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Architectural

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# ABOUT CLIPSAL

Clipsal® was founded in Adelaide, South Australia in 1920, based on a range of adjustable conduit fittings. Almost 90 years on, Clipsal is one of the leading producers of electrical products in its field.

In the early 1990's Clipsal began development in commercial lighting control products. This led to the formation of Clipsal Integrated Systems, specialising in the development and manufacture of electronic lighting and building automation products under the C-Bus® brand. Clipsal Integrated Systems has since grown rapidly and C-Bus has gained widespread acceptance in major commercial markets around the world.

## Clipsal Integrated Systems

Clipsal Integrated Systems first released the C-Bus Energy Management and Control System back in 1994. Since then C-Bus has become the "benchmark" of Clipsal Integrated Systems' product range. C-Bus was designed and manufactured for commercial applications and it is in this marketplace that the technology comes into its own. Due to increasing worldwide interest, the C-Bus DIN Rail Series products and a wide selection of sensors and detectors were also added to complement the range.

With the continued development of C-Bus for commercial applications, a new generation of products were born, including black and white, and colour touch screens; Neo® and Saturn™ C-Bus wall switches; as well as an extensive range of complementary products including DALI Gateways, Schedule Plus and Citect Facilities SCADA Solutions.

## Worldwide Lighting Control Solutions

Clipsal C-Bus has a long history of successful installations for commercial buildings, providing the lighting control solutions for worldwide iconic structures, from The Sydney Opera House, 10 Downing Street and Stadium Australia to The McLaren Formula 1 Technology Centre UK, NRMA House Sydney and Cisco Bangalore, for example.

Our vast experience enables us to provide a complete electrical solution for any commercial space, from the most exclusive boardroom to a completely integrated office environment.

## Fully Backwards Compatible

As a company, Clipsal believes in continuous product improvement and evolution to meet the needs of its commercial customers. However, as our products evolve, we understand that backwards compatibility is also a very essential requirement for our customers. That is why Clipsal C-Bus systems are second-to-none, as they continue to develop, yet always remain fully compatible with existing products and ranges. Thus, ensuring the investment of our customers now and long into the future.

Clipsal's strength is further enhanced, and our hardware and software solutions expanded by the relationship with our parent, Schneider Electric - a world leader in power and control solutions.





# ARCHITECTURAL HIGH POWERED DIMMERS

Clipsal's latest addition to the C-Bus portfolio is the comprehensive range of innovative Architectural high powered dimmers. These purpose designed, commercial products are the perfect platform upon which to build a lighting control strategy, offering a user-friendly range of dimmers that provide unrivalled flexibility, integration and energy management.

Their innovative design also presents a wide range of features and benefits, including easier creation, management, use and maintenance of complex lighting control systems.

## Fully Integrated with C-Bus

Clipsal Architectural high powered dimmers fully integrate into Clipsal's C-Bus automation system, providing access to the world leading range of switches, touch screens, sensors and other wall devices. As part of Schneider Electric you can be confident that Clipsal can also provide for all low voltage needs throughout the building. With a full suite of discrete electrical components available, as would be expected from market leaders such as Clipsal, APC, TAC, Citect, Pelco and all other members of the Schneider Electric family.

The Architectural high powered dimmers form part of a wider integrated approach to building lighting control, giving integration capabilities with building management systems, SCADA data acquisition solutions and numerous other third party devices and applications.

With the use of a Clipsal C-Bus OPC server or C-Bus BACnet gateway, integrating a new Clipsal C-Bus Architectural high powered dimmer with an existing building management system is straightforward, providing greater flexibility of control and further opportunities for energy savings.

## Ideal for the Most Demanding Environments

The dimmers are constructed to the highest standards, providing long term, robust and reliable service in the most demanding environments.

Designed without cooling fans or any other moving parts and having eliminated other high maintenance elements, the dimmers ensure the lowest cost of ownership and quietest operation to suit the most stringent of requirements.

## Modular Design – A Great Addition

We recognise that it is not always possible at specification stage to be precise about the final load type or load size for all dimmed circuits. It is also very common for customer requirements to change once a building is handed over, with additional circuits being added or load types changing to suit the buildings actual use. That is why Clipsal has set out to simplify the whole process of selecting, installing and making additions to installed dimmers, with the modular design of the Architectural high powered dimmers.

The modular design allows designers to add dimming channels to an existing Architectural high powered dimmer, or change the channel card to suit an alternate load size or load type.

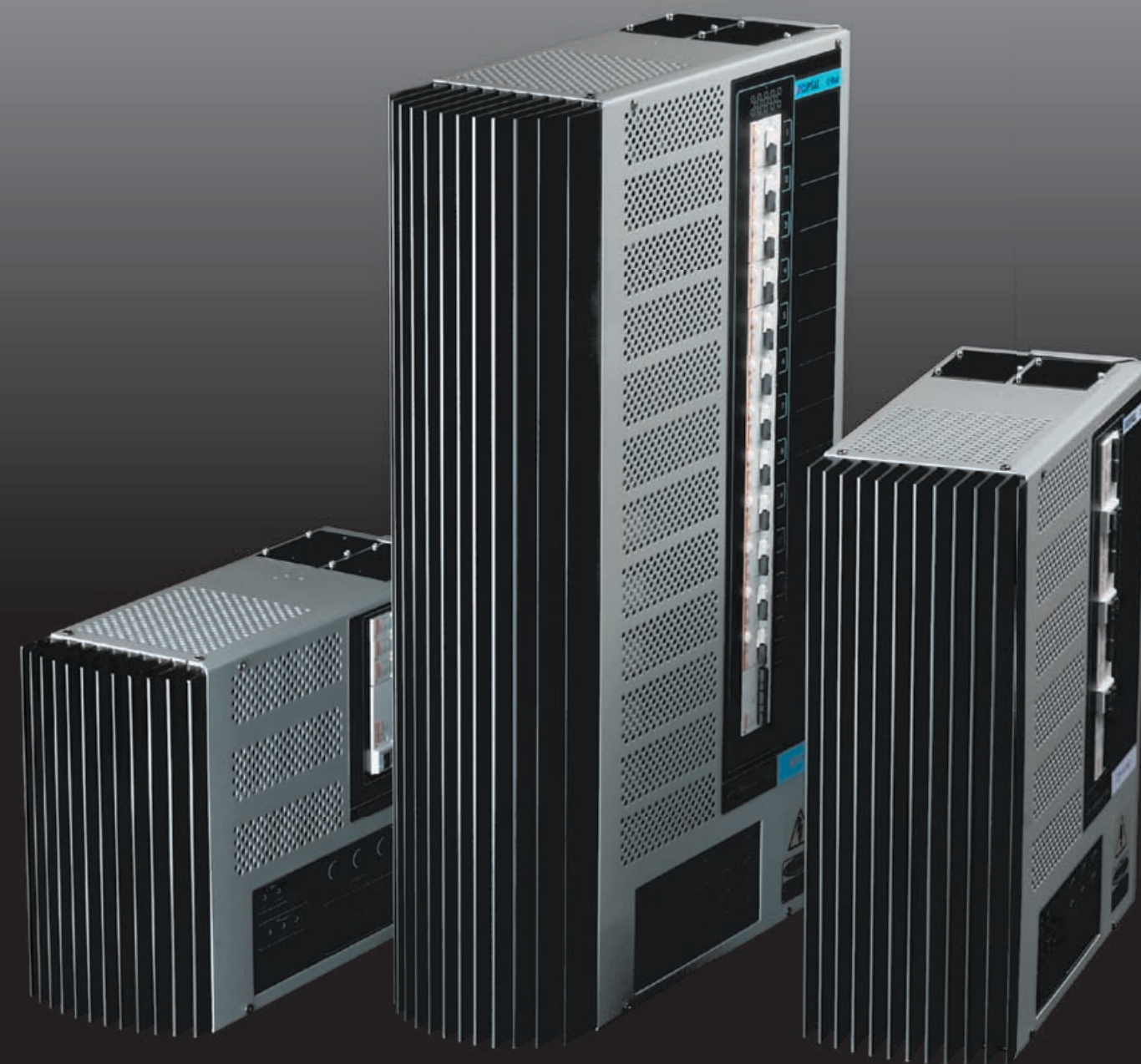
The channel cards are provided in the following range of current ratings and load types:

	Leading Edge	Universal (Trailing Edge/Leading edge) Auto Sensing	Ballast Card 0-10 Volts DSI Output Relay
20A	✓	✓	✓ (Relay contact)
16A	✓	X	
10A	✓	✓	✓ (Relay contact)
5A	✓	✓	
3A	✓	X	

The C-Bus Architectural high powered dimmers are made in a range of three sizes defined by the number of channels they support and the overall rating for the supply to the unit.

Leading Edge	RCD Option	3 Channels	6 Channels	12 Channels
20A	✓	✓	✓	X
16A	✓	✓	✓	X
10A	✓	✓	✓	✓
5A	✓	✓	✓	✓

Clipsal is clear that the needs of commercial spaces are under constant change. Particularly in multi-tenanted buildings where the building owner is required to meet the needs of a constantly changing tenant population. Clipsal Architectural high powered dimmer flexibility is designed to minimise the cost impact of change on the building owner and reduce the entry cost for new tenants.





# INNOVATIVE SOLUTIONS

Clipsal is focused on enhancing the use of its lighting control products, by supplying innovative solutions that benefit both customers and installers. Our goal is to ensure that all customers have access to market leading technology at cost effective prices. To do this Clipsal focuses on four key aspects when designing product for the commercial marketplace.

## Flexibility

In this day and age commercial spaces, and the businesses that occupy them are constantly evolving and undergoing change. Therefore in order to keep up, a building's lighting system must offer convenience and above all flexibility. With Clipsal's C-Bus Control and Management System, as a business evolves so too can the system.

Control units like the Architectural high powered dimmers are the latest products to enhance C-Bus flexibility by moving away from a fixed configuration of channels. This flexible approach allows on site variation in channel rating and load type, so the dimmer can adapt or change with the installation. Control groups can be reprogrammed at any time to accommodate business changes, such as the reallocation of floor space or extended trading hours.

## Integration

Today in a commercial buildings, customers demand integrated solutions. The benefits of integration, range from reduced training costs and system overheads, to lower complexity and above all greater flexibility in total building system use.

Integrated systems cost less to design, install and most importantly operate.

C-Bus provides a transparent platform for integration in the commercial environment including: air conditioning, audio visual equipment, security and access control, automatic doors and motorised blinds or shutters. Clipsal has a wide range of integration options for its own protocols and provides numerous industry standard options including OPC and BACnet.

## User-Friendliness

Clipsal C-Bus enabled dimming products, like the new Architectural high powered dimmer range, make it easy to integrate a wide variety of automation features, ultimately allowing customers to maximize the benefits and flexibility of their lighting solutions.

Requirements for varying light levels are often time or activity dependent, such as cleaners' rosters, public holidays and after hour's activities, or rotating the use of a space for breakfast, lunch, dinner or a dance venue. Taking all of these different elements into consideration, Clipsal's Architectural high powered dimmers provide flexible, easy to use controls in order to offer customers a convenient, safe and comfortable environment.

It is a given in business that operational requirements change and often at short notice. Therefore a user-friendly control solution that customers can operate themselves is essential. That's why Clipsal's new C-Bus Architectural high powered dimmer series is perfect, as it enables changes to occur quickly, efficiently and with little disruption to a businesses daily routine.

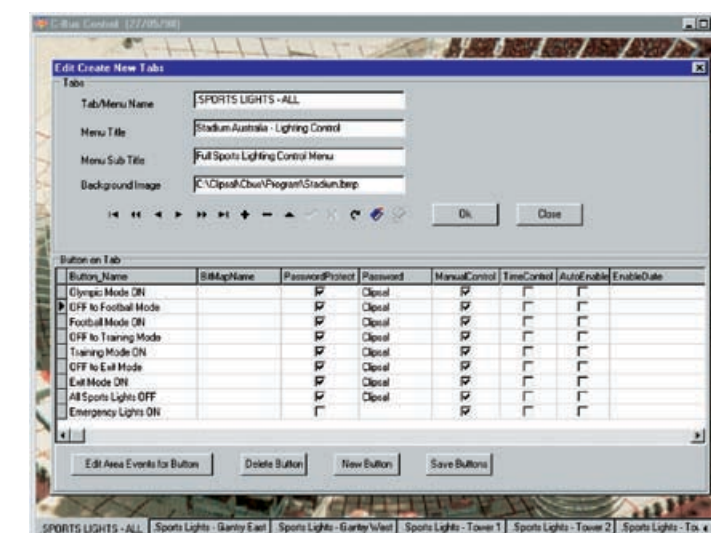
## Energy Management

If you want to increase profit, one of the most straightforward ways to boost the bottom-line in any organisation is to reduce costs, and for everyone today one of the most significant costs is energy.

We live in an increasingly environmentally conscious society. More and more emphasis is being placed upon the need for energy management in commercial buildings. In many cases this is also the subject of government regulation.

If by more efficient use of energy in lighting applications, the cost to operate a facility can be reduced, but productivity maintained or even improved, then fundamentally the profit derived from its function increases. Obviously being more energy efficient also has a huge beneficial impact on the environment, therefore saving money in this area of business also comes with the added bonus of feeling good about these actions.

Dimming technology is at the forefront for energy management and it is here that the new range of Architectural high powered dimmers provides significant advantages to commercial customers. Aside from highly efficient dimming solutions, C-Bus also utilises many other technologies such as occupancy detectors, ambient light sensors, temperature control and variable lighting levels to maximize the efficiency of commercial environments.





## ACCREDITATION

It is always important to know exactly what you are buying when choosing a product such as a high powered dimmer, especially when it comes to critical factors such as compliance and safety.

All electromechanical products manufactured today are required to be tested for several aspects of compliance, including:

- safety
- electromagnetic compatibility
  - emissions
  - immunity
- environmental considerations
  - use of hazardous substances in their manufacture.

Not all types of products have standards specific for their use, but in the electrical industry we are fortunate that this is not the case. In fact there are a range of standards created that specifically apply to lighting control products and dimmers in particular. These standards are defined by the IEC (International Electrotechnical Commission) and then incorporated into use by local authorities with any modification required to suit the local market.

Clipsal takes its responsibility in this area very seriously and always has its products independently tested by specialist, third party accreditation laboratories, in order to meet standards specific to the product application.

Manufacturers can also choose to carry out their own testing without referral to any external body. Clipsal however, considers the external oversight valuable and worthwhile, therefore always opts to have each of its product independently tested and accredited.

Amongst the range of standards to test against, there are generic standards. These are intended for use on products, which do not have their own specific category. However generic standards (as opposed to specific standards) tend to be less focused on the actual application, and in some cases are used by manufacturers to claim accreditation of lighting control and dimming products, even though specific standards do exist.

These standards introduce different testing requirements, for instance:

- Clipsal tests all of its dimmer products to standards specifically related to lighting equipment and dimming products.
- The specific electromagnetic testing defined for dimming products requires comprehensive testing of EMC performance at all dimming ranges under standard operating conditions.
- Other manufacturers have chosen to test and declare their dimmer products as “Energy Management Controllers” and test to generic standards only.
- Under the generic electromagnetic compatibility standard used by these manufacturers; a dimmers performance is only evaluated at 0% and 100% load. There is no requirement to establish the electromagnetic behaviour of the dimmer when performing its primary function of dimming loads.

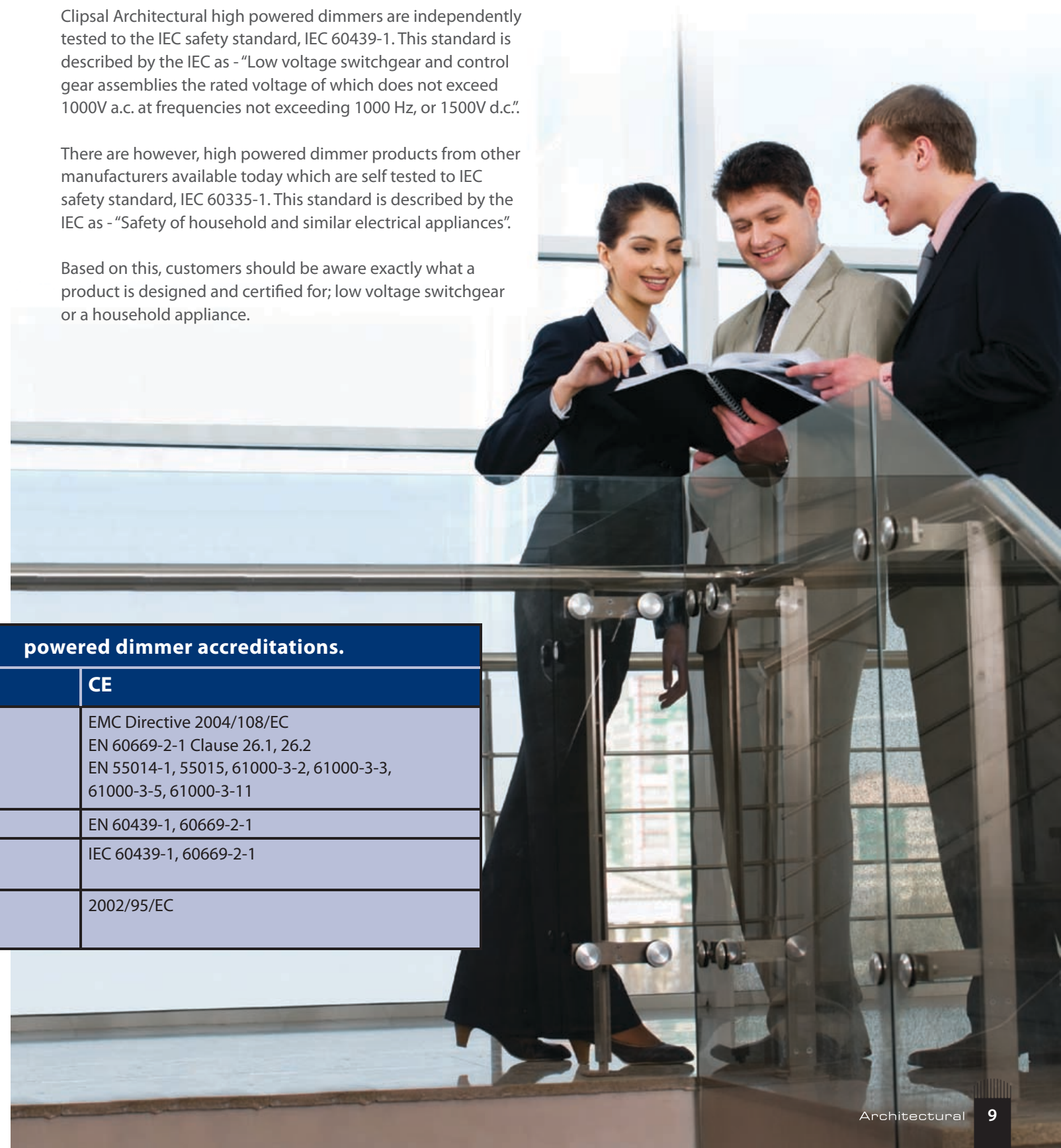
### “Safety is the most fundamental test”.

Clipsal Architectural high powered dimmers are independently tested to the IEC safety standard, IEC 60439-1. This standard is described by the IEC as - “Low voltage switchgear and control gear assemblies the rated voltage of which does not exceed 1000V a.c. at frequencies not exceeding 1000 Hz, or 1500V d.c.”.

There are however, high powered dimmer products from other manufacturers available today which are self tested to IEC safety standard, IEC 60335-1. This standard is described by the IEC as - “Safety of household and similar electrical appliances”.

Based on this, customers should be aware exactly what a product is designed and certified for; low voltage switchgear or a household appliance.

C-Bus Architectural high powered dimmer accreditations.		
Accreditation	C-Tick	CE
EMC	AS/NZS CISPR14-1 CISPR15	EMC Directive 2004/108/EC EN 60669-2-1 Clause 26.1, 26.2 EN 55014-1, 55015, 61000-3-2, 61000-3-3, 61000-3-5, 61000-3-11
Low Voltage		EN 60439-1, 60669-2-1
Electrical Safety	AS/NZS 3439-1 IEC 60669-2-1	IEC 60439-1, 60669-2-1
ROHS (Reduction of Hazardous Substances)		2002/95/EC





## STRONG, **RELIABLE** AND ROBUST

Lighting control products for commercial applications are increasingly required to handle a highly flexible space with constantly changing requirements.

Traditionally, commercial high powered dimmers provided for relatively fixed groupings of dimmer loads in set numbers of channels. This fixed nature does not suit a dynamic environment where mixed load types and sizes are required to be controlled from a single dimming source.

With modern spaces, reconfiguration is a regular occurrence and it is common for lighting loads and types to be frequently altered. In such cases, fixed format dimmers with pre-defined load sizes and types are limiting and potentially costly. By providing additional flexibility in channel load sizing and the opportunity to mix and match both load size and load type, Clipsal Architectural high powered dimmers provide the flexibility demanded by commercial environments today.

Clipsal's Architectural high powered dimmers are also ideally suited to control electronic transformers, used for low voltage halogen lighting, as no de-rating is required.

Single and three phase track lighting applications, as well as a comprehensive range of load types can all be configured from a single dimmer including:

- incandescent lamps
- halogen lamps
- fan motors
- iron core transformer based low voltage lamps
- electronic transformer based low voltage lamps
- high-reactance transformers for neon tube lighting.

### Easy Installation, Commissioning and Maintenance

In the commercial environment, installation time, ease of commissioning and maintenance requirements are important factors in determining true cost when providing dimming applications.

Clipsal consider that all its products should be easy to install commission and maintain. Our focus has been upon all aspects in the design of the Architectural high powered dimmer, from mounting the product, to marshalling field wiring and connecting control system cables. With the Architectural high powered dimmers, the installation time and ongoing maintenance is minimised, thus reducing the cost of ownership of these dimming products.

Careful thermal design and the use of highly efficient heat sink designs, the removal of cooling fans, their associated filters and moving parts all further reduce maintenance requirements.

In a commercial project the time to commission and the ability to override normal operation are also factors to consider when selecting a high powered dimmer.

If the control system is not available during commissioning, as is often the case early after installation, can the loads be controlled to provide for both testing and practical use of the space affected? Furthermore should some unforeseen error or failure occur, it is important to be able to quickly and easily override the controls and even bypass the physical dimming circuits themselves. C-Bus Architectural high powered dimmers provide multiple means to ensure connected loads can be controlled regardless of the availability of the overall control system.

### Precise, Accurate and Smooth Dimming

Clipsal understands that commercial environments rely upon the provision of services controlled by these dimmers to generate revenue. Therefore multiple means of ensuring the ability to bring on loads is an important factor. The Architectural high powered dimmer provides local C-Bus overrides as well as physical bypass switches per channel, ensuring that services can be maintained whenever possible.

Reliability and the ability to operate regardless of external influences are again important in a commercial space. The dimmer must be able to compensate for overloading without interruption. The Architectural high powered dimmer is designed to automatically compensate for general overload conditions and withstand full short circuit faults without damage.

Variations in supply and other control systems injecting frequency-based signals onto the mains can all have potentially detrimental effects on many dimming products. Clipsal has paid much attention to ensure the Architectural high powered dimmers provide precise, accurate and smooth dimming, regardless of all common external influences.



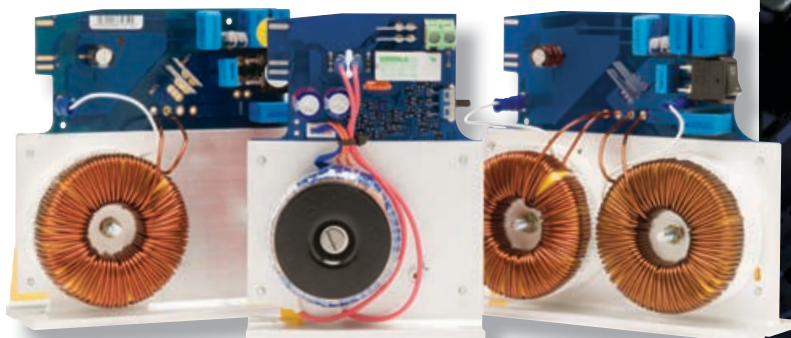
The Southern Ocean Lodge, photography by George Apostolidis



## FIELD INTERCHANGEABLE CHANNEL CARDS

Clipsal C-Bus Architectural high powered dimmers provide a wide range of features to simplify all aspects of commercial applications, from product selection through to the installation and operation. Specific innovative features include:

- The modular channel cards are an innovative aspect of the new range, providing numerous benefits for specifiers as well as installers and end users.
  - Channel cards are provided in a range of sizes from 3 Amp to 20 Amp. These cards can be mixed together in a single dimmer if required to permit wider flexibility in rating the whole dimmer.
  - Each channel card has individual overload protection and is capable of sustaining full fault current.
  - Each channel card has an individual load bypass switch completely bypassing all electronics and allowing the load to be forced on.
  - Channel cards are field upgradable without disturbing field wiring allowing for fast easy repair in needed.
  - Leading edge 3 Amp and 5 Amp channel cards use Triac based switching technology.
  - Leading edge 10 Amp, 16 Amp and 20 Amp channel cards use dual SCR based switching technology.
  - The universal channel cards use dual MosFET based technology.
  - The ballast channel card option provides 10 Amp or 20 Amp relay options along with Dali broadcast, DSI and 0-10 Volt outputs.
  - All channel cards use the latest phase control techniques. These provide highly efficient dimming whilst maintaining precise control.



## FLEXIBLE OPTIONS FOR RCD PROTECTION

A wide range of models are available with built in options for RCD protection to the latest requirements of AS/NZS3000:2007.

The rules defined by this standard are very specific about the requirements for protection of final sub circuits by RCDs where these are used for lighting.



The standard states in clause 2.6.3.2, for installations other than domestic installations - "Additional protection by RCDs with a maximum rated residual current of 30mA shall be provided for final sub circuits supplying" ... "One or more lighting points and having a rated current not exceeding 20 A."

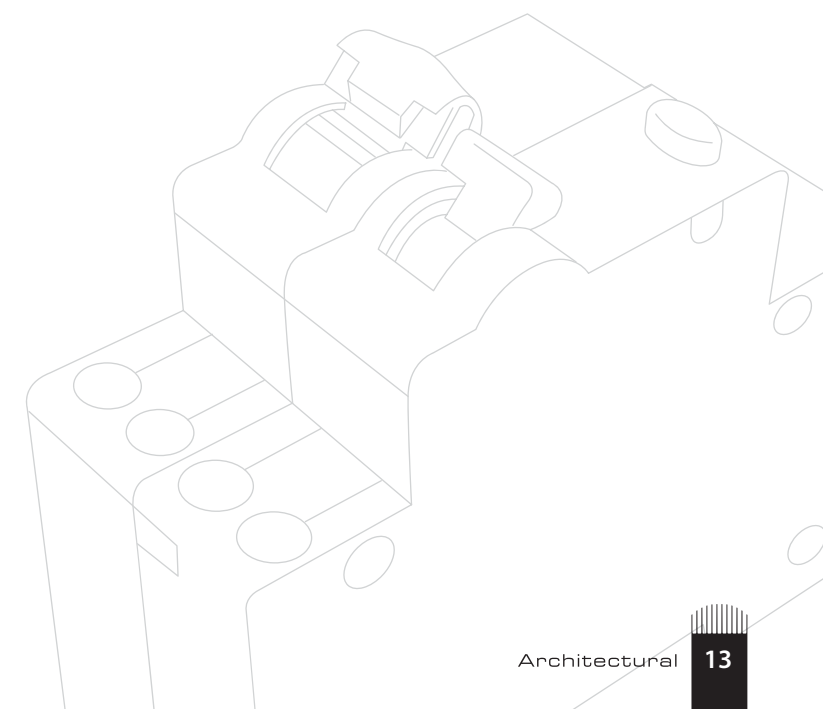
The standard also states in clause 2.6.2.4 (a) - "Not more than three final sub circuits shall be protected by any one RCD."

For installers this means that if the dimmer product selected has more than three channels and no onboard RCDs, then these will need to be installed in the secondary circuits feeding the loads.

All Clipsal Architectural high powered dimmers are available with onboard RCDs as standard, meeting or exceeding the requirements of AS/NZS3000:2007.

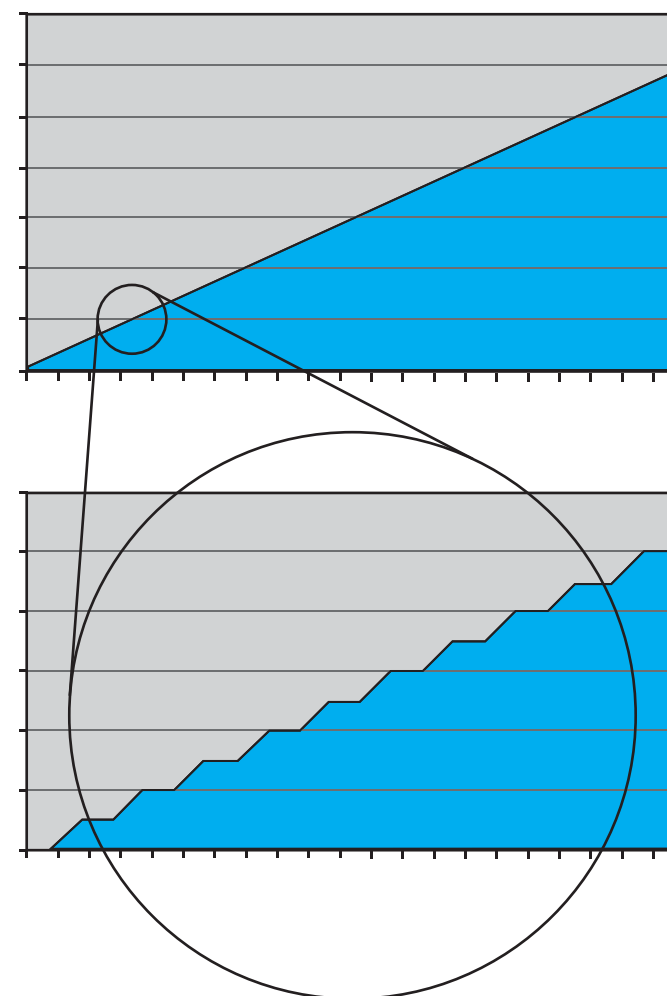
Channels	5 Amp	10 Amp	16 Amp	20 Amp
3 Channel	1 RCD	1 RCD	1 RCD	1 RCD
6 Channel	3 RCDs	3 RCDs	6 RCDs	6 RCDs
12 Channel	6 RCDs	6 RCDs	N/A	N/A

Models without RCDs are available for markets where these requirements do not exist or for retrofit situations where RCD compliance is not required.



# OPERATIONAL FEATURES

- The leading edge and universal dimmer modules are provided with a fixed bypass switch. This enables the control system to be fully bypassed for testing and pre commissioning operation. It also allows localized operation in the event of a system or channel card failure. The bypass switch completely segregates all control components and ensures the load can be enabled regardless of control status.
- If excessive load is drawn on a circuit or an over temperature condition occurs for any other reason, the dimmer channel card will automatically reduce the output power for as long as the condition exists.
  - The leading edge channel card is sufficiently robust to withstand the full short circuit fault current, allowing time for the associated MCB to operate to protect the circuit.
  - The universal channel card has built in short circuit overload protection and the card will shut down on overload.
  - As the circuit overloads, the channel card will detect a rise in temperature and will automatically reduce the output current to compensate.
- All channels incorporate soft load turn-on to protect lamp filaments.
  - The soft start function is built into each dimmer channel card.
  - Soft starts are valuable for some types of lamps. A cold tungsten filament for instance has a much lower resistance (by a factor of 8-10) than a hot filament, this lower resistance creates a large inrush of current. This current coupled with uneven filament wear causes local temperature hotspots during startup. The result is evaporation of the thinner filament sections. Soft start can make a sizeable difference to a tungsten lamp's life.
  - For C-Bus Architectural high powered dimmers there is an inbuilt soft start protection which slows the delivery of current to the lighting load, spreading the start over 220mS. This slower start allows the filament to warm through before being subjected to full load and therefore reducing wear.
- The dimmer incorporates voltage compensation over the majority of the dimming range to minimise load brightness variation if the AC supply voltage drifts from its nominal value.
  - By automatically adjusting the conduction time C-Bus Architectural high powered dimmers are able to eliminate brightness variations caused by fluctuations in the supply voltage.
- The dimmer incorporates specific filtering to reduce load brightness fluctuations typically associated with the presence of AC supply voltage signalling.
  - By closely monitoring and filtering the zero crossing point of the phase curve, Clipsal C-Bus Architectural high powered dimmers are able to offer a high degree of immunity to brightness fluctuations caused by signals injected on the mains by other control systems.
- In the event of AC supply voltage failure, real time dimming output levels are stored. When power recovers the dimmer can be configured to;
  - Restore each channel to the real time dimming output levels.
  - Restart each channel to any installer configured value from 0% to 100%.
- A permanent un-switched emergency lighting output is available on each channel.
- In leading edge mode the rise time for the universal channel card is in excess of 200µS.
  - Clipsal dimmers are always tested at:
    - their full rated load
    - the specified supply voltage
    - A 5mS conduction angle
    - using an incandescent load.
- Ultra smooth dimming curves.
  - With all digital control systems, analogue values need to be transmitted as digital data. This can lead to the smooth dimming curve being perceptible as a sequence of steps, particularly at the lower end of the dimming range.
  - Clipsal C-Bus uses innovative analogue control technology to eliminate this issue in the Architectural high powered dimmers.
  - Rather than relying on the digital control value being sent directly to the external control output, the Architectural high powered dimmer uses analogue control techniques. This sends a super smooth sequence of values on every half cycle of the incoming mains frequency.
  - This leads to the smoothest of dimming performances with no discernable steps at any point across the dimming curve.
- Three prioritised emergency auxiliary inputs.
  - The three emergency auxiliary inputs can be connected to external physical switches or other dry contact switching circuits which are used to activate special scenes. They can be used for any type of special event such as emergency, fire or security incidents.
  - These three inputs operate in order of priority and override all other inputs to the dimmer.
- Standby generator auxiliary input.
  - The backup generator/load shed input is used to send a signal to the dimmer that the electrical network is experiencing power loss. The signal activates a backup generator/load shed special scene, designed to handle situations of power loss. Upon activation of the special scene, the Architectural high powered dimmer typically reduces lighting levels or turns off circuits to reduce the load on the backup generator.
- Internal override functions.
  - There are two internal override functions which provide overrides to normal lighting control.
    - C-Bus network loss occurs. In the event that the Architectural high powered dimmer detects there has been a C-Bus network loss to the unit, this programmed override can be activated to set the loads to defined conditions.
    - Halogen cleaning override function. An internal function exists that can override normal lighting control in order to clean halogen lamps. Cleaning can increase light output and extend lamp life. Darkening of a low voltage halogen lamp occurs because of tungsten evaporation. The halogen cleaning special scene can be programmed to turn on channels controlling low voltage halogen lighting to 100% for a configured period to eliminate most of the black residue.





# DIMMING FEATURES

- C-Bus or DMX512 operation modes.

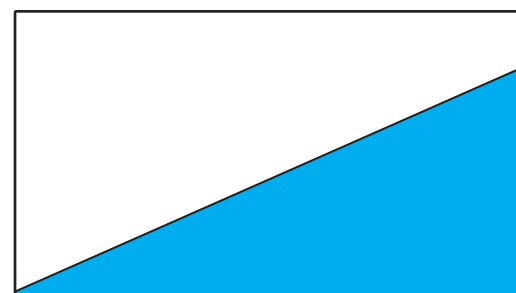
- The Architectural high powered dimmer can control its loads from commands received from C-Bus or from commands received from DMX-512 enabled equipment such as theatrical lighting control boards.
- The dimmer permits mixed control loads where some channels are C-Bus and others DMX controlled. This is individually selectable.
- The dimmer can dynamically switch from C-Bus to DMX control based upon system wide events such as commands from a touch screen, wall switch or time schedule.

- Optional output module for DSI\*, DALI\*\*, 0-10V d.c. or relay output.

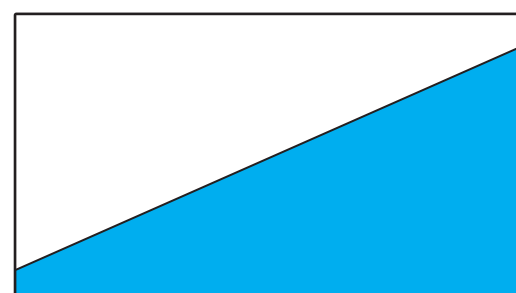
- The DSI output is a non addressed digital output providing a common level command to compatible lighting ballasts.
  - The output module acts as a power supply and can provide up to 250mA power as per the DSI standard.
- The DALI output provides a single non-address based DALI broadcast.
  - The channel card acts as a DALI power supply for up to 250mA load as per the DALI standard.
- 0-10V d.c. control signals are common in the building management and process control industries.
  - The output from the card is a voltage signal proportional to the control signal.
  - In this mode the channel card is able to sink up to 250mA.

- Selectable (pre-defined) dimming curves.

- The Architectural high powered dimmer contains curves for the following load characteristics.

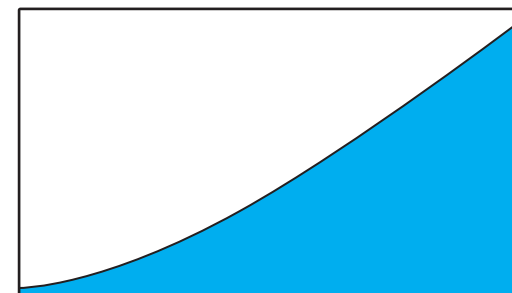


Linear 1:1 (Default Curve)

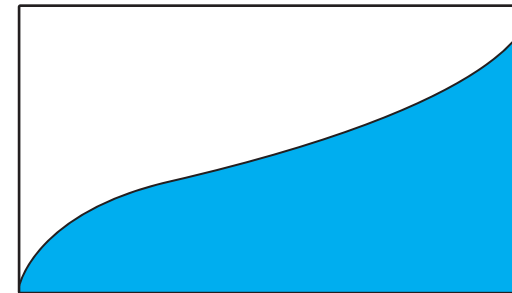


Fan Control\*\*\*

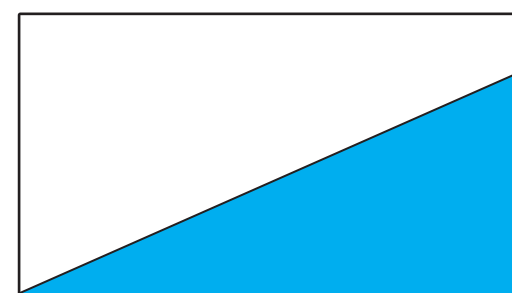
\*\*\*For fan control it is important to step up the supply immediately to overcome the fans initial starting momentum. An additional parameter is included when fan control curve is selected enabling the duration of the fan kick start to be set.



Tungsten



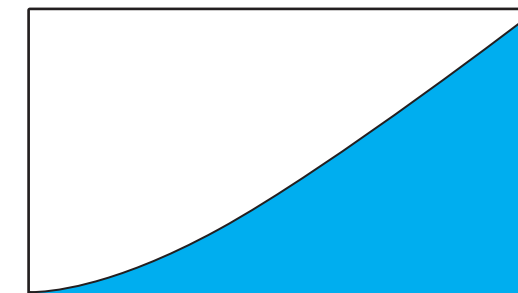
Tungsten Halogen



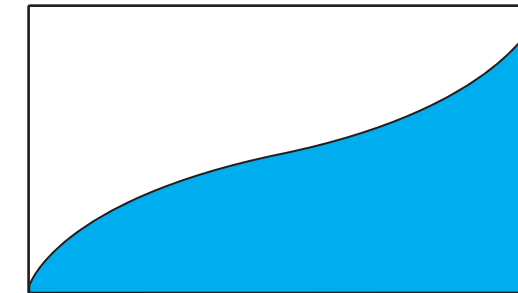
Neon



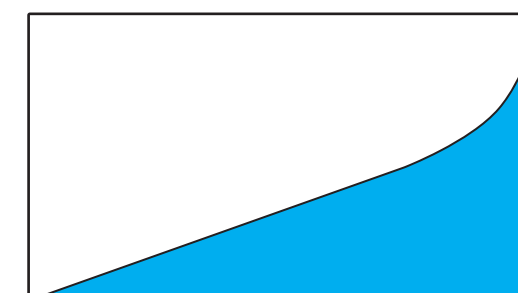
Switch Dimming



Square Law



S Curve



Linear Power

\*DSI is an acronym for Digital Signal Interface.

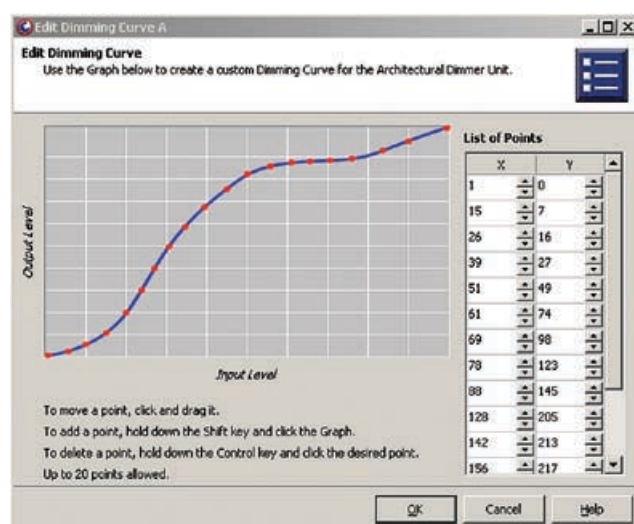
\*\*DALI is an acronym for Digital Addressable Lighting Interface.



# PROGRAMMING FEATURES

- Installer definable dimming curves.

- The Architectural high powered dimmer includes a comprehensive configuration for installers to create their own dimming curves.
- Using a drag and drop interface, the installer can create a unique curve with up to 20 user defined points along the curve.



- Support for onboard lighting scenes.

- Lighting scenes are a common method of controlling groups of loads based upon a single given event or input.
- Typical scenes in commercial environments might be used to set the right lighting conditions for cleaning or security, a sunrise or sunset scene perhaps and many more.
- Scenes can be activated in C-Bus from a switch, touch screen, time schedule from C-Bus itself or an external building management system through integration.
- The Architectural high powered dimmer can locally store 128 scenes, allowing the control and peer to peer distribution of load commands to be handled within the dimmer.
- Scenes can comprise loads contained anywhere on the C-Bus network and therefore across multiple dimmers.

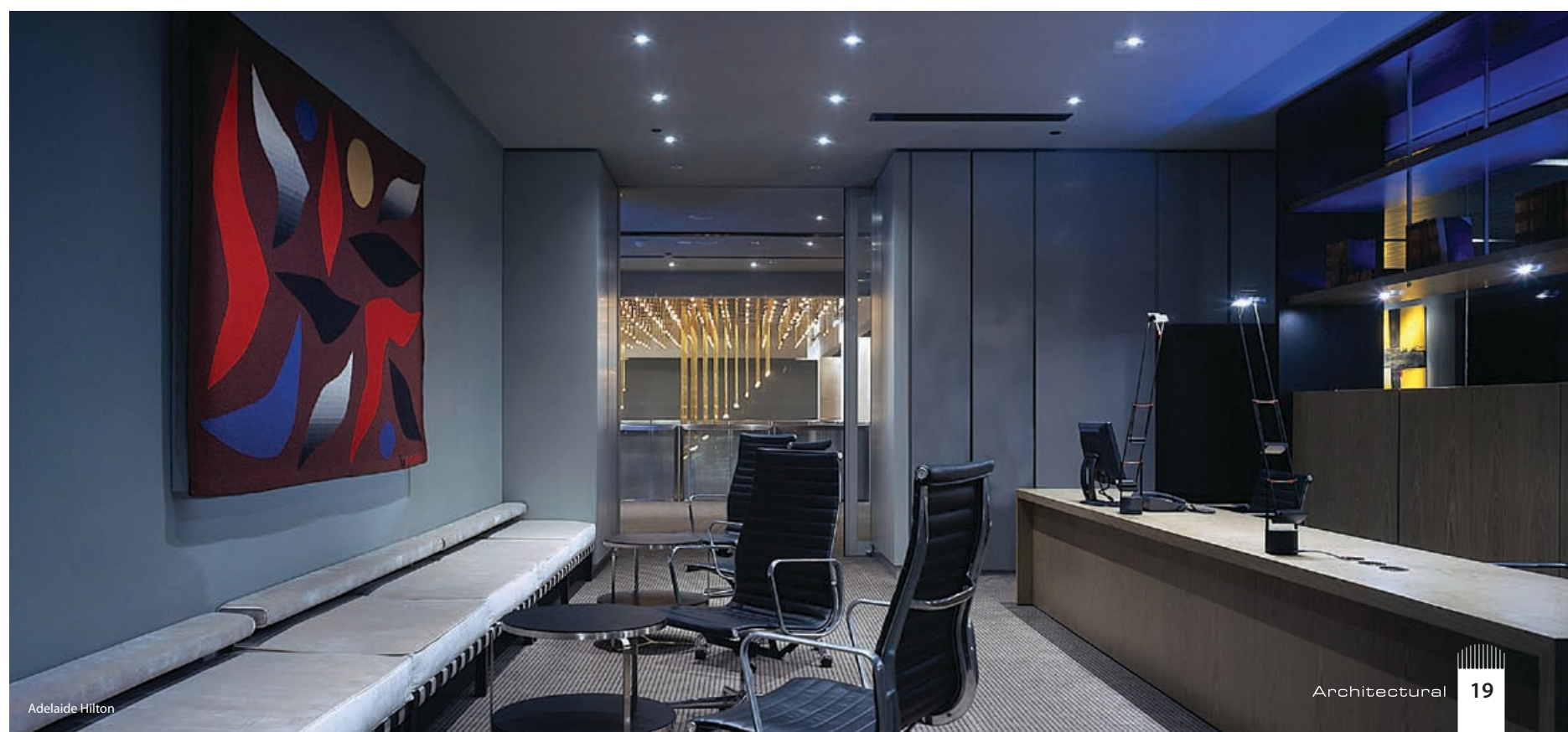
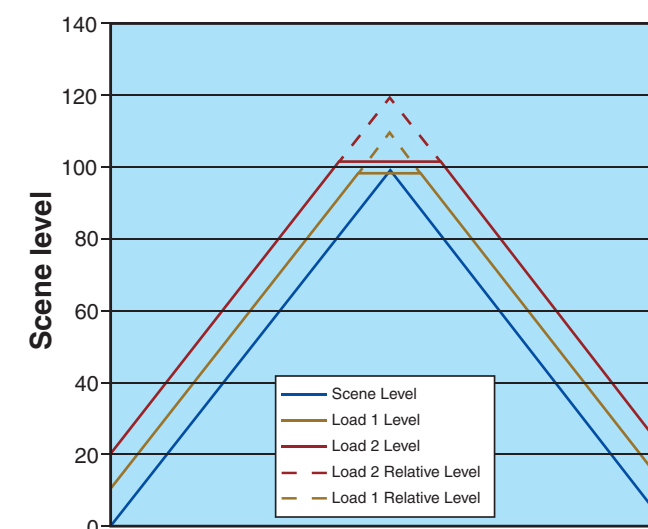
- Cross fading scene functions.

- A common requirement for lighting designers is to be able to make all the light loads in a particular area fade from their starting point to a set end point over a given time.
- The Architectural high powered dimmer automatically calculates the ramp rates required to move each load from their varied start points to the same end point.
- The Architectural high powered dimmer is able to coordinate cross fading between multiple dimmers and load locations.
  - Where a load is attached to a product that does not support individually configurable ramp rates C-Bus automatically selects the closest default ramp rate available in the device.

- Dimming offset.

- C-Bus Architectural high powered dimmers take account of relative offsets between loads, so that when these are ramped up to 100% the dimmer stores relative values so that when the loads are reduced the relative position of the loads can be restored.

Scene offset control





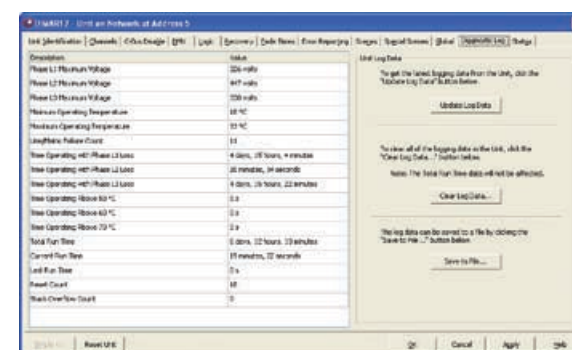
## INSTALLATION FEATURES

- Dimmer installation is greatly simplified by the use of an innovative design of wall bracket. The bracket is designed to be fixed to the wall independently of the dimmer, allowing the heavier item to be offered up onto the bracket easing installation effort.
- The wall bracket allows weight load to be distributed permitting more flexibility in wall construction that can support the dimmer.
  - Wall brackets enable dimmer to be mounted on solid as well as timber/steel framed walls.
  - The bracket provides a 25mm standoff for the dimmer from the wall surface easing cable management and installation.
  - Full mounting template supplied.
- Generous termination allowance with ample marshalling room
  - Special attention has been paid in the dimmer design to allow for cable termination and management within the dimmer enclosure.
  - Terminal sizes are generous and are designed to ensure adequate termination space for the contractor.
    - DIN rail mounted terminations provide robust termination for field cables.
    - Accommodates up to 25mm<sup>2</sup> incoming cables.
    - Accommodates up to 2 x 4mm<sup>2</sup> outgoing cables.
- The internal dimensions and layout of the dimmer enclosure have been carefully considered. They include multiple rear, top and bottom entry points to ensure cable management is simple, practical and neat to arrange.
- Removable lid with slotted escutcheon provide for easier access during installation.

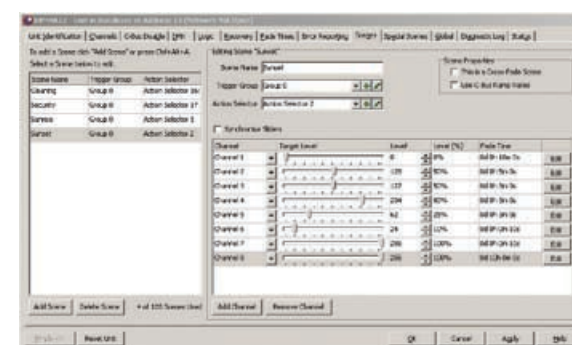


## C-BUS SPECIFIC FEATURES

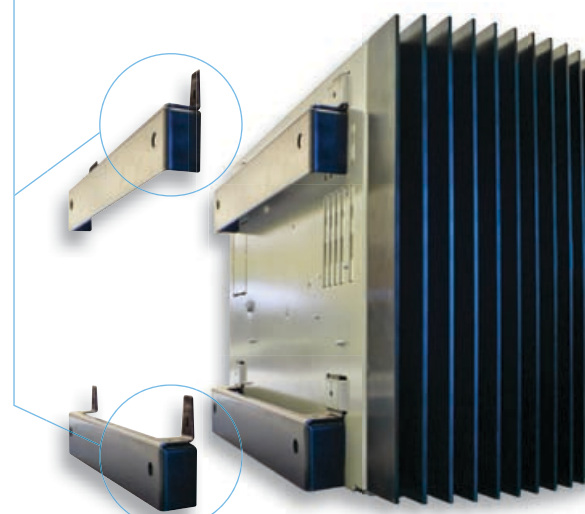
- At the C-Bus Group Address level, output load voltage variation follows the input control in a linear fashion.
- The C-Bus Toolkit software reports a wide range of dimmer performance characteristics including, network voltages, local unit temperatures, memory loadings and more.



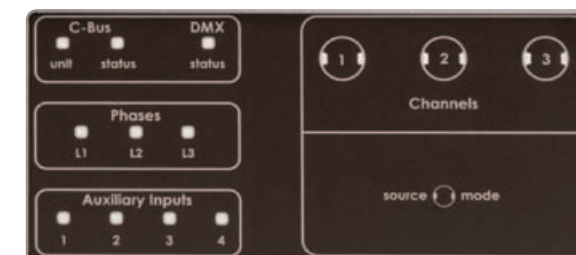
- The Architectural high powered dimmer provides the ability to store up to 128 scenes in the dimmer itself. These scenes are highly configurable.



Wall brackets enable the dimmer to be mounted on solid as well as timber/steel walls.



- Local C-Bus override switches on front panel.



- Channel Status indicators on front control panel.
  - Dynamic channel status indicates the type of channel card installed.
  - For the universal card the indicator shows the load type selected by the cards auto sensing circuitry.
  - For all cards fault conditions are also reported on a per channel basis.
- The dimmer unit has software-selectable C-Bus network burden and a network clock generator.
- Multiple external C-Bus and DMX-512 connections.
  - Multiple connections allow for simple interconnecting and daisy chaining of Architectural high powered dimmers and other C-Bus products together.

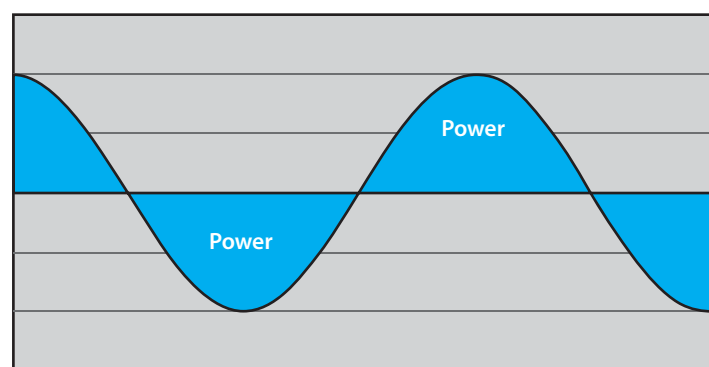




## THEORY OF DIMMING

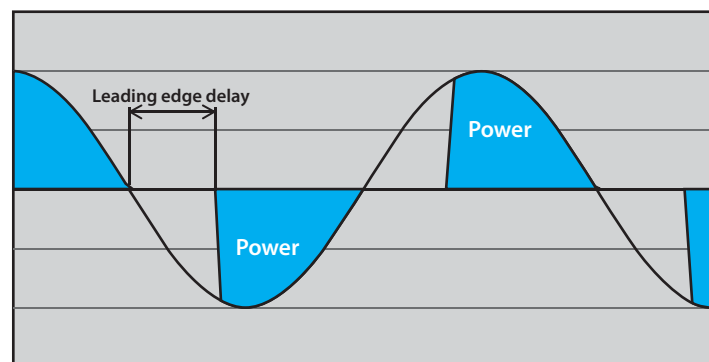
All dimmers use electronic circuits to regulate the amount of average power applied to a lighting load. These circuits use different semiconductor components depending upon the lighting load type to be dimmed.

In an AC wave form, the power derived and therefore the brightness of the lighting load is proportional to the area under the curve on both sides of the central axis.

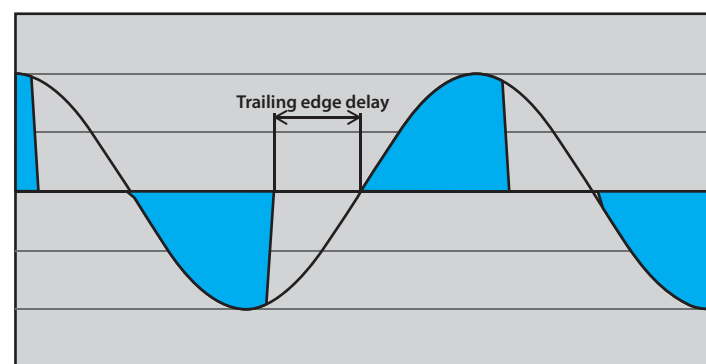


Most dimmers use a technique known as phase angle control to effect dimming control over the load. Phase angle control uses the switching characteristics of semiconductors to alter the shape of the AC wave form. There are two main types of phase angle control, leading edge and trailing edge.

In leading edge control shown below, the start point at which the load is switched on for each half-wave cycle is delayed. This delay reduces the area under the curve and therefore the power output of the dimmer channel.



In trailing edge control shown below, the AC current is switched off early to again reduce the area under the curve and therefore the relative power output of the circuit.



Dimming technology uses these two different methods because one approach does not suit all types of load encountered.

Different loads vary in their electrical properties, for example:

- Some are substantially resistive loads like simple incandescent light globes.
- Some loads like low voltage halogen globes use a transformer to derive their required voltage from the mains feed. These transformers introduce more complex electrical properties to the load seen by the dimmer.
- Cold cathode and neon lighting catered for.

## LEADING AND TRAILING EDGE DIMMERS

### Magnetic Transformers and Inductive Loads

If the transformer is a standard magnetic or iron core transformer with a wire-wound coil, it introduces inductance to the load. This inductance changes the way that the current is drawn through the circuit. With an inductive load, current rises more slowly and exhibits a degree of inertia once established. This effect means that inductive loads are not suitable to be controlled by trailing edge dimming as the inertia of the current can result in substantial back EMF across the load and dimmer as the phase cut occurs. Therefore inductive or magnetic transformers are dimmed using leading edge dimming technology.

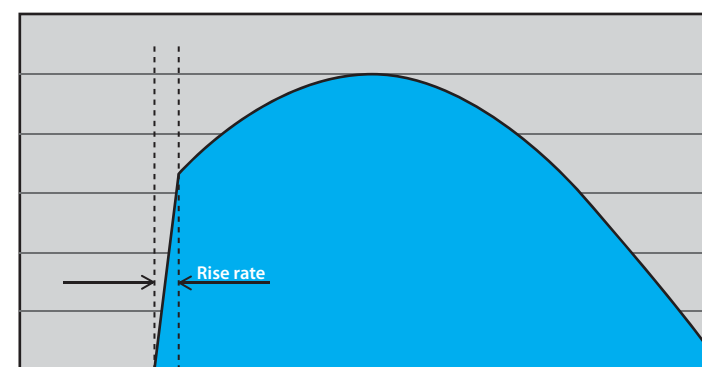
### Capacitive Loads

There are several types of transformer on the market that make use of electronic switch mode technology to create the required secondary voltage for the load. These transformers are generally capacitive rather than inductive in nature. This capacitance creates current spikes when driven from a leading edge dimmer. The net effect is to create buzzing in the transformer and to generate EMC noise. These types of transformers therefore are not usually controlled with leading edge technology and would normally be controlled using trailing edge or universal solutions such as those provided by the Clipsal C-Bus range of Architectural high powered dimmers.

### Rise Time and Leading Edge Dimmers

One issue experienced with leading edge dimming is caused by the sharp rise time of the leading edge in each AC half cycle voltage waveform applied to the load.

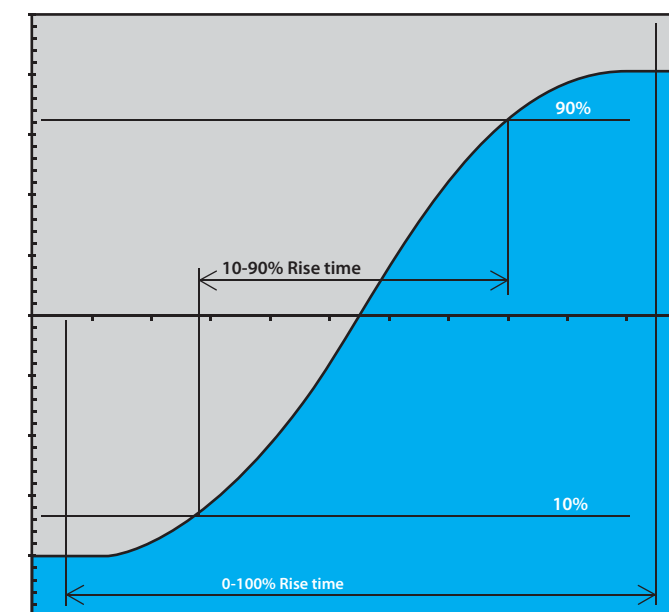
This steep rise can cause the filaments in some load types, notably incandescent bulbs, to “sing”. It can also generate higher levels of induced electrical noise in audio circuits often associated with theatrical equipment used in event staging. In thyristor or SCR controlled dimmers this effect is controlled by the introduction of an inductor to the dimmer channel to slow this sharp rise rate and therefore reduce the effect to an acceptable level.



In reality the rise time curve in a thyristor based dimmer is more complex than shown in this simple diagram and a more precise definition of rise time is required to be able to accurately compare different dimmer performances.

The curve is actually an “S” curve and the generally agreed standard of measurement is to quote the rise time from 10% to 90% of voltage, this eliminates the longer periods where the curve is more flattened at each end.

For acceptable behaviour the rise time should be 200μS or greater between 10% and 90%. If this figure were quoted across the whole curve from 0 to 100% it would yield a result of 350 to 400μS which would be misleading.



For rise time, dimmer channels are tested at:

- their full rated load
- the specified supply voltage
- a 5mS conduction angle
- using an incandescent load.



## USE WITH LOW VOLTAGE TRANSFORMERS

There are two different general types of transformer technologies used when installing safe extra low voltage (12V) tungsten halogen lighting:

### Wire-Wound Transformers

These transformers are also known as “ferro-magnetic” or “iron-core” transformers. They are constructed from copper wire wrapped around an iron core and have been used in the electrical industry for many years. They are generally suitable for dimming applications when used in conjunction with dimmers which use ‘leading edge’ phase angle control. These transformers are less efficient due to core/winding losses. This inefficiency combined with additional primary magnetizing current means that total primary current is larger than that calculated by the secondary load alone. This leads to the necessity for all manufacturers to marginally de-rate a dimmer when using this type of transformer. Typically the de-rating here is limited to around 10%.

### Electronic Transformers

The use of electronic transformers in conjunction with 12V tungsten halogen lighting has become commonplace. Electronic transformers are generally more suited for dimming applications when used with dimmers, which use “trailing edge” phase angle control. Electronic transformers that require trailing edge dimming are suitable for use with the Architectural high powered dimmer.

Many electronic transformers can be used with leading edge type dimmers; these are typically marked upon the transformer. The Architectural high powered dimmer will automatically detect and switch to the correct dimming method dependent on the load. Many dimmers available from other manufacturers require an appropriate de-rating of the dimmer to accommodate for the transformer losses.

Due to the advanced design of the Architectural high powered dimmer, no de-rating for electronic transformers is required.

## LOW VOLTAGE TRANSFORMER COMPATIBILITY

During development of the Architectural high powered dimmer, Clipsal tested numerous manufacturers’ electronic transformers to establish their compatibility. These tests were used to enable the advanced design of the new dimmer range. As a result of the large number of electronic transformer models that are now available on the market and the ongoing changes in product specifications made by manufacturers of electronic transformers, Clipsal recommends that customers contact the electronic transformer manufacturer (or distributor) to establish the preferred dimming method of a particular electronic transformer.

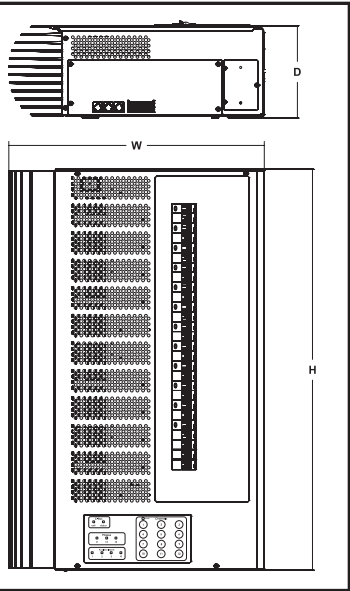
Unlike the majority of our competitors Clipsal recognises that loads; where electronic transformers of leading edge type are mixed with wire-wound transformers, often occur. For this reason we have designed the Architectural high powered dimmer so that any number of wire-wound and leading edge load types can be mixed on a channel.

The issues related to use of capacitive transformers with leading edge control remain, so capacitive transformers may exhibit buzzing and any required de-rating for the magnetic transformers needs to be considered.

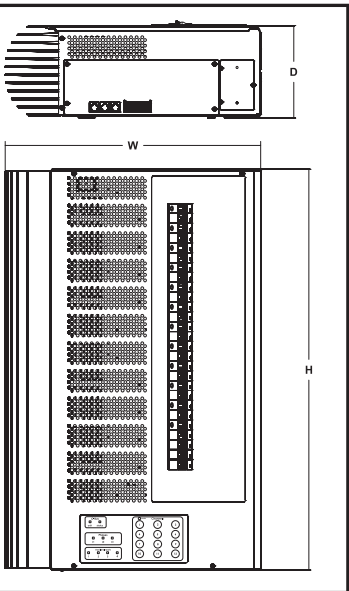


# DIMMER SPECIFICATIONS

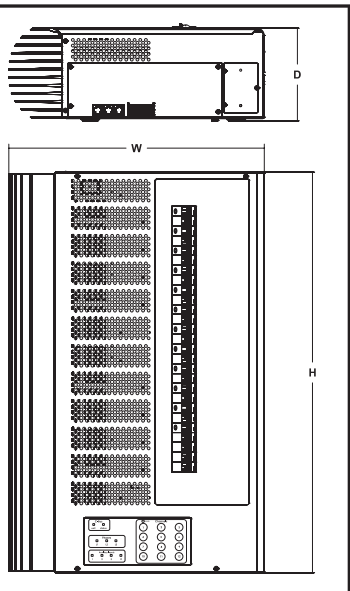
12 Channel		Part Number	
10A per channel		L5112D10UA	
10A per channel with 6 x RCDs		L5112D10UAR6	
Supply Phases	Max Unit	Weight (kg)	Dimensions (mm)
3 Phase	120A	25	455W x 713H x 164D



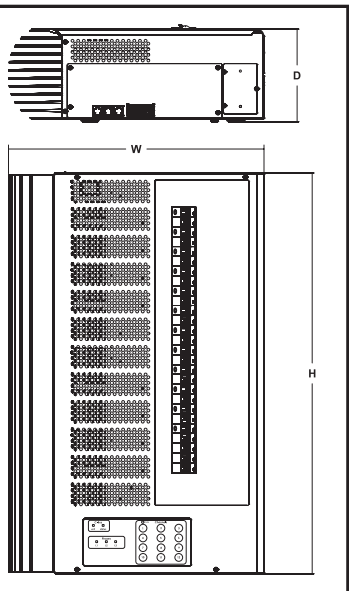
6 Channel		Part Number	
20A per channel		L5106D20UA	
20A per channel with 6 x RCDs		L5106D20UAR6	
Supply Phases	Max Unit	Weight (kg)	Dimensions (mm)
3 Phase	120A	18	455W x 713H x 164D



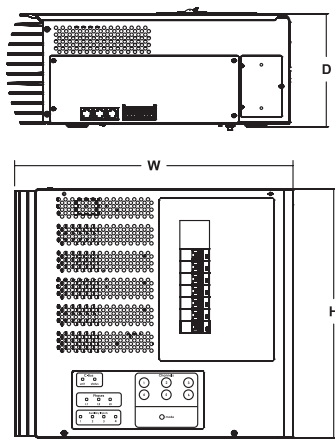
12 Channel		Part Number	
5A per channel		L5112D5UA	
5A per channel with 6 x RCDs		L5112D5UAR6	
Supply Phases	Max Unit	Weight (kg)	Dimensions (mm)
3 Phase	60A	24	412W x 713H x 164D

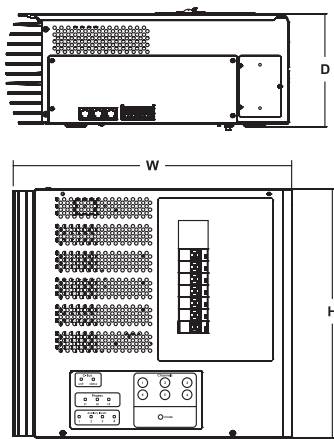


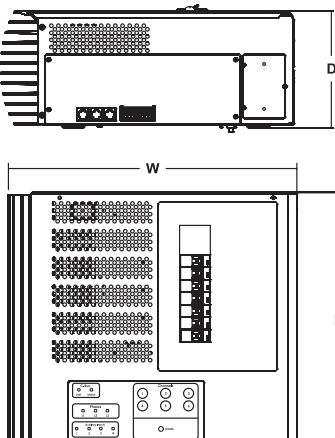
6 Channel		Part Number	
16A per channel		L5106D16UA	
16A per channel with 6 x RCDs		L5106D16UAR6	
Supply Phases	Max Unit	Weight (kg)	Dimensions (mm)
3 Phase	96A	18	455W x 713H x 164D

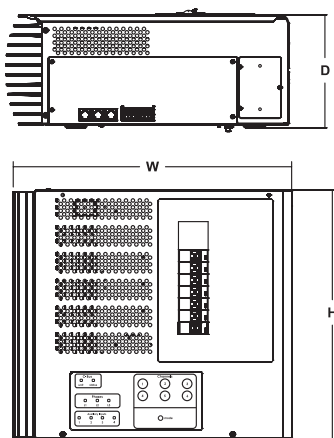




6 Channel		Part Number		
10A per channel		L5106D10UA		
10A per channel with 3 x RCDs		L5106D10UAR3		
Supply Phases	Max Unit	Weight (kg)	Dimensions (mm)	
3 Phase	60A	18	415W x 451H x 164D	

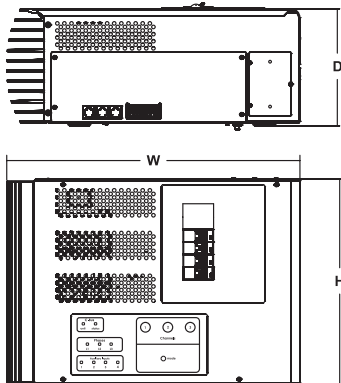
3 Channel		Part Number		
20A per channel		L5103D20UA		
20A per channel with 1 x RCD		L5103D20UAR1		
Supply Phases	Max Unit	Weight (kg)	Dimensions (mm)	
3 Phase	60A	11	455W x 451H x 164D	

6 Channel		Part Number		
5A per channel		L5106D5UA		
5A per channel with 3 x RCDs		L5106D5UAR3		
Supply Phases	Max Unit	Weight (kg)	Dimensions (mm)	
1 Phase or 3 Phase	30A	18	412W x 451H x 164D	

3 Channel		Part Number		
16A per channel		L5103D16UA		
16A per channel with 1 x RCD		L5103D16UAR1		
Supply Phases	Max Unit	Weight (kg)	Dimensions (mm)	
3 Phase	48A	11	455W x 451H x 164D	



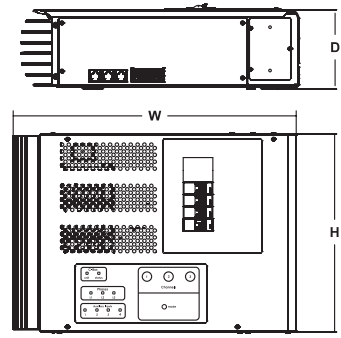
3 Channel		Part Number	
10A per channel		L5103D10UA	
10A per channel with 1 x RCD		L5103D10UAR1	
Supply Phases	Max Unit	Weight (kg)	Dimensions (mm)
1 Phase or 3 Phase	30A	10	455W x 289H x 164D



Technical drawing of the L5103D10UA and L5103D10UAR1 modules. The top view shows the width (W) and depth (D) of the unit. The front view shows the height (H) and width (W) of the unit. The front view also shows the internal components, including the RCD (Residual Current Device) and the 10A circuit breakers.

Parameter	Description
Load terminal standby leakage current	< 10 mA leading edge < 1 mA trailing edge < 2 mA universal
AC supply voltage	240/415V a.c.
AC supply frequency	47 to 53 Hz
Number of input phases	1 or 3 phase (5 Amp model) 3 phase (other models)
Minimum load/channel	20 W for incandescent
Dimming technology	Leading edge 3-5 A Triac Leading edge 10-20 A Dual SCR Universal 5-20 A Dual MOSFET
Soft-start ramp time	220mS
Load current rise time	>200 μs
Power control range	1.5% to 95%
Standby AC supply current	90 mA base current 75 mA each LE channel 20 mA each universal channel
Short circuit withstand strength	6 kA
Rated insulation voltage	500V
Dielectric test voltage	2500V

3 Channel		Part Number	
5A per channel		L5103D5UA	
5A per channel with 1 x RCD		L5103D5UAR1	
Supply Phases	Max Unit	Weight (kg)	Dimensions (mm)
1 Phase	15A	10	412W x 289H x 115D



Technical drawing of the L5103D5UA and L5103D5UAR1 modules. The drawing shows two views: a side view (top) and a front view (bottom). The side view shows the module's profile with dimensions W (width) and D (depth). The front view shows the module's face with dimensions W (width) and H (height). The front view also shows the module's internal components, including a large heat sink, a terminal block, and a control panel with buttons and a display.





by **Schneider Electric**

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