

TBC - Time Base Corrector

Operating Manual



electronic-design

Preface

Congratulations on buying a Time Base Corrector (TBC) from Electronic-Design. Choosing this product, it shows that you insist on excellent image quality and easy operation without making compromises.

The TBC, being a complex product relies on various other components (for example video equipment, cabel and tapes). In order to achieve maximum quality, you should know these components rather well, and if the case should arise consult the manual of your other hardware.

In combination with your subject knowledge an other manuals, the TBC manual should be a good guide to you in digital video processing. However, despite all guidance aids we would like to mention at this point, that a manual can never provide the answers to all your questions. So if you have additional questions, please take notice of the following paragraph.

The manual does not provide an answer to your question?

...in this case your retailer should be able to, as long as the usage of this TBC is in question. In the event, that this is still not sufficient then the experts of Electronic-Design will offer support. You can reach us Monday - Thursday from 9 am -12 pm and 1 pm - 5 pm and Friday from 9 am -12 pm under

Phone # +49-89 / 354 53 03 Fax # +49-89 / 354 56 74

We can help you more quickly and efficiently if you check the following beforehand:

- ▶ read the relevant passage in the manual
- ▶ when calling or writing please give following information:
 1. the model number of your video recorder and other video equipment;
 2. the video recorder's serial number;
 3. the nature of the fault (please give details rather than just „fault" or „warranty damage");
 4. when writing please enclose a daytime telephone number;
 5. a sketch showing how you connected the cables

Delivery

Once you have unpacked your Electronic-Design TBC, check that all the components are present and that there is no obvious damage e.g. damage caused in transit. The following items should be there:

- Electronic-Design TBC-Enhancer
- 12V 1000mA power supply
- TBC Operating Manual
- Warranty Card (please ask your dealer to stamp this)
- Customer Service card (please complete and return to Electronic-Design)

General information about your Electronic-Design TBC

The following paragraphs should give you a brief overview of the functioning and features of your Electronic-Design Time Base Corrector. In the following pages Time Base Corrector will be abbreviated to TBC.

What a TBC does.

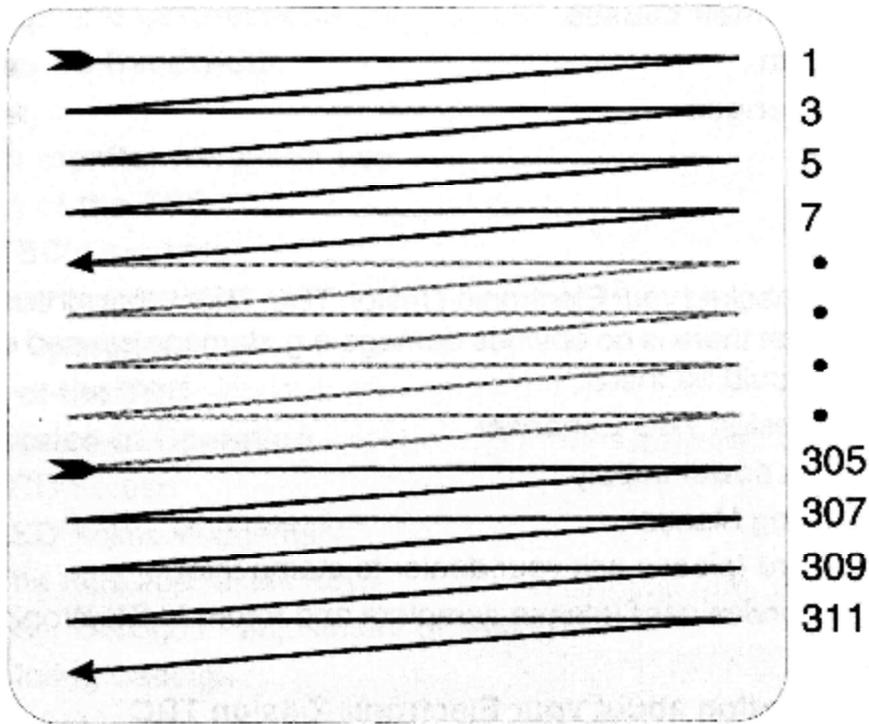
In video jargon TBC is a common abbreviation for Time Base Corrector. For the professional, a TBC has long been an indispensable gadget for synchronising various video equipment in the studio. Such machines have been and still are built for professional use and thus are correspondingly expensive. Highly integrated digital Videochips with their storage capacity have now enabled the home user to enter an area which up to now was closed by prohibitive cost.

General information

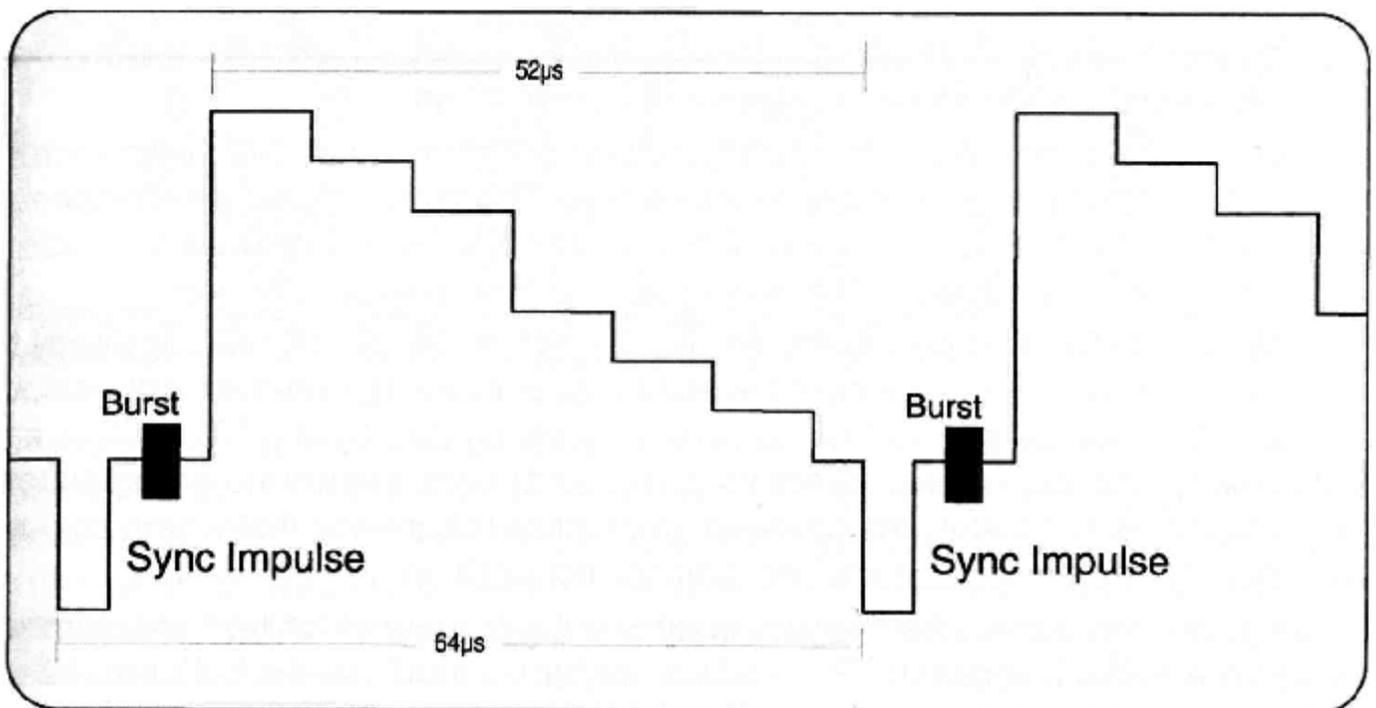
The requirements of the home user are of course somewhat different from those in the studio. In the studio the first priority is to synchronise video signals, to mix them or to edit them precisely. Signal conversion or improvement - if desired - takes place elsewhere. For home users it is different. Their first priority is to improve an imperfect video signal as much as possible.

The Electronic-Design TBC offers something new: it is equally suited to both the amateur and the professional alike. The professional can carry on as usual whilst the amateur can manipulate all the variables of his video.

first TV Half Frame



A closer look at one line of



What does a TBC actually do and why is one necessary? In order to understand this, we need to take a closer look at a video signal. It commences at the top left of the screen with a vertical sync impulse that starts the picture off. At short intervals the horizontal impulses follow starting on the left hand side of the screen. This occurs 312 times until the first half-image is complete. The first 20 lines are black or contain information such as the Timecode, teletext or copy protection.

After each horizontal impulse there follows the so called „Burst" - a signal that serves as a colour reference point for each line. The visible part of the line then follows, which contains the actual picture. Ideally the impulse and the burst are always equal, only the visible part changes.

Since the Sync and colour reference signals are only briefly on the left side of the picture, the monitor has to ensure a uniform deflection of the electron beam as it passes across the screen in order that the pixels appear in the correct place. As long as these impulse follow regularly, there is no problem. Difficulties arise though when they follow irregularly i.e when the impulses are too fast or too slow. The monitor or indeed any other video device attempts to correct these fluctuations but can only achieve this to a limited extent. The results are wavy edges, incorrect colours or in extreme cases frame jumping. The colour reference signal (the Burst) is especially susceptible to this problem.

These undesirable results stem from wow and flutter on the video cassette. In addition and especially when copying the signal is „slurred". The end effect is that the synchronisation can no longer be reproduced with precision. This phenomenon is known as Jitter".

This is where a TBC can help. It converts the video signal into a digital form and then splits it with digital precision into its various components. The picture is then stored pixel for pixel in the TBC's memory, it is irrelevant whether the signal is too fast or too slow. Thus each pixel is stored in exactly its right position.

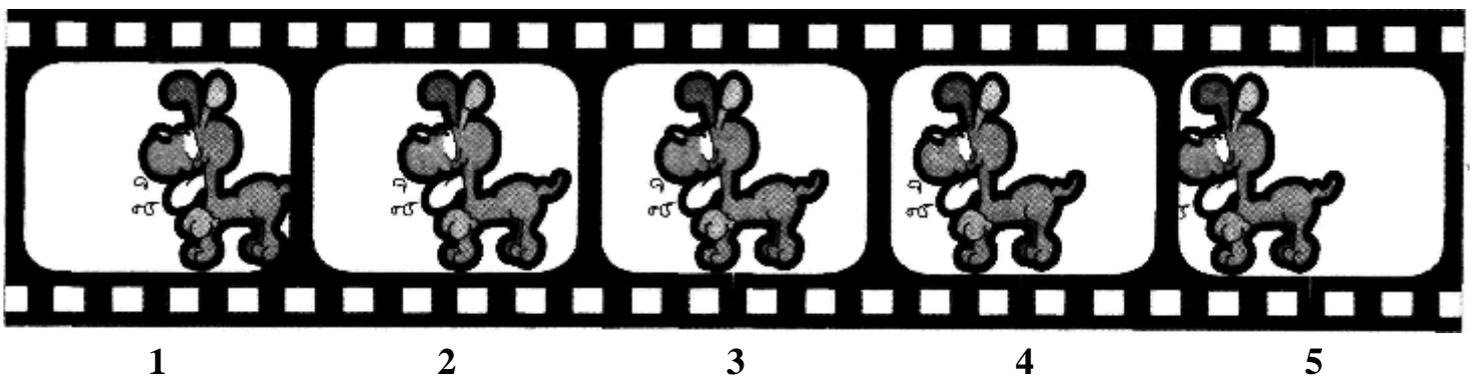
The picture is then retrieved with quartz precision either from the TBC's own internal timing device or from an external one in the studio. The picture signal is recomposed and converted into an analogue signal, a newly generated Sync and Burst are added, that come close to perfection. The video signal is then available for use.

For amateur use it is thus possible to correct a a picture signal. It is relatively easy to manipulate the usual enhancement functions e.g. sharpness, contrast or the colour components when the picture has been digitally dismantled by the TBC. There are though many other possibilities. Since the colour and brightness are stored separately they can also be separately manipulated. In practice this means that where colours have „run", they can be put back into their correct position.

In order to not only correct the image sequence but also to synchronise it with another frequency a buffer is required. The unstable picture is read into the buffer and then read out again with the new time base. Wow and flutter from the video recorder is thus evened out. Additionally, videos that come from recorders that run too fast or too slow can be converted by the TBC into standard interval signals. The number of buffers is an indication of the quality of the TBC.

The Electronic-Design TBC has three half-image buffers at its disposal. These enable it to correct any interference to the extent that it is invisible to the viewer as well as producing a video signal that corresponds to the standard specification.

Example:



The original plays a little too fast

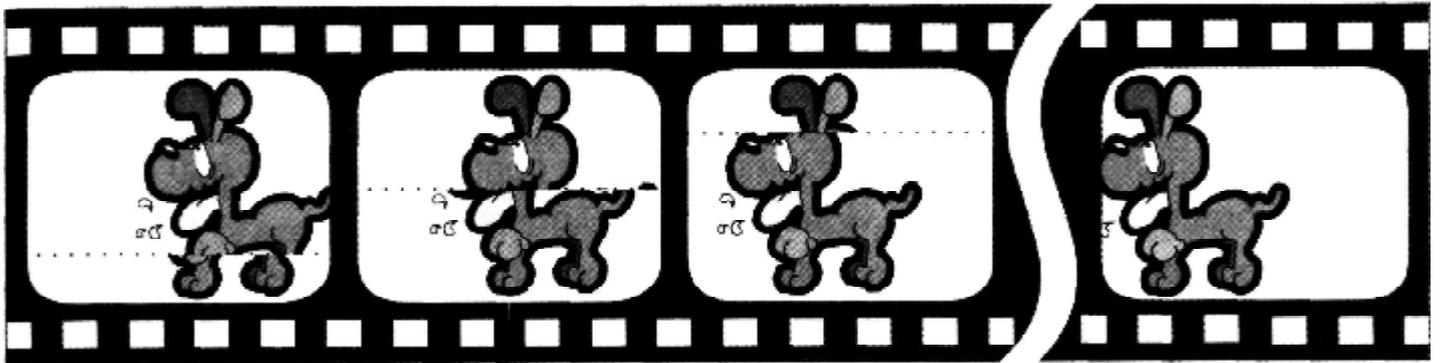
As a result of wow and flutter the frame frequency is too fast. This means that when the video is synchronised by the TBC more images are read into the memory within a given time than can be correctly read out. Sooner or later - according to the number of memories - the TBC is full and thus one image is skipped.

1/2

2/3

3/4

5



Lower quality TBCs produce cuts when the memory is full

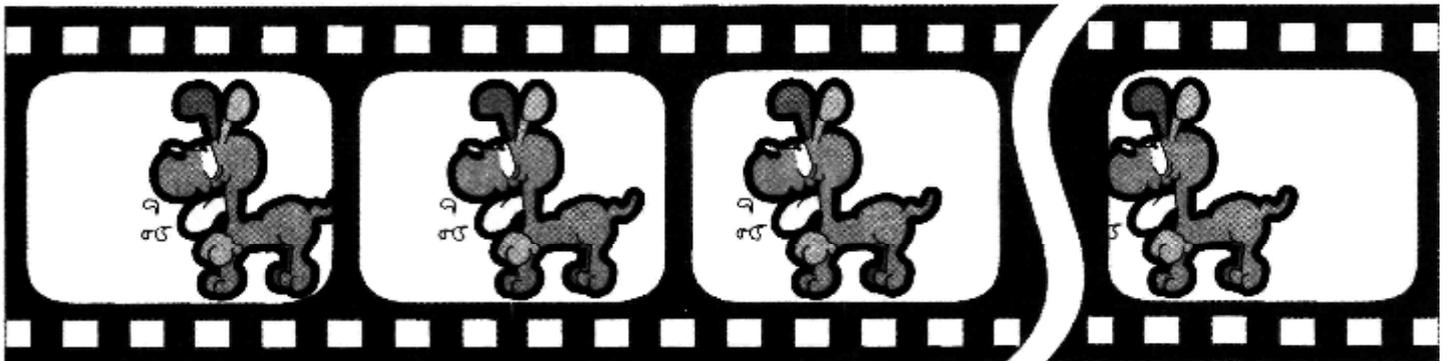
This is the result of a „cheap" TBC. The memory is not large enough to store a complete picture and therefore does not have enough capacity for certain situations. Whilst the first picture is being read out the next is already being read in. Somewhere in the middle of the picture the two „overtake" each other and there is a jump to the next picture. With still frames this does not matter but as soon as something moves these cuts can appear. They move slowly across the screen and in effect split it into two halves.

1

2

3

5



TBC with cutfree synchronisation, whole picture storage and wider regulation range

The 1.5MByte (3 Half Image) memory of Electronic-Design's TBC is sufficient for cut free synchronisation - each picture is fully reproduced. Sometimes, because of fluctuations in the source video, too few images are read into the memory within a given time. The TBC neutralises this effect. Only when the source video is excessively fast or slow the memory will overflow and then a picture is skipped or read out twice. In practice this is invisible to the viewer.

Overview of Video Technology

Special features of the TBC

- 4:2:2 digital technology as used in studios
- Compatible with YUV studio format
- Additional port for control monitor
- All video outputs duplicated enabling the easy connection of several machines
- Direct processing of normal video and Y-C Signals
- Video processing function with digital balancing
- Complete processor control of all picture variables
- Storage of three independent settings
- 3 half-image memories enabling cut free video images and wider regulation range
- Simple operation through microprocessor control
- Digital effects
- YUV analogue output
- Compatible with studio synchronisation through Blackburst IN and OUT sockets
- Chroma Shift function to minimise colour distortions when copying

Overview of Video Technology

This section includes a basic explanation of video technology in order to help you understand the rest of what follows. Careful reading will spare you a few surprises!

The various video formats

Video formats can be differentiated according to various criteria. Straight away they can be split into country specific standards such as NTSC, PAL or SECAM. These describe on the one hand the resolution and image frequency and on the other the encoding process for picture production. Taken together they describe the maximum achievable quality for each respective standard. Most readers need only concern themselves with PAL as this is the standard in Europe and additionally in Australia, Canada and South America. Even in France where SECAM is used, video recorder nearly all use PAL internally as the signal can be relatively easily converted. With video formats though, you certainly also think about VHS, Hi8 etc. This is concerned with the manner in which the image is recorded onto the cassette and thus each can theoretically be combined with any of the formats mentioned above. Accordingly a VHS cassette - given the right recorder - can be viewed in PAL or in NTSC. The commonest format is VHS (Video Home System) as pioneered by JVC. From this there are also the sub-formats such as VHS-C, S-VHS and S-VHS-C. The C stands for compact and refers only to the physical dimensions of the cassette which can be placed in an adaptor and be played in a normal recorder. Its advantage lies in its small size whereby it is especially used in hand held cameras and its compatibility with home recorders which allow a longer play time. S stands for Super and refers to a modified display process with a higher carrier frequency. This together with better quality cassettes has benefitted picture quality. As far as camcorders are concerned Sony's Video 8 format is the market leader. It was invented as a compact format and as far as picture quality is concerned is easily superior to VHS-C, but equally not VHS compatible. Here as well there is an offshoot - the Hi8 format - a sort of equivalent to S-VHS-C. Both Hi8 and S-VHS (C) are often described as S-Video. These formats are certainly the most popular but are definitely not the only ones. Besides from the out-dated Video 2000 and Betamax (not to be confused with Betacam) formats, Sony's U-Matic system has been used long times in the semi-professional field. It is often said that the S format is better, something which is not quite true. Its bandwidth of 3.5 MHz is sufficient for many cases especially as the colour interference is a lot less than the S-Video standards. In the professional field Sony's Betacam (SP), Panasonic's Mil or 1" equipment are the norm. They achieve such a level of quality that a fourth or fifth generation copy does not show any noticeable loss of quality. These formats also allow frame precise editing and frame-by-frame recording.

Video Signal Standards

The already mentioned video formats are not inextricably linked with the various standard video signals in which they are transmitted. However it is natural of course to match them in terms of quality. For ordinary, satellite or cable TV only a HF signal is relevant which is in turn converted by the tuner into a CVBS signal. Several video pictures as well as the sound can be carried simultaneously by one cable. Such a CVBS signal contains all the necessary information for a video picture and can be transmitted by a single core lead. It is somewhat better than the HF signal and sufficient for many applications. Accordingly it is used with VHS, Video 8, U-Matic and sometimes even in the professional field.

Y-C is transmitted through a two-core lead which divides the image into its colour and black and white elements.

Thus a clear division is achieved whose effects are especially noticeable in terms of color edges and band width without great expense being^ incurred. This transmission method is thus primarily utilised by S-Video machines.

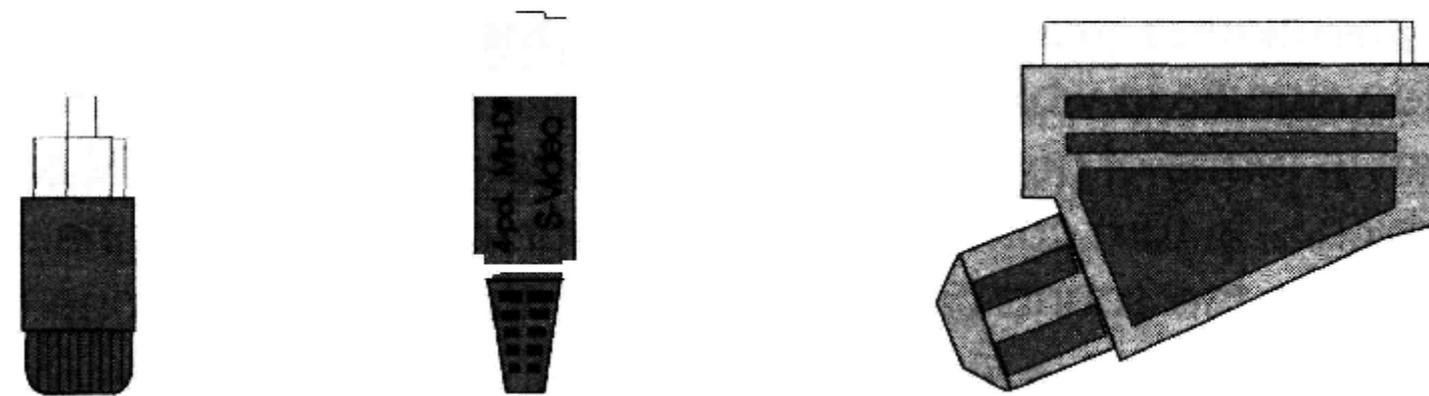
Y-U/V is transmitted using a three core cable and finds its use mostly in the studio and the professional field. In terms of quality it is equivalent to a RGB signal. RGB however requires a four-core lead (Red, Green, Blue and Sync) and is above all used for Computers and Monitors as these produce an RGB image.

Digital Standards

As the video industry has not evaded ever increasing digitalisation, the digital standards 4:1:1 and 4:2:2 have of late often appeared in the technical specification of some machines. 4:1:1 denotes that four neighbouring pixels are always the same colour whilst 4:2:2 denotes that 2 pixels are the same colours. 4:2:2 is thus superior but requires more memory - c. 1MByte for each picture as against 768Kbytes for 4:1:1. The brightness on the other hand can be adjusted for each pixel with up to 256 different levels. It is known that as is the case with analogue images, the human eye is much less sensitive to changes in colour than it is to changes in contrast and brightness. This fact can be exploited in order to keep the amount of data down to a manageable quantity without sacrificing visual quality.

N.B. 1 MByte = 1 Million characters which is equivalent to the data contained in approximately 1,000 typed pages. 1 KByte = 1,000 characters or the data contained in approximately one typed page.

Sockets and connections.



Cinch Mini Din

For each of the various signal standards, various plugs and sockets have gained acceptance. Thus for CVBS signals Chinch and BNC plugs (the latter finding use mainly in the professional field and thus not shown here) are the norm. Y-C i.e. S-Video connectors are almost exclusively of the 4 pin Mini Din type. Y-U/V connections use a single BNC lead. Especially common amongst home video recorders and televisions is the 21 pin SCART socket. This system offers stereo sound as well as NTSC signal input and output and with monitors often a RGB input. Two status leads control the signal whilst in RGB mode i.e between the Tuner and the SCART input. The existence of such a socket does not however automatically mean that all the various connections are possible. For example very few video recorders possess a RGB input. Occasionally such SCART connections will also accept a Y-C signal whereby the Y signal is supplied instead of the CVBS signal whilst the C signal is fed through the Red input. This usually requires an additional adjustment to the recorder.

For connecting RGB monitors, the following plugs are to a considerable extent the norm: the typical Amiga 23 pin Sub-D plug (which can also be found on every Genlock), a nine pin Sub-D plug from the days of Hercules and EGA graphic cards, a 15 pin Sub D plug (often found on PCs and flicker fixers and finally the single BNC plug for RGB Sync often found on high resolution CAD monitors. Thus adapters or special cables are often necessary, which can be obtained from the appropriate dealer.

Definition and Bandwidth

Both terms refer to picture sharpness. The definition is usually given in terms of lines (per screen). S-VHS has for example about 400 lines. As is well known the video or computer image is built up from individual lines. Each line

requires a given amount of time depending upon the frame frequency and the respective number of lines. With video the visible portion of the line requires exactly $52 \mu\text{s}$ and then a further $12 \mu\text{s}$ for the so called blanking interval which carries the sync signal and the colour data. The band width is accordingly easy to calculate and is given in MHz. For a line to be visible they must always alternate between a dark line and bright one. In our example with 400 lines, there are thus 200 bright/dark pairs. These are scanned in $52 \mu\text{s}$ which allows us to calculate the bandwidth as $200 \text{ lines}/52 \mu\text{s} = 3.85 \text{ MHz}$. *N.B. $1 \mu\text{s} = 1 \times 10^{-6} \text{ Seconds} = \text{one millionth of a second}$.*

Interlace

Interlace splits a complete picture into two halves which are displayed one after the other. The complete picture is therefore only repeated 25 times a second. Without interlace or a line skipping process, pictures would - at 25 full images per second - start at the top of the screen and progress downwards. The screen would remain dark until the last line had been displayed. With a picture frequency of 25 MHz there would be an unacceptable degree of flickering. For this reason the full image is split into two half-images. The first half-image consists of the odd lines 1, 3, 5 etc. and is displayed within $1/50$ of a second. Then follows the second half-image with lines 2, 4, 6 etc. which is also displayed in less than $1/50$ of a second. The screen is thus scanned twice to produce one full image.

This is of course a bit of a fiddle since only half the picture is displayed each time, but with flat pictures this is barely noticeable. Only when individual lines are for example depicted by a computer does flickering occur as the single line is only repeated every $1/25$ of a second. Such flickering can also occur as a result of a bad recording as the second half-image does not correctly follow the first. Wow and flutter from the Video heads can also lead to horizontal distortion between the two half images. This distortion manifests itself in very heavy flickering which quickly disappears if the sequence is frozen (a freeze-frame consists of one half-image displayed twice.)

Installation of the TBC

Which monitor for which use

The most expensive monitor is not always the best one for the desired application. If video images and Amiga graphics are to be displayed (e.g with a genlock) then a normal 1084 Amiga monitor is a good choice. Compromises must unfortunately be made when flicker-fixers or screens other than on the PAL format (e.g A4000) are used. In such cases a Multisync monitor is recommended which incidentally is compatible with the Amiga's 50Hz image frequency. Some Multisync monitors can also display video images or work in PAL mode when connected to the 23 pin output of the Amiga. For this it is absolutely essential that alongside the 50Hz picture frequency the line or horizontal frequency's lower range stretches to 15.6KHz. Although such monitors can theoretically display video pictures they are not usually well suited to this purpose as they cannot always handle the instability of video signals from camcorders. Those who often work with video equipment are well advised to obtain a good value video monitor such as the Commodore 1084 or a similar model.

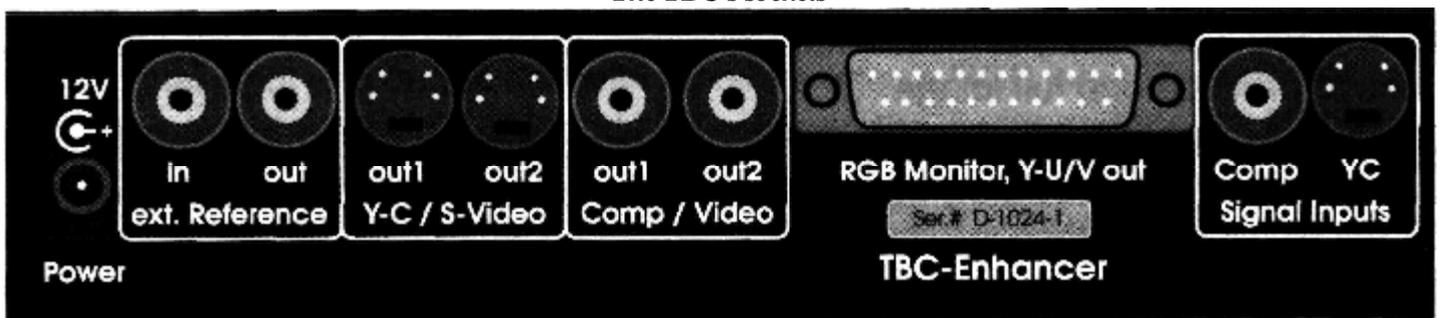
This section should show you all the various uses to which your Electronic-Design TBC can be put.

As the TBC is a technically very demanding device, we would recommend that even „old hands" should read through this section. When connecting or disconnecting the various video devices they should all be turned off in order to preclude the possibility of damage.

The TBC's sockets

The following section will explain how to connect the TBC to the various other pieces of video equipment. Please follow the instructions meticulously as incorrect connection is one of the most common sources of difficulty.

The TBC's sockets



- 2 x Signal Input (Chinch and MiniDin)

The source video can be connected to these two sockets. Both the composite and Y-C sockets may be used simultaneously as the TBC can be switched between them at the touch of a button.

- 2 x Video Out (2 x Chinch)

The edited composite video signal emanates from these two sockets and they can be directly connected to the destination recorder. To enable multiple recordings to be made using two machines, two sockets are provided. The destination recorder can be connected to either socket as both carry the same signal and the unused socket need not be connected and in any case should never be connected to the aerial input of your TV or video!

- 2 x Y-C Out (2 x MiniDin)

The edited Y-C signal emanates from these two sockets and they can be directly connected to the destination recorder. To enable multiple recordings to be made using two machines, two sockets are provided. The destination recorder can be connected to either socket as both carry the same signal and the unused socket need not be connected.

- Reference IN (Chinch)

An external Blackburst signal can be connected to this socket to act as an external timing source in order to synchronise the TBC with the rest of the studio equipment. The output of the TBC is thereby synchronised with the rest of the equipment and can be used without any further effort be utilised in the studio. The TBC can be switched between the studio timing and its own internal timing at the touch of a button.

- Reference OUT (Chinch)

This socket supplies a Blackburst synchronous to the video output signal. If you use studio timing the socket's output is always synchronised with this and can be used to supply other equipment with the same studio timing. If on the other hand you do not have a studio timing device then the Reference OUT socket can provide such timing.

- RGB/YUV Output (23 pin SubD)

This 23 pin socket can be used to connect an analogue RGB control monitor directly to the TBC. Monitors that are suitable for use with an AMIGA can in all cases be used with the TBC without any modification i.e the RGB socket is AMIGA compatible. Leads for connecting all conceivable types of analogue RGB monitors are available from your dealer. Multisync monitors as usually used with PCs are not fully suitable and you should therefore consult your dealer.

As a second option this 23 pin socket can also provide YUV analogue studio output. This YUV signal corresponds to the TBC output before the video processor i.e. the RGB, colour, contrast and brightness settings are irrelevant. The exact use of this socket is described in section 8, page 88.

- Power (Jack Plug)

The TBC's power supply is attached to this socket. Please only use the power supply provided. Should you prefer to use another power supply then it should have an electronically stabilised 1000mA 12V dc output.

Connecting the TBC

This section should show you how to connect the TBC to the various other equipment.

This graphic shows the typical connection of the Electronic-Design TBC

- The source recorder (either CVBS or Y-C) is connected to the video input socket. Two separate source recorders (one with CVBS and one with Y-C) can be simultaneously connected and then switched between using the Y-C key. You can of course connect the TBC to the output of any other (PAL) video equipment.

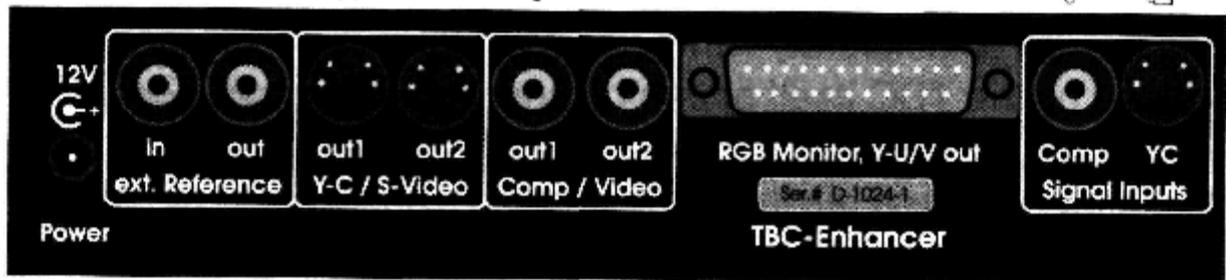
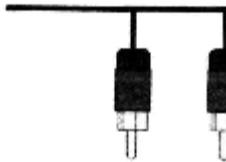
Recorder 1



Player

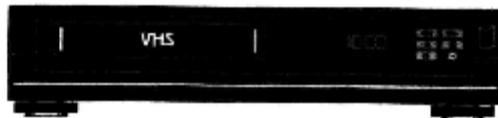


Studio

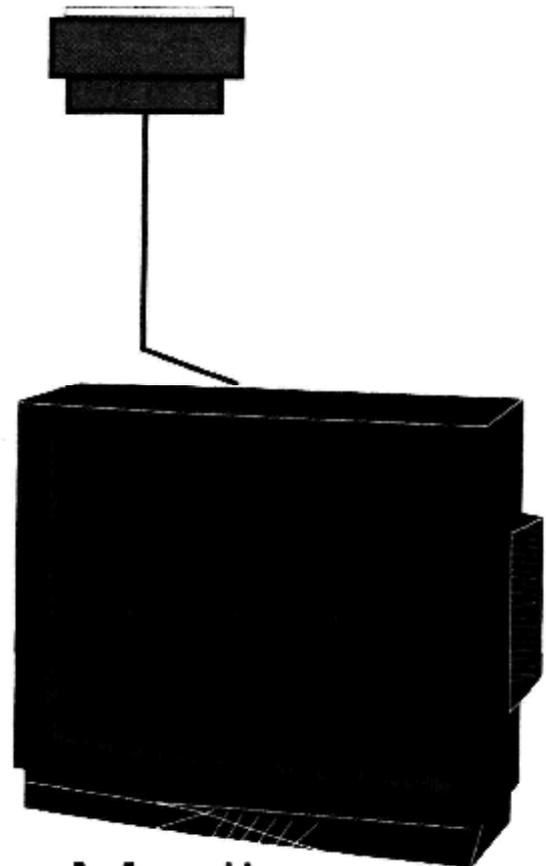


Power

12 V=, 1000 mA



Recorder 2



Monitor

This graphic shows the typical connection of the Electronic-Design TBC

- The RGB control monitor is connected to the RGB/YUV output. A television with a RGB-SCART socket can also be used. This monitor displays exactly what is being recorded by the destination recorder.
- It is possible to connect up to four video recorders (2 x Y-C; 2 x CVBS) to the video output sockets. These machines can all simultaneously record the output of the TBC. Of course other devices (e.g a video mixer) can also be connected to the video output sockets.
- If available a studio timing device (Blackburst) can be connected to the Reference IN socket. With the help of a studio timing device it is possible to synchronise the TBC with other studio equipment.
- A timing device (Blackburst) can be tapped from the Reference OUT which is either produced by the TBC itself or can be sourced externally. This output provides a Blackburst for the home user or in the studio allows other equipment to be supplied with the Blackburst. In all cases the Blackburst is synchronised with the video output.

Initial Operation

This section explains how to switch the TBC on and prepare it for use. Please follow these instructions below step by step and always ensure you know what you are doing. If you do not understand the precise details of a particular section, please read through the respective section in this handbook. Connect your TBC to your video appliances as shown in the diagram above.

- Switching the TBC on

Plug the power supply in and press the [Power] button. The light next to the [Power] button comes on and confirms that the TBC is in operation.

- Selecting the desired video signal

The correct input to use is decided by the which standard the source video uses. If you are using a CVBS source video then the light next to the [Y-C] key should be extinguished. If necessary switch off the light by pressing the [Y-C] key. If you are using a Y-C video as a source then the light next to the [Y-C] key should be on. You can switch it on by pressing the [Y-C] key.

- electing an internal or external Blackburst

If you do not have an external Blackburst available then please ignore this point.

To switch the TBC to an external Blackburst it is necessary to switch to external mode. The exact procedure is described in section 6.2.2

Congratulations, you are ready! It really is that easy to start up your Electronic-Design TBC. Don't worry if you've had difficulties, practice makes perfect! In any case the TBC is not a device that normally requires a long time to set up. The TBC works almost unnoticeably and improves all your videos.

The TBC now works with its default settings and should display all source videos stably on the control monitor and allow you to work with them. Should you still be unsatisfied with the picture quality this is not a problem as it can be improved using the video processor enhancer. Unstable videos are a thing of the past.

Operation of the TBC

The following section details the basic and general points concerning the use of the Electronic-Design Time Base Corrector. Its aim is to serve as a reference tool and accordingly the practical applications of the TBC are described later in Section 7.

Basics of operation

This section should pave the way to your use of the TBC. Please read carefully as a knowledge of these basics is assumed in later sections.

The LCD Screen

To enable easier use of the TBC, the user dialogue to a large consits of messages on the LCD screen. The LCD screen can display alphanumeric characters i.e the letters A - Z and the numbers 0 - 9. This screen enabled the TBC to be so compactly built and user friendly. The screen can display all image variables and their value e.g. RED 100 or COLOR 96. Most figures should be read as percentages.

e.g. COLOR 0 means that the colour is set at 0% i.e. black and white.

Status reports as well as changes in the mode of operation are clearly displayed on the screen. The LCD

alphabet and numbers are reproduced in section 8.2, page 89 as are some other „words" together with their meaning.

Where the text refers to a specific message on the LCD screen, this message is shown underlined, e.g. RED 100 or GREEN 96.

LED acknowledgement

In addition to the status reports given on the LCD screen, important information is shown by illuminated LED's. This additional feature improves the ease of operation no end, as all the varying working modes and special functions can be seen at a glance. Illumination of the relevant LED indicates that this function is in use whilst when the LED is not illuminated, the function is not in use. e.g when the Bypass LED is on, the TBC is in bypass mode. The function can be switched on and off by pressing the key to which the LED refers.

For example: The EXTERN LED is not lit i. e. the TBC is in internal mode. If the Extern key is pressed the LED comes on and the TBC is in external mode. If the key is pressed again the LED goes out and the TBC is back in internal mode.

As a general rule the TBC is in the mode that corresponds to the wording on the key. With each press of a key the mode of operation is changed. Where the text asks you to press a specific key, the name of the key will be given in square brackets e.g. [Power] or [Freeze].

The plus and minus keys

Many of the images variables are not just switched on and off rather their intensity can be controlled. In order to perform this control function the equipment can either be fitted with rows of knobs or a central medium for the adjustment of values and utilise a „dialogue" between the user and the machine. On the TBC this medium consists of the plus and minus keys. Such digital adjustment has numerous advantages:

- finding a previous setting is made easier
- settings can be stored and recalled
- protects against misadjustments
- identical procedures for changing a variable.

User dialogue - adjustment of settings

As was explained in the last section, continuous variables are not adjusted with knobs rather a user dialogue utilising a single key is employed to make the adjustment as easy as possible.

- to adjust a value, press the key which refers to the name of the variable (in our example it is [color])
- the screen displays the name of the variable and its current setting (COLOR 100)
- to change the setting use the [plus] or the [minus] key (in our example the [plus] key to increase the setting to 120%). The [plus] key always increases the variable by one step whilst the [minus] key always reduces it by one step. To keep the work of adjustment down to a manageable level, the values are always modified in steps. The increment/decrement varies from variable to variable.

For those interested, a step always represents 2.5% of the maximum setting.

As it is sometimes very laborious to adjust the value from say 8% to 150%, the [plus] and [minus] keys have a repeat function - if one of the keys is pressed for longer than two seconds, the value automatically quickly increases or decreases.

Examples:

- increasing the COLOR value (colour intensity) to 120%
 - Press the [Color] key. The screen displays COLOR 100
 - Press the [Plus] key until COLOR 120 is displayed
- Reducing the BLUE value to 80%
 - Press the [Blue] key. The screen displays BLUE 100
 - Press the [Minus] key until BLUE 80 is displayed
- Increasing the CONTRAST value to 140%
 - Press the [Contrast] key. The screen displays CONTRAST 100
 - Press the [Plus] key until CONT 139 is displayed
 - CONT 139 cannot be set because of the step system! Set the contrast instead to the nearest other value (CONT 140). Where a particular value cannot be set, use the nearest one instead. The resulting error will always be less than 1.5% and is thus not noticeable and measureably insignificant.
- Reducing the COLOR value from 120% to 0%
 - Press the [Color] key. The screen displays COLOR 120
 - Press the [Minus] key and keep it held down until COLOR 0 is displayed. In order to use the key repeat

function, the [plus] or [Minus] key must be held down for at least two seconds.

Storing settings

The TBC has three memories so that you can now store the settings that you have just done. Equally, the use of the memories avoids the loss of settings that are just right" following hours of laborious painstaking work. These memories allow you to store and retrieve all the particular settings. There is also a fourth read only memory which contains default values. By using this key it is always possible to change the TBC back to standard values.

N. B. On delivery the three other memories also have this default setting, but they can be altered at any time. To retrieve these settings simply press the key that corresponds to the relevant memory i.e [Mem 1], [Mem 2], [Mem 3] and [Default].

In order to file a setting for later use or simply to have it available after turning the machine off, the values should be stored. To store a setting simply press the relevant memory button and keep it held down for at least two seconds. Please ensure you press the key for long enough as otherwise the current settings will be lost and replaced by those already in the memory.

Examples:

- Retrieving the default values:
 - Press the [Default] key. The screen displays DEFAULT-.
- Storing of modified values in memory 1
 - Press the [Default] key. The screen displays DEFAULT-.
 - Press the [Color] key. This value is to be changed. The screen displays COLOR 100
 - Press the [Minus] key to reduce the colour intensity until COLOR 80 is displayed.
- Storing the modifications
 - press and hold the [MEM 1] key for at least two seconds. The screen should show MEMORY 1 and then - after holding the key about two seconds - it shows -STORED-.
- Retrieving the default values
 - Press the [Default] key in order to retrieve the standard values. Now press the [Color] key. The display now shows COLOR 100 as this is the default setting.
- Retrieving the modified settings in Memory 1
 - In order once again to use the modified values, press the [MEM 1] key. Press the [Color] key and the screen displays your old setting (COLOR 80)

***Summary:** The [Mem 1], [Mem 2] and [Mem 3] keys have two different functions. If pressed for a short time the current settings are replaced by those in the memory. If the key is depressed for longer than two seconds then the current values will be stored in the respective memory. The [Default] key has a special setting so that the standard values can always be recalled. These values cannot be erased.*

General Operation

This section explains the operation of all the functions of the TBC. It is assumed that you have read and understood the previous section. The explanations are for reference purposes. Practical applications of the functions here explained can be found in Section 7, page 83.

The Operation Group

The Operation group contains the basic functions of the TBC.

• The [Power] Key **LED Acknowledgement**

This key switches the TBC on and off. The status is shown by an LED - when the LED is on then the machine is switched on and vice versa. Each press of the key switches the TBC respectively on or off. See section 6.1.2

• The [Bypass] Key **LED Acknowledgement**

If this mode is selected, the video input is connected direct to the video output and thus the images are not altered in any way.

The Input Reference Group

This group contains the functions to control the video standard and the synchronisation. As the TBC has Y-C and normal video inputs, you need to choose which input to work with.

- **The [Y-C] Key** **LED and LCD Acknowledgement**

The Y-C key selects which video signal is to be used by the TBC. If the LED next to the [Y-C] key is illuminated then the Y-C input signal will be used. You can switch between Y-C and normal video signals. In any case the LCD screen will show which one is to be used.

- **The [Extern] key** **LED Acknowledgement**

This key is used to switch between internal and external synchronisation sources. When the LED is illuminated the output signal will be synchronised with a studio timing device (Blackburst) which is connected to the Reference-In socket. If the LED is not illuminated then the TBC is using its own quartz precision synchronisation.

N.B. You can only switch to an external synchronisation when you have connected a studio timing device!

THE IMAGE CONTROL GROUP

This function group contains all the possibilities to work on a video image using a video processor. All functions employ the user dialogue as described in section 6.1.4.

- **The [Red] Key** **Acknowledgement: LCD Screen**

This key is used to switch the TBC into the mode where the red portion of the video picture can be modified with the [Plus] and [Minus] keys. By use of this function the colour balancing can subsequently be altered.

- **The [Green] Key** **Acknowledgement: LCD Screen**

This key is used to switch the TBC into the mode where the green portion of the video picture can be modified with the [Plus] and [Minus] keys. By use of this function the colour balancing can subsequently be altered.

- **The [Blue] Key** **Acknowledgement: LCD Screen**

This key is used to switch the TBC into the mode where the blue portion of the video picture can be modified with the [Plus] and [Minus] keys. By use of this function the colour balancing can subsequently be altered.

N.B. In the video field colours are produced through a mixing process whereby the different tones are all made up from the appropriate mixture of red, green and blue. Below is a table showing which tones are produced by differing mixtures of the primary colours.

White = Red + Green + Blue

Red = Red

Green = Green

Blue = Blue

Yellow = Red + Green

Cyan = Blue + Green

Magenta = Blue + Red

If your video has a yellow tinge, then the red and green is too strong. You can correct the fault by reducing the red and the green or by increasing the blue. Of course it is possible to use these rules to deliberately create colour effects.

- **The [Color] Key** **Acknowledgement: LCD Screen**

This key is used to alter the colour intensity of your video. It is identical to the „colour" control on your television.

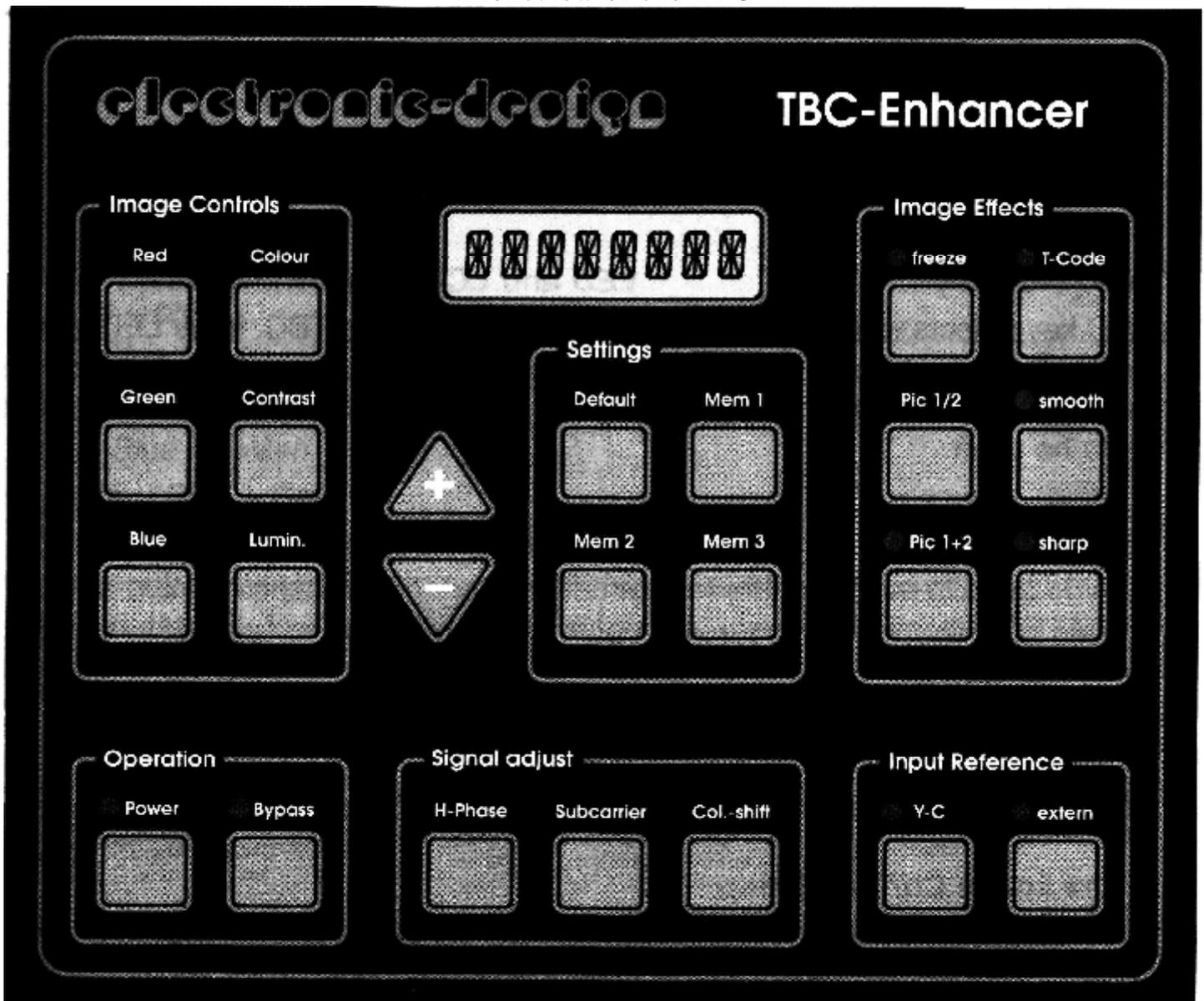
- **The [Contrast] Key** **Acknowledgement: LCD Screen**

This key is used to alter the contrast of your video. It is identical to the „contrast" control on your television.

- **The [Lumin.] Key** **Acknowledgement: LCD Screen**

This key is used to alter the brightness of your video. It is identical to the „brightness" control on your television.

Frontview of the TBC



THE IMAGE EFFECT GROUP

With the aid of the Image Effect Group's functions you can add digital effects to your video or reduce interference.

- **The [Freeze] Key**

Acknowledgement: LED & LCD Screen

This key puts the TBC into freeze-frame mode. The TBC displays the last stored video image as a digital freeze-frame. The LCD screen displays PIC 1+2 I to confirm this. Additional confirmation comes from the illuminated LED. The display of both half images as a digital freeze frame can lead to undesirable flickering. This occurs when the two half images are interlaced but do not follow each other precisely on the recording. As long as the film is playing the flickering is not noticeable. The only means of combating this (and something which video recorders also do) is to display only one of the half images but twice. The two following keys can control this double display. To turn the freeze-frame off again simply press the [Freeze] button again. The LCD screen is cleared and the LED goes out.

- **The [Pic 1/2] Key**

Acknowledgement: LCD Screen

This key is only used when the TBC is in digital freeze-frame mode (by pressing the [Freeze] key). When freeze-framing, two interlaced half-images are displayed. In order to suppress the inherent flickering it is possible using the TBC to display the same half-image twice. By pressing the [Pic 1/2] key it is possible to switch between double-display of the first half-image and double-display of the second half-image. In order to show that this function is in operation, the LCD screen displays either PIC 1 E or PIC 2 O for the first or second half-image respectively. By pressing the [PIC 1/2] key it is possible to switch between the alternate half-images. In order to view both half-images together again, the following key is used.

- **The [Pic 1 +2] Key**

Acknowledgement: LCD Screen

and to the left or right.

In order to make the operation as easy as possible, the [Col -Shift] key is used for both horizontal and vertical modifications.

Setting of the X-axis (CMOVE... must not be displayed on the LCD screen)

- Press the [Col-Shift] key - The screen shows CMOVEX 0
- With the [Plus] and [Minus] arrow keys you can move the colours left and right
- A further press of the [Col-Shift] key allows the colours to be adjusted on the Y-axis.

Setting of the Y-axis (CMOVE... must not be displayed on the LCD screen)

- Press the [Col-Shift] key - The screen shows CMOVEX 0 (or another value after CMOVEX)
- Press the [Col-Shift] key once again - The screen shows CMOVEY 0
- With the [Plus] and [Minus] arrow keys the colours can be moved up and down.
- A further press of the [Col-Shift] key allow the colour to be shifted on the X-axis.

THE SETTINGS GROUP

The settings group allows the storage and retrieval of TBC settings. Additionally a neutral default setting can also be called upon.

• The [Mem 1], [Mem 2] and [Mem 3] keys Acknowledgement: LCD screen

These keys replace the current settings with those stored in the memory. The current settings are erased! The switch to the settings in the memory is confirmed by the display of MEMORY 1, MEMORY 2 or MEMORY 3 on the LCD screen. Additionally, the current settings can be stored in the memory so that they can later be retrieved. To store the current settings in the memory depress the [Mem 1],[Mem 2] or [Mem 3] key for at least two seconds. That the settings have been stored is confirmed by STORED on the LCD screen. The previous content of the memory is deleted!

• The [Default] Key Acknowledgement: LCD Screen

By pressing the [Default] key, neutral values can be set. The current settings are erased! These settings can always be retrieved but not stored. As confirmation that the neutral values have been set, DEFAULT appears on the LCD screen.

TUTORIAL - HANDS-ON PRACTICE

The following section should explain the functions of the TBC by means of hands-on practice. In order to fully understand all the functions of the TBC, it is essential to conscientiously work through all the exercises and be sure that you know what does what. In order to learn from mistakes it is helpful to connect a video recorder and record the output. On later examination with the help of the recording, your work can be analysed quickly. These exercises are suited to all levels from total beginner through to professional. Please don't skip any exercises because you „already know it". Practice makes perfect!

All exercises take the following form:

Task:

...

Solution:

...

Practice:

...

Make sure you also try the further exercises under the „Practice" headings.

WORKING ON THE IMAGE USING THE TBC

This section should show you how to neutralise the effects of errors in the settings or quality lost through copying as well as showing you how to make specific changes to your video.

CHANGING THE WHITE BALANCE

-Task

A colour balance was not carried out, before camera recording commenced or a colour error has crept into the video because of bad lighting. In short there is a colour tint.

- Solution:

With video all colours are made up by the primary colours red, green and blue. All other colours can be made up from combinations of these colours.

The following table shows which colours are made up from various mixtures of the primary colours:

Red = Red

Green = Green

Blue = Blue

White = Red + Green + Blue

Yellow = Red and Green

Purple = Red + Blue

Light Blue = Green + Blue

From this table it follows that if the video has a yellow tinge then the green and the red are set too high or the blue is set too low.

Thus to eliminate a yellow tinge, do the following:

1. Press the [Red] key in order to change the Red component with the [Plus] and [Minus] keys. The screen should read RED 100.
2. Reduce the red component to around 90%. The screen should read RED 90.
3. Press the [Green] key in order to change the green component with the [Plus] and [Minus] keys. The screen should read GREEN 100.
4. Reduce the green component to around 90%. The screen should read GREEN 90.

If the yellow tinge is still visible then repeat the above four steps reducing the value once again to around 80%.

If the yellow tinge turns into a blue tinge then repeat the above four steps using a value between 80% and 100%. Alternatively, you can of course increase the blue component to around 110% to eliminate the tinge.

N.B. Don't increase the colour intensity too much as this can cause problems with your video recorder. If you increase the intensity to a great extent then you should also adjust the contrast and the brightness to prevent the picture from becoming too bright.

- Practice:

1. Adjust an image so that it has a strong yellow tinge. Adjust the brightness and contrast as well!
2. Reduce one of the colours to zero and note the change in the mood of the film.
3. Change a normal film into a „romantic" film by increasing the red component slightly.

WHAT CAN BE DONE WITH DARK IMAGES?

-Task

Whilst copying a video the brightness should be improved.

- Solution

There are two ways of changing an image with such problems. The first possibility is to change the brightness using the [Lumin] key. However by simply changing the brightness, very dark colours are made greyer. In order to avoid this, the contrast should also be changed using the [Contrast] key. Take care that dark colours remain dark and that bright colours (including white) do not become too bright.

- Practice

Copy a video and take care that black and white are always visible e.g. by using a TV test card or test card generator. Change the contrast and brightness settings and note the change in the appearance of the picture.

N.B. It is always a good idea to experiment with such changes using a TV test card as the changes are always more noticeable.

IMPROVING DULL COLOURS

- Task:

The video's colours are too weak (dull) or too strong (bright). The video's colour intensity should be changed whilst copying.

- Solution:

Using the [Color] key put the TBC into the mode where colour intensity can be modified. This colour control (as well as the contrast and brightness) works in exactly the same way as the colour control on your television. Thus to improve dull colours, set the colour at a value greater than 100% and for colours which are too intense at a value less than 100%. The exact value can only be determined by experimentation.

N.B. If you increase the colour intensity too much, this can damage your video recorder and mean that it cannot correctly display colours' brilliance. At best the colours are simply limited but at worst the video recorder is rendered useless. Thus please do not modify the colours beyond a sensible degree. This problem do not occur when reducing colour intensity, the pictures simply become more black and white!

- Practice

1. Copy a video with a colour setting of 50%. Copy it once again with a colour setting of 150%. You will notice that the colour intensity is the same but the quality has deteriorated.
2. Copy a video with a colour setting of 0% and then once again with a colour setting of 150%. You will notice that once the colour has been removed, it cannot be retrieved.

MOVING THE IMAGE HORIZONTALLY

- Task:

An image has been shifted horizontally i.e. it is not on the centre of the screen. This occurs sometimes when copies are made.

N.B. This shift should not be confused with such shifts caused by the monitor. Please make sure that the shift is definitely attributable to the video recording and not to a faulty monitor or television.

- Solution:

By pressing the [H-Phase] key it is possible to shift the image horizontally using the [Plus] and [Minus] keys.

- Practice

Copy a video with an extreme left shift. Copy it once again with an extreme right shift and look at the result.

N.B. The area that was no longer visible has now become a black stripe. This occurs because when the image is shifted it becomes ever narrower because the image data has to be artificially produced to keep the image width regular. This artificial data is black.

USING THE TBC'S SPECIAL EFFECTS

The following section deals with all the different special effects that the TBC can produce and their use in every day work with videos. In order to be able to fully utilise the TBC's special effects it is necessary to understand them properly. However, please do not make the mistake of overloading your video with special effects as picture quality can suffer severely as a result. By special effects mixing or similar processes are not meant, rather effects that influence picture quality.

FREEZING A PICTURE.

- Task:

An image is to be frozen for use in a trailer. The quality of the freeze-frame from the source recorder is not sufficiently good or the source material itself is of bad quality. In either case an acceptable analogue freeze-frame cannot be achieved.

- Solution:

The TBC has a digital freeze-frame facility which relieves the video recorder but does not damage the cassette and gives better results than an analogue freeze-frame.

To produce such a digital freeze-frame, simply press the [Freeze] key. The LED will light to show that this option has been selected. The output of the TBC is now a freeze-frame consisting of both half-images. This is confirmed by the message PIC 1+2 on the LCD screen.

N.B. Because both half images are displayed together interlaced, flickering can result. This is explained fully in section 6.2.4 on page 79 or alternatively in the next section. Accordingly the [Pic 1/2] and [Pic 1 +2] keys can be used to control the freeze-frame

- Practice:

1. Freeze a video with the freeze-frame function and then experiment with the [Pic 1/2] and the [Pic 1+2] keys.
2. Freeze a sports recording or another recording with fast camera movement and note the flickering. Now experiment with the [Pic 1/2] and [Pic 1+2] keys.

PRESERVING THE TIMECODE

- Task:

A video has been recorded with the VITC timecode intact. This must be preserved.

- Solution:

For many TBCs this is an impossible task, but not for the Electronic-Design TBC! In order to preserve the Timecode information press the [T-Code] key. The LED next to the [T-Code] key lights to confirm that the Timecode will remain intact. On the other hand, to discard data held in the Timecode area e.g. copy protection, press the [T-Code] key so that the LED goes out.

- Practice:

Copy from a source (e.g TV or video recorder) and use a teletext television as a monitor. Switch the source to a channel with teletext and use the [T-Code] key. If the Timecode is preserved the teletext can be modified as normal. If on the other hand the Timecode is discarded then the teletext can no longer be manipulated.

- N.B.*
1. Teletext and timecode data are transmitted in the same part of the screen.
 2. Where problems with copy protection are encountered, this function can prove very useful.

MAKING THE PICTURE SHARPER

- Task:

A video needs to have its contours sharpened. This is in any case only possible with an already good quality recording.

- Solution:

When the [Sharp] key is used the TBC increases the bandwidth somewhat. Confirmation that the function is in use is given by the LED next to the [Sharp] key. The widening of the Bandwidth is only worthwhile where it is already relatively good. A fifth generation copy cannot be made noticeably sharper.

- Practice

Using a camera record a piece of wood or another fine structure. Copy this twice using a good quality recorder (S-VHS!) once with the sharp function and once without and note the considerable difference in clarity.

N.B. If a VHS recorder is used, this function cannot perform to its full potential. This function should therefore mainly be used to improve the quality of an already good quality recording. Blurred videos can never be turned into sharp videos!

PREVENTING INTERFERENCE

- Task:

An old video with severe interference needs improvement.

- Solution:

By pressing the [Smooth] key an electronic filter is engaged. Confirmation that the filter is engaged is given by the LED next to the key. When the filter is used, interference will be removed. This improvement is achieved at the cost of picture quality and should thus be used only when the interference is severe.

- Practice:

Copy an old video with severe interference once using the Smooth function and once without. Note the substantial improvement.

- N.B.*
1. The digital filter reduces the bandwidth somewhat.
 2. This function cannot be used in connection with the Sharp function as they operate in an opposite manner to each other. Accordingly, if the [Smooth] key is pressed the [Sharp] function is automatically switched off.

REFERENCE

The following section acts as a reference book for using the Electronic-Design TBC. All user dialogues and LCD messages are repeated in abbreviated form.

USER DIALOGUE

The TBC communicates with the user through the keys, LEDs and the LCD screen. The following sections give these user dialogues in abbreviated form.

- **[Red], [Green], [Blue], [Color], [Contr.], [Lumin.], [H-Phase], [Subcarrier]**

On pressing the respective key the name of the key and its current setting is displayed on the screen. The setting can be changed using the [Plus] and [Minus] keys.

- **[Col-Shift]**

When this key is pressed C MOVE X is displayed on the screen along with its current setting. The setting can be changed using the [Plus] and [Minus] keys.

If the key is pressed again C MOVE Y appears on the screen along with its current setting. This can also be changed using the [Plus] and [Minus] keys.

- **[Bypass], [T-Code], [Smooth], [Sharp]**

On pressing the respective key the LED is illuminated - The respective function is in use.

If the key is pressed again the LED goes out and the function is switched off.

- **[Power], [Y-C], [Extern], [Freeze]**

On pressing the respective key the LED is illuminated and a message is displayed on the screen. The respective function is activated or in the case of the [Power] button, the TBC is turned on. If the key is pressed again the LED goes out and a message appears on the screen (or the TBC is switched off!)

- **[Pic 1/2], [Pic 1+2] - only active when the TBC is in [Freeze] Mode**

By pressing the [Pic 1/2] the freeze-frame is switched to displaying the alternative half-image.

By pressing the [Pic 1+2] key the freeze-frame is composed of both half images.

- **[Default], [Mem 1], [Mem 2], [Mem 3] keys for less than two seconds**

On pressing the respective key MEMORY and the respective number or DEFAULT is displayed on the screen - the current settings are erased and replaced with those in the memory (or the default setting.)

- **[Mem 1], [Mem 2], [Mem 3] keys for longer than two seconds**

When the key is pressed for longer than two seconds SAVED appears on the screen. When your finger is removed from the key MEMORY and the respective number is displayed to show that the current settings have been stored in the respective memory.

THE LCD ALPHABET

Because the LCD screen is limited in what it can display it is unfortunately very difficult to represent all characters properly. In order that reading the screen does not become an IQ test, the LCD alphabet is reproduced below.

Service and Warranty & Problems

Thanks to XILINX the TBC can always be updated. Electronic-Design are constantly working on technical improvements. These technical developments can be incorporated into the TBC by a simple Chip-update.

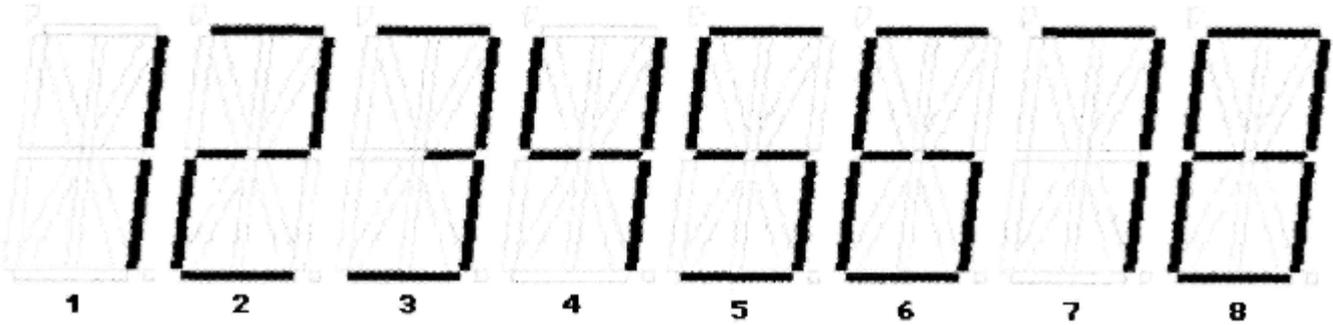
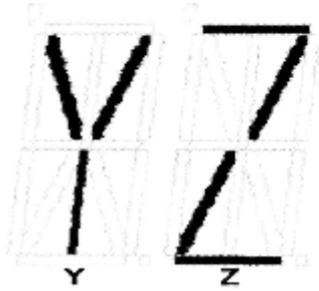
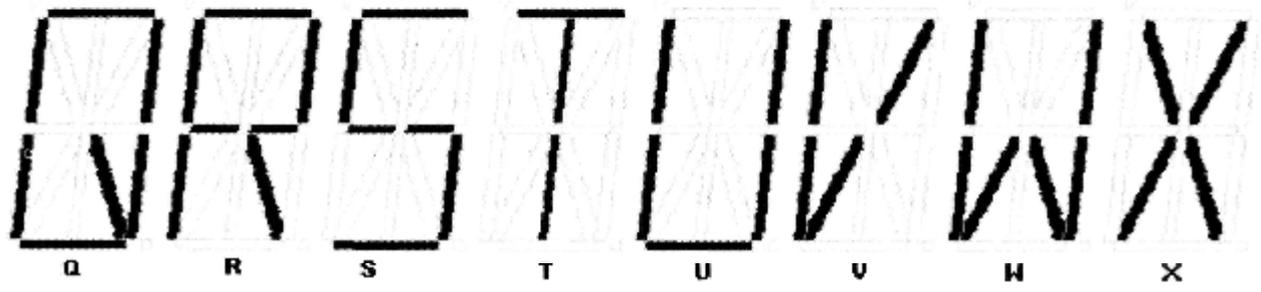
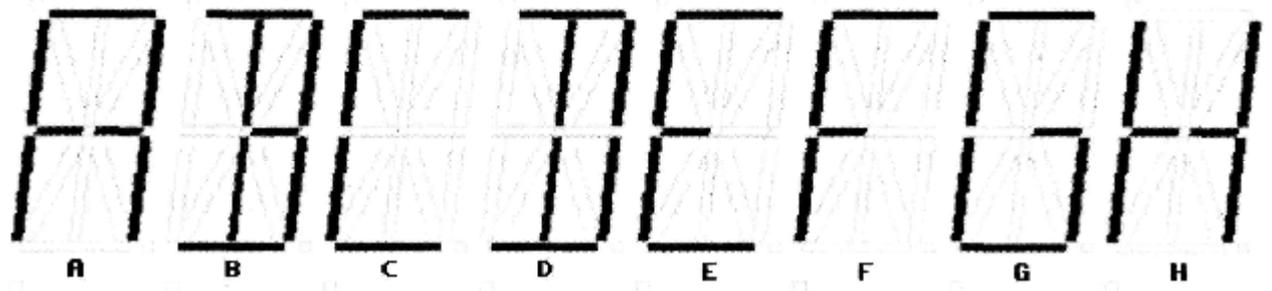
Enquire at your dealer or direct to Electronic-Design - we will be pleased to inform you of our latest developments. If you return the guarantee card we will inform of any new innovations.

Each TBC undergoes various quality checks and tests at the manufacturers. It cannot however be completely ruled out that faults may occur. Should the tips provided in this handbook not provide a remedy to your problem, then return the TBC to the dealer from which it was purchased.

As the manufacturer we guarantee the TBC and its faultless operation for one year. Should you wish to make use of the warranty then please send us the TBC along with the warranty card and the original receipt to the address below. Parcels with insufficient postage will not be accepted!

Electronic-Design GmbH

Detmoldstrasse 2a D - 80935 Munich Germany Tel: +49 89 354 53 03 Fax: +49 89 354 56 74 Business Hours
Mon - Thurs 8:30 -12:00 & 13:00 - 17:00, Fri 8:30 -12:00.



Problems and their causes

- **No picture is displayed**
 - No source video is connected
 - The TBC is incorrectly connected
 - The source video is not switched on
 - The lens cap is still on the camera
 - The TBC is not switched on
 - The wrong video input has been selected on the TBC

- **The picture is blurred**
 - The lighting is too bright
 - The source image is blurred
 - The source video is not properly connected
 - *Dirty camera lens*

- **The picture is too rough**
 - The lighting is not bright enough
 - The source video is incorrectly connected

- **Bright spots**
 - The lighting is too bright
 - The camera is wrongly adjusted

- **The image has „stripes“**
 - The source video is incorrectly connected
 - The TV reception is bad
 - Bad picture quality on the part of the video recorder
 - Interference from the earth connection!

Changes on the TBC

• **YUV - output**

The YUV-output is no longer available.

• **Video testpicture**

A video testpicture can be activated by pressing [PIC1/2] and [PIC1+2] at the same time.

To deactivate this funktion switch the tbc off and on again.

• **Saving the default settings**

If you get the message "DATA-ERR" in the display, you have lost your default settings. Please adjust all settings to normal (100%) and hold the [FREEZE] and the [DEFAULT] button for 2 seconds.

Technical Data

functions:	video:	Colour, Contrast, Luminance, Red, Green, Blue: via button and LCD dialog
	signal:	H-Phase, Subcarrier, Color-Shift: via button and LCD dialog
	effects:	Freeze, 1/2 1+2 half frame, Smooth/Sharp digital filter, bypass, Time-Code window, copy protection decoder, internal/external Sync, Y-C/CVBS switcheable via button and LCD dialog
buffer:	functions:	3 independent buffers for complete settings, 1x Power Down setting 1x unchangeable default setting
	video:	2x half frames = 1.0 MegaByte 1 full frame TBC + regulation range, for error free TBC operation.
power supply:		+12V= /1000 mA electrical stabilized via power jack
bandwidth:	CVBS:	4 MHz
	Y-C:	5,5 MHz
compatibility:		all CVBS and Y-C video systems IN and OUT all YUV video systems only OUT
accessory:		1 power supply, manual
Dimensions:	(B x H x T)	218x64x230 mm
Inputs:	CVBS In:	1 V _{ss} / 75 ohm via 2 Pol Chinch female
	Y-C In:	Y: 1 V _{ss} / 75 ohm C: 0,3 V _{ss} / 75 ohm via 4 pol Mini Din socket
	Blackburst:	1 V _{ss} / 75 ohm via 2 Pol Chinch female
Outputs:	2x CVBS Out:	1 V _{ss} / 75 ohm via 2 Pol Chinch female
	Y-C Out:	Y: 1 V _{ss} / 75 ohm C: 0,3 V _{ss} / 75 ohm via 3 Pol Mini Din socket
	RGB Out:	R, G, B: 0,7 V _{ss} /75 ohm H, V, C Sync: TTL level via 23 Pol Sub-D male
	YUV Out:	Y, U, V: 0,7 V _{ss} /75 ohm C-Sync in Y-signal via 23 Pol Sub-D male
	Blackburst:	1 V _{ss} / 75 ohm via 2 Pol Chinch female

Belegung der RGB-Buchse

Die 23-polige Sub-D RGB-Buchse ist sowohl mit RGB- als auch mit den YUV Signalen belegt; die Anschlußbelegung entspricht weitgehend der des Amiga Computers.

Pin:	Signal:
3	analoges Rot-Signal
4	analoges Grün-Signal
5	analoges Blau-Signal
6	Y-Signal
8	U-Signal
9	V-Signal
10	gepuffertes Composite-Sync-Signal
11	horizontales Synchronisationssignal
12	vertikales Synchronisationssignal
13	GND
16	GND
17	GND
18	GND
19	GND
20	GND
22	+12V
23	+ 5V