

Semiconductor Test Solutions

Wafer/Chip/Package

www.chromaate.com

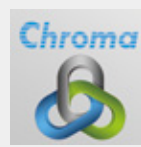


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Chroma ATE Inc, as a turnkey test & automation solution provider, integrates customized solutions with Test & Measurement Instruments, Automatic Test Systems and Intelligent Manufacturing Systems. Over the decades, Chroma ATE Inc. has accumulated vast experiences and deep knowledge in specific in semiconductor IC test areas. Chroma provides a wide portfolio of semiconductor IC test solutions ranging from ATE, PXI systems, IC handlers, system level test solutions, and specialized ATC thermal test capabilities.

On the ATE & PXI/PXIe side, the solutions cover applications in consumer SoC (MCU, controller, audio, peripheral), power management IC (Regulator, LDO, DC/DC, AC/DC, LED Driver), RF (FEM, Connectivity, Mobile) and other specific applications (CIS, Light Sensors, RFID).

On the handler & automatic system side, the solutions include ATC and PTC thermal control, LAP (Large Array Packaging) device handling technologies, bare die handling, pick and place handlers, CIS turnkey solutions, and system level test solutions. With the turnkey solutions, Chroma provides the best and most sensible approach for customers, enabling them to reduce the cost of test while maintaining the overall test quality and ultimate performance.

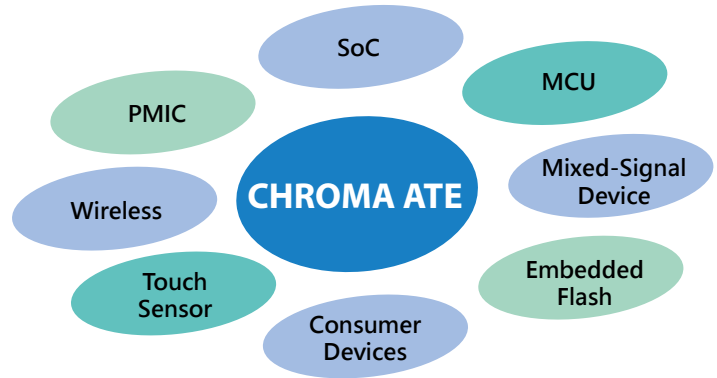


Semiconductor Automatic Test Equipment (ATE)

Chroma semiconductor ATE is specifically designed for high-throughput and high parallel test capabilities to provide the most cost-effective solution for fabless, IDM and testing houses. With the full functions of test capability, high accuracy, powerful software tools and excellent reliability, it is ideal for testing consumer devices, high-performance microcontrollers, etc.

Key Features

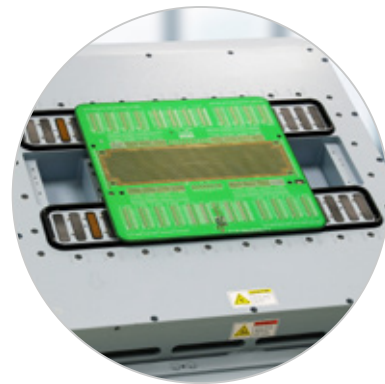
- ✓ High Performance in a low-cost production system
- ✓ High parallel test capability
- ✓ Flexibility from engineering to production
- ✓ Powerful suite of software tools
- ✓ Small footprint to save space in factory
- ✓ Adapter board to use another platform directly



SoC Test Systems

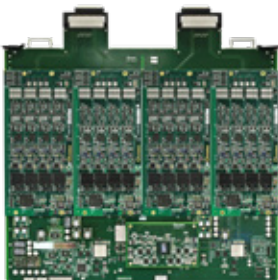
Model 3680

- ✓ 2048 digital I/O pins
- ✓ 150 Mbps up to 1Gbps data rate (muxed)
- ✓ 2048 sites parallel testing
- ✓ 256/512MW vector memory
- ✓ 64 Ch high precision PMUs
- ✓ 128 Ch high density DPS
- ✓ C#.NET And GUI programming interface
- ✓ CRISPro, full suite of intuitive software
- ✓ High density analog/mixed-signal option
- ✓ Applications: Digital, MCU, MPU, Audio & Video, DTV, STB, FPGA



3680 Series Options

- ✓ LPC128 digital channel board
- ✓ DPS32 device power supply
- ✓ HDAVO mix-signal board
- ✓ HDAWDG AD/DA board
- ✓ HDVI high density analog board
- ✓ HCDPS high current analog board



HDAVO Board



HDAWDG AD/DA Board





| Selection Guide - SoC/Analog Test System - 1 | | | |
|--|---------|-------|------------|
| | DPS64 | HCDPS | HDVI |
| V Range | 12V/±6V | ±4V | 70V ~ -40V |
| C Range | 1A | 32A | 200mA |
| Channels | 64 | 4 | 32 |
| Slot | I/O | I/O | DPS |
| 3680 | O | O | O |

S : Standard O : Option -- : None

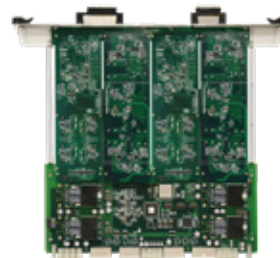
| Selection Guide - SoC/Analog Test System - 2 | | |
|--|----------------------------|---------------------------------|
| | HDAVO | HDAWDG |
| Sample Rate | AWG 400Msps DGT 250Msps | 1 Msps |
| Resolution | HF 16 bits LF 24 bits | 20 bits |
| Channels | 8S8M | 32 AWG, 8 DGT, 32 Vref, 32 PPMU |
| Slot | I/O | DPS |
| 3680 | O | O |

Model 3650

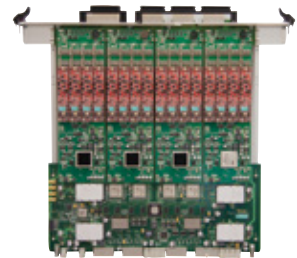
- 640 digital I/O pins
- 16/32 MW vector memory
- 2~20 Ch high precision PMUs
- 32 Ch high density DPS
- 40 high-voltage pins
- Microsoft Windows® 7 /10 OS

3650 Series Options

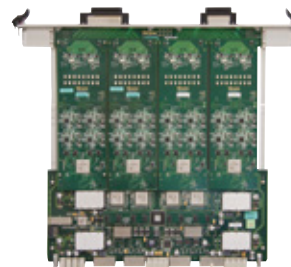
- MPVI pulsed analog option
- HDADDA mixed-signal option
- PVI100 analog option
- VI45 analog option
- Timing interval analyzer option



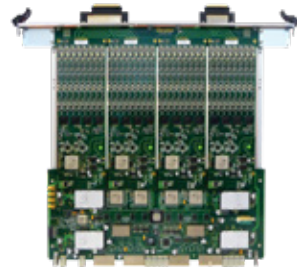
MPVI



HDADDA



PVI 100



VI 45

| Selection Guide - SoC/Analog Test System - 3 | | | | | | |
|--|-------|-------|-------|-------|-----------------|---------------------|
| | DPS | HDDPS | PMU | VI45 | PVI100 | MPVI |
| V Range | ±16V | ±12V | ±16V | ±45V | ±100V (±50V) | ±120V (±60V) |
| I Range | 800mA | 1A | 250mA | 100mA | 2A (4A) | 40A (80A) pulsed |
| Channels | 16 | 48 | 2 | 32 | 8 | 2 |
| Slot | DPS | DPS | None | I/O | I/O | I/O |
| 3650 | O | -- | O | O | O | O |

| Selection Guide - SoC/Analog Test System - 4 | | |
|--|---------|---------|
| | ADDA | HDADDA |
| Fs Max | 500KHz | 500KHz |
| Resolution | 16 bits | 16 bits |
| Channels | 1 | 32 |
| Slot | None | I/O |
| 3650 | O | O |

VLSI Test Systems

Model 3380-D

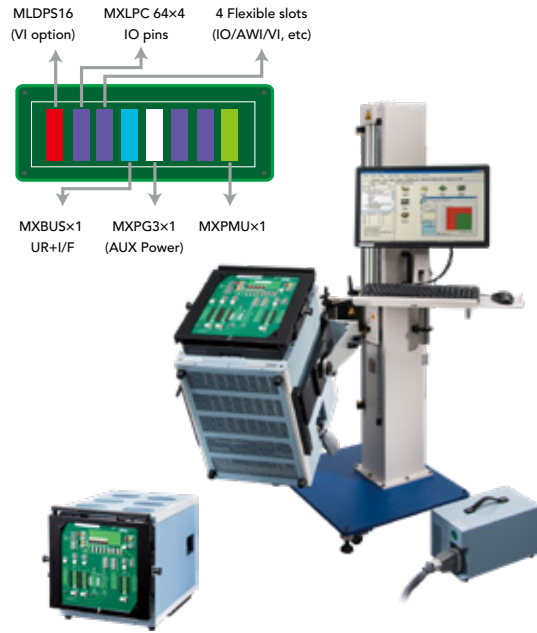
- ☑ 50/100 MHz clock rate
- ☑ Max. 256 digital I/O pins
- ☑ 32/64/128M pattern memory
- ☑ 256 sites parallel testing
- ☑ Max 32 Ch DPS (at 256 I/O pins)

Model 3380-P

- ☑ 50/100 MHz clock rate
- ☑ Max. 576 digital I/O pins
- ☑ 32/64/128M pattern memory
- ☑ 512 sites parallel testing
- ☑ Max 64 Ch DPS (at 512 I/O pins)

Model 3380

- ☑ 50/100MHz clock rate
- ☑ Max. 1280 digital I/O pins
- ☑ 32/64/128M pattern memory
- ☑ 1024 sites parallel testing
- ☑ Max 192 Ch DPS (at 1024 I/O pins)



Flexible Configuration

- ☑ Support flexible slots for inserting I/O, UVI, ADDA, PXIe, etc.
- ☑ 3380-D : 4 slots
3380-P : 9 slots
3380 : 20 slots
- ☑ Time/Freq Measurement unit

Selection Guide - VLSI Test System - 1

| | MXAWI | MAWI2 |
|------------------|-------------|-------------|
| Sample Rate (WD) | 250Ksps | 2.5Msps |
| Resolution | 16 bits | 24 bits |
| Channels | 4 AWG+4 DGT | 4 AWG+4 DGT |
| Slot | I/O | I/O |
| 3380D | O | O |
| 3380P | O | O |
| 3380 | O | O |

Selection Guide - VLSI Test System -2

| | MXDPS | MXUVI | MXREF | MLDPS | MLDPS-16 | MDDPS | Remark |
|--------------|----------|-------------|-------------|--------------|--------------|-----------------------------|------------------|
| V Range | ± 16 V | ± 12 V | ± 48 V | 12 V/± 6 V | 12 V/± 6 V | -6V~+18V | -- |
| C Range | ± 2 A | ± 1 A | ± 250 mA | ± 1 A (± 6V) | ± 1 A (± 6V) | ± 125mA/± 250mA/ ± 500mA | -- |
| Channel | 8 /board | 16 /board | 16 /board | 32 /board | 16 /board | 64 /board | -- |
| Slot | S slot | S / IO slot | S / IO slot | S / IO slot | S / IO slot | S / IO slot | -- |
| 4 wires VI | Yes | Yes | Yes | Yes | Yes | Yes | 1 -S/2CH (MLDPS) |
| Current Gain | None | Yes (4A) | Yes (1A) | Yes (32A) | Yes (16A) | Yes (32A) | -- |
| 3380D | O | O | O | O | S | O | -- |
| 3380P | O | S | O | O | O | O | -- |
| 3380 | O | O | O | O | O | O | Flexible |

S : Standard
O : Option
-- : None



PXIe/PXI IC Test Systems

High Speed PXIe Digital IO Card Model 33010

- ☑ Standard PXIe bus connector
- ☑ 100MHz maximum clock rate
- ☑ 32 channels per board
- ☑ Extendable up to 256 channels in one chassis
- ☑ Any pin to any site
- ☑ Per board sequencer architecture
(multiple time domains supported)
- ☑ Additional power supply A330101 (option)
- ☑ One A330101 power supply supports up to 200W (4 pcs of 33010 digital IO cards)



Digital IO Card
33010



Demo board
(option)



Additional Power Supply
A330101 (option)

Programmable Device Power Supply Model 33020

- ☑ High channel density with 8 channels per card
- ☑ -6V~12V independently programmable voltage levels
- ☑ Max. 250mA (500mA at 6V) current per channel
- ☑ Parallel current gang feature providing max. 4A output per card



6-slot chassis (option)

High Voltage Device Power Supply Model 33021

- ☑ Max. 48V DC output with 2 channels per card
- ☑ -12V~48V independently programmable voltage levels
- ☑ Max. 250mA current per channel
- ☑ Parallel current gang feature providing max. 500mA output per card
- ☑ 18-bit voltage programming resolution



9-slot chassis (option)

Universal Relay Driver Control Module Model 33011

- ☑ PXI-e based universal relay control for semiconductor load boards
- ☑ 32CH direct relay drivers
- ☑ 2 lanes of SPI relay control interface
- ☑ 5V @ 100mA for relay control
- ☑ For load board peripherals
 - 3.3V and 5V @ 0.6A
 - ±12V @ 0.75A



18-slot chassis (option)

Pick & Place Handler - Final Test (FT) and System Level Test (SLT)

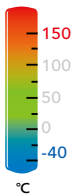
Final Test

FT is taken to test before delivery of the product to customers. This test through test patterns to verify the functionality of the device and measure the electrical characteristics to meet the desired specifications. The purposes of testing are listed as below.

- ☑ To verify product design
- ☑ To achieve high quality production
- ☑ To control production quality
- ☑ To acquire continue improvement in product yield

Full Range Tri-temp Final Test Handlers

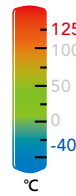
Model 3110
-40°C~150°C



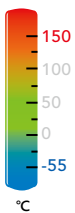
Tri-temp chamber



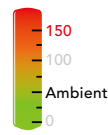
Model 3110-FT
-40°C~125°C



Model 3160C
-55°C~150°C



Model 3160A/3180
Ambient~150°C



System Level Test

In conventional IC backend process, to ensure shipment quality, most companies test packaged devices at speed with full function. However, this induces several issues:

- [1] Device shipment quality is not ensured due to the difference between ATE and real working environment
- [2] Time to market is delayed due to months-long test program development on ATE's
- [3] Test cost continually raises in contrast with reducing silicon cost.

Drivers to System Level Test

Time To Market

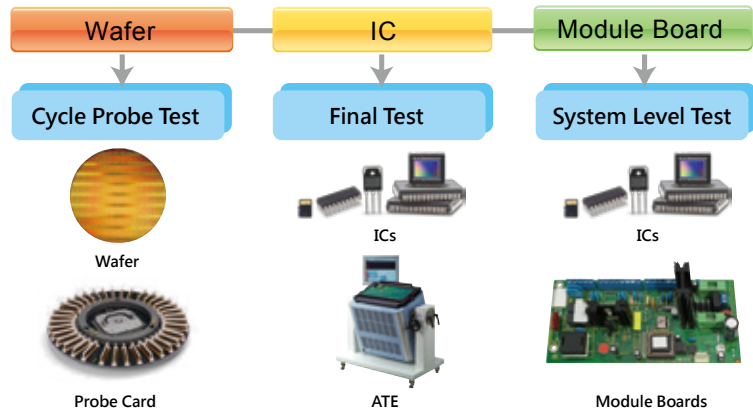
- Shipment made before ATE program ready
- Maximize device
- Availability

Cost

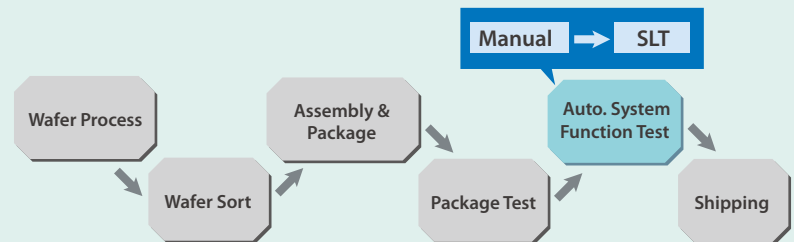
- Lower investing cost (COO) than ATE
- Higher efficiency (lower unit cost) than manual test

Fault Coverage

- Control DPPM
- Quality assurance
- Reduce personnel effort
- evaluating the system's compliance
- Test accessibility
- Detect inconsistencies between SW and the hardware assemblages



Disruptive Process Implement in Semiconductor Test



Mini Tabletop Single Site Test Handler

Model 3111

- IC packages: 5x5 mm to 45x45 mm
- Software configurable binning
- Air damper contact
- Optimizes IC force balance
- Maximize test socket lifetime
- Double stack protection
- Continuous automated re-test
- Remote control operation
- Real time system camera monitoring
- Alerts to mobile device



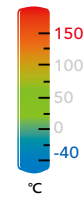
Tri-temp System Level Test Handlers

Model 3110

- ☑ 2 in 1 final test and system level test
- ☑ Auto tray load/unload & device sorting capability
- ☑ Air damper for good contact balance
- ☑ Shuttle remain IC check function
- ☑ Optional tri-temp IC test function (-40°C~150°C)
- ☑ Optional high power cooling function
- ☑ Perfect for device engineering characterization gathering and analysis

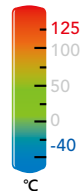
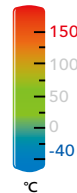


SLT handler with module board



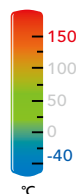
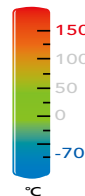
Model 3260

- ☑ Reliable high-speed Pick & Place handler
- ☑ Synchronous nozzle double pick and double place design
- ☑ The floating head can effectively balance the contact force
- ☑ IC remain detection function
- ☑ Universal kits design
- ☑ With tri-temp system SLT test classification function
- ☑ Optional TEC control system (-40°C~125°C)
- ☑ Optional compressor control system (-40°C~150°C)
- ☑ Faster temperature rise and fall response speed



Model 3200

- ☑ Supports multiple combinations and tests (6~24 Sites)
- ☑ Accurate balance contact force of bare die
- ☑ IC residue detection function (Remain)
- ☑ IC oriental rotation function (Rotator)
- ☑ Mixed lots production function
- ☑ Optional tri-temp ATC SLT classification function
Low temperature -40°C~150°C,
ultra-low temperature -70°C~150°C
- ☑ Optional PTC high disipation test classification function
- ☑ Optional TSD (Temperature Sensing Diode) feedback control
- ☑ Fast temperature rise and fall response speed
- ☑ Chroma virtual production tool import (CVOT)





CIS Turnkey Test Solutions

The CIS (CMOS Image Sensor) test solution is one of Chroma's unique turnkey solutions. It provides the best UPH with best optimized resource, which delivers the performance and quality for functional and image tests. Chroma integrated CIS solution provide the best COO (Cost of Ownership) to customers.

Model 3180-IS

- ✓ Smaller IC (2x2 mm) pick-and-place capability
- ✓ 32 Sites high throughput test
- ✓ CIS and ASIC test application
- ✓ Programmable control test of floating head pressure
- ✓ Light source quick change over design
- ✓ Optional temperature control system (Ambient~150°C)
- ✓ Optional STCM (Socket Temperature Control Module) function



LCOS Cell Automatic Optical Inspection System

Model 7710

- ✓ Package inspection size : 4mm x 4mm ~ 25mm x 25mm
- ✓ Four AOI Stations :
 - Non-uniformity Inspection 15µm/pixel
 - Back side inspection 10µm/pixel
 - High resolution optical side inspection 1.5µm/pixel
 - Optical side inspection 10µm/pixel
- ✓ UPH : ≥ 400 @ 100% yield rate - class 1000



RF integrated test solution

RF (Radio Frequency) testing is one of Chroma's unique integrated solutions. It provides the most suitable and stable test performance and quality to verify your equipment complies with local electromagnetic compatibility (EMC) electrical safety and radio frequency exposure regulations.

Model 3200

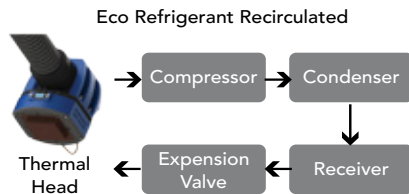
- ✓ OTA (Over the Air) test application
- ✓ RF shielding ability ≥ -60 dB
- ✓ Supports 8 sites test

Model 3260

- ✓ OTA (Over the Air) test application
- ✓ RF shielding ability ≥ -80 dB
- ✓ Supports 6 sites test



Temperature Forcing System



High Power
450W/600W
Passive Thermal Control

TEC Controller
Compressor Phase Change

High Power
Active Thermal Control
Cobra

High Power
Active Thermal Control
King Cobra

High Power
Active Thermal Control
Sea Cobra

| Selection Guide | | | Final Test Handlers | | | | |
|-----------------------|---|-----------------|---------------------|---------|------------|-------|------|
| Temperature Condition | | | 3110 | 3110-FT | 3160/3160A | 3160C | 3180 |
| Hot | Ambient | Ambient | O | O | O | O | O |
| | High Temperature (General Heater) | ~150°C±3°C | O | -- | O | O | O |
| | | ~125°C±3°C | O | -- | O | O | O |
| ATC | Tri-Temperature (TEC Control) | -40°C~125°C±2°C | O | O | -- | O | -- |
| | | -55°C~150°C±2°C | O | -- | -- | O | -- |
| | Tri-Temperature (Compressor Control) | -40°C~150°C±2°C | O | -- | -- | -- | -- |
| | | -70°C~150°C±2°C | O | -- | -- | -- | -- |

| Selection Guide | | | System Level Test Handlers | | | |
|-----------------------|---|-----------------|----------------------------|------|------|------|
| Temperature Condition | | | 3110 | 3111 | 3200 | 3260 |
| Hot | Ambient | Ambient | O | O | O | O |
| | High Temperature (General Heater) | ~150°C±3°C | O | -- | -- | O |
| | | ~125°C±3°C | O | O | O | O |
| ATC | Tri-Temperature (TEC Control) | -40°C~125°C±2°C | O | -- | -- | O |
| | | -55°C~150°C±2°C | -- | -- | -- | -- |
| | Tri-Temperature (Compressor Control) | -40°C~150°C±2°C | O | -- | O | O |
| | | -70°C~150°C±2°C | O | -- | O | -- |

| Selection Guide | | | Handlers for other applications | | | | |
|-----------------------|--------------------------------------|------------|---------------------------------|------|-------|------|------|
| | | | 3180-IS | 3200 | 3240Q | 3270 | 7710 |
| Applications | CIS | | O | -- | -- | O | O |
| | RF | | -- | O | O | -- | -- |
| Temperature condition | | | | | | | |
| Hot | Ambient | Ambient | O | O | O | O | O |
| | High Temperature (General Heater) | ~150°C±3°C | O | -- | O | -- | -- |
| | | ~50°C±3°C | -- | -- | -- | O | -- |

O : Option

-- : None





**HEADQUARTERS
CHROMA ATE INC.**

88 Wenmao Rd., Guishan Dist., Taoyuan City 333001, Taiwan
T +886-3-327-9999 F +886-3-327-8898
info@chromaate.com www.chromaate.com

CHROMA ELECTRONICS (SHANGHAI) CO., LTD.

3F, Building 40, No. 333, Qin Jiang Rd., Shanghai, China
T +86-21-6495-9900 F +86-21-6495-3964
info@chromaate.com www.chroma.com.cn

CHROMA ATE (SUZHOU) CO., LTD.

Building 7, ShiShan Industrial Gallery, No. 855, Zhu Jiang Rd.,
Suzhou New District, Jiang Su, China
T +86-512-6824-5425 F +86-512-6824-0732
info@chromaate.com www.chroma.com.cn

**JAPAN
CHROMA JAPAN CORP.**

888 Nippa-cho, Kouhoku-ku, Yokohama-shi, Kanagawa, 223-0057, Japan
T +81-45-542-1118 F +81-45-542-1080
info@chroma.co.jp www.chroma.co.jp

**KOREA
CHROMA ATE KOREA BRANCH**

3F, Richtogether Center, 14, Pangyoyeok-ro 192, Bundang-gu,
Seongnam-si, Gyeonggi-do 13524, Korea
T +81-45-542-1118 F +81-45-542-1080
info@chromaate.com www.chromaate.co.kr

QUANTEL PTE LTD.

(A company of Chroma Group)
25 Kallang Avenue, # 05-02, Singapore 339416
T +65-6745-3200 F +65-6745-9764
sales@quantel-global.com www.quantel-global.com

**U.S.A.
CHROMA ATE INC. (U.S.A.)**

7 Chrysler, Irvine, CA 92618
T +1-949-421-0355 F +1-949-421-0353
info@chromaus.com www.chromaus.com

**EUROPE
CHROMA ATE EUROPE B.V.**

Morsestraat 32, 6716 AH Ede, The Netherlands
T +31-318-648282 F +31-318-648288
salesnl@chromaeu.com www.chromaeu.com

CHROMA GERMANY GMBH

Südtiroler Str. 9, 86165 Augsburg, Germany
T +49-821-790967-0 F +49-821-790967-600
salesde@chromaeu.com www.chromaeu.com