ROHDE&SCHWARZ

Sound and TV Broadcasting
Division

Manual

POWER SUPPLY

IN 503 A1

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1 Characteristics

1.1 Uses

The Power Supply IN503A1 is used to supply transistorized RF amplifiers with the required operating voltages. It contains three identical primary-switched regulators for the collector current and two DC/DC converters for the base current.

1.2 Design and Circuit Description

1.2.1 Design

Power Supply IN503A1 is accommodated in a closed cabinet of protection class IP 0 and may be installed in transmitter racks. Electrical connections are established automatically by self-engaging connectors when the power supply is inserted in the rack. Connectors are not rigidly fixed and thus compensate for tolerances of the mating connectors.

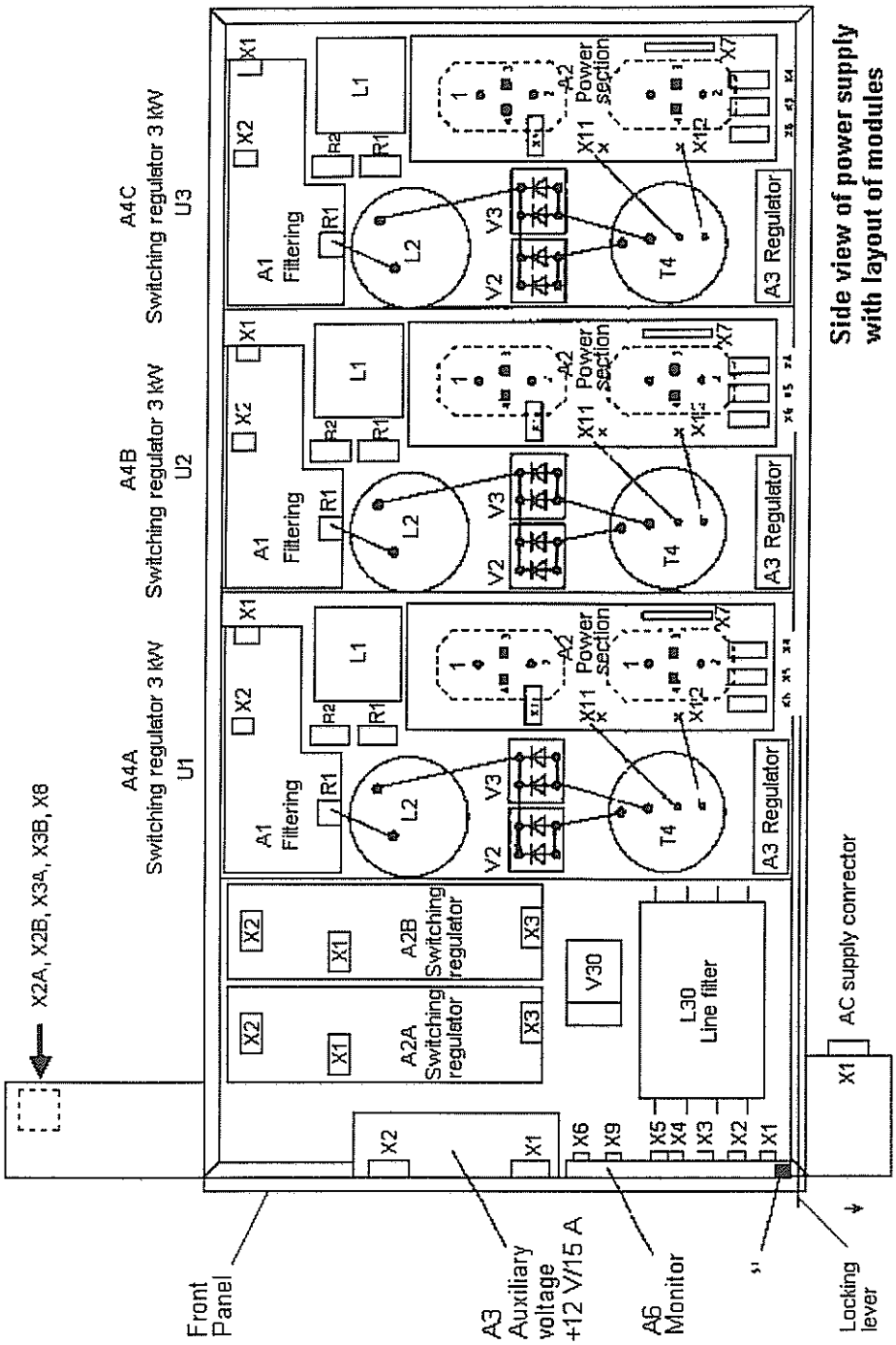
The power supply consists of several modules which can be easily replaced for maintenance and service. The operating mode and any fault messages are indicated by means of front-panel LEDs.

The side view (without cover) on the next page shows the position of the modules.

1.2.2 Description

Power Supply IN503A1 consists of the following main modules:

- Three identically designed, primary-switched regulators with a 30-V output (U1, U2 and U3) at 100 A provide the collector current for the RF transistors.
- Two switching regulators with a 3-V output (U4 and U5) at 15 A provide the base current for the RF transistors.
- Auxiliary power supply for +12 V (U6) and +5 V for the control of switching transistors and regulator modules in the primary-switched regulators as well as for the monitor. This power supply is permanently connected to two phases of the AC supply.
- Monitor for switch-on control and fault analysis.
- Three-phase bridge rectifier for generation of a DC circuit voltage for the two primary-switched regulators. It is permanently connected to the AC supply.
- Line filter for suppression of the switching frequency.


A4A
Switching regulator 3 kW
U1
A4B
Switching regulator 3 kW
U2
A4C
Switching regulator 3 kW
U3
A1
Filtering
A2
Power section
A3 Regulator
A2A
Switching regulator
A2B
Switching regulator
V30
L30
Line filter
X2A, X2B, X3A, X3B, X8
AC supply connector
Front Panel
A3
Auxiliary voltage +12 V/15 A
A6
Monitor
Locking lever
Side view of power supply with layout of modules

1.3 Typical Operating Parameters

Voltages U1, U2, U3
Output voltage at 100-A nominal current ..... 30.2 V ±0.1 V

Ripple
- 300 Hz ..... ≤0.1 V_{pp}
- 100 kHz ..... ≤0.8 V_{pp}

Regulation for ±10% of V_{AC} ..... ≤0.1 V

Load regulation
- DC, 0.1 to 1.0 x I_{nom} ..... ≤0.20 V
- 100-Hz squarewave, 50/100 A ..... ≤0.6 V
- Regulation time ..... ≤3 ms

Current limitation onset at ..... 110 A ±0.5 A
- switch-off after ..... approx. 3.5 s for undervoltage

Short-circuit current ..... 120 to 180 A

Overvoltage limitation to ..... 34.5 to 35.5 V
- output voltage switched on and off;
- permanent switch-off after ..... approx. 5 s

Output U1 ..... round female connector:
+ at X2A.1/.2
- at high-current connector X3A

Output U2 ..... round female connector:
+ at A2B.1/.2
- at high-current connector X3B

Output U3 ..... round female connector:
+ at X2A.3 and X2B.3
- at high-current connector X3A and X3B

Negative pole of U1, U2 and U3 taken to chassis (GND)

Voltage U4
Output voltage at 15-A nominal current ..... 3 to 5.5 V, settable

Ripple
- 300 Hz ..... ≤0.01 V_{pp}
- 100 kHz ..... ≤0.1 V_{pp}

Regulation for ±10% of V_{AC} ..... ≤0.1 V

Load regulation
- 0.1 to 1.0 x I_{nom}, DC ..... ≤0.05 V
- 0.1 to 1.0 x I_{nom}, AC ..... ≤-0.6 V_p
- 1.0 to 0.1 x I_{nom}, AC ..... ≤+0.8 V_p
- Regulation time ..... ≤1 ms

Current limitation onset at ..... 17 A ±10%
short-circuit current ..... 18 A

Output U4 ..... round female connector
+ at X2A.8
- at X3A

Voltage U5 ..... same as voltage U4

Output U5 ..... round female connector
+ at X2B.8
- at X3B

Power input
Three-phase input voltage, measured
between 2 phases, without N ..... 342 to 457 V
Current drain ..... 18.6 to 14.2 A
AC supply frequency ..... 47 to 63 Hz
Power factor ..... >0.93

Switch-on is disabled when the AC supply
voltage is outside the monitoring window
326 V (rising value) to 466 V (falling value)

Primary fusing
Motor-protection switch ..... 16 to 25 A
Magnetic cutout ..... approx. 300 A
Thermal cutout ..... set to 20 A

Ambient conditions, dimensions, weight
Temperature range
Compliance with specifications ..... 0 to +45°C
Operation ..... -20 to +50°C
Storage ..... -20 to +70°C
Humidity ..... 20 to 90% rel. humidity
Dimensions
Height with connector panels ..... 660 mm
Height without connector panels ..... 440 mm
Width ..... 178 mm
Depth ..... 830 mm
Weight ..... 36 kg

Cooling
Low-pressure cooling ..... approx. 2.2 mm^3/min, from bottom
Power dissipation ..... approx. 1300 W
Switch-off of switching regulators at ..... +80°C ±3°C
(temperature of heat sink)

Important

The AC-supply and output-power connectors are self-engaging. Connections are established when the power supply is inserted into the rack. Before insertion or removal, the switching regulators must be disabled by means of a locking lever to interrupt the current path. For tests outside the equipment special adapter cables have to be used. To avoid hazards from arcing, connectors should be plugged or unplugged only after the AC supply voltage on the feeder cable has been switched off. Connectors of the adapter cable have to be secured against inadvertent disconnection.

Contact assignment

Control lines are taken to a 25-contact sub-D connector.

Commands:

X8 7 Switch-on command with external 5 to 12 V, 1 mA;
input floating via optocoupler. Negative pole at X8.6.
Switches U1, U2, U3, U4, U5 and U6.

For all other signals the reference potential is 0 V and taken to ground.

1,3 0 V for logic signals

9 Reset command with high for clearing the battery-backed fault memory.
High ≥0.7 V into 10 kΩ, low ≤0.7 V with open input.

8 Lamp test with high
High ≥0.7 V into 4.75 kΩ, low ≤0.7 V with open input.
Causes all front-panel LEDs to light up.

2 Synchronization of the five switching regulators with a clock signal of 200 to 250 kHz, 6 V. Pulses of 0.5 µs width. Input current at 6 V: 2.5 mA.

Fault signalling:

X8.10 Failure of power supply or AC supply voltage missing signalled by closed contact with de-energized relay, simultaneously by front-panel LED H10.

X8.11 For details refer to section 4.1, Fault Analysis.

Auxiliary-voltage outputs:

X8.24 +12 V (switched) for on command, max. 100 mA

X8.25 +5 V (permanent), max. 100 mA

I^2C bus:

X8.13 +5 V, external voltage for I^2C-bus IC

X8.14 +5 V, external voltage for I^2C-bus IC

X8.15 SD1

X8.16 SLC

X8.17 ADDR0

X8.18 ADDR1

X8.19 ADDR2

X8.20 I^2C INT (with Low)

X8.12 GND

X8.22 GND

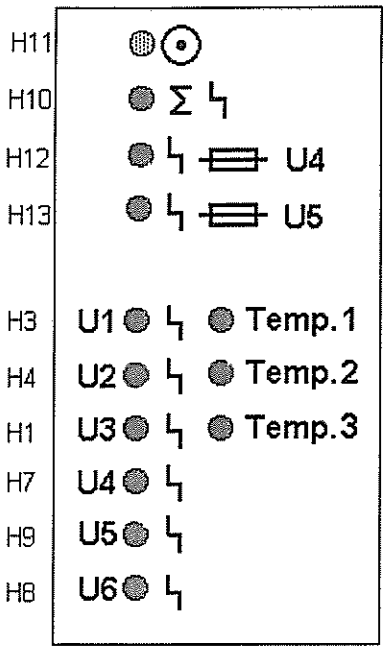
2 Preparation for Use and Operating Instructions

After inserting the power supply into the correct location in the rack (to do so press down locking lever), the unit is ready for operation.

During normal operation no manual control is required.

With the locking lever latched, the switch-on command applied and the unit correctly operating, the green front-panel LED "On" lights, all other LEDs remain off. Possible malfunctions are signalled by red LEDs.

2.1 Legend for Front Panel Elements



Description:

H11	Lights when the on-command has been applied.
H10	"Sum fault" lights after one or several faults have occurred (irrespective of whether they have been stored or not) or if no on command is present (can be disabled by means of links).
H12	Lights when the fuse on the 5-V/15-A switching regulator A2A for U4 responds.
H13	Lights when the fuse on the 5-V/15-A switching regulator A2B for U5 responds
H12 and H13	light, when the fuse for the +12-V auxiliary voltage on A3 responds. Each fuse has a red LED on the respective module.
H3	Single fault "U1 too low" stored.
H4	Single fault "U2 too low" stored.
H1	Single fault "U3 too low" stored.
H7	Single fault "U4 too low" stored.
H9	Single fault "U5 too low" stored.
H8	Single fault "internal auxiliary voltage U6 too low or too high" stored.
H5	Single fault "temperature 1 too high" stored.
H6	Single fault "temperature 2 too high" stored.
H2	Single fault "temperature 3 too high" stored.

3 Circuit Description

See circuit diagram 2062.1003.01S

DC circuit

For suppressing the switching frequency and its harmonics, the three-phase supply voltage is applied to the three-phase bridge rectifier V30. The latter generates the DC circuit voltage (UZW) of 462 to 594 V which is taken to the 3-kW switching regulators for generation of operating voltages U1, U2 and U3.

3-kW switching regulators

Switching regulators A4A, A4B and A4C are independent functional units requiring the DC circuit voltage UZW, a +12-V auxiliary voltage and the switch-on command for operation. Each switching regulator comprises a filter circuit (A1), a power section (A2) and a regulator (A3).

The switching regulators function as primary-switched forward converters with pulse-width regulation and a fixed switching frequency of 100 kHz. The DC circuit voltage UZW applied at the input is smoothed with an LC network and converted into a squarewave voltage by mean of a MOSFET half-bridge circuit. A pulse transformer isolates the 30-V output voltage from the AC supply and generates a low voltage. On its secondary side rectification is effected with a storage choke and a smoothing capacitor. The switching regulator operates on the single-ended forward-converter principle. The output voltages of the switching regulators are applied to connectors X2A and X2B.

5-V switching regulator, 15 A

Switching regulators A2A and A2B are fitted to a heat sink which also carries rectifier V30 and the line filter. The input voltage of 20 to 35 V required for operation is provided by the 3-kW switching regulators via a diode coupling circuit. The regulator functions according to the principle of an isolated forward converter with pulse-width regulation at a fixed switching frequency of 100 kHz. The output voltage can be set between 3 and 5 V and is taken to connectors X2A and X2B.

Synchronization

For the suppression of switching frequency in the transistor amplifiers powered from the power supply, all switching regulators can be synchronized by means of an external signal. In TV transmitters, synchronization to the line frequency is feasible. The frequency of the sync clock (200 to 250 kHz) has to be more than twice the free-running clock frequency.

+12-V auxiliary voltage, 1.5 A

The auxiliary power supply A3 is fixed to the front panel and provides the +12-V voltage for regulator ICs and MOSFET drivers of the 30-V switching regulators as well as the 5 V required by the monitor.

The two voltages are generated by means of transformer, rectifier with capacitive smoothing and series-voltage regulators. The +2-V voltage can be set and switched, the 5-V voltage is fixed and permanently applied. The monitor distributes the +12 V to the 33-V regulators.

Monitor

Monitor A6 controls switch-on of the +12-V auxiliary voltage and of the 3-kW switching regulators depending on the switch-on command, switch-on blocking and the state of the switching regulators. It also signals the state of the power supply by means of front-panel LEDs and sends off corresponding messages via the control connector at the rear.

4 Maintenance, Repair, Adjustments

Regular maintenance is not required. However, the lithium battery on monitor board A6 should be replaced about every 5 years. It is soldered to module A6 and accessible after removal of the monitor.

The power supply is designed such that the modules can be easily removed and replaced. A defective module can be tested and repaired either inside the power supply or externally after its removal.

4.1 Fault Analysis

Caution!:

AC supply voltage!
Please observe the relevant safety instructions when working on the power supply.

Troubleshooting is facilitated by many LEDs on the front panel and on the different modules inside the power supply. The following table informs on possible faults and how they can be eliminated.

Indication	Possible cause of fault	Remedy
All LEDs off although external command lamp test is given	No AC supply voltage	Check primary fusing
H11 off	No switch-on command	Apply switch-on command; check that the locking lever is latched so that S1 on A6 is held down.
H10 on and single fault	Fault according to fault indication	After eliminating the fault give switch-on command and apply 5 V (reset) to X8.9 against .1/3.
H12 on	Fuse F1 on A2A, 5-V switching regulator, has blown if H1 is red. Overvoltage thyristor has responded. Fault of switching transistor, free-running diode or smoothing capacitor.	Exchange defective module or eliminate fault. Then replace fuse. Use original fuse type only.
H13 on	Fuse F1 on A2B, 5-V switching regulator, has blown if H1 is red. Overvoltage thyristor has responded. Fault of switching transistor, free-running diode or smoothing capacitor.	Exchange defective module or eliminate fault. Then replace fuse. Use original fuse type only.
H12 and H13 on	Fuse F1 on A3, +12-V auxiliary voltage, has blown if H1 is red. Fault in transformer, rectifier or smoothing capacitor.	Exchange defective module or eliminate fault. Then replace fuse. Use original fuse type only.
H3 on	Voltage U1 on 3-kW switching regulator missing, too low or too high. Inside the power supply, watch LEDs on regulator A3 of switching regulator A4A.	In the case of overvoltage (U1 switched) check regulator circuit, eg for open loop or whether U1 is set to >30 V.
	H4 for DC-circuit voltage (UZW) fault on, H1 for U fault on: no DC circuit voltage or voltage outside permissible range.	Check AC supply voltage. Check power rectifier and corresponding cables and connectors.
	H3 on, H1 for U fault on:	

	no switch-on command for A4A due to overvoltage cutout on monitor A6.	Check control loop for U1; check cable W2; set U1 to 30 V using R5 within 3.5 s after reset.
	H5 for I_{short} on, H1 for U fault on: overvoltage cutout.	Eliminate short circuit; then switch power supply off and on again.
	H6 for I_{short} on, 6 to 10 s later H5 for I_{short} lights.	Same as above or set overvoltage threshold to 76 A using R71. I_{lim} must be set to >76 A. After switching off and on, set I_{lim} to 75 A.
	H1 lights for U fault only: U1 too low or too high due to response of current limiter	Remove overload
	Fault in 3-kW switching regulator: switching transistor, clamp diode, rectifier (secondary).	Check voltages and currents with differential amplifier and oscilloscope according to corresponding switching regulator description. If repair is not possible, replace switching regulator.
H4 on	Module A4B. See above description for switching regulator U1.	
H1 on	Module A4C. See above description for switching regulator U1.	
H5 on	Insufficient cooling or temperature sensor interrupted	Provide cooling; plug sensor to power section A2A at X3.
H6 on	Insufficient cooling or temperature sensor interrupted	Provide cooling; plug sensor to power section A2B at X3.
H2 on	Insufficient cooling or temperature sensor interrupted	Provide cooling; plug sensor to power section A2C at X3.
H7 on	Fault on A2A, 5-V/15-A switching regulator, eg switching transistor, free-running diode or pulse-width regulation	Troubleshooting according to corresponding description. If repair is not possible, replace module.
H9 on	Same as with fault U4, but module A2B.	
H8	Fault on A3, +12-V auxiliary voltage or A3 without switch-on command.	LED H2 on A3 must light up when voltage U6 is present. At test point P2 +12 V ±0.3 V should be present against P0, set with R6. Troubleshooting according to description; if repair is not possible, replace module.
H10 on, but no indication of single fault	5-V operating voltage for monitor A6 too low.	+12-V auxiliary voltage on A3, a voltage of +4.8 to 5.2 V has to be present at test point P1 against P0 (fixed voltage).
	DC circuit voltage UZW not within permissible range.	Check AC supply voltage; observe LED H4 for DC circuit voltage fault on 3-kW switching regulator (module A4A, A4B or A4C)
	Line or connector interrupted.	Check lines from rectifier V30 to switching regulator A1 (filter circuit) and from A1 to A2 (power section).

4.2 Checking and Restoring Rated Specifications

Caution!

AC Supply voltage!
During testing, AC supply voltage is accessible and may cause fatal accidents on contacting the unit.
Tests may be carried out by skilled personnel only, who are fully aware of hazards involved with AC supply voltages.
Please refer to the relevant local safety and accident-prevention regulations..

4.2.1 Test Equipment

Test equipment marked with an asterisk (•) is not required for a simple function test.

- If all fault messages are to be tested, it is recommended to make up an appropriate test adapter.

For a simple function test it will be sufficient to connect a dummy plug with the following links and connectors to X8:

Line X8.9 (reset = 5 V) switchable to X8.25 (5-V output).
Line X8.8 (LED test = 5 V) switchable to X8.25 (5-V output).
Line X8.7 (power section on = 5 to 12 V) switchable to X8.25 (5-V output).
Line X8.6 (0 V for on command) with X8.1 (AGND).

- Three-phase variable transformer settable on the secondary side 3 x 0 to 265 V (star point connection; not loaded), 10 A max. current drain.

  For troubleshooting on 3-kW/50-A switching regulators, if power semiconductors are faulty and for testing the DC circuit voltage and the AC supply voltage regulation.

- Settable load 30 V, 10 to 65 A, in case of short circuit approx. 160 A. Voltage measurement with digital voltmeter, 4-digit display, directly connected to the IN503A1 output and current measurement. For setting the current limitation and overcurrent cutout of 3-kW/50-A switching regulators. If the regulation behaviour is to be tested on pulse loading, a load variation between 50/100% is required for a 100-kHz squarewave.
- Settable load 3 V, 2 to 18 A, in case of short circuit approx. 20 A. Voltage measurement with digital voltmeter, 4-digit display, directly connected to the IN503A1 output and current measurement. For setting the current limitation of the 5-V/15-A switching regulator.

Adapter cable for 3-phase AC supply with PE (10 A).
- Adapter cable for loads according to currents.
- Fan for approx. 2.2 m^3/min if test lasts longer than 20 minutes.

750-V AC/DC Voltmeter

- Oscilloscope, 2 channels, for display of switching pulses and synchronization measurement (eg BOL from Rohde & Schwarz).
- Differential amplifier, 750 V_{rms} isolation, eg Pewatron SI-9000, if for measurements have to be carried out with an oscilloscope on the DC circuit or on associated components such as a switching transistors connected to the DC circuit. This can be dispensed with, if the variable transformer (see above) is isolated from the AC supply.
- Pulse generator, 250 kHz, 6 V, pulse width 0.5 µs (eg AFG from Rohde & Schwarz) for synchronization measurement.

4.2.2 Preparation

Caution!

The DC circuit is a balanced-to-earth configuration if no AC isolating transformer is connected ahead. It must therefore not be taken to ground, eg to the ground input of an oscilloscope..

Tasks marked with an asterisk (*) are not required for a simple function test.

Place IN503A1 so that it is properly cooled. Unscrew cover to allow visual checks and adjustments inside the unit.

Check of the coding links as described in the Annex.

Make sure that the power supply is correctly wired and 100-A lines are screwed down tightly (visual check).

High-current outputs (connectors X2A, X2B, X3A and X3B) may only be connected or disconnected with the IN503A1 switched off. Otherwise, there is a risk of burning from DC arcing and contacts could weld together.

* Connect three-phase connector of IN503A1 (X1) to variable transformer 3 x 0 to 265 V (against N, but N is not used in IN503A1) by means of an adapter cable. Connect loads.

For a simple function test, direct connection to the AC supply is possible without a variable transformer being required.

Caution!
Failure of one phase may cause the filter circuit after the power rectifier to be overloaded.

Connect adapter for control lines or dummy plug to connector X8 on IN503A1.

4.2.3 Final Testing

A precondition for the final tests are functionable and tested modules.

4.2.3.1 Switching On

Connect 750-V DC voltmeter to the DC circuit on 3-kW switching regulator A1, filter circuit A1; positive to R3, negative to R2.

Make the following connections on connector X8:
No lamp test, ie X8.8 open.
Off, ie X8. 7 open.

* Switch on variable transformer and slowly vary from 0 V to 230 V.

The DC circuit voltage should be approx. 550 V with given polarity.

Test the DC circuit voltage in the same way on switching regulator A5, filter circuit A1.

Caution! If the test lasts longer than15 minutes, IN503A1 will require cooling.

Apply switch-on command (+5 V at X8. 7 against X8.6); IN503A1 is switched on; check output voltages on filter circuit board, positive at X5, negative at copper rail (X6):.

U1 30.2 ±0.05 V,
U2 30.2 ±0.05 V,
U3 30.2 ±0.05 V,

If corrections are required, proceed as described in section 4.2.3.2.

Messages:
At the front panel of IN503A1 the green LED "ON" lights up. If a fault is indicated, apply reset (= +5 V at X8.9 against X8.1). If the fault indication stays on, check for fault.

LEDs inside IN503A1:

A3, +12-V auxiliary voltage	green LED H2 "+12 V U6" lights green LED H3 "+5 V" lights
A2A, A2B, 5-V switching regulator, 15 A	green LED H2 "+3 V U4 or U5" (below A3) lights

* The following messages are received at X8:
  No sum fault — X8.10 not connected to X8.11 (relay energized)

* Lamp test:
  Switch on lamp test (LT) (+5 V connected to X8.8 against X8.1).
  All front-panel LEDs should be on.
  Switch off lamp test.

Switch-off:
Cancel switch-on command.
All front-panel LEDs are off. The same applies to the green LEDs on A3, +12-V auxiliary voltage, and A2A, A2B, 5-V switching regulator. Voltages U1, U2, U3, U4, U5 and U6 are switched off.

* Sum-fault message (X8.10 connected to X8.11, relay not energized).

Apply switch-on command, IN503A1 switches on again.

On front panel, press down locking lever (S1 on A6 open). IN503A1 switches off. Let lever go. IN503A1 switches on again.

4.2.3.2 Regulation at Supply-Voltage and Load Variation, Current Limiting

* U1 at output X2A.1/.2 is loaded with 100 A.

If necessary, adjust U1 = 30.2 V at A4A.A3 with R5.

* Load U1 alternately with 50 A and 100 A. voltage variation ≤0.1 V

* Current limiting has to be tested according to the description of the 3-kW switching regulator after a replacement of the regulator module or the power section.

* Load U4 at output X2A.8 with 7.5 A.

If required, adjust 3.0 V on A2A with R7. Proceed in the same way for U5 on A2B, connect load to X2B.8.

* Vary supply voltage between 198 and 265 V (if possible), U1 should not change by more than 0.1 V.

* Reduce supply voltage to between 160 and 147 V, the output voltages should be switched off (switching frequency disabled). If the AC supply voltage reaches 177 to 190 V, the switching frequency switches on again. The high hysteresis of 30 V is necessary as, for a load variation at the resonant frequency of the DC circuit filter, an AC voltage of approx. 70 V_{pp} is superimposed to the DC circuit voltage.

* Switch off IN503A1, connect settable load to X2B.1/.2. Switch on IN503A1 again.

* Load U2 at output A2B.1/.2 with 100 A.

If required, adjust 30.2 V on A4B.A3 using R5.

* Alternately load U2 with 50 A and 100 A. Voltage change ≤0.1 V.

* Current limiting has to be tested according to the description of the 3-kW switching regulator after a replacement of the regulator module or the power section.

* Vary supply voltage between 198 and 265 V (if possible), U2 should not change by more than 0.1 V.

* Switch off IN503A1, connect settable load to X2A.3 and X3B.3. Switch on IN503A1 again.

If required, adjust 30.2 V on A4C.A3 using R5.

* Alternately load U3 with 50 A and with 100 A. Voltage change ≤0.1 V.

* Current limiting should be tested according to the description of the 3-kW switching regulator after a replacement of the regulator module or the power section.

* Vary supply voltage between 198 and 265 V (if possible), U2 should not change by more than 0.1 V.

4.2.3.3 Synchronization

Switch off AC supply voltage.

* Connect oscilloscope alternately to switching regulators using 10:1 probes:
  A4A.A2 P3, ground to P1
  A4B.A2 P3, ground to P1
  A4C.A2 P3, ground to P1
  A2A R28/V12 cathode, ground to screen at A2A
  A2B R28/V12 cathode, ground to screen at A2B

* At X8. 2 and .1, apply 250 kHz from pulse generator, 6 V = high, 0 V = low, pulse width 0.5 µs ±10%.

* Switch on AC supply voltage, switch on IN503A1. Clock frequency of U1, U2 and U3 is 125 kHz (period 8 µs). It can be reduced to 100 kHz (10 µs) by changing the pulse-generator frequency.

4.2.3.4 Fault Test

Simulate one fault at a time and then eliminate the fault. The fault stored last will be indicated, but not the sum fault. If an on-command is present, apply a reset pulse to the dummy plug to clear existing fault indication.

Fault:	Sum fault:	Single fault:	Notes:
Open control loop U1 by removing shorting link from X4.1-2 on regulator module of respective 3-kW switching regulator	On after 3.5 s	U1	IN503A1 on, U1 switched
	On after 3.5 s	U2	IN503A1 on, U2 switched
	On after 3.5 s	U3	IN503A1 on, U3 switched
Simulate fault U4: switch off IN503A1, disconnect X1 from X2A, switch on IN503A1 again	On	U4	
Simulate fault U5: switch off IN503A1, disconnect X1 from X2B, switch on IN503A1 again	On	U5	
Reduce U6 (using R6 on A3)	On	U6	Measure between P2 and P0 on A3; set again to +12 V +0.03 V
Simulate temperature fault Temp.1 by disconnecting X3 on A4A.A2.	On	Temp. 1	
Simulate temperature fault Temp. 2 by disconnecting X3 on A4B.A2.	On	Temp. 2	
Simulate temperature fault Temp. 2 by disconnecting X3 on A4C.A2.	On	Temp. 3	

After simulating the last fault, eliminate the fault but do not make a reset.

Switch off power supply for about 1 minute.

After the supply voltage is switched on again, the fault stored last is indicated.

Press reset; fault indication is cleared.

4.3 Codings

Factory-set codings are marked with the symbol • .

3-kW switching regulator (modules A4A, A4B and A4C):
Regulator submodule (A3)

X4	.1-2	•	Regulation via output of switching regulator (internal).
	.2-3		Regulation via output of power supply (external, ie voltage losses on the lines in the power supply are also regulated).
X5	.1-2		DC circuit monitoring switched off
	.2-3	•	DC circuit monitoring switched on

Monitor (module A6):

X8	.1-2	•	No "sum fault" message in the absence of switch-on command (voltage U6 +12 V off).
	.2-3		"Sum fault" message in the absence of switch-on command (voltage U6 +12 V off).
X7	.1-2	•	Single-fault evaluation blocked if no DC circuit voltage is present.
	.2-3		Single-fault evaluation is not blocked if no DC circuit voltage is present.

Note:
With DC circuit monitoring switched off, the switching transistors may be destroyed when the AC supply voltage is suddenly applied or in the case of very high AC supply voltage fluctuations.