

Honeywell Solutions for Corrosion *Corrosion as a Process Variable*



Global process control industries spend an average of US\$50 billion a year on corrosion problems that can hinder their abilities to operate at optimal levels. Honeywell's Proprietary On-line Corrosion Technology Can Reduce Corrosion Costs to Process Control Customers by up to 20 Percent.

Benefits

Honeywell field-proven corrosion solution offers measurable improvements and benefits:

- Increased plant uptime due to improved reliability of assets
- Reduction in maintenance costs by moving from scheduled to reliability-centered maintenance
- Maximized production throughput while protecting plant assets
- Improved safety by minimizing the effects of process upsets and excursions
- Significant reduction in inhibitor costs

A Winning Combination

With Honeywell's acquisition of InterCorr International, Inc. in 2005, Honeywell Process Solutions became the first and only automation and control supplier to offer real-time on-line corrosion detection for integration with the process control system. The integration of InterCorr technology with Honeywell's Experion® Process Knowledge System (PKS) will enable Honeywell customers to shift from traditional off-line corrosion assessment to on-line, real-time measurement, allowing them to realize significant reductions in corrosion expenditures and manage plant assets more effectively.

Corrosion as a Process Variable

Through integration with Honeywell's Experion Process Knowledge System (PKS), operators can transform raw corrosion monitoring data into high-value process knowledge. Operators can correlate corrosion data with process data to gain an awareness of their plant conditions, make critical business decisions quickly and take proactive actions to optimize short-term and long-term plant performance.

An integral part of the Process Knowledge System is the use of advanced applications, like Honeywell's asset, control and operations applications. Advanced applications with real time corrosion data are a further source of high-value process knowledge for the process engineer to make the right decision at the right time.

Honeywell's Corrosion Solution Consists of Three Elements *Systems, Expert Corrosion Services and Software*

Detecting corrosion is just the first step toward solving a plant's corrosion problems. Honeywell offers an integrated approach to corrosion problem solving with a solution that provides the correct and most efficient combination of products, services and software to our customers.

Systems

SmartCET® (Smart Corrosion Evaluation Technology) is the new Honeywell corrosion transmitter that embeds proprietary corrosion measuring technology to provide a convenient and efficient method to bring corrosion data to the process control system.

Services

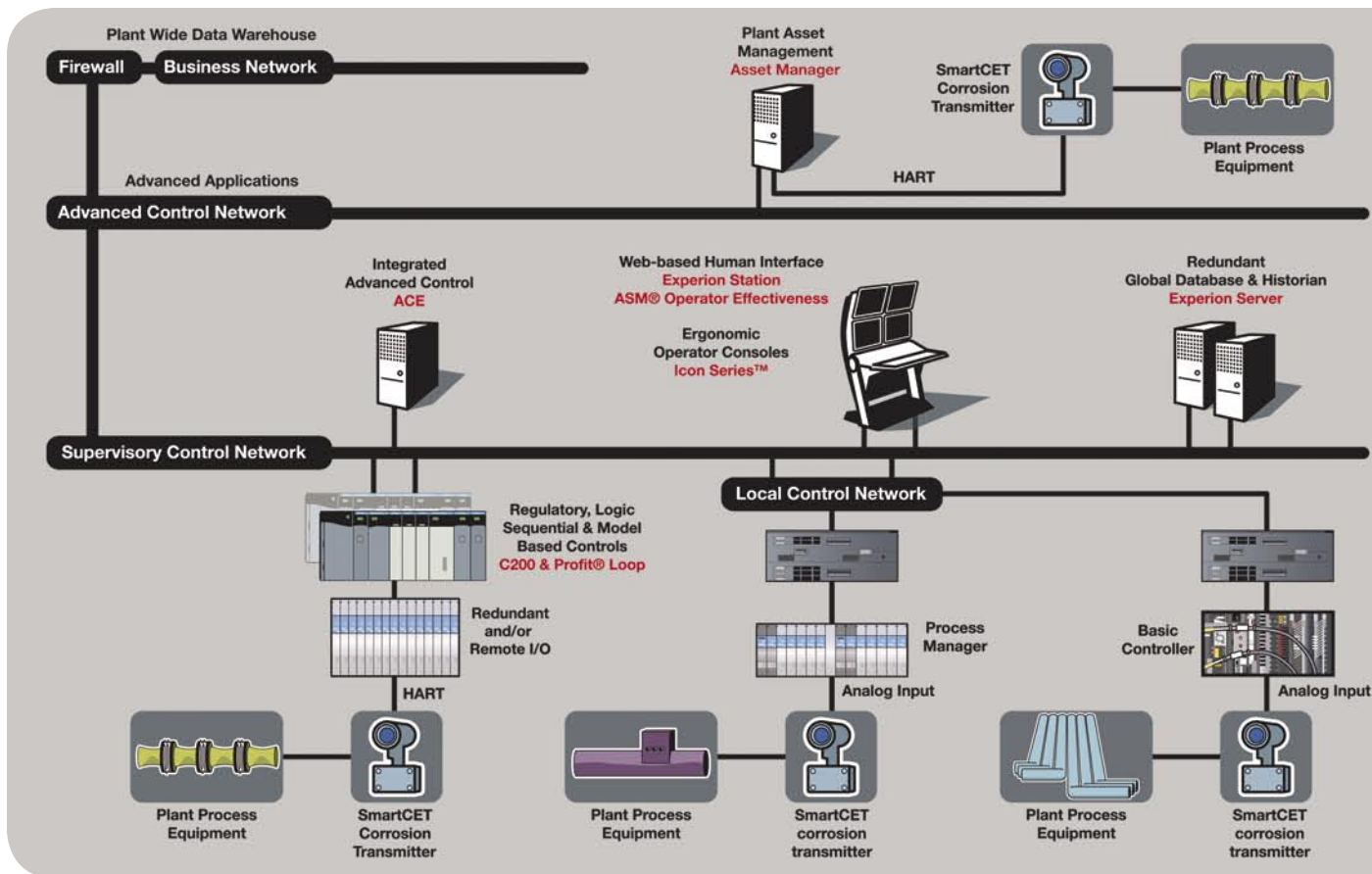
Honeywell's corrosion experts can complement your in-house corrosion resource and are fully capable of solving your tough plant corrosion problems. Our corrosion expertise ranges from lab services for metallurgical failure analysis to inhibitor screening to materials consultation with an emphasis on specific plant operating conditions to analysis of a plant's real-time corrosion conditions.

Software

Our software product offerings reflect over 20 years of corrosion expertise derived from our laboratory corrosion research benchmarked with actual field data and experience. Plant and consulting engineers have found tremendous value in our software products that aid in materials selection, corrosion rate prediction within pipelines and process equipment, and analysis of plant asset integrity and risk.

Serving customers in oil & gas, refining, chemicals, power generation, pulp & paper, aerospace, pharmaceuticals/biotech, and metals and mining industries, we offer a strong track record of creating value every day for major clients the world over.

Honeywell



Systems for Real-time, On-line Corrosion Measurement

The patented Honeywell SmartCET transmitter forms the foundation for our corrosion solution, uniquely providing on-line, real-time corrosion information that enriches the information in a process knowledge system.

SmartCET represents a major step forward for plant operators to improve equipment reliability, availability and integrity. SmartCET gives plant operators access to current, actionable process variable information including a time-trended general (uniform) corrosion rate. Also, it uniquely provides an indication of corrosion modality (localized or pitting corrosion) detection. **Localized corrosion accounts for approximately 70 percent to 90 percent of all corrosion-related equipment failures.**

SmartCET delivers on-line corrosion diagnostic data and improved accuracy of corrosion rate data previously unavailable to the process control system. Embedded within SmartCET is our proprietary Super LPR technology. Linear Polarization Resistance (LPR) is a proven method for measurement of corrosion trends. However, Honeywell scientists, with their extensive materials research background and plant corrosion knowledge, discovered a better, more accurate method to measure corrosion effects and developed a superior method to calculate corrosion, hence Super LPR. Super LPR couples LPR with two new Honeywell technologies for quicker and more accurate corrosion rate measurement and assessment of localized corrosion propensity. The result is that SmartCET is the only online, real time product capable of accurately monitoring localized corrosion (pitting).

SmartCET measures corrosion from a sensor or probe that interfaces with the process environment. Proper configuration of the probe to suit the specific process environment is essential to ensure accurate corrosion detection. The unique design of SmartCET enables it to connect to a range of different off-the-shelf and custom probe designs, each configured to provide the most accurate and reliable measurement of corrosion activity.

Equipped with the appropriate probe, SmartCET with proprietary Super LPR technology allows corrosion monitoring to be available to virtually all plant equipment, regardless of material or operating conditions. Examples include aqueous environments, oil-water or multiphase mixtures, vapor phase and high temperature applications. Honeywell specialists can review your existing corrosion monitoring system and provide valuable input for optimizing this system and updating it for online, real-time monitoring.

SmartCET communicates via the industrial standard HART protocol and can easily connect to your existing control system. As an input to the process control system, corrosion data can be alarmed, historized, trended, and assigned to process groups. Corrosion data can now seamlessly correlate with other process variables allowing the corrosion specialist and plant operator or engineer to work together, both having a broader view of plant operating conditions and methods of mitigation.

Users without HART capability in their process control system can connect the SmartCET signal to their process control system by means of an available 4-20 mA output from SmartCET, thus realizing all the benefits of corrosion detection. Additionally, a solution using Honeywell XYR5000 wireless transmitter product eliminates the need for new home run wiring.

“Our corrosion knowledge evolution grows from the application of expert services, systems, and software, thus adding to our customer’s bottom line value.”



Expert Corrosion Services

Honeywell's experienced staff of materials engineers and corrosion specialists provide expert services in the fields of corrosion, metallurgical and mechanical behavior, and failure analysis. Our staff of specialists is equipped to support these services with a state of the art and fully equipped corrosion testing laboratory and research center.

Testing Services

Honeywell's corrosion research laboratory specializes in the evaluation of metals, polymers, ceramics and coatings. Complete investigations are conducted in confidence, from initial field survey to delivery of the final report. The most advanced materials and sophisticated simulated service environment test equipment is available to support your field and plant engineering staff. Full-scale evaluations of load-carrying and pressurized components can be provided. Examples of our test services include:

- H₂S Exposures
- Hydrogen Embrittlement
- Naphthenic Acid Corrosion
- Simulated Service Tests
- Electrochemical Testing
- Mechanical Testing

Honeywell can also design and deliver customized corrosion and metallurgical testing equipment including Proof Rings, CERT Machines, High Pressure Reference Electrodes, Autoclaves, Flow Loops and more. Our research specialists have an excellent track record of designing test equipment to meet specific needs of our customers in all industries.

Engineering Services

With over 30 years of practical work experience in troubleshooting field corrosion problems, Honeywell corrosion experts have assisted clients by augmenting their in-house corrosion capabilities and functions. In addition to the engineering services listed below we can also develop and implement cost effective corrosion control procedures that are tailored to the unique needs of your process plant. Services include:

Plant Corrosion Surveys

- Review and analysis of historical corrosion data, failures, maintenance records, asset replacement
- Corrosion monitoring location recommendation
- Probe specification and electrode configuration
- Process-correlated analysis
- Plant diagnosis

Expert Consultation

- Plant material selection
- Inhibitor screening
- Failure investigation & analysis
- Process & corrosion simulation

Corrosion Testing & Modeling

- Corrosion prediction
- Operating condition analysis
- Sensitivity studies
- Process projections
- Simulation of service environments

Software

Honeywell's comprehensive set of software applications facilitates effective decision-making in the fields of corrosion and materials. These software offerings provide efficient and robust solutions to critical problems in corrosion, cracking and materials selection. Additionally, Honeywell offers software solutions for corrosion prediction in pipelines and production systems, and provides comprehensive services supported by the CorrosionAnalyzer™ modeling framework. Our corrosion software applications include:

Predict®-SourWater 2.0 Assessment of corrosion and flow effects. Materials optimization and risk reduction for refinery sour water systems (e.g. REAC, strippers, etc.).

Predict®-Pipe 3.0 Automated Internal Corrosion Direct Assessment (ICDA) for gas transmission pipeline systems.

Predict® 4.0 Assessment and prediction of corrosion rates for steels exposed to corrosive oil and gas production environments.

Predict® Amine Prediction and assessment of corrosion in amine systems for increased throughput and process optimization.

Socrates® 8.0 Provides comprehensive selection of corrosion resistant alloys (CRA) for oil and gas production environments.

Socrates®-B 3.0 Provides comprehensive selection of corrosion resistant alloys (CRA) for non-production environments (e.g. injected water, stimulation acids, completion fluids).

Strategy™ 3.0 Provides assessment of sulfide stress cracking and hydrogen induced cracking in steels, and prioritization of inspection in oil and gas production environments.

Strategy™-B 3.0 Provides assessment of sulfide stress cracking and hydrogen induced cracking, and prioritization of inspection in steels in refinery sour water systems.

Risk-IT™ Provides risk and integrity analysis for plant equipment. Evaluates common forms of corrosion degradation.

CorrosionAnalyzer™ Provides the ability to thermodynamically simulate and kinetically characterize corrosion in most industrial process environments; including interactions of over 2000 chemical environments and alloy combinations.

Each individual software package provides a unique solution to a corrosion problem. Additionally, many end users and Honeywell corrosion experts also have combined the use of Predict 4.0, Socrates 8.0, Strategy 3.0, Risk-IT, and CorrosionAnalyzer software applications to perform rigorous and complete corrosion and material characterizations for virtually any corroding system.

Joint Industry Programs

The Honeywell Joint Industry Programs provide specialized corrosion engineering and research services, dedicated to the investigation of common industrial corrosion problems. Each Joint Industry Program targets a specific industrial corrosion problem which all the sponsoring members of the specific program share equally in the results of the research study. Sponsors have the option to have additional tests conducted on their behalf under similar conditions on a proprietary basis. Sponsored programs include:

- Prediction and Assessment of Corrosion in Amine Systems
- Titanium Alloys for High Pressure, High Temperature (HPHT) Wells - Task 1 (Data & Experience Survey)
- Corrosion Prediction and Assessment in Sulfuric Alkylation Units
- Minimizing Refinery Crude Oil Corrosivity
- Assessment of Corrosion in Lean Amine
- Sulfide Stress Cracking (SSC) Limits for Sour Service and Deep Water Offshore Applications
- Prediction and Assessment of Ammonium Bisulfide Corrosion Under Refinery Sour Water Service Conditions - Phase II
- Prediction and Assessment of Ammonium Bisulfide Corrosion Under Refinery Sour Water Service Conditions - Phase I
- Remote Monitoring of Deep Water Pipelines
- Serviceability of Coiled Tubing - Phase II. Guidelines for Coiled Tubing in Corrosive Workover and Production Environments
- Predicting Crude Oil Corrosivity - Effects of Velocity, Interactions of Crude Oil Composition, Temperature and Alloying

CorrosionAnalyzer is a trademark of OLI Systems, Inc.

Find More Information

To learn more about Honeywell corrosion solutions, visit our website www.honeywell.com/ps or contact your Honeywell account manager.

Automation & Control Solutions

Process Solutions

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