Wiring the NTB to Displays

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1) INTRODUCTION.

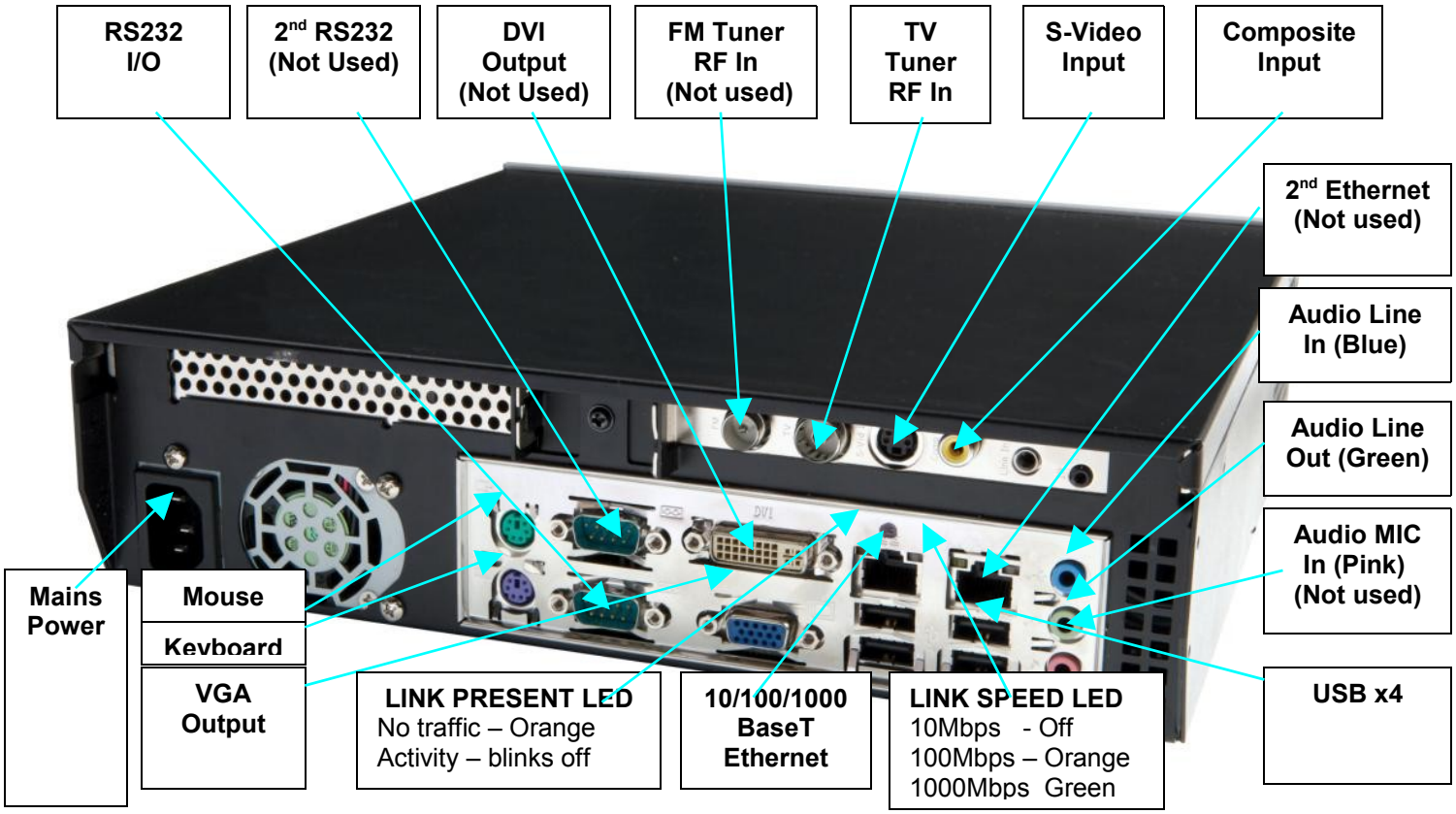
This Application Note describes some of options available in connecting a ONELAN NTB to a display.

The NTB has three types of Video output:

- **VGA** – At user configured resolutions up to 2048x1536 (NTB500x / NTB61x) or 1920x1200 (NTB40) using the industry standard high density sub-miniature 'D' 15 pin connector. The output horizontal and vertical refresh rates vary depending on mode of operation of the NTB. See below.
- **DVI-D** – Not enabled in software versions V7.0.0 or below.
- **TV type outputs – NTB40 only**. The NTB40 presents a Composite Video signal (aka CVBS) via an RCA 'Phono' socket. The NTB40 requires a change in its display settings (Configuration->Player Setup->Screen) and a BIOS change to enable the Composite output. The resolution will also fall back to a maximum of 1024x768 despite what may have been configured in the NTB's Display Settings.
  Note that Composite output is noticeably lower quality than VGA output due to the inherent limitations of the Composite standard.
  In view of the need for a change of resolution, we recommend the use of a VGA to Composite down-converters. These are available in a small package and at modest cost from various industry sources – e.g. http://www.avtoolbox.com/avt3155.shtml.
  Using these types of device allows the NTB to output a higher resolution (such as 1360x768) that is then down-converted to Composite (PAL or NTSC). Therefore a network of mixed VGA driven and TV driven Displays can use the same Layouts and media.

In manufacture, NTB's are set to output at 1360x768x60 resolution via the VGA connector.

'NTB5005 Panel'



The Composite and S-Video inputs are used to capture live analogue video from a local source such as a Camera, a FreeView (DVB-T) box or a Satellite Set-Top-Box.

The TV Tuner input on the NTB5005 is able to receive Analogue or Digital (DVB-T) Terrestrial broadcasts via a suitable Ariel. The FM Radio input is not supported.

The Line Out socket is normally delivered to the Display's audio input or an audio amplifier.
The MIC Input is not normally used.

The Ethernet connector will attach to a port on a Switch in the local LAN infrastructure.
The second Ethernet port is not enabled in software up to and including V7.0.0.

The Keyboard connector is only used for special maintenance purposes.
The Mouse connector is not normally used.

The USB connectors can be used for USB memory sticks and Touch Panel interface (if licensed).

The first RS232 (9 way 'D') connector is used for RS232 data and GPIO functions of the NTB.
The second RS232 connector is not enabled in software up to and including V7.0.0.

The Power connector is used to deliver power. 90VAC – 240VAC, 50-60Hz.

DISPLAY OUTPUT OPERATION SUMMARY

During the NTB boot up period, the NTB will display in character mode at lower resolutions than those set in the NTB's Display setup. Once fully booted, the NTB will output at the user defined resolution – Configuration->Player Setup->Screen.

The NTB ships with default media and displays resolution set for 1360x768x60. This type of material should display on any VGA interfaced display.

2 CABLING OPTIONS

2.1) TV Type Displays

2.1.1) Composite. This is the 'lowest common denominator' for wiring up TV type displays. Video is distributed on 75 ohm natural impedance coaxial cable. In principle, Any 75 Ohm cable will suffice but the quality of the cable (normally expressed in terms of dB loss per meter) will vary depending on the cable type. Typical cable types include RG59B/U available from distributors such as RS Components, Maplin Electronics, www.connectorco.com etc. Cable runs of 100 Meters or more are quite possible. Termination connectors are either BNC (processional) or RCA (normally domestic). Be sure to buy the 75 Ohm variant (rather than 50 Ohm) of BNC connector. RCA connectors don't make a distinction.

If the displayed media also has audio, a screened Stereo cable will also be required. There are no significant length limitations here since the bandwidth is relatively low but beware ground loops and noise issues on long cable runs.

It is possible to drive a number of TV type displays in 'daisy-chain' fashion provided only the display at the end of the chain is terminated with a 75 ohm impedance. Typically only professional grade monitors will have the facility for Composite in and Composite out with the ability to remove the normal 75 ohm termination.

The picture quality is limited by the inherent bandwidth limit of the Composite standard (circa 8 MHz). This means that resolution is in fact limited to a theoretical maximum of 720x576 pixels. In practice, this will limit the lower size for textural media to around 18 Point Fonts.

2.1.2) S-Video. S-Video (aka Y-C) is a two signal TV Video distribution standard. The two cables lead to higher bandwidth and therefore higher quality. In S-Video the Luminance (Y-Brightness) and Chrominance (C-Color) information are carried on separate cables. If the Color cable is disconnected, the display will typically still display but in Black and White.

S-Video can be run for several 10s of meters using either two cables or preferably a paired coaxial cable. Keep the two cable lengths similar since the S-Video standard is very sensitive to phase difference. Even a few meters difference in cable lengths will result in 'smeared' color rendition.

Termination connectors are 4 Pin Mini Din by convention.

Daisy chaining is not normally available for S-Video.

See Section 2.1.above for related audio issues.

2.1.3) Distribution Amplifiers. A more satisfactory way of driving more than one TV type Display is to use a Distribution Amplifier (DA). In this scheme, the Video signal(s) are received and terminated from the source (the NTB in this case) and regenerated using active amplifiers of appropriate bandwidth. Some units may also make provision for Audio. These devices are relatively cheap (less than £100 for a 1 in ; 4 out device). The advantage is that a break in one output cable will only lose a single display as opposed to a daisy-chaining arrangement where the entire chain will go down. The disadvantage is that the DA costs money and will need a power supply.

TV type DAs for Composite or S-Video (with and without Audio) are available form a number of sources in the AV Trade.

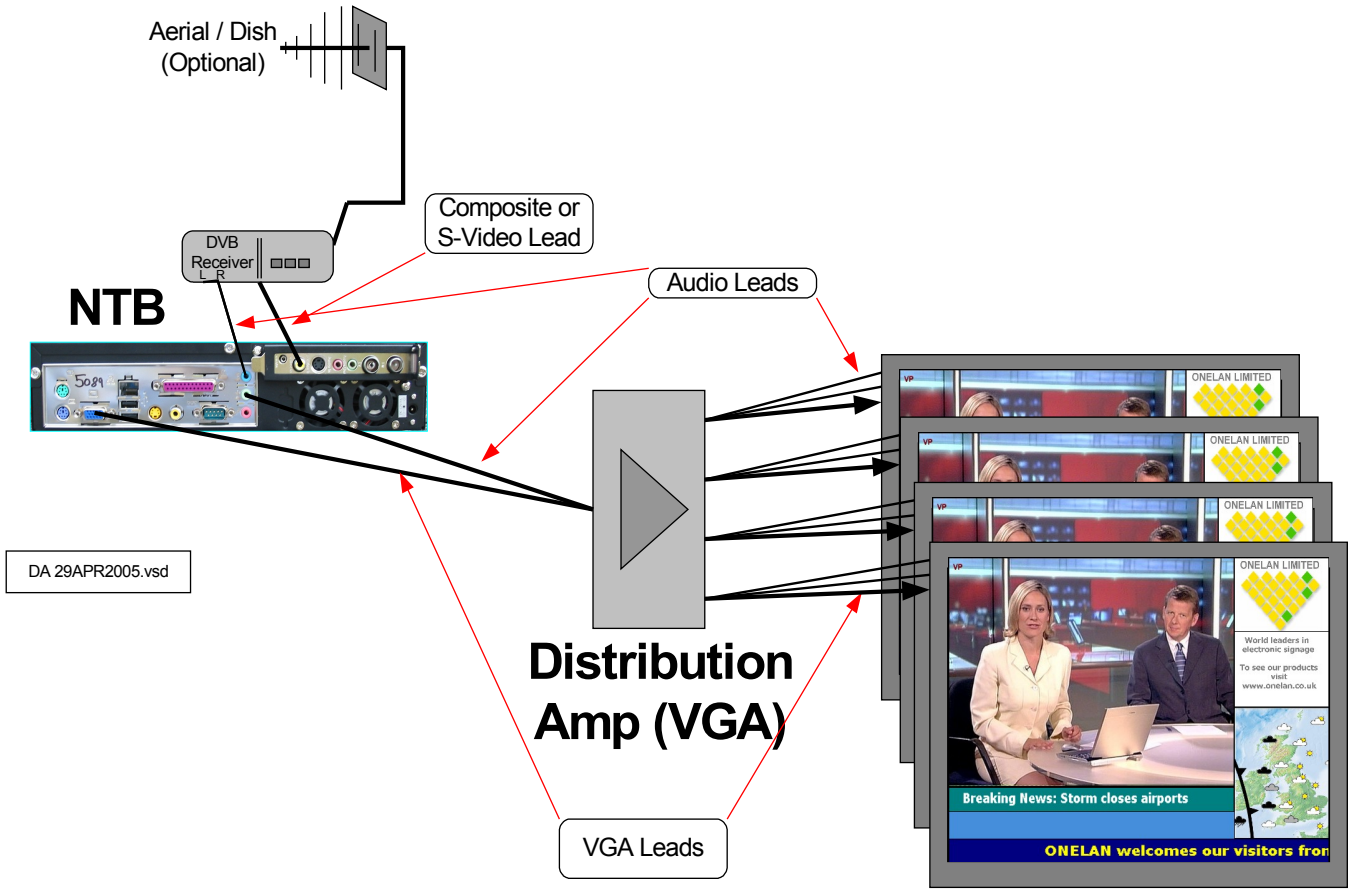


Figure 1 - Distribution Amplifiers

2.1.4) Composite and S-Video over CAT5/6 Cabling.

In many commercial situations, low cost structured cabling (aka CAT5 or CAT5e or CAT6) is already in place or is the preferred cabling method. CAT5/6 cable has surprisingly good bandwidth and crosstalk characteristics and has been tightly specified to carry, Voice, Video, limited power and Data signals.

The main difference with CAT5/6 cabling is that it has a 100 ohm natural impedance. It will not therefore carry native Composite or S-Video satisfactorily over any distance. To overcome this it is possible to use simple Baluns (which are essentially signal transformers) at either end of the cable to make the transition between 75 ohms to 100 ohms and back to 75 ohms.

A better approach is to use active electronics to make the transitions and also compensate for other loss effects of the cable. Using these Video-over-CAT5 (aka Active-Baluns) will allow distances of 300 meters or more to be achieved. Note however, that strictly speaking a CAT5 installation will only traverse a maximum of 100 Meters in order to meet the CAT5 specification.

Devices are available from a number of AV Trade sources. ONELAN have tested with various devices including those from Smart-e Ltd. (http://www.smart-e.co.uk)

Some vendors (including Smart-e) will also have devices that include the functions of a DA combined with a Balun. Some will also carry Stereo Audio, RS232 data and Infra Red signals over the same CAT5/6 cable.

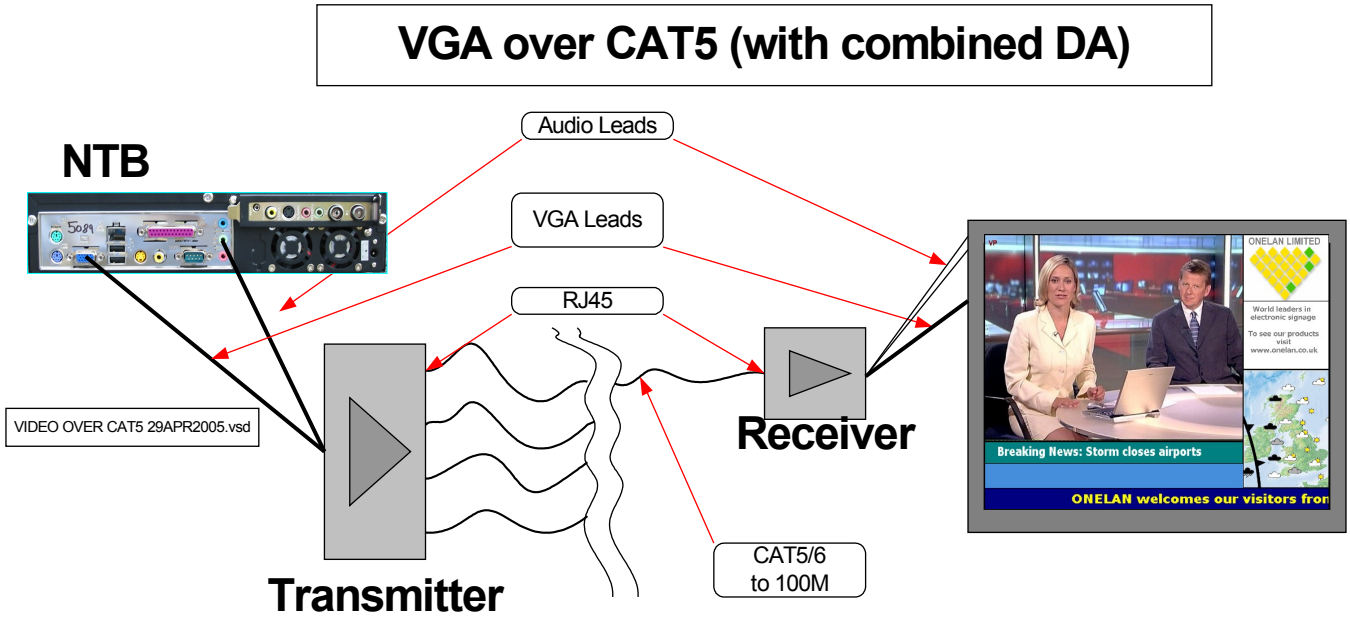


Figure 2 - Video or VGA over CAT5

2.1.5) Matrix Switches. Some larger commercial installations require numerous displays driven from a variety of Video sources. If it is required that any Display can show material from a varying source, it will be necessary to use a Matrix Switch rather than a static patching solution. The Matrix will typically also carry associated Audio and sometimes RS232 and Infra Red signals back to the Matrix in order to change Video / VGA source.

Matrix Switches are generally Rack Mounted devices. They provide a variable number of inputs and outputs – up to say 16 In ; 64 Out. The inputs are normally presented through the appropriate connectors (e.g. RCA, Mini Din, 15 Way sub 'D'). The outputs are generally presented on RJ45 sockets for use with structured cabling (CAT5/6).

The Matrix will generally have a management interface that allows an administrator to control the facilities available at each output port (perhaps on the basis of time-of-day etc.).

The NTB can easily be connected to a Matrix Switch input so that it provides one of the available sources of Input to the Matrix.

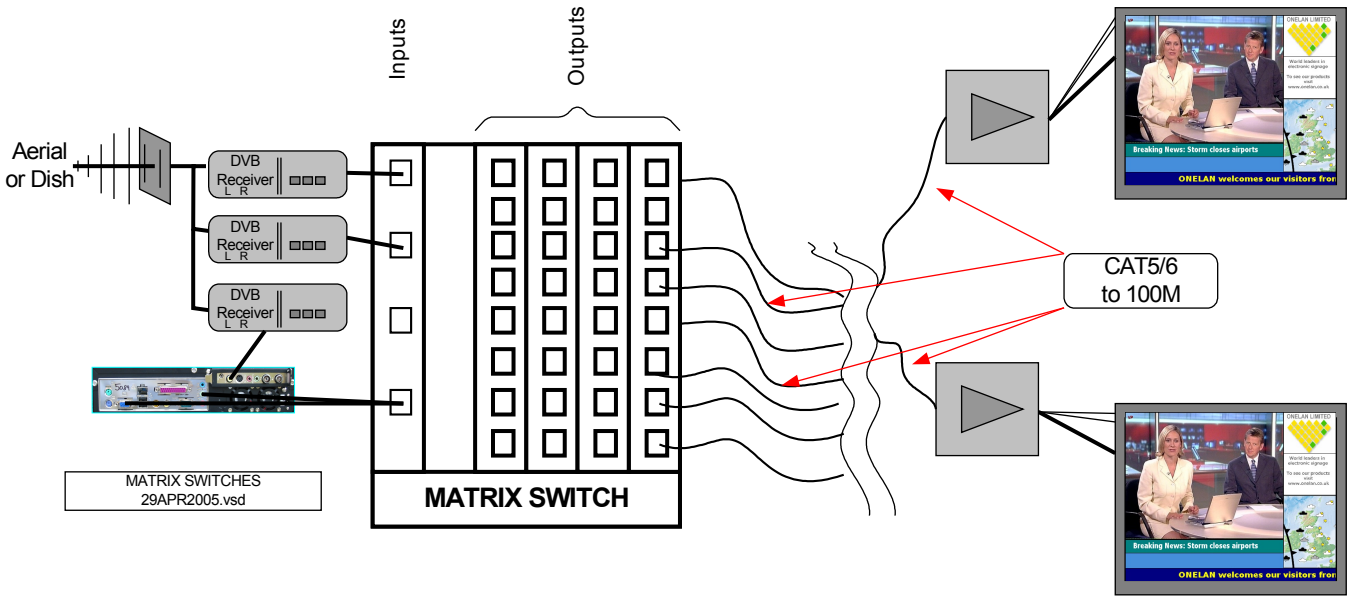


Figure 3 - Matrix Switches

2.2) VGA Driven Displays

2.2.1) Straight Cabling.

The VGA standard involves 3 high bandwidth signals (Red, Green Blue) and a variety of sync signals. The cable used is therefore a special multiple coax plus screened individual signals, compound cable. The quality of the cable varies in terms of RFI and attenuation characteristics. Generally the thicker the cable, the better the quality. Suppliers include RS Components – www.rswww.com.

A good quality VGA cable will typically drive to 50 Meters without noticeable display degradation for resolutions up to 1280x1024. It is preferable to have the cable in one section rather than a series of shorter cables concatenated with in-line connectors.

Cables are normally prepared off-site since on-site termination of this complex cable into a 15 Way 'D' sub connector takes considerable skill.

2.2.2) Distribution Amplifiers / Splitters.

These are commercially available from a number of sources. They will sometimes have Audio and other facilities. See also above in Section 2.1.3. VGA DAs are generally more expensive than Composite or S-Video devices because they provide greater bandwidth and are dealing with more signals.

2.2.3) VGA over CAT5/6 Cables.

Devices for carrying VGA over structured cabling are commercially available from sources such as Smart-e Ltd. (http://www.smart-e.co.uk). They will often provide signal paths for audio, RS232 (for controlling the Display) and Infra-Red. See also Section 2.1.4 above.

Distances of up to 300 Meters are achievable with good quality devices. There is a tradeoff between distance and resolution. 300 Meters at 1024x768 resolution and 150 Meters at 1600x1200 resolution are typical.

These devices will often require manual 'tuning' at installation time to compensate for the cable characteristics.

2.24) DDC

The VGA standard is able to convey Display information to an attached computer or Media Player such as the NTB. The DDC mechanism uses 2 wires within the VGA 15 way 'D' connector for this purpose. This allows the Computer/NTB to detect the type, size, resolution and preferred sync pulse timing of the Display.

The NTB presents the key Display information to the operator who is able to choose what resolution / timings to use. See Configuration->Player Setup->Screen. The NTB does not automatically set its output to the Display settings since it is normally desirable to run the NTB at a resolution defined by its Layouts and media.

Note that most VGA Splitters/DAs/VGA-over-CAT5 solutions do not propagate the DDC signals since it would be difficult to say from which display the DDC information should be supplied. In this case, the NTB user will not see the Display's preferred DDC information and will have to choose a setting suitable for the Display(s).

Wiring Option	Video Quality	Max Distance	Video Cable Type	Audio Cable Type	Connectors	Distribution Amplifiers	Comments
Composite	Poor. Max. of 720x576	100M+	RG59 B/U	Separate twin screened	RCA Plug – Video 3.5mm Jack – Audio	YES – with and without Audio	Lowest common denominator
S-Video	Better but still 720x576	50M	Twin 75 Ohm coax		4 Pin Mini-DIN	YES – with an without Audio	Better than Composite but still poor by Digital Signage standards
Video over CAT5	Poor. Max. of 720x576	300M+	CAT5/CAT5E/CAT6 Unshielded twisted pair (UTP). 4 pairs	Not normally required	RJ45 on the UTP. RCA for the Video 4 Pin DIN for S-Video 15 way sub-D for the VGA	Often combined with the Active Baluns	Active or passive Baluns commercially available
VGA over CAT5	Good. From 1024 x 768 to 1600x x 1200	300M 150M					Active Transmit and Receive units
Matrix Switch	Good. To 1600 x 1200	Per VGA over CAT5					Any Out to any In
VGA Cable	Good. To 1920 x1200	50M	RG-179	Separate twin screened	15 way sub-D	YES – with and without Audio	Simplest method for VGA