

Test Chest Manual

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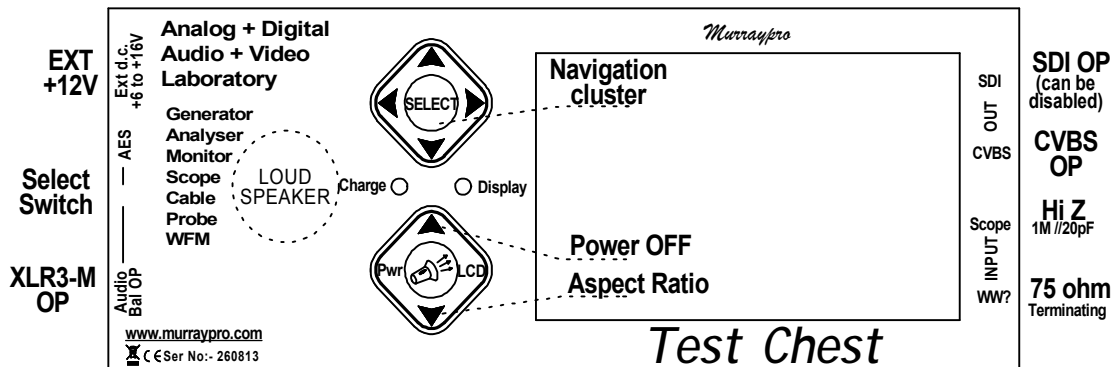


Congratulations on the purchase of your *Murraypro* **Test Chest**, which we are certain you will soon find to be an extremely powerful diagnostic Tool, and truly indispensable in your daily work on the Bench; or whilst away investigating problems, under battery power.

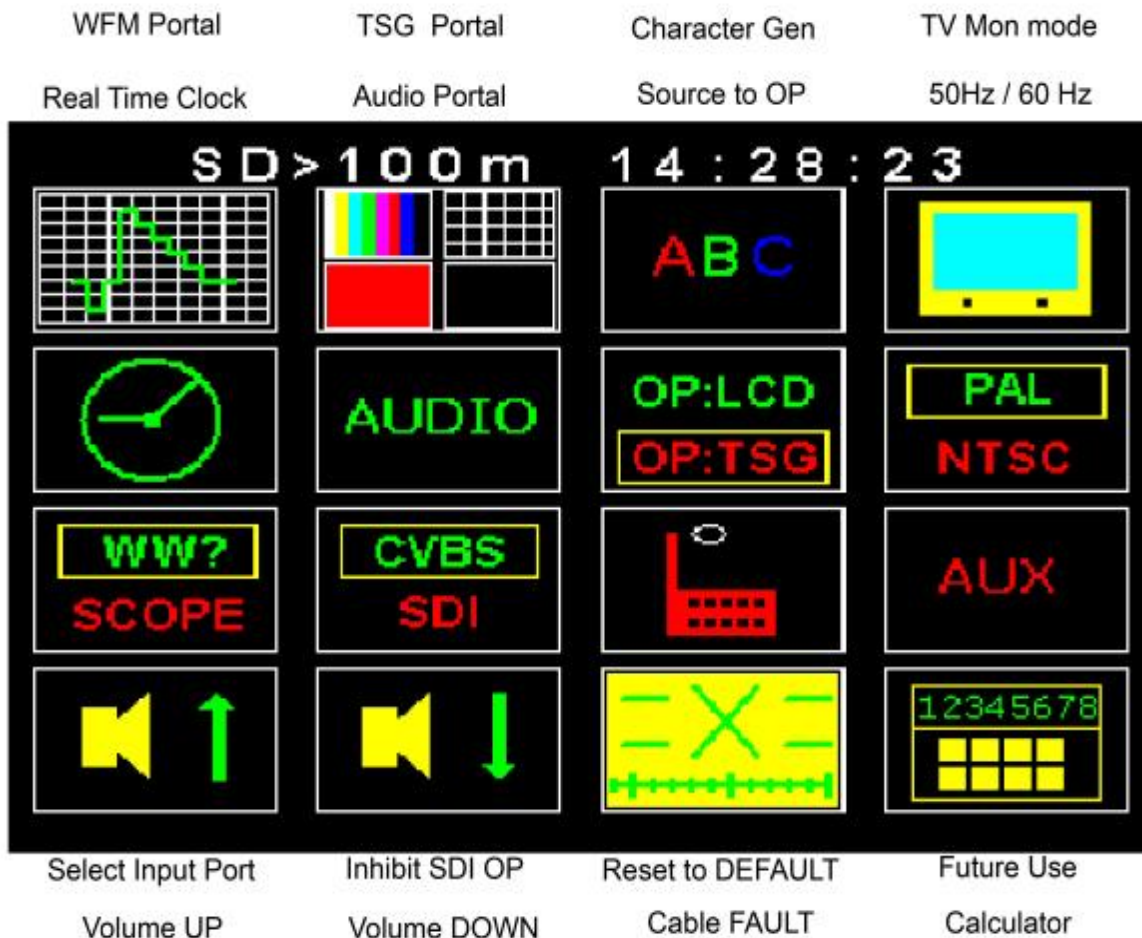
Test Chest is a deceptively powerful Product, so lets spend a few moments together getting to know it, and exploring it's features. In fact, most of the major features are immediately obvious as they are menu selected, but other more subtle features may be a key press or two away.

MOST functions are menu selected from the page presented after the **Test Chest** initially powers up (initiated by pressing the "Pwr" key of the lower key cluster) and by using the navigation keys and the centre "Select" key of the upper switch cluster. In a number of instances, **Test Signal Generation** and the **Wave-Form** display mode for example, selection of the required output Test Signal or WFM display mode, will require selection via a sub-menu.

Users should be aware that some Menu options, although subtle, will alter the mode of operation substantially. Turning off an unused SDI output to save power, for example when using the CVBS output, is a menu option; however the functions actually enabled are clearly shown on the Menu page.



Test Chest: Front.



Menu Functions

Power considerations.

Test Chest is powered from an internally mounted rechargeable battery pack which, when fully charged, should provide sufficient power for at least a couple of hours operation.

Test Chest is unusual in that it has two quite distinct modes of operation, and these are totally different, and separate, from any battery charging considerations:-

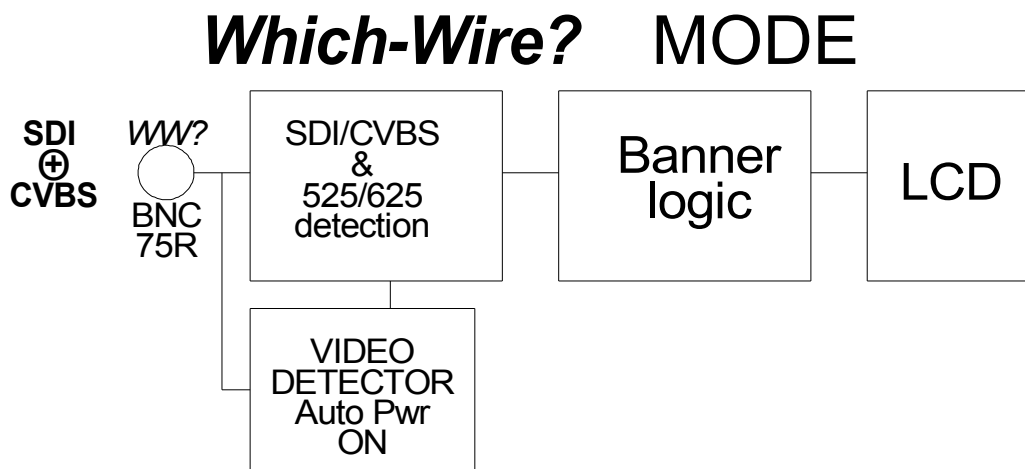
- In the **Which-Wire?** mode, the unit will *automatically power up* and display a signal as soon as an input is applied with no action being required, other to plug in the BNC.
- In the **Generation** and **Measurement** modes, it will be necessary to turn on the Unit by means of the front panel "**Pwr**" key on the lower cluster. In these modes, the **Test Chest** is turned **OFF** by pressing ▲ key of the lower cluster briefly.

Test Chest provides essentially 9 functions, which are described more fully later, but these are at present, perhaps, best initially considered under 3 major separate function headings:-

Which-Wire?

i) **Which-Wire?** A powerful investigative mode in which **Test Chest** emulates the original *Murraypro Which-Wire?* Unit, automatically awakening from slumber as soon as a signal is applied to the input BNC, and it is not necessary to manually power the **Test Chest** up in this mode. **Which-Wire?** then not only automatically displays the TV signal present on the input BNC via the internal 16:9 LCD screen, but additionally identifies between 525/625 & SDI/CVBS signal types, by means of an on-screen banner.

Users should connect to the lowest BNC connector, designated “**WW?**” at the bottom right of the front panel, and be aware that this connector always correctly terminates an input with 75 ohms. A fundamental feature of the **Which-Wire?** mode is that both Analogue and SDI signals enter the Unit *via the same connector*, so it will never necessary to double guess what signal type may be present on a given cable as the **Test Chest** will auto-switch between SDI and CVBS inputs. This is an important and vital difference between the **Test Chest** and some other products, which will require the User to consecutively offer the unknown signal to both of the separate SDI and CVBS inputs, in turn.



Test Signal Generator

ii) **TSG.** The **Test Chest** contains a very powerful, high quality **Test Signal** Generator that is eminently suitable for testing external equipment. Menu selection of the 15 different Test signals is easy, and the Generator can provide simultaneous SDI and CVBS output streams of the selected Test Signal. To increase battery endurance, the SDI OP may be disabled via the menu, reducing the power drain if only a CVBS OP is required.

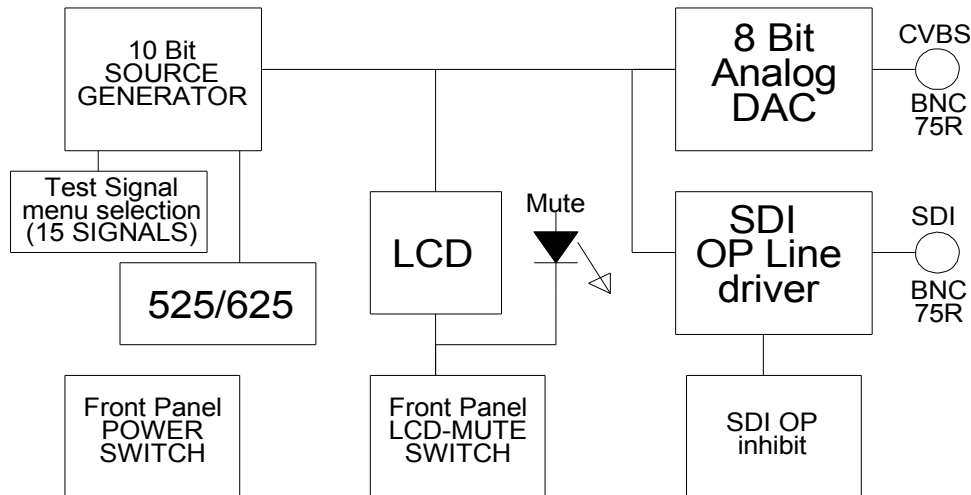
It is possible to insert a **local identification text string** in to the output video, a particularly useful feature when feeding long lines.

To conserve battery power the LCD panel may be turned off via the lower

switch cluster, reducing the load substantially, once the TSG has been set up.

An audio oscillator with balanced OP is incorporated, providing a useful source of spot frequency audio for generic testing. This is described in more detail later.

VIDEO Signal Generator



Wave-Form Monitor

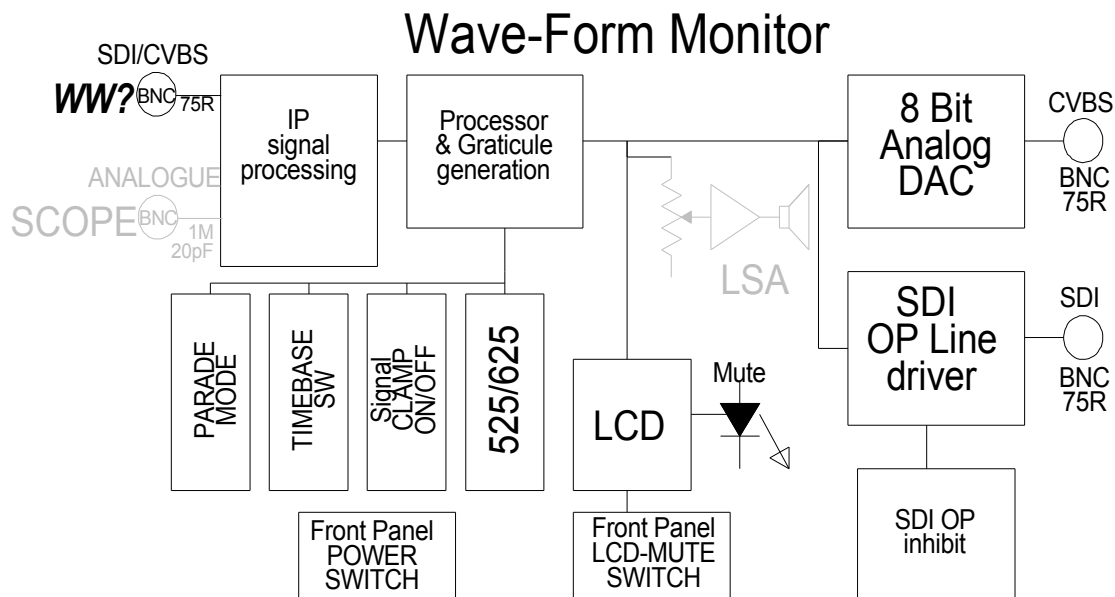
iii) **Measurement.** **Test Chest** incorporates an internal TV **Wave-Form Monitor** function. TV signals may be displayed from either SDI or CVBS sources as either standard video signals, or in Parade mode (SDI only) where the colour information is sequentially switched between either the RGB or YUV channels.

Embedded audio level for any channel pair 1&2 through to 15&16 may be displayed on the LCD panel, whilst an indication of Stereo phase is also given.

A Parade mode is available with SDI signals. The signal may be displayed in one of 3 menu selectable Parade modes: YUV, RGS or YRGB. To ease channel identification, the LCD display adopts the colour of the signal being instantaneously presented.

If desired, the CVBS and/or SDI OP of the Test Chest may be fed on to an external picture monitor in the event that a larger display is required.

In the Composite video display mode, the HF response extends up to about 10MHz.



Many additional functions are present within the Test Chest, and these are discussed below:-

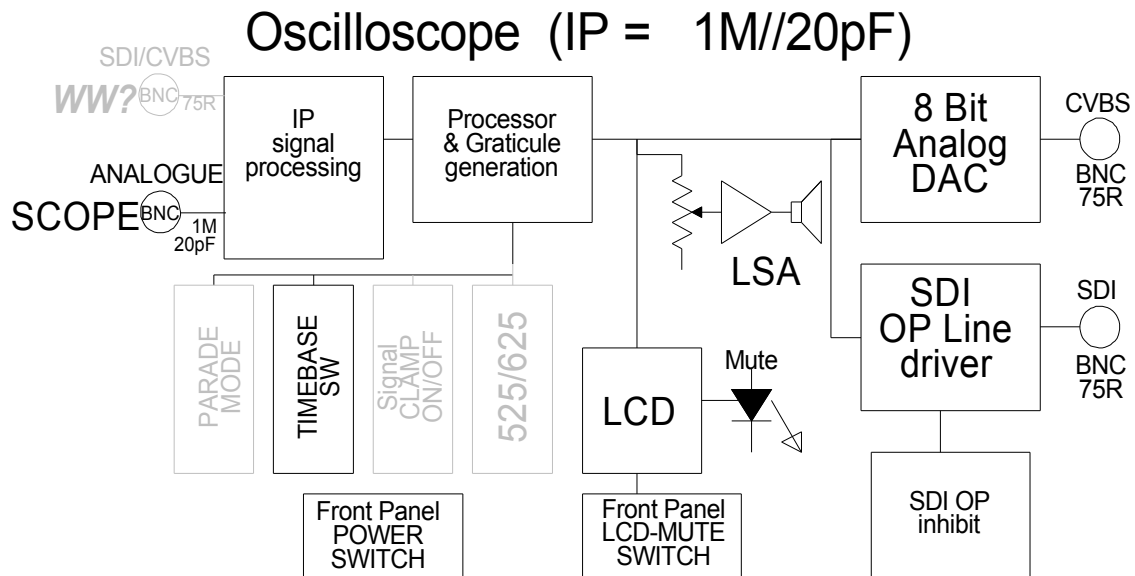
Oscilloscope mode

iv) Test Chest provides a very useful high impedance feature that enables simple investigative maintenance procedures to be undertaken without loading the external circuitry significantly.

The second BNC up from the bottom on the right hand side is specially buffered and presents a 1 Megohm // 20pF input impedance, suitable for use with a conventional oscilloscope probe.

To maximise flexibility at remote locations, Murraypro include a switchable x1 & x10 probe with the Test Chest when the optional ever-ready "Pouch style" case is ordered. The HF response extends above 10MHz, so the 'scope function can provide a useful general maintenance tool, when more powerful oscilloscopes are not available. Menu selectable gain settings of 200, 100 & 50mV/div are available.

Although the internal audio amplifier is operational in WFM mode, it becomes a really useful high impedance tool for audio investigation, when coupled through the high impedance port. Audio volume level is controlled by the "up" and "down" menu section.



OP Audio Audio level monitoring

v) Using the Test Chest's 75 ohm **WW?** input port, set initially to WFM or LCD Monitor mode, **Test Chest** provides accurate audio level monitoring of embedded audio signals, via the sub-menu's "Audio" options. Audio levels are presented as numeric values in tabular form on the LCD screen. By eliminating bargraphs for level indication, it is immediately possible to unambiguously differentiate between an AES reference level at -20FS and an EBU reference at -18FS for example, with a high degree of accuracy, in fact to a fraction of a dB.

Using the Audio sub-menu, selection between A1 & A2 or A3 & A4 pairs are possible for each of the 4 audio groups.

Additionally, the internal Loud Speaker Amplifier may be menu selected between the Left or Right channel of any stereo pair.

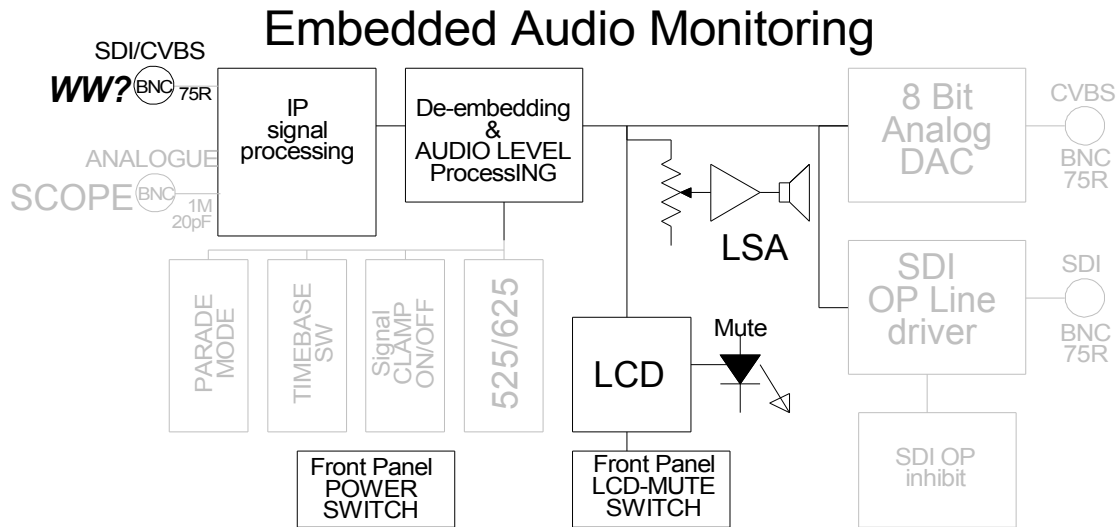
Stereo phasing is indicated by the dynamic ratio of:
 "Sum" to "Difference", also known as "Mix" to "Separation".

"L + R" = Sum (Mix)

"L - R" = Difference (Separation)

M = 100%, S = 0% would indicate two signals **perfectly in phase**, whilst.....

S = 100%, M = 0% signifies **stereo disaster**, with a total inversion of one channel.



Cable Fault Detection

vi) **Test Chest** offers a **Time Domain Reflectometry** mode for the identification of cable problems. The system launches a pulse into the end of the problem cable, which is connected to the **WW?** BNC port.

With a correctly terminated cable, all the launch energy is absorbed by the terminating load at the far end of the cable; however should the load not correctly match the cable's iterative impedance, a percentage of the launch energy will be reflected back from the far end of the cable. It is this reflected energy which **Test Chest** detects and displays on the LCD's display.

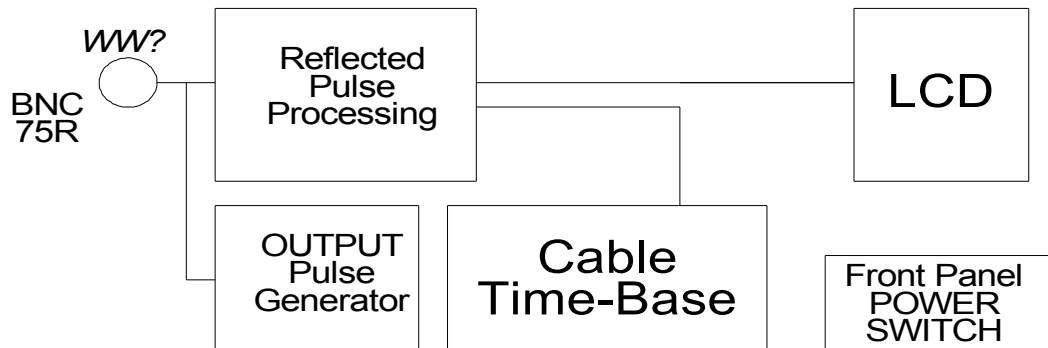
The X axis (Time-Base) of the display is calibrated in Metres, with an unterminated cable showing a positive reflection, and a short circuit as a negative reflection at the indicated distance of the anomaly.

On a 75 ohm system, Test Chest is easily able to differentiate between a correctly terminated system and one which is:-

- a) Open circuit (unterminated).
- b) Incorrectly terminated in 110 ohms.
- c) Incorrectly terminated in 50 ohms.
- d) Double terminated with 2 separate 75 ohm loads.
- e) Correctly terminated, but with an unterminated "stub".

Unless significant, mechanical damage or cable crushing is unlikely to be detectable.

Cable Fault Mode (TDR)



Audio Generator

vii) Test Chest offers, via the menu's audio sub-page, an audio oscillator generating tone, available as either an analogue source, or as a 48KHz AES encoded stream.

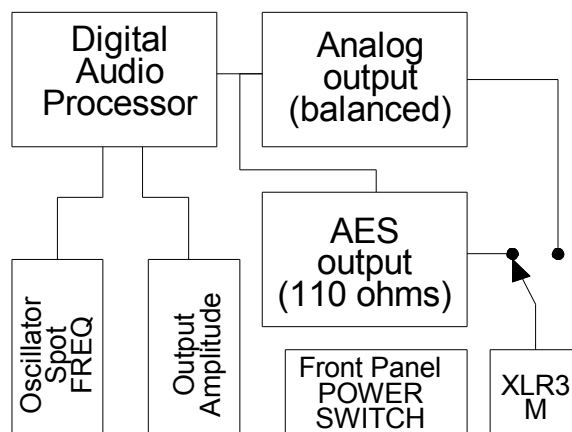
Selection between the low impedance balanced baseband audio, or the 110 ohm AES bitstream, is made by the miniature toggle switch which is mounted in the centre of the left end-plate.

Oscillator spot frequency, 100Hz, 400Hz, 1KHz & 10KHz, is set via the audio sub-menu.

Amplitude 0dBu, +2dBu & +4dBu is also set via the audio sub-menu.

Output loading: **Test Chest** follows current audio practice with a low output impedance, and does not anticipate a 600ohm load. Loading the XLR3-M balanced output with 600 ohms will cause the amplitude to drop by -0.3dB nominally.

Audio test Oscillator



LCD Aspect Ratio

Users may wish to alter the Aspect Ratio of the internal LCD panel to display external 4:3 pictures correctly,

The ***Test Chest's*** LCD aspect ratio is toggled using the ▼ key of the lower cluster. This only operates when the LCD is displaying a TV Picture, ensuring that the menus are always clearly visible.

Real Time Clock

Test Chest contains an **RTC** that is available for insertion into the output video streams, either SDI or CVBS. It is also displayed on the local LCD.

Setting of the battery powered **RTC** is straight forward, and further instructions should not be required.

Character Generator

Test Chest contains a Character Generator that is available to uniquely identify the Test Signals that have been generated by the Unit, and these may be inserted into the output video streams, either SDI or CVBS. It is also displayed on the local LCD.

The user generated unique IDENT is stored in battery backed up RAM. Setting of the Character generator is intuitive, and further instructions are not provided.

Calculator

Test Chest contains a 4 function Calculator, accessed via a sub-menu from the main page. Operation here is intuitive too, and further instructions are not given.

Reset

From time to time occasions may arise where a User might wish to “soft” reset all the ***Test Chest's*** variable options to their “factory default” settings. This option is menu selectable via the icon immediately above the “Cable Test” icon.

A “hard” reset may be performed by holding down the ▲ (power OFF) key of the lower cluster, for about 5 seconds.

Battery, and Charger

Test Chest uses a battery of 4 internal Metal Hydride cells connected in series. When fully charged, **Test Chest** should function for a minimum of 2 hours. By using power saving features, such as disabling the SDI output when only CVBS signals are required, and turning off the LCD panel by using the right switch (▶) of the lower cluster, a considerable extension in duration is achievable.

Users should be aware that, as with all rechargeable batteries, in **Test Chest** there will be a small level of “self discharge”, and also a tiny quiescent load current, which will reduce the level of stored charge with time. Murraypro recommend that the batteries in **Test Chest** are routinely given a “topping up” charge, perhaps once a month.

The battery pack is charged automatically as soon as low voltage external power is applied, by means of the 2 pin Lemo connector. An intelligent charger circuit monitors battery voltage, charge current and temperature through out the charge cycle, ensuring that the battery recharges in the shortest possible time consistent with the battery’s specification.

The internal battery charger monitors a number of parameters, as above, and will prevent overcharge, no matter how long the external power is connected.

From “flat”, expect the **Test Chest** to be fully recharged in no more than 2 hours.

The battery is protected against “deep discharge” damage by a special low voltage detector which powers down the **Test Chest** when the cells have discharged to their minimum safe level. Prior to that time a “*LOW VOLTAGE*” warning will appear at the top of the LCD screen, warning that only a limited period remains before automatic shutdown.

The Metal Hydride cells fitted in the battery have a capacity of 2300mAH, and are anticipated to have a service life in excess of 500 charge/discharge cycles.

Murraypro supply a +12V regulated supply that is capable of supporting operation of the **Test Chest** whilst it recharges it’s battery. Any external power source between 8.5V and 15V, and capable of sourcing of 1A via the 2 pin Lemo connector, should be suitable, The **Test Chest** can actually operate with a lower external voltage, but the internal battery charger operation is inhibited.

Flashlight

Test Chest provides an intense beam of white LED light, by pressing on the centre key of the lower switch cluster, illuminating those dark and inaccessible areas, which seem liberally positioned throughout the Broadcast TV environment. Cable colours and numbers are brilliantly illuminated in an instant, removing ambiguity caused by poor lighting.

CAUTION! The White LED fitted in the flashlight has an OP of 8-15 CD and a narrow (15°) beam width, and thus appears extremely bright.

NEVER flash the light in any person’s eyes; stare, or allow others to stare directly into the light along the beam axis, or *DAMAGE to EYES could occur.*

Test Chest Specification

(Firmware V0.5)

The Specification of the Test Chest is subject to a process of continuous review and development, and may be subject to Upgrade and revision. Flash Upgrades, which will require a return to the Works for installation, will be available from time to time; and information regarding the latest Issue will be given on the Murraypro Web Site, www.murraypro.com

INPUTs: “WW?” 75 ohm 1% terminating
“Scope” 1M ohm shunted by 20pF.

Outputs: SDI, 800 mV into load of 75 ohms. May be disabled for power saving.
CVBS, 1 Volt (nominal) into 75 ohm load.

Which-Wire?

Power on; Automatic signal detection and power up
Video: Automatic SDI/CVBS mode detection & switching
Standard: Automatic 525/625 Standard detection and switching
Aspect: Switch selectable 16:9 (default) or 4:3 aspect ratio.
Legend: On-screen text field declaring detected Video+Standard.

Test Signal Generator

Test Signals: 100.0.100.0 Colour Bars, White field, Red Field, Black Field,
Moving Puck, 2T +20T Chroma Pulse & Bar, DC Bounce,
Grill, 5 Step Staircase, 5 Step + Chroma, Sawtooth, S.T.+Chroma.
Pathological Test, Burnt-in character IDENT on/off.

SDI Generated to 10 Bit precision.
CVBS Generated to 8 Bit equivalent precision.
Multiburst. 50Hz: 0.5, 1, 2, 3, 4, 5 MHz
60Hz: 0.5, 1.25, 2, 3, 3.58, 4.2 MHz

Waveform Monitor

Input: Uses “WW?” 75 ohm input BNC
Clamp: Menu selectable Black Level Clamp.
TimeBase: 2H, H, H mag, 2V, V, V mag
Shift: X shift, Y shift only available in CVBS mode.
Parade: YRGB, RGB, YCrCb, available with SDI inputs only
Graticule & Traces appropriately coloured for identification.
HF resp. -3dB nominal at 10MHz

Oscilloscope

Input: Uses Oscilloscope 1M//20pF BNC
Shift: X shift, Y shift.
Gain: 200mV/div, 100mV/div (+6dB), 50mV/div (+12dB).
HF resp. -3dB nominal at 10MHz

Cable Fault

Range: 350Metre.
Detects: Open circuit, High impedance, Correct, Low impedance, Short circuit.

Audio Level measurement

IP signal: De-embedded from the SDI input signal.
Group: Menu selectable 1, 2, 3, 4
Pairs: A1&A2, through A15&A16.
Level: 2 digit + decimal unit resolution on LEFT & RIGHT channel.
Phase: Stereo phasing by ratio of M to S, expressed as %
Monitor: Menu selection of LEFT or RIGHT channel.

Audio Monitoring

Internally mounted miniature Loudspeaker (20mm) mounted on the front panel, sealed behind flexible membrane.
80mW drive 750 - 5KHz response.

Character Generator

Generator: 15 ASCII characters per line
Rows: 4, maximum.
Storage: Non-volatile RAM.

Calculator

Standard 4 function, 8 digit calculator.

Real Time Clock

24 hour HH+MM setting.

Physical

Size: 210, 83, 35mm
Weight: 0.6KG
Sealing: IP 65
Power: Internal 2300mAH Metal Hydride battery
DC Input: 2 pin male, mates with:- Lemo: HGG-0B-302-CLRP
Endurance: >2 Hours @ maximum operational load, with no power saving enabled.
External dc: Charging: 2 Hour nominal, from flat with 12V @ 1A.
8.5 - 16V dc external power for full function.
5 - 8.5V dc for Test Chest *only* function, no charging capability.
Float charge: Unit may be left connected continuously.
LVC: Automatic "deep discharge" low voltage cut off.
Keys: Micro switch, operated through flexible membrane.
LCD: 3.6", 330 x 234 pixel, 78 x 46mm, 16:9 Aspect ratio,
250mCD/M², Contrast: 350, Viewing: X 110', Y 50'.
LED: 8 - 15 CD 15' beam white LED.

Caution: do NOT flash into eyes.

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