



*UltraCEM All Weather  
Continuous Emissions Monitoring System*

*Clean Air Systems*

**tyco** | Flow Control | **Environmental Systems**

## Description

The Tyco UltraCEM system is a Field Mount Continuous Emissions Monitoring System that uses proven extractive monitoring technology, is coupled with state of the art measurement detectors and utilises an embedded controller for maximum measurement, communications and processing capabilities.

The UltraCEM is designed to extract a sample gas, condition the sample, analyse for the desired constituents, and process the emission data as stipulated in 40 CFR Part 60/75 regulations.

The UltraCEM system is also a Data Acquisition System that will store relevant raw/diluent corrected emissions, flags, calibrations and alarms for a period of three months.

## Features

- One to five (1-5) channel multi gas measurement capability
- Time proven high Accuracy/ Sensitivity gas detectors utilise: Paramagnetic (O<sub>2</sub>), IR (CO and CO<sub>2</sub>), Chemiluminescent (NO<sub>x</sub>), UV or IR (SO<sub>2</sub>), FID (THC)
- All weather NEMA 4X Box construction designed for Outdoor monitoring. Environmentally controlled shelter not required
- Independent Analysis and Sample conditioning enclosures allow for ultra versatile installation options:
  - Mount at Stack Port for minimum installation costs/Heated Sample Line not required.
  - Mount at the bottom of the stack utilising a stack sample probe and Heated Sample Line
  - Mount the SCU on the stack port and the MAS in a control room to allow for easy operator maintenance and low installation costs.
- Easy to service front access components
- All computer parts are industry format PC for easy upgrades or replacements
- Optional Laptop with wireless transmission



## Measurement Analysis System EPA Compliant

- HTML 'web-browser' operator interface provides user display and interface from anywhere in the world via the world wide web
- Digital Mass Flow Controller precisely controls gas sample flow resulting in the highest accuracy and stability
- Industry standard robust sample conditioning components
- Optional Hazardous area Class I, Div. I and II options.

## Sample Conditioning Unit (SCU)

The sample gas is extracted by a specially designed probe and is then conditioned by utilising the UltraCEM sample conditioning/ Probe Box. The box can be located at the sampling location or remote and consists of the following equipment.

## Housing

This enclosure is rated NEMA 4X (Optional Explosion Proof) and can be mounted directly in the outside environment. Sun and rain shields are recommended in certain environments to maintain proper performance specifications.

The temperature controlled housing is completely piped and wired and is accessible to the customer via bulkhead and terminal block termination points.

All sample lines, fittings and valving are stainless steel, Teflon and Polypropylene. The housing is equipped with a strong 2500 btu Vortex Air Cooler along with a strip heater that is equipped with a thermostat that precisely maintains the required internal enclosure temperature.

### Cleaning

The gas sample is cleaned with three levels of filtration: Primary filtration is performed at the probe tip by utilizing a 2 micron filter. Secondary filtration occurs after the sample pump via a coalescing filter/dryer. The MAS incorporates an additional 0.5 micron paper filter.

### Sample Drying

The UltraCEM provides a dry basis gas measurement. The UltraCEM dries the sample gas by utilising a dual pass thermo electric chiller. The chiller cools the sample to a temperature of 4°C +/- 1C.

As the temperature of the sample gas decreases below the moisture dew point, condensation is removed. The moisture is then drained continuously by a peristaltic pump while the dry sample gas is allowed to continue through the system. The gas sample is then passed through a membrane-type high efficiency permeation dryer that will dry the sample to a -40°C dew point.

This intensive drying process allows for extreme analytical accuracy and eliminates inaccuracies due to corrosion issues.

### Sample Pump

The pump is a positive displacement type pump that uses a moving diaphragm. All wetted parts are 316 Stainless Steel and/or Teflon depending upon the application. In normal operation the pressure at the pump outlet is set between 10 - 15 psi.

### Vents and Drains

All vented gases or drained fluids are vented through bulkhead unions. Customer may route them to a sump. If the housing is located in a well-ventilated area, the gases can be vented to the atmosphere, otherwise they should be vented out of the room.



## Wiring

All termination points for incoming or outgoing signals are provided on terminal strips or plugs.

## Sample Probe

A specially designed probe extracts sample gas from the stack. The probe is constructed of 316 Stainless Steel. The probe tip is fitted with a sintered filter and the filter can be easily changed and serviced.

Calibration fittings are provided so that system complies with EPA guidelines for auto calibration as outlined in US EPA 40 CFR Part 60 regulations. Tyco provides solenoid operated valve for auto blowback of probe. The customer must provide the instrument air supply.

The sample probe has optional 4" and 6" flange adaptors available and is available in a variety of probe lengths.

## Optional External Sample Probe

As an installation option the UltraCEM can be fitted with an External Probe to accommodate the user's exact installation requirement.

The use of the External Sample Probe will allow the user to locate the SCU either at the base of the stack where it can be easily maintained or in a temperature controlled room. Note that a Heated Sample Line is required when using the optional external probe.



The external probe design utilizes the following:

- Heated out of stack Ceramic 2µm filter element – 3" or 9" length dependent upon the application
- 2" ANSI mating flange
- Sub-flange for easy removal of filter chamber
- Integrated thermo-switch with SSR for control of filter chamber to 375°F
- 60" Probe Tube for insertion into stack.

## Measurement Analysis System

The UltraCEM design includes an Analysis box which accommodates all of the measurement detectors and computer components.

The box can be located at the sampling location or up to 300' away from the sample handling box for user installation flexibility. This enclosure is rated NEMA 4X (Optional Explosion Proof) and can be mounted directly in the outside environment. Sun and rain shields are mandatory to maintain proper performance specifications.

### O<sub>2</sub> Detector (Paramagnetic)

The determination of oxygen is based on the measurement of the magnetic susceptibility of the sample gas. Oxygen is strongly paramagnetic, while other common gases are not.

The detector used is compact, has fast response and a wide dynamic range. The long life cell is corrosion resistant and may be easily cleaned. It has rugged self-tensioning suspension and is of welded Non-Glued construction. Standard range is 0-25%.

### CO and CO<sub>2</sub> Detectors (IR)

The non-dispersive infrared method (Single beam double wave) is based on the principle of absorption of infrared radiation by the sample gas being measured.

The gas specific wavelengths of the absorption bands characterise the type of gas while the strength of the absorption gives a measure of the concentration of the gas component being measured.



A pair of gas filled cuvettes are mounted on a rotating disc. The reference cuvette is filled with a sample of the gas to be measured and the measure cuvette with nitrogen. This technique is known as gas filter correlation. They pass through the beam of light alternately. The difference in absorbance is measured by the detector and provides a direct output of the gas concentration. Standard dual range capability between 10-100% adjustable by user.

### **NO<sub>x</sub> (Chemiluminescent)**

The NO<sub>x</sub> detector consists of an ozone generator, chemiluminescence reaction chamber and a photomultiplier tube detector. The reaction chamber operates at atmospheric pressure.

This eliminates the bulky vacuum pump found in other chemiluminescent instruments. The reaction between Ozone and Nitric Oxide is used to determine the presence of Oxides of Nitrogen (NO<sub>x</sub>) in a sample gas. Nitric Oxide and Ozone readily react to form nitrogen dioxide in an electrically excited state.

The excited NO<sub>2</sub> immediately reverts to the ground state, emitting photons.

The light intensity is measured by the peltier controlled photo-multiplier tube detector. Standard dual range capability between 5 – 1000ppm is adjustable by user.

### **SO<sub>2</sub> Detector (UV or IR)**

The absorption measurement in the SO<sub>2</sub> spectral range is based on the same principle as the IR measurement. The standard range capability is between 25 to 2000 ppm and is adjustable by user.

### **Automatic Calibration**

To minimise the effect of long term zero and span drift in each analyser detector, the PC system controller periodically initiates a calibration cycle as specified by the user. This feature assures reliable, accurate data while minimising the attention required by operating personnel.

At adjustable intervals, the microprocessor will energise the appropriate valves which cause first zero, mid and then span gas to flow through each analyser. When the analyser readings stabilise, the PC Controller calculates the zero and span drift value for each detector. If a significant measurement deviation from the standard gas value exists, an alarm is generated which must be reset.

## System Controller/Data Acquisition System

The PC controller is a standard off the shelf PC based platform and will perform all hardware control, as well as provide select data processing capability for the UltraCEM.

Both analog and digital inputs and outputs are provided, including data correction and average values. Some capabilities are:

- All automatic and manual functions
- Automatically calibrates each gas analyser at selected time intervals to ensure accuracy and regulatory compliance
- Automatically controls backpurge of sample probe with instrument air
- System limit and failure alarms
- I/O digital and analog signal interfaces
- Applies calibration correction factor for each analyser output, data averaging for regulatory requirements (3 months data storage of 15 minute and 1 hour averages, 1 week storage of 1 minute averages)
- Applies O<sub>2</sub> diluent correction and stores data as separate value
- Standard Ethernet port for HTTP Web browser viewing/internet data download capability
- Access the menu and data from anywhere in the world from any PC via the internet

- RS232, RS485 or Ethernet links utilising state of the art TCPIP communications capabilities
- Latest processor with printer port, keypad port and monitor port
- Single button initiate to download data into Excel format. Simple regulatory reports can then be tailored by the user.

## User Interface Software and Communications

User Interface with the UltraCEM is performed with a PC or Laptop with either an Ethernet Cable Connection or via a Secure Wireless 802.11g WiFi Communication.

The UltraCEM utilises a very easy to use menu structure, Field Friendly Interface (FFI), allowing the user to easily scroll through menus, view, edit and print data via standard Microsoft tools.

An optional Laptop, configured for Wireless connection to the UltraCEM MAS, is available.

## Sample and Calibration Gas Distribution

- The gas and calibration gas samples are controlled by a single Mass Flow Controller (MFC). The MFC controls the sample gas and calibration gas sample gas flow very accurately. The use of an MFC allows for very high accuracy and reliable monitoring.



- The MAS Panel is equipped with a 3 way universal solenoid that will accommodate the gas sample for either the normal stack gas sample or direct the calibration gases directly to the analysers otherwise known as a local calibration.
- The UltraCEM is equipped with a manifold with four two-way Normally Closed solenoid valves that will direct the customer supplied calibration gases into the system. The three valves will be used for Zero, Mid and Span1 and Span2 gas calibrations respectively.
- The panel is equipped with a gas vent line. The vent will be routed to a sump by customer. If the housing is located in a well ventilated area, the gases can be vented to the atmosphere. Otherwise they should be piped out of the room or building.
- The Chemiluminescent detector requires a continuous source of instrument air from customer. The enclosure is equipped with a bulkhead fitting for this connection.

### Accurate Detector Temperature Control Box

All measurement detectors are located in a compartment design equipped with a highly efficient environmentally sealed electric controlled system.

The detector enclosure is kept at a constant temperature (42°C +/-0.1) enabling the analyser to produce extremely accurate measurement results due to the fact that the temperature control is stable and at ideal temperature.

### Equipment to be supplied by others

- Calibration gas bottles
- Calibration gas regulators. Dual stage with CGA connector
- Instrument Air supply
- 85-125 VAC, 50-60Hz plant power supply
- Stainless Steel or Teflon ¼" tubing between MAS and SCU
- Wiring trays for electrical interconnection wiring
- Sample ports for probe connection and monitoring
- Heated sample line between Probe and SCU for Optional External Sample Probe Version.



## Optional Data Acquisition System and Reporting

### EPA 40 CFR Part 60 thru 75 Regulations

- The DAS displays all pollutant concentrations, calculated emission values, required emission averages, alarm conditions calibration results and CEM status.
- Automatic and on-demand generation of all required reports. Reports may include daily, monthly and quarterly summary reports, exceedance reports, downtime reports and calibration reports.
- An event and alarm log that records all alarms, system problems and operator modifications.
- Operator-assignable reason codes for incorporation in exceedance reports.
- Five Year Data Storage in DAS Computer.



## Measurement Analysis System Specifications

### General

Power:	Universal Power Supply 85 - 125VAC, 50 - 60 Hz, + 10%, 500 Watts Maximum at Start Up. 250 Watts Nominal
Detectors//number:	NDIR (CO and CO <sub>2</sub> ), UV or IR (SO <sub>2</sub> ), Paramagnetic (O <sub>2</sub> ), Chemiluminescent (NO <sub>x</sub> ). Up to five in one analyser
Mounting:	Wall Mount
Area classification:	General purpose or Optional Hazardous Area
Compliance's:	CSA (Pending)
Ambient temperature range:	-40° to 50°C.
Relative Humidity:	99%

### Inputs/Outputs:

Digital:	RS-485 Serial Port. (Multi-Drop Network), RS-232 Serial Port, LAN, Ethernet 10/100-BaseT
Connectivity Protocols:	HTML (Web Browser) - Status, file transfer Modem/Web browser TCP/IP. MTTP ASCII string Microsoft shared drive, FTP Logs download, TELNET Server
Analog:	Analog Outputs: Isolated 4-20 mA dc, 500 ohms Max Load (O <sub>2</sub> , CO, CO <sub>2</sub> , SO <sub>2</sub> , NO <sub>x</sub> , THC) Analog Inputs: 4 (Typically; stack flow, opacity, MW, fuel flow)
Digital:	Outputs: 10 dry contact digital Outputs: maximum 110VAC @ 1 amp load. Typical: O <sub>2</sub> , CO, CO <sub>2</sub> , SO <sub>2</sub> , THC and NO <sub>x</sub> limit exceed, data valid, in calibration, in maintenance, trouble alarm Digital Inputs: 10: (Typical Process on/off, Flame Detect, Shutdown or Initiate Cal. flow signals and Opacity signals). Interrogated with 5 VDC.
Instrument Weight:	80 lbs typical
Size:	40" X 30" X 12" (H W D)
Ranges:	O <sub>2</sub> : 0 -1 selectable to 0 -25% (1% increments) CO: 0 -10 ppm selectable to 100% (1 ppm increments) CO <sub>2</sub> : 0 - 5 ppm selectable to 100% (1 ppm/% increments) NO <sub>x</sub> : 0 - 5 ppm selectable to 10,000 ppm (1 ppm increments) SO <sub>2</sub> : 0 - 25 ppm selectable to 2000 ppm (1 ppm increments) THC: 0 - 5 ppm selectable to percent levels
Sample Temperature:	0°C to 55°C
Sample flow rate:	1000 to 3000cc/min
Warm Up Time:	Max 30 minutes

## Sample Conditioning Unit Specifications

### General

Power:	Universal Power Supply 85 - 125VAC, 50 - 60 Hz, + 10% 500 Watts Maximum at Start Up. 250 Watts Nominal
Mounting:	Wall Mount
Area classification:	General Purpose
Compliance's:	CSA (Pending)
Ambient range temperature:	-40°C to 50°C (colder and hotter options available)
Instrument weight:	90 lbs typical
Size:	40" x 30" x 12" (H W D)
Stack sample moisture:	Typical 50%
Sample cooler:	Thermo electric type with dual pass Chiller in conjunction with Permeation Tube in series
Max. stack temperature:	Standard 1400°F (higher upon request)
Stack pressure:	Typical -5 to 15 inches H <sub>2</sub> O
Sample flow rate:	1000 to 3000cc/min
Response time:	30 seconds/100' of line (1/4" tubing)
Probe length:	48" length 316 Stainless Steel Probe with .5 micron sintered filter. Optional 5' and 6' probes.
Probe mounting flange:	Standard 4" 150# Raised Face (2 Hole Top). Shipped equipped with gasket
Optional external probe mounting flange:	Standard 4" 150# Raised Face (2 Hole Top). Shipped equipped with gasket
Sample pump:	316 SS or Teflon diaphragm type
Instrument air requirements:	Instrument grade air required. Max 25 SCFM @ 90 PSIG @ 50°C ambient

	Paramagnetic O <sub>2</sub>	NDIR SO <sub>2</sub> /FID THC	NDIR CO/CO <sub>2</sub>	Chemiluminescent NO <sub>x</sub>
Linearity	< +/- 1%	< +/- 1%	< +/- 1%	< +/- 1% (1)
Zero Drift	< +/- 1% /day	< +/- 1% /day	< +/- 1% /day	< +/- 1% /day (1)
Span Drift	< +/- 1% /day	< +/- 1% /day	< +/- 1% /day	< +/- 1% /day (1)
Repeatability	< +/- 1%	< +/- 1%	< +/- 1%	< +/- 1%/day (1)
Response Time (t <sub>90</sub> )	10 < +/--t <sub>90</sub> < +/-15	30 < +/--t <sub>90</sub> < +/-45s	15s < +/--t <sub>90</sub> < +/-30s	15s < +/--t <sub>90</sub> < +/-30s

### Influence of Ambient Temperature (-30°C to 50°C)

- On Zero	< +/--1%	< +/--2%	< +/--2%	+/--2%
- On Span	< +/--1%	< +/--2%	< +/--2%	+/--2%

(1) 0-10 ppm NO<sub>x</sub> range is < +/--2%.



**Sample Conditioning Unit  
EPA Compliant**

Example FFI Menu Screens

The screenshot displays the FFI menu screens with the following sections:

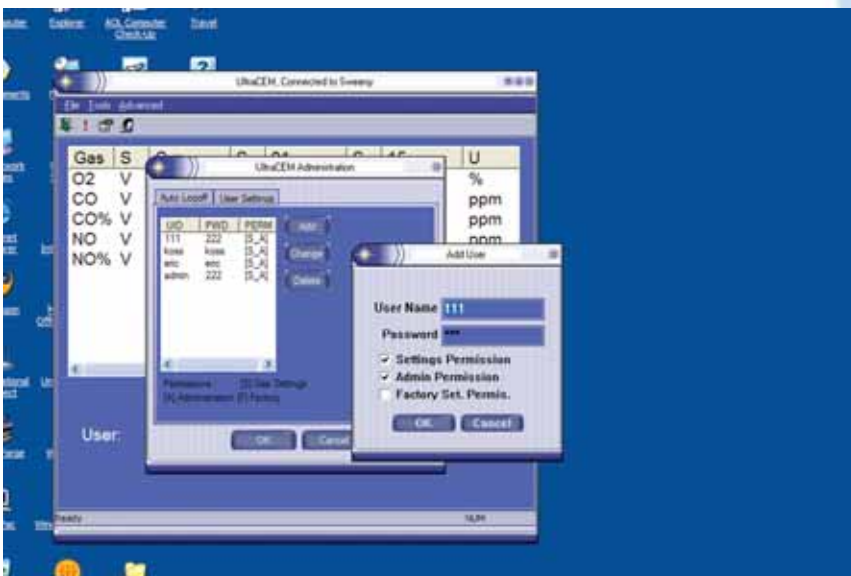
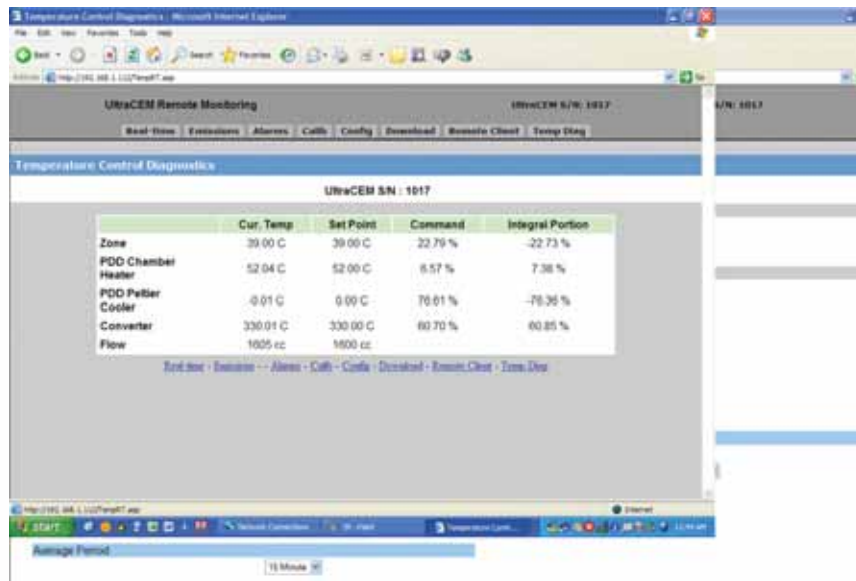
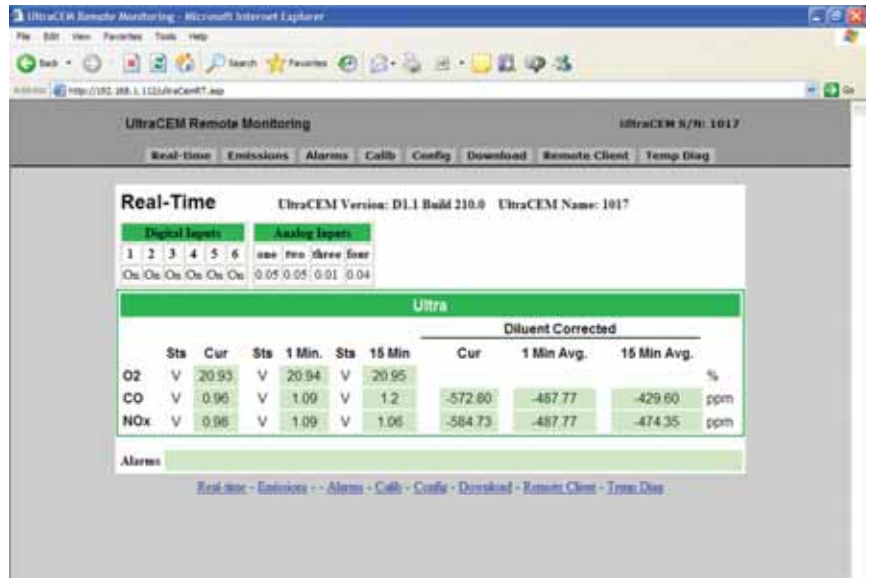
- Analog Outputs:** A grid of control buttons for various analog outputs.
- Digital Inputs:** A list of digital input channels with their corresponding status and descriptions.
- Digital Outputs:** A table listing digital output channels, their addresses, and descriptions.
- Analog Inputs:** A table listing analog input channels, their addresses, and descriptions.

The screenshot shows the 'UltraCEM Remote Monitoring' interface with the 'Calibration Info' tab selected. The calibration date and time are 11/19/2007 8:39:56 AM.

Gas	Zero Exp	Zero Act	Zero Drift	R1 Span Exp	R1 Span	R1 Span Drift
O2	0	-0.02	-0.01	20.9	20.94	-0.16
CO	0	-0.75	-0.15	445	452.03	9.61
NOX	0	-1.04	-1.04	89.2	93.85	4.65

The screenshot shows the 'UltraCEM Remote Monitoring' interface with the 'Emissions' tab selected. The date is 11/21/2007 and the average period is 1 Minute Averages.

Date	Time	O2	CO	NOx	CO @ 7%	NOx @ 3%
11/21/2007	11:00	21.08	V 1.65	V 0.98	V -104.08	-95.47
11/21/2007	11:01	21.06	V 1.59	V 0.98	V -177.88	-109.64
11/21/2007	11:02	21.05	V 1.65	V 0.99	V -196.90	-118.14
11/21/2007	11:03	21.04	V 1.58	V 1.10	V -202.01	-140.64
11/21/2007	11:04	21.03	V 1.52	V 1.06	V -209.29	-145.95
11/21/2007	11:05	21.02	V 1.41	V 1.04	V -210.32	-155.13
11/21/2007	11:06	21.02	V 1.50	V 1.07	V -223.75	-159.61
11/21/2007	11:07	21.01	V 1.43	V 1.04	V -232.70	-169.24
11/21/2007	11:08	21.00	V 1.42	V 1.00	V -254.18	-179.00
11/21/2007	11:09	21.00	V 1.43	V 1.01	V -255.97	-180.79
11/21/2007	11:10	20.99	V 1.39	V 1.06	V -276.46	-210.82
11/21/2007	11:11	20.99	V 1.37	V 1.13	V -272.48	-224.74
11/21/2007	11:12	20.98	V 1.33	V 1.11	V -297.59	-248.36
11/21/2007	11:13	20.98	V 1.28	V 1.07	V -286.40	-239.41
11/21/2007	11:14	20.97	C 1.30	C 1.04	C -332.43	-265.94





#### USA

Goyen Valve Corporation  
1195 Airport Road  
Lakewood  
New Jersey 08701  
USA

Telephone: 1 732 364 7800  
Facsimile: 1 732 364 1356

#### Australia

Head Office  
Goyen Controls Co Pty Ltd  
268 Milperra Road  
Milperra, NSW 2214

Telephone: 1800 805 372  
Facsimile: 1300 658 799

#### Europe

Goyen Controls Co UK Ltd  
Unit 3B Beechwood  
Chineham Business Park  
Basingstoke, Hampshire, RG24 8WA  
UNITED KINGDOM

Telephone: 44 1256 817 800  
Facsimile: 44 1256 843 164

#### Asia

Goyen Controls Co Pty Ltd  
Shanghai Representative Office  
1209 Greenland Business Centre  
1258 Yu Yuan Road  
Shanghai PC200050  
CHINA

Telephone: 86 21 5239 8810  
Facsimile: 86 21 5239 8812

#### Queensland

Telephone: 1800 805 372  
Facsimile: 1300 658 799

#### Victoria

Telephone: 1800 805 372  
Facsimile: 1300 658 799

Tyco Umwelttechnik GmbH  
Im Petersfeld 6  
D-65624 Altendiez  
GERMANY

Telephone: 49 6432 1001/1002  
Facsimile: 49 6432 63810

Goyen Controls Co Pty Ltd  
73-M Jalan Mega Mendung  
Kompleks Bandar OUG  
58200 Kuala Lumpur MALAYSIA

Telephone: 60 37 987 6839  
Facsimile: 60 37 987 7839

Office: Singapore  
Tel/Facsimile: 65 6457 4549

#### South Australia

Telephone: 1800 805 372  
Facsimile: 1300 658 799

#### Western Australia

Telephone: 1800 805 372  
Facsimile: 1300 658 799

Mecair S.r.l.  
Via per Cinisello 97  
20054 Nova Milanese  
Milano,  
ITALY

Telephone: 39 362 375 118  
Facsimile: 39 362 375 124