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AUTOMATED CONDITION CONTROL OF ANTI-CORROSION PROTECTION OF THE GAS PIPELINE

АВТОМАТИЗИРОВАННЫЙ КОНТРОЛЬ СОСТОЯНИЯ ПРОТИВОКОРРОЗИОННОЙ ЗАЩИТЫ МАГИСТРАЛЬНОГО ГАЗОПРОВОДА

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Abstract. Inside and outside corrosion is one of the most important problem which the gas companies deal with maintaining net pipeline. The effective and reliable anti-corrosion protection of underground and over ground pipelines saves company resources from repair or replacement entire facility which gives us economical effect.

Existing methods of anti-corrosion control have some real disadvantages the serious one is about finding out of violations in station work due to rarely visiting of staff the cathode protection units which leads to emergency. Solution of this problem is shown in the article the automated condition control of anti-corrosion protection method of the gas pipe-line in particular. A local subsystem of multifunctional information-measuring system of the gas transportation company (IMS GTC) consisting of three parts with information getting exchanged between them, the subsystem allows to keep the whole system work under control directly from a monitoring unit using radio channel means.

IMS must perform a sequence of particular actions for its nonstop and reliable function. The automated condition control of anti-corrosion protection algorithm of the gas pipe-line developed especially for that which helps us to get updated information from the cathode protection units, to handle and define its function status. The Scheme and algorithm description are presented in this article.

Аннотация. Защита трубопроводов от внутренней и внешней коррозии – одна из важнейших задач, которую ставят перед собой организации, эксплуатирующие данные сети. При грамотной и надежной защите от коррозии подземных и надземных трубопроводов сокращаются затраты на их ремонт или полную замену, что дает огромный экономический эффект.

Существующие методы контроля состояния противокоррозионной защиты имеют серьезные недостатки, главный из которых заключается в том, что из-за большого интервала времени между посещениями станций защиты персоналом имеет место запаздывание в обнаружении нарушений в их работе, что способствует возникновению опасности отказов и аварий. В статье приводится решение данной проблемы, а именно, представлен метод автоматизированного контроля состояния противокоррозионной защиты магистрального газопровода. Для этого создана локальная подсистема многофункциональной информационно-измерительной системы (ИИС) газотранспортного предприятия (ГТП), которая состоит из трех частей, обменивающихся информацией между собой, и позволяет по средствам радиоканала контролировать работу всей системы непосредственно с диспетчерского пункта.

Для надежной и бесперебойной работы информационно-измерительная система должна выполнять последовательность определенных действий. Именно для этого разработан алгоритм автоматизированного контроля состояния противокоррозионной защиты магистрального газопровода, при помощи которого мы сможем опрашивать контролируемые пункты станции катодной защиты, управлять ими, определять их

работоспособность. Блок-схема и описание алгоритма представлены в статье.

Key words: gas, information-measuring system, protection gas pipeline, corrosion, algorithm of automat control.

Ключевые слова: газ, информационно-измерительная система, защита газопровода, коррозия, алгоритм автоматизированного контроля.

The main cause of emergencies is corrosion of gas pipeline. The electric and chemical protection gas pipeline grows or declines depending on quality of work.

The cathodic protection stations (CPS) on the pipeline, makes the electric and chemical protection. The protective potential needed for the good protection of the pipeline [1].

The disadvantages of monitoring subsystem method at CPS:

- the seldom visiting of staff the CPS, it leads to emergency;
- the connecting with remote objects it need large costs;
- about human factors the low quality of data and estimation is subjective.

The location subsystem [2] needed for the cathodic protection working control. Three-connecting parts of the location subsystem.

First of all it's apparatus on the cathodic protection stations – the post CPS in control (CP CPS IMS). Means for streaming criteria, signal conversion of magnitude *U*, *I*, *E*, measurement signal unification and transfer into communication bus, within it.

CP CPS has the measuring device, analog-digital converter, encipher and wireless station.

CPS has commercial power supply but it doesn't have blocks of transmission of measuring information.

The methods for information transmission from CPS:

- by connect wiring along the direction of gas pipeline;

- by organization the high low level of telecontrol canal power line communication (PLC);
- by use the pipeline like line of connects;
- by method of information transfer.

The air-line connect, cable bus and PLC line connection aren't used because it very expensive.

The underground provider distorted information because of top noise level. For this provider needed good insulated coating and ground resistivity [3].

As the following the analysis shows that wireless station the most effectively for the data measuring transmission of CPS.

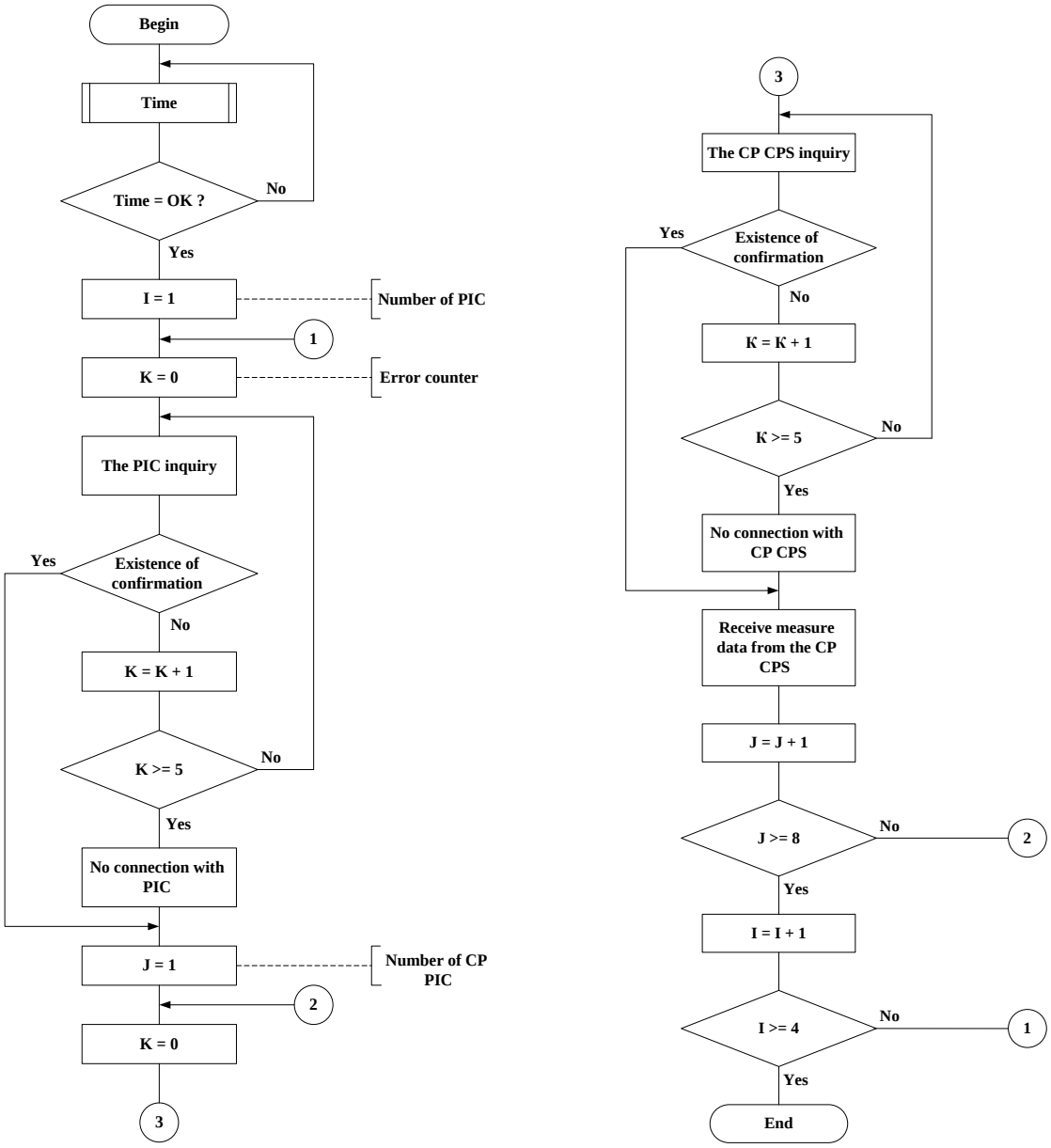
IMS and CPS integrated as a whole (CP CPS).

The second part of the system is the point of information collected (PIC). Is between CP CPS and control point. PIC unit configured for receiving the signal from the CP CPS and retranslation of the signal to in PIC canal next to the IMS central system, and also for receiving the signal from the IMS and translate it into CP CPS.

The information collected point has the wireless station, the data processing unit, line interface unit in the form of modulator-demodulator.

The third part is the control point. It has modulator-demodulator, interface, electronic computer IMS, monitor, printer, keyboard. Electronic computer is the center element IMS.

There is the connect algorithm CP CPS in the Figure 1. The realization accomplish with the IMS center element.



(1-st part) (2-nd part)

Figure 1.The algorithm inquiry of controlled units CP CPS

Used the next notation:

i (i = 1, 2, 3, 4) – the number PIC;

j ($j = 1, 2, \ldots, 8$) – the number CP CPS at the zone of PIC datum.

Δt (Δt = Const) – time target for algorithm started connect CP CPS.

The connect signal remit on the first PIC (i=1). If the answer from PIC doesn't come into central element IMS then inquiry repeats four more time (K=5). If the answers still be lacking electronic computer IMS fix the absence connection of the first PIC.

The PIC inquiry has the number CP CPS (j=1, 2, …, 8). At the start first CP CPS the questioning started. If the answers from CP CPS into the PIC doesn't come then inquiry repeats four more time (K=5). If the answers still be lacking electronic computer IMS fix the absence connection of this CP CPS.

CP directional information signal about the state of current strength and the rectified the voltage across the terminals CPS and the polarized potential into PIC inquiry answer. PIC retranslation the signal into the center equipment IMS.

If the following the inquiry algorithm (picture 1) from the center equipment IMS the inquiry into CP (j=2) PIC (i=1). After information collected all of CP PIC (j=8) the algorithm tries the link of inquiry into CP (j=1, 2, …, 8) of the second PIC and etc.

The algorithm of apparatus work CP CPS (Figure 2).

The reception of the address byte and compare with the address CP CPS. The starts of information conversion then address coincidence. At that the pipeline disable from the measuring polarized potential chain. Measuring the polarized potential on the electrical and chemical potential sensors (ECPS). The first measuring canal plumb in the analog-digital inverter (ADI). Then generate the byte shows us the measuring result.

The second measuring canal plumb in ADI.

The third measuring canal – the measuring canal of the current strength power, plumb in ADI.

The pipeline plumb in the sensors ECPS.

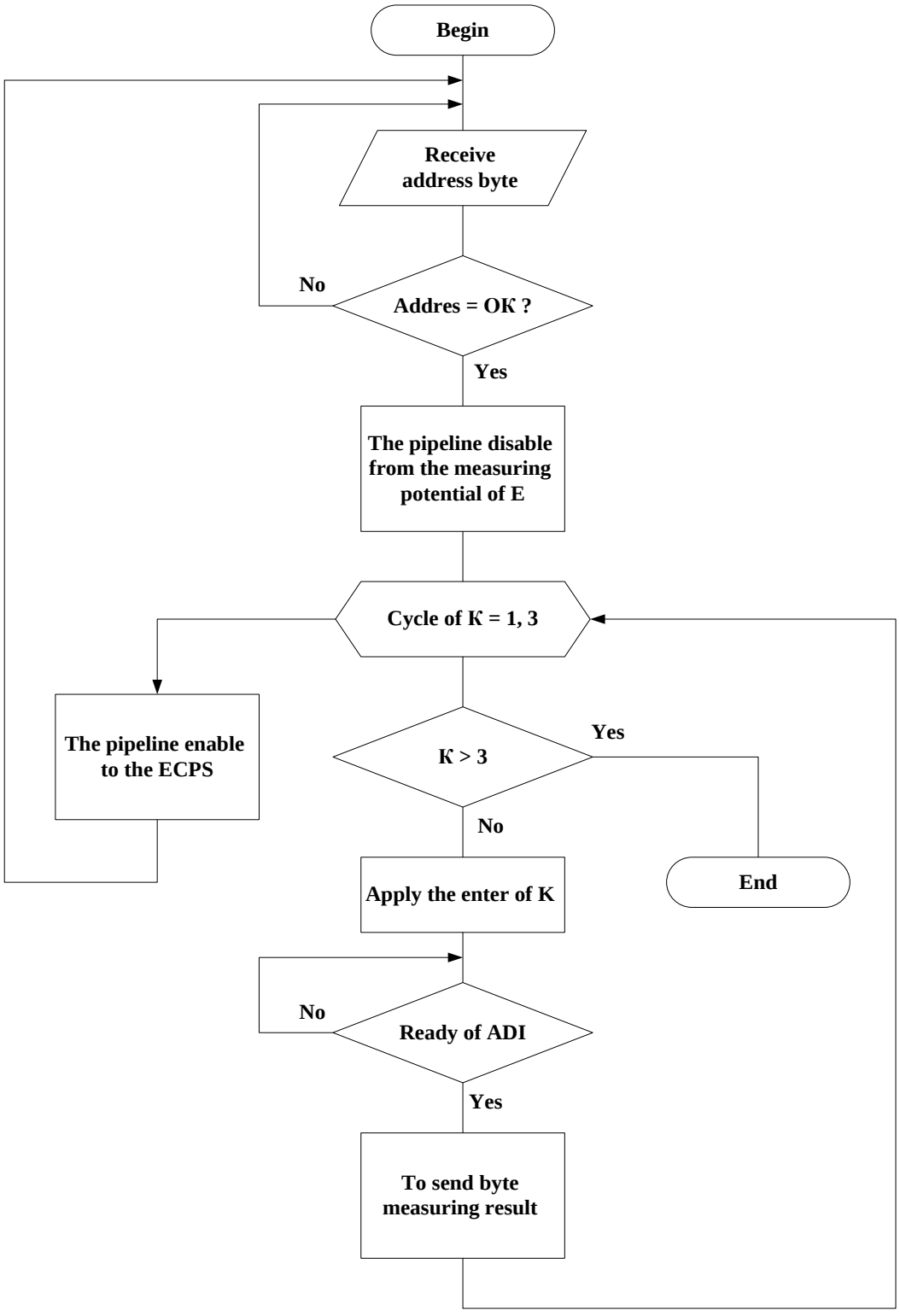


Figure 2. The algorithm of operation equipment CP CPS

One more algorithm is algorithm performance measurement CPS (Figure 3).

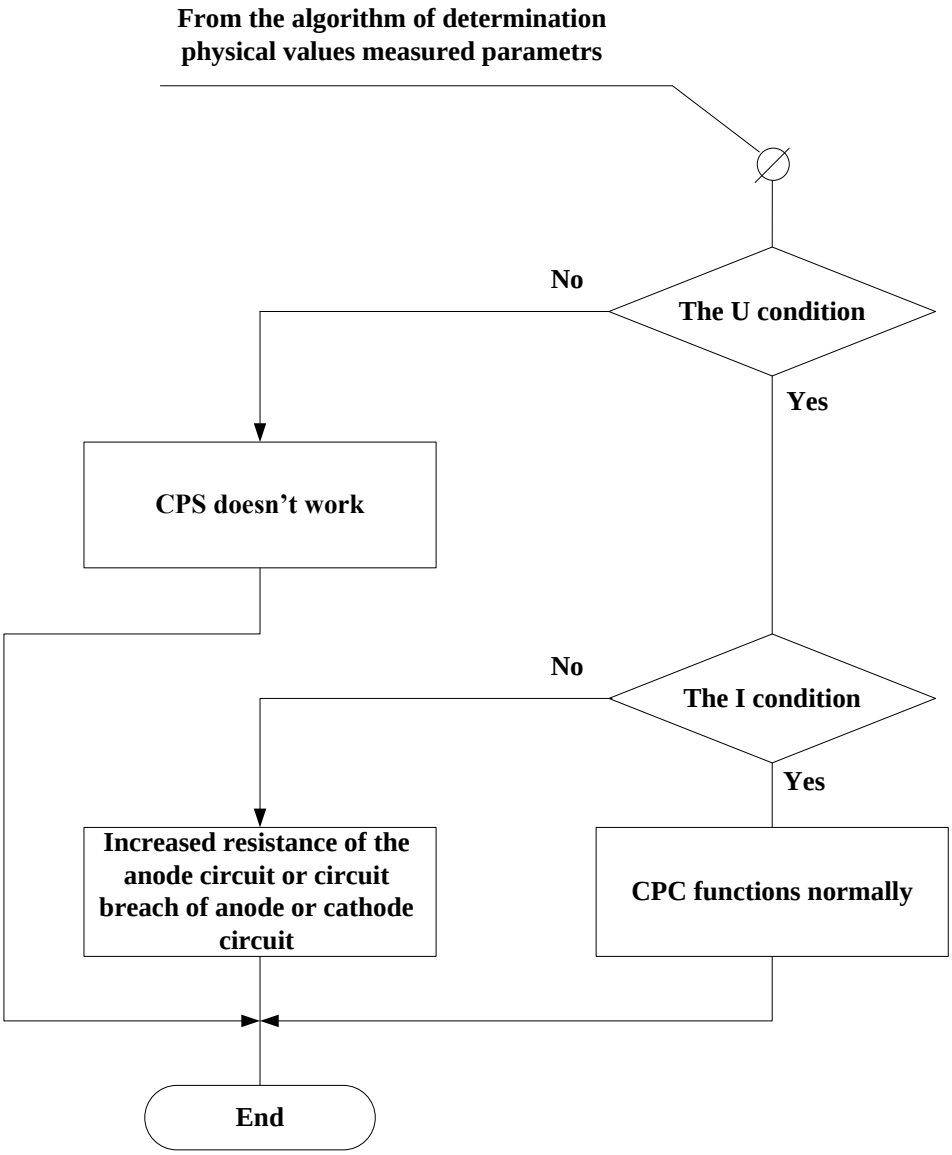


Figure 3. The definition of algorithm reliability CPS

Three rules: the analysis force value of protective current *J* and significance rectified voltage on the clamp CPS (problem voltage CPS). Give an message:

a) CPS to be functioning normally;

b) useful increase external plate impedance or break of cathode or anodic chains;

c) CPS non-working.

Conclusions

Significant downsides of existing methods of anticorrosion condition control of the gas pipe-lines were revealed. The most important one is a remote location objects of control from an information collect units. So that the local subsystem was designed which is used for an automated condition control of pipelines including controlled unit, information collect unit and monitoring unit.

It is proved that the most effective way of transmitting measure signals of the cathode protection station is radio channel.

A Software of the multifunctional informational measuring system gas – transport company developed and based on the algorithm of automated condition control of the anticorrosion protection of the gas pipeline which supports entire set of automation process: obtain, collection, store, transfer, processing and display measure information as a real time system function.

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