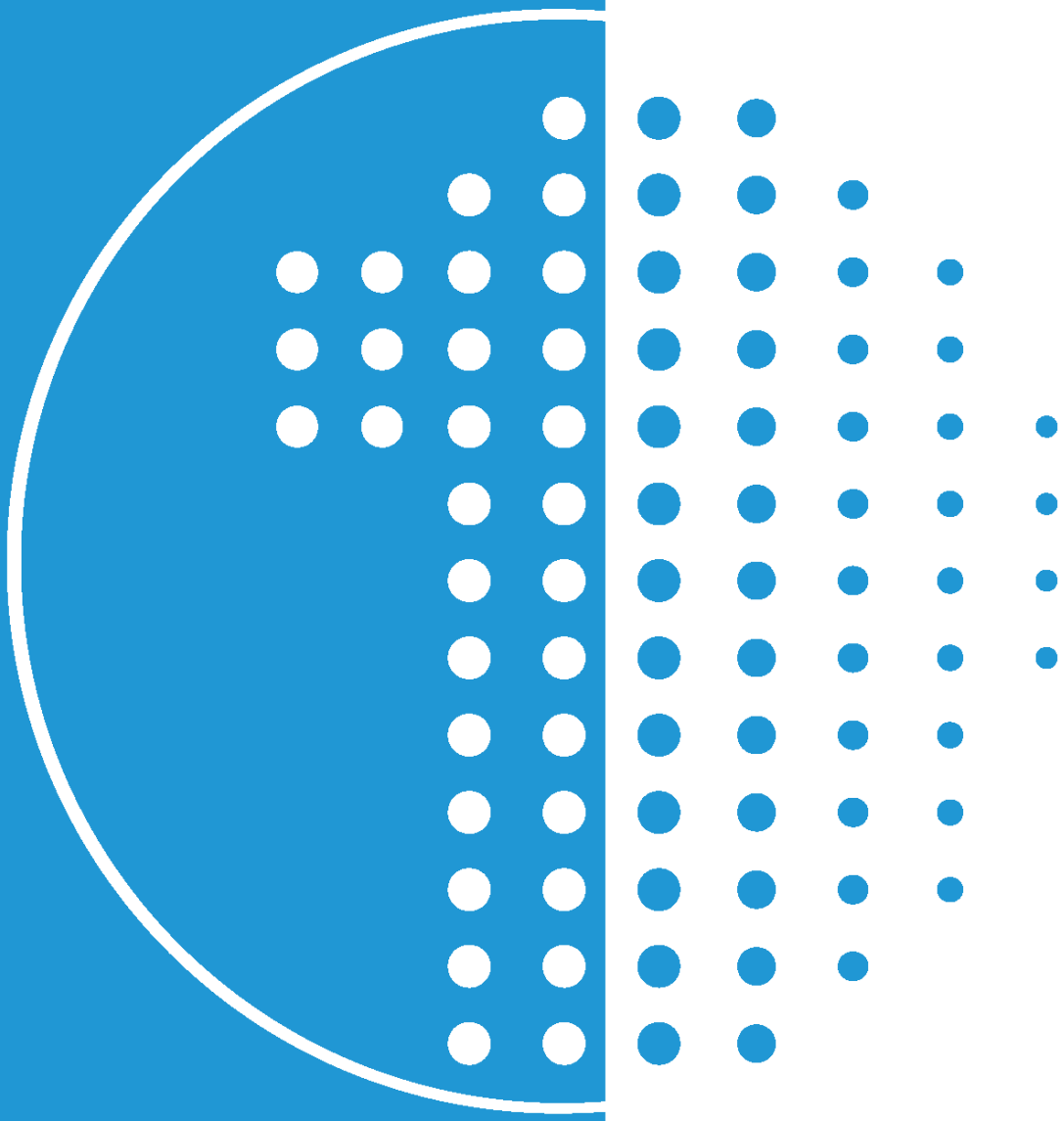
Digital Signage and LED Service Primer

Introduction to the service requirements and maintenence of digital signs and LED screens.



ONE WORLD LED
LED DESIGN, MANUFACTURE & WHOLESALE

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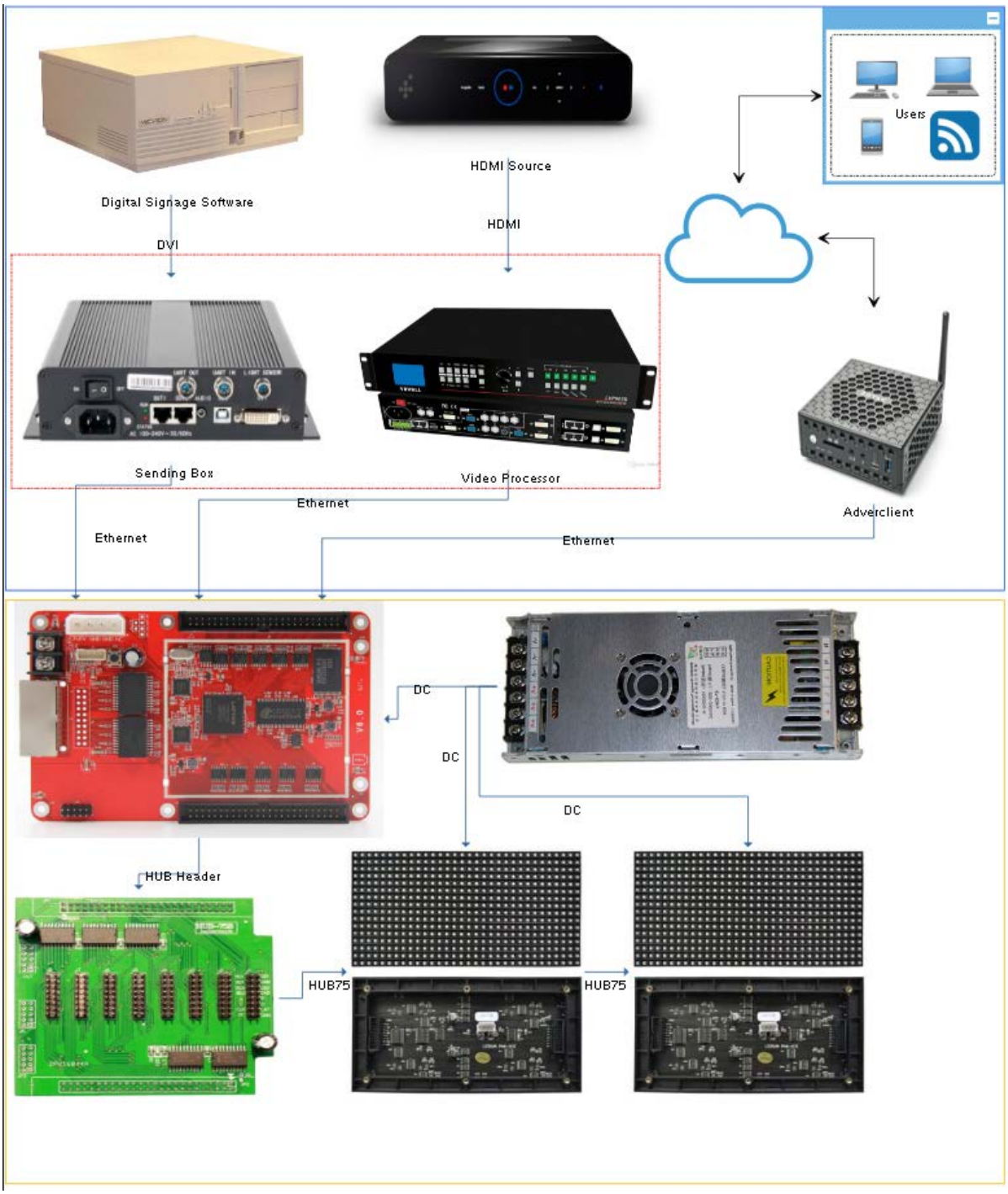
Visual Overview



Source

Screen

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Source

This subsystem is the input to the display. From this perspective when using a sending box or card the display presents itself as a virtual monitor over HDMI or DVI. For screens that require no video processing an appropriate sending card can be used on its own. If your content needs to be scaled to fit the screen (ie 1080p satellite decoder box output to a screen that is 720x320 pixels, content stretched or a region of it selected), then an LVP605 or similar video processor box is required in addition to a sending card. An Adverclient (used with the Adverpost cloud management system) uses a proprietary software based sending method negating the need for expensive additional sending and processing hardware.

Internet based signage problems

Some internet-connected signage systems will cease to function in the absence of an active wireless or Ethernet internet connection. The Adverclient is adaptable to weak and non-existent network conditions and capable of continuing to play the last received loop, checking constantly for an available connection before downloading the newest version when it becomes available.

Source monitor bypass

To narrow down the cause of a no-signal condition or scaling issues, it can be helpful to bypass the sending system and treat the source subsystem as standalone. To do this, a regular DVI or HDMI monitor should be connected in place of the sending card/video processor. If the fault is replicated on this monitor then the problem is determined to be in the source itself and the manufacturer of the equipment should be contacted.

Screen

The screen subsystem highlighted in yellow above is comprised of (in order of connection) the:
(Multifunction card and monitoring cards if applicable)
Receiving card
Hub card
Modules

The receiving card receives screen data over Ethernet from the sending card and converts it to LED control signals. The hub card provides an adaptor from the standard output of the receiving card to various LED interconnection standards, the most popular of which is the HUB75 standard which is used by Colorlight and most other LED manufacturers.

Power supplies are connected to each of the modules and the receiving card.

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Common screen fault appearance and rectification tables

The following tables give a list of some common faults and their causes.

Content Issues

Visible Fault	Probable Technical Cause	Solution
Distorted content.	User error – configuration file deleted.	Check LEDShow/Vision and re-run smart setup to reconfigure screen.
Distorted content only in certain area.	Faulty receiving card.	Swap distorted area to known good receiving card and observe results.
Offline content displayed.	Fault between sending card and first receiving card or source	Test cable between sending card and first receiving card.
Offline content displayed on a portion of the screen.	Fault between last working receiving card and first offline contents displaying receiving card.	Interconnecting links are likely to blame. Replace ethernet cables or bypass cabinets to further isolate.

Module issues

Visible Fault	Probable Technical Cause	Solution
Clustered group of red modules.	Dead or dying power supply, potentially caused by bright content confined to region.	Replace power supply (see 2.1.3), consult **LED Contents Primer** for more information on bright content.
Horizontal row of dead modules appearing at beginning of cabinet.	Failure of port on hub card or faulty receiver card.	Swap row to known-good row control cable and observe results. If the row re-illuminates, swap hub
Horizontal row of dead modules appearing midway through cabinet.	Faulty module at beginning of chain of dead modules.	Perform isolation test (see 1.3.2)
Off-white colour on cabinets following first in 240v power chain	Bright contents have overloaded preceding power supplies and caused heat failure in first.	Replace first power supply and redistribute load, consult **Electrical Recommendations** for more information.

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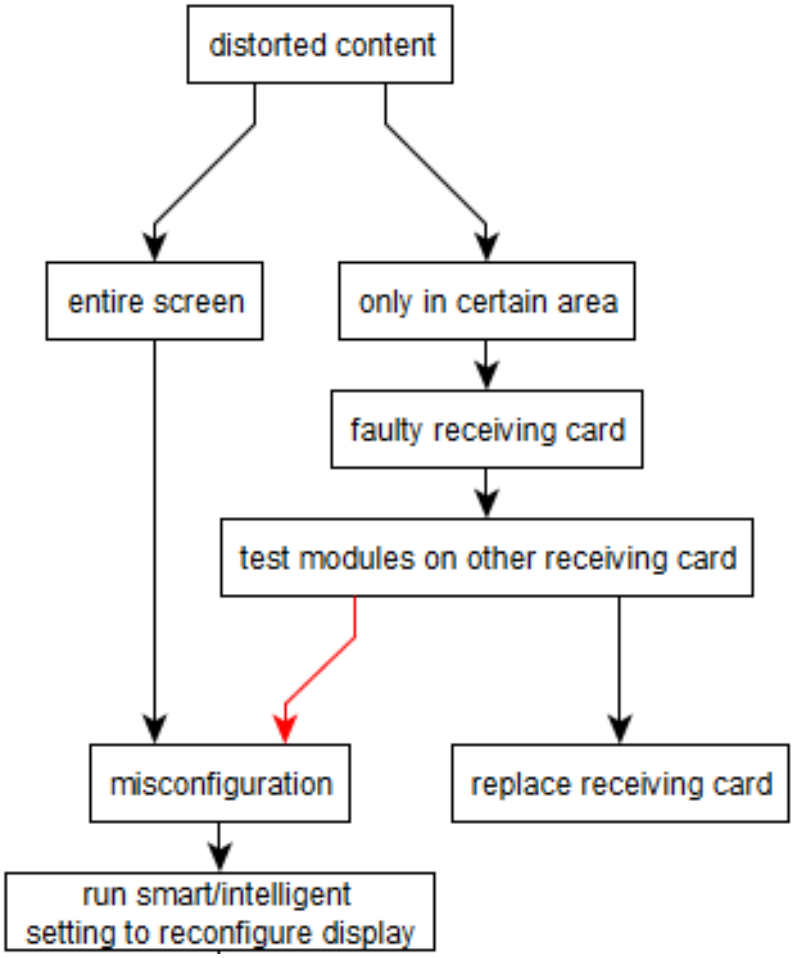
Fault-finding diagrams

The following diagrams display some common faults in the screen portion of the system, with a step-by-step process to try and solve the problem.
The red arrows relate to a malfunction occurring after performing a certain step.

Distorted image flowchart



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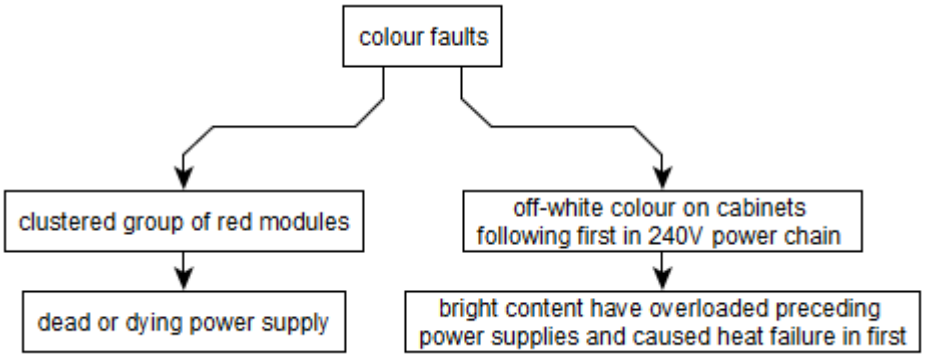
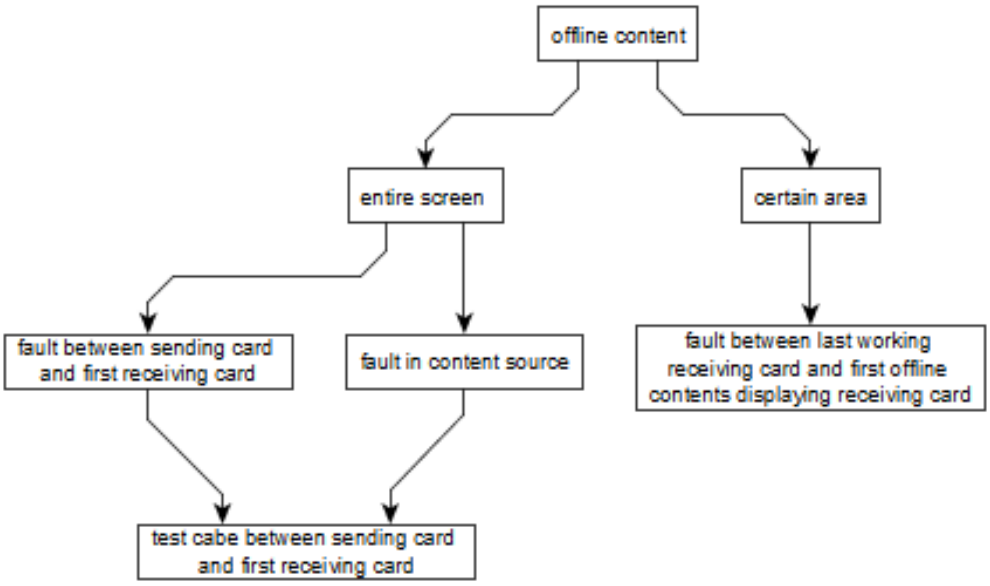
Discoloured module causes



Offline content display troubleshooting



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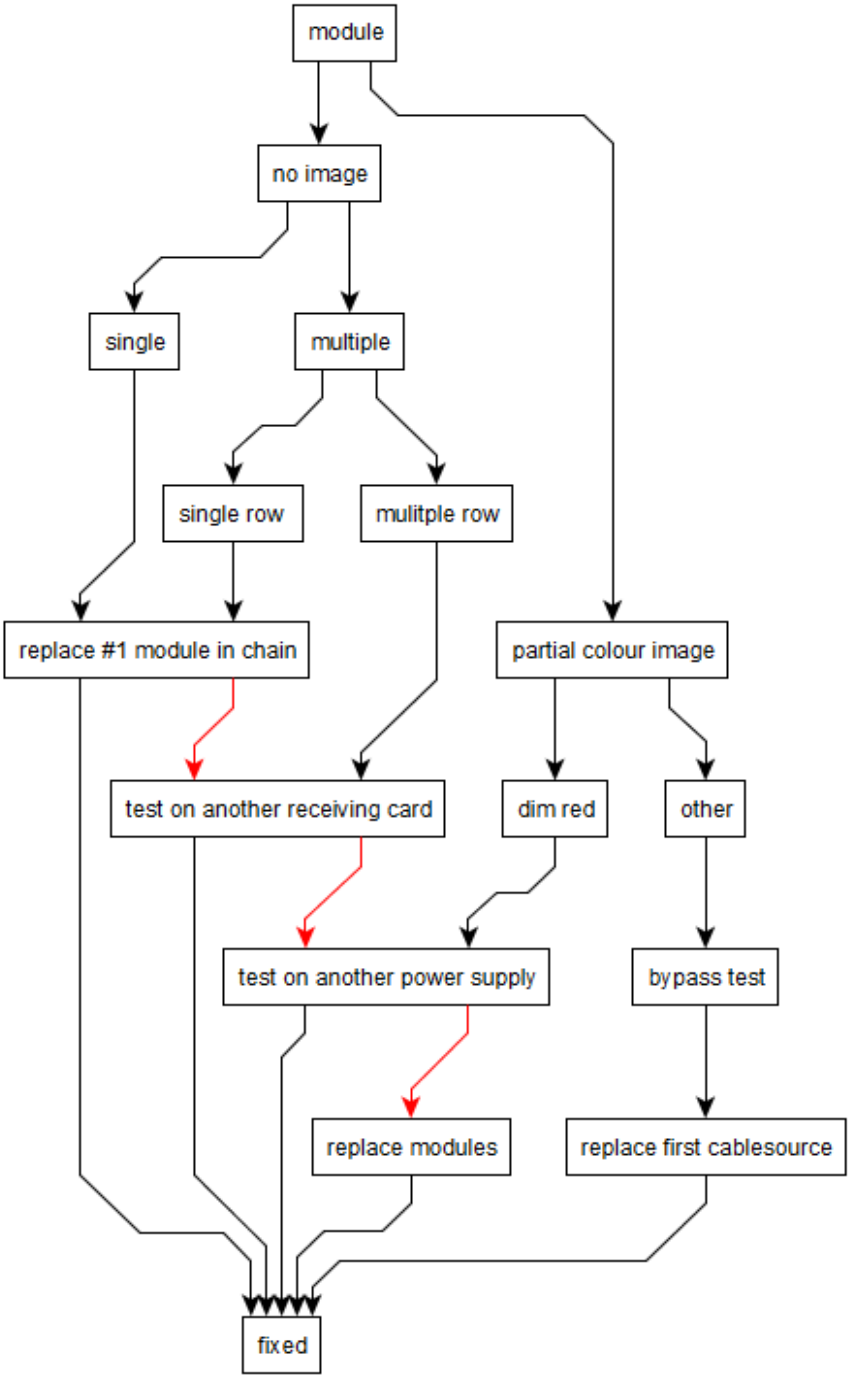
Per module distorted image flowchart



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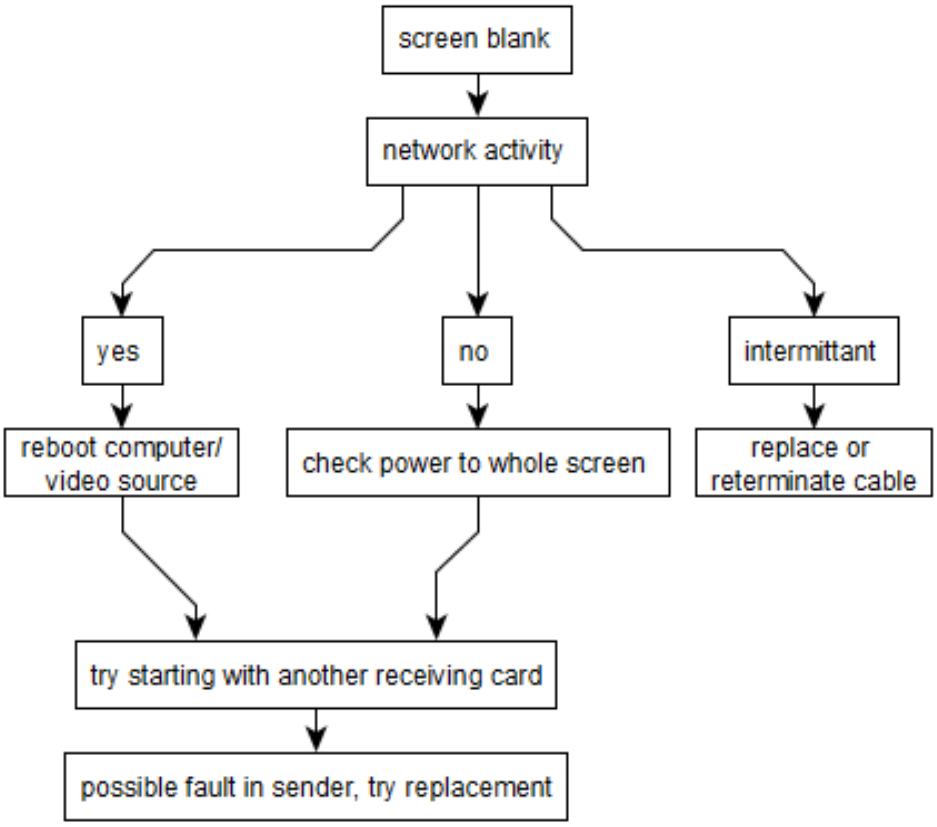
Steps to narrow down cause of blank screen



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Common fault explanations

Large number of pixel failures

When a large number of pixel failures is experienced, the content may be to blame. Issues such as off-white colour on cabinets, pixel failures and sometimes even receiving card faults can be attributed to poorly designed content. Content design plays an important role in the upkeep of a screen, content that is too bright or remains white between all slides in a certain area can lead to many failures. For more information please consult the *LED Contents Primer* available from http://oneworldled.com/PDF/One%20World%20LED%20Design%20Primer.pdf

Red modules

When modules turn completely red, this is a result of a lack of power or insufficient power being supplied to the affected module(s). The way that the data signals work between receiving cards and modules (HUB75 in the above diagram) causes enough voltage for dim displaying of the first signal (red in a RED, GREEN, BLUE arrangement like HUB75) on modules without any power connected. One way to observe this effect is to mimic a failed power supply condition by disconnecting the power cable to a module on a test bed. The result will in most cases be ¼ brightness or less red content still being displayed. Knowing how to spot this issue helps when narrowing down the origin of colour loss in modules. When presenting in an L-shape (most common) or however the power supplies have been wired, this is a sure sign that the power supply responsible for the red section needs to be replaced.

Vertical problems

When there is a line of faults vertically and the data is ran horizontally, this can point to an environmental fault. If the cabinets have not been chosen or installed correctly sometimes water ingression can occur from the top. Faulty seals not replaced regularly can also contribute to this. This water will find the weakest path down the screen and will pool above the seals before dripping. If you can see any marks of corrosion inside the screen in a vertical line consistent with the appearance of a fault, repairing the fault will only serve to band-aid the problem which will then reappear again when the water next gathers. More attention should be turned to how to repair the environmentally caused fault to properly fix this problem.

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Hot-fixing

Having the right parts on hand is important as detailed below, in the service and maintenance checklists. In an ideal world this will always be the case however realistically sometimes problems will be encountered that have a quicker 'needs-fix' date than is practical, particularly when waiting for parts to ship from overseas is a factor. This section details some "band-aid" fixes that allow a screen to continue to function at almost full capacity given limited on-hand spares.

Modules

When a chain fault is located in modules, the problematic module can sometimes still function as a last-in-the-chain. If the fault is only present on the output of the module then it is advisable to swap this module to the left or right-most (depending on data flow) position on the screen. The last module can be put into its place and will function to pass the signal through completely removing the fault.

Content

When there are several module faults or even power supply faults, using Adverpost it is possible to relocate these faulty components to the top or bottom row(s) and then shrink the content by a number of pixels or whole modules depending on severity. For example, if some modules are displaying lines of four dead pixels only on the top edges, these can be relocated to the top. Once at the top, the content can be bottom-weighted and shrunk by four pixels so that there is a strip of black across the top of the screen which hides the dead pixels and keeps the screen functioning whilst replacement parts are dispatched. Likewise for whole module faults, the entire height of the module can be removed. This relies upon there being enough modules overall to build a functional viewport.

Power supplies

When a power supply has failed, sometimes there is sufficient extra power available from surrounding power supplies to be used as an interim solution. The DC leads to the broken power supply can be disconnected and then evenly split up amongst other nearby power supplies. It is advisable to lower the overall brightness of the screen and perform current draw tests on the new links to ensure this doesn't place too much strain on the remaining power supplies. Check the rating sticker on the front for information on the specific supply.

Fans

Likewise, fans can be relocated to nearby cabinets as two cabinets with one fan each is far better than one cabinet with two dead fans and another with two functioning.

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Maintenance

Regular scheduled preventative maintenance

Air filters

Salt air filters are to be replaced every 3-5 years. A visual inspection for excessive particles present is recommended every year. The air filters for our cabinets are on the intake. As the cabinets use an exhaust fan configuration this means that the filters are not installed in-line with the fans.

To replace the air filter, remove the eight Philips head screws surrounding the filter on the cabinet and pull the filter out. Recommended replacement filters can be ordered through our wholesale sales team.

Weatherproofing seals

Whenever a service is performed on an outdoor screen, it is a good idea to visually inspect the various rubber and silicone seals installed to prevent the ingress of water and moisture. There are three kinds of seals used on most of our outdoor cabinet range:

- Module seals
- Outer seals
- Inner seals

During a visual inspection of the inner and outer seals, the main things to look out for are deterioration (flaking and peeling of rubber or glue) and gaps (due to the alignment of the inner seals).
A glue-dissolving solvent and access to the entire perimeter of the sign is required to replace the outer seals whilst the inner seals can simply be pulled off the metal holding them in place.

Power supplies

Power supplies are supplied with manufacturer quoted longevity figures and failure rates. Please check your purchase documentation for information on how regularly you should replace power supplies. It is a good idea to mark with stickers the date that each power supply was last replaced to aid in keeping the signs maintenance up to date.
To replace a power supply first ensure that all power to the screen is switched off and ideally disconnected. In the case of a self-standing screen you must ensure that the isolator for the structure (including any additional lightboxes, floods, etc) is switched to the off position. The screen should remain off for at least 5 minutes before you begin the service. This ensures all residual power in the capacitors and other current storing components has been allowed to drain.

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Corrective maintenance

Modules

Unlike power supplies or seals, preventative maintenance of modules is impractical because it would mean removal of every single module including working modules on a cycle. Instead it is far more efficient to repair visually identified faults. Module faults fall into two main categories:

- Single module fault
- Chain module fault

The former appears as a single module displaying errant lines, multiple noticeable dead pixels or nothing at all. The latter is any of those symptoms appearing on more than one module in a row. The daisy-chain nature of receiving card to module interconnection means that a single malfunctioning module may have a run-on effect that makes it seem as if more modules are out. Control signals flowing through the ribbon cables along each horizontal row of the screen can be interrupted by a faulty module, resulting in more apparent bad modules than there really are. A good quick test to determine whether you are dealing with multiple module faults or a chain module fault is called a Bypass Test.

Performing a bypass test

To perform a bypass test, disconnect the ribbon cable leading to the first problematic module and replace it with a longer one connected to the next module in the series
If the modules after the suspected faulty module function normally then the fault has been isolated to the bypassed module which must now be replaced.

Power Supplies

Power supplies should be replaced periodically to prevent issues as per the previous section. However, sometimes a power supply will fail before the suggested replacement date arrives. Symptoms indicative of a bad power supply are more than two modules in a cluster (not necessarily a horizontal row) completely out or displaying dim red content only.

To quickly troubleshoot a power supply the first course of action is to check for the green power LED. If your power supplies do not have LED indicators, you must instead use a multimeter to test the output of the supply.

Measuring loaded output voltage

To troubleshoot intermittent issues that may only occur under load it is a good idea to perform this test while the display is showing bright white content. This service is performed with the screen powered on so it is important to have a basic understanding of the dangers of diagnosing live equipment.

Set your multimeter to low range DC (<20V) and locate the output side of the power supply taking extra care to avoid touching the live 240V input side. Place the probes from the multimeter on their respective terminals and note the voltage reading on the screen.

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The reading should match the rating (shown in red above) on the power supply label. Typical voltages are 5v and 12v. A tolerance of +/-5% is acceptable but anything out of this range indicates a failing power supply.

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Service Checklists

Pre-departure:

- ❑ Fill out and print work order listing tasks to be completed
- ❑ Tools, height, environment: ensure you have the correct tools to perform the service including:
  - ❑ Cabinet rear keys (triangular or drum style)
  - ❑ Height access equipment (platform or standard ladder) + work permits
  - ❑ Environmental protection: warm clothing/gloves, high vis gear if exposed to traffic
- ❑ Check required parts (power and data cables, zip tiles, screws) are present. Bring extra parts if possible.

On arrival:

- ❑ Secure the service area with cones and fluoro meshing if there is a hazard of falling tools to the public
- ❑ Inspect the display from an appropriate viewing distance and take note of any discrepancies in the location of apparent faults and the listed location on the work order.

Cabinet opening:

- ❑ Visually inspect opening handles for spiders and other insects, isolate power and spray if necessary (taking care not to spray too much into fan vents)
  When unlocking a front-serviceable hydraulic cabinet ensure that the following criteria are met:
  - ❑ Safe to do so (force of hydraulics opening could pose knock/fall risk, do not stand in front of opening cabinet on an elevated platform)
  - ❑ Cables leading from back of cabinet to front of cabinet are not pulled taught (half open cab and then check before allowing it to open all the way)

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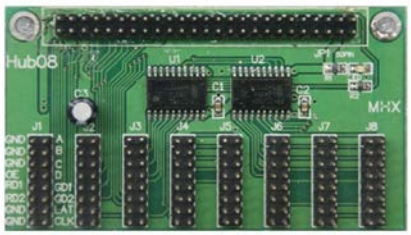
Fan replacement:

- ❏ Isolate power to screen
- ❏ Unscrew faulty fan from power supply
- ❏ Unscrew fan mounting screws
- ❏ Check new fans operating voltage, if DC then connect to DC side of PSU and if AC connect to AC side
- ❏ Mount new fan in place with screws

Module mesh cover replacement:

- ❏ Unscrew mesh cover fastening screws
- ❏ Replace them with new screws
- ❏ Replace the whole mesh cover if broken edges are evident

Hub card replacement:



- ❏ Isolate power to screen
- ❏ Remove data cables one by one from hub card to be replaced
- ❏ Insert into corresponding positions on replacement hub card (check orientation before starting)
- ❏ Once empty, remove the old hub card from the control card and attach the new (take care when aligning pins, bending damage may occur)
- ❏ Ensure ribbon cables are put in correct order and position on hub card (brown color is always put towards left when facing the control card)

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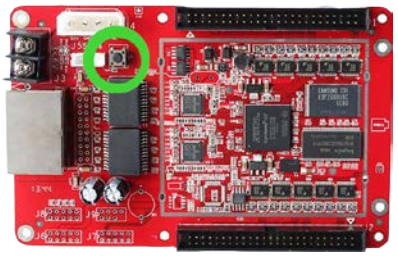
Module replacement:



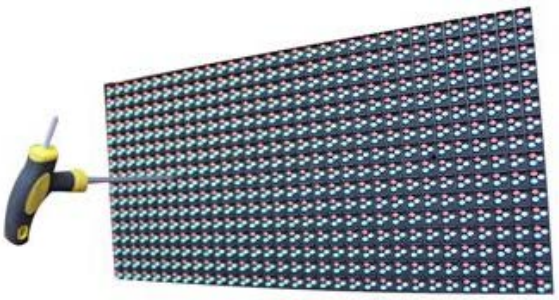
- ❑ Press the test mode button circled by green below on the receiving card to cycle through each pattern and stand back at an appropriate viewing distance each time to locate and note any additional faults

- ❑ Isolate power to screen
- ❑ Unscrew power supply leads and unclip data cables

Rear serviceable

- ❑ Unscrew the module supporting screws and inspect them for any corrosion or abnormalities
- ❑ Insert the new module (ensure the silicone weatherproofing seal is in place) and reattach screws

Front serviceable



- ❑ Lightly pull on the module or shim in between two modules with a thin piece of metal to lift the magnetic screws from the frame plate
- ❑ Unscrew the fastening magnetic screws from the faulty module and affix them to the replacement
- ❑ Check the magnetic cores for any damage and replace as needed
- ❑ Adjust the distance between screws and modules to an appropriate value, this ensures a flat fit with the rest of the modules

- ❑ Re-attach power supply leads and data cables

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Power supply replacement:

- ❏ Visually inspect power supplies for presence of green LED. Another sign of a faulty power supply is a non-rotating fan.
- ❏ Use multimeter to perform loaded output voltage test (see above) on suspected faulty power supplies
- ❏ Isolate power to screen
- ❏ Unscrew DC side of power supply first and then unscrew AC side. Power supplies contain capacitors which can store a charge for a significant time after power has been cut. Be careful not to touch multiple terminals.
- ❏ Unscrew power supply mounting screws and fasten replacement in place.
- ❏ Re-attach DC side of power supply first (ensure cable groups are the same as before for distribution of load across terminals)
- ❏ Re-attach and inspect AC side after inspecting DC side for shorts or stray wires

Control card replacement:

- ❏ Isolate power to screen
- ❏ Remove hub card leaving data cables attached
- ❏ Unscrew control card mounting screws
- ❏ Label it as damaged control card for further inspection
- ❏ Fasten new control card in place
- ❏ Attach hub card with data cables (take care when aligning pins, bending damage may occur)
- ❏ Energise screen and observe modules connected to the replaced control card. If issues persist, replace hub card