RCA SCENIUM

ATC32x

DLP Technical Training Manual

THOMSON

FOREWORD

This publication is intended to aid the technician in servicing the ATC322/323 DLP television chassis. It will discuss new and different technologies associated with the chassis, including theory of operation for video, audio, control, power supplies and light engine circuits. It is designed to assist the technician to become more familiar with circuit operation, module interdependancy and increase confidence and improve overall efficiency in servicing the product. The manual assumes the technician is familiar with the first generation of DLP chassis, the ATC311M and DLP technology in general. If not, obtain training publication **TATC311** by visiting the Thomson Service network at:

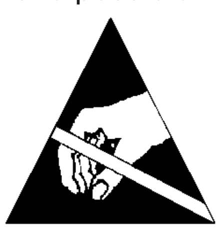
http://www.thomsonnetwork.com/

General information on DLP technology can be obtained from several websites by entering "DLP" in the search engine.

Note: This publication is intended to be used only as a training aid. It is not meant to replace service data. Thomson Service Data for these instruments contains specific information about parts, safety and alignment procedures and must be consulted before performing any service. The information in this manual is as accurate as possible at the time of publication. Circuit designs and drawings are subject to change without notice.

SAFETY INFORMATION CAUTION

Safety information is contained in the appropriate Thomson Service Data. All product safety requirements must be complied with prior to returning the instrument to the consumer. Servicers who defeat safety features or fail to perform safety checks may be liable for any resulting damages and may expose themselves and others to possible injury.



All integrated circuits, all surface mounted devices, and many other semiconductors are electrostatically sensitive and therefore require special handling techniques.

CableCARD™ is used with the permission of CableLabs.

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Introduction

The ATC322/323 chassis are Thomson's latest generation of television instruments using DLP light engine technology with integrated High Definition ATSC/QAM tuning. The ATC322 chassis drives the more traditional "Classic" cabinet designs. The ATC323 chassis drives the newest "Slim" cabinet design that is less than 7 inches deep. Not covered in detail but sharing many of the same features, electrical design and cabinetry is the PTV version of the chassis, the ATC321.

This manual will show differences and similarities between chassis components. Cabinet design to accommodate the new slim design chassis will be covered.

The next generation of DM module, the DM3, contains system control, signal reception, video and audio processing, communication and light engine formatting circuitry. Input Audio/Video signal switching is contained in a separate PCB. There are two main power supplies, the AC Input and Lamp supplies. AC Input transforms AC power into the DC supplies required by the modules. There are also smaller localized regulators that further distribute power on each board. The lamp supply module provides the proper operation for each of several different lamps used in the different chassis.

Slim DLP

The digital control module and associated chassis, ATC322/ATC323, were designed to upgrade the integrated ATSC receiver product line to include Digital Cable Ready (DCR) capability and reduce the number of modules from previous designs. Chassis complexity was reduced with increased component IC capability and by reducing the output to a single scan rate, performing all video format conversions digitally. To further simplify the chassis, audio processing has been moved to the DM3 module and the audio output and Video switching boards were combined into a single AVI/O board. To accommodate the new thin cabinet design the DM3 has a much shorter height and the capability to be mounted either vertically or horizontally in the cabinet.

A main feature comparison chart between the ATC311CR chassis (the original DLP instrument) and the ATC322/323 is shown below:

Feature	**ATC311CR**	**ATC322/323**
Tuning	ATSC/QAM/NTSC	DCR/ATSC/QAM/NTSC
TV Guide+	Yes	No
Multisync Component Inputs	2	1 or 2 (Model Specific)
Composite/S-Vid	2/2	1 or 2 (Model Specific)
Front AV	1	1 (ATC322 Only)
DVI	Yes	HDMI
DTV Link (1394)	2 (Two way)	2 (Two Way)
Digital Audio Out	Yes	Yes
External Speakers Out	Yes	No
Center Channel Input	Yes	Yes (Model Specific)
Ethernet	Yes	Yes
Web Browser	Yes	Yes (Model Specific)
Record Outputs	Yes	Yes
Audio Outputs	2 Channel Fixed/Variable	6 Channel (Model Specific)

The above inputs are dependant upon the model.

There will also be an additional 44" screen size in the DLP instrument lineup. The chart below indicates major feature differences, not all electrical or mechanical changes between instruments.

Features	HDxxTHW263	HDxxLPW165	HDxxLPW163	HDxxLPW164	HDxxLPW162	HDxxLPW52
Cabinet	Scenium 5.0	Scenium 4.0	Scenium 4.0	Scenium 3.8	Scenium 3.8	RCA 3.5
Tuning	DCR/QAM/ATSC/NTSC	DCR/QAM/ATSC/NTSC	DCR/QAM/ATSC/NTSC	DCR/QAM/ATSC/NTSC	DCR/QAM/ATSC/NTSC	QAM/ATSC/NTSC
Light Engine	Series 3	Series 2	Series 1.1	Series 2	Series 1.1	Series 2
DMD	720P: HD2+	720P: HD3s	720P: HD2+	720P: HD3s	720P: HD2+	720P: HD3s
FPA	Back lit touch Sensors	Back lit touch Sensors	Back lit touch Sensors	Standard	Standard	Standard
Ethernet	Yes: IE6 Browser	Yes: IE6 Browser	Yes: IE6 Browser	No	No	No
Audio Output	60W, 5 Speaker	40W, 4 Speaker	40W, 4 Speaker	30W, 4 Speaker	30W, 4 Speaker	30W, 4 Speaker
Audio	SRS TruSurroundXT	SRS TruSurroundXT	SRS TruSurroundXT	SRS Focus	SRS Focus	SRS Focus
2 way 1394	Yes	Yes	Yes	No 1394	No 1394	No 1394
Remote	Scenium Universal	Scenium Universal	Scenium Universal	Scenium Universal	Scenium Universal	RCA Universal
Wired IR	Yes	Yes	Yes	Yes	Yes	No
Keyboard	Wireless	Wireless	Wireless	NA	NA	NA
Screen Sizes	50", 61"	44", 50", 61"	50", 61"	44", 50", 61"	50", 61"	50", 61"
Misc	Wall Mountable					

Thomson has also introduced a new model number matrix. The following chart indicates the new structure.

HD	50	LP	W	165		
HD-High Definition D-Digitial Ready	Screen Size (Diagonal)	LP - DLP or Blank	W - 16x9 S - 4x3	Series 3-Digit - Scenium 2 Digit - RCA	D - DVD H - HDD	Specific Use

DCR (Digital Cable Ready)

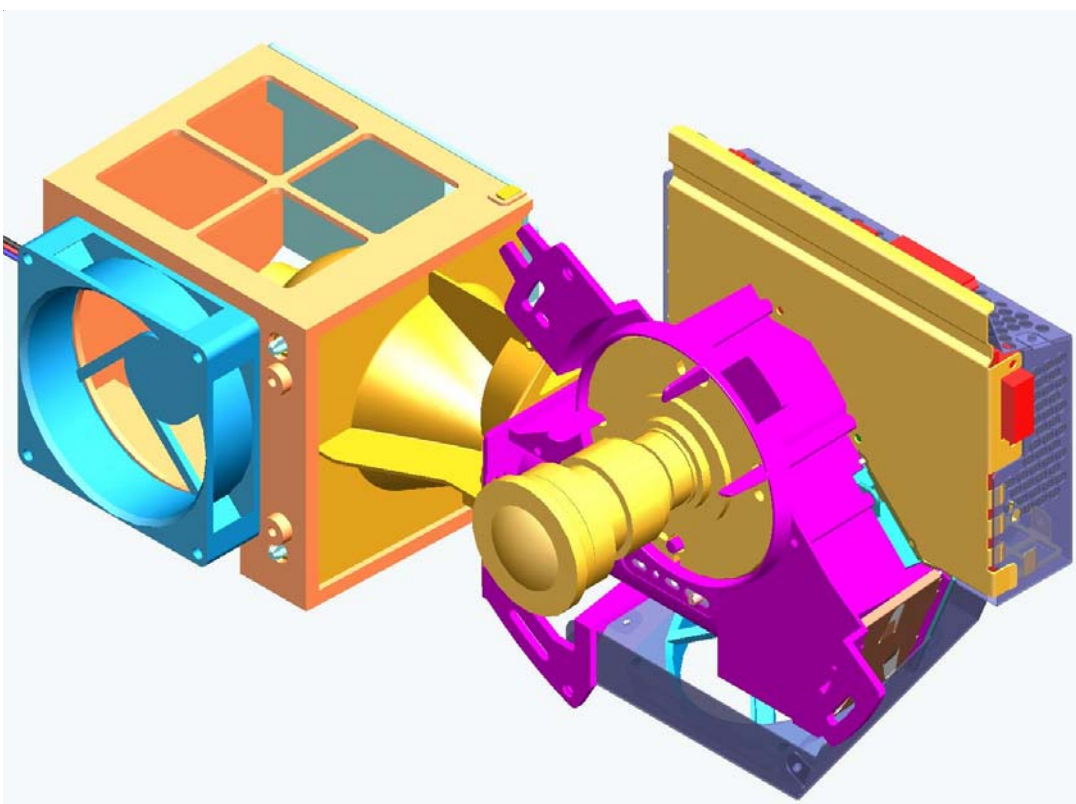
One major new addition to the instrument is the ability to receive Digital Cable Ready broadcasts from cable companies. DCR eliminates a set top box but still requires a Cable Card module from the cable provider to decode any encrypted channel programming. The DM3 contains a connector that will accept the preprogrammed Cable Card and allow viewing of program material. The current CableCARD™ is a one-way communication device that only allows programming according to how it is setup at the cable company. Even without the CableCARD™, the ATC322/323 is capable of receiving those digital cable channels that are not encrypted, or "In the Clear", giving it similiar capabilities as previous models using the DM2CR.

Light Engines

The ATC322, ATC323 and the previous ATC311M DLP instruments use four variations of light engines and two lamp variations. The light engines are coded by series numbers. Currently there are four different light engines in series 1-3. The following descriptions are for general understanding of the technology only, and have little to do with troubleshooting.

Series 1

Series one is the original DLP light engine used in the first generation DLP instrument driven by the ATC311M chassis. Nicknamed "IROC1" it uses the Texas Instruments HD2 DMD (Digital Micromirror Device) technology at its base. The resolution is 1280x720, making it HD compatible. It has a contrast ratio of 1000:1 and uses a 6 segment color wheel consisting of 2 sets of the three primary colors, red, green and blue. The driver board for the series 1 light engine accepted a DVI input via an intermediate conversion board between the DM2CR and driver called a formatter board. It is necessary to convert the output of the DM2CR module at 1080I to the 720P required by the DMD. Model numbers for the Series 1 light engine end with -151 as in the HDLP50W151 series.

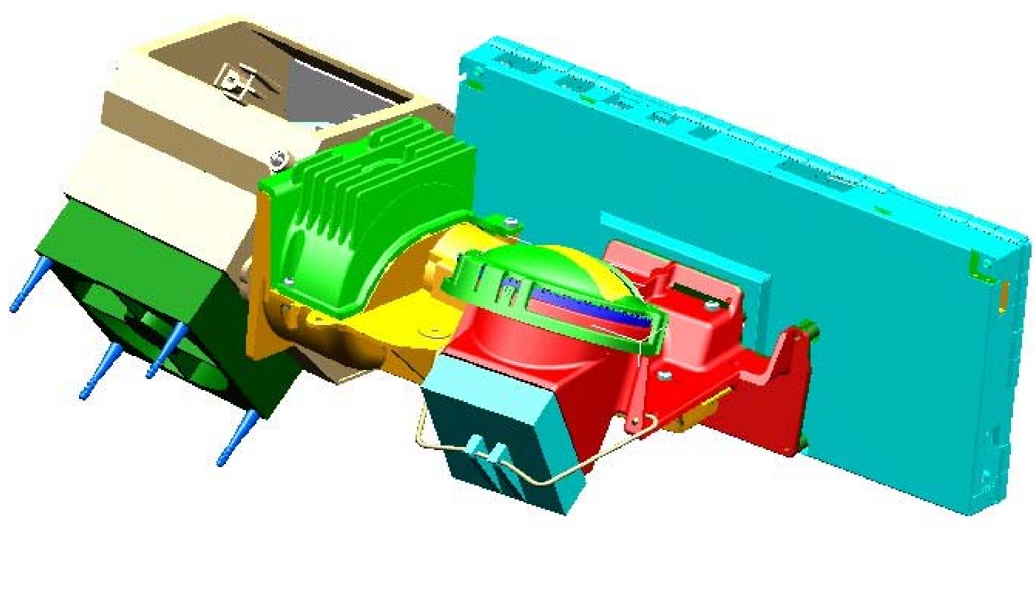


Series 1.1 Light Engine and Lamp

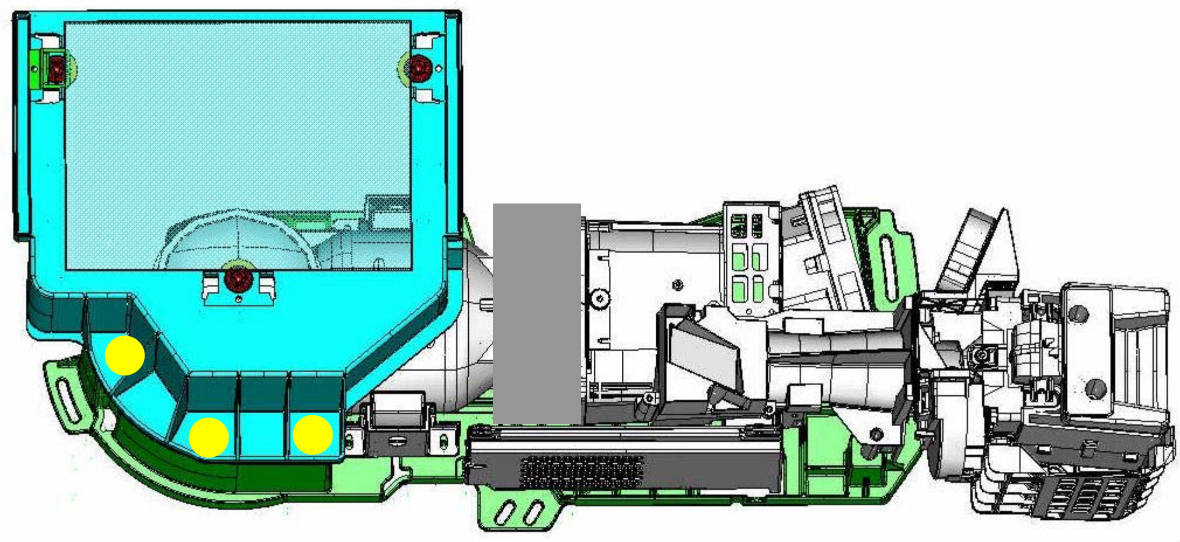
Series 1.1
The second generation DLP engine called "IROC2" is similar to the original light engine both in physical appearance and electrically. The resolution is 1280x720 however the contrast ratio from the newer TI DMD, HD2+, has increased to 1500:1. An HDMI (High Definition Monitor Interface) cable using LVDS (Low Voltage Differential Signal) technology is now used to transfer signals from the DM3 to the DMD drivers resulting in higher signal to noise ration and greater immunity to terrestrial interference. The formatter board has been eliminated since the signal conversion from 1080I to 720P now occurs in the DM3. Models using the Series 1.1 engine include DLP instrument numbers ending in -LPW162 and -LPW163 .

Series 2.0
The new generation of lower cost DMD device used in the Series 2.0 light engine has only half the horizontal pixels of HD2 and HD2+ at 640x720 but uses a second mirror to "double" the pixel resolution up to 1280x720. However an advantage of the series 2.0 engine is the ability to reduce the focal length of the light path. That allows cabinet designs with reduced "chin" area under the screen expanding possibilities for shorter cabinet styles in larger screen sizes. RCA-Scenium models ending in -164 and -165 use the Series 2.0 engines. In addition there will be several RCA models whose model numbers end in two digits rather than three that will use the Series 2 light engine.

There will also be an HD monitor series introduced later in the model year. It will use the Series 2.0 light engine with NTSC only twin tuner control and signal processing board currently used in ITC222 instruments modified to drive a DLP light engine.



Series 2.0 Light Engine and Lamp



Series 3.0 Light Engine and Lamp

Series 3.0
This light engine is designed specifically for the new "Slim" cabinet styles allowing a cabinet depth of less than 7". This allows wall mounting capablity and various other mounting scenarios in a wider variety of locations than conventional cabinet styles. Known as "Stingray" the engine uses the HD2+ DMD having the same resolution and contrast ratio.

Color Wheels
All current Thomson DLP instruments use 6 segment color wheels with two sets of sequential colors (R,G,B) running at 7200 RPM. Convergence alignments are eliminated since the DMD does not move. Colors are made by first separating the video into 24 bit RGB then sequentially sending each color to the DMD at the exact moment its corresponding color from the wheel is in front of the light path.

The DMD device itself has a resolution of 1280x720 which consists of 921,600 individual square mirrors each of which may be electonically tilted to either reflect the light source onto or away from the viewing screen up to 5000 times per second. Color shading is determined by the frequency the mirror is tilted. Tilting it slowly creates darker colors, flipping it more rapidly lightens the on screen pixel. The HD3s DMD has 460,800 diamond shaped mirrors in a 640x720 pixel array. The addition of a second mirror increases the effective screen resolution to 1280x720.

DLP Lamp and Lamp Power Supply

Due to the availability of lamps fromd different suppliers and because there is a difference between "Classic" and "Slim" DLP lamp wattage requirements, there are several variations of lamps and lamp supplies. More details are given in later chapters, however the main differences between the lamps are the supply voltages, arc and strike voltage and output wattage. Lamps are not interchangeable between supplies nor are they interchangeable between "Slim" and "Classic" DLP instruments. Always consult the latest service data with the complete instrument service suffix number for the proper replacement lamp or replacement lamp supply.

The lamp "Type" which determines the required replacement is printed on the inside of the lamp door and is part of the instrument service label on all models.

Standard Inputs

In recent years the variety of consumer electronics equipment has challenged each manufacturer to choose an output format they feel best showcases their own device's ability and features. As a result input connections and signal formats have become confusing. The ATC322/323 chassis accepts a wide variety of formats in its various inputs. The inputs meet all common standards. However it may not be able to process all formats for all equipment. The following table shows the input formats the chassis has been tested with and is compatible to. The inputs of the ATC322/323 adhere to EIA standards that exist at the time of manufacture. Due to equipment variations that may not exactly meet those same EIA standards there may some equipment that simply does not match well with the ATC322/323.

I/O	Video Formats	Audio Formats	Comments
Composite 1	Composite S-Video	L/R	S-Video will take priority over CV
Composite 2	Composite S-Video	L/R	S-Video will take priority over CV
Front Panel Input	Composite S-Video	L/R	S-Video will take priority over CV
Component 1	Composite (Interlaced) 480I (Interlaced) YPrPb 480P (Progressive) YPrPb 720P YPrPb 1080I YPrPb	L/R	Progressive Scan YPrPb has priority. Autodetect of 1H signals if frame comb is present. Otherwise consumer will select CV vs YPrPb via menu select
Component 2	Composite (Interlaced) 480I (NTSC Interlaced) YPrPb 480P (Progressive) YPrPb 720P YPrPb 1080I YPrPb	L/R	Progressive Scan YPrPb has priority. Autodetect of 1H signals if frame comb is present. Otherwise consumer will select CV vs YPrPb via menu select
HDMI	480P 720P 1080I 640x480P @ 60 Hz 1024x768 @ 60 Hz	2 Channel L-PCM @ 32kHz, 44.1kHz, 48kHz. L/R	Embedded audio has automatic priority over L/R
1394			
Record Output	Composite Video Only	L/R	Blocked when Digital Copy Protection detected Blocked always for component input sources and when V-Chip limits exceeded
Audio Outputs		Fixed & Variable	

Tuning

The DM3 will receive and decode all major cable and off-air transmissions and convert them to 720P for the light engine to display. The following table highlites the differences between the two tuners in the DM3.

Tuner	Formats	Notes
CABLE	NTSC (Air & Cable) ATSC (Cable) QAM in the Clear Digital Cable Ready	ATSC peaked for cable system performance
AIR	NTSC (Air & Cable) ATSC (Air)	ATSC peaked for off-air performance

In all cases the two major ATSC formats, 1080I and 720P, are received, digitally processed and converted to 720P for direct output to the light engine.

At this writing, QAM is emerging as the Digital Cable Systems broadcast format of choice although ATSC is being used by some cable systems. QAM and ATSC broadcast formats are both received and decoded by the ATC322/23.

In most cases a cable providers signal should be connected to the "Cable" input and off-air signals from an antenna connected to "Air".

QAM

QAM or *Q*uadrature *A*mplitude *M*odulation is a form of digital frequency modulation primarily used for sending data downstream over a coaxial cable network. QAM is efficient, supporting up to 28-Mbps peak transfer rates over a single 6-MHz channel. 64QAM can carry as many as 8 standard definition channels while 256QAM can carry as many as 12. By comparison, 8VSB (Off-air ATSC) supports 19.5Mbps in terrestrial broadcast applications and can carry only 4 standard definition channels. The QAM signals susceptibility to interfering signals makes it ill suited to noisy over the air transmissions. However its error correction capability makes it ideally suited to cable based transmission of signals.

For normal television chassis designs, differences between QAM and 8VSB, (the ATSC broadcast standard), are not great and troubleshooting the chassis requires no special equipment other than the availability of a proper signal. Complications normally occur because of faulty or confusing PSIP data carried by the broadcast signals.

DCR

This manual refers to **DCR** or ***Digital Cable Ready**,* as cable systems using the QAM system and transmitting encrypted or unencrypted (In-the-Clear) programming using OOB, (Out of Band), transmission to provide programming details that may or may not include Conditional Access information, Copy Protection, Program Tier Channel Group information and other data. Currently DCR supports only one channel at a time for Conditional Access and Copy Protection. It cannot lock or unlock a group of channels or multiple channels.

PSIP

PSIP or *P*rogram and *S*ystem *I*nformation *P*rotocol is a standard developed by the ATSC committee providing a method for transporting DTV system information and electronic program guide data. It allows broadcasters to identify themselves as their channel is tuned and can contain information such as call letters and channel number. It can also convey up to 16 days of programming information. Television receiver manufacturers are allowed to use PSIP data to display interactive program guides aiding in the navigation of channels.

Problems may occur due to the broadcaster's ability to change the PSIP data. The first application of PSIP noted upon tuning a channel is the station identifier. It can display information such as the station call letters, channel number, TOD and current program titles. However that Information is fully programmable by the broadcaster. It does not necessarily display the exact data expected.

Most broadcasters identify themselves by their analog channel number. In a specific area NBC might be channel 13, ABC channel 6 and CBS channel 8. Their DTV allocations will be different. For instance they may be NBC channel 46, ABC Channel 25 and CBS Channel 9. However the channel ID information is at the discretion of the individual stations. They can set their PSIP to identify themselves by their analog channel number or any other information they feel is appropriate. The number in the PSIP doesn't have to be their actual channel ID number or even a real channel number. A station might decide that it wants to be number 1. Doing so is simply a matter of setting their PSIP to 1 before anyone else in that market does. Eventually it is felt the broadcasters will be required to settle on their RF channel ID, but for now it is advantageous for them to identify themselves with their more recognized analog channel ID.

The next piece of information PSIP provides that is important for troubleshooting is the number of program sources expected within that DTV channel, more commonly called the "subchannel". Subchannels are always identified as "dash" numbers after the main channel number identified by the PSIP data. This information may be real or not. Occasionally broadcasters may do multicasting during the day, carrying as many as four SD channels. But they may broadcast high definition carrying only two active subchannels in the evening but leave the PSIP set for daytime activity and simply not broadcast the additional programming indicated by the PSIP. So there could be "blank" channels in the evening when there were channels available in the daytime.

Many broadcasters have now followed a template where their original analog channel ID is used to also designate the HD channel. In the example used previously the analog channel may have been 13 and the digital channel 46 and now the analog channel is received as 13-0 and the digital channel is 13-1 followed by other subchannels. The important thing to note is the RF channel frequencies do not change. Only the channel number can be changed. If the consumer chooses to download the "Guide" information from the menu, the channel order may not correspond to the consumers idea of logical progression. In the above instance the consumer may be aware his local digital channel is 46 however if they were channel surfing and had told the instrument to use the off-air guide information as they surf to channel 13 logically, they will first encounter the analog channel at 13-0, then the digital channel 46 at 13-1. If no other subchannels were present surfing would continue to channel 14 and on up. However if there were additional subchannels surfing would include all of the channel 13 subchannels before going to channel 14.

Another issue is that PSIP data allows redirection of the real channel. So the consumer could also direct access channel 46 by pressing 4, then 6 on their remote control. But if the Guide is set to use the PSIP information the tuner will tune RF channel 46 but display channel 13-1. Then if the consumer decides to "surf", instead of going to channel 47, they would go through the subchannels of 13, then on to 14 and so on. But channel 14 will not be reached until all the channel allocations (subchannels) of 13 have been accessed.

DCR (Digital Cable Ready)

A DCR compatible product refers to any digital TV, digital video recorder or other device capable of receiving unscrambled analog, digital basic and digital premium cable television programming by direct connection to a cable system providing such programming. All cable companies that support RF frequencies above 750MHz will be required to support the DCR format. The device must be capable of receiving unencrypted, or *unscrambled* video signals through direct connection to the cable system with no additional required component or components. To receive encrypted digital services, the device needs a CableCARD™, referred to as the CableCARD™, supplied by the cable operator. The CableCARD™ fits into a slot on the DCR product. The CableCARD™ device (explained later) is used to decode premium programming and unlock "tier" services. The important note is that digital channels can be delivered unencrypted (In-the-Clear), or encrypted. In-the-Clear broadcasts may be received by the DM3 without a decoder device or set top box. Encrypted programming requires a CableCARD™ or other device for descrambling the encrypted programming.

The DM3 does not contain technology that will allow the television to display encrypted digital signals. The decryption technology is contained in the CableCARD™. Since cable operators encrypt most premium digital cable signals a CableCARD™ must be inserted into a slot in the rear of the DM3 in order to receive that programming.

In the future, DCR will also support such services as call-ahead Pay Per View and a channel map with programming information supplied in a dedicated channel or from OOB data. That technology requires two-way communications between the CableCARD™ and cable head-end. Current technology supports only one way communication and an Electronic Program Guide is not possible. However PSIP data, which contains elementary program information is supported.

CableCARD™

The term CableCARD™ has been adopted by the cable industry refering to the security device acting as an interface module between the cable providers head end and the ATC322/323. The device was previously known as a "Point of Deployment" card or POD. The device is used to decrypt digital programming the customer has been authorized to receive. (The term CableCARD™ is used with the permission of CableLabs.)

In a compatible DCR system such as the ATC322/323, a CableCARD™ replaces the set-top box and enables consumers to view encrypted digital programming depending on the services purchased by the consumer. It electronically binds the DM3 to decrypt digital programming via a method that is also secure for copy protection purposes.

Once the CableCARD™ is installed and initialized it is electronically bound with the original DM3 in which it was installed. The CableCARD™ may be moved to other local devices but will have to be reinstalled in order to initialize itself with the other DCR instrument. This makes repairing an instrument that may require a DM3 module, upgrading, or exchanging an instrument possible without the need for a new CableCARD™. The CableCARD™ is simply pulled from the original instrument or DM3 then placed in the new one. Onscreen instructions will lead the technician through the process.

The CableCARD™ is unique to each program provider and will not work in other cable systems. If the consumer moves within the current cable service area, the card may stay with the DM3. But if the instrument is removed from the current cable providers system it is not transferrable to the new system and should be returned to the Cable Provider. A new CableCard from the new Cable Provider will be required.

DFAST

DFAST, or *Dynamic Feedback Arrangement Scrambling Technique* is the system enabling the DM3 to communicate securely with a CableCARD™. The CableCARD™ is then able to send all authorized services to the DM3. For services that carry copy protection restrictions, the CableCARD™ activates DFAST encryption to protect the content when it is passed back to the DM3.

Thomson obtains the right to use DFAST technology from CableLabs through a license agreement (either the DFAST License Agreement or the CableCARD™-Host Interface License Agreement, "PHILA"). As a part of the regulations for DCR, the FCC has permitted program providers to activate copy protection of specific digital content. The DFAST and PHILA license agreements require DCR products to respond to copy protection directives distributed with the programming material. This digital copy protection (DCP) allows programmers to limit the programming an end consumer can copy digitally. Copy protection directives are signaled through Copy Control Information embedded in digital content and may be:

"Copy Never,"

"Copy One Generation (i.e., no copy of a copy can be made),"

"Copy No More" (i.e., it has already been copied once) or

"Copy Freely."

The FCC's rules permit programmers to mark various categories of programming up to specified maximum copy protection levels, according to the following table:

Services	Copy Availability
Off-air broadcasting	Copy Freely
Pay television, Non-premium Subscription TV, Free Conditional Access Delivery , Tiered Subscription Services	Copy One Generation*
Video on Demand, Pay Per View	Copy Never
* One Copy is allowed for delayed recordings using DVR or other recording equipment	

OOB (Out of Band Tuner)

QPSK (Quadrature Phase Shift Keying) is a digital frequency modulation technique used for sending data over coaxial cable networks. Since it's both easy to implement and resistant to noise, QPSK is used by DCR systems for sending data to and from the headend. Currently the DM3 technology allows only one-way communications.

The QPSK receiver circuit in the DM3 tunes and demodulates the QPSK Forward Data Channel (FDC). The serial data in the FDC is used primarily to send conditional access entitlement messages from the cable provider to the CableCARD™ Module either allowing or blocking program material that is encoded. Program material that is not encoded will pass through the CableCARD™ regardless of the entitlement.

Tuning of the QPSK receiver circuit is under control of the CableCARD™ Module and is generally known as the OOB or ***O**ut **o**f **B**and* Tuner. That is to differentiate this specific set of data from the normal program material coming in on the standard set of frequencies and known as the INB or ***In B**and Tuner*. The OOB tuner in the DM3 is separate from the normal QAM, ATSC and NTSC tuners. The tuning range of the OOB tuner is between 70 and 130 MHz, well below the cable frequency allocation from 54 to 1000 MHz.

The DM3 module currently supports one-way data flow via the OOB however future Thomson chassis may add two-way communication as it becomes practical.

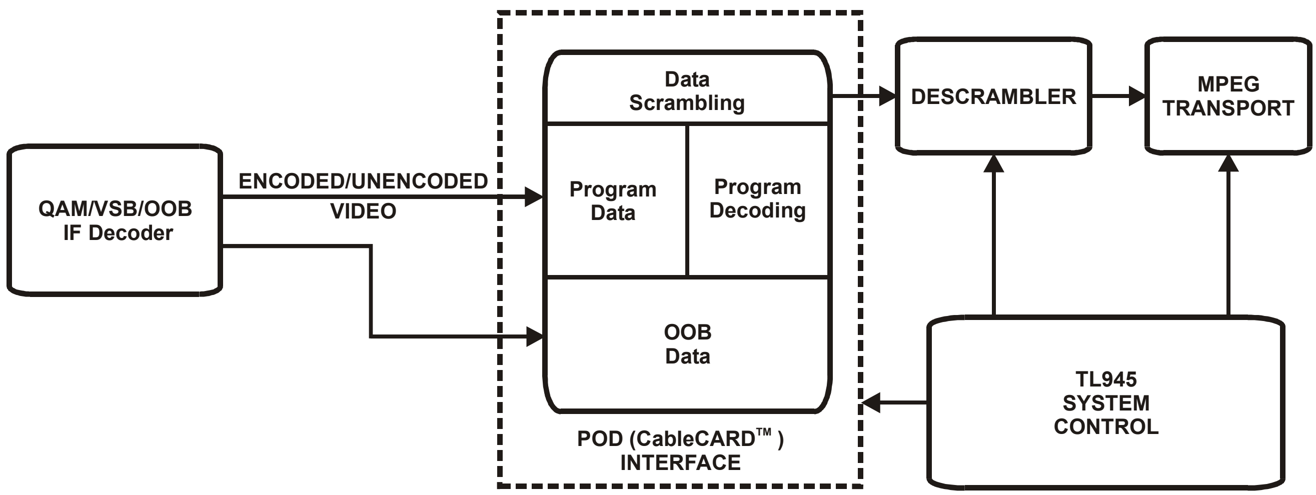
A CableCARD™ module must be inserted for the OOB to be activated. Whether the CableCARD™ is valid or not is determined by comparing incoming information from the cable provider via the OOB tuner data to the information contained in the CableCARD™.

If a CableCARD™ module is not inserted the OOB circuitry is inactive. When a CableCARD™ module is inserted the DM3 initiates a handshake with the CableCARD™. If successful, the DM3 then activates the OOB tuner and decoder circuits as instructed by the CableCARD™ module. The OOB circuitry is only connected to the CableCARD™ module interface. There is no direct control of OOB data by the DM3.

It generally takes the CableCARD™ module and DM3 about 5-10 seconds to handshake and provide onscreen data monitoring the activation of the CableCARD™. The first series of screens are shown later in this manual.

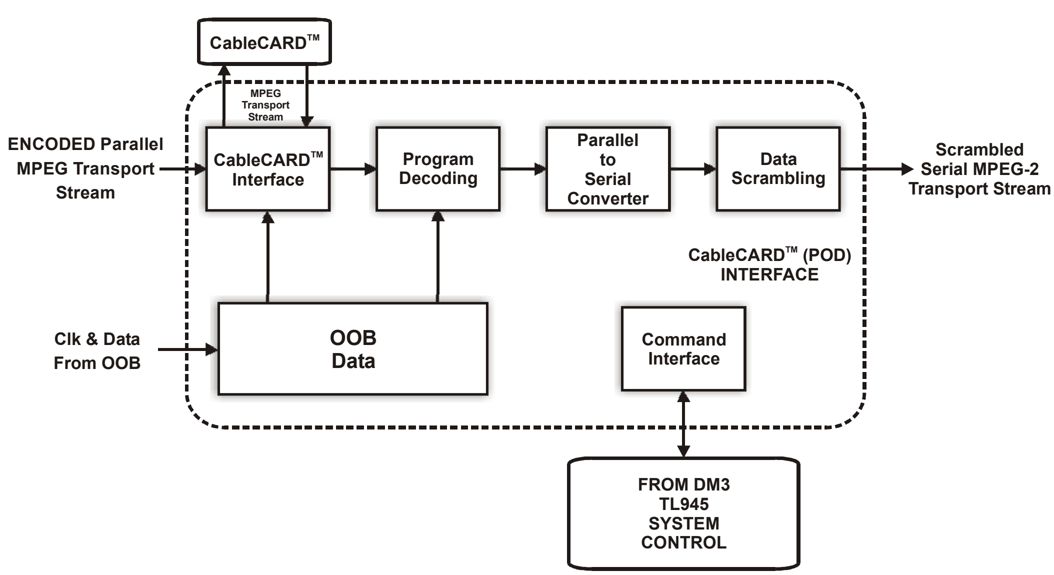
CableCARD™ ("POD" Point of Deployment Card)

The DCR standard requires a special module provided by the individual cable companies that "unlocks" the programming carried by the provider according to those services ordered by the consumer. The CableCARD™ plugs directly into a slot in the rear of the ATC322/323 chassis and is autodetected by system control. Many cable companies intend to use the CableCARD™ technology for delivering program services to their customers.



The system is complex requiring two separate data streams from the provider; one for normal program material and another (OOB) for the programming guide and channel information. The OOB tuner, previously described, delivers the channel lineup for the provider and also designates which program material, or group of programming is allowed to pass through the CableCARD™.

A block diagram of the CableCARD™ and interface while very simplistic will allow an explanation of its function.



First, if a CableCARD™ is **not** inserted the MPEG transport stream will be routed directly to the DM3 for decoding and video display. If a channel is encrypted, there are no decoding devices available on the DM3 module to remove the encryption. Any encrypted channel or channels will be unavailable for viewing.

However all program material that is **not encrypted** or *In-the-Clear*, will be available for viewing. Only when a valid CableCARD™ module is inserted will the MPEG stream be routed through the CableCARD™ and eventually to the DM3 MPEG decoders.

When a CableCARD™ is inserted and a DCR network is connected the MPEG stream from the IF is routed to the input of the CableCARD™. The OOB data signal is also routed to the CableCARD™ but through a different connection. The OOB provides a channel map telling the CableCARD™ input what channels are available and at the same time providing program information to the DM3.

By developing a list of channels the consumer will have available, the OOB provides data to the program decoders telling it which program material is available. The Program decoder then either passes groups of programs on to the Parallel to Serial convertor or decodes the desired channels, then passes them on.

The final stage of the CableCARD™ is to scramble the MPEG video for copy protection purposes. That scrambling now must be unscrambled by the TL945 MPEG decoder on the DM3. Both IC's must be in full sync to

"handshake" with each other or **all** programming will be blocked.

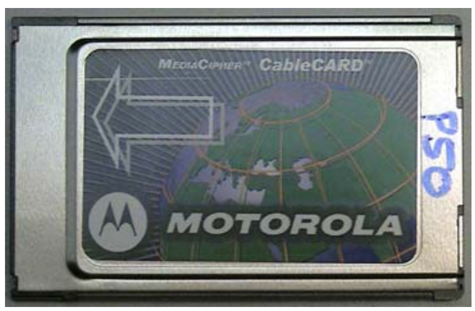
Firmware Upgrades

The CableCARD™ firmware is capable of being upgraded using either the OOB or an INB channel. Currently cable providers are not using the feature but may in the near future. Although the CableCARD™ is capable of an immediate upgrade, typically delayed upgrades will be used. The upgrade requires a reboot of the CableCARD™ which may take as long as 5 seconds causing an annoyance to consumers viewing the instrument. To prevent that upgrades will wait until the DM3 is in standby operation assuring no active television viewing by a consumer. The upgrade may then be done without disturbing normal operation of the instrument.

CableCARD™ Operation

The CableCARD™ appears very much like a common PCMCIA card used in computer operations. It is inserted into the DM3 module receptacle labeled "SmartCard Input". It makes no difference whether the instrument is on or off but when troubleshooting suspected cable card issues, proper television operation should be confirmed prior to installing the card. Remember that **all unencrypted programming** is available without a CableCARD™ inserted. To begin any troubleshooting always remove the CableCARD™ and make certain the television works with other standard DCR cable signals.

Since most cable providers continue to broadcast much of their programming without encryption (In-the-Clear) it should be possible to determine quickly whether the instrument is receiving and displaying video from a DCR cable system. The CableCARD™ itself provides only Conditional Access capability. Normal DCR reception (unConditional Access Programming) can occur without the CableCARD™ inserted. With proper operation determined and the DM3 tuned to a valid channel insert the cable card into the appropriate slot in the rear of the instrument.



Standard CableCARD™ or "POD"

Within a few seconds the following screen should appear:

Initial Insertion of CableCARD™

If the screen does not appear it means the CableCARD™ module has not been detected by the DM3. If this is the first time a CableCARD™ has been inserted, the CableCARD™ may be defective and a new one should be obtained from the cable provider. If the CableCARD™ previously worked but recently stopped, a new CableCARD™ should be tried. If the second CableCARD™ is not recognized the DM3 may be defective. There are no dedicated power supplies for the CableCARD™ so if the instrument works fine otherwise there is probably nothing wrong with any of the DM3 supplies indicating the DM3 should be replaced.

If the CableCARD™ is recognized as indicated by the previous screen, after several minutes, the onscreen prompts will indicate one of two things.

If the card is valid there will be further prompts to continue the cable system installation. Second, if the card is detected but determined to be invalid the following screen appears:

Invalid card

The instructions should be followed by the consumer. More importantly to the technician is that it also indicates the entire DCR system of the DM3 is working properly and the fault lies with the CableCARD™.

Finally if the card was recognized then removed, the following message appears onscreen:

CableCARD Removed

Pressing "Continue" will remove the message and normal operation of the TV will resume. The TV will be able to receive standard broadcasts and Digital Cable that is broadcast "In-the-Clear".

The following logos will be used on instruments capable of Digital Cable Reception. The DCR logo indicates current "one-way" technology. In the future, iDCR will provide two way communications.

DCR

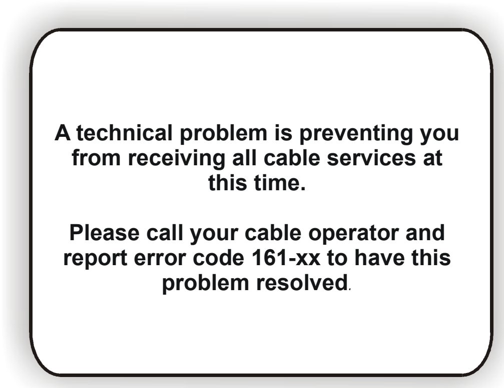
iDCR

CableCARD™ Error Codes

There are a number of error codes that may be displayed onscreen during CableCARD™ operation or insertion. The error code list is included in a CableCARD™ reference document from the SCTE organization, ANSI/SCTE 28 2004, Host-CableCARD™ Interface Standard, and is available at:

http://www.scte.org.

All error codes are reported in the error code message that will appear onscreen. Although different font sets and layouts from the different cable providers and CableCARD™ manufacturers may make the display appear slightly different the error code display will look similar to the following:



The error code is the "XX" portion of 161-XX and will be a decimal number between 10 and 99. In general, once the CableCARD™ is acknowledged as valid by the DM3, the codes will involve failures in the Conditional Access or Copy Protection schemes. In most cases the CableCARD™ will continue operation but all conditional access programming will be unavailable. The Cable Program Provider will need to resolve the issue.

The technician may also access CableCARD™ card information including error codes by pressing and holding "MENU" on the front panel, then pressing "9 9 9" on a compatible remote control. If **any** information is displayed, it should confirm the CableCARD™ is being recognized by the DM3 and all DM3 hardware is working correctly.

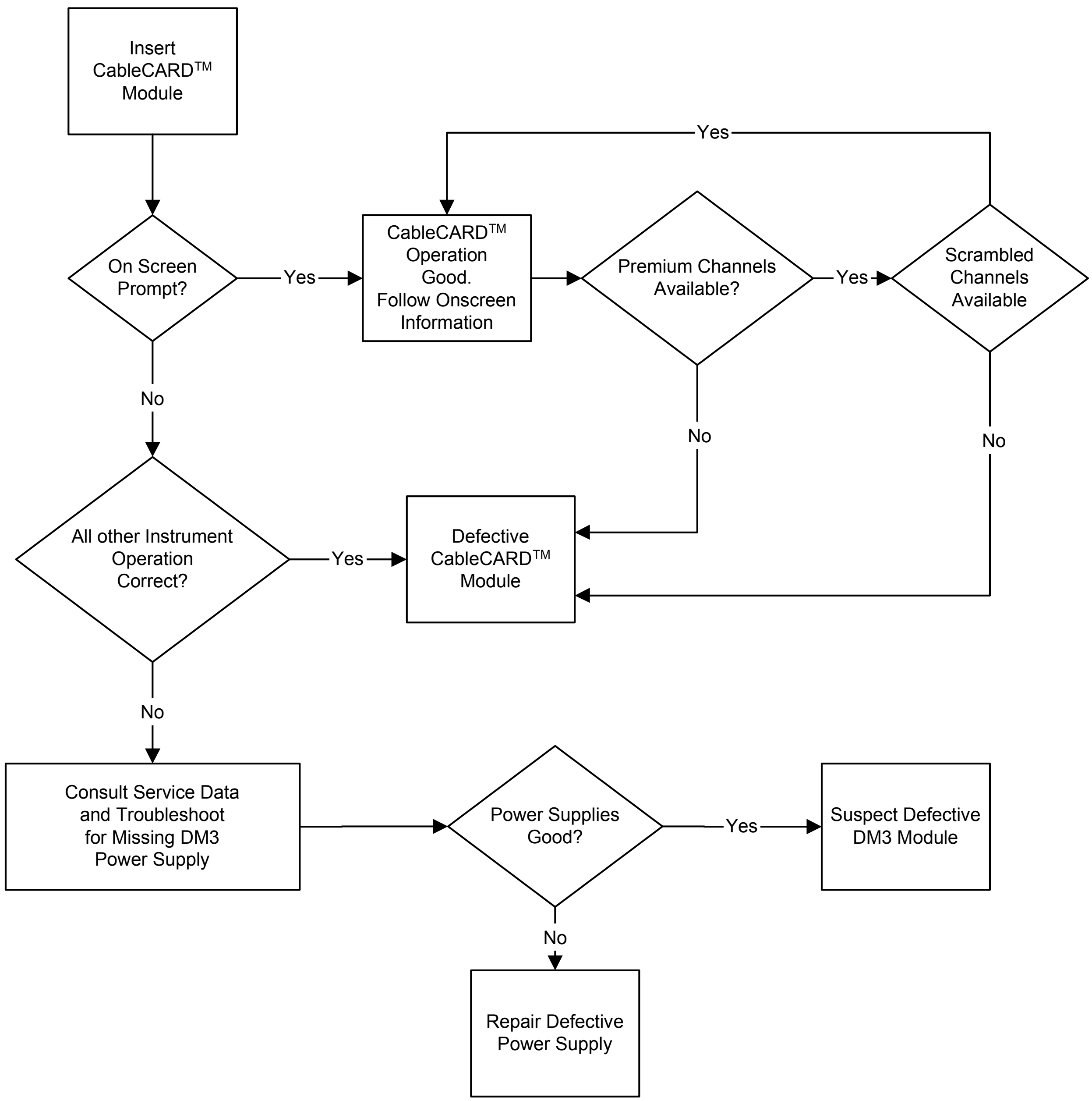
CableCARD™ Power Requirements

The DM3 supplies +3.3Vs on the CableCARD™ connector at all times. When a CableCARD™ module is installed, the DM3 then supplies a higher current +5V when requested by the CableCARD™ Module.

When a CableCARD™ is removed the DM3 senses the event and removes the +5V power from the PCMCIA connector. The +3.3Vs remains on.

When the CableCARD™ is installed, during operation it draws about 2.5 watts of power. There is no standby mode for the CableCARD™ so once a CableCARD™ is inserted the switched +5V must be supplied from the DM3 standby power.

The following is a troubleshooting flow chart that will either confirm CableCARD™ Module operation or show it is inoperative.



ATC32x ACIN CBA

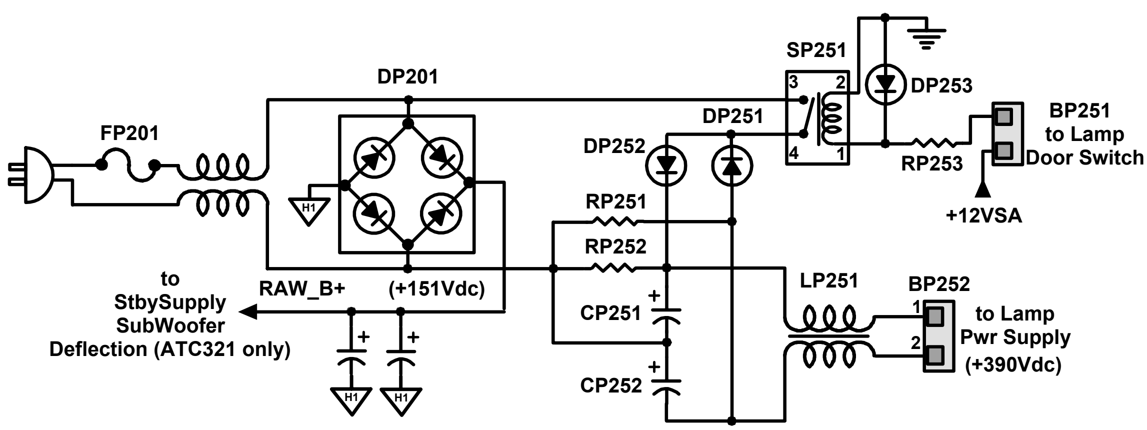
The ACIN CBA (circuit board assembly) of the ATC32x chassis consists of a standby supply to power the DM3 module, run supply to power the AVIO and Light Engine, and an unregulated supply to drive the lamp power supply. All voltages used in the ATC32x chassis come from the ACIN CBA. These voltages are either regulated by the ACIN or regulated further by the individual circuits they feed. The ACIN CBA produces the following voltages:

- +36Vdc
- +12Vdc
- +5Vdc
- -5Vdc
- +20Vdc
- -20Vdc
- Unregulated +151Vdc (RAW_B+)
- Lamp power supply B+ (300Vdc – 390Vdc)

There are two switched supplies (RUN) that are controlled by system control. These voltages are +12Vdc SW and +5Vdc SW. Both are controlled by the RUN_EN from the DM3.

AC In Raw B+ (ATC321 and ATC322)

Raw B+ is developed when AC is applied to the set. DP201 bridge rectifier and two filter caps convert the AC voltage to approximately +151Vdc unregulated. This Raw B+ feeds the standby supply and where applicable the deflection and sub woofer circuits.



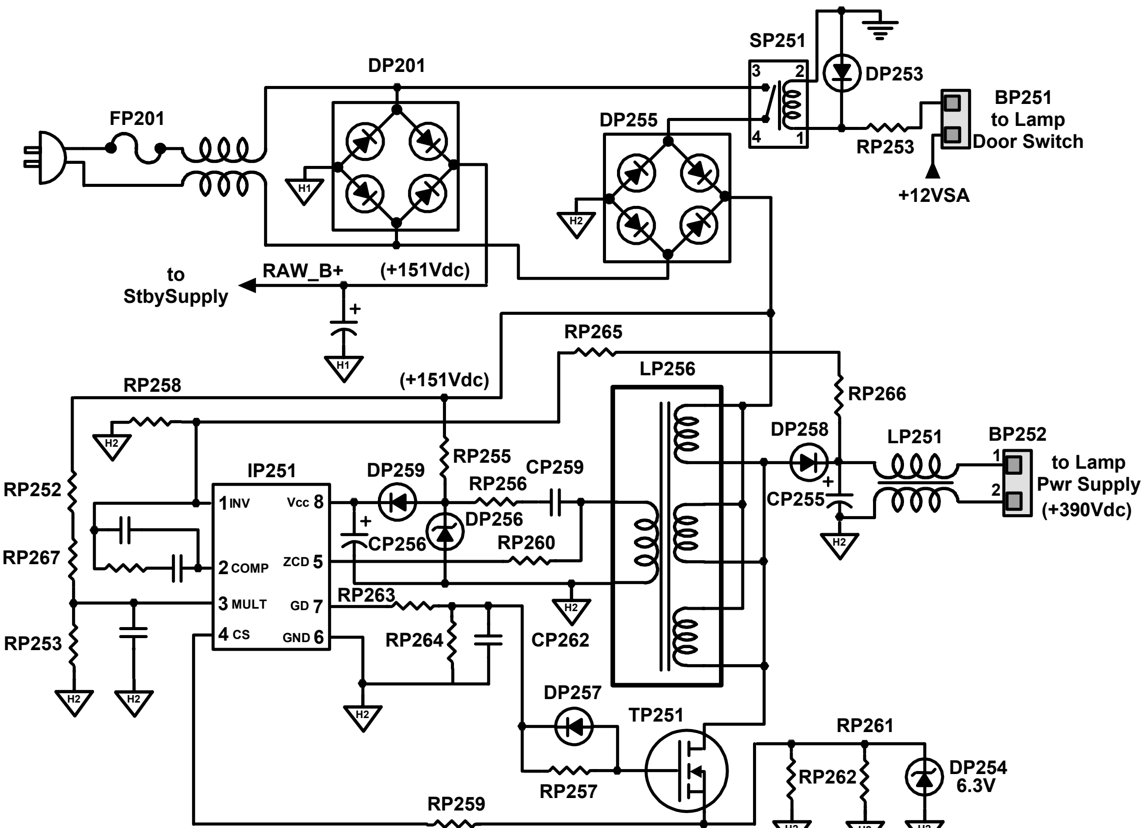
ATC321 / 322 ACIN

AC is also supplied to the voltage doubler circuit to develop the +300Vdc required by the lamp ballast supply. A lamp door switch and relay SP251 prevent the +300Vdc from being developed whenever the lamp door is open. This is a safety feature and should not be defeated except by qualified servicing technician.

The components that make up the voltage doubler circuit are:

- DP251 and DP252
- RP251 and RP252
- CP251 and CP252
- LP251

ACIN Boost Circuit (ATC323)



ATC323 ACIN and Boost Circuit

The ATC323 uses the same bridge rectifier circuit to develop the RAW_B+ found in the ATC321 and ATC322. The second bridge rectifier (DP255) is used to drive the boost regulator circuit required by the lamp power supply. The boost regulator is used to develop +380Vdc +/-5%. The boost circuit consists of a boost coil LP256, control IC IP251, and a high current switch TP251.

Operation of Boost Circuit

When AC is applied, bridge diode DP255 rectifies the voltage to approximately 151Vdc. This raw B+ is supplied to the drain of TP251 via LP256, to IP251 pin 3 via resistor network (RP252, RP267, and RP253), and to pin 8 Vcc via DP259. RP255 and DP256 prevent pin 8 of IP251 from exceeding 15Vdc. Startup of IP251 occurs when pin 8 exceeds 10Vdc.

When pin 8 of IP251 reaches 10Vdc, pin 7 sends drive to the gate of TP251. This starts TP251 conducting. As current builds in LP252 so does the source of TP251. The current sensed from the source of TP251 is fed back to IP251 pin 4 via RP259 telling IP251 to turn off drive. Energy stored in LP252 is transferred to the secondary winding. This winding provides re-supply current to IP251 via CP259, RP256, and DP259. The other path, through RP260, is used for zero current detection.

DP258 rectifies the boost pulses from TP251 and adds the voltage to the raw B+ from DP255. CP255 and LP251 filter the DC prior to being sent to the lamp power supply.

Regulation feed back of the boost circuit comes from RP266, RP265, and RP258 creating a voltage divider for pin 1 of IP251. The internal reference voltage is 2.5Vdc. As the voltage at pin 1 of IP251 goes above 2.5Vdc, IP251 turns off drive to TP251. As the voltage goes below 2.4Vdc drive is turned back on.

RP261 and RP262 are current sense resistors. If the load is such that pin 1 of IP251 drops below 2Vdc and current in the source of TP251 exceeds the threshold of IP251 pin 4, drive will be stopped until the load is removed. This will create a pulsing sound or a chirp from the boost circuit.

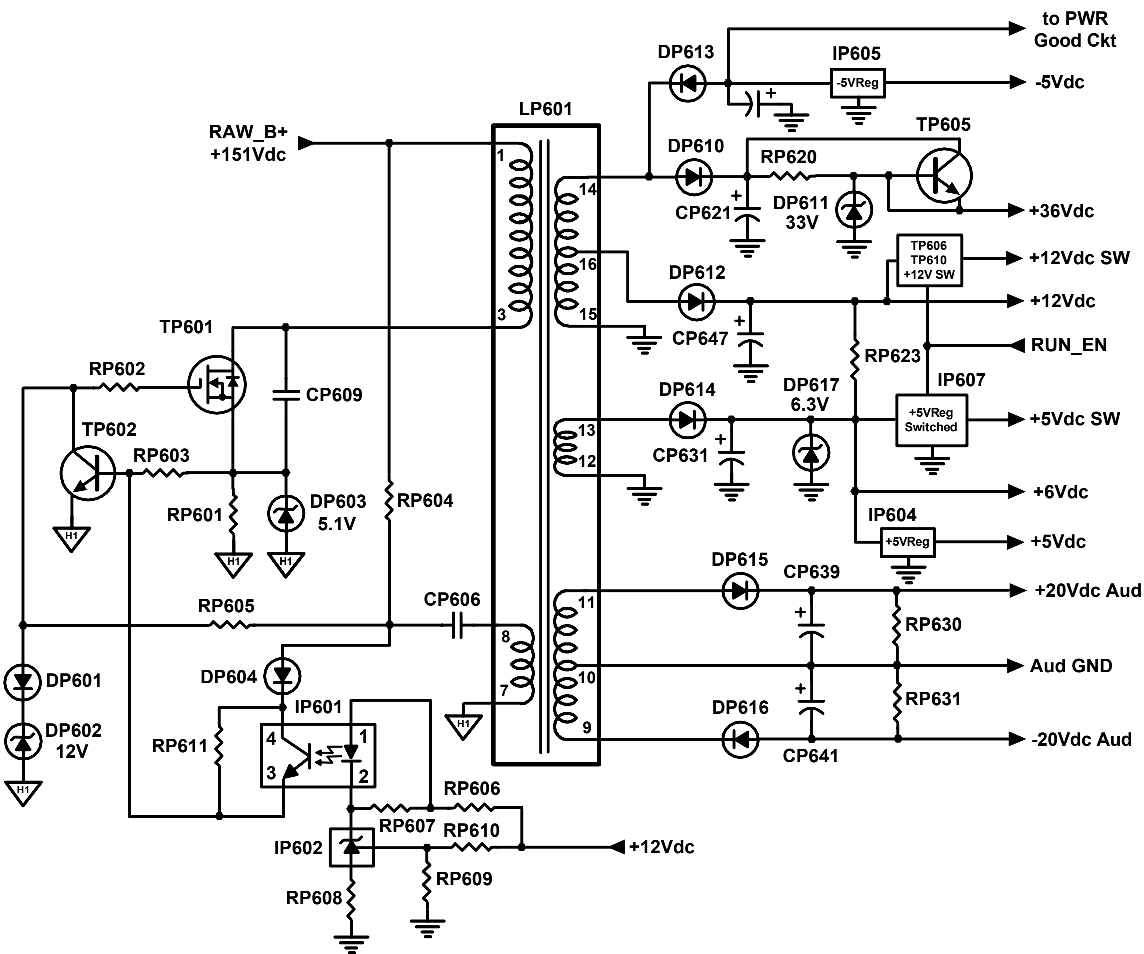
Other components are used to setup IP251 to regulate the boost circuit at 380Vdc +/-5%. These components are:

- RP252
- RP267
- RP253
- And components between pins 1 and 2 of IP251

DP254 is for protection against excessive current or shorting out of TP251. If TP251 shorts the raw B+ will be applied to DP254. DP254 will short to ground opening FP201.

ATC32x Standby Power Supply

The principle of the standby and run supplies is a current-mode controlled, zero voltage switching (ZVS) supply. The supply uses discrete control circuit and cold side regulation.



ATC32x Standby Power Supply

Startup comes from resistor RP604. This provides the initial gate bias voltage for the MOSFET (TP601) that begins to conduct. As TP601 conducts a positive feed back winding (pins 8-7) on the transformer LP601 begins to increase the gate voltage and causes TP601 to eventually saturate and begin the first cycle of operation. As the current in TP601 increases, the voltage drop across the current sense resistor RP601 increases until a threshold level is reached. At this point the transistor TP602 turns on and the gate drive of the MOSFET is removed.

The current flowing in TP601 drops quickly to zero and the energy stored in the primary inductance of the transformer is transferred to the resonating capacitor CP609. This causes the voltage across CP609 to rise and appears across the secondary winding outputs on pins 8, 9, 11, 13, 14, and 16 on LP601. The rectifier diodes (DP614, DP615, etc.) conduct when the anode voltage exceeds the voltage across the filter capacitors (CP631, CP639, etc.). When the rectifier diodes conduct the energy stored in the primary inductance of the transformer is delivered to the output capacitors and the load.

After the rectifier diodes stop conducting, the energy remaining in CP609 resonates with the transformer primary inductance driving the drain voltage towards zero. When the drain voltage tries to go below zero, the integral drain to source diode clamps the voltage near ground. The voltage on the drain of TP601 again goes positive causing the MOSFET to turn on and begins the next cycle.

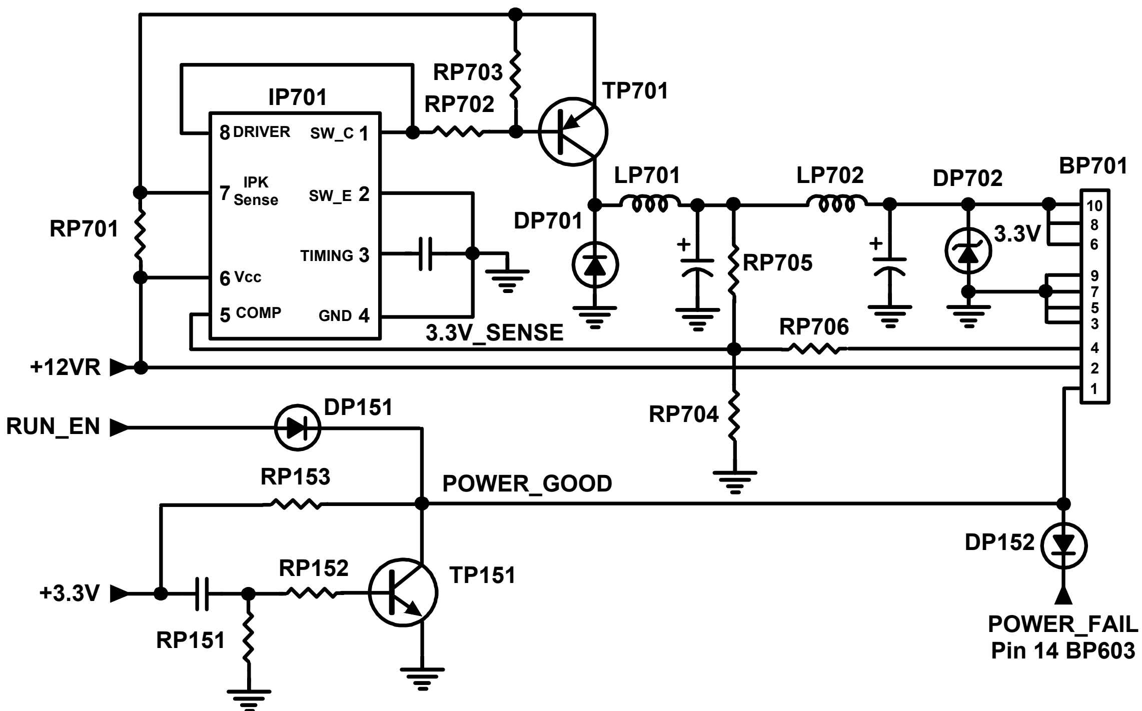
Regulation comes from an error amplifier IP602. IP602 monitors the +12Vdc and in conjunction with IP601 adjusts the point at which TP602 turns on by varying the bias voltage at the base of TP602. Opto-coupler IP601 provides AC line isolation. As the output voltage increases, the amount of current flowing in IP601 increases, this causes the voltage at the base of TP602 to increase. The increasing voltage reduces the current trip threshold and the current in the MOSFET is decreased, which lowers the energy stored at each cycle and maintains a regulated output voltage.

Lamp Ballast Supply

The lamp ballast supply used in the DLP instrument is an intelligent, processor controlled, switch mode power supply. The output is monitored for both current and voltage with this information being fed back to the light engine processor. The light engine processor uses this information for current state of the Lamp. It is with this information the processor can determine if the lamp has lit or how may strikes it has taken to light. The processor also can control how much power is sent to the lamp. This is software adjustable and is found in the customer menu. This allows the user to select between different brightness modes.

DLP sets use different lamp ballast supplies determined by what lamp is being used. To date there are three different ballast supplies used in the DLP sets. Series 1.0, 1.1, and 2.0 use a 120W supply to drive the lamp. In the 120W supply family there is type A and type B. Series 3.0 uses an 180W supply. These are not interchangeable and care needs to be taken when changing the Lamp or Lamp Ballast supply that the correct one is used. For obvious reasons the 120W and 180W are not interchangeable but neither is the type A and B found in the 120W family. Refer to the current ESI parts list when ordering any parts.

3.3V DC-to-DC Converter



3.3V DC-DC Converter

The 3.3V DC-to-DC converter provides the DM3 with a stable well-regulated 3.3Vdc. This is accomplished by controlling TP701 pass transistor with IP701. IP701 is a MC34063A monolithic control circuit containing the primary functions required for DC-to-DC conversion.

This is also known as a classic "buck" regulator where energy is passed through the transistor TP701 for part of the cycle and DP701 during the rest of the cycle. LP701 is the output choke for the DC-to-DC converter.

The +12VR is the Vcc for IP701 and the current source of TP701. RP701 provides over-current sense information to IP701 controlling regulation. Feedback for IP701 is provided by RP704, RP705, and RP706. These resistors form a divider producing the reference voltage of 1.25 volts that is feedback to pin 5. As the voltage changes at pin 5, the comparator internal of IP701 turns on or off the output at pin 1. LP702 and DP702 provide protection from spikes and over-voltage situations.

Power Fail or Power GOOD

The Power Fail signal is logically combined with the RUN_EN signal to form a POWER GOOD signal. This signal is sent to the DM3 where the system control determines the state of the power supply. This is also used for the "batten-down the hatches" routine commonly found in most Thomson TV products.

Troubleshooting ACIN CBA

As with the classic DLP, the ATC32x ACIN CBA can be powered as a standalone module. When operating the ACIN in this manner care needs to be taken to avoid injury.

When AC is first applied there is a relay click. This is the relay for the lamp power supply. This relay will only energize when the lamp door switch is closed or connector BP251 pins are shorted together and the +12Vs is present. In troubleshooting the boost or voltage doubler circuit it is necessary to short connector BP251, however if this is not were the problem is then it is not necessary to activate the boost or voltage doubler circuit (BP251 open).

If the relay clicks then the standby +12V supply is operational. This is key in troubleshooting a “dead” set as it indicates part of the power supply is operational.

1. Check for Raw B+. This is measured across CP603 or the Drain of TP601. Make sure you are using the correct ground (HOT GND)! If this voltage is present then go to the next step. If missing, troubleshoot the Raw B+, bridge rectifier circuit.
2. Raw B+ should be approximately 151Vdc at the drain of TP601 referenced to hot ground. When present there is also a start voltage each side of RP605. This voltage should be +1.5Vdc. If missing check RP604, RP605, and CP606. If +12Vdc is present at RP605, check for open TP601 or RP601.

TIP: *By unsoldering the Drain of TP601 and applying AC power one can check the startup circuit. Doing this will produce +12.6Vdc at RP605, RP602, and the Gate of TP601.*

3. With +1.5Vdc at RP605, TP602’s base should be +.3Vdc. TP602 turns off drive when the base reaches .5Vdc or greater. A reading of .5 or greater indicates an over-current or over-voltage condition and 0Vdc indicates DP603 has shorted. If DP603 (5.1V zener) is shorted, an over-current condition has occurred. The secondary of LP601 needs to be checked for excessive loads before replacing DP603.
4. For TP601 to function correctly it needs 1.5Vdc on the gate and 151Vdc on the drain. When these voltages are correct, this indicates the primary side of LP601 is working correctly. This includes the regulation feedback circuit, +12Vs, and the associated circuit with the +12Vs and regulation feed back.
5. It is possible for the supply to function and be missing one or more secondary voltages. Start by checking each of the following voltages. Keep in mind that these voltages are referenced to cold ground.

DP613	-5Vdc
DP610	+36Vdc
DP614	+5Vdc

DP615	+20Vdc Reference Aud GND
DP616	-20Vdc Reference Aud GND

NOTE: The +12V source is not listed. This is because if the +12V was missing the other voltages would not be present and the supply would not function. Remember the +12V is used for regulation feedback.

Troubleshooting Regulation Feedback Circuit

SETUP:

a) With supply removed from set, unsolder the Drain of TP601.

b) Connect a DC power source (+15V variable) to the cathode of DP612 (+ lead) and to cold GND (- lead). Do not turn on DC supply yet!

c) Connect DC meter to the collector of TP602 and hot GND.

d) Apply AC power to the ACIN CBA.

6. Turn on the DC supply, start at 0V and slowly increase until the DC meter reads 0Vdc.

NOTE: The DC supply should not exceed 15Vdc. If it does, the regulation feedback circuit is not functioning and IP601, IP602, RP606, RP607, RP608, RP609, and RP610 need to be checked.

7. Now measure the DC supply voltage. If it reads +12Vdc, then the regulation feedback is working correctly. If it is low, check RP606, 607, and IP602. If it reads high, check IP601, IP602, RP608 and RP609.

The DM3 uses power supplies regulated on the ACIN board as well as power supplies regulated on the DM3.

ACIN Regulated Supplies:

The DM3 receives: +30VS (was +33VS on the DM2), +12VS, +6VS, +5.2VS and -5VS from the ACIN board. All 5 are “standby” supplies that are active as long as the instrument is plugged in. The “POWER_FAIL” signal is monitored by the micro to give it advance warning that the supplies are about to drop out of regulation. The embedded system supplies are guaranteed for a minimum of 10msec after the POWER_FAIL is asserted to insure that any EEPROM write that might be in progress has time to complete. A separate EEPROM hold-up circuit maintains the power supply to the EEPROM for 10msec after the last EEPROM write to insure that that input buffer contents are properly stored in the non-volatile cells. Note that the EEPROM supply is disabled for 10msec during the Boot routine to insure that the EEPROM input buffer is cleared prior to any IIC Bus traffic on the internal DM3 IIC Bus.

DM3 Internal Regulated Supplies:

The internal power regulators used for the DM3 incorporate two dual out-of-phase synchronous buck controllers that drive synchronous rectifiers for the +3.3Vdc, +2.5Vdc, +1.8Vdc, and the +1.2Vdc supplies. A linear regulator IC is also used to provide a +1.5Vdc supply. These post-regulators are used to provide adequate regulation for large load variations and to reduce the ripple content of the supplies.

DM3 Overview

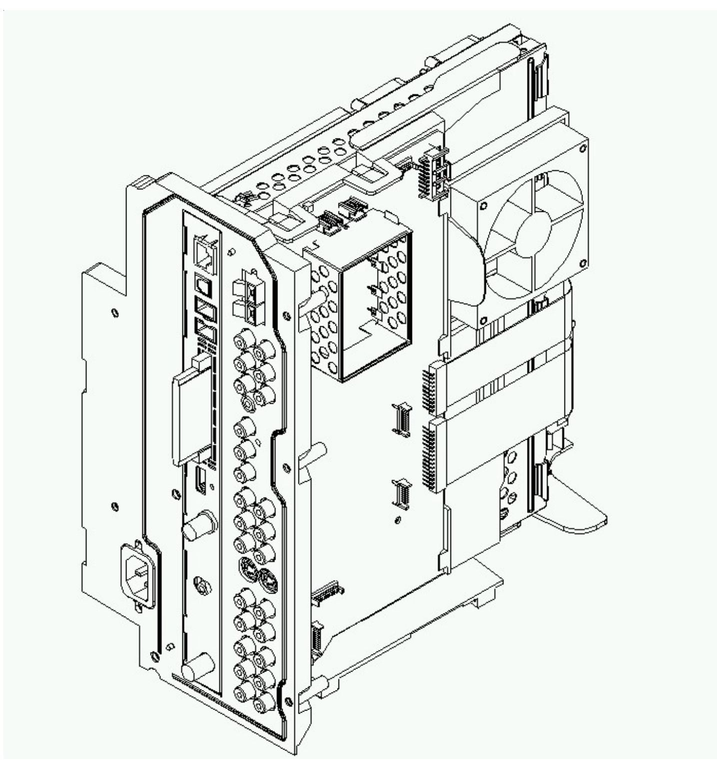
The DM3 is the latest generation of control, signal processing and signal reception circuitry contained in a single module for the current high end HD Integrated television instruments. There are provisions for ATSC, NTSC and QAM RF reception. QAM provides the capabity to receive Cable "In the Clear" and with a "POD" (supplied by the cable provider), will also display encrypted signals depending on the consumers program package. It will also upconvert NTSC RF or baseband video and perform all audio processing from the various sources including AC3, Dolby Digital and XT True Stereo.

With minor modifications the DM3 will drive the 3 current series of DLP light engines or a PTV chassis, replacing the onboard formatting IC for DLP with a digital convergence microprocessor for PTV.

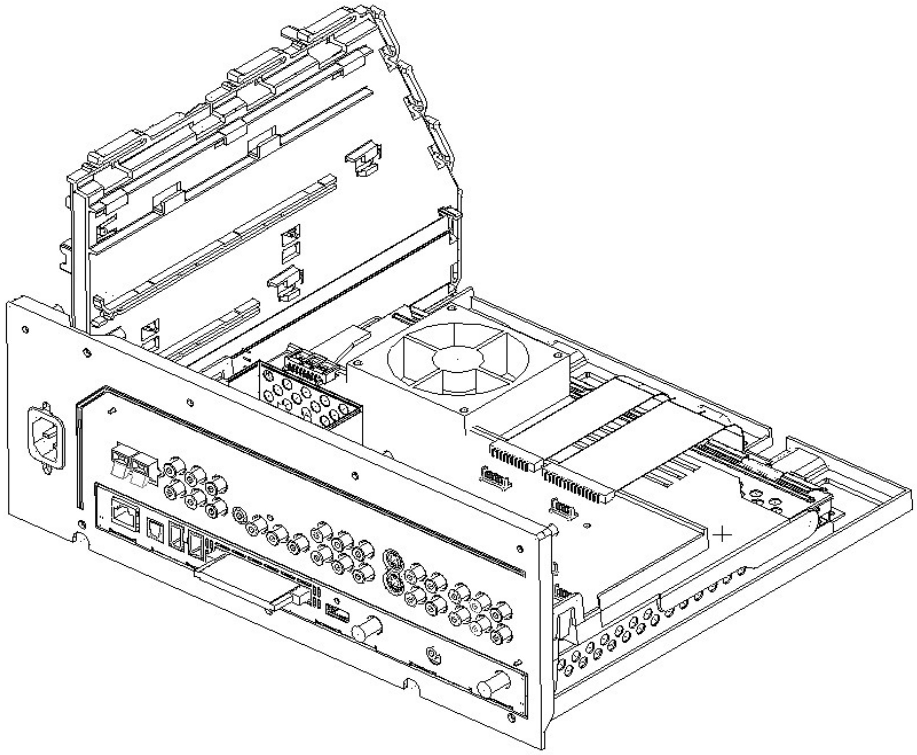
The DM3 contains all previous DM2CR features adding:

- Digital Cable Ready Tuning (DCR)
- Single scan frequency (PTV: 2.14H, DLP 3H)
- HDMI input (replacing DVI-HDCP)
- Wired remote control (Wired IR)

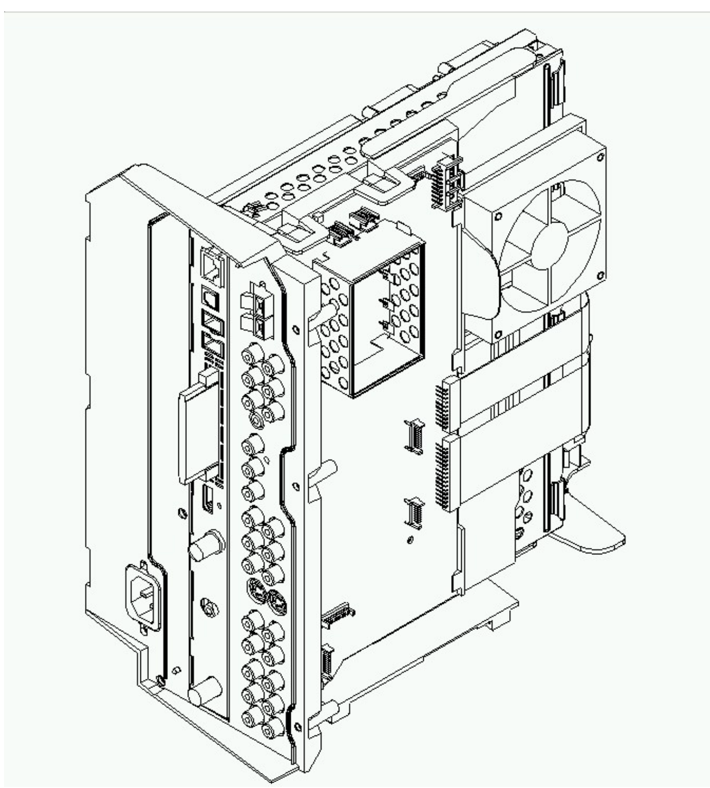
The DM3, although contained entirely on one PCB, requires a power supply and an AV IO board to form a complete signal processing and control system. The following diagrams show the different DM3 configuration required for the three instruments it will drive.



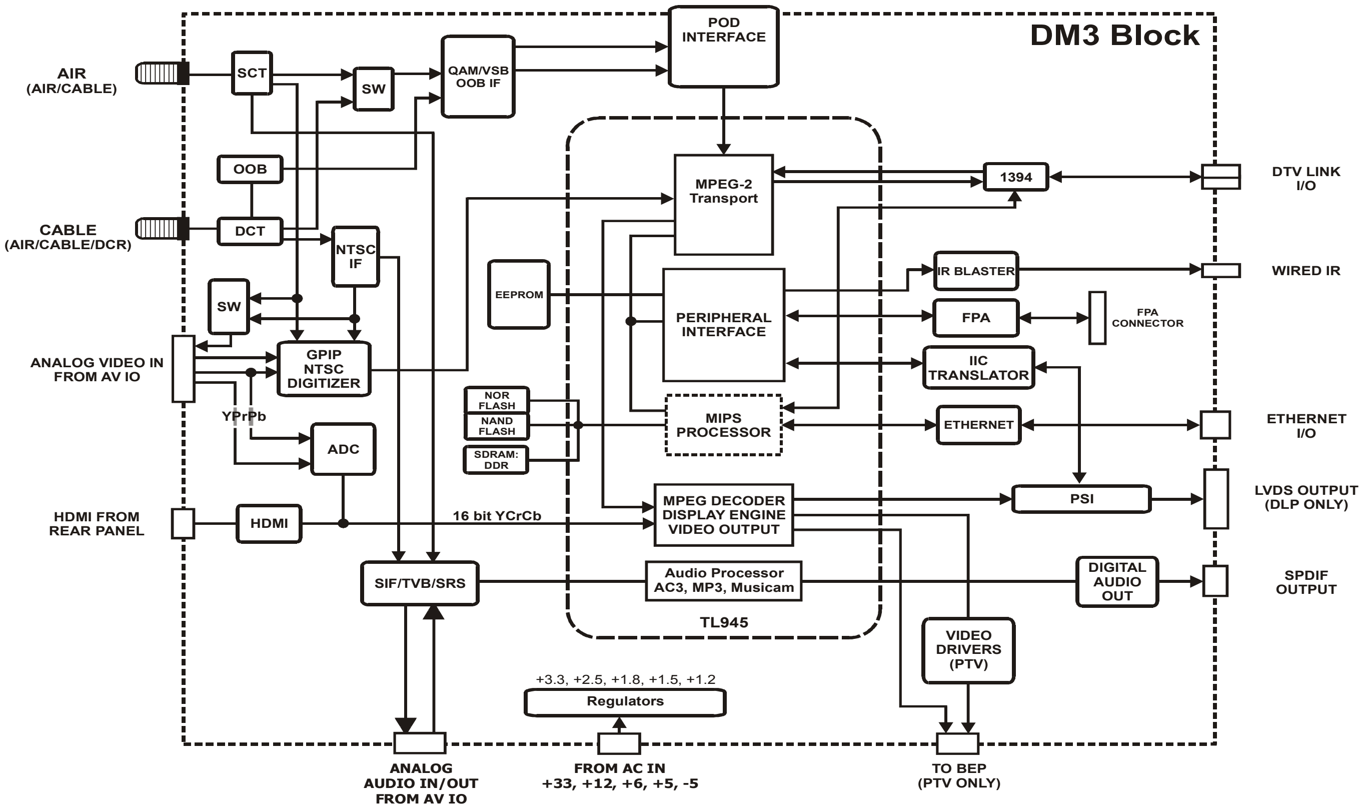
ATC321 (PTV)



ATC322 (Classic DLP and HD3)



ATC323 (Slim DLP)



DM3 Block Diagram

The DM3 consists of eight functional sections:

- Tuning and PIP,
- POD,
- Analog Video Processing,
- Audio Processing and Output,
- Peripheral Control & Communication,
- MPEG Decoding,
- Video Output,
- System Control

These sections can be simplified into three hardware sections; input processing, system control and output processing and is how the DM3 operation will be explained.

The DM3 does upconversion of NTSC RF, baseband and component video and also accepts component inputs that may be 2H, 2.14H or 3H. All signals are converted to one output format for PTV, (2.14H, 1080I) and one for DLP, (3H, 720P). When necessary and for the purposes of discussion these three scan rates, 2H (31.469KHz), 2.14H (33.67KHz) and 3H (45KHz) will be used to designate the horizontal scan rates and 480P, 1080I and 720P will be used to designate the common vertical refresh rates.

To alleviate confusion it may be better to understand the three common DTV formats that provide SD (Standard Definition) and HD (High Definition) by presenting them in a table.

H Scan	H Freq	H Pixels	V Pixels	Refresh	Screen Format
1H	15.73KHz	720	480	Interlaced	4x3
2H	31.47KHz	854	480	Progressive	16x9
2.14H	33.67KHz	1920	1080	Interlaced	16x9
3H	44.95KHz	1280	720	Progressive	16x9

Note that 720P is not a perfect 3H, but closer to 2.85H. 3H is simply the accepted popular nomenclature. HD screen formats are always 16x9 however SD may be 16x9 or 4x3. To broadcast a 4x3 program on a 16x9 SD screen many broadcasters will de-interlace the 720x480I, upconverting it to 480P. Unfortunately if a one-to-one upconversion is done, there are only 720 pixels on a 854 pixel screen. Unless the video is horizontally stretched to 854 pixels there will be 128 missing pixels or 64 on each side of the screen. That's about 15% of the picture size without video information resulting in black border curtains on each side of the screen. On the 50" DLP screen the horizontal length is about 43.6 inches which means each side would have a black border of about 3 inches. If the broadcaster is sending the video in 16x9 format, there is little that can be done to fill the screen. This is because the DM3 already believes the video is in 16x9 format and the video is in its largest screen format. But if the broadcaster sends the video in 4x3 format, the DM3 can increase the active video size proportionally until most of the screen is filled with video. The consumer may choose from a variety of screen format options for the most acceptable performance.

Wired IR

In order to provide better control of the ATC32X instruments in Home Theater environments, a wired IR is provided. That enables compatible Home Control devices to connect directly to the instrument avoiding "remote" confusion encountered by having multiple remote controls for various devices used in a typical Home Theater installation.

When the Wired IR is used, the IR receiver is disabled. The technician must be aware of this as many times IR commands are required during service. If they are, the wired IR must be disconnected before using a remote control. It is required to disconnect the wired IR when troubleshooting just to be certain the control device is not the cause of improper or unexpected operation.

Tuning

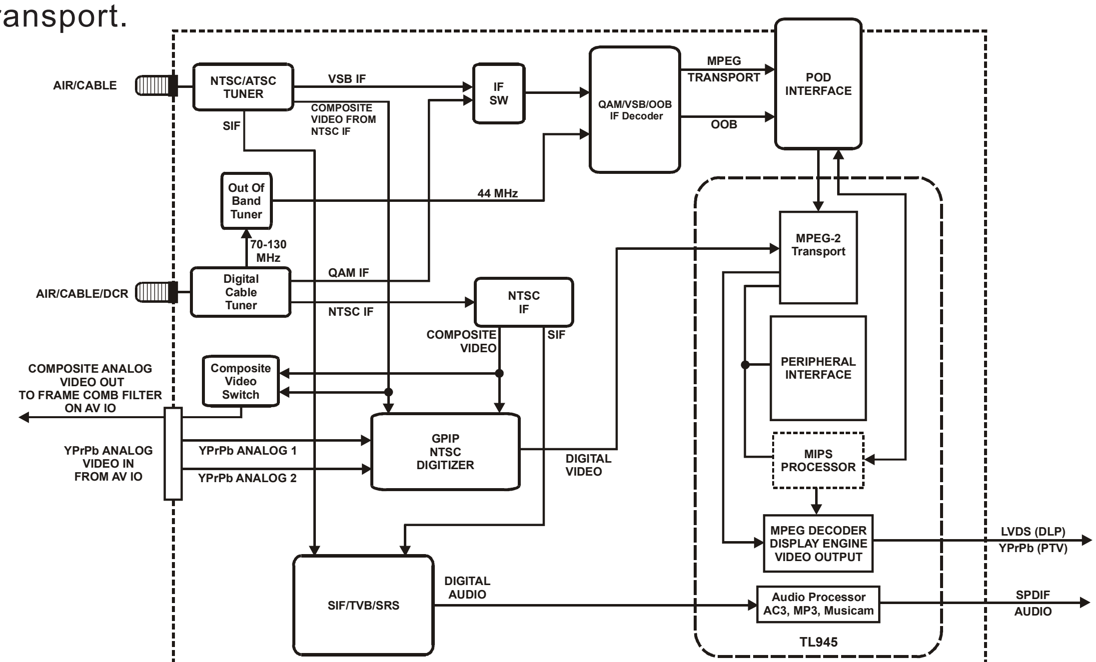
The DM3 is capable of NTSC, ATSC and QAM tuning covering all current broadcast systems including terrestrial, CATV and DCR. (ATSC is simply a designation for digital 8VSB transmissions.) All RF reception is upconverted to 720P for DLP display. There are two tuners called "Air/Cable" (labeled "Air" on the rear panel) and "DCR" (labeled "Cable" on the rear panel). That nomenclature is somewhat misleading by analog standards, but accurate when applied to digital reception. Here's why.

The tuners used for the inputs are slightly different. The "Air" tuner is capable of receiving standard NTSC broadcasts (whether off-air or cable) and can also receive off-air ATSC broadcasts. The second tuner is capable of standard NTSC (off-air and cable) and adds Digital Cable QAM and DCR capability. Although this tuner is also capable of off-air ATSC, it is designed for the special conditions present when ATSC is sent via a cable provider and is not recommended for off-air reception.

Air/Cable

From the incoming RF line, marked "Air/Cable" (AIR) the integrated tuner outputs three signals; SIF, analog NTSC IF, and ATSC IF. This includes current analog Off-air, CATV and ATSC signals. The analog IF from Off-air or CATV is routed to the GPIP NTSC Digitizer where it is upconverted, digitized then output to the MPEG-2 transport in the TL945 IC. In chassis with frame comb filters on the AV IO board the composite video is routed to the AV IO via the composite video switch, combed, converted to YPrPb, then routed back to the GPIP.

If an ATSC channel is received the digital IF is routed to the QAM/VSB/OOB IF IC where the MPEG-2 stream is decoded and routed to the POD interface. If the signal has no encryption it is then routed directly to the MPEG transport.



RF Tuning

The sound IF, SIF, is routed to the SIF/TVB/SRS IC where it is digitized, decoded into right and left audio, processed and the digital output sent to the TL945 IC for output to either analog or SPDIF audio. The analog output goes directly to the Audio Output connections on the rear panel.

Air/Cable/DCR

The second tuner is capable of Off-air, CATV, CATV delivered ATSC and QAM reception. From the incoming RF line, marked "Air/Cable/DCR" (CABLE) the integrated tuner outputs two signals; analog NTSC RF, and QAM IF. This includes current analog Off-air, CATV and Digital Cable QAM signals. The analog RF from Off-air or CATV must be converted to an analog IF signal in a separate IC, then routed to the GPIP NTSC Digitizer where it is upconverted, digitized and output to the MPEG-2 transport in the TL945 IC. This makes the second tuner available for analog PIP. In chassis with frame comb filters on the AV IO board the composite video is routed to the AV IO via the composite video switch, combed, converted to YPrPb, then routed back to the GPIP.

If a QAM channel is received the digital IF is routed to the QAM/VSB/OOB IF IC where the MPEG-2 stream is decoded and routed to the POD (CableCARD™) interface. If the signal has no encryption it is then routed directly to the MPEG transport. If the signal is encrypted and there is no POD device supplied by the cable company the signal is blocked. If it is encrypted and a valid POD is inserted, the POD decodes the channel information, recodes it, then sends it to the MPEG-2 transport on the TL945 IC where it is decoded into normal MPEG-2 video.

OOB

If the second tuner is connected to a Digital Cable Ready provider there will be an Out of Band (OOB) signal. The OOB signal carries a channel map with information on the providers programming including a complete channel availability map plus all channels that are encrypted. The OOB data is decoded by the POD according to the specific channel map requested by the consumer.

The purpose of the OOB is to capture a 70-130 MHz signal that is riding with the normal DCR signals. If that signal is present it is routed to the OOB tuner converted to a 44MHz IF signal then routed to the QAM/VSB/OOB IF IC. It then passes information to the POD via the POD interface. The POD actually determines a valid OOB signal and initiates the lock onto it when it finds a channel with a valid QPSK signal. That channel carries the program information for the DCR system and is decoded by the POD into the program guide plus a programming map informing the system which channels are encrypted, which are not, and which channels are grouped into the different program levels of the cable provider. The POD can then determine, based on the consumers selection of services, which channels to pass on to the MPEG transport and which to block.

DM3 Video Inputs

The DM3 is capable of receiving and processing most current analog and digital video formats found in video equipment supplied to the consumer market. That includes recorders, players and set top boxes. Among the input capabilities are:

Analog NTSC composite	2 inputs shared with S-Video
Analog NTSC S-Video	2 inputs shared with Composite
Analog Component (YPrPb)	2 inputs both with composite capabilities
HDMI/DVI	1 Input
DTV IEEE1394 (Firewire)	2 2-way inputs

All 1H interlaced (480I) signals are digitized by the GPIP IC, then sent to the MPEG Transport for digital upconversion. DTV IEEE1394 (Firewire) signals are processed by a dedicated 1394 IC and also sent to the MPEG Transport. HDMI signals enter a dedicated IC that converts the signal to digital YPrPb commonly called YCrCb.

All analog 2H/3H YPrPb (Component) signals are also converted to YCrCb by an ADC switch. Both signals are routed to the video output converter of the TL945.

On selected models the Front Panel jack has composite and S-Video inputs. These are in addition to the above video inputs.

DM3 Video Outputs

The DM3 ultimately converts all video inputs to 720P in the PSI IC and outputs that signal directly to the DLP Light Engine via the LVDS connection.

There is also a composite video out that outputs a 480I baseband video signal for all inputs except HDMI. HD inputs are downconverted to 480I and cropped to fit a 4x3 screen format. The DTV 1394 is a two way path allowing compatible DVI recording from any input following the copy protection standards previously mentioned. In general any incoming video with digital copy protection can not be recorded. All incoming interlaced analog signals are routed directly to the video output so that any copy protection remains intact.

DM3 Audio Inputs

There are complementary analog stereo inputs for all video inputs. HDMI contains audio inputs as do the DTV IEEE1394 inputs.

DM3 Audio Outputs

There are three audio outputs, two analog and one digital. One line level output accompanies the composite video output. The other analog output carries front right, front left, center, right rear, left rear and subwoofer outputs generated from any audio input including the digital inputs. These outputs may be fixed or variable via menu selection. If only the stereo outputs are used, any Dolby Digital signals will be downmixed to the Front Right and Left outputs.

An SPDIF optical output using linear PCM coding or Dolby Digital is used for connection to compatible inputs of A/V Receivers.

There is also one additional headphone jack on the Front Panel that carries a low amplification stereo signal derived from any selected audio to a set of compatible headphones.

Center Channel Speaker Input

There is one speaker level input that will accept standard speaker outputs from an A/V Receiver meant to turn the internal speakers of the instrument into a center channel speaker. That allows the A/V Receiver to turn the internal speakers into one center channel fixing the dialog channel at the center of the instrument.

Audio Processing

Internally the DM3 has an array of audio signal processing. These include:

- SRS (Sound Retrieval System)
- SRS TruSurround XT
- Dialog Clarity
- SRS Focus
- SRS-EFFECT
- Sound Logic
- Dolby Digital AC3

All are menu selectable by the consumer depending on their individual preferences and the incoming signal. SRS processing works on any standard stereo audio input and is meant to widen the sound stage, fix center dialog, provide a "surround" effect without rear speakers or enhance dialog. Sound Logic is used to bring all audio levels to an "average" level reducing loud audio or amplifying low audio to create a nominal sound track. SRS processing may still be used with Sound Logic.

Dolby Digital AC3 provides decoding for the six discrete sound tracks of Dolby Digital 5.1 Sound Tracks being received either from a Dolby Digital equipped playback source such as a DVD, or from Digital broadcasts using Dolby Digital AC3. SRS and Sound Logic should be turned off when listening to Dolby Digital programming as they interfere with the originally recorded audio.

Ethernet

Most models containing the DM3 will contain an ethernet connection meant to connect to broadband internet access. The ethernet connection may not be connected directly to a cable modem or DSL modem line, but requires the use of a router. The DM3 then connects to the router and through the router will have internet access. The current browser is IE5 giving increased capability from previous designs. However there is no hard drive for the browser to store things like cookies and a history. The browser is meant to compliment video viewing, not to become the primary internet access point for a family.

HDMI

A word about **HDMI** or ***H**igh **D**efinition **M**ultimedia **I**nterface*. HDMI was developed to remedy interconnection problems using the original DVI connection standard. DVI was introduced as an interdevice format with enough bandwidth to enable the transfer of uncompressed HD video. Loose standards complicated hookups or made them impossible even though the two devices both met their interpretation of the DVI standard. HDMI has added to the standard resolving many of the conflicts that resulted in incompatibilities making it more consumer friendly. Since HDMI also contains HDCP the broadcast and movie industry have endorsed it and the new standard adds digital audio making a single HDMI connector all that is required for an A/V hookup.

Future versions of the HDMI connection will be able to offer two-way communications between the DM and a connected device. That might enable features such as automatic screen format setting or audio processing selection without manual consumer selection.

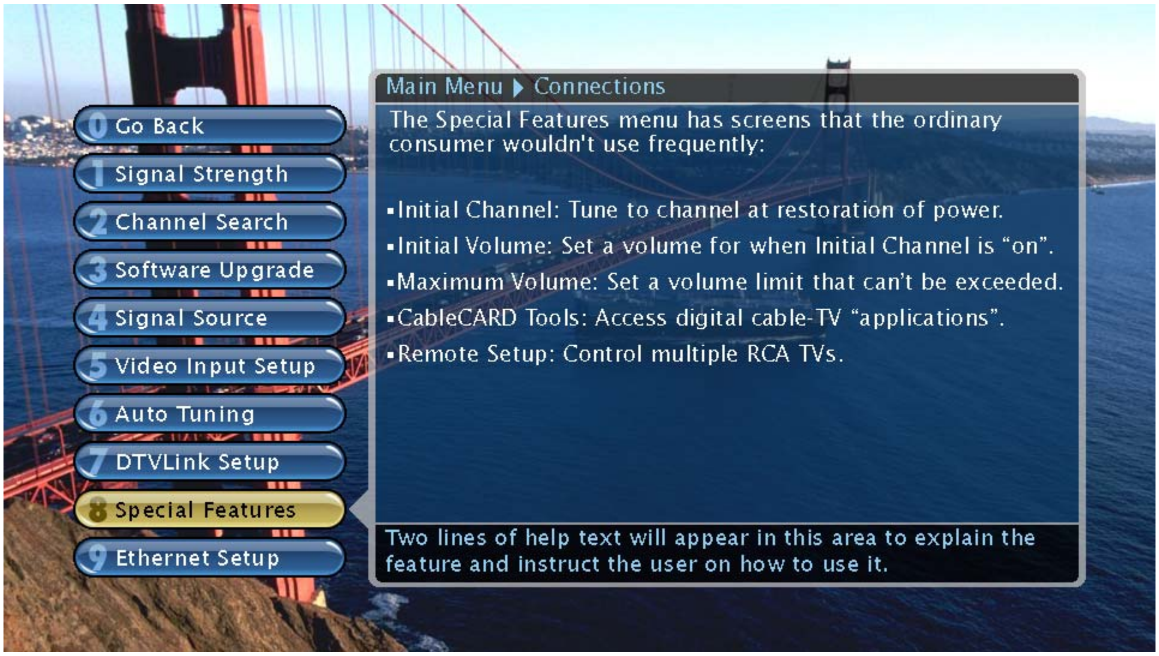
HDMI is also fully backward compatible with DVI requiring only a DVI-HDMI adapter. There are no special converters required.

The DM3 supports existing high-definition video formats (720p, 1080i, and 1080p) and also has the flexibility to support enhanced definition formats such as 480p plus standard definition formats such as NTSC.

HDMI Interconnection Cable

Commercial/Showroom Features

The DM3 provides several special features that may prove useful in some commercial applications and showroom demonstration situations. They are located in the consumer menu under "Connections" and "Special Features".



The four features specifically aimed to the commercial market and showroom floor demonstration applications are:

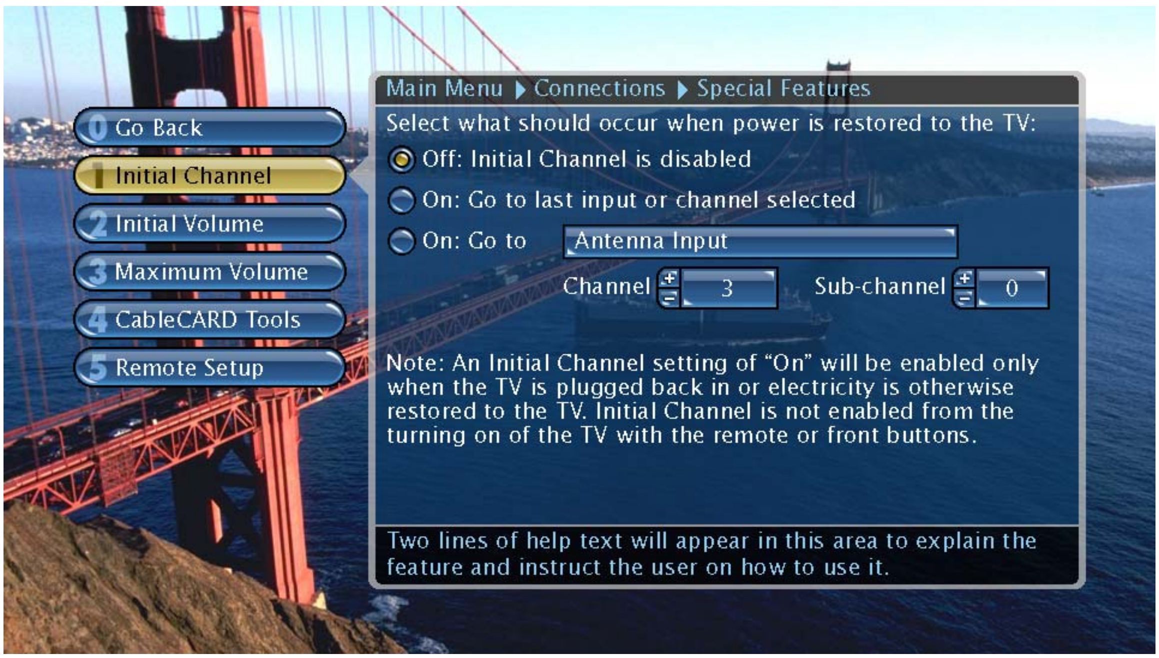
- Initial Channel,
- Initial Volume,
- Maximum Volume, and
- Remote Setup.

In some cases the commercial features will overide any consumer settings. "Initial Volume" is also not active unless an "Initial Channel" is set. Following is are expanations of all four features in greater detail.

Initial Channel

A specific channel, sub-channel or input may be placed in this menu that will be the channel selected when power is restored after a power outage, or in situations where a large number of instruments are turned on and off by removing AC power. This should not be confused with the more traditional consumer oriented "15 Second Timer" which restores all operating conditions as they were prior to an AC outage of less than 15 seconds.

If Initial Channel is active, after ANY power outage, (regardless of the length of time power is lost), the instrument will automatically turn on and tune to the channel or input selected in this menu.



If "Initial Channel" is turned off, the normal "15 Second" timer is active. If power is lost for less than 15 seconds (approximately), when power is restored the set will return to the same operating conditions it was in prior to the outage. If power is lost for more than 15 Seconds (approximately), when power returns the instrument will go through a normal bootup sequence and place itself in standby operation.

There are two options available when power returns.

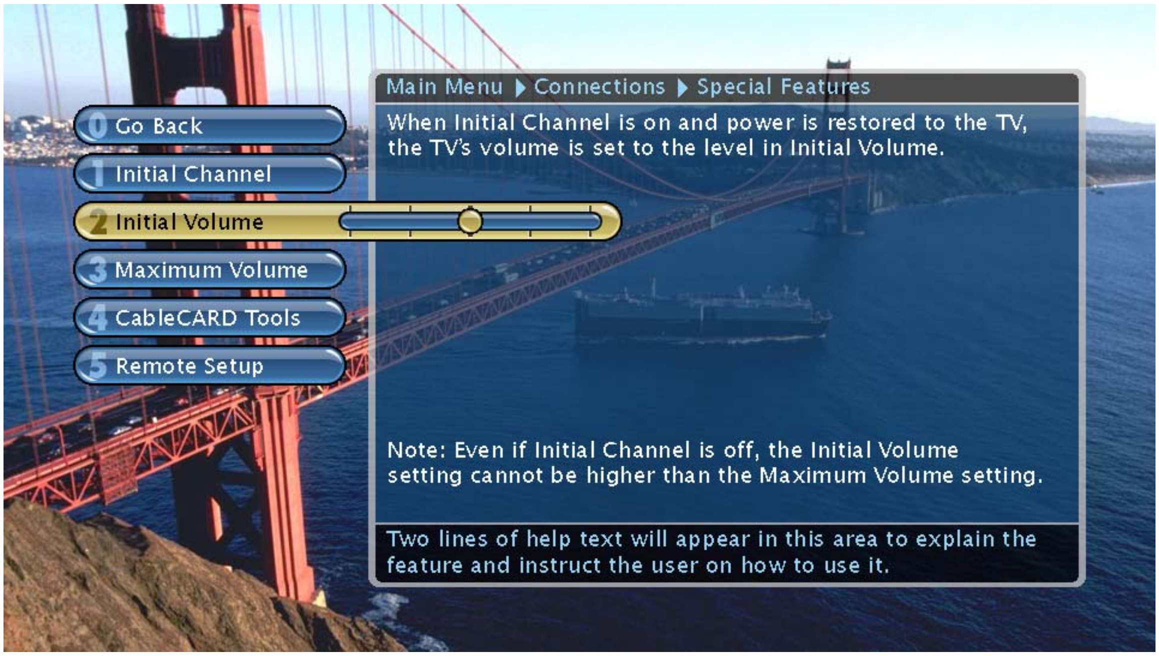
ON: Go to Last Input or Channel Selected: Returns the instrument to the exact channel or input it was on when AC power was lost.

ON: Go to: Specifies a single channel, sub-channel or input the instrument will return to when power is restored.

In both cases "Initial Volume" (and "Maximum Volume") are automatically turned on.

Initial Volume

Similar to "Initial Channel" a specific volume setting may be chosen that will be used when AC power is restored after a power loss. "Initial Channel" must be active for "Intitial Volume" to be available. Initial channel does not limit volume. It only sets the volume the instrument will be at when power is restored. For volume limiting see "Maximum Volume".



Maximum Volume

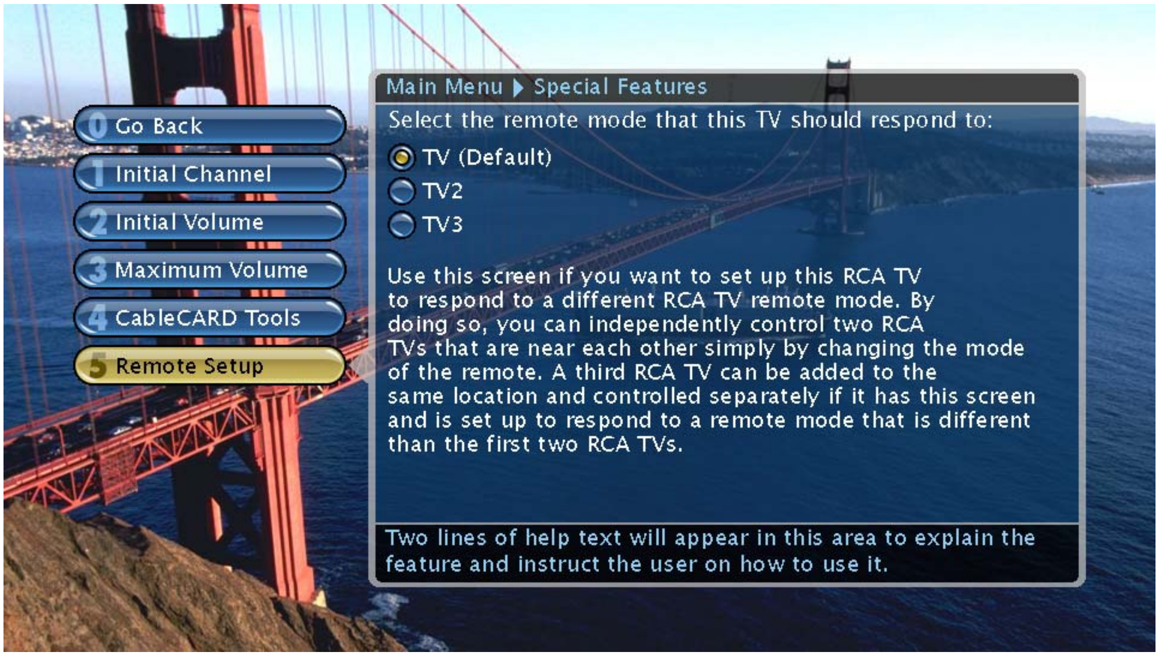
In some situations the maximum volume obtainable by the audio system of the ATC322/323 may not be desired. This feature allows setting a maximum level that is below that threshold. There is no onscreen indication that maximum volume has been reached. The consumer volume slider will simply stop at the maximum volume set in this menu.

Maximum Volume is available regardless of "Initial Channel" or "Initial Volume" settings.

The Maximum volume setting is not "Sound Logic". It does not dynamically change volume to sustain an average volume level. It simply limits the maximum loudness levels attainable by the audio amplifiers.

Remote Setup

The Remote Setup feature is used when there may be several ATC322/323 instruments in close proximity causing confusion when a single or multiple compatible remotes are in use. Remote Setup can be used to control up to three instruments in the same location. It does by programming one or two of the auxillary buttons on the included remote to control the TV.



For instance, by selecting "TV2", the TV will now respond to TV Code 1222. Using the learning capability of the RCA-Scenium universal remote control included with the ATC322/323 instruments (265418), program the "AUX" button with code "1222" using the instructions for the remote or instructions in the manual for the television.

Now by pressing "TV" on the remote the first instrument will be controlled and second will ignore all remote commands from the remote. By pressing "AUX" control will switch to the second instrument and the first one will ignore all commands from the remote.

If a third instrument is nearby and it is desirable to control it independantly of the other two, enter the menu of the third instrument and select "TV3". The VCR or DVD button of the remote may now be programmed with code "1223". At this point when the programmed button is pressed the third instrument will be under control of the remote and the other two instrument will ignore the commands.

Note: The RCA-Scenium Universal remote control included with the ATC322/323 instruments are the only remotes at this time capable of using the secondary TV control codes. The "TV" button is fixed with the universal RCA "TV" code and cannot be changed. However any two of the "DVD", "SAT/CATV", "VCR" and "AUX" buttons may be changed to control up to three different instruments.

ATC32x System Control and I2C Bus Communication

The ATC32x System Control is contained inside the DM3 module. IM301, a TL945 processor, controls all internal functions of the DM3 and is responsible for monitoring and controlling the AVIO CBA, and Light Engine. IM301 performs such functions as channel change, audio adjust, A/V switching, Light Engine on/off and control, Ethernet communication, browser function, service alignments and more.

System Control start-up occurs when the DM3 module has power applied to it. The system control comes out of reset and starts downloading software from an EEPROM. This software tells the system control what features and functions to perform. Next system control initializes the other devices internal of the DM3. This process is called the Boot Sequence or Boot Routine of the DM3 and takes approximately 45 sec to complete. During this process the DM3 is oblivious to any external devices connected to it. It is only after system control completes the boot process that it is ready to accept commands from an external input such as the FPA or IR. During the boot process the power LED turns on and remains lit until the boot process is complete. When the power LED goes out system control has completed the boot process and is ready to accept commands.

User input for the DM3 consists of front panel assembly and infrared remote input. These signals are the standard key-scan lines and IR found in other Thomson chassis. They are routed from the FPA / IR CBA through the AVIO CBA to the DM3 module.

Once system control receives a power ON command, system control accesses the external I2C bus lines checking for other devices. Depending upon what system control finds, it will enter one of three modes. These modes are:

- DLP
- PTV
- Stand-Alone (Requires Reboot to exit Stand-Alone mode)

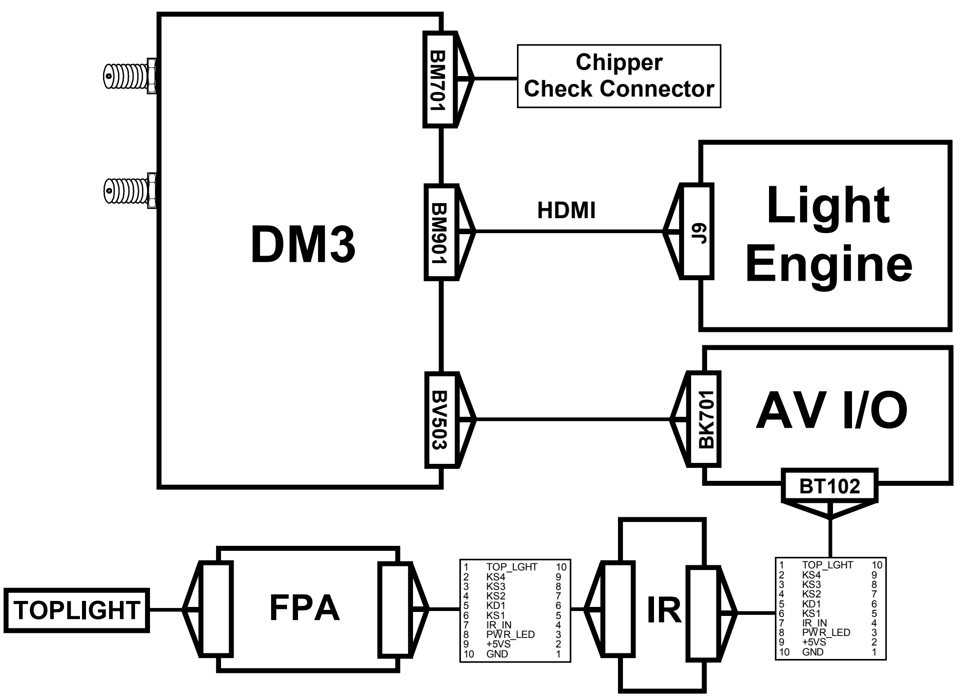
In the DLP mode, system control communicates with the Light Engine processor telling it to start it’s own startup sequence. It then communicates with the AVIO. If the Light Engine fails to communicate back, the DM3 system control will default back to stand-alone mode.

For PTV, system control accesses the deflection processor and bus expander starting the deflection. AVIO is accessed next. If the deflection CBA is not found during this process, the DM3 system control will default to stand-alone mode.

In the stand-alone mode, system control turns off external communication and only performs internal functions. This presents a problem in trouble-shooting, as there will be no I2C communication external of the DM3 to check. How ever all is not lost because the DM3 functions as a stand-alone device and processes signals. This means that if power is applied to the DM3 it has the ability to process signals, tune channels, and perform as though it was connected in the set.

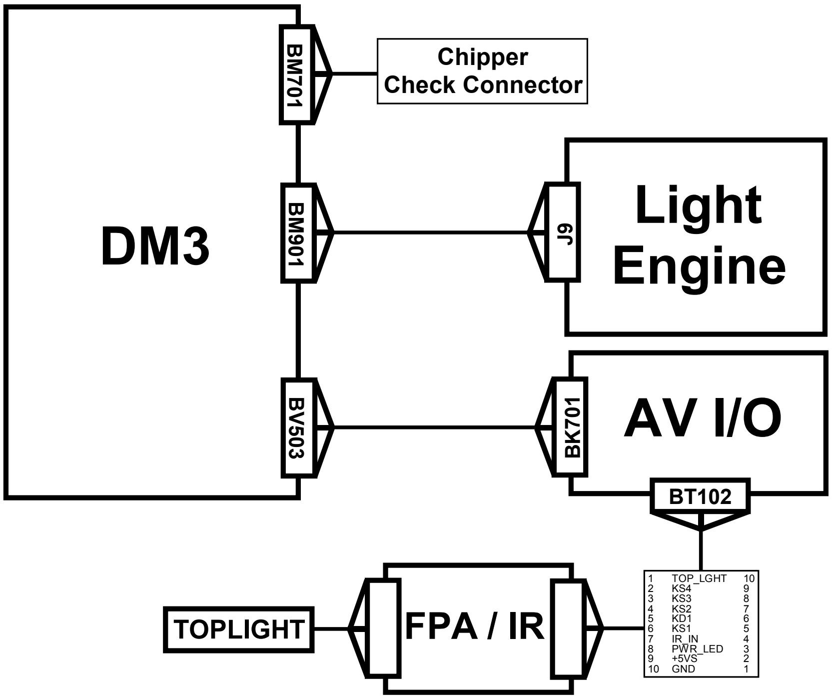
There are three connectors on the DM3 module that carry clock and data communication lines external of the DM3. These I2C lines allow the DM3 module to communicate with the Light Engine, AVIO, and Chipper Check software. The three connectors are:

- BM701 (Chipper Check)
- BM901 (Light Engine) HDMI Cable
- BV503 (AVIO CBA)



SIGNAL	BK701
TUNER CV	31
GND	30
RESET	29
DACQ_I2C_CLK	28
DACQ_I2C_DAT	27
GND	26
SWITCHED_L	25
SWITCHED_R	24
GND	23
RECORD_CV	22
GND	21
Y_VOUT1	20
Y_VOUT1_RTN	19
PB_OUT1	18
PB_OUT1_RTN	17
PR_OUT1	16
PR_OUT1_RTN	15
C_OUT1	14
C_OUT1_RTN	13
C_OUT2	12
C_OUT2_RTN	11
PR_OUT2	10
PR_OUT2_RTN	9
PB_OUT2	8
PB_OUT2_RTN	7
Y_VOUT2	6
Y_VOUT2_RTN	5
HNVSYNC	4
HD_HSYNC	3
GND	2
N/C	1

ATC322 Block



SIGNAL	BK701
TUNER CV	31
GND	30
RESET	29
DACQ_I2C_CLK	28
DACQ_I2C_DAT	27
GND	26
SWITCHED_L	25
SWITCHED_R	24
GND	23
RECORD_CV	22
GND	21
Y_VOUT1	20
Y_VOUT1_RTN	19
PB_OUT1	18
PB_OUT1_RTN	17
PR_OUT1	16
PR_OUT1_RTN	15
C_OUT1	14
C_OUT1_RTN	13
C_OUT2	12
C_OUT2_RTN	11
PR_OUT2	10
PR_OUT2_RTN	9
PB_OUT2	8
PB_OUT2_RTN	7
Y_VOUT2	6
Y_VOUT2_RTN	5
HNVSYNC	4
HD_HSYNC	3
GND	2
N/C	1

ATC323 Block

BM701 (Chipper Check Connector) has two I2C bus communications lines. One is tied to the I2C bus lines used by the Light Engine and AVIO CBA. The other is used to communicate with the other I2C devices internal of the DM3.

BM701 Pin Out:

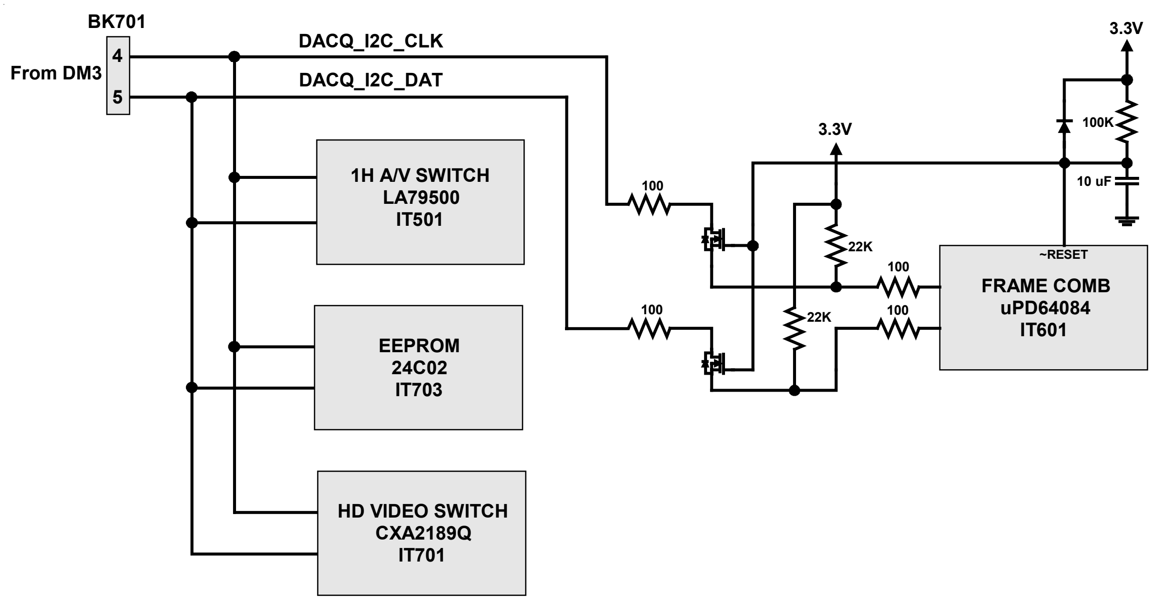
1. SER_EN
2. GND
3. DCLKP
4. DATA0
5. SCL_INST
6. NC
7. SDA_INST
8. SCL_3
9. SDA_3
10. EEPROM_EN

BM901 (Light Engine) HDMI connector is connected to the Light Engine assembly. This allows system control to communicate with the Light Engine. Internal to the Light Engine is another processor and EEPROM. The internal processor controls all functions of the Light Engine including striking the lamp and control of the color wheel.

When the user turns on the set, the DM3 receives the command to turn on and sends out power up commands to the Light Engine. Once the Light Engine receives these commands it starts it's own boot-up process. Once this boot-up process begins any problem detected by the Light Engine processor is communicated back to the DM3. This communication occurs repeatedly while the set is in operation. At any time there is a problem detected by the Light Engine, the Light Engine will send the command back to the DM3 telling it to shut down the set and log an error code.

BV503 (AVIO CBA) is connected to BT701 on the AVIO CBA. For more information see AVIO I2C Bus Distribution.

AVIO I2C Bus Distribution



AVIO I2C Block

I2C bus on the AVIO CBA is routed to four devices on the AVIO. They are:

- IT501 (1H A/V Switch)
- IT703 (EEPROM)
- IT701 (HD Video Switch)
- IT601 (Frame Comb)

IT601 Frame Comb is connected to the I2C bus line through a buffer circuit. This buffer circuit allows the normal 5V I2C buss to communicate with the lower 3.3V Frame Comb IC.

The EEPROM (IT703) provides setup information for the HD video switch IT701.

Troubleshooting I2C Bus Communication

To start off with we need to understand that any bus communication problem external to the DM3 will cause the DM3 to enter the Stand Alone Mode. This will also occur if the DM3 is disconnected from the AVIO and Light Engine.

With that said, the best way to determine where the problem is would be to use Chipper Check to read the error codes. The error codes will indicate what device / module has not responded.

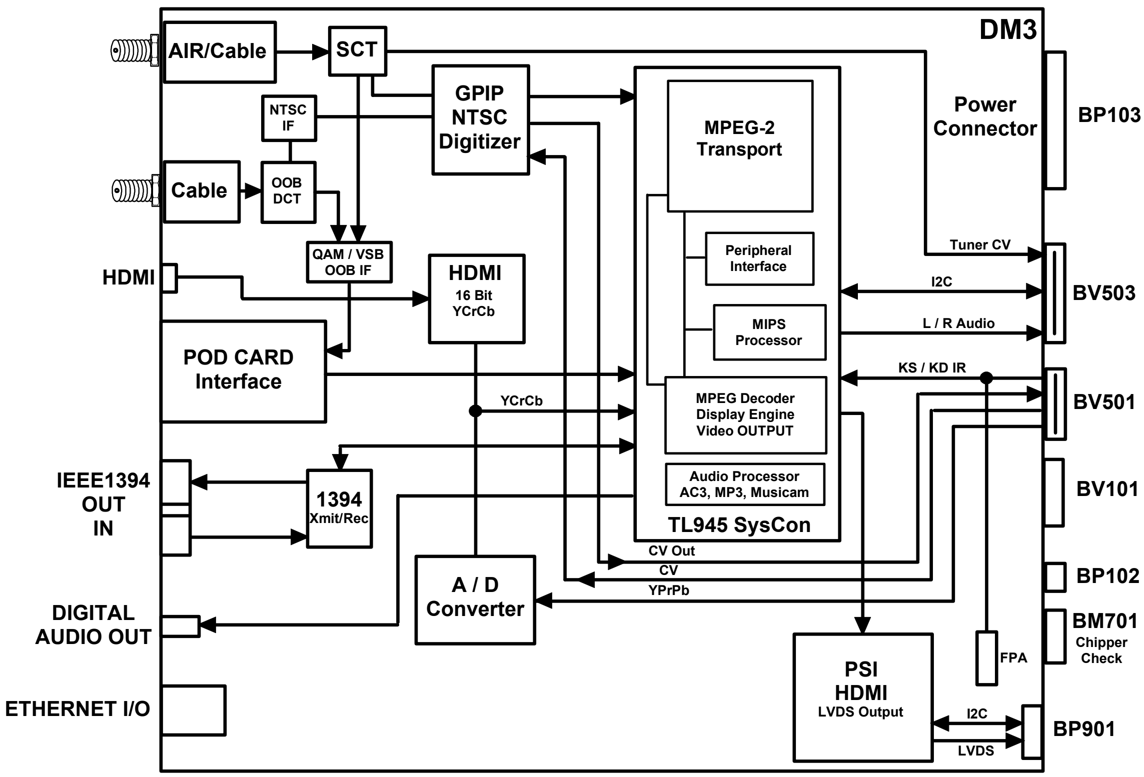
1. Start by observing the power LED when the power is pressed. The FPA lights will flash if an error code has been logged. This will indicate System Control has detected and recorded an error code. Connect Chipper Check and read error code(s). Troubleshoot accordingly.
2. If there are no flashing lights when power is pressed, unplug AC power, wait a few seconds to reset the DM3. Remember during boot up the power LED will remain lit for approximately 45 seconds.
3. Apply AC power and observe the power LED. If it goes out after 45 seconds then go to step 4. If it stays on or never comes on suspect the DM3 module (see troubleshooting DM3 module) or ACIN CBA.
4. One nice thing about the standalone feature of the DM3 is that it will function even if it is disconnected from the Light Engine or AVIO CBA. Disconnect the HDMI cable from the Light Engine. This will remove clock and data from the Light Engine.
5. Apply AC power and after the boot sequence has finished (power LED goes out) press the power switch. If the power LED comes on and stays on, connect the record out to a video monitor and see if the DM3 is processing signal.

NOTE: There is no OSD overlay on the record out video, so channel information is not present. Make sure to direct access a known good station when using the record out for troubleshooting. That way you can be sure if it is working or not.

6. If there is video present then suspect the Light Engine.
7. No video suspect AVIO CBA. Scope the Record CV at pin 10 of connector BK701 on the AVIO CBA. This is the output from the DM3 to the AVIO CBA.
8. If CV waveform is present suspect AVIO CBA. If missing suspect DM3.

ATC32x DM3 Video

Video processing in the DM3 is complex. With the majority of video processing being done internal to the DM3, troubleshooting is left to what goes in and what comes out. This section however will cover what actually goes on inside of the DM3 video processing. The different stages and signal processing sections will be discussed. This will allow us to focus on each signal and it's path through the video processing. Because all signals are converted to a single output from the DM3, it is important to understand what is actually going on with the signal in order to troubleshoot it effectively.



DM3 Video Block

All video signals are processed by the DM3. The main component IC on the DM3 is the TL945. The TL945 contains an MPEG-2 video decoder, display processor with scan rate converter, and graphics accelerator. Processing blocks in the TL945 include:

Transport Stream De-multiplexer (TSD)

The TSD reads up to four simultaneous MPEG transport streams and splits them into a number of elementary streams as well as Program Specific Information.

MPEG Core Engine (MCE)

MCE decodes the MPEG video streams. It reads the channel buffer(s) written by the TSD and outputs un-scaled video pictures. Depending on the frame type (I, P, or B), the MCE might need zero, one, or two previously decoded pictures in order to form the new picture. I & P pictures are always written out to memory so they can be used for future P and B picture prediction. All pictures, whether or not written to memory, are processed directly by the HPIP processor.

Horizontal Picture-In-Picture Processor (HPIP)

This horizontal downscale processor takes the output of the MCE directly, scales each line down using a high-order filter, and writes it out to memory. The HPIP processor can only do *down*scaling for horizontal.

Video Scaler (VSC/VSC2)

This unit takes digitized CCIR-656 standard definition analog video, scales it horizontally, and places the result in memory where it is processed by the VPIP processor for vertical scaling. The VSC can also extract VBI data so that the CPU can further decode it.

High Definition Capture (HDC)

This unit captures and horizontally scales down uncompressed digital video. It is more general than the VSC and can capture a wide variety of high-definition video formats.

Vertical Picture-In-Picture Processor (VPIP)

This vertical downscale processor takes the output of the MCE, HPIP, VSC, VSC2, or HDC; downscales it vertically; and writes it out to a video frame buffer. The VPIP processor is always a memory-to-memory operation. VPIP can also work in a bypass mode where it is simply copying a picture to an arbitrary location in the video buffer.

Programmable Signal Processor (PSP)

The PSP is a special-purpose micro controller designed for implementing video signal processing algorithms, such as deinterlacing (line doubling) or film mode detection algorithms. The PSP also can be used for filling, copying, and blending video images in real time. The VPIP and PSP share some common hardware and cannot be used at exactly the same time. However, they can be time multiplexed so that both units can be used in one field time.

Display Processor (DPC)

The display processor generates the video output. It reads data from the frame store, reformats it if necessary, and outputs it to a display device. It generates the time base for a raster-scanned display device. The display processor supports multiple video objects, multiple graphic objects, and a hardware cursor. They are composite and displayed in real-time in one of many formats.

Video objects are stored in YCrCb color space and may require horizontal, vertical, and temporal sample rate conversion. The video plane can be scaled up arbitrarily and continuously and can scale down by at most 2:1, which complements the scale-down capabilities of the HPIP and VPIP processors. Graphics objects are stored as indexed bitmaps and do not undergo sample rate conversion. Both may undergo color space conversion.

Auxiliary Display Processor (AUX)

Either the composite output of the DPC or just the video plane can be fed to the AUX unit, which can downscale an image to fit within the CCIR-656 (NTSC) video format. It can be used to simultaneously display graphics and video to a high-definition monitor as well as provide an analog video output (in this case without graphics) for VCR recording. The downscaling provided by the AUX unit is generally not as high quality as that provided by HPIP and VPIP, although it is still acceptable for recording. In dual surface mode, the AUX unit obtains video data directly from memory rather than from the DPC.

Video Encoder (VENC)

The VENC unit is an NTSC video encoder. It takes the output of the AUX unit and outputs analog composite video.

Texture Processor (TEX)

The TEX unit is a general-purpose video and graphics blending and warping engine. In blend mode, it can alpha blend up to four separate input planes into an output plane. In warp mode, the TEX unit can perform various geometric transformations on video or graphics, such as rotation, skewing, or simple up scaling or downscaling.

Block Transfer (BLT)

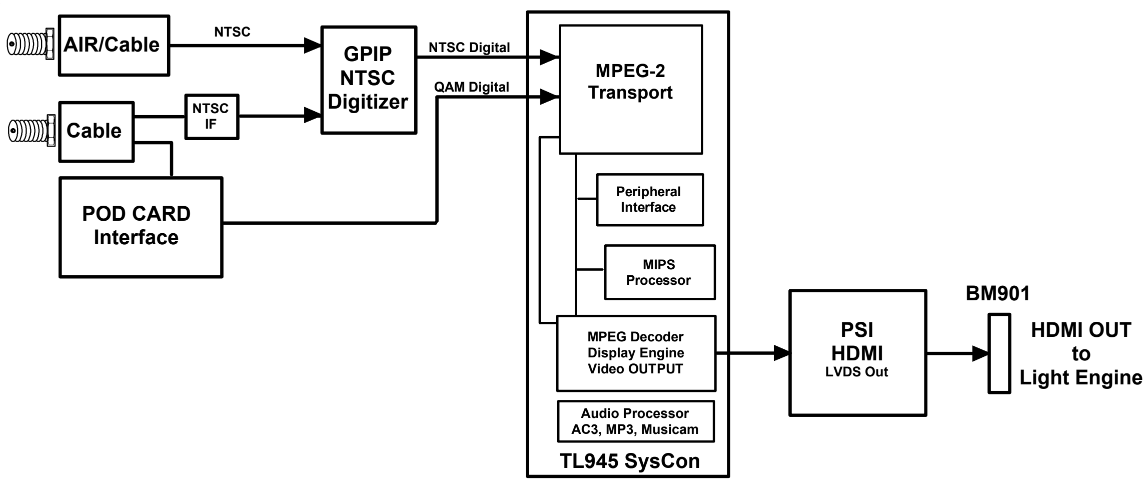
The graphics driver is a 2D graphics accelerator used to speed up operations. Such operations are scrolling, color filling, or blending different bitmap images.

Memory Interface (MIF)

This unit controls all access to the Dual Data Rate Memory (DDRM) attached directly to the TL945; it arbitrates among all of the clients that wish to read or write memory. It provides some memory buffering for various clients depending on expected memory usage patterns in order to optimize available memory bandwidth.

Video Flow

The first input we will cover is Air and Cable. Because these two inputs are very similar they will be combined. For more info on what each is capable of, see the overview section on the DM3 called **"Air / CATV Tuners"**.

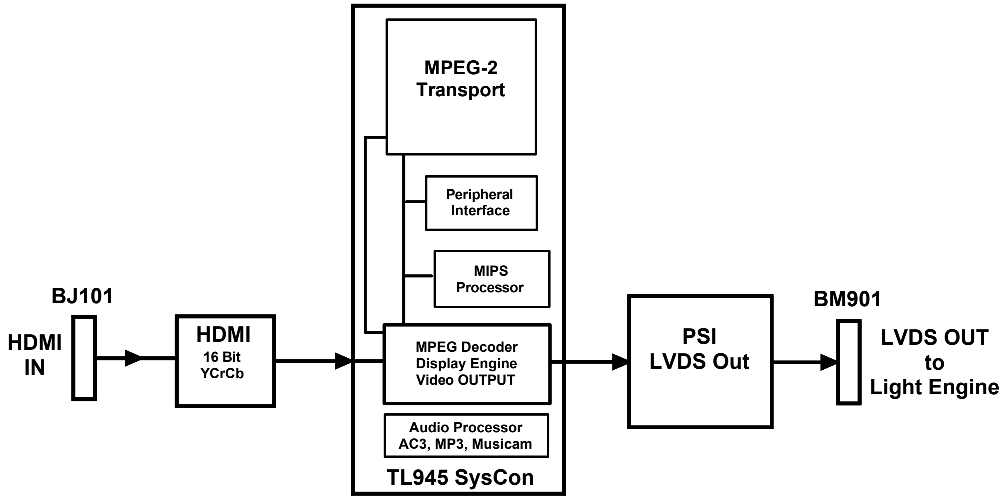


Tuner Video Block

The NTSC signal coming from the AIR/Cable tuner needs to be converted to digital format. The GPIP performs this conversion and outputs digital video (CCIR656). This signal is sent to the TL945 MPEG-2 Transport for further processing before being sent to the PSI and to the light engine.

The Cable input has two paths. One follows the NTSC path of the AIR/Cable input and is digitally converted by the GPIP NTSC Digitizer. This path is for all NTSC signals found on either RF input. The other path is for digital cable only. Since the digital cable is already in digital format it only needs to be checked for In-The-Clear. This is determined by the POD interface. Once determined the user has the ability to view the content, the digital signal is also fed to the TL945 MPEG-2 Transport. There the signal is processed and sent to the PSI and then to the light engine.

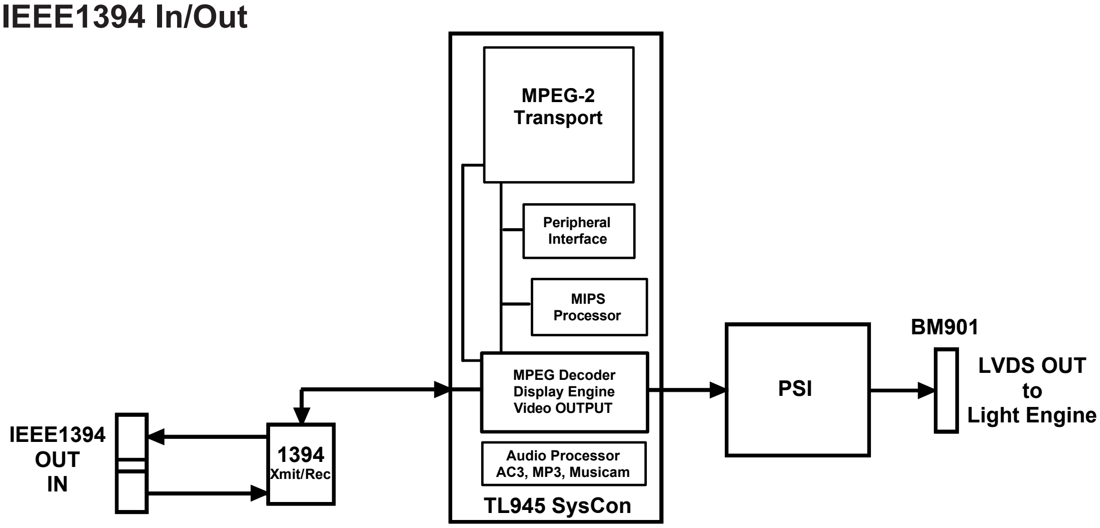
HDMI Input



HDMIVideo Block

HDMI enters the DM3 at BJ101 and is sent to the HDMI processor. The output of the HDMI processor is 16 Bit YCrCb. This signal bypasses the MPEG-2 Transport of TL945 and is sent directly to the MPEG Decoder. From there it is sent to the PSI and then the light engine.

IEEE1394 In/Out

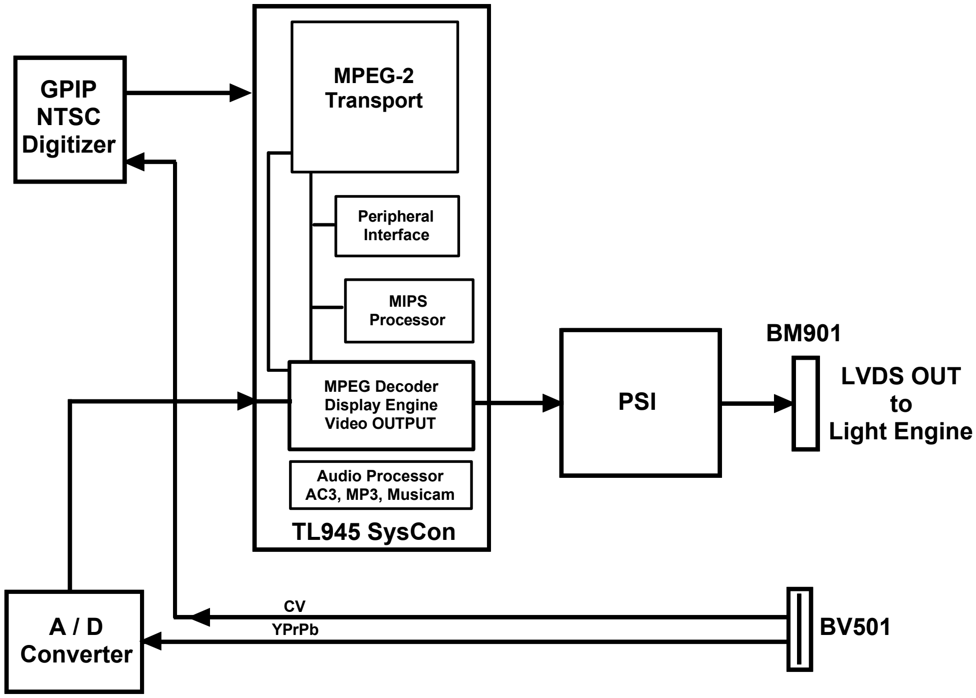


IEEE1394 Video Block

The IEEE1394 handles both input and output. The 1394 Xmit/Rec processes the digital signal and sends it to the MPEG decoder of TL945. From there it is sent to the PSI and then to the light engine.

Output of the IEEE1394 comes from the MPEG decoder section of TL945. The IEEE-1394 connections support output of digital source (Terrestrial ATSC and digital cable [QAM]). Only content that is in-the-clear will be available for IEEE1394 output.

Composite Video (CV) and YPrPb Input



Composite Video and YPrPb Block

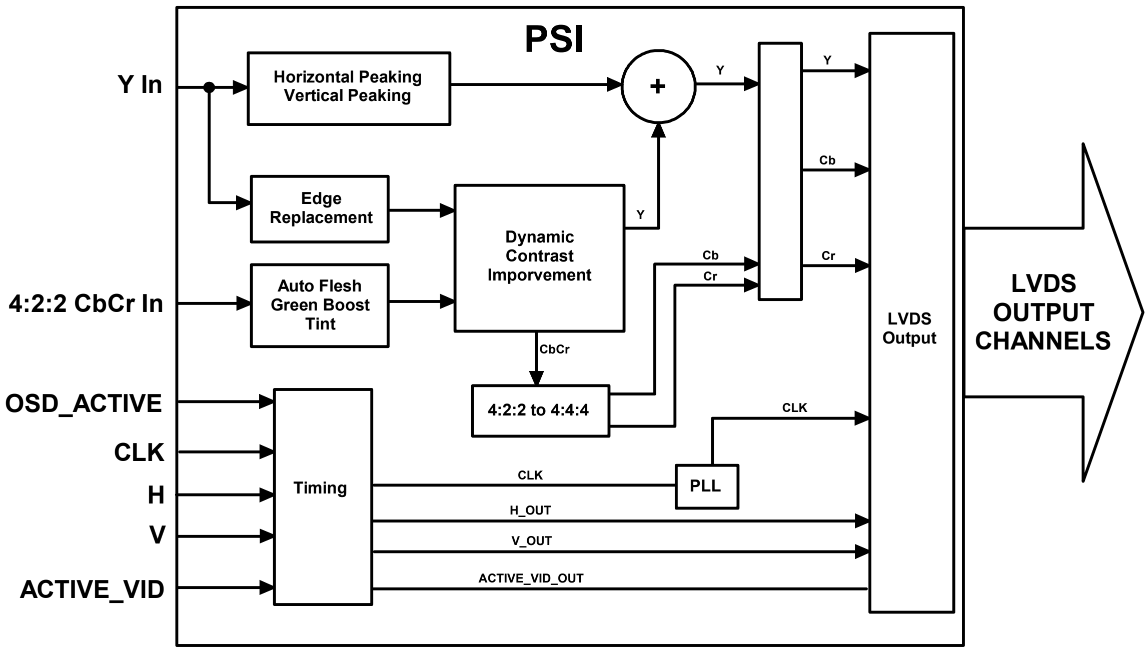
Because Composite Video (CV) is NTSC, it needs to be converted and digitized. The GPIP NTSC Digitizer performs this function for CV. From there it is sent to the TL945 MPEG-2 Transport and then to the PSI for output to the light engine.

The YPrPb is sent to an Analog to Digital converter and then sent to the TL945. This digital signal is sent to the MPEG decoder section of TL945 and then output to the PSI. From there it is sent to the light engine.

The triple HD A/D converter will accept analog luma, color difference (YPrPb), and sync signals (H/V) from the AVIO board that are at scan rates of 480p or higher and digitize them for processing in the Teralogic IC. The output is configured as a 16-bit bus, with 8 bits dedicated to the luma signal and 8 bits dedicated to the alternating Pr/Pb signals. It will also produce horizontal and vertical signals of its own (either from the separate syncs or from the Y input signal), as well as an output clock.

PSI Picture Signal Improvement

The PSI provides picture signal improvement (PSI) functions for video processed by the DM3 module. The video functions provided by the PSI include horizontal and vertical peaking, edge replacement, dynamic contrast improvement, auto-flesh, green boost, tint, and saturation. The figure below shows the major functional blocks and I/O signals.



PSI Block

The IC accepts 8-bit luma (Y) data and multiplexed 8-bit CbCr data (4:2:2). The IC output is 4:4:4 9-bit luma and 8-bit Cb and Cr data presented as part of 4 LVDS channels. Data at either interface can be signed/two's complement or unsigned/offset binary. All input signals are sampled on the rising edge of CLK. Controls are provided to accept positive or negative polarity OSD_ACTIVE, H, V, and ACTIVE_VID input signals.

Peaking

The horizontal peaking block filters the high frequency components of the luma signal, applies adjustable gain and adds the result back to the original luma signal. This results in an increase in picture sharpness. The amount of gain to apply and the center frequency of the peaked signal is selectable by I^2C registers. The peaking center frequency can be shifted so that it is appropriate for the frequency content of the incoming source video. A coring function with a programmable level control is also included to attenuate the peaking of high-frequency low-level noise.

The vertical peaking operates in a similar manner to increase the sharpness of vertical contours. A separate gain and coring control is available for the vertical peaking circuit.

Edge Replacement

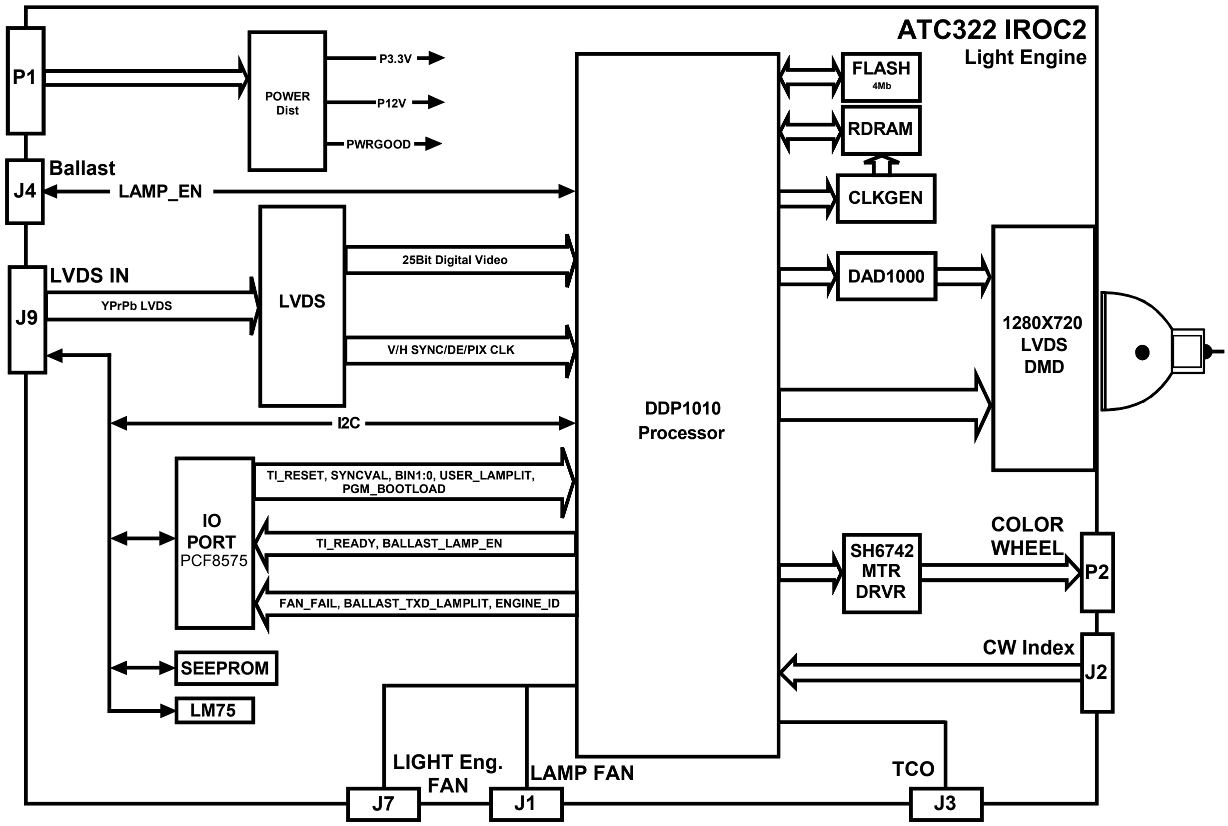
The purpose of edge replacement is to increase picture sharpness by reducing the rise and fall times at luma transitions in the horizontal dimension. The edge replacement circuit used does this without introducing unwanted overshoots and undershoots. The edge replacement function operates on lower spatial frequencies than those enhanced by the peaking block.

User controls are provided to select the frequency range affected by the edge replacement algorithm and for controlling the gain of the edge replacement function.

Dynamic Contrast Improvement

The Dynamic Contrast Improvement function attempts to make efficient use of the display-device dynamic range based on the picture content to increase picture contrast. Dynamic Contrast Improvement, or DCI, analyzes the video frame by frame and adjusts a dual-segment transfer function to maintain the best picture contrast. Each incoming frame is analyzed for average brightness, dark sample distribution, and peak value. These measurements are used to adaptively control the shape of a dual-segment luma transfer function.

ATC322 Light Engine Interface



ATC322 Light Engine Block

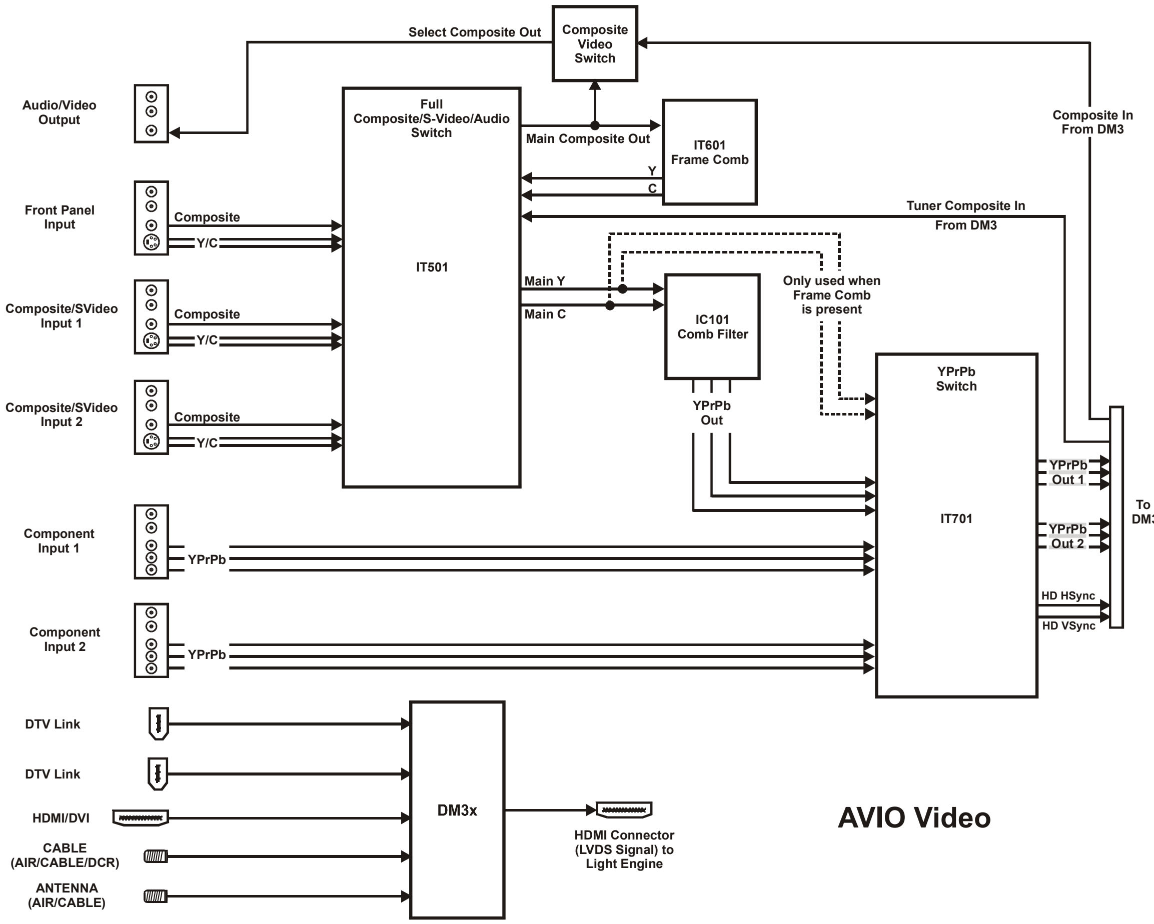
The DDP1010 is at the heart of the Light Engine system. This IC provides video processing including de-gamma, contrast and brightness control. DMD data formatting including sequential color frame buffering and PWM bit sequencing are also done by the DDP1010. Other non-video related are color wheel timing control, lamp maintenance, and fan control.

Video is applied to the driver board via a LVDS serial stream consisting of 5 differential pairs (one clock pair and 4 data pairs). The electronics are controlled via an I2C serial port. A separate UART channel is also used to communicate to the lamp ballast that is used to monitor lamp performance.

After processing by the DDP1010, the digital data is sent to the DMD.

Audio/Vidio Input/Output (AVIO)

The AVIO board for the ATC322/323 has been redesigned to also include the audio outputs. Previously there were separate audio and video input boards. The AVIO handles all analog Video and Audio input switching.



AVIO Video Switching

The main differences from the ATC311 Audio and Video boardset are:

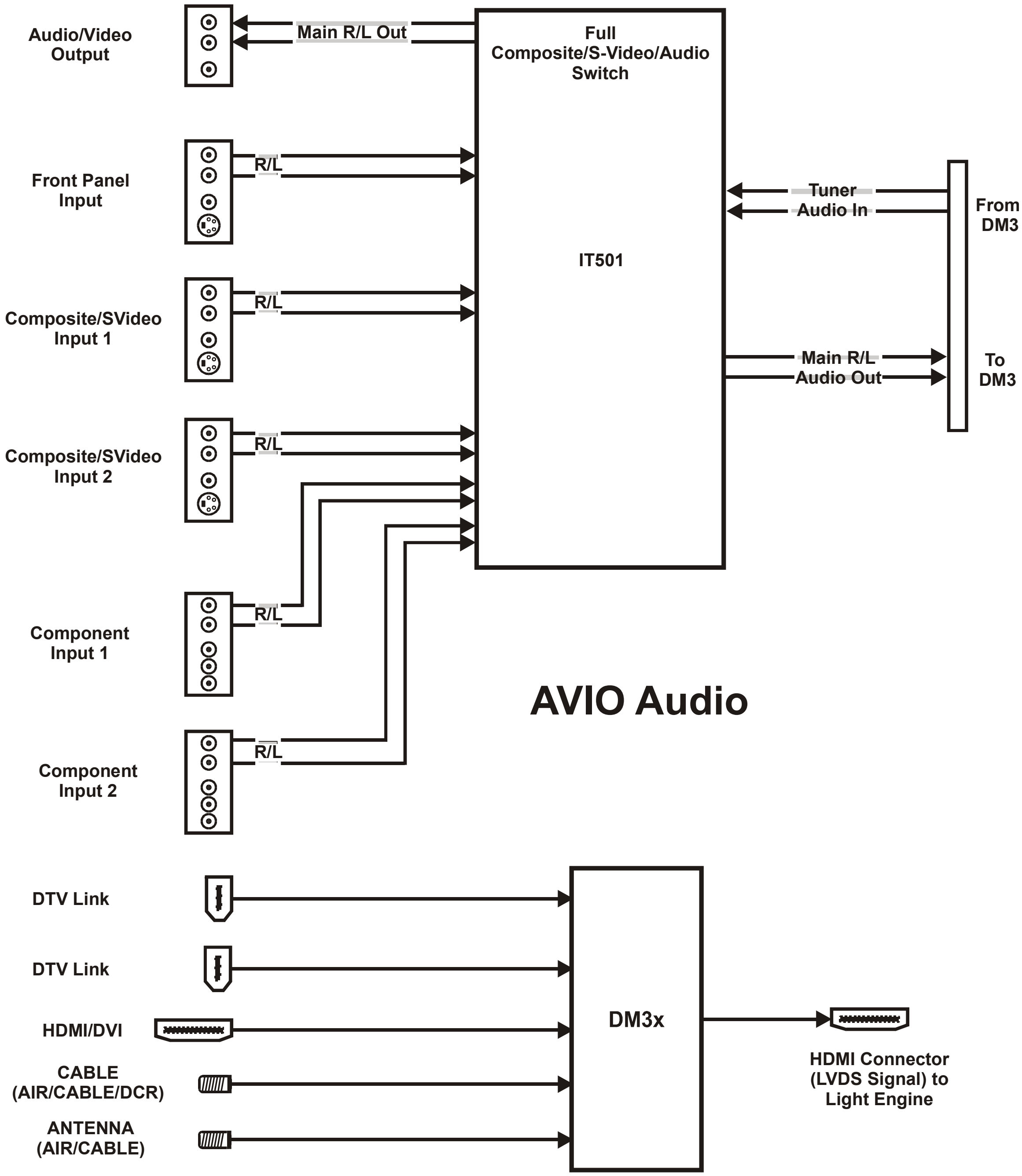
- Common-mode chokes have been removed and replaced by 0 ohm resistor packs.
- Option for a chroma decoder onboard.
- New frame comb IC set.
- New component video switch, sync counter and sync separator.
  - All analog signals now pass through this switch.
  - Output video goes to both main and PIP channels
- On board EEPROM to store chroma decoder alignments and luminance gain offset values.
- HDMI (formerly DVI) connector removed from AVIO and placed on DM3.
- DTV Link routed directly to DM3.

Interlaced Analog Video

All 480i signals with modulated chroma (Baseband, S-Video), including the tuner composite input from the DM3, are input to IT501. There are two possible comb filters depending upon the model. If a frame comb filter is present all baseband video is routed to it where the video and chroma are separated and routed back to IT501. From there the selected Y/C signals are routed directly to the main video switch, IT701. The Y/C signals then go to the G-PIP IC on the DM3 where they are digitized and upconverted for display.

If no frame comb is present the composite video (or Y/C) signal goes directly to IC101. Composite signals are first combed, then converted to YPrPb. Y/C signals are converted to YPrPb. These YPrPb signals then go to the main video switch IT701. If a frame comb is present all baseband video remains Y/C, otherwise all output from the AVIO is YPrPb.

All component (YPrPb) inputs, whether interlaced or progressive are routed directly to the output IC, IT701. The IC counts the frequency and separates the horizontal and vertical sync for output to the DM3 along with the YPrPb signals.

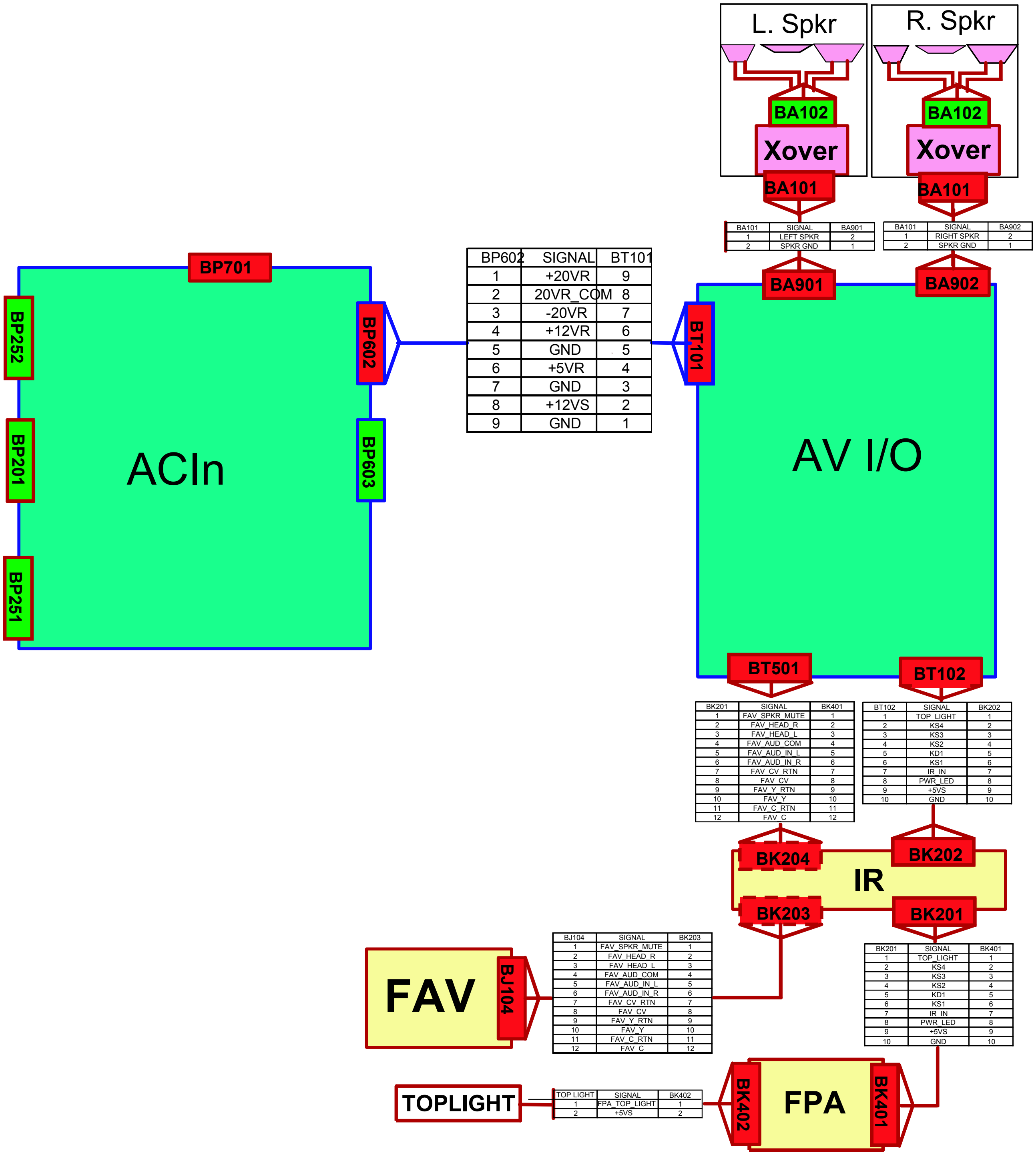


AVIO Audio Switching

Audio Switching

Audio switching is done by IT501, the input video switch. All analog audio inputs, (including tuner audio from the DM3), are routed to IT501 and switched in tandem with their corresponding video inputs. No audio processing is done on the AVIO board.

The selected two channel analog audio is output to the DM3 where it is digitized and processed according the information in the individual channels.



BA101	SIGNAL	BA901
1	LEFT SPKR	2
2	SPKR GND	1

BA101	SIGNAL	BA902
1	RIGHT SPKR	2
2	SPKR GND	1

BP602	SIGNAL	BT101
1	+20VR	9
2	20VR_COM	8
3	-20VR	7
4	+12VR	6
5	GND	5
6	+5VR	4
7	GND	3
8	+12VS	2
9	GND	1

BK201	SIGNAL	BK401
1	FAV_SPKR_MUTE	1
2	FAV_HEAD_R	2
3	FAV_HEAD_L	3
4	FAV_AUD_COM	4
5	FAV_AUD_IN_L	5
6	FAV_AUD_IN_R	6
7	FAV_CV_RTN	7
8	FAV_CV	8
9	FAV_Y_RTN	9
10	FAV_Y	10
11	FAV_C_RTN	11
12	FAV_C	12

BT102	SIGNAL	BK202
1	TOP_LIGHT	1
2	KS4	2
3	KS3	3
4	KS2	4
5	KD1	5
6	KS1	6
7	IR_IN	7
8	PWR_LED	8
9	+5VS	9
10	GND	10

BJ104	SIGNAL	BK203
1	FAV_SPKR_MUTE	1
2	FAV_HEAD_R	2
3	FAV_HEAD_L	3
4	FAV_AUD_COM	4
5	FAV_AUD_IN_L	5
6	FAV_AUD_IN_R	6
7	FAV_CV_RTN	7
8	FAV_CV	8
9	FAV_Y_RTN	9
10	FAV_Y	10
11	FAV_C_RTN	11
12	FAV_C	12

BK201	SIGNAL	BK401
1	TOP_LIGHT	1
2	KS4	2
3	KS3	3
4	KS2	4
5	KD1	5
6	KS1	6
7	IR_IN	7
8	PWR_LED	8
9	+5VS	9
10	GND	10

TOP LIGHT	SIGNAL	BK402
1	FPA_TOP_LIGHT	1
2	+5VS	2

AVIO Interconnects

Power and FPA

All FPA commands to the DM3 must be routed through the AVIO board although there is no processing done on the board. It is simply used as a convenient passthrough for FPA signals and the IR receiver.

The power supply connections are shown in the diagram. If the AVIO board is suspected during troubleshooting first verify all power to BT101 is present and correct.

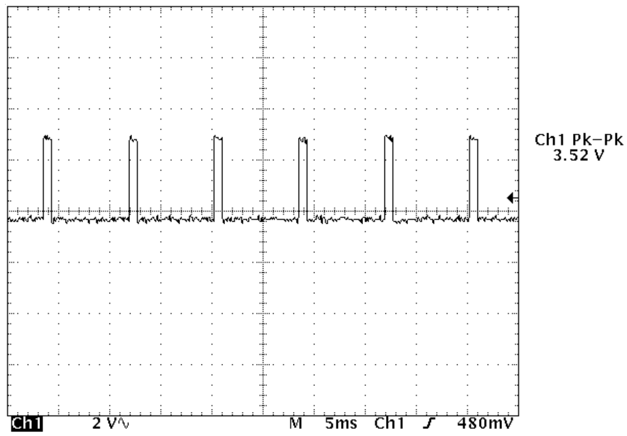
Start-UP Sequence of ATC322 / 323

When AC is first applied to the set the DM3 module will go through a boot routine. This routine takes approximately 45 seconds to complete. After the DM3 completes the boot routine, it is ready to accept commands from the remote IR or front panel keypad.

During the boot routine the DM3 is initializing the processing and switching circuits internal of the DM3. No external devices are accessed during this boot routine. If any of the internal circuits fail to initialize, the DM3 will lock up and remain in a boot state (locked up). A locked DM3 is indicated by the power LED remaining lit after the normal boot cycle time of approximately 45 seconds.

After the boot routine completes and the DM3 is ready to accept user commands, via the remote IR or front panel keypad, the set is ready to be turned on. It is during this on time (power **ON** command) that the DM3 accesses the external clock and data lines for the Light Engine. Light engine initialization takes about 20 seconds. Once the Light Engine is initialized, the DM3 will access the AVIO CBA and initialize it. The chart below shows the order of startup.

Time	Seconds (App)	Description	Notes
T0	--	Power Led On and Run_Enable pin 2 BP103 or pin 13 BP603 goes high	Power switch has been pressed.
T1	1-2	Ping Key I2C Devices for Acknowledgement	Failure to ACK DM3 enters Stand Alone Mode (Reboot required to Exit Stand Alone Mode.)
T2	3-4	Light Engine Resets. DM3 tells Light Engine to start boot routine.	Failure to start results in DM3 entering Stand Alone Mode.
T3	7	Light Engine Processor starts Color wheel	7 seconds after power switch is pushed. Whine is heard from Color Wheel.
T4	8-9	Color wheel stable CW Index has 3Vdc on pin 1 and pulses on pin 2.	Failure to become stable causes Light Engine to shutdown telling the DM3 to shutdown.
T5	10-12	Lamp Ballast Start-up (Light Engine sets Lamp Enable pin high.) Pin 4 J4 or BT251 Pin 4.	Failure of Ballast supply results in Error Code being logged and set shuts down.
T6	13-15	Lamp is Struck (Lamp Lit pin 1 J4 or BT251 pin 1 = 0Vdc)	Different ballast supplies have different start times.
T7	15-18	Lamp Lights and stays lit	If lamp fails to light pin 1 J4 or BT251 pin 1 = +4.9Vdc
T8	18-19	Light Engine is ready to accept further I2C commands	
T9	20	DM3 sends commands to setup Light Engine for video display.	Video is sent for display by the DMD device.



Color Wheel Index Pulses

There are several key things to watch and listen for during the startup sequence. For example:

- When AC power is first applied, the relay (SP251) on the ACIN CBA will “click”. This indicates the +12Vs is working.
- The DM3 keeps the power LED lit during the boot routine. If the power LED remains lit for more than 45 sec. or starts to flash there is a problem.
- After the 45 seconds it takes for the DM3 to boot up the power led will extinguish and remain out until a power on command is sent to the DM3 via the remote IR or front panel keypad.
- No power LED, when AC is first applied to the set, indicates a problem with the DM3 or ACIN CBA.
- After a successful DM3 boot up, if you press the power switch and power LED remains on but Light Engine does not start, this indicates the DM3 entered the Stand Alone mode (see System Control and I2C Bus Communication).
- Power LED Flashing indicates an error occurred during start-up. Check error codes for logged problem(s).

Lamp Power Off

NOTE: All Times are approximate

Lamp power off has 3 modes. The first is the blue screen fade out where after the user presses the Power OFF key, a blue screen comes up and then this screen starts to fade out over a period of time normally 20 seconds. The second mode is the lamp cool down period where the lamp in the Light Engine cannot be turned on for a period of time, normally 15 seconds, to give the lamp a chance to cool down before it is restarted. The third mode is the time the lamp fan runs after the other two modes. This is needed to keep the lamp temperature from getting too hot after the lamp has been turned off (normally 2 minutes).

Blue Screen Fade: Whenever the unit is powered off, video is immediately 'blanked' but the lamp remains on. A 20 second timer is activated. This is done in case the customer accidentally turned off the unit or has changed their mind. If power on is pressed before the 20 sec timer runs out, video is immediately un-blanked.

Lamp Cool-Down: After the standby timer expires (20 secs), the lamp is turned off & enters the Cool-Down mode. When the lamp is turned off a 30 sec timer is started that prevents the instrument from being turned on until cool-down timer has expired. After 30 secs, the unit can be powered up again. If the Power On is pressed before the 30 sec cool down timer has expired, the Power LED will light and remain lit until the lamp is ready for re-strike. It's important to realize that this is normal and is done to protect the lamp. After the 30 sec cool down timer expires the unit will start normally. A two minute timer, that keeps the fans running to cool the lamp, starts after the 30 sec cool down timer has expired.

DLP Lamp Characteristics "Check Lamp"

When the lamp is no longer pulling current or burned out, the POWER LED will blink 5 times every 20 seconds. This is to indicate to the user it is time to replace the lamp. The "check lamp" process will continue for 5 minutes.

When the TV is turned off the "check lamp" process will stop. However, if the consumer tries to turn the TV on again then the "check lamp" process starts over.

Close Lamp Door / Dead Lamp Power Supply Indication

If the lamp-access door is left open or if the lamp power supply has failed, the "check lamp" process is started. Because of this, the "check lamp" process indicates the possibility of three types of failures. These failures are:

- Lamp Defective
- Lamp Door Open
- Lamp Power Supply Defective

When servicing a DLP that indicates the "Check Lamp" process (flashing LED 5 times), do not assume it is the lamp. Check the door switch and lamp power supply for proper operation before replacing the lamp.

Troubleshooting

With the exception of the ACIN Power Supply, the ATC32x lends itself to a module replacement strategy. The other sections; DM3, AVIO, Lamp, Lamp Ballast Supply, Light Engine, and FPA are contained on replaceable PCB modules.

The following troubleshooting trees enable technicians to narrow down defective instruments to the module level. Every attempt has been made to keep troubleshooting requirements to a minimum. In most cases a technician can narrow down troubleshooting by observing and listening to instrument operation. In many others, only a DVM is required. In a few, an oscilloscope or a video monitor may be needed.

There are two terms that will be used frequently: Boot Up Sequence and Start Up Sequence. They are two very different functions and must be understood for the following troubleshooting instructions to be usefull.

Boot Up Sequence

When AC is first applied to the chassis, the DM3 must initialize itself much the way a desktop computer does. All low level drivers required to provide minimal maintenance operation along with all drivers required for the DM3 to respond to front panel keypresses or remote control IR commands must be loaded and the operating system must stabilize.

On occasion some of these drivers may become corrupt or conditions may change that require a reboot of the system. The following instructions detail the boot and reboot process. Anytime troubleshooting instructions request a reboot, the following instructions may be used.

1. Remove AC Power for < 15 seconds. (This step is deleted for initial startups.)
2. Apply AC Power
3. Power LED will light up.
4. After 20-30 Seconds, the Power LED will go out.
5. After another delay of 10-15 seconds the instrument is in full standby operation.

Start Up Sequence

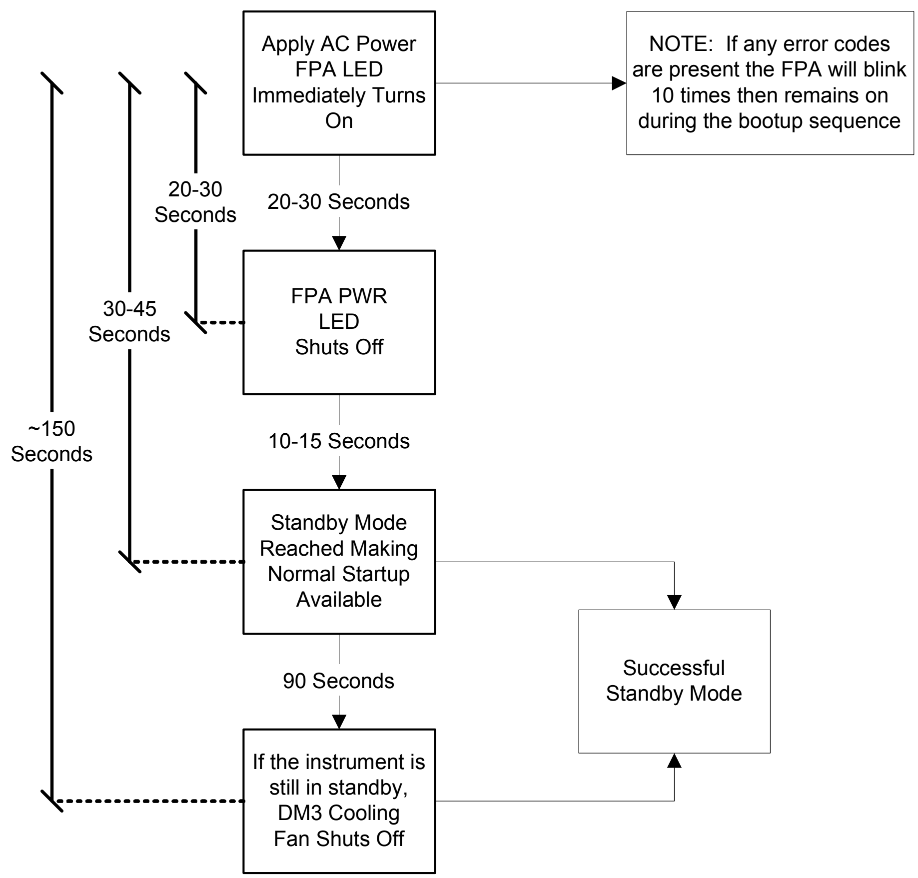
Once the DM3 has reached full standby the instrument may be started by pressing the Power Button on the FPA or a Compatible Remote Control. The start up sequence now initializes all hardware and loads all software required for full operation. From the moment the Power Button tells the DM3 to startup the instrument, to the time when video is present takes about 20 seconds.

NOTE: During troubleshooting when the rear panel is removed the door safety switch must be defeated for instrument operation. Simply short the door switch leads together with an alligator clip (BP251 located on the rear apron directly under the lamp assembly).

Boot up Sequence (AC Applied to Full Standby)

The following process flow chart details what happens during a ***normal*** boot up sequence of the DM3 instrument. It typically takes the DM3 about 30 seconds after removal of AC to reach a point where a complete reboot is possible.

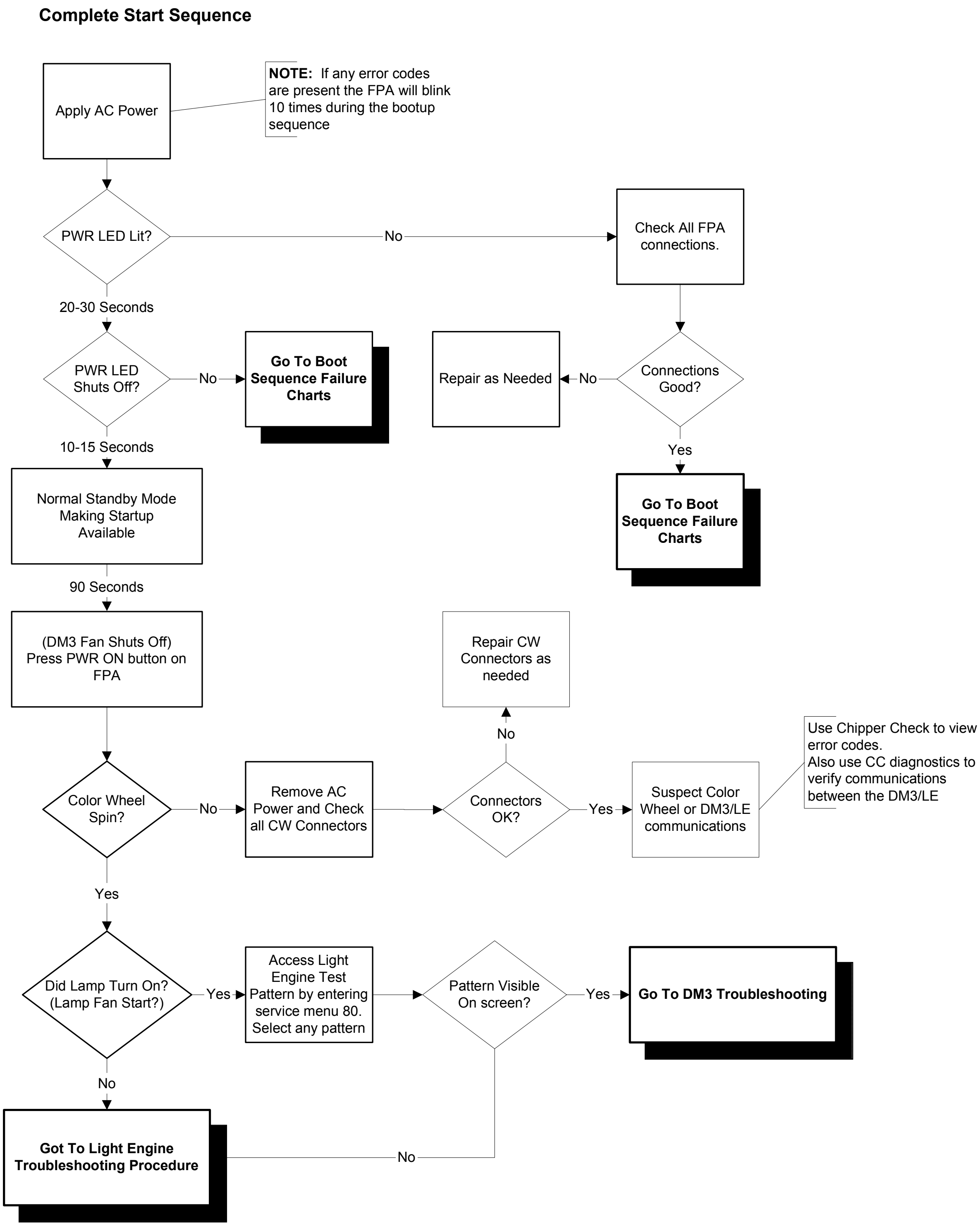
Normal Bootup Sequence



The important point in the successful boot sequence is that some things may be eliminated from suspicion during troubleshooting efforts. If the DM3 gets this far, it may assumed one of the components or modules external to the DM3 may be keeping the instrument from starting up or displaying video or menu. It also means that more than likely the +3.3V and +12V supplies from the ACIN board are good.

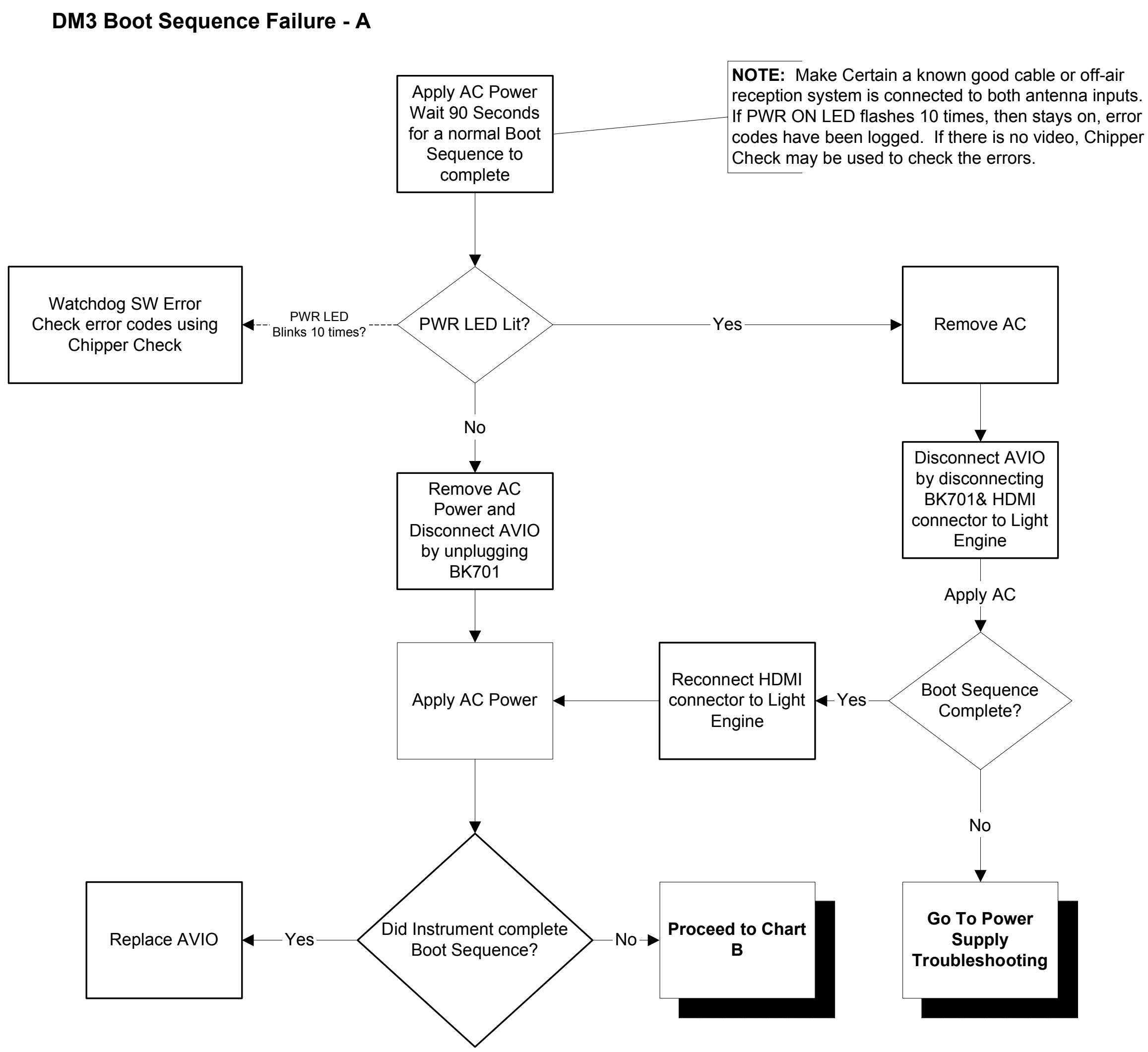
Complete Startup Sequence

The following troubleshooting chart may be used to identify which section or which sequence (boot up or start up)of the ATC322/323 could be defective. For easier troubleshooting always connect a standard CATV/MATV or off-air signal to each antenna input and have available an assortment of baseband video input signals to fully exercise all inputs.



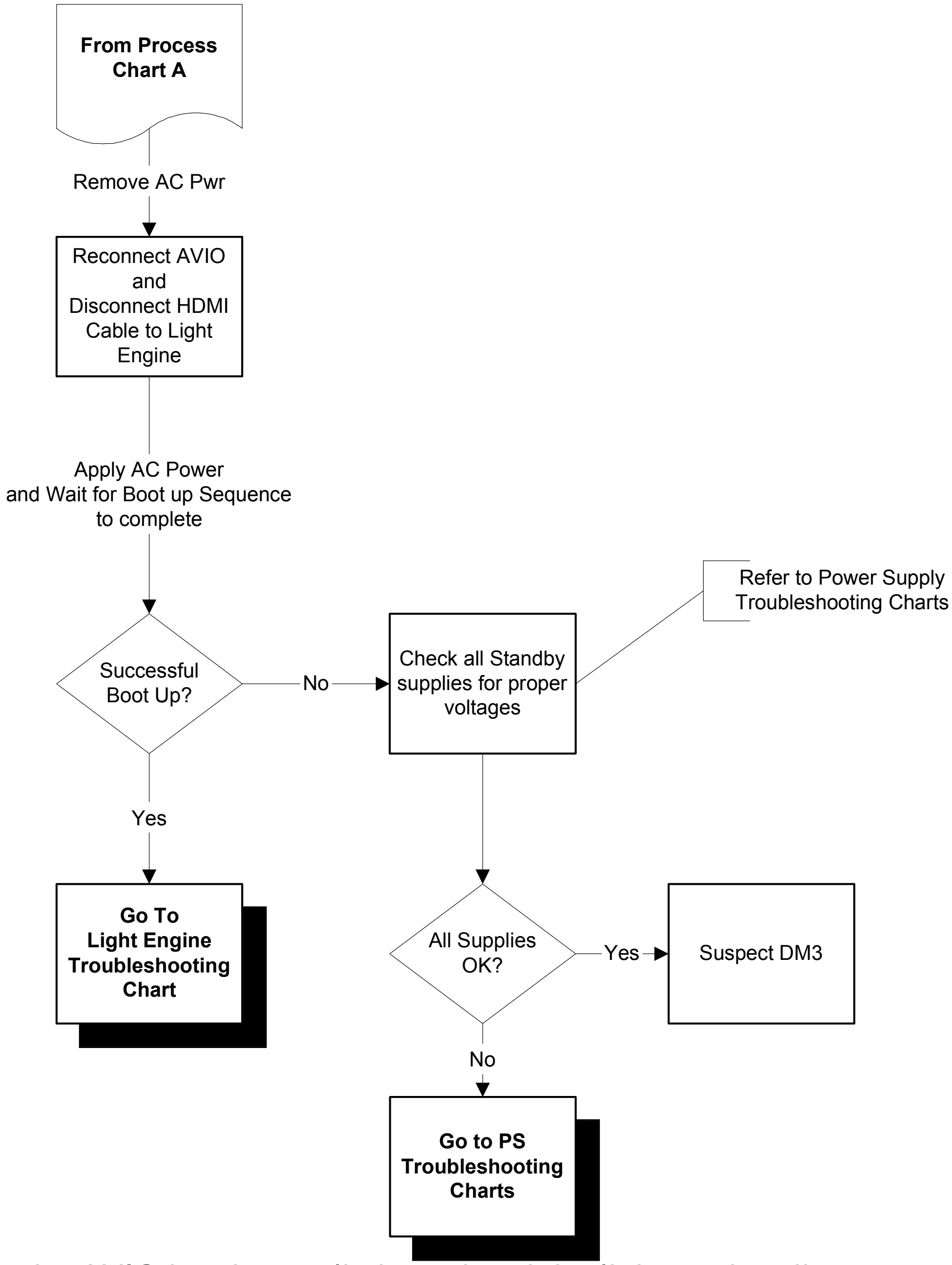
Boot Sequence Failure

The following process chart details what happens during a boot up sequence of the DM3 instrument when it fails to reach full standby mode.



At this point the AVIO and Light Engine have either been eliminated from suspicion or confirmed as the direct problem although the light engine or components of that system could still be an issue. If problems are still apparent continue to the next chart.

Boot Sequence Failure - B

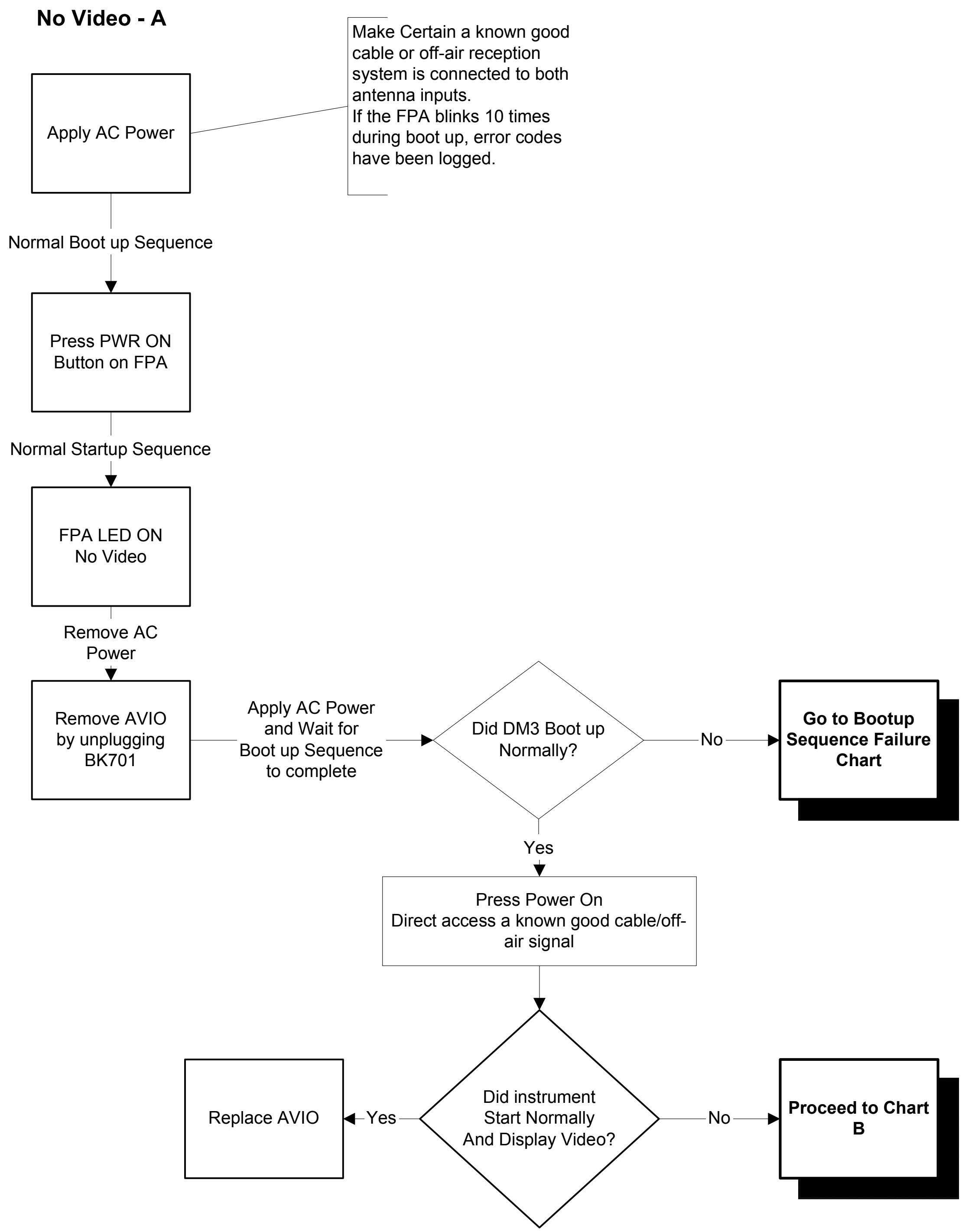


Since the AVIO has been eliminated and the light engine disconnected, if a normal boot up occurs it now points toward the light producing components. The light engine has a boot process of its own however there is little way to determine if its even attempting that process except for the momentary spin of the color wheel shorly after the PWR ON button is pressed. But that requires a successful boot sequence.

In this case if Boot Up has still not occured the next step is to confirm that all standby voltages and supplies are OK. If they are, the DM3 is the most likely source of problems. If they are not, consult the power supply troubleshooting charts.

Standby Mode Available (Successful Boot Sequence), No Video

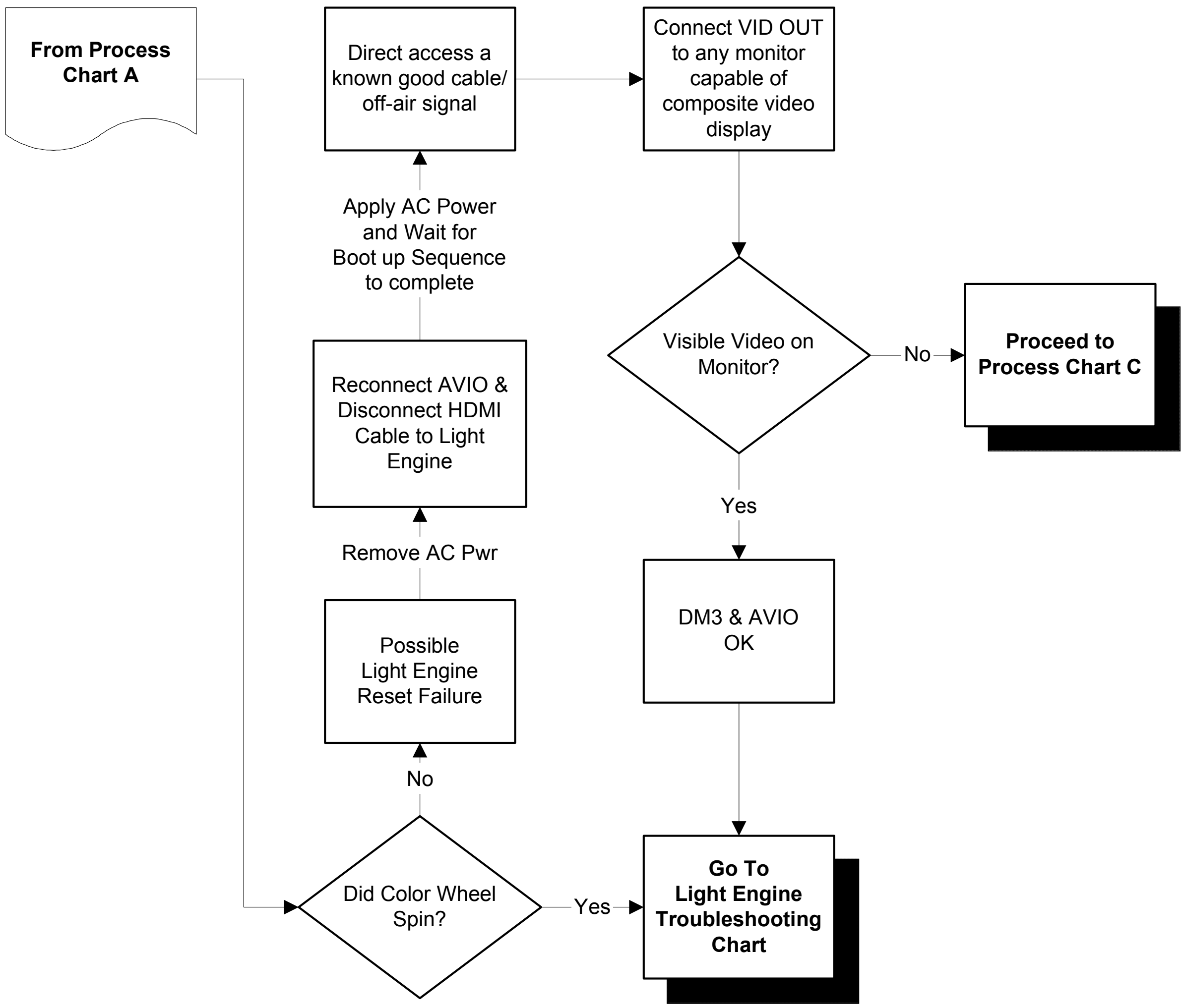
The following process chart details troubleshooting steps after what appears to be a normal boot up sequence of the DM3 instrument yet the instrument fails to start when the PWR ON button is pressed.



In the case where the power button appears to be active but no video is available the first thing to determine is whether the boot process was successful. The procedure is very similar to troubleshooting the boot process. The first step is to eliminate the AVIO.

The important point to remember is the DM3 can produce normal video without the AVIO as long as it is using the tuners for signal reception. All other inputs flow through the AVIO.

No Video - B

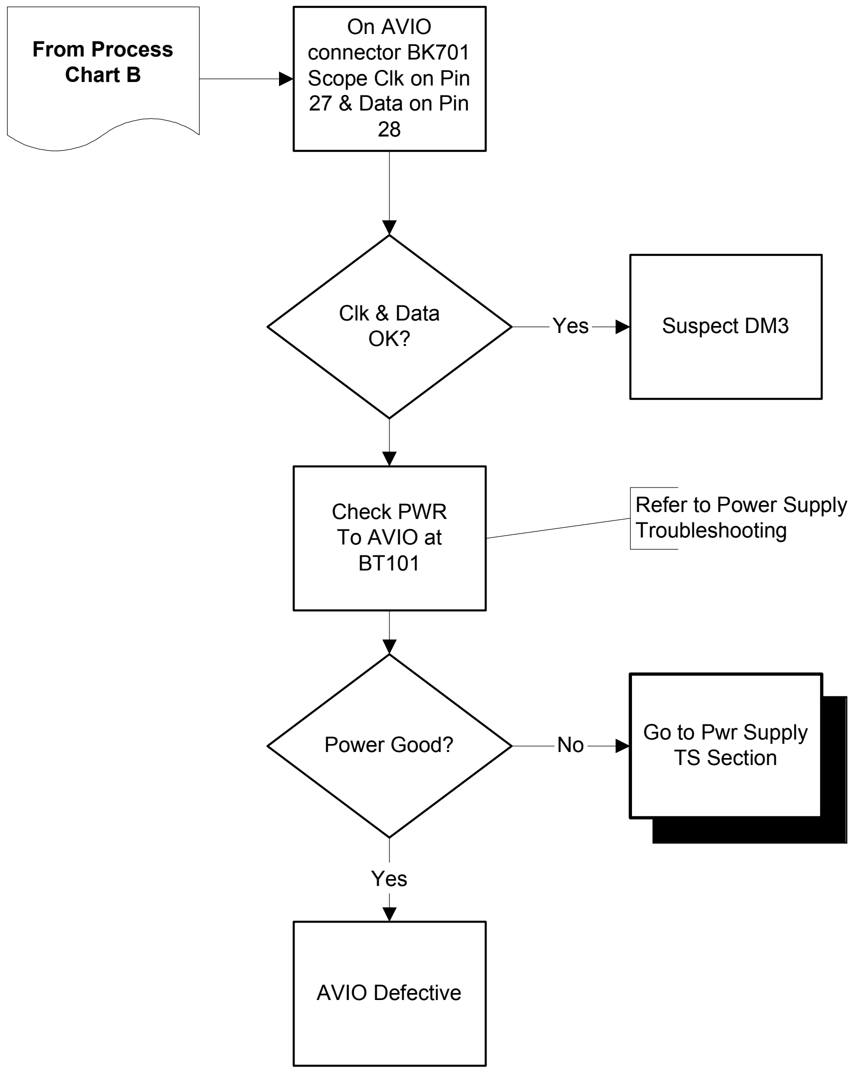


If the color wheel spins it indicates the light engine controller is alive and that many of the run supplies from the ACIN are OK. That would lead directly to the light engine as the problem.

If the color wheel did not spin it indicates the light engine is in reset failure which could also be stopping the successful startup of the DM3. To find out whether the light engine is failing or whether the DM3 is simply not putting out a video signal follow the instructions in this chart.

If the color wheel did not spin, and there is not a video monitor capable of displaying the video output of the DM3 available, skip this chart and go directly to Chart C.

No Video - C



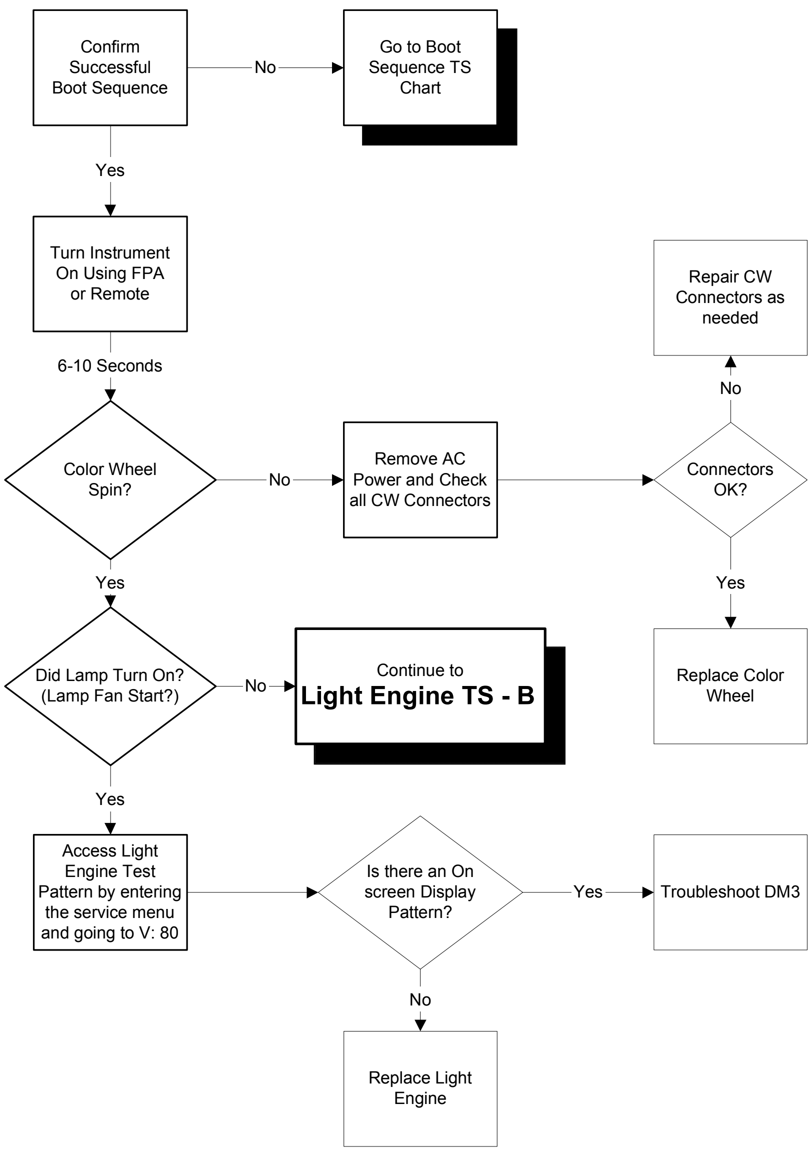
If the DM3 and light engine have both been successfully eliminated or there is no video monitor to confirm active video from the DM3, then troubleshooting points back to the AVIO again. First check clock and data at the AVIO connector BK701. These are typical IIC data and clock lines that will show standard 56KHz clock signal and random data waveforms if they are OK. If they are good that means the DM3 is generating proper control signals but the AVIO is not responding for some reason and must be replaced. If they are not good then power to the AVIO is probably not correct. If power is correct, then the AVIO is defective.

Troubleshooting the Light Engine/Lamp/Lamp Ballast Supply

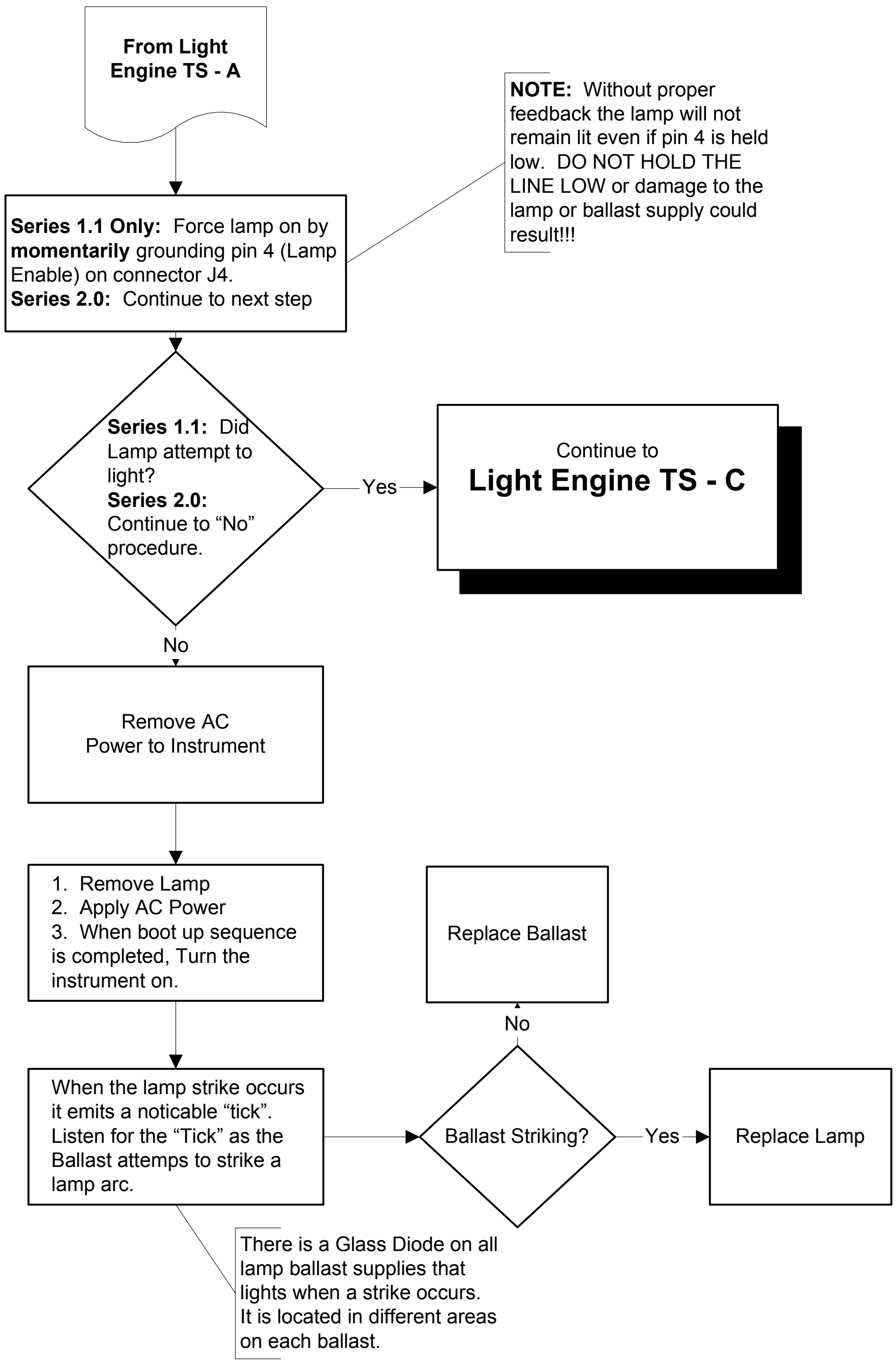
If any of the three light producing elements of the ATC322/323 fail there will be no video. As long as the DM3 is operational, a lamp failure will be shown by the PWR ON LED on the FPA. If the DM3 senses a defective lamp, the PWR ON LED will blink rapidly 5 times every 20 seconds. That indication is fairly accurate. It may be assumed the lamp ballast and light engine are operational and all that is required is a new lamp. The more difficult diagnosis is a light engine or lamp ballast problem. Once proper DM3 operation is confirmed the following troubleshooting process charts should help narrow down individual component failure.

Since the rear panel must be removed to take measurement and observe operation remember to short the "Lamp Door" safety switch, BP251 to allow the instrument to operate. Proper boot sequence operation is essential. Start by confirming it is occuring and the DM3 is in standby mode before proceeding. Use the following charts to identify the individual module that may be defective.

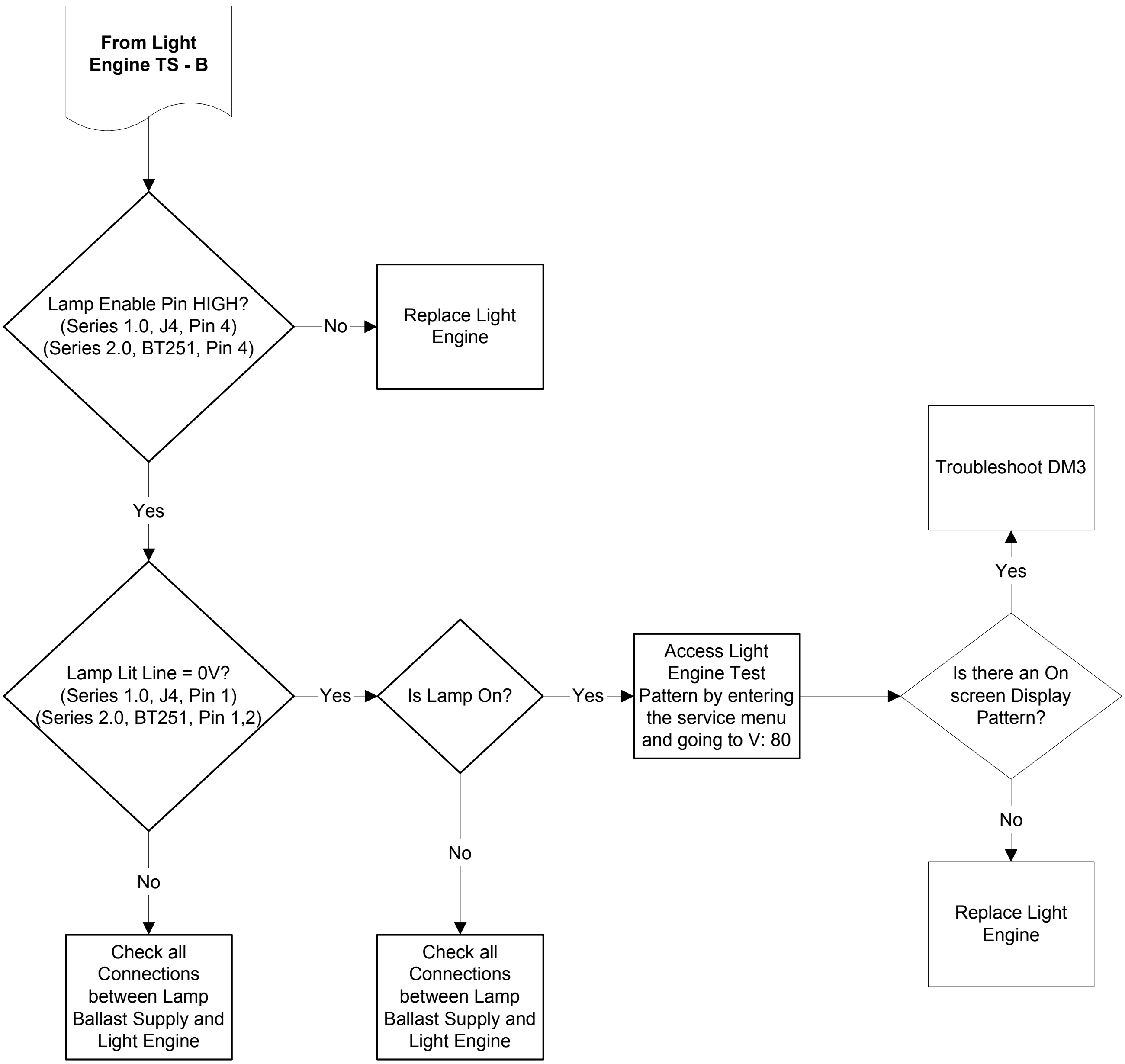
Light Engine TS - A



Light Engine TS - B



Light Engine TS - C



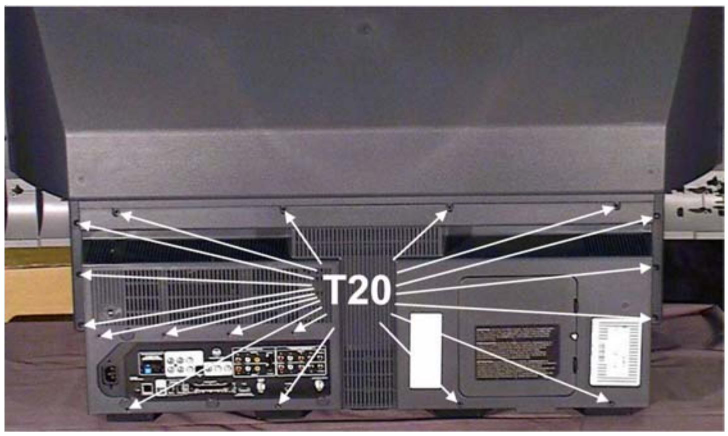
The troubleshooting trees are as generic as possible, applying to all versions of the ATC322/323 chassis. When troubleshooting the chassis it may be as important to understand what is occuring correctly as it is to know what is not occuring. Most troubleshooting may not require test equipment as long as there is a basic understanding of the circuit interaction.

ATC322 Service Positions

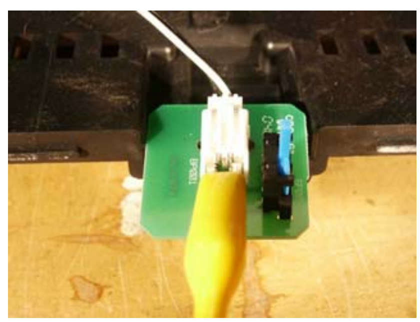
Chassis Tower Service Position

Start with removing the back cover by:

1. Remove AC power from the instrument.
2. Remove eighteen (18) T20 Torx head screws (see view below) to release the back cover. *The number and placement of screws may vary depending on the particular model.*
3. Slide Back Cover straight back to remove.



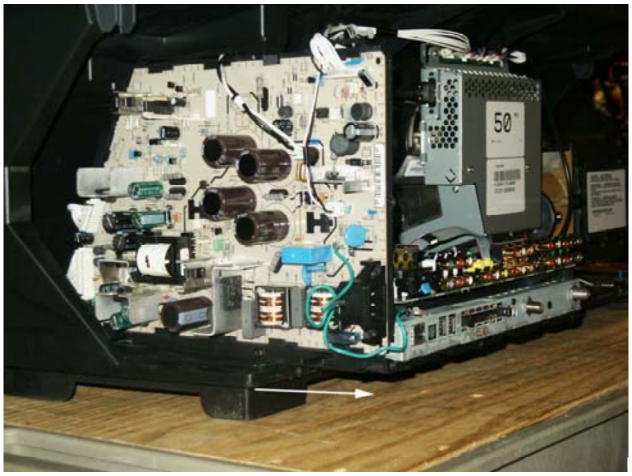
NOTE: *With the back off the "Safety Interlock Switch" will disable the supply voltage to the Lamp Power Supply preventing the Lamp from operating. To defeat the interlock switch during servicing short connector BP001 by placing an alligator clip across the pins.*



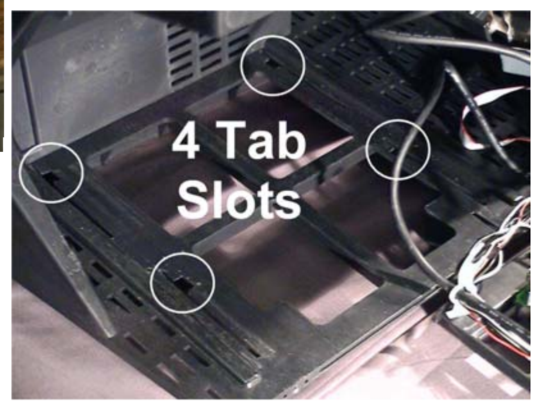
Remove the six (6) T20 and eight (8) T10 screws on the back of the Jack Panel Cover. (See photo below) This will expose the DM3 and AVIO CBA for access to these modules.

After all screws are removed from the Jack Panel apply pressure to separate it from the Chassis Tower. The overlay is stuck to the DM3 module with glue. Take extra care when removing the Jack Panel to avoid damaging the overlay.

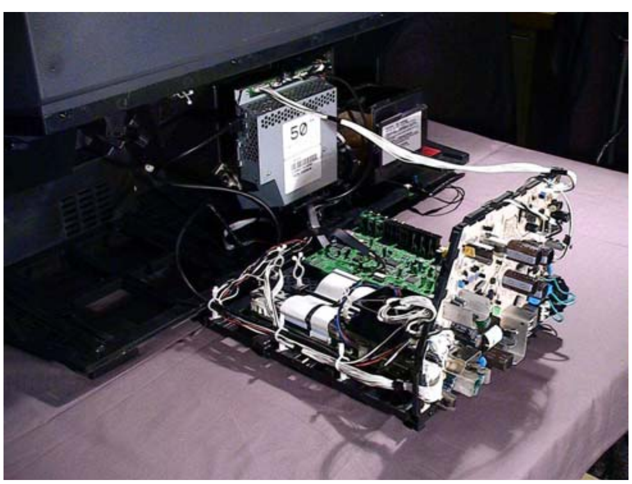
Once Chassis Tower is exposed, slide Chassis Tower toward you lifting slightly.

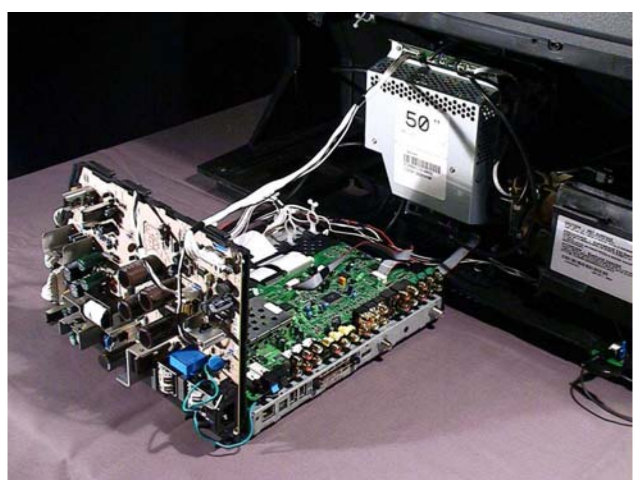


NOTE: Pulling Chassis Tower more then ½ inch will put it in the position shown on the left. The Chassis Tower will slide out about 4 inches but wont release from the cabinet.



By lifting slightly and pulling back on the Chassis Tower it will release from the cabinet tab slots. (Photo on the right) This will allow access to the connectors on the DM3 module and better access to the AVIO. See photos below.





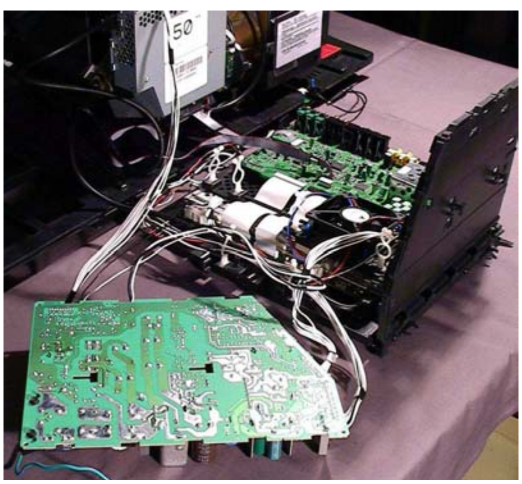
In this position the AVIO can be removed allowing access to the lower side.

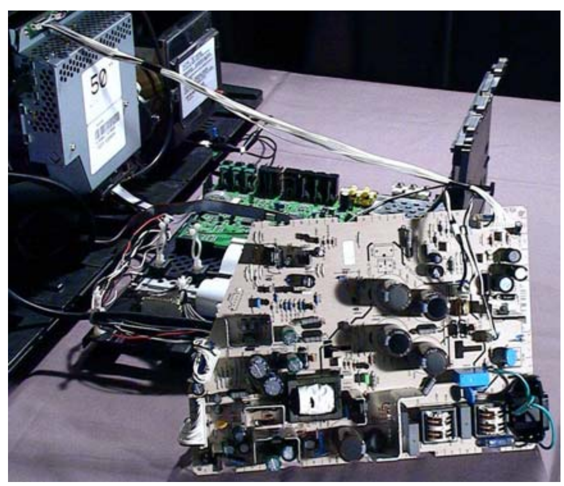
This is accomplished by:

1. Removing Lower Back Cover and Jack Panel Cover.
2. Disconnect cables from AVIO CBA.
3. Releasing the tabs, 2 on the left side, 1 on the right (see picture) securing AVIO CBA to the frame assembly
4. Lifting AVIO CBA out.

Reconnect all cables before servicing.

The ACIN CBA has service position as well. With the Chassis Tower in the service position above and remove the ACIN CBA, it can be placed as shown in the following photos for servicing.

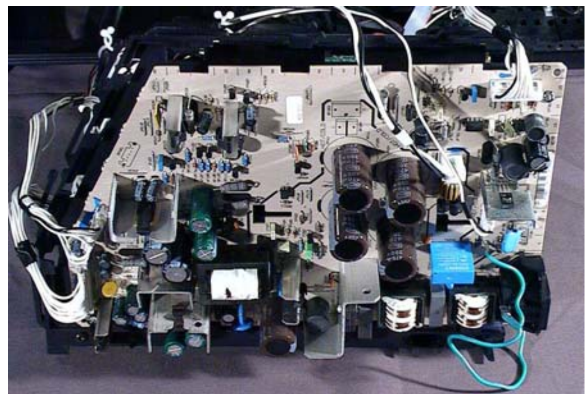




Follow these procedures for removing the ACIN CBA.

1. With the Chassis Tower in the service position, release all cables going to the ACIN CBA from their retainers.
2. Release the retaining clip on the top edge between locations GG and II and slide the ACIN CBA toward the rear of the Chassis Tower. Slide the ACIN CBA until the tabs on the frame assembly line up with slots on the ACIN CBA.

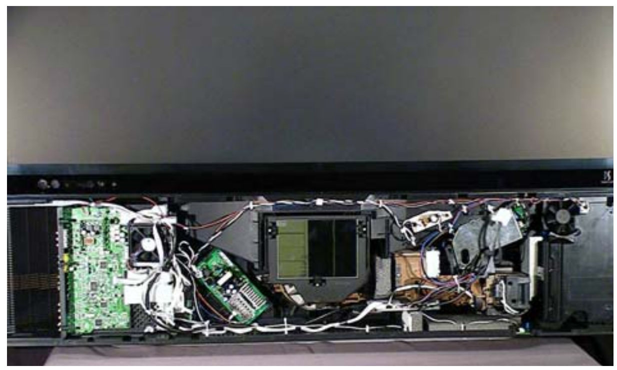
With the slots aligned with the tabs the ACIN CBA can be pulled away from the Chassis Tower frame top and lifted out of the bottom rail. See photo below.



ATC323 Service Positions

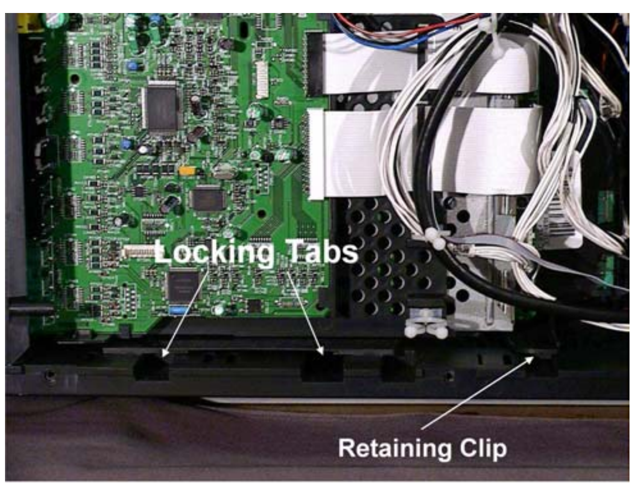
With the ATC323 chassis removal of the Chassis Tower is totally different from the ATC322. Because of the slim design of the ATC323, all servicing is done from the front of the instrument. To gain access to the Chassis Tower it is necessary to remove the front cover. Once removed access to the small mirror adjustment is all that is visible. An additional cover that holds the front cover in place needs to be removed to gain access to the Light Engine and Chassis Tower.

After the front cover is removed locate and remove nineteen (19) T-20 Torx head screws. These are located as shown in the photo below.



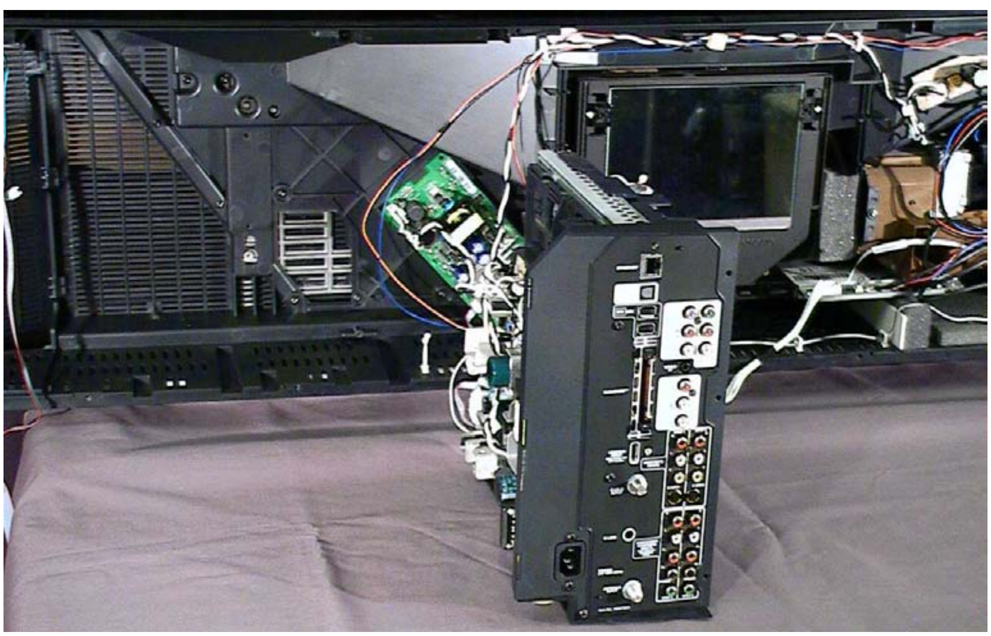
As shown by the photo to the right above, everything can be accessed from the front of the DLP set.

Removal of the Chassis Tower starts by removing one T-20 Torx head screw located in the lower right hand corner of the Chassis Tower assembly. With this screw removed, the whole assembly will slide to the right slightly and to the rear releasing the Chassis Tower from the cabinet. There is a retaining clip on the lower right that prevents movement when screw is removed. See photo below.



NOTE: The photo to the right shows the Chassis Tower release order. First lift up on the release clip and then slide the assembly to the right as shown. This will move the Chassis Tower to a position that allows removal from the cabinet.

Once the Chassis Tower is released from the cabinet it can be placed is several positions for servicing. (See photo below) To further disassemble the Chassis Tower refer to the ATC322 Chassis Tower disassembly procedures.



Service Alignments & Adjustments

All electrical adjustments and alignments are done digitially either through the front panel service mode or by Chipper Check software. System control upgrades are also possible using Chipper Check. Chipper Check will connect using the ethernet connection as in previous high end chassis designs or using an internal connection as with previous core line product.

Electronic Service Data for the ATC322/323 chassis will have the latest service adjustments and list all required test signals for performing those adjustments and alignments. This manual will be limited to defining the available and required adjustments and implementation. In all cases the latest version of Chipper Check and Electronic Service Data for the ATC322/323 chassis will contain the most current service alignments.

There are four main service menus, 1 Information, 2 Service Alignment, 3 IP Configuration and 4 Factory Defaults each with different functions. With the instrument on, the Service Menu is accessed by momentarily pressing Menu and Channel Down on the Front Panel Assembly. That brings up a hidden secondary menu with service menu access. The menu appears below:

Information, IP Configuration and Factory Defaults will be discussed later. Service Alignment is the main alignment and adjustment menu.

The Information Screen may be filled in by pressing OK on the remote control or Menu/OK on the FPA. The screen will fill with data from the various pieces of hardware and software components of the ATC32X. Some are valuable to troubleshooting efforts, many are not, existing for engineering purposes only.

Following are examples of the information available and brief explanations of what the data may mean.

Although this representation may be hard to see in print form, the layout will always be similar. The following table lists the same detail that appears on screen although not neccessarily in the same order. The list may change over time as new development techniques or engineering requirements change its usage.

When the Information screen is first displayed it will be blank. To fill out the screen press OK on remote control.

The most useful data at this time is the current software and bootloader code, designated "DM Bootloader" and " DM Application". Chipper Check will be able to provide any necessary updates to this software so it is important to know which software versions are being used.

Title	Description	Data Format	Use
DM Bootloader	Start up Software	B6.01	
DM Platform	Hardware revision	A6.01	
DM Application	Main OS	A6.01	
Guide	TVGuide+ (when available)	8.1.10	
1394	VL_WCE_Mar182004	IEEE Firewire Version	
Link Hardware	Link IC Firmware version	Currently not used	
Link Software	Link IC Software Version	Currently not used	
FPGA	FPGA IC Revision	32	Engineering use
Video Driver		T9-317.v395	Engineering use
DM Serial #		17749410272133	
DM EEPROM		14	
Module	DM module Version	DM3	
Instrument	Chassis Version	ATC323	
Deflection EEPROM	Not used on DLP	N/A	
Driver Flash		N/A	Engineering use
Driver EEPROM		N/A	Engineering use
PSP	Firmware version of PSP IC	2.9	Engineering use
HDMI	Firmware version of HDMI IC	1.12	Engineering use
PSI	Firmware version of PSI IC	4.5	Engineering use
AVHDD	Installed HD model	AVR10	Identifies any HD connected to the chassis
Lamp Type	Identifies the lamp type used in the chassis	A	

There are also several lamp types available for DLP instruments. Each lamp has its own power supply specifically designed for the construction and performance of the lamp. Exact replacement lamps must be used or damage will occur. The Lamp Type is available in the service menu, in the consumer menu (under "Preferences" and "Lamp Power"), and is on service stickers located on the Lamp door and on the Lamp Power Supply.

Currently there are two types of lamps. New types are under development and may be utilized in the future. The table identifies the two current types and provides the RCA-Parts order number for each.

Type	RCA-Parts #	
A	260962	
B	265103	

Service Alignments

Many of the service adjustments required for routine maintenance and instrument adjustments may be accessed from the front panel.

With the instrument on, the Service Menu is accessible by pressing Menu and Channel Down on the Front Panel Assembly while the ATC322/323 is ON. That brings up a secondary menu with instrument default and the service menu access. Select the "Service Menu" option and press OK on the remote or Menu/OK on the FPA.

That will bring up the traditional service menu appearing similar to:

P: 00 V: 00

Using the VOL UP button on a compatible remote or the FPA, increment the V:00 parameter to the desired service Menu. The following menus are available:

Security Location (V)	**Description**
50	Error Codes
76	Instrument Alignment
80	PTV Convergence **OR** DLP Centering
82	*Automatic Convergence Sensor Calibration (PTV Only)*
83	*Restore Convergence Data from Factory Reference (PTV Only)*
84	*Save Convergence Data to Factory Reference (PTV Only)*
196	Reset Shipping Defaults
200	Chipper Check

Note menus 82-84 are for PTV applications only. Once the desired security parameter is reached, press CH UP on the remote or FPA to enter the menu.

Error Codes

The error code list for the ATC322/323 is extensive and can be somewhat difficult to interpret. Menu 50 is the error code list and when first entered will display the first error code which will appear similar to:

0: 01-01-2005 12:00:00 Type=22 Count=07 b802011200000000

Error #	Date	Time	Type=	Count=	Code
0-9	MM-DD-YYYY	HH:MM:SS	Two Digit hex	Two digit hex	16 digit hex

The numeric data represented in the Type, Count and Code data is in hex format and is two digits. If there is no error code, the box will say "Empty". If there is an error code but no date or time, those values will appear as 0-0-0 and 0:00:00.

While being a little busy, the following charts must be understood to effectively use the error codes generated by the DM3. The chart is the main reference for any error codes noted.

Using the format above, the first two digits represent the "Type" in the chart below. On the screen the description that follows will closely follow the "Description" in the chart. The first several error codes will have no further explanation. For example if the error code reads:

8 5-27-2004 4:08:56 Type=08 Count=01 41 0 0 0 0 0 0 0, no further information is available. That might indicate the lamp on the light engine has failed to light in the allotted time one time. This type of error would be considered normal the the ATC322/323 chassis family as the lamp may not light the first time, every time.

Type (hex)	Description		Data ("Code") (hex) 0	1	2	3	4	5	6	7
1	Chassis (General)		0	0	0	0	0	0	0	0
3	Chassis Power	Initial Power Fault	10	Additional Data				0	0	0
		Other	14	Additional Data				0	0	0
		Invalid Handle	15	Additional Data				0	0	0
		Power Supply Fault	16	Additional Data				0	0	0
4	Power On Reset	POR	12	0	0	0	0	0	0	0
7	Back End Video	Algorithm Error	0	0	0	0	0	0	0	0
8	DLP	Driver Fan Fail	40							
		Lamp Fail	41							
		No Lamp Strike	42							
		No Lamp Lit	43							
		DDP1010 Reset	47							
		Color Wheel Blower	48							
		System Fan Fail	49							
21	IIC Read		Chip	Bus	Details	0	0	0	0	0
22	IIC Write		Chip	Bus	Details	0	0	0	0	0
23	IIC Bus Latched		Chip	Bus	0	0	0	0	0	0
31	App (General)									
32	Reset Count		SRV	ARC	EXC	SPF	APF	SWR	Reset Count	
41	Software Watchdog		Task ID(s) - See Type 41 Table							
42	Hardware Watchdog		Task ID(s) - See Type 42 Table							
51	Guide	Process Termination		Process Exit Code			0	0	0	0
61	Audio	Audio Exception	0	0	0	0	0	0	0	0
71	Other	Fan Max Speed	0	0	0	0	0	0	0	0
81	POD (CableCARD)	SCTE28*								
82	POD (CableCARD)	Bad Certs**								
83	POD (CableCARD)	Trans Timeout**								
84	POD (CableCARD)	FR Timeout**								
E1	DM Hardware Error									
E2	DM Hardware Error									

* Type 81 errors refer directly to the ANSI/SCET POD interface standard 28 2004

** Type 82-84 refer to onboard POD related errors.

Where it tends to get more complicated is in the IIC error codes where further information is available. Interpreting that information may sometimes be challenging.

For instance (ignoring the date and time stamp) consider an error code such as:

Type=22 Count=0b 3403010000000000

Type (hex)	Description		0	1	2	3	4	5	6	7
			Data ("Code") (hex)							
1	Chassis (General)		0	0	0	0	0	0	0	0
3	Chassis Power	Initial Power Fault	10	Additional Data				0	0	0
		Other	14	Additional Data				0	0	0
		Invalid Handle	15	Additional Data				0	0	0
		Power Supply Fault	16	Additional Data				0	0	0
4	Power On Reset	POR	12	0	0	0	0	0	0	0
7	Back End Video	Algorithm Error	0	0	0	0	0	0	0	0
8	DLP	Driver Fan Fail	40							
		Lamp Fail	41							
		No Lamp Strike	42							
		No Lamp Lit	43							
		DDP1010 Reset	47							
		Color Wheel Blower	48							
		System Fan Fail	49							
21	IIC Read		Chip	Bus	Details	0	0	0	0	0
22	IIC Write		Chip	Bus	Details	0	0	0	0	0
23	IIC Bus Latched		Chip	Bus	0	0	0	0	0	0
31	App (General)									

Finding "22" in the "Type" column on the first chart indicates there is an IIC Write error and it has occured 11 times (0bh = 11 decimal).

The next series of numbers are actually 8 pairs of hex digits. Think of them as a series of eight digits in a format similar to:

0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
34	03	01	XX	XX	XX	XX	XX

For type codes 21-23 byte "0" corresponds to a "Chip" address, byte "1" corresponds to a bus number and byte "2" provides additional details, if available.

For other type codes the first byte location is the most important detail but for other types different bytes are active. The charts will provide direction to interpret the byte locations for each type of error.

A separate table of errors must consulted that refer to only error codes 21, 22, and 23. In this example byte 0 is the next error code, **34**, found in the Chip chart. Going down the column titled "Chip", 34 corresponds to the DLP Bus on the Light Engine.

The next code, "03" confirms the DLP bus line and leads to the Light Engine.

The final code, "01" is defined in the "Details" section. "01" indicates an IC in the Light Engine did not ackowledge in the time expected by the start up routine.

Since the controller IC's for the light engine are an integral part of the engine, this error code would indicate the need to concentrate on the light engine as a source of problems.

Additional Data Description IIC Errors ("Code")				
21,22,23	**Chip**	**Bus**	**Module**	**Comment**
	24	AVIO	AVIO	TA1270 Chroma Decoder
	28	Tuner	DM3	Nextwave
	2A	Tuner	DM3	Nextwave
	30	DM	DM3	Picture Signal Improvement (PSI) FPGA
	34	DLP	LE	DDP1010 Light Engine Controller
	40	Deflection	Deflection	Deflection DAC
	42	DLP	LE	PCF8574 I/O Expander
	54	DM	DM3	GPIP
	60	DM	DM3	9993 HDMI Receiver
	68	DM	DM3	9993 HDMI Receiver
	80	DM	DM3	Micronas Audio Processor
	84	Tuner	DM3	Cable IF
	86	Tuner	DM3	Air IF
	88	Deflection	BEP	TA1316 Back End Video Processor
	8C	Deflection	Deflection	TA1317 Deflection Processor
	90	AVIO	AVIO	LA79500 1H A/V Switch
	92	AVIO	AVIO	CXA2189Q HD Switch
	96	DM	DM3	LM77 Digital Temperature Sensor
	98	DLP	LE	LM75 Digital Temperature Sensor
	98	DM	DM3	9883A HDADC
	A0	DM	DM3	DMx Main EEProm
	A0	Deflection	Deflection	Deflection EEProm (lower 256 bytes)
	A2	Deflection	Deflection	BEP EEProm (upper 256 bytes of Deflection EEProm)
	A8	AVIO	AVIO	AVIO Eeprom
	AC	DLP	LE	Light Engine Eeprom (lower 256 bytes)
	AE	DLP	LE	Light Engine Eeprom (upper 256 bytes)
	B8	AVIO	AVIO	Frame Comb
	C0	Tuner	DM3	Cable Tuner PLL -1
	C2	Tuner	DM3	Air Tuner PLL
	C6	Tuner	DM3	Cable Tuner PLL - 2
	DC	Deflection	Convergence	Convergence Micro
21,22,23	**Bus**	**0**	3 Bus: DM	
		1	3 Bus: Tuner	
		2	Run Bus: AVIO	
		3	Run Bus: DLP	
		4	Run Bus: Deflection	
21,22	**Details**	**1**	chip did not acknowledge when was expected to	
		2	some hardware error detected, maybe one of the lines is grounded	
		3	some software error, e.g. not enough memory, or could not acquire the mutex	

Many codes are extremely complex and may only be applicable for engineering development. However many are useful in troubleshooting long term or intermittant issues. Those three codes are Type 32, Reset Count, Type 41 Watchdog, and Type 51 Guide. In most cases the numbers are paired representing one complete byte of data. Leading zeros are dropped but there is always at least one zero as a placeholder.

Reset

Reset counts the number of times software has done an internal reset. There are no specific occurances or failures that might be indicated, it simply counts all the times software feels the hardware must be reset. That might also include AC dropouts and forced hardware or software resets. The format is:

32 Reset Count 0 0 0 0 0 0 X X where "X X" are hex numbers representing the number of resets that have occured since the last time this field was cleared. The errors indicated in Bytes 00-07 are all internal to the DM3 and may be used for diagnosis. To clear the reset number, press "Clear" on the remote control.

Additional Data Description (Type 32)	
This is a count of all system resets since the field code was last cleared. This includes AC dropouts, forced system resets in the code, and resets due to unknown causes. The following errors (00-05) indicate problems internal to the DM3.	
Byte	Data
00:	SRV: Software Reset
01:	ARC: IM301 Reconfigure - IM301 has been reset.
02:	EXC: Exception - An exception occurred in the kernel
03:	SPF: Software Power Pail - power fail software was triggered by an interrupt
04:	APF: IM301 Power Fail - IM301 triggered power fail interrupt.
05:	SWR: Software Reset - Software wrote to an IM301 register forcing a reset.
06:	CT1: High byte of 16 bit reset counter
07:	CT0: Low byte of 16 bit reset counter

Watchdog

Type 41and Type 42 Watchdog timeouts can occur for any number of reasons including hardware and software failures or resets. It will be in the format:

41 Watchdog XX XX XX XX XX XX XX XX where "X" is a hex number decoded by the chart that follows.

There may or may not be any values in the positions 1-7. The positions are populated according to the following rules. All events are allowed several "chances" to complete their task. The number of chances may vary according to the task. When the first watchdog event reaches 0 which is defined as a task that has been given a number of chances to complete over a period of time, it is logged in position 0. Software then looks at any other event that has less than 16 "chances" left to complete before the timeout and logs them in the order of "chances" left.

For instance, **41 Watchdog 2E 29 47 00 00 00 00 00**

would indicate the cable tuner failed to complete a specific task in the allotted time and retries. When it timed out, POD Control (29) was attempting a task that it was still trying to complete as was another POD task, 47. Although this is necessarily complex it might indicate a Cable Tuner problem if the complaint is no DCR tuning or anything else that may involve the Cable tuner operation.

Additional Data Description (Type 41)

The first Task Id is the first task to count down to zero. The remaining 7 Ids are any tasks whose counts are at or below 16.

Thread Name	Hex Value		Thread Name	Hex Value
UNKNOWN_TASK_ID = 0,	00		POD_PHYS_LINK_MAIN_TASK_ID,	3E
CC_TASK_DRAW_MAIN_ID,	01		POD_LINK_SEND_MAIN_TASK_ID,	3F
CC_TASK_MAIN_ID,	02		TV_POWER_TASK_ID,	40
CC_TASK_WINMAIN_ID,	03		KEYMGR_MAIN_TASK_ID,	41
DM_MAIN_TASK_ID,	04		POD_CAMAIN_TASK_ID,	42
AV_DRV_MONITOR_ID,	05		POD_CPMAIN_TASK_ID,	43
AV_DRV_CTL_MAIN_ID,	06		EXT_CHAN_MAIN_TASK_ID,	44
AV_DRV_CTL_PIP_ID,	07		POD_HOMING_TASK_ID,	45
CA_MAIN_TASK_ID,	08		MMI_MAIN_TASK_ID,	46
CC_DRAW_MAIN_ID,	09		POD_RESMGR_MAIN_TASK_ID,	47
CC_MAIN_TASK_ID,	0A		POD_SESSION_MAIN_TASK_ID,	48
CHANACQ_MAIN_TASK_ID,	0B		POD_TRANSPORT_MAIN_TASK_ID,	49
CHANACQ_PIP_TASK_ID,	0C		IEEE1394P2PINPUT_TASK_ID	4A
CHANACQ_VBI_TASK_ID,	0D		IEEE1394P2POUTPUT_TASK_ID	4B
CHANACQ_RECORD_TASK_ID,	0E		POD_UPGRADE_TASK_ID	4C
CHANACQ_1394_TASK_ID,	0F		Not Assigned	4D
CHANACQ_P2P_TASK_ID,	10		Not Assigned	4E
CHANEPG_MAIN_TASK_ID,	11		Not Assigned	4F
CHANEPG_PIP_TASK_ID,	12		Not Assigned	50
CHANEPG_VBI_TASK_ID,	13		Not Assigned	51
CHANEPG_RECORD_TASK_ID,	14		Not Assigned	52
CHANEPG_1394_TASK_ID,	15		Not Assigned	53
CHANEPG_P2P_TASK_ID,	16		Not Assigned	54
EAS_MAIN_TASK_ID,	17		Not Assigned	55
EPG_ACQ_TASK_MAIN0_ID,	18		Not Assigned	56
EPG_ACQ_TASK_MAIN1_ID,	19		Not Assigned	57
EPG_ACQ_TASK_MAIN2_ID,	1A		Not Assigned	58
EPG_ACQ_TASK_MAIN3_ID,	1B		Not Assigned	59
EPG_ACQ_TASK_MAIN4_ID,	1C		Not Assigned	5A
EPG_ACQ_TASK_MAIN5_ID,	1D		Not Assigned	5B
EPG_ACQ_TASK_MAIN6_ID,	1E		Not Assigned	5C
EPG_ACQ_TASK_MAIN7_ID,	1F		Not Assigned	5D
EPG_ACQ_TASK_MAIN8_ID,	20		Not Assigned	5E
EPG_ACQ_TASK_MAIN9_ID,	21		Not Assigned	5F
EPG_ACQ_TASK_MAIN10_ID,	22		Not Assigned	60
EPG_ACQ_TASK_MAIN11_ID,	23		Not Assigned	61
IEEE1394_INPUT_TASK_ID,	24		Not Assigned	62
IEEE1394_OUTPUT_TASK_ID,	25		Not Assigned	63
IEEE1394_MONITOR_TASK_ID,	26		Not Assigned	64
HWCTRL_TASK_ID,	27		Not Assigned	65
POD_CTRL_OOB_MONITOR_TASK_ID,	28		Not Assigned	66
POD_CTRL_MAIN_TASK_ID,	29		Not Assigned	67
SCHED_TASK_MAIN_ID,	2A		Not Assigned	68
TP_BRIDGE_TASK_ID,	2B		Not Assigned	69
TP_EXT_CHAN_TASK_ID,	2C		Not Assigned	6A
TP_RECEIVE_TASK_ID,	2D		Not Assigned	6B
TUNER_CABLE_TASK_ID,	2E		Not Assigned	6C
TUNER_AIR_TASK_ID,	2F		Not Assigned	6D

Type 51 Guide errors refer to the TV Guide+ system not currently used in the ATC32X instruments. The error codes follow the same layout as all other codes but are more detailed in the hex string. The string that reads out will exactly match one of the errors in the following chart.

Additional Data Description (Type 51) If the TVGuide process terminates, the exit code may be one of the following exception values. All other values are undefined.				
Exception	**Value**		**Exception**	**Value**
ACCESS_VIOLATION	C0000005		FLT_UNDERFLOW	C0000093
DATATYPE_MISALIGNMENT	80000002		INT_DIVIDE_BY_ZERO	C0000094
BREAKPOINT	80000003		INT_OVERFLOW	C0000095
SINGLE_STEP	80000004		PRIV_INSTRUCTION	C0000096
ARRAY_BOUNDS_EXCEEDED	C000008C		IN_PAGE_ERROR	C0000006
FLT_DENORMAL_OPERAND	C000008D		ILLEGAL_INSTRUCTION	C000001D
FLT_DIVIDE_BY_ZERO	C000008E		NONCONTINUABLE_EXCEPTION	C0000025
FLT_INEXACT_RESULT	C000008F		STACK_OVERFLOW	C00000FD
FLT_INVALID_OPERATION	C0000090		INVALID_DISPOSITION	C0000026
FLT_OVERFLOW	C0000091		GUARD_PAGE	80000001
FLT_STACK_CHECK			INVALID_HANDLE	C0000008

The three Type Codes will always be the most reliable error indicators. For DLP any convergence or deflection errors are meaningless. If one occurs it is not valid and should be erased.

The complete information display consists of:

Error#, Date, Time, Type, Count, Code.

Error Code Order

Errors are stored in reverse order from when they originally occured according to this rule:

- First: The first error that occured since all error codes were reset,
- Second: The next to final error that has occured since all error codes were reset.
- Third: The next to final error that has occured since all error codes were reset.
- ......Last: The last error that has occured since all error codes were reset. This is the most recent error. All other errors occured before this one.

Error Code Counts

The error code counts may also be confusing. The above error code occurance rules will always apply to the original error event. If an error occurs that is already in the list, only the count will increment. The error code will not change positions.

Clearing Error Codes

There are two ways to clear the error code list. From the front panel enter the service menu, then the error code list, then press "Clear" on a compatible remote control. The error codes may only be cleared one line at a time. There is no global way to erase all errors with one keypress. Chipper Check may also be used to reset the error codes.

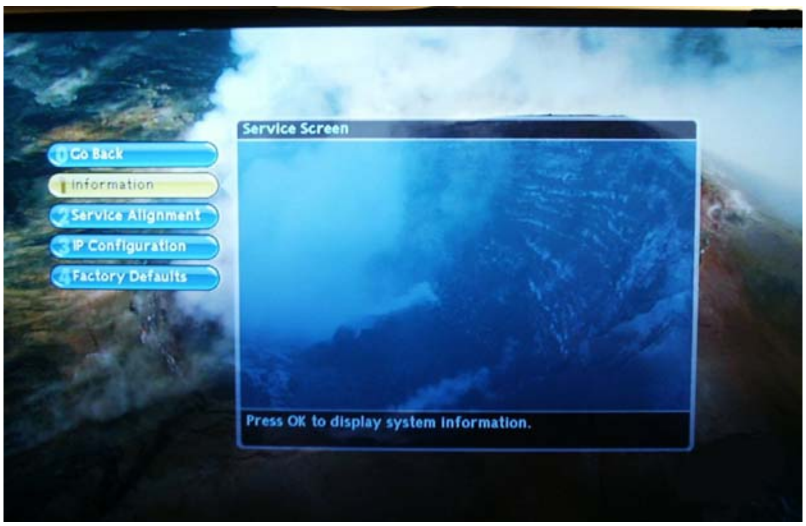
Menu 76, Alignments and Adjustments

Service menu 76 accesses all alignments and adjustments available via the front panel service menu. There are also several alignments and service aids available using Chipper Check that will be discussed later.

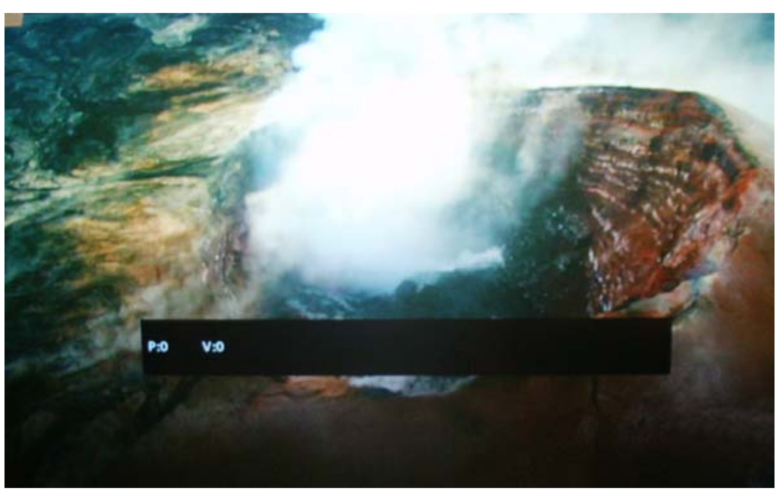
To enter the service menu

Turn the instrument on and wait for normal operation,

Press the **MENU** & **DN** buttons on the FPA. The service menu will appear.



There are four selections. Press 2 or navigate to the "Service Alignment" menu pick and press "OK" to enter the Service menu. The following screen will appear:



Using the remote control or the front panel buttons, press Vol UP until V:0 reaches "76". This is the security entry location for the alignment and adjustment menu. Press CH+ or CH– to increment or decrement the P: value. Alignments are in full text. All electronic alignments or adjustments available via the service menu for DLP instruments are noted below. Default values are shown. They may be used to assure minimum characteristics and to confirm operation. Consult service data for the model being serviced for alignment procedures.

Instrument	Alignment	Range	Description/Default Values
			For Error Code Access, select Security Parameter 0 Value 50
DLP/PTV	Service Menu Background	00 01	00 = Black; 01 = Transparent
DLP/PTV	NTSC Video Align	0 .. 3	1
DLP/PTV	Cable Tuner Analog RFAGC	0 .. 31	17
DLP/PTV	Tuner Digital RFAGC 256QAM	0 .. 255	160
DLP/PTV	Tuner Digital RFAGC 8VSB	0 .. 255	48
DLP/PTV	Tuner Digital RFAGC 64QAM	0 .. 255	88
DLP/PTV	System Test/Chipper Check Server IP Byte 3 (MSB)	00 .. FF	169
DLP/PTV	System Test/Chipper Check Server IP Byte 2	00 .. FF	254
DLP/PTV	System Test/Chipper Check Server IP Byte 1	00 .. FF	1
DLP/PTV	System Test/Chipper Check Server IP Byte 0 (LSB)	00 .. FF	0
DLP/PTV	System Test/Chipper Check Server Port Byte 1 (MSB)	00 .. FF	136
DLP/PTV	System Test/Chipper Check Server Port Byte 0 (LSB)	00 .. FF	19

Service Menu Items

Service Menu Background

This sets the background color of the service menu where V:0 = Black and V:1 is transparent. Black is the default to make the service menu text and numbers stand out onscreen. Transparent may be useful when full video needs to be observed.

NTSC Video Align

Used to adjust the IF_PLL demodulator IC, I304 after a tuner replacement. The instrument must have the Air Tuner selected and tuned to a strong NTSC channel. If NTSC operation is suspect a quick check of NTSC tuner operation is to increment this alignment until some interference bars or patterns are noticible in the video. Then back the adjustment down three numbers.

Cable Tuner Analog RFAGC

AGC alignment for the standard tuner. Values may be from 0 .. 255. For proper adjustment the instrument must have the Air Tuner selected and tuned to a strong NTSC channel.

Tuner Digital RFAGC 256QAM

Adjusts the digital RFAGC control at II101. The instrument must be tuned to an RF channel broadcasting in QAM256. Since there are no onscreen prompts from a cable provider to indicate whether a channel is being broadcast in QAM256 or QAM64, the cable provider may have to be contacted for the information.

Unless a tuner has been replaced, this alignment should not be required. Replacement DM3 modules have all tuners prealigned. No further adjustment or alignments should be necessary.

Tuner Digital RFAGC 8VSB

Adjusts the digital RFAGC control at II101. Instrument must be tuned to an RF channel broadcasting in 8VSB (Cable or Off-air ATSC). Unless a tuner has been replaced, this should not require adjustment. Replacement DM3 modules have all tuners prealigned. No further adjustment or alignments should be necessary.

Tuner Digital RFAGC 64QAM

Adjusts the digital RFAGC control at II101. Instrument must be tuned to an RF channel broadcasting in 64QAM. Unless a tuner has been replaced, this should not require adjustment. Replacement DM3 modules have all tuners prealigned. No further adjustment or alignments should be necessary.

System Test/Chipper Check Server IP Byte 3 (MSB)

Used to program an IP address for Chipper Check connectivity. The IP address will be in the form of: **169.254.1.0** where 169 is considered the Most Significant Byte (Byte 3) and would be entered as a value in this location.

System Test/Chipper Check Server IP Byte 2

Used to program an IP address for Chipper Check connectivity. The IP address will be in the form of: **169.254.1.0** where 254 is considered Byte 2 and would be entered as a value in this location.

System Test/Chipper Check Server IP Byte 1

Used to program an IP address for Chipper Check connectivity. The IP address will be in the form of: **169.254.1.0** where 1 is considered Byte 3 and would be entered as a value in this location.

System Test/Chipper Check Server IP Byte 0 (LSB)

Used to program an IP address for Chipper Check connectivity. The IP address will be in the form of: **169.254.1.0** where 0 is considered the Least Significant Byte (Byte 0) and would be entered as a value in this location.

System Test/Chipper Check Server Port Byte 1 (MSB)

Used to program a server port for Chipper Check connectivity. The IP address will be in the form of: **169.254.1.0** where 169 is considered the Most Significant Byte (Byte 3) and would be entered as a value in this location.

System Test/Chipper Check Server Port Byte 0 (LSB)

Used to program a server port for Chipper Check connectivity. The IP address will be in the form of: **169.254.1.0** where 169 is considered the Most Significant Byte (Byte 3) and would be entered as a value in this location.

Menu 80

Menu 80 is used for displaying various test patterns on the DLP screen. It is accessed similar to accessing Menu 76. First select an active off air or cable channel for the 4x3 alignment or HD channel for the 16x9 alignment, then enter the service menu as before but increment past V:76 to V:80 and press CH+. A new service menu will be overlaid onto the active video that will appear as below.

INPUT: Change Modes. SKIP: Next Image. MENU: Toggle Image

The following remote control keypresses are available when Menu 80 is active.

Power On/Off :	Exit Alignment, return to P:0 V:80 display Second press exits the service menu.
Input:	Toggles through the three alignment modes
Skip &/or Info:	Next Test Pattern
Reset or Go Back:	Display 1st Test Pattern
Menu:	Toggle Current Test Pattern
Arrow Up/Down:	Adjust Vertical Position
Arrow Right/Left:	Adjust Horizontal Position
Antenna:	Color Wheel Index, Color Temp or Actuator Adjust: Resets the value to the factory setup values.
Mute:	Color Wheel Index: Starts the sequence to overwrite factory aligned values.
Swap:	Color Wheel Index: Verification to overwrite factory aligned values. Actuator Adjustment: Swaps between fine and coarse adjustment modes.

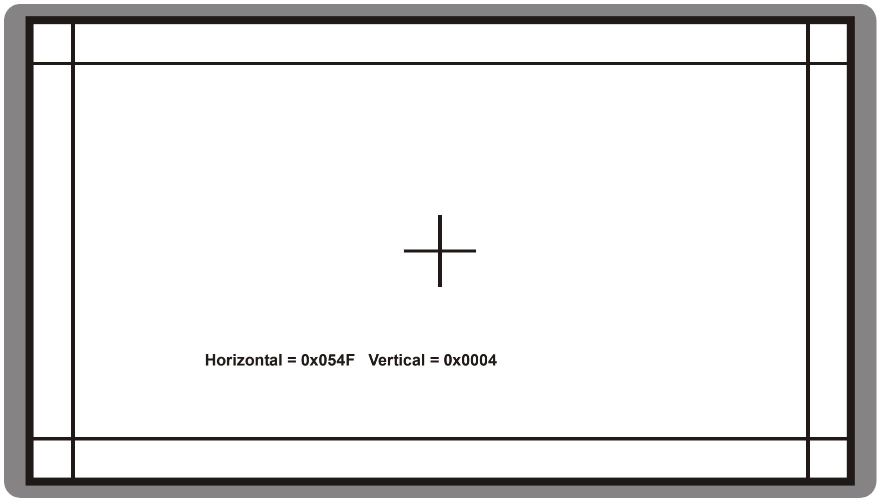


Figure 12-1, Boundary Pattern

INPUT: Changes Alignment Modes. Pressing the INPUT button on a compatible Remote Control toggles through the following alignments:

Horizontal/Vertical Position: Brings up an intersecting boundary square pattern allowing the raster to be moved right/left or up/down via the arrow (navigation) buttons on the remote control. A crosshair in the middle of the video assists in centering of the video. The lines are about 1" from the screen frame.

Color Wheel Index: Used to align color purity. (Vol +/– to adjust)

Cool CIE x (Color Temp): Used to align color temperature (Vol +/– to adjust).

NOTE: There are five additional sub-menus associated with Cool CIE allowing color temperature adjustment.

SKIP: Toggles through the following test patterns:

Live Video,

Full White Screen (100 IRE),

Full Black Screen (0 IRE),

Black and White Checkerboard, 9x5 (0, 100 IRE),

Full Red Screen (100 IRE),

Full Green Screen (100 IRE),

Full Blue Screen (100 IRE),

Two Horizontal lines, top and bottom of screen,

Two vertical lines, right and left of screen,

Boundary Square with lines approximately 1" from outer edges,

Intersection Boundary Square.

MENU: Toggles between live video and selected Test Pattern

Most of the patterns are useful for specific tests or alignments that may be required after component or module replacement. Several may only be useful for verification of operation. The **SKIP** and **MENU** functions work in all three alignments (H/V Position, Color Wheel Index and Color Temp) allowing patterns to be changed during adjustments and also allowing live video to be shown for comparison.

The color index adjustment is explained in the mechanical adjustments and should only be required if the color wheel is changed.

Color temperature adjustments are different from previous Thomson CRT based chassis. Color temperature is not aligned using a test signal. Instead CIE information of the primaries and white point are stored in the Light Engine EEPROM. The target is then programmed into the light engine and video is scaled electronically to achieve the desired color temperature. To check color temperature, use one of the internal full screen patterns according to the requirements of available equipment.

The color temperature menu is located in the "Cool CIE" selection. Toggle through the service menu and stop at "COOL CIE". Use "Channel Up" or "Channel Down" to move through the 6 color temperature adjustments;

Cool CIE x,	Norm CIE x,	Warm CIE x,
Cool CIE y,	Norm CIE y,	Warm CIE y.

Individual adjustments are made using "VOL+" and "VOL–".

Color Temperature adjustments should not be required. There are no phosphors to age and the lamp has a very even temperature output over its normal life. The light engine is adjusted from manufacturing to provide the followingconsumer selectable color temperatures:

Cool:	D14000
Normal:	D9300
Warm:	D6500

Changing color temperature requires a colorimeter specifically designed for DLP applications. Making color temperature adjustments to the DLP instruments is not advised without access to that equipment.

Replacement light engines are prealigned for the above color temperatures and do not require field adjustment.

IP Configuration

The third service menu option is used to check all IP settings affecting both the internet access provided by the instrument and Chipper Check connectivity.

Using the previous method to enter the service menu, with the instrument on press Menu and Channel Down on the FPA. That brings up the secondary menu with instrument default and service menu access. Select the "IP Configurate" option and press OK on the remote or Menu/OK on the FPA.

The initial screen will be blank. Press OK on the remote or FPA and it will fill out looking similar to the following screen:

This contains all the internal ethernet configuration data available for the instrument. The consumer must know their correct IP Configuration in order to verify the ethernet is set up correctly. The screens correspond to consumer settings in the "Connections" menu.

The following table will crossreference the service IP Configuration data with consumer entered data. It is important to verify the consumer settings with those provided by their internet provider in cases where internet access is a problem. The consumer must have a broadband ISP connection and an ethernet port for the DM3 connection. The ethernet connection would typically be supplied by a router or hub, but could also be the ethernet connection on the cable or DSL Modem. If the consumer is uncertain how to connect the instrument they should consult the ISP or the manufacturer of the hub or router.

The most important data on this screen is the IP Address, IP Mask (subnet Mask), Gateway IP Address (Default Gateway), Host Name, Primary DNS Server, Secondary DNS Server, Primary WinServer, and Secondary WinServer.

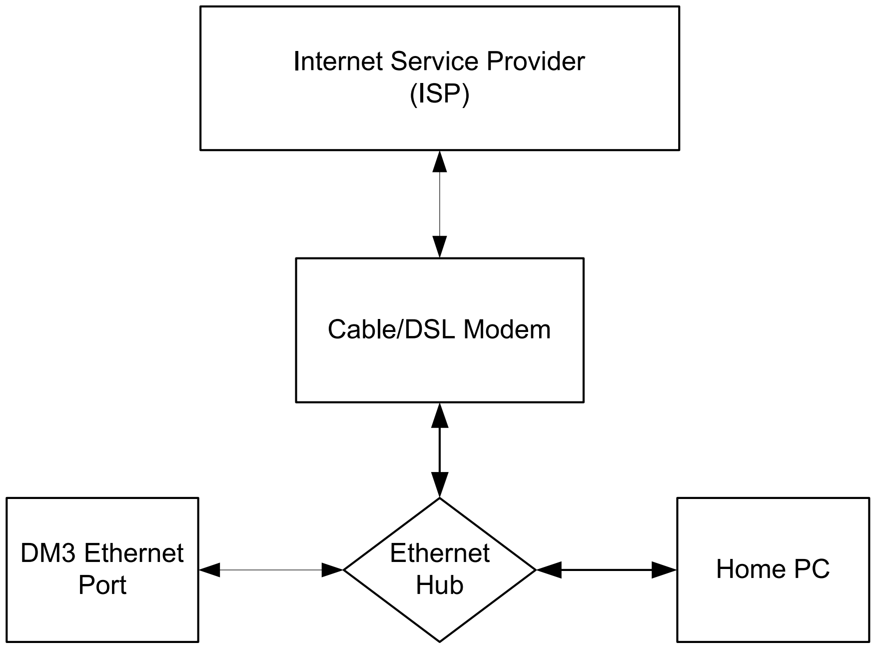
Service Menu	**Consumer Menu**	**Description**
IP Address	IP Address	DHCP or entered by Consumer
IP Mask	Subnet Mask	DHCP or entered by Consumer
Gateway IP Address	Default Gateway	DHCP or entered by Consumer
MAC/Physical Address	Host Address (Display Only)	Fixed during manufacture. Address may be required by some ISP's
DHCP Enabled	Menu Selection	Dynamic Host Configuration Protocol
DHCP Server	Automatic	Automatic
Primary WinServer	Primary WinS	DHCP or entered by Consumer
Secondary WinServer	Secondary WinS	DHCP or entered by Consumer
Proxy Enabled	Proxy Server	Entered by consumer or Not used
Host Name	Host Name	DHCP or entered by Consumer
Domain Name	Proxy Server	Entered by the consumer or not used
Primary DNS Server	Primary DNS	DHCP or entered by Consumer
Secondary DNS Server	Secondary DNS	DHCP or entered by Consumer

In most applications the consumer will use DHCP to connect the DM3 to an existing network. That connection will fill in the required fields allowing communications between the DM3 and the ISP. Unfortunately this information is not readily available to the consumer. Their only indication of a solid ethernet connection is by observing the the rear panel. If the LED next to the ethernet connector shows a solid green LED, the indication is there is a good electrical connection between the DM3 and the router or hub. If there is a yellow flashing LED that indicates data traffic and confirms there is good physical and electrical connectivity between the DM3 and the router/hub or cable/DSL Modem. At that point it may be concluded one or more of the settings are incorrect.

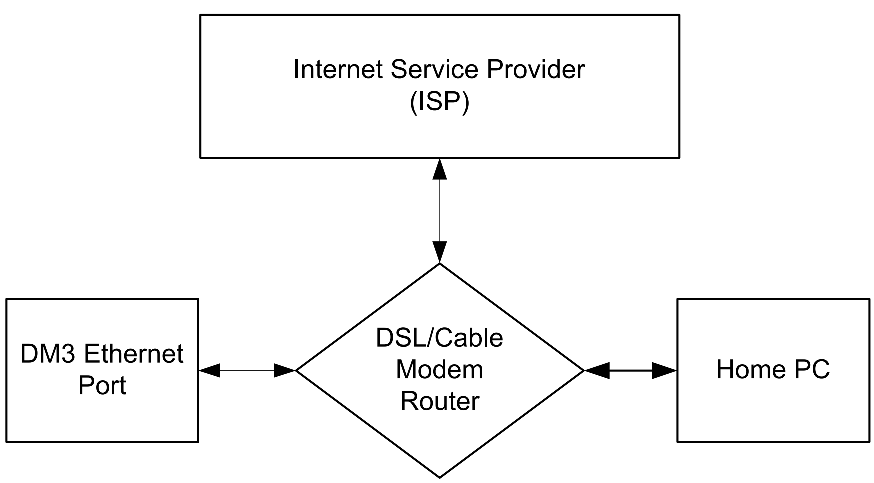
The final selection in the consumer and service menu gives both the ability to reset all the ethernet addresses and settings to default. The ethernet connection must then begin again.

In some cases the consumer may have to provide the MAC address to their ISP. In other cases they may need a domain name. In still other cases all information will be provided by the ISP and will have to be manually placed in the proper data locations by the consumer.

The internet browser does not directly support PPPoE client for Internet connectivity. The DM3 does not allow clients to run on it therefore will not support any operations that may require that capability. If the ISP requires a PPPoE client, another PC on the local network will have to run the client or a router must be used. An existing PC must be connected to the DSL modem either through a hub or a Cable/DSL router. The router will then handle the PPPoE client.



The two diagrams represent the most common hookups providing internet access to the DM3. In the first a standard Ethernet Hub is used to add the DM3 to an existing network. The ethernet Hub then provides the connection to the DSL/Cable Modem. A home PC must negotiate the connection with the ISP also using the Hub.



The next diagram shows a less complex hookup using a DSL/Cable Modem Router. The ethernet connection for the DM3 is provided by the router as are all setups for the ISP connection.

Finally, the DM3 is capable of direct connection to a DSL/Cable Modem **if the ISP does not require running client software on the DM3.** If any sort of software must be running on the DM3 such as PPPoE or Slipstream, the connection must be accomplished with a standard home desktop computer.

Due to this limitation and other limitations the browser is not intended to replace a home computer browser. The DM3 browser was designed for enhancing TV viewing experiences not for doing full web surfing, downloading or replacing a home computer. For example, a consumer can surf the web during commercials or check email using an online email service. Or using the split screen function a consumer can watch a favorite program and surf the program's website at the same time. That might allow them to watch a football game and visit a favorite sports website to view a team's statistics.

The browser is not capable of any operations that require software applications to be downloaded onto the computer. The DM3 has no hard drive storage capabilies. Also, many games that are becoming available on websites cannot be played using the DM3 browser because it does not allow software to be downloaded. Games may require Javascript, Macromedia Flash, etc to be loaded into the browser.

One feature that is available is Parental Control blocking of websites. Like its counterpart on the TV side, the Parental Control may be blocking websites and the consumer may not understand why. If the TV is connected to a cable modem or DSL unit, individual websites may be blocked by following these steps:

Go to the ***Parental Controls*** menu and select ***Web Browser Block***.

Choose ***Block Web Browser***.

Go to ***Lock TV***, enter a password, and then re-enter the password to verify it.

Now the TV is locked and the web browser requires entering a password for access just like any blocked TV channel in the Locked List or V-Chip blocked rating. Since the TV browser is very basic it does not include individual website filtering. The only method of Parental Control is to either block or allow all browser access.

If the password is forgotten or misplaced it may be removed by simultaneously pressing and holding the **MENU/OK** button on the front panel and **VOL DN** button on the remote for three seconds. This resets the password and unlocks the TV. Parental Control settings are not disturbed, only the password is removed.

At this time, there are no plans to upgrade the browser.

Factory Defaults

There are two ways to return the ATC322/23 to out of box factory condition. The last service menu is one way. Simply enter the service menu as before, select option 4, Factory Defaults, and the instrument will be returned to the out of box conditions. That includes resetting all Picture Quality Controls, Audio controls, Parental Controls (and the password), Connections, other Preferences and the Web Browser settings to a default defined by engineering to place the instrument in "first startup" condition. This will not reset the hours-in-use menu.

Menu 196

A second similar reset is included in the Service Menu and called "Shipping Defaults". Enter the service menu as before this time decrementing to V:196. Press CH+ to load the shipping defaults. This starts a software routine that places the instrument in the exact consumer conditions as the day it was set up at manufacturing then exits the service mode automatically. This reset is identical to the "Factory Defaults" menu in the standard service menu.

These menus are useful in cases where its suspected the consumer has somehow made selections or adjustments that have placed the ATC32X outside its normal operating range or condition. This will not reset the hours-in-use menu. When the instrument starts back up it will go into the "first use" routine beginning with the assisted setup.

In both cases the instrument will shut down and restart itself.

Chipper Check

At publication deadline Chipper Check has not been released for the DM3 based instruments. When available it will have similar capabilities as it does currently for the DM2 and DM2CR with the addition of a "dead set" mode that will require hookup to the DM3 via a more traditional connection.

Overview

Chipper Check will employ two different methods of connection; Ethernet via the rear panel Ethernet connector, and an internal Chipper Check connection similar to those used in previous chassis designs. Both connections are autodetected by the chassis which after sensing a Chipper Check connection attempt will place itself in a condition allowing Chipper Check to control all alignments, adjustments and diagnostics from the PC interface computer.

Chipper Check will provide a method allowing all service menu adjustments via the standard windows interface. It will also provide several adjustments and alignments not normally available via the standard front panel service adjustments. A "dead set" diagnostic mode is available enabling the technician to read error codes as long as the standby supply is operational. The technician will also be able to verify certain hardware operation and identify EEPROM values that could place the instrument out of normal operating range.

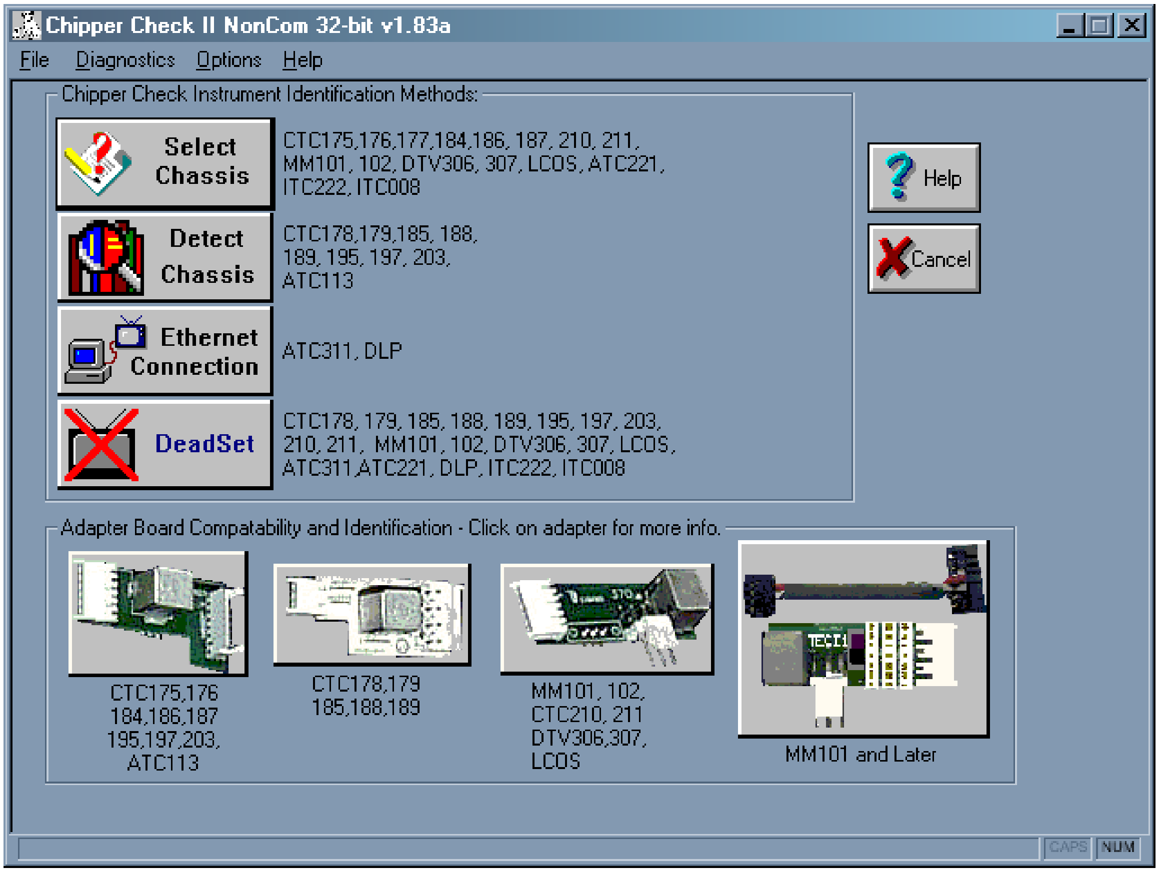
Although the front panel service menu may be more convenient most adjustments and alignments are easier and more accurate using Chipper Check.

These instructions are preliminary for the DM3. Final screens may appear different however the steps required to connect Chipper Check and the DM3 will be very similar.

To connect Chipper Check for alignments, adjustment or diagnostics, first enter the service mode by using the following instructions.

1. Connect Chipper Check using the Ethernet port on the rear of the ATC32X and the ethernet adapter port of a laptop or desktop computer using a "Crossover" ethernet cable.
2. If the instrument is not on, turn it on and wait for it to come up to operational status.
3. Launch Chipper Check on the laptop or desktop computer.

The following screen will appear:



4. Return to the instrument. With it on and operating, the Service Menu is accessible by pressing Menu and Channel Down on the Front Panel Assembly.

That brings up a secondary menu with instrument default information and service menu access.

5. Select the "Service Menu" option and press OK on the remote or Menu/OK on the FPA.

That will bring up the traditional service menu appearing similar to:

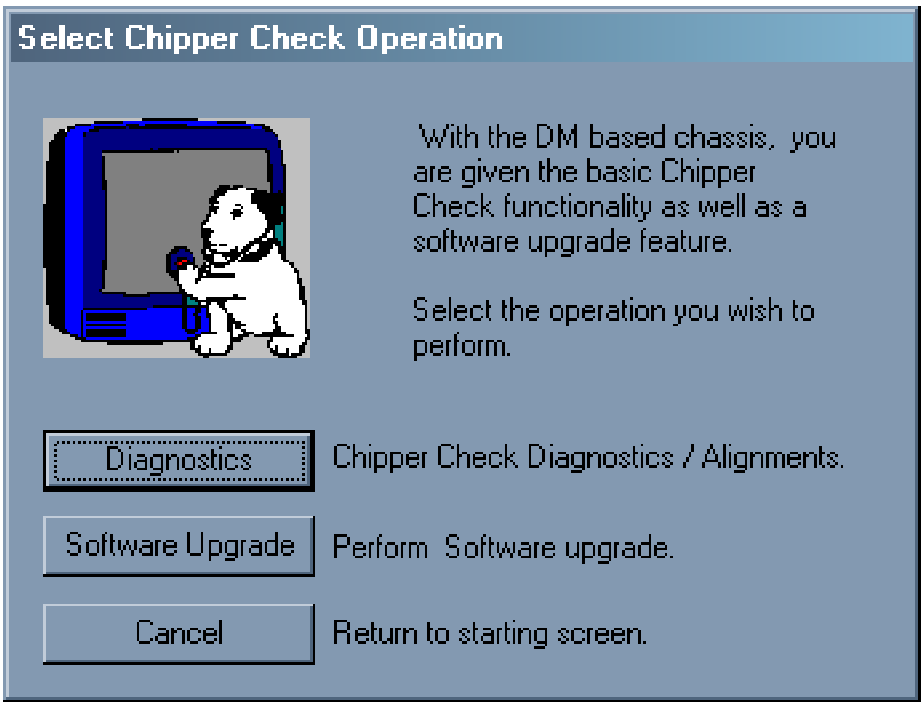
P: 00 V: 00

6. Using the VOL UP button on a compatible remote or the FPA, increment the V:00 parameter to 200.

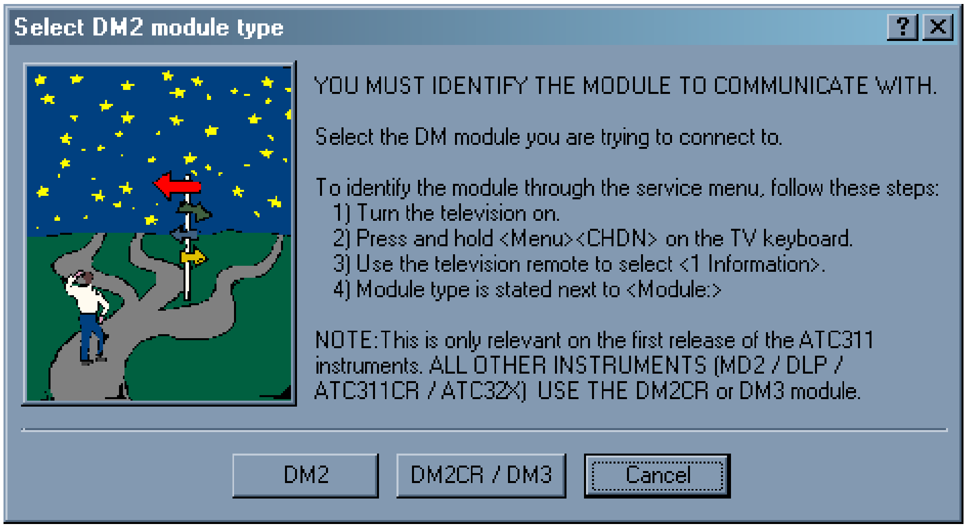
7. Press "CH+" on the front panel. Chipper Check access is now available.

8. Using Chipper Check press "Ethernet Connection".

That brings up another menu:

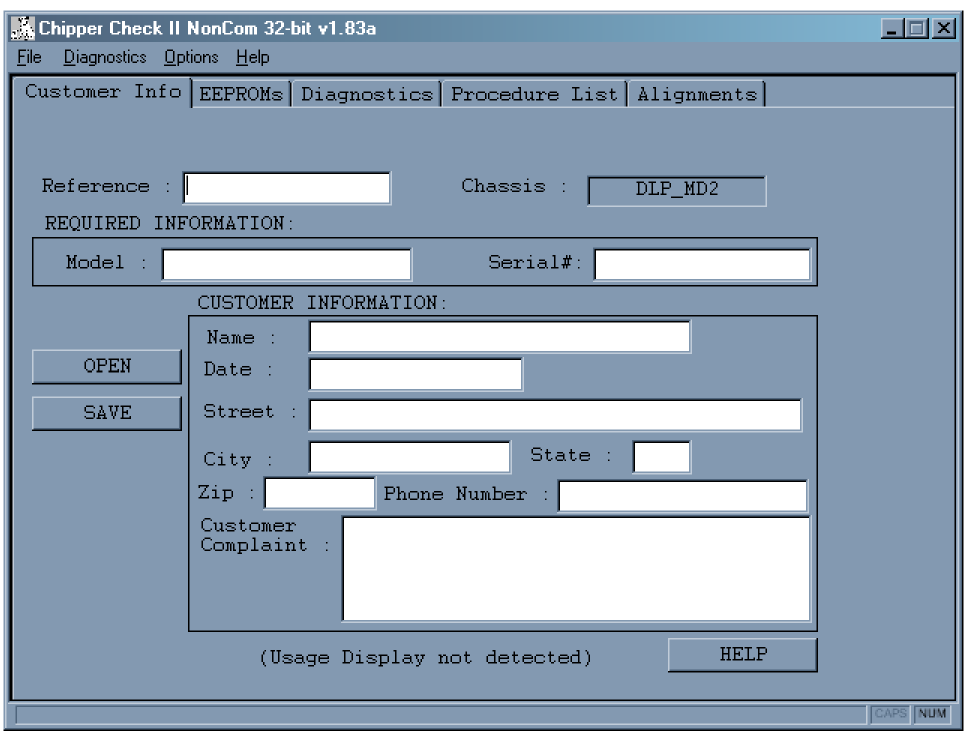


9. Press "Diagnostics". Another menu will appear asking which module is being used. Select DM2CR/DM3.



10. Chipper Check will autodetect the settings of the instrument and provide the diagnostics entry screen. If it does not, instructions will be given for changing the IP address of the instrument so that Chipper Check will be able to detect it.

11. Chipper Check will now provide the normal Customer Information screen and full functionality.

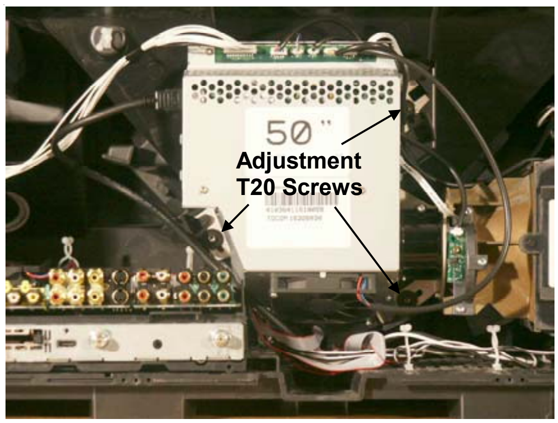


DLP Tilt Adjustment

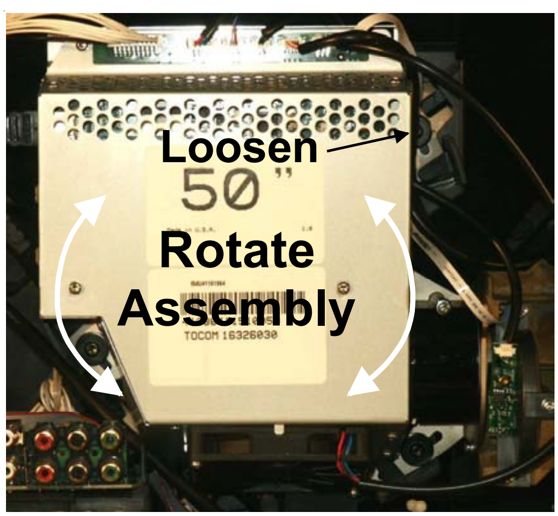
At present time all light engines have some sort of tilt adjustment. There are differences between mountings from Series 1 to Series 3 but the end result is the same for all. The only light engine that has not tilt adjustment is Series 2.

To start off with the Series 1 and 1.1 use the same mounting assembly. Therefore, the tilt adjustment for Series 1 is the same for Series 1.1. To do the Series 1 and 1.1 tilt adjustment follow these steps:

1. Remove back cover to gain access to the light engine assembly.
2. Locate and loosen the two bottom mounting T20 Torx head screws as shown in the photo below.



3. With the bottom two screws loose to allow rotation of the light engine assembly, loosen the top screw just enough to rotate the light engine.

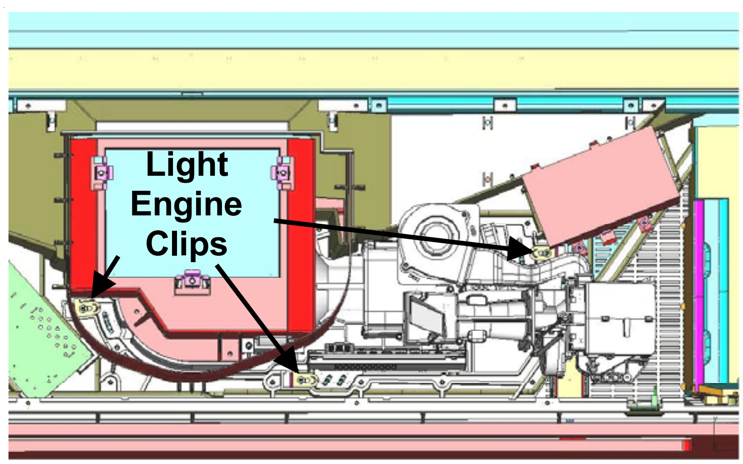


4. Access the service menu 80 and bring up boarder pattern.
5. Using this pattern rotate the light engine assembly until the pattern is no longer tilted as shown in the photo below.

Series 3 Tilt Adjustment

The Series 3 Light Engine mounting is different from Series 1 and 1.1 and requires a slightly different procedure. The main difference is the addition of Light Engine clips located near the light engine mounting screws. These clips hold the light engine in place during the tilt / rotation adjustment. Also because of the different mounting, the Series 3 has limited adjustment range.

The image below shows the locking clips.

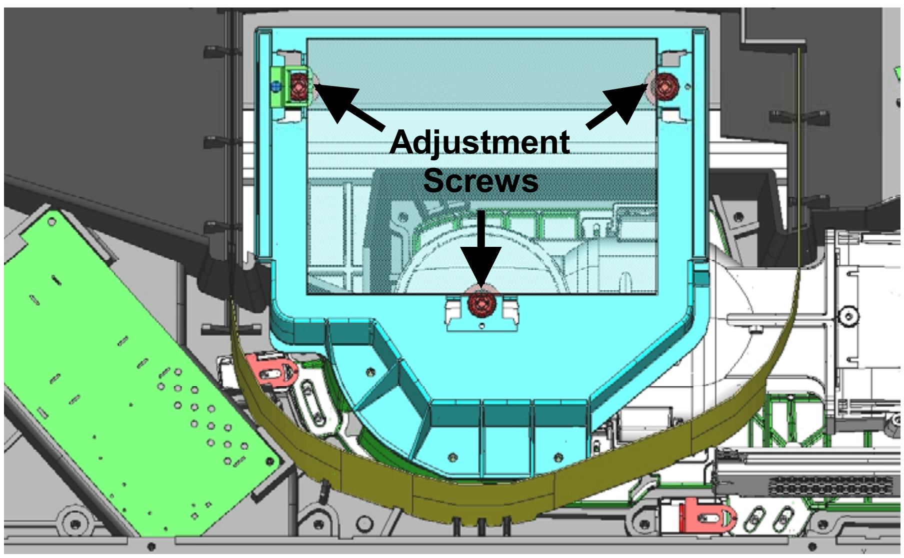


The adjustment is done using the same pattern that is used in Series 1 and is accessed the same way. The adjustment procedure is the same however; in the Series 3 all three Light Engine screws are loosened. The rotation of the light engine is the same adjust for best pattern displayed.

ATC323 Small Mirror Adjustment

First off, the Slim DLP screen technology is new in that the fresnel bends light in both refracting and reflecting it. Because of this the fresnel lens faces backwards and is more susceptible to handling damage. This is also noticed when pushing on the screen or in adjusting the small mirror as slight pressure causes distortion in the displayed image.

There are three mechanical adjustment screws on the Small Mirror. Two located on the upper corners and one in the middle along the bottom edge. These adjustments are used to align the reflected image with the fresnel lens. Proper adjustment is critical because of the extreme angles that are found in the slim DLP. They are accessed without removing the chassis cover.

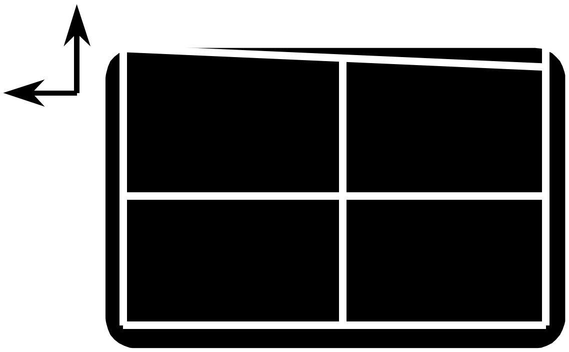


To make the adjustments, first enter the customer menu. Select Picture Quality menu then Advanced Settings (9). Next, select Mirror Adjustment (4). Follow the on-screen prompt.

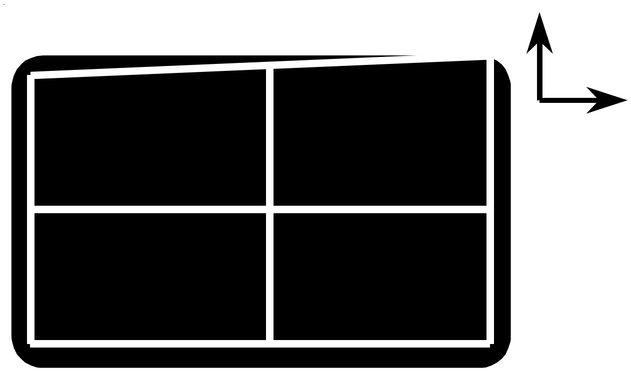
NOTE: The Trap adjustments are reset upon entering the Mirror Adjustment. This is to center the electrical adjustments before doing the mechanical adjustments. Once the mechanical adjustments are complete, the electrical adjustment can be used for fine-tuning the picture.

Using a driver of proper size, carefully adjust the three adjustors until the boundary pattern is centered and not distorted inside the screen frame. When adjusting, the pressure of the screwdriver will cause distortion in the display. This adjustment is more of a trial and error procedure requiring a light touch to do it correctly.

The following images show how each adjustment affects the pattern. The pattern shown here is for reference only and does not represent the boundary pattern used in the alignment.



TURN UPPER LEFT ADJUSTER
CCW TO MOVE UPPER LEFT
CORNER UP AND LEFT



TURN UPPER RIGHT ADJUSTER
CCW TO MOVE UPPER RIGHT
CORNER UP AND RIGHT

TURN BOTTOM CENTER
ADJUSTER CCW TO BRING TOP
DOWN AND ADJUST SIDE TRAP
EQUALLY

Color Wheel Index Adjustment

The Color Wheel (CW) Index adjustment is best done using Chipper Check. However, if Chipper Check is not available, the CW adjustment can be done using the Serviceman Menu.

To do the CW adjustment via the serviceman menu, access service menu 80. Once in service menu 80, use the input button on the remote to toggle through until the display reads Color Wheel Index. To make the adjustment start by noting what the value is. Using the volume down, adjust until the green color starts to fade. Note the point where the green screen starts to fade and write down the value indicated as stop point A.

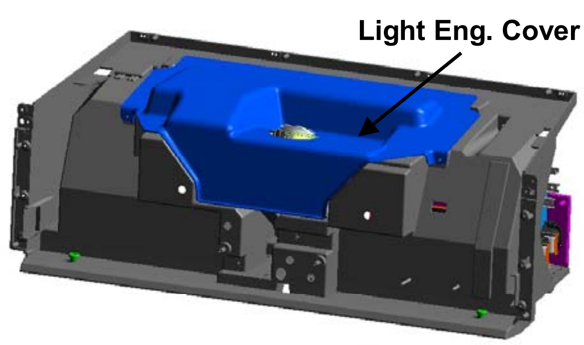
Next, using the volume up, run the value back through the starting point and proceed until the green starts to fade in the opposite direction. Make note of this value as well and write it down as stop point B.

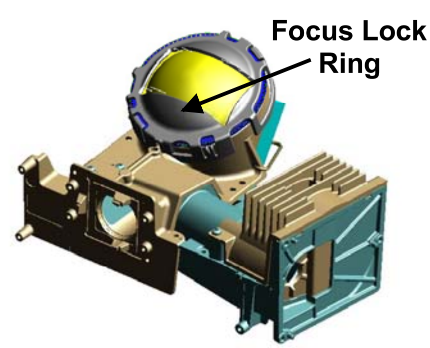
Now using the two stop points (A and B), find the center value between the two. This is done by subtracting point A from point B, dividing this value by 2 and adding it to point A. This value will be the middle point between point A and point B and also the Color Wheel Index value.

Series 2 DLP Focus Adjustment

The Series 2 DLP is the only DLP instrument that has a focus adjustment. This is because the Series 2 uses one light engine configuration for all screen sizes.

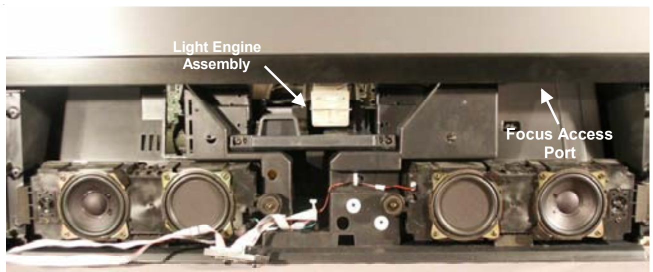
Adjustment of focus starts with disassembly of the unit. First, the front grill assembly needs to be removed to gain access to the lower screen frame bracket. Next, the screen it's self must be remove to gain access to the Light Engine Cover. This cover needs to be removed in order to do the focus adjustment.

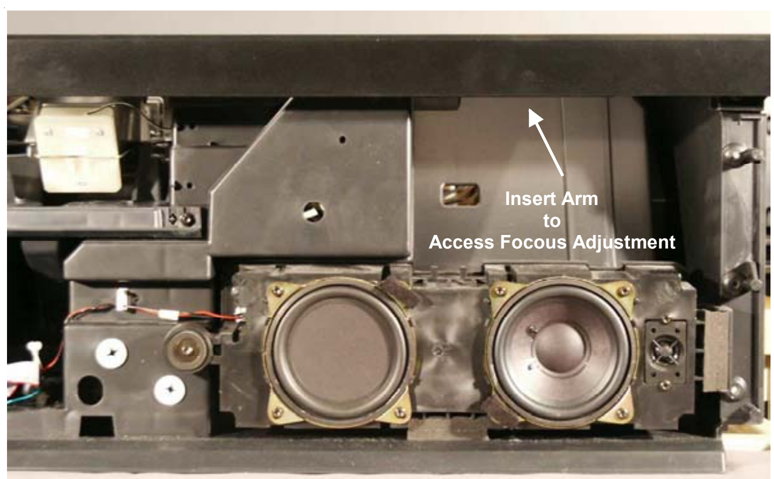




With the Light Engine cover removed and the focus locking ring removed, reassemble the screen. The screen needs to be in place for focus adjustment but the lower screen bracket does not.

With the screen in place, access the focus ring from the front right side of the cabinet. There is enough room to insert your arm. Using any quality focus pattern, make the adjustment. This may require a second pair of eyes because you will be up to your elbow in the cabinet to do the adjustment.





THOMSON RCA SCENIUM

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