

Gas concentration control systems on the basis of the GSM-03 gas detector

Author: Rozhenok R.M.
Deputy chief metrologist
SME “Tomsk Electronic Company” Ltd.

At the present time more and more attention is paid to the gas explosion protection at hazardous manufacturing sites, such as oil stores, measuring systems of oil and gas quality and quantity, different oil products handling systems, motor-vehicle refueling complexes, refrigerating systems, boiler houses etc.

Today there are many means of gas detection. Lots of stationary and portable vapor detectors were developed, both in our country and abroad.

The detectors and analyzers of explosion hazardous gases in the domestic market include thermocatalytic and electrochemical sensors. But the gas detection is not the ultimate goal. Taking into consideration the universal implementation of the automated process control systems (APCS), the consumers want to monitor the gas content at their site on a real time basis, at long range and moreover to analyze and predict increase or decrease of the gas concentration during operating procedures.

The GSM-03 gas detector can easily fulfill these functions. It was developed in 2001 and is series-produced by SME Tomsk Electronic Company (www.npptec.ru).

The GSM-03 module gas detector is designed for non-stop control of the under-explosion-hazardous combustible vapor concentration, flammable liquid vapors and their mixtures of the IIA, IIB, IIC categories and T1, T2, T3, T4 types (according to GOST P 51330.5, GOST P 51330.11) by thermochemical sensor in the explosion hazardous zones indoors and outdoors, as well as on the open-air fields in compliance with the article 7.3 Electrical Safety Rules. Controlled environment temperature range varies from - 60 °C to +50 °C. The exterior appearance of the GSM-03 gas detector is shown in the Fig. 1.



Рисунок 1

Figure 1 - exterior appearance of the GSM-03 in construct OKW and Compact

At the present time GSM-03 is successfully operating at sites of such companies as Rosneft, Sibneft, LUKoil, Slavneft, UKOS, Tomsk Petrochemical Plant and other enterprises in Russia and abroad.

GSM-03 provides point control. It is designed according to the modular approach. It consists of the interface unit (БИ), alarm units (БС), which amount ranges from 1 to 20 depending on the amount of sensors, and detector unit (БД). It is the same catalytic combustion sensor as in the famous STM-10. БС is designed to connect with БД (catalytic sensor). The sensor is regularly energized and gas content control is fulfilled. When the concentration is lower than 50 % of the lower explosive limit (LEL) the sensor automatically starts continuous operation. БИ call over the БС units and transfers the current data of gas concentration, threshold response and rejections of the device to the telecontrol system via interface RS-485 and RS-232 with ModBUS RTU protocol. It creates new possibilities for development of gas concentration control systems for oil extracting sites, enables to predict events, enables the operator to monitor gas concentration and take necessary measures to prevent explosions.

The chart of the GSM-03 external and internal connections is shown in the Fig 2.

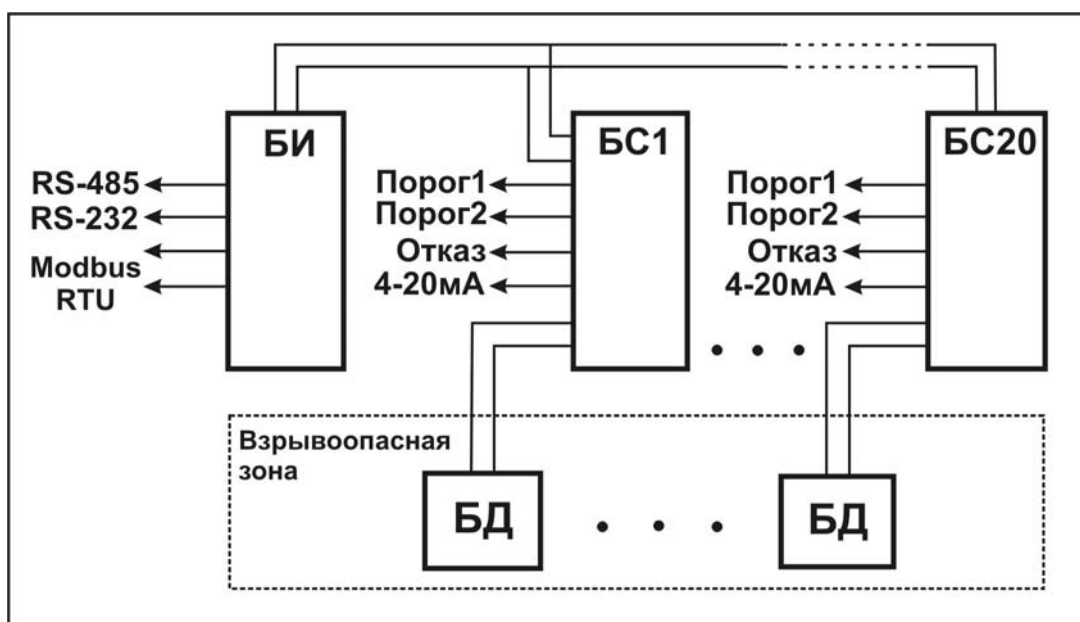


Figure 2 – Example of GSM-03 external connections chart

The GSM-03 special feature is the extended useful life of the product by 1.5-2 times in comparison to STM-10, which was provided by stable current parameters of the sensor. GSM-03 also enables zero correction by a command of the operator from display system without calibrating.

GSM-03 is developed in full compliance with GOST 27540 – “Thermochemical combustion gas and vapor detectors. General requirements”. It has preset by software thresholds, quantized output (Threshold 1, 2, emergency), necessary to control light and audio alarm and ventilation. The measurement error does not exceed $\pm 5\%$ of the LEL.

The gas detector has explosion protection marking 1ExdIICT4.

GSM-03 is included in the State register of measuring devices and has permission to be applied at hazardous industrial facilities.

On additional order GSM-03 can be equipped with display systems, implemented in the "environment" InTouch 8.0, Trace Mode, Win CC, A-Studio or any other at the Customer request. The example of display system is shown in the Figures 3 and 4.

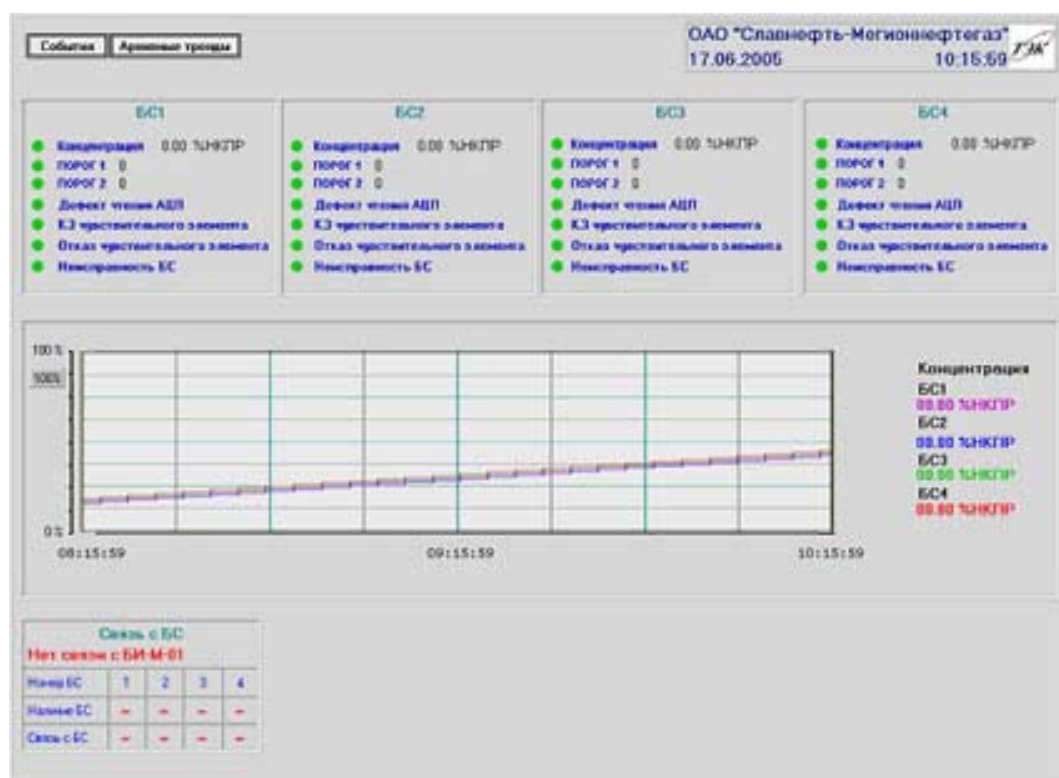


Figure 3 - The example of GSM-03 display system

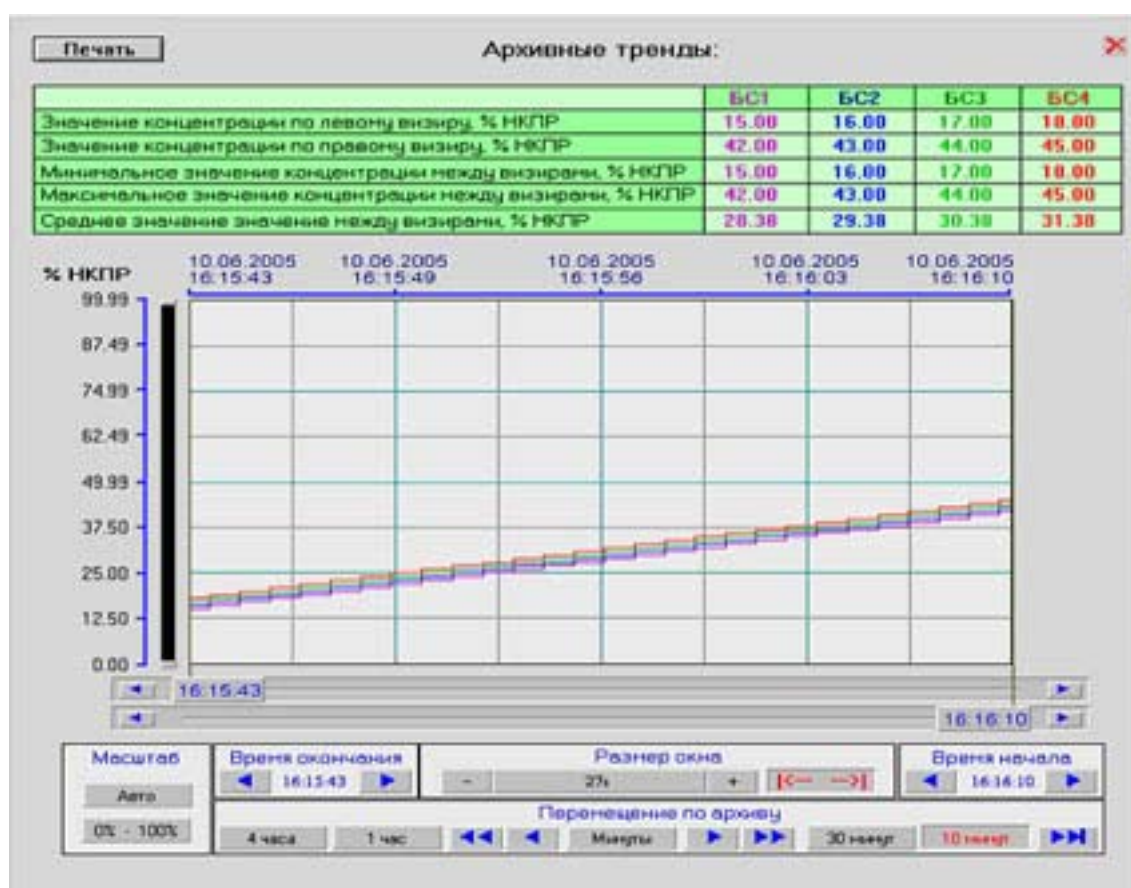


Figure 4 – Example of gas concentration trend line GSM-03

A range of such systems was implemented at the Customer facilities, for example oil treatment facilities Sredne-nyurolsky oil field JSC East Transnational Company.

The structure chart APCS is shown in the Fig. 5. The solution is special because it transfers data from gas detector to controller Delta V, which regulates and controls whole APCS, not only the gas concentration control system.

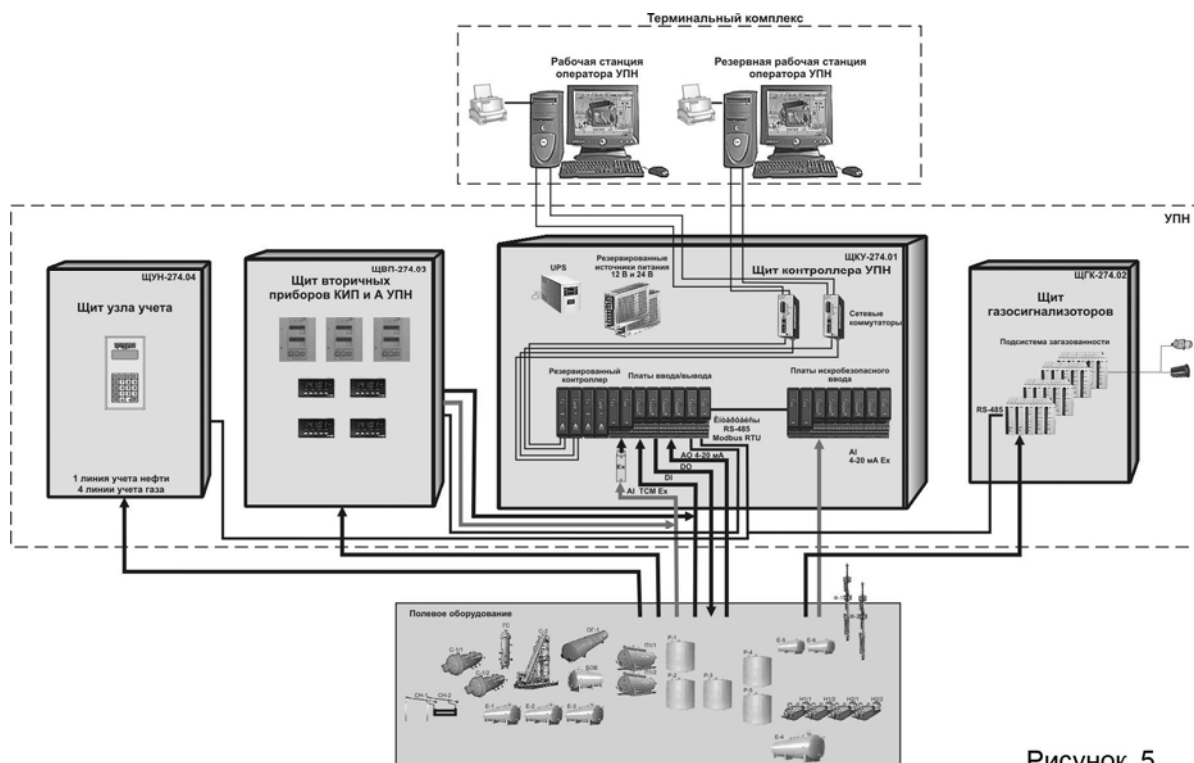


Рисунок 5

Figure 5 - Structure chart APCS Sredne-nyurolsky oil field

The gas concentration control systems can also include several GSM.

The Fig. 6 shows APCS structure scheme of Barabinsky greases store house. APCS consists of three subsystems: gas concentration control, regulation and control of technological parameters, including estimation per tanks and fire-extinguishing system. The special feature is the integration of 4 gas detectors on one interface block БИ-М3, which is also developed by SME TEC. БИ-М3 converts three physical interfaces: RS-485, RS-232 и CAN.

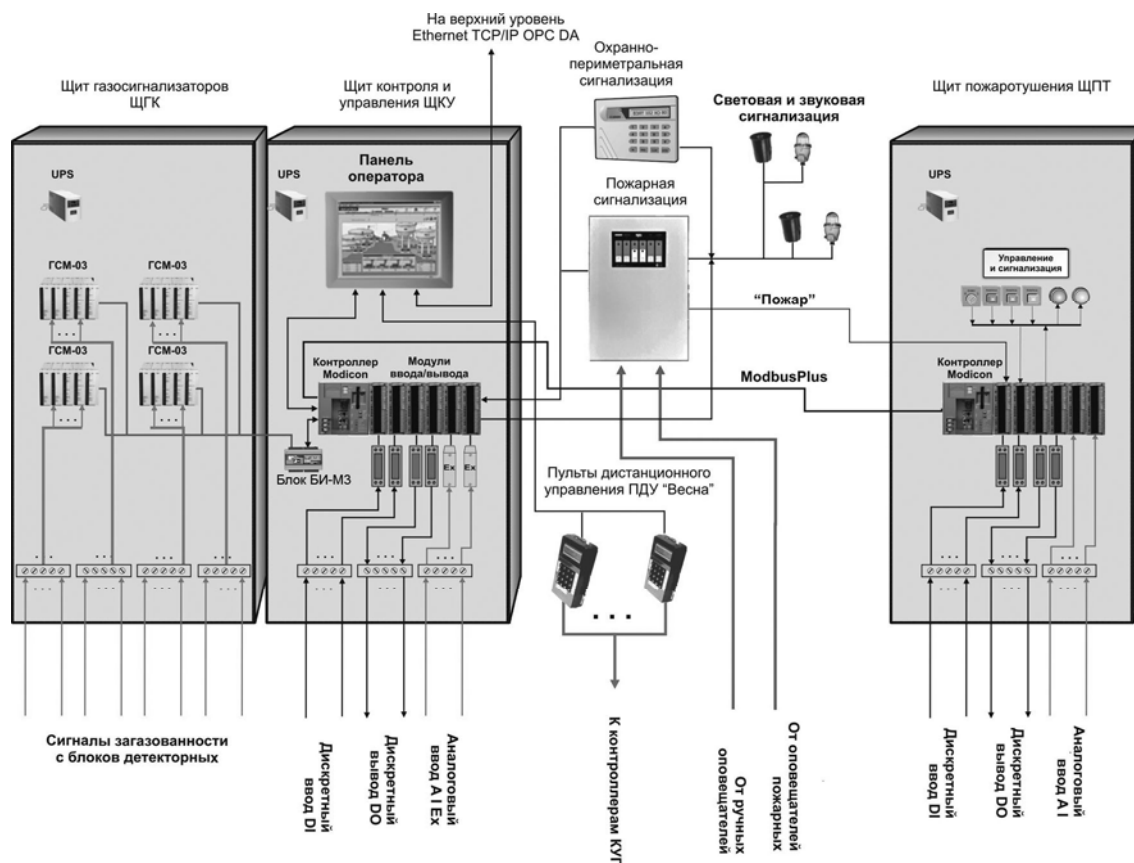


Figure 6 - APCS structure scheme of Barabinsky GSM

Apart from gas concentration control systems, SME TEC develops and produces oil, gas and water accounting systems. Fig. 7 shows the example of joint use of the MicroTEC measuring and estimating system and GSM-03 at operating metering stations УПСВ-9 JSC «Tomskneft» OWC (read details about the MicroTEC measuring and estimating system in the previous issue).

The specialty of this application is that the accounting and gas concentration are displayed on the same terminal complex. The operator can simultaneously monitor the transportation of oil and control gas concentration in the places equipped with sensors.

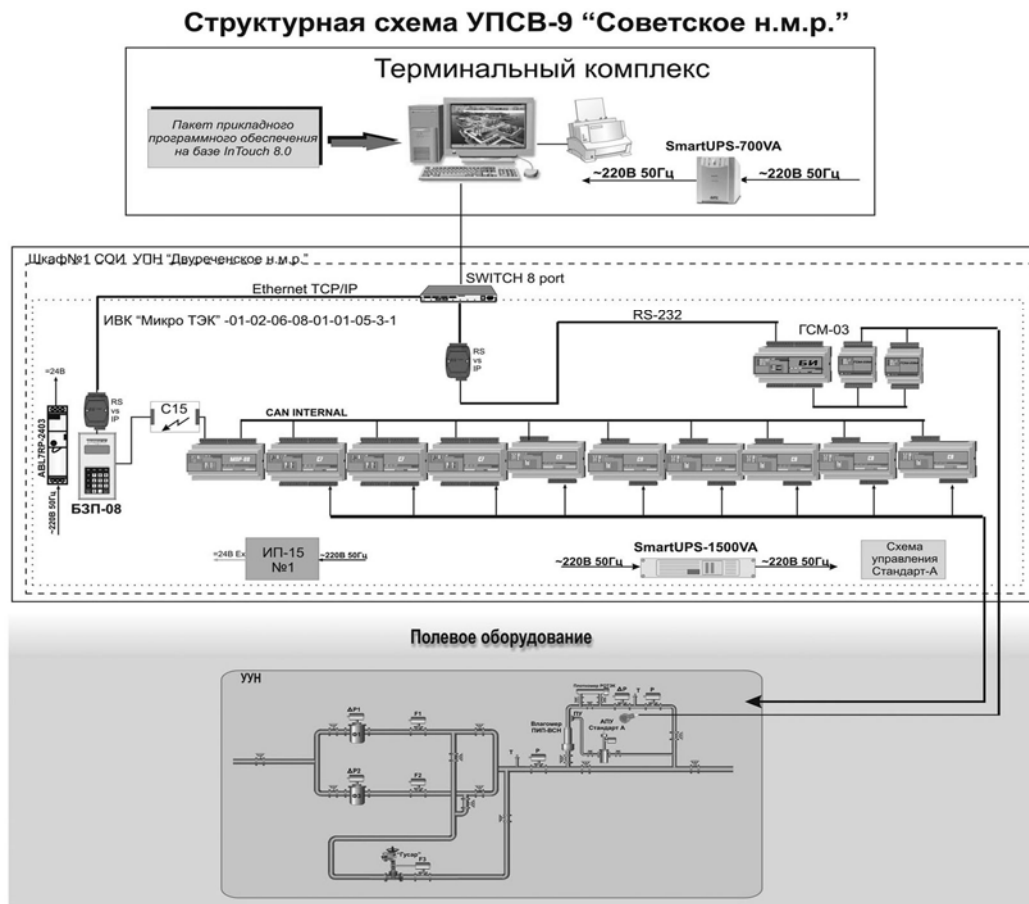


Figure 7 – Structure scheme OUUN UPS-9 JSC «Tomskneft» East Oli Company

All the abovementioned options GSM-03 cover all the tasks of the gas concentration control at hazardous facilities. It transfers information to telecontrol system via open industrial protocol MODBUS RTU and controls working order not only of its units, but also the sensor, which is almost always affected by combustion gases.

Send questions about application of gas detector GSM-03 to the e-mail account: npptec@mail.tomsknet.ru.

In autumn of the current year SME TEC will introduce a new modification of gas detector GSM-05, which will fulfill digital indication of the current gas concentration and process the signal both from thermocatalytic and semiconducting sensors.

To make an order, the GSM-03 can be denoted as following:

газосигнализатор модульный ГСМ-03 ОФТ.512.00.00.00 ТУ

GSM-03 XX – X / X / X - X - X - X

Amount of sensors *

The type of detector unit

Design

1 – Compact

2 – OKW

Internal interface type

1 – ИРПЦ

2 – RS – 485

Current output

A – yes

B - no

Interface block

0 - no

1 – yes

Power supply

0 - no

1 - yes

2 – yes, with backing-up

Type of threshold device quantized output

1 – normally closed

2 – normally open

Note: * - amount of sensors is up to 20.