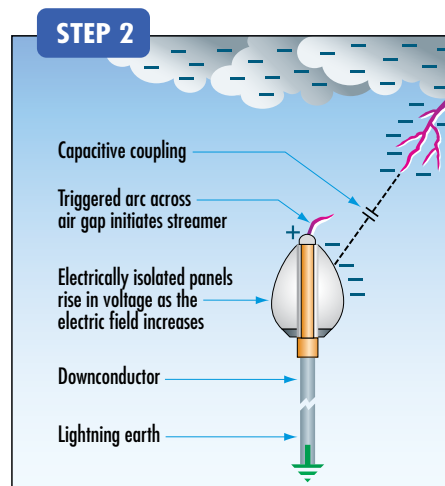
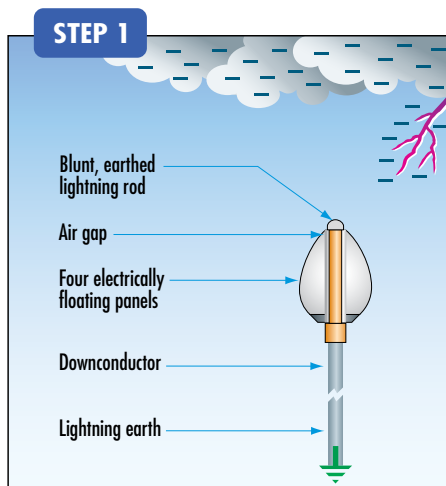
This restricts the production of "corona" or "point discharge" ions and is critical because excessive production of ions [corona] results in a "space charge cloud" above the air terminal which tends to mask the electrical field and inhibit the formation and progression of an upward leaders. [See step 1].

The panels are isolated from each other as well as from the lightning rod to allow the panels to rise in voltage due to capacitive coupling with the approaching downward leader, regardless of its direction of approach. The electric field increases as the lightning downward leader approaches closer, causing increased voltage difference between the panels and the lightning rod. Eventually, the voltage

rises to the point where a triggering arc is generated between the panel and the lightning rod. [See step 2]. By design and appropriate terminal placement, this arc occurs at the right time to ensure the resulting streamer will form a stable, progressing upward leader. [See step 3].

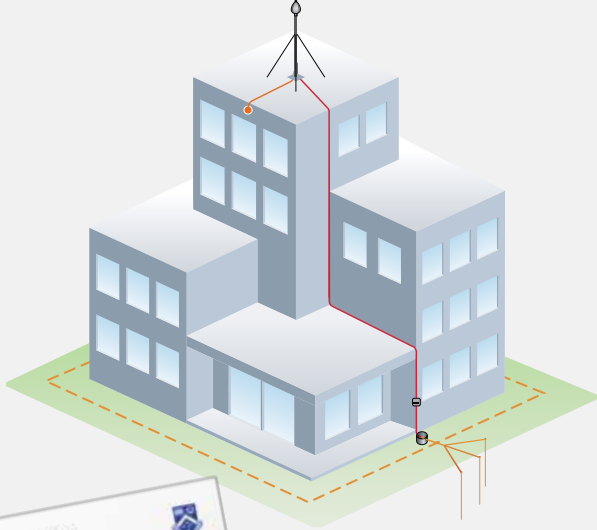
The triggering arc has two key effects, namely:

- (i) It produces a large number of ions to aid the initiation of an upward leader.
- (ii) It causes a large increase in the electric field at a critical distance from the air terminal, aiding propagation through this critical area. This ensures a more efficient mode of protection with an enhanced area of protection.



## Downconductors

LPI offers a comprehensive range of downconductors for the safe and efficient passage of lightning energy to a dedicated lightning earth.



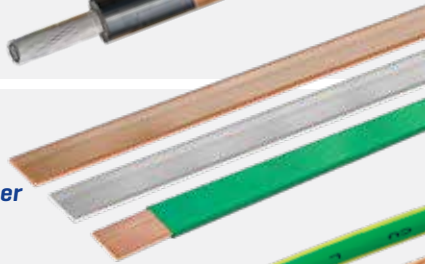
HVSC Plus has been tested by a certified, independent high voltage laboratory located at Monash University, Australia. Withstand Voltage  $\geq 500$  kV

LPI offers a selection of downconductors and fixing accessories:

### High Voltage Shielded Cable (HVSC Plus)



### Flat tapes - Bare, Tinned & PVC Covered, Copper and Aluminium



### Stranded Conductors - Bare, Tinned and PVC Coated (Copper) Smooth Weave Conductors - Bare Al, Cu and Tinned Copper



### Downconductor Fixings and Connectors



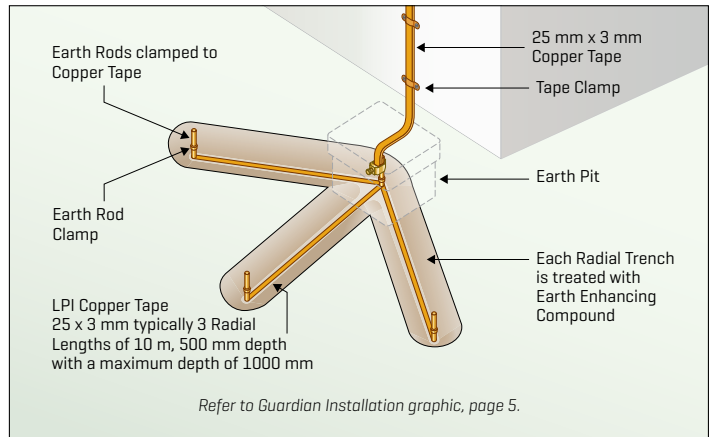
## Lightning Strike Recorder (LSR2)

LPI has developed a LSR which is designed for easy mounting on a downconductor to effectively count the number of lightning strikes captured by the Guardian CAT Terminal. LSR Tester available on request, contact LPI for details.



## Lightning Protection Earths

The installation of a radial and rod arrangement is recommended for each lightning protection earth. This earthing configuration provides an effective means for the safe dissipation of the lightning energy into the ground mass. All individual lightning earths should be bonded together in a ring earth arrangement to minimise ground loops and potential differences under transient conditions. Compliance to all international standards requires an earth resistance reading of less than 10 Ohms for the lightning earths.



Key components of a lightning earth include:

- **Earth Rods** - Copperbonded (threaded or unthreaded), Solid Copper or Stainless Steel
- **Earth Enhancing Compounds** to assist in lowering soil resistance



- **Mechanical Clamps and Earth Pits** Polymer earth pit Concrete earth pit
- **Earth Electrodes** - Use of flat copper tape is recommended as it provides greater surface contact with the soil mass as opposed to circular or stranded copper conductors

# GUARDIAN LIGHTNING PROTECTION SYSTEM 5

## Application

LPI's Guardian CAT series terminals come in three sizes, providing users with a tailored, customised design (provided by LPI) for the application at hand.

LPI uses a software program called "CATCALC". It takes into consideration all of the key lightning parameters and site factors relevant to the project, e.g., lightning activity, structure height and dimensions, and level of protection (a choice of "Standard", "High" and "Very High").

A key part of the calculations involves the identification and allowance for "competing features" on the structure and elsewhere, which also have the ability to launch upward leaders. Allowance for this phenomenon is critical, especially on tall structures and on sites that comprise more than one major structure.

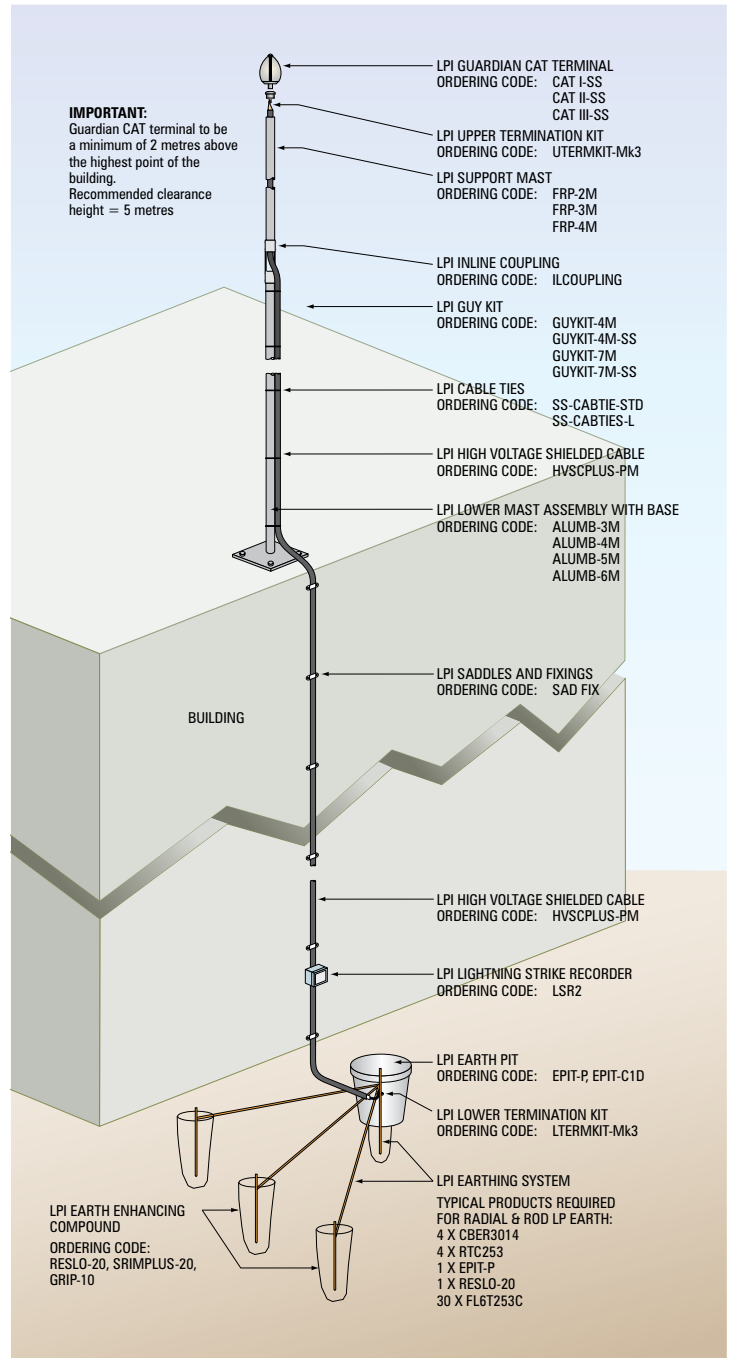
CATCALC designs are certified by LPI and therefore offer additional security with regard to the provision of satisfactory lightning protection levels, particularly in relation to the level of lightning activity around the installation.

The protection radius computed for the Guardian CAT air terminals is dependent on a number of variables. The main variables are:

- Structure height, via the original "Collection Volume" model of Eriksson in 1987, where the striking distance has a dependence not only on peak stroke current but also structure height.
- The degree of electric field enhancement which depends on the structure geometry, position of the CAT terminal on the structure, the model of CAT terminal and any enhancement multiplier effects due to sub-structures superimposed on the base structure.
- The electric field distribution in the space between the downward leader tip and the top of the structure or CAT terminal. This calculation is based on a model of the downward leader charge.
- The velocity boundary that limits the striking distance surface of the collection volume. This parameter is typically defined via the velocity ratio of the downward and upward leaders.
- Various other parameters, such as the cloud base height and the site altitude above sea level.

The table at right provides indicative attractive radii achieved with the CAT terminals when placed according to the CVM / IEEE Std. 998.

NOTE: Blank entries provide guidance on the structure height at which the next model (larger size) of CAT terminal should be used in order to provide optimum performance with regard to space charge / corona effects, as described earlier.



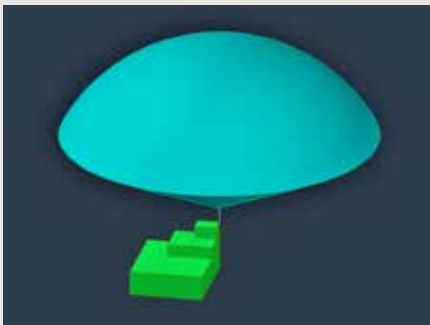
Structure height + installed CAT 5 m above structure	Protection Level - Very High			Protection Level - High			Protection Level - Standard		
	CAT I	CAT II	CAT III	CAT I	CAT II	CAT III	CAT I	CAT II	CAT III
10	35	40	50	50	60	70	70	80	90
20	45	55	65	60	75	90	75	100	110
30	50	60	75	70	85	100	80	110	120
50		70	85		95	110		120	130
80		75	90		100	120		120	130
100		75	90		115	120		128	130
120		75	90		115	120		128	130
150		75	90		115	120		128	130

The figures in this table are indicative only, a full design should be completed by LPI upon application. All figures represented as metres (m).

# GUARDIAN LIGHTNING PROTECTION SYSTEM 5

## Advantages of Guardian Terminals

1. For most applications, a Guardian System consists of a single CAT lightning terminal which provides an enhanced area of protection, a single, purpose-designed, insulated lightning downconductor cable for sensitive structures, or a conventional downconductors for standard structures, and a low impedance earthing system.
2. LPI's CATCALC software can determine the optimum number, height and location of CAT terminals required for your project.



3. The Guardian system can be installed to comply with most lightning protection standards. The predominant placement method used in the CATCALC software is the CVM, per IEEE Std. 998.
4. LPI's Guardian system is simple to install and requires no special maintenance.
5. LPI's Guardian is a very economical lightning protection solution whilst providing superior security.
6. The design of LPI's CAT terminals is based on the most recent research, development and improvements within the industry.

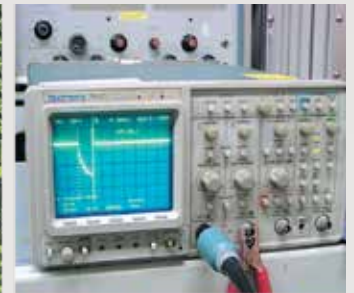
## Research and Development

The company has an ongoing commitment to Research and Development.

LPI personnel and their associates have been involved in a number of field trials throughout lightning prone regions of the world. This experience has extended

throughout such countries as Australia, Indonesia, Sri Lanka, USA and South Korea.

LPI has extensive experience with HV and surge current laboratory testing, both in-house and at external, accredited laboratories around the world.



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ACCORDANCE  
WITH IEC  
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### Disclaimer

- LPI maintains a policy of on-going product development, specifications are subject to change without notice.
- Application detail, illustrations and schematic drawings are representative only and should only be used as guides.
- It should be noted that 100% protection level for direct strike lightning, lightning detection and surge and transient protection equipment cannot be provided due to the lightning discharge process being a random atmospheric event.

Distributed by:

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