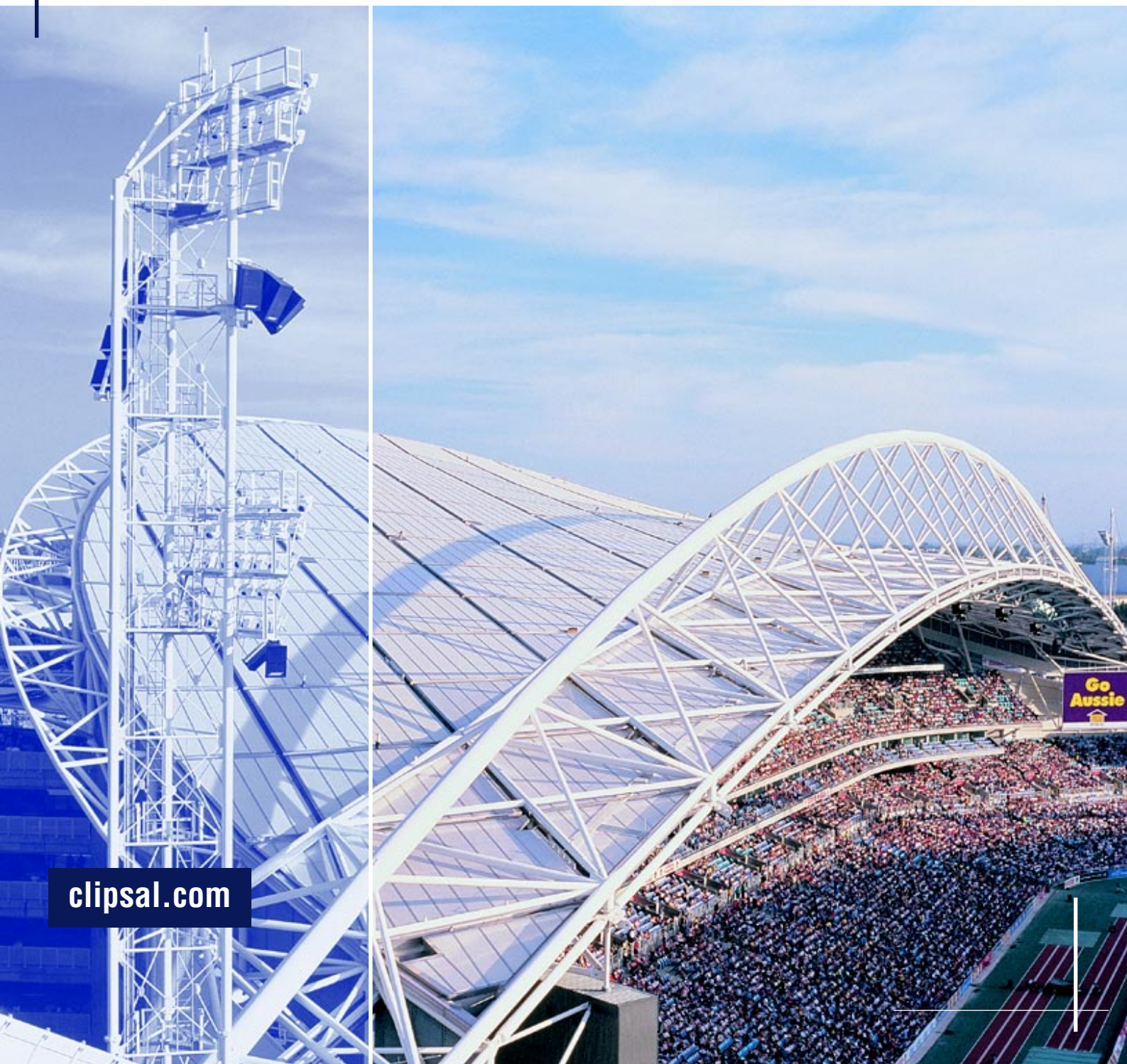
CLIPSAL®
INTEGRATED SYSTEMS

Stadium Australia SYDNEY

C-Bus Energy Management System

Case Study 12



clipsal.com

CLIPSAL
INTEGRATED SYSTEMS

Australia's first **world class** performer in **S**tadium **A**ustralia

The Sydney 2000 Olympic Games will be the biggest and most spectacular event ever staged in Australia.

The centrepiece of the celebrations will be Stadium Australia, the magnificent new arena that has already seen huge attendances for a number of high profile events.

During the Olympic Games and Paralympics, the Stadium will hold up to 110,000 cheering spectators for the opening and closing ceremonies, track and field events, the start and finish of the marathons, and the football final.

C-Bus was selected as the Stadium's lighting management system for a number of reasons.

Firstly, with the eyes of the world on the Stadium in September 2000, it was essential that any technology used was proven and reliable. Furthermore, as the stadium will be used for events as diverse as rock concerts, football matches, and of course the Olympic Games, the system had to provide extreme flexibility.

Specifiers were also impressed with C-Bus' renowned energy savings, and local manufacture and support base.

CLIPSAL
INTEGRATED SYSTEMS

C-Bus networks extend across the entire Stadium. Located in over 120 Electrical Distribution Boards, the C-Bus units control approximately 1500 individual lighting points.

C-Bus Networks

All networks in the Stadium are connected by C-Bus Network Bridges, providing electrical isolation, while at the same time enabling messages to travel between networks. Therefore, messages can be sent from any control point on the network to any light point, or group of points, in the Stadium.

This provides the flexibility to control or monitor any circuit from a central location.

Within Stadium Australia, C-Bus controls:

- All of the Stadium floodlights, including the four main lighting towers and the gantries along the length of the Stadium. C-Bus offers several lighting modes, from Training Level right through to full brightness for Olympic Competition.

  C-Bus also controls approximately 650 x 2kW, 415V metal halide flood-lights that provide lighting in the spectator areas.
- Corridors, lobbies, access ramps and concourse lighting over 6 levels.
- Lighting in the car park, change rooms, toilets and access areas.
- Administration offices lighting.
- Function rooms and banquet hall lighting.
- Ticketing, signage and turnstile lighting.
- Perimeter and landscape lighting.
- Architectural lighting towers, incorpo-rating solar collectors.

C-Bus, 20A mechanically latched relays shown here in one of the 120 distribution boards.

CLIPSAL
INTEGRATED SYSTEMS

Control in **S**tadium **A**ustralia

To achieve control flexibility throughout the Stadium, various types of C-Bus equipment were used. These include Passive Infrared Motion Detectors in corridors, Ultrasonic Detectors in large common areas, Photoelectric Cells to compensate artificial lighting, and Scene Controllers in banquet and function areas, to select preset lighting modes.

The C-Bus Occupancy Sensors were programmed to turn lights on automatically when movement was detected. The PIRs are suitable for areas up to 36m².

Ultrasonic Detectors, featuring infrared and ultrasonic movement sensing, and a coverage range of 225m², were used in large areas.

Details are as follows:

- Passive Infrared Occupancy Sensors provide automatic control of lighting in public areas such as corridors, lobbies and the concourse. The Sensors can be enabled or disabled from a personal computer, based on event requirements.
- Ultrasonic Sensors provide lighting control on ramps between levels.
- C-Bus switches were used in toilets, programmed as timers which automatically timed out after a preset period.
- Scene Control switches in banquet rooms provide preset mood lighting for different functions. Several modes are available from each key switch.
- Photoelectric Cells control perimeter lighting and decorative floodlighting.
- Control is also available from a personal computer, running custom End User Software developed for Stadium Australia. The End User Software, known as Schedule Plus, could be used to control any point, or group of points. The user-friendly application allows a non-technical officer to use the application.

CLIPSAL
INTEGRATED SYSTEMS

C-Bus Architecture in Stadium Australia

Over 1000 C-Bus units are distributed throughout Stadium Australia, connected together via low cost, unshielded twisted pair cable. As well as lowering costs, this greatly reduced the amount of PVC material used, helping to meet the promise of a "Green Games".

Network Topology

The C-Bus system consists of 16 Networks in total, the Local Network and 15 Remote Networks. The C-Bus architecture permits a maximum of 1000 metres of cable in each network. Network Bridges were used to connect between networks, as well as providing optical isolation between networks and allowing messages to be transferred from one network to another.

The Local Network hosted a personal computer which was used to monitor and control the whole C-Bus installation.

Load Control

C-Bus offers the advantage of 20A inductive load rated, mechanically latched relays, which enable relay outputs to stay in the current state, even if C-Bus communications or power is lost. The 20A relay used in the C-Bus is DIN Rail mounted with a local override, independent of the state of C-Bus.

A remote override was also incorporated, so the state of the relays could be toggled from a remote switch location. This provides an added safety feature in the event of any communication or cabling failure.

The relay channels are programmed with a 200mS power up delay between relay channels on switch on, minimising inrush current.

The relays were used to switch high power contactors, which in turn switched the stadium floodlights.

The C-Bus architecture was such that one C-Bus Relay Card, was required for every 4 x 20A relays. Features of the C-Bus Relay Units are as follows:

- Each relay output can switch a 20A HID or fluorescent load. No de-rating is required for inductive lighting loads.
- In the event of power cycling, non-volatile memory retains programmed variables, which are automatically restored on power up.
- Each individual relay is mechanically latched.
- Each unit can be connected to both 'On' and 'Off' Remote Manual Override push-button switches. These overrides can also be connected in parallel to multiple units, allowing manual override of multiple units from one push-button location.
- Each relay has a manual operation lever built-in with visible on/off indication.
- Each relay contact has a 2000A inrush and 1500A short circuit capability.

CLIPSAL
INTEGRATED SYSTEMS

Lighting Management Software

Part of the requirements for this project was to provide a simple to use, graphical, front end application software suite, which would allow control of all lighting in Stadium Australia from one central location.

Security was an important consideration. The software includes password protection to prevent unauthorised personnel making changes to the program or accessing the menu selections.

The application software is designed to run on a PC with Windows 95, 98 or NT, providing:

- The ability to use the PC's real time clock to facilitate a master schedular for events.
- A graphical user interface, which allows scenarios and modes of operation to be programmed.
- Configurable screens that enable the user to issue commands to the C-Bus controlled lighting loads throughout Stadium Australia.
- A History File that logs every event.
- Password Protection, which protects all set-up functions.

The user interface is a 'tab' based multi-menu structure, which enables an unlimited number of menus, control buttons, modes, event schedules, and user configurable control screens to be programmed. There is also the facility for generating, viewing and printing a series of reports, which provide full details of the system's control setups.

Operator Control Functions

The application software was designed for ease of use by a relatively skilled person. The C-Bus software enables:

- The operator to dim or switch loads on/off.
- The operator, via a series of on-screen 'buttons', to control devices connected to the system. It is possible to assign 'macro functions' to each of these buttons from the software's user interface. Each of these macro functions corresponds to a particular user defined function of the lighting control system.
- Assigning of automatic scheduling or manual control of multiple loads located anywhere in the system by way of a grouping function.
- Control buttons to be configured to each of the unlimited number of tab based menus, thereby providing an unlimited number of control functions.
- Controlled C-Bus output addresses to be grouped together and user 'Areas' created. These output addresses can also be linked to multiple Areas,e.g, an address called 'Lobby Lights Level 1' could be included in an Area called 'All Lighting Level 1' and also in another called 'Lobby Lights All Levels.'
- Staggering of load operations to reduce the inrush effects on the power system. Multiple loads will therefore not operate simultaneously, even when triggered by the same control button or time schedule.
- Password protection of all control buttons, with the ability to assign a different password to each button, if required.
- The ability to enable and disable manual control of individual buttons by mouse clicking in check boxes within the user interface.
- Full customisation of the control buttons, by importing bitmaps from applications such as Paintbrush.

CLIPSAL®
INTEGRATED SYSTEMS

Automatic Control Functions

Macros and events can be programmed for automatic operation based on a condition or time event. Functions available include:

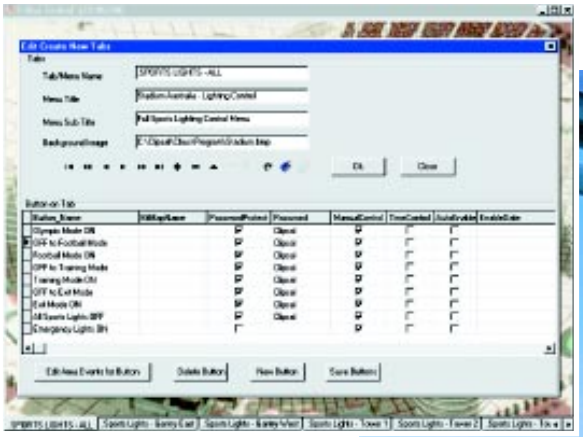
- Control schedules that can easily be set up and re-configured by an operator with no previous experience. The software provides a visual indication to the user when a time schedule is linked to a control button.
- Easy configuration of an unlimited number of automatic time based schedules.
- Time schedules that can be set up to be valid always or between user specified dates only.
- Time schedules that can be activated on specific days, everyday, every weekday or every weekend.
- Time schedules that can be programmed to 'auto-enable' at a specific date. This allows the user to set up an automatic time based control sequence that can be initiated in the future.

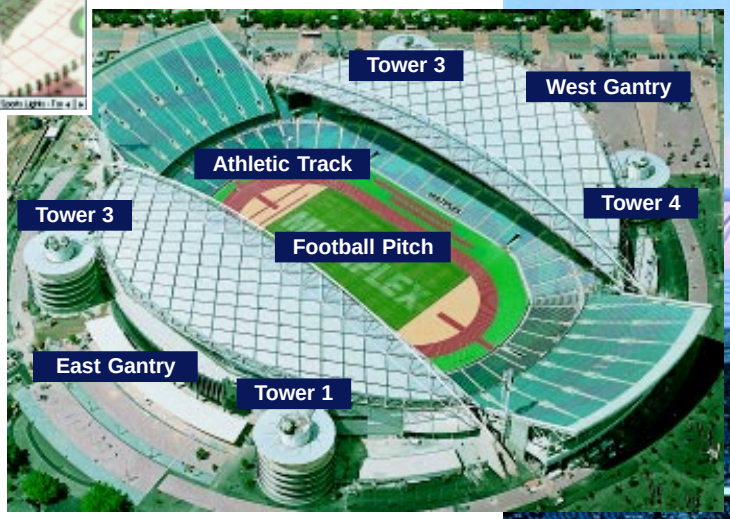
Lighting **Management Software**

Sports Lighting

The sports lighting in Stadium Australia shows the flexibility and control options that are available with C-Bus. The following screen shows the Sports Lighting Control Menu. As you can see, all controls are password protected to ensure that only authorised personnel can operate floodlights.

The tabs along the bottom of the screen show that the sports lighting consists of two gantries (east and west) and four towers, each with individual control.





The sports lights are controlled in the following four modes.

Towers & Gantries	
OLYMPIC MODE	Provides focussed lighting to the athletics track. Operation of this mode also enables the other three modes to be used.
FOOTBALL MODE	Provides even illumination over the football field area.
TRAINING MODE	Provides a lower level of lighting, sufficient for training.
Gantries Only	
EXIT MODE	Minimum lighting to facilitate crowd movement.

CLIPSAL
INTEGRATED SYSTEMS

Generator Control Details

There are two generators on site, one on the eastern side of Stadium Australia and one on the western side. A C-Bus relay module is located in two of the main switch rooms to provide an input to the generator control system. There are two channels in each switch room, as the generator can be run in Sports Lights Mode or Co-Generation Mode.

Sports Lights Mode sets up the change-over motorised switchgear, enabling the floodlight distribution boards to be powered by the generator and not the mains supply. In the event of a generator failure, the switchgear will provide selected floodlights with power from a UPS until it can be switched back to the mains supply.

The Co-Generation mode is designed to provide power to not only the Stadium general lighting, but to also put excess capacity back into the supply authority grid.

The generators use natural gas as their primary fuel. They also incorporate a heat exchange system to supply the Stadium with its hot water requirements, in both Co-Generation and Sports Lights Mode.

CLIPSAL INTEGRATED SYSTEMS

Stadium Australia
The Benefits of C-Bus Control

Features	Benefits
Scene control	Can provide specific lighting for different events (eg. Concert, Football, Track and Field) without additional wiring. Can be performed by Building Manager.
Central control	Control buttons can be made 'on the fly' from a PC. Individual buttons can be password protected, eg. General Control. Manual control can be removed from a button.
Local scene control in specific areas	Local control of toilets out of event mode. Local control of PIRs out of event mode. (Areas that are only occupied for short periods of time.) eg. banquet halls.
Control can be duplicated	Control can be provided from several locations - e.g. security room, event control room and facility manager's room for added convenience.
PIRs, PE cells and push-buttons	Greatly reduced energy costs.
Load sequencing	Ensures peak current reduction.
PC controlled switching of any lighting	Enables automatic lighting (external security, landscape, office) to be programmed for set times and for a set duration.
Local overrides	Provides fail safe modes/overrides of system.
Latching relays (Non permanent energised coil)	Highly reliable, fail safe mode.

Clients

Architect - Bligh Lobb Sports Architecture

Builder and Construction Managers - Multiplex Construction

Electrical Consultant - D. Rudd and Partners

Electrical Contractor - Kennedy Taylor Pty Ltd

Electrical Switchboard Manufacturer - Harwal Industries

CLIPSAL
INTEGRATED SYSTEMS

Clipsal C-Bus is becoming renowned for superior lighting control and energy management in sports venues around the world. Here are just some of the recent projects that feature the benefits of C-Bus:

Sports Lighting Expertise

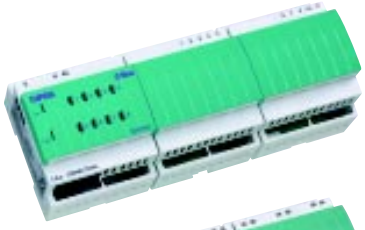
- Millennium Park, Cardiff, Wales, which is a 72,500 capacity arena with a retractable roof and state-of-the-art facilities.

  Venue for the 1999 Rugby World Cup, Millennium Park is now used for rock concerts and a range of other sporting and entertainment events.
- Eden Park, Auckland, the home of Rugby Union in New Zealand and also Auckland's premier cricket ground.
- Colonial Stadium, Melbourne, the $430 million multi-purpose sports and entertainment venue has opened in 2000. The stadium provides under cover seating for 52,000 spectators and features a retractable roof and seating.

The state of the art Colonial Stadium, the first in Australia with a retractable roof.

- The SuperDome in Homebush Bay, Sydney, Australia's largest and most versatile indoor arena. The 20,000 seat SuperDome will be the venue for a number of Olympic Games programmes, including the artistic gymnastics, gymnastic trampolining and the basketball finals.
- WACA, Perth, Western Australia's premier AFL and cricket ground.
- Multi Function Venue, Melbourne, a 10,000 seat stadium with a retractable roof in the Tennis Centre, which will accommodate a number of sporting events.
- Campbelltown Sports Ground, Sydney, home of the National Rugby League team, the 'West Tigers'.

Reg. Design



Each lighting pole used for perimeter lighting in Homebush includes a C-Bus relay unit for ultimate flexibility.

For further information on the benefits of C-Bus Energy Management System for your customers, please contact your Clipsal C-Bus Specialist in each State, or Clipsal Integrated Systems Pty Ltd.

CLIPSAL
INTEGRATED SYSTEMS

A product of Clipsal Integrated Systems Pty Ltd
ACN 089 444 931

Head Office
12 Park Terrace, Bowden South Australia 5007

PO Box 103 Hindmarsh, South Australia 5007
Telephone (08) 8269 0560
International +61 8 8269 0560
Facsimile (08) 8346 0845
International +61 8 8346 0845
Internet clipsal.com/cis
E-Mail cis@clipsal.com.au

Offices in all States

NSW	Sydney	(02) 9794 9200
	Albury	(02) 6041 2377
VIC	Melbourne	(03) 9207 3200
	Country areas	1800 653 893
QLD	Brisbane	(07) 3244 7444
	Townsville	(07) 4729 3333
SA	Adelaide	(08) 9442 4444
TAS	Hobart	(03) 6272 3177
	Launceston	(03) 6331 6951
NT	Darwin	(08) 8947 0278

International Enquiries
Head Office Export Department
Telephone +61 8 8269 0587
Facsimile +61 8 8340 7350
E-Mail export@clipsal.com.au

New Zealand
Clipsal Industries (NZ) Ltd Auckland
Telephone (09) 576 3403
Facsimile (09) 576 1015
E-Mail headoffice@clipsal.co.nz

Customer Service - North Island
Telephone (09) 572 0014
Free Fax 0800 733 567

Customer Service - South Island
Telephone (03) 379 5368
Free Fax 0800 250 305

Malaysia Clipsal Technologies
Lot 26, Jalan Pengapit 15/19
Shah Alam Industrial Estate
40000 Shah Alam
Selangor Darul Ehsan
West Malaysia
Telephone (3) 5519 1111
Facsimile (3) 5519 4378
E-Mail cbus@pd.jaring.my

Singapore
Clipsal Technologies Singapore Pte Ltd
No. 5 Fourth Chin Bee Road
Singapore 619699
Telephone (65) 266 1998
Facsimile (65) 266 3922

International Representatives

Argentina
Controles Tecnova S.A. Telephone (114) 207 9534

China
Clipsal (China) Ltd Telephone (755) 246 1122

Greece
Clipsal Hellas S.A. Telephone (1) 600 3718

Middle East
Clipsal Middle East Telephone (6) 557 0777

South Africa
Clipsal South Africa (Pty) Ltd Telephone (11) 314 5200

Taiwan
Clipsal (Taiwan) Co Ltd Telephone (2) 2558 3456

Thailand
Clipsal Thailand Ltd Telephone (2) 952 5338

United Kingdom
Clipsal Ltd (UK) Telephone (1494) 521 111

Vietnam
Clipsal - VTEC Telephone (8) 856 3002

Printed by Custom Press Pty Ltd (08) 8346 7999

00/1 Order No. 15640