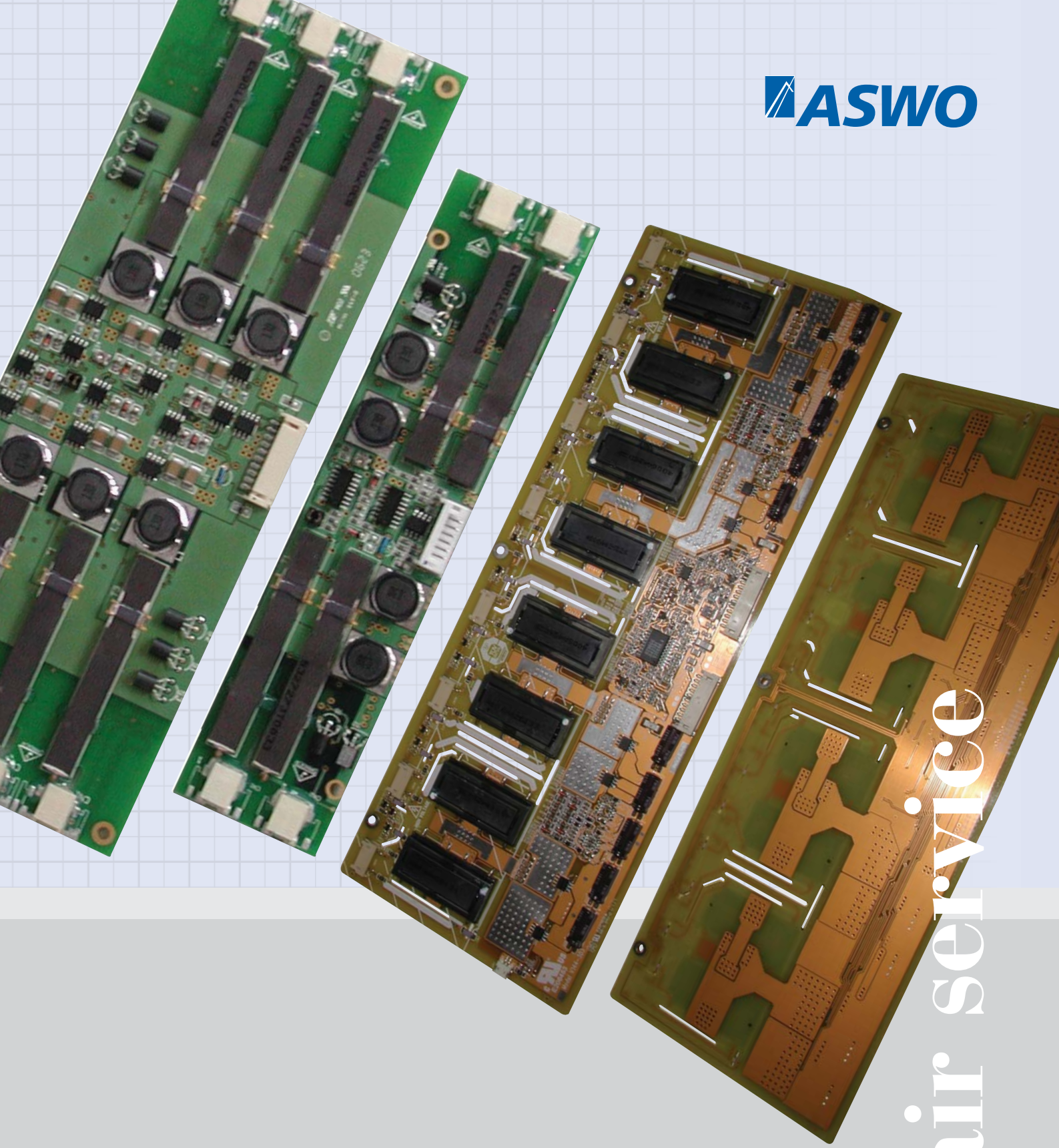
ASWO



LCD technology

Repair service

Foreword

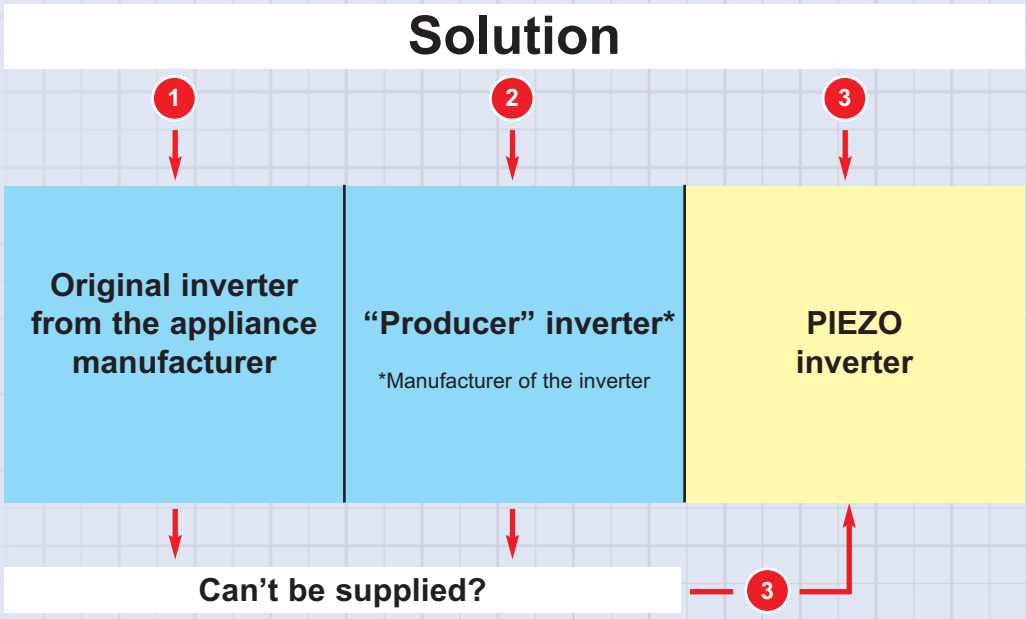
Dear technician colleagues, dear specialist dealers,

Is this new technology really too difficult for us?
Is the servicing of plasma and LCD/TFT appliances really 'impossible' for us?
I have concerned myself with this new technology for a long time now. However, as is so often the case: the new technology appears to be 'insurmountable' at first. Consider the first CD players: I can remember types, groups and modules that were extremely complex and demanded great respect. But what remains of that today? We have learned to deal with the servo-loop; whether DVD or CD - the principle is clear in your head and thus the repair procedure too.

A similar pattern is emerging more and more in the LCD technology and other digital processing boards Of course there are particular hurdles to be overcome here too. But all of that is also possible. Therefore giving up before you even start is certainly not the right way. A great many logical interrelationships can be found in the appliances which, if evaluated properly, will lead us to the fault. Components which typically fail with the widest variety of fault behaviours can often be identified at the flick of the wrist.

Take for example one of the commonest causes of faults in LCD TVs – the inverter board. There are now several possibilities for you to carry out repairs yourself. On one hand, there is the measurement method, whereby we observe and check all connections to the inverter, such as operating voltage, the enable connection, the various possibilities to control dimming, etc.
On the other hand, ASWO Partners provides you with the possibility of replacing defective inverter boards

Select one of the three repair solutions:



Of course everything is difficult at the beginning. Of course it is once again the case that information and experience are lacking at the beginning… but nowadays – as opposed to the middle of the 1980s – the Internet provides completely different possibilities, and ASWO Partners and EURAS are also still there…

In this workbook, Mr Alwin Rieseberg (product manager at ASWO Germany), Mr Axel Grychta (ECO GmbH) and I have made a start, and have summarised for you the commonest causes of faults in the LCD technology and their remedies, as well as illustrating important interrelationships, in order to open up this service area to you.

I wish you interesting and enlightening reading.
Your
Reinhard Kösters

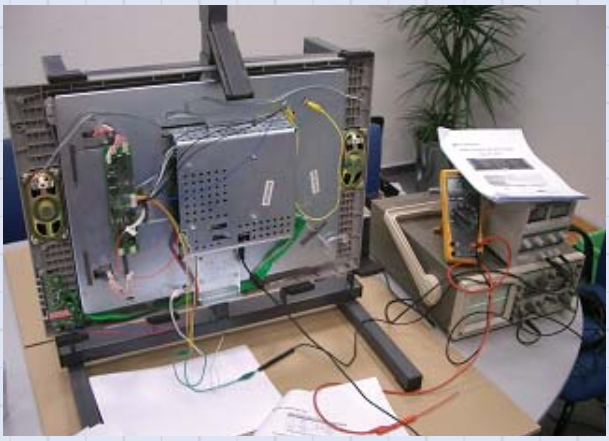
Table of contents

Further information can be found in the ASWO Partners Shop (address see last page)

Introduction

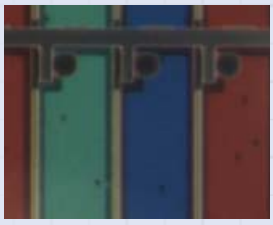
LCD service

The guarantees on the first larger numbers of flat-screen appliances will run out in 2007. The high sales figures prove that we as technicians must concern ourselves forcefully with the service of these appliances. In the past, it has always been said that these appliances very rarely break down if at all, and that repair would be too complicated because of a lack of know-how. However, the large number of repair hints regarding these appliances, which have been received by EURAS from colleagues, and the many repair discussions on the EURAS pin boards tell a completely different tale.



Which faults CANNOT be repaired?

Glass breakage: if the glass of an LCD is broken, the display is irreparably damaged and is no longer usable. However, intact parts can still be removed from the defective panel and used again. ASWO Partners is currently examining the replacement of defective panels with new and refurbished LCD displays.



Pixel faults: pixel faults are production-related and are often unavoidable due to the large numbers of pixels in a display. In order to regulate this for guarantee cases, there is an ISO regulation that specifies how many pixel faults a newly-manufactured display may have without the manufacturer having to take it back. The seriousness of a pixel fault depends on where the fault lies. A defective pixel can light up permanently or appear totally black ('black spot'), for example.

Pixel faults of TFT displays, evaluation according to ISO 13406-2

Pixel faults are caused by faults in the production of the panel, when the transistors that control the pixel are defective. Distinction must be made between a complete pixel failure (either black or white pixel) and a partial pixel failure (sub-pixel faults, one pixel colour no longer reacts).

These principles give rise to the following fault structure and classification of the TFT according to ISO 13406-2:

Fault type 1:
One pixel lights up completely white. Per 1 million pixels/panel are allowed:
Class 1: 0
Class 2: 2
Class 3: 5
Class 4: 50

Fault type 2:
One pixel has completely failed; it is black. Per 1 million pixels/panel are allowed:
Class 1: 0
Class 2: 2
Class 3: 15
Class 4: 150

Fault type 3:
A sub-pixel has failed or lights up permanently. Or: a complete pixel flashes. Per 1 million pixels/panel are allowed:
Class 1: 0
Class 2: 5
Class 3: 50
Class 4: 500

Fault cluster type 1:
Several faults of type 1 or 2 occur in a field of 5 x 5 pixels. Per 1 million pixels/panel are allowed:
Class 1: 0
Class 2: 0
Class 3: 0
Class 4: 5

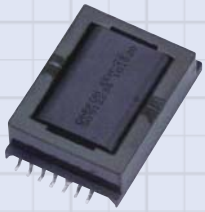
Fault cluster type 2:
Several faults of type 3 occur in a field of 5 x 5 pixels. Per 1 million pixels/panel are allowed:
Class 1: 0
Class 2: 2
Class 3: 5
Class 4: 50

Which faults can be repaired?

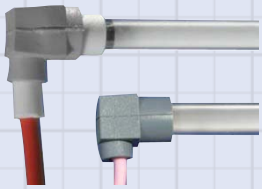
1st Level

External power supply: notebooks, monitors and LCD TVs up to max. 30“ usually have an external power supply. Identifying and exchanging the power supply is absolutely no problem.
Internal power supply: the internal power supply can usually be repaired at component level. Exchanging the power supply circuit board is likewise no problem, provided it can be obtained.

Inverter: the unit which is most commonly defective. If an original inverter is offered as a spare part, the exchange is relatively simple. If an original inverter is not available for the repair, a piezo inverter can alternatively be used.
(See page 13)



SMD transformers: the SMD transformers on the inverter circuit boards are problem parts. It is possible to exchange the transformers if they are available in future (ASWO Partners is currently examining this topic). However, it cannot be ruled out that the replacement transformers will have a different number of windings and a different winding direction. For this reason, differences could occur in the brightness of the CCFL tubes.



CCFL: the CCFL tubes, which serve to illuminate the display, can also be replaced. The service lifetime of such tubes is nowadays over 50,000 hours. The CCFL tubes should be replaced when their brightness is 50 % or less than the original brightness, or if they are mechanically defective.

Complete LCD panels: from a purely technical point of view, replacement is no problem. ASWO Partners is currently examining the price setting for new and refurbished LCD panels.

2nd Level

Scratches on the LCD surface: scratches can be rectified by replacing the polarizer. This process can only be carried out in workshops with special equipment, since amongst others cleanroom conditions are required.

3rd Level

Faulty display: usually in the form of horizontal or vertical stripes on the screen, or a flickering screen. Such so-called ‘lines and blocks’ are caused by defective electronic chips (driver ICs) and can usually only be repaired in workshops with very special equipment.

Work process for the replacement of an inverter

The inductive inverter is currently the commonest required unit in the LCD TV, notebook and LCD monitor service sector. The SMD high-voltage transformers mounted on the inverters are the most sensitive parts. They often become defective, but are usually not obtainable or only obtainable with great difficulty. For this reason we recommend you to replace the defective original inverter by an original or ‘producer’ inverter. If this is not or no longer available, you still have the possibility to install a piezo inverter in order to complete the repair. We will briefly explain or illustrate both procedures here.

Replacement of the original inverter

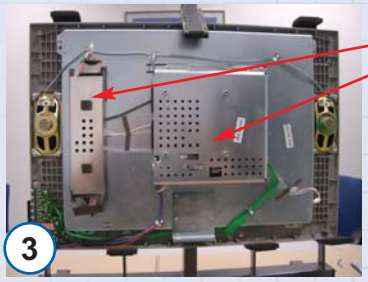
Which tools are necessary:

- cross-head screwdriver
- bit set
- digital multimeter

Acquiring the appliance data

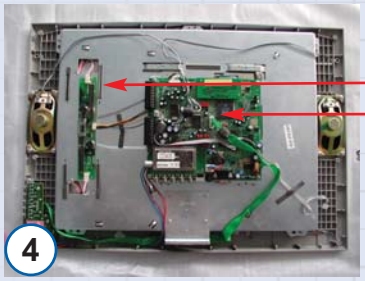
for later ordering of spare parts

Tip: the type of the LCD panel is sometimes to be found on the rear side



Removing the shielding plate

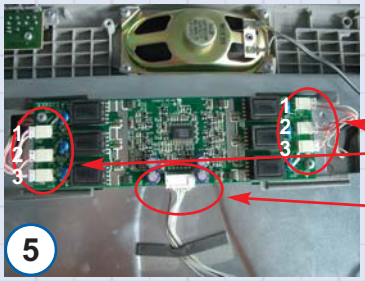
Loosen the shielding plate screws



Identifying the units

1. Inverter
2. Main board

Work process for inverter replacement 1



5

Removing the inverter

Loosen the inverter screws

Unplug connectors 1 - 6 for the CCFL tubes

Unplug the power supply plug 7

6

Where can I find the correct inverter code?

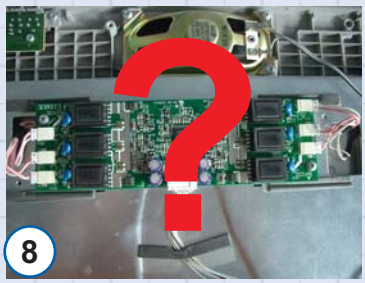
Look for the inverter code on the upper and lower side.

Tip: note as many details as possible (labels and PCBs) to avoid unnecessary enquiries.
(See page 9)

ASWO EURAS
7

How do I find the correct inverter at ASWO Partners/EURAS?

(See pages 10-11)

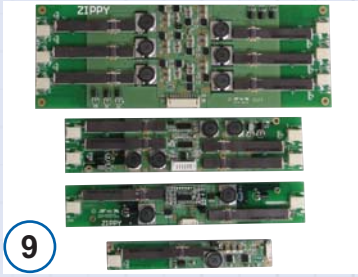

8

Original or producer inverter cannot be supplied?

The piezo inverter – a genuine alternative
(See pages 13-15)

Please note!

Before installing an original/producer inverter, ensure that none of the CCFL tubes are defective. CAUTION: the inverter can be damaged if a CCFL tube is defective! A suitable testing device can be found on page 28.

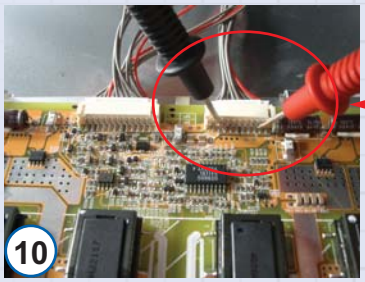


9

Which data do I need in order to identify and install the correct piezo inverter?

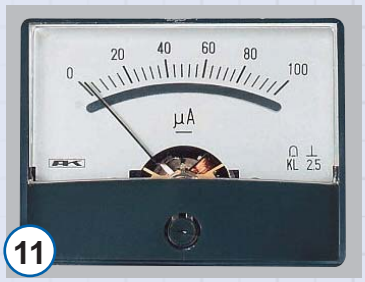
1. Number of CCFL tubes

Where can I find the information?
a) Clearly recognisable after opening the appliance
b) From the LCD panel data sheet
(See page 16)


10

2. Inverter operating voltage

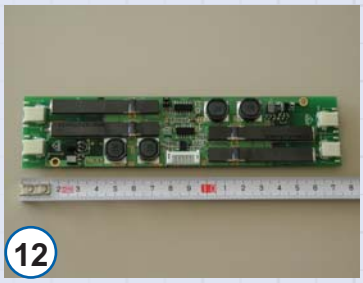
Where can I find the information?
Measure at the inverter input socket
(12 V, 24 V or 36 V?)



11

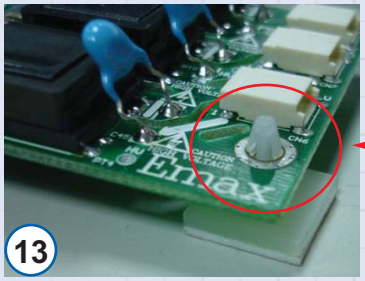
3. CCFL tube current

Where can I find the information?
From the LCD panel data sheet
(5 mA, 6 mA or 7 mA)
(See page 16)


12

4. Determining the dimensions of the piezo inverter

Is there enough space to install the piezo inverter?
The data can be found in the inverter specification in the ASWO Partners Internet Shop under the corresponding article number.

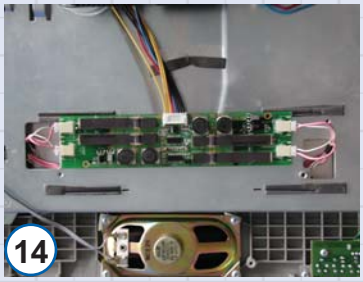

13

Installing the piezo inverter

How can I install the piezo inverter if the mounting holes are not identical?

Use the installation aids
(See page 24)

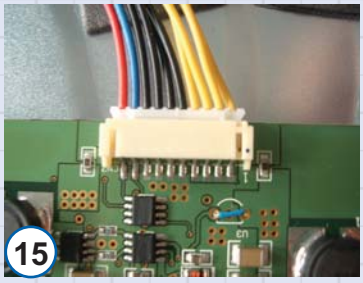
Work process for inverter replacement



How do I connect the CCFL tubes to the piezo inverter?

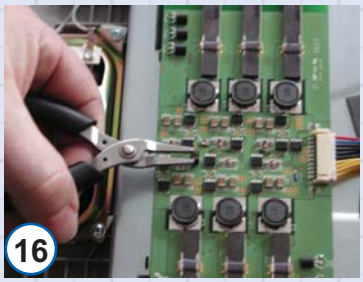
Is the plug identical? Yes - just plug in
No - select the correct adaptor cable

(See page 26)



How do I connect the inverter input plug?

This is no problem with the aid of the connector cable supplied with the inverter. The piezo inverter can be taken into operation quickly, even without dimmer and on/off controller.
The correct connection diagram can be found in the ASWO Partners Internet Shop as a PDF file under the respective piezo inverter.



How do I adjust the lamp current on the piezo inverter?

Two bridges are located on the PCB.

Both bridged = 5 mA (delivery condition)
One bridged = 6 mA
None bridged = 7 mA

How do I fit the shielding plate?

It is no longer necessary to fit the shielding plate, as the piezo inverter has a minimal EMI.

All piezo inverters are certified.

EMI = electromagnetic interference

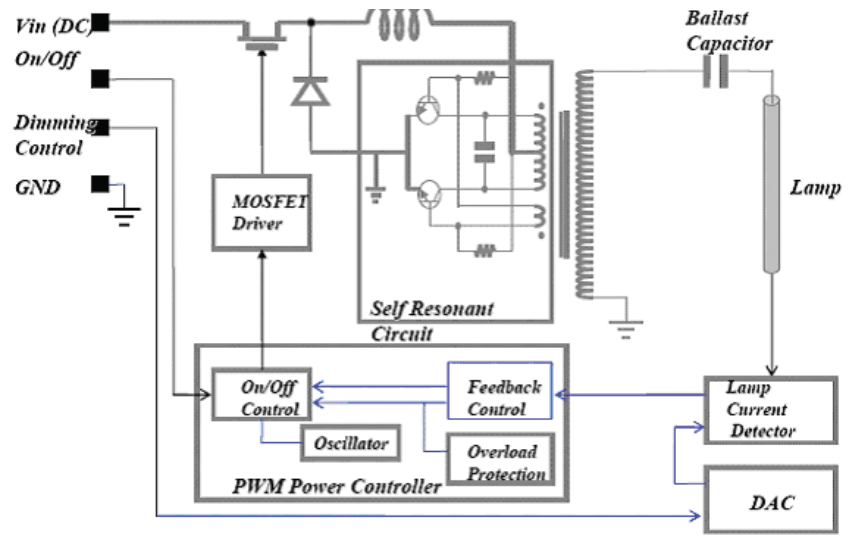
Please note!

Never disconnect the tubes during operation of the piezo inverter. The piezo inverter may otherwise be damaged.

2 The inductive inverter

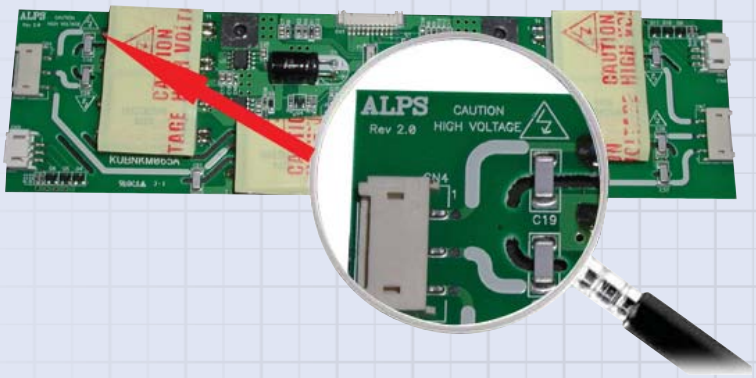
Inverter (inductive)

To put it simply, the inverter serves to convert a dc voltage of normally 12 V, 24 V or sometimes even 36 V into a high frequency (40 – 60 kHz) ac voltage. The size of the ac voltage depends amongst others on the properties of the CCFL tubes and serves initially to ignite the CCFL tubes (1000 – 2000 V) and subsequently to supply the operating voltage for the lamps (400 – 900 V). In practice, the inverter boards are often very much more complex and fulfil a series of additional functions, such as brightness regulation, monitoring of the CCFL tube current with safety switching and frequency regulation for particularly flicker-free illumination.



Block diagram: inductive inverter

Identifying the correct inverter code



If the inverter has been diagnosed as being defective, it is very important when ordering the inverter to quote all relevant identification.

The identification can be found:

- Directly on the PCB (front and/or rear side)
- On a small label (front and/or rear side)

Ordering an inverter on the basis of the appliance type only is not usually possible. Even quoting the details of the LCD panel is insufficient, since the panel manufacturer may have changed to a different CCFL lamp manufacturer and thus also to a different inverter manufacturer within the series.

Furthermore, it must be considered that most boards will have version or revision numbers. For each technical modification of the inverter by the manufacturer (producer of the inverter board), the inverter receives an amended rev. number. Under certain circumstances, this could mean a totally different specification. If these numbers are disregarded and a spare inverter with the same ‘basic description’ but different rev. number is installed, serious consequential faults may occur.

For this reason, we will show you as follows which identification is important and where it can be found.

Inverter codes: what might they look like and where can I find them?

e.g. DARFON

Rear side

REV	Rev. 2G1
Typ	V08914410205

e.g. Type V0.89144.102 05
The first 10 digits of the alphanumeric code are relevant for ordering!
The second digit (0 or K) refers to the RoHS conformity as follows:

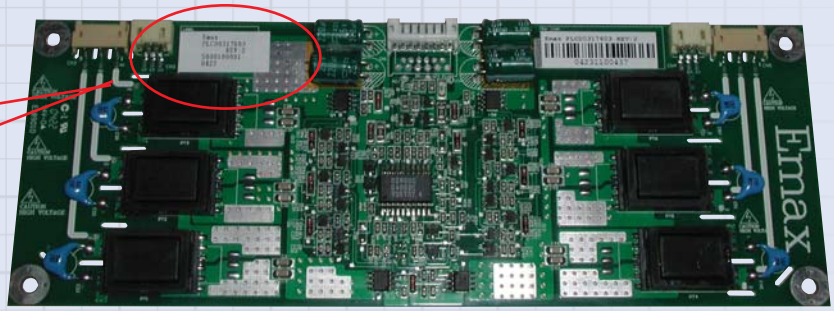
V0.89144.102 05 = does not conform to RoHS
VK.89144.102 05 = conforms to RoHS = same board

Art. No. 871 54 79

e.g. EMAX

Front side

REV	REV: 2
Typ	PLCD0317603



Rear side

REV	REV: 2
Typ	PLCD0317603

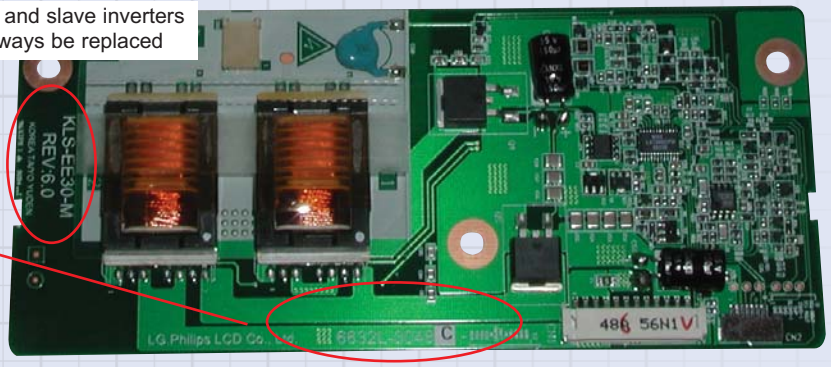
Art. No. 745 25 58

e.g. TAIYO YUDEN

In the case of master and slave inverters both PCBs must always be replaced

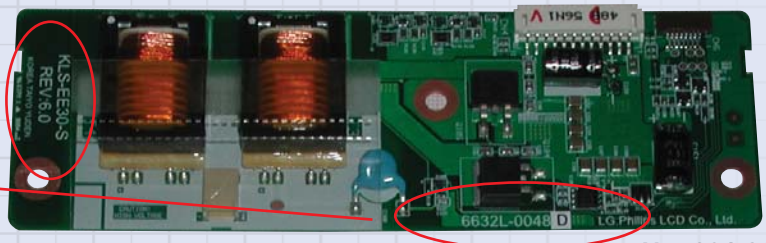
Master

REV	REV: 6.0
Typ	KLS-EE30-M
Typ	6632L-0048C



Slave

REV	REV: 6.0
Typ	KLS-EE30-S
Typ	6632L-0048D

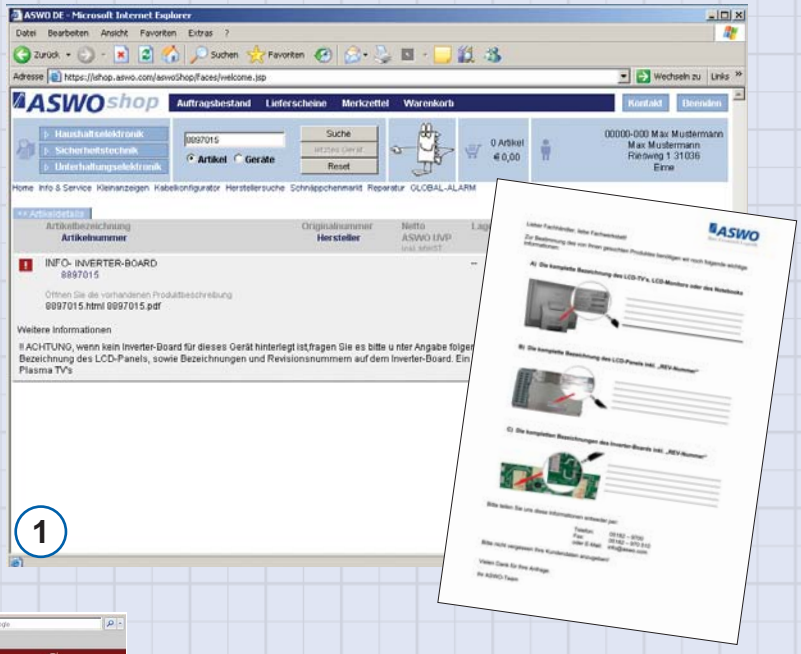


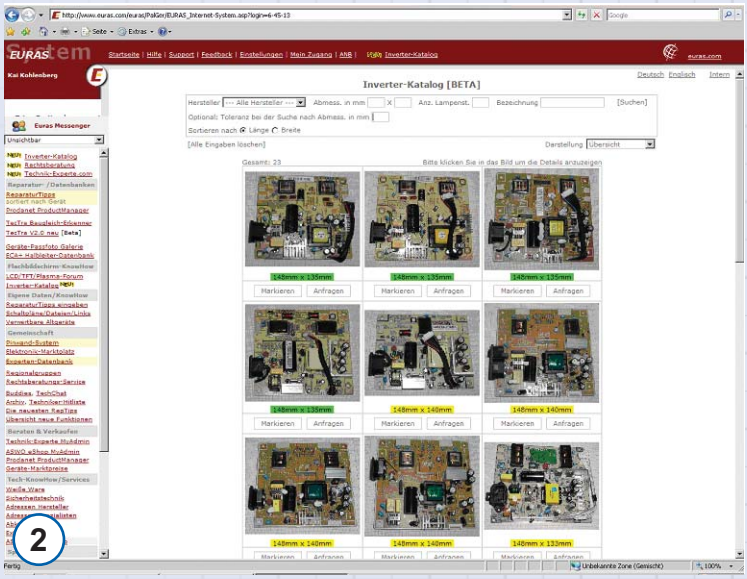
Art. No. 891 80 31

2 The inductive inverter

Ordering the identified inverter through the ASWO Partners/EURAS system

First of all, you can enquire to ASWO Partners in the usual way about the spare inverter – by telephone, e-mail, fax or Internet Shop. We have developed an enquiry form especially for inverter enquiries and have placed it alongside all appliances with LCD/TFT screens. You can call up this form (HTML and PDF file) in the ASWO Partners Internet Shop via the appliance or ASWO Art. No. 889 70 15 and use it to supply us with all necessary data.

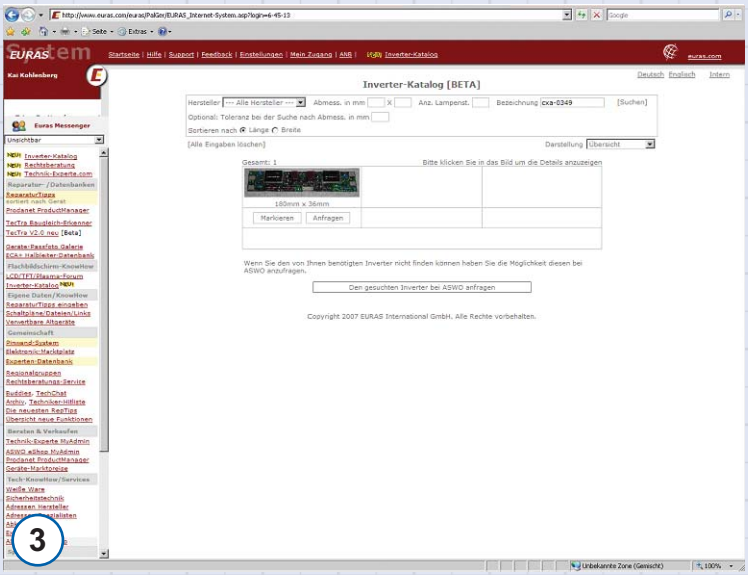


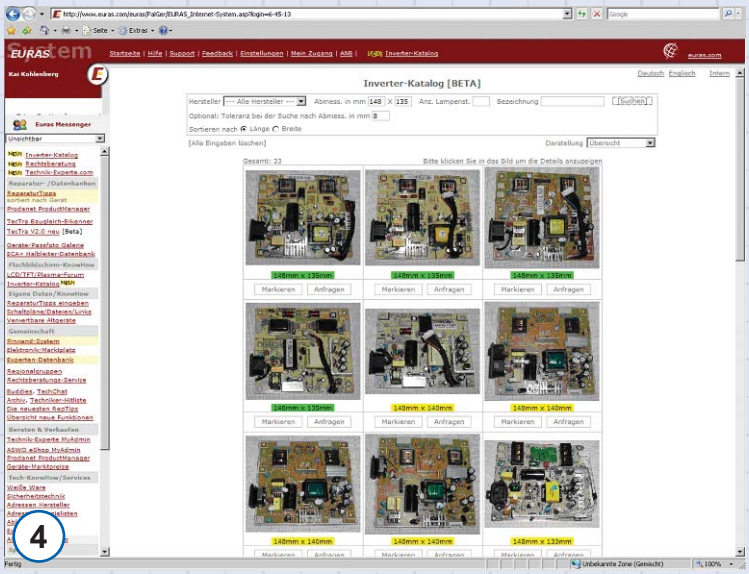


However, if you have not found a suitable inverter, please use the Euras inverter catalogue in the EURAS system at www.euras.com. All of the numbers on the PCBs have been stored for all inverters in the catalogue; you can perform a full text search for them in the database. For example, you can enter the number of the inverter, e.g. CXA-0349, the number of lamp sockets, or the manufacturer, etc. Additionally, it is possible to search for the identification of the transformer on the inverter.

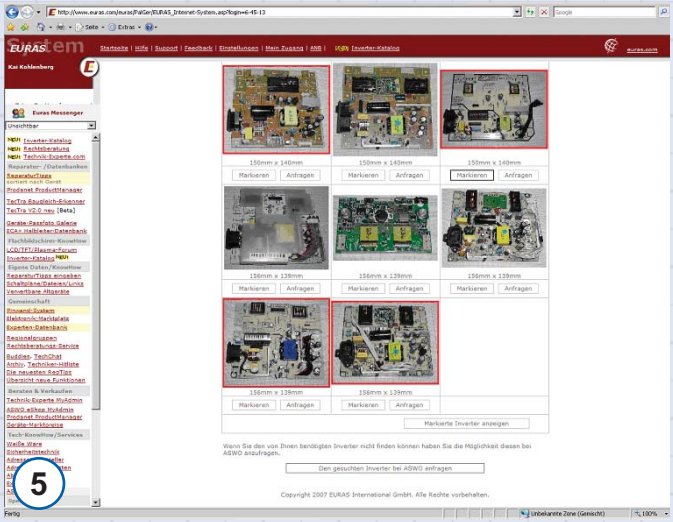
The possibility of filtering according to size is particularly interesting. You simply measure the length and width of your inverter and enter them as search criteria, optionally including a freely-selectable tolerance. The database will show you the hits with a tolerance and sort them sensibly with a colour marking.

Here is an example, entering 148 x 135 mm.

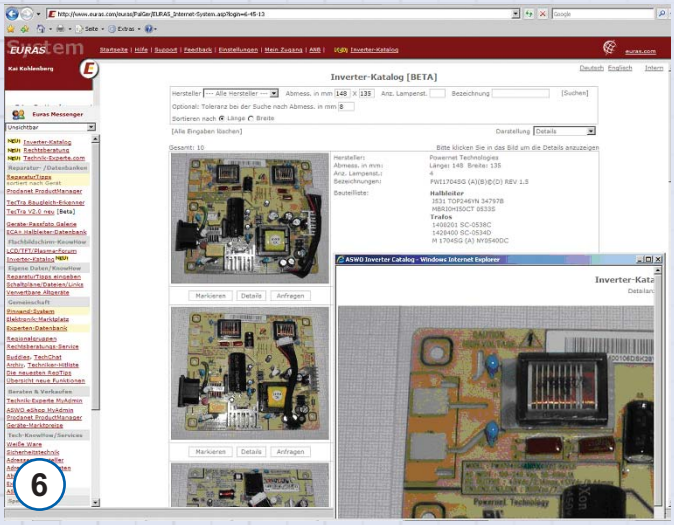




In our example, 23 inverters were found which correspond approximately to these dimensions. In the next step, you can mark all of the inverters that look like the one you are searching for using the ‘Mark’ button (under each inverter picture). Using the button ‘Show marked inverters’, only the inverters which you selected will be shown.



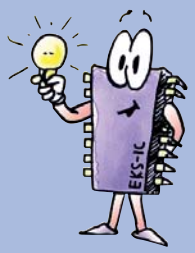
This selection option is very important, because many inverters look almost identical, but have small differences that could be significant to the functional capability of the inverter in the appliance which you are repairing. Within the selection list, you can allow all of the details for each inverter to be shown and also call up a high resolution image of the inverter in order to compare precisely.



If you have found a suitable inverter, you can send us an enquiry about it. All appliance and panel data will then be included in the enquiry, so that all info necessary for searching is available.

Check list for ordering an inverter from ASWO Partners

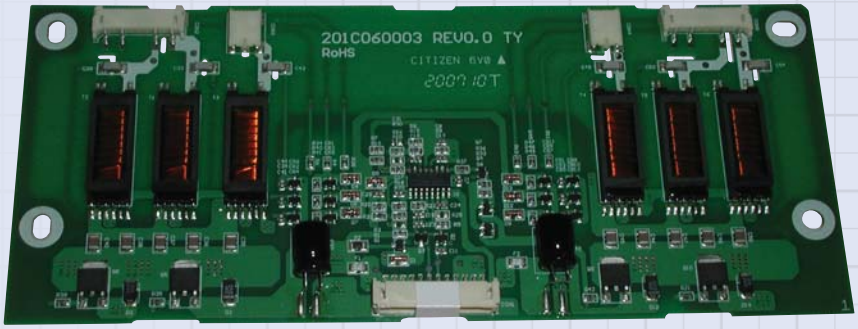
- ☑ Note the complete appliance data (rear side of the appliance)
- ☑ Note the complete LCD panel data (label)
- ☑ Note the complete inverter data (PCB and label)
- ! CAUTION: the data may be located on the front and/or rear side of the inverter



2 The inductive inverter

The current ‘most common’ inverter boards

Inverter for 20” LCD TV with LG-Philips panel



Suitable for original inverter:
Taiyo Yuden KLS-LC201 V02 REV 1
Grundig 275990108000

Art. No. 898 96 53

Inverter for 30” LCD TV with Chi Mei panel

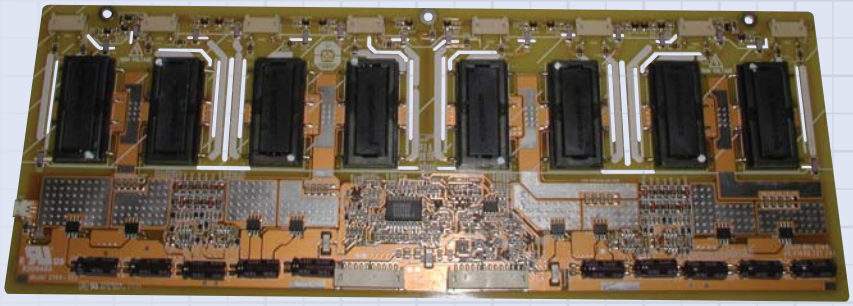
Suitable for original inverter:
Darfon V0.89144.102 Rev. 2G1
Darfon V0.89144.102.05 Rev. 2G1
Darfon V0.89144.102.06. Rev. 2G1
Grundig 275990216900

Label auf der Rückseite

V0.89144.102 Rev 2G1

Art. No. 871 54 79

Inverter for 30” LCD TV with AVO panel



Label on the rear side

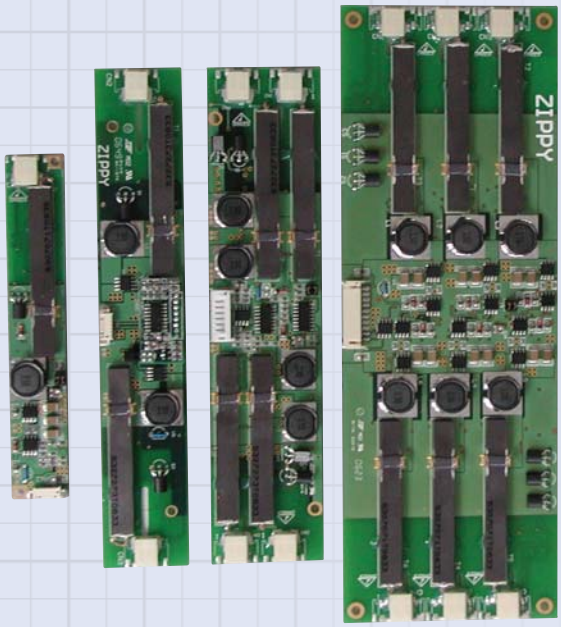
V0.89144.303 Rev 1A

Art. No. 871 57 50

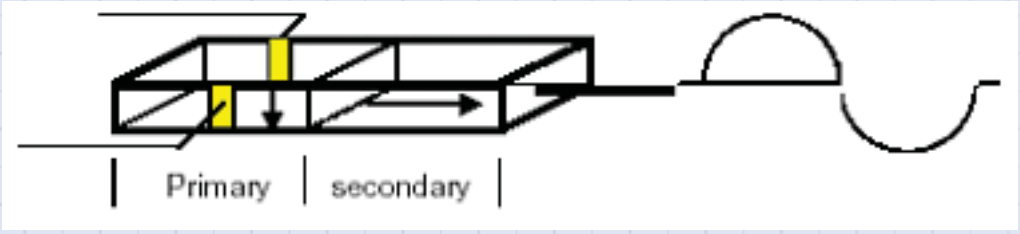
Suitable for original inverter:
Darfon V0.89144.301 Rev. 1A
Darfon V0.89144.301 Rev. 1B
Darfon V0.89144.301 Rev. 1C
Darfon V0.89144.301.04 Rev. 1A
Darfon V0.89144.301.04 Rev. 1B
Darfon V0.89144.301.04 Rev. 1C
Darfon V0.89144.301.05 Rev. 1A
Darfon V0.89144.301.05 Rev. 1B
Darfon V0.89144.301.05 Rev. 1C
Darfon V0.89144.301.06 Rev. 1C
Darfon V0.89144.303 Rev. 1B
Darfon V0.89144.303 Rev. 1C
Darfon V0.89144.303.04 Rev. 1A
Darfon V0.89144.303.04 Rev. 1B
Darfon V0.89144.303.04 Rev. 1C
Darfon V0.89144.701 Rev. 1A
Darfon V0.89144.303 Rev. 1A
Grundig 275990217000

Piezo inverter

LCDs use CCFL tubes as a stable light source for backlighting. The working circuit of the CCFL inverter directly affects the quality of the LCD display. The piezo-electric transformer is suited to CCFL working circuits because the piezo transformer possesses properties that are directly proportional to the load resistance, which adapts itself to the CCFL characteristics, since the resistance of the CCFL drops after ignition. The CCFL tubes require an ignition voltage of over 1000 V to 2000 V, and after ignition their voltage sinks to around one half or one third of the ignition voltage.



Principle of the piezo-electric transformer:
The piezo-electric transformer possesses primary and secondary electrodes on the piezo-electric ceramic. The primary electrode is transversely poled and the secondary electrode longitudinally poled. If an ac voltage is applied to the primary electrode, a strong mechanical vibration is generated due to the 'inverted piezo-electric effect' of the ceramic, and a high voltage can be output by the secondary electrode by reconverting the vibration into energy via the 'direct piezo-electric effect'. The piezo transformer possesses the unique property of being able to output variable voltages.



Safety:
Integrated non-flammable ceramic transformers, automatic output current control function, integrated interrupter and patented arcing protection – if a lamp breaks, the power supply will be disconnected, reducing the risk of fire. The piezo inverter delivers a high ignition voltage to ignite the lamps with a short warm-up time, and subsequently lowers the supply voltage to around 1/3 of the ignition voltage for illumination; this way, the system safety is increased and the service lifetime of the lamps is prolonged.

Compatibility with panels and tubes:
Suitable for all panels and tubes. The voltage output of the piezo transformer is based on the load variables. Several lamps with different lengths can be ignited with a single type of piezo inverter.

Long service lifetime of the CCFL tubes:
The internal resistance of the lamps increases as they get older. In this case – as opposed to the fixed-voltage output of electromagnetic inverters - the piezo inverter outputs a higher voltage in order to maintain the brightness of the CCFL tubes at the same level.

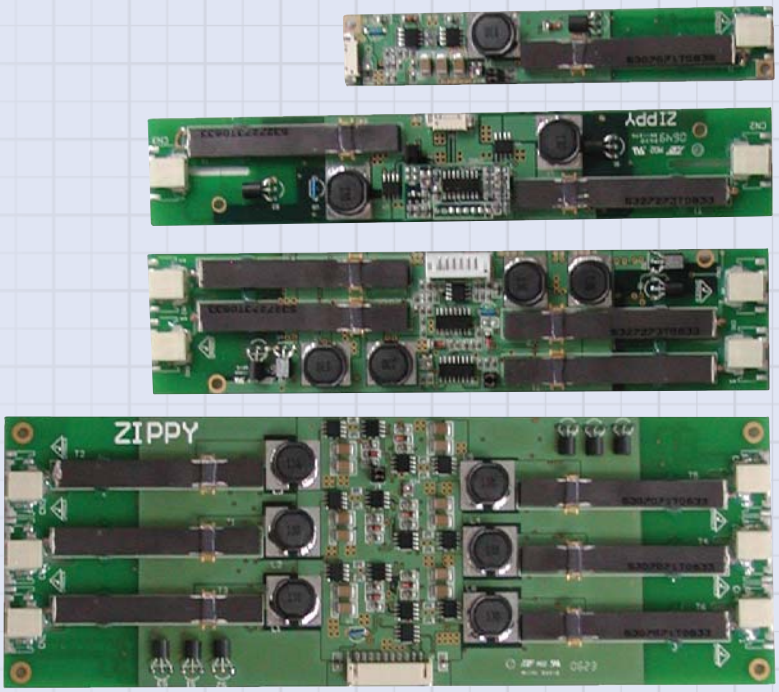
Dimming range: 20~100%

3 The piezo inverter

Cause: defective inverter board. The possibility of exchanging a defective inverter board is now cheaper than replacing the entire LCD panel

Problem: countless varieties of original inverters; appliance manufacturer does not offer the inverter as a spare part, the inverter is not available (because it is no longer produced) etc.

Solution: if the original inverter is not available, then the piezo inverter is a possible alternative!



Dimensions: 120 x 20 mm
1 CCFL tube

Art. No. 898 86 68

Dimensions: 175 x 30 mm
2 CCFL tubes

Art. No. 898 86 71

Dimensions: 175 x 40 mm
4 CCFL tubes

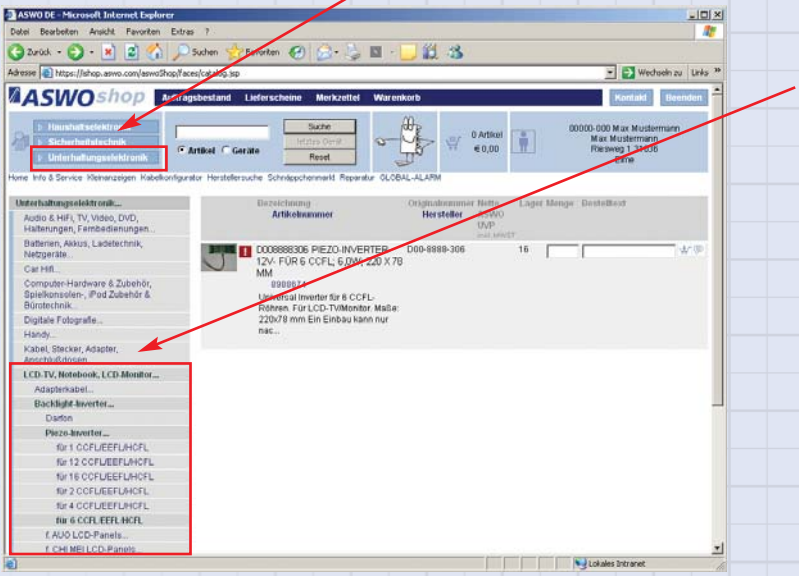
Art. No. 898 86 72

Dimensions: 220 x 78 mm
6 CCFL tubes

Art. No. 898 86 74

How do I find the piezo inverter at ASWO Partners?

Please login to the ASWO Partners Internet Shop /adress se last page) and click on the ‘Entertainment electronics’ button.



... further path

>> Entertainment electronics
>> LCD TV, Notebook, LCD monitor...
>> Backlight inverter...
>> Piezo inverter

Questions & answers on installing the piezo inverter

1 **Question: how can I tell how many CCFL tubes the appliance has?**
Answer: a) after opening the appliance, I may be able to see the number of tubes.
b) I can find the data in the LCD panel specification.
(PDF file available in the ASWO Partners shop – e.g. Art.No. 800 01 07)

2 **Question: where can I find information about the input voltage of the original inverter?**
Answer: the voltage can be simply measured on the original inverter.

3 **Question: how can I determine the CCFL tube current?**
Answer: I can find the data in the LCD panel specification.
(PDF file available in the ASWO Partners shop – e.g. Art.No. 800 01 07)

Questions 1 to 3 must be clarified in all cases, otherwise the clear ordering of a piezo inverter is not possible!

4 **Question: what happens if the current of the CCFL tubes is different?**
Answer: Over 90 percent of all CCFL tubes operate with a current from 5.0 mA to 7.0 mA.
I can set the current using a jumper on the piezo inverter.

5 **Question: CCFL tubes have different ignition and operating voltages.**
Can the piezo inverter generate different voltages?
Answer: YES, the piezo inverter can generate all voltages.

6 **Question: what happens if the plug connections of the original inverter and the piezo inverter are different?**
Answer: ASWO Partners offers corresponding adaptor cables for simple assembly. (See pages 26/27)

7 **Question: do the piezo inverters fit the mounting of the original inverter?**
Answer: Not usually! ASWO Partners offers self-adhesive mounting aids for this purpose. (See page 24)

8 **Question: the shielding plate of the original inverter can no longer be fitted! What do I do?**
Answer: It is NO LONGER necessary to fit the shielding plate, as the piezo inverter has minimal EMI.

9 **Question: which tube sizes can I drive using the piezo inverter?**
Answer: the piezo inverter can drive all tube sizes (diameter and length).

10 **Question: can I also drive EEFL or HCFL tubes with the piezo inverter?**
Answer: YES: besides the commonest CCFL tubes, I can also drive EEFL and HCFL tubes.

11 **Question: are all piezo inverters dimmable?**
Answer: Answer: YES, all piezo inverters have a dimmer input (analogue and PWM).

Question: inverters with small dimensions are built into the new notebooks.
Is there a piezo solution for them too?
Answer: The manufacturers will be offering a solution from July 2007. ASWO Partners will inform you.

12 **Question: can the piezo inverter drive different tube shapes (I-shape, U-shape, C-shape)?**
Answer: YES, the piezo inverter can drive all tube shapes.

13 **Question: where can I find further information?**
Answer: You will find all information in the ASWO Partners Internet Shop under entertainment electronics and the following path: (address see last page)
Entertainment electronics >> LCD TV, Notebook, LCD monitor >> Know-how

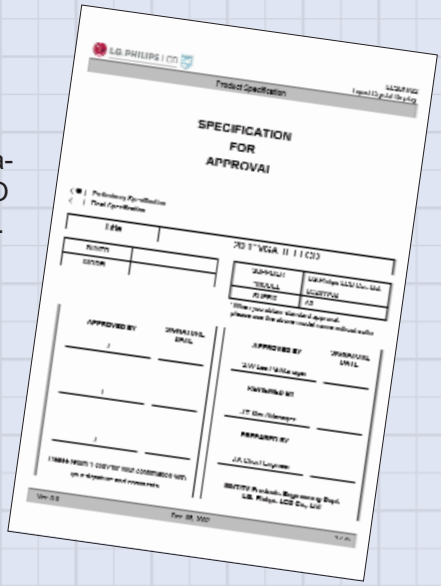
3 The piezo inverter

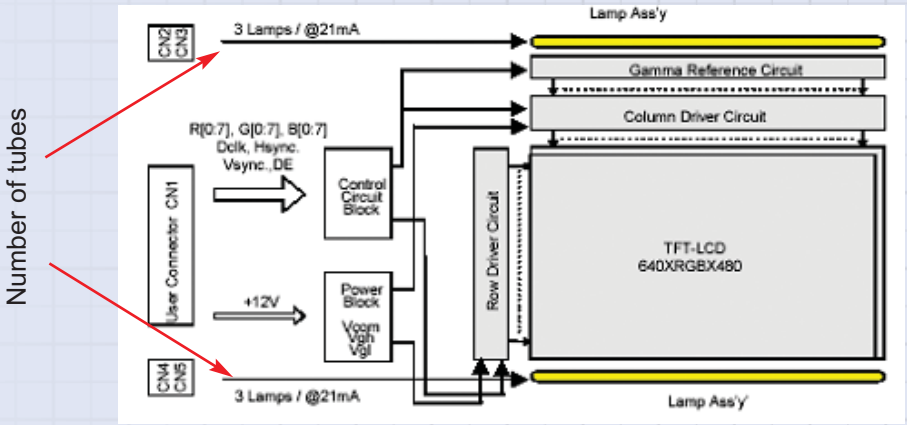
Where can I find important information on the installation of the piezo inverter?

Specification of the LCD panel

Determining the number of CCFL tubes from the PDF file

First of all, it is important to obtain the PDF file containing the technical data relating to the panel. The PDF files can be found amongst others in the ASWO Partners Internet Shop (adress see last page) under the LCD panel identification. We will show you this using the Samsung LC201V02 LCD panel as an example.

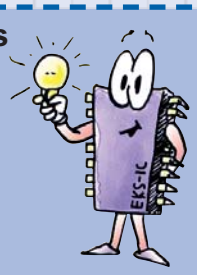




Determining the CCFL tube current from the PDF file

Parameter	Symbol	Values Min.	Typical	Max.	Unit
Operating voltage	V_{BL}	700(7,5 mA)	720(7 mA)	825(3 mA)	V_{RMS}
Operating current	I_{BL}	3,0	7,0	7,5	mA_{RMS}
Measured start-up voltage	V_S				
at 25°C				1,100	V_{RMS}
at 0°C				1,430	V_{RMS}
Operating frequency	F_{SL}	40	50	60	kHz
Discharge stabilisation time	T_S			3	Min
Power consumption	P_{BL}		30,24	33,27	Watt
Service lifetime		50,000			Hrs

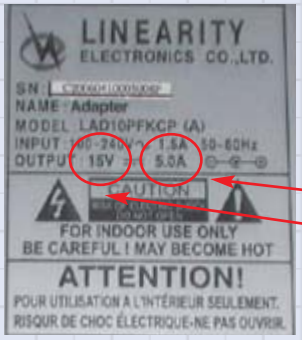
Check list for the installation of a piezo inverter from ASWO Partners



- ☑ First download the LCD panel specification from the ASWO Partners Internet Shop
- ☑ Check the installation dimensions from the data sheets for the piezo inverter
- ☑ Determine the number of CCFL tubes (in the appliance or from the LCD panel specification)
- ☑ Determine the CCFL lamp current (in the appliance or from the LCD panel specification)
- ☑ Determine the operating voltage of the original inverter by measuring at the input socket

External power supplies for LCD TVs and LCD monitors

External power supplies are primarily used for LCD TVs and LCD monitors with small and medium diagonal display sizes. The commonest voltages are 12 V, 14 V, 15 V and 24 V, whereby the 24 V version is primarily used for LCD TVs with diagonal screen sizes > 20". With regard to power, the models which are mostly produced are 50W, 80 W and 120 W.



How do I identify the power supplies?

Determining the current and voltage specifications

Please take the corresponding current and voltage specifications from the rear side of your power supply.

Identifying the connecting plug on the output side

The following types cover more than 90 % of the market for the plug variants on the secondary side.

4 Pin

10 mmm

Hollow plug with centre pin

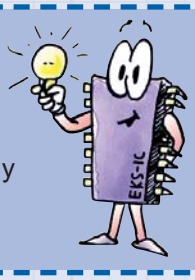
6,5 x 4,5 mm

Hollow plug

5,5 x 2,1 mm
5,5 x 2,5 mm

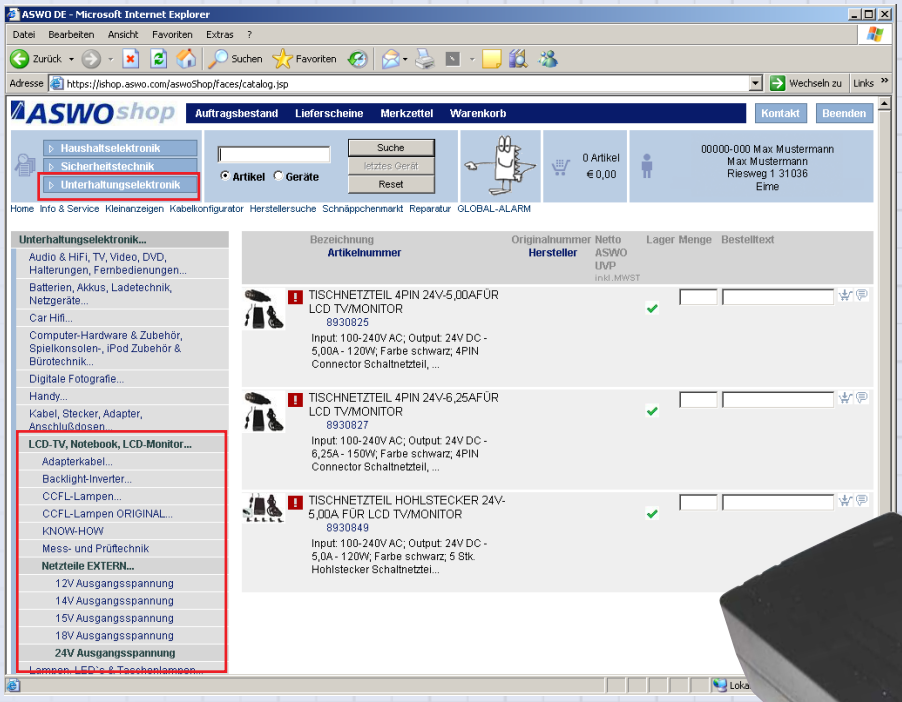
Check list for ordering from ASWO Partners

- ☑ Determine the output voltage of the external power supply
- ☑ Determine the maximum output current of the external power supply
- ☑ Identify the type of plug on the secondary side



4 External power supplies

Where can I find external power supplies at ASWO Partners?



Please login to the ASWO Partners Internet Shop (adress see last page)

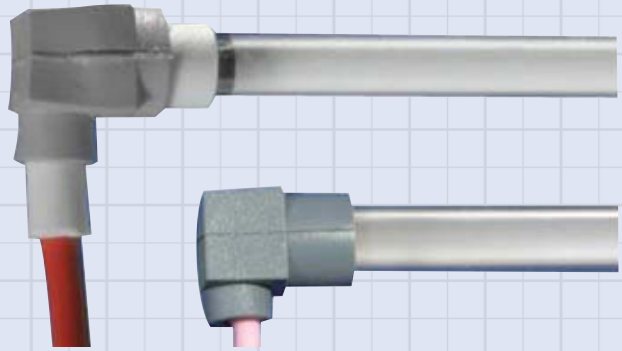
You will find the required power supplies under entertainment electronics and the following path:

>> LCD TV, Notebook, LCD monitor
>> External power supplies

Table power supplies for LCD TVs and LCD monitors

Plug view	Plug	Output (VDC)	Current (A)	Power (W)	Art. No.
	4-pin 10 mm	12	6,66	80	**893 08 15**
		14	8,57	120	**893 08 22**
		15	5,33	80	**893 08 23**
		24	5,00	120	**893 08 25**
			7,50	180	**907 08 27**
	Hollow plug 4.8 x 1.7 mm 5.5 x 1.7 mm 5.5 x 2.1 mm 5.5 x 2.5 mm 6.3 x 3.0 mm	12	4,16	50	**893 08 32**
			6,66	80	**893 08 35**
		15	5,33	80	**893 08 45**
		24	5,00	120	**893 08 49**
	with centre pin 6.5 x 4.5 mm	12	3,33	40	**893 08 53**
			6,66	80	**893 08 60**
		14	4,28	60	**893 08 62**

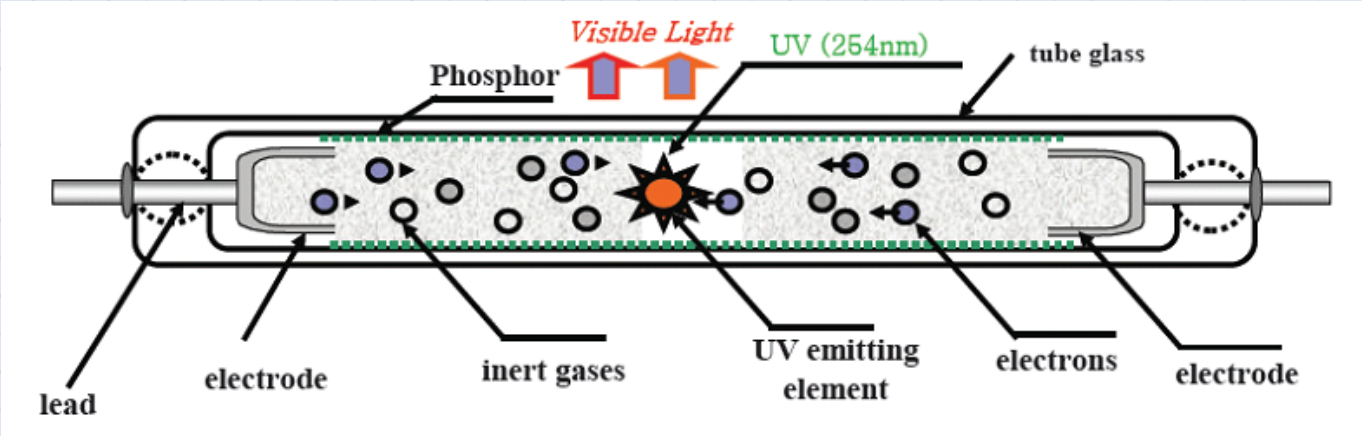
CCFL = Cold Cathode Fluorescent Lamp



CCFL tubes are used above all for the backlighting of the colour LCD displays of notebooks and portable electronic appliances, because they have the highest currently available efficiency for illuminating displays. CCFL tubes require high frequency ac voltage for operation (400 – 900 V), therefore an inverter must also be used.

Functional principle

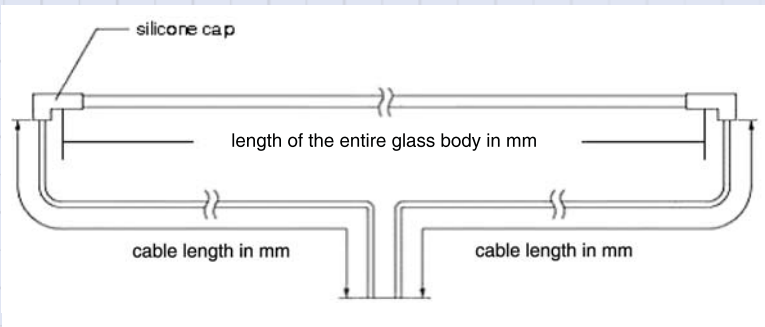
One can imagine a CCFL tube as being a 'small fluorescent tube' with an enormous lighting power. It is comprised of a thin glass tube containing mercury, phosphor and a noble gas mixture (neon or argon). Soldered connections to a silicone cable are usually to be found at both ends (cathodes). If a high frequency ac voltage is applied to the lamp (40 – 60 kHz), a strong electrical field is generated in which gas discharge takes place. The lamp is ignited. The electrons emitted from the electrode due to the electrical field (field emission) are accelerated on their way to the opposite electrode and collide with the gas atoms. Step ionisation takes place, whereby the existing gaseous mercury atoms are excited by the collision. As a result, the now instable electrons of the excited atoms give off their absorbed energy again – in the form of ultraviolet light with a wavelength of 253.7 nm. Ultraviolet light in turn activates the phosphor inside the tube - the result is visible light.



How do I identify the CCFL tube?

ASWO Partners has already adopted several CCFL tubes in various diameters and lengths into its product range. All CCFL tubes are already prefitted with a connecting cable at both ends. The silicone caps mounted on both ends of the tube protect the sensitive electrodes against damage.

To order the CCFL tube from ASWO Partners, you just need the diameter, length and shape of the lamp.



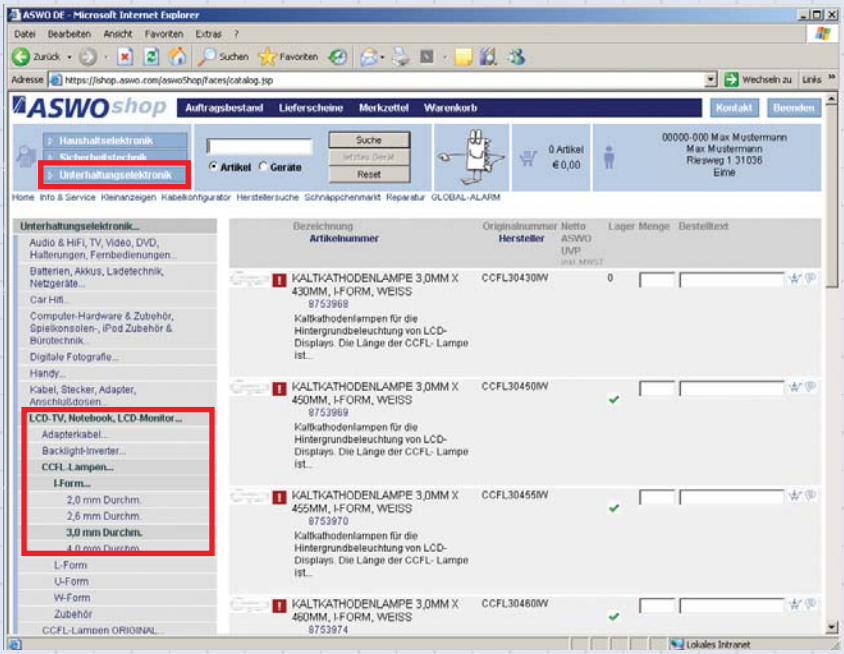
5 The CCFL tube

Where can I find CCFL tubes at ASWO Partners?

Please login to the ASWO Partners Internet Shop (address see last page)

You will find the required tube under entertainment electronics and the following path:

>> LCD TV, Notebook, LCD monitor
>> CCFL lamps



We have specified the following criteria for fast searching:

CCFL XX XXX X X

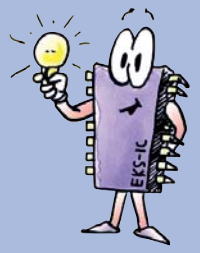
General description	Diameter in mm (excluding ".")	Length in mm	Shape	Colour

Shape: I = straight, U-shape, C-shape, W-shape, L-shape
Colour = W = white

Search example e.g. Art. No. 875 39 69: **CCFL 30 450 I W** (enter without spaces)

Check list for ordering a CCFL tube from ASWO Partners

- ☑ Determine the shape of the CCFL tube (usually I-shape)
- ☑ Determine the diameter of the CCFL tube
- ☑ Determine the length of the CCFL tube
  (The selected tube may vary in size,
  it can be up to 5 mm shorter, but not longer)



We can presently offer the following sizes of CCFL tubes:

CCFL Ø 2,0 mm

Length Glass body	Art No.
250 mm	**875 39 43**
258 mm	**875 39 45**
290 mm	**875 39 47**
300 mm	**875 39 48**
305 mm	**875 39 49**
310 mm	**875 39 50**
315 mm	**875 39 51**
324 mm	**875 39 52**
334 mm	**875 39 60**

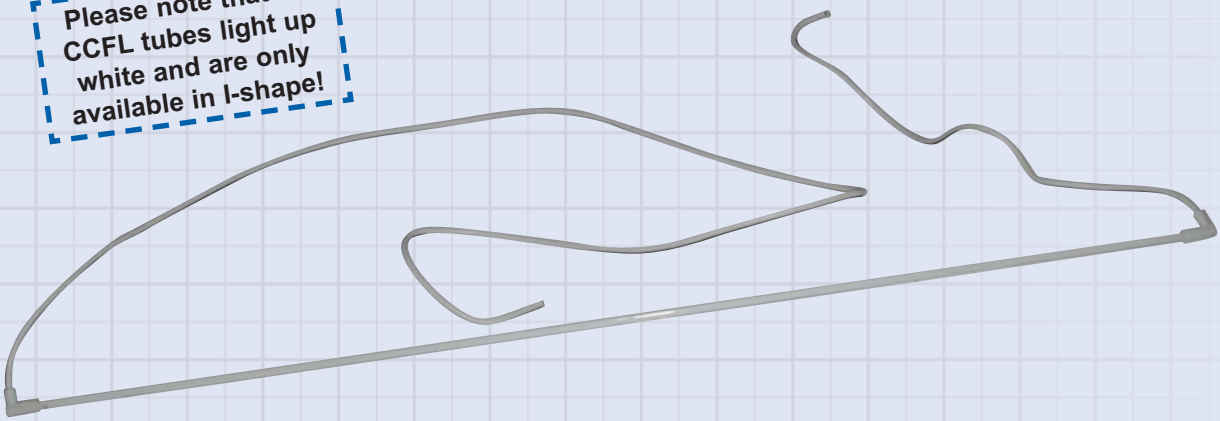
CCFL Ø 2,6 mm

Length Glass body	Art No.
250 mm	**875 39 53**
285 mm	**875 39 54**
300 mm	**875 39 55**
310 mm	**875 39 58**
315 mm	**875 39 59**
345 mm	**875 39 61**
355 mm	**875 39 62**
361 mm	**875 39 63**
390 mm	**875 39 66**
430 mm	**875 39 67**

CCFL Ø 3,0 mm

Length Glass body	Art No.
430 mm	**875 39 68**
450 mm	**875 39 69**
455 mm	**875 39 70**
460 mm	**875 39 74**
465 mm	**875 39 88**
472 mm	**875 39 89**
500 mm	**875 39 90**
520 mm	**875 39 91**
659 mm	**875 39 92**
665 mm	**875 39 94**
670 mm	**875 39 95**
722 mm	**875 39 96**

Please note that all CCFL tubes light up white and are only available in I-shape!



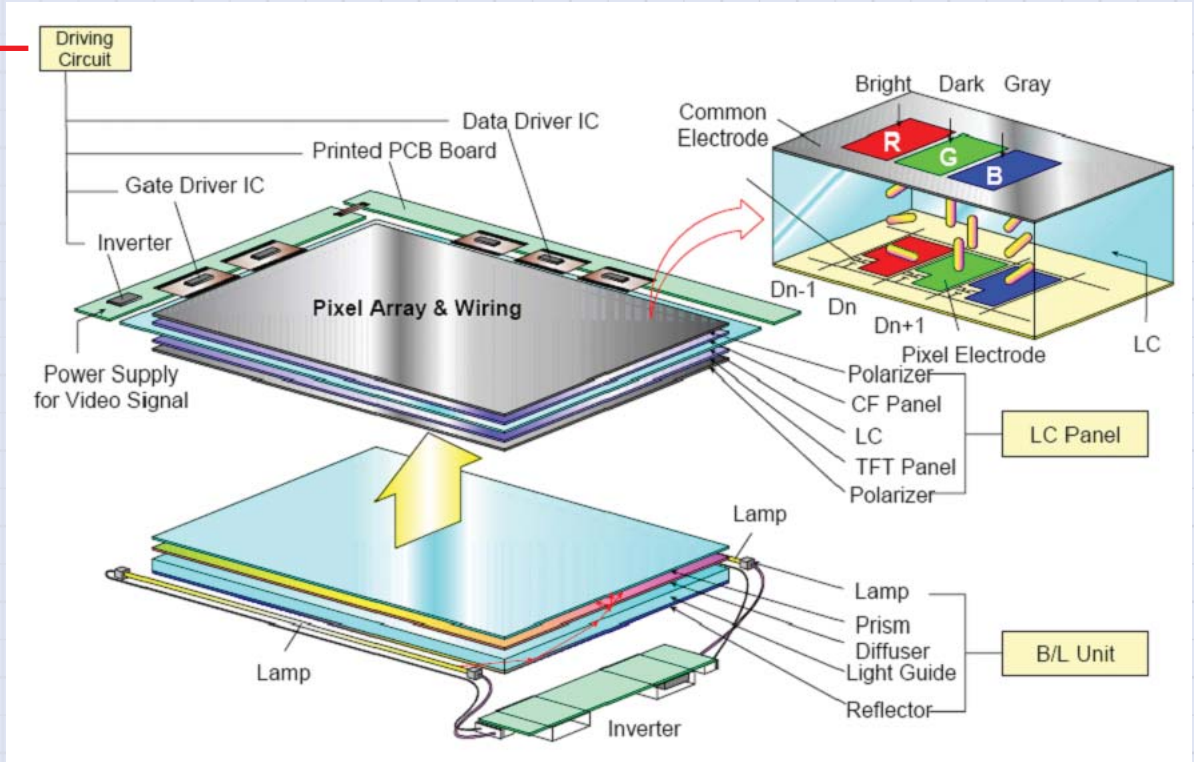
CCFL backlighting of a 32“ LCD panel

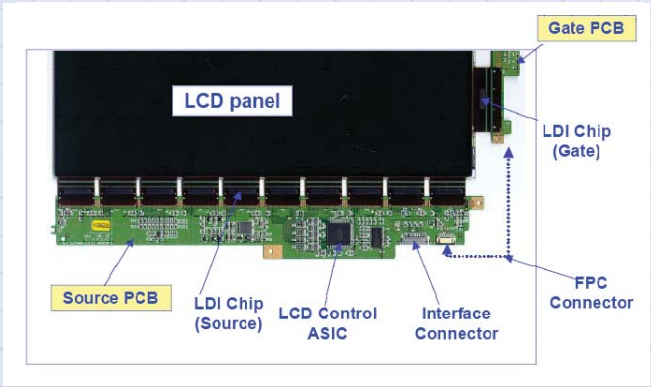
6 The LCD panel

Functional method of the LCD panel

The abbreviation LCD stands for liquid crystal display. In LCD panels, pixels are formed by chambers – one pixel per chamber – which are trapped between two glass plates. White light shines onto the glass plate from behind. The liquid crystals are located in the chambers, into which one electrode leads per pixel. The liquid crystals have the property of letting more or less light through depending on the size of the voltage on the electrode. However, due to the white backlighting, we initially have only a black and white picture. So how we bring the colour into the LCD panel? The construction of the LCD panel is naturally not quite as simple as we have described it here. There is a further layer between the glass plates. In this layer, there are 100 so-called sub-pixels per pixel, which contain the primary colours red, blue and green. The sub-pixels form a striped structure inside the square 'main pixel'. The filters are in turn controlled electrically and perform a corresponding colour filter function depending on the applied voltage. This construction is also known as TFT (thin film transistor).

In summary: first of all, the brightness for the white backlighting is varied by the 'main pixel' by means of the voltage applied to the liquid crystals. The 'main pixel' is then assigned its corresponding colour via the colour filter layer. This takes place by activating one of the filters in the three primary colours, red, blue or green in the striped structure of its sub-pixels by means of applying a voltage.





Driving Circuit

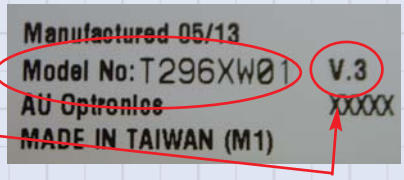
When ordering a panel, we require the following information:
Panel type + version or revision no.

Identification of LCD panels

It should be remembered here that not only the type of the panel plays an important part, but also the version or revision numbers. Every change of version or revision number is brought about by a change/modification to the LCD panel.

AU Optronics (AUO)

Type	**T296XW01**
Version	**V.3**



Further examples:

Type	Version
A201SN01	V5
B152EW01	V1
M170EG01	V6
T370HW01	V2

Chi Mei (CMO)

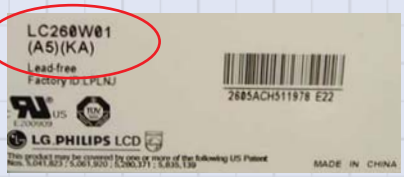
Type	**V296W1 - L14**
Version	**Rev. C2**

Further examples:

Type	Version
M170E5 L09	Rev. C1
N141X6 L06	
V270W1 L04	REV C4

LG-Philips

Type	**LC260W01 (A5)(KA)**

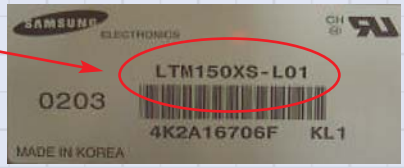


Further examples:

Type	Version
M170E5 L09	Rev. C1
N141X6 L06	
V270W1 L04	REV C4

Samsung

Type	**LTM150XS - L01**



Further examples:

Type
LT170E2 131
LTA260W1 L03
LTI460WT L13
LTM240M1 L02 A05
LTN170WX L05

Sharp

Type	**LQ315T3LZ28**

7 Workshop and repair aids

Workshop & repair aids for LCD and Plasma appliances

New requirements for working tools have arisen due to the servicing of flat-screen TVs. We can distinguish between repair, protection, transport, storage and dispatch. In view of the fact that, ultimately, many appliances can actually be repaired locally by specialists, it is necessary to make suitable tools available in order to transport the appliance safely from the customer's home to the workshop, to work on it professionally there or to place it temporarily into storage, and to return it to the customer. In the past, consideration was always given to the possibility of repairing the appliance at the customer's home (because of transport difficulties). Based on the experiences which colleagues have had so far, this does not appear to be an option. Professional working, test runs etc. are also essential here, and it is better if this is carried out in the workshop, where all necessary tools, measuring instruments and information systems are available. The dispatch of the entire appliance to a central workshop or specialist will certainly be necessary from time to time, but priority should still be given to a local solution.

>> Protective transport hood

- Protects against scratches, rain etc.
- Suitable for screens from 32 to 42 inches

Art. No. 911 22 33

>> Knitted gloves

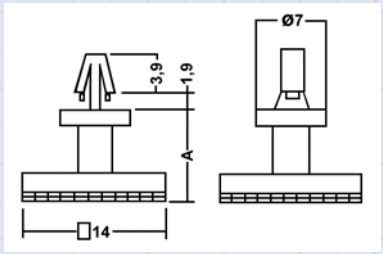
- Ideally suited for the transport or assembly of large LCD, TFT and plasma appliances
- Clean working without fingerprints
- Non-slip nubby palms
- Made from breathable cotton-polyester mix

Size 7
Art. No. 867 42 45

Size 9
Art. No. 984 87 07

>> Mounting aids

- For fixing the piezo inverter to the panel
- Contents: 10 pieces/pack



A = 6 mm mounting height
Art. No. 916 44 62

A = 12 mm mounting height
Art. No. 916 44 66

>> Cotton gloves

- Special gloves for handling sensitive electronic components
- No destruction due to sweating handd
- Safe gripping of tools, components and mounting materials

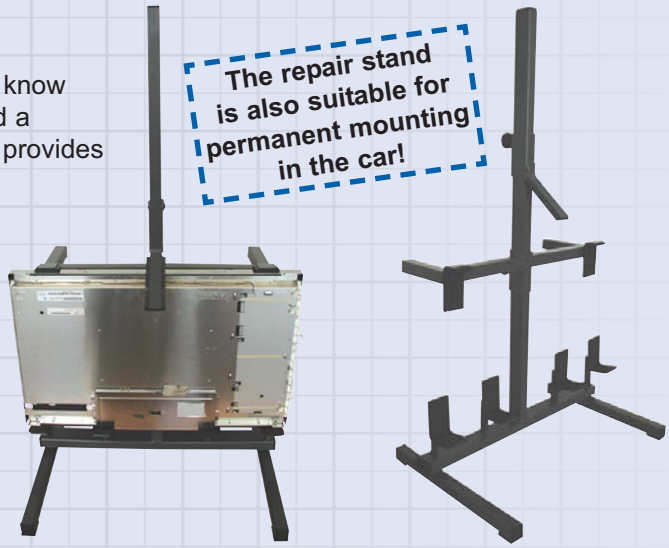
Art. No. 42 30 02

>> Repair stand – for repairs

If you have already dealt with these appliances, then you know all about it. They may look good on the wall, but you need a ‘third hand’ when you’re repairing them! This repair stand provides help quickly.

- Stable, solidly constructed
- Foldable with one hand
- For horizontal and vertical repairs
- Cushioned with durable foam
- Suitable for appliances from 21” to 60”

Art. No. 899 88 77



>> Stores system stand – for storage

Are you also familiar with this problem? Your customer brings you a TFT/LCD or plasma appliance for repair. But where to put it when you’re not working on it, or if you’re waiting for it to be collected? Just placing it against the wall is much too risky. It could tip over and be severely damaged or the display could be scratched

- Exclusively for storage
- Stable, solidly constructed
- With cushioned tray and cushioned retaining clamp
- Suitable for appliances from 21” to 60”

Art. No. 899 88 66

>> Dispatch system

You get the transport solution ready-assembled, packed in an outer carton, delivered. Naturally with instructions and safety warnings on the outside.

- Suitable for appliances from 32 to 42 inches
- Up to max. 35 kg in weight
- The appliance stands in a hi-tech transparent foil
- If the appliance is fixed between the two foil bearers, it is floatingly supported in all directions
- Can be used many times over for appliances of different sizes
- Complete with sealing material,no additional tools necessary

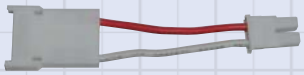
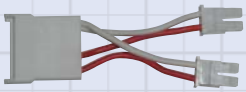
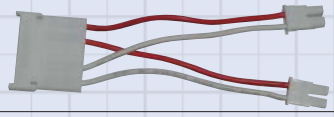
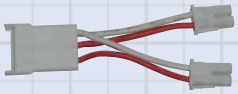
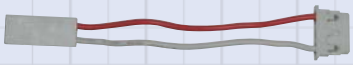
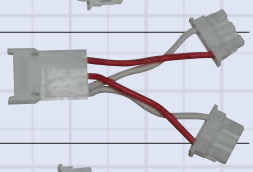
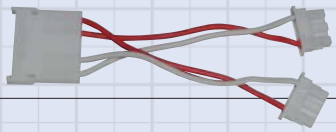
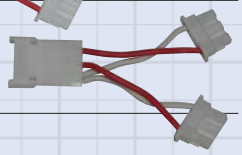
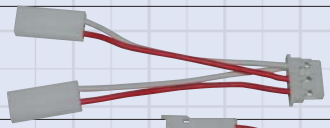
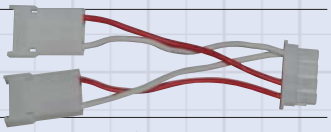
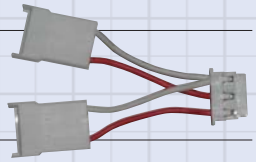
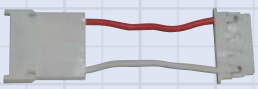
Art. No. 977 88 99

The belt and clamp systems and the skids can be re-ordered:

Pallet skid (1 piece)	Art. No. 906 69 91
Belt set	Art. No. 906 69 93

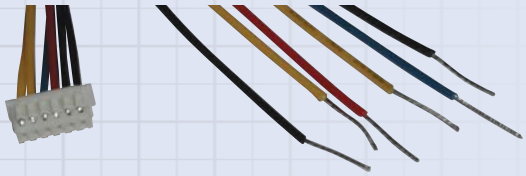
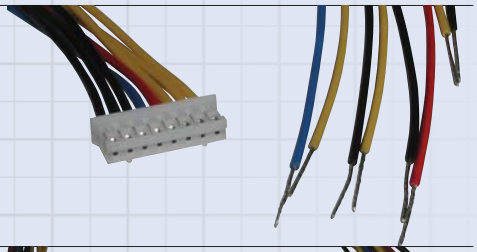
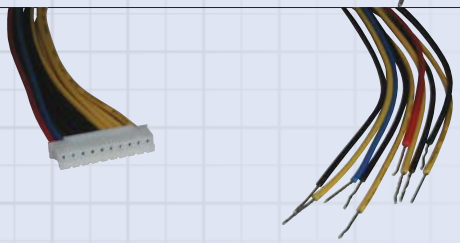
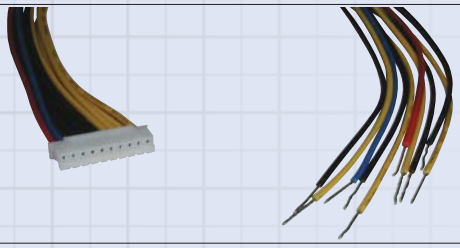
7 Workshop and repair aids

>> Adapter cables from the inverter to the CCFL lamp

IN sizes/mm	Number of pins	OUT sizes/mm	Number of pins	Length	Art. No.	
13,1 x 3,7	2	7,5 x 3,2	2	60 mm	**900 81 72**	
17,1 x 3,7	3	7,5 x 3,2	2x2	60 mm	**900 81 85**	
21,1 x 3,7	4	7,5 x 3,2	2x2	80 mm	**900 81 89**	
13,1 x 3,7	3	7,5 x 3,2	2x2	60 mm	**900 81 93**	
7,5 x 3,7	2	13,8 x 13,2	2	90 mm	**900 81 94**	
17,1 x 3,7	3	13,8 x 3,2	2x2	60 mm	**900 81 97**	
21,1 x 3,7	4	13,8 x 3,2	2x2	85 mm	**900 81 98**	
13,1 x 3,7	3	13,8 x 3,2	2x2	60 mm	**900 82 00**	
7,5 x 3,7	2x2	17,8 x 3,2	3	80 mm	**900 82 01**	
13,1 x 3,7	2x2	17,8 x 3,2	3	80 mm	**900 82 02**	
7,5 x 3,7	2x2	13,8 x 3,2	3	80 mm	**900 82 03**	
13,1 x 3,7	2x2	13,8 x 3,2	3	60 mm	**900 82 04**	
17,1 x 3,7	2	17,8 x 3,2	2	60 mm	**900 82 05**	
13,1 x 3,7	2	17,8 x 3,2	2	60 mm	**909 12 49**	

Adaptor set (one of each of the above-listed adaptor cables) **909 12 49**

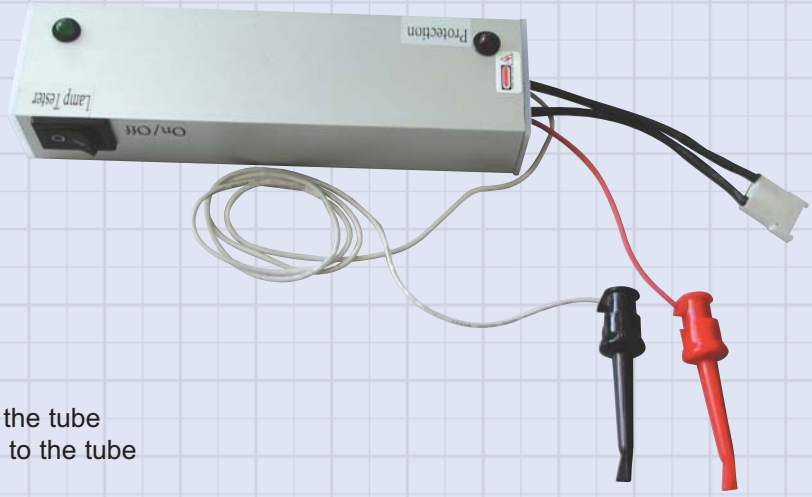
>> Adapter cables from the inverter to the power supply

Sizes/mm	Pins	Pin spacing	Lamps	Length	Art. No.	
9,3 x 3,2	6	1,25	1+2	300 mm	**900 82 07**	
17,6 x 4,4	8	2,0	4	300 mm	**900 82 12**	
21,6 x 4,4	10	2,0	6	300 mm	**900 82 14**	
25,6 x 4,4	12	2,0	12	300 mm	**911 45 26**	
Cable set (one of each of the above-listed cables)					**909 12 55**	

7 Workshop and repair aids

>> Lamp tester for CCFL, EEFL and HCFL tubes

- For testing CCFL/EEFL/HCFL tubes for LCD backlighting
- Dimensions 140 x 38 x 25 mm
- Input: 12 V DC (plus pole on the centre pin)
- Output: variable high voltage AC (dependent on the connected tube)
- Power supply not included! Suitable power supply: Art. No. 984 86 83



LED display:
Green LED lights = ON
Green LED does not light = OFF
Red LED lights = unsatisfactory connection to the tube
Red LED does not light = optimum connection to the tube

CAUTION:
Disconnecting the tube when the tester is operating should be avoided at all costs. Disconnection during operation can lead to damage to the device.

Art. No. 909 12 57

Reference list of inverter boards (as of May 2007)

Inverter code	For manufacturer	Art. No.
1003711	Universum	8715479
3108743	Universum	9017048
8003001	SEG	8715782
30037626	Vestel	8715479
30037627	Vestel	8715782
30043172	Vestel	8989847
2714240004	Toshiba	8715479
2714240016	Toshiba	8715479
275990195200	Grundig	8715782
275990216900	Grundig	8715479
275990217000	Grundig	8715750
996500038221	Philips	8715750
6632L-0048C-REV6.0	Taiyo Yuden	8918031
6632L-0048D-REV6.0	Taiyo Yuden	8918031
6632L-0066B	Taiyo Yuden	8918032
6632L-0067B	Taiyo Yuden	8918032
6632L-0106A	TDK	8918042
6632L-0107A	TDK	8918042
6632L-0117H	Taiyo Yuden	8918026
6632L-0118H	Taiyo Yuden	8918026
6632L-0120E	Taiyo Yuden	8918027
6632L-0121E	Taiyo Yuden	8918027
6632L-0189A	Taiyo Yuden	8918035
6632L-0190A	Taiyo Yuden	8918035
6632L-0191A	ALPS	8918039
6632L-0192A	ALPS	8918039
6632L-0193A	Taiyo Yuden	8918041
6632L-0194A	Taiyo Yuden	8918041
6632L-0201B	Taiyo Yuden	8918040
6632L-0202B	Taiyo Yuden	8918040
6632L-0211A	Taiyo Yuden	8918037
6632L-0212A	Taiyo Yuden	8918037
6632L-0213A	Taiyo Yuden	8918043
6632L-0214A	Taiyo Yuden	8918043
AB-A501-7	divers	9017042
AB-A501-7-01	divers	9017043
AB-A502-16	divers	9017044
AB-A504-17	divers	9017046
AB-A504-18	divers	9017047
AI-0021	divers	9064897
AI-0059	divers	9064898
AI-0067	divers	9064899
AI-0068	divers	9064900
AI-0093	divers	9064901
AI-0095	divers	9064903
AI-0097	divers	9064904
AIP-0108	divers	9064905
AIP-0118	divers	9064906
AIP-0122	divers	9064907
AIVP-0001A	Lien Chang Co	9064908
AIVP-0001B	Lien Chang Co	9064914
AIVP-0003	Lien Chang Co	9064915
AIVP-0003A	Lien Chang Co	9064916
AIVP-0006C	Lien Chang Co	9064917
AIVP-0009	Lien Chang Co	9064918
AIVP-0009A	Lien Chang Co	9064921
AIVP-0017	Lien Chang Co	9064922
AIVP-0026	Lien Chang Co	9064923
AIVP-0026A	Lien Chang Co	9064924
AIVP-0032	Lien Chang Co	9064925
AIVP-0035	Lien Chang Co	9064927
DAC-12M018B1F	Delta	9006731
DAC-12M019A0F	Delta	9006736
DAC-12M019C0F	Delta	9006738
KLS-420W1SD-A	Taiyo Yuden	8918041
KLS-420W1SD-B	Taiyo Yuden	8918041
KLS-42CP22-B	Taiyo Yuden	8918043
KLS-44CP22-A	Taiyo Yuden	8918043
KLS-EE26-M	Taiyo Yuden	8918026
KLS-EE26-S	Taiyo Yuden	8918026
KLS-EE30-M	Taiyo Yuden	8918031
KLS-EE30-S	Taiyo Yuden	8918031
KLS-EE32CI-M	Taiyo Yuden	8918037
KLS-EE32CI-S	Taiyo Yuden	8918037
KLS-EE32-M-REV09	Taiyo Yuden	8918035
KLS-EE32P-M	Taiyo Yuden	8918035
KLS-EE32P-S	Taiyo Yuden	8918035
KLS-EE32-S-REV09	Taiyo Yuden	8918035
KLS-EE37CI-M	Taiyo Yuden	8918040
KLS-EE37CI-S	Taiyo Yuden	8918040
LI-1045	divers	9064848
LI-1047	divers	9064849
LI-1048	divers	9064850
LI-2165	divers	9064851
LI-2205	divers	9064852
LI-2206	divers	9064891
LI-4018	divers	9064892
LIV-1050	divers	9064893
LIV-2209	divers	9064894
LIVP-6009	divers	9064895
LIVP-6010	divers	9064896
QF131V100	divers	9017048
V0.84090.001-REV1A	Darfon	9130860
V0.84218.001-REV1A	Darfon	9130854
V0.86234.001-REV1D	Darfon	9130865
V0.87238.301-REV1A	Darfon	9130891
V0.88070.00104-REV1G	Darfon	8715756
V0.88070.001-REV1G	Darfon	8715756
V0.88070.101	Darfon	9070865
V0.88070.10105-REV1G	Darfon	8715787
V0.88070.10106-REV1H	Darfon	8715782
V0.88070.101-REV1G	Darfon	8715787
V0.88070.101-REV1H	Darfon	8715782
V0.88070.102	Darfon	9070866
V0.88070.10206-REV1H	Darfon	8715783
V0.88070.102-REV1H	Darfon	8715783
V0.88070.70206-REV3E	Darfon	8715779
V0.88070.702-REV3E	Darfon	8715779
V0.88070.70306-REV2A	Darfon	8715781
V0.88070.703-REV2A	Darfon	8715781
V0.88070.901-REV1A	Darfon	8715739
V0.88070.Q01	Darfon	9048440
V0.88070.Q02	Darfon	9048441
V0.88070.S01	Darfon	8715773
V0.88070.S02	Darfon	8715774
V0.88070.S03	Darfon	9048443
V0.88070.S04	Darfon	9048444
V0.88070.S06	Darfon	9048448
V0.88070.S08-REV1A	Darfon	9130874
V0.88070.T02	Darfon	9048450
V0.88070.T04-REV1A	Darfon	9130866
V0.88070.V01-REV1A	Darfon	9130875
V0.88070.W01-REV1A	Darfon	9130877
V0.89070.R02-REV1A	Darfon	9130863
V0.89144.00103-REV2D	Darfon	8736617
V0.89144.001-REV2D	Darfon	8736617
V0.89144.101	Darfon	8715479
V0.89144.10204-REV2G1	Darfon	8715479
V0.89144.10204-REV2H1	Darfon	8715479
V0.89144.10205-REV2G1	Darfon	8715479
V0.89144.10205-REV2H1	Darfon	8715479

Inverter code	For manufacturer	Art. No.
V0.89144.40106-REV1A	Darfon	8715740
V0.89144.40106-REV1B	Darfon	8715740
V0.89144.40106-REV1C	Darfon	8715740
V0.89144.401-REV1A	Darfon	8715740
V0.89144.401-REV1B	Darfon	8715740
V0.89144.401-REV1C	Darfon	8715740
V0.89144.60106-REV1A	Darfon	8732026
V0.89144.60106-REV1B	Darfon	8732026
V0.89144.60106-REV1D	Darfon	8732026
V0.89144.60106-REV1E	Darfon	8732026
V0.89144.601-REV1A	Darfon	8732026
V0.89144.601-REV1A-1B-1C	Darfon	8732026
V0.89144.601-REV1B	Darfon	8732026
V0.89144.601-REV1C	Darfon	8732026
V0.89144.601-REV1D	Darfon	8732026
V0.89144.601-REV1E	Darfon	8732026
V0.89144.60205-REV1A	Darfon	8715741
V0.89144.602-REV1A	Darfon	8715741
V0.89144.603	Darfon	9070884
V0.89144.60304-REV1A	Darfon	8715742
V0.89144.60305-REV1A	Darfon	8715742
V0.89144.603-REV1A	Darfon	8715742
V0.89144.70104	Darfon	8715750
V0.89144.701-REV1A	Darfon	8715750
V0.89144.804	Darfon	9048455
V0.89144.C01	Darfon	8715752
V0.89144.C0104-REV1G	Darfon	8715752
V0.89144.C01-REV1A	Darfon	8715752
V0.89144.C0205-REV1A	Darfon	8715753
V0.89144.C02-REV1A	Darfon	8715753
V0.89144.C0305-REV1B	Darfon	8715755
V0.89144.C03-REV1B	Darfon	8715755
V0.89144.C0605-REV1A	Darfon	8715752
V0.89144.C06-REV1A	Darfon	8715752
V0.89144.H0206-REV1B	Darfon	8715769
V0.89144.H02-REV1A	Darfon	8715769
V0.89144.H02-REV1B	Darfon	8715769
V0.89144.H03	Darfon	8715771
V0.89144.H05	Darfon	9070889
V0.89144.H05-REV1A	Darfon	8715770
V0.89144.H05-REV1B	Darfon	8732038
V0.89144.U01	Darfon	9048458
V0.89144.U02	Darfon	9048460
V0.89144.U03-REV1B	Darfon	9130879
V0.89144.U06-REV1C	Darfon	9130882
V0.89144.U07-REV1A	Darfon	9130884
V0.89144.U08-REV1A	Darfon	9130886
V0.89144.X01-REV4E	Darfon	9130878
V0.89211.001	Darfon	8715772
V0.8A183.001	Darfon	8715822
V0.8A183.011	Darfon	8715822
V0.8A183.021	Darfon	8715822
V0.8A183.031	Darfon	8715822
V0.8A183.041-REV1D	Darfon	8715821
V0.8A183.041-REV1E	Darfon	8715821
V0.8A183.051-REV1D	Darfon	8715821
V0.8A183.051-REV1E	Darfon	8715821
V0.8A183.061-REV1D	Darfon	8715821
V0.8A183.061-REV1E	Darfon	8715821
V0.8A183.071-REV1D	Darfon	8715821
V0.8A183.071-REV1E	Darfon	8715821
V0.8A183.B01-REV1F	Darfon	9048461
V0.8A183.F0106-REV1A	Darfon	8715775
V0.8A183.F01-REV1A	Darfon	8715775
V0.8A183.I06-REV1B	Darfon	9130887
V0.8A183.L01	Darfon	9048468
V0.8A183.M02	Darfon	8715776
V0.8A183.M06	Darfon	9048471
V0.8A183.M09-REV1A	Darfon	9130888
V0.8A183.M0A-REV1A	Darfon	9130889
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V0.8A183.P04-REV1A	Darfon	9130897
V0.8A183.T02-REV1A	Darfon	9130898
V0.8A243.101-REV1A	Darfon	9130909
V0.8A243.102-REV1A	Darfon	9130911
V0.8B215.002-REV1A	Darfon	9130892
VIT.58001.00	Logah	8999983
VIT.58003.00	Logah	8999934
VIT.66002.00	Logah	8999999
VIT.66003.50	Logah	9134368
VIT.68001.51	Logah	8999966
VIT.70002.00-REV3C	Logah	8989847
VIT.70002.50	Logah	8989847
VIT.70002.50-REV4	Logah	8989847
VIT.70002.51-REV2	Logah	8989847
VIT.70002.60-REV0	Logah	9064845
VIT.70002.61-REV0	Logah	9064845
VIT.70003.50-REV2	Logah	9064847
VIT.70023.50	Logah	9140882
VIT.70023.51	Logah	9140882
VIT.71008.50	Logah	8999955
VIT.71008.60	Logah	8999958
VIT.71008.90-REVL1	Logah	9064820
VIT.71008.91-REVL3	Logah	9064826
VIT.71008.92-REVL0	Logah	9064829
VIT.71009.50	Logah	8999969
VIT.71010.50	Logah	8999952
VIT.71010.51-REVL2	Logah	9064831
VIT.71010.52-REVL0	Logah	9064832
VIT.71010.53-REVL3	Logah	9064834
VIT.79002.53	Logah	9134369
VIT.79003.60	Logah	8999961
VIT.79005.50	Logah	8999984
VIT.79005.60	Logah	8999980
VIT.79005.80	Logah	8989845
VIT.99003.00	Logah	8999999
VK.84090.001-REV1A	Darfon	9130860
VK.84218.001-REV1A	Darfon	9130854
VK.86234.001-REV1D	Darfon	9130865
VK.87238.301-REV1A	Darfon	9130891
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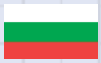

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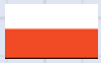

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