Natural Gas (NG)

Natural Gas Industry

Process Analytics throughout the entire natural gas pipeline supply chain

Case Study · December 2008

Natural Gas is a vital component of the world’s supply of energy. It is one of the cleanest, safest, and most useful of all energy sources. Unlike other fossil fuels, natural gas is clean burning and emits lower levels of potentially harmful byproducts into the air. While natural gas is formed primarily of methane, it can also include smaller amounts of higher Hydrocarbons. Found in underground reservoirs, natural gas is commonly associated with oil deposits. Once brought from underground, the natural gas is refined to remove impurities like water, other gases, sand, and other compounds. Some hydrocarbons are removed and sold separately, including propane and butane. Other impurities are also removed, like hydrogen sulfide to gain pipeline quality natural gas.

Monitoring NG during pipeline transmission

The purified natural gas is transmitted through a network of pipelines to its point of use. Transmitting natural gas from the wellhead to the end-user typically involves multiple processing steps and several physical transfers of custody. During pipeline transport of NG, it is important to monitor quality parameters such as calorific value (CV), hydrocarbon dew point, hydrogen sulfide and other compounds. Determination of the calorific value is particularly important in the energy measurements of natural gas for billing purposes (fiscal metering) at gas transfer stations. Monitoring of gas quality parameters is also required on the LNG-route where the natural gas is liquefied for easier transportation.

Siemens process gas chromatographs (PGCs) are also applied for NG monitoring: SITRANS CV as especially designed analyzer of the calorific value and MAXUM II as universal PGC for enhanced quality and process control measurements.
Natural Gas Transmission from Wellhead to End User

Transmission of natural gas from the wellhead to the end-user (fig. 1) involves various physical transfer and processing steps including metering and custody transfer.

**Production and processing**

**Gas gathering at the wellhead**
Gathering systems are a series of pipes that collect natural gas and transport it to the larger transmission pipeline. This begins at the wellhead and may be through a series of piping systems that consolidate gas from different wells. The pipeline directs the flow either to a natural gas processing plant or directly to a main transmission grid, depending upon the initial quality of the wellhead product. Natural gas exiting the production field is usually referred to as "wet" natural gas if it still contains significant amounts of hydrocarbon liquids and contaminants.

**Natural Gas processing plant**
The principal service provided by a natural gas processing plant is to produce pipeline quality natural gas. NG mainline transmission systems are designed to operate only within certain tolerances of specific gravities, pressures and HCPD, BTU (British Thermal Unit) content range, or water and H2S content level to avoid operational problems. Natural gas processing plants are also used to recover natural gas liquids and to extract impurities from the gas, employing various techniques and technologies. The objective is not only to produce pipeline quality "dry" gas but also to remove higher hydrocarbons from the natural gas and separate into "fractions," such as propane, butane, and ethane.

**Natural Gas liquefaction to LNG**
Of growing importance, natural gas is liquefied to LNG, which, because of its reduced volume, can be easily transported over long distances in pipes or tankers. It is finally converted back to gas. Various metering and custody transfer stations are distributed along this transport route.

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![Natural Gas transmission path from production to use](https://example.com/natural_gas_transmission_diagram.png)

**Fig. 1:** Natural Gas transmission path from production to use
Transmission and storage

Mainline transmission systems
Mainline transmission systems are wide diameter, long-distance pipelines to transport natural gas from the producing area to market areas. A grid type transmission system is usually characterized by a large number of laterals or branches from the mainline, which tend to form a network of integrated receipt, delivery and pipeline interconnections to serve major market areas.

Storage facilities
In between or at the end of a mainline transmission system, natural gas storage facilities provide for inventory management, supply backup, and the access to natural gas to maintain the balance of the system. Natural gas is most commonly held in inventory underground under pressure in depleted reservoirs such as oil or gas fields, aquifers or salt cavern formations. Storage facilities provide suppliers with the means to meet peak customer requirements up to a point.

Compressor stations
Natural gas is highly pressurized as it travels through a main pipeline. To ensure that the natural gas flow through the pipeline remains pressurized, compression of this natural gas is required periodically along the pipe. This is accomplished by compressor stations, usually placed at 40 to 100 mile intervals along the pipeline. The size of the station and the number of compressors vary, based on the diameter of the pipe and the volume of gas to be moved. Typical pressure levels for major transmission systems are in the range of 5000 to 9000 kPa.

Metering stations
Metering stations are placed periodically along natural gas pipelines. These stations allow pipeline companies to monitor and manage the natural gas in their pipes. Essentially, these metering stations measure the flow of gas along the pipeline, and allow to ‘track’ natural gas on its way to the end-user.

Mixing stations / Biogas feed
The main purpose of a mixing station is to mix natural gases from two different gas suppliers with often different calorific values. Another objective is to feed biogas as renewable energy fraction into the natural gas. One issue related to mixing stations is to ensure a constant calorific value of the mixed gas.

Custody transfer stations
Natural gas is priced and sold based on the energy flow that is delivered to the customer. Energy flow is calculated from the product of volume flow under standard conditions and the calorific value. Each time that custody of natural gas changes, it is measured at custody transfer stations for billing purposes.

Volume flow is determined using flow measuring systems, e.g. based on ultrasonics. Energy content (calorific value) is measured by means of gas chromatography when determining the composition of the gas. New and improved technology in chromatography, as represented by the Siemens SITRANS CV gas chromatograph (page 4) have significantly increased accuracy, reliability and integrity of custody transfer measurement systems. Additional quality parameters such as hydrocarbon and water dew point, as well as concentration values of sulfurous compounds has to be measured as well.

Distribution
Distribution is the final step in delivering natural gas to end users. While large industrial, commercial, and electric power generation customers get natural gas directly from high capacity pipelines, most other users receive natural gas from local distribution companies through small diameter low pressure distribution pipes. Market centers for the pricing of natural gas are located at certain points of this distribution systems.
Physical Properties of Natural Gas as Quality Parameters

Composition and physical properties of Natural Gas in a pipeline transmission and distribution system vary in time and space. Information about the quality of NG is important for gas transmission, gas use and gas supply billing.

Heating Content (CV, BTU)

The calorific value of a fuel is the quantity of heat produced by its combustion, at constant pressure and standard conditions of temperature (0, 15, 20, 25 °C) and pressure (101,325 kPa). The combustion of a fuel generates water vapor. Special techniques are used to recover the quantity of heat contained in this water vapor by condensing it.

The Superior Calorific Value (CVS) supposes that the water of combustion is entirely condensed and that the heat contained in the water vapor is recovered. The Inferior Calorific Value (CVi) supposes that the products of combustion contain the water vapor. The heat contained in the water vapor is not recovered. The British Thermal Unit (BTU or Btu) is a unit of energy used in the power, steam generation, and air conditioning industries. It is used in parallel with the other unit of energy, the joule (J, 1 BTU = 1 055.06 J).

CV determination by Gas Chromatography

Determination of the calorific value is based on the composition of the gas. The composition is also used to calculate the compressibility of the gas which is required to convert the flow volume from process conditions to standardized conditions. Natural gas is analyzed in accordance with ISO 6974 (see page 6). The gas is separated into its constituent compounds methane, ethane, carbon dioxide, C3, C4, C5, C6+ and the amount of each constituent determined. The physical properties of each component, as defined by standards, e.g. ISO 6976 or GPA 2172, are programmed in the chromatographs software. Hence, the overall energy content of the gas can be calculated from the measured composition using the values of gas flow, pressure and temperature as variables (Fig. 2).

SITRANS CV (Fig. 3) has been especially designed to perform the entire CV analysis including calculation in one compact analyzer Read more about SITRANS CV on page 7.

Gas Interchangeability

Wobbe Index / Density

The Wobbe index is the Calorific Value divided by the square root of gas relative density, commonly expressed in Btu per standard cubic foot or mega joules per standard cubic meter. In the case of natural gas, the typical heating value is around 1 050 Btu per cubic foot and the specific gravity is approximately 0.59, giving a typical Wobbe index of 1 367. The Wobbe Index is the main indicator of the interchangeability of fuel gases and is frequently defined in the specifications of gas supply. If two fuels have identical Wobbe Indices then for given pressure the energy output will be identical.

![Diagram](https://example.com/diagram.png)

*Fig. 2: Calculation of energy content of a gas flow using gas chromatography*
Hydrocarbon Dewpoint

The hydrocarbon dew point is a measure for the concentration of hydrocarbons in a gas. It is defined as the temperature (at a given pressure) where the hydrocarbon components of the gas mixture, such as natural gas, will start to condense out of the gaseous phase. It is often also referred to as the HDP or the HCDP. The hydrocarbon dew point is important because higher hydrocarbons in natural gas, in form of droplets, tend to damage the compressors’ blades. Hydrocarbon dewpoint is typically analyzed by using a gas chromatograph for gas composition analysis combined with a calculation method based upon equations of state, or using chilled mirror based technologies.

Water Dewpoint

The water dew point is the temperature at a given pressure where water begins to condense out. At a given pressure, independent of temperature, the dew point indicates the mole fraction of water vapor in the gas, and therefore determines the specific humidity of the gas. Typically analyzed by sensor (ZrO₂, Al₂O₃, ceramic) or laser analyzers.

Sulfur compounds and CO₂

Numerous natural gas wells produce what is called “sour gas”, i.e. natural gas containing hydrogen sulfide, mercaptans, sulfides and disulfides in concentrations that makes the natural gas unsuitable for transport and usage. Efforts are spent to remove these undesired compounds. In addition, the natural gas may also contain varying amounts of carbon dioxide, which often has to be removed as well. A number of processes are known for the removal of sulphur compounds and optionally carbon dioxide from natural gas. Process gas chromatographs such as MAXUM II, (Fig. 4) are typically used to control and optimize these processes.

Odorants

After purification, natural gas is virtually odorless, which is a major safety issue, because leakages cannot be detected easily and quick enough. Therefore, it is a regulatory requirement that natural gas which is delivered to customers must be odorized so that leaks are readily detectable. In the USA, e. g., 49 CFR 192 (Transportation of natural gas by pipeline, minimum federal safety standards) demands operating companies to test and confirm concentrations of odorants to be in accordance with the regulations. One option to do this efficiently and reliably is the use on-line process gas chromatographs such as MAXUM II, Fig. 4.
Use of Process Gas Chromatography

High demands on Process Gas Chromatographs

The demands placed on chromatographs with respect to accuracy and reliability are extremely high in such applications. Remote monitoring and system ruggedness are also significant factors when considering the infrastructure associated with the transportation of natural gas.

State of the art

Current state-of-the-art technology to perform the required analysis tasks normally applies a universal process gas chromatograph for quality control (impurities, odorants, hydrocarbon dew point) and a specialized chromatograph for fiscal metering of the calorific value.

Micro Process-GC for fiscal metering

Due to the growing global demands for natural gas as a source of energy, liberalization of the markets as well as the international networking of pipeline systems, a further increase in the necessity for dedicated calorific value analyzers in custody transfer plants exists. Considering the demands on such specialized analyzers with respect to analytical performance, harsh installation environments in remote locations, unmanned remote operation, micro process gas chromatographs provide the ideal prerequisites for satisfying such demands.

Measuring locations and measuring objectives

Fig. 5 shows the location of typical measuring stations along a NG transmission path from the wellhead to the end user. Measuring objectives will vary from fast process control, focussed CV determination at mixing stations through fiscal metering at Biogas line entries to enhanced quality measurement at big cross border stations. Instrumentation will vary accordingly (table 1). Installation examples are shown in fig. 6: SITRANS CV (left and center) and SITRANS CV in combination with MAXUM II (at right).

<table>
<thead>
<tr>
<th>Measuring Objective</th>
<th>Recommended analyzer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Gas Pipeline Quality control</td>
<td>SITRANS CV</td>
</tr>
<tr>
<td>N₂, CO₂, C1 to C5, C6+ (Application 1)</td>
<td>MAXUM II</td>
</tr>
<tr>
<td>H₂S and COS (Application 2)</td>
<td>MAXUM II</td>
</tr>
<tr>
<td>Odorants (Mercaptans, Disulfides, Application 3)</td>
<td>MAXUM II</td>
</tr>
<tr>
<td>Fiscal Metering (billing purposes)</td>
<td>SITRANS CV</td>
</tr>
<tr>
<td>CV / BTU determination</td>
<td>SITRANS CV</td>
</tr>
<tr>
<td>Process Control</td>
<td>MAXUM II, SITRANS CV</td>
</tr>
<tr>
<td>Combined Measuring Objectives</td>
<td></td>
</tr>
<tr>
<td>Fiscal metering and quality control (Appl. 1)</td>
<td>SITRANS CV</td>
</tr>
<tr>
<td>Fiscal metering + enhanced quality control (Appl. 1, 2 and/or 3)</td>
<td>SITRANS CV + MAXUM II</td>
</tr>
<tr>
<td>Fiscal metering + process control</td>
<td>SITRANS CV + MAXUM II</td>
</tr>
</tbody>
</table>

Table 1: Measuring objectives and recommended analyzers

Fig. 6: Installations of SITRANS CV and MAXUM II (at right) for natural gas monitoring
SITRANS CV design

SITRANS CV is a very compact on-line gas chromatograph that has been especially designed for calorific value analysis. From upstream to distribution network SITRANS CV is suitable for multiple applications, like fiscal metering, full component analysis and quality control with metrology quality results.

Hardware

SITRANS CV hardware is based on micro-machined systems on the scale of microchip technology. Miniaturisation of the most important components using this pioneering technology permits an extremely compact design for the complete device which is also associated with high resistance to environmental influences. High protection against moisture, dust and corrosion (IP65, NEMA4X), operation at extreme ambient temperatures (-20 to +55 °C), as well as explosion protection using a pressurised enclosure without purging, are indispensable for typical field installations which are frequently directly at the sampling points.

The analyzer comprises three modules (analytics, pneumatics and electronics) which are integrated in a transmitter housing. These modules have standardised designs, connection systems and interfaces. This allows rapid replacement and reduced stocking of spare parts.

Analytical module

The analytical module has been specially designed for the analysis of natural gas. All hardware components such as valveless live injection, high-resolution narrow bore capillary columns, valveless column switching as well as multiple and in-line detectors (μ-thermal conductivity detectors, μ-TCDs) are matched to one another, e.g. through almost identical internal diameters, usually 0.15 mm. This ideal interaction without dead volumes makes a significant contribution to the analytical performance of the entire system.

Analytical configuration

Fig. 7 shows the analytical configuration of SITRANS CV. Three analysis sets each comprising a capillary column and an in-line μ-TCD are arranged along the sample path. Polarity and length of the columns are designed such that the measurement can be carried out in the fastest and simplest manner. The lists below the analysis sets indicate the components measured here.

Further three detectors are arranged in-line at various points of the system. Thereby it is possible to monitor the injection peak, the progress in the separation following each column and all gas outputs. Thus the system delivers information on the injection quality, the exact setting of the backflushing or the time for the cut. These can be used for system verification.

In addition to the most interesting components, the system can individually evaluate hydrocarbons of higher boiling point (C6+) using column 1 and components such as nitrogen, methane, ethane and CO₂ using column 3.

An advanced calorific value analysis is also available where oxygen and CO are separated in addition. The analysis time of <180 s for all options is not extended by this.

Software

The micro process GC is equipped with simple, easy-to-use and intuitive Windows-based software. Some of the remarkable features are:

- Data saving > 30 days and generation of mean values for all components and calorimetric values are implemented
- Automatic method optimization increases reliability
- Logbook for traceability of events and alarms.
- Optimum pressure setting of the electronic pressure controllers (EPCs) can be computed and need not be set by a complex empirical method.
- Calculation of Calorific Value, Density and Wobbe Index
- Self diagnosis of all analytical parameters monitors health status
- Password protected access guarantees high security
- Internal mean value calculation
- Internal trend evaluation of individual components and calculated values
Interfacing to controllers and telecontrol via internet (fig. 8)
The integral interfaces of the analyzer permit communication to host equipment such as flow computers over RS485/MODBUS or a control computer over Ethernet TCP/IP for remote operation. SITRANS CV is often installed in the outback, where no telephone line is available. For those installations, a GPRS/VPN (General Packet Radio Service / Virtual Private Network) solution is available using proven components from Siemens.

OutBack: A Box PC is installed (containing SITRANS CV control software and a remote control software like PC-Anywhere) and connected to the net via modem and firewall. The Box PC and the modem can easily be integrated into a EEx-d Box.

MSR-office: A desktop PC is installed with PC-Anywhere and SITRANS CV control software. The PC is connected to the internet via a security modem, firewall and a DSL module.

The Integrated firewall and VPN technology permit secure bi-directional communication between remote station and control room.

SITRANS CV performance

Measuring components and calculated parameters
As dedicated analyzer, SITRANS CV measures, calculates and displays all values which are required in natural gas transmission monitoring. Table 2 (upper part) shows the measuring components with measuring ranges, measured mean concentration values and resulting relative standard deviations. Calculated values (Calorific Value, Density and Wobbe Index) including standard deviation are shown in the lower part. Measurements and calculations are performed according to recent ISO standards, see below.

Separation performance
Separation and detection of the components are performed by various narrowbore capillary columns and in-line detectors. As an example, the high resolution between n-butane and neopentane allows a detection limit for neopentane of < 5 ppm.

Repeatedability
The standard deviations as proof of the repeatability of all measured components as well as the calculated values (table 2) significantly satisfy the minimum requirements placed on highly precise calorific value analysers (ISO 6974).

Linearity, single point calibration
When used for fiscal metering, calorific value analysers must be calibrated regularly, usually weekly. The calibration is carried out using a procedure comparable to gas chromatography where an external calibration gas is mainly used which is directly connected to the analyzer and usually supplied to this automatically.

As a result of the high linearity of the micro-TCDs, SITRANS CV only requires a single point calibration for each component using just one calibration gas, even during initial start-up of the analyser. Complex multilevel calibrations on site with up to seven calibration gases are not essential.

### Table 3: SITRANS CV measurements with components, ranges and repeat abilities

<table>
<thead>
<tr>
<th>Measured Values (Gas components)</th>
<th>Measuring range [%]</th>
<th>Concentration (Mean values)</th>
<th>Repeatability as relative Standard Deviation [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen ( \text{N}_2 )</td>
<td>&lt; 25</td>
<td>1.3464</td>
<td>0.485036</td>
</tr>
<tr>
<td>Carbon Dioxide ( \text{CO}_2 )</td>
<td>&lt; 20</td>
<td>0.3480</td>
<td>0.319118</td>
</tr>
<tr>
<td>Methane ( \text{C}_1 )</td>
<td>&gt; 55</td>
<td>97.3048</td>
<td>0.008662</td>
</tr>
<tr>
<td>Ethane ( \text{C}_2 )</td>
<td>&lt; 20</td>
<td>0.3982</td>
<td>0.359759</td>
</tr>
<tr>
<td>Propane ( \text{C}_3 )</td>
<td>&lt; 10</td>
<td>0.1996</td>
<td>0.358462</td>
</tr>
<tr>
<td>neo-Butane ( \text{n-C}_4 )</td>
<td>&lt; 5</td>
<td>0.1031</td>
<td>0.596241</td>
</tr>
<tr>
<td>iso-Butane ( \text{i-C}_4 )</td>
<td>&lt; 1</td>
<td>0.0509</td>
<td>0.857970</td>
</tr>
<tr>
<td>neo-Pentane ( \text{neo-C}_5 )</td>
<td>&lt; 1</td>
<td>0.0500</td>
<td>0.956977</td>
</tr>
<tr>
<td>n-Pentane ( \text{n-C}_5 )</td>
<td>&lt; 1</td>
<td>0.0500</td>
<td>0.956977</td>
</tr>
<tr>
<td>Sum ( \text{C}_6+ )</td>
<td>&lt; 3</td>
<td>0.0502</td>
<td>0.841165</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Calculated Values</th>
<th></th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Superior CV</td>
<td>39,8284</td>
<td>MJ/m³</td>
<td>0.006913</td>
</tr>
<tr>
<td>Inferior CV</td>
<td>35,9134</td>
<td>MJ/m³</td>
<td>0.006981</td>
</tr>
<tr>
<td>Density</td>
<td>0,7433</td>
<td>Kg/m³</td>
<td>0.009645</td>
</tr>
<tr>
<td>Relative Density</td>
<td>0,5749</td>
<td></td>
<td>0.009661</td>
</tr>
<tr>
<td>Wobbe Index</td>
<td>52,5300</td>
<td></td>
<td>0.009064</td>
</tr>
</tbody>
</table>

Fig. 9: Separation performance of SITRANS CV
Metrological Approvals
SITRANS CV has been certified for fiscal metering in many countries (table 3).

Minimal temperature influence
Due to the extreme installation conditions the influence of ambient temperature changes on the precision of the measuring device is a crucial factor. Hence, SITRANS CV has been tested (fig. 10) extensively according to different parts of the EN 60068-2 standard, which deals with cold test, dry heat test and damp heat test. The results have been excellent.

Fig. 11 shows, as typical result, the very small measuring error of the CV output signal (green) over an extensive range of temperature changes together with the error (red) tolerated by the PTB (German metrological authority).

Natural gas -- Determination of composition with defined uncertainty by gas chromatography
Part 5: Determination of nitrogen, carbon dioxide and C1 to C5 and C6+ hydrocarbons for a laboratory and on-line process application using three columns

ISO 6976 (1995)
The DIN EN ISO 6976 standard specifies methods for the calculation of both the superior calorific value and the inferior calorific value, density, relative density and Wobbe index of dry natural gas and other combustible gaseous fuels. The calculation is done from the composition of the gas by mole fraction, that is obtained from GC measurements of the gas components. It also describes the determination of accuracy (precision of CV) from precision of analysis.

Fig. 11: Absolute measuring error of SITRANS CV

<table>
<thead>
<tr>
<th>SITRANS CV</th>
<th>Type Approval Certificates for Legal Metrology Regulations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Authority</td>
<td>Country</td>
</tr>
<tr>
<td>PTB</td>
<td>Physikalisch-Technische Bundesanstalt</td>
</tr>
<tr>
<td>General Administration of Quality, Supervision, Inspection and Quarantine of the P.R. of China</td>
<td>China</td>
</tr>
<tr>
<td>Committee for Technical Regulation and Metrology of Kazakhstan Republic</td>
<td>Kazakhstan</td>
</tr>
<tr>
<td>GOST Standard</td>
<td>Russia</td>
</tr>
<tr>
<td>BRLM</td>
<td>Romanian Bureau of Legal Metrology</td>
</tr>
</tbody>
</table>

Table 2: SITRANS CV Type Approvals
User Benefits

Determine natural gas precisely
• Analyze C6, C7, C8 and C9 individually for more accurate CV value
• Independent of sample and ambient pressure variations using valveless Live injection
• High separation power using narrow bore capillary columns; clogging of columns has not been observed
• Low detection limits using sensitive detectors
• High linearity throughout measuring ranges saves expensive calibration gases

Determine natural gas fast
• Fast analysis through pioneering MEMS technology
• Update of calorific value each 180 s

Determine natural gas reliable
• Reliable technology through many years of experiences
• Plug and play maintenance guarantee short down times < 2 hours
• Separation reliability guaranteed through in line detection
• Improved reliability – no conventional valve switching with movable parts
• Automatic optimization of methods increases availability
• Perfect integration into network through communication options

Low operating costs through modular design
• Low maintenance in operation
• Repair in minutes, just exchange analytical plug & play module, stable operation already 30 min. later
• During stand-by modus gas consumption only 6 ml/min
• Low power consumption

Flexible installation through compact design
• Minimal space needed
• Rugged design for extreme areas of use NEMA 4X / IP65 enclosure suitable even for off-shore installation and ambient temperature suitability (-20 °C to +55 °C) even for e.g. Middle East desert installations
• Simple installation on site

Fig. 12: Field installation of SITRANS CV
Analytical Solutions

Our solutions

Analytical solutions are always driven by the customer’s requirements. We offer an integrated design covering all steps from sampling point and sample preparation up to complete analyzer cabinets or for installation in analyzer shelters. This includes also signal processing and communications to the control room and process control system.

We rely on a wide scope of extractive and in-situ gas analyzers and gas chromatographs (table 4), many years of world-wide experience in process automation and engineering and a collection of specialized knowledge in key industries and industrial sectors. We provide Siemens quality from a single source with a function warranty for the entire system.

Analyzer networking for data communication

Engineering and manufacturing of process analytical solutions increasingly comprises “networking”. It is getting a standard requirement in the process industry to connect analyzers and analyzer systems to a communication network to provide for continuous and direct data transfer from and to the analyzers. The two objectives are (fig. 13)

- To integrate the analyzer and analyzer systems seamless into the PCS / DCS system of the plant and
- To allow direct access to the analyzers or systems from a maintenance station to ensure correct and reliable operation including preventive or predictive maintenance.

Siemens Process Analytics provides networking solutions to meet the demands of both objectives.

![Fig. 12: Networking for DCS integration and maintenance support](image)

<table>
<thead>
<tr>
<th>Process Gas Chromatographs (Process GC)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MAXUM edition II</strong></td>
</tr>
<tr>
<td><strong>MicroSAM</strong></td>
</tr>
<tr>
<td><strong>SITRANS CV</strong></td>
</tr>
</tbody>
</table>

* DCS: Distributed Control System
* ASM: Analyzer System Manager
* CEMS: Continuous Emission Monitoring System

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Analytical Services

Service portfolio
Our wide portfolio of services is segmented into Consulting, Support and Service (fig. 14). It comprises really all measures, actions and advises that may be required by our clients throughout the entire lifecycle of their plant. It ranges from site survey to installation check, from instruction of plant personnel to spare part stock management and from FEED for Process Analytics (see below) to internet-based service hotline. Our service and support portfolio (including third-party equipment) comprises for example:

- Installation check
- Functionality tests
- Site acceptance test
- Instruction of plant personnel on site
- On site repair
- Remote fault clearance
- Spare part stock evaluation
- Spare part management
- Professional training center
- Process optimization
- Internet-based hotline
- FEED for Process Analytics

FEED for Process Analytics
Front End Engineering and Design (FEED) is part of the planning and engineering phase of a plant construction or modification project and is done after conceptual business planning and prior to detail design. During the FEED phase, best opportunities exist for costs and time savings for the project, as during this phase most of the entire costs are defined and changes have least impact to the project.

Siemens Process Analytics holds a unique blend of expertise in analytical technologies, applications and in providing complete analytical solutions to many industries.

Based on its expertise in analytical technology, application and engineering, Siemens Process Analytics offer a wide scope of FEED services focused on analyzing principles, sampling technologies, application solutions as well as communication system and given standards (all related to analytics) to support our clients in maximizing performance and efficiency of their projects.

Whether you are plant operators or belong to an EPC Contractor you will benefit in various ways from FEED for Process Analytics by Siemens:

- Analytics and industry know how available, right from the beginning of the project
- Superior analyzer system performance with high availability
- Established studies, that lead to realistic investment decisions. Fast and clear design of the analyzer system specifications, drawings and documentation
- Less project management and coordination effort, due to one responsible contact person and less time involvement
- Additional expertise on demand, without having the costs, the effort and the risks of building up the capacities
- Lowest possible Total Costs of Ownership (TCO) along the lifecycle regarding investment costs, consumptions, utilities supply and maintenance
- Predictable time schedule by agreed on design early in the project phase
- Greatly minimized change orders during project execution

Fig. 14: Portfolio of services provided by Siemens Process Analytics
Siemens Process Analytics - Answers for industry

If you have any questions, please contact your local sales representative or any of the contact addresses below:

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