User manual

Demonstrational device for JETA series power supplies parallel work

EVA-JETA2000

2015

Contents

1. Purpose and description of demonstrational device EVA-JETA2000

EVA-JETA2000/3-230WS28, demonstrational device for parallel work of JETA series power supplies (further referred to as the device) is intended for familiarization with functioning of three AC/DC power supplies (modules) JETA2000-230WS28-SCN with outputs connected in parallel. Device allows monitoring of following parameters of each module:

- Input voltage value, V
- Input current value, A
- Input power value, W
- Power factor, -
- Output voltage value, V
- Power supply case temperature, °C

and also general device parameters:

- Output current, A
- Output voltage ripple, mV

The device is provided with a switchable sound notification system that reacts to a radiator temperature getting close to a critical value.

The device is set with following protections: short-circuit, output over-current, output overvoltage and overheating.

The device has direct access to its modules and its output part to allow certain changes to connection of modules.

Modules JETA2000, used in the device, are installed onto common heatsink which allows producing output power of approximately 3600 W with no additional active air cooling at 30 °C ambient temperature.

2. Package contents

EVA-JETA2000/3-230WS28	1 pcs.
Power cord	3 pcs.
Shorting blocks for output diodes	3 pcs.
Complementary part of service connector	3 pcs.
Jumpers for external feedback	6 pcs.
Measuring probe for output ripple	1 pcs.
Trimmer resistor	1 pcs.
Warranty certificate	1 pcs.
User manual	1 pcs.

Tab. 1: package contents

3. Device description

Front panel:

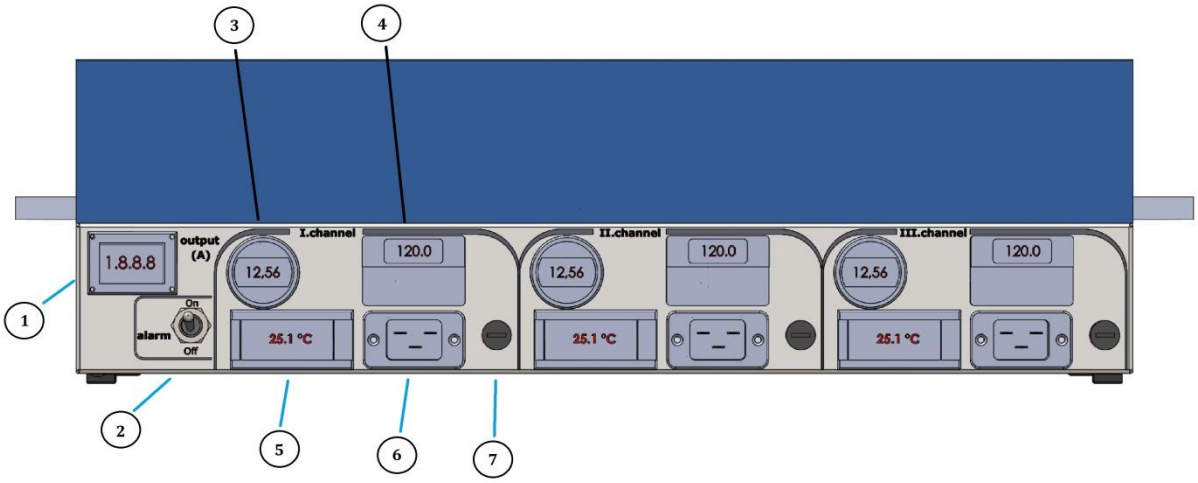

Fig. 1: front device panel

1 – Display of total output current;

2 – Switch to disable overheating sound notification;

3 – Display of output voltage (for each module channel);

4 – Display of input parameters (for each module channel): input voltage, input current, input power, power factor;

5 – Display of module's case temperature (for each module channel);

6 – Input AC connector (for each module channel);

7 – Input fuse 25 A 6,3 x 32 mm (for each module channel).

Back panel:

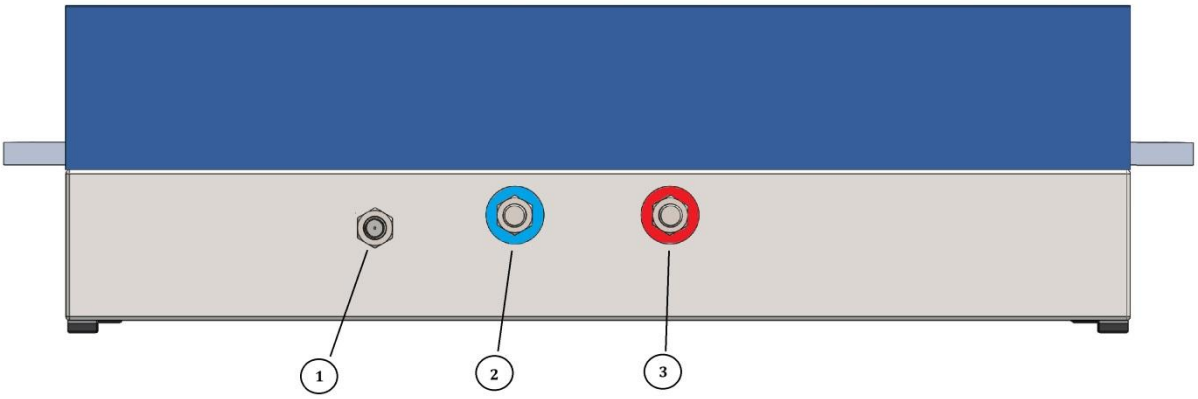

Fig. 2: back device panel

1 – BNC 50 Ohm connector for output voltage ripple measurement;

2 – Common negative output, M12x35;

3 – Common positive output, M12x35.

4. Standard JETA2000 modules connection in the device

The device is delivered with JETA2000 modules connected standardly as shown on fig. 3. Fuses FU1, FU2, FU3 are installed at inputs of JETA2000 modules; separating diodes VD1, VD2, VD3 are installed at outputs to isolate defective module from the rest of modules in case of its failure. Separating diodes type is Schottky diode with minimal forward voltage drop. Schottky maximal reverse voltage is 1,5 – 2 times higher than nominal output module voltage. Maximal forward diode current is at least twice as high as maximal output current of a single module.

External feedback is not used: +RS and –RS are shorted to +OUT and –OUT of each module respectively.

For parallel work of three modules with common load, pin PARAL is used. In such connection, output voltage of common device output would be lower than output voltages of each module because of voltage drops on separating diodes and output wire buses.

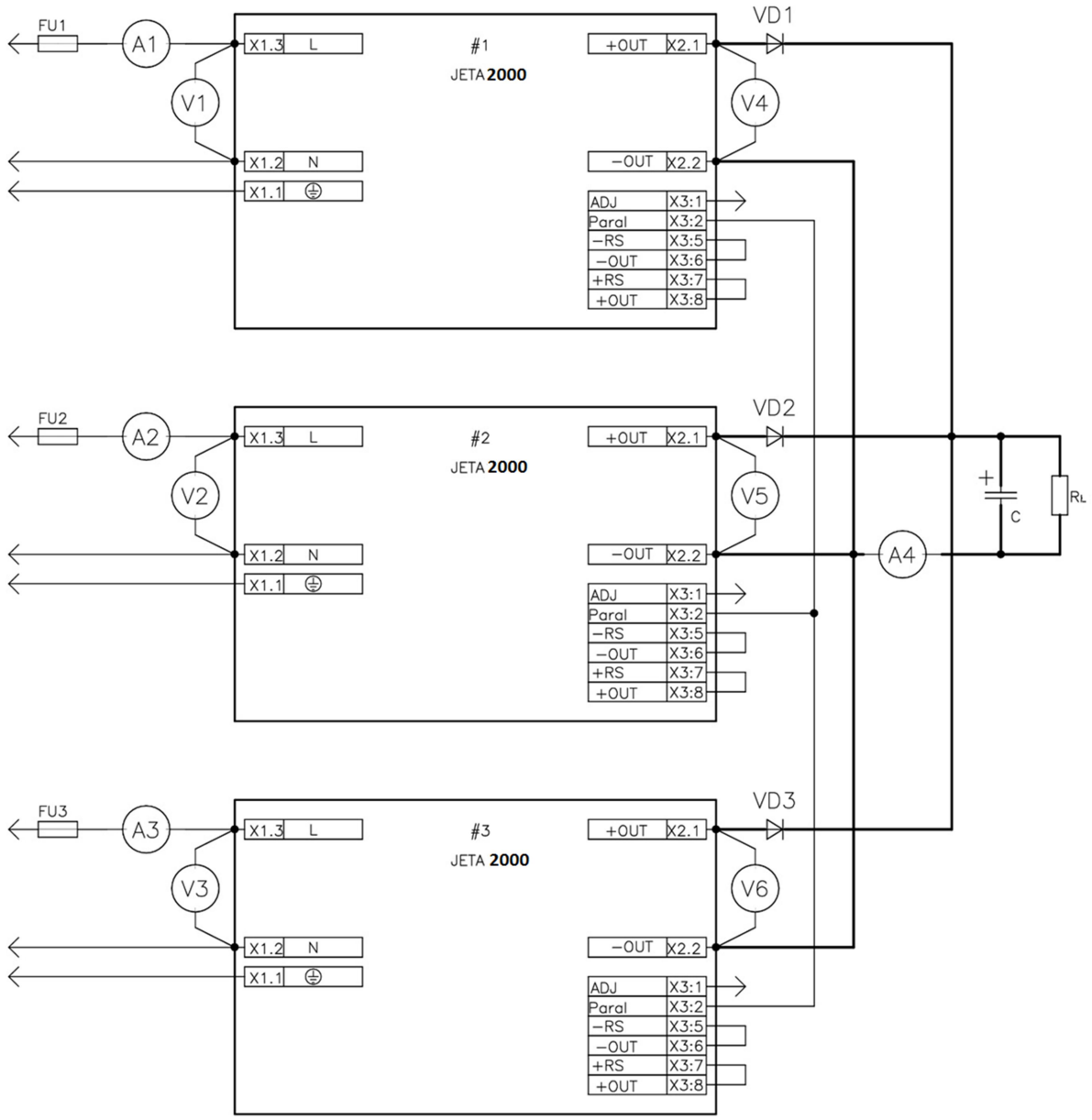

Fig. 3: standard connection of modules for parallel work with backup system N+M, where N – modules quantity required to supply the load R_L, M – modules quantity required to provide power backup.

5. General device characteristics

1. Input voltage range: <100; 242> VAC.
2. Input power frequency: <47; 440> Hz.
3. Output power: <3600; 6000> W @ U_{IN} = <100; 176> VAC;
   6000 W @ U_{IN} = <176; 242> VAC.
4. Nominal output voltage and nominal output current: defined by module type installed in the device.
5. Output voltage adjustment by connecting external trimmer resistor (included in package): <-30, +10> % of output nominal voltage value.
6. Instability of output voltage when changing input current from 10 to 100 % (omitting voltage drop at dividing diodes): ±2%.
7. Instability of output voltage when changing input device voltage: ±0,5 %.
8. Output peak-to-peak voltage ripple at 20 MHz: max. 2% of output voltage.
9. Output overcurrent protection: 1,1 – 1,25 of nominal max. output current followed by transition to current source mode.
10. Max. output capacity: unlimited.
11. Safe work in no-load mode (idle).
12. Operating ambient temperature: <-10°; +50°> C.
13. Weight: approx. 30 kg.

6. Caution

1. It's allowed to connect 1, 2 or 3 modules, however it's always necessary to connect the first module for all device functions to be active.
2. It's strictly restricted to commutate output connections during operation.
3. It's strictly restricted to connect and use the device where at least one of the modules has pins +RS and –RS unconnected.
4. It's restricted to commutate modules, in order to prevent contact burn, by disconnecting power cord from power input connectors of the device.
5. While testing, when disconnecting any module from input power, it's allowed to reconnect the module after at least 15 seconds.

6. Power delivered to resistive device load shouldn't be more than 50% of load maximal power. During tests it's necessary to provide adequate load air cooling to prevent load overheating.

7. First start

1. Connect power cord of each device modules to input power or laboratory autotransformer.
2. To switch between controllable parameters on input measuring display (4 - fig. 1) use button "SEL".
3. It must be made sure, monitoring output voltage displays (3 – fig. 1), that output module voltages are equal, specifically voltage differences are not higher than 1% of nominal output voltage.
4. To measure output voltage ripple it's necessary to connect an oscilloscope cable, that is a part of the package, to BNC connector (1 – fig. 2).
5. For modules' pins functions refer to the original datasheet of module JETA2000.
6. The device is provided with a preventive sound notification system in case of module over-heating. The system reacts to temperature of any modules' case exceeding 80 - 85 °C. If needed, turn the switch (2 - fig. 1) on the front panel to "OFF" position to disable sound notification. In case of overheating - provide additional heatsink cooling, for example, by using ventilator's air flow.

8. Check of output power distribution among modules

1. At input voltage U_{IN} = 110 VAC and total output power of 30% - 70% - 100% of 3600 W, perform measurements and record input currents of modules.
2. At input voltage U_{IN} = 230 VAC and total output power of 30% - 70% - 100% of 6000 W, perform measurements and record input currents of modules.
3. Calculate power distribution [%] at U_{IN} = 110 VAC and U = 230 VAC using equation:

$$P_{dis,\%} = (I_{in.max} - I_{in.min}) / I_{in.max} \cdot 100,$$

where Iin,max is maximal, and Iin,min is minimal values of input current of a particular module.

- Power distributions with different total output loads should not exceed values in table 2.

U_{IN}, VAC	Power distribution		
	at ΣP_{OUT} 30%	at ΣP_{OUT} 70%	at ΣP_{OUT} 100%
U_{IN} = 230 VAC	14 %	9 %	8 %
U_{IN} = 110 VAC	16 %	10 %	9 %

Tab. 2: power distribution at different load

9. Common device output voltage adjustment using ADJ output pin.

- To test output voltage adjustment function, connection must be made according to fig. 4 with using trimmer resistor Radj (part of the package).

- At input voltage U_{IN} = 230 VAC and P_{OUT} = 4200 W, by regulating output trimmer resistor R_{ADJ}, confirm that output voltage adjustment range matches -30% - +10% of $U_{OUT,NOM}$ (nominal output voltage). When regulating output voltage, load resistance must be constant.

- Simultaneously, power distribution should be monitored and its values shouldn't exceed those in table 3.

U_{IN}, VAC	Power distribution	
	at 70% $U_{IN.NOM}$	at 110% $U_{IN.NOM}$
230	9 %	8 %

Tab. 3: power distribution at different input voltage

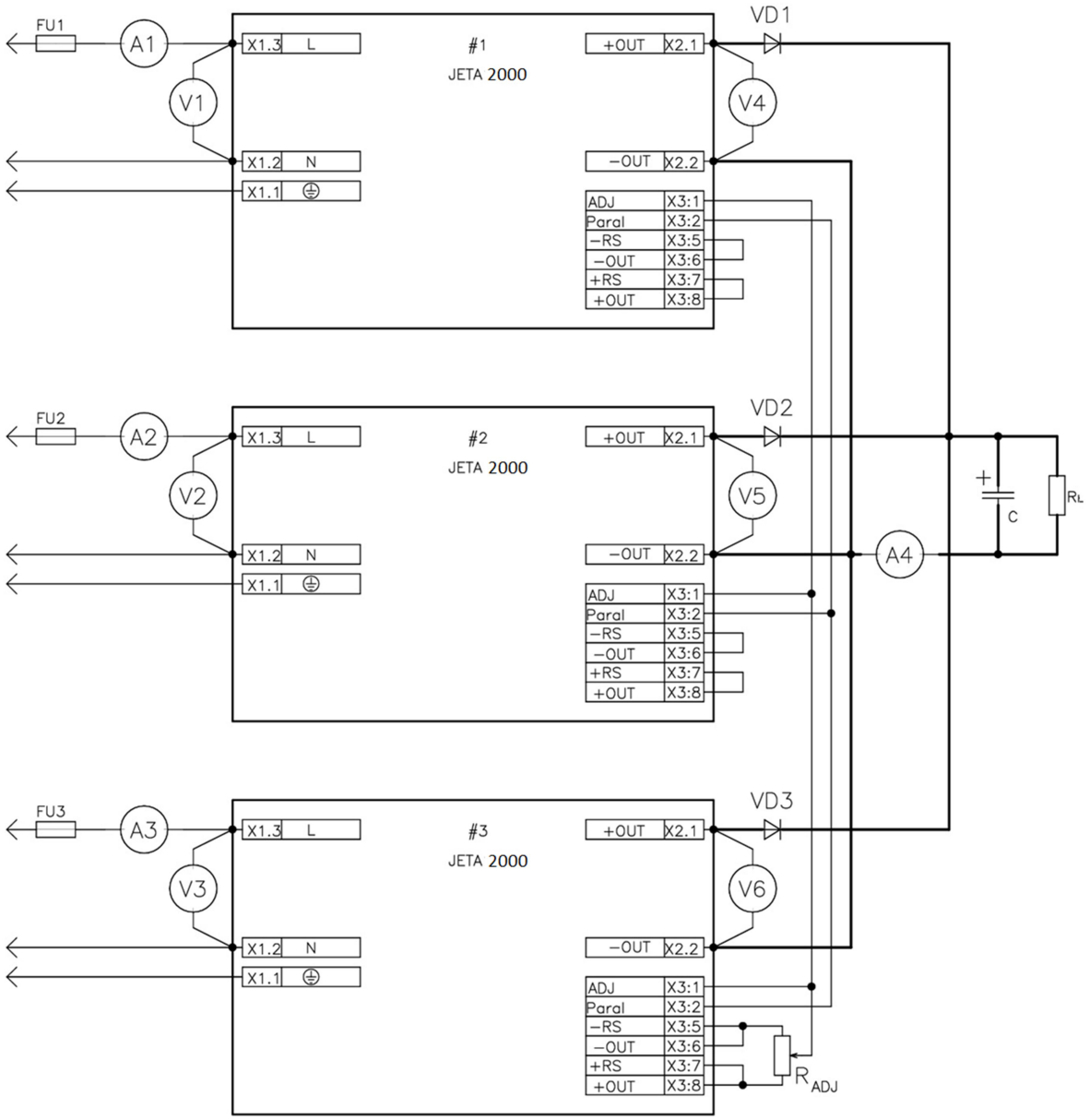

Fig. 4: modules connection scheme for adjusting device output voltage using the pin ADJ

10. Module connection for parallel work with one master module and application of external feedback connection.

- When using backup system in "master-slave" mode (fig. 5), external feedback output pins "+RS" and "-RS" (following correct polarities), of "master" module, are connected directly to the load. The rest of the modules ("slaves") must have their "+RS" and "-RS" connected to their own "+OUT" and "-OUT" outputs respectively.

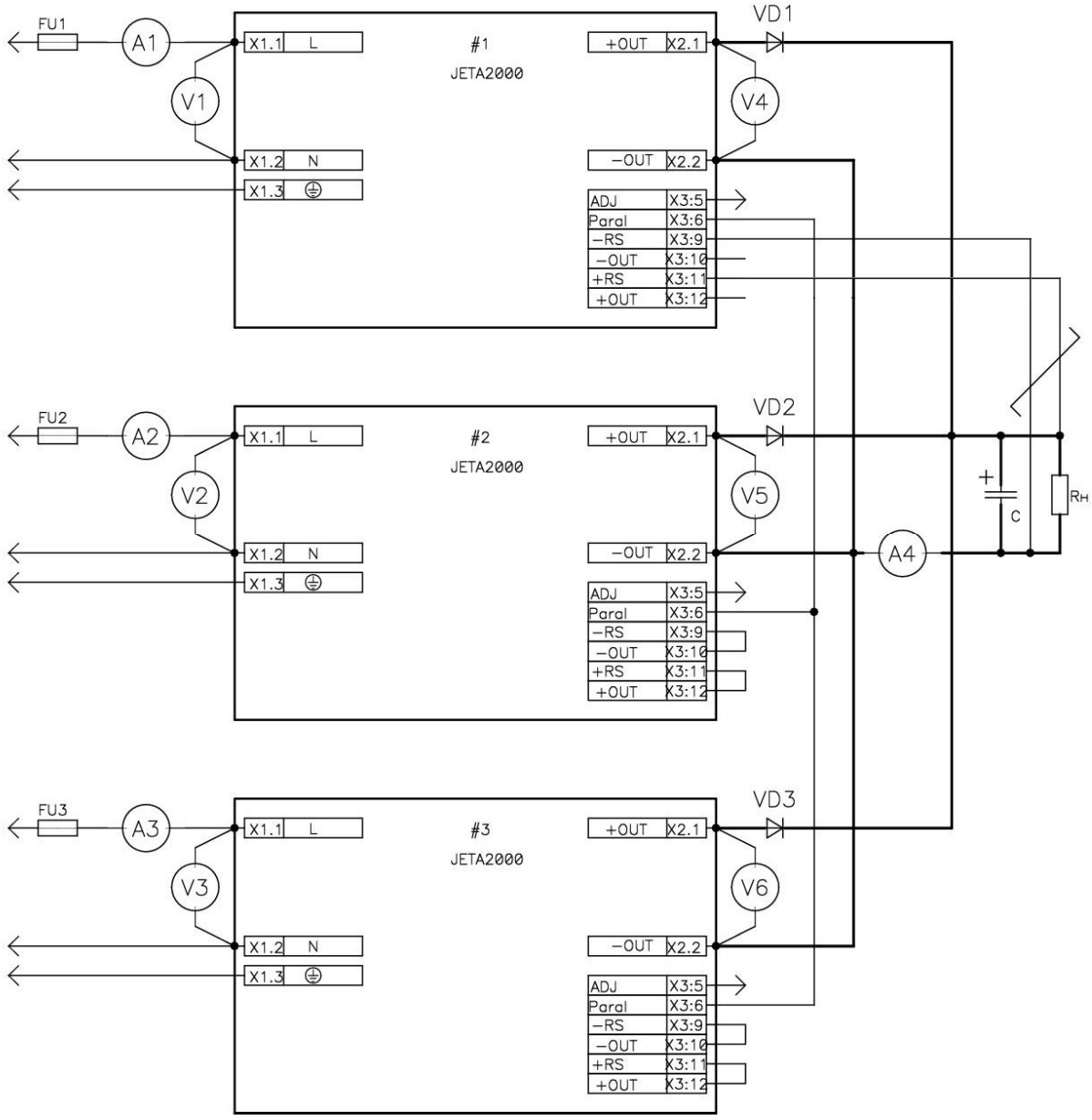

Fig. 5: connection scheme for parallel work in "master-slave" mode.

- In such connection output device voltage would rise to equal to nominal output module voltage. External feedback connection compensates for voltage drops at diodes and wire buses. Output device voltage isn't dependent on output current.
- Output modules voltages would rise by the value of voltage drop at diodes and wire buses and it would depend on output current.
- Power distribution at different total load is shown in table 2 and should not exceed presented values.

11. Output power increase, parallel work without dividing diodes

- In case when only output power increase is needed, without backup system, there is a possibility to use connection scheme shown in figure 6.
- For this mode, dividing diodes must be shorted by copper shorting blocks (included in package).
- Power distribution at different total load is shown in table 2 and should not exceed presented values.
- When using connection scheme from figure 6 it's important to check thoroughly all function modes, which must be provided in equipment, for stable work. In terms of stable work - connection scheme with dividing diodes is more appropriate.

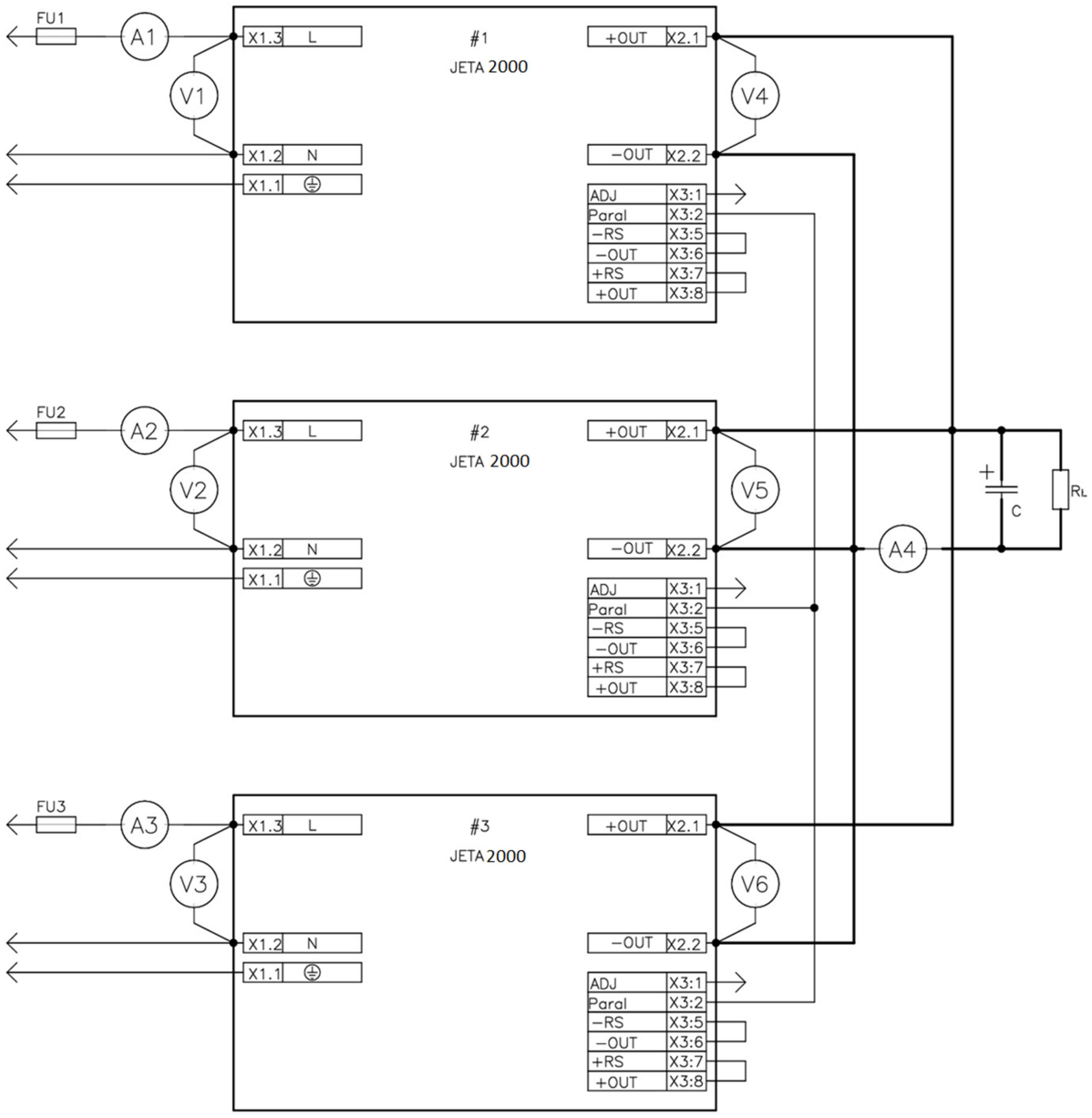

Fig. 6: increasing output power with parallel work

12. Monitoring transients at common device output when connecting input power to modules' inputs.

- Monitoring transients at common device output may be done with connection scheme shown on fig. 3 - 6.

- Connect oscilloscope (in waiting mode) to common output of modules connected in parallel.
- At total output power of 30%, 100% of 3600 W at input voltage U_{IN} = 110 VAC and at total output power of 30%, 100% of 6000 W with input voltage U_{IN} = 230 VAC, record deviation of output common voltage.
- Voltage deviation during transient must not be more than +5% of $U_{OUT.NOM}$.
- During transient there should be no voltage drops or module restarts visible on oscilogram.
- Transients time should not exceed 800 ms.

13. Conclusion

Other backup systems connections are possible. Such connections would be specified by powering equipment and primary power sources. In such cases it's necessary to consult module producer.