# V1682

## VALID READER

## INSTALLATION and OPERATION



Filename: V1682OPMA.doc
Issue : A
Date: February 2005

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**CONTENTS**

# 1. DESCRIPTION

The V1682 reader is the counterpart of the V1681 generator, which together, make up the VALID (Video & Audio Line-up and ID) system. The function of the V1682 is to detect the presence of a VALID test signal, and verify that the audio/video timing has been preserved, and that the audio channels have not been swapped, or inverted. Read-outs are provided on the front panel, indicating the audio-video delay in milliseconds, the originating channel, and a warning if a channel is inverted.

The unit may take its audio input from an AES, or analogue input (depending on which audio module is fitted), or it will also accept an audio stream embedded in the SDI video input.

The unit will also provide audio multiplexing and de-multiplexing functions, so the selected audio input may be embedded into the SDI stream, or if the audio source is from embedded data, the audio may be output in either AES or analogue form (depending again on the audio module fitted).

## 2. INSTALLATION

Due to the large amount of IO available on the V1682, a variety of rear panels are available. Presently there are four; two for the 3U chassis, V1606, and another two for the 1U chassis, V1601. The L type rears provide most of the possible facilities, except for the last two SDI outputs, but the audio connections are on a less convenient multi-pole connector. This means that if separate audio connectors are needed then a 'break-out' box will be required. The P type rears provide direct unbalanced AES audio connection on BNC connectors, but not all signals are available.

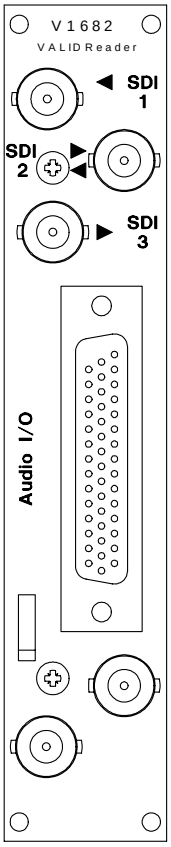
This manual has generally been written assuming that one of the L type rear panels is being used with access to all signals.

### 2.1 3 U REAR PANELS

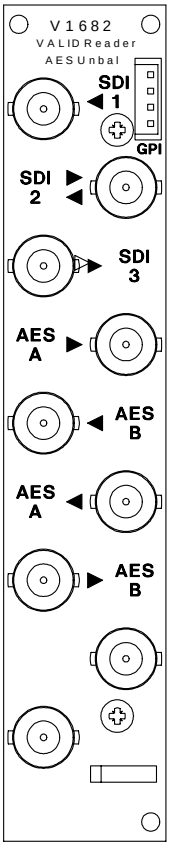
For the 3U Chassis two types of rear panel are available. The 16VR3L provides connections for all possible I/O using a high density D-type connector for the audio and other ancillary signals, such as GPI and AES reference. For those applications where unbalanced audio is used and not all connections are needed, then a nine BNC panel is available, the 16VR3P. This has the advantage of simpler cable connections, but at the expense of losing some signals.

Connection details are given in section 2.3.

16VR3L




16VR3P

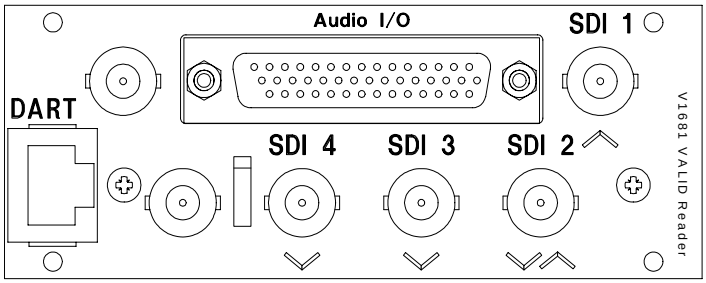


## 2.2 1 U REAR PANELS

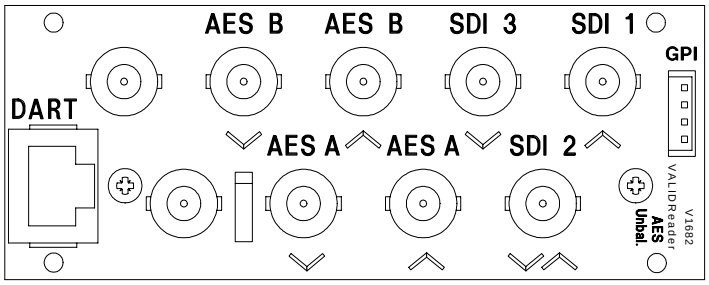
For the 1U Chassis two types of rear panel are also available. The 16VR1L provides connections for all possible I/O using a high density D-type connector for the audio and other ancillary signals, such as GPI and AES reference. For those applications where unbalanced audio is used and not all connections are needed, then a nine BNC panel is available, the 16VR1P. This has the advantage of simpler cable connections, but at the expense of losing some signals.

Connection details are given in section 2.3.

16VR1L




16VR1P




## 2.3 CONNECTIONS

### 2.3.1 SDI BNCs

On all the rear panel types the upper three BNCs are for SDI video as follows:

| Rear Type | SDI 1 | SDI 2 | SDI 3 | SDI 4 |
|---|---|---|---|---|
| 16VR3L | Input 1 | I/P 2 or O/P 2 or SDI Buffer | Output 1 | N/a |
| 16VR3P | Input 1 | I/P 2 or O/P 2 or SDI Buffer | Output 1 | N/a |
| 16VR1L | Input 1 | I/P 2 or O/P 2 or SDI Buffer | Output 1 | Output 3 |
| 16VR1P | Input 1 | I/P 2 or O/P 2 or SDI Buffer | Output 1 | N/a |

Note: The three options for SDI 2 are by a pair of links on the main PCB (LKs 2 and 3). It is important that both links are set up the same way.

### 2.3.2 AES BNCs

These are only available on the 16VR3P and 16VR1P rear panels. They provide for unbalanced AES inputs and outputs for channels A and B. With these rear panels it is not possible to have the second AES outputs or re-entrant audio.

### 2.3.3 Audio I/O

On the 16VR1L and 16VR3L rear panels there is a 44 way connector in the same footprint size as a standard 25 way D type connector. It is used for all the audio connections, both digital and analogue, although many of them share pins, and other signals. Of course whether the audio signals are analogue or digital (or present at all) depends on the type of module fitted to the unit.

If the HDD socket is to be used for audio and connected with multi-way cable it is essential that the audio pairs, both analogue and digital, are individually screened.

The signals to and from the pins on this connector are as shown in this table:

| Pin | Signal | | Pin | Signal | | Pin | Signal | |
|---|---|---|---|---|---|---|---|---|
| | Analogue | Digital | | Analogue | Digital | | Analogue | Digital |
| 15 | GND | GND | 30 | GPI_3 | GPI_3 | | | |
| 14 | ALinP | AESAinP | 29 | GND | GND | 44 | ALinN | AESAinN |
| 13 | ARinP | AESAin75 | 28 | GND | GND | 43 | ARinN | AESAin0 |
| 12 | BLinP | AESBinP | 27 | N/C | N/C | 42 | BLinN | AESBinN |
| 11 | BRinP | AESBin75 | 26 | GND | GND | 41 | BRinN | AESBin0 |
| 10 | GND | GND | 25 | GPI_2 | GPI_2 | 40 | GND | GND |
| 9 | ALoutP | AESA1outP | 24 | GND | GND | 39 | ALoutN | AESA1outN |
| 8 | AROutP | AESA1out75 | 23 | AESREFinP | AESREFinP | 38 | AROutN | AESA1out0 |
| 7 | BLoutP | AESB1outP | 22 | AESREFinN | AESREFinN | 37 | BLoutN | AESB1outN |
| 6 | BROutP | AESB1out75 | 21 | GND | GND | 36 | BROutN | AESB1out0 |
| 5 | GND | GND | 20 | GPI_1 | GPI_1 | 35 | GND | GND |
| 4 | AESCinP | AESA2outP | 19 | GND | GND | 34 | AESCinN | AESA2outN |
| 3 | AESCin75 | AESA2out75 | 18 | AESREFin75 | AESREFin75 | 33 | AESCin0 | AESA2out0 |
| 2 | AESDinP | AESB2outP | 17 | AESREFin0 | AESREFin0 | 32 | AESDinN | AESB2outN |
| 1 | AESDin75 | AESB2out75 | 16 | GND | GND | 31 | AESDin0 | AESB2out0 |

**Notes:**
1. Pin 1 is at the bottom

### 2.3.4 GPI

The 16VR1P and 16VR3P panels have a separate Molex connector for external GPI connection. (On the other panels the Audio I/O connector is used.) The connections are:

| Pin | Signal |
|---|---|
| 1 | GND |
| 2 | GPI 1 |
| 3 | GPI 2 |
| 4 | GPI 3 |

The GPI inputs are currently unused on the V1682.

## 2.4 SIGNAL SPECIFICATIONS

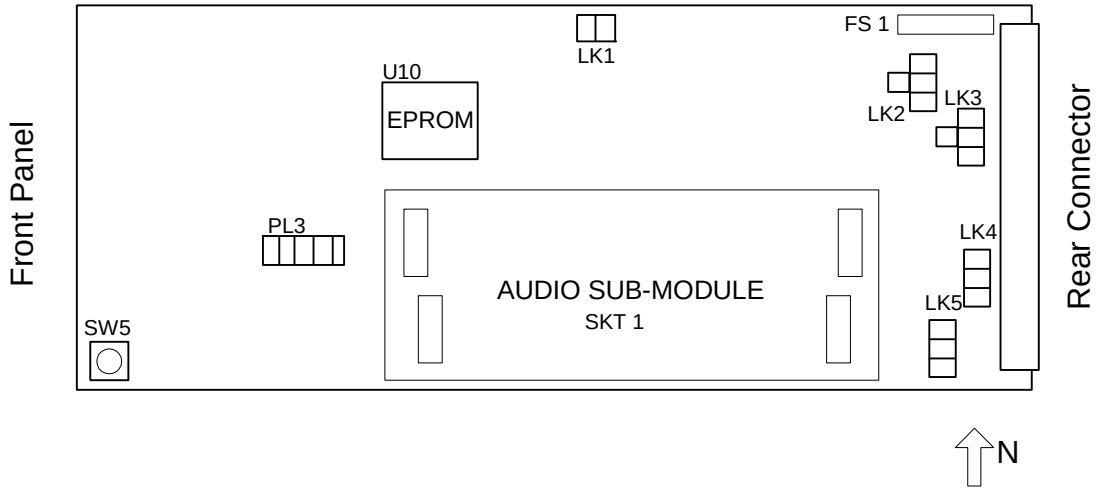
| SIGNAL | TYPE | COMMENTS |
|---|---|---|
| Power (No Module) | 9.8W | Supplied from rack |
| Power (A-A Module) | 12.5W | Supplied from rack |
| Power (A-D Module) | 12.5W | Supplied from rack |
| Power (D-A Module) | 11.7W | Supplied from rack |
| Power (D-D Module) | 10.6W | Supplied from rack |
| Power (H-H Module) | TBA | Supplied from rack |
| SDI Inputs and Outputs | BNC | SDI Video to SMPTE 259M<br>Max cable length >200m |
| Video Reference | B+B | Any 1V Composite video may be used, but Black & Burst is recommended. |
| Audio, Analogue | Balanced | Zin = 20kΩ Zout = <50Ω |
| Audio, Digital (AES) | Balanced | Zin = 110Ω Zout = 110Ω<br>Input Sample rate 32–48kHz<br>Output Sample rate 48kHz |
| Audio, Digital (AES) | Unbalanced | Zin = 75Ω Zout = 75Ω<br>Input Sample rate 32–48kHz<br>Output Sample rate 48kHz |
| AES Reference | Balanced | Zin = 110Ω or HI Z<br>Sample rate 48kHz |
| AES Reference | Unbalanced | Zin = 75Ω or HI Z<br>Sample rate 48kHz |
| ID SYNC 75 | TTL, 75R | Positive pulse, high during external voice ident cycle. |
| GPI | 5V pull-up via 4K7 | Connect to GND to activate. |

## 2.5 HARDWARE

### 2.5.1 The PCB

The figure below shows diagrammatically the printed circuit board along with certain other components of interest. In particular it shows the position and orientation of the links and switches which set up the operation modes and the location of the audio sub-module if fitted.

The EPROM location is shown, as it is the component that would need to be changed as a result of any software upgrade in the field. This is a PLCC type and the proper tool should be used to remove a device and care must be taken to ensure that a replacement is inserted the right way round and pushed fully ‘home’.




## 2.5.2 Links and Switches

The purposes of the links and switches is shown in the following table. Details of their operation are described in later sections.

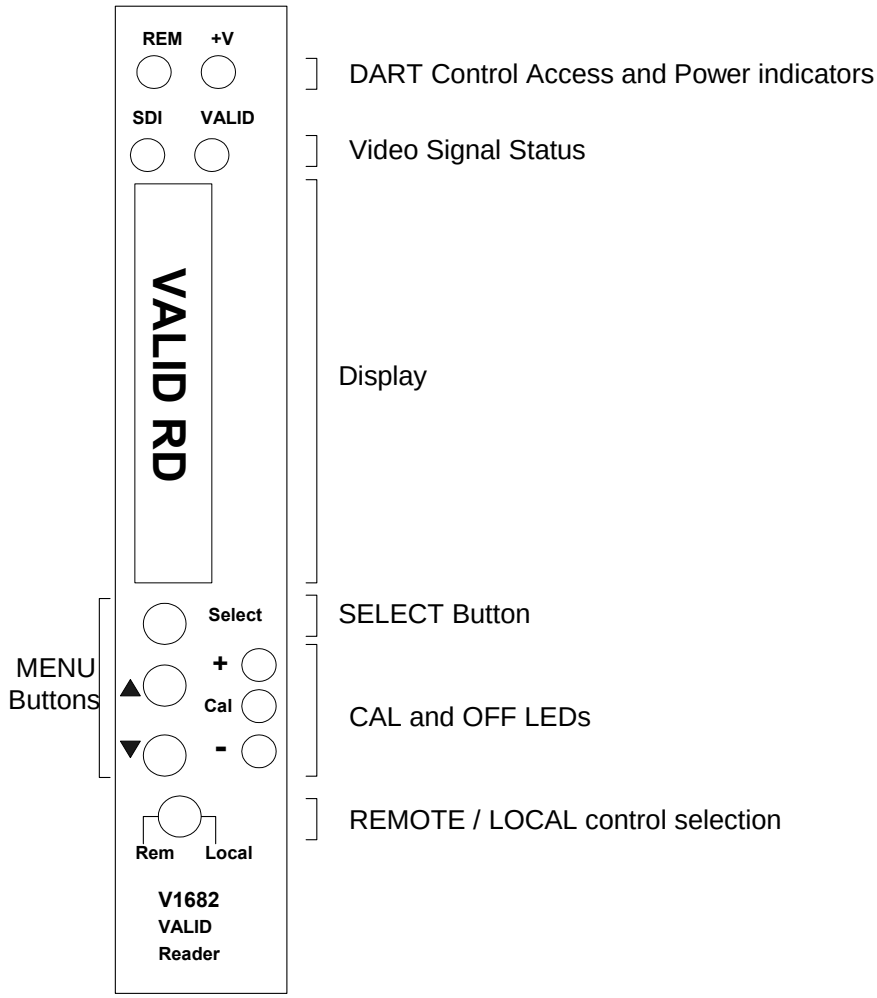
| ITEM | Title | Comments |
|---|---|---|
| FS 1 | Fuse | In series with the +15V input to the module. |
| SW 5 | RESET | Used to reset the internal micro-controller and DSP. |
| SKT 1 | Audio Sub-module | Various sub-modules are available for the different audio options. See section 2.7 |
| PL 3 | JTAG Connector | For development and test use only. (May not be fitted) |
| LK 1 | JTAG enable | Never used in operation. (May not be fitted) |
| LK 2, 3 | Define BNC 2 | North – Buffered Output<br>West – SDI Input 2<br>South – SDI Output 2 |
| LK 4 | AES REF Term | North – High Z<br>South – Terminated |
| LK 5 | Not used | |

## 2.5.3 Fuse

There is only one fuse on the V1641 which is in series with the main DC input:

| | | | |
|---|---|---|---|
| FS 1 | Fuse 2 Amp Wire ended | | In series with the +15V input to the module. |

## 2.6 FRONT PANEL




The front panel on the V1682 is a considerable advance on what is usually available on single module interface equipment. It provides the user with total control and monitoring of the unit without the need to consult manuals and read unlabelled indications. While this kind of control is generally available with a remote control system, as it is over DART, it is unusual to have this level of access locally.

At first use the menu system may seem cumbersome but with only a small amount of practice it will become very easy to use.

### 2.6.1 Direct Indications

The four LEDs at the top of the panel provide these direct indications of the unit:

| | |
|---|---|
| REM | Short blinks to indicate access by the DART controller, if fitted. It does **not** directly indicate that the unit is in remote control mode. If the rack frame does not have a Rack Controller fitted then this LED will not blink. |
| +V | Indicates that the main +5V is present on the board. This is derived from the +15V distributed through the rack. The V1682 does have many power rails, but only the main +5V is indicated here. It will, of course, be off if the fuse, FS1, were to have been blown. |
| SDI | Indicates that a D1 signal is being received. |
| VALID | Indicates that a VALID test signal is being received. This LED 'winks' every 4 seconds, in synchronised to the 'black flash' in the video input. |

### 2.6.2 Display and Switches

The main display is an eight character LED matrix display. It has been set so that when fitted into a 3U rack (V1606) it can be read from the left, and when fitted to a 1U rack (V1601) it is horizontal and the 'proper' way up.

The three buttons are labelled **Select**, σ and τ. The **Select** button is used to move down and up the menus. A short press will move down one level, while pressing and holding for about half a second will move up one level. If you continue to hold it will progressively move up a level every half second until it reaches the top level (**SLEEP**), or you let go, in which case it will stay where it is. When at any level the σ and τ buttons will move through the list of options, or if in an actual variable they will change the values.

The menu system is described in more detail later in section 3.1.2.

If the unit is in Local control then the display and switches are used to set up and show the operation the module. If in remote mode then they are still active for showing the status but cannot be used to actually change anything.

Beside the σ and τ buttons are three LEDs marked **+**,**CAL** and **–**. In general the **CAL** LED is used to show that a variable is set to its normalised value and if not then the others show which direction to which it has been changed or that it is no longer on its CAL value.

### 2.6.3 Remote/Local Control

The lowest switch selects between Local control and Remote control over DART:

| | |
|---|---|
| Local | Control is from the front panel itself. |
| Rem | Control is from the DART system. This requires the use of an external controller running a suitable programme, which communicates with multiple racks using the Dartnet protocol. |

## 2.7 AUDIO I/O SUB MODULES

Various audio sub-modules are available for the V1682 depending on the audio requirements.

To change the module remove the V1682 from the chassis and carefully remove the existing one, if fitted, by lifting evenly at both ends. To fit a new one check the orientation by aligning the offset connectors and place the module carefully. Push it home evenly at both ends. It may be stiff but do not force it aggressively since if the connectors are not mating correctly then one or more of the pins may get bent.

The details of the analogue and digital audio signals are given in Section 2.4.

These are the available modules:

| Type | Part No. | Description |
|---|---|---|
| AA | 130-2920 | Analogue Audio In and Out – Both channels |
| DD | 130-2930 | Digital Audio In and Out – Both channels |
| AD | 130-2940 | Analogue Audio In and Digital Audio Out – Both channels |
| DA | 130-2950 | Digital Audio In and Analogue Audio Out – Both channels |
| HH | 130-3090 | Hybrid: Channel A – Analogue Audio In and Out<br>Channel B – Digital Audio In and Out |

# 3. SYSTEM OPERATION

## 3.1 LOCAL CONTROL

### 3.1.1 Start up

Local control and monitoring of the V1682 is done through the front panel with its eight character LED display and three control buttons **Select**, σ and τ. There are three LEDs which also contribute to the status indication; these are labelled **+**, **Cal** and **–**.

After power up the display will start at the top level and show the unit type and any options that are included. These options are not the same as the plug-on modules for the audio I/O. The V1681 has no options, so the display should show **VALID RD.**

### 3.1.2 Menu Control

The **Select** and σ and τ buttons are used to manoeuvre around the menu system. The menu structure has five levels and the **Select** button is used to go up and down the structure. The σ and τ buttons are used to move between selections or to adjust a parameter depending on which sort of menu is displayed. The five levels are as follows:

| | |
|---|---|
| Sleep | Display is blank (except for Banner warnings). |
| Top Level | As above, e.g. **VALID RD** |
| Main Menu | The Main menu items, such as **`MEASURE`**, **`AUDIO`** etc. These items are all in Upper Case. |
| Sub Menu | Menu items under each main heading, such as **`Aud I/P`** or **Mux Grp** under the **`AUDIO`** main menu. These items are all in Sentence Case (generally lower case but with upper case first letters). |
| Parameter | The lowest level under the Sub Menu, and used to actually adjust a parameter, or view a status. The display will depend on the actual parameter and usually offers a selection of options e.g. **Analog / Group 1 / Group 2** .There is usually a title to describe the variable and a small icon in the left hand character position, but 8 characters cannot provide for a detailed description. |

Many of the sub menus depend on which audio I/O sub modules are fitted. For example the Calibration functions of the analogue audio ADCs and DACs under **`CALIB`** do not appear unless a suitable sub-module is fitted.

To move down a level just press the **Select** button briefly; then press either the **Select** button again to go down another level or the σ and τ buttons to move around the options within a level.

To move up a level press and hold the **Select** button for about half a second which will move up one level. If you continue to hold the **Select** button then it will move up a level every half a second until it reaches the Sleep level (one above the Top Level).

A complete list of all the menus is given in Section 8

### 3.1.3 Menu Examples

This section has examples of how to manoeuvre through the menu system. The first one starts with the unit in its 'sleep' mode where the display is blank, and then proceeds to set the output Multiplexer to use group 2. The sequence assumes that audio channels are ganged.

| Action | Display | Comments |
|---|---|---|
| | | Start in 'sleep' mode |
| Select | `VALID RD` | Top Level |
| Select | `MEASURE` | First Main Menu |
| ▼ | `AUDIO` | The menu we want |
| Select | `Aud I/P` | |
| ▼ | `Mux Grp` | The control we want |
| Select | `None` | Default (or last setting) |
| ▼ | `Mux Gp 1` | |
| ▼ | `Mux Gp 2` | Audio embedding on group 2 |
| Select+Hold | `Mux Grp` | Up to control selection |
| Select+Hold | `AUDIO` | Up to Menu selection |
| Select+Hold | `VALID RD` | Up to top level |
| Select+Hold | | Sleep |

### 3.1.4 Sleep

If the front panel is not used for a certain amount of time then the display will automatically go into a sleep mode when it will be blank. Pressing any of the buttons will cause it to 'wake up' back into the top level. The time delay before the unit slips into sleep mode can be set up using the **ENG'ING > Sleep** menu.

### 3.1.5 High Level Signal Status

There are two LEDs on the top of the front panel to indicate that the SDI input is present, and that the unit is set up to generate a 'VALID' test signal. However there is no direct indication as to the format the SDI input, i.e. 625/50 or 525/60. Since many installations may use multiple formats and therefore need a quick indication there are parallel menus with the Top Level.

If you press the $\tau$ button from the Top Level then you will see the SDI status directly. This will show the signal presence and if it is there then what format it is.

The audio/video delay can also be read on the top level, as well as any source errors that are present. Use the $\sigma$ and $\tau$ buttons to select the channel of interest. This will be described more in Section 4.5

These indications are still at the Top Level, so a single press of the Select button will immediately move down the menu tree.

### 3.1.6 Variable Calibration

Most variables have a calibrated or normalised value. In the listing of all the variables in Section 11 the normalised value is shown.

Any variable can be individually set to its normalised value by pressing the $\sigma$ and $\tau$ buttons at the same time.

Within each the Main Menu at the end of the list of Sub Menus is a pseudo Sub Menu called **Norm**. Selecting into this will let you normalise all the parameters within the Main Menu item to their normalised value.

The three LEDs beside the $\sigma$ and $\tau$ buttons are used to show whether the variable is calibrated or not. After calibration the **CAL** LED will be ON.

# 4. MAKING MEASUREMENTS

## 4.1 INTRODUCTION

The V1682 VALID reader, when fed with video and audio signals from the V1681 VALID generator, has the capability to measure audio delay relative to video, audio level, and will identify the channel cross-overs, L/R swaps, and channel inversions. The time-marked video signal from the V1681 is rugged enough to pass unscathed through almost any video processing or transport medium, including ARCs, standards converters, compression links, noise reducers and noisy satellite links.

## 4.2 VIDEO INPUT

The V1682 accepts a CCIR601 SDI input through on of its two** inputs. Selection of the video input is done under the **VID OSD > SDI Src** menu option. If only one input is available, this control is not adjustable.

In order to make correct timing measurements, the input video must contain a continuous signal from a V1681 VALID generator. The V1682 is capable of making timing measurements even when the video from the V1681 has been reduced to any size down to ¼ screen, with any additional stationary content in the picture, as long as all but the VALID test signal is stationary (Figure 4.1a). The VALID system will NOT work correctly if any significant movement has been superimposed picture received by the V1682, but stationary captions / logos are allowed (Figure 4.1b).

The system is not dependent on background test pattern, so any of the test patterns generated by the V1681 generator are suitable for measurements (e.g. Figure 4.1d), except for the pluge signal which may give unreliable results due to the low luminance level.

The system is also tolerant of very low signal levels (as low as –12dB), and high levels of noise.

The VALID system Is designed to work through cross-standards, so even if the generator is working in a 625 line format, the receiver will measure correctly after standard conversion to 525 (or vica-versa).

** The second SDI input is optional and only available with the correct link settings, see Sec 2.5.2 .

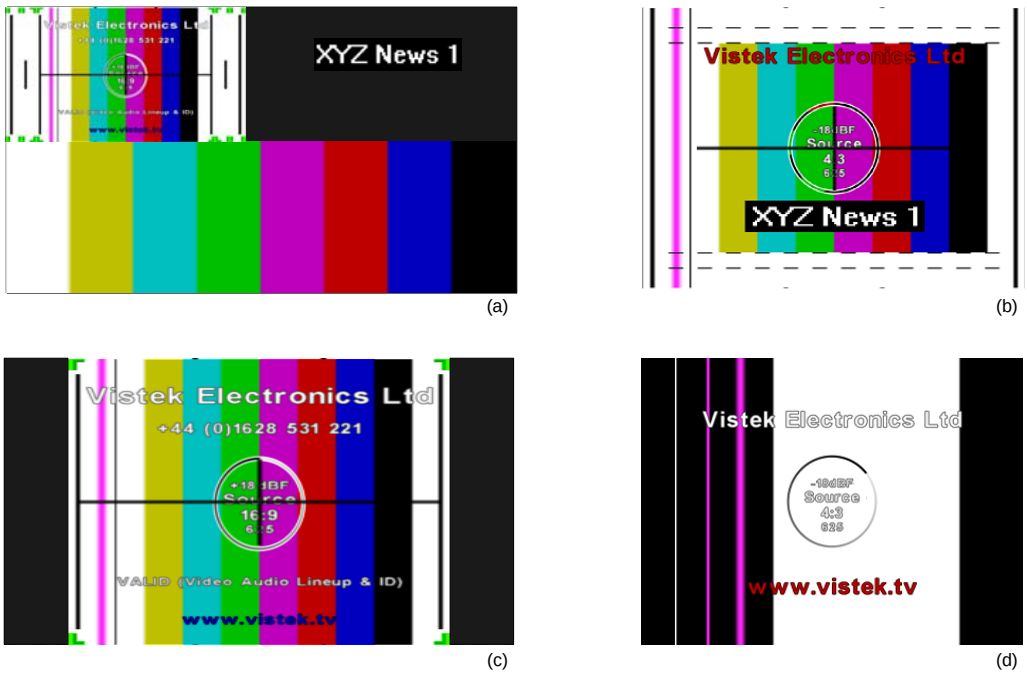



**Figure 4.1 – Examples of acceptable VALID test signals**

## 4.3 AUDIO INPUT

The V1682 can measure audio embedded in the SDI input stream, or take an analogue or AES input (depending on the sub-module fitted). See Sec. 5.2 for information on input selection.

## 4.4 MAL (MAXIMUM ANALOGUE LEVEL) SETUP

The VALID system works in both analogue and digital domains, and therefore must be aware of the relationship between the two domains. The relationship is set up by specifying the maximum analogue level (MAL) in dBu that may be represented in the digital system. This parameter is adjustable from +12 to +24dBu, and may be found adjusted with the **AUDIO > MAL A/B** menu option.

The VALID generator always generates a test tone level of 0dBu in the analogue and digital domains, however because the relationship between them is variable, the digital level with respect to full scale will change as the MAL control is adjusted. In order for correct level measurements to be made, both reader and generator must have the same MAL setting, OR a compensating gain must be applied when going between regions with different digital level representations.

NOTE : The MAL control is irrelevant if ONLY analogue I/O is being used.

## 4.5 READING MEASUREMENTS FROM FRONT PANEL

Timing, level, and source measurements can all be read from the front panel display under the **MEASURE** menu; timing and source information is however also available for quick access at the top level of the menu tree.

### 4.5.1 Quick Access

For quick access to delay and source information, press τ when at the top level (when the display reads '**VALID RD**') to scroll through several status displays as shown in tabular form below.

| | | | | |
|---|---|---|---|---|
| | Top level | VALID RD | | |
| τ | SDI status | IP FAIL | IP 625 ✓ | IP 525 ✓ |
| τ | AL status | AL -1234 | AR ▸ AL | |
| τ | AR status | AR -1234 | AL ▸ ARτ | |
| τ | BL status | BL ---- | ?? ▸ BL | |
| τ | BR status | BR 0000 | | |
| τ | VALID status | Valid Л | No Л | |

The left hand two columns show the button pushes and display function, while the right hand columns show examples of possible readouts. The first status shows the SDI input status, and format if present. The next four stati show the audio/video delay, and originating channel of the four audio inputs. The final display shows the detection of a 'VALID' SDI input.

The SDI and VALID status should be self explanatory, but the audio stati require a little more explanation below :

The primary information that is displayed is the audio / video delay in milli-seconds e.g. '**AL –1234**' which denotes that the audio is 1234ms earlier than the video, so the audio needs to be delayed by 1234ms to achieve correct lip-sync. If the audio is coming from the audio output of the V1681 that corresponds to the V1682 input, then the delay is all that will be displayed. If, however, the audio source is incorrectly connected, then the display will continue showing the delay for the channel, and will also flash up, at approximately 2s intervals, an indication of what the connection problem is.

For example,

If there was a left right swap on channel A, then the status for channel AL would flash up the message '**AR ▸ AL**', indicating that channel A right of the generator is connected to the channel A left input of the V1682.

If, not only were the left and right channels swapped on channel A, the channel feeding the V1682 channel AR was inverted as well, then the message '**AL ▸ AR↓**' would be displayed periodically. The down arrow at the end indicates that the channel has been inverted.

If, for some reason, the unit is not able to make a measurement for the channel, then dashes will be displayed instead of a delay reading, e.g. '**BL ----**' , and the message '**?? ▸ BL**' will be flashed up, indicating that both the delay and source are unknown.

### 4.5.2 MEASUREMENT menu

The measurement menu contains all of the information available in the quick access menu (Sec. 4.5.1) plus audio level measurements for each channel.

Audio/Video delay and source information can be found in the **MEASURE** menu under two sub-menus, one containing information for channel A the other channel B (**MEASURE > Audio A** and **MEASURE > Audio B**).

In each of these sub-menus are to be found 4 measurements; two delays, and two providing source information for channel (See table below).

Audio levels may be read under the **MEASURE > Aud Lev** menu. All level measurements are in dBu (relative to 0.775mV RMS). It should be noted that the level reading is always in dBu, even if the input is digital. The relationship between digital and analogue domains is set up with the **MAL** control (See Sec. 4.4, page 16). It is also important to note that the V1681 VALID generator always generates a tone level of 0dBu on analogue outputs, and the equivalent digital level dependant on the MAL setting of the V1681. It is important that the MAL of both the V1681 and V1682 are set up correctly.

| | | | |
|---|---|---|---|
| **MEASUREMENT** | **Audio A** | **AL -1234** | Channel A audio is 1234ms early with respect to video. |
| | | **AR -1234** | |
| | | **AR ▸ AL** | Channel A has a left/right swap, and the signal on AR is inverted. |
| | | **AL ▸ AR↓** | |
| | **Audio B** | **BL ----** | Channel BR timing unknown. |
| | | **BR 0000** | Channel BR is co-timed with video |
| | | **?? ▸ BL** | Channel BL from unknown source. |
| | | BR ▸ **BR** | Channel BR from correct source. |
| | **Aud Lev** | **AL -02.0** | All level measurements are in dBu. Make sure MAL is set correctly for digital signals (See Sec. 4.4, page 16) |
| | | **AR +02.0** | |
| | | **BL -99.9** | |
| | | **BR +00.0** | |

## 4.6 ON SCREEN DISPLAY

### 4.6.1 Introduction

The on screen display contains the same data that is to be found in the **MEASURE** menu, but overlaid over the input SDI signal. The display is split into two panels one on either side of the screen. The left hand display contains source and delay information, with delay being display both numerically and as a bar graph, and a four channel ppm display on the right.

### 4.6.2 Display Control

In some applications it may not be desirable for the on screen displays to be permanently keyed into the SDI output of the unit. The on-screen displays are controlled in the **VID OSD** menu using front panel control.

Within **VID OSD** there are two controls, the first of these, **VALIDMtr**, is used to turn the displays on and off, also there is the ability to put the displays into '**auto**' mode; this only keys the displays into video, when a test pattern from a V1681 VALID generator is detected. The second control, **SDI Src**, selects which of the two SDI inputs to use; note that this control is only operable if the unit is set up for two SDI inputs (see Sec. 2.5.2).

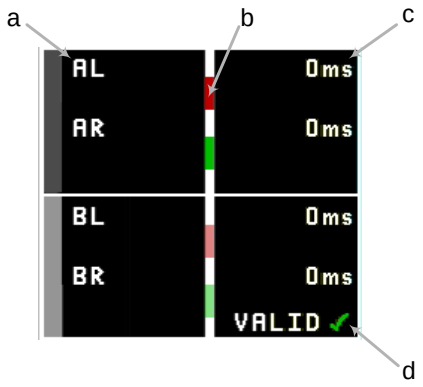
### 4.6.3 Delay and Source Display

Audio / video delay, and audio source information is displayed in the left hand display. Source information is shown on the left hand side of the display, while the audio/video delay is shown on the right-hand side. The audio/video delay, is also displayed as a horizontal bar graph with a logarithmic scale.

In Figures Figure 4.2 - Figure 4.4 are shown the delay/source display in various states. Figure 4.2 shows the system operating correctly, with audio and video synchronised, and all four audio inputs fed by the correct V1681 source.

A more complex scenario is shown is Figure 4.3. Here, all four audio channels are connected, but the two stereo pairs, A and B, are swapped over, and the video has been delayed by 35ms. The channel swap over is indicated by the source text on the left hand side of the display. A display such as BL > AL implies that the AL input of the unit is being fed by output BL form the V1681 generator. Also the audio feeding input BL has been inverted, which is shown by the down arrow - see Figure 4.3(f).

Figure 4.4 shows fail conditions. Here the audio sources are of an unknown nature, indicated by showing ?? > AL etc (a). Also the VALID with the strike through, and red cross (e) show that no VALID test pattern has been detected. The delay measurements on the right hand side (d) show dashes, as the delay is not calculable.



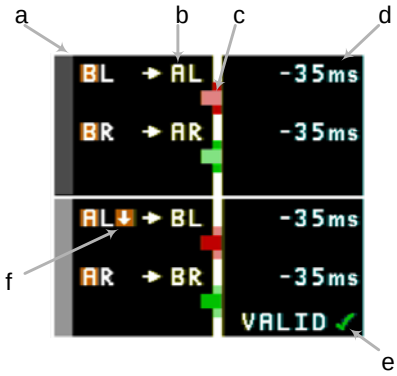

a - V1681 audio output is connected to the correct V1682 audio input

b - Delay bar showing no delay.

c - Delay showing 0ms

d - VALID symbol and tick, indicating the presence of a VALID test pattern.

**Figure 4.2 – All inputs from correct source, audio and video in sync.**




a - V1681 output

b - V1682 input

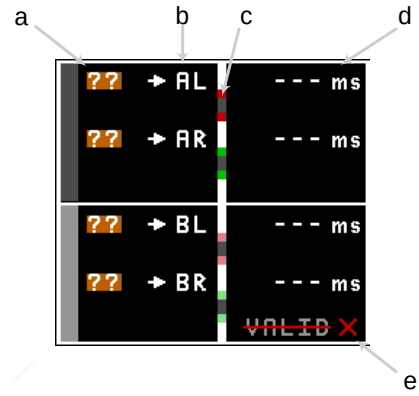
c - Delay bar

d - Video to audio delay in milli-seconds

e - VALID and tick, indicating VALID test-pattern detected.

f - Audio inversion symbol

**Figure 4.3 – Channels A and B swapped over, audio 35ms earlier than video, with audio on BL input is inverted.**




a - Unknown source channel

b - V1682 input

c - Delay bar showing unknown

d - Unknown video to audio delay

e - VALID struck through, and cross, indicating VALID test-pattern has not been detected.

**Figure 4.4 - Display with no, or non-VALID SDI input.**

It is of obvious importance to understand the direction of the delay measurements. The delay reported is that from the video to the audio i.e. the more positive the number, the later the audio. The delay bars indicate that the audio is later than the video if extending right, and earlier if extending left from the centre column.

### 4.6.4 PPM Audio Level Meters

An audio PPM level meter (conforming to IEC 60268-10 Type IIb) is provided on the right hand side of the on screen display. The meter has a fixed range of –14 to +14 dBu, with scale markings at 4 dBu intervals as shown Figure 4.5. The green to yellow, and yellow to green transitions are at +8dBu and +12dBu respectively.

The audio channels represented by the PPM meter are from left to right :

*Channel A left, Channel A right, Channel B left, Channel B right.*

In AES terms the meters represent channels 1 to 4 from left to right.

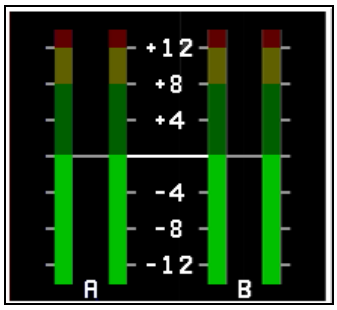



**Figure 4.5 – Audio PPM display**

It should be noted that the display is always in dBu (relative to 0.775V) irrespective of the input domain (analogue or digital), more importantly, the levels are effected by the MAL (Maximum Analogue Level) setting if a digital input format is being used. For more information on MAL see Sec. 4.4.

The V1681 generator always outputs audio tone at 0dBu in both analogue and digital domains, so if the audio system is set up correctly, the meters should read 0dBu as shown in Figure 4.5.

# 5. AUDIO PROCESSING

## 5.1 V1682 AUDIO OVERVIEW

The V1682 not only acts as a measurement unit, it also has full audio embedding and dis-embedding functionality. Dependent on what module is fitted, the unit will output whatever is coming in on its selected audio input in either AES or analogue form. This is particularly useful for monitoring the audio channel under test especially if the input audio is embedded in the SDI stream. The audio DAC in the unit is broadcast quality 24 bit, so the unit may be used 'in service' for live audio de-multiplexing.

The embedding facility allows the multiplexing of the currently selected audio input into the output SDI. The audio source maybe either analogue or AES (dependant on module fitting) or it may be audio already embedded in the SDI.

The V1682 does not apply gain or any other operation to audio passed through the system, so measurements done by the V1682 apply equally to the inputs and outputs of the unit. It should be noted that there is a very small latency on the audio outputs of at most 3ms with respect to the video.

## 5.2 AUDIO INPUT SELECTION

There are two paths of entry for audio into the unit, either through the sub-module (AES / analogue), or through an embedded audio channel. The audio input to the unit is set up in the **AUDIO > Aud I/P** menu which will have the following options dependent on the sub-module fitted (if any) :

| Module | None | AES | Analogue |
|---|---|---|---|
| I/P options | >Group 1 | > AES | > Analog |
| | >Group 2 | >Group 1 | >Group 1 |
| | >Group 3 | >Group 2 | >Group 2 |
| | >Group 4 | >Group 3 | >Group 3 |
| | | >Group 4 | >Group 4 |

The selected audio input is used for all measurements, and is reproduced on all audio outputs including the selected multiplex group.

It is possible to check which audio groups are present in the incoming SDI stream under the **STATUS > I/P Grps** menu. Occupied groups are shown by the group number being displayed, as shown in the table below.

| I/P groups | Display |
|---|---|
| | |
| none | None |
| 1 | 1 - - - |
| 2 & 4 | - 2 - 4 |

## 5.3 AUDIO MULTIPLEXING

The SDI multiplexing process supports up to 4 'Groups' of audio data on a single SDI digital video data stream. These are called Groups 1 to 4 and each group may contain up to 2 channels of AES audio data, i.e. 4 individual channels. When a group has audio data embedded on it is termed *occupied*, and when it does not have embedded audio data on it is called *free*. The V1682 has the ability to embed the selected audio input into the SDI stream on any of four available groups, this is with the restriction that groups cannot be overwritten, without first blanking the whole ancillary data space. The group into which the unit will embed audio is selected in **AUDIO > Mux Grp**. If ANC

data is already embedded, it may be removed by setting **ENG'ING > Anc Data** to '**blank**', see Sec. 6.3 for more details.

If the selected multiplex group is already occupied, no audio will be embedded, and the input group will be passed through. The groups which are occupied on the input SDI can be checked in the **STATUS > I/P Groups** menu (see Sec. 7.5).

Audio may be embedded in either basic 20 bit form or in extended 24 bit form. The embedding resolution can be controlled in the **ENG'ING > Aud Bits menu**, in which the options are 20 or 24 bit. All internal audio processing is done in 24 bit form.

## 5.4 MUTE

Audio coming from the selected audio input may be muted using the **AUDIO > Mute** control, which has the options '**Pass**' and '**Mute**', the former being the default. When set to 'Mute' all audio from the selected audio input will be muted, including to the measurement systems. This will cause all measurements on the audio to cease, on-screen ppms to fall to zero, and delay measurements to stop.

# 6. VIDEO PROCESSING

## 6.1 VIDEO PROCESSING OVERVIEW

Video passed through the V1682, other than the on screen display keying, encounters very little processing. However the vertical blanking interval, and ancillary data space may be independently blanked, and EDH may be inserted. These controls are available irrespective of on screen display insertion.

## 6.2 VBI BLANKING

Data on vertical blanking interval lines can be blanked if necessary. VBI blanking may be enabled disabled using the **ENG'ING > VBI** control which has the option **Pass** and **Blank**. When the unit is set to blank the VBI, the blanking only applies to the active part of the digital line, ancillary data is untouched.

The **VBI** control blanks all lines in the vertical blanking interval, there is no ability to blank only some lines.

Lines which are blanked :

| Format | VBI Lines |
|---|---|
| 525/60 | 1 to 20 & 264 to 282 |
| 625/50 | 624 to 6 & 311 to 318 |

## 6.3 ANCILLARY BLANKING

The ancillary data space may be blanked if necessary. This is especially useful when it is desired to multiplex audio onto a group which is already occupied. Blanking when applied, clears all data between EAV and SAV, the removal of single audio groups is not possible. Any other data in the ancillary blanking space will also be lost.

Ancillary blanking can be enabled and disabled with control **ENG'ING > ANC Data**, which has two options '**Pass**' and '**Blank**'.

## 6.4 EDH INSERTION

The V1682 by default inserts EDH into the outbound video. If EDH is already present, it is overwritten. If EDH is not desired, it may be disabled with control **ENG'ING > O/P EDH**. There are only two options for this control – '**EDH On**' and '**EDH Off**'.

Note – EDH is inserted at the last point in the processing chain, so EDH will be correct whether or not the on screen displays are on.

# 7. STATUS MENU

## 7.1 STATUS OVERVIEW

The status menu has read only controls reflecting the input statuses, hardware profile, firmware revision.

## 7.2 SUB-MODULE IDENTIFICATION

There are several audio I/O sub-modules available for the V1682. The module fitment can be identified from the front panel. Modules are available with analogue or AES inputs and outputs, or m mixture e.g. analogue inputs, digital outputs. The module type is shown in the **STATUS > Sub-Mod** menu.

| Sub-Mod | Module Type |
|---|---|
| ᵐAI/O | Module has analogue inputs and outputs |
| ᵐDI/O+DO | Module has AES inputs and outputs + auxiliary AES outputs |
| AI+DO+DO | Module has analogue inputs, and AES outputs + auxiliary AES outputs |
| DI+AO | Module has AES inputs, and analogue outputs |
| ᵐ None | There is no audio sub-module fitted |

It should be noted that the audio multiplexing and de-multiplexing facilities are available irrespective of the module fitted.

This information is also echoed in the **STATUS > Mod I/Ps** and **Mod O/Ps** menus.

## 7.3 INPUT STATUSES

The status of all inputs (other than analogue) may be checked within the **STATUS** menu.

The SDI input can be monitored under **STATUS > SDI I/P**, which will report on of three things :

| Display | Meaning |
|---|---|
| IP FAIL | No SDI input detected |
| IP 625 ✓ | 625/50 SDI input detected |
| IP 525 ✓ | 525/60 SDI input detected |

The selected AES input may be verified (an audio input from an embedded audio group also counts as an AES input) in the **STATUS > AES A** and **AES B** menu displays, which may either display **No AES A** or **AES A OK**. It should be noted that, if an analogue input is selected, both of these statuses will show an AES failure.

The AES reference status may be checked in **STATUS > AES Ref**, this will report either **RF AES** ✓ or **RF AES** ✕.

## 7.4 SECOND SDI INPUT

The V1682 has an optional second SDI input. It can be determined from the front panel whether this input is present or not in the **STATUS > SDI I/P2** menu. This will report **SDI 2 OK** if the second SDI input is available, or **SDI 2 NA** if it is not.

For information on how to change the second SDI input option see Sec. 2.5.2.

For information on input selection see Sec. 4.2.

## 7.5 EMBEDDED GROUPS

It maybe useful to know which audio groups are present on the incoming SDI input. This information may be found in the **STATUS > I/P Grps** menu. Occupied groups are shown by the group number being displayed, as shown in the table below.

| I/P groups | Display |
|---|---|
| | |
| none | None |
| 1 | 1 - - - |
| 2 & 4 | - 2 - 4 |

## 7.6 DE-MULTIPLEXER STATUS

The status of the audio de-multiplexer can be found in **STATUS > DMX Aud**, which reports the presence, and resolution (20 or 24 bit) of audio being de-multiplexed. The status reported is that of the input group selected in the **AUDIO > Aud I/P** menu, if a non-embedded audio input is selected, the status of group 1 will be reported.

The status displayed will be one of the following three :

| **Display** | **Meaning** |
|---|---|
| **No DMX** | No usable audio detected on selected group |
| **DMX 20bt** | 20 bit audio being de-muxed from selected group |
| **DMX 24bt** | 24 bit audio being de-muxed from selected group |

## 7.7 MULTIPLEXER STATUS

The status of the audio multiplexer is available under **STATUS > Mux Grp**. This indicates whether or not audio is being embedded as selected in the **AUDIO** menu. This status will either report **MUX OK** if all is well, or **MUX over** if the unit has been instructed to overwrite an existing group without first blanking the ancillary data space.

For further information on ancillary blanking, see Sec. 6.3.

## 7.8 GPI STATUS

Although GPIs are currently unused on the V1682, this status indicates the levels of the 3 GPI inputs to the unit (an up arrow indicating that the input is held high).

## 7.9 FIRMWARE VERSIONS

There are four separate items of software/firmware in the V1682 and they all have separate version numbers. These can be read on the following read only menus:

| | | | |
|---|---|---|---|
| **STATUS** | **Softver** | **0.00.00** | The operating code |
| **STATUS** | **DSPver** | **0.00.00** | The Audio DSP code |
| **STATUS** | **Audiover** | **0.00.00** | The Audio FPGA data |

**STATUS** **Videover** **0.00.00** The Video FPGA data

# 8. CALIBRATION

This section describes how to calibrate the unit as it is done in the factory. The V1682 and its modules do not contain any potentiometers, but like most equipment with analogue parts still needs to be calibrated. Normally this calibration is done in the factory and should not need to be repeated in the field but this section describes the procedure and is included for completeness.

High quality, calibrated test equipment should be used for this calibration. Note that it is not possible to return to the pre-calibration settings other than by making a note of the values and re-entering them.

## 8.1 SET-UP

There is a separate Main Level Menu for Calibration and this should be used throughout. The first sub-level menu is **CALIB > Cal Mode**, which is used to set the unit into a known state for calibration. The options available are '**Cal On**' and '**Cal Off**'.

The calibration mode must be turned ON before any parameter can be adjusted. The calibration mode will be turned OFF in one of four ways:

1. Manually on the **CALIB > Cal Mode** menu.
1. By going up to the Top Level Menu
2. By re-powering the unit.
3. By letting the display timeout and go to sleep mode.

When the calibration mode is on then the unit will automatically set up the required conditions in the unit as you enter each sub-menu. For example if you go into the CntrFreq sub-menu the unit will automatically go into free run. Similarly if you go into a DAC calibration menu it will produce tone onto that channel. For obvious reasons this should not be done on a unit that is being used On Air.

## 8.2 FREE-RUN FREQUENCY

The V1682 has a voltage controlled crystal oscillator which is usually locked to the external video reference or to the input video. However if there is no input or reference then it will free-run and this free running frequency should be set. The oscillator on the V1682 is not accurate enough to be used as a frequency reference but nevertheless should be set close to the ideal so that any succeeding SDI equipment will be able to lock to its output, and so that when in free run it will only drift slowly away from its starting reference.

To calibrate the frequency set the unit into Free Run by turning Cal Mode ON and selecting the **CntrFreq** sub-menu.

Now monitor the clock frequency on TP 50 (Issue B and C PCB), or compare the output picture movement on a monitor with an accurate external reference and adjust the frequency in the **CALIB > CntrFreq** menu.

The setting is stored on the unit in non-volatile memory, and should not need regular adjustment.

## 8.3 ANALOGUE AUDIO SUB-MODULES

The audio sub-modules with analogue interfaces, both inputs and outputs, need to be calibrated. This operation is to 'trim out' the small errors in the components.

The ADC and DAC sections are adjusted separately, but if an A-A module is fitted then the DAC adjustment should be done first.

The calibration values relate directly to the sub-module and not the main board, and they are stored on the sub-module itself. This means that there is no need to re-calibrate a sub-module if it is moved from one board to another.

### 8.3.1 DAC

By turning Calibrate Mode ON and selecting one of the DAC sub-menus the unit will automatically generate tone with an MAL of +18dBFS.

To calibrate the frequency set the unit to generate Tone by turning Cal Mode ON and selecting one of the DAC sub-menus.

```
CALIB      Cal Mode   Cal On
```

Connect the outputs in turn to a high quality analogue audio analyser and adjust each of the four channels for 0dBu on:

```
CALIB      DAC A(L)
CALIB      DAC A(R)
CALIB      DAC B(L)
CALIB      DAC B(R)
```

### 8.3.2 ADC

There is no need to change the internal settings to calibrate the ADCs, so it is not necessary to turn Calibrate Mode ON.

Connect the inputs from a high quality audio generator to the inputs at +16dBu and the outputs to an analyser. Set MAL to +18dBFS, and adjust the level +16dBu.

```
CALIB      ADC A(L)
CALIB      ADC A(R)
CALIB      ADC B(L)
CALIB      ADC B(R)
```

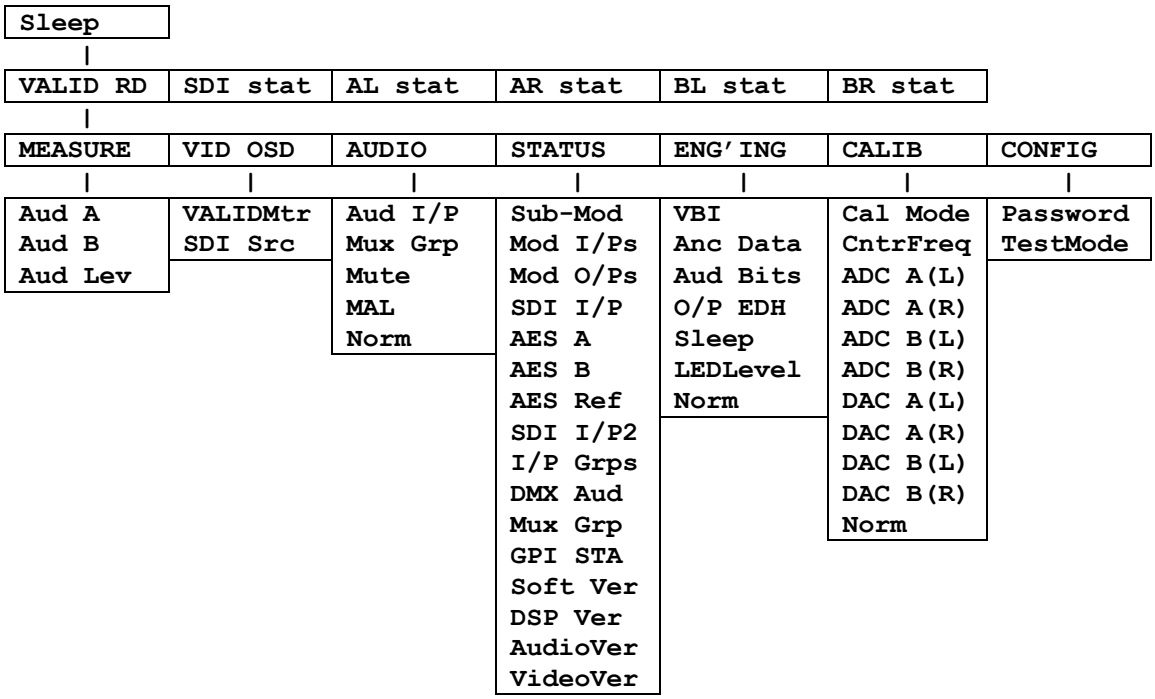
## 9. CONFIG MENU

The **CONFIG** contains has no user adjustable controls. The only function of this menu is to set the unit into a diagnostic 'test' mode. In order for the unit to be put into test mode, a password is required. This should not be attempted by the user, and will provide no useful information.

## 10. FRONT PANEL MENUS

The next section shows the menus available on a V1681.

Some menu items may only appear with certain configurations.



# 11. CONTROLS

These tables show a complete list of all the parameters that can be controlled locally for the various configurations. Unless otherwise shown they can also be controlled over the DART remote control system. Not all menus are available at any one time, since they depend on which module type may be fitted, and sometimes on the operating conditions.

The tables also show the full range of the controls and their ranges and normalised value, if appropriate. The normalised value or setting is shown by the '**n**'.

## 11.1 VALID MEASUREMENTS - MEASURE

| | | | | |
|---|---|---|---|---|
| **MEASURE** | **Aud A** | **AL+0040** | | Channel A left is delayed 40ms with respect to vid |
| | | **AR-0023** | | Channel A right is leading video by 23 ms |
| | | **AR▶AL ▼** | | AL input inverted |
| | | **AL▶AR** | | Left-Right swap over on channel A |
| | **Aud B** | **BL+0000** | | Lip synch correct. |
| | | **BR+0000** | | |
| | | **AL▶BL** | | Channels B input is originating from the generator |
| | | **AR▶BR** | | channel A output. Phases OK |

## 11.2 ON SCREEN DISPLAY CONTROLS – VID OSD

| | | | | |
|---|---|---|---|---|
| **VID OSD** | **VALIDMtr** | **Auto** | | Meters appear if VALID test pattern is detected |
| | | **On** | | Meters always on. |
| | | **Off** | | Meters Off |
| | **SDI Src** | **SDI 1** | | SDI 1 Input select |
| | | **SDI 2** | | SDI 2 Input select (if 2nd input fitted) |

## 11.3 AUDIO – AUDIO

| | | | | |
|---|---|---|---|---|
| **AUDIO** | **Aud I/P** | **> Module** | n | Either **Analog / Digital /** not available |
| | | **>Group 1** | | Embedded group 1 |
| | | **>Group 2** | | Embedded group 2 |
| | | **>Group 3** | | Embedded group 3 |
| | | **>Group 4** | | Embedded group 4 |
| | **Mux Grp** | **Mux None** | n | |
| | | **Group 1** | | |
| | | **Group 2** | | |
| | | **Group 3** | | |
| | | **Group 4** | | |
| | **Mute** | **Pass** | n | |
| | | **Mute** | | |
| | **MAL A/B** | **MA +12dB** | | Maximum analogue level |
| | | **MA +24dB** | | n at +18dB |

## 11.4 OPERATING CONDITIONS – STATUS

| | | | | |
|---|---|---|---|---|
| STATUS | Sub-Mod | DI/O+DO | | For example: Digital Input & Output |
| | Mod I/Ps | ~AB⊓␣---- | | |
| | Mod O/Ps | ~--⊓␣ABAB | | |
| | SDI I/P | IP 625 3 | | |
| | | IP 525 3 | | |
| | | IP FAIL | | |
| | AES A | AES A OK | | |
| | | No AES A | | |
| | AES B | AES B OK | | |
| | | No AES B | | |
| | AES Ref | RF AES 3 | | |
| | | RF AES x | | |
| | SDI I/P2 | SDI 2 NA | | |
| | | SDI 2 OK | | |
| STATUS (cont.) | I/P Grps | None | | No groups occupied. |
| | | 1 - - - | | SDI input has Group 1 only is occupied |
| | | - 2 - - | | SDI input has Group 2 only is occupied |
| | | - - 3 - | | SDI input has Group 3 only is occupied |
| | | - - - 4 | | SDI input has Group 4 only is occupied |
| | | - 2 - 4 | | Group 2 and 4, for example, occupied |
| | DMX Aud | No DMX | | |
| | | DMX 20bt | | |
| | | DMX 24bt | | |
| | Mux Grp | MUX OK | | |
| | | MUX over | | |
| | GPI STA | 1↓ 2↓ 3↓ | | ↓⇒ Inactive. ↑⇒ Active. |
| | Soft Ver | 01.00.05 | | The operating code |
| | DSP Ver | 00.01.01 | | The Audio DSP code |
| | AudioVer | 01.02 | | The Audio FPGA data |
| | VideoVer | 01.03 | | The Video FPGA data |

## 11.5 ENGINEERING – ENG'ING

| | | | | |
|---|---|---|---|---|
| ENG'ING | Aud Gang | Ganged | n | MAL ganging |
| | | Separate | | |
| | Aud Bits | OP 20bit | n | |
| | | OP 24bit | | |
| | O/P EDH | EDH On | n | |
| | | EDH Off | | |
| | Free-run | Free Off | n | |
| | | Free On | | |
| | Sleep | 5 min | n | Variable 0 to 30 minutes. |
| | LEDLevel | ▓ ▓ ▓ | | |

## 11.6 CALIBRATION – CALIB

| | | | | |
|---|---|---|---|---|
| CALIB | Cal Mode | Off | n | |
| | | On | | |
| | CntrFreq | Frq=+20 | | Free-run Frequency |
| | DAC A(L) | -128 | | |
| | | +0 | n | |
| | | +127 | | |
| | DAC A(R) | -128 | | |
| | | +0 | n | |
| | | +127 | | |
| | DAC B(L) | -128 | | |
| | | +0 | n | |
| | | +127 | | |
| | DAC B(R) | -128 | | |
| | | +0 | n | |
| | | +127 | | |
| | | | | |
| | ADC A(L) | -128 | | |
| | | +0 | n | |
| | | +127 | | |
| | ADC A(R) | -128 | | |
| | | +0 | n | |
| | | +127 | | |
| | ADC B(L) | -128 | | |
| | | +0 | n | |
| | | +127 | | |
| | ADC B(R) | -128 | | |
| | | +0 | n | |
| | | +127 | | |

## 11.7 CONFIGURATION – CONFIG

| | | | | |
|---|---|---|---|---|
| CONFIG | Banner | On | n | |
| | | Off | | |
| | Password | 0 | | |
| | TestMode | Off | n | |
| | | On | | Password required |

## 11.8 TEST MODE – TEST

| | | | | |
|---|---|---|---|---|
| TEST | Aspect R | | | |
| | TP AR | | | |
| | AUD ERRA | | | |
| | AUD ERRB | | | |
| | DMX STA | | | |
| | DSP OPFL | | | |
| | SRC VERS | | | |
| | StatFlgs | | | |
| | GPI FUNC | | | |