

AMPLIFIER-MULTIPLIER OF NMEA SIGNALS MDU-102

Operating manual

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INTRODUCTION

This operating manual (hereinafter referred to as OM) is intended to describe the structure, operating principles, technical specifications and service of Amplifier-Multiplier of NMEA signals MDU-102 (hereinafter referred to as the Product, the MDU).

In addition to the instructions given in this document, the safety regulations and rules applicable in the field shall be observed.

Only those who have read and understood this document and those who have had special training shall be permitted to operate with the Product according to the applicable regulations.

Terms and abbreviations:

OM – operating manual;

SB – storage battery;

SC – short circuit;

TS – technical service;

CL – check list;

MDU – Amplifier-Multiplier of NMEA signals MDU-102;

LFSG – large fine-pored silica gel granular.

1 DESCRIPTION AND OPERATION OF THE PRODUCT

1.1 DESCRIPTION

The Product is designed for the multiplication of NMEA 0183 signals, version 1-3 (IEC 61162-1, 61162-2) or other serial data transmissions via RS-232 and RS-422/485 interfaces from one or two sources. The unit provides a checksum test for data received on the first channel.

1.2 TECHNICAL SPECIFICATIONS

Technical specifications of the Product are represented in Table 1.

Table 1 – General technical specifications of the Product

Parameter	Value
Electrical specifications	
Input voltage, DC, V	24 (10 to 36)
Max. power consumption, W	3
Galvanic isolation from power mains	+
Reverse polarity protection	+
Overvoltage protection	+
Inputs	
Number of input ports, pcs.	2 (“CH1”, “CH2”)
Supported interfaces	RS-232, RS-422/485
Max. baud rate, bit/s	115200
Optoisolation of inputs	+
Outputs	
Number of output ports, pcs.	8 (2×4)
Number of output groups	2 (“A” and “B”)
Output optoisolation	4 non-isolated 4 isolated
Supported interfaces	RS-232, RS-422/485
Max. baud rate, bit/s	115200
General specifications	
Overall dimensions, mm	194×119×31
Protection degree	IP22
Limiting temperature, °C	–60 to +70
Operating temperature, °C	–15 to +55
Weight, kg	0.65

1.3 STRUCTURE AND OPERATION OF THE PRODUCT

1.3.1 The Product is manufactured in metal casing where a grounding stud and connection ports are located, see Figure 1.

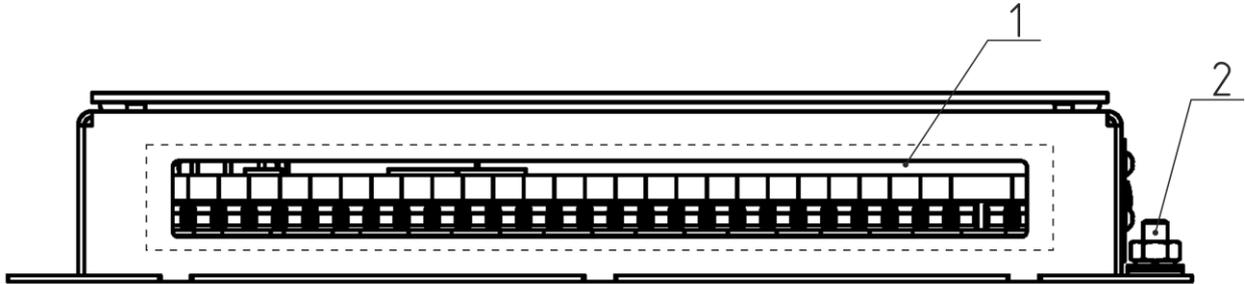


Figure 1 – The Product’s appearance

The Product’s functional elements are represented in Table 2.

Table 2 – Functional elements

№	Element	Type, size and identifier	Description
1	Ports	–	To connect power supply and data input (output)
2	Grounding stud	M4x10	Main element of the Product grounding

Note – Positions (№) are shown in Figure 1.

1.3.2 The Product connection via RS-232 and (or) RS-422/485 interfaces is shown in Figure 2. Assignment of port terminals is represented in Table 3.

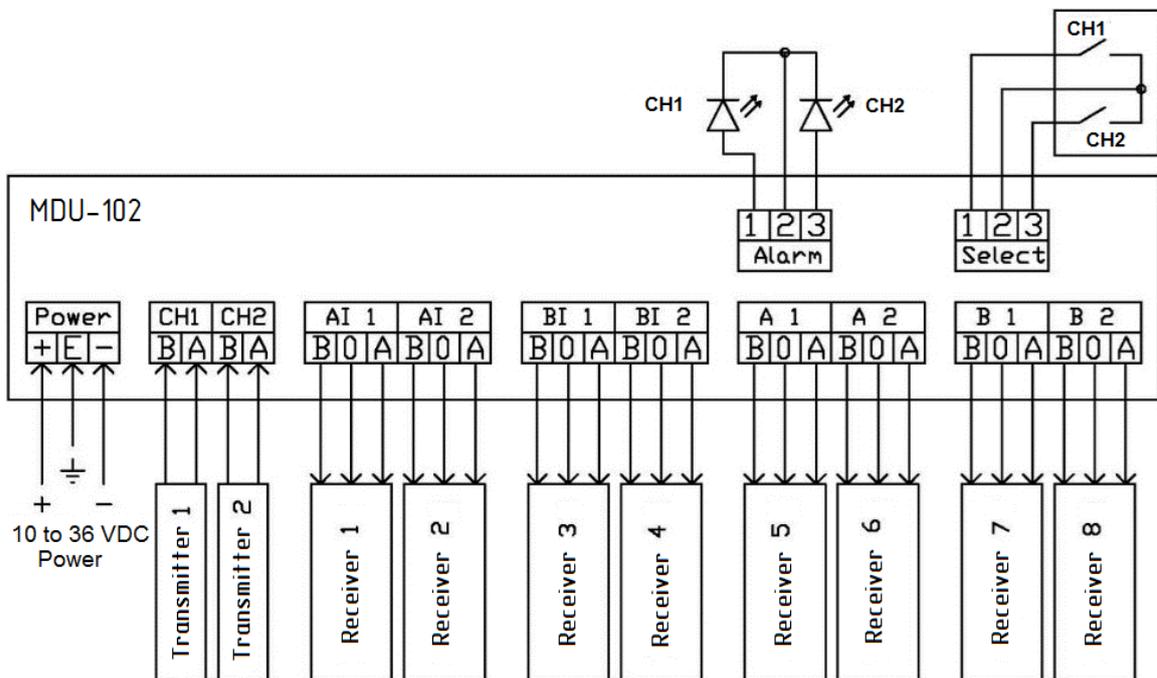


Figure 2 – RS-232 and (or) RS-422/485 connection diagram

Table 3 – Assignment of the Product port terminals

Connector	Terminal №	Description (assignment)
“12/24V”	+	To connect input power supply
	E	
	–	
“CH1”	B	To input data
	A	
“CH2”	B	
	A	
“AI 1”, “AI 2”, “BI 1”, “BI 2”	B	To output data via optoisolated outputs
	0	
	A	
“A 1”, “A 2”, “B 1”, “B 2”	B	To output data
	0	
	A	

1.4 MEASUREMENT INSTRUMENTS, TOOLS AND APPLIANCES

Consumables required for the TS are represented in Table 4.

Table 4 – Consumables required for the TS

Name and identifier of consumables	Amount of consumables	Note
Cleaning cloth	0.10 kg	1 To clean the Product’s surface – use clean cloth 2 To remove severe contamination – use cloth soaked in alcohol
Rectified hydrolytic technical ethyl alcohol	0.05 l	To soak cloth and remove contamination from screen
Varnish	0.05 kg	To cover surfaces of the Product in case of paint coating damage
Abrasive cloth	0.06 x 0.06 m	To polish surfaces of the Product in case of paint coating damage

1.5 MARKING AND SEALING

The Product has a nameplate indicating name, serial number, date of manufacturing, weight, protection degree, input voltage and power consumption.

The sealing of the Product is not provided.

1.6 PACKAGING

At the time of delivery the Product is packed in a corrugated board box and inner packaging (air bubble film) ensuring its transportation and storage at the warehouse.

Transport packaging is also used as a returnable packaging for transportation of the Product to the repair location and back.

The sealing of transport packaging is not provided.

2 INTENDED USE OF THE PRODUCT

2.1 OPERATIONAL CONSTRAINTS

Select the installation site in compliance with operational constraints (operating temperature and protection degree – IP).

Caution! Distance between the installation site and magnetic compass shall not be less than 1 m!

2.2 USAGE PREPARATIONS

2.2.1 Safety features

While preparing the Product for operation, check it visually after unpacking; mechanical damage shall be absent.

Connection to power mains shall be provided only in compliance with input power requirements.

Before connecting the Product shall be switched off and have a proper grounding.

While using the Product the staff shall follow “The technical rules for operation of electric installation” and “Safety rules for operation of electric installation” while testing electrical circuits and insulation resistance.

2.2.2 Visual check procedure

Before switching the Product on:

a) observe visually integrity and initial position of the controls on the front panels;

b) check the absence of dust and dirt on the Product casing; clean with a soft cloth if necessary, see Table 4;

c) check that cable connectors are securely connected to the Product and reliable grounding.

2.2.3 Switching on instructions. While connecting the Product and preparing it for operation follow the steps below:

a) transfer circuit breakers of main power switchboard to “OFF” position;

b) connect connection cables to the Product;

c) transfer circuit breakers of main power switchboard to “ON” position».

Note – The Product is ready for operation within 5 second after power supply.

2.2.4 To switch The Product off:

- a) transfer circuit breakers of main power switchboard to “OFF” position;
- b) disconnect the connection cables.

2.3 USAGE OF THE PRODUCT

2.3.1 Operation modes

The MDU ensures operation in three modes:

- a) signal multiplication mode with select of active channel;
- b) independent mode of signal multiplication;
- c) signal multiplication mode with a checksum test.

Operation modes and other settings are carried out by closure of plug contacts “SW1”, see Figures 3, 4.

1 	not used
2 	stop bit
3 	parity
4 	
5 	baud rate
6 	
7 	
8 	operation mode
9 	
10 	

Figure 3 – MDU settings on plug contacts “SW1”

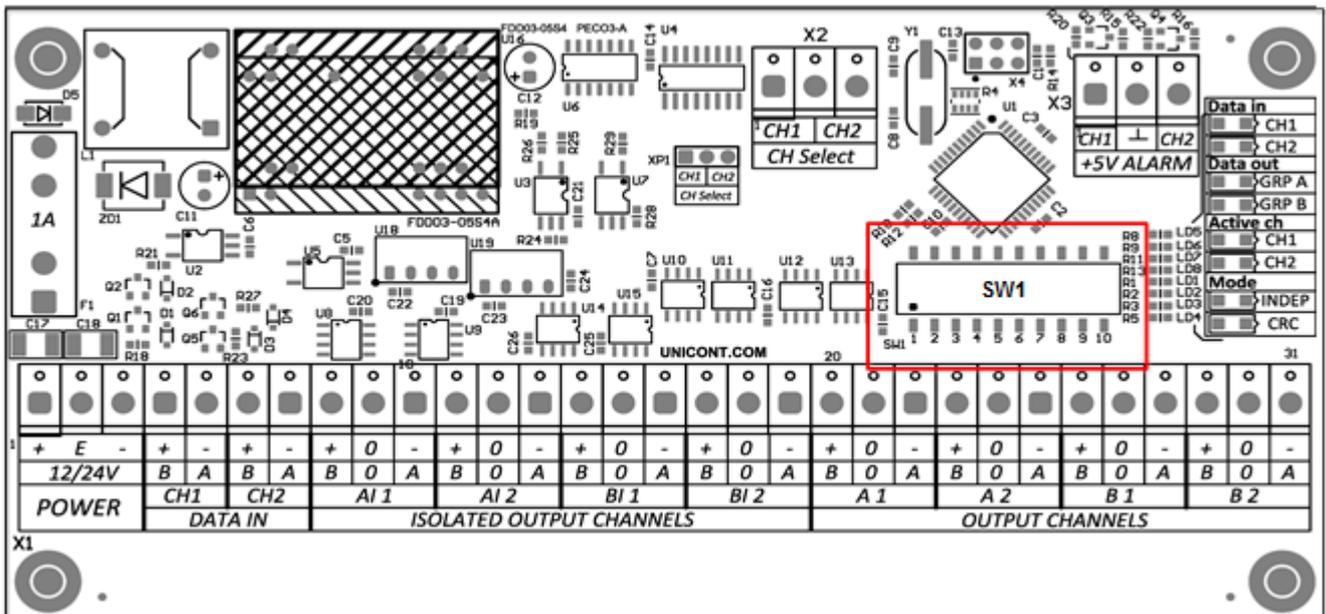


Figure 4 – Plug contacts “SW1” on the Product’s PCB

Modes are selected by plug contacts “SW1” position “9” and “10” according to Table 5.

Table 5 – Modes and corresponding plug contacts “SW1” positions

Multiplication mode	Input channel	“SW1”		“XP1”
		position “9”	position “10”	
With active channel select	“CH1”	0	0	1–2
	“CH2”			2–3
	Automatic select			×
Independent	–	1	0	–
With checksum test	Automatic select	0	1	–
Notes				
1 Sign “×” means - jumper is not set.				
2 Sign “–” means - parameter is not used.				
3 Sign “0” means - switched off (OFF).				
4 Sign “1” means - switched on (ON).				

2.3.2 Signal multiplication mode with active channel select

2.3.2.1 In this mode the Product receives data from active input “CH1” or “CH2” and transmits it to eight outputs, see Figure 5.

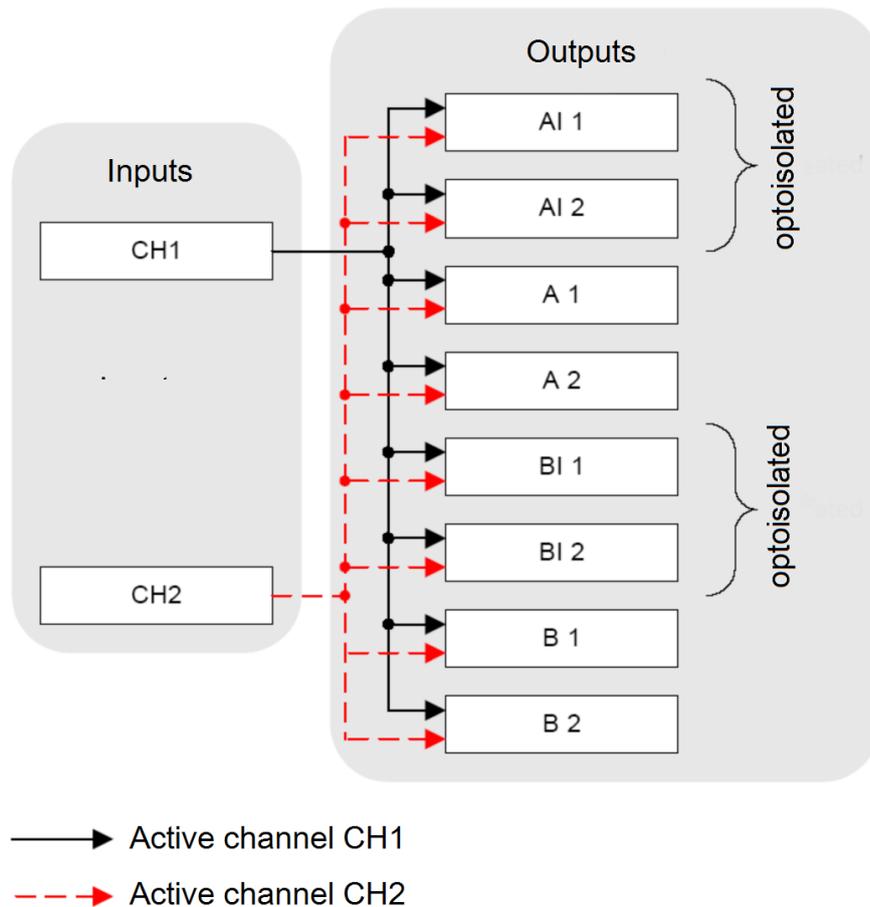


Figure 5 – the Product’s operation scheme in signal multiplication mode

Active channel may be selected in three ways:

- automatic select of active channel;
- manual select of active channel;
- remote select of active channel.

2.3.2.2 In automatic select mode the Product monitors input information on “CH1” input. If data is received on “CH1” input, the Product transmits it to eight output channels. In case of no data on “CH1” input or data transmission breakdown (for example, channel breakdown), the Product switches to channel “CH2” in 3 second, in this case the channel operates as a backup channel. Information from “CH2” input is transmitted to eight outputs; the Product controls data on “CH1”. As soon as data reception on channel “CH1” is restored, the Product automatically switches to it.

2.3.2.3 The Product has a manual select of active channel. It is carried out by setting jumper on connector “XP1”, see Figure 6.

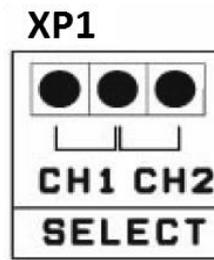


Figure 6 – Connector “XP1”

When jumper is set to position “CH1”, input “CH1” is activated forcefully, automatic switchover to “CH2” does not occur. When jumper is set to position “CH2”, input “CH2” is activated forcefully, automatic switchover to “CH1” does not occur.

2.3.2.4 Remote select of active channel is a type of manual channel select. To select this mode, the PCB has a terminal block with three outputs “SELECT”, see Figure 7.

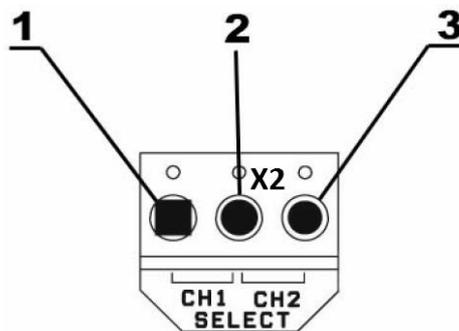


Figure 7 – Terminal block “SELECT”

Three-core cable is connected to this terminal block; closing remote cable outputs (for example, using switch), users may select active channel. To select “CH1”, close “1” and “2”, to select “CH2” – outputs “2” and “3”.

2.3.3 Independent operation mode

Independent operation mode is used for multiplication of data received via two input channels at the same time. Therefore, the Product has two groups of input channels – group A and group B. Each group has two non-isolated outputs and two optoisolated outputs, see Figure 8.

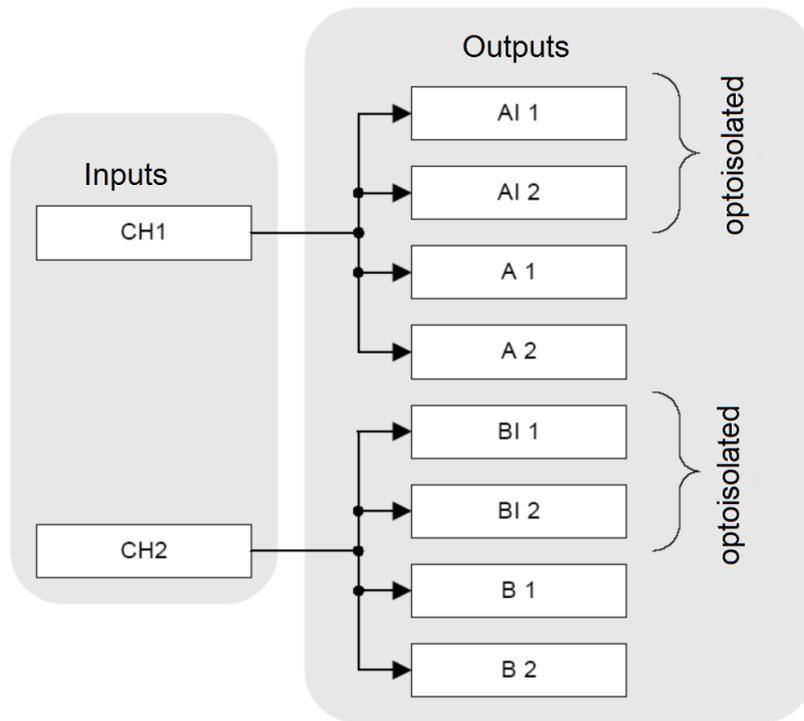


Figure 8 – the Product’s operation scheme in independent mode

Data received on “CH1” input is transmitted to group outputs A (“AI 1”, “AI 2”, “A 1”, “A 2”), where “AI” – optoisolated outputs, “A” – non-optoisolated outputs.

Data received on “CH2” input is transmitted to group outputs B (“BI 1”, “BI 2”, “B 1”, “B 2”), where “BI” – optoisolated outputs, “B” – non-optoisolated outputs.

Using this operation mode, user can receive two independent NMEA signal distributors format 1×4.

2.3.4 Signal multiplication mode with checksum test

This mode is used to control validity of data received on “CH1” input, see Figure 9.

Integrated processor calculates checksum of NMEA 0183 sentences received on “CH1” input; if checksum does not comply, the Product automatically switches to channel “CH2” in 3 second. All eight outputs receive data from active input channel.

Caution! The Product does not test checksum received on “CH2” input, assuming that backup channel receives correct data

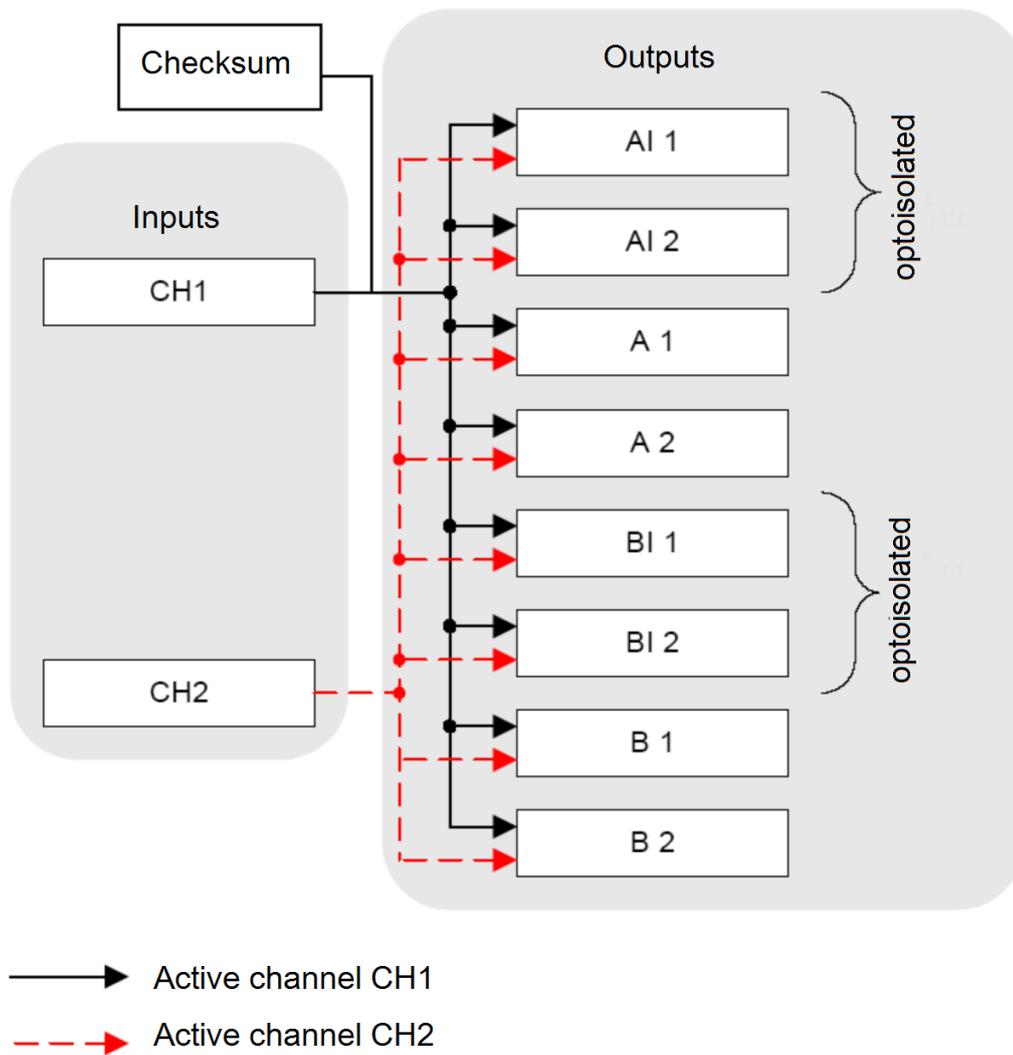


Figure 9 – the Product’s operation scheme in checksum test mode

To ensure correct decoding of received data, provide pre-configuration of input signal parameters that are configured by means of plug contacts on the PCB.

Configuration of input interfaces parameters is carried out by plug contacts “SW1” on the PCB according to Tables 6–8.

Table 6 – Stop bit configuration

Stop bit	“SW1” position “2”
1	0
2	1

Note – In Tables 6–8 “0” - means “switched off” (OFF), and “1” means “switched on” (ON).

Table 7 – Parity configuration

Parity	“SW1”	
	position “3”	position “4”
None	0	0
Even	0	1
Odd	1	0

Table 8 – Baud rate configuration

Baud rate, bit/s	“SW1”			
	position “5”	position “6”	position “7”	position “8”
1200	0	0	0	0
2400	1	0	0	0
4800	0	1	0	0
9600	1	1	0	0
14400	0	0	1	0
19200	1	0	1	0
28800	0	1	1	0
38400	1	1	1	0
48600	0	0	0	1
56000	1	0	0	1
57600	0	1	0	1
76800	1	1	0	1
115200	0	0	1	1

Note! Output signal parameters comply with input signal parameters

2.3.5 Alarm principle of operation

Operation principle of alarm is based on voltage output +5 VDC to the line. To connect external alarm, for example, remote alarm unit AU-106, terminal block “+5V ALARM” is provided on PCB, see Figure 10.

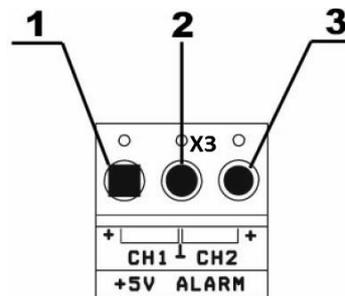


Figure 10 – Terminal block “+5V ALARM”

If the Product operates from input channel “CH1”, constant voltage level is formed on contact “1”. If the Product operates from input channel “CH2”, constant voltage level is formed on contact “2”.

Caution! Max. consumption current of external alarm unit on input shall not exceed 20 mA

2.3.6 The Product settings

The Product default settings are carried out by plug contacts “SW1” on PCB according to Table 9.

Table 9 – MDU default settings

“SW1”	Position	Description
position “1”	0	Not used
position “2”	0	Stop bit: 1
position “3”	0	Parity is switched off
position “4”	0	
position “5”	0	Data baud rate (reception / transmission) 4800 bit/s
position “6”	1	
position “7”	0	
position “8”	0	Operation mode: signal distribution with active channel select
position “9”	0	
position “10”	0	

Notes

1 Sign “0” means - switched off (OFF).

2 Sign “1” means - switched on (ON).

The Product software ensures (automatic) reboot if input interfaces settings, operation mode, etc. are changed. Thus, users do not have to switch the Product on or off in order to apply changes while configuring.

2.3.7 LEDs

LEDs that indicate parameters are located on the PCB, see Table 10 and Figure 11.

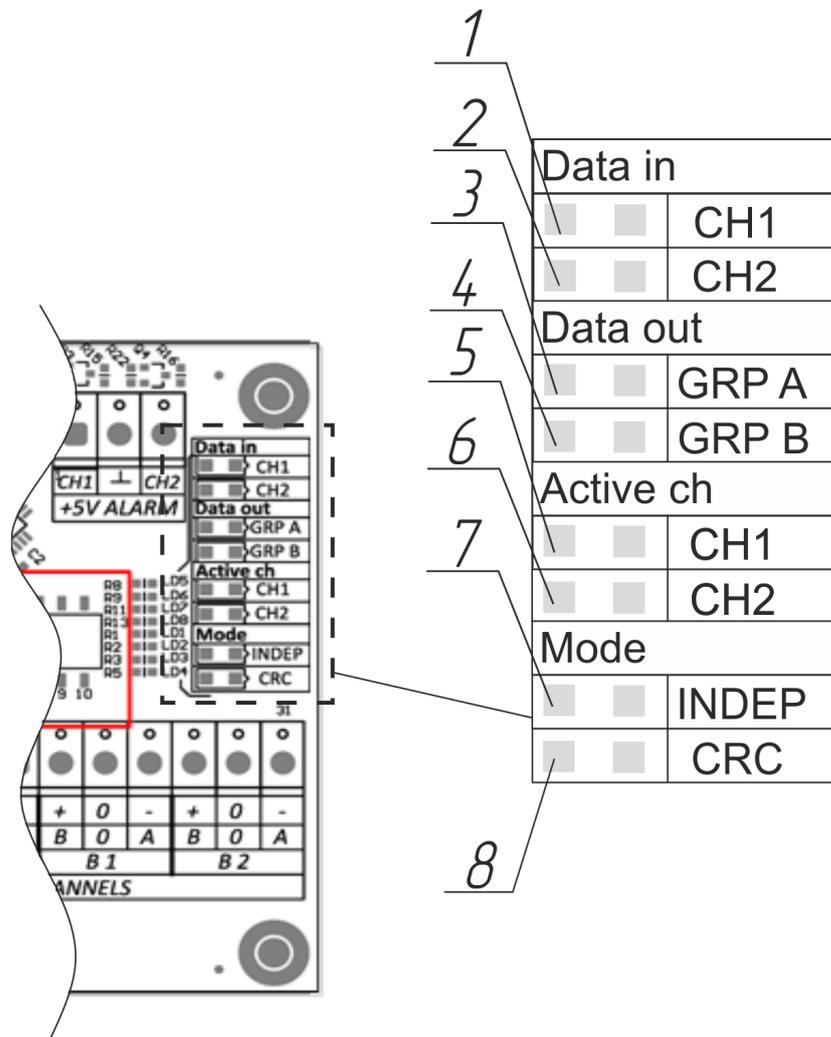


Figure 11 – Layout of LEDs on MDU-102 PCB

Table 10 – LEDs for MDU parameters

№	LED	Description
Data in (input data)		
1	“CH1”	Signal on “CH1” channel input, while receiving data LED is flashing
2	“CH2”	Signal on “CH2” channel input, while receiving

№	LED	Description
		data LED is flashing
Data out (output data)		
3	“GRP A”	Output signal on output group “A”, while transmitting data LED is flashing
4	“GRP B”	Output signal on output group “B”, while transmitting data LED is flashing
Active ch (active channel)		
5	“CH1”	Current active channel “CH1”, if channel is active, LED is glowing
6	“CH2”	Current active channel “CH2”, if channel is active, LED is glowing
MODE (operation mode)		
7	“INDEP”	Independent mode operation; if independent mode is selected, LED is glowing
8	“CRC”	Operation in checksum test mode; if this mode is selected, LED is glowing
Note – In signal multiplication mode with active channel select “INDEP” and “CRC” LEDs are not active.		

3 TECHNICAL SERVICE OF THE PRODUCT

3.1 GENERAL DESCRIPTION

The Product's TS shall be provided by the staff acquainted with its composition, structure and operation features.

In order to provide safe and reliable operation for the Product, the staff shall maintain semi-annual TS.

TS shall be provided by the staff on the running equipment.

3.2 SAFETY FEATURES

While maintaining the TS, observe 4.2.

3.3 MAINTENANCE ROUTINE

List of works by TS types is represented in Table. Maintenance routine procedure is given in CL, represented in Tables 12–13.

The list of works for all types of TS is given in Table 4.

Table 11 – List of works by TS types

CL No.	Work	TS Type
1	Visual check of the Product	+
2	Output data test	+

Note – Sign “+” means – work is obligatory.

Table 12 – CL №1. Visual check of the Product

To be done	Routine	Man-hours per 1 Product
Visually examine the Product	1 check completeness and appearance of the Product; mechanical damage, paint defects must be absent; marking plates shall be present; legends are to be read easily; 2 clean up the Product surfaces with clean cloth; 3 remove severe contamination, parts of corrosion, oil spots from the metal surfaces – using ethyl alcohol, avoiding its penetration inside the Product; all surfaces clean dry by clean cloth and dry up; 4 If varnish paint coating is damaged, polish it with sand paper, then clean with alcohol-soaked cloth, cover with varnish and dry up	1 person 5 minutes
Check reliability of cable and bus connection to the Product	1 check that connectors and attaching screws are fastened tight; provide further fastening if needed; 2 check the cable integrity (mechanical damage shall be absent) within visibility	1 person 5 minutes

Table 13 – CL №2. Output data test

To be done	Routine	Man-hours per 1 Product
Output data test	1 supply power to the Product; 2 provide required settings for channels by means of plug contacts “SW1”; 3 supply input data on “CH1” and “CH2”; 4 compare output data with data received on “CH1” input; 5 set jumper to terminals 2-3 of terminal block “X2” and compare output data with data received on “CH2” input	1 person 15 minutes

3.4 PRESERVATION

The Product and set of operational documents are stored in preserved condition in Manufacturer’s packaging boxes.

The time of represervation – 2 years from the Manufacturer’s commissioning.

The represervation is done in heated rooms in the same order as the preservation. The represerved Product, SPTA kit and documents are placed in package. The time of storage – 2 years.

The represervation is done in heated rooms in the same order as the preservation.

The represerved Product and documents are placed in package.

4 CURRENT REPAIR OF THE PRODUCT

4.1 GENERAL DESCRIPTION

To diagnose the problem, see Table 14.

If you cannot diagnose the problem, contact the Manufacturer’s service centre.

4.2 SAFETY FEATURES

Any repair works must be provided by personnel examined and received proper qualifications in the area of the occupational safety.

Check grounding of the PSU before providing any repair works.

It is PROHIBITED to put a poster “DO NOT switch on! Under Operation!”, when power supply switch is in OFF position.

Replacing damaged parts, boards, modules is PROHIBITED if power supply of the repaired unit is on.

Installation, aligning and repair works are PROHIBITED in the room, where less than 2 people are present.

4.3 CURRENT REPAIR

The list of malfunctions that can be eliminated by own employees is represented in Table 14.

Table 14 – The list of possible malfunctions and troubleshooting

Malfunction	Possible reasons	To be done
The Product does not switch on	Power cable is not connected	Connect power cable
	No power mains	Provide power mains
	Fuse malfunction	Replace fuse
No output data	Input data source is not connected	Connect input data source
	Invalid channel settings	Set required position of plug contacts “SW1” according to Table 9

5 STORAGE

The Product must be stored in packaging inside areas complying with the required storage conditions (+ 5 to + 40 °C) with the concentration of dust, oil, moisture and aggressive impurities in the air within the required limits for the working areas of production facilities.

After storage or transportation of the device below + 10 °C, it must be unpacked only in heated premises and left in normal climate conditions for 12 hours beforehand.

6 TRANSPORTATION

The Product must be transported in the Manufacturer's transportation package in closed means of transport.

Types of shipment:

- motor vehicle and railroad transportation in closed means of transport (covered cars, multipurpose containers);
- air transportation (in sealed and heated compartments);
- sea transportation (in dry service premises).

The Product must be transported in compliance with transportation rules applicable for each means of transport.

During loading/unloading operations and transportation, the requirements indicated on warning labels on the boxes/packaging must be observed, and no impacts are permitted since they can affect the safety and performance of the Product.

Inside the means of transport, the packed device must be firmly secured/fastened.

7 DISPOSAL

New equipment, the parts of the Product damaged during operation, and any overage equipment must not be disposed as standard household wastes, since they contain the materials suitable for re-use.

Decommissioned and non-used components of the Product must be delivered to a special waste disposal center licensed by local authorities. You can also send an overage equipment/unit to the manufacturer for its further disposal.

Proper disposal of Product components allows avoiding possible negative environmental and health impacts, and it also allows for proper restoration of components with substantial energy and resources saving.

During operation and upon completion of its service life, the equipment is not hazardous for health and environment

This unit must be disposed according to the rules applied to electronic devices (Federal Law dated 24.06.98 No. 89-FZ On Production and Consumption of Waste as amended of 30.12.2008 No.309-FZ)



Any products marked with a crossed trash bin must be disposed separately from standard house-hold wastes

8 WARRANTY OBLIGATIONS

Manufacturer is under warranty obligations in case of correct Product use according to OM. In case of operation abuse Manufacturer does not accept damage claims.

For more warranty details visit our website www.unicont.com section Support.

Address and contacts of Manufacturer's service centre:

NPK MSA LLC

26E, Kibalchicha Str., St Petersburg, Russia, 192174

Tel.: + 7 (812) 602-02-64, 8-800-100-67-19;

fax: +7 (812) 362-76-36

e-mail: service@unicont.com

**APPENDIX A
(MANDATORY)
OUTLINE AND INSTALLATION DIMENSIONS**

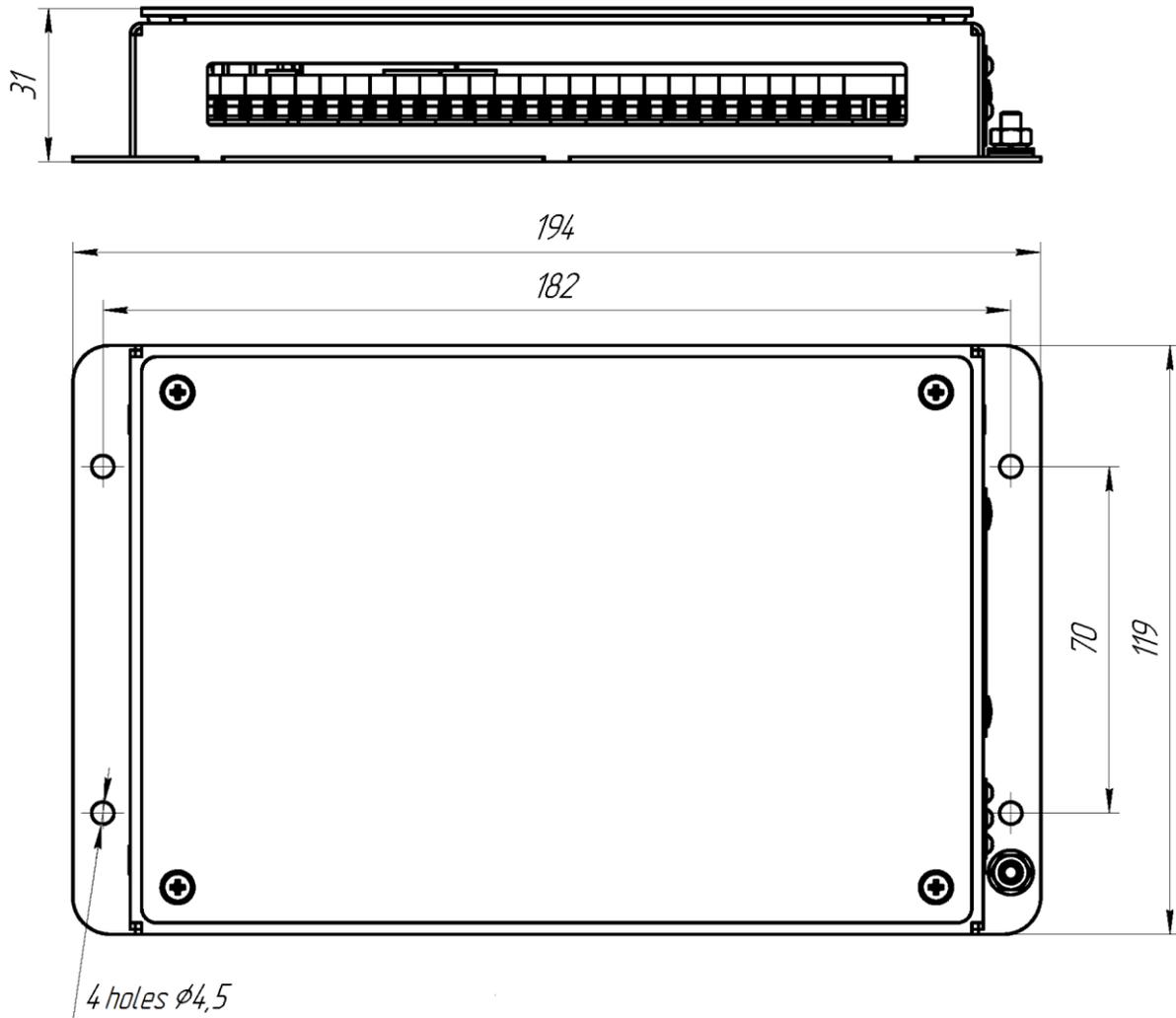


Figure A.1 – The MDU outline and installation dimensions