Technical Manual

COBHAM

The most important thing we build is trust.

Messenger 2 Decoder

(M2D)

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Revision History

Version	Date	Main Changes from Previous version	Created by
X1	02-17-2010	Initial Release	TG
X1A	05-13-10	Add Embedded Audio feature	TG.
X1B	07-15-10	Update LCD front menu to correspond to latest Firmware release	TG.
X1C	09-01-10	LCD menus changes to correspond to latest FW, Decryption option added, Network *static* config added; explanation how to set decryption keys using Telnet.	T. G.

1. Acronyms

This section lists and describes the various acronyms used in this document.

Name	Meaning
16QAM	16-state Quadrature Amplitude Modulation
A/V	Audio/Video
AES	Advanced Encryption System
ABS	Basic Encryption System (8 bit)
COFDM	Coded Orthogonal Frequency Division Multiplexing
CVBS	Composite Video
BDC	Block-Down Converter
FEC	Forward Error Correction
GUI	Graphical User Interface
I/O	Input/ Output
KBaud	Kilobaud per second
Kbps	Kilobits per second
M2D	Messenger Decoder
M2T	Messenger 2 Transmitter
Mbps	Megabits per second
MDL	Messenger Digital Link
MER	Modulation Error Rate
MPEG	Moving Picture Experts Group
MVRD	Messenger VETA Receiver Decoder
NTSC	National Television System Committee
PAL	Phase Alternation Line
QPSK	Quadrature Phase Shift Keying
QAM	Quadrature Amplitude Modulation
RF	Radio Frequency
RX	Receiver
S/N	Signal-to-Noise Ratio
THD	Total Harmonic Distortion
TX	Transmitter
VDC	Volts (Direct Current)
VR	VETA Receiver
VT	VETA Transmitter
VDR	VETA Digital Repeater
CSM	Compact Surveillance Modem
UDP	User Datagram Protocol
VNA	VETA Network Adapter

2. Introduction

2.1. About the Manual

GMS User Manuals focus on providing the end user an easy to understand operational instructions to quickly setup and deploy the equipment. The GMS Technical Operation Manuals focus on the technical details and setup of the equipment. The Technical Manuals also provide a more in depth explanation of the settings and specifications of the equipment that technicians can use to verify the operational status.

The manual is divided into three main sections:

- Getting started and basic operation (sections 3 and 4)
  This section describes to users how to deploy and use a M2D unit. It also provides basic theory and general information regarding the M2D.
- Advanced operation (sections5 to 8)
  This section describes the operation of the system, hardware details and optional features in more depth.
- Technical Specifications (section 9)
  This section provides technical specifications and control protocol data and will be of interest to those integrating the M2D into larger systems or using unusual configurations.

2.2. Warranty

Gms Cobham Surveillance offers a 12 month standard product warranty. During this period, should the customer encounter a fault with the equipment we recommend the following course of action:

- Check the support section of the website (www.cobham.com/gms) for information on that product and any software/firmware upgrades.
- If fault persists call our support line (760-496-0055, 888-880-9339) and report the fault. If fault persists and you are informed to return the product, please obtain an RMA number from the GMS support department or website and ship the equipment with the RMA number displayed and a description of the fault. Please email the support section the airway bill/consignment number for tracking purposes.

Depending on the na
ture of the fault GMS endeavor to repair the equipment and return it to the customer within 14 days of the item arriving at our workshops. Obviously it is impossible to cater for all types of faults and to manage 100% replacement part availability, and delays are sometimes inevitable.

Please contact GMS for details of packages that can be tailored to meet your individual needs, whether they are service availability, technical training, local geographic support or dedicated spares holdings.

2.3. Safe Operating Procedures

- Ensure that the power supply arrangements are adequate to meet the requirements of VETA product.
- Operate within the environmental limits specified for the product.
- Only authorized, trained personnel should open the product. There are no functions that required the User to gain access to the interior of the product.
- Warranty could be voided if the unit is opened.

3. General System Information

3.1. M2D Description

The Messenger 2 Decoder (M2D) is a companion product to GMS Cobham Surveillance Encoders and Transmitters providing the highest Video Quality with Ultra-Low Latency and Fast Recovery essential for Wireless coverage of Real-Time events such as Sports and Surveillance Applications. It supports HD & SD AVC Baseline Profile Decoding with certain additions and exclusions as described in the specification section below including interlaced support.

It provides AVC (Advance Video Coding) decoding with resolutions up to 1920 x 1080, frame rates to 60 frames per second with Progressive or Interlaced formats, CBR (continuous bit rate) or VBR (variable bit rate) all with down to 45 mS delay when encoded with a GMS AVC encoder or transmitter. Additionally with GMS AVC Encoders Instantaneous Decoder Refresh or re-lock can occur on slice boundaries providing the fastest recovery from corrupted streams.

☛ **Note**: The M2D supports Ultra-Low Delay mode of GMS Messenger 2 TXs (M2T & M2T-C) only. Normal Mode is not currently supported.

3.2. Product Highlights

- Provides Ultra-Low-Latency for Real-Time Applications(down to <44 mS end to end) when used with GMS Messenger 2 AVC Encoders and Transmitters
- Built-in HD to SD Down-Conversion
- Compact Design with Local Control & Monitoring
- Optionally mounts to GMS MSR COFDM Rx

3.3. Key System Features

- DVB-ASI and LAN** Inputs & Outputs
- Supports ISO 13818 Transport Stream Demuxing & NAL Streams
- Support up to 60 megabits per second H.264 stream processing
- Pre-processing adaptive noise filter – MCTF
- HD-SDI, DVI, Component & Composite Video Outputs
- Balanced Analog Audio Outputs plus Digital Audio
- SDI embedded audio
- Optional Genlock Capability
- Ethernet Port Connectivity (10/100 Mbits/s) for Streaming** and Control/Monitoring**

** Note: In Development

3.4. Theory of Operation

The M2D Decoder includes both DVB-ASI and Ethernet ports (refer to Figure 1 block diagram below). The system also offers a choice of transport protocols with support for AVC embedded within a MPEG-2 TS (ASI input or over IP**) and raw H.264 bit streams. Both transport mechanisms can be delivered over UDP** and RTP/UDP**. A compressed stream can be input from the DVB-ASI interface, and reformatted for IP Streaming** and output at the same time that it is being locally decoded.

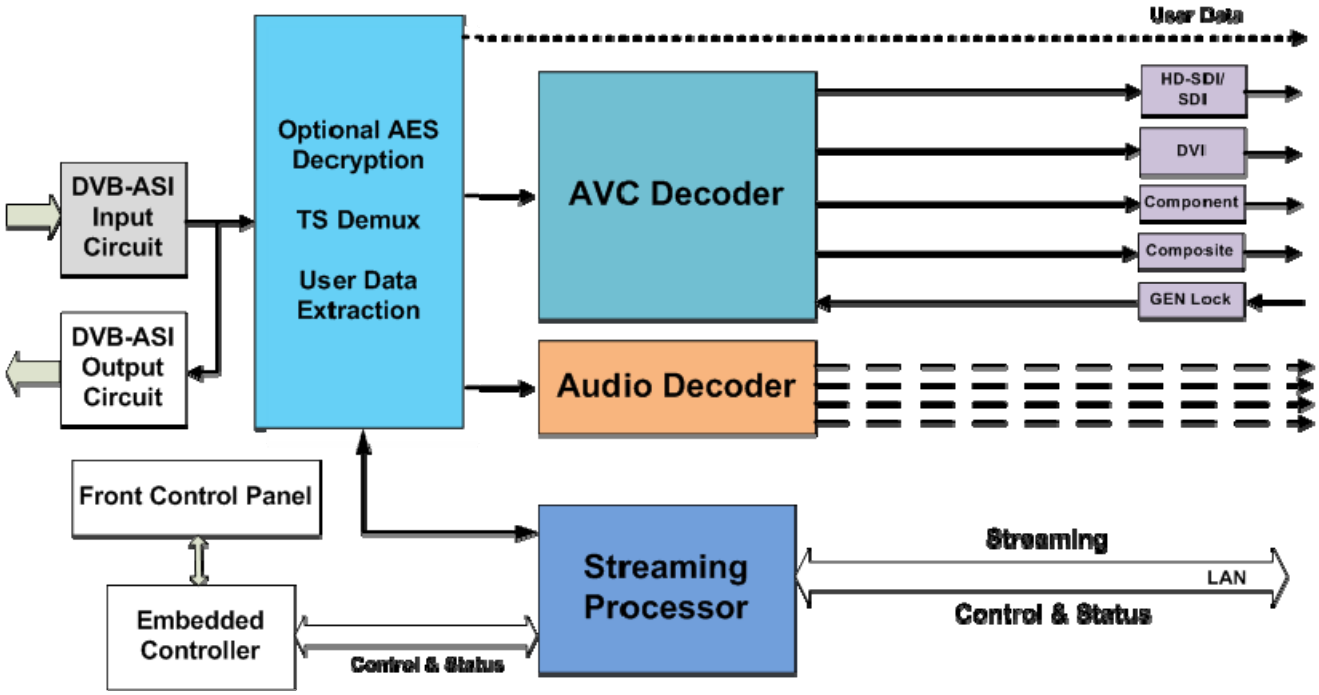


Figure 1 – Block Diagram

The Decoder can be set to tune both video and audio in two ways: **Auto** or **Manual**. In *Auto* mode the unit will self acquire the first MPEG program in the transport stream and decode the first audio & video PID listed in the PMT for that Program.

In **Manual** mode the program number can be selected when Multi Program Transport Streams (MPTS) are present.

The M2D can be controlled through its front-panel control interface. Additionally, it has two LED status lights. The green "Lock" LED notifies user that the M2D has a valid ASI stream and is able to decode the Transport Steam. The second red LED status light is for "Error" conditions.

The Decoder incorporates error resiliency features. In the event of damaged bit-stream the Decoder can replace the corrupt slice with skips and resume decoding at the next NAL (Network Abstraction Layer) unit. Alternatively it can freeze the output until a new I-frame is received.

** In Development

3.5. Normal or Ultra-low Latency

All GMS Messenger 2 transmitters and encoders include two operating modes that relate to system latency. In "Normal" latency mode GMS offers full compatibility with conventional digital video products. In this mode, delay will be equivalent to the normal delay found in commercial equipment (250msec to 500msec decoder dependant).

The M2D has been designed for Ultra-low latency mode and provides an incredibly low system latency of down to ˜44 msec plus propagation time! This unique capability provides the fastest response times to time critical situations. The main contributor to normal operating mode latency is the size of the "I" or Intra-Refresh frame and the time it takes for this to travel through the wireless link. The 'I' frame is normally 5-7 times larger than the "P" or Progressive frames. In Ultra-low latency mode we perform a non-conventional compression operation. We break-up the I-frame and send it in pieces along with multiple P-frames. This tends to level or smooth the data throughput through our Constant Bit Rate (CBR) wireless link. This allows the latency to be dramatically reduced!

☛ **Note:** This non-conventional operating mode is part of the MPEG standard. However, it is not universally supported by all commercial vendors because many applications do not need to deal with its complexity.

3.6. Multi Program Transport Stream

Transport Streams containing multi-programs can be decoded. Up to 16 programs can be detected from the PAT table, all others are ignored. Users can decide which program to decode when the decoder is set up for MANUAL under the PROGRAM menu setup (see section 5.3.1.2).

3.7. Genlock Option

Genlock is a system which allows the synchronization of two or more video sources, such as cameras. Without this synchronization, switching between sources will result in a momentary loss of image stability while the monitor or other equipment tries to lock itself to the new signal.

In cases where more than one source needs to be displayed within the same picture, the monitor or other device may be forced to switch back and forth from one to the other up to several thousand times per second. Without synchronization between all sources, the images may roll either vertically or horizontally, break up completely, or at a minimum suffer extreme color shifts.

Genlock performs four main functions: vertical, horizontal, frame, and color synchronization. These features are all normal parts of a standard composite video signal, which allows a TV or monitor to display an image properly. A fifth function, field 1 reference, is used mainly in broadcast video. A standardized signal which includes all of these, without any actual video image, is known as black burst. In the absence of a source of true black burst, many Genlock cameras will accept a standard composite video signal instead.

In order to Genlock two video sources, at least one must have a Genlock input. The other signal source may be used as the *master*, from which the sync signal must be derived.

Genlock can be used to synchronize as few as two isolated sources (e.g. a television camera and a videotape machine feeding a vision mixer (production switcher)), or in a wider facility where all the video sources are locked to a single synchronizing pulse generator (e.g. a fast paced sporting event featuring multiple cameras and recording devices).

Genlock is optional feature in M2D and can be purchased separately.

3.8. Embedded Audio

The audio on the TS which is decoded by the M2D is automatically embedded into the SDI output along with the video. There are no controls or selections to enable, this is done automatically *if the embedded audio feature has been purchased and enabled*. Only two channels are supported and they are mapped to channel 1 and channel 2 on the output. The sample rate supported is 48 KHz. See the *SYSTEM MENU* under the Optional Features screen to check if embedded audio featured is enabled.

3.9. AES 128/256 Option

Both the Messenger 2 and the VETA product lines optionally support the Advanced Encryption Standard (AES) BCYYPT for keys with 128 or 256 bit lengths. The VETA MPEG2 product also includes standard a simple CS scrambling security algorithm called ABS.

3.10. Ancillary Data**

The Messenger product line Ancillary Data capability, GMS specification calls it User Data. GMS has two implementations of User Data. Consult factory for equipment compatibility before purchasing this option.

4. Hardware Overview

4.1. Front Panel Description

Front Panel view of M2D is shown in Figure 2 below. A brief description of the LEDs, power switch, connectors, and front panel are stated below.

Figure 2 – Front Panel

4.1.1. ON/OFF Power Switch

The PWR switch is a toggle type switch, up for ON and down for OFF.

4.1.2. Local Control Panel

The Local Control Panel consists of a backlit LCD Display (dual line, 16 characters per line) and 4-button keypad, ENTR, CTRL, the up ↑ and the down ↓ arrows. Refer to the flowcharts (see section 5).

- The **CTRL** key allows the user to sequence through the available menus and sub-menus.
- The **ENTR** key allows the user to enter menus and sub-menus when available and to confirm a selection from a list of available choices.
- The **UP ↑** and **DOWN ↓** arrows are for toggling through various choices when available.

4.1.3. Status Indicators

The green **LOCK** LED lights when the M2D receives a valid MPEG Transport Stream (TS).
The red **ERROR** LED lights when an error occurs in the unit:

- When the unit first powers up and when there is no TS, a corrupt TS or a non-valid TS
- For units with the optional Genlock :
- Genlock function is enabled but the M2D can't lock to the reference Genlock clock.
- The Genlock reference input signal does not match the video format which is decoded.

☛ **Note**: If the red error LED lights on the front panel and the unit has Multi-Program or Genlock optional features installed then it's a good idea to check the STATUS menu (see section 5.3) for clues as to why the errors are occurring.

4.1.4. A/V Connectors

VID yellow RCA-F type connector is the port for Composite Video. When processing HD AVC the composite video out is from an internal video scaler. When unable to scale the output displays color bars.

☛ **Note**: The Video Scaler does not always accurately represent the HD signal. Test patterns with very narrow lines can be distorted by the scaler. However, it does an acceptable job of converting normal video from a camera.

AUD 1 and AUD 2 red and white respectively are single ended audio outputs, type RCA-F connectors. Audio levels are not adjustable from the M2D.

4.2. Rear Panel Description

Figure 3 shows the rear view of the M2D. A brief description of the connectors (type and function) is mentioned here. Refer to the section 9 for additional detailed information.

Figure 3 – Rear Panel

4.2.1. DC PWR

The **DC PWR** consists of a three pin connector:

Pin 1: +Vcc (+12 Vdc)
Pin 2: Return
Pin 3: Chassis Ground

Mating Connector Type: AMD Tyco Electronics PN: 172166-1

4.2.2. LAN

The **LAN** connector is a type RJ45 Ethernet 10/100 base T. It can be used to update new firmware versions (see section 7.2), streaming video (future update) and for remote operations (future update).

4.2.3. ASI IN

The **ASI IN** is the input connector (BNC-F) for an ASI stream (TS input/DVB compliant) which is to be decoded.

4.2.4. ASI OUT

The **ASI OUT** is a loop-through output (connector type BNC-F) of the ASI stream presented on the ASI IN connector.

4.2.5. HD-SDI/SDI

The **HD-SDI/ SDI** is an output (connector type: BNC-F) which can display high definition or standard definition through the serial digital interface (SDI).
Available as an option; audio which is decoded is automatically placed on the SDI stream (embedded). Only two channels are available and are mapped to channel 1 and channel 2.

4.2.6. SNYC

The **SYNC** is used as an input sync source for Genlock (a BNC-F connector).

4.2.7. Y,Pb,Pr

Y, Pb and Pr are the three RCA-F output connectors for analog component video. These connectors are not color coded according to industry standards. Y carries the luma, the brightness & sync information (colors associated with this connector are usually green or yellow).
Pb carries the difference between Blue and Luma (B-Y) and Pr carries the difference between red and Luma (R-Y). Blue & red colors are associated with these connectors respectively.

4.2.8. VID

The **VID** connector (RCA-F) is a second composite video output which essentially mirrors the front composite video output. As mentioned above when processing HD AVC the composite video out is from an internal video scaler. When unable to scale the output displays color bars.

☛ **Note:** The Video Scaler does not always accurately represent the HD signal. Test patterns with very narrow lines can be distorted by the scaler. However, it does an acceptable job of converting normal video from a camera.

4.2.9. DVI

The **DVI** (Digital Video Interface) connector (DVI-I socket-female) is an output which provides another means of viewing the video into a monitor with a DVI connector or it can be converted to HDMI (using a external adapter) Composite signals (NTSC & PAL) are not available through this output.

4.2.10. MISC I/O

The **MISC I/O** is a specialized connector (see the specifications section 9 for details and pin outs) which contains the signals for RS232 user data (future update), USB control (future update) and digital audio (future update).

4.2.11. AUD 1 & AUD 2

AUD 1 and **AUD 2** are XLR-M connectors providing balance audio out. Audio levels (gain) are not adjustable from the M2D

4.2.12. RF1 & RF2

These spaces are reserved for RF inputs which are not used on the M2D.

5. Local Front Panel Display & Screens Explained

The M2D's front panel LCD display and various screens are explained in this section.

☛ **Note**: The words **display** and **screen** are used interchangeably.

When power is first applied the LCD backlight lights up and within 5 seconds or so the unit boots up and displays the product type, in this case it's a Messenger 2 AVC Decoder. The display then changes to the MAIN menu screen. This screen as explained below gives the user a quick status of the system. For example it shows if a TS (transport stream) is present, if audio and video are being decoded and in addition it shows the decoded video format.

In general the CTRL button sequences through the top level menus or if in a submenu it will traverse through each of the menu options within the submenu. The ENTR button allows the user to enter a submenu if presented with a choice to do so and it also allows the user to confirm a selection when more than one option is available. In some cases the ENTR button can act as a shortcut and allows the user to jump to a setup menu. The UP ↑ and DOWN ↓ arrows allows the user to choose between various options when presented with them. When you see the following symbol in a screen then you have other options to select from: ⇳

5.1. Flow Chart (including the Genlock option)

This section explains the various screens available to the user. The menu structure consists of the ***Main*** menu page, the ***Status*** menu page, the ***Setup*** menu page (which is broken down into the *Genlock* (if available), *Program and Decryption* (if available*) sub*menus) & the ***System*** menu page.

5.2. Main Menu

The M2D boots up in the **MAIN** menu which is shown in Figure 4 below. The **Main** menu is literally the status of the TS (transport stream). It shows the user at a glance if TS is present with a capital 'Y' for yes or an 'N' for no. It shows if a PRG (program) is present on the transport stream with the same indicators 'Y' or 'N'. It also shows if 'Aud (audio) and VID (video) are present. All other menus and submenus returning to the **MAIN** menu return here.

☛ **Note**: If the PRG shows E the program is encrypted.

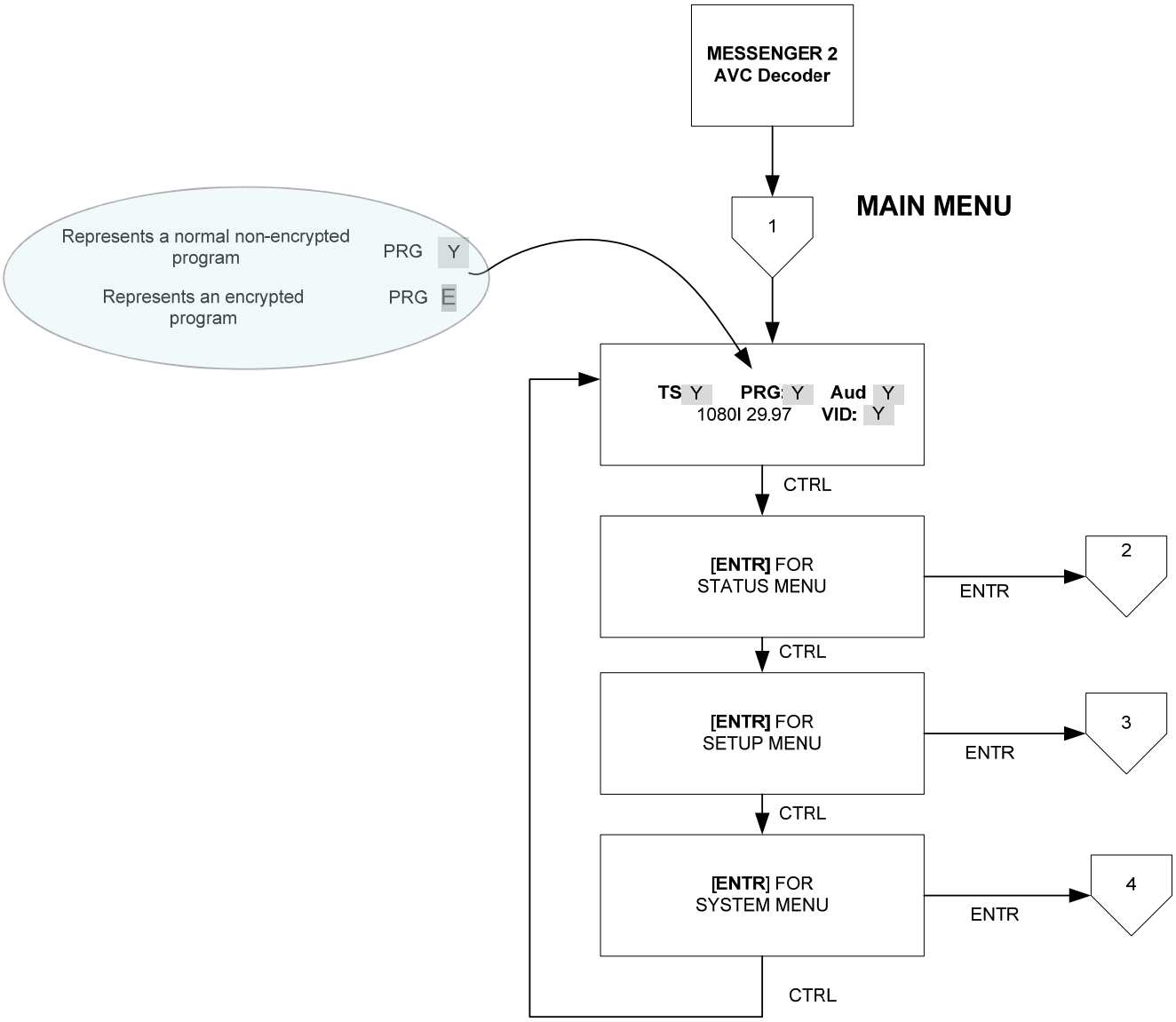


Figure 4 – Main Menu

5.3. Status Menu

The following displays are found under the **STATUS** menu (refer to Figure 5 below):

The DECODER MODE is the first screen which appears when entering the STATUS menu. It allows the user know that a valid HD or SD AVC (advance video coding) TS is being received. If it states UNKNOWN, then either there is no TS present on the ASI input or it does recognize the stream as being valid TS which it can decode.

The current IP Address is displayed in this screen. If the default DHCP Client is selected then an IP cable (from a network or a standalone PC) must be attached to the LAN input connector (on the rear of the M2D) and it must be on a network or PC which provides DHCP services otherwise no address is displayed but rather a *0.0.0.0*. If STATIC addressing is selected then it provides an initial default static address. This address can be changed using an Internet Browser and opening up the M2D web page. The internal web page of the M2D has a "Network" configuration page in which all the parameters associated with addressing can be changed. This is explained in more detailed later in the manual in section 7 (see also section 5.3.2, System Menu, Network Setup screen).

☛ **Note**: Keep in mind you will need to know the current address when upgrading firmware.

If the Genlock option was purchased the next status screen displayed will be the Genlock status. It shows the current Mode (ON, OFF, AUTO), if it's locked (Y or N), shows the reference signal format (REF :), and shows the decoded output video format (OUT). This screen is valuable in determining if Genlock is working as expected. In addition if the red error LED lights the Genlock status screen should be monitored to determine if there is a conflict or error with the Genlock setup. Pressing the ENTR key while in this screen takes you immediately to the Genlock Setup Menu.

The next display is the "Number of Programs in TS: xx". It shows the number of programs in the current TS. The default mode is AUTO in which if there is more than one program it decodes the first program it finds in the PAT table. If the PROGRAM mode is set to MANUAL the user chooses the program to be decoded. This is done from the PROGRAM Setup menu. Pressing the ENTR key while in this display takes you immediately to the Program Setup menu.

The "Selected Prg: xx" display shows the current selected program and then automatically cycles through the PCR, Video, Audio and PMT PIDS for this program. Pressing the ENTR key while in this display take you immediately to the Program Setup menu.

Finally the last display offers a chance to return to the **MAIN** menu or to return to the start of this menu (the STATUS menu).

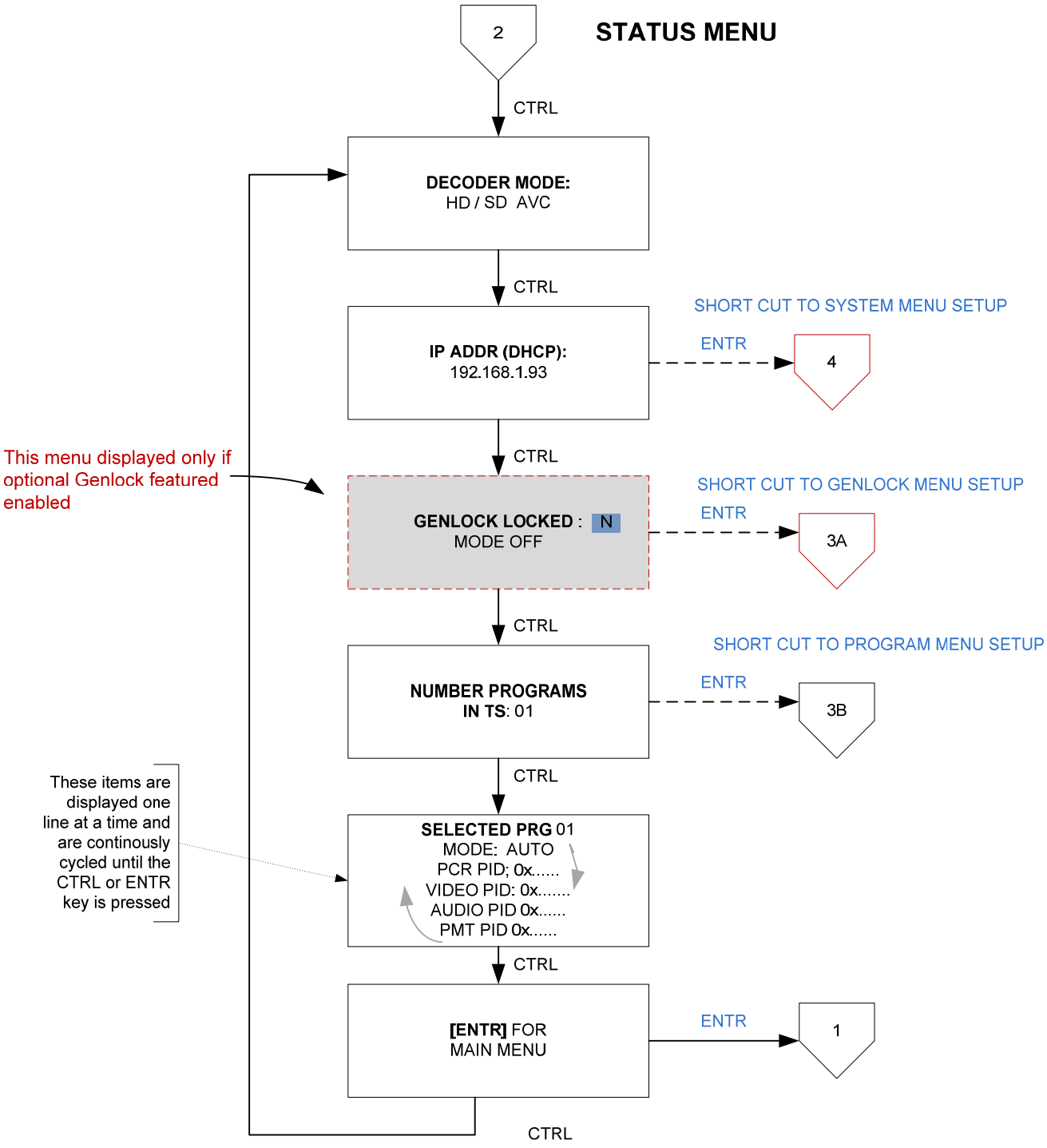


Figure 5 – Status Menu

5.3.1. Setup Menu

The Setup menu provides entry to the **Genlock** (if the option has been purchased); **Program** *and* **DECRYPTION** (if the option has been purchased) setup submenus and also offers the option to return to the **Main** menu. The menu structure below in Figure 6 is self-explanatory.

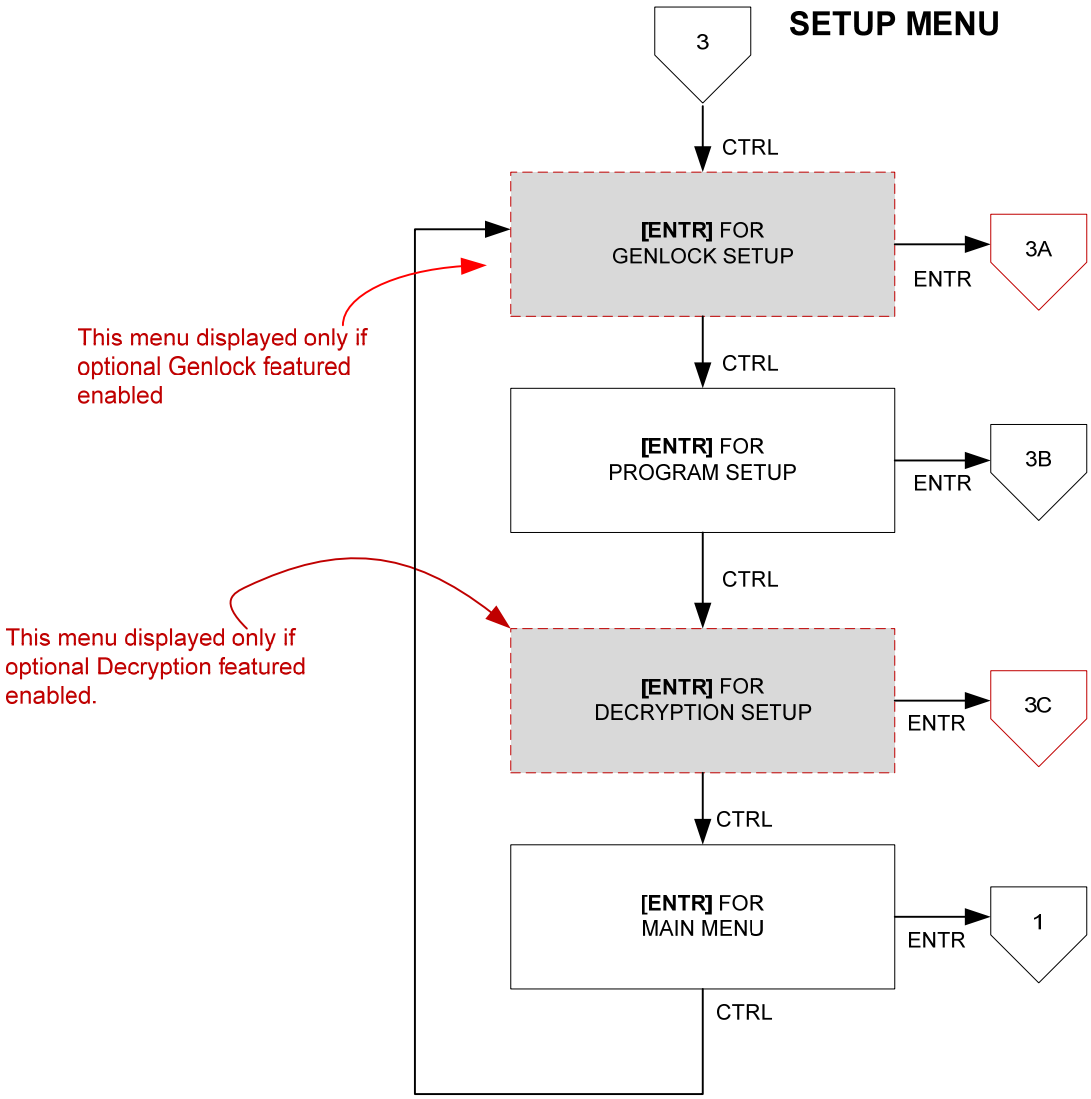


Figure 6 – Setup Menu

5.3.1.1 Genlock Setup Menu (option)

☛ **Note**: This is an optional feature and may not be available on all units
Refer to section 5.4 for an explanation of the various Genlock setup option

- The first screen presents the user with the options to turn Genlock **ON**, **OFF** or to **AUTO**. If **ON** and there is no reference signal or incorrect reference on the SYNC input the red error LED on the front panel lights. Otherwise if the reference is correct the green LOCK LED on the front panel lights. If **OFF**, Genlock is disabled regardless if and what type of reference signal is on the SYNC input. . In **AUTO** mode Genlock automatically locks if there is a reference signal on the SYNC in which it can lock to.
- If Genlock is **ON** or in **AUTO** mode then the Genlock offset Pixels and Genlock Offset Lines can be adjusted through their respective screens. These screens give the user the option of adjusting the Genlock signal offset in terms of pixels or lines. The total number of pixels or lines available for adjustment is determined by the type of reference signal on the SYNC input.
- The remaining screens allow the user to either return to the **SETUP** menu or to the **MAIN** menu.

Once Genlock has been setup it can be monitored from the **STATUS** menu, (see section 5.4 and Figure 7). The **STATUS** menu "Genlock" screen shows if Genlock is locked, if it is ON, OFF, or in AUTO mode, if a reference signal is present (and the format), and the output video format the decoder is decoding.

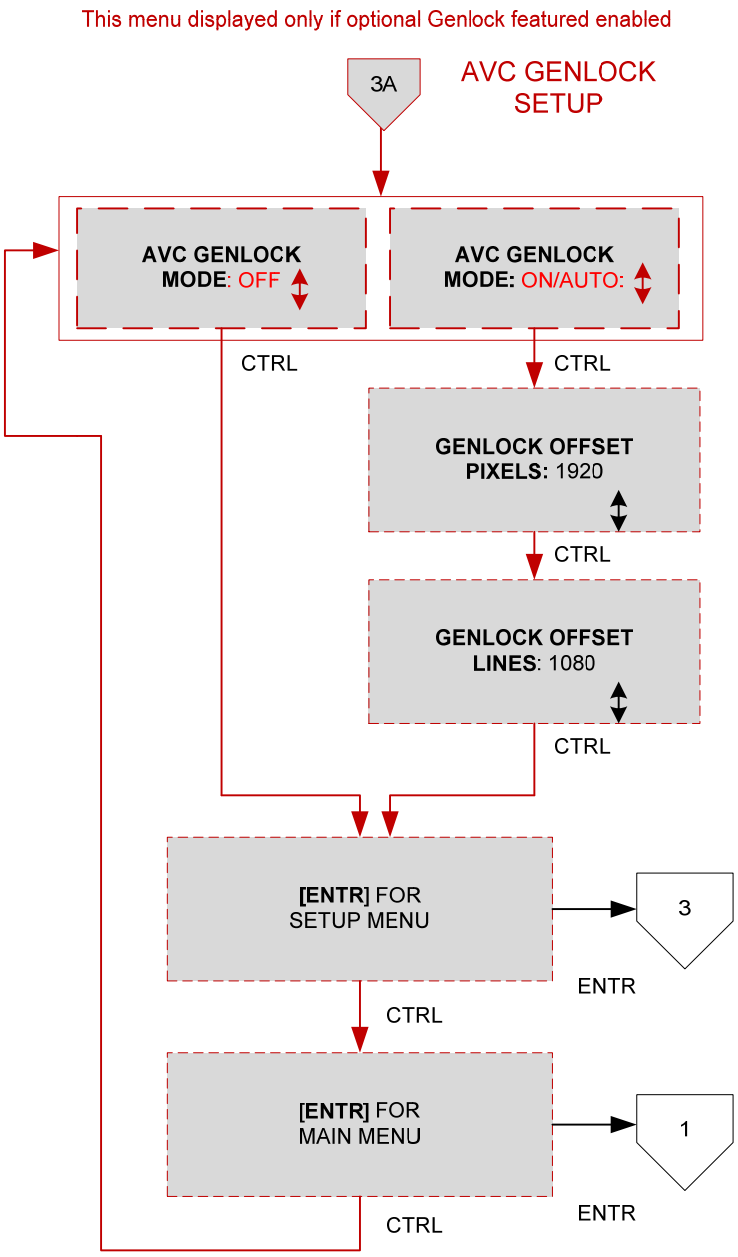


Figure 7 – Genlock Menu

5.3.1.2 Program Menu

The PROGRAM menu (see Figure 8) allows users to choose **AUTO or MANUAL** mode detection. Basically if decoding a multi-program stream the MANUAL mode offers the user the ability to choose which program is to decode. AUTO mode is mainly for TS with a single program. If the TS has multi-programs and AUTO mode is enabled then the first program it can detect (from the PAT table) is decoded.

The “SELECTED PRG: #” screen shows which program is currently being decoded and it cycles through the PIDs of the decoded program.

☛ **Note**: *If the M2D is power cycled and it was previously set for MANUAL program detection it remembers the specific program number it was decoding. Hence if for some reason that particular program number is no longer present then another program number needs to be selected from the “MANUAL PROGRAM” display in order for decoding to continue (or it can be set to AUTO mode).*

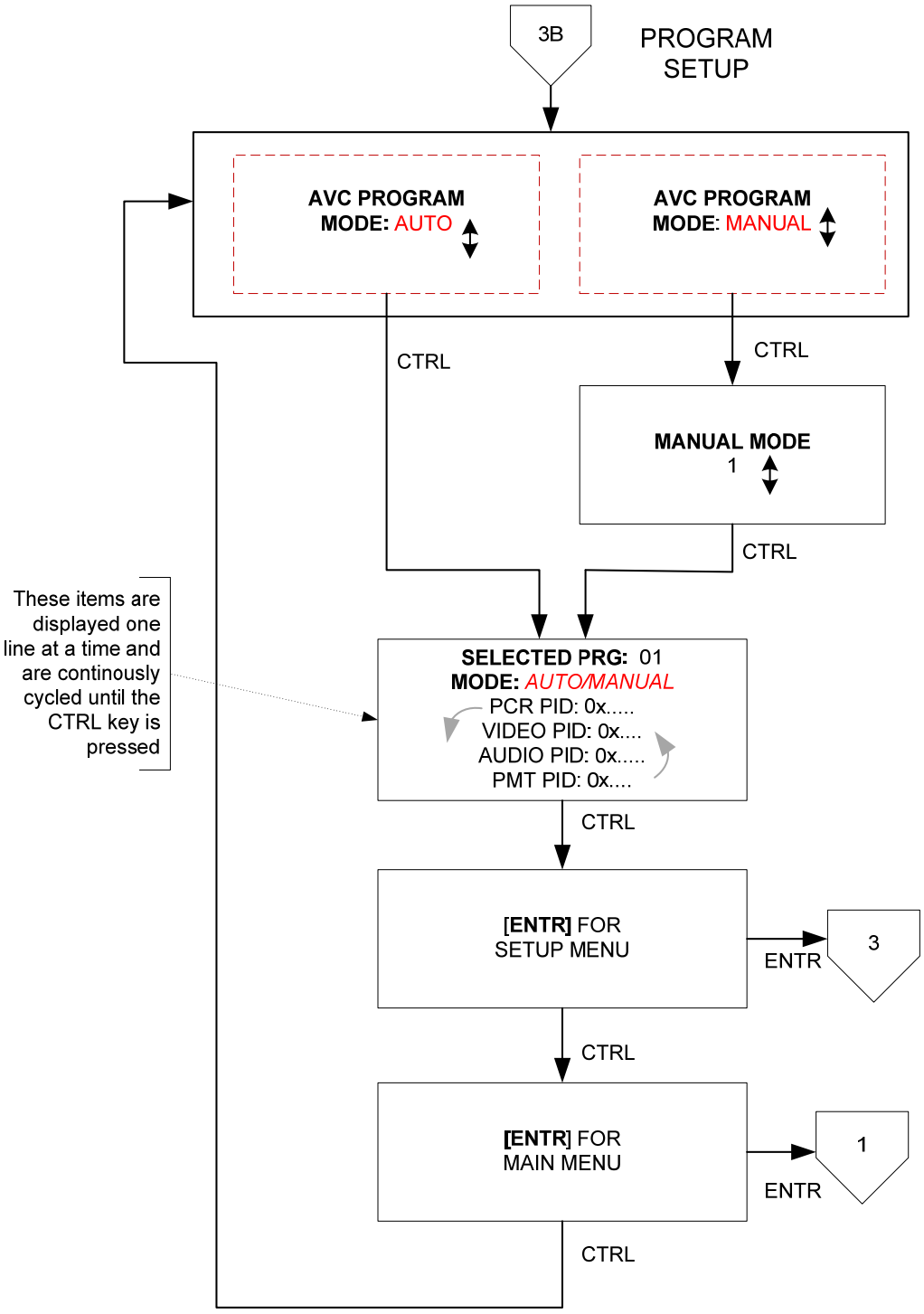


Figure 8 – Program Menu

5.3.1.3 Decryption Menu (option)

☛ **Note**: This is an optional feature and may not be available on all units Refer to section 6.1 for setting decryption keys

- The first screen (see Figure 9) is the **DECRYPTION MODE**; the decryption options available are 128 or 256 bit (BCRYPT). This selection must agree with the incoming encrypted transport stream. Currently a 128+ and a 256+ are also available selections however they are functionally equivalent to the 128 and 256.

- The second screen is the **DECRYPTION KEY**. There are five groups to choose from. Each group can be associated with a key. *The actual association is done through Telnet and is explained later in section 6.1*. Once the association is made every time a particular group is selected the key associated with that group is enabled. For example if a key is associated with Group 1 and Group 1 is selected then that key must agree with the encrypted transmitter key for the decoder to properly decode the video and audio.

- The third screen is the **STORE DECRYPTION KEY**. If **YES** is selected then the keys associated with the Groups are saved; when the decoder is powered down the keys do not have to be re-entered once the decoder is powered back on. If **NO** is selected then the keys are loss and new associations must be made between the keys and the groups each time the decoder is re-powered. Keep in mind the keys which were associated with the corresponding group and saved when **YES** was selected are still viable and are stored in memory and only are erased when overwritten with new keys or if **NO** is selected.

- The remaining two screens enable the user to return to the **SETUP MENU** or return to the **MAIN MENU**.

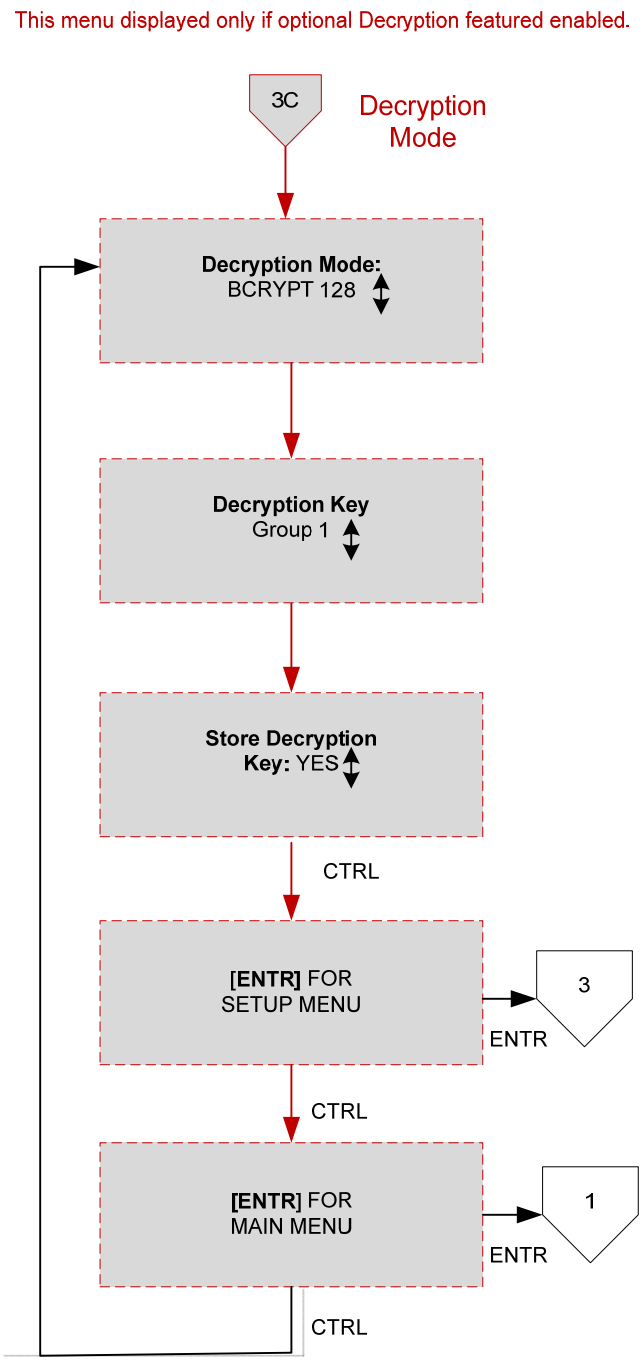


Figure 9 – Decryption Menu

5.3.2. System Menu

The following screens are found under the **System** menu (see Figure 10).

- The first screen is the NETWORK SETUP. It allows the user to choose either DHCP (Dynamic Host Configuration Protocol) CLIENT or STATIC addressing. The default is DHCP Client and in short this is the most practical one to use assuming the server network (or PC) in which the M2D decoder is attached provides DHCP services. The server automatically issues an address when the M2D is attached to the network or PC. The current assigned address can be found under the STATUS MENU (section 5.3) in the second screen. With DHCP Client the M2D decoder must be attached to the network (or PC) for the address to appear otherwise "0.0.0.0" is displayed. Once the address is known an Internet Browser can be used to communicate with the decoder (by opening up the M2D web page) for updating new firmware, changing address configuration or entering codes to enable new features.

- If STATIC addressing is used the M2D initially provides a default static address (current assigned address can be found under the STATUS MENU (section 5.3) in the second screen). In order to change the default address you need to note the default address and then set up the PC or network in which the M2D is on for static addressing. Once initial communication is established using an Internet Browser to open up the M2D web page the address and other parameters can be changed under the Network Configuration page. See section 6 for further details.

- There are three firmware versions labeled DSP, Xil, and Dec. The firmware versions are displayed in the first screen one line at a time (briefly) and the versions are continuously cycled until the CTRL key is pressed. If updating to new code this is a good place to check to see if the new versions are actually correct.

- The next two displays, 'Hardware Version' and 'Serial Number' are self-explanatory. The serial number should be recorded in case it's needed when talking to customer service.

- The next screen displays the model name.

- The OPTIONAL FEATURS screen displays the options which are enabled one line at a time and are continuously cycled until the CTRL key is pressed.

- The final screen gives the user the ability to get back to the Main menu.

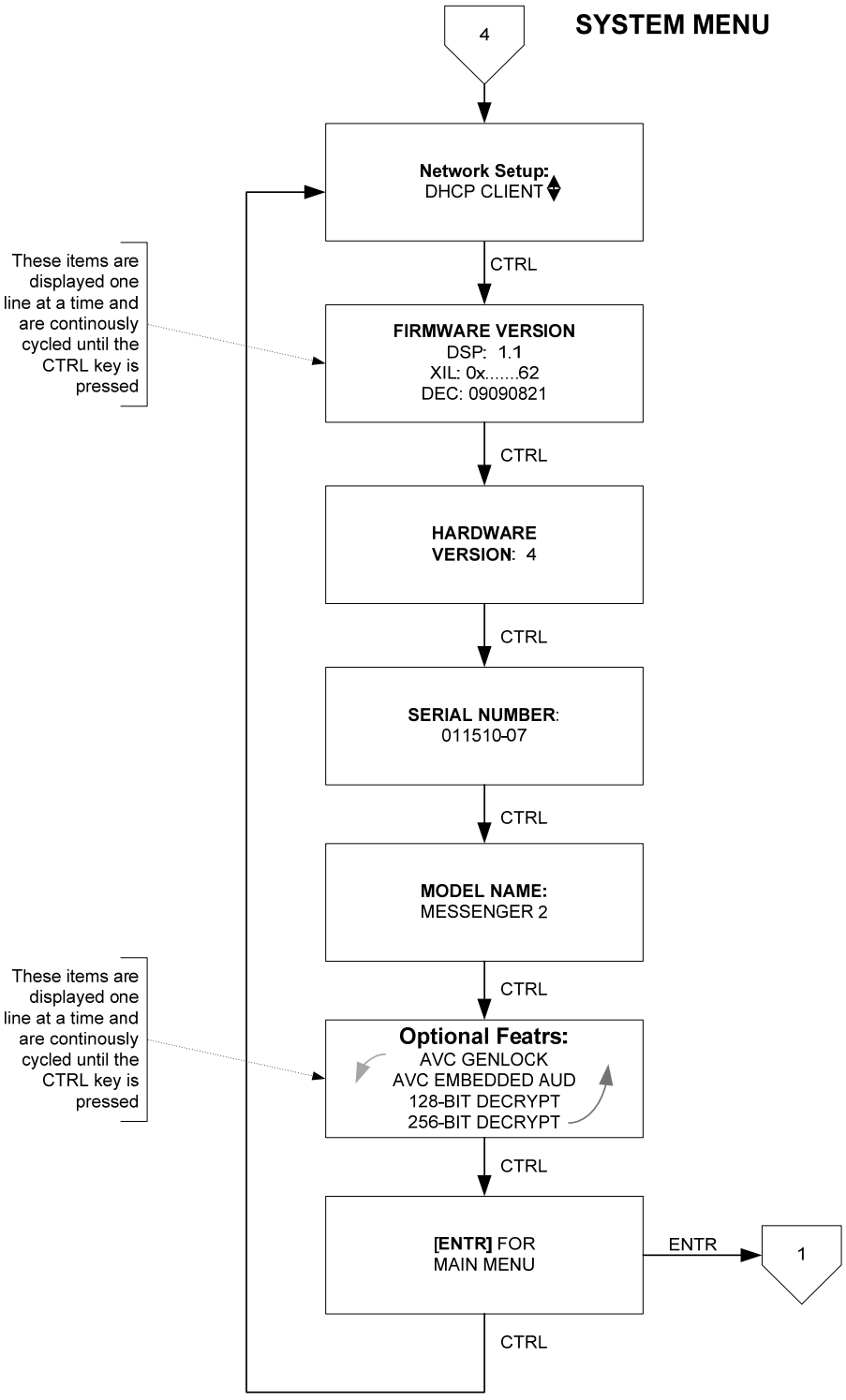


Figure 10 – System Menu

5.4. GenLock (option)

Genlock is a means to ensure video signals are synchronized; this is an optional feature and is not available on all units. The specifications for Genlock are listed in section 9, "Genlock Option". The Genlock input signal is attached to the SYNC BNC connector on the rear of the M2D (see rear panel description, 5.2). Genlock can be setup under the GENLOCK MENU (see section 5.3.1.1). This is where it can be turned ON, OFF or to AUTO and offsets (pixels or lines) can be adjusted. Once Genlock has been setup it can be monitored under the STATUS menu (see section 5.3). Under the STATUS menu Genlock is continuously monitored and shows the reference signal format (if there is one) the video format which is being decoded and the current mode it is set to (ON, OFF, AUTO).

A brief description of the operating modes (ON, OFF, AUTO) are described below:

- **ON** keeps the Genlock function enabled regardless if there is a reference signal on the SYNC input. If TS is present the audio & video are processed with or without a Genlock reference signal. However, extra latency is added to the decoding process with Genlock always ON, (see specifications section 9).

- **AUTO** mode turns the Genlock function OFF until it detects a reference signal on the SYNC input connector. If TS is present audio & video are processed with or without a Genlock reference signal. If a reference signal is detected the Genlock function is enabled. The benefit to this mode is that until a reference signal is detected on the SYNC input the Genlock function is essentially OFF and therefore the decoding latency is not increased.

- **OFF** mode keeps the Genlock function disabled regardless if there is a reference signal on the SYNC input.

In addition to the operating modes, Genlock synchronization can be fine adjusted by entering the number of pixels or lines based on the reference signal. The numbers of lines or pixels which are available correspond to the reference signal video format.

5.5. Embedded Audio (option)

The audio on the TS which is decoded by the M2D is automatically embedded into the SDI output along with the video. There are no controls or selections to enable, this is done automatically *if the embedded audio feature has been purchased and enabled*. Only two channels are supported and they are mapped to channel 1 and channel 2 on the output. The sample rate supported is 48 KHz. See the SYSTEM MENU under the Optional Featrs screen to check if embedded audio featured is enabled.

5.6. Multi Program Transport Stream

Transport Streams containing multi-programs can be decoded. Up to 16 programs can be detected from the PAT table, all others are ignored. Users can decide which program to decode when the decoder is set up for MANUAL under the PROGRAM menu setup (see section 5.3.1.2).

The PIDS (PCR, Video, Audio & PMT) of the current program selected are displayed under the PROGRAM setup menu and in addition are monitored and displayed under the STATUS menu (see section 5.3 "Selected Prg: #" screen).
If running a multi-program TS and the decoder is set for AUTO (under the PROGRAM menu setup it) will decode the first program it finds in the PAT table.

☞ Note: When running in MANUAL mode the M2D decoder remembers the program number it currently is decoding. If for some reason the program number becomes unavailable the decoder will not continue decoding until another program number (which is available) is selected. It will however show if a particular program number is no longer available.

6. Network Configuration

☛ ***Note**: It is beyond the scope of this manual to explain IP addressing. Suffice it to say the user should use caution before changing addressing parameters. The most practical way of acquiring an address is to leave the default setting, DHCP Client (see section 5.3), and attach the M2D to a network (or PC) which supports DHCP services. An address is acquired automatically in this manner. The address can then be entered into an Internet Browser which will open up the M2D internal Web page. The Web page contains a user friendly interface for updating new firmware (see section 7.2), for viewing the enabled optional features, upgrading to new features (see section 7.1) and changing network configuration.*

The following section is for users which have knowledge of IP classful addressing and need to adjust network parameters or switch to a static address.

Detailed addressing parameters are found under the NETWORK page in the M2D web page. Refer to Figure 11 , Figure 12 & and Figure 13 below. Before opening up an Internet Browser you need to know the current address of the M2D decoder. Attach an IP cable from the PC or network to the LAN connector on the rear of the M2D.

Enter the current address into the Browser address bar (the current M2D decoder address can be found under the Status Menu, the second screen, see section 5.3). The Web page opening screen is shown in Figure 11. Click on the CONTINUE button. You then will need to log in using "admin" for both USER NAME and PASSWORD (see Figure 22 below). Next follow the path as shown in Figure 12; *System\Setup\Network*. Finally the picture as shown in Figure 13 appears. Here is where the address can be changed and the parameters can be adjusted.
Addressing is limited to Ipv4 (Internet Protocol Version 4) only.

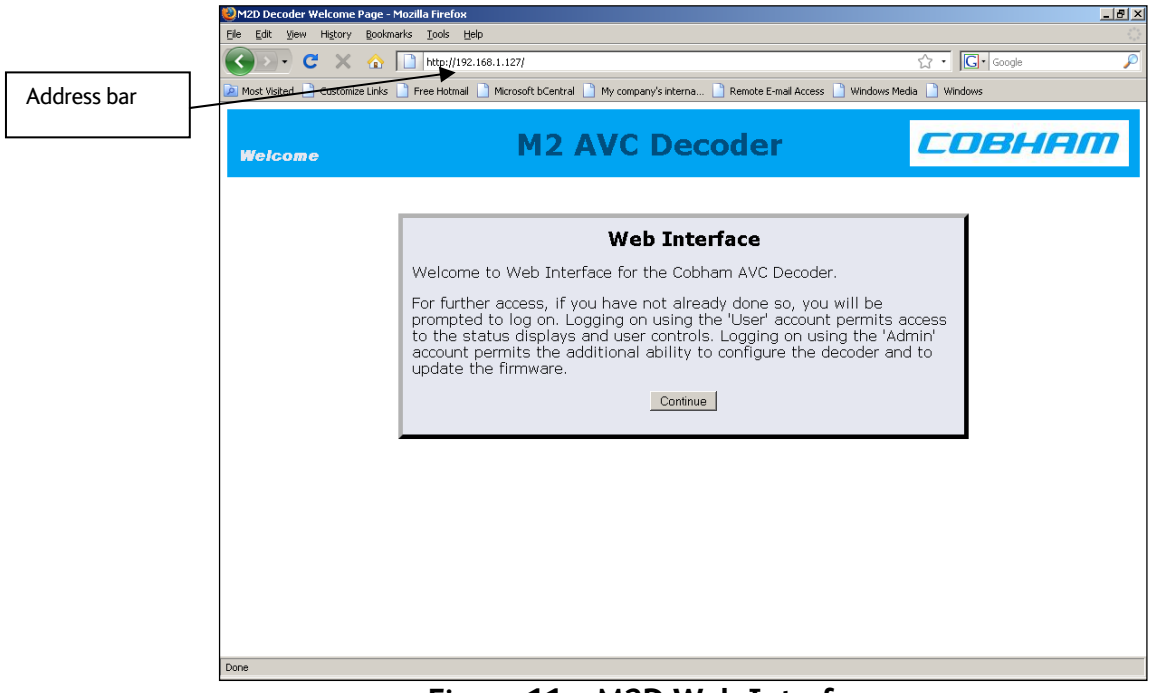


Figure 11 – M2D Web Interface

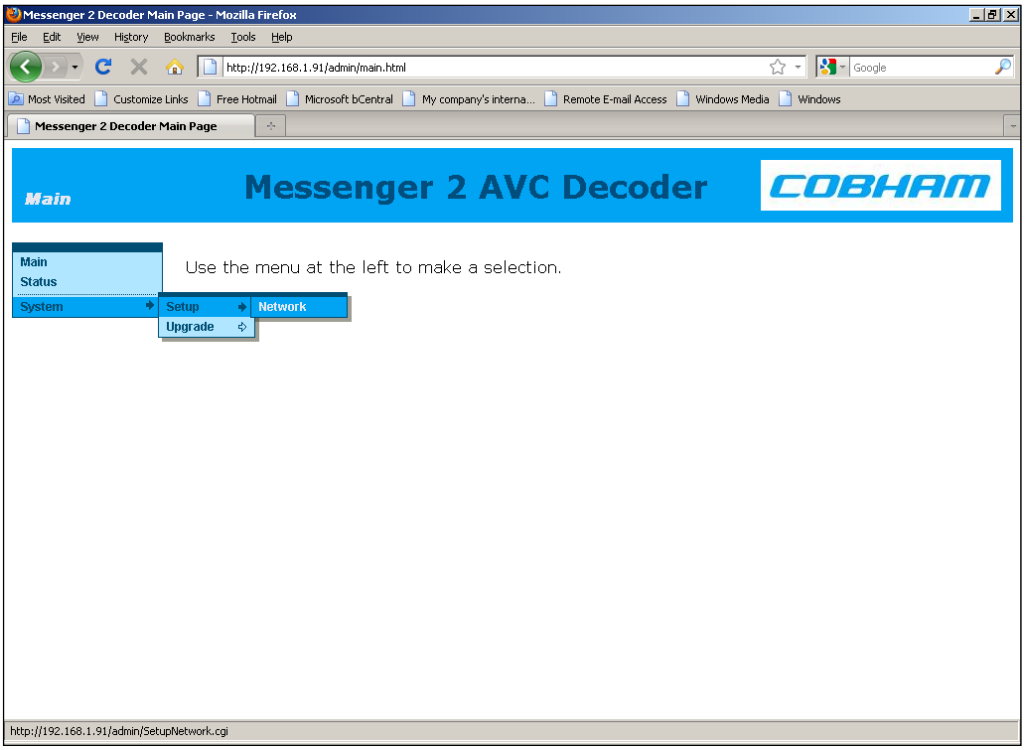


Figure 12 – Network Configuration

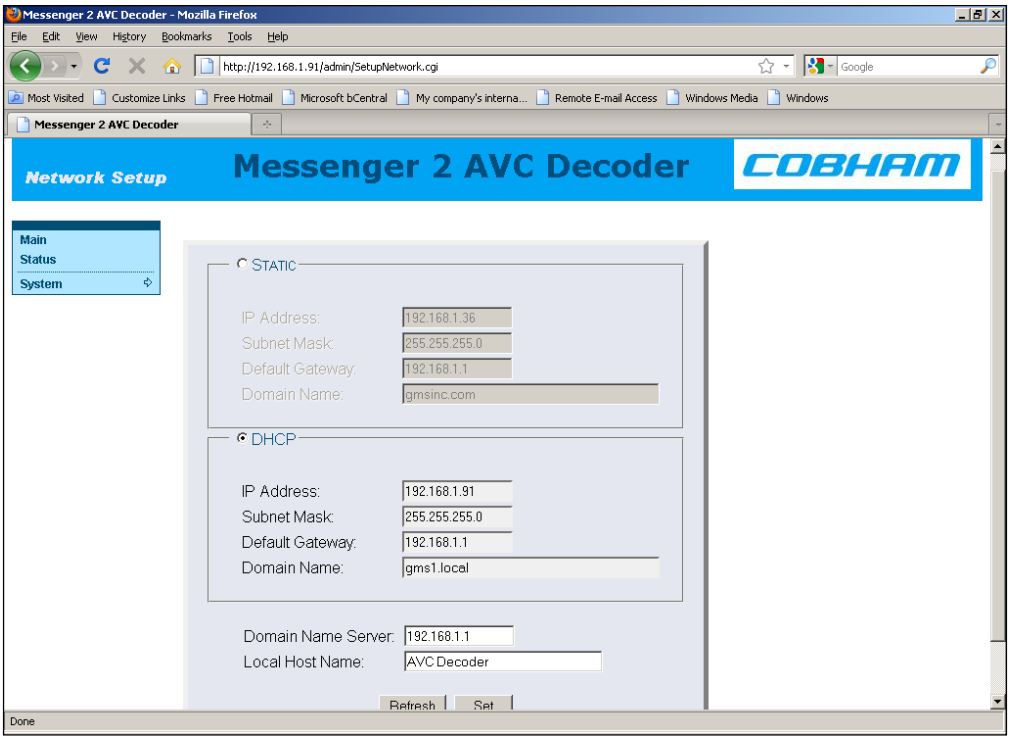


Figure 13 – Addressing Parameters

6.1. Set Decryption Keys

- Decryption keys are set through the COMMAND PROMPT on a PC using **Telnet.** Telnet is a simple text based program which allows you to connect to the M2D decoder and issue commands.
- Ensure the M2D decoder using an IP cable is attached to a PC or a computer network (the IP cable may need to be a crossover cable if the M2D decoder is directly connected to a PC). Find the current address of the M2D (under STATUS MENU section 5.3, screen 2, IP Address). Enter the COMMAND PROMPT on the PC. You can usually get to the COMMAND PROMPT by clicking on the Windows start button, click on ALL PROGRAMS, ACCESSORIES and then the COMMAND PROMPT. Another way is to click on the Windows start button and click on the RUN command, enter CMD into the text box and then click on the OK button.
- Once the COMMAND PROMPT opens type TELNET and hit the ENTER key. Type OPEN and then the address of the M2D decoder see (Figure 14) then hit the ENTER key.

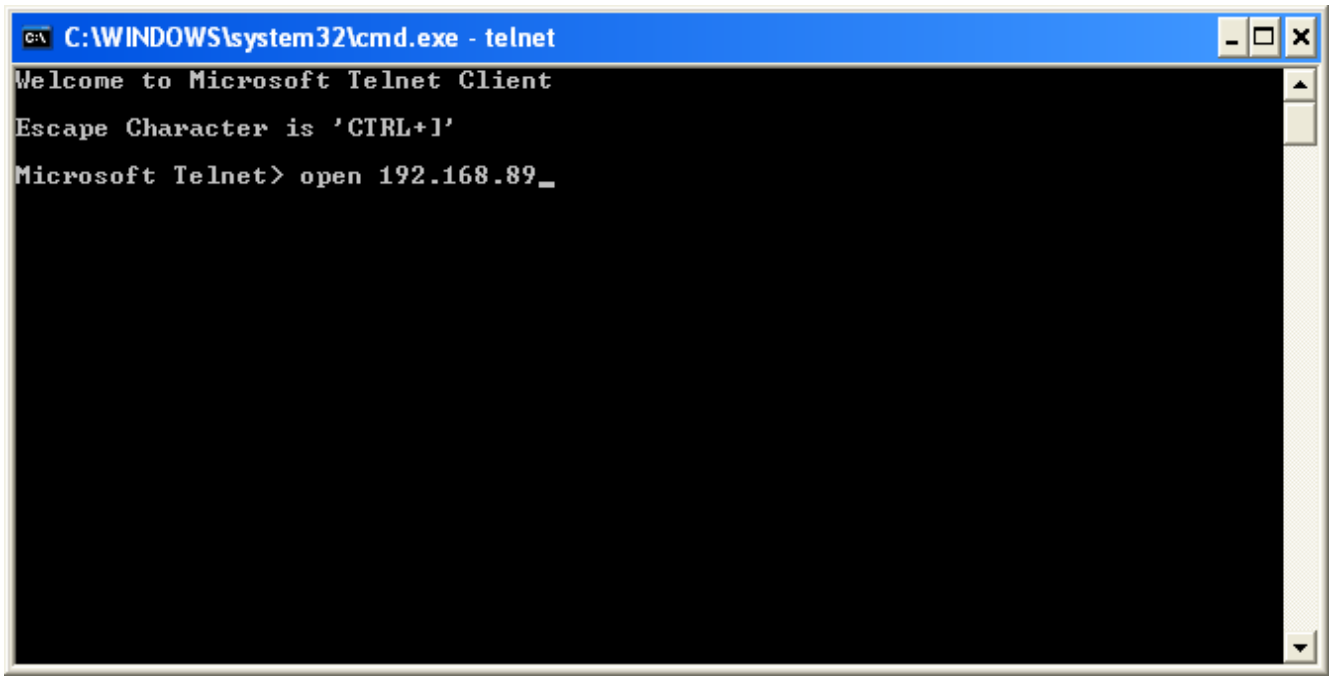


Figure 14 – Telnet

An authentication prompt appears (see Figure 15). Enter "user" for the NAME and "user" for the PASSWORD and then hit the ENTER key. The M2D server opens.

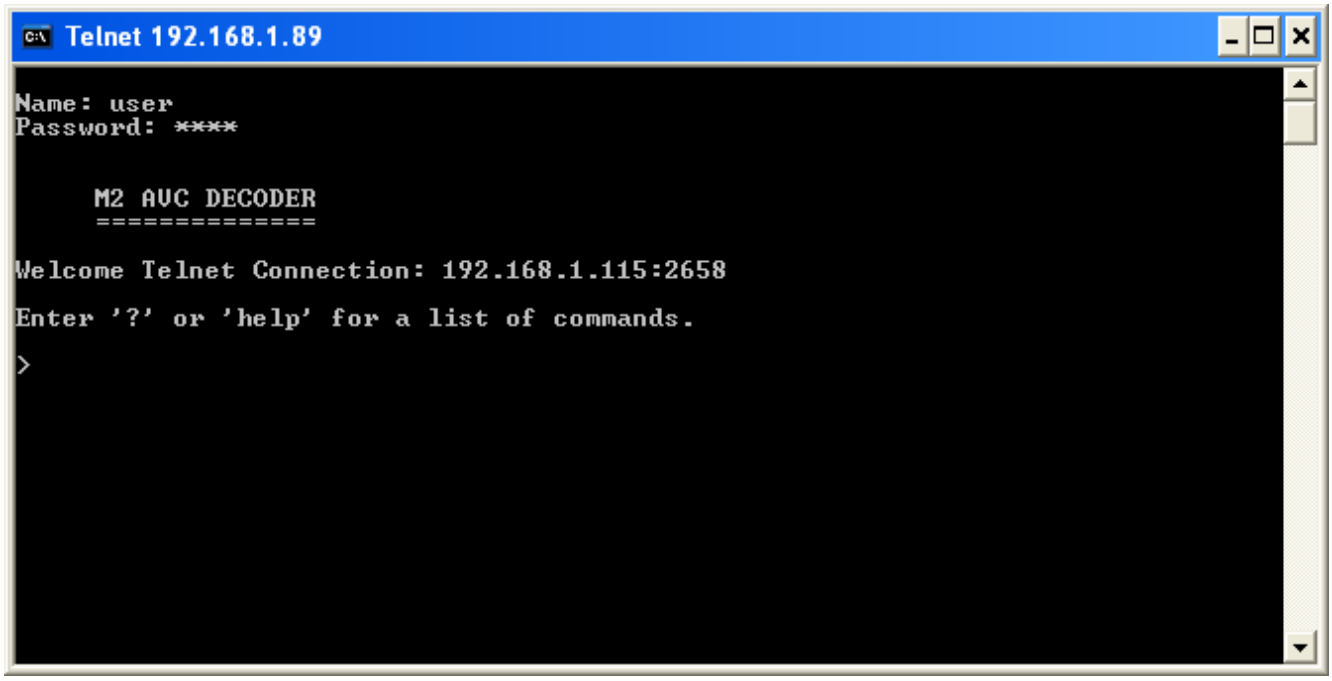


Figure 15 – Telnet Authentication

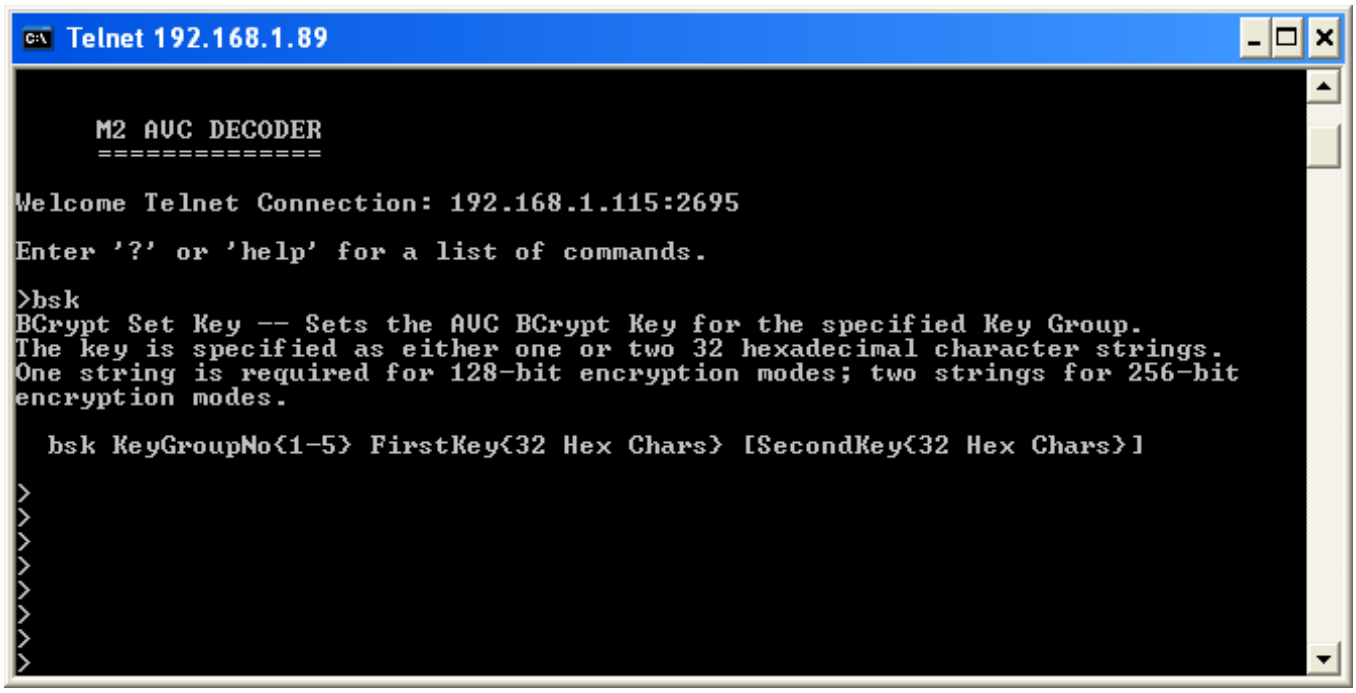


Figure 16 – Telnet Decryption Key Command

The command “bsk” is used to set the key or keys and the group associated with each key. You can just type “bsk” and hit the ENTER key and the help (?) explains how the command is used (see Figure 16).

Figure 17 shows some examples on setting the group and associating the decryption key with a group. For example if I want to associate a 128 bit key (in this case the key is all 1’s) with group 1 I would type “bsk 1 11111111111111111111111111111111 and then hit the ENTER key. If the command is typed correctly and the correct amount of characters for the key are typed correctly then after hitting the ENTER key I get the response “key set successfully”.

Another example, if I wish to set a 256 bit key (in this case the key is all 2’s for the lower 32 bit and all e’s for the upper 32 bit portion) and associate it with group 3, I would type “bsk 3 22222222222222222222222222222222 eeeeeeeeeeeeeeeeeeeeeeeeeeeeeeee”

Keep in mind the key is entered in as a 32 bit hex characters. Two 32 bits hex characters (lower key and upper key) are required for a 256 bit decryption. Also the key must agree with the transmitter encrypted key.

The “bsm” command sets the Bcrypt mode, the Active Group Key Number and the Key Group Save Mode (see Figure 18 below). Once the key is set (associated with a group) from Telnet you can set the **decryption mode**, (0 = off, 1 = 128, 2= 128+, 3=256, 4 = 256+) the **key group number** (1-5) and the **key group save mode** (Y or N). For example “bsm 1 1 Y” sets the decryption mode to 128 bit Bcrypt, sets the group to 1 and sets the save mode to Yes. These actions can also be completed from the M2D decoder front panel in the DECRYPTION sub-menu (see section 5.3.1.3) assuming the keys have already been associated with a group.
Finally from Telnet, the “bgm” command shows the current status of the decryption setup.

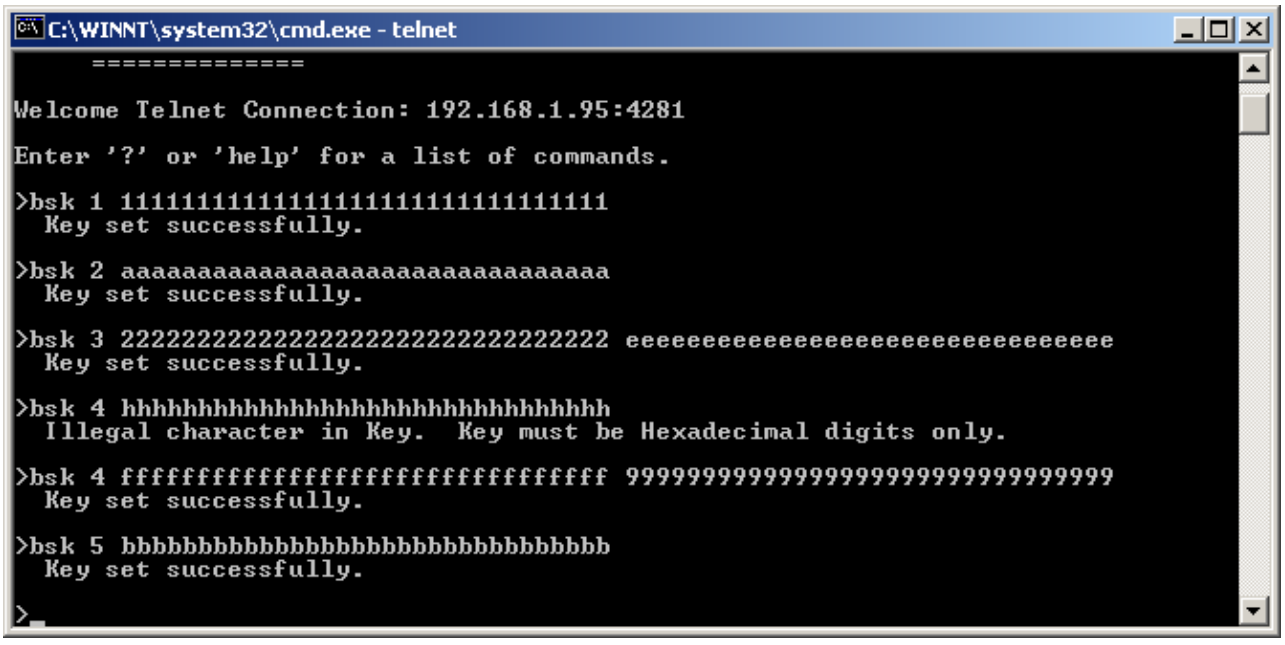


Figure 17 – Telnet Decryption Keys

☛ ***Note**: 128 bit Bcrypt mode and 128+ bit Bcrypt mode is at this time functionally the same. This also applies to the 256 bit Bcrypt mode and the 256+ bit Bcrypt mode.*

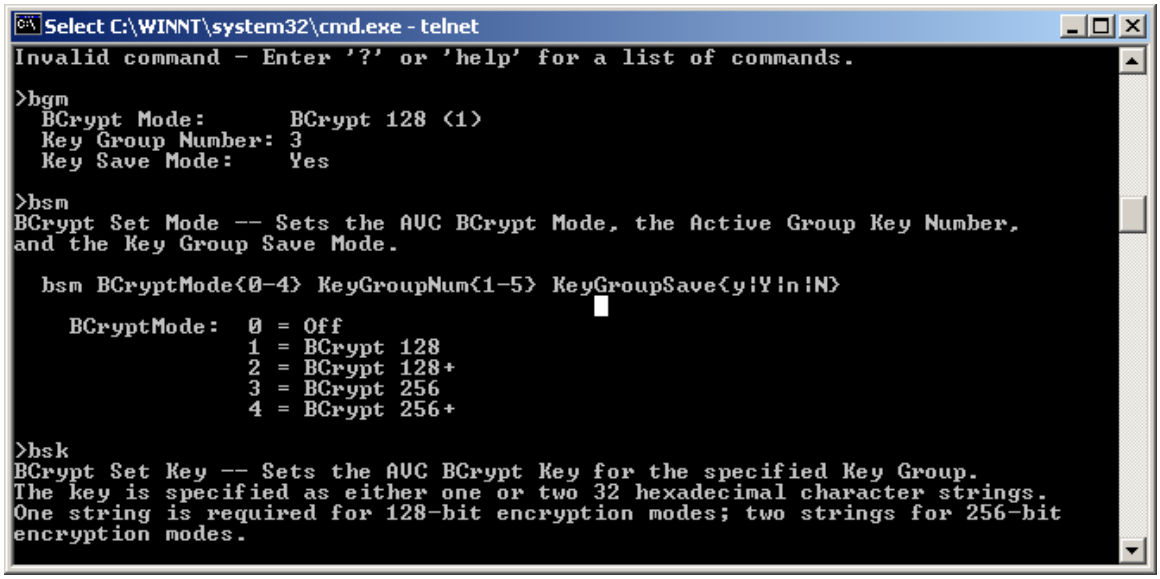


Figure 18 – Telnet Bcrypt Mode

7. Optional Features, upgrading to new features

7.1. Upgrading Options

Current factory enabled options can be viewed by using an Internet Browser and opening up the M2D internal Web page (factory options can also be viewed under SYSTEM MENU, section 5.3.2 screen 6, Optional Features). In addition new features can be enabled by entering a 32 bit Upgrade Code Word supplied by customer service on this same Web page once a new option is purchased.

Attach an IP cable from a PC or Network to the M2D decoder. Using an Internet Browser enter the M2D IP address (see section 5.3, STATUS MENU, IP Address, screen 2) in the address bar. The opening screen Web page is shown in Figure 11 above. Click on the CONTINUE button and then enter "admin" for both USER NAME and PASSWORD in the authentication page. Next follow the path as shown in Figure 19; System\Upgrade\Factory Options and press the ENTER key.

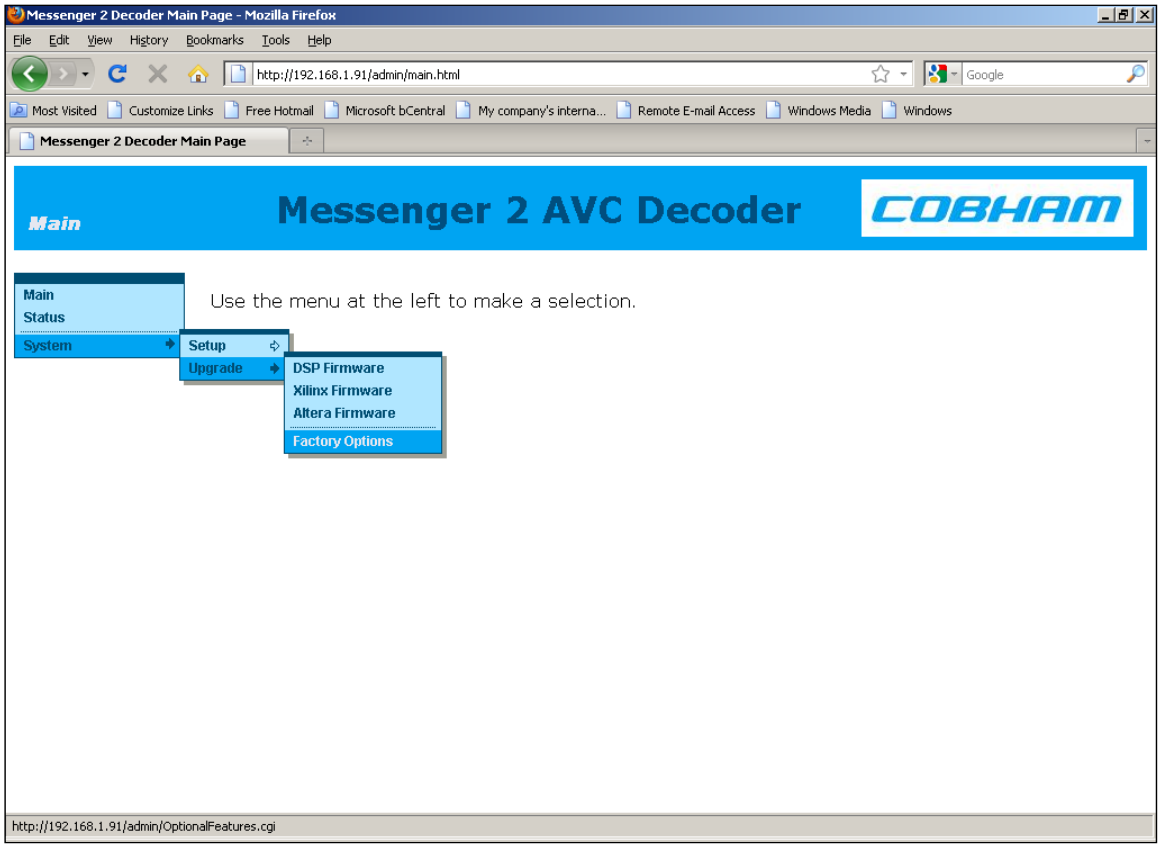


Figure 19 – Factory Options

The Factory Options page opens (see Figure 20). The top half of the page (top pane) shows the current enabled features. The bottom pane is where the user can enter or paste a 32 bit upgrade code word

(supplied by customer service) to enable other optional features which are purchased. New features which are enabled should be verified upon re-powering the M2D under the SYSTEM MENU, screen 6, Optional Features.

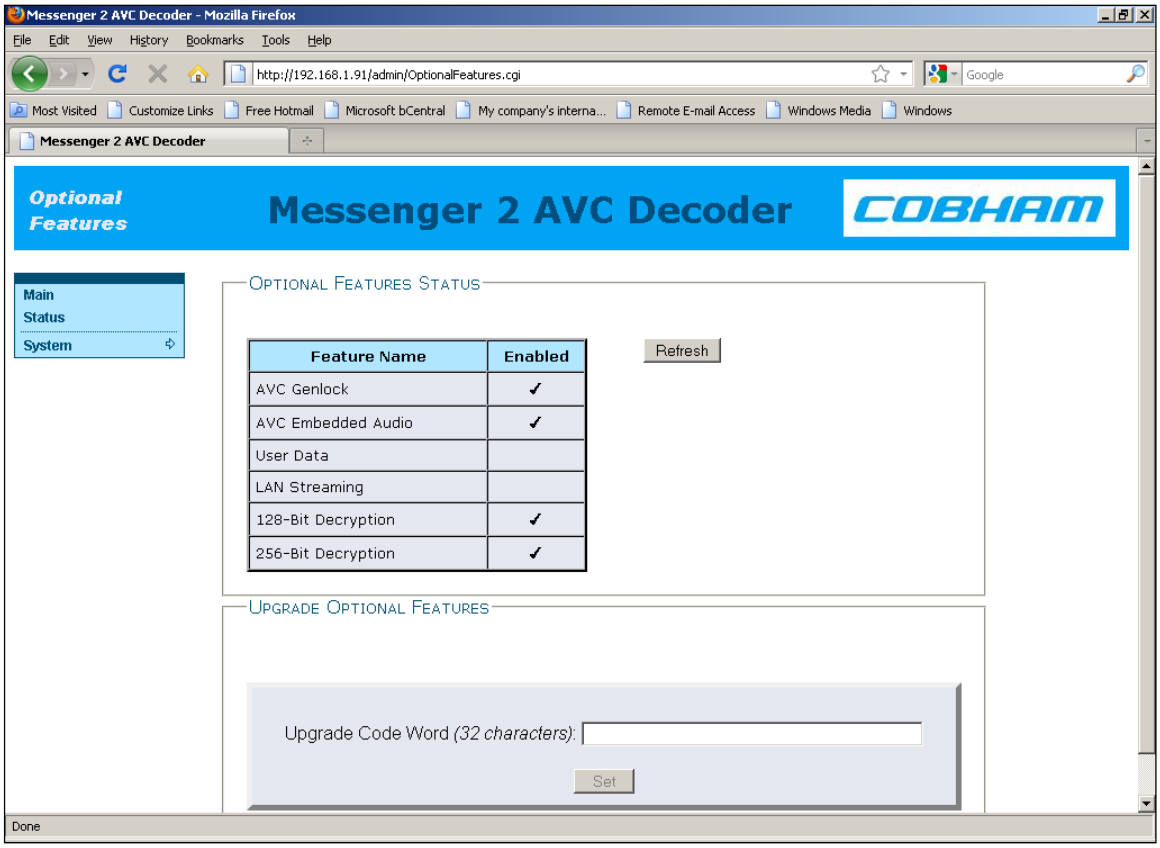


Figure 20 – Upgrade Code Word

7.2. Upgrading New Firmware through the IP Port

This section explains how to load the M2D with new firmware releases. There can be up to three separate firmware loads. They are usually labeled as D; X & W.

- D: The LCD displays DSP code as a "D:" (this code is always updated with the "***.out***" file)
- X: The LCD displays this FPGA code (for Xilinx) as an "X" (this code is always updated with a "***.bit***" file)
- W (also noted as "DEC"): The LCD displays this FPGA code (for the Altera) as a "W" or "DEC" (this code is always updated with an "***.rbf***" file).

The correct file type (.out, .bit, or an .rbf) must be selected before programming.

Step 1: Open Microsoft Internet Explorer or Firefox and type in the IP address, see section 5.3 on how to acquire the IP address from the M2D. See Figure 21 below. The Web page opens...click on the "**continue**" button.

Step 2: Next an "Authentication required" text box appears. Type-in "**admin**" for User Name and "**admin**" for Password.

Step 3: The main M2 AVC Decoder screen opens, see Figure 23 below. Select "System/Upgrade/DSP Firmware" (or the corresponding firmware which needs to be loaded - ***Xilinx*** or ***Altera)***. This example deals with the DSP upgrade, however all upgrades are very similar.

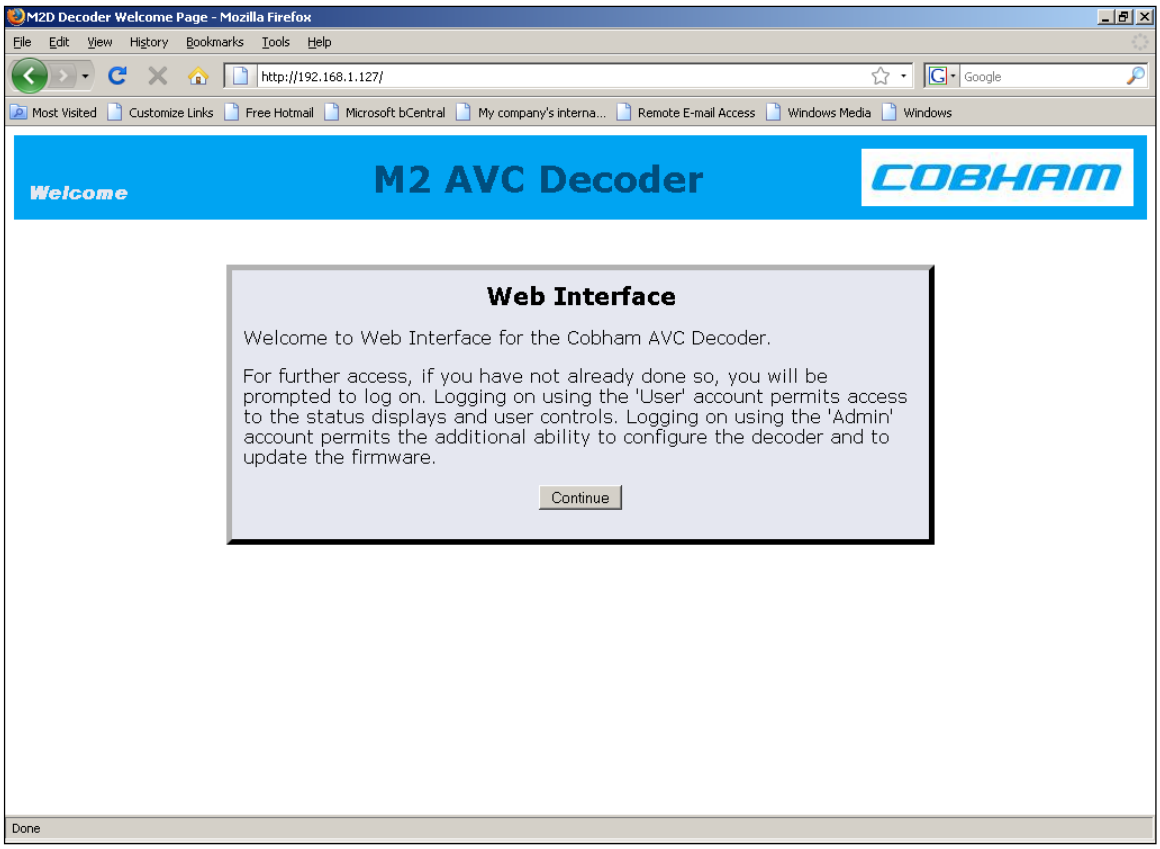


Figure 21 – Web Interface

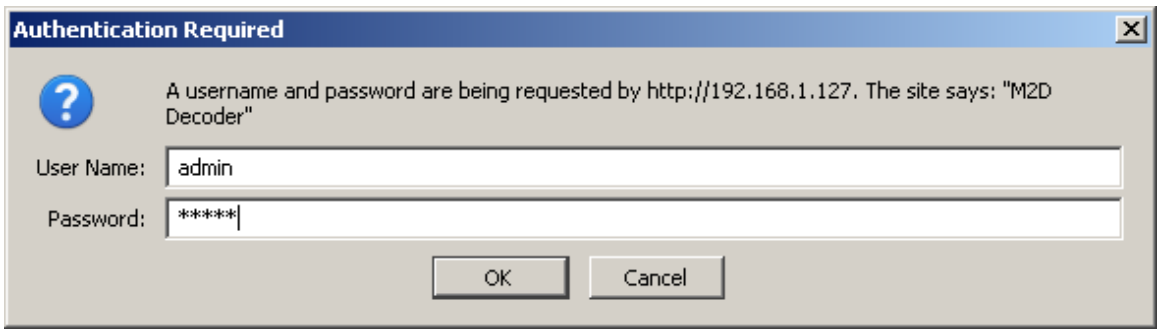


Figure 22 – Authentication

☛ ***Note*** *If a firmware upgrade is necessary customer service notifies the end user as to which firmware load is necessary and sends the link to the FTP site where the correct file can be downloaded.*
Step 4: The "Browse" for file screen opens. See Figure 24. Scroll down to the bottom of the screen and click on the "Browse" button to browse for the correct file. Remember in this example the DSP firmware is being updated so the "**.out**" file is the correct file to use. Also in this example the DSP presents a checkbox choice for the "**Program Number**"; 1 for "**(factory)**" or 2 for "(***field upgrade***".) The "field upgrade" checkbox should be selected. What this ensures is that the new firmware will be loaded from location 2. If for some reason the new load is corrupted (or does not load correctly) the M2D will fall back to the firmware in location 1 (the firmware which was running before the upgrade). Also it is *not necessary* to check the "Update Boot Loader". This is done during the initial programming of the flash at the factory.

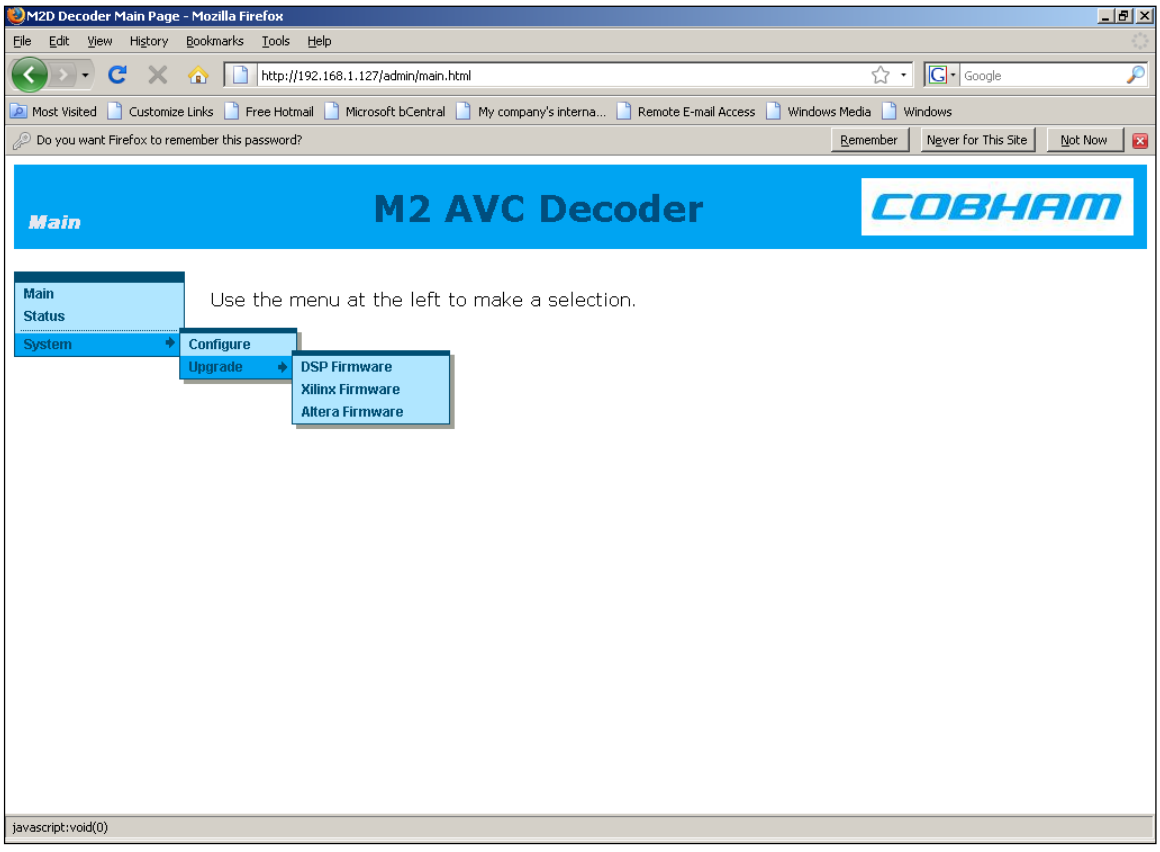
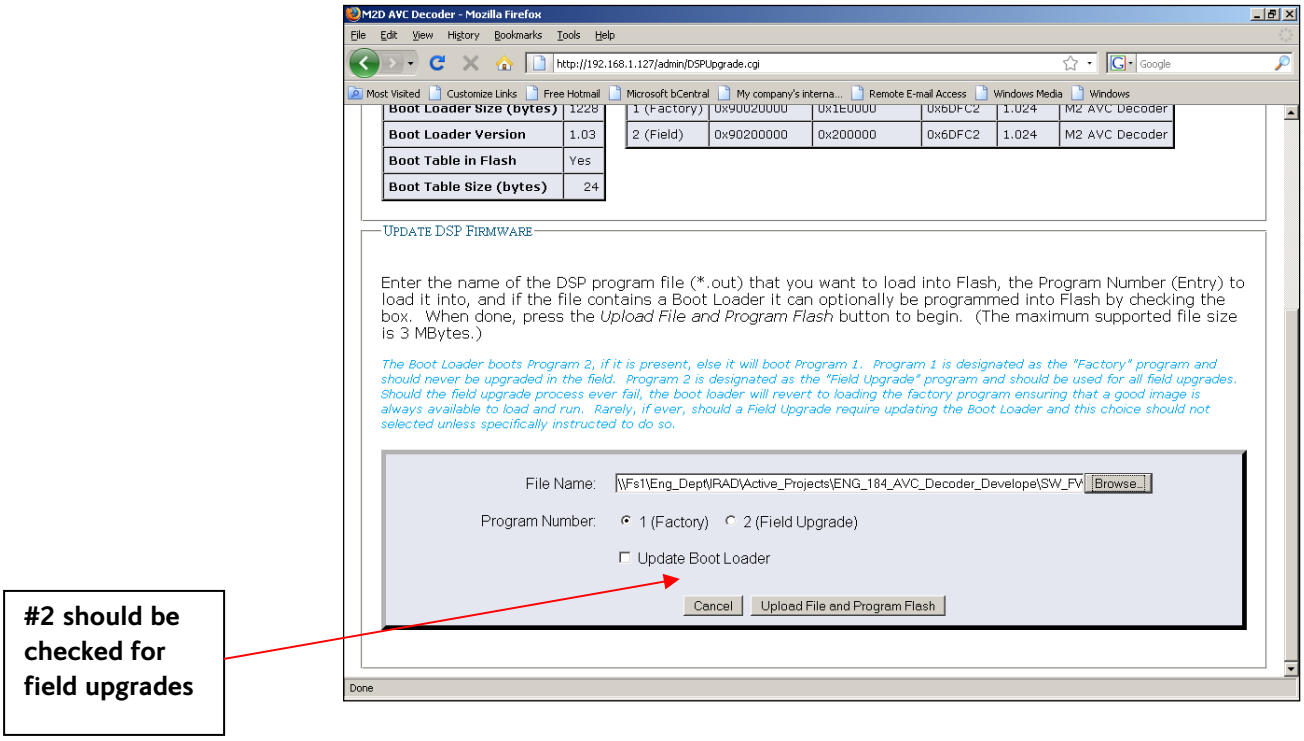


Figure 23 – Main Screen

Step 5: After browsing for the correct file and it's been placed into the "File Name" text box, click on the "Upload File and Program Flash" button. The "Progress" screen appears (see Figure 25 below). Wait until the programming is complete before removing power or taking any other action.

Step 6: After the file has been written into Flash an update status screen appears (see Figure 26) notifying the user that the file was successfully written into Flash (or not). To run the new code the M2D must be re-powered. The new version (s) should also show up under the "Firmware Version" LCD screen (see section 5.3.2 System Menu, screen 2).



#2 should be checked for field upgrades

Figure 24 – Browse for File

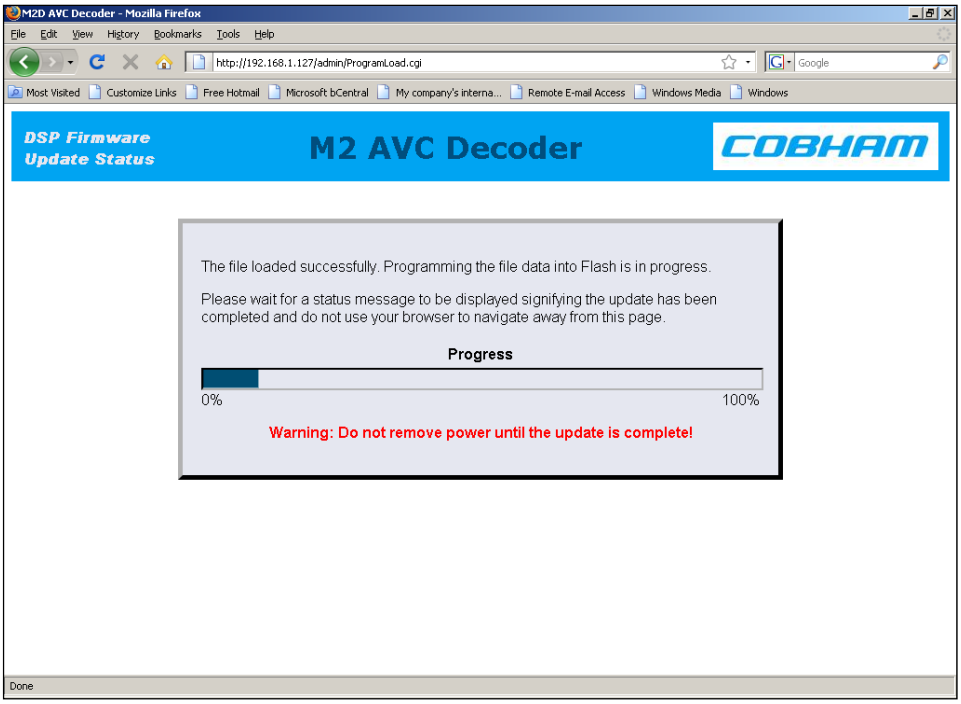


Figure 25 – Progress Screen

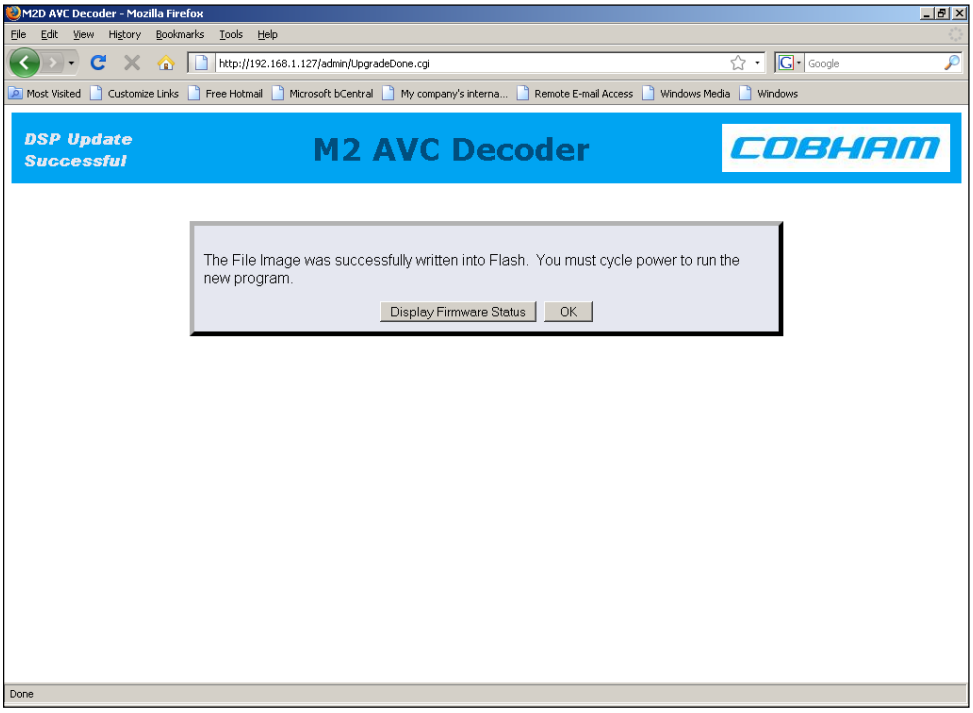


Figure 26 – Status Screen

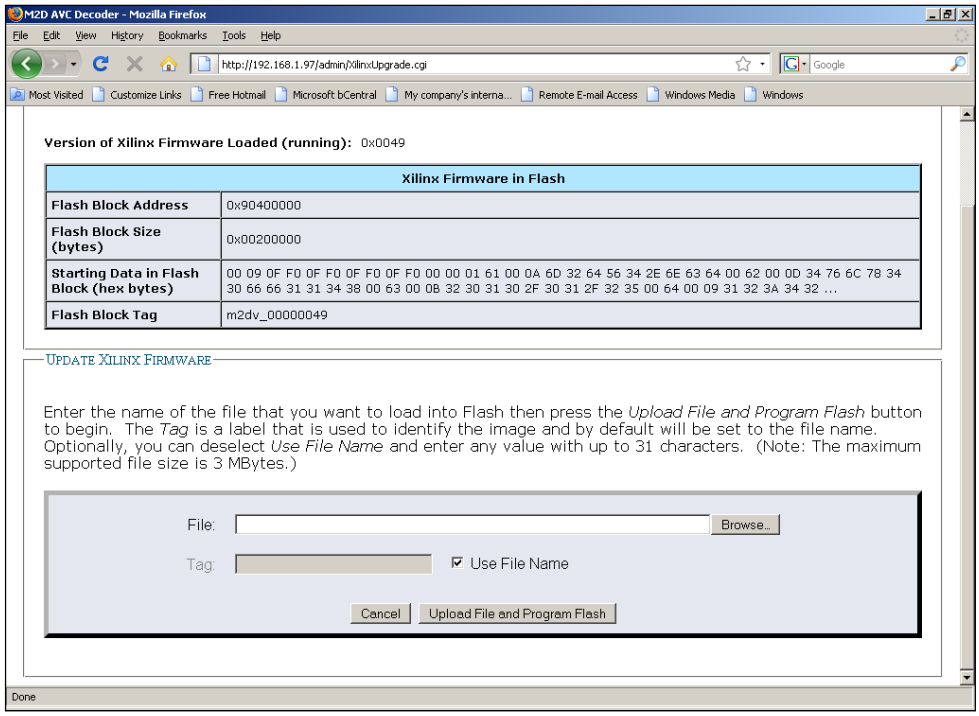


Figure 27 – Xilinx Browse Screen

☛ ***Note:*** Although the example above deals with uploading new code for the DSP the procedure is almost exactly the same for loading new FPGA (Xilinx or Altera) code. The only difference is the "Browse" screen. There are no check boxes to worry about (see Figure 27)

8. Initial Check Out

Prior to installing a M2D unit into the desired target environment, an initial checkout should be performed to ensure proper operation of the unit. The initial checkout consists of taking an ASI source and feeding it into the ASI IN of the M2D and ensuring video and audio are decoded.

The M2D is pretty much a 'plug & play' unit and thus is ready to work "right out of the box".
Just supply a power source and power cable along with an ASI stream, switch on the unit and it will start to decode without any input from the user.

The following power supply and power cable are available from the factory as follows:

- 780-C0485 Cable, M2D Mic Conn Pigtail
- 473-064-G Power Supply with Mic Connector

If a +12 Vdc source is already available with the proper current handling capability (see specifications under section 9) then only a pigtail cable with the proper connector needs to be ordered.

- 780-C0484 Cable

The basic setup is shown in Figure 28 below.

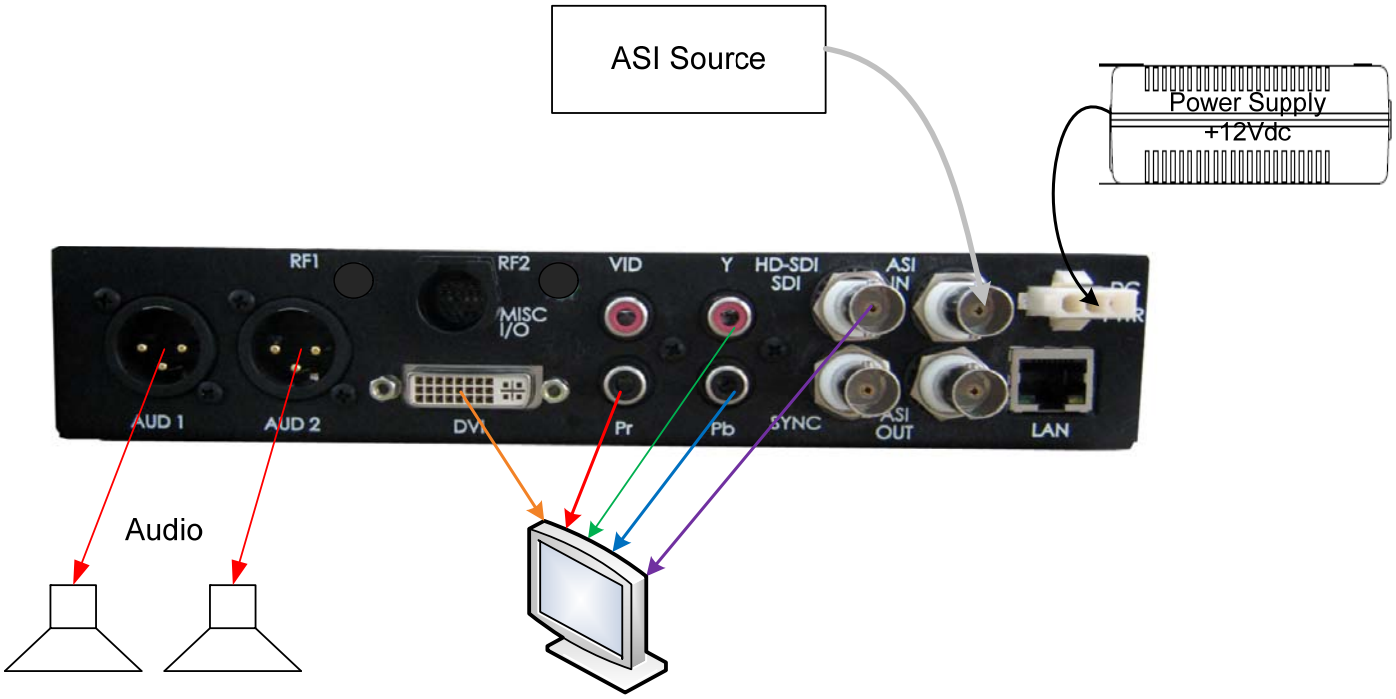


Figure 28 – Check Out

- Provide power to the M2D by attaching GMS # 473-064-G pigtail mic connector to the M2D "DC PWR" connector and to GMS power supply 780-C0485. Plug the supply into a wall socket.

☛ ***Note*** If using an off the shelf power supply ensure it can source at least 1.5A at +12 VDC and use GMS pigtail cable # 780-C0484 to attach to the M2D.

- Attach a known good ASI stream (DVB compliant) into the ASI IN connector of the M2D.
- Attach video cables from the video outputs to a monitor.
- Attach audio cables from the audio XLR connectors to speakers.
- Power on the M2D by toggling the "PWR" switch on the front panel to up position. The two LEDs on the front panel momentarily turn on & off. After a few seconds the front panel LCD lights and displays the "Messenger 2 AVC Decoder" logo and then displays the TS (transport screen). It should decode the video and audio from the program on the TS. The front "LOCK" green LED should light.

The initial checkout described above is simply to check the basic video operation of the M2D unit.

9. Specifications

Serial Transport Stream I/O

General

Configuration: DVB-ASI or LAN IP**, selectable

ASI Serial TS Input/Output

of ASI Inputs: 1, BNC-F
# of ASI Outputs: 1 (loop-through), BNC-F
Max TS Rate: Up to 150 Mbps

IP Serial Input/Output**

of Ethernet Ports: 1, RJ-45
Streaming Format: ** RTP/UDP; IP Unicast or Multicast
Supports MPEG-2: Transport Stream over UDP or RTP
Output:** DVB-ASI input can be reformatted for streaming and output at the same time that it is being decoded.

Table 2 Ethernet Connector

Connector Name	Connector Type	Pin	Function
Ethernet	RJ45	1	Transmit+
Ethernet	RJ45	2	Transmit-
Ethernet	RJ45	3	Receive +
Ethernet	RJ45	4	NC
Ethernet	RJ45	5	NC
Ethernet	RJ45	6	Receive-
Ethernet	RJ45	7	NC
Ethernet	RJ45	8	NC

MPEG Decoder (Video, 2 Audio)

General

Compatibility Standard: MPEG-4 AVC/H.264 Baseline Profile Plus Interlace Support
Bit streams Accepted: AVC video in MPEG TS per ISO/IEC 13818-2
PES packets per ISO/IEC 13818-1
Video Bit Rate: 1 Mbps to 100 Mbps

Video Decoder

Format @ Frame rate: 1080P @ 30 Hz, 29.97 Hz, 25 Hz, 23.98 Hz, 24 Hz
1080I @ 30 Hz, 29.97 Hz, 25 Hz, 23.98 Hz, 24 Hz
1080PsF @ 30 Hz, 29.97 Hz, 25Hz, 23.98 Hz, 24 Hz
720P @ 60 Hz, 59.94 Hz, 50 Hz
480I @ 29.97 Hz
576I @25 Hz

Display modes supported:	Letterbox**, Cropped
Aspect Ratio:	16 x 9, 4 x 3 (selectable - format dependant)

Audio Decoder

Decoder Capabilities:	MPEG-1, layers I and II MPEG-2, layer II,
MPEG-2 PES Formats:	MPEG-2, MPEG-1
Audio Source:	Selected Audio Services 1-4

Video Output

General

Output connectors:	Qty 1 -HD-SDI, Qty 1 – DVI, Qty 1- Component, SD Only - Qty 2 – Composite
Output formats supported:	1920 x 1080 Progressive 1920 x 1080 Interlaced 1280 x 720 Progressive 720 x 480 Interlaced 720 x 576 Interlaced
Frame rates:	60/50/30, 59.94/29.97, 25, 24, 23.98 Hz (progressive/interlaced) PsF supported with Interlaced Format (1080p limited to 30 frames per second max)
Aspect Ratio:	16 x 9 (fixed: 1080i, 720p) 16 x 9, 4 x 3
Display Modes (selectable):	HD: Letterbox**, Cropped, Full SD: Letterbox**, Cropped

HD-SDI (High Definition Serial Digital Interface)

Standard:	SMPTE 292 M
Data Bit Rate:	1.485 Gbps
# of Serial Outputs:	1
Connector:	BNC (x1), female

Embedded Audio (Future Option)**

Embedded audio format:	SMPTE299M
Sample rates supported:	32, 44.1, 48 KHz
Sample rate out:	48 KHz
# embedded audio ch pairs:	4 (2 complete audio groups)
Audio types supported:	MPEG2 layer 1 and 2
Embedded audio control:	Selectable, .type./disable (each pair independently controlled)

Analog Video

SD

Video format standards:	PAL & NTSC Composite

# of Analog outputs:	2
Connectors:	RCA-F

HD

Video format standards:	Component
# of Analog outputs:	1 set (Y, Pb, Pr)
Connectors:	RCA-F

DVI (Digital Visual Interface)

DVI Connector:	DVI-I Socket – Female

☛ ***Note**: Can be converted to HDMI (Video Only) with external adapter (Sold Separately)*

Audio Output

General

# of Services:	2 Mono or 1 Audio Stereo Pairs 4 Mono** or 2 Audio Stereo Pairs**

Embedded Audio (Option)

Embedded audio fomat:	SMPTE299M
Sample rate supported:	48 KHz
# embedded audio ch pairs:	2 channels

☛ ***Note**: Audio on the TS which is decoded is automatically embedded on the SDI output stream along with Video. Only two channels are supported and are mapped to channel 1 and channel 2.*

Analog Audio Out

Output Type:	Balanced, 2 channel pairs (+/-, L/R)
Connectors:	Qty 2 – XLR-M Qty 2- p/o High density 15-pin D-sub, female
Cable w/Optional connectors:	DB15 to Qty 2 - XLR-M
Impedance:	600 ohms nominal

Remote Operation/Update Interface

Type:	Ethernet, 10/100 BaseT
Connector:	RJ45

Serial Remote operation interface

Type:	USB
Connector	USB-A

Front Panel Indicators

Input LED:	Green indicates valid input on selected input, Off indicates no valid signal on the selected input
Error LED:	Red indicates error is occurring

OFF indicates no errors detected

Power

DC Input:	+9 to +36 VDC
DC Power:	15 Watts
AC Input Option:	Via External Power Supply
Voltage Range:	100 - 120/ 200 – 240 VAC
Power:	Maximum – 200 W
Frequency:	47 – 63 Hz
Line cord:	Detachable, 3-prong
Cooling:	Forced air

General

Operating Temperature:	0 to 50 degrees C
Operating Humidity:	<95% Non-Condensing

GENLOCK (Option)

Genlock capability:	HD – SD
Genlock Reference:	480i @ 29.97, Ref NTSC "black and burst" 1080i @ 29.97 fps Ref NTSC "black and burst" or 1080i tri-level sync @ 29.97 fps 1080i @ 30 fps – Ref 1080i tri-level sync @30 fps 1080i @ 25 fps – Ref 1080i tri-level sync @25 fps 720p @ 50 fps – Ref 720p tri-level sync @ 50 fps 720p@ 59.94 fps–Ref 720 tri-level sync @ 59.94 fps 720p @ 60 fps – Ref 720 tri-level sync @ 60 fps Fps = frames per second ☞ *NOTE: Genlock functions can add additional latency to the decoding process. Approximately 3 fields in 1080i formats and 1to 2 frames in 720 p formats*
Physical Dimensions:	8.5" (W) X 10.75" (L) X 1.75" (H) (2" with feet installed) 21.6 cm (W) X 27.3 cm (L) X 4.5 cm (H)
Weight:	2.89 lbs

*: Option
**: in Development. This feature will be supplied as a field FW update, when available.

Miscellaneous I/O connector

The MISC I/O (see figure below) is a specialized connector containing signals for digital audio, RS232 user data and USB control. The table below shows in detailed the signal types and the pin outs for each signal.

☛ ***Note:*** *These features, RS232 user data, digital audio and USB control are future upgrades for the M2D.*

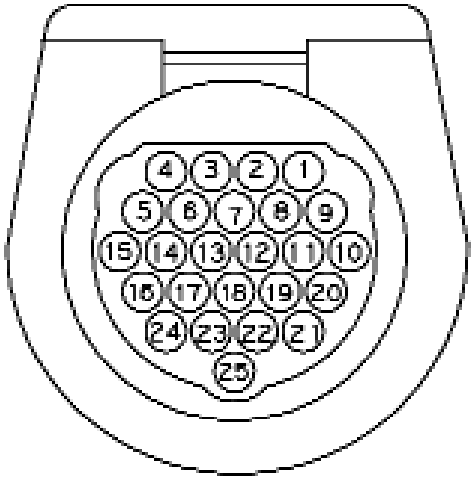


Table 1 – Pin Out MISC I/O

Pin Number	Pin Signal Name	Pin Number	Pin Signal Name
1	Audio SPDIF AN	**14**	Not connected
2	Audio SPDIF AP	**15**	Not connected
3	Audio SPDIF BN	**16**	RS232 RX User Data
4	Audio SPDIF BP	**17**	RS232 TX User Data
5	Audio Analog 3P	**18**	Ground RS232
6	Audio Analog 3N	**19**	Not connected
7	Audio Analog 4N	**20**	Not connected
8	Audio Analog 4P	**21**	USB Dn (Control)
9	Ground Audio SPDIF	**22**	USB VCC (Control)
10	Not connected	**23**	USB Dp (Control)
11	Not connected	**24**	Ground USB (Control)
12	Not connected	**25**	Ground Audio Analog
13	Not connected		

Video Scaler

When processing HD AVC the composite video comes from an internal Video Scaler. The table below shows details of the scaling and the valid configurations.

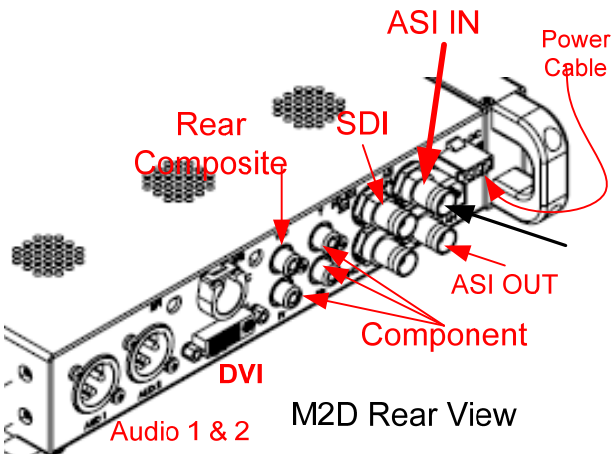
Table 2 – Video Scaler Modes

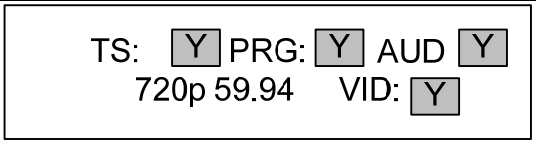
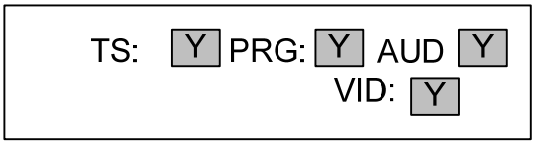
Input Format	Input Field/ {Frame} Rate	Input Pixels	Input Lines	Horizontal Scale (720)	Vertical Scale (576 or 480)	Output Frame Rate
480i, YCbCr, 4:2:2	59.94 Hz	720	480	1	1	No Scale
576i, YCbCr, 4:2;2	50 Hz	720	576	1	1	No Scale
720p, YCbCr, 4:2:2	{50}	1280	720	.5625	.8	576i 50 (Interlace)
720p, YCbCr, 4:2:2	{59.94}	1280	720	.5625	.666	480i 59.94 (Interlace)
720p, YCbCr, 4:2:2	{60}	1280	720	.5625	.666	480i 59.94 (Interlace)
1080p, YCbCr, 4:2:2	{23.98}	1920	1080	.375	.4444	480i 59.94
1080p, YCbCr, 4:2:2	{24}	1920	1080	.375	.4444	480i 59.94
1080p, YCbCr, 4:2:2	{25}	1920	1080	.375	.5333	576i (Interlace)
1080p, YCbCr, 4:2:2	{29.97}	1920	1080	.375	.4444	480i 59.94
1080p, YCbCr, 4:2:2	{30)	1920	1080	.375	.4444	480i 59.94
1080i, YCbCr, 4:2:2	50	1920	1080	.375	.533	576i 50
1080i, YCbCr, 4:2:2	59.94	1920	1080	.375	.444	480i 59.94
1080i, YCbCr, 4:2:2	60	1920	1080	.375	.4444	480i 59.94
1080i, YCbCr, 4:2:2	48	1920	1080	.375	.4444	480i 59.94
1080i, YCbCr, 4:2:2	47.96	1920	1080	.375	.4444	480i 59.94

The Video Scaler does not always accurately represent the HD signal. Test patterns with very narrow lines can be distorted by the scaler. However, it does an acceptable job of converting normal video.

10. Troubleshooting Section

Table 3 – T/S

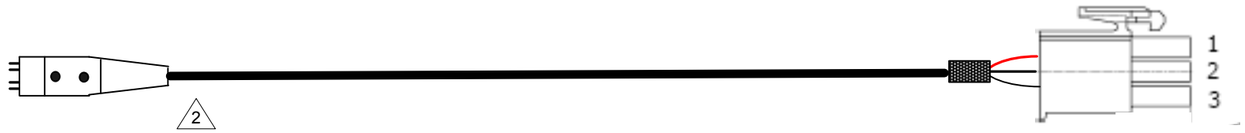
Fault Condition	Action
LCD displays "TS = N"	Ensure ASI source output is connected to the correct ASI INPUT BNC connector on the rear of the M2D decoder. See figure below.  M2D Rear View
	This can be an indication of a non-valid or corrupt transport stream. Check the ASI source to ensure the integrity of the TS, perhaps feed the ASI source into a commercial TS analyzer.
	Check the Progam mode. See section 6.1.3.2. If Progam mode is set for "manual" and it doesn't recognize the TS number it won't decode. Either switch to the correct TS number or set the progam mode to "auto".
No Video Out	IF TS = Y, PRG = Y and VID = Y and the screen indicates a video format such as "720p59.94" then chances are it is receiving and decoding an ASI stream. If this is the case check the video out BNC connectors on the rear of the M2D and ensure they are correctly connected to the video monitors, that the video monitors are on and they are capable of receiving the format indicated.

	
	If TS = Y, PRG = Y but VID = N then chances are the video source into the transmitter has been disconnected or is not functioning.
	If TS = Y, PRG = Y and VID = Y but no video format is displayed then ensure video source into the transmitter and the selected video format of the transmitter are the same (see figure below). 
No Audio	Audio will always indicate a 'Y' unless it's been set to OFF at the transmitter end or there is a hardware failure.
	Ensure it is enabled at the transmitter end.
	Volume level is not adjusted from the M2D. Ensure the volume level is sufficient (either at the transmitter end or an external amplifier).
Genlock Error	Genlock is on but M2D decoder can't lock to the reference Genlock clock.
	Genlock reference input signal does not match the video formt which is decoded.

GENERAL NOTES:

1. SEE BOM 780-C0485X1 FOR PART REFERENCE DESIGNATORS.
2. LABEL FINAL CABLE ASSEMBLY WITH PART NUMBER 780-C0485X1 USING BEST COMMERCIAL METHOD APPROXIMATELY WHERE SHOWN.
3. REFERENCE SHEET 2 FOR ASSEMBLY INSTRUCTIONS.
4. FIGURE A SHOWS COMPLETED ASSEMBLY.

REVISIONS				
ECO	REV	DESCRIPTION	DATE	APPROVED
E1366		INITIAL RELEASE	01/14/10	



ASSEMBLED
CABLE

FIGURE A

TOLERANCES UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES DO NOT SCALE DRAWING LINEAR X.X = ± 0.5 X.XX = ± 0.125 X.XXX = ± 0.020	ENG/TECH T.GIOTTA DRAWN ENG PROD QC	COBHAM GMS Products SIZE B DATE 01/14/10 SCALE: NONE	DWG TITLE CABLE,M2D MIC CONN PIGTAIL DWG NO 100-C0485X1 REV X1 SHEET 1 OF 2

GENERAL NOTES:

1. SEE BOM 780-C0484X1 FOR PART REFERENCE DESIGNATORS.

2 LABEL FINAL CABLE ASSEMBLY WITH PART NUMBER 780-C0484X1 USING BEST COMMERCIAL METHOD APPROXIMATELY WHERE SHOWN.

REVISIONS				
ECO	REV	DESCRIPTION	DATE	APPROVED
E1347	X1	INITIAL RELEASE	12/14/09	

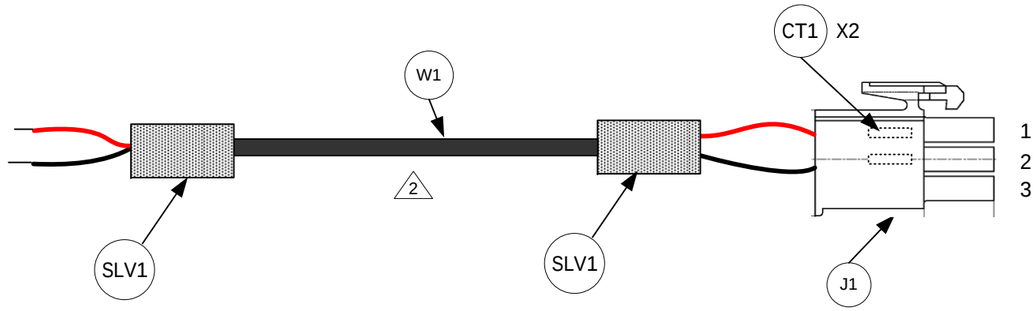


FIGURE A

CABLE ASSEMBLY INSTRUCTIONS

1. CUT AND STRIP CABLE [W1] APPROXIMATELY TO THE LENGTH SHOWN IN FIGURE 1.

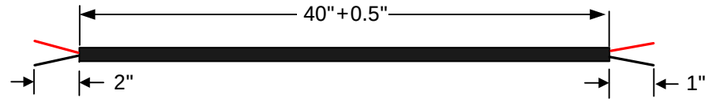


FIGURE 1

2. STRIP THE INSULATION OFF THE WIRE ENDS (0.25") ON BOTH ENDS OF CABLE.
3. CRIMP CONTACTS [CT1] TO EXPOSED WIRES OF THE CABLE AS SHOWN IN FIGURE 2.

FIGURE 2

4. INSERT CONTACTS INTO [J1]. RED WIRE MUST BE INSERTED INTO PIN 1 AS SHOWN.
5. SLIDE 2 PIECES OF HEAT SHRINK SLEEVE [SLV1], APPROXIMATELY 1" LENGTH EACH, OVER CABLE AND SHRINK.
6. TIN THE EXPOSED WIRE ENDS.

TOLERANCES UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES DO NOT SCALE DRAWING LINEAR X.X = ± 0.5 X.XX = ± 0.125 X.XXX = ± 0.020	ENG/TECH R. Manvelyan DRAWN ENG PROD QC	COBHAM GMS Products	DWG TITLE CABLE, M2D/MVRD, EXTERNAL POWER, PIGTAIL	
		SIZE B	DATE 12/14/09	DWG NO 100-C0484X1 / REV X1
		SCALE: NONE		SHEET 1 OF 1

Appendix C – Power Cable (473-064)