TOC StarTOC™ On-Line TOC Analyzer (Pumpless)

UV/Heated Persulfate

Features

- On-Line TC/TOC
- Pumpless, Reagent Saver Package
- Microsoft Windows Touch Screen Computer
- 2 Alarm Levels 1 Master Fault Alarm
- 4-20 mA Outputs
- RS-232C/485 Outputs
- Stainless Steel Enclosure
- Separate Electronics & Liquid Compartments
- Low Maintenance

Options

- Correlated BOD/COD
- Dual NDIR Analyzers
- Benchmark/Auto Validation
- Auto-Cal/Auto-Clean
- Automatic Multi-Range
- Multi-Stream Analysis
- Alkalinity Direct Analysis
- Network Ready
- Stainless Steel Enlosure
- NEMA 4X / IP66

Star Instruments, Inc.

Pumpless
UV/Heated
Persulfate

UVPDI

Description

Star Instruments, Inc. uniquely offers all methods of TOC analysis* and recommends UV/Heated Persulfate as the method of choice for many applications. The basic analyzer is configured to provide maximum utility with an advanced Microsoft(1) Windows-based computer with touch screen.

Only Star offers the features and reliability of operation associated with its team's pioneering experience in TOC analysis since 1969.

For difficult or questionable streams, we invite you to send a sample for our complimentary analysis to verify the adequacy of this method. In return, we will provide a confidential report and recommendation for the best method for your application.

Because we offer a full line of High Temperature Combustion, UV/Heated Persulfate, Ozone Promoted and Ultra-Pure TOC Analyzers, we feel we are able to provide you objective, unbiased advice. We can therefore fully commit our total resources to providing our customers the best possible installation available.

Preferred Applications

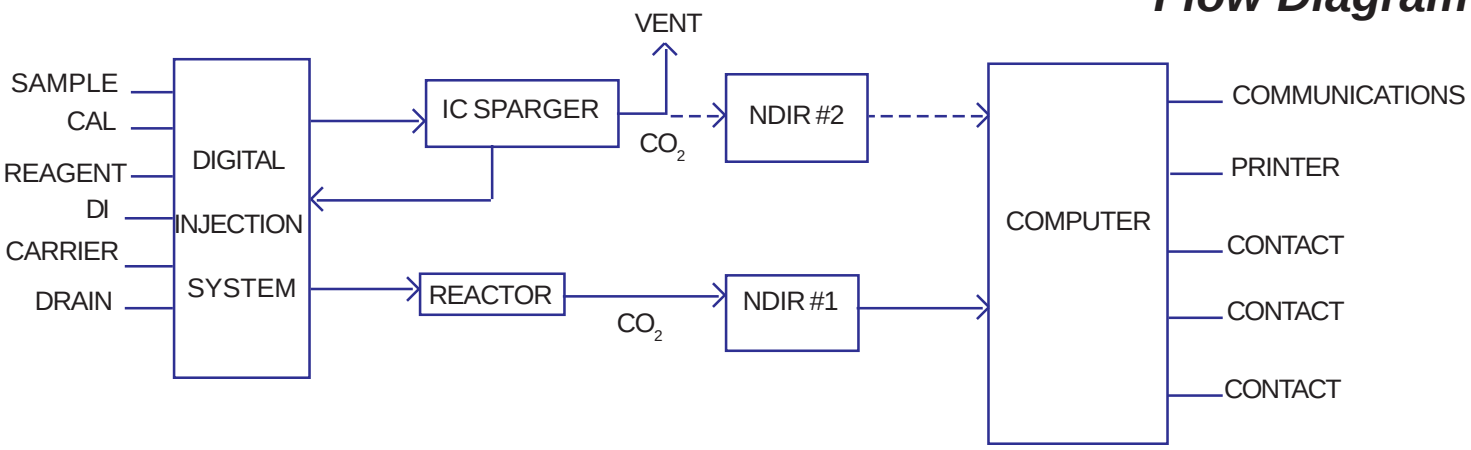
Excellent TOC accuracy from low parts-per-billion to moderate concentration levels of salt-free samples, with minimum maintenance.

Standard Method 5310 C/D
EPA 415.1
EPA 9060
ASTM D 4839-88
ASTM D 4779-88

Boiler Feedwater
Cooling Water
Drinking Water
Wastewater (Limited)
River Water
Oil In Water

* Visit our website at ***www.starinstruments.com*** to view our entire family of TOC analyzers.

Flow Diagram



Analysis

The sample stream is initially directed to the Inorganic Carbon Sparger, where it is mixed with an acid reagent. The pH of the solution is lowered to approximately 2, converting the inorganic carbon to CO_2, which is sparged out by the carrier gas. The carbonate-free sample and persulfate reagent are then directed to the Reactor where remaining organic carbon is oxidized to CO_2 and measured by the NDIR (Non-Dispersive Infrared) Analyzer and converted to direct units of TOC.

TOC-True

To include the volatile/purgeable organics which are normally lost in the sparging stage, a TOC_{True} analysis should be performed. Typical manufacturers measure one aliquot of sample for TIC, then measure a completely separate sample for TC. They then infer the TOC by a mathematical subtraction of the two CO_2 readings as follows:

$$\mathbf{TOC_{Inferred} = TC_{Reactor} - TIC_{Sparger}}$$

The inaccuracy of this method is caused by the tolerance build-up of performing two measurements and the instrumental computation of subtracting a normally much smaller TIC reading from a relatively much higher TC reading. However, high TIC content could also make this subtraction technique useless for accurate TOC analysis.

Star uses the more accurate $\mathbf{TOC_{Direct}}$ analysis by performing a TOC measurement on the same aliquot of sample after it has been sparged, eliminating the errors associated with alternate methods. A second optional TIC NDIR enhances overall accuracy for determining a "**True"** TOC, including all organic carbon components, both non-purgeable organic carbon (NPOC) and purgeable organic carbon (POC), as well as providing an accurate TIC analysis.

Benchmark/Auto-Validation

Benchmark[(2)] is the validation technique, whereby on command a chemical calibration standard is automatically introduced to the analyzer and the response is compared to the previous analyzer calibration. If the response falls within a certain specified limit, the computer/output indicates "Benchmark Passed". If the response falls outside specified performance limits, either a "Maintenance Request" or a "Fault" alarm is activated, depending on preset tolerances.

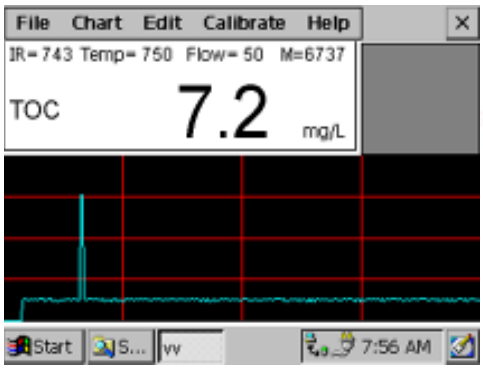
Thus, in cases of process spills, when the analyzer performance is questioned, benchmark can rapidly and automatically validate analyzer performance. It eliminates time consuming and unnecessary recalibration cycles, which take the analyzer out of service just when it is most critically needed. Benchmark may be on-demand, or operator programmed for designated day and time activation on a repetitive basis.

Auto-Cal and Auto-Clean utilities are also available.

(2)*The Pitfalls of Process TOC Analysis and How to Avoid Them* by John W. Small
1999 Instrument Society of America Tutorial

Advanced Technology, Today and Tomorrow

Star analyzers use Microsoft(1) Windows CE Computers to ensure that you are always up-to-date with the latest technologies. By incorporating a modular software design, Star is capable of offering advanced options unavailable elsewhere.

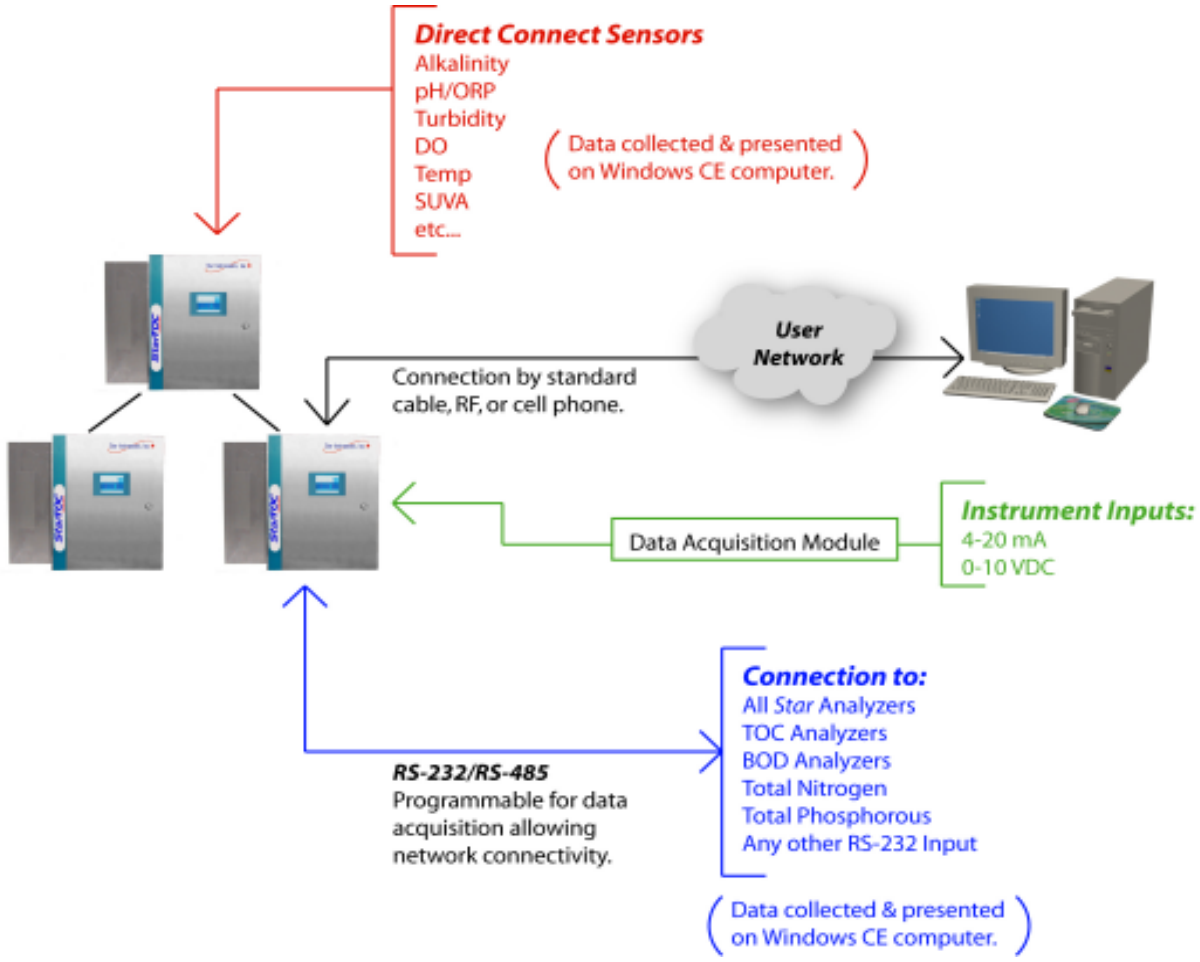


Microsoft Windows CE Computer with Touch Screen Control

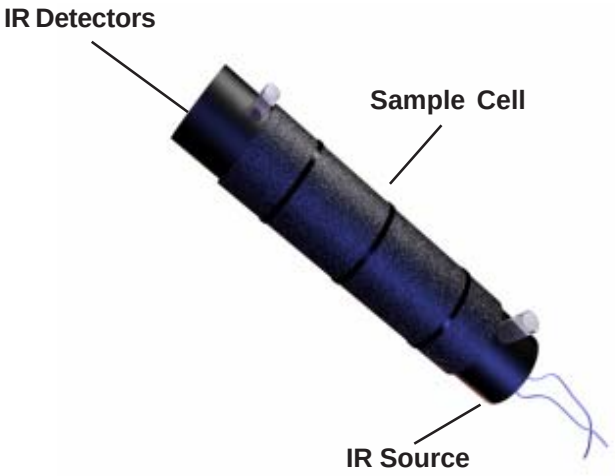
- VGA Color Display
- Network Ready
- Paperless Chart Recorder
- PCMCIA Slot
- Solid State Data Storage

Network Enabled

Star's utilization of an onboard Windows CE computer allows direct networking. Central control of analyzer operation and data management are easily facilitated.



NDIR (The key component for reliable TOC analysis.)



- Specific, Interference-Free CO_2 Detection
- Dual-Wavelength Ratioing Compensates for Drift
- Computer-Controlled for Accuracy
- Sapphire Protected Optics
- Non Corrosive, Non-Reflective Sample Cell (Borosilicate)

- No Moving Parts or tools required for Easy Maintenance and Service
- No Critical Realignment Required

Installation Requirements

The StarTOC™ UV/Heated Persulfate model can handle suspended solids up to 1,000 microns without filtration, thus providing a truly representative sample.

Star furnishes recommended installation drawings. The user must provide the following:

1. Electrical Source (110/220 VAC 10 Amp service with cutoff switch)
2. Sample flow of a minimum of 10 ml / minute. A fast bypass loop is recommended.
3. Gravity fed drain with air break.
4. A source of CO_2-free air, or oxygen with a maximum flow rate of 300 cc/minute at 15 psig.

(Optional Star Oxygen Generator requires electricity only.)

LOW MAINTENANCE SAMPLING

Eliminates Peristaltic Pumps

Eliminates monthly peristaltic pump retubing & recalibration.

Easy range changes without changing hardware.

Greater metering accuracy.

Conserves reagents by precisely dispensing exact amount required.

Pulse-free liquid flow.

Field-proven.

Digital Injection System
Star P/N: 200008-2

Star's Digital Injection Sample System (P/N: 200008-2) uses pressure delivery to eliminate peristaltic pumping. Particulate sample handling and non-contact of the sample and reagents to eliminate corrosion have been retained. The infinitely variable sample/reagent flow control design overcomes past limitations, which often required dilution or multiple pumps, depending on the application.

While peristaltic pumping is still preferred for some applications and has long been a succesful method of sample delivery since it was first introduced in 1971* for on-line TOC analysis, there are noted drawbacks and defficiencies in some applications.

The ability to handle particulates and the use of relatively inert, corrosion-resistant tubing were the major design features that early peristaltic pumping offered.. The sample and corrosive reagents were never in contact with the pump/motor mechanisms, making them very reliable for the applications intended. However, to maintain their accuracy, frequent retubing was required, as dimensional characteristics of the tubing would change with wear, caused by the squeezing action of their external rollers. The resultant metered flow rate changes required periodic retubing and recalibration in order to maintain analyzer accuracy. Some samples were degraded by the pulsed sample delivery, inherent in peristaltic flow. Analyzer range changes often required changing peristaltic pumps and motors to accomodate different flow rates.

The Star Digital Injection System is the method of choice for certain applications, as suggested by your Star Representative.

*The Star team (and previously owned Astro International Corporation) introduced the world's first on-line TOC analyzer in 1971. Peristaltic pumps were chosen for sample and reagent delivery for the applications of that time period.

Specifications

Nominal at 25°C. Subject to custom application requirements.

Measuring Range (Std.)	0-10 ppm through 0-1,000 ppm without dilution 0-50,000 ppm with dilution
Repeatability	Governed by repeatability specifications (+/- 2% of Full Scale)
Drift	Compensated, self-calibrated NDIR (+/- 2% non-accumulative)
Response Time T_{90}	From 9 minutes, depending on range
Analog Outputs	4-20 mA (2 each)
Relay Outputs	2 TOC adjustable level alarms 1 master fault alarm
Computer/Display	Microsoft Windows CE Touch Screen Computer: Color VGA Display, Solid-State Data Storage, Paperless Chart Recorder, PCMCIA Slot, Network-Ready, RS-485 Modbus
Power Supply	110/220 VAC 10 Amp service recommended
Enclosure	Powder Coated Steel
Dimensions (HxWxD)	50.8 x 50.8 x 38.1 (cm) 20 x 20 x 15 (in.)
Weight	34 Kg. 75 Lbs.

Ordering Information

Description	*Order number*
Microprocessor-based, Single Stream Analyzer, Manual Calibrate/Clean	
TOC Configuration (NPOC)	UVPM
TC Configuration	UVPM-1
Microsoft Windows-CE Computer based, Single Stream Analyzer, Benchmark, Auto-Calibrate, Auto-Clean, Paperless Chart Display, Historical Records Digitally Stored Up to One Year	
(Specify "TOC-True or "NPOC")	
TOC Configuration ("NPOC")	UVPI
TOC Configuration ("TOC-True")	UVPI-4
TC Configuration	UVPI-1
Multi-Stream Sequencer to Multiplex Up to 6 Streams, Std. (Requires Microsoft Windows Computer)	
2-Stream Sequencer with independent 4-20 mA	MSS-2
3-Stream Sequencer with independent 4-20 m	MSS-3
4-Stream Sequencer with independent 4-20 m	MSS-4
6-Stream Sequencer with independent 4-20 m	MSS-6

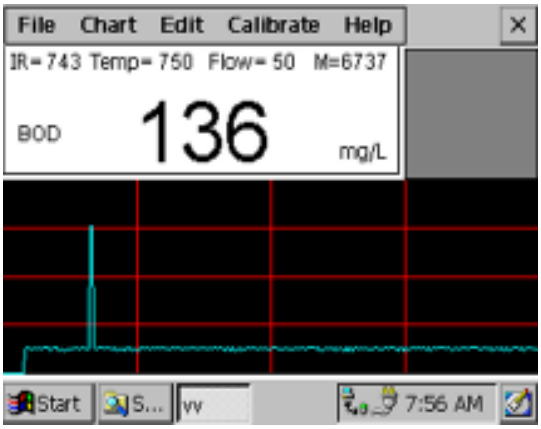
(1) Microsoft is a Registered Trade Mark of Microsoft Corporation

CORRELATED PROCESS COD/BOD

(Available For All StarTOC On-line Models)

- **Completely Automatic**
- **Microsoft Windows CE Computer**
- **Operator Prompting Menus**
- **Correlated COD**

- **Self-Calibrated NDIR**
- **Paperless Chart Recorder**
- **Auto-Cal/ Benchmark**
- **Correlated BOD**



- **Touch Screen**
- **VGA Color Display**
- **Solid State Data Storage**
- **Paperless Chart Recorder**
- **PCMCIA Slot**
- **RS-485 (MODBUS)**

Microsoft Windows CE Computer

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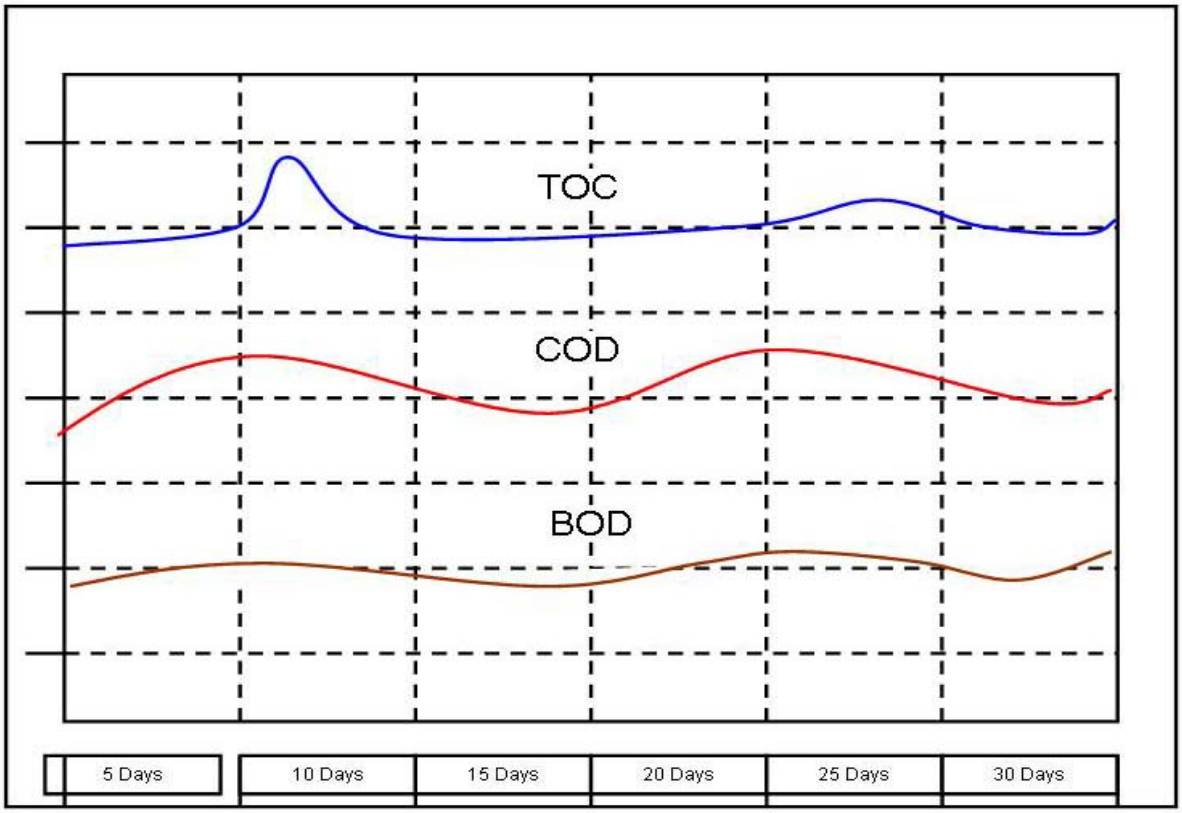
"Committed To Keeping You On Line"

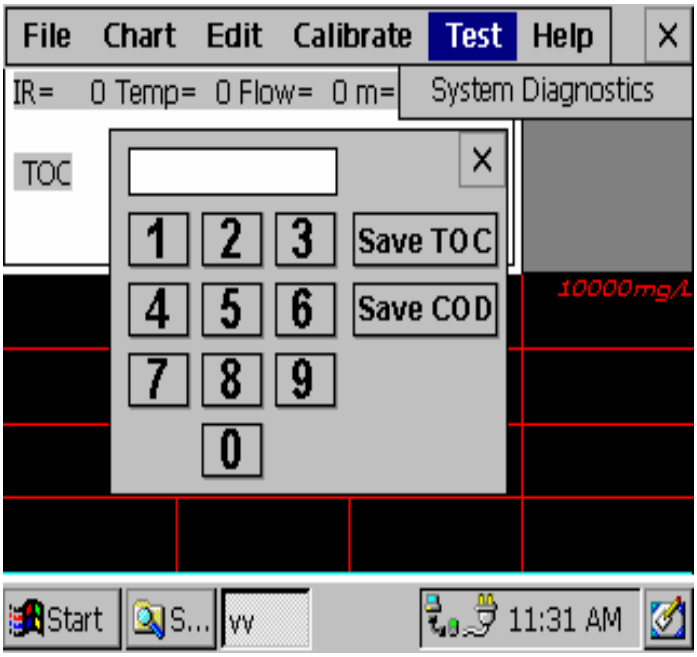


Benefits

- **Excellent Correlation**
- **Rapid Response**
- **More Adequately Relates**

Procedure

- **Collect representative grab samples from analyzer & press "Store TOC" button.**
- **Send grab samples to lab for BOD or COD analysis.**
- **After receipt of lab analysis, enter BOD or COD analysis values as prompted by the Microsoft Windows CE Computer. This will automatically correlate in time with the TOC measurement previously taken.**
- **Thereafter organic values are displayed in units of choice.**

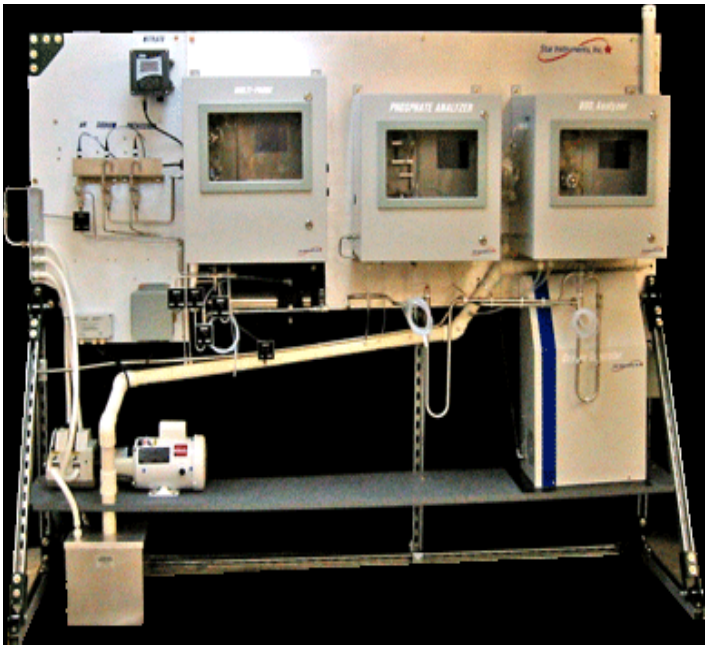


Offering Complete Analyzer & Sample Systems

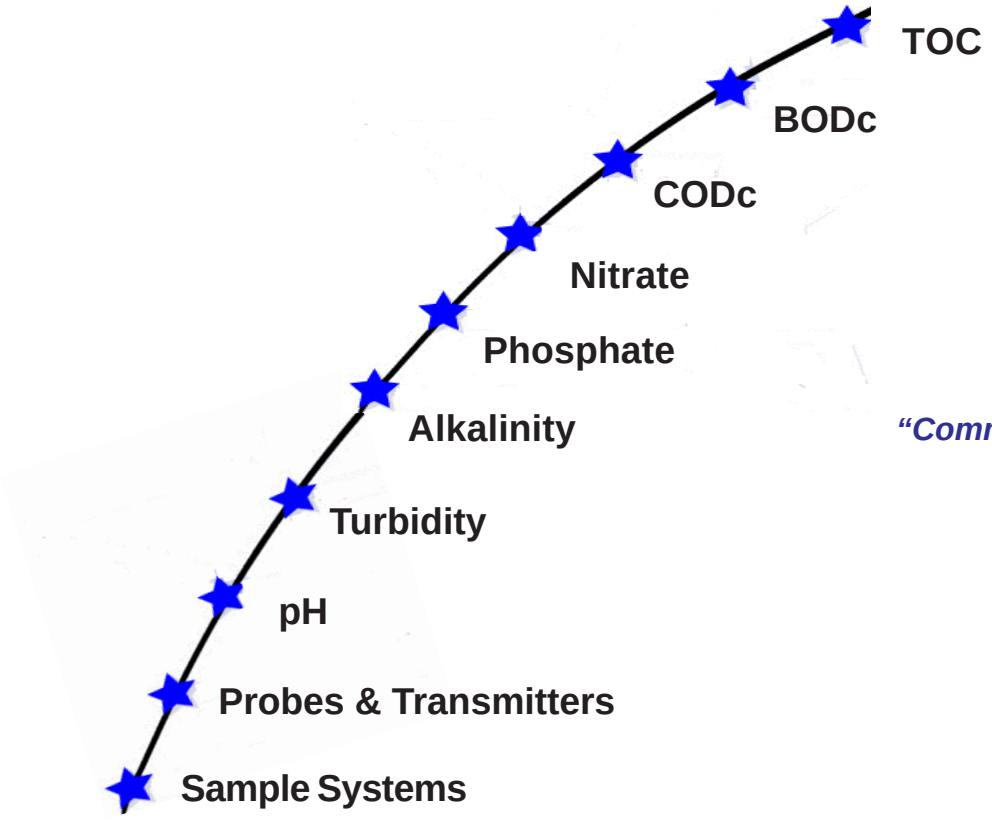
Pre-Engineered System Packages

Star provides pre-engineered & custom systems, including small shelters with all utilities installed & ready to be delivered to your site.

- **Effluent Monitoring**
- **Waste Treatment**
- **Drinking Water**
- **Process Monitoring**
- **Panels & Small Shelters**
- **Custom Packages**



STAR'S ANALYTICAL LINE



"Committed to keeping you online."

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