

The key words in the evolution of Cathodic Protection remote monitoring

DATA ACQUISITION

MANAGEMENT

NEW PHILOSOPHY

FLEXIBILITY

MODULARITY

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Gas distribution is a world in continuously change in function of new arising needs and new organizations. This requires more flexibility and capability to adjust accordingly to the new strategic and operative exigencies of gas companies. The remote monitoring systems which supports technical processes, included the Cathodic Protection, must be able to quickly adequate to the new technical operating structures, both for large groups and for small companies. Cathodic protection systems must be reallocated without impacting on the new structures, maintaining all the information, taking advantage of the new concept of 'cloud', in order to guarantee flexibility and quick adjustment to new realities.

Not only the management systems but also the data acquisition units must be designed accordingly to modularity and scalability concepts, both economic and technical, to guarantee the best response to the real operating needs.

The last generation of data acquisition units must be able to cover all the possible requirements: from the essential control measures of the basic C.P. parameters to more complex measures as for DC and AC currents are concerned.

They must be characterized by common technological platforms but, at the same time, must have scalable costs in function of their real use.

Innovation - in services and products - and flexibility are now the new key words to move with the current times of deep and important transformations.

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1 Data Acquisition: the Data Loggers

The Data Loggers

Remote monitoring is a technique very influenced by the constant development of technologies.

After 10 years of working in Research & Development, as well as in the field of Cathodic Protection remote monitoring, Tecnosystem gets the advantage of its own knowledge, acquired both in direct field experience and by the feedback coming from end users.

The first consideration which comes out is that needs can be very different: they vary not only from country to country, accordingly to local regulations, but also from gas company to gas company, since each one applies its own internal rules and methods to control and measure Cathodic Protection values. Of course, this is always done in the respect of the main regulations (EN 12954, EN 13509).

However, different ways exist to manage CP measurements and remote monitoring: in Italy, as far as remote monitoring is concerned, there are two local regulations particularly applied to remote monitoring: UNI 11094 and UNI 10950. They are specifically dedicated to this subject, and considers the peculiarity of the Italian territory (presence of stray currents).

The Italian CP operators normally require two main measure: pipe to soil ON potential and current intensity, 24hours log in presence of stray current, and in case of low variability of the electrical field OFF off measures, effected disconnecting a coupon. A two channels datalogger is what they need; the data transmission is effected by GPRS, with SMS / GSM redundancy in case of low coverage. Of course, the unit must be able to perform 24 hours detailed log and ON OFF function.

The station is normally programmed with the standard threshold at -0,85 Volt, in order to detected how many times and how long the pipe has been out of protection in the day.

The unit detects 86.400 measures on each channel, reporting the summary of the day in terms of Minimum, Average, Maximum, Standard deviation, Number of times of threshold oversteps, Number of seconds out of protection in the day. This information is essential also in consideration of local requirements of the Italian Authority for Gas and Energy, which allows a maximum of 60 'missing' days of (not protection or not transmission)

Since the Datalogger is not a measuring instrument but it's classified like an 'indicator', a good practice is to provide a calibration auto-check to be executed at each measure, with an automatic report in case of wrong calibration.

The Datalogger is powered by an integrated battery package, which must have a significant duration, for few years.

The unit must be very simple to install, no specific knowledge nor special instruments such as laptop should be required, in order to optimize and simplify installation and maintenance operation.

Other useful features should take into consideration, like the possibility of storing the detected data in memory for a time extended enough to permit their subsequent recover in case of non transmission (which may happen for problems related to GSM coverage, due to phone operator temporary dysfunctions), the remote update of internal firmware, etc.

Are the needs for other countries than Italy the same? Not always. Although Cathodic Protection is a universal technique, controls and checks may vary.

For instance, in Italy, at least for the time being, we are not suffering many troubles coming from AC current interference. But in other European countries this is a real problem. The problem of induced AC currents on pipelines and its corrosive effects has been discussed for decades. The most recent research and field studies have provided more visibility to this issue. Research studies have indicated that pipeline AC current densities that exceed a specific threshold in Amps/m² at specific locations can exhibit AC corrosion, even though the cathodic protection levels on the pipeline are maintained within industry standards.

In practice, in such situation, where AC current is present, standard threshold of -0,85 V is considered not efficient enough, and AC current must be measured, normally through a 1 cm² coupon.

This brings to the surface the need of a different data logger, which must be able to measure both DC and AC current, at the same time.

In other situation, in addition to potential and current, also the T/R output voltage is required to be monitored. A two-channels data logger, in this case, is not enough, and more channels are required.

Again, some operators want to take advantage from the presence of power at installation (ex. T/R), and therefore a unit which can be adapted, or is designed to work with standard power sources can be required, satisfying, at the same need, an important requirement in terms of respect for environment, thanks to the minor use batteries.

2 Management: the platform

The Platform

Once the measures have been done by the Datalogger, it's necessary to have a good instrument to manage them.

Tecnosystem management platform – the website CCOL – G3 – has been specifically designed with the purpose of having a tool for handling the CP data, in a simple, quick, easy and economical way having, at the same time, a complete, detailed and historical view of the Cathodic Protection system, thanks to the automatized and continuous data collection.

The original idea, which aimed the creation of CCOL since its very beginning, is to always take advantage of the most recent technological solutions: born at the end of '90, CCOL was one of – or probably 'the' – first web application able to handle CP data. The platform has been restructured twice before arriving at the current version, the G3 – Third Generation, which has been enriched and implemented not only with several analysis tools but also with the most recent mobile applications for its utilization through the current smartphones or tablets, for controls, verifications and consultation directly in the field if when necessary.

One of the CCOL leading concepts is the constant control of detected and transmitted data: the backstage of what operators see when they surf on the website, is a complex and structured system which foresees the management of all the issues related to the front end machine to machine, such as the control of the correct transmission and receipt of data coming from acquisition units installed in the field, the proper functioning of the units, the control of faults and non-transmission, the calls repetition in case of missing transmission, as well as the control of the entire gsm network. The units are kept updated with remote upload of firmware and software upgrades, faults are monitored, battery levels are checked.

This – but not only – it's what's happening behind the scene in order to have an up-and-running system which allows the smooth manage of a critical issue like Cathodic Protection is.

3 New philosophy: CCOL G3, a pioneer

CCOL G3, a pioneer

We can consider CCOL like a precursor of the modern 'cloud' concept.

Wikipedia definition of Cloud computing is '...cloud computing is the use of computing resources (hardware and software) that are delivered as a **service** over a network (typically the Internet). The name comes from the use of could-shaped symbol as an abstraction for the complex infrastructure it contains in system diagrams.



Picture 1 – CCOL G3 as cloud computing

End users access cloud-based applications through a web browser or mobile app while the business software and user's data are stored on servers at a remote location.

Cloud computing allows enterprises to get their applications up and running faster, with improved manageability and less maintenance, and many advantages:

- **Location independence:** enable users to access systems using a web browser regardless of their location or what device they are using (e.g., PC, mobile phone). As infrastructure is off-site, provided by a third-party, and accessed via the Internet, users can connect from anywhere

- **Cost** is claimed to be reduced. Infrastructure is typically provided by a third-party and does not need to be purchased for one-time or infrequent intensive computing tasks.
- **Virtualization** technology allows servers and storage devices to be shared and utilization be increased. Applications can be easily migrated from one physical server to another.
- **Multitenancy** enables sharing of resources and costs across a large pool of users thus allowing for:
 - **Centralization** of infrastructure in locations with lower costs (such as real estate, electricity, etc.)
 - **Peak-load capacity** increases (users need not engineer for highest possible load-levels)
 - **Utilization and efficiency** improvements for systems that are often only 10–20% utilized.
- **Reliability** is improved if multiple redundant sites are used, which makes well-designed cloud computing suitable for business continuity and disaster recovery
- **Scalability and elasticity** via dynamic ("on-demand") provisioning of resources on a fine-grained, self-service basis near real-time, without users having to engineer for peak loads
- **Performance** is monitored, and consistent and loosely coupled architectures are constructed using web services as the system interface
- **Security** could improve due to centralization of data, increased security-focused resources, etc. Security is often as good as or better than other traditional systems, in part because providers are able to devote resources to solving security issues that many customers cannot afford. However, the complexity of security is greatly increased when data is distributed over a wider area or greater number of devices and in multi-tenant systems that are being shared by unrelated users. Private cloud installations are in part motivated by users' desire to retain control over the infrastructure and avoid losing control of information security.
- **Maintenance** of cloud computing applications is easier, because they do not need to be installed on each user's computer and can be accessed from different places.

CCOL presented some of the above listed characteristics already in its very beginning version over ten years ago, but they fit perfectly to the current version of the platform.

4 Flexibility: one resource, more solutions

One resource, more solutions

Going back to point 1, we saw that many different needs exist on the market, at the same time. They may depend on territory, on company's philosophy and also on company dimensions.

Always with reference to Italy, which is the territory where Tecnosystem is mainly operating – but the consideration can be valid also for other countries – we have assisted in the last 3 years to a considerable transformation, with a strong reduction of the existing gas companies. From almost 500 gas distribution companies existing in 2004, we now arrived to 239 in 2011 gas distribution company on the Italian territory, accordingly to AEEG data. Merges and acquisitions lead to the disappearing of small gas companies and to the creation of larger groups: this will be more and more happening in the near future, thanks to the next tenders for geographic franchises renewals.

Number of distributors in Italy

31 december 2011

Year	Number
2004	480
2005	430
2006	360
2007	338
2008	295
2009	259
2010	246
2011	239

Fonte: Indagine annuale sui settori regolati

March 2013

Table 1 - Number of gas distributors in Italy – source: AEEG website

As a company grows, the normal trend is to become owner of the data and to directly handle all the processes: a ‘make or buy’ analysis’ is conducted at the strategic and operational level in order to define how the most important company process have be handled. Make or buy decision is always a valid concept in business. No organization should attempt to make something by their own, when they stand the opportunity to buy the same for less price or effort.

Reasons a company would consider when it comes to making in-house are related to cost concerns, need of direct control over the process, intellectual property concerns, lack of competences regarding the process, political and environment reasons, etc.

At the same time, the reasons companies may consider when it comes to buying from a supplier are connected to lack of technical experience, supplier's expertise on the technical areas and the domain, cost considerations, strategic choice, etc.

Even for a large company, the number of necessary competences in order to go toward the ‘make’ option is considerably high, especially for a niche and specific process like Cathodic Protection is, which may not justify the opportunity cost, which could remain too high.

At the same time, two very important factors must be considered :

- CP data are not sensible data
- Cathodic Protection i is a direct process (and not a one-to-many one)

Since the CP data is not impacting on other process, like invoicing, for instance, it rather natural that the decision goes toward the 'buy' option and to outsource the process: data is not so much strategically important and, in addition, buy costs are normally lower.

The opposite is normally happening for the one-to-many processes like, for instance, remote readings of gas meters, where the detected and transmitted data is going to impact on several other company sectors: it's evident, in this case, that the strategic evaluation of the 'buy or make' analysis is very different, and can naturally lead to the opposite choice.

In this view, CCOL G3 fits perfectly either to large companies and to small ones companies, which may have opposite needs: both of them get advantage of a ready-to-go solution, having high level performances, analysis tools, mobile apps, etc.

5. Modularity: adaptation capability to different needs

Adaptation capability to different needs

In consideration of described up to know, if we combine the needs in terms of data acquisition units with the data management requirements, we could obtain a variety of combinations, which are the response to real operating needs as well as to the financial and strategic ones.

A new data acquisition units

During the last 8 years Tecnosystem has evolved and developed different types of data acquisition units:

- the Drone, the standard 2 channels Datalogger dedicated to the Italian market;
- the Tricorder, the special 2 channels Datalogger, specifically designed for GRT Gaz;
- the Hyperdrone, the 2 channels Datalogger, for the measure of DC or AC current;
- the Skydrone, the 2 channels Datalogger, for the measure of DC or AC current and satellite transmission;
- the Megadrone, the 4 channels Datalogger, for the measure of DC and AC current:

Each one respond to a specific need, and has been designed having in mind a particular country or a specific need.

Now, after 5 years from the release of the last born of the Drone family, the Megadrone, a new data acquisition unit is going to come to light: the Next - the new data acquisition unit - is the new multi channel station, which shall become the company standard for all markets and customers, combining customization and standardization in one unique solution.

The Next shall replace all the previously existing units, covering all end users' needs thanks to its dynamic customization possibilities.

The development of the new data acquisition unit responds to the different filed needs in a quick and flexible way, as well as to new technical requirements (i.e AC current measures).

At the same time, it's very important to be able to respond also to company's organization needs:

- some companies want to become owners of their data;
- other ones may have different requirements, which could come out from complex organizations and structures';
- other may want to harmonize data collection with internal procedures;
- other need to satisfy territorial organization needs.

The reply to these needs it the capability of adapting quickly and easily, in order to fit large customers' requirements, but without forgetting small companies; in this view, Tecnosystem has developed system architecture solutions, to fulfill companies organization needs in a structured and modular way.

6. Conclusions

The innovation in services and products and implementation of new technologies are essential elements to maintain process on line with the varied needs and requirements.

The capability of quick adaptation to the

- Field technical needs
- Strategic and organization requirements
- Respect of environment and consideration of the whole life cycle
- Satisfaction of small customers' needs as well as of large groups

is the key factor, flexibility and modularity are the new key words for moving with the current times of deep and important transformations.