AFLOWT

REMOTE COMPUTING
COMPLEX

AFLOWT RCC

VERSION
RCC-102

OPERATION MANUAL
PART I

ISO 9001:2015

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Manufacturer quality management system is certified to ISO 9001:2015

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URL: http://www.aflowt.com

TABLE OF CONTENTS

INTRODUCTION

This document covers “AFLOWT RCC” remote computing complex RCC-102 version and contains the information about their design and operation.

Part I is devoted to technical description and maintenance procedures. Part II describes device's operation.

Due to continuous improvement of product policy, actual device's specifications may differ from the data specified in this manual. However, this will not affect the metrological characteristics and functionality.

LIST OF ABBREVIATIONS

FRT	- Flow rate transmitter
LCD	- Liquid crystal display
PC	- Personal Computer
PT	- Pressure transmitter
RCC	- Remote computing complex
SPS	- Secondary power source

* * *

Validation documents are available on website **www.awlowt.com**

1. DESCRIPTION AND OPERATION

1.1. Functionality

1.1.1. Remote computing complex “AFLOWT RCC” v.RCC-102 is designed for collection, processing and storage of measurement data and its subsequent transmission to peripheral equipment.

1.1.2. Remote computing complex (RCC) provides:

- Receiving and transformation of pulse-frequency signals in flow rate values, current signals in pressure
- Cumulative calculation of volume of the measured medium for each channel of measurement
- Storage in the permanent memory of calculation results and operation parameters
- Entering setup parameters from built-in keypad
- Output of measuring, diagnostic, setup and logged information via serial interface RS-232 or RS-485
- Formation of logical output signals
- Automatic monitoring and indication of faults and out-of-order flow rate and pressure measuring channels with entering data on their type and duration in the log
- Protection archived and setup data from unauthorized access.

1.2. Specifications

1.2.1. Input and output:

- 2 pulse-frequency inputs
- 1 current input
- 2 discrete outputs.

1.2.2. Connected devices:

- Flow meters with pulse-frequency output and pulse frequency below 100 Hz
- Pressure sensors with unified current output 0...5, 0...20 or 4...20 mA range.

1.2.3. Connection type:

- RS-232 interface
- RS-485 interface.

1.2.4. RCC provides data storage in minute, hourly, daily and monthly logs.

Guaranteed preservation of archived and setup data without external power (and full battery charge drop) – at least 10 years.

1.2.5. Power supply options:

- 18 to 25 V stabilized direct current with pulsation level ± 1.0 %
- Rated power – not more than 0.1 W.

Secondary power supply source (SPS) for 220 V 50 Hz can be provided, optional.

Additionally, RCC has a battery that maintains the device operation during power outages: up to 330 hours while conversing of signals and registering parameters, display off, interface and keypad off.

1.2.6. Operating parameters:

- Mean time between failures – 75 000 h
- Mean service life – 12 years.

1.2.7. RCC complies with the requirements for resistance to:

- Climatic influences – ambient-air temperature 5 to 50 °C, relative humidity up to 80 % at temperature up to 35 °C, without moisture condensation
- Mechanical stress – vibration frequency 10 to 500 Hz with displacement amplitude 0.35 mm
- Atmospheric pressure – 66.0 to 106.7 kPa.

Protection degree code is IP54.

1.2.8. Appearance and dimensional characteristics of measuring computer system RCC-102 is given in Appendix A.

1.3. Metrological characteristics

1.3.1. Permissible relative error of transformation of the pulse-frequency measuring signal into the flow rate is ± 0.5%.

1.3.2. Permissible relative error of transformation of the number of pulses in volume is ± 0.05%.

1.3.3. Permissible reduced error δ_P of transformation of DC signal into pressure determined by the following formula:

$$\delta_p = \pm\left[0.15 + 0{,}06 \cdot \left(\frac{P_L}{P_M} - 1\right)\right], \%$$

where P_L – pressure limit, MPa;

P_M – measured pressure, MPa.

1.3.4. Permissible relative error of the various modes operating time registering is ± 0.01%.

1.4. Contents

Scope of delivery is shown in table.1.

Table 1

Name and designation	Num.	Note
Block RCC	1	
Secondary power supply	1	Optional
Mounting kit	1	Note
Certificate	1	

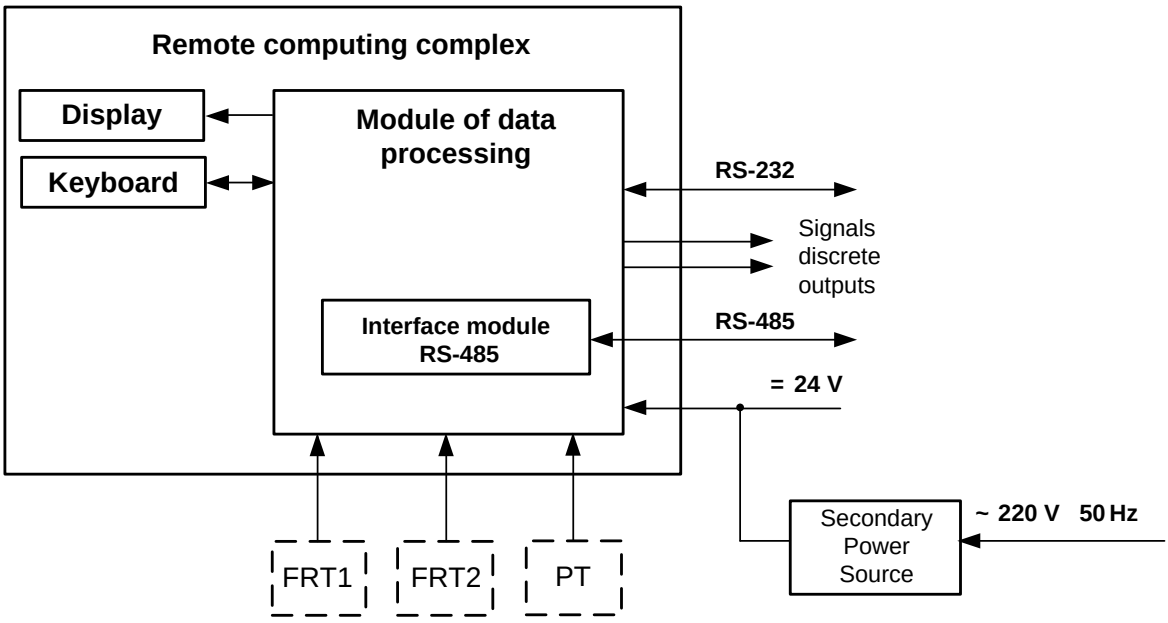
NOTE. The kit includes power and communication cords. Cable lengths on request.

User documentation for this product and other products published on the site **www.aflowt.com.**

1.5. Operation and description

1.5.1. Principle of operation

1.5.1.1. The principle of operation is based on measuring primary parameters of the controlled fluid (flow and pressure) with primary converters, installed on the pipelines, and the processing of measurement data with the given values of parameters. RCC structural scheme is shown in Fig.1.



FRT – flow rate transducer; PT – pressure transducer

Fig.1. Structural scheme of the complex

1.5.1.2. Values of measured and calculated parameters are displayed on liquid crystal display (LCD) of the RCC unit and via interface RS-232 (RS-485) are transmitted to peripheral equipment.

1.5.1.3. Setup the RCC at the object and reading the archived data also may be performed using the keypad and LCD or via serial interface RS-232 (RS-485).

1.5.1.4. RCC provides indication of measured parameters with a precision specified in the table.2.

Table 2

Name of parameter	Unit of measurement	Number of display characters	
		Integer part	Fractional part
Average flow rate	m^3/h	4	3
Volume cumulative total	m^3	7	3
Pressure	kPa	5	2
Operating time	h	6	2

1.5.1.5. For building based on RCC data collection system it is important to use the flow rate transducers (FRT) and pressure transducers (PT) compatible with the RCC's technical characteristics.

1.5.2. Compatible flow rate transducers

1.5.2.1. Flow rate transducers of following types can be used with RCC-102:

- Electromagnetic flow meters "AFLOWT MF Lite M modification"
- Ultrasonic flow meters "AFLOWT UF".

Communication line flow meters – RCC can be up to 300 m length.

Description of operation principle and technical characteristics of related transducers can be found in appropriate operational documentation.

1.5.2.2. The power supply of flow meters can be from separate sources or from optionally delivered with RCC power supply =24 V. In the latter case, it has to be verified that the power supply has sufficient capacity to power the RCC and the specific transducers.

1.5.3. Compatible pressure transducers

1.5.3.1. With RCC can be used measuring relative (excess) pressure transducers of various type with unified current output with 0...5, 0...20 or 4...20 mA range and meeting specified accuracy requirements and application conditions: JUMO, MBS1700, MBS3000, MBS33, DMP330F.

The maximum length of communication line with these transducers is determined by technical characteristics of particular pressure transmitter and the communication line parameters.

1.5.3.2. Transducer power supply can be from a separate power source or from optionally delivered with RCC power supply =24 V.

1.5.4. Registration of operation results

1.5.4.1. Measurement and processed data is recorded in the internal archives: minute, hourly, daily and monthly. The list of archived parameters is given in part II of this manual. These archives can be displayed either on the LCD or transmitted via serial interface to an external device.

1.5.4.2. Archives capacities:

- Minute – up to 14400 records (for the previous 10 days)

- Hourly – up to 1080 records (for the previous 45 days)
- Daily – up to 185 records
- Monthly – up to 48 records.

After exhausting the storage space a new archive is overrated on top of the oldest archival record.

1.5.4.3. Following data is stored: time of recording, measured value of the parameter, status words containing the codes for abnormal situations and failures that occurred during the archived interval.

The archived interval is the time interval of certain duration – one minute, one hour, one day, or one month.

For each archive there is an established search procedure.

1.5.5. Control modes

1.5.5.1. Control mode of measuring-computer complex is specified by the level of access to information and the ability to change parameters of functioning of the RCC.

RCC has three modes of operation:

- WORK – standard operation mode (user);
- SERVICE – maintenance;
- SETUP – setup and calibration.

The control mode is set by combination of presence / absence of the jumpers on contact pairs, located on the data processing module board (Fig.A.2, Appendix A). Correspondence of the combinations to the control modes given in table.3, where "+" denotes the presence of jumper on contact pairs, and "-" – absence.

Table 3

Name of the mode	Contact pair		Purpose of the mode
	J1	J2	
WORK	-	-	Operating mode
SERVICE	-	+	Maintenance
SETUP	+	-	Setup and calibration

1.5.5.2. The modes differ in the level of access to information: indicated on the display information and ability of changing device settings from the keyboard and via RS-232 (RS-485).

SETUP mode is the highest level. In this mode all parameters are displayed and all the settings of the RCC can be possible modified. The least capacity has WORK mode.

In all modes you can view and read accumulated and archived parameters.

Management of RCC in various modes can be processed from the keyboard using the menu system and different level indication windows that are displayed on the LCD, or by using the personal computer (PC) via serial interface RS-232 (RS-485). Structure and contents of the main menus are given in part II of this manual.

1.5.5.3. The WORK mode is the regular operation mode of RCC at the facility. In the WORK mode the user is able to view:

a) Values of the measured parameters such as: volumetric flow rate, accumulated volume, pressure, operating time, FRT and PT out of range time

b) Contents of the archives

c) Operating parameters of the RCC:

- Periods of processing measurements
- Dates of switching the device clock to "winter" / "summer" time
- Pulse-frequency inputs, pressure inputs and digital outputs settings
- Communication parameters for the RS-232 (RS-485)
- Time indication on the device clock.

In the WORK mode the user may:

- Set the operation parameters for RS-232 (RS-485) interface: network address of the device, data transfer speed, delay and pause
- Adjust once a day the device clock at up to ± 60 s
- Enable / disable the use of "summer time" (only during "winter time").

1.5.5.4 SERVICE mode – mode of preparing the unit to operation at the object.

Additionally, in the SERVICE mode (comparatively to the WORK mode), the user can:

a) View the input pulse-frequency values on the flow rate transducers and the output current values of pressure transducers;

b) To change:

- Set device clock (current time and date)
- Enable / disable transfer to "summer" / "winter" time
- Set the parameters of the frequency-pulse inputs (assign inputs, set the values of conversion factors, mode of operation (active / passive), range of measurement, etc.)
- Set the parameters of pressure measurement (output current range, pressure range, etc.);

c) Enter the serial numbers of FRT and PT;

d) Set the parameters of digital outputs: work modes, triggering values;

e) Set the start times for daily and monthly logs;

f) Reset values of accumulated volume and cleaning up the logs.

1.5.5.5. In SETUP mode you can view and modify all parameters without exception.

1.5.5.6. Modification of settings in SERVICE and WORK modes does not affect the metrological characteristics of the device and can be performed at the facility if necessary.

Setup parameters and calibration of RCC in SERVICE and WORK modes are unavailable.

1.5.6. Interface

1.5.6.1. Serial interface

Serial interface RS-232 (RS-485) allows you to manage RCC, read measurement, archival, setup and diagnostic information, modify the setup parameters. Serial interfaces support the ModBus Protocol (RTU ModBus).

Serial interface RS-232 can be used for direct connection with PC:

- By cable (length of connection up to 15 m)
- Telephone line (dial-up modem)
- Over the air (via radio modem)
- Via GSM 900/1800 MHz using special adapter.

The range of communication via telephone line, radio and mobile connection is determined by the characteristics of the telephone line, radio or mobile channel, respectively.

Serial interface RS-485 can provide linkage to multiple subscribers, one of which can be PC, by the cable when the length of the communication line is up to 1200 m.

Data transfer speed (1200 to 4800 Baud), and other communication parameters can be set using RS-232 (RS-485), or from the keyboard of RCC-102.

1.5.6.2. Pulse-frequency inputs

Pulse-frequency inputs are used for connecting flow rate transducers with pulse-frequency output.

The input cascade can work in two modes that may be set from the keypad or via serial interface:

- Active mode when pulse-frequency input is powered from an internal power source
- Passive mode when pulse-frequency input disconnected from internal power source.

In active mode the input can be fed by the electronically or mechanical key.

In passive mode the input should be fed with voltage pulses of following parameters: logical zero 0...0.5 V, logical high – 3,0...5,0 V.

When connecting to pulse-frequency inputs polarity should the observed in accordance with marking on the circuit board.

Scheme and parameters of the input cascade of pulse-frequency input is given in Appendix B.

ATTENTION! The maximum allowable voltage on pulse-frequency inputs is 5.5 V!

The input pulse frequency should not be more than:

- 10 Hz – in active mode;
- 100 Hz – in passive mode.

1.5.6.3. Discrete outputs

Assignment of the outputs and their working parameters are set programmatically either during manufacture in accordance with the order or at the facility during commissioning (see part II of this guide).

Terminal cascade circuit and description of work modes are given in Appendix B.

The presence / absence of the event (or its state) correspond to one certain state of the terminal cascade of the discrete output.

Programmatically for each output by setting the value **open** / **high** or **closed / low** the active state of the output (**Outp. act. lvl.**), corresponding to the occurrence of an event can be specified. The electrical parameters of signal levels are given in Appendix B.

1.5.7. Transfer to "summer"/"winter" time

RCC-102 provides the ability of automatically transfer of the device clock to the "summer"/"winter" time. User may enable or disable the transfer feature (only during winter time).

Enabling /disabling are made by the appointment of the relevant parameter (see part II of the manual).

When the option is on the transfer is carried out on the last Sunday of March at 2:00:00 AM one hour ahead, and the transfer to "winter" time on the last Sunday of October at 3:00:00 AM one hour back.

If transfer is disabled, the device clock goes only on "winter" time.

1.5.8. Design

The appearance of the RCC-102 is shown in Fig.A.1. The RCC casing is made of plastic and consists of two parts: front – data processing module and base, intended for placement of the signal cables with the corresponding parts of the contact pads.

On the base are placed: built-in RS-232 interface, plugged holes for power cable entries, signal lines of FRT, PT and external devices that may be connected to RCC. On the rear panel there are holes for brackets allowing fixing RCC to DIN rail at the site of operation.

The data processing module contains a board with electronic components and battery. On the front panel are the LCD and keypad. The data processing module is joined with the base by means of screws, forming RCC block.

1.6. Marking and sealing

1.6.1. Marking on the front panel of the RCC unit contains designation and product name, trademark of the manufacturer. Serial number is stated on a separate nameplate.

1.6.2. After calibration done the contact pair that allows modification of the calibration parameters on data processing module board.

1.6.3. After installation and testing the operation contact pair that permits modification of service parameters on the data processing module board should be sealed.

In addition, to protect against unauthorized access during transportation, storage or operation lugs of the housing of RCC can be sealed.

2. INTENDED USE

2.1. Operating limitations

2.1.1. Operation of the RCC should carry out under conditions, specified in sec.1.2.7.

2.1.2. Lightning protection of an object, at which the product is placed, protects RCC from lightning discharges.

2.1.3. Requirements to the operating conditions and the choice of mounting site, conferred in this operational documentation, take into account the most typical factors influencing the work of the RCC.

At the site of operation may exist or arise factors beyond the preliminary forecast, assessment or inspection and that the manufacturer might not have considered during development.

In case of existence of such factors a different should be found, where these factors are absent or not impact on the product operation ability.

2.2. Security measures

2.2.1. Only operating personnel who have studied the operating documentation for the product allowed working with RCC.

2.2.2. Hazardous factors while operating are:

- AC voltage with the current value up to 264 V, frequency 50 Hz (when using the secondary power source)
- Other factors caused by the specificity of the object of operation.

2.2.3. It is strictly prohibited during installation, commissioning or repair of the products:

- To make connections to the unit or replacement of any elements while the power is on
- To use faulty electrical tools or appliances or without connecting them to the protective grounding bus.

2.3. Preparation for use

2.3.1. Preparation for installation

2.3.1.1. Not allowed mounting RCC in conditions other than those listed in sec.1.2.7.

2.3.1.2. When choosing the placement of RCC the following should be considered:

- The length of the communication cables RCC – FRT and RCC – PT
- To ensure free access to RCC
- Do not place RCC near any heat sources such as hot piping
- To avoid dripping condensate or liquid from passing pipelines in vicinity of RCC.

External lighting is needed for reading RCC parameters.

2.3.1.3. Transportation RCC to the place of installation must be performed in original container.

After transportation at temperatures below freezing to avoid condensation of moisture it is necessary to retain RCC indoors wrapped not less than 3 hours.

While unpacking check RCC completeness according to the passport on the device.

2.3.2. Installation of RCC

2.3.2.1. Fixing RCC and the second power supply source is done on DIN rail.

2.3.2.2. Connection of FRT and PT to the RCC is performed in accordance with the connection diagram (Appendix B) and the layout of the commutation elements on the data processing module board (Appendix A).

2.3.2.3. As the signal cable for pulse-frequency and current inputs any double-wire cable with cross-section area not less than 0.35 mm^2 can be used.

2.3.2.4. As the communication line cables for digital outputs can be used any double / four-wire cables with cross-section area not less than 0.35 mm^2 and the length of 300 m.

2.3.2.5. Interface RS-232 cable is connected to the output 9-pin connector on the RCC unit. Standard null modem cable 15 m length may be used. For the serial interface RS-485 shielded twisted-pair cable with a total length up to 1200 m is recommended.

2.3.2.6. As the power supply cables of voltage =24 V for the RCC unit, FRT and PT can be used any two-wire cable. Allowable length and cross-section is determined from the condition of the voltage drop not more than 5 V.

2.3.2.7. Before connecting the ends of the cables are stripped of insulation for a length of 5 mm and tinned. Cut and tinned ends of the FRT and PT signal cables from the RCC side are passed through the membrane plug and connected to the corresponding part of contact pad.

2.3.2.8. Communication and power cables are fixed to the wall if possible. For protection against mechanical damage it is recommended that the cables to be placed in metal or plastic pipes, sleeves, trays or cable ducts. It is allowed to place in a single tube (box) the communication cable and the power cable of FRT or PT.

It is not recommended to lay signal cables if they are not routed in a metal tube, sleeve or box along with the power cables of other equipment at a distance of less than 30 cm. It is allowed to cross them at 90°.

NOT ALLOWED TO FIX THE CABLES TO THE HOT PIPING.

2.3.3. Commissioning

2.3.3.1. Commissioning is performed by the representative of the organization, entitled to conduct these activities, or by the representative of the manufacturer.

2.3.3.2. Before putting into operation of complex RCC-102 it is necessary:

a) To restart RCC by pressing the button on the data processing module board

b) To set the device clock

c) Reset accumulated values of the measured parameters

d) Clean the archives

e) Perform other necessary settings.

2.3.3.3. While preparing product for use also should be checked:

- Correct connection of RCC to interactive equipment in accordance with the selected scheme
- The correctness of the selected operating modes of the inputs and outputs of the RCC
- Compliance of power voltage with specifications.

After the setting and testing RCC must be sealed (sec.1.6).

3. MAINTENANCE

3.1. Commissioned RCC is recommended to subject to the periodic technical inspection in order to monitor:

- Serviceability
- Compliance with the operating conditions
- Power supply
- Absence of external damage
- Secure electrical and mechanical connections.

The frequency of inspection depends on operating conditions but should not be less than once in two weeks.

***ATTENTION! In the absence of external power supply within 3 months, you must connect to the RCC a power source of voltage =24V for charging the internal battery*.**

3.2. Non-compliance with operating conditions in accordance with sec.1.2.7 can lead to failure.

External damage can also cause failure in the product normal operation. In case of external damage to the product, power or connection cables, you need to contact the manufacturer for the definition of possibility of further exploitation of the device.

3.3. While sending product for repair the passport for the product should be enclosed. Postal details, telephone and fax of the sender should be stated as well as the method of return and delivery address.

3.4. If you need to send RCC in repair:

- Disable external power supply
- Unscrew the screws securing the data processing module to detach it from the base
- Disconnect the signal cables from the data processing module main board
- Pack module for transport.

4. PACKAGING, STORAGE AND TRANSPORTATION

4.1. RCC equipped in accordance with the application is packed in individual container (corrugated cardboard). Set of operational documentation is also put there.

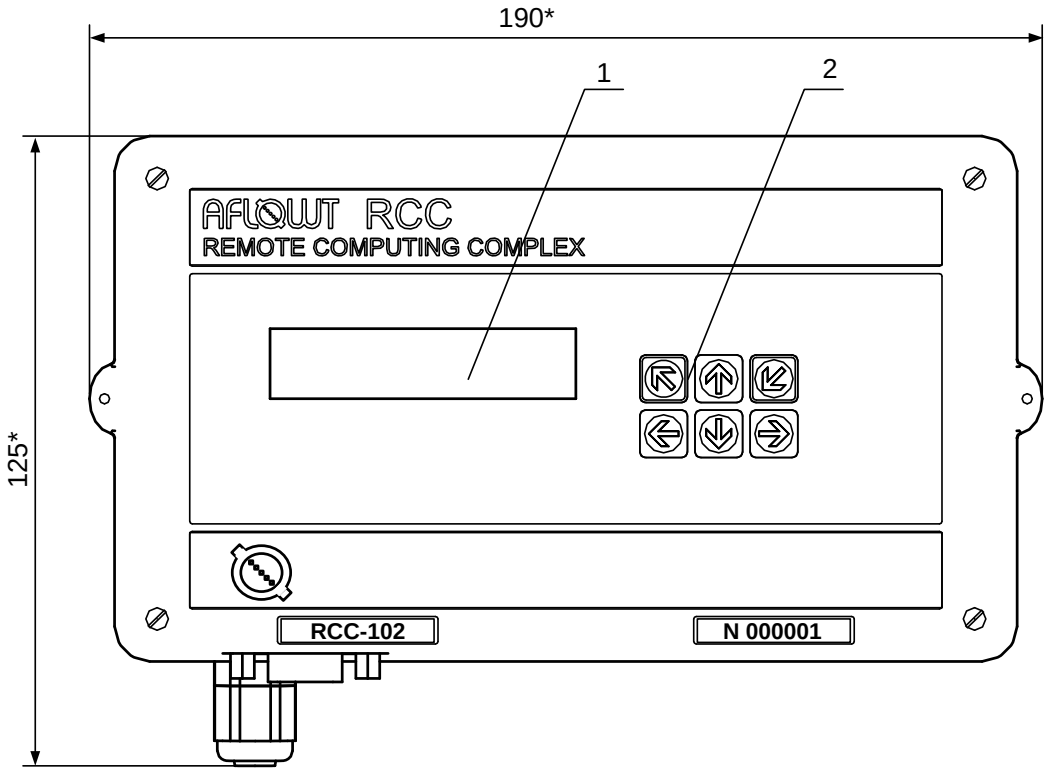
4.2. Should be stored in the original package in a dry heated room. Conductive dust, vapors of acids and alkalis and gases that may cause the corrosion and destroy insulation should not be present in the storage room.

***ATTENTION! At least 1 time in 3 months it is necessary to charge the internal battery of the device (sec.3.1)*.**

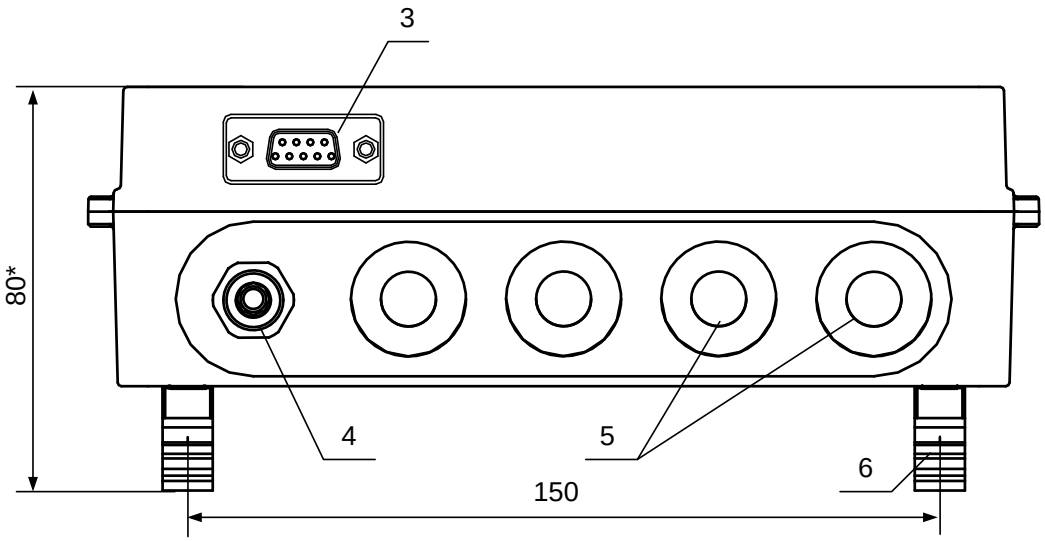
4.3. RCC can be transported by road, river, railway road and air transport (except unsealed compartments) under the following conditions:

- Transportation must be in original container
- No direct moisture allowed
- Temperature is within the range from minus 30 to 50°C
- Humidity does not exceed 95% at temperatures up to 35°C
- Vibration frequency is within the range from 10 to 500 Hz with amplitude up to 0.35 mm or acceleration up to 49 m/s^2
- Impacts with peak acceleration up to 98 m/s^2
- Packed product is secured to prevent falling and collisions.

APPENDIX A. View of RCC



a) front view

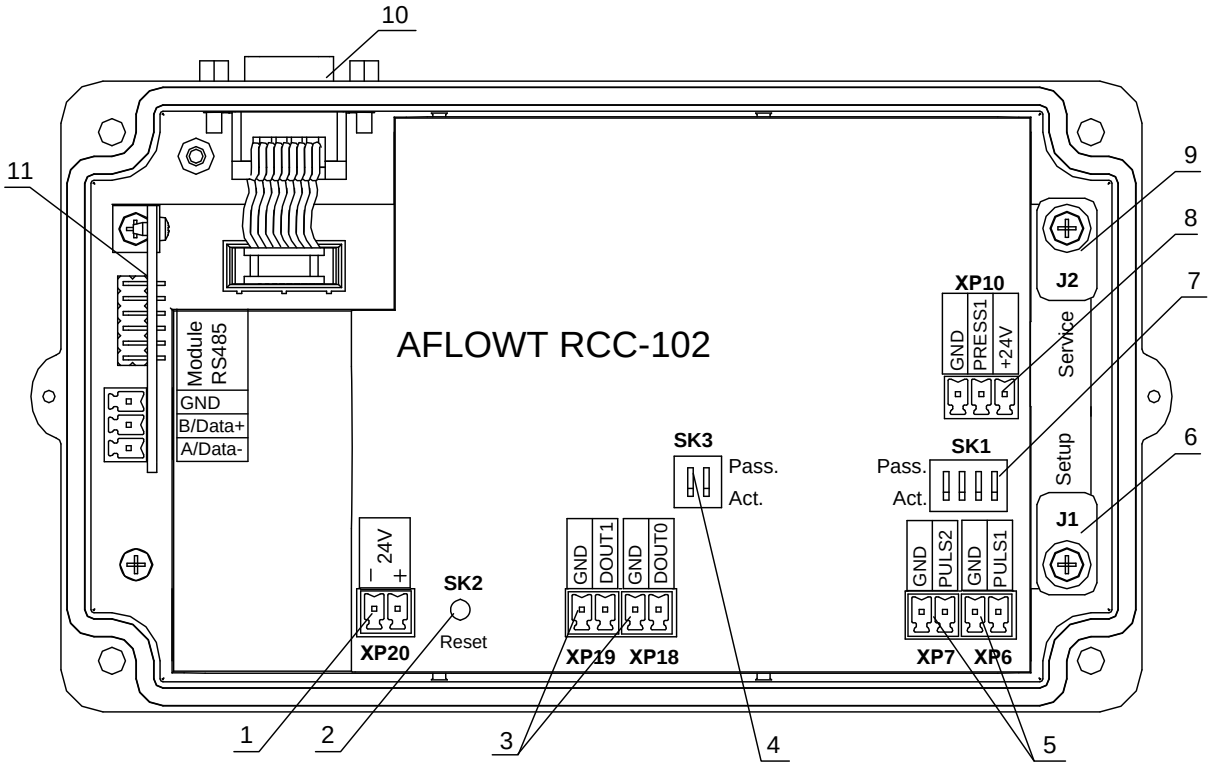


b) bottom view

* - reference dimension

1 – indicator; 2 – keyboard; 3 – RS-232 connector; 4 – cable gland of power supply cable; 5 – membrane stubs; 6 – brackets.

Fig.A.1. RCC-102.



1 – Terminal block connection of power supply =24 V

2 – Restart button (restart)

3 – XP18 and XP19 sockets of first and second digital outputs, respectively;

4 – Switch SK3 for setting the operation mode of the first and second digital outputs (active/passive)

5 – XP7 and XP6 sockets of the first and second frequency-pulse inputs, respectively

6 – Pin pair J1 - permission of modification of calibration settings, sealed after the inspection

7 – Switch SK1 to set the mode of operation of the first and second frequency-pulse inputs (active/passive)

8 – Socket XP10 of the PT

9 – Pin pair J2 - permission of the modification of service parameters, sealed after setup at the operation site

10 – RS-232 interface socket

11 – RS-485 interface module.

Fig.A.2. Rear view of the data processing module of RCC-102.

APPENDIX B. Electrical schematics

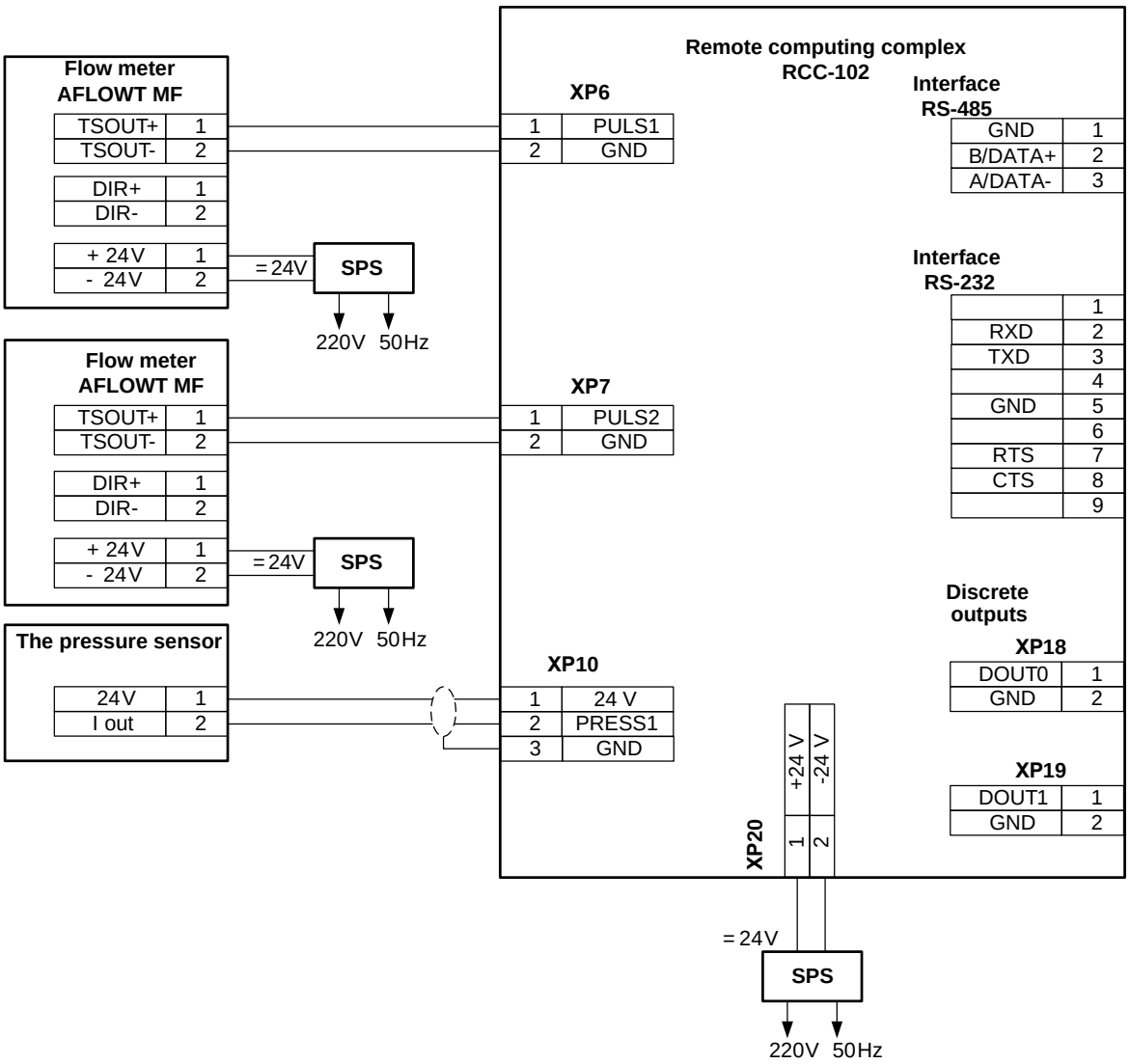


Fig.B.1. Wiring diagram of RCC-102 and 2 FRT and 1 PT powered from a separate secondary power sources.

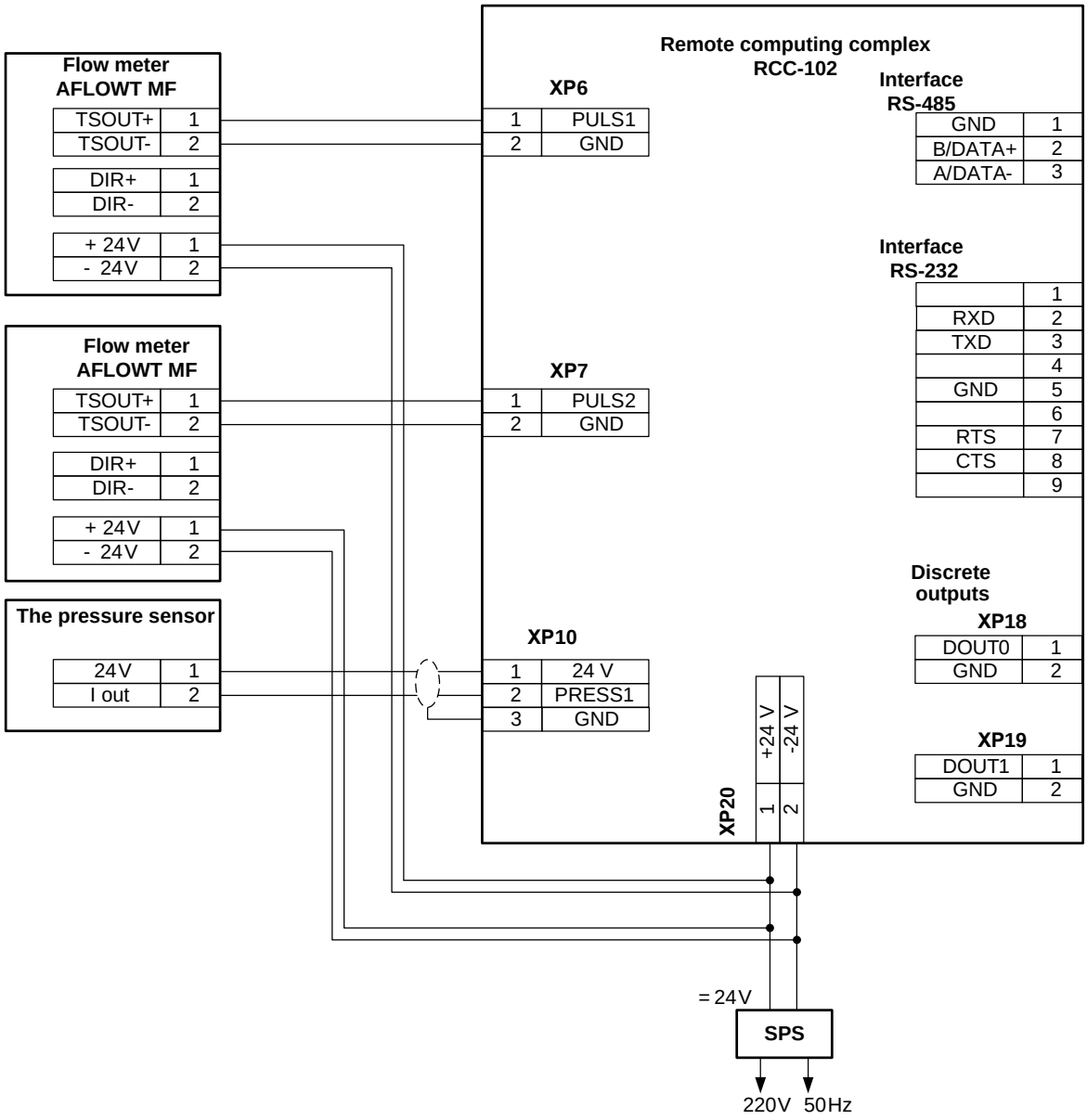


Fig.B.2. Wiring diagram of RCC-102 and 2 FRT and 1 PT powered from the internal SPS.

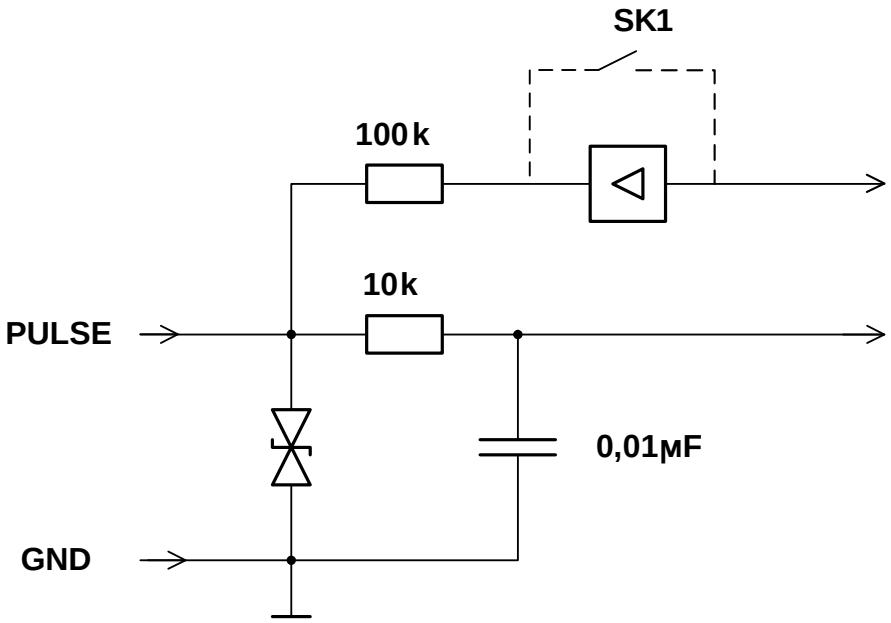


Fig.B.3. The scheme of the input cascade of the frequency-pulse input.

In passive mode the input should be fed with voltage pulses of the following parameters: logical zero 0 ... 0.5 V, the logical unit – 3.0 ... 5.0 V.

In active mode the input can be driven by the circuit of the electronic or mechanical key. The resistance of the external circuit when the key is closed should not exceed 500 Ohms, and the current in the open state must not exceed 5 μa.

In the closed state of the key resulting current is not more than 36 μa.

ATTENTION! Unused frequency-pulse input must be set to the active state with the switch SK1.

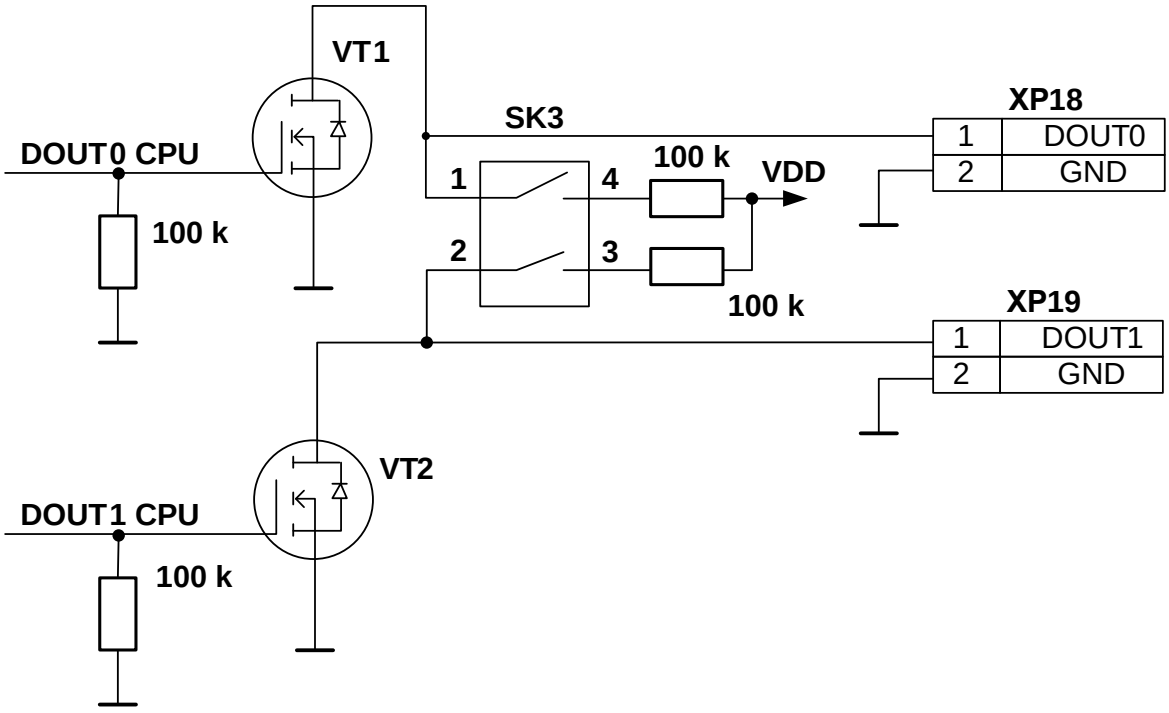


Fig.B.4. The scheme of the digital output of the data module processing of RCC-102.

The terminal cascades of discrete outputs can operate when powered by internal isolated power source (active mode) or from an external power source (passive mode).

In active mode, the output voltage corresponding to the "**high**" level can be from 1.7 to 3.3 V with load resistance at least 100 k. The "**low**" level output voltage is less than 0.2 V.

In passive mode power supply by the external DC power source of voltage up to 20 V is allowed, the allowable load current is up to 1 A.

Connection of terminal cascade to the internal power source + 3.3 V is performed by means of switch SK3.

The communication line length up to 300 m.

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