

Cathodic Protection
The managing experience of a supplier of services, handling the day by day running
of a remote control system

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In these last years the institutional set of rules has been continuously requiring to all gas distribution companies an always more and more careful managing of cathodic protection; at the same time, technology improvements allow people to have access to new instruments and innovations, in order to better satisfy the always growing request of remote control in this peculiar field.

The translation of operating company's requests into real projects of cathodic protection monitoring in order to satisfy both technical and economical requirements, has been our mission since 2000.

To supply data relevant to the measure of the single cathodic protection detection point under the formula of an 'all inclusive' monthly rental fee has been the key of our success.

Up to day, we are able to monitor over 8.000 points spread around the Italian and European territories. Our operating experience as supplier of services, showed us how to recognize the success critical factors and avoid the system's inefficiencies, pushing us to constantly invest in research and innovation.

Chapter 1 – The history

Tecosystem Group has been founded in 1988 and started working in the field of Cathodic Protection.

Thanks to skilled and qualified resources, and to the wide experience in all application fields of data detection and cathodic protection – engineering, building, and remote control, either for distribution networks and for industrial plants – Tecosystem is able to supply a complete service and innovative solutions as for remote control, detection, data handling and prevention from corrosion.



Picture 1: Examples of piping subject to corrosion with buried electrode



Picture 2: image of yard with drill



Picture 3: image of a test point with transformer rectifier

Chapter 2 – The measures

The intense activity in the cathodic protection sector led us in few years to handle more than 300 electric systems, even on account of third parties, spread on the whole Italian territory.



The measures were initially effected in a traditional way, that is to say the measures were detected manually, and this made us reflecting about following implications:

- ⇒ The human resource absorption for the manual handling normally grows and grows in a way which cannot be initially defined and which can be hardly organized on a wide territory
- ⇒ The prescription trend leads to a higher and higher measures capillarity, higher frequency and, generally speaking, to an higher managing complexity from the manual point of view

- ⇒ The utilization of 'skilled' human resources to perform a field activity subtracts time and resource to the much more important job relevant to the analysis of the detected data, without enhancing the capabilities of qualified personnel
- ⇒ The non homogeneity of the data post processing and of their distribution, in terms of frequency, formats, etc.

In addition the recent regulations put in always higher evidence the difficulties connected to a manual handling which can be considered adequate for such a high number of measures

Chapter 3 – From manual controls to traditional remote control

In order to better handle the measurements activity, the company projected, initially for an exclusively internal use, some devices for remote control; the same instruments were then sold to those customers interested to perform the remote control on their cathodic protection systems; this first natural passage to the remote control starts in the first '90s.

Initially, only the transformer rectifiers are equipped with 220V peripherals; this choice is strictly connected to the rectifiers nature: since they are power supplied with 220V they can be connected to a remote control devices working with 220V current as well.

The peripherals are traditional RTU units with communication multi-vector (radio, phone, gsm) and, since powered with 220V current can be installed only in cabinets equipped with current supply and having room enough to locate the unit.



Picture 4: a test point with remote control unit on electro-mechanic power supply



Picture 5: a test point with unit for remote control and command of the power supply

The instruments can be matched either to electro-mechanic power supplies for the sole remote detection, or to digital ones, for the remote detection and command.

This led us to develop a sort of traditional architecture: the Data Center is constituted by a unique operator who, periodically, connects to the peripherals for effecting the data control.

Initially, this kind of approach seemed to be correct and efficient, and we therefore started to transfer our technology to all our customers but, after few years, we realized that many of them did start to installed the instruments (either ours or of our competitors) but no one was going on up to the end in a systematic way, realizing a capillary and distributed data collection.

It was clear that the installation of the remote control normally stopped after being effected on few installations; despite various tens of installations, nobody (or almost so) was reaching the end of the process, neither with ours or with competitors products

At this point we decided to form a working group to analyse the reasons which were leading – both from a technical and from a procedural point of view – to a stalemate situation.

This analysis brought to the surface few essential points which can help to clarify why the traditional approach is not right for the real exigencies.

Here following what we call the 'critical points', whose nature is essentially Technical – Economical and Managerial

Chapter 4 – The critical points

Technical nature:

- ⇒ It was not sufficient to concentrate the attention on transformer rectifiers only, just because their nature includes the presence of current, and where there was space enough to admit the use of peripherals but it was necessary to develop smaller devices, able to work – battery powered - for long periods, having a dimension which allows their installation also in the test points inside the standard containers normally installed in the field
- ⇒ The materials were subject to a quick obsolescence because of new technological and/or prescriptive exigencies

- ⇒ To maintain the process in line with regulations, the number of data transmissions from and to the peripherals was constantly growing; this makes more efficient an 'out bound' process rather than an interrogation, even programmed, on the whole territory
- ⇒ The installation of those devices which were needing a local programming was particularly complex

Economical nature

- ⇒ Uncertainty of ordinary and extra ordinary maintenance costs, for failures on devices, thefts, atmospheric events, etc
- ⇒ Uncertainty of telephone costs, either ordinary or extraordinary for phone cards failures, billing mistakes, etc.
- ⇒ Hidden costs for devices technological update for future implementations either technical and prescriptive
- ⇒ Uncertain costs for personnel dedicated to the continuous monitoring of the GSM devices to guarantee the transmission continuity for a minimum period per year (currently, the Authority guide line fixes this period in a minimum of 30 days for Italy)

Managerial nature

- ⇒ Handling of purchases for the consumable materials (batteries, dischargers, etc)
- ⇒ Complex handling of programming, repairs, substitutions, supply of consumable materials, etc.
- ⇒ Problems connected to the continuous software updated for data detection and processing, in order to maintain the system in line with the current and future regulations
- ⇒ Complex handling of reports to be submitted to third parties (like Railways Company, Authority, etc)
- ⇒ Difficulty of information distribution to more offices, or even to more desktops in the same building
- ⇒ Complexity of handling on users' side, in consideration of the technological know how, like periodical back up, disaster recovery systems, etc

We understood that for a substantial improvement it was necessary to change the method and the approach.

The immediate consequence of this intuition became concrete in the choice of dedicating to the project people and structures; a working team was created initially to operate as R & D and then, after a detailed exam of the technologies available on the market and after a careful evaluation of their possible evolutions, we created a structure properly dedicated to the various activities connected to the Service (Data Center, Laboratory, etc.)

Chapter 5 – The cooperation with Italgas

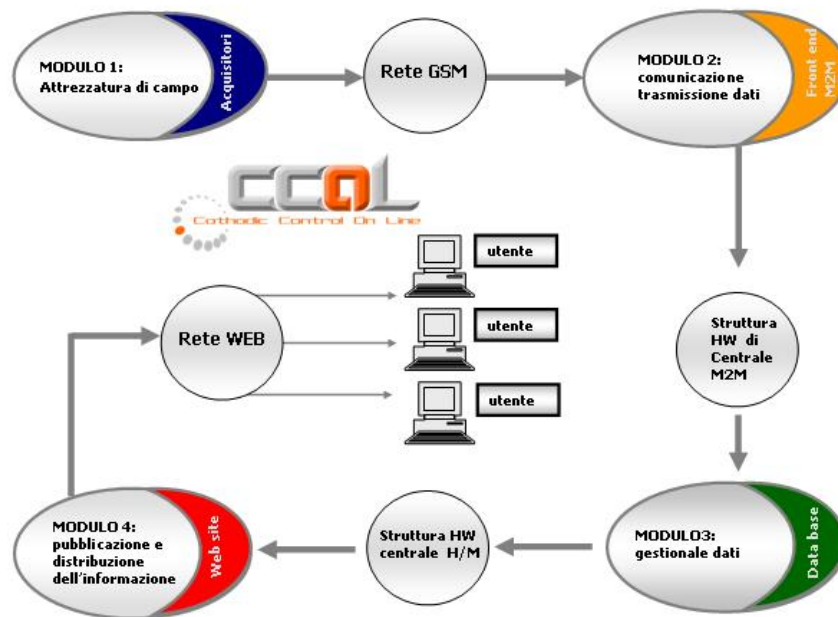
The embryonic project which was conceived on the paper was at that time submitted to Italgas, who did already effect the maximum rationalization of control and maintenance procedures; in order to further reduce the costs and, at the same time, improve the service level, it was necessary to adopt a new philosophy and the utilization of a completely automated system.

It was clear that Italgas had the exigency to introduce a managing system founded on the completely automated and continuous acquisition of the main electrical parameters, thanks to innovative technologies which lead to the elimination of programmed maintenance manual controls.

The cooperation with Italgas confirmed once more that the concept of 'sale of technology' was no more sufficient and not adequate to the managerial exigencies; we therefore passed to a new concept, the concept of SERVICE, subsequently structuring a modular system which includes everything's necessary to get at certain costs and times the required information.

The service structure can be either *GLOBAL (all inclusive)* or *MODULAR*

Charter 6 - The service and its elements



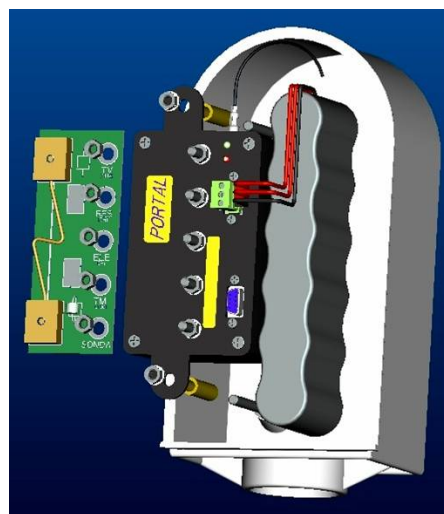
Picture 6: the information flow chart

MODULE 1: the Acquisition Unit

- ⇒ Specific remote control unit for the measures equipped with GSM modem for data communication
- ⇒ Periodical update of the hardware and firmware functions in view of possible future prescriptions or technological implementations (like change of communication vectors, or further functions to accomplish to new regulations)



Picture 7: the acquisition unit inside a standard container



Picture 8: exploded view

MODULE 2: communication and data transmission

- ⇒ 'All Inclusive' ordinary and extraordinary maintenance of all the field devices (acquisition units, GSM, sensors,) to cover any damage (with the only exclusion of theft) for an unlimited number of times
- ⇒ Total warranty against external events (atmospheric discharges, vandalism acts, accidents, flooding, fires) to cover any damage for an unlimited number of times
- ⇒ Supply of all consumable materials like batteries, including the handling of expiring dates for a due time supply of new pieces, relevant deliveries and stocking of adequate spares to in order to meet possible future lacks for production interruption
- ⇒ Availability of the entire Data Center structure for the handling of the M2M front end for communications, including the GSM vectors, amplified filtered directional antennas, data receiving PC clients, redundancy 220V power supplies, UPS systems, emergency power supplies, wide band network structures, multi-channels and multi-protocols GSM softwares and drivers (SMS, fax/data, GPRS); the service is comprehensive of the ordinary and extraordinary maintenance of the entire Data Center structure, including the continuous technological upgrades of the telecommunications and ICT sectors
- ⇒ GSM Sim Card supply, as well as the entire phone traffic with an 'open flat rate', independently from the real traffic volume, or SIM failures, or Acquisition Unit failures which can cause unpredictable abnormal traffic. Handling of the telephone contracts with the GSM network phone operators, handling of failures and blocks, Sim recharge costs, taxes, etc.
- ⇒ Continuous monitoring of the whole network: acquisition units, GSM network, M2M front end, with immediate information to final user of anomalous facts, field diagnostic, like acquisition unit failures, batteries, prolonged lack of transmissions, immediate shipment of substitution pieces to local customers premises. Handling of all the dossiers for field interventions openings and closures, storing of all acquisition units installation details, detection of satellite position of each single test point, with proper tools
- ⇒ Call center providing assistance (business time) with a company tutor, for any information relevant to Internet and website use, help for data analysis or calls for interventions on failure acquisition units



Picture 9: the Data Center activity



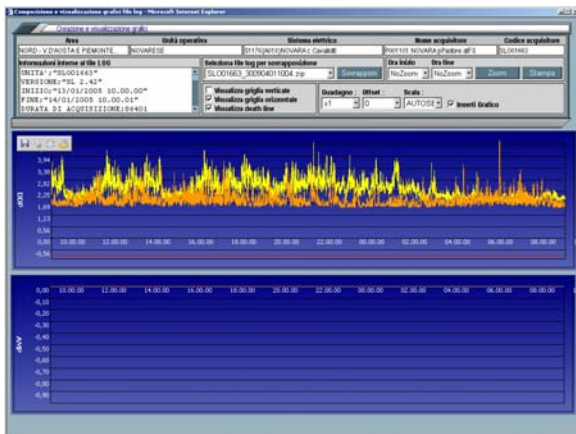
Picture 10: the Data Center

MODULE 3: Data handling

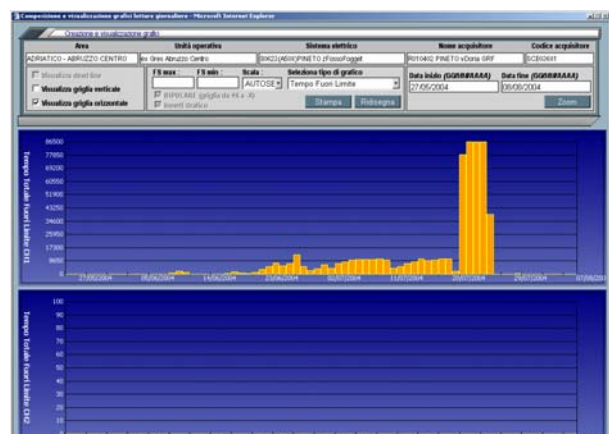
- ⇒ Structured data base for the storing of all clients details as well as the storing of the complete data detected in the field, including the 'manual' data, like measures manually executed in the field, external cartographies, log files produced with other devices and / or instruments
- ⇒ Specific managing software, for single application, containing all the service operating procedures for the process and the presentation of all the detected data, including reports for third bodies, like the Railways Company, adequate to current regulations, data export for other environments, like GIS or SAP systems
- ⇒ Availability, relevant handling and ordinary maintenance of the necessary servers for the data base utilization; the service is comprehensive of all the Hardware and Software structures for the scheduled back up, 'disaster recovery systems', and the Data Center client / server network
- ⇒ Periodical update of the managing software for possible changes of customer's exigencies and/or new prescriptions



Picture 11: the data base



Picture 12: Graphs



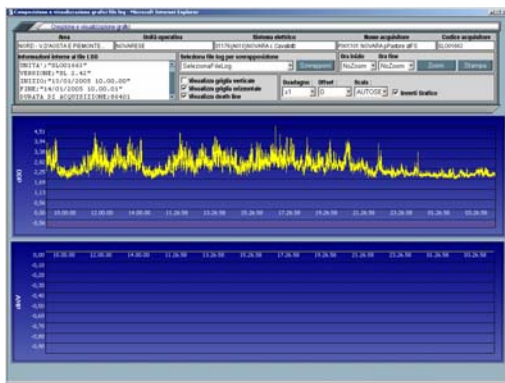
Picture 13: Graphs

MODULE 4: Information distribution and publication

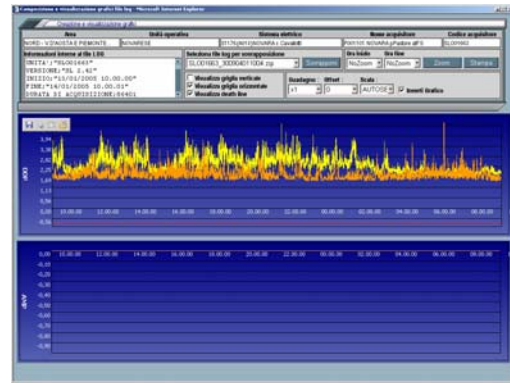
- ⇒ Web server and network structures rental, handling, ordinary and extraordinary maintenance, for the publication and distribution on Internet platform of all detected and processed data
- ⇒ Application software for the utilization of the data base directly on the Web, with standard browsers like Internet Explorer
- ⇒ 2 MByte guaranteed wide band connectivity, with no limits for simultaneous access and including all the traffic either in download or in upload
- ⇒ Web Housing services:
 - Safe environment, conditioned and guarded to host operating devices in complete efficiency H24 , 365 days / year

- High performances wide band Internet connectivity, tested on direct connexions at MIX – Milan, and on multiple connexions with international carriers
- Possibility of acceding to alternative carriers services, present inside the Data Center: Colt, Fastweb, EdisonTel
- Power supply and network connectivity redundancy to increase the availability of the supplied services
- Pro-active monitoring of network, systems and applications critical conditions
- Warranties of service level regarding availability, connectivity and delivery times

⇒ Anti – intrusion data base safety system, guaranteed by hardware and software firewall systems, multiple levels of user names and passwords, with scheduled periodical changes (agreed with users), cryptographic keys with SSL certified codes



Picture 14: The access to the website



Picture 15: The access to the website

We are currently handling not only the activities connected to the ordinary running of more than 10.000 points distributed on about 45 gas and water companies, but we are also constantly active on the new processes, on the continuous update respect to technological innovations and on increasing and improving the daily routines, for an always better optimisation of time and resources.

Chapter 7 – The regulations evolution

The recent evolution in terms of prescriptions and regulations confirmed that our decision to change the method and the approach revealed to be a fundamental passage; respect to guide lines, the evolutions put always a major emphasis on measures and systems.

The instant manual measures decrease, to leave their place to the recorded measures. The remote control is recognized as a valid warranty for service continuity. In Italy, for the first time, a measure which contains short no protection times is considered valid and accepted.

In addition, the detected data will be collected in a tool called the 'cathodic protection indicator' which supplies the system protection evaluation.

If the sufficiency is not reached, the company is compelled to set up the necessary recovery plans.

A new character is introduced, that is to say the Responsible for the Cathodic Protection, a skilled and qualified person named inside the Company, who must issue once a year a report on the cathodic protection systems.

Charter 8 – The service advantages

A 'service' can not only solve the 'critical points' we have illustrated, but also gives important advantages:

- ⇒ Certain and invariable cost of the system, respect the traditional manual method or respect the traditional housing remote control, which verges to inevitably increase as time goes by
- ⇒ Extremely high efficiency level of the maintenance system
- ⇒ Ready-to-go reports issuing, with no mistake possibility
- ⇒ Exemplification of the internal procedures respect the ISO quality systems, and increase of the safety level
- ⇒ Immediate evidence of problems on the cathodic system, which could produce economical damages to the network
- ⇒ Behaviours uniformity and enhanced company vision on the handling of one of the most relevant processes in the distribution network

Chapter 9 – The current distribution of the test points

- ⇒ More than 10.000 points on the whole European territory
- ⇒ 4.500.000 data transmissions per year
- ⇒ More than 400 Gb of GSM detected information / year