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TELEVISION MODULE

TM-1104-3

Operating Manual

ТЭ3.623.912-03РЭ

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CONTENTS

Operating Manual ТЭ3.623.912-03РЭ is intended for studying the content, operation principle, parameters and characteristics of the ТМ-1104-3 ТЭ3.623.912-03 television module to help correct operation and full use of the technical capabilities thereof.

For studying and operation of the ТМ-1104-3 ТЭ3.623.912-03 television module the following additional documents should be guided by:

ТМ-1104-3 television module:
- electric connection diagram ТЭ3.623.912-03Э4;
- component list ТЭ3.623.912-03ПЭ4;
- block diagram ТЭ3.623.912-03Э2.

МТК-110МЭ television complex:
- general electric diagram ТЭ1.133.110-02Э6;
- block diagram ТЭ1.133.110-02Э2;
- operating manual ТЭ1.133.110-02РЭ.

The list of the special terms and abbreviations used in the present Manual is given in Appendix A.

1 DESCRIPTION AND OPERATION

1.1 Description and Operation of Device

1.1.1 Application

The ТМ-1104-3 ТЭ3.623.912-03 television module, hereinafter referred to as "device", when used as a part of the TV-complex is intended for:

- commutation of video signals from TVDs to TVMs of the TV-complex;
- displaying of video information from TVDs of the TV-complex on the screen of the ВС-2 TVM, that is built into the device;
- generation and reception of control signals during data exchange via RCLI channels with the ТМ-1215-4 control modules and ТМ-1213 terminal module of the TV-complex;
- generation and reception of control signals during data exchange via RCLI channels with the ТМ-1304 combined modules of the TV-complex;
- generation and transmission of the DGP signal to the ТМ-1304 combined modules of the TV-complex;
- reception of chronometrical information from device "Гном-2МЭ", indication of that on the screen of the ВС-2 TVM and its transmission to the ТМ-1213 terminal module of the TV-complex via RCLI channel;
- supplying the ТМ-1304 combined modules, ТМ-1215-4 control modules and ТМ-1213 terminal module of the TV-complex with a feeding voltage of plus 27 V;
- gathering and processing of information on the TV-complex state;
- indication of information on the TV-complex state on the screen of the ВС-2 TVM;
- indication of information on the TV-complex state with the built-in LEDs;
- checkout of the equipment of the TV-complex during maintenance and operation.

To provide easy restoration of the device some modules and units of the BSP are built immediately into the device.

The device provides the parameters and characteristics given below under the following operating conditions:

- ambient temperature from 0 to 40 °C;
- relative humidity up to 98% at a temperature of 35 °C;
- air pressure from 600 mm Hg to 1520 mm Hg;
- sinusoidal vibration in a frequency range of 5 to 60 Hz at an acceleration amplitude of up to (2,0 ± 0,4)g.

1.1.2 Main Technical Parameters

The device has the following main technical parameters:
- number of video signal inputs - 21;
- number of video signal outputs - 4;
- swing of input and output video signals - (1 ± 0,3) V;
- load resistance in video signal circuit - (75 ± 5%) Ω;
- video channel bandwidth, at least 7,3 MHz;
- scanning - interlaced, 625 lines, 25 frames a second;
- number of RCLI channels for data exchange with the TM1215-4 control module and TM-1213 terminal module - 4;
- number of RCLI channels for data exchange with the TM-1304 combine modules - 6;
- lock mode - autonomous;
- number of DGP output signals - 6;
- two independent channels for receiving chronometrical information from device "Гном-2МЭ";
- supply voltage - three-phase, from 180 to 231 V;
- feeding voltage frequency - (50 ± 1) Hz;
- power consumption - no more than 500 VA, including total power consumption of external load not exceeding 350 VA;
- continuous operation time - 5000 h;
- overall dimensions – no more than 1722 x 360 x 629 mm;
- weight, maximum - 125 kg.

1.1.3 Device Contents

The device includes the parts shown in Table 1.

Table 1

Designation	Code	Part Name	Qty.
ТЭ2.045.544	ВС-2	Television monitor	1
ТЭ2.067.408	ФСП-3В	Interference rejection filter	6
ТЭ2.072.492	ЭМ-1211	Diagnostics module	1
ТЭ2.201.769	ЭМ-1213	Power supply unit	3
ТЭ2.242.434-01	ЭМ-1204-1	Videoswitch module	1
ТЭ2.242.435-01	ЭМ-1205-1	Videoswitch module	1
ТЭ2.275.261	ЭМ-1242	Interface unit	1

Table 1 (continued)

Designation	Code	Part Name	Qty.
ТЭ3.057.439-01	ЭМ-1209-1	Controller	1
ТЭ3.679.117-01	ЭМ-1212-1	Control module	1
ТЭ5.883.022		Assembly unit	1

1.1.4 Device Structure and Operation

Modules and units of the device form several functional systems, that are parts of the corresponding systems of the TV-complex. This functional systems are listed below:
- system providing generation, processing and displaying of video signals;
- genlocking system;
- control system;
- automated checkout system;
- chronometrical information input system;
- power supply system;
- auxiliary communication system.

Most modules included by the device contain units that are parts of different systems.

The description of the device and operation thereof refers to elements in the ТМ-1104-3 ТЭ3.623.912-03Э4 TV-module electric connection diagram and the ТЭ1.133.110-02Э6 TV-complex general electric diagram.

1.1.4.1 Video Signal Generation, Processing and Displaying System

The system of video signal generation, processing and displaying provides:
- “mirror” rotation of the image arriving from the КТ-257 TV-camera;
- multiplexing of 21 input video signals to five outputs;
- generation of a video signal for displaying information on the TV-comlex state on the ВС-2 TVM;
- displaying of video information from the TVDs of the TV-complex on the screen of the ВС-2 TVM.

The device contains three main modules of the video signal generation, processing and displaying system:
- videoswitch module, ЭМ-1204-1 (A31);
- videoswitch module, ЭМ-1205-1 (A32);
- ВС-2 television monitor (A11);
- ЭМ-1211 diagnostics module (A21) that generates the video signal containing data on the TV-complex state.

The ЭМ-1205-1 videoswitch module converts the inverse image from the КТ-257 TV-camera (created by the lens of pull-out optical device “Сигнал-3”) to an erect image. The ЭМ-1205-1 videoswitch module provides several modes of image rotation: by line, by frame and by both at the same time. The rotation mode is set by parallel binary code that is used for remote control. The code comes from the ЭМ-1204-1 videoswitch module.

The video signal from the KT-257 TV-camera comes to connector X1 of the device and then – to the input of the ЭМ-1205-1 videoswitch module. The ЭМ-1205-1 videoswitch module contains a DAC, an ADC and a PLIC. The ADC performs conversion of the analog video signal into a digital one. Then, the PLIC provides writing of the data into the internal RAM and reading the content of the RAM in an inverse order thereby performing the image rotation required. The rotation process is initiated on a remote control command. From the output of the PLIC the digital data come to the DAC that does the conversion into an analog output video signal.

The ЭМ-1204-1 videoswitch module performs multiplexing of 21 input video signals to five outputs in accordance with remote control commands that come from the ЭМ-1209-1 controller via RCLI lines.

The ЭМ-1204-1 videoswitch module contains an analog matrix multiplexer providing commutation of 24 input signals to 6 outputs. The device employs only 21 inputs and five outputs. The matrix multiplexer is driven by a built-in microcontroller (MC) receiving commands from the ЭМ-1209-1 controller.

The video signal from the output of the ЭМ-1205-1 videoswitch module comes to input 1 of the ЭМ-1204-1 videoswitch module. The signals from the TVDs of the TV-complex are connected to inputs 2 to 20. "Video Input 21" of the ЭМ-1204-1 videoswitch module is reserved and not used in the TV-complex. The output video signals of the ЭМ-1204-1 videoswitch module are assigned as follows:

"Video Output 1" via connector X22 of the device comes to TVM BC-2-1 No.1 of the TV-complex (first CP of TV-complex);

"Video Output 2" via connector X23 of the device comes to TVM BC-2-1 No.2 of the TV-complex (second CP of TV-complex);

"Video Output 3" via connector X24 of the device comes to the BC-1-1 No.1 of the TV-complex (third CP of the TV-complex);

"Video Output 4" comes to connector X25 of the device and is not used in the TV-complex;

"Video Output 5" comes to the video input of the ЭМ-1211 diagnostics module and then - to the BC-2 TVM.

The ЭМ-1211 diagnostics module performs switching between video signals for the BC-2 TVM coming from the ЭМ-1204-1 videoswitch module and a diagnostics signal that is generated by the ЭМ-1211 diagnostics module by itself.

Commutation of video signals is done by pressing the buttons on the front panel of the ЭМ-1211 diagnostics module. By pressing button SELECT the video signal from the ЭМ-1204-1 videoswitch module (from the TVD chosen on the ЭМ-1212-1 control module) is connected to the BC-2 TVM. Pressing button ENTER provides connection of the video signal formed in the ЭМ-1211 diagnostics module, containing data on the TV-complex state, to the screen of the BC-2 TVM.

1.1.4.2 Genlocking System

The genlocking system provides centralized synchronization of all the TVDs of the complex by forming DGP signals on the six output connectors of the device. The DGP signal constitutes a pulse sequence with a swing of 3 V, frequency of 15625 Hz and duration of 5 μS. Every 625-th pulse has a duration of 12 μS. The centralized synchronization reduces the mutual interference level and simplifies video signal processing.

The main unit of the genlocking system is the EM-1209-1 controller. The PLIC of the unit forms the DGP signal basing on clock pulses of a quartz oscillator and supplies it to the six DGP outputs via a buffer amplifier. This signals are fed to connectors X26-X31 of the device and finally arrive to the TM-1304 combined modules. One DGP output (connector X31) is reserved and not used in the TV complex.

1.1.4.3 Control System

The functional control system (CS) is formed by the ЭМ-1209-1 controller (A33) along with microcontrollers and microprocessors of the main device modules interconnected via RCLI lines. The ЭМ-1209-1 controller constitutes a dedicated computer performing the main control functions of the TV complex. The microcontrollers and microprocessors that are parts of the ЭМ-1204-1 videoswitch module (A31), ЭМ-1211 diagnostics module (A21), ЭМ-1212-1 control module (A22), and ЭМ-1242 interface unit (A23) perform local control functions.

The control system provides:

- communication with the TM-1215-4 control modules and the TM-1230 control module of the TV complex CPs to receive control instructions from the module buttons;
- input of control instructions from the ЭМ-1212-1 control module, that is a part of the device, during the TV complex operation check.
- processing of control instructions and output of instructions to the execution units of the device and other modules of the TV complex to provide power supply and control of the TVDs, correction and commutation of video signals, centralized genlocking and video recording.
- receiving and analysis of replies of execution units and indication of instruction fulfillment results;
- preparation and output of data about the state of the TV-complex to the automatic checkout system (ACS).

The ЭМ-1209-1 controller is the main control element of both the device control system and the whole TV complex. The working software of the controller is written to ROM and provides control of the TV complex via serial duplex communication channels. The ЭМ-1209-1 controller incorporates a power supply supervisor and a watchdog timer, controlling the working program execution and automatically resetting the system in case of a fault. The ЭМ-1209-1 controller provides 14 serial duplex interface channels (RCLI) and an RS-232 channel. The working program can be reset by pressing the RESTART button, mounted on the front panel of the controller. The ЭМ-1209-1 controller is installed on the third floor of the device in the rightmost row (see Appendix B, pos.13). To the left of that the two ЭМ-1209-1 controllers of the BSP are installed.

The modules that are parts of the device as well as other modules included by the TV-complex are controlled via RCLI channels.

The RCLI channels have the following parameters:

- loop-type channel, duplex, four-wire, two wires are used for output datastreams (data transmission lines) and two wires are used for input datastreams (data reception lines);
- data transmission and reception circuits are galvanically decoupled;
- baud rate - 19200;
- number of data bits - 8;
- number of stop bits – 1;
- LSB is transferred first;
- pause, stop bit and logic one are transferred as current from 0 to 1 mA;
- start bit and logic 0 are transferred as current from 15 to 25 mA;

- receiver operation threshold is from 5 to 8 mA.

Data in the RCLI channels is transmitted as byte arrays. Data arrays are transferred with a frequency from 10 to 25 Hz. The pause between arrays is no less than 1 ms. Pause between neighboring bytes within an array is no more than 100 μS. Every array ends with a check sum. Data exchange in RCLI channels is started by the ЭМ-1209-1 controller by transmission of the corresponding command instruction arrays. On reception of the command instruction array all the units and modules of the TV-complex start transmission of reply arrays.

Data exchange between the ЭМ-1209-1 controller and the TM-1304 No.1 - TM-1304 No.5. combined modules is performed via channels " RCLI 1" – " RCLI 5". During this exchange the datastream passes through assembly modules, TM-1308 No.1- TM-1308 No.3.

Every command array consists of nine bytes and contains the following data: command to switch on the power supplies of four TVDs, video signal correction factors for four TVDs, type of synchronizing pulses and delay of those for synchronization of four TVDs, instructions for control of TVD modes. The reply arrays contain data on functioning of the modules that are parts of the TM-1304 combined modules, supply voltage presence on four TVDs, presence of video signals from four TVDs, diagnostic information from four TVDs.

Data exchange between the ЭМ-1209-1 controller and the TM-1213 terminal module is performed via channel " RCLI 7". During this exchange the datastream passes through connector X38 of the device and the TM-1308 No.4 assembly module.

The command array contains commands to light up the LEDs of the TM-1215-4 No.1 and the TM-1230 control modules, commands for control of the ДЕ-118-1 VRD, data for mixing into the video signal before video recording (abbreviated name of TVD, date and time). The reply array contains the codes of the buttons pressed on the control modules, TM-1215-4 N 1 and TM-1230, and also information about the state of the ДЕ-118-1 VRD.

Data exchange between the ЭМ-1209-1 controller and the TM-1215-4 No.2 control module is performed via channel " RCLI 8". During this exchange the datastream passes through connector X38 of the device, the TM-1308 No.4 assembly module and the TM-1201 No.1 terminal module. The command array contains commands to light up the LEDs of the TM-1215-4 No.2 control module. The reply array contains the codes of the buttons pressed.

Data exchange between the ЭМ-1209-1 controller and the TM-1215-4 No.3 control module is performed via channel " RCLI 9". During this exchange the datastream passes through connector X39 of the device, the TM-1308 No.5 assembly module and the TM-1201 No.2 terminal module. The command array contains commands to light up the LEDs of the TM-1215-4 No.3 control module. The reply array contains the codes of the buttons pressed.

The ЭМ-1209-1 controller transmits data to the ЭМ-1211 diagnostics module via channel " RCLI 11". The data array contains information on data transfers between the ЭМ-1209-1 controller and all the peripheral modules, information on the state and control of all the TVDs and VRDs.

Channel " RCLI 12" is used for data exchange between the ЭМ-1209-1 controller and the ЭМ-1212-1 control module. The command array contains instructions for controlling the LEDs of the ЭМ-1212-1 control module. The reply array contains the codes of the buttons pressed.

Channel " RCLI 13" is used for data exchange between the ЭМ-1209-1 controller and the ЭМ-1242 interface module. The command array contains a request for transferring chronometrical information from the first or the second channel of the ЭМ-1242 interface module. The reply array contains chronometrical information from the requested exchange channel of the ЭМ-1242 interface module.

Channel " RCLI 14" is used for data exchange between the ЭМ-1209-1 controller and the ЭМ-1204-1 videoswitch module. The command array contains instructions for commutation of the input video signals to the six outputs. The reply array contains information on the instruction execution.

Channels " RCLI 6" and " RCLI 10" are brought out to connectors X37 and X39 of the device. They are reserved and not used in the TV-complex.

The RS-232 channel is brought out on connector X43 of the device. This channel is used for setup and debugging of the TV-complex.

The ЭМ-1209-1 executes the program stored in its non-volatile memory. This program periodically, with a frequency of 10 to 25 Hz, carries out the following actions:

- communication with the TM-1215-4 control modules, TM-1230 control module and ЭМ-1212-1 control module via the RCLI channels;
- handling of commands coming from the TM-1215-4 control modules, TM-1230 control module and ЭМ-1212-1 control module when their buttons are pressed;
- forming of control instructions for all the modules connected to the ЭМ-1209-1 via the RCLI channels.
- transferring of instructions via the RCLI channels and interrogation of the ЭМ-1204-1 video signal commutation module, ЭМ-1242 interface module, ЭМ-1202 control and synchronization modules in the TM-1304 combined modules, ЭМ-1241 control modules in the TM-1220-1 optical TV-units and the КТ-257 TV camera;
- forms and transfers the diagnostic data to the ЭМ-1211 diagnostics module.

The ЭМ-1212-1 control module (Fig.1) provides manual command input for the ЭМ-1209-1 controller with the buttons mounted on the front panel and LED indication of execution of the following commands:

- switching on and off of any of the 20 TVDs of the TV-complex with buttons GROUP1-GROUP5, CHANNEL1-CHANNEL4, OFF.
- enabling the night mode of the КТ-257 TV-camera with button NIGHT MODE;
- control of the selected TM-1220-1 optical TV-module with button TEST ON.
- indication of location of faulty TVDs under servicing or servicing completion with buttons TVD TO CHECK and TVD FROM CHECK.
- testing LEDs and buttons of the ЭМ-1212-1 control module with button TEST of the ЭМ-1212-1.

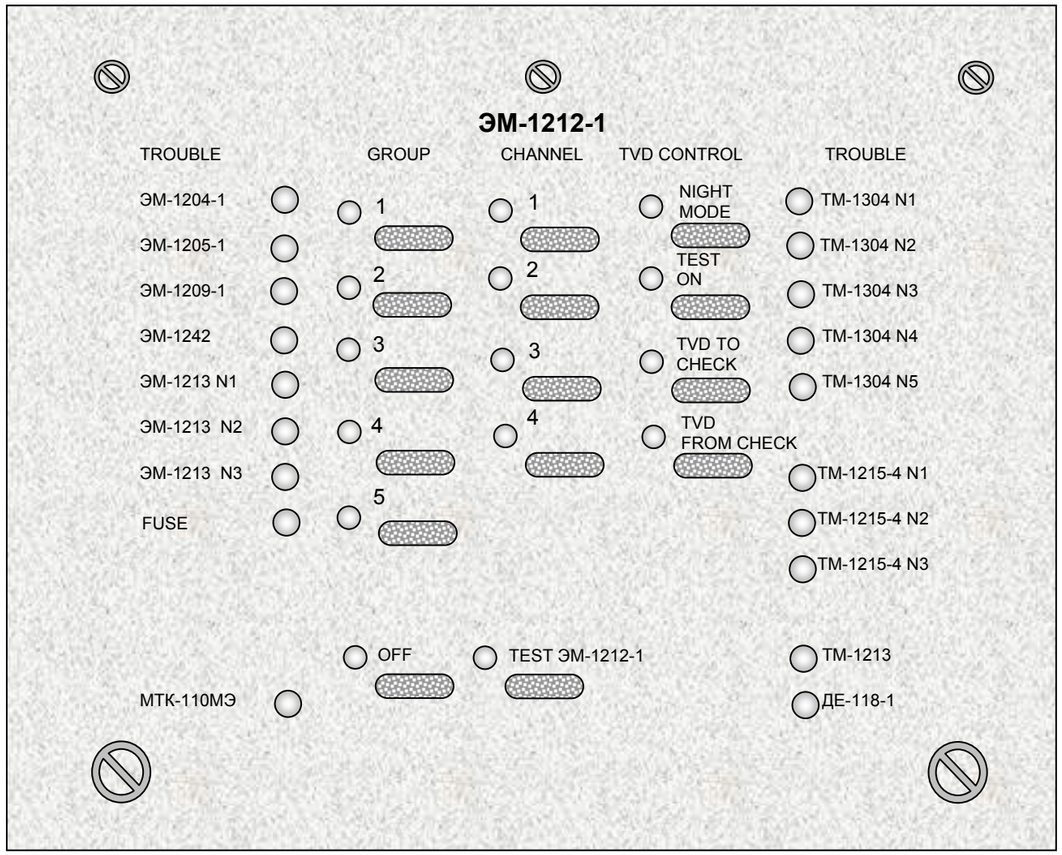

Fig. 1 – Front panel of the ЭМ-1212-1 control module.

Functioning of the ЭМ-1212-1 control module as a part of the control system is provided by microcontroller CS, PLIC, interface and buttons with LEDs. The microcontroller (MC) together with the PLIC inquires the buttons. On request from the ЭМ-1209-1 controller the MC forms a reply array with the codes of the buttons pressed and transfers it via the RCLI channel to the ЭМ-1209-1 controller.

The MC of CS receives from the ЭМ-1209-1 controller a command array with instructions for lighting up the LEDs and switches on the corresponding LEDs by means of the PLIC. The working program of the ЭМ-1209-1 controller analyses the button state and decides whether to light up the LEDs.

Correspondence between group numbers, channel numbers, TVD installation places and the designation on the TM-1215-4 control module is shown in Table 2.

The ЭМ-1211 diagnostics module has a microprocessor and an interface receiving arrays with data on the CS state from the ЭМ-1209-1 controller and provide visualization of the data in video frames of the ACS.

The ЭМ-1204-1 videoswitch module contains a MC and an interface that receive instructions from the ЭМ-1209-1 controller for commutation of video signals and control their execution.

Table 2

Group-channel	Place of TVD installation	Video signal source	Designation on TM-1215-4
1-1	Device ″Сигнал-3″	КТ-257	PERISCOPE
1-2	Fore end, – 6 frame	ТМ-1220-1	FE –6FR
1-3	1 room, 1 deck, starboard side	Неотон-08-2	1R 1D STB
1-4	1 room, 2 deck	Неотон-08-1	1R 2D
2-1	1 room, 1 deck, port side	Неотон-08-1	1R 1D PS
2-2	Superstructure, 20 frame	ТМ-1220-1	SUPRSTR 20FR
2-3	3 room, 1 deck	Неотон-08-2	3R 1D
2-4	3 room, 3 deck	Неотон-08	3R 3D
3-1	4 room, 1 deck	Неотон-08-2	4R 1D
3-2	BF, winch automated communication system	ТМ-1220-1	WINCH ACS
3-3	4 room, 2 deck, starboard	Неотон-08-1	4R 2D STB
3-4	4 room, 2 deck, port side	Неотон-08-1	4R 2D PS
4-1	5 room, port side	Неотон-08-2	5R PS
4-2	5 room, starboard	Неотон-08-2	5R STB
4-3	Pod, winch sonar system	ТМ-1220-1	WINCH SS
4-4	4 room, 2 deck, PCS	Неотон-08	4R 2D PCS
5-1	6 room, 1 deck, aft	Неотон-08-1	6R 1D A
5-2	6 room, 1 deck, fore	Неотон-08-1	6R 1D F
5-3	Tiller compartment	Неотон-08	TC
5-4	Pod, 108 frame	ТМ-1220-1	POD 108FR

The ЭМ-1242 interface unit contains a MC and a PLIC that form an array with chronometrical data on request from the ЭМ-1209-1 controller.

The ЭМ-1209-1 controller working program provides various priorities for the ЭМ-1212-1 and TM-1215-4 control modules as per enabling and control of the TVDs. The ЭМ-1212-1 control module has the highest control priority. The second comes the TM-1215-4 No.1 control module, then - the TM-1215-4 No.2 control module and TM-1215-4 No.3 control module.

The ЭМ-1209-1 prohibits accidental enabling the night channel of the КТ-257 TV-camera in the day time. On the first press on button PERISCOPE NIGHT on any of the TM-1215-4 control modules, the ЭМ-1209-1 controller will switch on the day channel of the

KT-257 TV-camera. If button PERISCOPE NIGHT is pressed again the night channel of the KT-257 TV-camera will be switched on in at least 5 s since the day channel switch-on. If the night channel of the KT-257 TV-camera has already been switched on and button PERISCOPE NIGHT on the other TM-1215-4 control module is pressed, the signal of the night channel will be connected to the TVM without delay.

The ЭМ-1209-1 controller prohibits the TM-1215-4 control module with the lowest priority from execution of the following control commands:

- input a test into the TM-1220-1 optic-television module if it was already switched on from the ЭМ-1212-1 control module or from a TM-1215-4 control module having a higher priority;
- switch on the day channel of the KT-257 TV-camera if the night channel was switched on from the ЭМ-1212-1 control module or from a TM-1215-4 control module having a higher priority;
- switch on the night channel of the KT-257 TV-camera if the day channel was switched on from the ЭМ-1212-1 control module or from a TM-1215-4 control module having a higher priority;

The ЭМ-1209-1 controller prohibits to switch on the KT-257 TV-camera and the TM-1220-1 optic-television modules from the TM-1215-4 No.3 control module. If an attempt at switching on this units occurs, light-emitting diode NO TVD lights up on the TM-1215-4 No.3 control module.

The ЭМ-1209-1 prohibits to enable video recording from the TM-1215-4 No.2 и TM-1215-4 No.3 control modules. On pressing button RECORD ON on this modules light-emitting diode NO CTRL lights up.

The ЭМ-1209-1 prohibits controlling the ДЕ-118-1 VRD from the front panel of the TM-1230 control module, if prior to that the registration mode was activated on the TM-1215-4 No.1 control module.

A TVD generating an abnormal image undergoes checking and servicing. The ЭМ-1209-1 controller provides indication of the servicing mode from the ЭМ-1212-1 control module with recording the number of the TM-1215-4 control module from which the TVD was forwarded for servicing. During this the power supply remains connected to the TVD and the video signal of the TVD comes to the corresponding TVM. On enabling the TVD under servicing from any of the TM-1215-4 control modules or ЭМ-1212-1 control module light-emitting diode TVD TO CHECK lights up thereon.

The ЭМ-1209-1 controller allows to take a TVD out of servicing only from the ЭМ-1212-1 control module panel.

1.1.4.4 Automated Checkout System

The automated checkout system (ACS) is intended for continuous supervision over the state of all the modules and units of the device, gathering of data on the state of units and modules of the TV-complex. The ACS analyses the incoming data and indicates the state of the TV-complex modules and units by means of the LEDs and the screen of the BC-2 TVM.

The ЭМ-1211 diagnostics module (A21) is the main module of the ACS of the device and the TV-complex also. The ACS comprises the following modules of the device:

- ЭМ-1212-1 control module (A22);
- ЭМ-1209-1 controller (A33);
- BC-2 television monitor (A11).

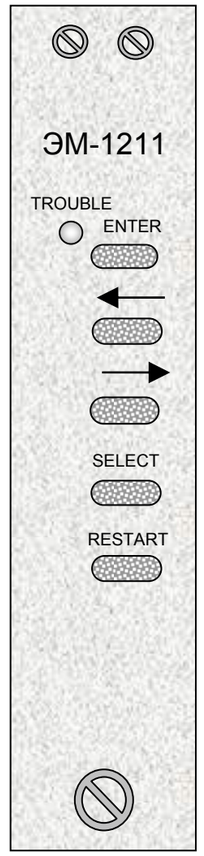

Fig. 2 – Front panel of ЭМ-1211 diagnostics module.

The ЭМ-1211 diagnostics module constitutes a special computer whose working software is written into the ROM by Manufacturer. It has a built in power supply supervisor and a watchdog timer automatically controlling the working program execution and resetting the system in case of a fault. The ЭМ-1211 diagnostics module includes a video adapter forming the video signal and a switch connecting either the external signal or the adapter signal to the common output. The 55-channel ADC measures the incoming d.c. voltages from minus 30 to plus 30 V with a ratio error of no more than 0,2%. The ЭМ-1211 diagnostics module has an RS-232 and a RCLI interface channels. There are five buttons and one LED on the front panel of the ЭМ-1211 diagnostics module (Fig.2). The LED indicates a fault in the TV-complex. Button ENTER outputs the ACS frame No.1 on the BC-2 TVM screen. The arrow buttons allow switching between frames of the ACS. Button SELECT switches the video signal from the ЭМ-1204-1 videoswitch module to the screen of the BC-2 TVM. Button RESTART forces reset of the working program. The ЭМ-1211 diagnostics module is installed on the second floor of the device in the leftmost row (Fig. B1, pos.3).

The ADC of the ЭМ-1211 diagnostics module samples the d.c. voltages from the three ЭМ-1213 power supply units, outputs of fuses F1-F16, power supply units built into the device modules and control voltages +27V from connectors X38 and X39. The ЭМ-1211 diagnostics module measures these voltages and finds faulty modules that fall out of the corresponding tolerances.

Via a RCLI channel the diagnostics module receives data from the ЭМ-1209-1 controller on the state of the TV-complex units and modules. This information is prepared during data exchanges via the RCLI channels and contains data on the presence of feeding voltages and video signals, character of data exchanges between different modules of the TV-complex, state of the TVDs, VRDs and the TM-1215-4 control modules. The ЭМ-1211 diagnostics module transfers data for light indication of faulty units and modules to the ЭМ-1212-1 control module via a separate RCLI channel.

The ЭМ-1212-1 control module forms three video frames of the ACS for indication of the TV-complex state on the screen of the BC-2 TVM.

The ACS frame No.1, "STATE OF MTK-110МЭ" (Fig.3), is formed on pressing button ENTER. In this frame enabled modules and units are shown as their codes against a light background, disabled – as theirs codes against a dark background and faulty ones – as their codes against a blinking background.

The states of the main modules and fuses F1-F16 of the device are shown in the upper part of the frame. The state of the TM-1215-4 No. 1- TM-1215-4 No.3 control modules is shown below. The TM-1215-4 No.1 interacts with the TM-1213 terminal modules having the ЭМ-1240 interface unit therein and the ДЕ-118-1 VRD. This devices are grouped together in the frame. Near the ДЕ-118-1 VRD its state is shown. The following states of the VRD are shown: "STOP", "OFF", "RECORD", "PLAY", "PAUSE", "REWIND <<", "FAST FORWARD >>", "NO VIDEO CASSETTE", "VRD TROUBLE", "NO CONTROL".

The five columns of the units related to the TM-1304 No.1 - TM-1304 No.5 combined modules are shown below. There are the states of the ЭМ-1202 control and synchronization modules, ЭМ-1203 video amplifier modules, БПИ-183-a power supply units incorporated by the TM-1304 combined modules shown togethes with the states of the four TVDs connected to each TM-1304 module depending on their location. In the lower area of the frame are shown the data and time that are received by the ЭМ-1242 interface unit from device "Гном-2МЭ". In case of signal absence in any of the channels for exchange with device "Гном-2МЭ" dashes are displayed instead of date and time.

The number of the ACS frame No.2 is shown in the right lower corner.

The ACS frame No.2, "STATE OF MTK-110МЭ TVDs" is shown in Fig.4.

The left column, "N", shows the numbers (group-channel) of the TVDs. The group number is the number of the TM-1304 combined module. The channel number corresponds to the TVD connected to this TM-1304 combined module.

The "NAME" column contains the location of the TVD.

The "CODE" column contains the code of the TVD.

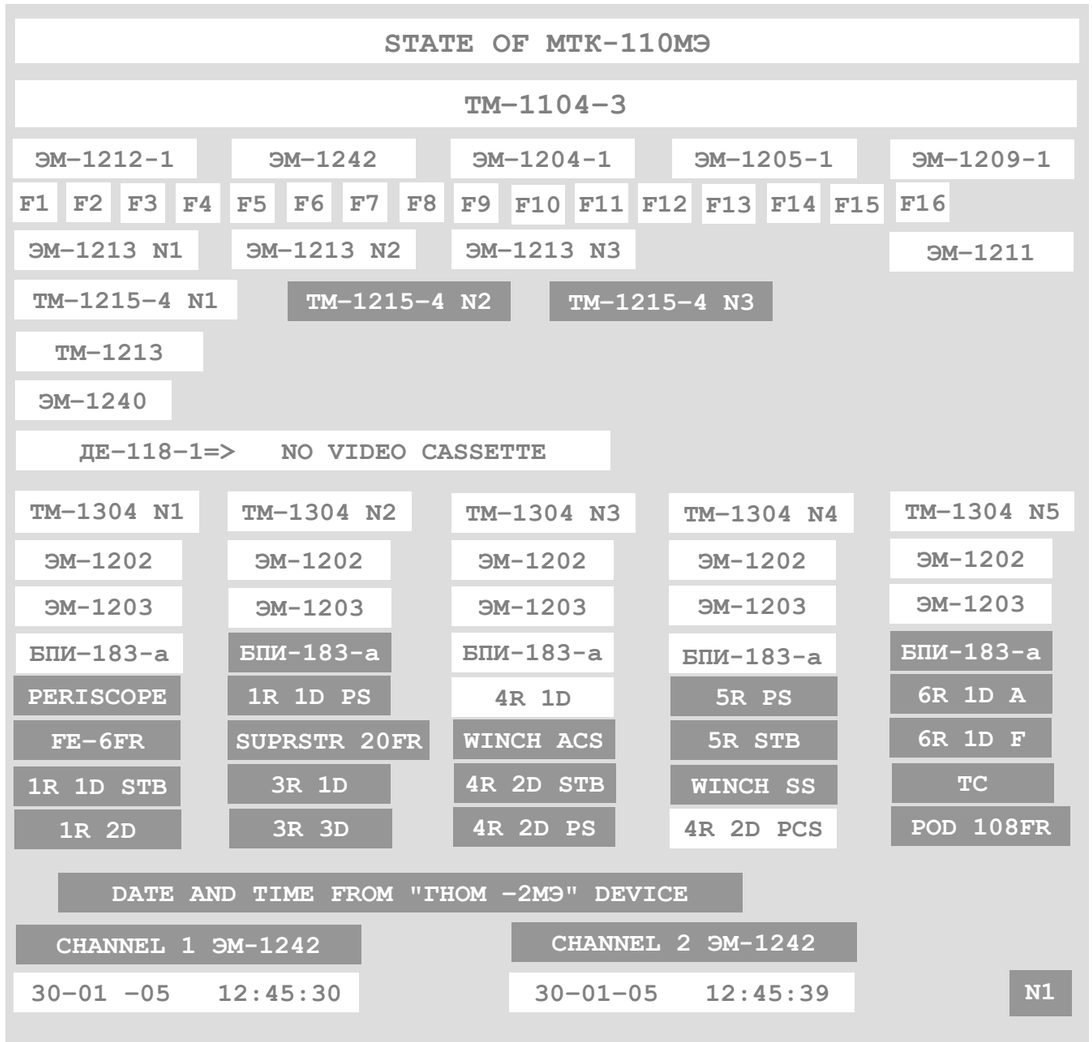

Fig.3 –ACS Frame No.1 "STATE OF MTK-110МЭ".

STATE OF MTK-110MЭ TVDs					
N	NAME	CODE	ON	CTRL	CHECK
1-1	PERISKOPE	KT-257	1	1 DAY	---
1-2	FE-6FR	TM-1220-1	2 3	2 TEST	---
1-3	1R 1D STB	HEOTOH-08-2	----	---	1
1-4	1R 2D	HEOTOH-08-1	4	---	---
2-1	1R 1D PS	HEOTOH-08-1	----	---	---
2-2	SUPRSTR 20FR	TM-1220-1	----	---	---
2-3	3R 1D	HEOTOH-08-2	----	---	---
2-4	3R 3D	HEOTOH-08	----	---	---
3-1	4R 1D	HEOTOH-08-2	----	---	---
3-2	WINCH ACS	TM-1220-1	----	---	---
3-3	4R 2D STB	HEOTOH-08-1	----	---	---
3-4	4R 2D PS	HEOTOH-08-1	----	---	---
4-1	5R PS	HEOTOH-08-2	----	---	---
4-2	5R STB	HEOTOH-08-2	----	---	---
4-3	WINCH SS	TM-1220-1	----	---	---
4-4	4R 2D PCS	HEOTOH-08	----	---	---
5-1	6R 1D A	HEOTOH-08-1	----	---	---
5-2	6R 1D F	HEOTOH-08-1	----	---	---
5-3	TC	HEOTOH-08	----	---	---
5-4	POD 108FR	TM-1220-1	----	---	---

N2

Fig.4 –ACS Frame No.2 "STATE OF MTK-110MЭ TVDs".

The "ON" column contains the numbers of the CPs, from which the TVDs were switched on. If the same TVD was switched on from several CPs, their numbers are displayed via blanks. The device including the ЭМ-1212-1 control module and the BC-2 TVM is designated as CP No.4 of the TV-complex. The "CTRL" column shows the number of a CP of the TV-complex and the remote control command being executed from this CP.

The "CHECK" column shows the number of CP of the TV-complex from which the TVD was chosen for servicing.

The number of ACS frame No.2 is shown in the right lower corner.

The ACS frame No.3, "MODULE FEEDING VOLTAGES" is shown in Fig.5.

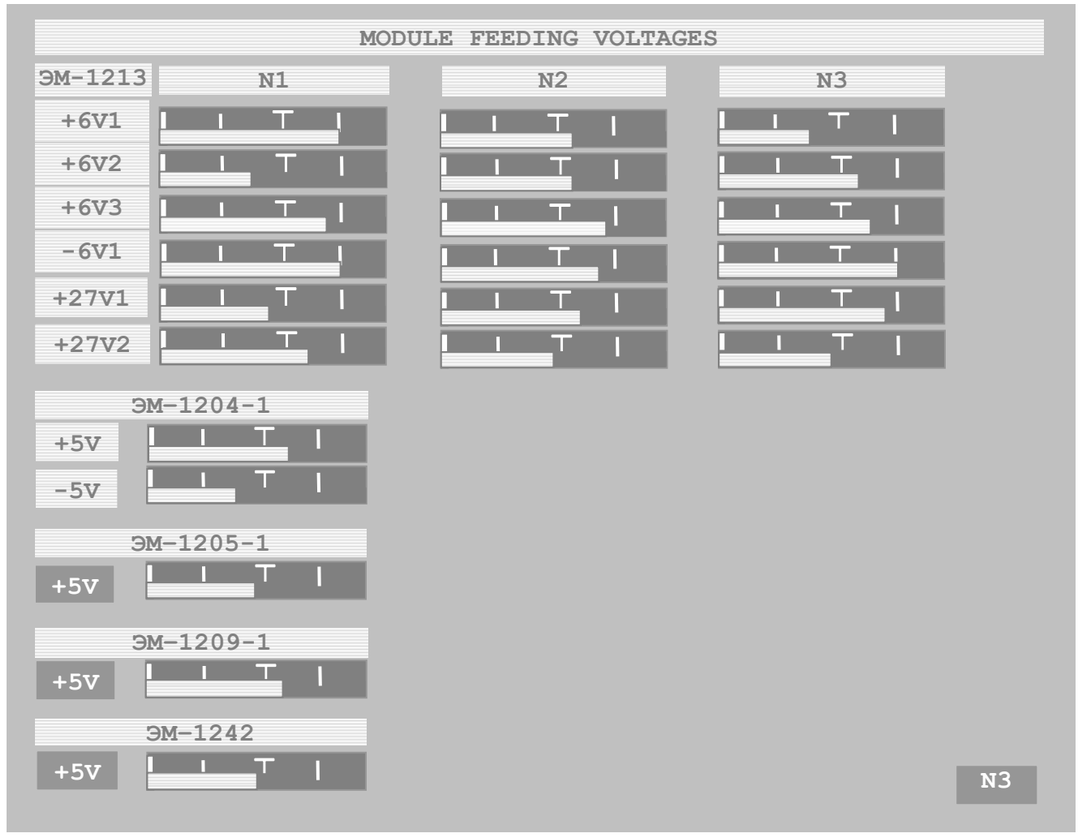

Fig. 5 – ACS Frame No.3 "MODULE FEEDING VOLTAGES".

The feeding voltages are symbolically shown as horizontal lines with four marks. The leftmost mark represents the zero point. The next three marks represent the minimum, nominal and maximum values of the voltage. The length of a line denotes the voltage in a non-linear scale. The position of the minimum mark corresponds to 95% of the rated voltage. The position of the rightmost mark corresponds to 105% of the rated voltage. If the voltage controlled falls out of the tolerance limits, the line blinks that is a sign of a fault in the module. The output voltages of the three ЭМ-1213 power supply units are displayed in the upper part of the frame. The supply voltages produced by power supply cells in the corresponding modules are displayed below. The number of ACS frame No.3 is shown in the right lower corner.

Frames are switched over by pressing the arrow buttons on the front panel of the ЭМ-1211 diagnostics module (Fig.2).

The ЭМ-1212-1 control module indicates faulty modules of the TV-complex with the LEDs, in accordance with the information received from the ЭМ-1211 diagnostics module via the RCLI channel. Light-up of the LED of the MTK-110MЭ indicates a fault in some unit or module not represented on the ЭМ-1212-1 control module front panel. To get more specific information about the faulty module, the ACS frame No.1 should be output on the TVM screen.

Light-up of one of the LEDs on the TM-1304 No.1 – TM-1304 No.5 combined modules on the ЭМ-1212-1 control module front panel means that either one of the modules comprised by the TM-1304 combined module is malfunctioning or the TVD working with this combined module is out of order. To localize the faulty module, the ACS frame No.1 should be output on the TWM screen.

Light-up of the FUSE diode on the front panel of the ЭМ-1212-1 control module means that one of fuses F1-F16 installed on the fifth floor of the device is blown out. To localize the faulty fuse, the ACS frame No.1 should be output on the TVM screen.

Information acquisition and control of the indication LEDs of the ЭМ-1212-1 control module is performed by the microcontroller and PLIC of the ACS. The ЭМ-1212-1 control module is installed in the middle of the second floor of the device. The device door has a glassy window opposite to the ЭМ-1212-1 control module thereby allowing observation on the state of the TV-complex when the door is closed.

1.1.4.5 Chronometrical Information Input System

The chronometrical information input system receives chronometrical data via separate serial channels from device "Гном-2МЭ", transmits it to the external TM-1213 terminal module for mixing into the video signal during video recording and displays this data on the screen of the BC-2 TVM.

The main unit of the chronometrical information input system is the ЭМ-1242 interface unit. The signals of the main and reserved channels of device "Гном-2МЭ" are supplied to the interface unit via connectors X40 and X41. The MC and PLIC of the ЭМ-1242 interface unit perform processing of these signals, reception of the incoming arrays containing chronometrical information and writing the data to the internal RAM of the PLIC.

On request from the ЭМ-1209-1 controller the MC forms a reply array that is transferred to the ЭМ-1209-1 controller via a RCLI channel.

The ЭМ-1209-1 controller periodically interrogates the ЭМ-1242 interface unit, forms data arrays containing date and time and transfers them to the TM-1213 terminal module and ЭМ-1211 diagnostics module. The latter displays the date and the time received from each of the "Гном-2МЭ" channels in ACS frame No.1. In case of absence of the information in one of the "Гном-2МЭ" channels, dashes are displayed in ACS frame No.1.

1.1.4.6 Power Supply System

The power supply system provides secondary feeding voltages for the units and modules incorporated by the device as well as some other units of the TV-complex.

The power supply system comprises the following device modules:

- assemble unit (A1);
- interference rejection filters, the ФСП-3В (A2 - A7);
- power supply unit, the ЭМ-1213 (A61, A71, A72);
- fuses F1 - F16;
- power supply cells that are parts of the ЭМ-1204-1 and ЭМ-1205-1 videoswitch modules, ЭМ-1209-1 controller, ЭМ-1211 diagnostics module, ЭМ-1212-1 control module and ЭМ-1242 interface unit.

The three-phase feeding voltage 220 V, 50 Hz from the ЩР-03 switchboard is supplied to the device via a cable through connector XP1 and the assembly unit (A1). The device is switched on with toggle switch POWER. The three-phase voltage form the switch arrives to the indicator lamps through the three fuses and then - to PCB XT1 of the assembly unit. The switch and the fuses are found under the drop cover on the assembly unit front panel. The lamps indicating presence of feeding voltage 220 V, 50 Hz are mounted on the assembly unit front panel.

The three-phase feeding voltage 220 V, 50 Hz from assembly unit PCB XT1 through PCB XT1 of the device is supplied to the ФСП-3В interference rejection filters (A2 - A7) and then – to the ЭМ-1213 power supply units (A61, A71, A72). The ЭМ-1213 power supply units are connected to different phases of the three-phase mains.

Each of the ЭМ-1213 power supply units has six galvanically decoupled d.c. outputs with the following parameters:

- one 27 V output with a current of up to 4 A;
- one 27 V output with a current of up to 2 A;
- four 6 V outputs with a current of up to 2 A.

All the d.c. power supplies in the ЭМ-1213 power supply units have overcurrent and short-circuit protections that are automatically reset when the overload conditions are removed.

The 6 V supply voltages produced by the ЭМ-1213 power supply units are used for feeding the modules of the device. The feeding voltage of plus 6 V is provided by connecting the negative terminals of the 6 V power supply units to the common bus, whereas for obtaining a feeding voltage of minus 6 V the plus 6 V power supply units are connected vice versa. The 6 V supply voltages are supplied to the device modules through PCB AP2 of the device.

All the device modules that are supplied with the plus 6 V and minus 6 V voltages are fed from two or three ЭМ-1213 power supply units simultaneously. This ensures operability of the device in case of failure of one of the ЭМ-1213 power supply units.

The modules consuming the plus 6 V and minus 6 V voltages contain power supply cells that form their own feeding voltages, provided at least one of the ЭМ-1213 power supply unit voltages is present. The internal supply voltages of the consuming modules are connected to the ЭМ-1211 diagnostics module inputs for control.

The BC-2 TVM is fed from the ЭМ-1213 power supply unit (A72) with the plus 27 V voltage. The ЭМ-1239 power supply installed into the BC-2 TVM produces its own supply voltages of plus 12 V and plus 5 V.

The plus 27 V voltage from the other outputs of the ЭМ-1213 power supply unit is distributed among various units and modules of the TV-complex, passing through PCB AP1 and fuses F1-F16 to the output connectors of the device. The fuses protect the power supplies against short-circuits in each of the loads. The fuses are installed on a panel on the fifth floor of the device. There is a LED near each of the fuses indicating presence of the plus 27V voltage on the fuse output.

The external loads of the plus 27 V supply voltage of the ЭМ-1213 power supply units are shown in Table 3.

Table 3

+27V power supply unit	fuse number	Device external connector	External load
ЭМ-1213 No.1 (A61)	F1	X32	TM-1304 No.1
ЭМ-1213 No.3 (A72)	F2	X32	TM-1304 No.1
ЭМ-1213 No.2 (A71)	F3	X33	TM-1304 No.2
ЭМ-1213 No.3 (A72)	F4	X33	TM-1304 No.2
ЭМ-1213 No.3 (A72)	F5	X34	TM-1304 No.4
ЭМ-1213 No.1 (A61)	F6	X34	TM-1304 No.4
ЭМ-1213 No.1 (A61)	F7	X35	TM-1304 No.5
ЭМ-1213 No.2 (A71)	F8	X35	TM-1304 No.5
ЭМ-1213 No.2 (A71)	F9	X36	TM-1304 No.3
ЭМ-1213 No.3 (A72)	F10	X36	TM-1304 No.3
ЭМ-1213 No.3 (A72)	F11	X37	Reserved
ЭМ-1213 No.1 (A61)	F12	X37	Reserved
ЭМ-1213 No.1 (A61)	F13	X38	TM-1213, TM-1215-4 No.1, TM-1215-4 No.2
ЭМ-1213 No.2 (A71)	F14	X38	TM-1213, TM-1215-4 No.1, TM-1215-4 No.2
ЭМ-1213 No.2 (A71)	F15	X39	TM-1215-4 No.3
ЭМ-1213 No.3 (A72)	F16	X39	TM-1215-4 No.3

The TM-1308 assembly modules and TM-1201 terminal modules via which the 27 V voltage passes in transit are not shown in Table 3.

All the 27 V and 6 V d.c. voltages produced by the ЭМ-1213 power supply units are fed to the analog inputs of the ЭМ-1211 diagnostics module (A21). The ЭМ-1211 diagnostics module performs continuous tolerance check-up of these voltages. Also fed to the ЭМ-1211 diagnostics module are the 27 V d.c. voltages from the outputs of fuses F1-F16 and voltages from internal power supply cells of the modules that are parts of the device.

1.1.4.7 Auxiliary Communication System

The auxiliary communication system provides wire duplex communication between different modules of the TV-complex that is used during servicing of the complex.

There is a connector X42 for connecting the auxiliary communication device (ACD). The auxiliary communication lines come in parallel to the TV-complex modules via connectors X32-X39. The +27 V feeding voltage is applied to an ACL via a current-limiting resistor for feeding the ACD.

The TC-0120 ACD is included into the TV-complex BSP.

1.1.4.8 Device Design

As per design the device constitutes a splash-proof cabinet with an amortization base. The general view of the device is shown in Fig. B1 (appendix B). The floors of the cabinet are numbered top-down.

The modules comprised by the device are located as follows.

In the upper part of the cabinet the assembly unit (1) is installed. The feed switch and the fuses are mounted under the drop cover (23) to the left of the assembly unit front panel. The indicators (28) of phase voltage presence (220 V,50 Hz) are fastened on the front panel of the assembly unit.

The BC-2 TVM (2) is installed on the first floor. The TVM can be pulled out on a movable base.

On the second floor are installed the ЭМ-1211 diagnostics module (3), ЭМ-1212-1 control module (4) and ЭМ-1242 interface unit (5).

On the third floor are installed (from left to right): the ЭМ-1204-1 videoswitch module (6), ЭМ-1205-1 videoswitch module (7), ЭМ-1204-1 videoswitch module of the BSP (8), ЭМ-1205-1 videoswitch module of the BSP (9), ЭМ-1211 diagnostics module of the BSP (10), ЭМ-1209-1 controller of the BSP (11), ЭМ-1209-1 controller of the BSP (12) and ЭМ-1209-1 controller (13).

The fourth floor contains modules of the BSP such as the ЭМ-1211 diagnostics module (14), ЭМ-1212-1 control module (15) and ЭМ-1242 interface unit (17).

On the fifth floor are installed the panel (17) with fuses F1-F16 and the LEDs.

The ЭМ-1213 No.1 (18) power supply unit and ЭМ-1213 (19) of the BSP are installed on the sixth floor.

On the seventh floor are installed the ЭМ-1213 No.2 and ЭМ-1213 No.3 (18) power supply units.

The ФСП-3В interference rejection filters are mounted near the connectors of the ЭМ-1213 power supply units under the rear cover (21) of the cabinet. There are two ФСП-3В interference rejection filters per power supply unit.

The ЭМ-1204-1 and ЭМ-1205-1 videoswitch modules, ЭМ-1209-1 controllers, ЭМ-1211 diagnostics modules, ЭМ-1212-1 control modules, ЭМ-1213 power supply units and ЭМ-1242 interface units constitute a frame with two horizontal slide rails. On the frames are mounted one or two PCBs with connectors. The front panel of the module is fastened to the frame. There are slide ways for each module in the cabinet. This modules are fixed in the working position with special locks and screws.

The BC-2 TVM is fastened to a pull-out base that is mounted on telescopic holders. The BC-2 TVM is fixed in the working position with four screws.

The cabinet has a door with a rubber gasket, closing the modules from the second to the seventh floors. The door has four locks providing its fixing in the closed position. There are glassy windows opposite to the ЭМ-1212-1 control module (4). The ORDER OF UNITS (26) and a special wrench for module extraction/mounting (27) are fastened on the internal side of the door.

The bottom part of the cabinet is installed on an amortization base (25).

In the upper part of the cabinet under the rear cover two resilient supports (24) for mounting the cabinet in a vertical position are installed.

On the top of the assembly unit are installed the following elements: connector XP1 for connecting the mains voltage (220 V, 50 Hz), connectors X32 - X41 for interconnection cables, auxiliary communication connector X42 and connector X43 for an RS-232 channel. The latter is used during setup and servicing of the TV-complex.

Coaxial connectors X1 - X31 are mounted on the rear cover of the cabinet.

In the place of installation the cabinet on the amortization base is mounted on the foundation and fastened from the back to the corresponding mounting elements with the resilient supports. If the cabinet is transported through a hatch with a diameter of 594 mm the rear supports should be temporarily removed.

The connector designation system, providing easy location of a connector basing on its number, is given in schematic connection diagram ТЭ3.623.912-03Э4.

Cooling of the cabinet is done by natural ventilation. Cold air enters into the cabinet through the lower grating and leaves the cabinet through the upper grating.

On the front of the lower part of the cabinet the "⊥" (bonding point) terminal is located. This terminal must be coupled with the hull of the object of installation.

1.1.4.9 Measurement Instrumentation, Tools and Accessories

There are no special meters, tools and accessories required for work with the device. The control over the parameters of the device is performed with the means of automated control.

To maintain the device a special wrench (Fig.B1, pos.27) and the tools of the toolkit included into the TV-complex BSP are used.

1.1.4.10 Marking

The device is identified on the nameplate. The nameplate contains the device code, its industrial number and mass.The nameplate is fastened on the assembly unit.

1.2 Description and Operation of Device Component Parts

1.2.1 BC-2 Television Monitor

The BC-2 TVM is intended for displaying black-and-white images with scanning parameters according to the broadcasting standard (interlaced scanning, 625 lines, 25 frames per second).

The BC-2 TVM is based on the MO1-12 flat-panel LCD-module.

Technical parameters:

- power supply of the BC-2 TVM – from d.c. network, (27±3) V;
- power consumption – 50 W, maximum;
- dimensions of screen visible area – (246×185) mm;

- BC-2 TVM screen resolution – no less than 500 TV-lines;
- viewing angle of BC-2 TVM screen – from 100 to 140 deg. (horizontal), from 90 to 120 deg. (vertical);
- screen brightness (in white) for the whole visible area – from 250 to 350 cd/m^2.
- image contrast of BC-2 TVM screen – 250:1.
- image adjustment on the screen of BC-2 TVM is done with five buttons on the TVM front panel via an on-screen menu.

1.2.1.1 Layout and Operation

For studying the BC-2 TVM electrical diagram ТЭ2.045.544Э3 should be used.

The contents of the BC-2 TVM is given in Table 4.

Table 4

Designation	Code	Part Name	Qty.
ТЭ2.049.458	MO1-12	Display module	1
ТЭ2.201.833	ЭМ-1239	Power supply unit	1
ТЭ3.057.444	ЭМ-1229	Video adapter	1

The following signals are applied to the BC-2 TVM:

- feeding voltage, coming to connector X1;
- black-and-white video signal with a swing of (1,0 ± 0,3) V, coming to connector X3.

The BC-2 TVM is switched on and off by pressing buttons ON and OFF on the front panel. On applying to the TVM a voltage of (27±3) V the "27 V" indicator lights up. As button ON is pressed, the LED near the button lights up and the TVM turns on.

The ЭМ-1239 power supply unit feeding voltage to the ЭМ-1229 video adapter and MO1-12 display module.

The ЭМ-1239 power supply unit converts the primary d.c. voltage, 27V, into secondary stabilized d.c. voltages of 12 V and 5 V.

The ЭМ-1229 video adapter converts the black-and-white video signal with interlaced scanning into SVGA-standard signals with non-interlaced scanning and a frame frequency of 60 Hz. These signals are input of the MO1-12 display module. At the same time, the video adapter generates sync pulses with horizontal and frame frequencies for synchronization of the display modules.

The MO1-12 display module is intended for displaying TV-image. The module constitutes a LCD-panel with backlighting lamps, a control circuit and an inverter for feeding the lamps. The LCD-panel with the control circuit and inverter is installed into a hermetic metal case and covered with a protective glass.

As a voltage of 12 V is applied to the displaying module and the video signal is given to the VGA-input, the luminescent backlighting lamps switch on and an image of 800×600 pixels with a refresh frequency of 60 Hz is formed on the screen.

1.2.1.2 Instructions on Switching-On and Testing

To switch on the BC-2 TVM press button ON and check if the indicator is lit.

Select the source of the TV-signal on the ЭМ-1212-1 control module. Check the quality of the image and adjust brightness and contrast with the buttons on the TVM front panel (see item 1.2.1.3) if necessary.

If there is no video signal, an image of chaotically lighting pixels is displayed on the TVM screen.

1.2.1.3 Intended Use of TVM

To use the TVM, chose the video signal source on the ЭМ-1212-1 control module.

In case of normal operation of the BC-2 TVM the image from the video signal source selected is displayed on the screen. The image should be sharp and have stable synchronization.

Adjustment of the image parameters is done with the buttons on the front panel of the BC-2 TVM.

The on-screen menu is called by pressing the MENU button. After that, the main menu in the English language appears on the screen:

Input Source
PIP Enable
Auto Tune
Brightness
Contrast
Color
Quality
Position
Language
Recall
Save Exit
Cancel Exit

Only the following items of this list are used during operation of TVM as a part of the TV-complex:

Brightness;
Contrast;
Auto Tune – automatic quality adjustment and fitting the image into the screen;
Position – placing the picture and menu window on the screen.

On rare occasions additional quality adjustment is required:
Quality – enhancing image sharpness and noise reduction.

To finish work with MENU the following modes are used:
Save Exit – save all the settings and leave the menu;
Cancel Exit – cancel all the new settings and leave the menu;

There is an additional key, AUTO, on the panel that is used for fast adjustment the BC-2 TVM for the video signal source.

The on-screen menu is controlled with the following buttons on the panel:

▲ - allows to move the cursor frame upwards and increase the parameter chosen;

▼- allows to move the cursor frame downwards and decrease the parameter chosen;

Use this buttons to move the cursor to the needed item of the menu and activate the chosen item by pressing the MENU button.

If the item chosen constitutes a group of settings (e.g. Quality), the submenu is displayed on the screen.

If the item chosen is a parameter, (e.g. Contrast), adjustment of this parameter with the ▲ and ▼buttons is activated.

Apart from the menu control buttons, there is an ON/OFF button allowing to switch on/off the screen backlighting and image displaying. The LED in the lower corner of the screen decorative frame should light yellow and green simultaneously when turning off and only green – when turning on.

To switch the BC-2 TVM off press the OFF button on the TVM control panel. The ON LED should go out.

2 OPERATION

2.1 Operating Conditions and Safety Rules

The maximum permissible ratings of the device are shown in Table 4. Operation under stresses beyond these maximum limits is unsafe and can cause permanent damage to the device.

Table 4

Technical Parameter	Maximum Limit	Note
Primary side supply voltage	≈231 V, continuous ≈249 V, transient, up to 3 s	

2.1.1 The device should be operated only by qualified personnel acquainted with this OM, electric connection diagram ТЭ3.623.912-03Э4 and knowing the operating principle of the device.

2.1.2 The device is fed with a dangerous for life voltage of 220 V. Therefore the following safety rules must be observed:

- do not use the device without reliable grounding;
- do not use the device with its side or rear covers removed;
- do not use self-made fuses or those with ratings different from the recommended;
- never replace fuses or modules, connect or disconnect any cables when the device is on.

2.1.3. No mechanical works should be done while the device is switched on.

2.2 Device Preparation for Operation

2.2.1 Safety Precautions during Installation

When preparing the device for operation make sure that:

- bonding point "⊥" is connected to the hull of the object;
- all the modules are installed and fastened in their dedicated positions;
- all the fuses are installed and fixed in the holders.

During operation, bright rays of light from external sources of light should not fall onto the screen of the BC-2 TVM.

2.2.2 External Examination of Device

Check connection of external cables to the device.

2.2.3 Initial Position of Controls before Use of Device

Prior to the device switch-on the POWER toggle switch under the drop cover of the assembly unit should be in the off position. To open the drop cover unscrew the captive screws.

2.2.4 Interconnection wit other Devices

The device is used together with device "Гном-2МЭ" that is not a part of the TV-complex.

The device receives chronometrical information from "Гном-2МЭ" device via a line with transformer decoupling. No reply information is transmitted to the "Гном-2МЭ" device. The device state does not influence on operation of "Гном-2МЭ".

The device is the central module of the TV-complex and interacts directly or non-directly with all the modules of the TV-complex.

2.2.5 Switching-On and Testing of Device

2.2.5.1 Make sure that the POWER switch on the ЩР-03 switchboard and also the МТК-110МЭ, PANELS and PERISCOPE switches are turned on. The indicators of phase voltage presence should light, phase voltages should be from 180 to 231 V.

2.2.5.2 Open the drop cover of the assembly unit.

Open the door of the device by rotating counter-clockwise the clamping nuts of the locks and putting the handles of the locks into the "UNLK" position.

2.2.5.3 Switch on the POWER toggle switch under the drop cover of the assembly unit. The following indicators should light up:

- presence of phase voltages, "P1", "P2", "P3"; this indicators are mounted on the front panel of the assembly unit;
- "27V" on the front panel of the BC-2 TVM;
- 16 indicators on the fuse panel of the fifth floor of the device;
- two indicators on each of the front panels of the three ЭМ-1213 power supply units.

2.2.5.4 Turn on the BC-2 TVM by pressing the ON button. After this the indicator near the ON button should light up.

Adjust brightness and contrast with the buttons on the TVM front panel as described in item 1.2.1.3. of the present OM if necessary.

2.2.5.5 Press the button TEST ЭМ-1212-1 on the ЭМ-1212-1 control module. After that:

- by turns, from top to bottom and from left to right, the red LEDs under the TROUBLE inscription will light up and then go out;

- by turns, from top to bottom and from left to right, the green LEDs installed near the buttons will light up and then go out;

Such lighting-up of all the LEDs means that the LEDs indicating the state of the TV-complex are serviceable.

After completion of testing lighting-up of the LEDs, no LED under the TROUBLE inscription should be lit.

2.2.5.6 Press the ENTER button on the ЭМ-1211 diagnostics module. Frame No.1 of the ACS, "STATE OF MTK-110MЭ", should appear on the BC-2 TVM screen. All the modules, units and fuses in this frame should be in on-state and should not blink.

Press the "←" button on the ЭМ-1211 diagnostics module. Frame No.3 of the ACS, "MODULE FEEDING VOLTAGES", should appear on the BC-2 TVM screen. The horizontal lines showing the values of the supply voltages should be between the marks corresponding to the minimum and maximum values.

Press the SELECT button on the ЭМ-1211 diagnostics module. The ACS frame will disappear from the screen of the BC-2 TVM and the screen will display the VS from the TVD activated from the ЭМ-1212-1 control module.

2.2.5.7 Check operation of the TVDs and viewing the signals from those. This is done by pressing the GROUP1 button and then – the CHANNEL1-CHANNEL4 buttons. The screen of the TVM should display the image from the TVD corresponding to the selected channel and group. Then repeat the same for groups 2 – 5 for all the channels of these groups and make sure that image from each of the TVDs is present. Press the OFF button to switch the TVDs off.

2.2.5.8 Close the cover of the assembly unit. Close the door of the device by putting the lock handles into the "LK" position and tighten the clamping nuts by rotating them clockwise.

2.3 Usage of Device

2.3.1 Personnel Operation during Intended Use of Device

After enabling and testing the device does not require any servicing by special personnel.

The device begins to execute its main functions in 1 s. after switching on the POWER toggle switch on the assembly unit regardless of operations during testing the device.

2.3.2 Checking Operability of Device

The operability control is done in compliance with items 2.2.5.2 - 2.2.5.8. If the toggle switch on the assembly unit is on do not switch it again.

2.3.3 Possible Troubles and Remedies thereof

Repair of the device is performed by replacing the faulty modules with serviceable ones included into the BSP and DSP.

For detection of faults in the device the ACS should be used.

Lighting of a red LED of the TROUBLE group on the ЭМ-1212-1 control module front panel near the code of a module or a group of modules testifies to malfunction of those.

For more exact location of the faulty module, unit or fuse switch on the BC-2 TVM and press the ENTER button on the front panel of the ЭМ-1211 diagnostics module. ACS frame No.1, "STATE OF MTK-110MЭ", will appear on the screen of the BC-2 TVM. The codes of faulty modules, units and fuses of the device will be blinking. Replace these modules, units and fuses with good ones from the BSP or DSP.

The ACS permits to find the most probable troubles in the device.

For detection of less probable troubles follow the recommendations given in items 2.3.3.1 - 2.3.3.11.

2.3.3.1 After pressing the TEST button on the ЭМ-1212-1 control module one or several LEDs do not light up.

Cause – the ЭМ-1212-1 control module is out of repair.

Remedy – replace the ЭМ-1212-1 control module with the serviceable one from the BSP.

2.3.3.2 Several TVDs of the same group or of the same channel in several groups can not be switched on from the ЭМ-1212-1 control module. The corresponding LED near the button does not light up.

Cause – the button or the PLIC of the ЭМ-1212-1 control module are out of order.

Remedy – replace the ЭМ-1212-1 control module with the serviceable one from the BSP.

2.3.3.3 One group or one channel of the ЭМ-1212-1 control module does not switch off by pressing the OFF button. In this case, the LED near this button goes out only when the button is pressed and lights up again if the button is released.

Cause – the button or the PLIC of the ЭМ-1212-1 control module are out of order.

Remedy – replace the ЭМ-1212-1 control module with the serviceable one from the BSP.

2.3.3.4 When the ON button of the BC-2 TVM is pressed the LED near the ON button does not light and the BC-2 TVM does not work. At the same time the "27V" LED lights.

Case – fault in the ЭМ-1239 power supply unit that is a part of the BC-2 TVM.

Remedy – replace the ЭМ-1239 power supply unit with the serviceable one from the BSP.

2.3.3.5 There is no image synchronization on the screen of the BC-2 TVM.

Cause – fault in the ЭМ-1229 video adapter that is a part of the BC-2 TVM.

Remedy – replace the ЭМ-1229 video adapter with the serviceable one from the BSP.

2.3.3.6 There is no image on the screen of the BC-2 TVM when signals from a TVD or from the ЭМ-1211 diagnostics module are commutated to the TVM screen. The image does not appear even after pressing the RESTART button on the ЭМ-1211 diagnostics module.

Cause No.1 – fault in the ЭМ-1211 diagnostics module as per signal commutation.

Remedy – replace the ЭМ-1211 diagnostics module with the serviceable one from the BSP.

Cause No.2 – fault in the ЭМ-1229 video adapter that is a part of the BC-2 TVM.

Remedy – replace the ЭМ-1229 video adapter with the serviceable one from the BSP.

Cause No.3 – the BC-2 TVM is out of repair.

Remedy – replace the BC-2 TVM with the serviceable one from the BSP.

2.3.3.7 No image from several TVDs on the TVM screens of all the CPs. The ACS indicates that the TVDs and the ЭМ-1204-1 VS commutation module are fault-free.

Cause – the VS matrix switch in the ЭМ-1204-1 VS commutation module is out of order.

Remedy – replace the ЭМ-1204-1 VS commutation module with the serviceable one from the BSP.

2.3.3.8 No image from the КТ-257 TV-camera on the TVM screens of several CPs. The ACS indicates the КТ-257 TV-camera and the ЭМ-1205-1 VS commuatation module are fault-free.

Cause - the ЭМ-1205-1 VS commutation module is out of order.

Remedy – replace the ЭМ-1205-1 VS commutation module with the serviceable one from the BSP.

2.3.3.9 According to the ACS, one of the 27 V output voltages in one of the ЭМ-1213 power supply units is missing. The “27 V” LED on the front panel of the ЭМ-1213 power supply does not light. After replacing the ЭМ-1213 power supply unit with the serviceable one from the BSP the trouble persists.

Cause – one of the six ФСП-3В filters is out of order.

Remedy – using the ACS determine exactly the faulty ФСП-3В filter by missing +27V voltage as follows:

- no "+27 BI" from the output of the ЭМ-1213 No.1 (A61) – fault in A2 (designations of the ФСП-3В filters is shown in diagram ТЭ3.623.912-03 Э4);
- no "+27 VII" from the ЭМ-1213 No.1 (A61) - fault in A3;
- no "+27 VI" from the ЭМ-1213 №2 (A71) - fault in A4;
- no "+27 VII" from the ЭМ-1213 №2 (A71) - fault in A5;
- no "+27 VI" from the ЭМ-1213 №3 (A72) - fault in A6;
- no "+27 VII" from the ЭМ-1213 №3 (A72) - fault in A7.

Replace the faulty filter with the serviceable one of the DSP.

2.3.3.10 The ACS indicates a fault in some module or unit of the device because the feeding voltage of this module or unit exceeds the tolerance bounds. Even so, the faulty module or unit continues to operate normally. After replacing the faulty module with the serviceable one from the BSP, the ACS indicates the same fault.

Cause – the ЭМ-1211 diagnostic module is out of repair.

Remedy – replace the ЭМ-1211 diagnostics module with the serviceable one from the BSP.

2.3.3.11 No chronometrical information from both the channels of the "Гном-2МЭ" device. The latter operates normally. The ACS indicates that the ЭМ-1242 interface unit is fault-free.

Cause - the ЭМ-1242 interface unit failure as per the interface with device "Гном-2МЭ".

Remedy - replace the ЭМ-1242 interface unit with the serviceable one from the BSP.

2.3.3.12 After replacing a faulty module with a serviceable one, make a record in TV-complex logbook ТЭ1.133.110-02ФО.

2.3.4 Switching the Device off

To switch the device off press the OFF button on the BC-2 TVM.

Move the toggle POWER switch on the assembly into the off position. Make sure that the phase voltage indicators do not light.

Close the drop cover on the assembly device. Close the door of the cabinet.

2.3.5 Safety Precautions during Usage of Device

The device is fed with a voltage of 220 V that is dangerous for life.

Never replace fuses, remove the included modules or unlink the connectors of external cables when the device is energized.

If a faulty module is detected, it should be replaced only after switching-off the power supply of the device by moving the POWER toggle switch into the off position.

Prior to replacement of the ФСП-3В filter, the POWER switch of the device and all the switches on the ЩР-03 switchboard must be moved in the off position.

2.4 Measures under Emergency Conditions

Under emergency conditions in the place of device installation, e.g. appearance of smoke, fire, a danger of flood, de-energize the device by moving the POWER toggle on the ЩР-03 switchboard in the off position.

If an emergency situation arises in the place of installation of the TM-1304 combined modules, TVDs or TM-1215-4 control modules of the TV-complex, the conditions there should be observed on as long as possible.

Under the danger of failure or in case of some TV-complex equipment failure de-energize the corresponding units and modules.

The feeding voltage can be switched off by removing the fuses on the fuse panel of the fifth floor of the device. In case of module or unit failure under emergency conditions the following fuses must be removed:

- in case of the TM-1304 No.1 combined module failure - F1, F2;
- in case of the TM-1304 No.2 combined module failure - F3, F4;
- in case of the TM-1304 No.3 combined module failure - F9, F10;
- in case of the TM-1304 No.4 combined module failure - F5, F6;
- in case of the TM-1304 No.5 combined module failure - F7, F8;
- in case of failure of the TM-1213 terminal module, ДЕ-118-1 VRD, TM-1215-4 No.1 and TM-1215-4 No.2 control modules - F13, F14;
- in case of the TM-1215-4 No.3 control module failure - F15, F16.

The said fuses can blow-out by themselves. In this case, do not replace them until the effects of the emergency situation are not removed.

In case of emergency evacuation of the operating personnel switch the device off by moving the POWER toggle on the ЩР-03 switchboard in the off position.

3 MAINTENANCE

3.1 Servicing of Device

3.1.1 General Guidelines

Servicing of the device is performed for maintaining operability of the device within the whole service life.

Servicing envisages carrying out examinations No.1 and No.2 and maintenance of the device as well as their execution order and contents when the object on which the TV-complex is installed stays at the depot.

Maintenance should not be carried out in case of intended use of the device.

Maintenance should be performed by two qualified specialists having radio engineering education with TV and computer techniques specialization. At least one of the specialists must have a higher education.

3.1.2 Safety Measures

A life-hazardous voltage of 220 V, 50 Hz is used in the device.

Only personnel allowed for work with voltages of up to 1000 V should maintain the device.

When servicing all operations that are not associated with the device parameters check-up during examination No.2 are done on the de-energized device.

Never replace fuses, remove the included modules or unlink the connectors of external cables when the device is energized.

3.1.3 Maintenance Execution Order

3.1.3.1 Examination No.1.

Examination No.1 includes the following actions done without removing the modules and units from the device:

- visual inspection of the device and front panels of its modules behind the door of the cabinet, cleaning the outside of dirt, dust and moisture;
- check on paint and electroplate coatings;
- check on the conditions in the place of installation and operation, with making a decision on possibility of using the device under such conditions.

3.1.3.2 Examination No.2

Examination No.2 includes Examination No.1 in full and besides the operability check-up in accordance with items 2.2.5.2 - 2.2.5.8 of the present Manual.

3.1.3.3 Maintenance.

Maintenance involves removal of the electronic modules from the installation places and includes Examinations No.1 and No.2 in full and also some additional measures:

- cleaning of the device inside of dust with a vacuum cleaner using a soft brush;
- check on the condition of printed circuit tracks in the electronic modules;
- check on the condition of connector contacts;
- check on whether the plastic details have flaws or dents.

3.1.3.4 Examination No.1 should be done daily, the device being in the off-state.

Examination No.2 should be done weekly.

Maintenance should be carried out once in half a year or if necessary. If a faulty module is detected, it should be replaced with a serviceable one from the DSP or BSP. While replacing, the POWER toggle switch on the assembly unit must be in the off position.

3.1.4 Replacement of Modules in Device

When replacing the TVM, modules and units of the device use the wrench fastened on the inside face of the door and the tools of the toolkit from the TV-complex BSP (box 2/8).

3.1.4.1 Replacement of ЭМ-1204-1 and ЭМ-1205-1 videoswitch modules, ЭМ-1209-1 controller, ЭМ-1211 diagnostics module, ЭМ-1213 power supply units and ЭМ-1242 interface unit.

Modules and units are removed from the device in the following order:

- unscrew the two captive screws fixing the module (unit) front panel in the device;
- put the special wrench into the slot of the module (unit) lock and turn the wrench by 180º counter clockwise, the module (unit) should move out by approximately 10 mm;
- remove the module (unit) from its place by careful pulling it out.

Installation of a serviceable module (unit) of the BSP into the device is done as follows:

- set the horizontal slide rails of the module (units) into the slots in the device;
- push in the module (unit) up to the stop, about 10 cm off the final position;
- put the wrench into the slot of the module (unit) lock and slightly pushing the module (unit) in turn the wrench clockwise by 180º. The module (unit) should move into the working position;
- put on the captive screws on the module (unit) front panel.

3.1.4.2 Replacement of the ЭМ-1212-1 control module is done as follows:

- unscrew the three captive screws fixing the module (unit) front panel in the device;
- by turns put the wrench into the slots of the left and the right locks of the module and turn it counter clockwise by 30-60º each time. Acting as described above, move the module out by approximately 10 mm;

- remove the module from its place by careful pulling it out.

Installation of the serviceable module from the BSP into the device is done as follows:

- set the horizontal central slide rails of the module into the slots in the device;
- push in the module up to the stop, about 10 cm off the final position;
- by turns put the wrench into the slots of the left and the right locks of the module and turn it clockwise by 30-60º each time. Acting as described above, move the module into the working position;
- put on the captive screws on the module (unit) front panel.

3.1.4.3 Replacement of the ФСП-3В interference rejection filter (hereinafter referred to as “filter”) is done as follows:

- undo the screws fastening the cover in the lower part of the device rear wall;
- remove the cover and put it aside;
- take the soldering iron out of the toolkit; connect it to the plug-transformer for 24V;
- unsolder the wires off the contacts of the filter, mark them and move them aside;
- undo the screws fastening the ФСП-3В in the device;
- take out the ФСП-3В;
- install the serviceable ФСП-3В from the DSP in the place of the faulty one;
- fix the ФСП-3В with the screws;
- solder the wires to the contacts of the ФСП-3В;
- switch the soldering iron off;
- install the cover and fix it with the screws.

3.1.4.4 Replacement of the BC-2 TVM is done as follows:

- undo the four captive screws in the corners of the BC-2 TVM front panel;
- pull the handles and move the BC-2 TVM out of the device up to the stop on the telescopic holders;
- remove the cable connectors linking the BC-2 TVM with the device;
- undo the screws fastening the BC-2 TVM to the movable base;
- take the BC-2 TVM out of the device;
- mount the serviceable BC-2 TVM from the BSP on the movable base of the device;
- fasten the BC-2 TVM on the movable base with the screws;
- fix in the cable connectors linking the BC-2 TVM with the device;
- push in the BC-2 TVM into the device until it stops in the working position;
- put on the captive screws on in the corners of the BC-2 TVM front panel.

3.1.4.4.1 Replacement of the ЭМ-1229 video adapter and ЭМ-1239 power supply unit in the BC-2 TVM is done as follows:

- remove the BC-2 TVM out of the device (see item 3.1.4.4);
- put the BC-2 TVM on a smooth and plane surface with its face side down;
- undo the screws on the rear wall of the BC-2 TVM;
- open the rear wall of the BC-2 by an angle exceeding 90 deg.;
- undo the four screws, fastening the faulty unit to the two laths on the rear wall;
- unplug the unit off the connector;
- install the serviceable unit from the BSP instead of the faulty one and fasten it with the screws;
- install the rear wall and fasten it with the screws;
- install the TVM into the device (see item 3.1.4.4).

3.1.5 Device Operability Check-Up

Testing the device while maintaining it is to be done in accordance with item 2.2.5 of the present Manual.

APPENDIX A
(obligatory)

List of Abbreviations and Special Terms Used in this Manual

ACD – auxiliary communication device;
ACL – auxiliary communication line;
ACS – automated checkout system;
ADC – analog-to-digital converter;
BSP – onboard spare parts;
CP – control panel;
CS – control system;
DAC – digital-to-analog converter;
DGP – device genlocking pulse;
DSP – depot spare parts;
LC – liquid crystal;
LED - light-emitting diode;
MC – microcontroller;
MP – microprocessor;
OM – operating manual;
PLIC – programmable logic integrated circuit;
RAM – random access memory;
RCLI – radial corrent loop interface;
RCB - printed circuit board;
RGP – receiver genlocking pulse;
ROM – read only memory;
RS-232 – standard serial interface;
TVD – television device, this term generalizes names of following devices: Неотон-08, Неотон-08-1, Неотон-08-2, КТ-257, ТМ-1220-1;
TVM – television module;
VRD – video recording device;
VS – video signal.

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Лист регистрации изменений

Изм.	Номера листов (страниц)				Всего листов (страниц) в докум.	Номер документа	Входящий номер сопроводительного документа и дата	Подп.	Дата
	измененных	замененных	новых	аннулированных					

Инв.№ подл. | Подпись и дата | Взам.инв.№ | Инв.№ дубл. | Подпись и дата

Изм.	С.	№ документа	Подпись	Дата	ТЭ3.623.912-03РЭ	С.

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С.	ТЭ3.623.912-03РЭ	Изм.	С.	№ документа	Подпись	Дата