DCM Process Control

s::can Intelligent. Optical. Online.

Info Sheet

- Real-time Detection
- Auto Sampling of Events
- Alarms to Trade Waste/Operations
- Direct Source Identification
- Lab Validation
- Automatic Diversion Control
- Real-time Support
- Low Maintenance

Industrial Overload & Toxic Shock to WWTPs

Pro-active Risk Management System

Biological overload and inhibition of WWTPs is an increasingly common problem.

A Pro-active Risk Reduction and Toxic Shock Management pathway is now available

2013-04_V1

Proactive Management of Risk Associated with Industrial Overload and Toxic Shock to WWTPs

The Problem:

WWTPs receive Waste from a Variety of Industries

Occasionally an industry discharges chemicals which have high nutrient loading or potentially inhibitory effects on receiving WWTPs. These may affect either the anaerobic digesters or the aerobic processes (or both). These effects usually only become apparent during major inhibition events or when blowers reach 100%. Unnoticed minor inhibition or increased overall power usage due to out of spec industrial loads may be a standard feature in many WWTPs. Such inhibition or load surges result in on-going reduction in plant efficiency and increased operational costs.

There are difficulties in detecting smaller events.

On line data shows that shock load or potentially toxic events are surprisingly common. Most are only rendered nontoxic by dilution from other waste flows. This means a simple change in discharge time of the toxic material may result in WWTP failure. Reliance on dilution is a high risk option. DCM's data division receives significantly higher numbers of enquiries for WWTP influent data during peak production periods by seasonal industries. During peak periods, extra shifts are often run by production. This means events becoming visible due to discharges occurring at times of lower municipal flow. Periods where water restrictions apply also increase risk factors due to reduced dilution.

Response time usually precludes source identification.

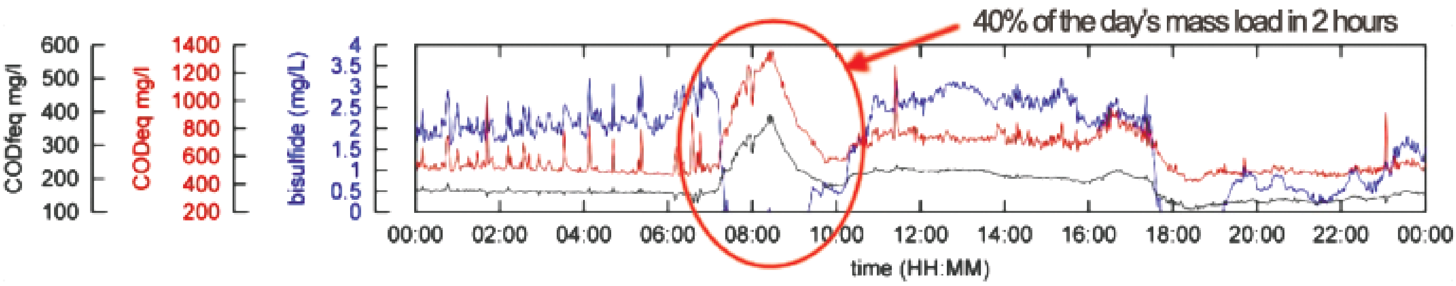
The time taken for operations to detect an event varies. This is a function of the plant configuration/size, the type of material involved and the detection systems in place. Typically the only detection system is a combination of an operators eyes and a daily composite effluent sample. Solids carryover from the clarifiers and/or breaches of compliance on the WWTP discharge occur hours or sometimes days after the event. This makes identification of the cause highly unlikely. A sudden increase or drop in aeration demand, foaming in the aeration tank or unusual smells may be noted within an hour. This allows a diluted sample to be taken for lab analysis. The likelihood of identification of the cause remains very slim unless dilution factors are low such as in extreme events. Positive identification of the source is central to prevention of future events.

Without it, the risk of WWTP failure or breach of discharge consent from repeat events is high.

Real time data shows major failure or overload events are often caused by a combination of contributing factors:

- A regularly occurring slight inhibition may combine with a second discharger's accidental toxic product loss.
- A high flow wash out event may weaken a plant with a following small toxic event providing the tipping point for plant failure.
- A shift in timing of discharge moves the event to a time of lower in sewer dilution.
- A significant product loss by two industries simultaneously.

Increases in industrial production capacity, reduction of industrial water use and the move to utilise off peak power all change dilution factors. The result is increased risk of process failure on the receiving WWTP.



Typical Weekly Trend of Municipal WWTP with Dairy Industry contribution. The High COD peak is mainly fat and protein– i.e. milk. The high morning flow and large volume of the event reduced the retention time in the sewer. This lowered sulphide concentration. Cost to treat such events is high.

Solution:

Real-time Detection

The first stage in defining the risk present is to determine whether unusual or high concentrations of commercial or industrial compounds are entering the WWTP. High concentrations of non-municipal compounds indicate a tendency by dischargers to be lax with waste discharge management. To detect unusual compounds DCM installs s::can UV/Vis and other sensing systems at the plant inlet or in a suitable upstream sewer location. This allows the determination of the size and number of such events.

Alarming and Grab Sampling

To enable alarms to be set at appropriate levels for the defined compositional anomalies, sophisticated mathematical analysis is undertaken by DCM. The spectral data is "normalised" and then re-analysed for deviation from normal. This allows set points to be programmed into the real-time system to target "events".

Alarms are then generated by the sensing system which activates an auto sampler to draw concentrated grab samples of the event. The system then sends a sms and/or email to operations staff to alert them of the event and to advise that a sample is present to collect.

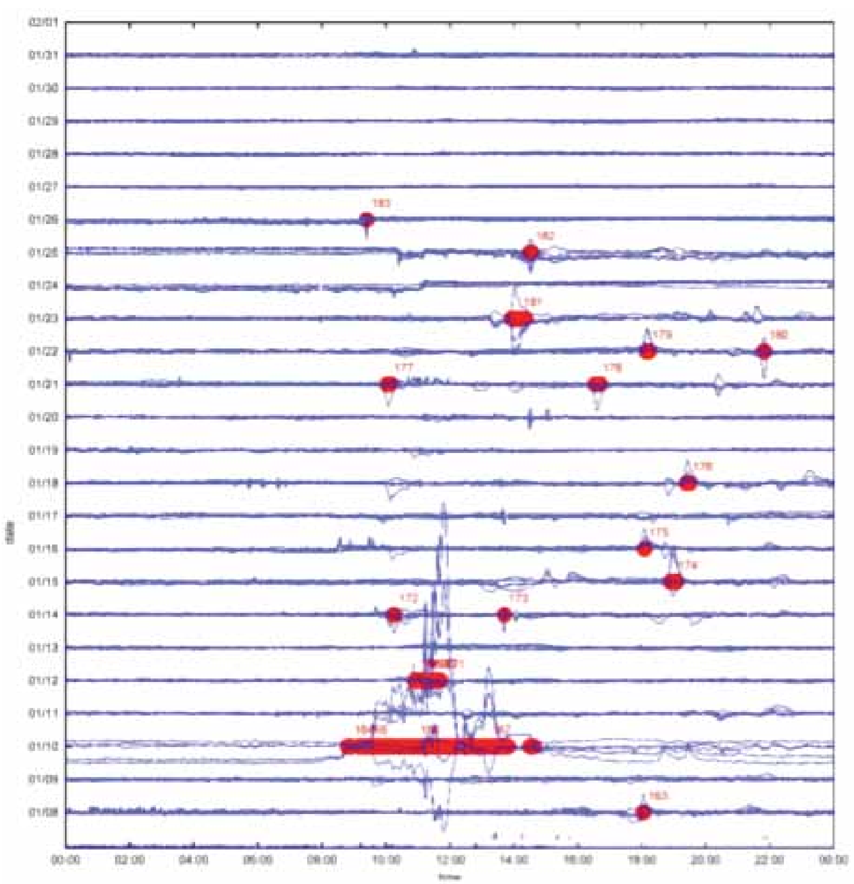


Chart: *Alarm events are detect according to deviations from normal conditions. This can be visualised on a plot similar to the seismogram- flat blue lines indicate normal influent conditions and spikes up or down show incoming trade waste compounds. An email alarm is triggered after a predefined threshold is breached (red labels) Note: Events are selectively sam pled and sent for lab analysis to provide optimum result at lowest lab cost. Images show installations on raw or screened sewage using DCM PQMS unit with sample provided by DCM SDU.*

Laboratory Verification

The on line sensing data often allows DCM staff to recognise the "signature" of certain industry types and this information is provided to the customer. DCM also recommends specific lab tests based on spectral fingerprints determined by mathematical processing of the UV/Vis data before and during the event. For the lab, verification of the presence of the event, its magnitude and the particular chemicals involved becomes a relatively simple process due to the high concentrations present. Combining the flow, s::can and lab data enables calculation of the mass of the chemicals/product discharged. This data then provides both the practical and legal basis for approaching the discharger involved.

Identification of the Discharger

The data obtained by this stage usually points clearly to a specific industry type. Meat works, food industries and chemical industries are normally easily identifiable. The amount of material lost will normally indicate the industries size. The timing of the event timing often narrows the source possibilities further. The time pattern of the trend may imply the source was on gravity or a wet well fed line. Combining these factors in a matrix generally allows trade waste staff to focus on a very small number of potential sources.

If there is still uncertainty, a second system can be installed further up the network to separate potential sources.

Determination of the Cost of an Event

Determination of the effect of high loads or biological toxicity on the WWTP is critical to defining the cost of an event. To define cost, a second s::can system is typically installed on the end of aeration tank or on the outfall of the WWTP. This unit is configured to monitor for signs of biomass distress and the presence of un-removed nutrients such as ammonia.

By integrating inlet flow data, aeration input power and the discharged nutrient levels (reported by the s::can) an accurate cost of high load and toxic effects can be calculated. Where units are permanently installed the data can provide real time management reporting of cost by industry or industry type. The comprehensive data enables informed management decisions. It also assists operator real time decision making and simplifies plant control.

Implementing a suitable management plan is very site specific and for some sites requires constant revision based on catchment realities as defined by the real time data.

Outcomes:

The outcome of a DCM toxic shock risk study is a comprehensive understanding of the incoming waste. It provides a clear picture of the activity and discharge patterns of different industries and the response of the receiving WWTP to each discharge. It enables realistic costs of such discharges to be calculated. In most cases it provides the ability for those costs to be allocated to a specific discharger.

This leads to:

- A factual basis for the setting of a trade waste policy appropriate for each industry.
- Accurate gauging of the risk of failure of WWTP processes as a result of industrial discharges.
- Ability to plan and design appropriate mitigation measures.

A Pro-Active Risk Management System (PRMS) also provides an opportunity to improve operational control of the WWTP. This comes from both load management by key industries and minimising costs/KgCOD by adjusting the process to the incoming load in real time.

Other gains include the potential to reduce issues in sewers. These range from sulphide induced asset destruction to OSH issues caused by the presence of volatile organic/ BTX compounds.

Typical Case Study:

The case study shows the pathway taken and provides examples of outcomes at each stage through the investigative process. It takes snapshots from a number of applications.

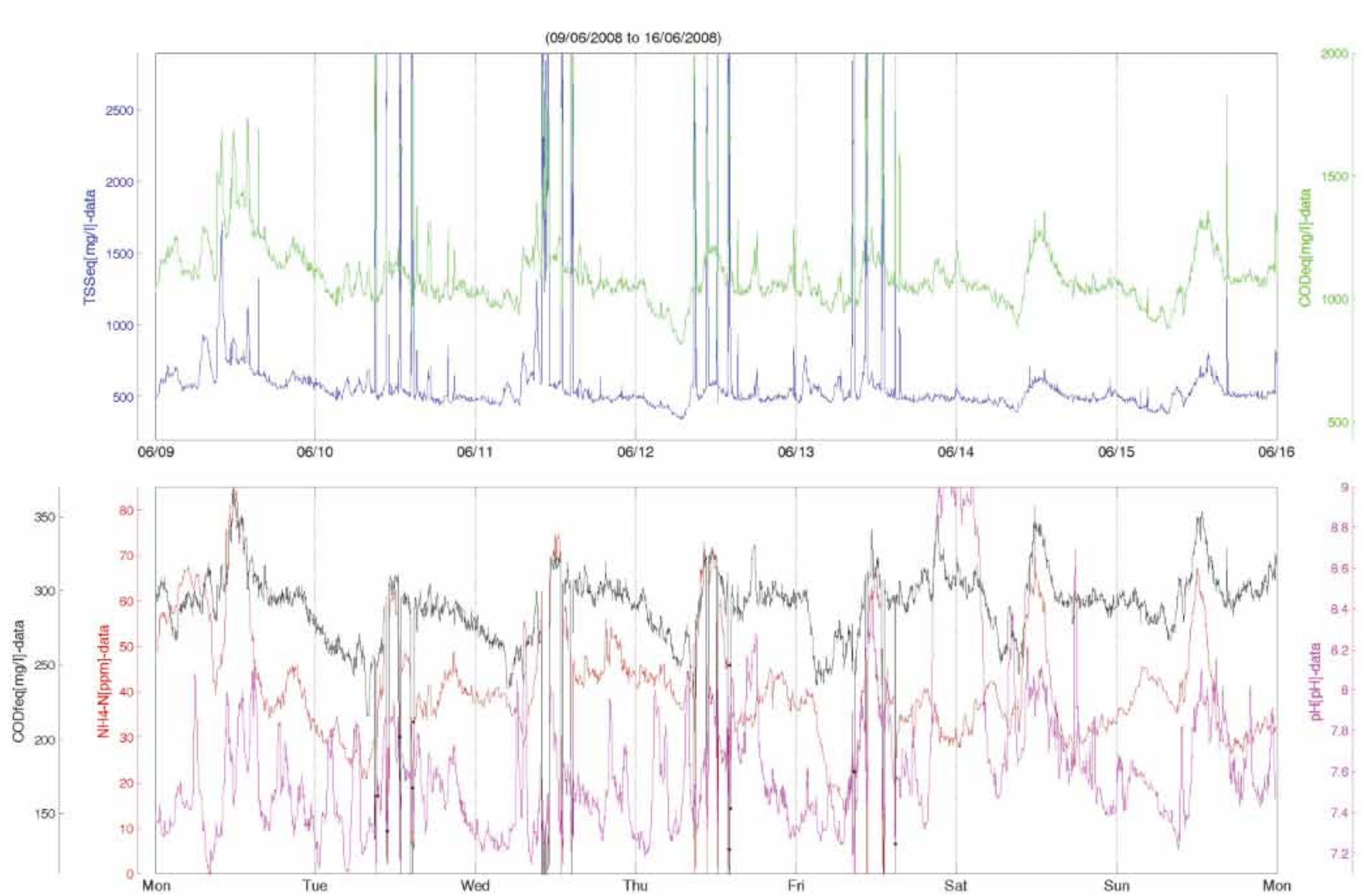
Site evaluation

A site evaluation is the first step in the process

Hardware installation

Installation position and ease of maintenance is critical to obtaining good data

Industrial Overload & Toxic Shock Risk Reduction Pathway

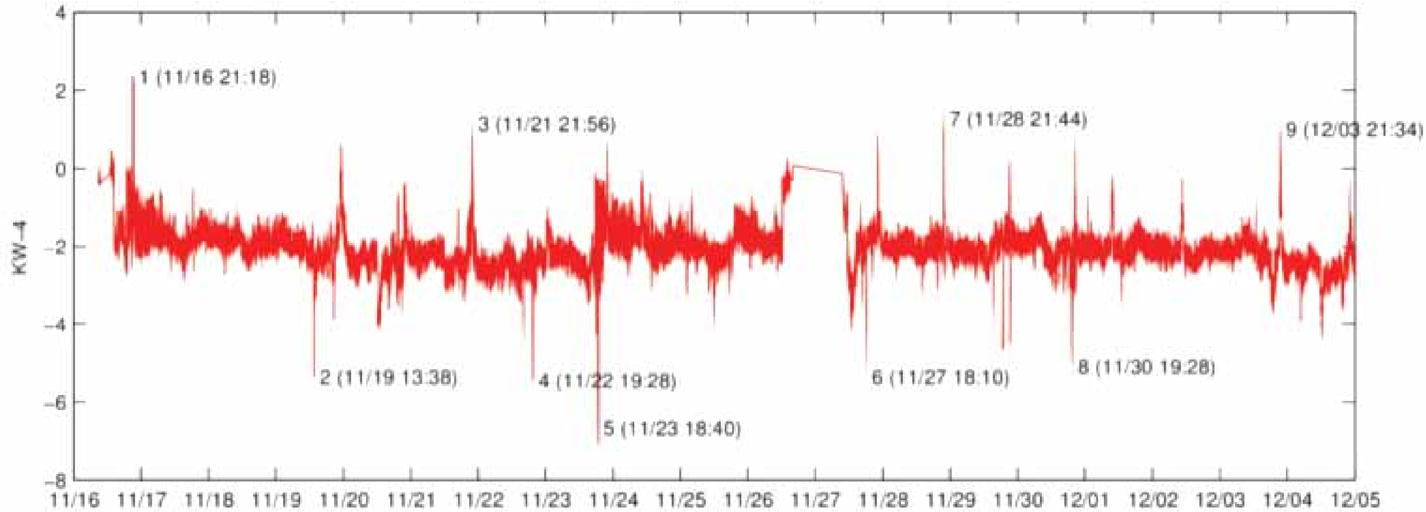


Data collection and trending

Typical weekly trend plot for inlet of a WWTP with industrial components. Short term sensor overload occurs during some wet well pump outs.

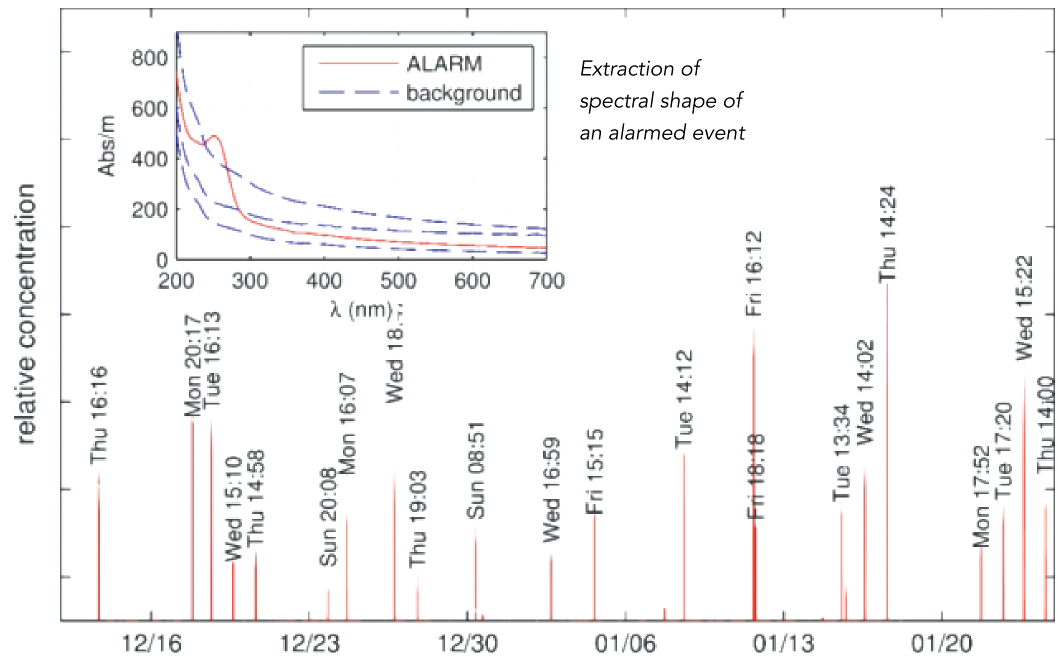
Clarification of effect of events

Process response to surges in load. Note blower speed rises to 100% during high load events resulting in low DO readings in the aeration tank.



Alarm development and defining of set points

Alarm Events are defined by the use of specialised parameters set up in onboard software.
This Time series is one of seven alarm parameters set up in a sewer location. Background (normal) conditions return a value of around -2 units. High or low deviations exceeding the defined alarm set point are indicated with a number and date stamp. Each marked deviation resulted in the auto sampler drawing a sample.



Operation of autosampler

The combined alarm event record for all 7 deviation alarm parameters over one month is shown here. Events peaked during Christmas shutdown and New Years start up of industry with those operating through Christmas clearly defined and more concentrated due to lower dilution by other industries.

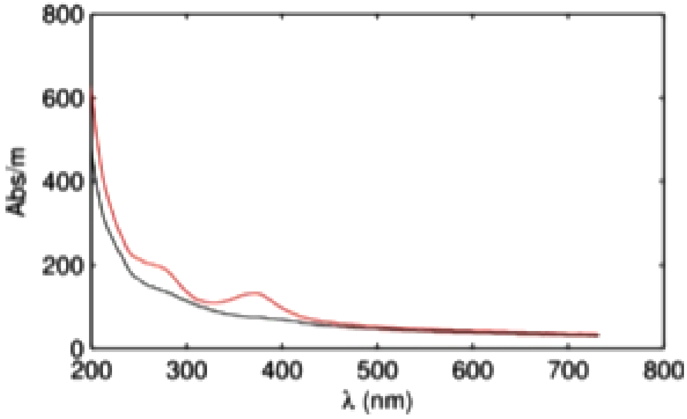
Sample collection

Examples of samples drawn by the autosampler during alarm conditions for laboratory validation analysis.

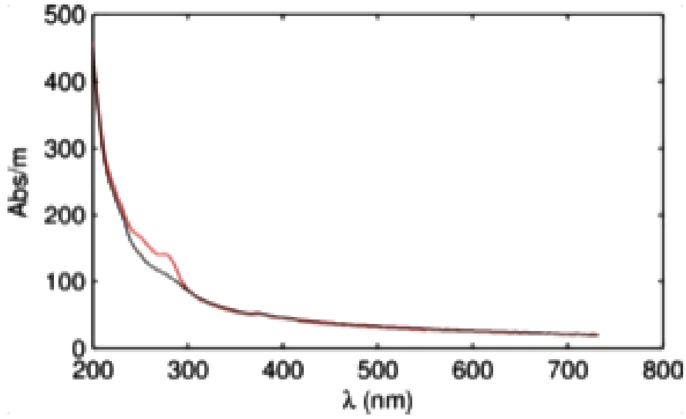
Industrial Overload & Toxic Shock Risk Reduction Pathway

Spectral components seen by sensor and lab/trade waste outcome.

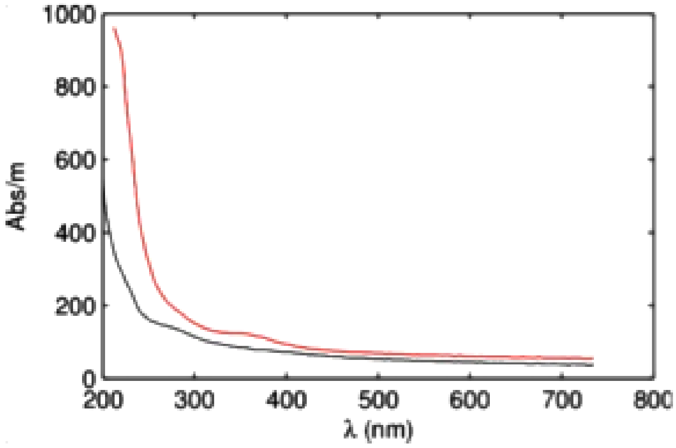
The samples proved to contain a range of toxic and high load events. These would not have been detected, sampled or their sources identified using traditional composite sampling or on line pH/EC/Temp monitoring,



Chromium VI ≈5mg/L – Major electroplater identified. *(Lab confirmed)*



Halogenated aromatics - Chemical manufacturer identified. *(Lab confirmed)*



Dissolved organics - Laboratory soluble COD > 10,000 mg/L – Upstream tracing led to a specific food industry source. *(Lab confirmed)*

Likely components pre-defined from spectral shape extraction process, simplifying lab verification.

Alarm UV/VIS spectra from recent applications

(red = alarm spectra, black = spectra measured 15 minutes earlier)

Individual events contained a range of toxic and high organic load events which would not have been sampled or clearly identified using traditional composite sampling or pH/EC/temp monitoring.

PRMS provides the risk management systems to protect WWTPs

Contact Details

Auckland Office
Level 1, 131 New North Road
Eden Terrace
Auckland
New Zealand

Ph: +64 9 365 2774
Fax: +64 9 365 2776
0800 345 456

nzoffice@dcmprocesscontrol.com

Brisbane Office
Unit 4/18 Tombo Street
Capalaba
Queensland 4157
Australia

Ph: +61 7 3107 1304
Fax: +61 7 3112 5046
1300 735 123

ausoffice@dcmprocesscontrol.com

Melbourne Office
30 Argyle Street
Fitzroy
Victoria 3065
Australia

Ph: +61 3 9417 0254
Fax: +61 3 9417 0294
1300 735 123

2013-04_V1