Informatics and Control Problems 43 Issue 1 (2023)
journal homepage: www.icp.az

Operating algorithms of the "TRAP" automated group measuring device controller

As.H. Rzayev, G.A. Guluyev, Y.G. Aliyev*, M.H. Rezvan

Institute of Control Systems, Baku, Azerbaijan

ARTICLE INFO

Article history:
Received 15.09.2022
Received in revised form 30.09.2022
Accepted 10.10.2022
Available online 05.04.2023

Keywords:
Oil well
Production
Control device
Algorithm modules
Automated measurement
Manual control
New technology

ABSTRACT

The article highlights the importance of measuring the production capacity of wells (oil, water, gas) in the process of operation to ensure efficient development of oil and gas fields. Modernization of hardware and software by the Institute of Control Systems of "Trap"-type automated group measuring devices (AGMU), widely used in the oil fields of the Azerbaijan Republic, is demonstrated. An overall block diagram of the operating algorithms compiled during implementation of the new controller module in the upgraded "Trap" control device for measuring oil-well production rate as well as its separate sub-components are given: Initial parameter setting service; Automatic and manual query identification service; Manual command execution service; Service connecting (i)-th well to the measuring tank; Service of monitoring the filling of the tank over time (mi); Service of disconnecting (i)-th well from the measuring tank and waiting for fluid settling; Production rate measurement and calculation service; Automatic query analysis and execution service, their algorithms are described, and the principles of their operation are explained.

1. Introduction

In oil fields, average daily production rate is one of the most important indicators. Therefore, during the development of oil reservoirs, it is required to determine the amount of oil, water and gas components in each well. Determining the production rate of wells (oil, water, gas) in the process of operation to ensure efficient development of oil and gas fields is one of the most important problems [1].

Various measuring equipment is used in measuring the production capacity of oil wells: SKZh individual measuring meter [2]; AGMU, automated group measuring unit (Trap AGM-3) [3].

The Institute of Control Systems of ANAS is constantly working on modernization of existing group measuring devices, new methods and means of oil well production capacity measurement.

The following published works, in particular, can be indicated:

– Intelligent "Trap" controller for wells connected to AGMU with in-phase pneumatic stepper [4];

*Corresponding author.
E-mail addresses: asifrzayev48@gmail.com (As.H. Rzayev), scb_06@mail.ru (G.A. Guluyev), aliyevyaver@gmail.com (Y.G. Aliyev), rezvanmahammad@gmail.com (M.H. Rezvan).

www.icp.az/2023/1-09.pdf https://doi.org/10.54381/icp.2023.1.09

– Microprocessor (MP) monitoring, measuring and control device for "Trap" AGMU [5];
– System of remote oil well production rate measuring with "Trap" AGMU [6].

In order to carry out technological adjustments at oil and gas fields, select optimal well modes and achieve proper operation of the "reservoir-well-equipment" production system, there is a great need for modern equipment based on new technologies.

Cybernetics SCB (Special Constructor Bureau) under ANAS has upgraded with application of modern technologies the control, measurement and management controller, which is the main component of Trap Control Device (TCD) for the "Trap" AGMU used in oil production, that allows measuring well production rate by a new method [7].

2. Problem statement

Drawing an overall block diagram of the control, measurement and management controller based on new technologies, constituting the core of the Modernized TCD (MTCD), and the algorithms reflecting the various stages of the measurement process, describing the principles of operation.

3. Solution

Drawing an overall block diagram of well production rate measurement

The overall block diagram of the controller operation is given in Fig. 1

The block diagram consists of the following algorithms:
– Initial parameter setting service;
– M1 – Automatic and manual query identification service;
– M2 – Manual command execution service;
– M3 – Service of connecting (i)-th well to the measuring tank;
– M4 – Service of monitoring the filling of the tank over time (mi);
– M5 – Service of disconnecting (i)-th well from the measuring tank and waiting for fluid settling;
– M6 – Production rate measurement and calculation service;
– M7 – Automatic query analysis and execution service.

3.1. Initial parameter setting service

Each time voltage is applied to the device, the memory of the ATmega32-16 microprocessor (MP) is cleared, the ports (PA, PB, PC, PD) are assigned, the set parameters (**RF** frequency, **UART** speed, **Ether** speed, **Interface** type) of the radio modem (RMD) are loaded directly from the flash memory (program memory) of the MP. The following parameters are written to addresses **08h-0Fh** of the non-volatile EEPROM (electrically erasable programmable read-only memory): TRAP number to **08h**, RF frequency of the RMD to **09h**, lower bits (1-8) of well row to **0Ah**, higher bits (9-16) of well row to **0Bh**, Method (Measurement Type) to **0Ch**, Number of SS (Synchronous Signal) to **0Dh**, Number of repeated measurements to **0Eh**, Number of non-transmitted results to **0Fh**, and the "Measurement Time" of (**1-16**)-th wells to addresses **10h-1Fh**, respectively. After that the Trap control program is started according to the algorithm: Each MP cycle is reflected by timing pulses; The presence and row number (1...16) of the measured (i)-th well is determined.

3.2. M1 - Automatic and manual query identification service

The diagram of module M1 is shown in Fig. 2.

Ports **PD7** and **PB0** of the MP determine whether the query comes from the upper level or from the manual panel. If **PortD7=1**, the service is sent to module M7 (upper level), otherwise **PB0** is checked: if **PinB0=1**, the service is sent to module M3 (connecting the i-th well); if **PinB0=0**, it is sent to module M2 (manual control).

3.3. M2 – Manual command execution service

The diagram of module M2 is shown in Fig. 3.

Port **PB0** of the MP is checked. If **PinB0=0**, module M2 starts, control commands are reset (**MEASURE=0, REVERSE=0, SCAN=0**). Depending on the inputs **PD4** Measure_FB and **PD5** Reverse_FB (FB - Feedback), the "Measure" or "Reverse" button is pressed on the manual panel. If a second command is issued during the execution of one command, the execution of the previous command is canceled and the next command is executed.

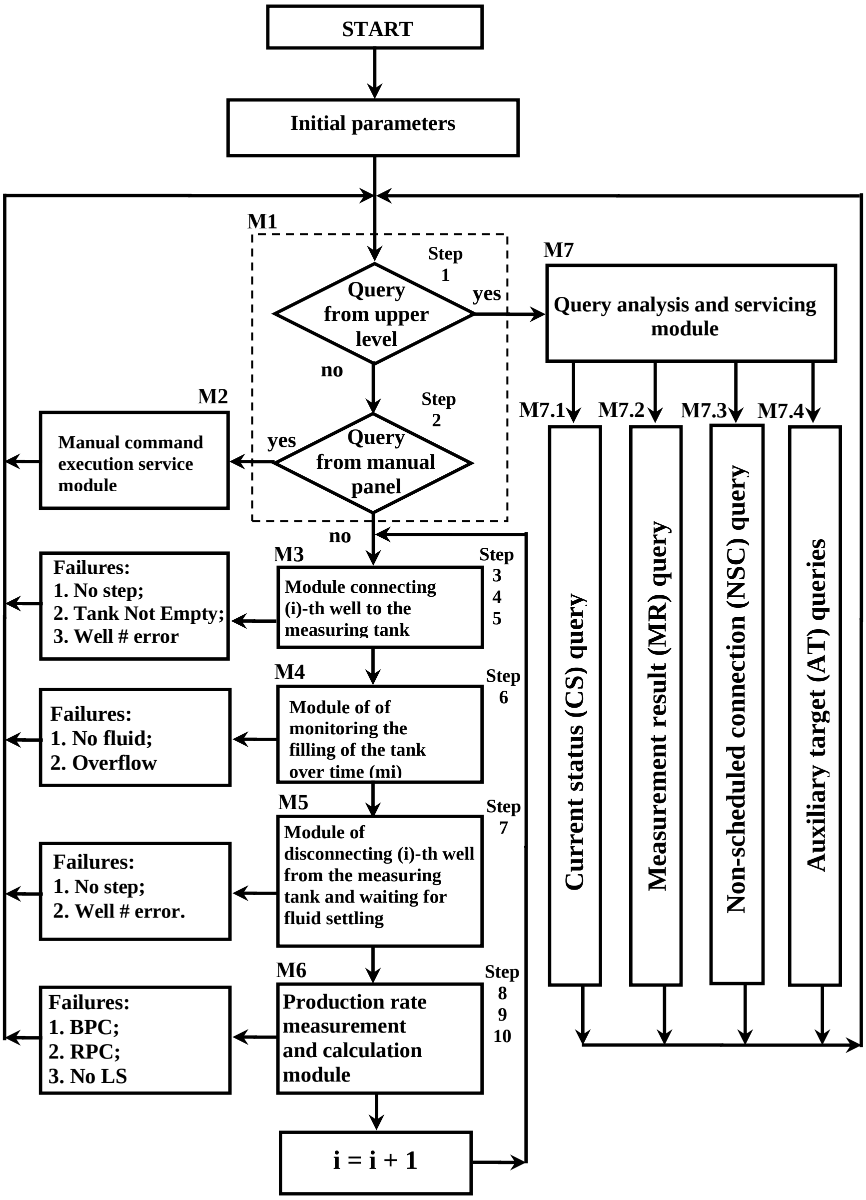


Fig. 1. Overall block diagram of the algorithm for measuring the well production rate with MTCD Controller

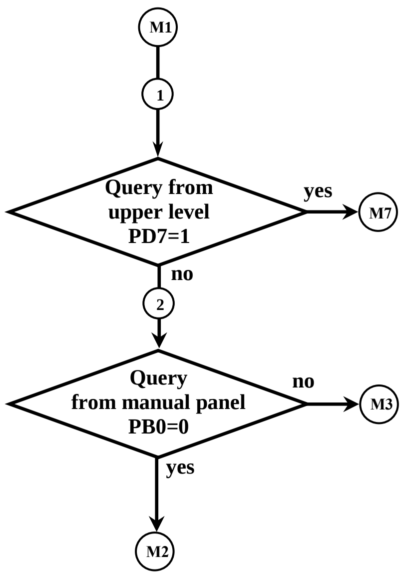


Fig. 2. Algorithm of M1 – Automatic and manual query identification service

The correct execution of the "Measure" or "Reverse" command depends on the position of the Bottom and Reverse contacts. During the execution of the commands, the position of the contacts is monitored via the multifunction input PB3 "STATUS" of the MP with making the "SCAN" ("Check") signal "1" or "0" in the corresponding points. Depending on the value of the "STATUS" signal (**PinB3 = "1"** or **"0"**) the controller software (SW) either continues to execute the command normally according to the algorithm, or stops it normally and replaces it with another command, or in case of failure, stops all commands and cancels the process completely.

If the "**MEASURE**" button on the manual panel is pressed during the check and **PinD4=0 (Measure_FB)**, control is transferred to the "Measure" circuit. **SCAN (PortC2=1)** and **MEASURE (PortC6=1)** commands are issued, the **REVERSE (PortC7=0)** command is accepted, after **τ=1** second **PB3** input is checked, the "**STATUS**" signal is expected to become **PinB3=0** (BPC closed) to ensure that the load is moving up and Bottom Position Contact (BPC) is closed. As long as **PinB3=1**, BPC is open, control is transferred to M1 and the load continues to move up. Once **PinB3=0**, the BPC is closed, the **SCAN (PortC2=0)** command is canceled and **PinB3=0** (RPC closed) is expected to watch the load rise and go into Reverse. While **PinB3=1**, the RPC is open and the load continues to move up. When Reverse is reached, the Reverse Position Contact (RPC) is closed, and since the BPC is already closed, **PinB3=0**. A **MEASURE (PortC6=0)** command is received, a **REVERSE (PortC7=1)** command is issued, the load begins to go down, and service is transferred to M1.

When a **REVERSE** command is issued according to the SW algorithm or when the **REVERSE** button on the manual panel is pressed, in the next cycle control is transferred to the "Reverse" circuit. If during the check **PinD5=0 (Revers_FB)**, the **SCAN (PortC2=0)** and **MEASURE (PortC6=0)** commands are accepted, the **REVERSE (PortC7=1)** command is issued, after **τ=1** second PB3 input is checked, the "**STATUS**" signal is expected to become **PinB3=1** (RPC open) to monitor RPC opening and the load lowering: while **PinB3=0**, RPC closed, control is transferred to M1, and RPC is expected to open. If **PinB3=1** when RPC opens, the load continues to go up. The **SCAN** (**PortC2=1**) command is issued, after **τ=1** second **PB3** input is checked, the **"STATUS"** signal is expected to become **PinB3=1** (BPC open) to monitor the load reaching the bottom. While **PinB3=0,** BPC is closed, control is transferred to M1 and load continues to move down. When **PinB3=1** BPC opens, the load reaches the bottom, the process completes in normal mode, **MEASURE=0, REVERSE=0, SCAN=0** commands are reset and service is transferred to M1 for a new query. If there is no query from the manual panel, service is transferred to M3.

3.4. M3 – Service of connecting (i)-th well to the measuring tank

The diagram of module M3 is shown in Fig. 4.

The availability of the well, the production rate of which will be measured, is checked. If there is no well to be measured, service is transferred to M1. Otherwise, the address is read from the encoder, and the well (**i-1**) before the measured (**i**)-th well is expected to be off. If **Well_i-1=off**, control goes to **Step_5**, otherwise the **EPV1 Change** command (**PortC4=1**, after **τ=2** seconds **PortC4=0**) is issued, which drives the pneumatic stepper with **Electro-Pneumatic Valve** (EPV) to connect the wells to the measuring tank one by one and reads the encoder status (address). (For simplicity we will not repeat the sequence of its issuing, but will say "**Change** command is issued"). If the state of the Encoder does not change within three repeats of the EPV1 command, a "No step" failure is recorded and service is transferred to M1 for a new query. If there is a change, **Step_4** is repeated until the current and expected states of the well (**i-1**) are identical. When the states are identical, i.e., **Well_i-1=off**, control goes to **Step_5**.

Since after the Change command in **Step_5** the current and expected state of the well corresponds to (**i-1**), Tank Empty-Full (TEF) is checked by PB6 input: if **PinB6=0**, "**Tank Full**" is recorded, if **PinB6=1**, "**Tank Empty**". If the tank is full, it is expected to be emptied; if the tank is empty, it is expected to be completely emptied of residual fluid within additional **τ=120** seconds, and queries are serviced. When the wait time has expired, the **EPV1 Change** command is issued and the Encoder state is read. If Encoder state does not change within three repeats of EPV1 command, "No step" failure is recorded and service is transferred to M1 for a new query. If there is a change and the (**i**)-th well whose production rate is to be measured is not connected, "Well # error" failure occurs, and service is transferred to M1 for a new query. If Change is present and the (**i**)-th well is in the connected state, **EPV2 (PortC5=1)** command closing the lower EPV is issued to fill the measuring tank. "**Time counter**" is reset and starts counting until the pre-recorded "Measurement time" limit is reached in RAM and service is transferred to **M4**.

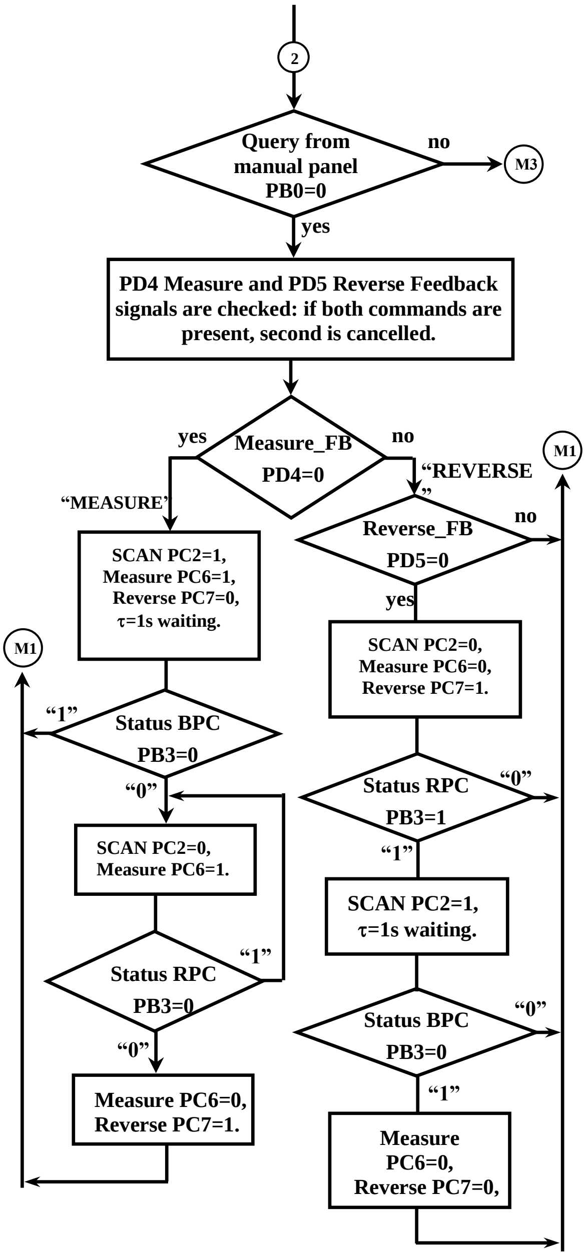


Fig. 3. Algorithm of M2 – Manual command execution service

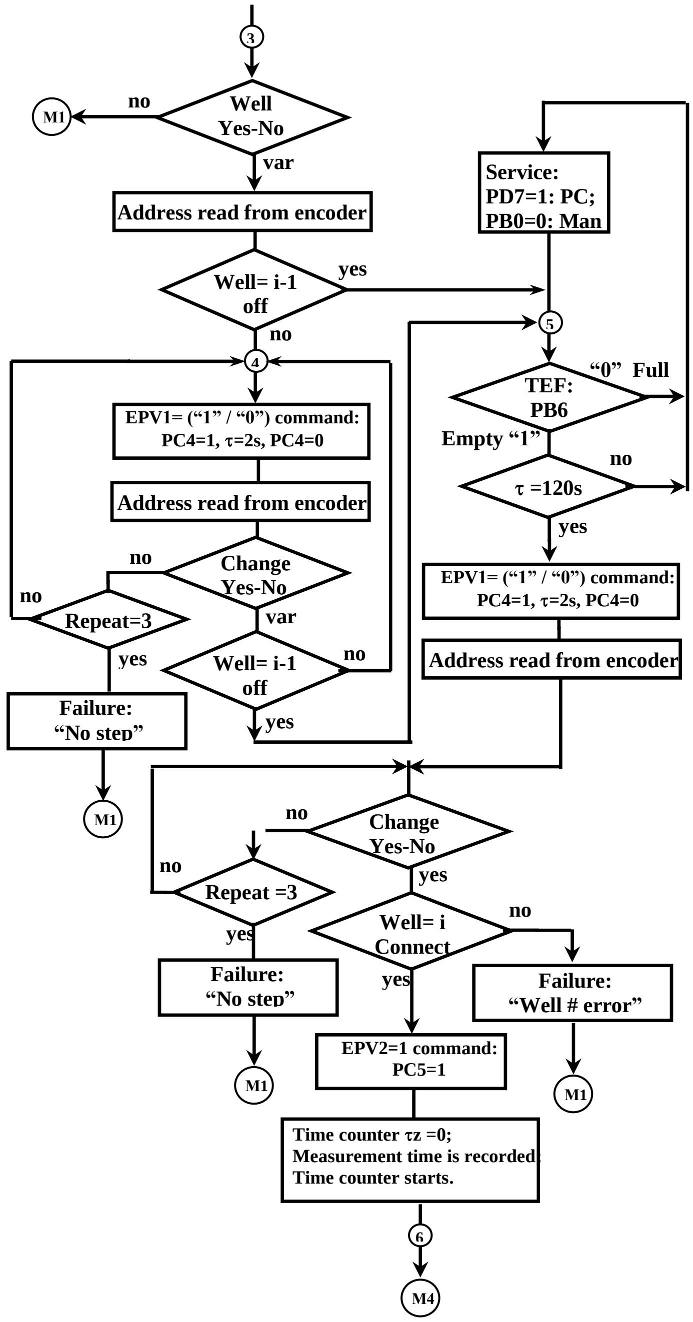


Fig 4. Algorithm of M3 – Service of connecting (i)-th well to the measuring tank

3.5. M4 – Service of monitoring the filling of the tank over time (mi)

The diagram of module M4 is shown in Fig. 5.

While Time counter counts until "Measurement Time" threshold is reached, "**Fluid/No fluid**" signal is recorded based on TEF state: **PinB6=1** creates "No fluid" failure and **PinB6=0** creates "Fluid", that is fluid is accumulated in the tank, creating the signal. When fluid accumulates, Overflow (OF) of the tank is checked by PB5 input: if **PinB5=1**, “No overflow” is recorded, and control goes into **Step_6**, the prosess continues; if **PinB5=0** “Overflow” failure is recorded, **EPV2** (**PortC5=0)** command is accepted, i.e. the bottom value of the tank opensr. When “No fluid” and “Overflow” failures take place, the commands are reset and service is transferred to M1 for a new query.

Until the measurement time has expired, the manual control, the computer query, the non-scheduled connection commands are checked and a response is given to each of them.

If **“Time counter”** =“Measurement time”, service is transferred to **M5**.

3.6. M5 – Service of disconnecting (i)-th well from the measuring tank and waiting for fluid settling

The diagram of module M5 is shown in Fig. 6.

The measurement time expires and the **EPV1 Change** command is issued, the Encoder state is read. If Encoder state does not change within three repeats of EPV1 command, "No step" failure is recorded and service is transferred to M1 for a new query. If there is a change and the (**i**)-th well whose production rate is to be measured is not in the off state, "Well # error" failure is recorded, and service is transferred to M1 for a new query. If there is a change and the (**i**)-th well is in the off state, the settling time **τ=120** seconds is expected. During this time, queries from the manual panel and the upper level are serviced, the state of the tank is monitored, in case of failure the process is stopped and service is transferred to M1 for a new query. After the settling period has expired, service is transferred to **M6**.

3.7. M6 – Production rate measurement and calculation service

The diagram of module M6 is shown in Fig. 7.

After the settling time is over, the state of the tank is checked: if the tank is empty, **EPV2 (PortC5=0)** command is given, the "No fluid" failure is recorded and service is transferred to M1 for a new query, otherwise the number of repeated measurements "Repeat=n" is recorded, the number counter "Number=0" is reset and the **MEASUREMENT** process begins:

SCAN (PortC2=1) command is issued, after **τ=1** second it is checked if the load is at the Bottom by the value of **"STATUS"** signal on **PB3** input:

– If **PinB3=0**, BPC is closed (load is not at the bottom), **MEASURE (PortC6=0)** command is accepted, **REVERSE (PortC7=1)** command is issued and **PinB3=1** is expected within **τ=120** seconds (BPC open), that is, the load to arrive at the bottom. If **PinB3=0** persists within **τ=120** seconds after the **REVERSE** command, a "BPC closed" failure is recorded indicating that the load has not reached the bottom, commands are reset (**SCAN=0, EPV2=0, REVERSE=0**) and service is transferred to M1 for a new query;

– If **PinB3=1**, BPC is open (Load at bottom), **REVERSE (PortC7=0)** command is received, **MEASURE (PortC6=1)** command is issued, **PinB3=0** (BPC closed) is expected after **τ=1** second, i.e., the load to move away from the bottom. If **PinB3=1** persists for **τ=120** seconds after the **MEASURE** command, "BPC not closing" failure is registered, commands are reset (**SCAN=0, EPV2=0, MEASURE=0**) and service is transferred to M1 for a new query.

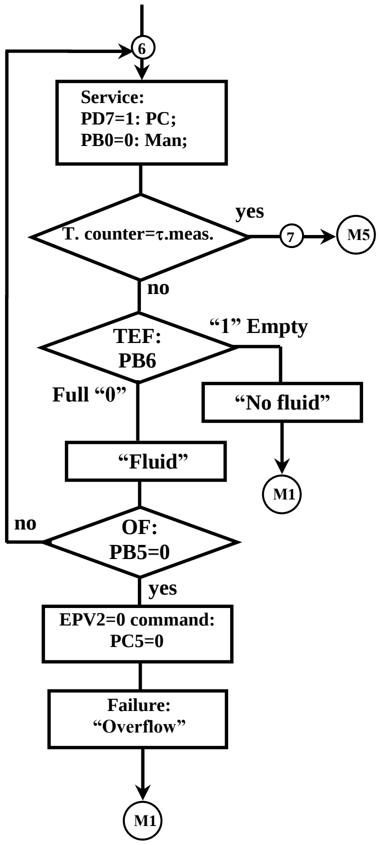


Fig. 5. Algorithm of M4 – Service of monitoring the filling of the tank over time (mi)

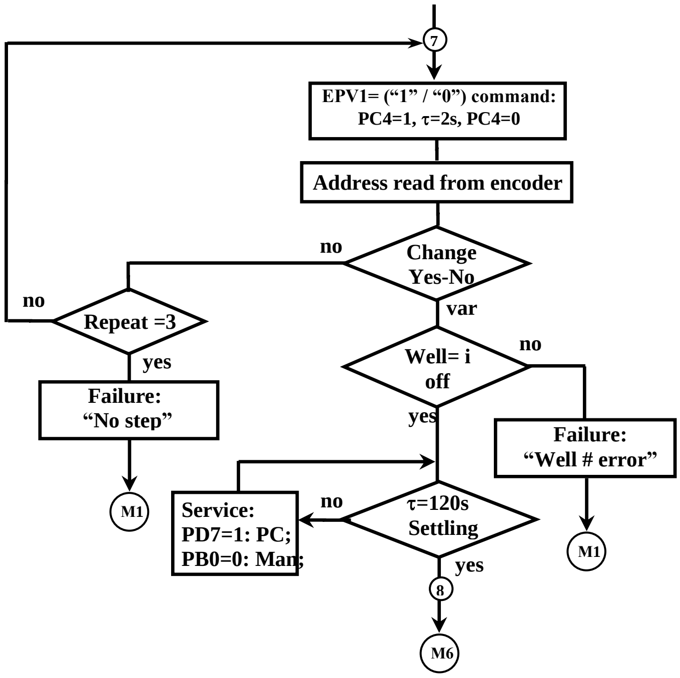


Fig. 6. Algorithm of M5 – Service of disconnecting (i)-th well from the measuring tank and waiting for fluid settling

If the process goes correctly, when the load starts to go up after the **MEASURE** command, the BPC is closed, because the **SCAN=1** signal is still active **PinB3=0** (BPC closed) and the "**LS counter**" that determines the fluid level in the tank is started. After the BPC is closed, the **SCAN (PortC2=0)** signal is accepted to confirm that the RPC is open, after **τ=1** second **PB3 "STATUS"** input is checked. Since there is no **SCAN** signal, **PB3=1** (RPC open) is expected.

– If **PinB3=0**, "RPC closed" failure is recorded and service is transferred to M1 for a new query. If **PinB3=1**, if Level Signal **LS1(2)** (**PinB2=0**) is received within **τ=120** seconds of the load rising, control goes into **Step_10**, otherwise a "**No LS**" failure signal is recorded, the load continues to rise and **PinB3=0** (RPC closed) is expected for it to return from the Reverse point. If **PinB3**=1 persists when the rising load reaches the RPC, a "RPC not closing" failure is recorded, commands are reset, and service is transferred to M1 for a new query. If the RPC is closed and because the BPC is also previously closed, the "**-12Vio**" (signal **0**) goes through these contacts, creating a **PinB3=0** signal on the "**STATUS**" input (RPC closed). The **MEASURE (PortC6=0)** command is received, the **REVERSE (PortC7=1)** command is issued, **PB3** input is checked after **τ=1** second. **PinB3=1** (RPC open) is expected to monitor when the load starts to go down and the RPC opens: if **PinB3=0** persists for **τ=120** seconds after the **REVERSE** command, the "RPC not opening" failure is recorded, "Time counter", "LS counter" and commands are reset (**EPV2=0, REVERSE=0 SCAN=0**), service is transferred to M1 for a new query; if **PinB3=1** (RPC open), **SCAN (PortC2=1)** command is issued, PB3 input is checked after **τ=1** second. **PinB3=0** (BPC closed) is expected to monitor the lowering of the load and the opening of the RPC. The load continues to go down, and **PinB3=1** (BPC open) is expected to monitor the load going down. If **PinB3=0** persists after **τ=120**, a "BPC closed" failure indicating that the load has not reached the bottom is recorded and service is transferred to M1 for a new query. If BPC opens when the load reaches the bottom, then **PinB3=1**, “Load at bottom” is recorded, **SCAN=0** and **REVERSE=0** commands are accepted. if "LS" is not generated during the measurement process, the normal return of the load from the RPC completes, and service is transferred to M1 for a new query.

When the Measure command is given in **Step_10**, the content of the "LS" counter, which starts counting the time from the moment of the load separation from the bottom, is stored in the memory (in seconds and milliseconds) with generation of the **LS1(2)** signal (**PinB2=0**). The **MEASURE (PortC6=0)** command is received, **REVERSE (PortC7=1)** and **SCAN (PortC2=1)** commands are issued, **PB3** input is checked after **τ=1** second. The load starts to descend, it is checked that **PinB3=0** (BPC closed): if **PinB3=1**, the "BPC open" failure is recorded and service is transferred to M1 for a new query; if **PinB3=0** (BPC closed), the load continues to descend, the load is expected to reach the bottom within **τ=120** seconds, and **PinB3=1** (BPC open). If **PinB3=0** persists after **τ=120** seconds, a "BPC closed" failure is recorded, indicating that the load has not reached the bottom, and service is transferred to M1 for a new query. If **PinB3=1** for **τ=120** seconds, it is recorded that the BPC is open, the cargo has reached the bottom normally, and the first measurement process is completed. **SCAN=0, REVERSE=0** commands are accepted.

The required number of measurements is checked. If the number of measurements is not exhausted, control goes to **Step_9** and the second measurement process is started, if the number of measurements is exhausted, **EPV2=0** command is accepted, and at the required number the Measurement process is completed. The measurement results are stored in the **EEPROM**, and control is transferred to M1 to service the next well.

3.8. M7 – Automatic query analysis and execution service

The diagram of module M7 is shown in Fig. 8.

The query analysis and servicing module consists of the following submodules:

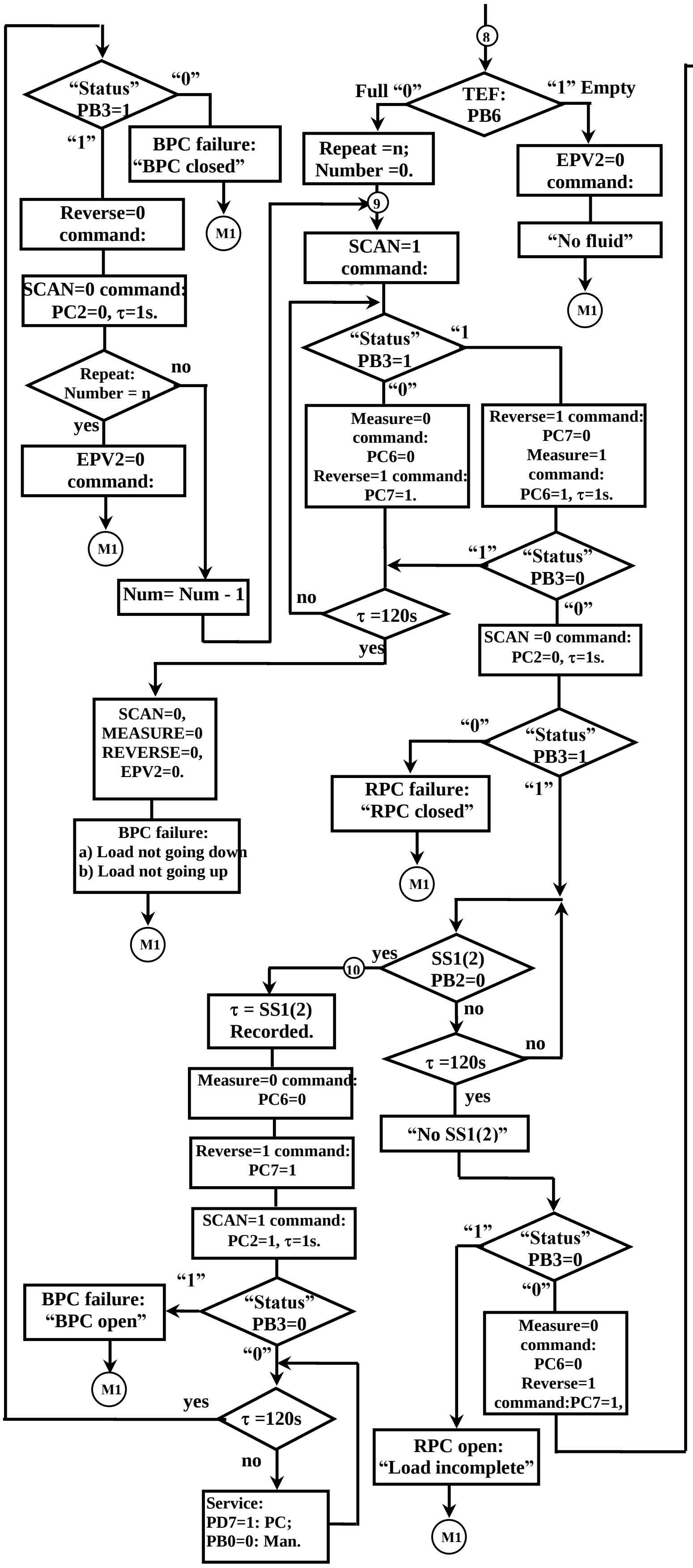
– M7.1 – Current status (CS) query;
– M7.2 – Measurement result (MR) query;
– M7.3 – Non-scheduled connection (NSC) query;
– M7.4 – Auxiliary target (AT) queries.

3.8.1. M7.1 - Current status query

When a CS query occurs, information about the current status of the MTCD is transmitted to the Operator's Station (OS). The CS information transmitted from the MTCD reflects the following current stages of operation of the TRAP device: Finding the well to be measured; Waiting for the tank's emptying; Connection of the well to the tank; Waiting for settling; Performing the measurement process; Control from the manual panel; Information about a scheduled connection process or a non-scheduled connection process; Active well sequence number (1-16), well state (connected, open); Time of connection of well to tank; Time elapsed after connection of well to tank (minute, second); Time elapsed after beginning of settling (minute, second); Establishing presence or absence of fluid after connection of well to tank; Number of Normal Total Measurement (NTM); Failures information.

In the event of the TRAP equipment failure, MTCD transmits the following information to the OS: Change command was given, but no change occurred; The required well was not found; The tank was not emptied; The LS signal was not generated; The connection time has expired, but no fluid has formed; BPC and RPC failures.

If there are NTM in the CS information transmitted to the OS (number of NTM > 0), Measurement Result query takes place.



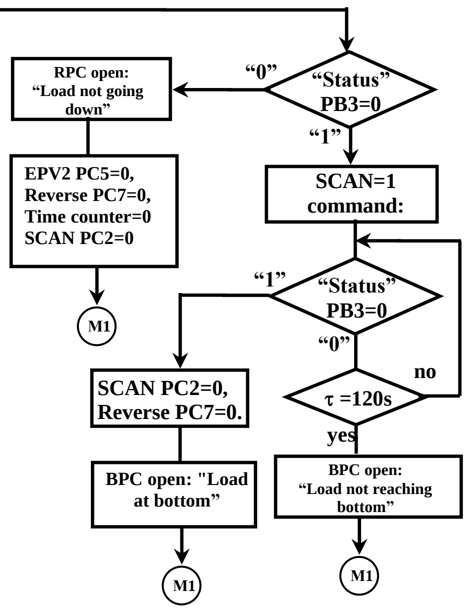


Fig. 7. Algorithm of M6 – Production rate measurement and calculation service

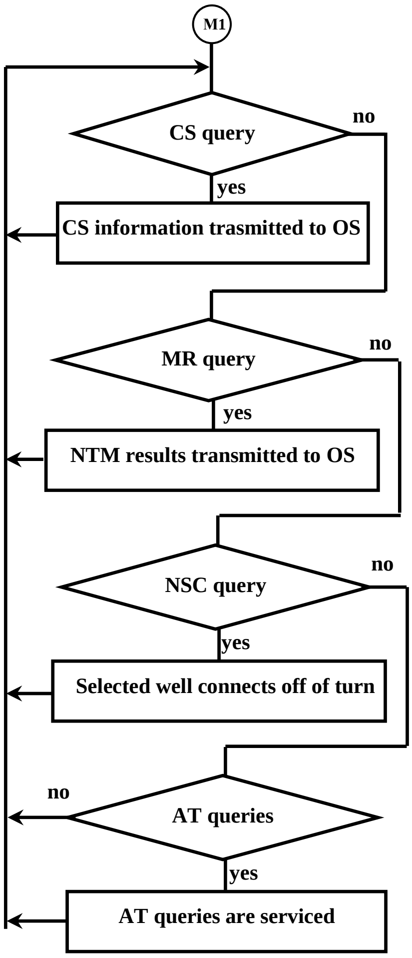


Fig. 8. Algorithm of M7 – Automatic query analysis and execution service

3.8.2. M7.2 – Measurement result query

All NTM results are transmitted to the OS during an MR query. These may be results either about the current measurement or accumulated due to lack of connection to the OS. The result of each normally completed measurement consists of 4 bytes: 1st byte - sequence number of the measured well; 2nd byte - connection time (m); 3rd byte - LS time (s); 4th byte - LS time (ms).

3.8.3. M7.3 – Non-scheduled connection (NSC) query

An NSC query is issued to connect any selected well for an immediate (non-scheduled) measurement process. Once this query occurs, the current well connected to the tank is disconnected from TPAP and all commands are reset. If no connection time is specified for the selected well in the NSC, the connection time is taken from the appropriate memory, otherwise the connection time specified by the query is taken and START is given to the measurement process.

3.8.4 M7.4 – Auxiliary target queries

MR queries are for MTCD debugging and operation: Retrieve connection time from TCD; Send connection time to TCD; Retrieve well placement order from TCD; Send well placement order to TCD.

When a query is made to retrieve connection time from the TCD, all connection times in MP memory are transmitted to the OS.

When a query is made to send connection time to TCD, the connection time of the well selected in the OS is written to the appropriate place in the MP memory.

When a query is made to retrieve well placement order from TCD, well placement order in the MP memory is transmitted to the OS.

When a query is made to send well placement order to TCD, well placement orders in the SW database in the OS are written to the appropriate place in the MP memory.

4. Conclusion

Modernization of technological schemes of Trap-type AGMU and construction of measurement, control and management algorithms of the Trap controller designed on the basis of modern technologies for new MTCD result in increase of functionality and technical capabilities of oil well production rate measurement systems.

References

[1] С.И. Райкевич, Нетрадиционные способы определения производительности скважин на нефтегазовых месторождениях, Международный технологический симпозиум «Интенсификация добычи нефти и газа», Москва, 26-28марта (2003). [In Russian: S.I. Raykevich, Non-traditional methods of measuring well production rate in oil and gas fields, International Technological Symposium "Intensification of oil and gas production", Moscow, March 26-28 (2003)].

[2] SKZH fluid control meters. http://www.specudm.ru/production/ catalog_2/ position_24/schetchik_skzh.html

[3] Т.М. Алиев и др., Информационные системы в нефтяной промышленности, Издательство «Недра», (1972) p. 240. [In Russian: T.M. Aliev et al., Information Systems in the Oil Industry, Nedra].

[4] Gambar Guluyev, Asif Rzayev, Yavar Aliyev, Magomed Rizvanov, Intellectual "TRAP" operatıng controller, The Third international conference "Problems of cybernetics and informatics", September 6-8, 2010, Baku, Azerbaijan. Volume I, pp.231-234.

[5] Ас.Г. Рзаев, Я.Г. Алиев, М.Г. Резван, Микропроцессорное устройство контроля, измерения и управления АГЗУ «трап», Проблемы получения, обработки и передачи измерительной информации: Сборник научных

трудов I международной научно технической конференции Уфа, РИК УГАТУ. (2017) pp.181-184. [In Russian: As.H. Rzayev, Y.G. Aliyev, M.G. Rezvan, Microprocessor (MP) monitoring, measuring and control device for "Trap" AGMU, Problems of obtaining, processing and transmission of measurement information: Proceedings of the I International Scientific and Technical Conference Ufa, UGATU RIC].

[6] Т.А. Алиев, Г.А. Гулуев, Ас.Г. Рзаев, Ф.Г. Пашаев, Система дистанционного измерения дебита нефтяных скважин с АГЗУ «трап», Проблемы получения, обработки и передачи измерительной информации: Сборник научных трудов I международной научно технической конференции Уфа, РИК УГАТУ. (2017) pp.150-153. [In Russian: T.A. Aliev, G.A. Guluyev, As.H. Rzayev, F.H. Pashayev, System of remote oil well production rate measuring with "Trap" AGMU, Problems of obtaining, processing and transmission of measurement information: Proceedings of the I International Scientific and Technical Conference Ufa, UGATU RIC].

[7] As.H. Rzayev, Q.A. Quluyev, Y.Q. Əliyev, M.H. Rezvan, Neftçixarmada “Trap” avtomatlaşdirilmiş qrup ölçü Qurğusu Kontrollerinin Modernləşdirilməsi, Sumqayıt Dövlət Univesiteti “İnformasiya sistemləri və texnologiyalar: Nailiyyətlər və Perspektivlər” mövzusunda II Beynəlxalq Elmi konfransın materialları, Sumqayit, 09-10 iyul (2020) pp.291-293. [In Azerbaijani: As.H. Rzaev, G.A. Guluyev, Y.G. Aliyev, M.H. Rezvan, Modernization of the controller of the "Trap" automated group measuring unit, Sumgayit State University, Proceedings of II International scientific conference "Information systems and technologies: achievements and prospects", Sumgayit, July 09-10 (2020)].