Reliable on-line monitoring of color for the optimization of coagulation processes

**Reliable color measurement**
- automatic 2-point calibration
- analysis of up to 3 sample streams

**Easy to operate**
- familiar Windows™ menu system
- built-in context-sensitive help
- data trending and analysis

**Easy to maintain**
- self-cleaning measurement cell
- simple-to-perform annual service
- helpful maintenance diagnostics screens

**Full communications**
- web- and ftp-enabled for easy data file access, remote viewing and configuration
- email capability
- optional Profibus® DP V1.0
The Aztec 600 colorimetric range

The Aztec 600 colorimetric series of analyzers from ABB are a range of compact, yet reliable, on-line colorimetric analyzers for the key parameters in water treatment. They combine the unique Aztec fluid handling system with the latest electronics platform, featuring Windows menu-driven software, to create a range of analyzers that are simple-to-operate and maintain and capable of measuring up to 3 sample streams. The following parameters are available in the Aztec 600 Colorimetric Range:

— Aluminium
— Ammonia
— Color
— Iron
— Manganese
— Phosphate

Aztec 600 Color analyzer

The Aztec 600 Color analyzer has been designed specifically for the measurement of color through the drinking water treatment process for coagulation optimization. It offers reliable and accurate on-line analysis of the color of surface waters and treated waters up to 500 Hazen units. All the sample and chemical fluid handling for measurement, mixing and disposal is controlled precisely by the patented Aztec fluid handling system that cleans the measuring cell with every movement. Users of this system also benefit from the Aztec 600 Color’s low maintenance requirements, ease of use, auto-calibration, adjustable measurement frequency and proven chemistry methodology.

Process data, as well as the content of alarm and audit logs, can be saved to a removable SD card for record keeping and analysis using ABB’s DataManager data analysis software.

Applications

Typical applications for the Aztec 600 Color are:

— Assessment of coagulation effectiveness
— Optimizing color removal for D/DBP rule compliance
— Predictive coagulant control based on raw water color
— Monitoring the efficiency of carbon filtration
— Monitoring of final water for verification that process targets have been met

Fig. 1: Cost-effective on-line colorimetric analysis to improve drinking water quality and treatment efficiency
Natural organic matter in surface waters

Natural organic matter (NOM) is a complex and heterogeneous mixture of organic substances produced from vegetative decay processes that create problems for water treatment plants tasked with producing drinking water of a consistent high quality.

In waters free of industrial pollution, the majority of NOM originates from the soils. These aquatic humic substances are mainly derived from decomposing plants and animals and color the water from yellow to brown. They also provide a substrate for bacteria and fungi, that, if not removed during the treatment process, can contribute to excess microbial growth in the water distribution system. This in turn can lead to secondary problems such as disease, fouling, poor taste and odor.

It is important to remove humic substances prior to chlorination, as any remaining NOM will react with the added chlorine to create undesirable disinfection by-products (DBPs) such as trihalomethanes.

User benefits of on-line color monitoring

The daily challenge faced by many water treatment operators is to maximize the removal of natural organic matter, while ensuring adequate microbial control.

For compliance with the Disinfectant/Disinfection By-Product (D/DBP) Rule, utilities are using modified conventional processes, such as enhanced coagulation and softening, in order to achieve higher Total Organic Carbon (TOC) removal. Implementation of these processes are difficult without reliable, on-line analysis.

On-line color analysis provides an early warning of changes to the treatment process that allows operational decisions to be made in near real-time. This level of process control is not possible with manual testing alone, where potentially important events can be missed.

The Aztec 600 on-line color monitor provides water treatment operators with a cost-effective tool for quick and accurate assessment of treatment performance in real time.

Studies have demonstrated that by achieving a color removal goal, the TOC removal requirement for the D/DBP rule can be met.
Overview of the Aztec 600 Color analyzer

Easy-to-use Windows-based menu system

Graphical results trending

Flexible communications

Simple navigation

Advanced optics

Simplified fluid handling

— Ethernet Connectivity
— 6 mA Outputs
— 10 Alarm Relays (configurable)
— Profibus DP v1.0
— SD Memory Card
— Process Data Trends

Single- or multi-stream options

— Integrated side-sample pot for ease of plumbing
— Magnetic sample flowswitch alarms when sample is not present

— Automatic LED intensity adjustment at every calibration – eliminates drift and compensates for any cell fouling
— Temperature-controlled for optical stability
— Automatic 2-point calibration

— Single piston pump draws in precise volumes through a valve manifold into the optical measuring cell
— Piston movement provides mechanical cleaning of the measurement cell
Reliable measurement

The Aztec 600 Color analyzer has been designed for ease-of-use and maintenance simplicity, while offering the benefits of flexible communication and advanced data acquisition.

The Aztec 600 Color can measure up to 12 samples per hour. A fully-programmable multi-stream option is available, providing up to 3-stream capability with user-programmable stream sequencing.

Measuring principle

The absorbance of the sample is measured at 400nm and expressed as a color corresponding to the Platinum-Cobalt Scale (Pt-Co) or Alpha-Hazen Scale.

The Hazen color scale was introduced in 1892 by chemist Allen Hazen as a way to evaluate pollution levels in water. It is now used extensively in the water industry. It compares the water color to known concentrations of platinum-cobalt, ranging from 0 at the light end of the scale to 500 at the darkest.

1 mg/l Pt-Co is often referred to as 1 Hazen unit and is equivalent to the color produced by 1mg platinum/L in the form of the chloroplatinate ion.

‘True color’ measurement

For analytical purposes ‘true color’ may be described as that due to dissolved matter. ‘Apparent color’ is that which is seen in the presence of suspended matter in the sample. Turbidity can seriously affect color determination as the ‘apparent color’ will be much higher than the ‘true color’. To obtain the true color intensity in these circumstances it is necessary to filter the sample prior to the analyzer.

Fig. 2: Change in river-water color through the coagulation process
**Aztec 600 color**

**Color analyzer**

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**Fluid handling**
A single piston pump provides all the sample and chemical fluid handling for measurement, mixing and disposal. The pump is stepper motor controlled for repeatability and precision.

This 'motorized syringe' approach has the added benefit of wiping the optical cell on every movement of the piston, resulting in a highly efficient automatic cleaning process. This is particularly important when measuring waters where optical contamination can be a real issue without having stringent automatic cleaning.

**Measurement technique**
The optical cell is rinsed thoroughly with sample before measurement, eliminating dead zones and enabling multi-stream measurement across different samples without cross contamination. The sample is then drawn into the measurement head where the absorbance is measured before being expelled to waste.

To ensure accuracy and reliability, the Aztec 600 Color analyzer performs a 2-point calibration automatically using a zero color standard and a 50 Hazen color standard. The analyzer also performs a zero compensation measurement periodically to account for any optical variations (for example, cell fouling) when measuring manganese-rich waters.

The Aztec 600 Color analyzer has the capability to enable an automated chemical cleaning routine. This programmable rinse routine enables a separate acid/alkali or biocide to be drawn through the sample tubing and optical cell.
Simple to operate

The powerful and user-friendly Windows menu driven software enables user’s to operate the analyzer with the minimum amount of training. The comprehensive range of available menu screens is simple-to-access using the 6 membrane keys.

These menus include data logging and graphical trending screens, operation command screens, full setup configuration screens and a range of self-diagnostics (including full calibration and operating status screens). Historical logs provide operators with access to alarm data and audit trail data. Process data and historical logs are archived securely to a removable SD card. All information is displayed clearly on the easy-to-read 145 mm (5.7 in) color LCD display and is available in a range of languages.

Simple to maintain

The Aztec 600 colorimetric range is designed to be as maintenance-free as possible. The inherent product design and auto-calibrating features reduce the amount of maintenance required to external cleaning of sample lines, changing of reagents and annual servicing.

**Service schedule**

<table>
<thead>
<tr>
<th>Period</th>
<th>Schedule</th>
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<tbody>
<tr>
<td>12 monthly</td>
<td>Replace piston seal and sample tubing.</td>
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<td></td>
<td>Rotate the glass cell.</td>
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<tr>
<td>24 monthly</td>
<td>Replace valve diaphragms, piston seal, monitor tubing and glass cell.</td>
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All parts are provided in convenient maintenance kits.

**Solution usage**

<table>
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<tr>
<th>Solution</th>
<th>Average consumption</th>
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<tbody>
<tr>
<td>Color standard</td>
<td>5 liters every 180 days</td>
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<tr>
<td>Zero color standard</td>
<td>10 liters every 60 days</td>
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Flexible communications

Ethernet-ready
The Aztec 600 provides 10BaseT Ethernet communications via a standard RJ45 connector and uses industry-standard protocols TCP/IP, FTP and HTTP. The use of standard protocols enables easy connection into existing PC networks.

Data file access via FTP (file transfer protocol)
The Aztec 600 features FTP server functionality. The FTP server in the analyzer is used to access its file system from a remote station on a network. This requires an FTP client on the host PC. Both MS-DOS® and Microsoft® Internet Explorer version 5.5 or later can be used as an FTP client.

- Using a standard web-browser or other FTP client, data files contained within the analyzer's memory or memory card can be accessed remotely and transferred to a PC or network drive.
- Four individual FTP users' names and passwords can be programmed into the Aztec 600. An access level can be configured for each user.
- All FTP log-on activity is recorded in the audit log of the instrument.
- Using ABB's data file transfer scheduler program, data files from multiple instruments can be backed-up automatically to a PC or network drive for long-term storage, ensuring the security of valuable process data and minimizing the operator intervention required.

Fig. 6: Aztec 600 FTP server
Embedded web server
The Aztec 600 Color has an embedded web-server that provides access to web pages created within the analyzer. The use of HTTP (Hypertext Transfer Protocol) enables standard web browsers to view these pages.

- Accessible through the web pages are the current display of the analyzer, detailed information on stream values, reagent and solution levels, measurement status and other key information.
- The audit and alarm logs stored in the analyzer’s internal buffer memory can be viewed on the web pages.
- Operator messages can be entered via the web server, enabling comments to be logged to the analyzer.
- The web pages and the information they contain are refreshed regularly, enabling them to be used as a supervision tool.
- The analyzer’s configuration can be selected from an existing configuration in the internal memory or a new configuration file transferred to the instrument via FTP.
- The analyzer’s real-time clock can be set via the web server. Alternatively, the clocks of multiple analyzers can be synchronized using ABB’s File Transfer Scheduler software.

E-mail notification
Via the Aztec 600 Color’s built-in SMTP client, the analyzer is able to e-mail notification of important events. E-mails triggered from alarms or other critical events can be sent to multiple recipients. The analyzer can also be programmed to email reports of the current measurement status or other parameters at specific times during the day.

Profibus
The Aztec 600 Color can be equipped with Profibus DP V1.0 to enable full communications and control integration with distributed control systems.
Aztec 600 color
Color analyzer

Specification

Measurement
Units
— Hazen units
— Pt-Co units

Range
— 0.00 to 500 Hazen units
— 0.00 to 500 mg/l Pt-Co

Chemical method
Color
Measurement of water color by absorbance at 400nm expressed in Hazen scale or Platinum-Cobalt scale

Self-cleaning
Programmable automatic chemical rinsing – piston cleaned every measurement

Measurement mode
Batch measurement
User-selectable 1 to 12 measurements per hour

Sample streams
Single or up to 3 streams – sequencing is programmable

Measurement performance
Accuracy
— 0 to 300 Hazen <±2 % of reading or ±0.5 Hazen (whichever is the greater)
— 300 to 500 Hazen <±5 % of reading

Repeatability
— <±1 % of reading (at 20% of span)

Resolution
— 0 to 10 Hazen – 0.01 Hazen
— 10 to 100 Hazen – 0.1 Hazen
— 100 to 500 Hazen – 1 Hazen

Calibration
2-point, automatic calibration, with the option of manual initiation. The interval between automatic calibrations is selectable manually from four times a day to once per week.

Zero Compensation Frequency
User-selectable 1 to 12 hour frequency

1 Maximum measured error across full measurement range.
3 Tested in accordance with BS ISO 15839 : 2003.
Environmental data
Ambient operating temperature:
5 to 40 °C (41 to 104 °F)
Ambient operating humidity:
Up to 95 % RH non-condensing
Sample temperature:
1 °C to 40 °C (32 °F to 104 °F)
Sample flow:
Continuous, 200 to 500 ml/min
Sample pressure:
5 psi maximum
Sample limitations:
Samples containing particles 100 microns (0.004 in) in diameter or larger may require pre-filtration.

Maintenance
Routine service interval:
12 months

Display
Color, TFT, liquid crystal display (LCD) with built-in backlight and brightness adjustment
Diagonal display area:
— 145 mm (5.7 in)
— 76800 pixel display*

* A small percentage of the display pixels may be either constantly active or inactive. Max. percentage of inoperative pixels <0.01 %.

Mechanical data
Ingress protection
Wet section
Case:
— IP31
Critical components:
— IP31
Sample connections
Inlet:
— 6 mm OD push-fit x ¼ in BSP elbow
Outlet:
— 10 mm OD push-fit x ⅜ in BSP elbow

Dimensions
Height:
— 653 mm (25.7 in)
Width:
— 366 mm (14.4 in) max.
Depth:
— 183 mm (7.2 in) door closed
— 430 mm (16.9) door open
Weight:
— 15 kg (33 lb)

Materials of construction
Electronics enclosure:
— 10 % glass loaded polycarbonate
Main enclosure:
— Noryl
Lower tray:
— 20 % glass loaded polypropylene
Door:
— Acrylic
Aztec 600 color
Color analyzer

Electrical
Power supply ranges
— 90 to 264 V max. AC / 50 to 60 Hz
— 18 to 36 V DC (optional)

Power consumption
60 W max.

Analog outputs
Single- and multi-stream analyzers
6 isolated current outputs, fully assignable and programmable over a 0 to 20 mA range (up to 22 mA if required)

Alarms/relay outputs
Single- and multi-stream analyzers
One per unit:
— Stop relay
— Attention relay
— Failure relay
— Calibrate relay

Six per unit:
— Fully user-assignable alarm relays

Rating
Voltage:
— 250 V AC

Current:
— 5 A AC
— 5 A DC

Loading (non-inductive):
— 1250 VA
— 150 W

Connectivity/communications
Ethernet connection
Web server with ftp for real-time monitoring, configuration, data file access and email capability

Communications
Profibus DP V1.0 (optional)

Data handling, storage and display

Security
Multi level security:
— Operator and configuration password or security switch

Storage
Removable Secure Digital (SD) card

Trend analysis
Local and remote

Data transfer
SD card or FTP

Approvals and certification
UL
Pending
CSA
Pending
CE mark
Covers EMC & LV Directives (EN 61010)

EMC
Emissions & immunity
Meets requirements of IEC61326 for an Industrial Environment
Overall dimensions (shown with optional reagent tray)

Dimensions in mm (in)

Maximum 1100 (43.3)

600 (23.6)

400 (15.7)

300 (11.8)
### Aztec 600 color
#### Color analyzer

**Electrical connections**

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<tr>
<th>O/P 6</th>
<th>O/P 5</th>
<th>O/P 4</th>
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- **Sockets for Optional Digital Communications**
- **AC Power Supply Earth (Ground) Stud (AC models only)**
- **Optional Digital Communications**
  - **Ethernet RJ45 Connector**
  - **Current Outputs**
    - O/P 6
    - O/P 5
    - O/P 4
    - O/P 3
    - O/P 2
    - O/P 1
  - **Stop Relay**
  - **Calibration in Progress Relay**
  - **Alarm 1 Relay**
  - **Alarm 2 Relay**
  - **Alarm 3 Relay**
  - **Alarm 4 Relay**
  - **Alarm 5 Relay**

- **Attention Relay**
- **Failure Relay**

**Electrical Connections**

- **AC Fuse 1 A Type T**
- **DC Fuse 10 A Type F**

- **AC Power Supply**
  - 90 V to 264 V AC Max.
  - 50/60 Hz

- **Current Outputs**
  - 18 V to 36 V DC
## Ordering information

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</table>
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Fax: +44 1453 829 671

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