



**MODCON**

# Company Profile

Process Analysis, Control & Optimization  
Integrated Solutions



- the real implementation your Industry 4.0 approach, using high-technology solutions and advanced experience

## Contents

1. INTRODUCTION.....	3
2. MANAGEMENT TEAM.....	4
3. COMPANY CORE PRINCIPLES.....	5
4. MANUFACTURING FACILITIES.....	8
5. MODCON PRODUCTS.....	9
5.1 Petroleum Analyzers.....	9
5.2 Crude Oil Analyzers.....	10
5.3 Gas Analyzers.....	11
5.4 Oxygen Analyzers.....	12
5.5 Hydrogen Analyzers.....	13
5.6 Blending Analyzer NH/H2.....	14
5.7 SCADA and IIoT.....	15
5.8 System Integration.....	16
5.9 AI and Industry 4.0 Solutions.....	17
6. EPC PROJECTS.....	26
7. TECHNICAL SUPPORT.....	27

## 1. INTRODUCTION

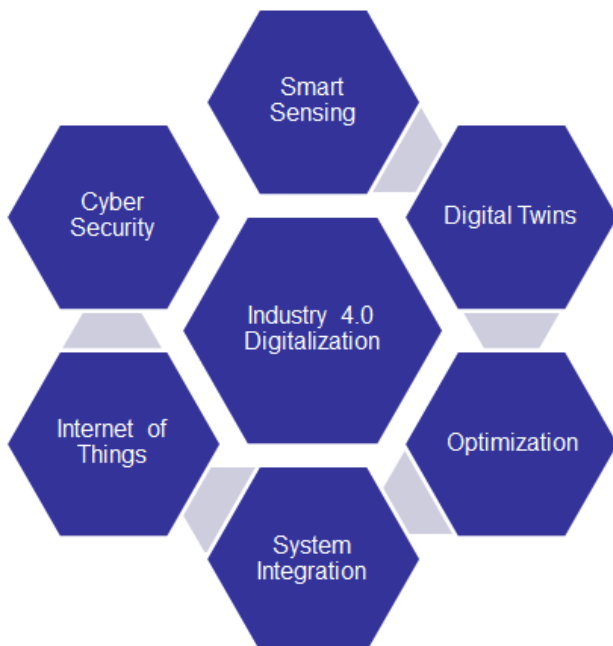
Modcon Systems Ltd. is a deep technology company specializing in process analytics and AI-enabled optimization for industrial operations.

Founded in 1972, the company brings over 50 years of expertise in process analysis, control and optimization across oil refining, natural gas, pipeline, chemical, petrochemical and biotechnology industries. Modcon develops and deploys advanced analyzer systems and digital solutions that enable real-time decision-making, helping operators maintain product quality, improve efficiency and reduce environmental impact.



Fortune 100 energy and industrial companies rely on Modcon's technologies for real-time process analysis and optimization. By combining proprietary measurement technologies with industrial AI, Modcon focuses on delivering high-value, on-specification production at optimal cost.

A major strategy in process industries is to run industrial processes at the highest economic performance through involvement of hardware and software solutions. Just like internet companies that can create high value by optimizing the commercial assets in the consumer market by data analytics, process industries can also generate high value by optimizing their assets from analytics of machine and processes data they have acquired from the operations and productions. Modern machine and deep learning technologies enables simply interacting with the process and incrementally improving control behavior.



The purpose of Modcon.AI & Industry 4.0 solutions is to provide process engineers with set of automation, data exchange and manufacturing technologies coalesce under Cyber-Physical Systems, the Internet of Things and the Internet of Services.

These packages include advanced smart sensing, industrial I/O connectivity and automation, which forms a basic tool for artificial intelligence, digital twins, process optimization, cyber security, IIoT and system integration. Data analysis, storage and compute power at the edge of networks, mobile, data communication technologies, MES, PLC, HMI, SCADA, ERP, sensors and actuators and innovative data exchange models all play a key role.



# MODCON

## 2. MANAGEMENT TEAM



**Mr. Gregory Shahnovsky**  
President & CEO



**Mrs. Ludmila Boudman**  
Finance Department Manager



**Mr. Evgeny Mosarsky**  
CTO (Chief Technical Officer)



**Mr. Ariel Kigel**  
R&D Department Manager



**Mr. Dmitry Chernokozinsky**  
Business Development Manager



**Ms. Ina Luzon**  
COO



**Mr. Gregory Yakhnin**  
Market Strategy Manager (Canada)



**Mrs. Parul Varma**  
Senior Account Manager



**Mr. Dmitry Belenkov**  
Country Manager (Israel)

### 3. COMPANY CORE PRINCIPLES

Modcon Systems Ltd operates and pursues its business objectives in line with “sustainable development” and in accordance with the regulations in force wherever it carries out activities. Observance of legal requirements, and of Company and “Code” rules, is of fundamental importance for the optimal functioning of the Company and its reputation among its human resources, with third parties, institutions and the market generally. The principles enunciated by the “Code” provide mutual advantages for the parties involved, who are consequently required to operate according to the same ethical lines of conduct.

The rules of the “Code” apply to directors, managers and employees of Modcon Systems Ltd and to its subsidiaries and their application are required of all persons operating in pursuit of Company objectives, whether in Israel or abroad.

Through its designated functions, the Company is committed to making the “Code” known as widely as possible among its own employees and to third parties, making suitable cognitive tools available for the interpretation and implementation of the rules it contains.

In pursuing Company objectives and concluding operations, all Modcon Systems Ltd employees must operate with professionalism and dedication, in harmony with the policies of the Company, and with a spirit of social responsibility.

Employees may consult their superiors or the Supervisory Body for any explanations required in interpreting “Code” rules. Employees shall report to the said parties any information concerning breaches of the law and of the “Code” and the Company shall ensure that no retaliation is suffered by anyone in the context of their working activity as a result of any such communications.

Managers must set an example to the staff assigned to them, whether hierarchically or functionally, so as to make them understand that observance of the rules of the “Code” is for all an essential aspect of the quality of their work performance. Managers shall pay particular attention to the selection of employees, subcontractors and third-party contractors generally.

Managers are in all cases bound to report to their superiors or to the Supervisory Body any information concerning breaches of the “Code”, to adopt immediate corrective measures, according to the situation, and to strive to prevent retaliations in the work environment.

In carrying out its functions, the Ethics Executive Committee avails itself of the Supervisory Body endowed with the appropriate requisites of competence, authoritativeness, integrity and autonomy.

Modcon Systems Ltd operates in a multitude of economic, social and institutional contexts in continuous rapid evolution. This requires the Company to act with efficiency and transparency, as well as in conformity with Company rules aimed at ensuring that the conduct of those involved in the production process is always dictated by principles of honesty, integrity, and loyal competition.

All persons involved in the pursuit of Company objectives must avoid any situation and activity in which a conflict of interests may arise between personal economic activities and the function they cover within or on behalf of the Company.

Acts of commercial courtesy or customary gifts are permissible only when they cannot be interpreted as being aimed at acquiring advantages in an improper manner.

During negotiations in countries where it is customary to offer gifts to customers or third parties, including public officials, this may be done only if such gifts are of an appropriate nature and of modest value and in all cases without breaking any law.

Modcon Systems Ltd employees and collaborators are not allowed to receive, either directly or indirectly, money, gifts or favors of any kind from any third party, except for gifts or advantages of modest value.

No money, gifts or favors of any kind may be offered directly or indirectly to Italian or foreign public officials, nor to their kin or other persons operating in the interest of public institutions, except for customary gifts or benefits of modest value.

In its relations with Customers, Modcon Systems Ltd pursues not only conformity to contractual requirements, but also the supply of products or services tending to excellence in terms of quality, safety, care for the environment, the safeguarding of health and human rights. All persons involved in project management and implementation are consequently required to contribute to the attainment of this added value with determination and commitment.

Third parties (suppliers, subcontractors, partners, consultants, agents, etc.) are selected according to objective assessment criteria, based on established Company procedures and principles of correctness and transparency. Such persons are required to know and adhere to the principles of the "Code".

As an activity, competition must always be wholly conducted according to law and to the protection of competitors. The obtaining of information about competitors by illegal means or contrary to ethics is forbidden.

Accounting transparency and veracity are irreplaceable values and parameters that must impact the work of all Modcon Systems Ltd employees.

Accounting transparency is based on the veracity, accuracy and completeness of the documentation regarding each activity and its related accounting operations. All operations must therefore be accompanied by the appropriate supporting documents for the activity performed to permit its entry as an account item, its detailed reconstruction and the identification of the various levels of responsibility.

Each employee shall endeavor to ensure that operational facts are represented correctly and promptly in the accounts and that the related documentation is traceable and consultable. Should an employee find or become aware of any falsification, omission or negligence in accounting or in the documentation on which the account entries are based, he/she must immediately report the same to his/her own superior or to the Supervisory Body.

Since Modcon Systems Ltd considers its human resources indispensable for the Company's continued existence and success, its policy is to foster the growth of each employee's professional abilities and skills, so that each potential achieves full development in the implementation of common objectives.

With this aim in mind, through its dedicated functions, the Company selects, hires, remunerates and manages human resources according to criteria of equity, competence and merit, without any discrimination and in accordance with all regulations in force.

Furthermore, the Company is committed to safeguarding the psychophysical integrity of its employees, both by respecting their moral character and privacy and by protecting them from undue influence or embarrassment. Employees are bound to co-operate in maintaining an in-house atmosphere based on total respect for the honor, dignity and reputation of each single person.

The health and well-being of persons, the safety of plants, works and installations, and the protection of the environment are Modcon Systems Ltd primary objectives and guide all Company actions with regard to its employees, customers, partners, subcontractors, suppliers and any third parties involved in Company activities.

The Company is committed to providing work premises, utilities and plants that comply with current regulations and with the highest HSE levels. This aim is pursued in every sector of Company activity at each phase of project implementation, from engineering and procurement to field operations.

The Company delegates responsibility and authority to the HSE Function to set up and maintain an HSE Management System, with the involvement and participation of all in sharing and supporting HSE objectives, as also in achieving the performance levels foreseen.

In line with the principles of the “Global Compact” launched by the United Nations and signed by the Group, and in compliance with the requirements of SA 8000, Modcon Systems Ltd is committed to the fundamental values of labor, in accordance with laws in force, contractual agreements and ILO (International Labor Organization) recommendations.

The said commitments focus particularly on the following:

- Child labor
- Forced labor
- Health and Safety
- Freedom of Association and Right to Collective Bargaining
- Discrimination
- Disciplinary Practices
- Working Hours
- Remuneration
- These objectives are pursued in a context of “sustainable development” and continuous improvement involving all stakeholders, employees, suppliers and subcontractors.

Modcon Systems Ltd possesses its own or utilizes third-party know-how in the development of its activities. Information or data acquired or processed by directors, managers and employees during their work or in carrying out their duties belongs to the Company and may not be utilized, communicated or divulged without specific authorization.

Persons belonging to the Company Organs and employees may not divulge information about the Company’s organization and management methods or use the same in any way prejudicial to the Company or other contractual parties. The Company undertakes to safeguard employees in processing personal data, in accordance with law.



## 4. MANUFACTURING FACILITIES

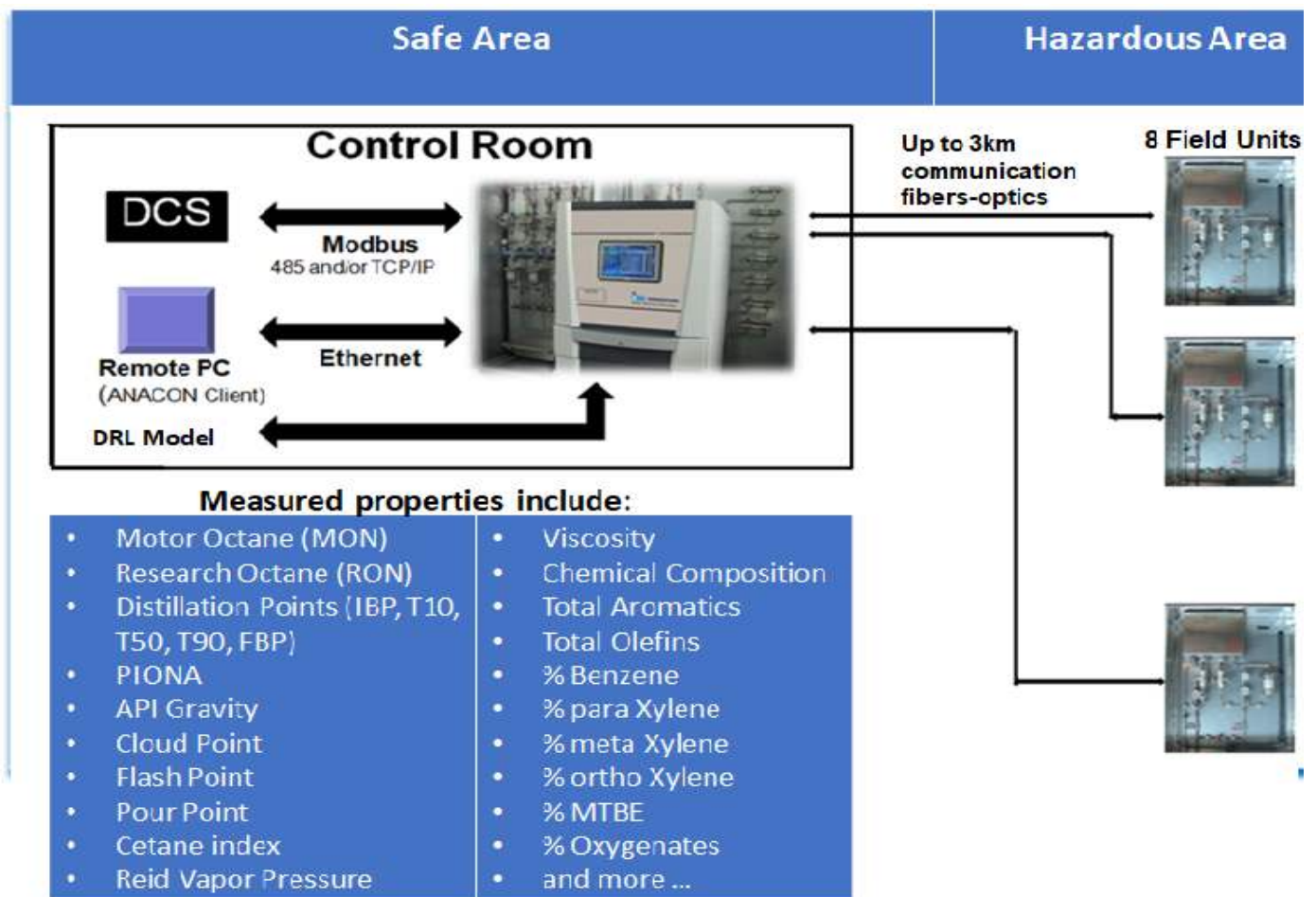


- The main Modcon Systems Ltd. manufacturing facility is wholly owned and registered as 100% property of the company
- The research and production building includes production facility, warehouses, R&D division, chemical laboratory, electronic laboratory, automated warehouses, as well as numerous office premises
- Major equipment available in plant includes the following:
  - Machinery equipment
  - Instrumentation appliances
  - Containers
  - Implements
  - Tools and components or anything fitted or connected to those things
  - Lifts
  - Cranes
  - Computers
  - Scaffolding components
  - Forklifts
  - Vehicles
  - Power tools
  - Amusement devices

## 5. MODCON PRODUCTS

### 5.1 Petroleum Analyzers

The Beacon 3000 is an inline, multi-channel Process NIR Analyzer. It enables non-contact, real-time monitoring and closed-loop control of physical properties and chemical composition in industrial process applications. Based on novel algorithms, the Beacon 3000 measures the absorption spectrum in the near infrared (NIR) fast and accurately without labor and material waste.



#### Features & Benefits

- The Main Beacon 3000 NIR Analyzer is located in the Control Room, protected from the process environment. The Main NIR Analyzer connects, via telecommunications fiber optics, to the Field Units, that are installed up to 3 km (2 miles) away, close to the process. Up to 8 Field Units can be connected to one Main Analyzer.
- The Field Unit uses no electricity and contains no moving parts. This 100% optical probe requires no explosion proof housing or analyzer shelter. The Field Unit is certified under the ATEX Directive 94/9/EC (EN 60079-28:2007).
- In many applications, the Beacon 3000 Process NIR Analyzer's performance and price make it an attractive alternative to traditional analyzers, such as gas chromatographs or distillation analyzers. No analyzer shelter is required, and the low maintenance requirements reduce ownership costs to a minimum.

## 5.2 Crude Oil Analyzers

The MOD-4100 crude analyzer represents a breakthrough in crude oil on-line analysis. It is a single analyzer, that performs on-line a variety of different critical crude oil measurements to provide real time analytical data, which is highly important for optimized operation processing of crude oils. The new design of the MOD 4100 analyzer system is based on a “Modular Package concept”. It is inspected and tested by the factory, and ready for immediate installation on-site. The following crude oil critical parameters can be measured on-line and correlated to ASTM:

- Salt Concentration (D3230)
- Distillation (D2892, D86)
- SARA (IP-143 and D893-69)
- Emulsion stability (F3045, D4007 and D3707)
- Hydrogen Sulfide content (D5705)
- RVP (D6377 and D323)
- Viscosity (D445 and D2501)
- Water Content (D4928 and D4006)
- Sulfur content (D2622 and D4294)
- Density (D4928 and D1250)

### Crude oil blending:

- Optimization of the ratio between crude oil being blended to provide a blend of required physical properties.
- Reduction of blend cost by maximum incorporation of low-cost crudes in the blend.

### Crude Oil Distillation

- On-line monitoring of the crude oil properties before, between and after the desalters enables efficient operation of the desalter, at minimum cost of energy and process chemicals.
- On-line monitoring of the physical properties such as the SALT, H<sub>2</sub>S and TAN of the crude oils entering the CDU is also of high importance for evaluating the potential of corrosion and fouling that affect the equipment and the pipelines.

### System Configuration

- The new MOD 4100 On-line Analytical System is a complete equipment set.
- MOD-4100 allows real time analysis of critical crude oil properties under field conditions.
- Continuous crude oil sampling from pipelines, tanks or process vessels, its filtration and separation from solid particles.
- The analyzer is equipped with an integrated sampling handling and sample condition system, to bring the samples to physical condition that is required by the analyzer.
- Transfer of analysis results to customer’s control room DCS.
- The analyzer comes installed in outdoor enclosure.





## 5.4 Oxygen Analyzers

MOD-1040 Oxygen Analyzer is designed to provide accurate and reliable measurements of oxygen levels in high-pressure pipeline, making it ideal for a range of industrial applications. With its advanced optical sensor technology and rugged construction, MOD-1040 delivers precise measurements even in the harshest of conditions. Its user-friendly interface and intuitive controls make it easy to operate, while its compact design allows for easy installation directly on process pipe without any sample extraction.

Key features of the Oxygen Analyzer for high-pressure applications include:

- High-accuracy measurement of oxygen levels up to 100%
- Explosion proof certified: ATEX & IECEx
- Response time (T90): <5 sec
- Ambient temperature: -10 to 600C
- Rugged construction and compact design for reliable operation in harsh environments
- Flexible installation options to suit a variety of industrial applications



Whether you're working in the oil and gas industry, hydrogen production, chemical processing, or any other process industry, the MOD-1040 Oxygen Analyzer is the ideal solution for precise and reliable oxygen measurement in high-pressure applications.

Industrial gas production systems, including those for hydrogen and oxygen, typically involve the use of equipment rated for both non-hazardous and hazardous locations. One approach to lowering installation costs is to utilize general-purpose equipment, but this may only be feasible if the risk of gas leaks is minimized.

Reducing the potential for leaks can create difficulties in sampling gas from high-pressure pipelines, making it challenging to perform accurate oxygen analysis. Traditional oxygen analysis technologies, including paramagnetic, zirconia, coulometric and TDL, are not designed to withstand high gas pressures and therefore require gas sample extraction and conditioning prior to analysis. MOD-1040 allows for direct measurement of oxygen content in high-pressure pipelines, eliminating the need for gas sample extraction or conditioning.

## 5.5 Hydrogen Analyzers

MOD-1064 Hydrogen Analyzer is designed for accurate hydrogen measurement in high-pressure pipelines. It utilizes thermal conductivity sensor technology for reliable operation in harsh environments. The analyzer features a compact design for direct installation on the process pipe, eliminating the need for sample extraction, and offers simple, user-friendly operation.

Whether you're working in the oil and gas industry, hydrogen production, chemical processing, or any other process industry, MOD-1064 Hydrogen Analyzer is the ideal solution for precise and reliable oxygen measurement in high-pressure applications.



Key features of the Oxygen Analyzer for high-pressure applications include:

- Precise, fast and sensitive measurement of (quasi-) binary gas mixtures
- Area Classification: Zone 2 under the ATEX 2014/34/EU Directive
- Response time (T90): < 5 sec
- Rugged construction and compact design for reliable operation in harsh environments
- Flexible installation options to suit a variety of industrial applications

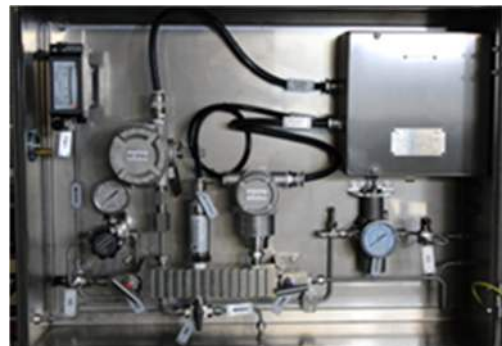
Industrial gas production systems, including those for hydrogen and oxygen, typically involve the use of equipment rated for both non-hazardous and hazardous locations. One approach to lowering installation costs is to utilize general-purpose equipment, but this may only be feasible if the risk of gas leaks is minimized.

Reducing the potential for leaks can create difficulties in sampling gas from high-pressure pipelines, making it challenging to perform accurate hydrogen analysis. MOD-1060 allows for direct measurement of hydrogen content in high-pressure pipelines, eliminating the need for gas sample extraction or conditioning.

The measurement is based on the thermal conductivity principle, which is extremely well suited for the measurement of gases with widely differing thermal conductivity, e.g. H<sub>2</sub> and Ar. By perfecting this method, it has become possible to detect the measurement of small H<sub>2</sub> concentrations (100 ppm and even less).

## 5.6 Blending Analyzer NH/H<sub>2</sub>

MOD-1080 NG/H<sub>2</sub> Blend Quality Analyzer is a compact on-line analyzer system for hydrogen-enriched natural gas service, combining thermal conductivity measurement for hydrogen concentration with real-time density and temperature measurement for gas-quality inference. The analyzer is intended for direct installation in the gas stream or in a compact bypass arrangement and is designed to provide fast, continuous indication of H<sub>2</sub> concentration, gas density, specific gravity, calorific value and Wobbe Index for NG/H<sub>2</sub> blending applications.



Key features of the Oxygen Analyzer for high-pressure applications include:

- Fast on-line measurement of hydrogen concentration in NG/H<sub>2</sub> blends
- Real-time measurement of gas density and gas temperature
- Continuous calculation of specific gravity, calorific value, and Wobbe Index
- Suitable for hydrogen-enriched natural gas blending control and gas-quality indication
- Compact design for direct in-line installation or compact bypass mounting
- Can be calibrated for a specific natural gas composition envelope
- Supports off-line ISO-based verification using customer-provided stream composition data
- Fast response for dynamic blending applications
- Rugged stainless-steel construction for industrial environments
- 4–20 mA / RS485 communication for easy integration into plant systems

MOD-1080 provides a practical way to monitor hydrogen-enriched natural gas blends in real time, helping operators maintain safe and stable blending conditions while also tracking the gas quality parameters that matter in actual operation.

This approach reduces dependence on more complex analyzer systems for routine operational monitoring and offers a compact solution that can be integrated directly into blending skids, fuel gas systems, and gas quality stations. In addition, the calculation model can be aligned to a specific natural gas composition using off-line ISO-based verification, allowing the analyzer to be adapted to the customer's gas composition envelope and updated later if the composition changes.

MOD-1080 is a compact fusion analyzer designed for on-line monitoring of hydrogen-enriched natural gas blends in applications where hydrogen concentration alone is not sufficient and gas quality indication is also required. By combining thermal conductivity measurement for H<sub>2</sub> with density and temperature measurement, the analyzer provides continuous indication of specific gravity, calorific value and Wobbe Index for blending control and operational monitoring. The calculation model can be calibrated to a defined natural gas composition envelope and may be verified off-line against ISO-based calculation using customer-provided stream composition data. For enhanced accuracy, optional gas composition correction from external sources via Modbus can also be applied.

## 5.7 SCADA and IIoT

Modcon SCADA and IIoT systems provides robust, scalable, user friendly and nonproprietary solutions that seamlessly can be integrated into existing platforms and systems. The solution focuses on all the crucial factors like pipeline product quality, control system flexibility and leak detection traceability, low system maintenance and pipelines performance, and regulatory compliance during all the phases of a project – from the initial design development to installation and future expansions.



Pipelines leakage could threaten neighborhoods, contaminate water supplies, or pollute environmentally-sensitive land. Pipeline companies face increasing requirement to protect their assets from different kinds of malicious activities, ranging from simple theft to terrorism. The system is designed to allow their pipeline controllers to efficiently and effectively monitor and control pipeline operations in real time in a centralized control room.

Early leak detection technologies includes pressure, flow, acoustic, seismic, electromagnetic, mechanical, chemical, thermal and other pipeline measurements. The system analyses the calculated pipeline state, searches for anomalies that suggest a leak and determines their location. Real-time operational implementation of dynamic model and monitoring system for detailed post-event analysis allows to pinpoint the source of a chemical release using meteorological data and concentration measurements from the analyzers/sensors.

The system includes main components as below:

- Field instrumentation for quantitative measurement and control
- Real-time control pipeline security system around the perimeter and on the pipelines
- Radio, satellite, fiber optic or cellular communication network to acquire field data for room control SCADA master station which allows operator to view current or previous data, alarm messages, and to issue controls to field equipment.
- On-line Analyzers for petroleum products quality determination and control
- Early leak detection system analyses which calculates pipeline state, searches for anomalies that suggest a leak and determines their location

Pipeline companies use Modcon SCADA & IIoT systems to allow their pipeline controllers, in a centralized control room, to efficiently and effectively monitor and control pipelines, pump stations, filling terminals operations in real time. Data is collected from field instrumentation and Product Quality Modules by remote terminal units (RTUs), flow computers, and/or programmable logic controllers (PLCs) which then relay the information to the SCADA master station via the deferments field communication networks.

## 5.8 System Integration

Modcon provides complete integrated analyzer systems and all related services from initial engineering through manufacturing, testing and field start-up. Analyzers Systems are normally supplied installed in the special Analyzer Houses including air-conditioning, power distribution, lighting, termination and junction boxes, gas and flame detection, relevant piping and wiring.

Process sample probes and sample transport lines designed to ensure representative and rapid sampling, avoiding a possibility of contamination or dead volume. Sample Conditioning systems to provide the sample in a state and condition compatible to the measurement technique used by analyzers. Sample recovery systems, stream selection facilities, telephone modem connections, furniture, special equipment and tools, etc.

Modcon's core activities provide proven technology based on worldwide experience of 50 years across a wide range of applications in chemical, petrochemical, energy, food, pharmaceutical and water industries.



One team of specialists manages your project from start to finish. Modcon's staff has extensive experience with virtually every type of process analyzer, as well as with various forms of packaging such as stainless steel or fiberglass buildings, galvanized-steel buildings, cabinets and racks. Years of in-plant experience guarantee the best available technology in your system designs.

## 5.9 AI and Industry 4.0 Solutions

A major strategy in process industries is to run industrial processes at the highest economic performance through involvement of hardware and software solutions. Just like internet companies that can create high value by optimizing the commercial assets in the consumer market by data analytics, process industries can also generate high value by optimizing their assets from analytics of machine and processes data they have acquired from the operations and productions. Modern machine and deep learning technologies enables simply interacting with the process and incrementally improving control behavior.



The purpose of Modcon-AI package is to provide process engineers with set of economic optimization tools, which enables prediction of physical properties and chemical composition for different process streams, to optimize the setpoints of unit operations.

Predicted products quality is continuously updated against process analyzers data and laboratory results to allow the simulated process' "digital twin" to continuously be trained to allow highest possible efficiency of the process at lowest cost.

Modcon-AI package provides an entire overview of the operation of the process units based on streams quality data and safety/security/environmental considerations. Using the modern AI tools powered by accurate KPIs measurement and process analyzer data, forms a basic tool from managers to operators to take the correct decisions to maintain and improve effective industrial processes management.

Big data analysis functionality, including multidimensional fusion and distribution of incoming data, abnormality of novel events detection, clustering, decision trees, linear, polynomial, logistic regression, escalation of novelty real-time analysis, etc. – using deep learning technologies.

Deep reinforcement learning (DRL) is a powerful machine learning technique, which can be effectively used to optimize industrial processes for different strategic goals, allowing to shift focus intelligently and confidently. Reinforcement learning makes use of algorithms that do not rely only on historical data sets, to learn to make a prediction or perform a task. Just like we humans learn using trial and error, these algorithms also do the same. A reinforcement learning agent is given a set of actions that it can apply to its environment to obtain rewards or reach a certain goal. These actions create changes to the state of the agent and the environment. The DRL agent receives rewards based on how its actions bring it closer to its goal.

Being a powerful tool, which requires no historical data for reinforcement learning, DRL has one significant weakness, which makes it more difficult to implement for hydrocarbons processing with wide ranges of operation. DRL is likely to improve performance only where the pre-trained parameters are already close to yielding the correct process streams quality. The observed gains may be due to effects unrelated to the training signal, but rather from changes in the shape of the distribution curve. Therefore, there is a need in real-time monitoring of process yields, rather than only their prediction using the pre-trained models. This can be reached using the on-line analyzers installed in the process to determine the chemical composition or physical properties of substances involved in hydrocarbons processing

### 5.9.1 REFINERY ECONOMIC OPTIMIZATION

The current situation, where crude oil prices are low, makes it even more important to refineries to pay attention to the economization of the entire refinery organization. Hydrocarbons industry becomes more sophisticated and have invested heavily in cleaner fuel production, molecular recycling, plastic waste reduction efforts, and more efficient and environmentally friendly production methods. Modern refineries must be capable to take immediate and unexpected actions to prevent any financial losses, and should cover the entire refinery, from a technical, as well as from a logistic point of view. Process optimization became an undisputable requirement and only solution to survey in competitive markets.

Refinery margins are typically measured as a value contribution of the refinery per barrel of feedstocks processed. The gross margin is the difference between the value of the products made and the feedstock used to make them. This parameter is typically used to measure the effects of changing market conditions or differences in yield across different refineries. The variable cash margin subtracts all variable costs from the gross margin and can be very useful for setting optimal short-term run levels as a part of refinery optimization.

Efficient refinery optimization includes a complex of different components. Under proper operation conditions, each component will increase the process efficiency of the refinery. A major strategy in achieving the goal to run a refinery at highest economic performances is to involve different technologies of hardware and software (HW/SW) solutions.

Hardware solutions are given by on-line process analyzers, which provide real time measurements of physical properties of raw materials and products in process streams. Software solutions to increase the refinery's financial performance include optimization software, dedicated to specific processing units, among which blending stations, the CDU, the FCC etc.



Common Challenges	AI Implementation Results
<ul style="list-style-type: none"> <li>Increasing crude and feedstock variability</li> <li>Tightening environmental and product quality regulations</li> <li>Maintaining high equipment reliability</li> </ul>	<ul style="list-style-type: none"> <li>Operational efficiency improvement 5-10%</li> <li>High-value products yield increase 3-6%</li> <li>Reducing risks that can impact quality, profit, environment and safety</li> </ul>

## 5.9.2 PREDICTIVE OLEFINS PRODUCTION

The growing consumption of polyethylene (PE) and polypropylene (PP) demands an increase in the production of their monomer, ethylene and propylene. As per the report published by Fior Markets, the global alpha olefins market is expected to grow from USD 8.6 billion in 2020 and reach USD 13.7 billion by 2028, growing at a CAGR of 6% during the forecast period 2021-2028.

Ethylene production optimization is an integrated and complicated process, where multiple technologies are combined. It requires an integrated process control system based on different sensors to measure physical, chemical and process parameters. Online analyzers play an important role to measure critical quality properties of the feed, semi-final and final products. Data from different sources must be interlinked to determine whether to perform corrective or preventive actions.



Although the process comprises of different steps, ultimately the performance of the cracker is the bottleneck. As such, it is the primary target according to which the sequential processes must be synchronized. Until recently, the lack of computer power and sophisticated mathematical solvers obstructed dynamic real time optimization. Today, dynamic modelling is based on nonlinear models and the processes are based on the correlation between design and online optimizer models, as well as theoretical laws with respect to chemistry, reaction kinetics and physics.

A combination of proper AI optimizer models and accurate measurement of feedstock properties, which represent the type and chemical composition of the feedstock, feedback from temperature sensors, flow sensors, and historical data, provides a valuable tool for predicting the ethylene/propylene composition. This can be further utilized to determine the KPIs of the fractionator that have the most influence on production efficiency.

Efficient utilization of the process data from each process unit and mathematical models that are developed for dynamic optimization, enables to run the process in an efficient and cost-effective mode. Increasing the production capacity and reducing the cost of energy helps to increase the profitability of the ethylene/propylene production unit, which forms the platform to withstand global competition in the production of raw materials for the petrochemical industries.

Common Challenges	AI Implementation Results
<ul style="list-style-type: none"> <li>● Gas and liquid feedstocks variability</li> <li>● Volatility in crude oil prices</li> <li>● Constant margin erosion in certain petrochemical chains</li> </ul>	<ul style="list-style-type: none"> <li>● Ethylene yield maximizing 8-10%</li> <li>● Improvement in energy efficiency 10-20%</li> <li>● Reducing risks that can impact quality, profit, environment and safety</li> </ul>

## 5.9.3 NATURAL GAS PROCESSING

The optimization of both the gathering system and gas processing facilities—with their multitude of associated meters, commercial contracts and variable commodity pricing—in an integrated fashion is challenging to carry out in real time. System size, complexity and data requirements can complicate the real-time optimization of these facilities.

The gas plant is the heart of a gathering- and processing-focused midstream operator’s asset portfolio because of its role as the treating and processing hub, which receives raw gas from the gathering network, removes contaminants such as H<sub>2</sub>S, CO<sub>2</sub> and water in amine and glycol units, and separates NGL and sales gas in a cryogenic unit.

The challenge for gas plant operators is to optimize plant uptime and equipment maintenance to ensure consistent, optimum and high-quality sales gas and NGL production rates, while balancing numerous issues, including:

- Feed gas rate composition/quality variability
- H<sub>2</sub>S and CO<sub>2</sub> concentrations exceeding environmental limits
- Running the cryogenic unit in ethane recovery or rejection mode
- Controlling residue gas heating values
- NGL composition ratios, such as C<sub>1</sub>/C<sub>2</sub> and CO<sub>2</sub>/C<sub>2</sub>, as well as fluctuating methane, ethane and propane prices.



The capability to carry out this analysis for gas plants and act in near-real time, vs. an offline weekly or monthly reactive approach, is essential for responding rapidly to operational and price/market fluctuations, as well as optimizing production. Near-real time, financial-based optimization of a single gas plant train can yield \$2,500/d–\$3,000/d (approximately \$1 MM/yr), and up to 1.5 times this amount per gas plant in a gathering and processing super system.

Common Challenges	AI Implementation Results
<ul style="list-style-type: none"> <li>• Changing operating conditions and feed composition</li> <li>• Product quality regulations tightening</li> <li>• Environmental, social and governance (ESG) risks</li> </ul>	<ul style="list-style-type: none"> <li>• Throughput increase 1-5%</li> <li>• Reduced energy consumption 2-5%</li> <li>• Reduction of CO<sub>2</sub> emissions 10-15%</li> <li>• Improve quality control and safety</li> </ul>

## 5.9.4 BIOTECHNOLOGY INDUSTRY

The success of bioprocesses control and optimization strategies directed to obtain high throughputs relies on the possibility to characterize with detail and to follow-up cell populations in almost real-time conditions and thus, on the availability and sensitivity of suitable cell analysis methods.

The improvement of control strategies and processes optimization in biotechnology requires the application of analytical methods, which allow a rapid evaluation of metabolic processes, cell viability, and cell growth in the bioreactor.

Online analysis of TOC content and bioburden provides efficient solution for rapid measuring microbial contamination in pharmaceutical grade waters and enables optimization of the bioprocesses. It offers a real-time microbial monitoring solution, providing continuous results every two seconds to allow the simulated process' "digital twin" to continuously be trained to allow highest possible efficiency of the process at lowest cost.



Reaching the maximum production capacity of the bioprocesses without loss in quality is one of the main challenges in biotechnology. The priority is to prevent production failures and to detect possible bottlenecks and available options to remove them with the help of a pharmaceutical simulation model. If an error occurred during production, the time-consuming process had to be restarted from the beginning, resources were wasted and, most importantly, the patient might not have enough time to receive treatment.

In addition, simulated process' "digital twin" enables several products to be manufactured simultaneously with the same scarce resources that needed to be preserved to prevent processing failures. The goals of the pharmaceutical manufacturing simulation includes procedures prioritizing, minimize failures, increase the efficient use of resources, reduce the overall production duration, and minimize overtime for operators.

Common Challenges	AI Implementation Results
<ul style="list-style-type: none"> <li>• Changing operating conditions and feed composition</li> <li>• Product quality regulations tightening</li> <li>• Environmental, social and governance (ESG) risks</li> </ul>	<ul style="list-style-type: none"> <li>• Prioritize procedures and minimize failures</li> <li>• Increase the efficient use of resources</li> <li>• Reduce the overall production duration</li> <li>• Improve quality control and safety</li> </ul>

## 5.9.5 CHEMICAL INDUSTRY

Chloro-Alkali industry is a typical example of chemical manufacturing, where on-line analysis and real-time optimization has a significant impact on the performance and operation costs of plant. One of the biggest challenges is to control the hardness (Ca/Mg) and chlorine concentration in the treated brine. Scrubbers' optimization is achieved by maintaining a NaOH concentration range sufficient to achieve satisfactory removal of scrubbed components without wasting NaOH.

Within process engineering, a number of different objectives and restrictions has to be taken into account. For example, operating and fix costs are to be minimized, while simultaneously the quality of the final products should be maximized. Additionally, health and environmental issues play an important role.



To find a good compromise between these different requirements, the process engineer not only has to compare the various tunings of a given layout, but also a number of several devices, this is a challenging task. So far, this layout process is done with the help of AI-based simulations, where good solutions are found empirically.

The precise description of real-world appliances requires complex, often highly parameterized models. The solution of optimization problems based on these models generally requires a great amount of function evaluations which in many cases are obtained from expensive simulations. This leads to a significant numerical complexity, especially when an overview over the entire decision space is desired.

Modcon-AI package provides an entire overview of the operation of the process units based on streams quality data and safety/security/environmental considerations. Using the modern AI tools powered by accurate KPIs measurement and process analyzer data, forms a basic tool from managers to operators to take the correct decisions to maintain and improve effective industrial processes management.

Common Challenges	AI Implementation Results
<ul style="list-style-type: none"> <li>• Changing operating conditions and feed composition</li> <li>• Product quality regulations tightening</li> <li>• Environmental, social and governance (ESG) risks</li> </ul>	<ul style="list-style-type: none"> <li>• Improvement in energy efficiency 10-20%</li> <li>• Reduction of CO2 emissions 5-10%</li> <li>• High-value products yield increase 3-6%</li> <li>• Reducing risks that can impact quality, profit, environment and safety</li> </ul>

## 5.9.6 POWER GENERATION

Power generation boilers use fuels such as coal, oil or natural gas to heat water and therefore produce steam, which is in turn used to drive turbine generators. The economics of power generation rely to a great extent on the efficiency of the fuel to heat conversion process and therefore the power generation industry are amongst the most advanced users of efficiency techniques based on on-line process analysis and real-time optimization.

Within the power station the aim of water and steam control is to minimize contamination of circuit, thereby reducing corrosion as well as cutting down the risk of the formation of harmful impurities. Therefore, it is very important to control the quality of water to prevent the deposits on turbine blades by Silica ( $\text{SiO}_2$ ), reduce corrosion by dissolved oxygen (DO) or to prevent acid corrosion by Hydrazine ( $\text{N}_2\text{H}_4$ ). Measurement of water conductivity gives an excellent initial indication of falling water quality, analysis of Chlorine ( $\text{Cl}_2$ ), Ozone ( $\text{O}_3$ ) and Chloride (Cl) used for control of cooling water disinfecting, indication of corrosion and detection of cooling water leaks in the condense stage.



Power generation optimization solutions emphasize two key strategic imperatives. One is transforming the utility network by changing the electric grid and gas and water infrastructures from a rigid one-way system to a dynamic, automated and reliable information network. The second is investing in green initiatives, such as incorporating renewable energy and meeting stringent greenhouse gas emissions targets, while maintaining a reliable, cost-effective power supply.

When thermoelectric plants are used as a reserve source of energy, they are paid for availability. In these cases, the optimization of availability, reliability, and performance of the generating machines are critical issues to maximize the economic results of the business and to guarantee the supply to the electric sector.

Common Challenges	AI Implementation Results
<ul style="list-style-type: none"> <li>Balancing baseload power and renewables</li> <li>Increasing environmental regulations</li> <li>Additional complexity and straining operating margins related to environmental and labor regulations</li> </ul>	<ul style="list-style-type: none"> <li>Reduced energy consumption 2-5%</li> <li>Reduction of CO<sub>2</sub> emissions 5-10%</li> <li>Increasing plant availability and reliability</li> <li>Better control and monitoring of solar and wind combined cycle energy assets</li> </ul>

### 5.9.7 WATER TREATMENT

Water is all around us and forms an intimate part of our everyday life. Most of the earth's surface is water and thanks to rain and evaporation, our water recycles again and again. We use water to conduct heat, carry off waste, wash, irrigate and so on.

Water quality monitoring has become a matter of governmental and industrial concern on an international basis. From an industrial viewpoint, the major applications for on-line water monitoring are found in raw water and process water treatment, cooling water systems, boiler feedwater treatment, internal boiler water and blowdown control, steam condensate and potable water production, and waste water treatment.



Wastewater treatment is estimated to consume 2 - 3% of a developed nation's electrical power. In municipal wastewater treatment, the largest proportion of energy is used in biological treatment, generally in the range of 50 - 60% of plant usage. That represents an opportunity for process optimization and requires practical solutions to water pollution and water scarcity. Applications of Modcon AI-enabled technology enables to reduce the operational expenditures of the water treatment process by decreasing the cost and optimizing chemicals usage. Numerous AI models have successfully predicted the performance of different adsorbents for the removal of numerous pollutants from water.

The starting point for successful water treatment optimization is choosing which KPIs are key to a particular process, should be to be focused on those, that can characterize the given inputs against target outputs. There is a well-proven technology of setting network input and output parameters, input preprocessing settings and output postprocessing settings, using weight initialization techniques to match input/target data.

This enables to establish a simplified process' digital twin, which describes process objectives and includes in decision tree only those KPIs, which are more relevant for the process efficiency. Additional KPIs to be considered are related to safety, security and environmental requirements, which shall be applied as a constraints. This method enables overall process optimization through integration of the network input and target KPIs, using AI-enabled techniques to maximize the overall profit.

Common Challenges	AI Implementation Results
<ul style="list-style-type: none"> <li>High energy consumption</li> <li>Disposal of excess sludge produced</li> <li>Tightening environmental and water quality regulations</li> </ul>	<ul style="list-style-type: none"> <li>Reduced energy consumption 2-5%</li> <li>Reduction of CO2 emissions 5-10%</li> <li>Minimizing excess sludge production 3-5%</li> <li>Reducing risks that can impact quality, profit, environment and safety</li> </ul>

## 5.9.8 OIL AND GAS PRODUCTION

Oil and gas industry is under constant pressure in all production environments: conventional or unconventional; onshore or offshore; oil or gas. In the face of rising costs and recent widespread production target misses, exploration and production (E&P) companies are looking to grow reserves and maximize production—while ensuring safe operations and avoiding environmental impact. But imprecise or redundant decisions often result in unnecessary downtime, suboptimal production rates, and increased maintenance and safety issues. This is why effective processes optimization has become a crucial step on an oil and gas company’s journey to high performance.



The first prerequisite for an effective implementation of a production optimization solution is access to high fidelity data from a variety of different sources such as well data, production data, reservoir modeling data, field infrastructure data, and financial and economic planning data for the production business.

In the case of AI-based virtual metering, for example, data should include all frequent measurements that can be used as input features and well test results that will be used as target values for training the models. For a typical oil and gas field, this data needs to be available for many pads, with each pad including multiple production wells.

The number of wells for a production optimization application can easily be in the order of hundreds to thousands. Organizing and unifying all the data sources necessary for a production optimization application requires an efficient data lake and a data model that enables quick and reliable access to all data sources. That enables to establish a simplified process’ digital twin, which describes process objectives and includes in decision tree only those KPIs, which are more relevant for the process efficiency. Additional KPIs to be considered are related to safety, security and environmental requirements, which shall be applied as a constraints. This method enables overall process optimization through integration of the network input and target KPIs, using AI-enabled techniques to maximize the overall profit.

Common Challenges	AI Implementation Results
<ul style="list-style-type: none"> <li>Reducing costs to remain competitive</li> <li>Improving performance to ensure the valorization of assets</li> <li>Improving the Environmental footprint</li> </ul>	<ul style="list-style-type: none"> <li>Efficiently optimizing a large number of wells</li> <li>Accurately estimating production</li> <li>Avoiding downtime by optimizing operational triggers</li> </ul>

## 6. EPC PROJECTS

Modcon Systems is the globally integrated Corporation, which is capable to provide best-in-class technology solutions for process industries EPC projects development. Modcon is committed to earning our place as a trusted partner to our clients by providing the highest level of service, value and advanced technology.

Modcon expertise in project opportunity identification, process technology selection and standard proven designs give you the tools to generate new products and inspired innovations that will delight consumers. The process starts by defining crystal clear goals based on the strategy and determining shared criteria for making choices. Only then are issues and opportunities identified, and ideas developed in a diverging / converging process with enrichment and concept creation stages. We can help you all the way from concept to successful realization with knowledge, experience and hands-on project support. This work culminates in our major deliverable: a detailed company action plan that puts you on the road to achieving both your long and short-term business goals.



Modcon provide all or part of the services for basic and detail engineering, procurement, construction and project management. We have an extensive track record in the implementation of large turnkey contracts and the arrangement of related international financing on behalf of our clients. We offer our services for:

- Value engineering and feasibility studies
- Basic engineering package
- Development of technical specifications and selection of equipment and materials
- Detailed multi-discipline engineering
- Purchasing and trade contracts with vendors, as required for the project execution
- Equipment expediting and logistics
- Construction administration and management
- Budget control
- Quality assurance, safety and site security
- Start-up and Commissioning
- Testing, performance validation and acceptance
- Operators and site personnel extensive training
- Process control strategy development and considerations
- Technological parameters definition for measurement and control
- Development the basic strategy for process control and optimization
- Optimization targets definition for different industrial processes and technological conditions
- Conceptual and strategic planning for process analysis, automation and advanced control

## 7. TECHNICAL SUPPORT



Process analyzers play today an important role in refinery and petrochemical processes control and optimization. Success in their implementation significantly depends on close attention to maintenance and ongoing technical support. Customer service is the primary function of the support packages offered by MODCON, providing our customers with best practice services, level of knowledge and professionalism. In order to provide expert service to its process analyzer systems users, Modcon offers a comprehensive technical support and maintenance program. The program's objective is to provide the resources to keep the complete customer's System on line with minimized down time. The program includes three different support options – basic, advanced and premium.

ANACON is a full-distributed Analyzer Management and Control System that was developed to provide more efficient tools for maintenance calibration and validation of the analyzer systems. It was configured to be connected to remote systems using communication links like TCP/IP or RS-485. ANACON was developed to be running on Microsoft Windows platform and able to monitor the operating state of the installed equipment and validate a wide variety of analyzers and instruments.

Graphical display tool from the multiple analyzers provides not only on-line information but also allows viewing historical data which is archived automatically upon configuration. Maintenance tool based on a remote access platform allows remote access to the appropriate analyzer's GUI for remote maintenance and calibration procedures.

With comprehensive expertise and dedication, our specialists will provide on-site commissioning with full inspections and conduct verification and functional testing of your system. This service will ensure that your overall project stays on schedule. Once this phase is completed your system is ready for commissioning. Verifying normally includes running calibration standards to ensure proper operations and compliance with design specifications.

With Modcon Service contract, you will be connected to the Modcon Service Center via Modcon Remote Service (MARS), the efficient and comprehensive infrastructure for the complete spectrum of remote support. Many services, updates and even immediate repairs that previously required on-site visits are now performed remotely.



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