НЕФТЕПРОМАВТОМАТИКА

INDICATOR BRIG-015-I001

Information-management unit in explosion-proof design.

Operation manual

32050732.465275.003 ОМ

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CONTENTS

This document contains data on construction, operating principle, technical characteristics of BRIG-015-I001 unit. Operation manual is intended to inform on regulations that are necessary for correct and safe operation of the unit (its proper use, technical maintenance, maintenance repair, storage and transportation) as well as for evaluation its technical conditions in order to define whether it requires maintenance.

Only staff that have studied the operations manual and have no less than III group on electrical safety in accordance with Appendix №1 to Guidance on job safety during usage of electronic equipment adopted by Department of Labor of Russian Federation on 24.07.2013 N 328n are allowed to perform works on installation, mounting and service of information-management unit in explosion-proof design «BRIG-015».

Manufacturer reserves the right to make review and changes in operation manual and unit’s design related to its technical characteristics improvement without preliminary notification. All changes will be published in a revised version of operation manual on manufacturer’s site: http://www.npaufa.ru.

1. DESCRIPTION AND FUNCTIONING

1.1. Product designation

1.1.1. Unit BRIG-015-I001 is designed to display information in alpha-numeric mode.

1.1.2. The unit has explosion proofing for electrical equipment marking type 1ExdIIBT3 in accordance with GOST R 30852.0-2002 (IEC 60079-0:1998) «Explosion proof electrical apparatus. Part 0. General requirements» and is designed for usage in explosion hazardous zones of 1st and 2nd classes installed on stationary objects in accordance with GOST R 30852.0-2002 (IEC 60079-0:1998) « Explosion proof electrical apparatus. Part 0. General requirements», GOST R 30852.9-2002 (IEC 60079-10:1995) « Explosion proof electrical apparatus. Part 10. Classification of explosion hazardous zones», GOST R 30852.13-2002 (IEC 60079-14:1996) «Explosion proof electrical apparatus. Part 14. Electrical installations in explosion hazardous zones (with exception of underground working)».

1.1.3. The unit conforms with Federal norms and regulations in the sphere of industrial security “General rules of explosion-proofing for explosion hazardous chemical, petro-chemical and oil-processing plants” that were adopted by order of Federal service on ecological, technological and atomic supervision on March 11th 2013 №96

1.1.4. Unit functions under control of a master device (for example PC) in dialogue mode according to MODBUS RTU exchange protocol. EIA-485 interface is used for data exchange with master device. There is also a design of a unit (for indicator unit) that is designed for joint work with BRIG-015-K001 controller (as well as NPA-2007 and MS-UITV-VZ-K devices). In this case special protocol and communication interface are used for connection to master device.

1.1.5. The unit is designed for long-term continuous operation.

1.1.6. Range of application.

The unit is designed to be used as an information display device at oil-loading posts, systems of access monitoring and other objects located in explosion hazardous zones.

1.1.7. Unit operation conditions:

· on degree of protection from environmental impact IP65 in accordance with GOST 14254-96 (IEC 529-89) «Degrees of protection provided by enclosures (IP code)»;

· on endurance and durability to sinusoidal vibrations impact – in accordance with GOST R 52931-2008 meets N3 «Instruments for process monitoring and control. General specifications»;

· on durability to ambient air temperature and humidity impact in accordance with GOST 15150-69 meets U1 «Machines, instruments and other industrial products. Modifications for different climatic regions. Categories, operating, storage and transportation conditions as to environment climatic aspects influence».

1.1.8. During purchasing and for other products’ documentation where the unit can be used the unit must be indicated as follows: “Indicator BRIG-015-I001”. While purchasing the unit in special design the unit must be indicated as follows: “Indicator BRIG-015-I001-O”

1.1.9. Unit’s service life – 10 years.

1.1.10. Unit does not bear any danger to health or life and environment. Unit should be utilized after service life in accordance with technology that is accepted on the plant that uses the unit.

1.1.11. Warranty operation period is 12 months from manufacturer shipping date.

1.1.12. If the user does not follow operation rules and requirements listed in operation manual manufacturer does not bear warranty obligations in case user-caused unit’s failure or housing integrity damage.

1.2. Technical characteristics

Product design is shown in picture 1.

Picture 1. Unit BRIG-015-I001.

Main technical characteristics of the unit are as follows:

Supply voltage:	12 V+10%.
Power supply type:	DC
Power consumption, no more than:	5 W
Indicator type:	Alpha-numeric, 3 lines, 6 symbols each
Communications interface with master device:	EIA-485 or special
Communication protocol to master device:	Modbus RTU or special
Cable entry quantity	1 or 2
Working mode:	Continuous, twenty-four-hour
Degree of protection from environmental impact:	IP 65
Explosion proofing marking:	1ExdIIBT3
Ambient temperature during operation:	-50..+60°C
Relative air humidity during operation, no more than:	100%
Weight, no more than:	2 kg.
Dimensions, WxHxD:	290x228x109 mm.

1.3. Composition of the unit and package contents

1.3.1. Unit delivery set includes:

· Indicator BRIG-015-I001.

· operation documentation: 1 set;

· configurational software (compact disk): 1 pcs. (is not provided for the unit in special design);

· transport packaging: 1 set;

1.3.2. Operation documentation includes:

· Operations manual;

· Passport.

1.4. Unit design

1.4.1. Design.

Design of the unit includes metal case with glass front panel, electronic components boards are located inside housing of the unit.

Cable glands are located on the side of the unit.

Grounding device with corresponding marking is located on the outer side of the unit.

1.4.2. Indicator.

LED alpha-numeric indicator has 3 lines 6 character each. It can show both Cyrillic and Latin alphabetic symbols. Standard design of the unit provides possibility to display user-defined symbols.

1.5. Marking

An engraved nameplate that is located on the left side of unit’s bottom contains the following information:

· Common product commercialization mark in the market of Specials Union member-states;

· Special explosion safety marking;

· Type of explosion proofing;

· Degree of protection from environmental impact;

· Manufacturer’s name;

· Serial number.

Marking remains strong for the whole service life of the unit, mechanically strong and cannot be wiped off (washed off) by liquids that are used during operation and technical maintenance.

1.6. Packing

The unit is wrapped in paper and then packed into polyethylene bag. Documentation and compact disk with software are packed into polyethylene bag. Then the package is packed into cardboard box. Hollow space is filled with corrugated cardboard or synthetic filler.

1.7. Provision of explosion proofing

Explosion proofing type «d» (explosion-proof cover) in accordance with GOST 30852.1-2002 (IEC 60079-1:1998) «Part 1. Explosion proofing type «explosion-proof cover».

Categories and groups of explosion hazardous zones environment where the unit is to be installed should correspond or be less dangerous than categories and groups of explosion proofing stated in explosion proofing marking of the unit.

Installing and energy supply should be performed in accordance with current operation manual, “Rules of electrical facilities maintenance” (ПУЭ) chapters 7.3, 7.4 and “Rules of electrical facilities maintenance” (ПУЭ) chapter Е3.4, Technical safety rules, other executive directives that regulate installation of electrical equipment in explosion hazardous zones.

Connection of the unit should be done via cable. Cable shall not have any damages both of isolation and separate wires.

Maintenance of the unit should be performed in accordance with GOST 51330.18-99 “Electrical apparatus for explosive gas atmospheres. Part 19. Repair and overhaul for apparatus used in explosive atmospheres (other than mines or explosives)”.

2. INTENDED USE

2.1. Unit operation preparation

2.1.1. Unpacking.

Upon receiving the unit packing integrity should be checked. After the box is opened the unit should be taken out of package material and wiped. Package contents should be checked against paragraph 1.3.

2.1.2. Safety precautions.

Only staff that have studied current manual and possess necessary qualifications should have access to installing, operation, technical maintenance and service of the unit.

Installing, operation, technical maintenance and service of the unit should be performed in accordance with requirements of “Users rules on electrical devices technical maintenance” and “Users safety measures during electrical devices operation”, as well as other department and sectoral norms that are implemented on the operation facility.

Installing, operation, technical maintenance, troubleshooting and connecting cables are allowed to perform only if the supply voltage is off.

The unit shall be grounded, this should be done before other cables are connected. Ground loop is connected to the grounding device that is located on the outer side of the unit’s housing and is marked correspondently.

2.1.3. Installation of the unit.

Fastening of the unit is performed with fastening brackets that are located on the flanks of the unit.

Overall and connection dimensions are shown on the sketch in Appendix 1.

To connect cables it is necessary to take of the front panel by unscrewing studs that are located along its perimeter.

Cables are to be entered through cable glands, after they are terminated cable glands should be tightened.

Before termination of the cables ensure they are de-energized and protection grounding has been arranged.

Cables should be connected in accordance with connection table (Appendix 2).

EIA-485 net interconnection should be performed in accordance with requirements of this standard.

After termination the front panel must be closed and studs that are located along its perimeter must be screwed. Front panel should be car sealed.

Installation and termination must be performed in accordance with safety requirements (paragraph 2.1.2).

2.2. Precommissioning

After installation works are finished and the unit is powered the unit is ready to work. Using the unit as a part of automated systems may require changing Modbus address. This should be done with configurational software that is included in package set. Instruction manual to the software is provided in Appendix 3. Special unit does not require a configuration.

2.3. Maintenance check

Maintenance check provides visual examination that is performed to make sure these cables do not have any breakages or damages, all connections are safe, there have been no mechanical damages to the housing of the unit and that plates with explosion proofing marking are provided. Safety of grounding should also be checked. Operation the device with deviations from requirements listed above is not permitted.

2.4. Technical maintenance

Technical maintenance is conducted in order to provide normal operation and maintenance of operational and technical characteristics of the unit during service life.

Technical maintenance consists of periodical control of technical state and of emerging malfunctions repair.

During conducting all kinds of technical maintenance safety measures listed in paragraph 2.1.2 must be followed.

Technical maintenance should be conducted no less than once a quarter. During the maintenance requirements in paragraph 2.3 should be followed.

During technical maintenance it is necessary to remove contaminations from surface of the housing; it is prohibited to use corrosive fluids of solvents.

Maintenance (as well as warranty repairs) is performed by manufacturer.

2.5 Unit operation

In normal mode the unit works as ancillary device in accordance with Modbus RTU protocol. Master device initiates information output to the indicator, reading keyboard codes, data exchange with contactless cards.

EIA-485 interface is used for connection to master device.

Unit in special design works as slave device in accordance with special interface and protocol.

Description of communication parameters that are used by Modbus, connection principles and register map are provided in Appendix 4.

2.6. List of possible malfunctions during operation

List of possible malfunctions during operation, their cause and directions on their removal are provided in Appendix 5.

In case of unit's failure it is necessary to stop it and shut down power supply system that uses the device.

2.7. List of critical failures, possible human errors that lead to emergency state of the unit and actions that prevent such errors

Incorrect connection. Can lead to failure during energization.

Visual signs of the failure: full absence of light indication.

In case of unit failure it is necessary to check technical state of the unit in accordance with paragraph 2.3. If solving cause of a failure did not lead to proper operation of the device it is necessary to stop using the device and sent it to manufacturer to be repaired.

In case of failure during operation the unit it is necessary to stop the device and to shut down power supply that device uses.

2.8. Parameters of limit states

It is prohibited to run the unit under at least one of the following circumstances:

- The unit reached the limit of service life (10 years)
- Mechanical damage that prevent the unit from normal operation as well as other damage that interferes with providing explosion proofing (see paragraph 1.7).
- Disruption of components caused by corrosion, erosion and material degradation.

2.9. Rules of storing and transporting

Transporting and storing should be performed in accordance with GOST 15150-69 «Machines, instruments and other industrial products. Modifications for different climatic regions. Categories, operating, storage and transportation conditions as to environment climatic aspects influence" (terms of storing 3). Before being put into operation unit should be stored in a warehouse in factory packing at temperature -40...50 °C and relative humidity up to 90% (at temperature 25 °C).

Transportation of the unit should be performed in its factory packing. Storage time for the unit in factory packing in warehouse, including time of transportation, is 3 years.

2.10. Conservation guidelines (depreservation, reconservation)

2.10.1. Conservation

Conservation is a set of measures of unit temporary protection from environmental impact. Only serviceable unit can be conserved. Conservation of a unit should be performed in accordance with the method provided below.

Conservation is performed directly before the unit is being placed into storage in a specially equipped dry room, isolated from noxious gases permeation, vapors of acids and caustic, relative humidity no more than 70% and temperature no lower than 288 K (15 °C). Increase of relative humidity up to 80% can be accepted if temperature changes in the premises are no greater than 5 K (5 °C).

All materials used for conservation must be clean and dry and providing the unit a necessary protection against environment impact during storing. Unit should come in to preservation without corrosion damages on metal and metal covers.

Before conservation it is necessary to check operability in accordance with paragraph 2.3 of the current operation manual.

Conservation is performed by method of static air dehumidification. The unit is placed into polyethylene bag with silica gel and hermetically sealed. Bag with indicating silica gel should be placed so after packed unit is put into long-term storing box it was located in front of inspection window. Visual control of bag and its welded seams integrity is performed. Welded seams must not have openings, faulty fusions, bulging, foreign inclusions and burn outs. Time between placing silica gel on the unit and finishing welding bag’s last seam should not exceed 2 hours. For air dehumidification finely porous lump or granulated silica gel is used. A special bag is filled with 0,1 kg silica gel and placed into the bag. To control humidity inside the bag a bag with indicating silica gel is used. Blue and purple colours of indicating silica gel indicate acceptable humidity inside the bag. In case silica gel is pink it is necessary to open the bag and change silica gel.

2.10.2. Depreservation

Depreservation is a complex of measures on removing all means of temporary anticorrosive protection from the unit. Depreservation is performed directly before putting the unit into use or when term of conservation has expired.

Depreservation works should be performed in the following order – examine long-term storage packing in which the unit is stored and make sure that seals on packing box are untouched and that there are no damages; - take off seals and open long-term storage packing. Take out compacting cardboard and paper; - take out the unit packed in polyethylene bag from the long-term storage box; - unfasten the bag with indicating silica gel; - open the polyethylene bag, take out the unit that is packed in its bag and bags with silica gel. While opening the bag cut off the narrowest possible stripe with the welded seam; remove the tape and wrapping paper. Conservation materials should be put into long-term storage box; - conduct a thorough examination in order to make sure the main block housing bears no damage and there are no dents, scratches or other mechanical damage, no faults in paint-and-lacquer coating, no traces of oxides and corrosion, and to remove faults that are found; - check composition of the set; - check unit operability in accordance with requirements listed in current operation manual;

Measures of temporary anticorrosive protection, packing materials and long-term storage packing should be stored for reconcervation of the unit.

2.10.3. Reconservation

Reconservation is a process of restoring favorable conditions for storing the unit; it consists of changing (drying) damp silica gel and restoring damaged means of conservation (bags).

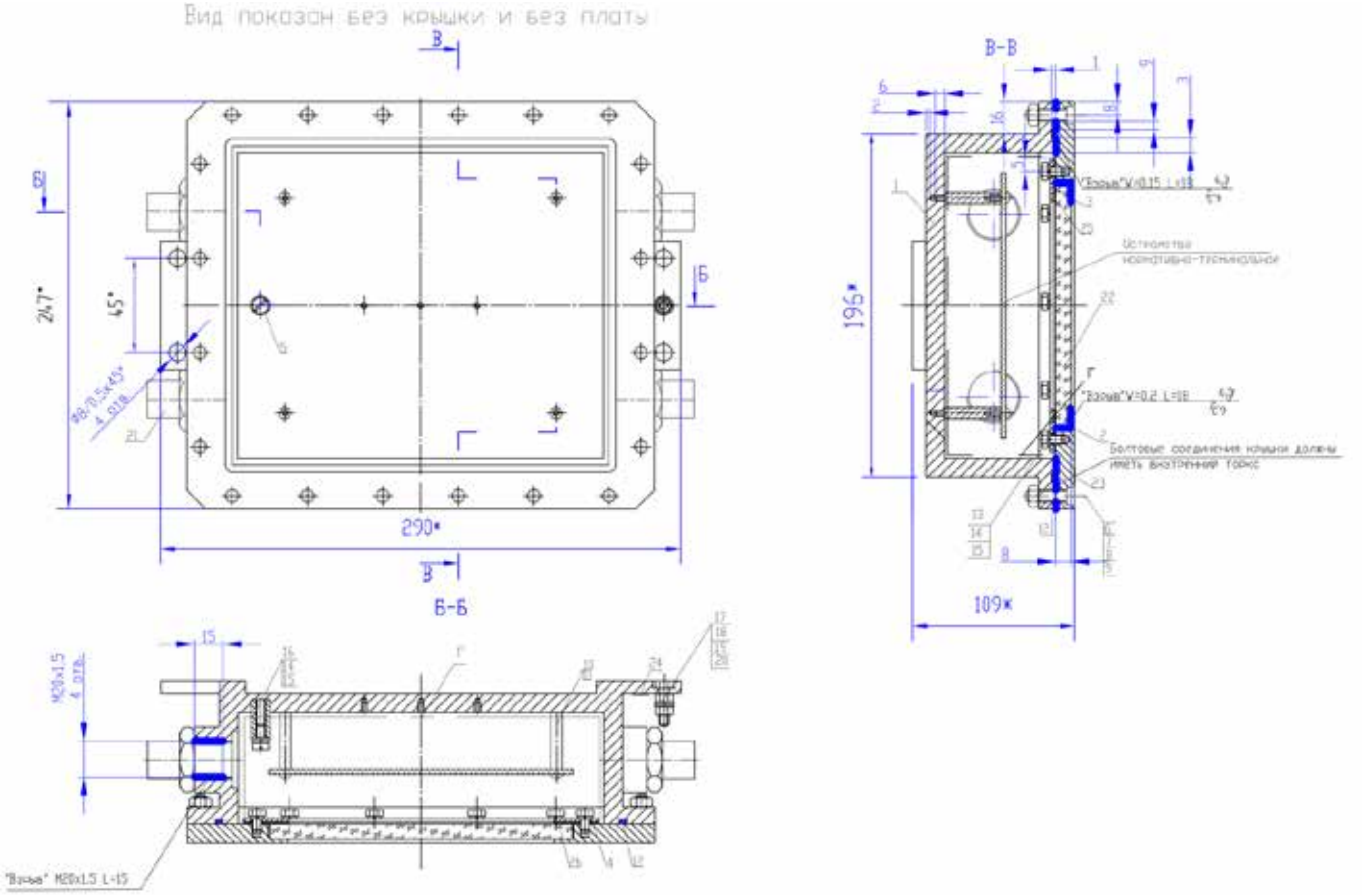
The same version of temporary protection and inner packing that is used for conservation of the unit is used for its reconservation (ВЗ-10 in accordance with GOST 9.014-78 “Unified system of corrosion and ageing protection. Temporary corrosion protection of products. General requirements)”. During reconservation it is possible to reuse undamaged inner packing that was used during previous conservation, as well as means of temporary anticorrosive protection after restoring their protection capability.

Reconservation of the unit is conducted: - after term of conservation (three years) set up by operation documentation has expired; - in case failures in conservation were found on checkup during storing; at other circumstances that require unsealing stored unit.

Reconservation is performed in the following order: - examine long-term storage packing in which the unit is stored and make sure that seals on packing box are untouched and that there are no damages; - take off seals and open long-term storage packing; - perform partial opening of polyethylene bag and change (dry) bags with silica gel; - perform re-sealing of the polyethylene bag.

APPENDIX №1

Overall and connection dimensions



Picture 2. Overall and connection dimensions.

APPENDIX №2

Unit power

1. Base design.

X1 **BRIG-015-I001**

Cont.	Circuit
1	EIA-485 data -
2	EIA-485 data +
3	Gen. (Gnd)
4	Usup.+ 12V

Picture 3. Unit power in base design.

2. Special design.

X1 **BRIG-015-I001-O**

Cont.	Circuit
1	
2	IND
3	Gen. (Gnd)
4	Usup.+ 12V

Picture 4. Unit power in special design.

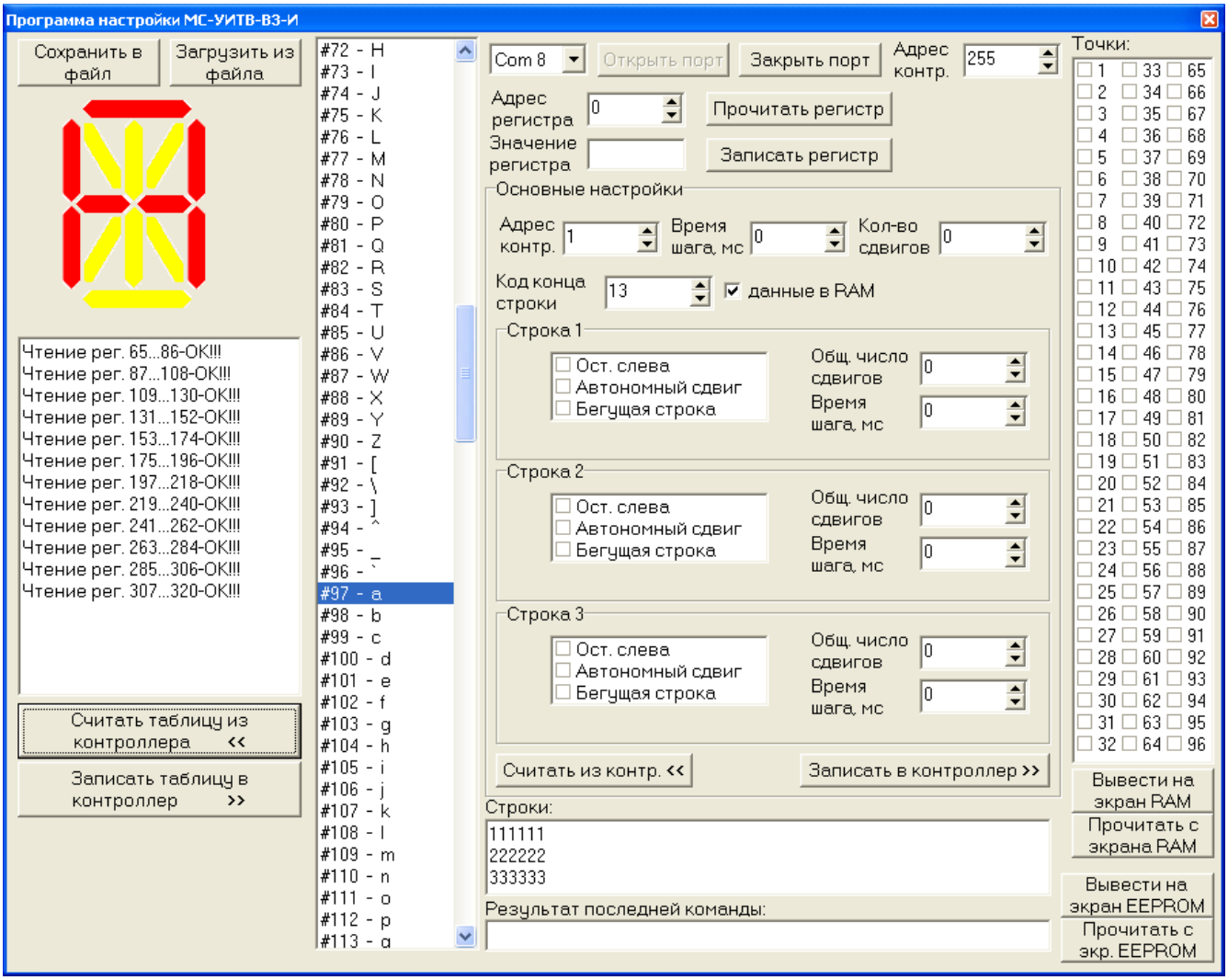
APPENDIX №3

Exchange protocol.

Configuration software. Operating instructions.

Work with settings program MS-UITV-V3-I during setting up BRIG-015-I001

Main program window is shown in picture 5. This program can work only with basic design of the unit.



Picture 5. Indicator setting program.

To start working with the program it is necessary to choose Com-port to which the unit is connected to, set up its MODBUS address (in picture 6 port – Com 8 and address – 255) and then press *Open port*.

Left part of the window allows working with unit's coding. It is possible to download a symbol table from the unit (addresses 65-320) or from a file, to change symbols' image and save the result in a file or in a non-volatile memory unit. To change symbol's image one should select its code in the codes list

(from #0 to #255) and then in the upper left part of the window find its current 14-segmental image, clicking at segments (red colour – segment is lit, green – segment is not lit) to create its new image.

With the help of this program it is possible to read or write any register in the unit BRIG-015-I001. In order to do this one should enter register address (0-374) in the field *Register address*, and if it is necessary to change its value one should write in the *Register address* field and press *Read the register* or *Log the register*.

General settings program region allows reading and changing unit's registers with addresses (54 – 64). It allows changing MODBUS address of the unit and "scrolling text" regimes.

Lower right part of the window allows displaying the text on the screen.

APPENDIX №4

List of possible malfunctions during operation, their cause and directions on their removal

Description of malfunctions and damages consequences	Possible causes	Directions on malfunctions and damages consequences determination	Directions on malfunctions and damages consequences removal
Total absence of indication	The unit does not receive supply voltage	Check supply voltage on the input supply cable	Investigate the cause of supply voltage lack
	Power cable is damaged	Check cable integrity	
	The unit is faulty	-	Hand the unit over for maintenance*

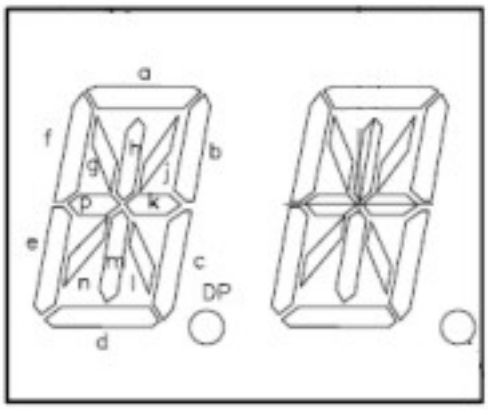
* Maintenance of the unit (including warranty maintenance) is conducted by manufacturer.

APPENDIX №5

Exchange protocol and connection parameters.

1. Introduction

Unit MS-UITV-V3-I is meant to display information in text format on a LED character indicating display. Display consists of three lines, six symbols in each line. Each symbol is synthesized via 14-segmental (+1 dot) indicator that is shown in picture 6.



Picture 6. Indicator.

Information output for this unit in basic design can be organized in a scrolling text regime (left moving), while speed and number of shifts (steps) for each line can be set up independently. There is also a regime when scrolling text stops when the first symbol in line that is not a zero (symbol's code <> #0) reaches left side of the screen. The unit displays information in Windows 1251 coding by default, but it is possible to load another table of symbols (code) to the unit.

Communication with the unit in basic design in done in accordance with MODBUS RTU protocol through EIA-485 interface.

Communication with the unit in special design is done in accordance with special interface and protocol. This regime is used in working along with BRIG-015-K001 controller (as well as units NPA-2007 and MS-UITV-VZ-K) to display information on status of oil or other petrochemical products loading into tank lorries or railway tanks. During that indicator can show only the following information:

- 1 line: required amount
- 2 line: loaded amount
- 3 line: state of loading unit sensors (scrolling text).

2. Connection parameters (for basic design only).

Settings parameters for Com-port see in table 2.1.

Parameter	Value
Connection speed, baud	9600
Quantity of bit data	8
Parity control	none
Stop bit quantity	2
Operation mode	asynchronous

Table 2.1 – Connection parameters

3. MODBUS register card (for basic design only)

List of registers that are available to the external unit is provided in table 3.1.

While describing the register high byte is described first (and upper).

Table 3.1 – Registers MS-UITV-V3-I

Address	Name	Access	Description
Registers in unit's RAM			
0	Dots0	R/W	**Bit 0** of 16-byte register **Dots0** corresponds with 1st symbol in symbols code area (**registers 6-53**) (**register 6**, lower byte), **bit 15** of 16-byte of 16-byte register **Dots0** corresponds with 16th symbol (**register 13**, upper byte). If a bit in this register has been set up then corresponding symbol would appear on the display with a determined **DP** segment (picture 1.1). At output of a dot you may not use registers **Dots0**-**Dots5**, then dot takes a whole symbol (**segment E**, **#46** in **Windows 1251** coding).
- / -			
5	Dots5	R/W	**Bit 0** of 16-byte register **Dots5** corresponds with 81st symbol in symbols code area (**registers 6-53**) (**register 46**, lower byte), **bit 15** of 16-byte of 16-byte register **Dots5** corresponds with 96th symbol (**register 53**, upper byte). If a bit in this register has been set up then corresponding symbol would appear on the display with a determined **DP** segment (picture 1.1). At output of a dot you may not use registers **Dots0**-**Dots5**, then dot takes a whole symbol (**segment E**, **#46** in **Windows 1251** coding).
6	Chars0 (hi)	R/W	Upper byte of the register contains 2nd symbol that is displayed on the screen.
	Chars0 (lo)		Lower byte of the register contains 1st symbol that is displayed on the screen.
- / -			
53	Chars47 (hi)	R/W	Upper byte of the register contains 96th symbol that is displayed on the screen.
	Chars47 (lo)		Upper byte of the register contains 95th symbol that is displayed on the screen.
Registers in EEPROM (non-volatile memory) of the unit			
54	Not used	R/W	
	Adr (lo)		Lower byte of the register contains MODBUS address of the controller.
55	Time_Step	R/W	Step in (ms). Used at arranging scrolling text.

Address	Name	Access	Description
56	Not used	R/W	
	Steps (lo)		This register is used at arranging scrolling text, it contains line's maximum number of steps. For example the line contains a text "hello world" and this register – 3, then on the 0th step display would be empty, on the 1st step (step changes with the period **Time_Step**) display would contain «-----h», on the 2nd – «----he», on the 3rd – «---hel», then back to step 0.
57	Str_Steps1	R/W	This register is used at arranging scrolling text, it contains line's maximum number of steps for line №1 (upper line) of the unit. This register is used if line №1 contains an autonomous scrolling text operating mode (in this case **Str_Time_Step1** and **Str_Steps1** are used instead of registers **Time_Step** and **Steps**).
	Str_Mode1		This register contains regime of displaying line №1. If the line has a **bit 7** set up then this line is displayed as scrolling text. If the line has a **bit 6** set up then this line has an autonomous operating mode (in this case **Str_Time_Step1** and **Str_Steps1** are used instead of registers **Time_Step** and **Steps**). If the line has a **bit 0** set up then shift of the line stops until the end of the period when the first non-zero (with #**0** code) symbol in the line reaches left limit.
58	Str_Time_Step1	R/W	Step in (ms). Used at arranging scrolling text in autonomous operating mode
59	Str_Steps2	R/W	This register is used at arranging scrolling text, is contains line's maximum number of steps for line №2 (middle line) of the unit. See description of **Str_Steps1**.
	Str_Mode2		This register contains regime of displaying line №2. See description of **Str_Mode1**.
60	Str_Time_Step2	R/W	Step in (ms). Used at arranging scrolling text №2 in autonomous operating mode.
61	Str_Steps3	R/W	This register is used at arranging scrolling text, is contains line's maximum number of steps for line №3 (lower line) of the unit. See description of **Str_Steps1**.
	Str_Mode3		This register contains regime of displaying line №3. See description of **Str_Mode1**.
62	Str_Time_Step3	R/W	Step in (ms). Used at arranging scrolling text №3 in autonomous operating mode.
63	Car_Ret	R/W	Symbol of line's transition (usually #**13**). Area of display's characters **Chars0**..**Chars47** (**addresses 6..53**) contains information for display for all 3 lines. Characters in this area that are located before first character with code **Car_Ret** are displayed on the 1st line of the screen between 1st and 2nd characters **Car_Ret** are displayed on the 2nd line of the screen, other characters – on the 3rd.
64	Mode_Reg	R/W	If a 0 bit of this register has been set up then information from usual RAM memory of the unit is shown on the screen. **Chars0**..**Chars47** and **Dots0**..**Dots5**. Otherwise **CharsF0**..**CharsF47** и **DotsF0**..**DotsF5** are shown from non-volatile EEPROM, whilst range **Chars0**..**Chars47** is rewritten by registers **CharsF0**..**CharsF47**, and **Dots0**..**Dots5** by registers **DotsF0**..**DotsF5**.
65	SymbView0	R/W	This register contains image of the character with code #0. To understand coding creation see table 3.2

Address	Name	Access	Description
- / -			
320	SymbView255	R/W	This register has image of the character with code **#255**. To understand coding creation see table 3.2
321	DotF0	R/W	This register is used instead of **Dot0** if **бит 0** of **Mode_Reg** register has been reset.
- / -			
326	DotF5	R/W	This register is used instead of **Dot5** of **бит 0** of **Mode_Reg** register has been reset.
327	CharsF0	R/W	This register is used instead of **Chars0** if **бит 0** of **Mode_Reg** register has been reset.
- / -			
374	CharsF47	R/W	This register is used instead of **Chars47** if **бит 0** of **Mode_Reg** register has been reset.

Table 3.2 – Registers decoding SymbView0..SymbView255

Bit	Corresponds to the segment (see picture 1.1)
0	b
1	a
2	p
3	j
4	h
5	g
6	f
7	c
8	-
9	e
10	n
11	m
12	l
13	k
14	d
15	-

Part of unit’s registers is located in RAM and do not save data after power is cut off. Another part of registers is located in EEPROM. While working with the display you can use both RAM and EEPROM, it depends on setting bit 0 of **Mode_Reg** register. This EEPROM has a guaranteed 100000 overwriting cycles, so if you want to display data that changes several times in a minute (current time, temperature, data on oil products loads etc.) use RAM registers.

Current unit supports MODBUS commands with the following codes: **03 – Read Holding Registers**, **04 – Read Input Registers** – these commands are identical and allow to read no more than 22 registers at a time; **06 – Write Single Register**; **16** (**0x10**) – **Write Multiple Registers** – these commands allow to write no more than 20 registers at a time.

4. Special design of the unit

Special design is used during joint work with controller BRIG-015-K001 (as well as units: NPA-2007 and MS-UITV-VZ-K) to display information on status of oil or other petrochemical products loading into tank lorries or railway tanks.

Upper line displays required amount in litres. Middle line displays loaded amount in litres. Lower line displays state of loading.

Information from master device is passed as voltage impulses amplitude 12V, level of logical zero – 0V, level of logical one +12V. State of line in absence of transmission – logical zero.

The unit can work only in information reception mode, the following parameters are used for connection:

Table 4.1 – Connection parameters for unit in special design

Parameter	Value
Connection speed, baud	1200
Quantity of bit data	9. 8 bit contains data itself, 9th is control bit: at transitioning of 1st byte of the package it is set up, at transitioning the rest of 9 bytes it is reset
Parity control	none
Stop bit quantity	1
Operation mode	asynchronous.
Maximum time between transition of two neighboring bytes	Infinity. Thus the package has a fixed length – 10 characters, receive data buffer resets after receiving 10th character. Also receive data buffer resets after receiving byte with a set up 9th data bit (this byte goes to receive data buffer, counter of bytes received set up at 1)

Data message format for the unit is provided in table 4.1. 8-bit part of character is used (control 9th bit is not taken into account).

Таблица 4.2 – Data message format for the unit BRIG-015-I001 in special design.

№ byte	Value	Description
1	5	Function code.
2	Dose0	Byte 0, byte 1 and byte 2 of a integer number that is amount given for loading in litres
3	Dose1	
4	Dose2	
5	Otp0	Byte 0, byte 1 and byte 2 of a integer number that is quantity of loaded oil products in litres
6	Otp1	
7	Otp2	
8	State	Value of byte and text on the third line of the unit display: 0 – ready to loading 1 – overloading 2 – “stop” button or prohibition

		3 – loading arm is up and truck is not grounded 4 – loading arm is up 5 – truck is not grounded
9	CRC (Lo)	Control sum of package. It is calculated through the same algorithm that is in MODBUS RTU protocol
10	CRC (Hi)	