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DC / DC Power Supply

K1846-R

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Documentation	Date	Signature
Issued	**25.05.2020**	**N. Deufel**
Checked	30.06.2020	J. Schludecker

Specifications K1846-R

Input

Voltage range	1200 ... 1800V DC (2250V for 100ms, 3000V for 10ms)
Recommended input fuse	two-pole 2A slow, external
No-Load input power	approx. 100W
Switch-on time	600 ms typical

Output

Voltage	375V DC
Current	4A
Line regulation (±10%)	0.1 %
Load regulation (10-90%)	0.2 %
Ripple	≤ 1%
Load transient (10-90-10%)	6 % typical
Response time to ± 1 %	2 ms typical
Turn-on rise time	Softstart, 300 ms
Overload protection	current limited to 105 ... 110 % of full load
Over voltage protection	OVP switches off the module at U_{out} = 415 < $V_{o/p}$ < 420V_{DC}

General

Temperature coefficient	0.02 %/°C typical
Operating temperature	-20°C to +75°C
Load derating	2.5 %/°C from +55°C
Storage temperature	-40°C to +85°C
Cooling	contact cooling
Emergency power off	The module switches off at a heat sink temperature > 80˚C
Efficiency at full load	approx. 80%
Switching frequency	approx. 33 kHz
Isolation resistance	> 10 MΩ at 500V DC
Isolation test	acc. to EN 60950-1
Safety / Construction	acc. to EN 60950-1
Earth leakage	< 3.5 mA acc. to EN 60950-1
EMC compatibility	acc. to EN 61000-6-2 / EN 61000-6-4
Weight	24kg

Options

- Special mounting style for 3-dimensional contact cooling
- DC-OK with relay (switching threshold: U_{OUT} > 340VDC)
- Internal temperature switch 60˚C for external fan control
- Monitoring of input voltage by analogous voltage (galvanically insulated):

0V	=>	0V input voltage
1.25V DC	=>	562V input voltage
2.50V DC	=>	1125V input voltage
3.75V DC	=>	1687V input voltage
5V DC	=>	2250V input voltage

- Monitoring of input current by analogous voltage (galvanically insulated):

0V	=>	0A input current
1.25VDC	=>	0.37A input current
2.50VDC	=>	0.70A input current
3.75VDC	=>	1.105A input current
5V DC	=>	1.4A input current

- Monitoring of output voltage by analogous voltage (galvanically insulated):

0V	=>	0V output voltage
2.50V DC	=>	210V output voltage
3.75V DC	=>	315V output voltage
4.47V DC	=>	375V output voltage

- Monitoring of output current by analogous voltage (galvanically insulated):

0V	=>	0A output current
1.25VDC	=>	1A output current
2.50VDC	=>	2A output current
3.75VDC	=>	3A output current
4.64V DC	=>	4A output current

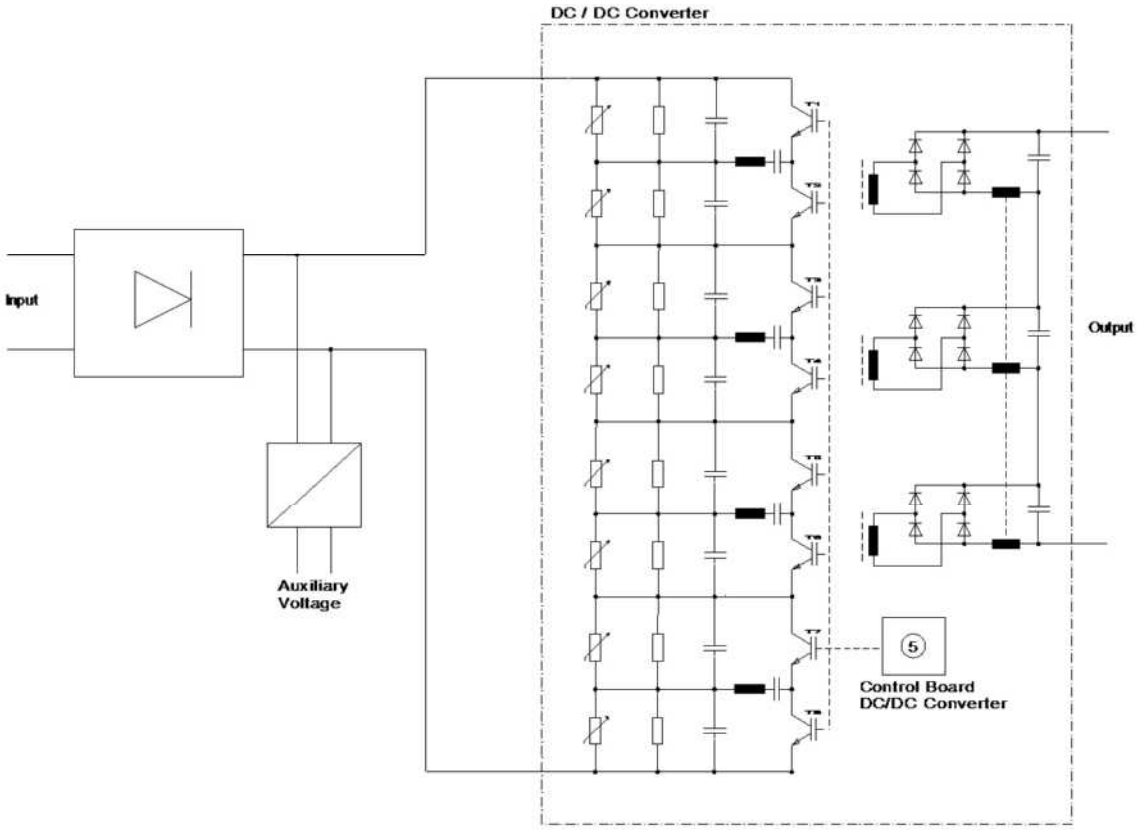
1. Primary circuit

The input is de-coupled and connected to the multi-stage primary half bridge configuration.

Each stage is monitored for function in terms of voltage and current.

Recovery from this protection mode of operation is achieved by re-cycling the input power and initiating a new start up cycle.

The voltage is both measured and represented by an internally visible LED for each half of each stage. The detection of a fault which influences the symmetry so that correct and safe function is endangered or excessive current through the Transformer winding results in the immediate disablement of the IGBT switching circuit.



There are 4 groups of IGBTs with their respective transformer and capacitors. These are collectively referred to as 4 stages.

Each stage receives its gate signals from the control board.

The function of the auxiliary voltage generator is to deliver a stabilised and isolated voltage to each of these stages.

There is an LED to indicate the voltage of Gate driver circuit is being supplied.

This LED is not externally visible, but upon removal of the chassis cover is can be viewed as mounted on the gate driver PCB.

The circuit is allowed to operate when the detected input voltage is within design parameters. Both a minimum voltage has to be reached for the unit to be permitted to generate an output voltage, and a maximum voltage is not to be exceeded for the generation of this output voltage to continue.

Should either of these parameters be exceeded, via an internal hysterises, the monitoring function shall disable the transfer of power to the output terminals.

It should be noted that the auxiliary power generator continues to operate even though the power transfer to the output load connection has been de-activated.

2. Secondary circuit

The secondary circuit is a series connection of 3 full bridge rectification circuits that pass through filters and are buffered, while being actively monitored by the control board, to the load connection.

There is no externally visible LED to indicate operation.

1. Indication of operation – telemetry.

There is no externally visible LED to indicate operation.

There is however, a telemetry signal from 0V DC to 5V DC which equates to the output voltage and current, as well as the input voltage and current.

Details to these values can be found in the tabulated results of the test report.

2. Voltage control

Voltage control is achieved via an internally connected sense lead which delivers the output voltage in real time to the control board.

The control board compares this down divided value against an internally generated reference to decide if the output parameters are being met.

Should the load demand be altered, this is immediately sensed and triggers an immediate response through an opto-coupler to the primary side of the control board to alter the PWM that defines the switch on time of the primary IGBT network. This altered transfer of energy is brought through the primary winding of the transformer to the secondary side, rectified, smoothed, buffered and ultimately to the load with immediate effect.

3. Current limitation.

The output current is sensed and delivered to the control board regulation circuit.

Upon detection of the maximum permitted current having been reached, the regulation circuit is influenced to reduce the output voltage through its PWM signal, and the current is held at this maximum value until the load demand has been reduced or removed.

This is the constant current mode of operation.

It limits in an active PWM circuit the transfer of energy from the Primary to the galvanically isolated secondary circuit, such that the sensed current value should not be exceeded.

4. Short circuit protection.

The output is short circuit protected. The design is such that a spontaneous, continuous or sporadic short circuit shall not impede the function of the unit.

The current regulation circuit is coupled in the control board to the voltage regulation circuit so that the PWM signal is altered according to the load demand.

The internally generated auxiliary voltages are independent of the output power stream, and thus are not affected by the short circuit.

5. Over voltage protection (OVP).

The output voltage is measured and sensed independently of the voltage regulation circuit.

Should the regulation circuit fail in its function, resulting in a higher than desired output voltage; the OVP circuit is activated, resulting in the disabling of ability to generate a PWM signal for the gate driver circuit via an additional opto-coupler.

Detection of an OVP condition results in the latching off of the unit.

For this condition to be removed, the input power has to be removed for a minimum of 30 seconds, and reinitialized.

The latched off function reoccurs should the condition persist.

6. Initial start-up.

The input, output and signal terminals are mated to the unit via their respective connectors.

The application of input power should be in line with the specifications and applied from the K912 HVPS.

The availability of the input voltage within the specified parameters results in the establishment of functionality, the initiation of auxiliary voltage power at first form the input power conduit and later from the main transformer, then the evaluation of the control board that all parameters are within specified values, followed by the generation of the output voltage in a soft-start design feature.

Once generated, the output voltage is stabilised and able to deliver the output power as required by the load to the limitation of its current value.

7. Parallel operation

The single unit is viewed as a standalone power supply.

The power supply output is de-coupled from the DC load connection.

The power supply can operate within a power system consisting of more than one power supply in a parallel configuration.

There is no interconnection between the individual units required, resulting in no active current sharing of the load current.

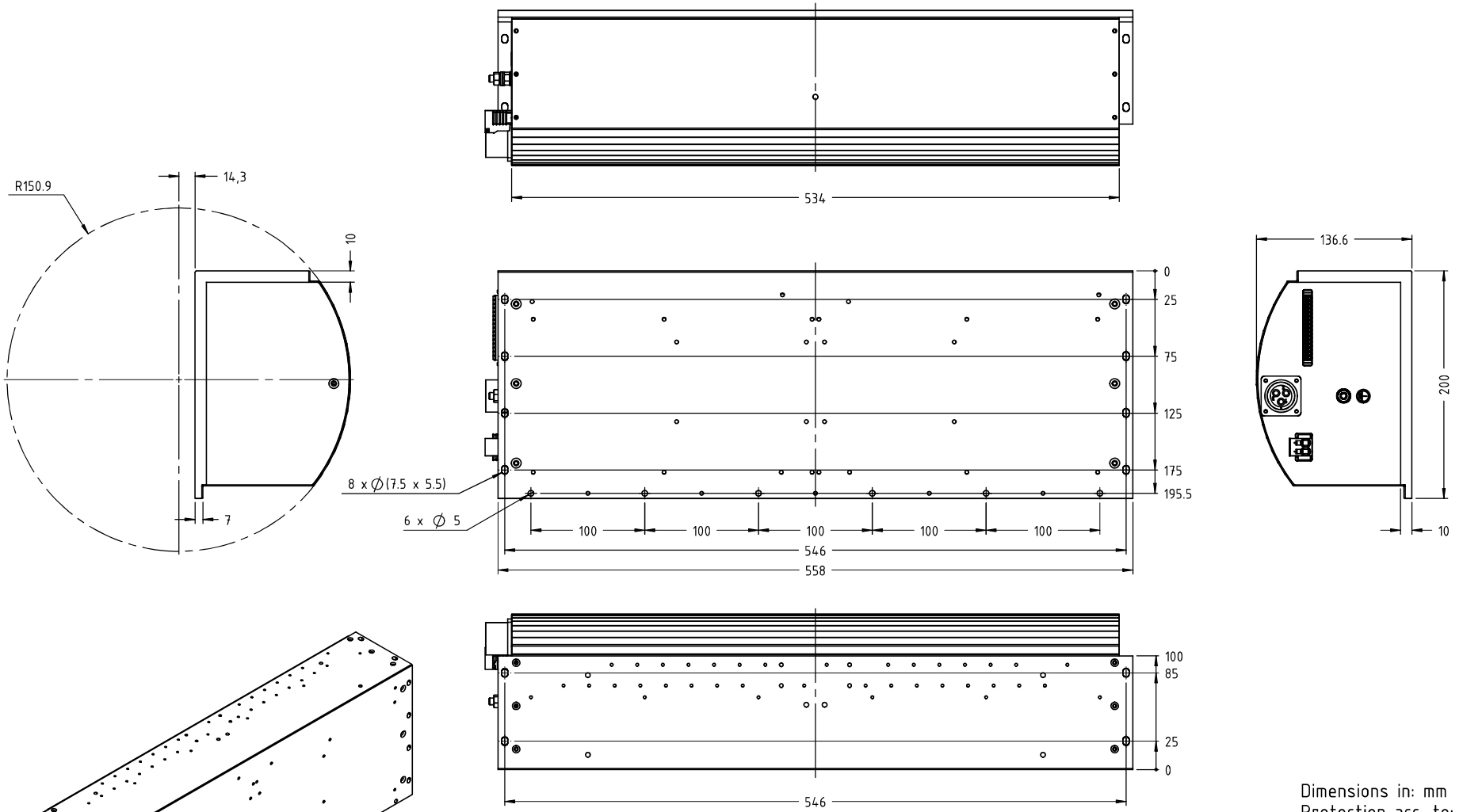
8. Input current.

The input current as measured and delivered as a telemetry signal is monitored.

The value is compared with a maximum permitted values calculated as a reference in the internal monitoring circuit, and should it be reached as a measured value results in the switching off of the power circuit. This is a latched condition.

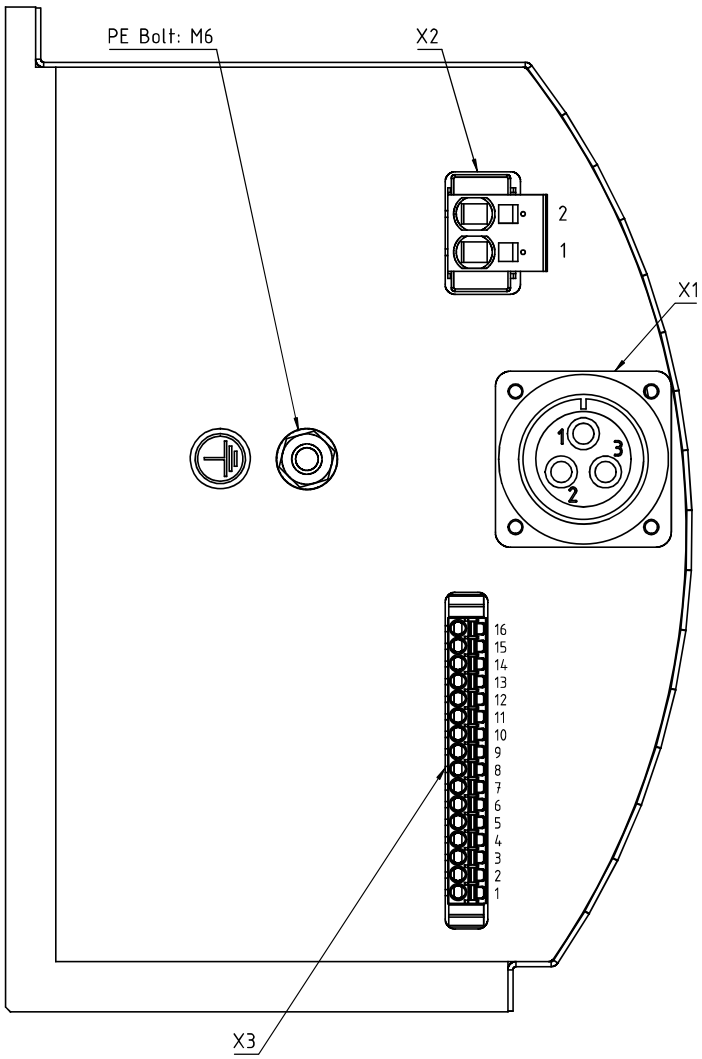
For this condition to be removed, the input power has to be removed for a minimum of 30 seconds, and reinitialized.

The latched off function reoccurs should the condition persist.



Dimensions in: mm
Protection acc. to: IP20

SCHAEFER				gen. tolerances DIN ISO 2768-mK		DIN 6 T1 - Proj.method 1	Material:
					Date	Name	Surface:
				Drawn	27.05.2020	N. Deufel	Title: Dimensional drawing
				Verified	30.06.20	J.S.	K1846-R
				EDP			
				Schaefer Electronics Inc www.SchaeferPower.com			Drawing number: 74 K1846-R E
Rev.	Change	Date	Name				Identnr.: SW: 00090253 Sheet / of 1 / 1



DC Input connector (X1)
Plug (GES Elecronic, GS-MC 307)
Socket (GES Electronic, KB-MC 307)
1: PE
2: - Input
3: + Input

DC Output connector (X2)
Plug (Phoenix, 1718481, SPC 5/ 2-STCL-7,62)
Socket (Phoenix, 1720466, PC 5/ 2-G-7,62)
1: - Output
2: + Output

Signal connector (X3)
Plug (Phoenix, 1952160, FMC 1,5/16-ST-3,5-RF)
Socket (Phoenix, 1731811, MC 1,5/16-G-3,5-RN)
1: -24V (auxiliary voltage for logic board)
2: +24V (auxiliary voltage for logic board)
3: mon-GND
4: mon-U_in (0 - 5V)
5: mon-I_in (0 - 5V)
6: mon-U_out (0 - 5V)
7: mon-I_out (0 - 5V)
8: DC OK (com)
9: DC OK (com)
10: DC OK (nc)
11: DC OK (no)
12: 60°C-temp
13: 60°C-temp
14: not connected
15: not connected
16: not connected

DC OK: (Relay-contact: 30VDC / 2A):
com-nc: contact is open, if output voltage is ok.
com-no: contact is closed, if output voltage is ok.

60°C-temp: internal temperature switch (max. 250VAC / 1A or max. 110VDC / 1A):
heat sink temperature < 60°C = contact open
heat sink temperature > 60°C = contact closed

Rev.	Change	Date	Name

SCHAEFER

gen. tolerances DIN ISO 2768-mK

DIN 6 T1 - Proj.method 1

	Date	Name
Drawn	17.03.2020	AS
Verified	30.06.20	J.S.
EDP		

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Material:
Surface:

Title
Connection diagram
K1846-R

Drawing number
73 K1846-R E

Identnr.: SW: 00090253 Sheet / of 1 / 1