

Three-Phase Inverter System IV6678.6-2

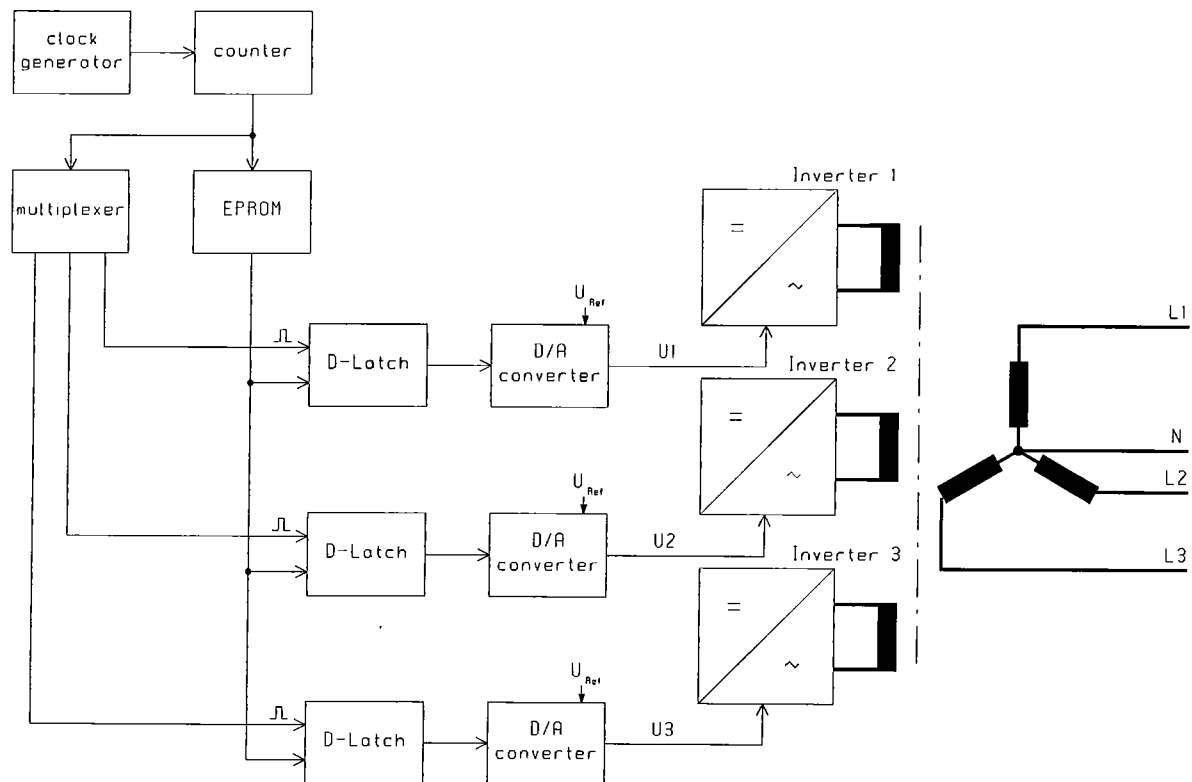
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Manual Inverter IT5878.6-IV66-2-S (Slave)	7 Pages

Documentation	Date	Signature
Issued	26.01.2012	N. Deufel

B	Cover sheet name / Wiring scheme / Manual inverter IT5878.6-IV66-2-M /-S	26.01.2012	A. Eckert
A	Manual Inverter IT5878.6-IV66-2-M /-S	18.01.2012	A. Eckert
0	First edition	15.12.2011	N. Deufel
Rev.	Description	Date	Signature

Generation of 3-phase sinusoidal voltage

For a three-phase inverter, three 120° phase-shifted sinusoidal voltages are required. The following block diagram shows the procedure how to generate those sinusoidal voltages:



The counter, which is driven by the clock generator, activates the single addresses of the EPROM. On the addresses, the ratings for the sinusoidal voltages are coded. They are read out via data lines and are available at the inputs of the three D-latches. The D-latches release the available data to the output after receiving a signal from the multiplexer. The multiplexer gives signals to the D-latches in the following sequence:

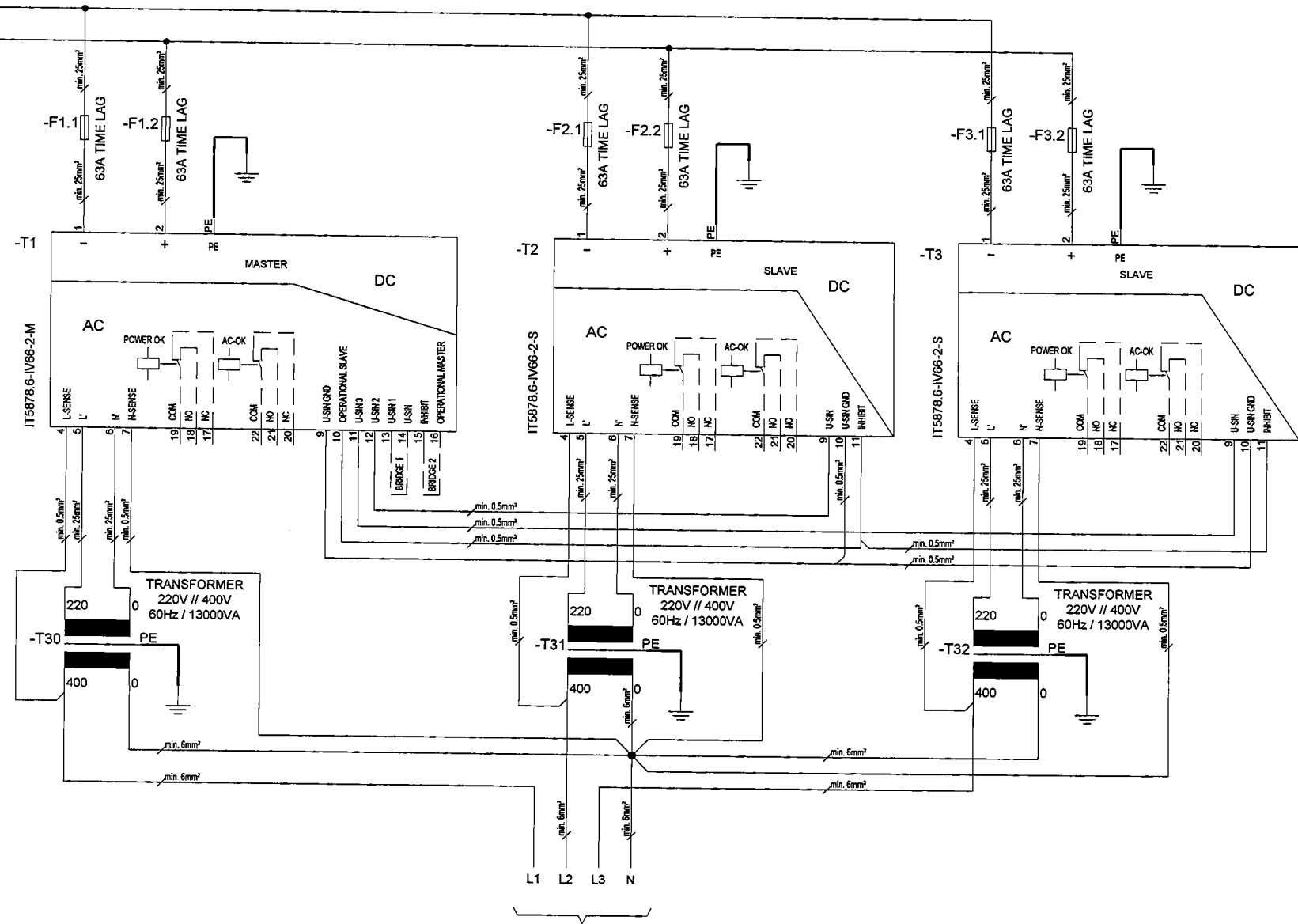
At first, a rating for the first sinusoidal voltage is available at the output of the first D-latch, afterwards, a rating for the second sinusoidal voltage is available at the output of the second D-latch, and finally, a rating for the third sinusoidal voltage is available at the output of the third D-latch. Then, in the D/A converter, the coded ratings are converted into analogue voltages. The D/A converters are equipped with an additional input for a reference voltage. By multiplying the coded ratings with the externally applied reference voltage the amplitude of the sinusoidal voltages can be modulated by modifying this reference voltage.

A
B
C
D
E
F

1 2 3 4 5 6 7 8

DC INPUT
340 ... 450V DC

3~ AC OUTPUT
690V PH-PH
400V PH-N
60Hz, 38000VA



IV6678V_6-2-003
26.01.2012
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				User	ND
				Proved	A. Eckert
Status	change	date	name	Standard	Origin

SCHAEFER

Circuit diagram
Three-phase inverter system IV6678V.6-2

76 IV6678.6-2-H1 E

DC / AC Inverter (Master)

IT5878.6-IV66-2-M

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Documentation	Date	Signature
Issued	26.01.2012	N. Deufel

B	Specifications	26.01.2012	A. Eckert
A	Specifications	18.01.2012	N. Deufel
0	First edition	15.12.2011	N. Deufel
Rev.	Description	Date	Signature

DC Input

Voltage range	340 ... 450V DC, unit switches off at under- and overvoltage
Recommended input fuse	63A slow, external
No-load input power	approx. 100W
Hold-up time	10 ms typical
Inrush current	limiting by thermistor
Immunity:	
- ESD	acc. to EN 61000-4-2 (level 3)
- Fast transients	acc. to EN 61000-4-4 (level 3)
- Surges	acc. to EN 61000-4-5 (level 3)

AC Output

Waveform	sine-wave
Voltage	400V AC (secondary voltage of external transformer)
Power	13000VA (secondary power of external transformer)
Line regulation	2 %
Load regulation (10-90%)	1 % typical, 3 % max.
Frequency	60 Hz, crystal stabilized
Efficiency at full load	85 % typical
Distortion	3 % typical
Overload protection	current limited to approx. $1.05 I_{nom}$
Surge power	$2 \times P_{nom}$ for 4 sec.
Short circuit current	electronically limited to $3 \times I_{nom}$
Crest factor	approx. 3
Power factor	$\cos\varphi \geq 0.7$ inductive / capacitive

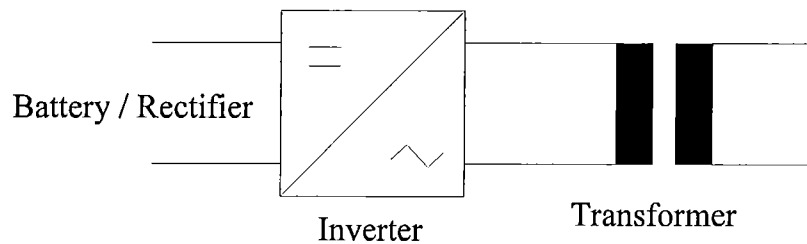
General

Temperature coefficient	0.05 %/°C typical
Operating temperature	-40°C to +75°C
Load derating	2.5 %/°C from +55°C
Storage temperature	-40°C to +85°C
Switching frequency	approx. 20 kHz
Isolation resistance	$> 10 M\Omega$ at 500V DC
Isolation test	acc. to EN 60950-1: 2003
Safety / Construction	acc. to EN 60950-1: 2003
Earth leakage	< 3.5 mA at 230V AC, acc. to EN 60950
RFI-interference	acc. to EN 55022, class A
Cooling	with temperature-controlled fans
Connection	via terminals
Dimensions	19" x 6U x 460mm

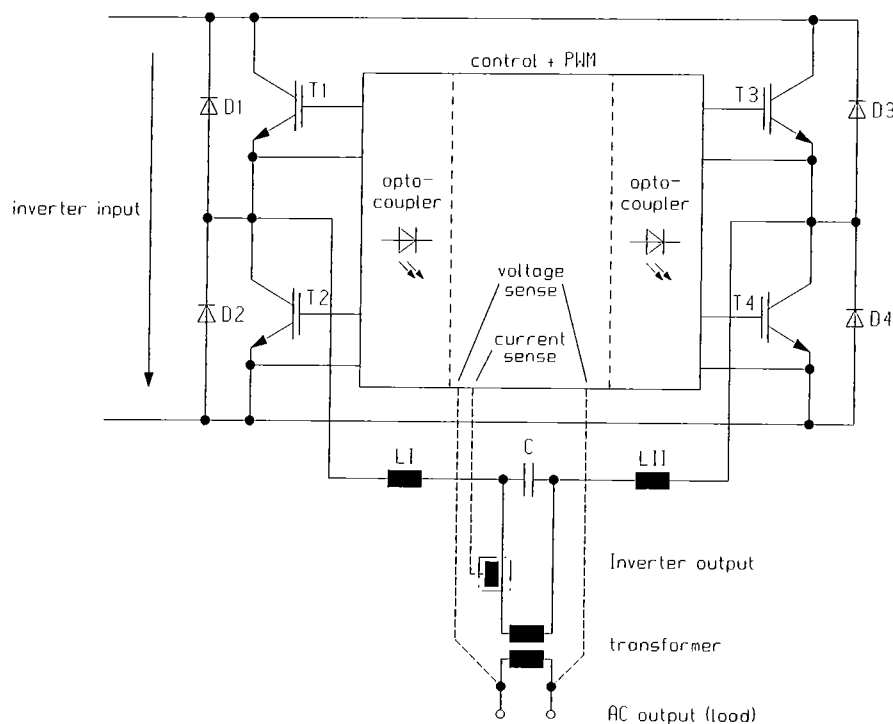
Options

- External transformer
- As Master-Inverter for three phases control suitable
- Power OK with relay
- AC OK with relay

The figure beside shows the connection of a switchmode inverter and a transformer.



The figure below shows the circuit of the inverter:



The intermediate circuit voltage (DC-input voltage) is transformed by the power transistors T1-T4 with the parallel inverse diodes D1-D4 in a pulse-width square-wave voltage. The choke with the windings LI and LII integrates this voltage, and at the capacitor C there is a sinusoidal output voltage.

The power transistors are controlled by opto-coupler, making sure, that not both transistors of one branch are switched on at the same time by the control pulses. The output voltage is connected via sense leads to the control circuit and controls after a comparison with a reference the control pulses for the power transistors. The voltage drop of the output current at shunt R1 is also supplied to the control circuit and serves for current limiting.

Alternating voltage at the output of the inverter is transformed by means of a transformer to the requested output voltage with galvanical isolation.

SWITCHING ON

On application of the input DC voltage, an auxiliary voltage is internally produced. The softstart will then allow the output voltage to be supplied after a time delay, typically 150 ms.

- SUPERVISORY AND PROTECTION FUNCTIONS:**1.) Input voltage**

The DC input voltage is supervised for over voltage and undervoltage. The threshold values are adjusted according to the specifications in the inverter's data sheet. The inverter is switched off, if the input voltage is not within the specified range.

2.) Electronic Inrush current limiting

This option utilizes additional circuitry to control the input current. During powering up, the input current is controlled while the supply is inhibited. When the input capacitance is charged up, the supply will provide a soft-start, to insure, that the input current remains at a minimal value.

3.) Output voltage

a) The green LED on the frontpanel is activated when the inverter has reached, of its nominal voltage, a minimum value of 80%. Optionally, a potential-free relay contact is provided for signaling AC-ok.

b) The inverter is switched off, if the output voltage has exceeded, of its nominal voltage, a value of 120 %. After returning below the threshold value the inverter turns on automatically as described in paragraph "Switching On".

4.) Output current

The output current is limited to a value, of the nominal current, of 105 %. The inverter can supply twice the nominal current for typically 4 sec.

For applications with cyclic current, (i.e. a pulsed capacitive load), it must be taken care that the effective current (r.m.s. current) does not exceed the nominal current of the inverter.

The inverter is switched off, if a short circuit occurs at its output terminals and the inverter switches on again automatically as described under item "Switching On".

Due to current limitation the inverter is also switched off if the load impedance is such, that the output voltage is less than or equal to 60V.

5.) Auxiliary voltage

The internally generated auxiliary voltage is 15 volts. The inverter is switched off, if the auxiliary voltage drops below 12 volts. The inverter turns on automatically if the auxiliary voltage rises above 12.5 volts.

6.) Temperature

If the temperature of the heat sink exceeds 90° C, the inverter is switched off. After the heat sink has cooled down to < 60° C the inverter turns on again.

7.) Power output amplifier

A fault in the power output amplifier is also monitored. When such a condition occurs, the inverter is switched off and remains latched in this condition.

8.) Safety instructions

Operation of Inverter causes internally dangerous voltages. The instructions VDE 0100, 0105, 0680 (T2 §5) have to be strictly observed.

The unit should only be use for its determinated purpose.

Disconnect the unit from the mains before opening!

The discharging of the internal capacitors is 5 minutes at least.

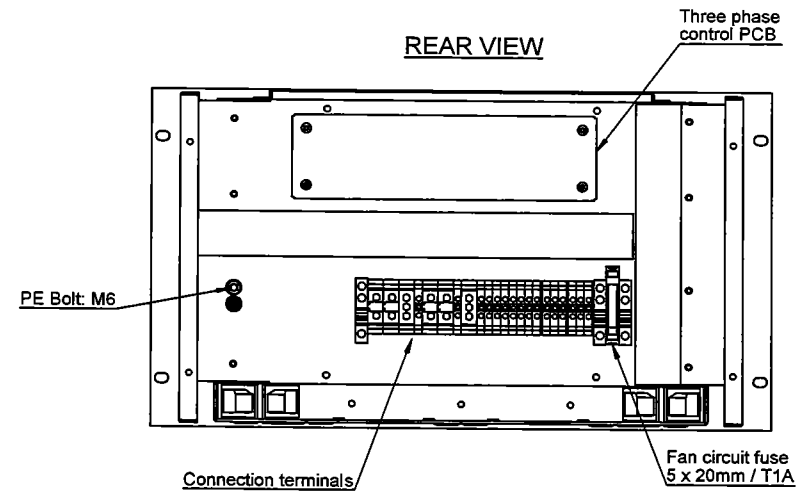
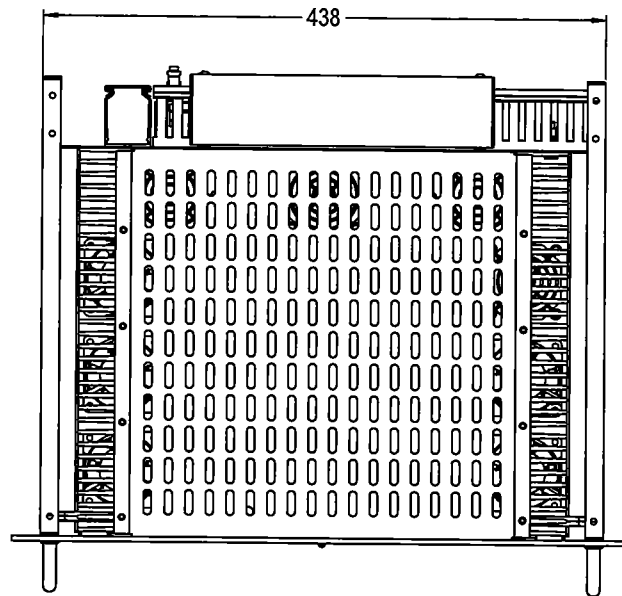
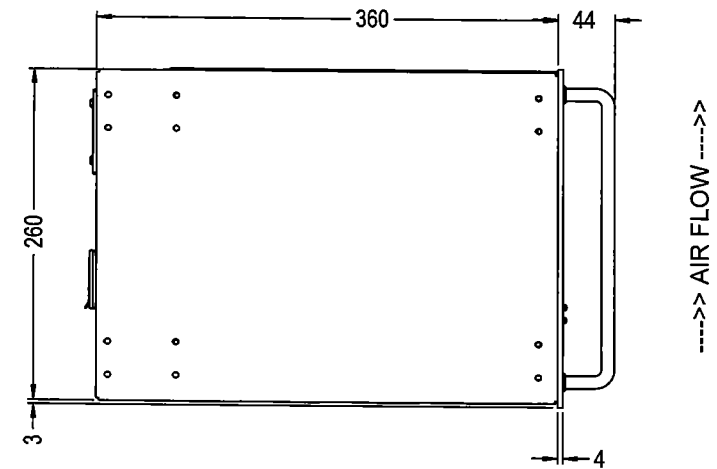
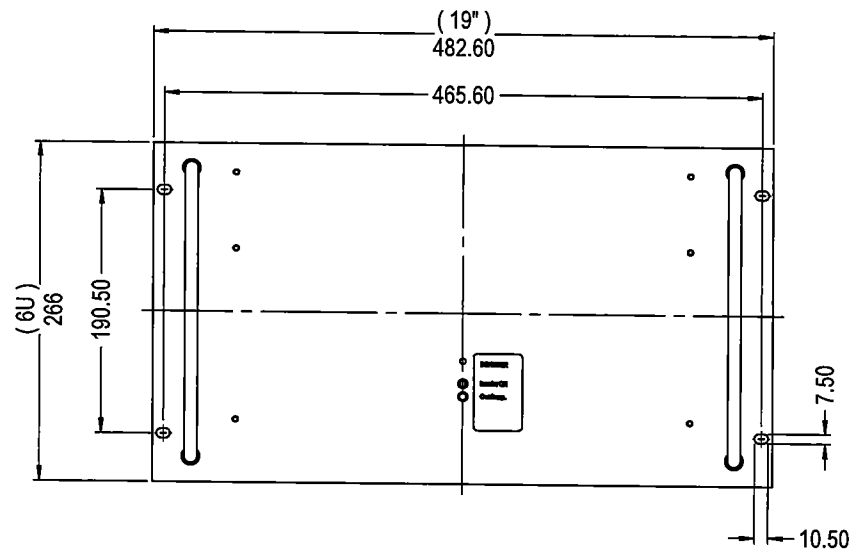
9.) Storage Instructions

Storage temperature: -40°C ... +85°C

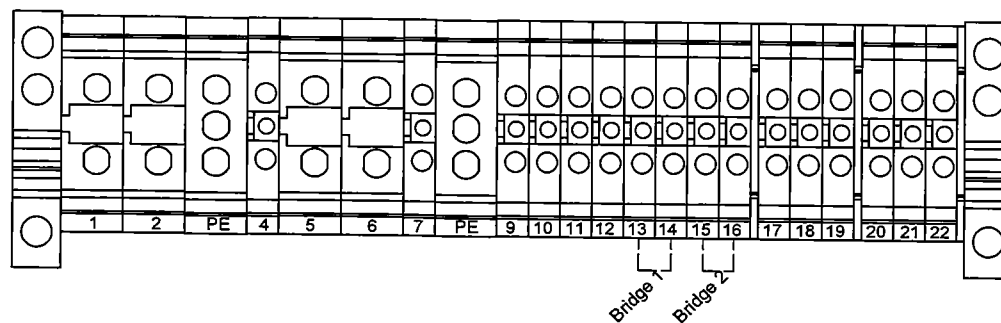
We recommended the following conditions for storage:

- Do not store the unit at a high temperature (at higher temperatures the ageing process is increased) or in high humidity. Store the unit indoors at a temperature of +5 to +35°C and a humidity of less than 75% RH.
- Keep the unit in the original package.

If the unit are stored below the operating temperature it has to be stored at least 5 hours in operating temperature conditions to be sure there is no condensing water.



SCHAEFER				Allgemein- toleranzen DIN ISO 2768-mK		Material:
				Datum	Name	Oberfläche:
				Erstellt 15.12.2011	ND	Benennung:
				Freig. 13.12.11	A. Eckert	IT5878.6-IV66-2-M (Master)
				EDV		Dimensional drawing
				Schäfer Elektronik GmbH www.schaeferpower.de		Zeichnungsnummer:
						74 IT5878.6-IV66-2-M E
Zust.	Änderungen	Datum	Name	Identnr.: 147650	SW: 007581	Blatt / von 1 / 1



Connection terminals				
No.	Function		Type	Size
1	(-) DC input	340 ... 450V	UK 16	4 - 16mm²
2	(+) DC input			
PE	PE	PE	USLKG 16	
4	L-sense	L-sense	UK 5N	0.2 - 4mm²
5	L' output	connection to external transformer	UK 16	4 - 16mm²
6	N' output			
7	N-sense	N-sense	UK 5N	0.2 - 4mm²
PE	PE	PE	USLKG 16	4 - 16mm²
9	U-SIN GND	connection to slave 1 and 2	UK 5N	0.2 - 4mm²
10	OPERATIONAL SLAVE			
11	U-SIN 3	connection to slave 1		
12	U-SIN 2	connection to slave 2		
13	U-SIN 1	Bridge 1		
14	U-SIN			
15	INHIBIT	Bridge 2		
16	OPERATIONAL MASTER			
17	NC	POWER OK		
18	NO			
19	COM			
20	NC	AC OK		
21	NO			
22	COM			

Sense:

Remote sense terminals have to be connected to the secondary side (400V) of external transformer under regard of the polarity.

Power OK (Relay-contact: max. 250VAC/max. 5A or max. 30VDC/max. 5A):

nc: contact is open, if input voltage is ok.

no: contact is closed, if input voltage is ok.

AC OK (Relay-contact: max. 250VAC/max. 5A or max. 30VDC/max. 5A):

com-no: contact is closed, if output voltage is ok.

com-nc: contact is open, if output voltage is ok.

Bridge 1 and bridge 2:

the terminals have to be bridged for function as a master-module.

SCHAEFER		Allgemein- toleranzen DIN ISO 2768-mK				Material:	
		Datum		Name		Oberfläche:	
Erstellt		15.12.2011		ND		Benennung:	
Freig.		23.12.11		A. Eckert		IT5878.6-IV66-2-M (Master)	
EDV						Connection diagram	
						Zeichnungsnummer:	
						73 IT5878.6-IV66-2-M E	
Zust. Änderungen		Datum		Name		Identnr.:	
						SW: 007572 Blatt / von 1 / 1	

DC / AC Inverter (Slave)

IT5878.6-IV66-2-S

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Connection diagram	73 IT5878.6-IV66-2-S E

Documentation	Date	Signature
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B	Specifications	26.01.2012	A. Eckert
A	Specifications	18.01.2012	N. Deufel
0	First edition	25.05.2011	A. Scherer
Rev.	Description	Date	Signature

DC Input

Voltage range	340 ... 450V DC, unit switches off at under- and overvoltage
Recommended input fuse	63A slow, external
No-load input power	approx. 100W
Hold-up time	10 ms typical
Inrush current	limiting by thermistor
Immunity:	
- ESD	acc. to EN 61000-4-2 (level 3)
- Fast transients	acc. to EN 61000-4-4 (level 3)
- Surges	acc. to EN 61000-4-5 (level 3)

AC Output

Waveform	sine-wave
Voltage	400V AC (secondary voltage of external transformer)
Power	13000VA (secondary power of external transformer)
Line regulation	2 %
Load regulation (10-90%)	1 % typical, 3 % max.
Frequency	60 Hz, crystal stabilized
Efficiency at full load	85 % typical
Distortion	3 % typical
Overload protection	current limited to approx. $1.05 I_{nom}$
Surge power	$2 \times P_{nom}$ for 4 sec.
Short circuit current	electronically limited to $3 \times I_{nom}$
Crest factor	approx. 3
Power factor	$\cos\phi \geq 0.7$ inductive / capacitive

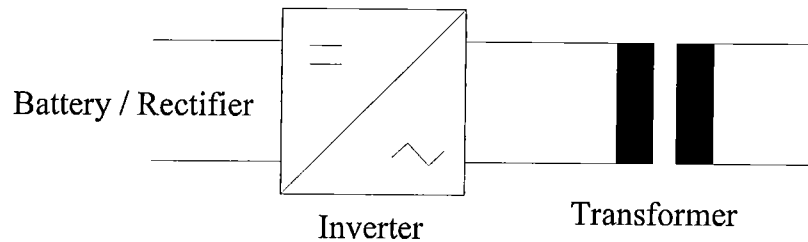
General

Temperature coefficient	0.05 %/°C typical
Operating temperature	-40°C to +75°C
Load derating	2.5 %/°C from +55°C
Storage temperature	-40°C to +85°C
Switching frequency	approx. 20 kHz
Isolation resistance	> 10 M Ω at 500V DC
Isolation test	acc. to EN 60950-1: 2003
Safety / Construction	acc. to EN 60950-1: 2003
Earth leakage	< 3.5 mA at 230V AC, acc. to EN 60950
RFI-interference	acc. to EN 55022, class A
Cooling	with temperature-controlled fans
Connection	via terminals
Dimensions	19" x 6U x 460mm

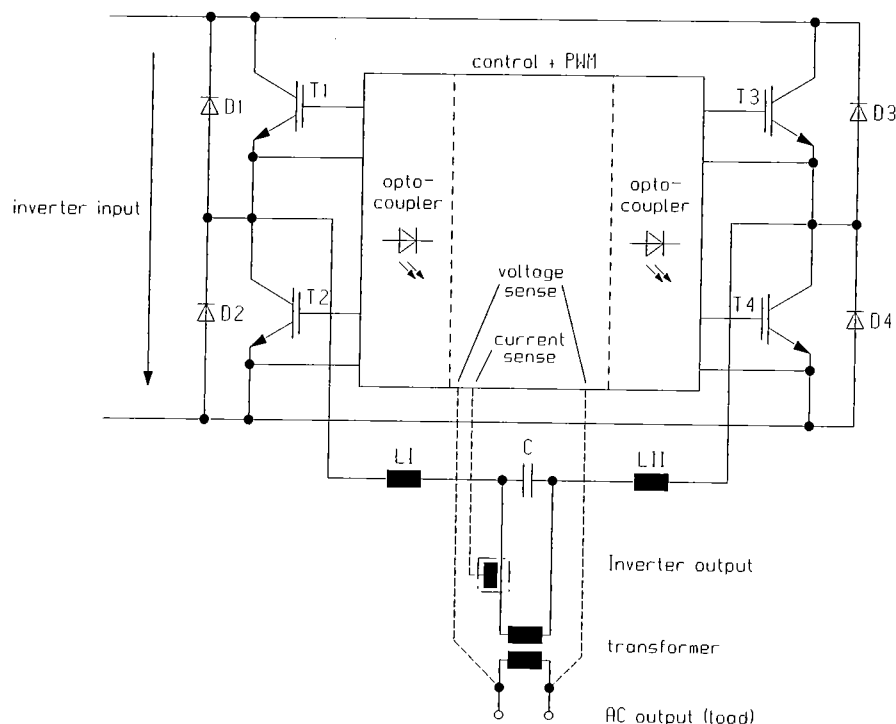
Options

- External transformer
- As Slave-Inverter for three phases control suitable
- Power OK with relay
- AC OK with relay

The figure beside shows the connection of a switchmode inverter and a transformer.



The figure below shows the circuit of the inverter:



The intermediate circuit voltage (DC-input voltage) is transformed by the power transistors T1-T4 with the parallel inverse diodes D1-D4 in a pulse-width square-wave voltage. The choke with the windings LI and LII integrates this voltage, and at the capacitor C there is a sinusoidal output voltage.

The power transistors are controlled by opto-coupler, making sure, that not both transistors of one branch are switched on at the same time by the control pulses. The output voltage is connected via sense leads to the control circuit and controls after a comparison with a reference the control pulses for the power transistors. The voltage drop of the output current at shunt R1 is also supplied to the control circuit and serves for current limiting.

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For applications with cyclic current, (i.e. a pulsed capacitive load), it must be taken care that the effective current (r.m.s. current) does not exceed the nominal current of the inverter.

The inverter is switched off, if a short circuit occurs at its output terminals and the inverter switches on again automatically as described under item "Switching On".

Due to current limitation the inverter is also switched off if the load impedance is such, that the output voltage is less than or equal to 60V.

5.) Auxiliary voltage

The internally generated auxiliary voltage is 15 volts. The inverter is switched off, if the auxiliary voltage drops below 12 volts. The inverter turns on automatically if the auxiliary voltage rises above 12.5 volts.

6.) Temperature

If the temperature of the heat sink exceeds 90° C, the inverter is switched off. After the heat sink has cooled down to < 60° C the inverter turns on again.

7.) Power output amplifier

A fault in the power output amplifier is also monitored. When such a condition occurs, the inverter is switched off and remains latched in this condition.

8.) Safety instructions

Operation of Inverter causes internally dangerous voltages. The instructions VDE 0100, 0105, 0680 (T2 §5) have to be strictly observed.

The unit should only be use for its determinated purpose.

Disconnect the unit from the mains before opening!

The discharging of the internal capacitors is 5 minutes at least.

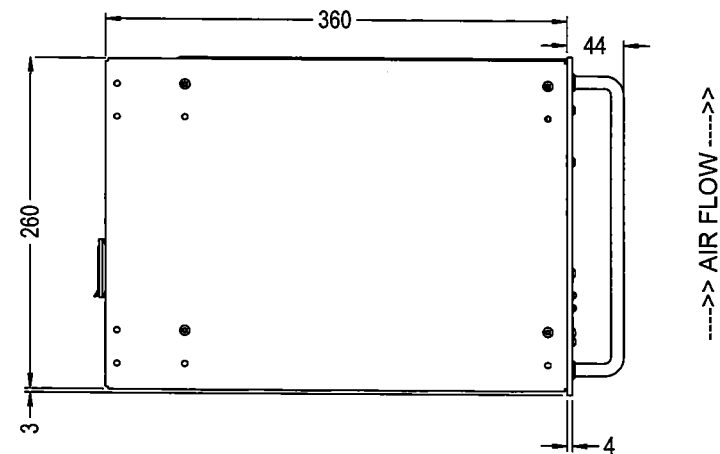
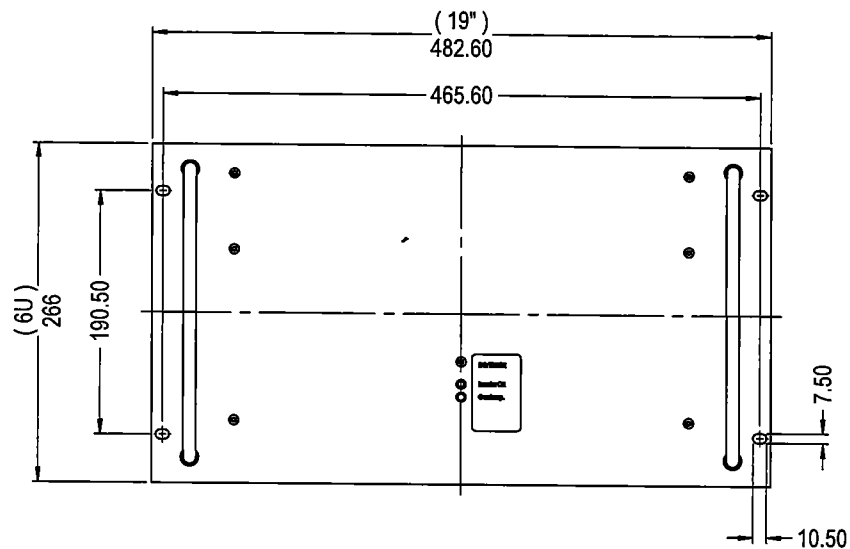
9.) Storage Instructions

Storage temperature: -40°C ... +85°C

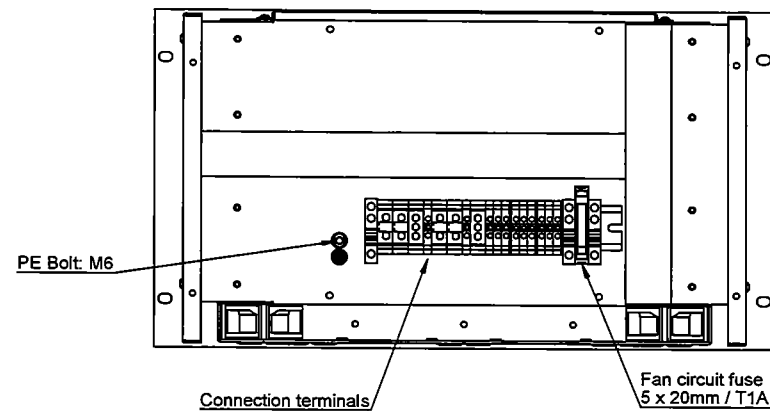
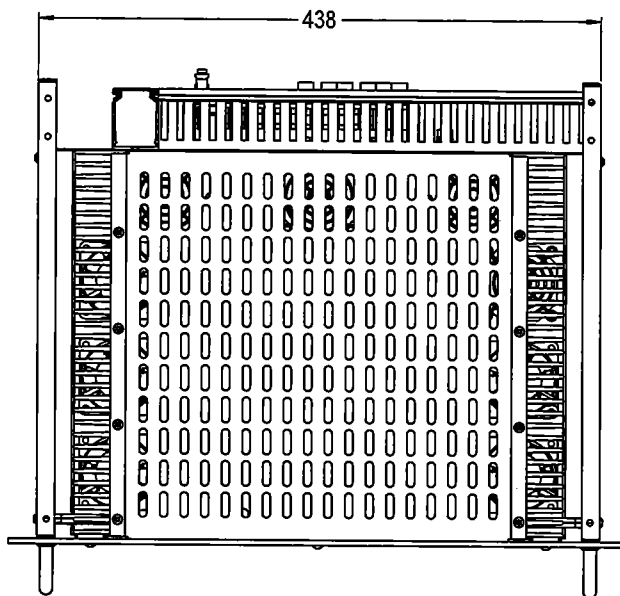
We recommended the following conditions for storage:

- Do not store the unit at a high temperature (at higher temperatures the ageing process is increased) or in high humidity. Store the unit indoors at a temperature of +5 to +35°C and a humidity of less than 75% RH.
- Keep the unit in the original package.

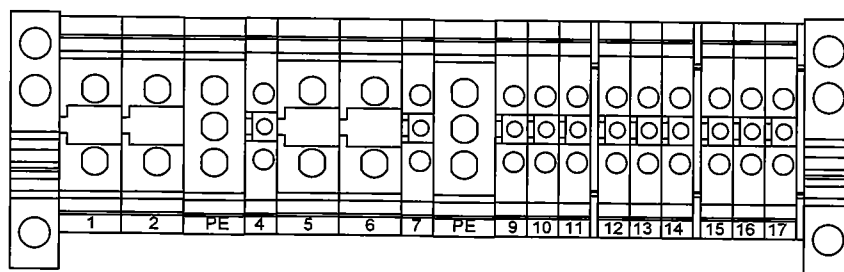
If the unit are stored below the operating temperature it has to be stored at least 5 hours in operating temperature conditions to be sure there is no condensing water.



REAR VIEW



SCHAEFER			Allgemeintoleranzen DIN ISO 2768-mK	DIN 6 T1 - Proj.methode 1	Material: Oberfläche:		
			Datum	Name	Benennung:		
			Erstellt 15.12.2011	ND	IT5878.6-IV66-2-S (Slave)		
			Freig. 23.12.11	AEKert	Dimensional drawing		
			EDV		Zeichnungsnummer:		
			Schäfer Elektronik GmbH www.schaeferpower.de			74 IT5878.6-IV66-2-S E	
Zust.	Änderungen	Datum	Name		Identnr.: 147650	SW: 007593	Blatt / von 1 / 1



Connection terminals				
No.	Function		Type	Size
1	(-) DC input	340 ... 450V	UK 16	4 - 16mm ²
2	(+) DC input			
PE	PE	PE	USLKG 16	
4	L-sense	L-sense	UK 5N	0.2 - 4mm ²
5	L' output	connection to external transformer	UK 16	4 - 16mm ²
6	N' output			
7	N-sense	N-sense	UK 5N	0.2 - 4mm ²
PE	PE	PE	USLKG 16	4 - 16mm ²
9	U-SIN	connections to master	UK 5N	0.2 - 4mm ²
10	U-SIN GND			
11	INHIBIT			
12	NC	POWER OK	UK 5N	0.2 - 4mm ²
13	NO			
14	COM	AC OK	UK 5N	0.2 - 4mm ²
15	NC			
16	NO			
17	COM			

Sense:

Remote sense terminals have to be connected to the secondary side (400V) of external transformer under regard of the polarity.

Power OK (Relay-contact: max. 250VAC/max. 5A or max. 30VDC/max. 5A):

nc: contact is open, if input voltage is ok.

no: contact is closed, if input voltage is ok.

AC OK (Relay-contact: max. 250VAC/max. 5A or max. 30VDC/max. 5A):

com-no: contact is closed, if output voltage is ok.

com-nc: contact is open, if output voltage is ok.

SCHAEFER Allgemein- toleranzen DIN ISO 2768-mK		 DIN 6 T1 - Proj.methode 1	Material:	
			Oberfläche:	
Datum Erstellt: 15.12.2011 Freig. 23.12.11 EDV		Name ND A. Ebert		Benennung:
				IT5878.6-IV66-2-S (Slave)
				Connection diagram
				Zeichnungsnummer:
				73 IT5878.6-IV66-2-S E
Zust. Änderungen		Datum		Identnr.:
				SW: 007589
				Blatt / von 1 / 1