LABOR-ASTER

REDUNDANCY UNIT TYPE RED2

I N S T R U C T I O N M A N U A L

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1. Introduction

The purpose of this instruction manual is to provide the users of redundancy unit type RED2 with the general technical data of the device and to explain the basics of its functioning and operation. The installation and maintenance conditions, as well as procedures in case of failure are given.

2. Scope of supply, warranty

The device is dispatched to the recipient in individual and/or bulk containers together with the collective Warranty Card, valid for 12 months. The manufacturer guarantees the service within the warranty period and afterwards at the head office. Instruction Manual and Compliance Statement come with the device in amounts agreed with the recipient.

3. Application

Redundancy module type RED2 is designed for redundant connection of one out of two amplifiers type WZM (AMPLIFIER MODULE) to the regulation circuit of the object. Current from the second amplifier is then connected to load resistor R=300÷400Ω / 20W.

4. Technical data

Supply voltage / Power consumption - 20...28 V_{DC} / 4 W

Input R – input current measurement of the amplifier WZM number [1]

Input T – input current measurement of the amplifier WZM number [2]

These are the signals from “Control input” output of the WZM amplifiers

voltage range - 0.2V÷1V since 2012

input resistance - 100kΩ

Input S – output current measurement of the basic amplifier WZM number [1]

Input W – output current measurement of the spare amplifier WZM number [2]

These are the signals from “Control output” output of the WZM amplifiers

voltage range - 3.025Ω•(±0.15A)≈(-0.454V...+0.454V) since 2012

input resistance - 100kΩ

Analog outputs from internal shunts 3.025Ω:

Output E, F – information about the current flowing through the regulated object (redundancy)

voltage range - 3.025Ω•(±0.15A)≈(-0.454V...+0.454V) since 2012

Bistate inputs G, H: - 0 / 24V_{DC}, U_{MAX}=30V_{DC}

G – connect to the regulated object the basic WZM amplifier [1]

H – connect to the regulated object the spare WZM amplifier [2]

Outputs N, M, I, J, P bistate opto-relay - resistance in short state: R<10Ω, U_{MAX}=30$V_{AC/DC}$, I_{MAX}=100mA

5. Technical characteristics

5.1. Functional description of the unit

For the details of functioning see block scheme in Appendix 1.

5.1.1. RED2 MODULE DESCRIPTION

RED2 module performs following actions:

1. Measures voltage on the input and output shunts of both WZM amplifiers.

   Basing on two-point calibration (see point 5.1.2.1.) simple calibration of both amplifiers $I_{OUT}=f(I_{IN})$ is saved by the module.

   The amplifier connected to terminals A, R ,S is the basic amplifier [1].

   The amplifier connected to terminals B, T, W is the spare amplifier [2].

2. Checks if in signal on the output of WZM amplifier is equal to the signal on its input.

   If there is a deviation from a simple calibration by more than 2.5% (∆Iout=±2.5%•300mA=±7.5mA) in the basic channel and a deviation more than 1.6% (±4.8mA) in the spare channel the amplifier is consider to be damaged.

   This state is indicated by:

   - LED diode D3 and binary output “I” in short state for basic amplifier [1],
   - LED diode D4 and binary output “J” in short state for spare amplifier [2],

3. Switches currents from the outputs of the WZM amplifiers (-150mA...0...+150mA), which are connected to A and B inputs of the RED2 module, to the regulated object (output C) or load resistor R=300÷400Ω / 20W (output D) according to the following algorithm:

a) without $24V_{DC}$ supply voltage the current from the basic WZM amplifier [1] is always directed to the regulated object and the current from the spare WZM amplifier [2] is directed to the load resistor;

b) after turning on the $24V_{DC}$ power the current from the basic WZM amplifier [1] is always directed to the regulated object;

c) if both WZM amplifiers are operational (no damage according to point 2) than bigger current from the output of one of the amplifiers is directed to the regulated object;

d) if only one WZM amplifier is operational, the current from its output is directed to the regulated object;

e) if both amplifiers are damaged than the current from the basic amplifier [1] is directed to the regulated object.

4. Indicates:

a) connection of the $24V_{DC}$ power supply – green D1 LED diode is lit up,

b) condition of both $24V_{DC}$ supplies (redundancy):

- binary outputs M, N (power present – short contacts),

c) which amplifier is damaged:

- basic amplifier damaged

binary output "I" (short contact), red LED diode D3 is lit up,

- spare amplifier damaged

binary output "J" (short contact), red LED diode D4 is lit up,

d) connection of the spare amplifier to the regulated object

- binary output "P" (short contact), yellow LED diode D2 is lit up,

5. The module has two binary inputs ($24V_{DC}$ connected from the outside) which enforce immediately and independently from other signals connection of the current from the basic WZM amplifier [1] or the spare WZM amplifier [2] to the regulated object:

- input G – connect the basic amplifier,

- input H – connect the spare amplifier.

6. The module also has two analog outputs E, F – these are voltage from the shunt R=3,025Ω

- outputs E, F – information about the current directed to the regulated object.

5.1.2. SIGNALS CALIBRATION

RED2 module is based on microcontroller, which performs measurement of the signals in both channels, controls signals switching keys, reads buttons used for calibration (see description below) of the measurement channels and controls LED diodes indicating operational of the RED2 module channels.

The processor operates in 5ms cycle which provides adequate switching speed.

In each 5ms cycle are performed: eight measurements for the input signal of the amplifier and eight measurements for the output signal of the amplifier for each channel of the redundancy module and calculated normalized measurement signals for both channels.

5.1.2.1. Calibration of WZM amplifiers

a) Fully install the whole module bloc which are fabric set:

(2 pieces WZM) + RED2 + (2 pieces U-S2) + (2 resistors R=300÷400Ω / 20W representing valve coils)

b) Connect the power supply and wait 15 minutes.

c) Set to the input of the WZM amplifiers the same signal 4÷20mA (e.g. on serial connection of the input of both amplifiers).

By measuring the real current on the outputs of each WZM amplifier calibrate each amplifier. The calibration is done by ZERO and SPAN potentiometers which are on the front panel.

signal on the input of WZM amplifier	4.00mA	12.00mA	20.00mA
current of the WZM output number 1	-150.0mA	0.0mA	+150.0mA
current of the WZM output number 2	-150.0mA	0.0mA	+150.0mA

5.1.2.2. Calibration of measurement channels of the redundancy module RED2

(modules RED2 made in 2006 do not have calibration buttons)

Beginning of the range calibration:

1. Set 4mA signal in both measurement channels.
2. Press calibration button "ZERO" and hold it until the end of calibration process, which starts with reading the button for about 1.5 sec., then measurement cycle is performed for about 1.5 sec. which is indicated by blinking LED diodes D3, D4. If the calibration is correct both LED diodes D3, D4 will turn off and "ZERO" button should be released. If after blinking is over (and "ZERO" button is released) one of LEDs is still turned on it means there is a calibration error.

   D3 is ON ⇒ error in channel 1.

   D4 is ON ⇒ error in channel 2.

If all four measured values (2 x Control Input + 2 x Control Output) are reliable, they are written in the non-volatile memory of the RED2 redundancy module and the correctness is indicated by turning off LED diodes D3, D4.

3. Releasing the button ends the calibration.

End of the range calibration:

1. Set 20mA in both measurement channels.
2. Press “SPAN” button and hold it until the end of calibration process, which starts with reading the button for about 1.5 sec., then measurement cycle is performed for about 1.5 sec. which is indicated by blinking LED diodes D3, D4. If the calibration is correct both LED diodes D3, D4 will turn on and “SPAN” button should be released. If after releasing “SPAN” button one of LEDs is still turned on it means there is a calibration error.

   D3 is ON ⇒ error in channel 1.

   D4 is ON ⇒ error in channel 2.

   If all four measured values (2 x Control Input + 2 x Control Output) are reliable, they are written in the non-volatile memory of the RED2 redundancy module and the correctness is indicated by turning off LED diodes D3, D4.
3. Releasing the button ends the calibration.

5.1.2.3. Calibration of U-S2 transmitters

Set to the inputs of WZM amplifiers the same signal 4÷20mA (e.g. on serial connection of the inputs of both amplifiers). By measuring the real current on the outputs of each U-S2 transmitter perform calibration for each of them. The calibration is done by ZERO and SPAN potentiometers on the front panel.

signal on the WZM amplifier input	4.00mA	12.00mA	20.00mA
current on the input of U-S2 number 1	4.00mA	12.00mA	20.00mA
current on the input of U-S2 number 2	4.00mA	12.00mA	20.00mA

5.1.2.4. After this procedure start up with DCS system can be done

If the devices were not installed as LABOR-ASTER delivered than calibration above is necessary. Otherwise errors can reach 1%.

Modules RED2 made in 2006 do not have calibration buttons. That is why calibration of WZM amplifiers and U-S2 transmitters should be perform carefully.

5.1.3. RED2 MODULE ALGORITHM DESCRIPTION

Checking algorithm for the signals described below is performed in each cycle.

Measurement signals from WZM amplifiers are normalized. After pressing each of the two buttons calibration program is performed according to description from point 5.1.2.2. “Calibration of measurement channels of the redundancy module RED2”.

Step 1: - Signal deviation between input and output signals in both channels is checked and if it is bigger than 2.5% (∆Iout=±2.5%•300mA=±7.5mA) in the active channel or 1.6% (±4,8mA) in the spare channel red signaling LED diodes D3, D4 are lit up and bistate indication outputs I, J are set.

Step 2: - The condition is checked whether the channels have been switched over the last 100ms and if so the remaining steps are skipped in this cycle (this prevents the generator effect at greater measurement disturbances).

Step 3: - The condition is checked which WZM amplifier is connected as main (basic) and if it is amplifier [2] step 5 is performed.

If the amplifier [1] is active it is checked if it is operational and if “no” step 4 is performed. If “yes” it is checked if the signal from amplifier [2] is more than 2% greater than the signal from amplifier [1]. If “no” there is „End of the cycle”, if “yes” step 4 is performed.

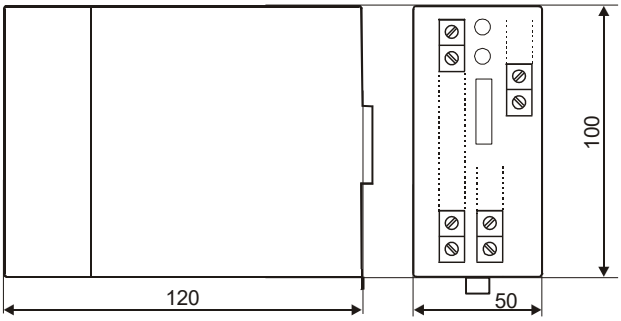
Step 4: - It is checked if amplifier [2] is operational. If “yes” channel is switched to amplifier [2]. If “no” there is “End of the cycle”.

Step 5: - The condition is checked whether amplifier [1] is operational. If “no” step 6 is performed. If “yes” it is checked if signal from amplifier [2] is more than 2% greater than the signal from amplifier [1]. If “yes” step 6 is performed. If “no” channel is switched to amplifier [1].

Step 6: - It is checked if amplifier [2] is operational. If “yes” there is “End of the cycle”. If “no” channel is switched to amplifier [1].

5.2. Housing description and construction

The module is placed inside a housing made of a self-extinguishing plastic material (polyamide PA 6.6). The housing should be mounted on the standard TS 35mm rail. The safety rate for housing and terminals corresponds to IP20. Electronic circuits are mounted on printed circuit boards. The figure below shows the housing look and dimensions (in mm).

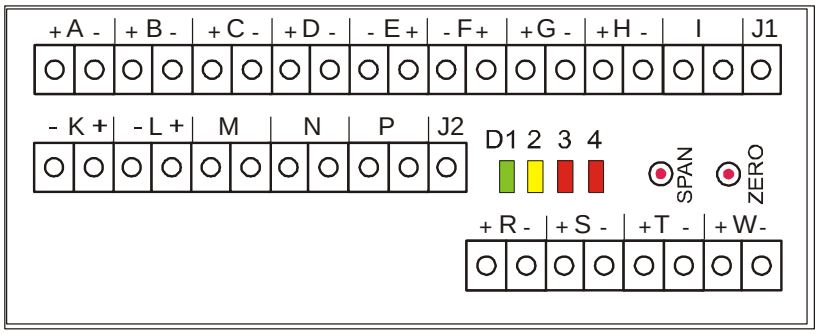


Drawing of the housing

6. Installation, operating conditions

6.1. Assembling and connections

For details of the unit connection in redundant system see the scheme in Appendix 2.



Front panel view

Terminals description:

A Current input ±150mA from basic WZM amplifier [1]
B Current input ±150mA from spare WZM amplifier [2]
C Current output ±150mA to the connected regulated object
D Current output ±150mA to the connected load resistor R=300÷400 Ω / 20W
E Current measurement directed to the regulated object – voltage from shunt R=3,025Ω
F Current measurement directed to the regulated object (redundancy) – voltage from shunt R=3,025Ω
G Binary input 0/24V – connect the basic WZM amplifier [1] to the regulated object
H Binary input 0/24V – connect the spare WZM amplifier [2] to the regulated object
I Binary output – basic WZM amplifier [1] is damaged (short switch)
J Binary output – spare WZM amplifier [2] is damaged (short switch)
K Supply 24VDC of the module (there are two redundant supplies)
L Supply 24VDC of the module (there are two redundant supplies)
M Binary output – information that 24VDC supply is connected to terminal K (short switch)
N Binary output – information that 24VDC supply is connected to terminal L (short switch)
P Binary output – information that the spare WZM amplifier [2] is connected to the regulated object (short switch)
R Analog measure input – measurement of the 4÷20mA current controlling basic WZM amplifier [1].
Voltage from “Control input” output from the basic amplifier.
S Analog measure input – measurement of the output current ±150mA from the basic WZM amplifier [1].
Voltage from “Control output” output from the basic amplifier.
T Analog measure input – measurement of the 4÷20mA current controlling spare WZM amplifier [2].
Voltage from “Control input” output from the spare amplifier.
W Analog measure input – measurement of the output current ±150mA from the spare WZM amplifier [2].
Voltage from “Control output” output from the spare amplifier.

LED diodes description:

D1 Indication of 24VDC supply – green light
D2 Indication that the spare WZM amplifier [2] is connected to the regulated object – yellow light
D3 Indication that the basic WZM amplifier [1] is not operational – red light
D4 Indication that the spare WZM amplifier [2] is not operational – red light

Buttons description:

ZERO Calibration for the beginning of the measurement range (4mA)
SPAN Calibration of the end of the measurement range (20mA)

The unit is designed to be mounted exclusively on standard TS 35mm rail. The housing strip catch should be placed vertically. Allow a distance of at least 5 mm between the housing and neighboring device side-walls.

External terminals require cupper cables with the wire diameter $\varnothing \leq 2.5$ mm. Wire endings should be protected with clam sleeves or twisted with no tin coating.

Twisted cables for input and output circuits of signal lines and separate tracks for signal and energetic supply lines are recommended. Signal and energetic cables tracks should cross under right angle. Twisted, shield cables are required in zones of high electromagnetic interference.

6.2. Normal operating conditions

Ambient temperature	-	5°C...+60°C
Relative humidity	-	30...80 %
Atmospheric pressure	-	80...120 kPa
Constant and variable magnetic field	-	0...400 A/m
Sinusoidal vibrations (within range of 5...80 Hz)	-	up to 2 g
Ambient atmosphere	-	dust and corrosive vapors free
Working position	-	housing catch vertically
Warming up time	-	15 minutes

7. Settings and calibrations

Redundancy module type RED2 requires calibration after installing the whole set (according to the Appendix 2).

Calibration should be done according to point 5.1.2.

8. Usage, maintenance, services: surveys, repairs

8.1. Periodical survey

While normal working the device does not demand any special maintenance. Surveys should be carried on periodically according to the users control standards. During the survey external examination of the device condition is required. Wiring terminals and cramps should be controlled and fixed if needed. Attention should be paid to faultfinding falling into subsequent categories:

-mechanical damages,

- loosening of electrical connections and fixing to the mounting board,
- legibility and integrity of the nameplates and labels.

8.2. Non-periodical survey

In case of malfunction make sure that the voltage supply of the unit is in range of 22 ÷ 28 V_{DC}. When the non-stabilized source of power is used make sure that the voltage supply value never drops below 22 V_{DC}.

If the cause of malfunction persists nevertheless voltage supply is correct, contact the manufacturer or his authorized representative. Repairs and interferences into the electronic system of the device by other persons are not permissible. Only the manufacturer or his representative are authorized to carry out repairs and examinations of the device.

9. Labeling and types of device

The device is labeled with type name: RED2 and it comes in only one version.

10. Packing, storage and transport

10.1. Packing

Individual packaging or bulk containers are equally recommended, provided they prevent damages of the device during the transport. Indoor space, air temperature above 15°C and relative humidity below 85% are required for packing of the device.

10.2. Storage

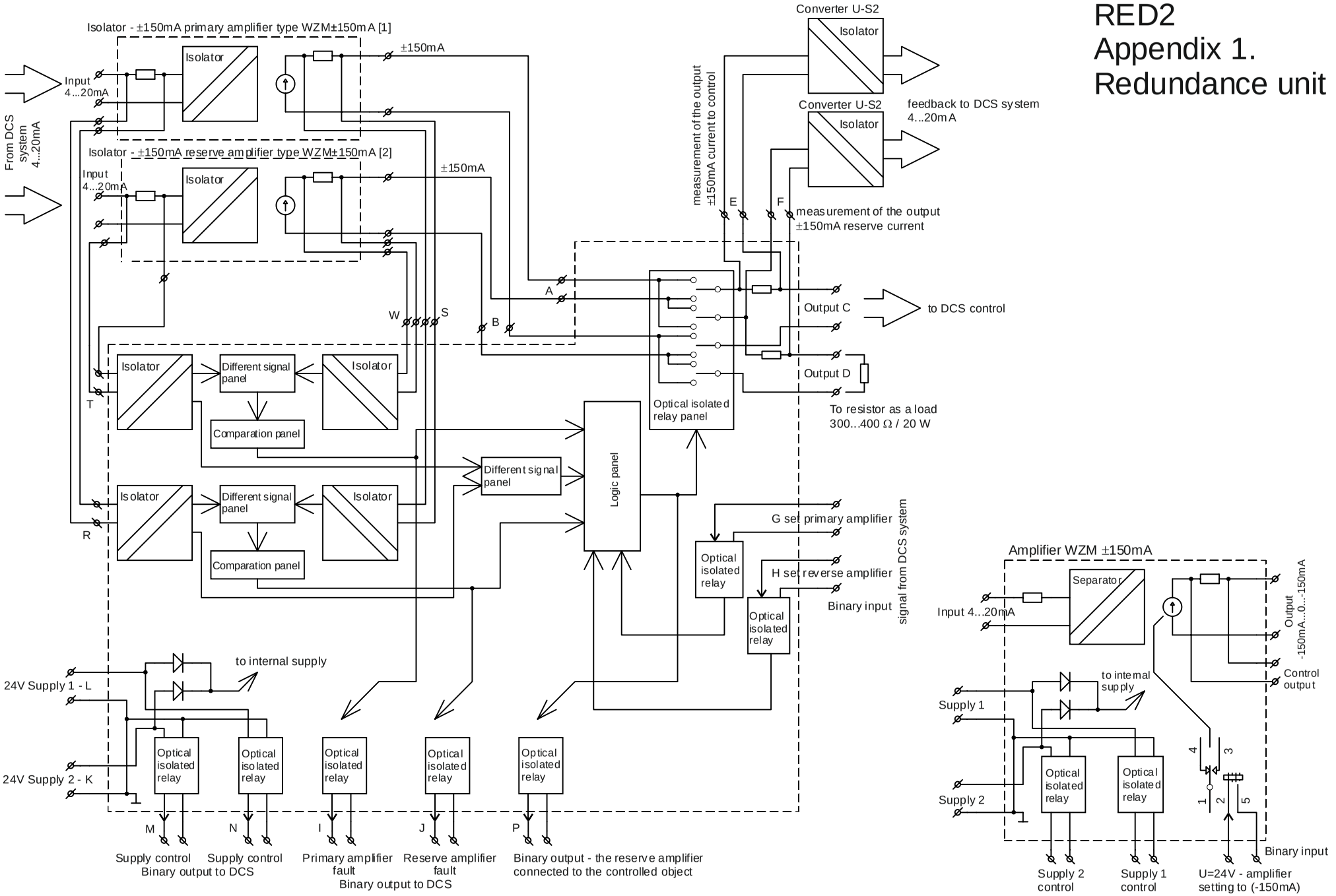
The devices should be stored in bulk containers. Indoor space, ambient atmosphere free of corrosive vapors and substances, with temperatures ranging from +5°C to +40°C are required for storage of the devices.

10.3. Transport

Individual packaging or bulk container are equally appropriate for transport. The packaging should prevent the translocation of the device during the transport. Air, see and surface transport are suitable, provided the direct influence of atmospheric factors on the device is eliminated.

THE END

RED2
Appendix 1.
Redundance unit



Appendix 2. RED2 REDUNDANCY UNIT
Scheme of connections in redundant system