

**ABSTRACT: The importance of an adequate management and schedule of the activities for maintenance and control of the Cathodic Protection systems' efficiency**

The current technical regulations indicate that, in addition to the typical control activities on the electrical parameters of the cp systems – typically the 'measures' – it's necessary to periodically effect some maintenance activities both on installations and test points.

These activities must be carried on in the respect of a typical planning and of a scheduled maintenance, with operations and times to be respected accordingly to a pre-defined action plan.

For the activities inherent to verifications and controls of the apparatus installed in the field have the purposes of testing the efficiency of the cathodic protection applied to the structure, the under evaluation of such operations importance could seriously compromise the system's efficiency and, as a consequence, lead to the necessity of expensive extraordinary maintenance actions.

The incorrect planning and schedule of the activities revolves into an incorrect human resources optimization and to a weak managing efficiency: last, but not least, it's always more and more necessary to create an history and document the activities effected on each single measure point, with the enhanced necessity of a sort of 'certification' of the effected maintenance intervention.

This presentation analyses which are the current proper instruments which can put the operators in condition of effecting these activities in the respect of a simple, homogeneous and efficient handling.

**ABSTRACT: L'importance d'une correcte gestion, programmation et planification des activités de maintenance pour le control de l'efficace des systèmes de protection cathodique**

Les réglementations techniques en vigueur prévoient que, en plus des activités typiques de contrôle des paramètres électriques de protection cathodique, typiquement les 'mesures', il est nécessaire d'effectuer périodiquement des activités de maintenance des installations et des points de mesure.

Ces activités sont conduites dans le respect d'une planification typique d'une maintenance programmée, avec des opérations et des temps à respecter selon un échéancier prédéfini.

Lorsque les activités inhérentes les vérifications et les contrôles des appareils installés sur le terrain ont comme but de vérifier l'efficacité de la protection cathodique appliquée à la structure, le sous-évaluer l'importance de telles opérations pourrait en compromettre l'efficacité avec, en suite, la nécessité de coûteuses interventions de maintenance extraordinaire.

Une incorrecte programmation et planification des activités se traduit dans une manquée optimisation des ressources humaines et une fiable efficacité de gestion ; encore, il est toujours nécessaire historier et documenter les activités effectuées sur chaque point de mesure, avec l'évidente nécessité d'une 'certification' de l'intervention de maintenance effectuée.

Cette présentation analyse les instruments nécessaires et actuellement disponibles pou mettre les operateurs dans la conditions de dérouler les activités dans le respect d'une gestion simple, homogène et efficace.

## TEXT

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. In consideration of this, Tecnosystem Group introduced, in the last 8 years, the CCOL service, which is now an established and recognized standard in cathodic protection, for the automated collection of CP data which are then made available to end user through Internet platform.

Up to day, Tecnosystem handles over 15.000 remote control devices, installed throughout over 80.000 km network in Europe.

Since we are continuously focused on the service improving accordingly to the different exigencies expressed by users, thanks to this the system is constantly getting better and better, for a sort of 'auto regeneration'; recently, we have been led to draw our attention on the fact that in the cathodic protection maintenance, in addition to the typical activities relevant to the control of the electrical parameters (typically: the measures) it's necessary to effect periodically few maintenance activities of the installations and of the test points.

These activities are foreseen by the current technical regulations, and must be carried on in the respect of a typical planning of a scheduled maintenance, with operations and times to be respected accordingly to pre-defined schedule.

These activities are substantially of two types:

- Lists of control activities to be effected and checked out
- Data parameters to be detected

The European reference for the 'Maintenance and Verification' is the UNI EN 12954, integrated in Italy by the UNI 11094.

In particular, at chapter 10 UNI-EN-12954 says that *'The purpose of maintenance and verifications is to ensure the efficiency of cathodic protection through the entire structure's life'. It is necessary to have available recording systems of those data relevant to verifications and maintenance. For a limited quantity of data the manual systems can be considered acceptable, while for large data volumes informatics systems have to be preferred..'*

**Point 10.3:** *"The verification of a cathodic protection system efficiency, can be subdivided in two areas: control of the installations and measures on the structure.... Examples of measures are the structure – electrolyte potential measures. Examples of installations verifications are the visual controls of power supplies, of its output data as well as the mechanical integrity of the test point*

Comment: the activities relevant to verifications and controls have the purpose of testing the efficiency of the cathodic protection applied to the structure. They can be executed manually, by an operator, or through remote monitoring. In case of activities effected by the operator, at the same time the measure activities are effected also the visual controls of the installations are done.

As for systems controlled by remote monitoring, where, as per article 10.3.3.3, the scheduled verification activities are not applied, the visual controls of the installations are done along the maintenance activities.

**Point 10.4:** “it is recommended that the maintenance to impressed current installations and to drainages is done yearly. When the functioning verifications or the visual controls indicate the necessity, also the maintenance at the test point must be executed. The electrical safety must be verified accordingly to local regulations. The results of the verifications must be registered and archived...’

Comment: the periodical maintenance of the installations and of the test points, must be planned and scheduled in order to guarantee the efficiency of the installations and systems related to the cathodic protection. The maintenance operations must, in addition, guarantee the safety of the electrical installations accordingly to what the local regulations prescribe (in Italy che CEI 64-8 regulation)

**Italian regulation UNI 11094 point 9.3 Verification of the efficiency of the components of a cathodic protection system**

The chapter 9.3 of the UNI11094, integrated what already mentioned in the UNI EN 12954, make a list of all the possible components present in a cathodic protection system, and for each one it indicates the activities to be effected in order to guarantee the operative efficiency

**SUMMARY**

- The verification activities are finalized to guarantee the efficiency of the cathodic protection systems. The controls done by operators are scheduled by a planning of the verifications themselves and a data archiving systems, as per what indicated in the table at point 10.3.3.1 of UNI EN 12954 (detailed in Italy by UNI 11094). The adoption of a remote monitoring system, the scheduled verifications are omitted since the system itself guarantees a more specific and punctual control on the system’s efficiency
- The maintenance activities guarantee the efficiency of the installations related to the cathodic protection system. The installations and the test points must be submitted to regular maintenance accordingly to a properly scheduled program, in function of their typology. In this program, it must be listed the activities to be effected, the frequency of the interventions, in function of installation type. The collected data must be archived along with the results of the effected maintenance operations and made available for subsequent controls.

We are therefore going through how planning and archiving the data relevant to the activities of scheduled maintenance. An example of a power supply maintenance sheet can make clearer the activity to which we are referring:

ALIMENTATORI					
TIPO DI OPERAZIONE					
MANUTENZIONE			MANUTENZIONE		
DESCRIZIONE	FREQUENZA			DESCRIZIONE	FREQUENZA
	R1	R2	R3		
<b>Lecture e Misure:</b> 1. lettura contatore dell’Ente fornitore di Energia Elettrica 2. corrente e tempo d’intervento interruttore differenziale 3. resistenza dispersore di protezione catodica 4. resistenza di terra 5. tensione di rete 6. isolamento cavi di alimentazione 7. prova di continuità tra nodo principale e la presa di terra 8. prova di continuità tra nodo principale e l’apparecchiatura	2A	2A	2A		
<b>Attività:</b> 1. prova funzionamento apparecchiatura con: controllo presenza tensione di alimentazione elettrica 2. controllo efficienza dispositivi protezione 3. controllo valori strumentali e massima erogazione 4. controllo visivo e/o strumentale della funzionalità degli scaricatori 5. controllo della presenza e dello stato della segnalatica funzionale ed antinfortunistica 6. prova funzionamento interruttore differenziale premendo il tasto di prova “T” previsto su ogni apparecchio (**da svolgere preventivamente anche tutte le volte che si interviene per eventuali anomalie sull’impianto, che generano un intervento di manutenzione non programmata)	2A	2A	2A	<b>Attività:</b> • sostituzione batterie dell’apparato trasmissione dati di protezione catodica (anche non in contemporanea con le altre attività) 1. pulizia armadio (interna ed esterna), apparecchiatura e morsetti 2. verifica ed eventuale aggiornamento della documentazione d’installazione e di esercizio, come schemi elettrici e denunce impianti. Le documentazioni devono essere rispondenti all’effettivo stato attuale delle installazioni, comprendendo le variazioni introdotte rispetto al progetto originario. Tali operazioni saranno a cura dell’Unità Operativa che ha in gestione l’impianto 3. sostituzione dei componenti che si sospetta o che risultano essere di scarsa affidabilità 4. eventuale sistemazione, fissaggio, o sostituzione dei cartelli e contrassegni antinfortunistici 5. manutenzione serratura armadio 6. verifica elettrodo di riferimento fisso e collegamenti elettrici	2A



NUMERO SAS 000001	SAS		CODICE SISTEMA S00001	
AZIENDA	XXXXX			
AREA	XXXXX			
UOT	XXXXX			
SISTEMA	S00001			
SCADENZA	APRILE 2006			
		L'Attributo Punto indica la tipologia del punto di misura		Nella colonna Operatore compare il nome dell'operatore che effettuerà l'attività
CODICE PUNTO	ATTRIBUTO PUNTO	MAP	DATA	OPERATORE
C0706	Drenaggio	MAP00001-D	12/04/06	G. Rossi
B0568	Drenaggio	MAP00002-D	20/04/06	G. Rossi
A1200	Alimentatore	MAP00003-A	20/04/06	F. Verdi
A0215	Attraversamento	MAP00004-T	20/04/06	F. Verdi
F0358	Giunto	MAP00005-G	30/04/06	A. Bianchi
G4588	Punto di Misura	MAP00006-M	30/04/06	A. Bianchi
F0006	Nella colonna MAP compare il numero di riferimento del Modulo Attività Punto	MAP00007-A	30/04/06	R. Ferrari
R0205		MAP00008-A	30/04/06	R. Ferrari

NUMERO MAP 000001	MAP		CODICE SISTEMA S00001	
AZIENDA	XXXXX			
AREA	XXXXX			
UOT	XXXXX			
SISTEMA	S00001			
SCADENZA	APRILE 2006			
SEZIONE MISUR				
DESCRIZIONE			ESITO	
<ul style="list-style-type: none"> <li>lettura contatore dell'Ente fornitore di Energia Elettrica</li> <li>controllo e tempo di intervento interruttore differenziale</li> <li>resistenza di percorso di protezione catodica</li> <li>manutenzione di terra</li> <li>testazione di rete</li> <li>isolamento cavi di alimentazione</li> <li>prova di continuità tra nodo principale e la presa di terra</li> <li>prova di continuità tra nodo principale e l'apparecchiatura</li> </ul>			MISURA	conf / n/conf
SEZIONE ATTIVITA'				
DESCRIZIONE			ESITO	
<ul style="list-style-type: none"> <li>sostituzione batterie dell'apparato trasmissione dati di protezione catodica (anche non in contemporanea con le altre prove)</li> <li>controllo presenza tensione di alimentazione elettrica</li> <li>isola armata (interna ed esterna), apparecchiatura</li> <li>controllo efficacia dispositivi protezione</li> <li>verifica ed eventuale aggiornamento della documentazione tecnica</li> <li>controllo valori strumentali a manina sequenza</li> <li>sostituzione dei componenti che si sospetta o che risultano essere in avaria/irrimediabili</li> <li>controllo visivo/visivo strumentale della funzionalità degli scaricatori</li> <li>eventuale manutenzione, risaggio, o sostituzione dei controlli e contrassegni antirifurto</li> <li>controllo della presenza e dello stato della segnaletica funzionale ed antirifurto</li> <li>manutenzione struttura armata</li> <li>prova funzionamento interruttore differenziale premendo il tasto di prova "T" previsto su ogni apparecchio</li> <li>verifica elettrodo di riferimento fisso e collegamenti elettrici</li> </ul>			MISURA	conf / n/conf

### Examples of the different scheduling forms

In addition, it is useful to integrate this planning instrument with other complementary tools, for a simpler, homogeneous and integrated management of such activities; in particular, in order to speed up the finding of the working forms, it is useful an adequate hardware instrument, a palmtop which we named PAD, featured by an extremely simply use, which does not need any specific instruction, able to dialogue with the main database, receive the data through a serial / USD port for a subsequent fill up in the field once the activities are performed.

The palmtop is able then to transfer the data to the main database, on the Internet server, always through the serial port.

We also know that, sometime, for different reasons, it is necessary to integrate the automatically detected measures with manual measures:

- One or more remotely controlled points gave protection values which are far from the reference parameters
- Post commissioning measure campaign
- Extraordinary measures campaign for network balancing
- Individuation of new significant points
- Measures acquisitions during the maintenance operations
- Insulating measures
- Extraordinary registrations for electric field variability analysis
- ON OFF campaigns

It can be therefore considered useful to have available a traditional data logger, which we named DATA BOX: this data logger connects to the palmtop for the immediate data transfer, in the field, of the collected data, through a serial port; then the data must be transferred in the main data base, in a format which is compatible with the one of the automatically collected data.

A typical application of extraordinary registered measure is the electric field analysis

- The analysis and the evaluation of the electrical fields, in order to adopt the most suitable active PC solutions, it is necessary to have available at the same time a number of 24 hours registrations on more points throughout the network in order to localize the anodic and cathodic areas and the electric field intensity

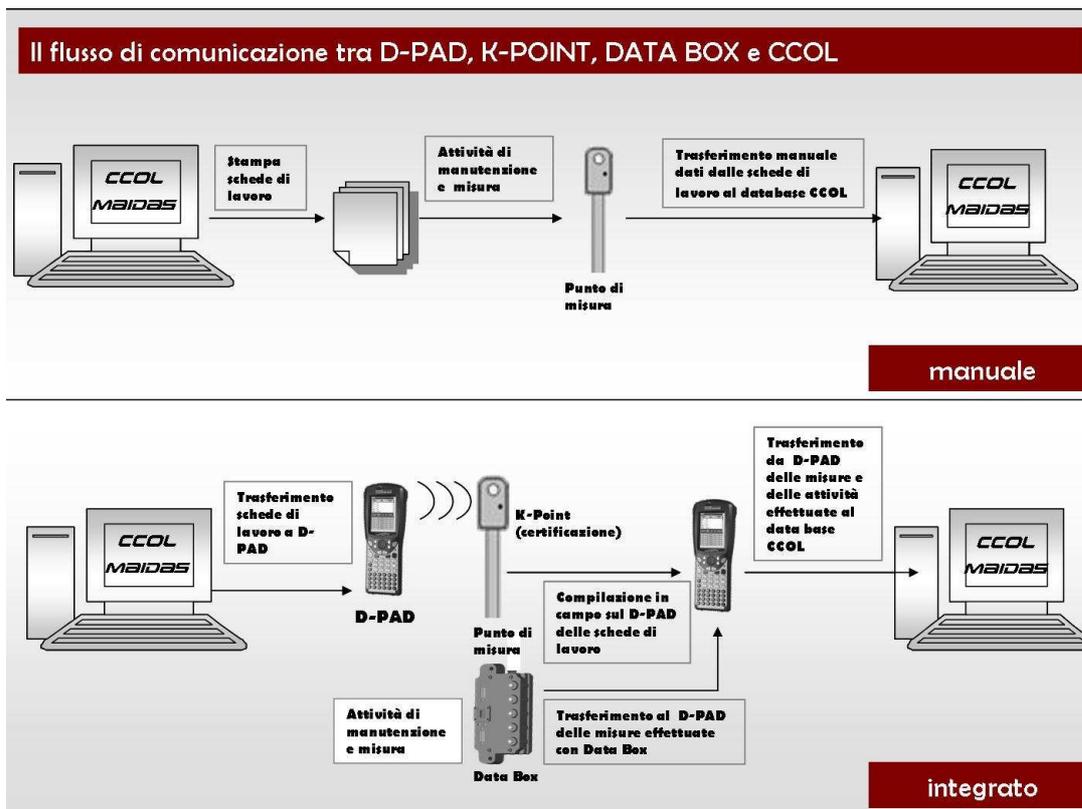
- The proper tool can be individuated in a low cost data logger, in order to have more of them, which thanks to a computer application allows the graphs overlapping to effect the relevant analysis

Again, we individuated another significant complementary tool in something which allows to have the certification of the real deployment of the activity, through its recording on a RFID TAG (transponder) which can be installed on board of the test points. This recording can be effected directly via radio from the palmtop which this last is near to the RFID itself (abt 10-150 cm) to certify the real presence of the operator.

This tool, which we named KEY-POINT, is a reduced dimensions memory unit, able to archive up to 1Kbyte information. Installed with a simple adhesive, it communicates to the D-PAD when they are each one near the other.

The advantage hidden in the KEYPOINT is double:

- 1) Certification of the physical presence of the operator in proximity of the test point
- 2) Archiving of the operations, which a warranty of the executed activity, also for possible future controls



## CONCLUSIONS

The CCOL service, which has been now been implement with different complementary tools, presents now different advantages, above all the huge advantage of having one system only which collect, handles, archives, analyze the data coming from different type of collected information:

1. Extreme simplicity of use : the pre-defined codification of the 8 different types of points allows to plan and handle the activities, both maintenance and measures, guiding the operator step by step, with no mistake possibility
2. Precision: the typologies definition, which are not entered by the operator but are already resident in the system, avoids codes mistakes and eliminates the possible duplications
2. Modularity: it is possible to start using the CCOL with the MAIDAS from the very start, thanks to the access to the website CCOL. The implementation of the system with the other complementary tools can be done lately
3. Homogeneity: one instrument only for the management and archive of all the activities related to CP
4. Optimization of th Human resources, thanks to a more efficient and quick scheduling
5. Certification of the execution of the operations: the radio transmission from KEY POINT to D-PAD, which happens only if they physically near one to the other, and this is proving the operator's presence
6. History of the activities: in case of controls the KEY POINT allows to verify the activities done in the past
7. Timing optimization: the automatic transfer from D-PAD to PC avoids un useful printings and data entry
8. Automatic extrapolation, done by CCOL, of the effected measures during the maintenance, which automatically feed the main database