

**Time Code Module**  
**TCM-4020**  
**User Operation Manual**

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**Anitech Systems Inc.**

25021 Anza Drive, Valencia, CA 91355 USA

Phone (661) 257-2184 Fax (661) 257-2025

Email Mail@Anitech-Systems.com

Web <http://www.Anitech-Systems.com>

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# Contents

CONTENTS.....	V
PREFACE.....	VII
RELATED PUBLICATIONS.....	VII
SYSTEM REQUIREMENTS.....	VIII
GETTING STARTED.....	VIII
OPERATING ENVIRONMENT.....	IX
WARRANTY.....	IX
SERVICE OPTIONS.....	IX
<b>SECTION 1 – INTRODUCTION.....</b>	<b>1</b>
1.1    MODULE DESCRIPTION.....	1
1.2    PURPOSE AND INTENDED USE.....	3
1.3    SPECIFICATIONS.....	3
<b>SECTION 2 – PREPARATION FOR USE.....</b>	<b>5</b>
2.1    UNPACKING AND INSPECTION.....	5
2.2    INSTALLATION CONSIDERATIONS.....	5
2.3    USER-CONFIGURABLE JUMPERS AND OPTIONS.....	6
2.3.1    Jumper Settings and Options.....	8
<b>SECTION 3 – INSTALLATION.....</b>	<b>11</b>
3.1    TYPICAL INSTALLATION EXAMPLE.....	11
3.2    KEYING AND CONNECTOR INFORMATION.....	13
3.2.1    TCM-4010 Connectors.....	14
3.2.2    TCM-4020 Connector.....	14
3.3    SUPPORT TOOLS AND PART NUMBERS.....	15
3.3.1    Field Connector Kit.....	15
<b>SECTION 4 – MODULE OPERATION.....</b>	<b>17</b>
4.1    NORMAL OPERATIONS.....	17
4.2    FAULT CONDITIONS.....	17
4.3    INDICATORS.....	18
4.4    TROUBLESHOOTING.....	19
4.5    MAINTENANCE.....	19
<b>SECTION 5 – PROGRAMMING.....</b>	<b>21</b>
5.1    MODULE PROGRAMMABLE FUNCTIONS.....	21
5.2    SOFTWARE CONFIGURATION.....	21
5.3    SUPPORTED COMMAND FORMATS.....	22
5.3.1    Set Output Token for TCM-4020.....	23
5.4    EXAMPLE USAGE.....	25
5.5    LOAD STATUS STATEMENTS.....	26
5.6    APPLICATION EXAMPLE.....	29
5.6.1    Playing Cues Against SMPTE.....	29
5.7    SMPTE CUE SYNCHRONIZATION.....	30
5.8    PLAYING ANIMATION AGAINST SMPTE.....	33
<b>SECTION 6 – APPENDIX.....</b>	<b>37</b>
6.1    SAVING FILES FROM A WEB PAGE WITHOUT DISPLAYING -.....	37
6.2    POWER SPECIFICATION FOR CONTINUOUS <i>NORMAL</i> OPERATION.....	38
6.3    TCM-4020 FIRMWARE - REVISION LEVEL RELATIONSHIPS.....	39
6.4    DOWNLOADING NEW VERSION OF FIRMWARE TO A MODULE.....	41
GLOSSARY.....	44



## Preface

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Welcome to the Media Pro® TCM-4020 User's Operational Manual. Highlighted in this manual are the component features, installation, configuration, software operation, programming reference, examples of typical applications, and technical support information.

This document is provided so users of the Media Pro® 4000 can gain an understanding of the system design and implementation techniques. It is assumed the reader has a basic knowledge of typical show elements and their control requirements. In addition, a basic understanding of programming concepts will help the user understand Anitech System's powerful English based Media Pro® Control Language (MPCL).

For specific information about other Media Pro® 4000 products, please refer to the applicable user manual or on-line help system.

## Related Publications

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The following documents contain additional information concerning ASI Media Pro® 4000 products. To obtain a copy of any of the documents listed below, contact ASI or visit our website.

Document	Description
ABM – 4010	Allen Bradley Remote Input/Output Module (RIO)
AOM – 4010	Analog Output Module - 16 Channel
APC – 4020	Animation Programming Console
ASM – 4030/4020	Analog Servo Module - 8 Channel / 4 Channel with Compliance
DSM – 4020	Digital Sound Module with PCMCIA socket
HMR – 4000	Horizontal Module Rack - 5 Slot
ICM – 4020	Intelligent Control Module
IMC – 4020/4010	Integrated Module Controller
IOM – 4020	Input/Output Module - 16 Bit (24vdc)
LCM – 4020	Lighting Control Module (DMX 512)
SEM – 4020	Serial Expansion Module - 8 Channel (RS-232)
TCM – 4020	Time Code Module (SMPTE)
VMR – 4000	Vertical Module Rack - 18 Slot

## System Requirements

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- IBM PC compatible computer running Windows 95 / 98 environment with 1 serial port at 19.2Kbps.
- The PC should be at least Pentium 90 MHz, with a minimum of 16 Mbytes of Ram.
- The recommended minimum system is Pentium 400 MHz or faster with 32M RAM and a serial port at 115.2Kbps.
- An EPP 1284-1994 compatible parallel port is required for animation and is recommended for all other operations, but not required. Downloads for Animation and DSM sound files are much faster over the EPP parallel port.
- Approximately 12 Mbytes of disk space are required for the MP4000/APU4000 software. In addition, we recommend a minimum of 30 Mbytes storage for each show's application files. This size will vary depending on the show configuration and the size of the sound and animation files that may be required.

## Getting Started

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The Media Pro® 4000 Software is provided on a set of floppy disks. To install the files, follow these directions:

- Place disk 1 into the floppy drive. Open the Explorer and browse **FLOPPY [A:]**
- Double click on **SETUP... .EXE**
- Follow the on-screen installation instructions.
- The default directory **C:\MP4000** will be created and placed on the desktop.
- To enter the program, browse the directory and double click **MP4000.EXE**
- Current versions of the MP4000 software place an icon on the desktop, earlier versions (1998) do not.



## Operating Environment

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All Media Pro<sup>®</sup> Products are manufactured to the highest standards. With proper care and maintenance, they should provide many years of trouble-free service.

To ensure that your equipment has the longest life possible, it should be placed in an area with good ventilation and low humidity, out of direct sunlight and away from heat sources or lamps. Never expose equipment to moisture of any sort. Always maintain a dust, dirt and smoke free environment.

Always remember that high temperature is the enemy of all electronic equipment.

### Environmental Conditions:

Recommended Operating:	10° to 32° C (40° - 90° F)
Storage Temperature:	-40° to 60° C (-4° - 140° F)
Relative Humidity:	0 to 95% (Without Condensation)

## Warranty

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Anitech Systems warrants this product to be free of manufacturing defects for 1 year from the date of purchase. At Anitech System's discretion, Anitech Systems will repair or replace a module that fails due to manufacturing defects.

The warranty does not cover shipping charges or modules damaged due to improper configuration, misapplication, misuse, abuse, accidents, or shipping damage.

## Service Options

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Obtain a Return Materials Authorization by contacting Anitech Systems.  
The contact information for customer support follows:

E-mail	<a href="mailto:Mail@Anitech-Systems.com">Mail@Anitech-Systems.com</a>
Web	<a href="http://www.Anitech-Systems.com">http://www.Anitech-Systems.com</a>
Telephone	(661)257-2184
Fax	(661)257-2025

### Non-Warranty Modules Returned for Repair-

Charges will be based on parts used, labor, and shipping charges. Make sure the product is properly packed and insured. Anitech Systems is not responsible for damage that occurs during shipment.



# 1

## Section 1 – Introduction

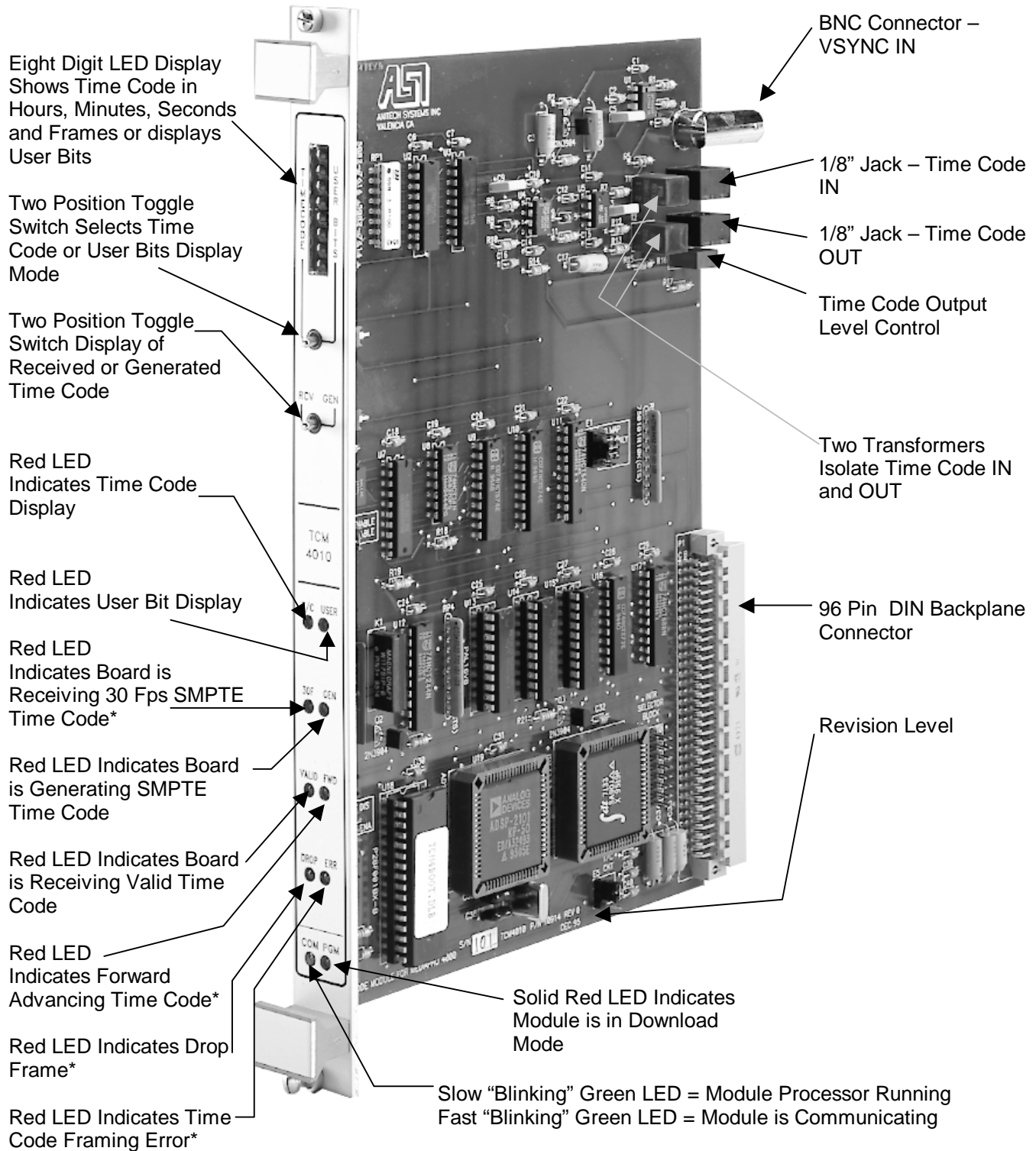
This manual is a technical reference for the TCM-4020 Time Code Module. It contains specifications, diagrams and instructions that should help with the implementation of Media Pro controlled shows using this product.

### 1.1 Module Description

- The TCM-4020 Time Code Module is a DSP-powered SMPTE Generation and Synchronization Module.
- The Time Code Module allows Cues and Animation to track SMPTE Time Code for synchronized applications.
- Any number of TCM modules can be added to provide synchronization of numerous cues and real time animation data to multiple sources of SMPTE.
- In addition, external video can be connected to the TCM's video sync input to provide for the generation of SMPTE that is phase-locked to external video devices.
- The TCM-4010 & TCM-4020 have different field wiring connectors. The TCM-4010 has individual discrete connectors, and the TCM-4020 has a single DIN48 permitting board removal without manual disconnection of field connector.

**Figure 1-1. Media Pro® 4000 Time Code Module**

**TCM-4010**



\*Indications applicable to input Time Code only

## 1.2 Purpose and Intended Use

---

The TCM-4020 provides SMPTE Time Code generation and synchronization capabilities for the Media Pro 4000.

It enables the user to synchronize show operation to multiple sources of SMPTE time code. In addition, external video sync can be connected to the TCM's video sync input to provide for the generation of SMPTE that is phase-locked to external video devices.

There are no quantity restrictions for the TCM-4020.

The TCM must be located in rack 0.

## 1.3 Specifications

---

- Simultaneous SMPTE Generator and Receiver
  - LED Display of Time Code and User Bits
  - Transformer-isolated input and output
  - Controllable from MPCL cue events
  - Used to synchronize Cues and Animation to SMPTE
  - Balanced SMPTE Time Code in and out
  - Video Sync input will take VSYNC, or Strip sync from composite video
- ❖ SMPTE Time Code Module Input Level
- The TCM input is a Balanced 600 Ohm Transformer
    - Absolute minimum input level with no noise
      - 120mv p-p
      - 60mv pk
      - 42mv rms
      - -25db



# 2

## Section 2 – Preparation for Use

This section describes the board layout, jumper configurations, and switch setting selections. These user-defined configurations need to be set before the TCM will operate correctly.

### 2.1 Unpacking and Inspection

Inspect the shipping carton immediately upon receipt for evidence of mishandling during transit. If the shipping carton is severely damaged or water-stained, request that the carrier's agent be present when the carton is opened. If the carrier's agent is not present when the carton is opened and the contents are damaged, keep the carton and packaging materials for the agent's inspection.

It is suggested that all salvageable shipping cartons and packing material be retained for future use in the event the product must be shipped.

### 2.2 Installation Considerations

If the SMPTE is to be phase-locked to video sync, the video sync should be fed to the ICM as well as the TCM. This allows cues that are not synchronized to SMPTE to be phase locked to the video sync.

Choose which connector to use (see section 3.2 Keying and Connector Information for more information).

## 2.3 User-Configurable Jumpers and Options

The diagrams on the following pages provide information on user configurable jumpers and options.

Figure 2-1. TCM – 4010 Layout

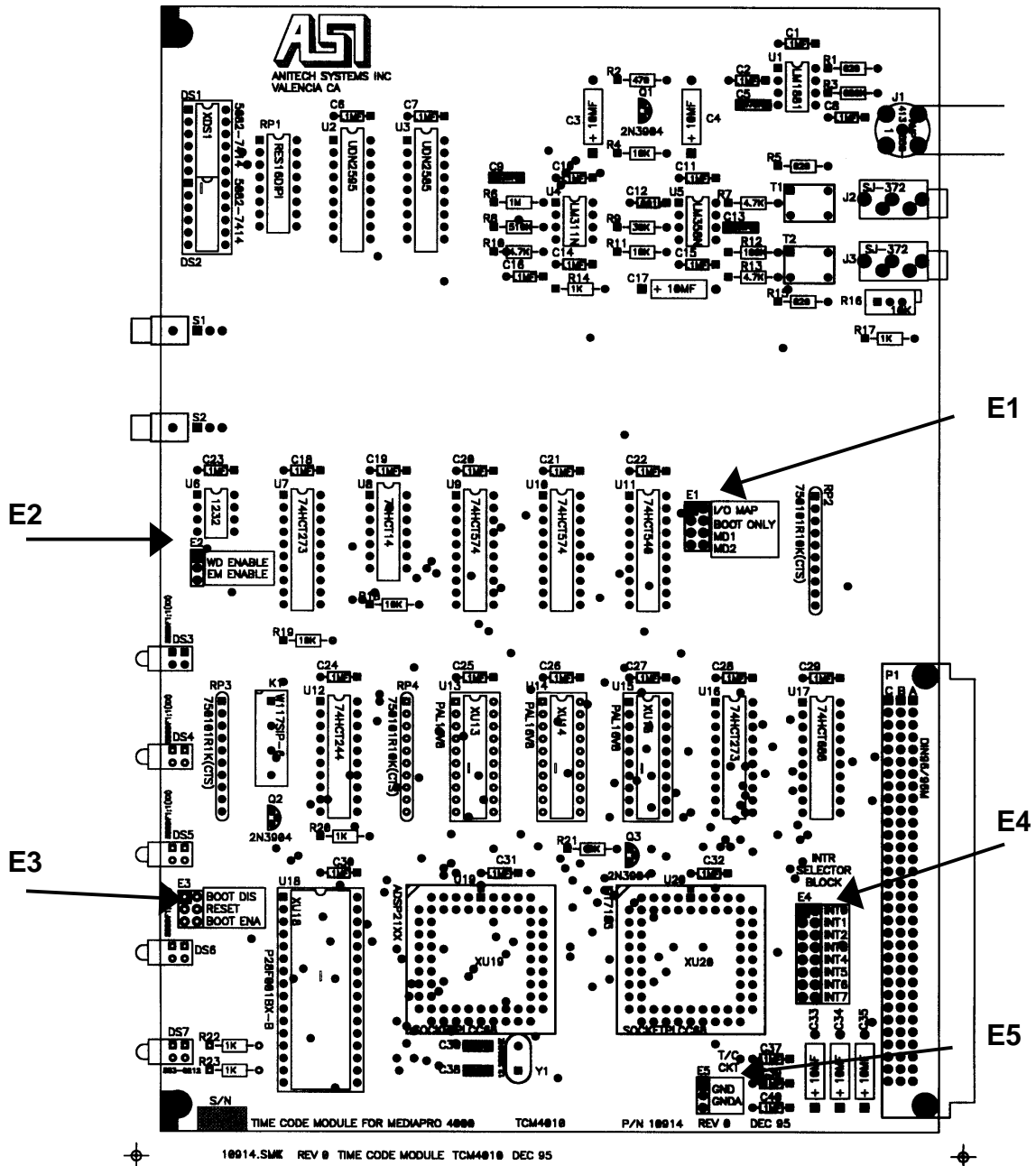
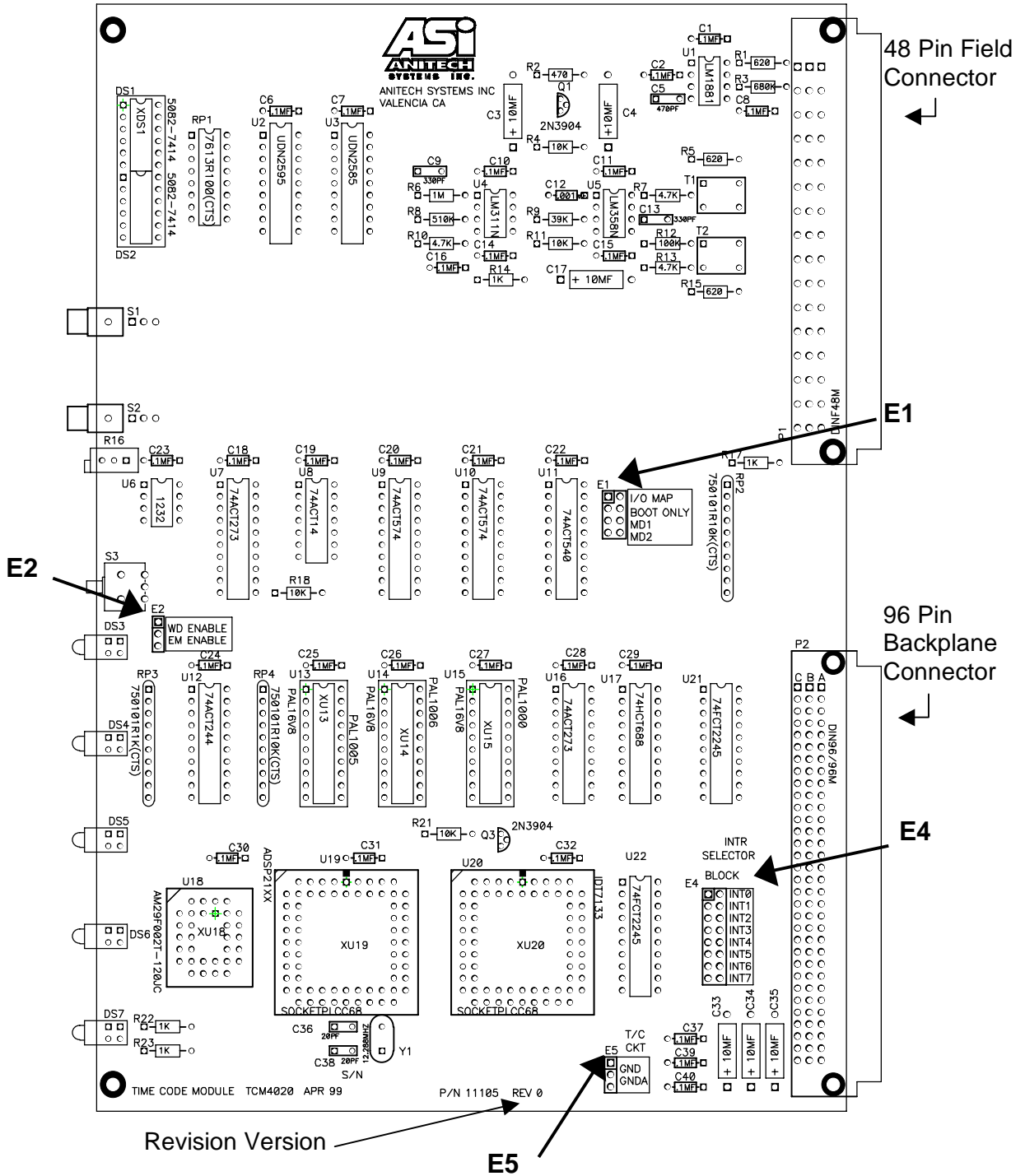




Figure 2-2. TCM – 4020 Layout

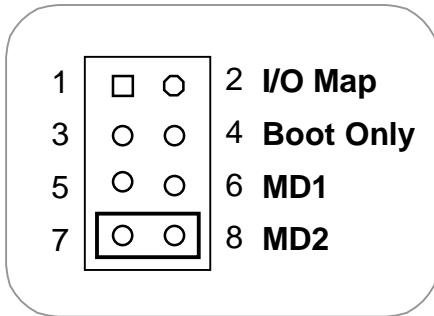


Preparation for Use

### 2.3.1 Jumper Settings and Options

#### E1

##### I/O Map – Boot Only – MD1 – MD2

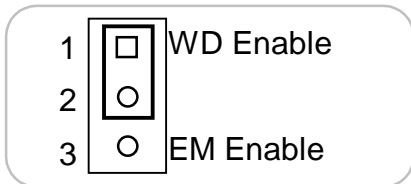


For normal operations:  
 E1: 1-2 should be open  
 E1:3-4 should be open  
 E1: 5-6 should be open  
 E1 7-8 should be Jumpered  
 (Factory Configured)

<u>MD2</u>	<u>MD1</u>	<u>Initial Operating Mode</u>
Open	Open	Input Only
Open	Closed	Input, Regenerate Input at Output
<b>Closed</b>	<b>Open</b>	<b>Input, Output @ 30 fps</b>
Closed	Closed	Input, Output increment from VSYNC

#### E2

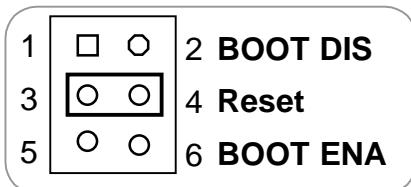
##### Watchdog – Emulator Enable



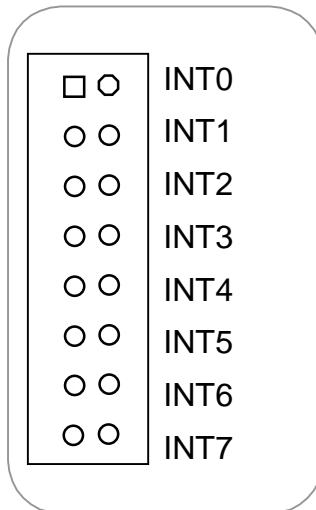
For normal operations:  
 Pins: 1-2 should be Jumpered.  
 (Factory Configured)

#### E3 (on TCM-4010 Only)

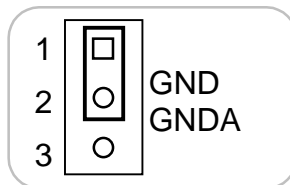
##### Flash Pin 30



For normal operations:  
 Pins: 1-2 should be open  
 Pins: 3-4 should be Jumpered  
 Pins: 5-6 should be open  
 (Factory Configured)

**E4****INTR SEL**

For normal operations:  
All Pins should be open no jumpers.  
(Factory Configured)

**E5****Ground**

For normal operations:  
Pins: 1-2 should be Jumpered.  
(Factory Configured)



# 3

## Section 3 – Installation

This section describes the considerations for installing the TCM. Typical pinout information is provided.

### 3.1 Typical Installation Example

To install the TCM-4020, turn off the system and refer to the following diagrams for typical installation information.

Figure 3-1. VSYNC IN

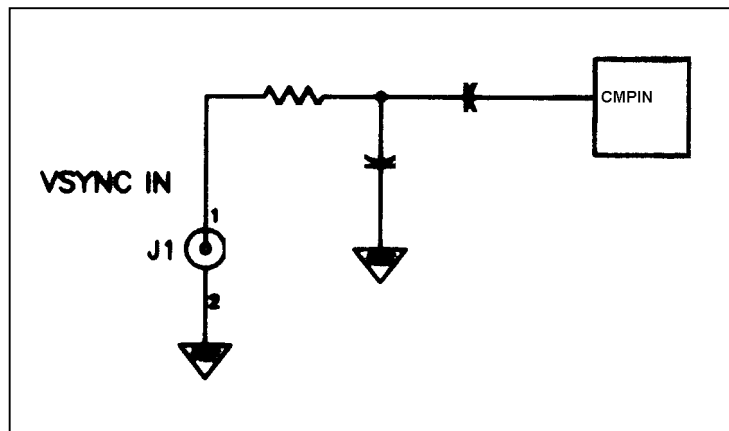


Figure 3-2. TIME CODE IN

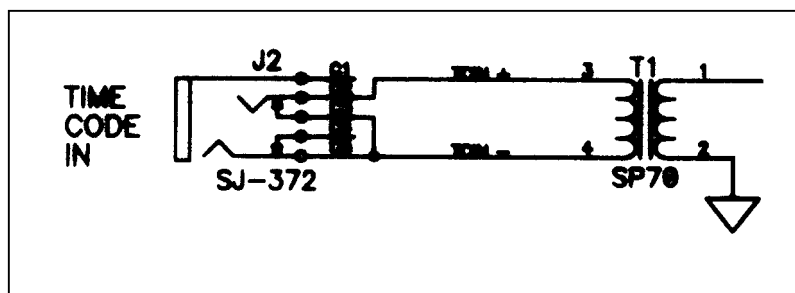
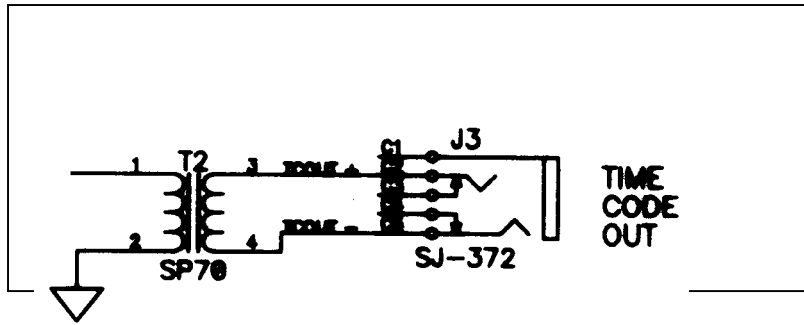


Figure 3-3. TIME CODE OUT



### 3.2 Keying and Connector Information

See figure 3.2a (below) for keying information and figures 3.2b & 3.2c (next page) for pinout information.

**Figure 3-2a. TCM-4020 Keying and Connector Information**

Rear View, Looking at TCM-4020 Male Contacts					Front View, Looking at Field Connector Female Contacts				
The Key is located at the intersection between column d & b, between row 12 & 14					The Key is located at the intersection between column d & b, between row 12 & 14				
d		b		z	z		b		d
	○		○			○		○	
	2							2	
	○		○			○		○	
	4							4	
	○		○			○		○	
	6							6	
	○		○			○		○	
	8							8	
	○		○			○		○	
	10							10	
	○		○			○		○	
	12							12	
	●		○			○		●	
	14							14	
	○		○			○		○	
	16							16	
	○		○			○		○	
	18							18	
	○		○			○		○	
	20							20	
	○		○			○		○	
	22							22	
	○		○			○		○	
	24							24	
	○		○			○		○	
	26							26	
	○		○			○		○	
	28							28	
	○		○			○		○	
	30							30	
	○		○			○		○	
	32							32	
Legend:		=	Contact		Legend:		=	Contact	
	●	=	Key Hole Location			●	=	Key Pin Location	
	○	=	unused position			○	=	unused position	

Installation

### 3.2.1 TCM-4010 Connectors

**Figure 3-2b. TCM-4010 Pinout Information**

	<b>Tip</b>	<b>Sleeve</b>	<b>Ring</b>
J3: 1 / 8" SMPTE Time Code Out	+ SMPTE Audio	Shield	- SMPTE Audio
J2: 1 / 8" SMPTE Time Code In	+ SMPTE Audio	Shield	- SMPTE Audio
J1: BNC Video Sync	Video Sync	Shield	

Reference Figure 2-1, TCM-4010 layout.

### 3.2.2 TCM-4020 Connector

**Figure 3-2c. TCM-4020 Field Connector Pinout**

Din F48 Female	<b>d</b>	<b>b</b>	<b>z</b>
2	Video Sync IN	Shield, VSYNC	Video Sync IN
4	+ SMPTE Audio IN	Shield, SMPTE IN	- SMPTE Audio IN
6	+ SMPTE Audio OUT	Shield, SMPTE OUT	- SMPTE Audio OUT
8			
10			
12			
14			
16			
18			
20			
22			
24			
26			
28			
30			
32			

Rear view, looking at TCM-4020 Male Pins.  
 For connector part numbers, check section 3.3 for the parts list.  
 Reference figure 2-2, TCM-4020 layout.



### 3.3 Support Tools and Part Numbers

The following connectors or equivalents may be used:

Parts for TCM-4010	Number
1/8" balanced (stereo) plug {for TCM-4010}	
BNC Male {for TCM-4010}	

Parts for TCM-4020	Number
Din48F connector (Z-Rail mount) (Solder Tail)	Harting 09-06-248-6823
Din48F connector (Z-Rail mount) (Wire Wrap)	Harting 09-06-248-6821
Din48F connector (Z-Rail mount) (Crimp Pins required)	Harting 09-06-248-3201
(50) crimp pins (for above connector) 26-20 AWG	Harting 09-06-000-8481
(50) crimp pins (for above connector) 20-16 AWG	Harting 09-06-000-8482
Crimping tool for 26-20 AWG pins	Harting 09-99-000-0076
Crimping tool for 20-16 AWG pins	Harting 09-99-000-0077
Pin Locator (for above crimping tools)	Harting 09-99-000-0086
Crimp Pin Insertion Tool	Harting 09-99-000-0088
Crimp Pin Removal Tool	Harting 09-99-000-0087
* (2) M2.5X6 Screws	* Schroff 21100-146
Code Pin (metal key post)	Harting 09-06-000-9950
Code Pin Insertion Tool	Harting 09-99-000-0103

\*These items are packed in bags of 100. Only 2 screws are needed per TCM-4020.

#### 3.3.1 Field Connector Kit

A kit for the field connector is available from Anitech Systems which may be purchased separately. Refer to the Product Price List and/or contact ASI to order the item.

**DIN-F48C** – Contains the following items:

<u>Qty</u>	<u>Description</u>	<u>Part Number</u>
1	Din 48F Pin Connector	Harting 09-06-248-3201
50	Crimp Pins	Harting 09-06-000-8481
3	Mounting Screws	Schroff 21100-146



# 4

## Section 4 – Module Operation

This section describes the operating modes of the module. It includes fault conditions, indicators, and troubleshooting information.

### 4.1 Normal Operations

- ☑ The T/C and User LEDs {Red} reflect the selection of the Time Code / User Bits Switch and Display.
- ☑ The GEN {Red} LED will be on when the TCM is Generating Time Code.
- ☑ The 30F {Red} LED will be on when 30 frame per second time code is received.
- ☑ The Valid {Red} LED will be on when Valid Time Code is received.
- ☑ The FWD {Red} LED will be on when the received Time Code is a forward stream. (vs Reverse T/C generated by playing audio backwards).
- ☑ The Drop {Red} LED will be on when Drop Frame (29.97) Time Code is received.

### 4.2 Fault Conditions

- ☑ The ERR (Red) LED will be on when bad time code *is* received.
- ☑ The Valid (Red) LED will be off when the time code *is not* received.

### 4.3 Indicators

Figure 4-1. TCM-4020 Indicators

Indication		Description	Probable Cause	Recommended Action	
ⓘ	OFF	T/C Indicator {Red}	User Bits Display	Time Code / User Bits switch is set to User Bits position	
ⓘ	ON	T/C Indicator {Red}	Time Code Display	Time Code / User Bits switch is set to Time Code position	
ⓘ	OFF	User Indicator {Red}	Time Code Display	Time Code / User Bits switch is set to Time Code position	
ⓘ	ON	User Indicator {Red}	User Bits Display	Time Code / User Bits switch is set to User Bits position	
ⓘ	OFF	30F Indicator {Red}	Normal Condition	a T/C rate other than 30 frames per second is being received	
ⓘ	ON	30F Indicator {Red}	30 FPS	30 frame per second T/C is being Received	
ⓘ	OFF	GEN Indicator {Red}	Normal Condition	The TCM is not Generating T/C	
ⓘ	ON	GEN Indicator {Red}	Generating Time Code	The TCM is Generating T/C	
ⓘ	OFF	Valid Indicator {Red}	No Time Code	Valid T/C is not being received	
ⓘ	ON	Valid Indicator {Red}	Valid Time Code	Valid T/C is being received	
ⓘ	OFF	FWD Indicator {Red}	Normal Condition	a Forward stream of T/C is not being received	
ⓘ	ON	FWD Indicator {Red}	Normal Condition	a Forward stream of T/C is being received	
ⓘ	OFF	Drop Indicator {Red}	Normal Condition	Drop Frame (29.97) T/C is not being received	
ⓘ	ON	Drop Indicator {Red}	Drop Frame Time Code	Drop Frame (29.97) T/C is being received	
ⓘ	OFF	ERR Indicator {Red}	Normal Condition	Bad time code is not being received	
ⓘ	ON	ERR Indicator {Red}	Bad Time Code	Bad T/C, or no T/C is being received	
✱	Blinking Slow	COM {Green}, Communications	Normal Condition	The TCM is communicating with the ICM.	
✱	Blinking Fast	COM {Green}, Communications	Normal Condition	The TCM is Receiving Animation Data from the ICM.	
ⓘ	OFF	PGM {Red} {Programming}	Normal Condition	The TCM is not in Program Mode.	
ⓘ	ON Solid	PGM {Red} {Programming}	Programming	The TCM is in Program Mode.	
✱	Blinking	PGM {Red} {Programming}	Maintenance Forces Active	The TCM has Maintenance forces Active.	If necessary remove Maintenance forces.
ⓘ	OFF	COM {Green}, Communications	No Communications	The ICM is NOT communicating with the TCM.	1) Make certain that the TCM is fully seated in its slot. 2) Make certain that the Module Rack is Powered, and Turned on 3) Make certain ICM is running, & no downloads are active
ⓘ	ON Solid	COM {Green}, Communications			

## 4.4 Troubleshooting

The following table identifies troubleshooting problems and solutions for the TCM-4020.

Problem	Solution
Timecode can be seeked, but not played	Make certain MD2 is jumpered
Cues won't sync to Time Code	<ol style="list-style-type: none"> <li>1. Make certain Time code is prerolled, several valid frames are need to sync</li> <li>2. Cue Needs to be set to SMPTE Source</li> <li>3. Check incoming Time Code Level</li> <li>4. Check for Noisy Time Code</li> </ol>
Intermittently loses sync to Time Code, or Cues reach time out after starting sync	<ol style="list-style-type: none"> <li>1. Watch Valid, and Error LEDs</li> <li>2. Check incoming Time Code Level</li> <li>3. Check for Noisy Time Code</li> </ol>

## 4.5 Maintenance

### TCM-4010

J:3 Time Code output audio level adjustable by adjacent potentiometer.

### TCM-4020

J:3 Time Code output audio level adjustable by front panel potentiometer.



# 5 Section 5 – Programming

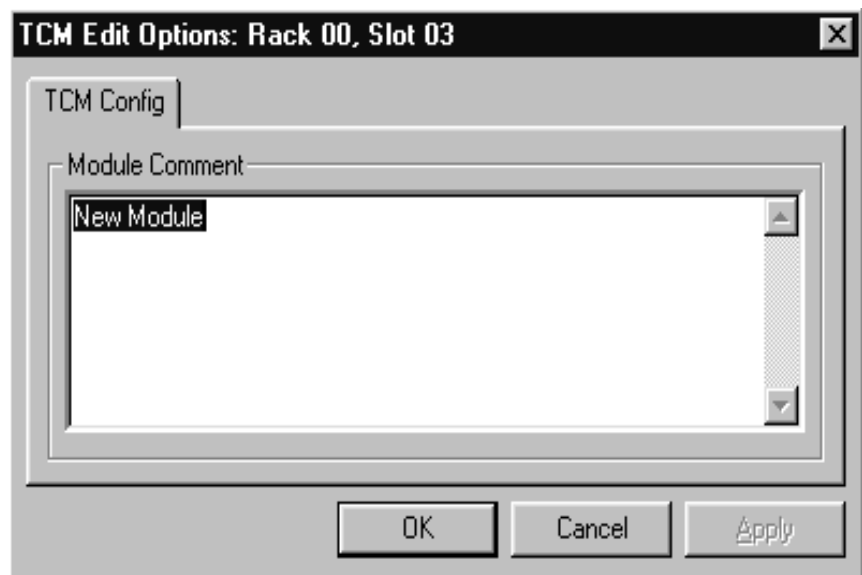
This section describes the programming considerations of the module. It includes details of programmable functions and software configurations.

## 5.1 Module Programmable Functions

- Time Code rate 24 / 30 fps
- The TCM can also be assigned aliases
- Mode of Operation (input only, regenerate input at output, input with output, input with output incremented by vsync input)
- Seek, Stop, Play Generated Time Code

## 5.2 Software Configuration

The TCM-4020 must be properly configured for proper operation; TCM configuration in the ICM is necessary to ensure proper operation. Cues must select SMPTE as their source in order to sync to SMPTE.



### 5.3 Supported Command Formats

Verb	RSP	Token 1	Parameter 1	Token 2	Param 2	Token 3	Param 3
Seek	@r0,0,1	To	00:00:00.00				
Seek	'TCM'	To	23:59:59.29				
Play	@r0,0,1						
Play	'TCM'						
Stop	@r0,0,1						
Stop	'TCM'						
Set	@r0,0,1	Rate	24				
Set	'TCM'	Rate	30				
Set	@r0,0,3	State	0				
Set	@r0,0,3	State	1				
Set	@r0,0,3	State	2				
Set	'TCM'	State	4				
Set	@r0,0,1	SmpteUser	0				
Set	'TCM'	SmpteUser	4294967296				
Load	@vVVV	With	@r0,0	Status	0	Byte	0-3
Load	@vVVV	With	@r0,0,0	Status	0	Byte	0-3
Load	@vVVV	With	@r0,0,2	Status	0	Byte	0-3

❖ **Port Usage in the TCM –**

- Port 0 is SMPTE Input
- Port 1 is SMPTE Output
- Port 2 is VSYNC Input
- Port 3 is Operating Mode/State, no status is available

❖ **SMPTE Input Level for Port 0 –**

- The TCM input is a Balanced 600 Ohm Transformer
  - Absolute minimum input level with no noise
    - 120mv p-p
    - 60mv pk
    - 42mv rms
    - -25db



### 5.3.1 Set Output Token for TCM-4020

This section describes how to use the Set OUTPUT token for the TCM-4020.

- 1- Syntax & Example Usage: Set 'TCM' Output 1;
  - A- Set @r0,0,0 Output 1;
    - 1) Will Turn the output on with the SMPTE Input as the source for the output.
      - a) **Note:** If there is no SMPTE on the Input, there will be no SMPTE on the Output.
  - B- Set @r0,0,1 Output 1;
    - 1) Will Turn the output on with Internal (Seek/Play) as the source for the output.
      - a) **Note:** If a Stop is sent to Port 1 the last frame number (at the time the stop happened) will continuously be sent on the Output.
  - C- Set @r0,0,2 Output 1;
    - 1) Will Turn the output on with the Vsync Input as the source for incrementing the output.
      - a) **Note:** If there are no Vsync Pulses on the Vsync Input, the last frame number (when the vsync pulses stopped) will continuously be sent on the Output.
  - D- Set @r0,0,3 Output 1;
    - 1) Will Turn the output on without changing the previously selected source for the output.
  
- 2- Syntax & Example Usage: Set 'TCM' Output 0;
  - A- Set @r0,0,0 Output 0;
    - 1) Will Turn the output off with the SMPTE Input as the source for the output.
  - B- Set @r0,0,1 Output 0;
    - 1) Will Turn the output off with Internal (Seek/Play) as the source for the output.
  - C- Set @r0,0,2 Output 0;
    - 1) Will Turn the output off with the Vsync Input as the source for incrementing the output.
  - D- Set @r0,0,3 Output 0;
    - 1) Will Turn the output off without changing the previously selected source for the output.

- 3- The new Set OUTPUT token is supported in TCM-4020 Firmware. Refer to section 6.3 for a detailed explanation of firmware version compatibility.
  - A- P/N 11105 PCB rev A should use Firmware TCM42D11 or Later.
  - B- P/N 11105 PCB rev 0 should use Firmware TCM42D03 or Later, (but less than D09)
    - 1) **Note:** When the TCM front panel display switch is set to "Gen", the display will be --:--:--:-- (blank), if no source is selected for the output.
      - a) Most likely cause, the power-on default mode set by Jumpers MD1 & MD2 is set to input only, and no cue commands have changed the source of the output since power on. Refer to Jumper section, 2.3.1, for correct jumper positions.
  
- 4- Board Status now reflects the state of the output on bit 14
  - A- Load @vVVV With @rR,S Status 0 Byte 0-3;
    - 1) Bit 14 (Byte 1, bit 6) will be ON if the SMPTE output is disabled.

## 5.4 Example Usage

Commands specific to the TCM:

- ❖ Stop @r0,0,1;
  - Stops the TCM
- ❖ Seek @r0,0,1 to 00:00:00.00;
  - Seeks the TCM T/C to 0 hours, 0 minutes, 0 seconds, 0 frames
- ❖ Play @r0,0,1;
  - Plays the TCM (the TCM increments the T/C)
- ❖ Load @v511 With @r0,0,0 Status 2 Byte 0-3;
  - Loads variable 511 with the current SMPTE Input User Bits
- ❖ Set @r0,0,1 Rate 24;
  - Set the TCM to the 24 fps rate
- ❖ Set @r0,0,1 Rate 30;
  - Set the TCM to the 30 fps rate
- ❖ Set @r0,0,3 State 0;
  - Put the TCM in Input Only mode
- ❖ Set @r0,0,3 State 1;
  - Put the TCM in Regenerate Input at Output mode
- ❖ Set @r0,0,3 State 2;
  - Put the TCM in Input & Output mode
- ❖ Set @r0,0,3 State 4;
  - Put the TCM in Input, increment Output from Vsync
- ❖ Set @r0,0,1 smpteuser @v511;
  - Sets the SMPTE Output User Bits to the bit pattern / value in variable 511.

See also Media Pro 4000 User's Operation Manual and Programming Reference for more information.

## 5.5 Load Status Statements

This section describes the syntax of Load Status statements available for loading status of the TCM-4020. The description of the Port Status and the Board Status bits are provided in this section. Some example statements are given, as well. For more detailed description of the Load Statement, refer to the MP4000 Operation and Programming Manual.

### Port Status 0, Port Status Bits

Load @vVVV With @rR,S,P Status 0 Byte 0-2;

Byte	Bit							
0	7	6	5	4	3	2	1	LSB
1	7	6	5	4	3	2	1	0
2	X	X	MSB	4	3	2	1	0

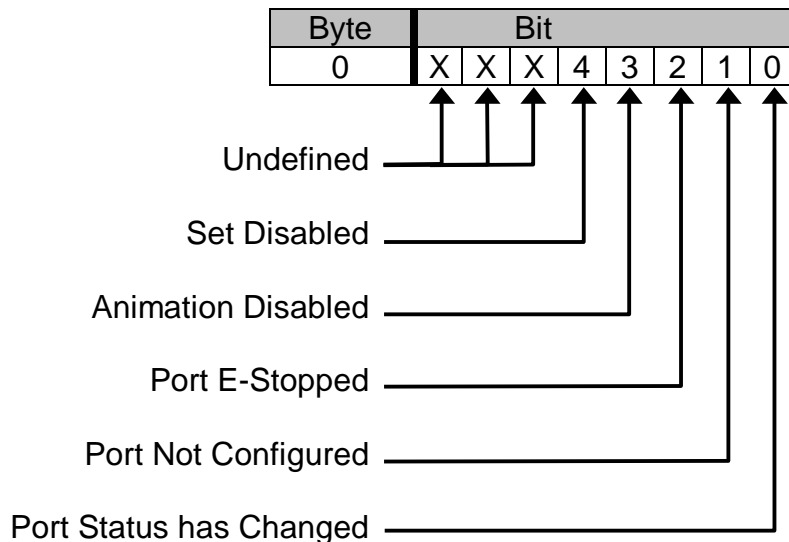
### Port Status 1, Time Code Frame Number

Load @vVVV With @rR,S,P Status 1 Byte 0-3;

Byte	Bit							
0	7	6	5	4	3	2	1	LSB
1	7	6	5	4	3	2	1	0
2	7	6	5	4	3	2	1	0
3	MSB	6	5	4	3	2	1	0

### Port Status 2, Time Code User Bits

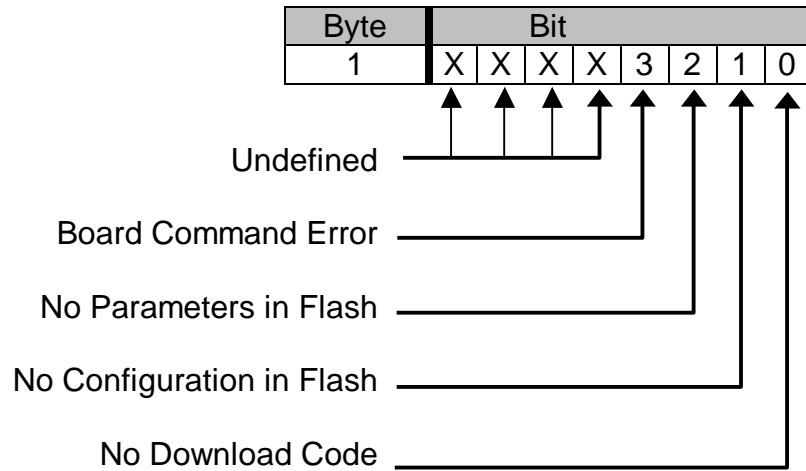
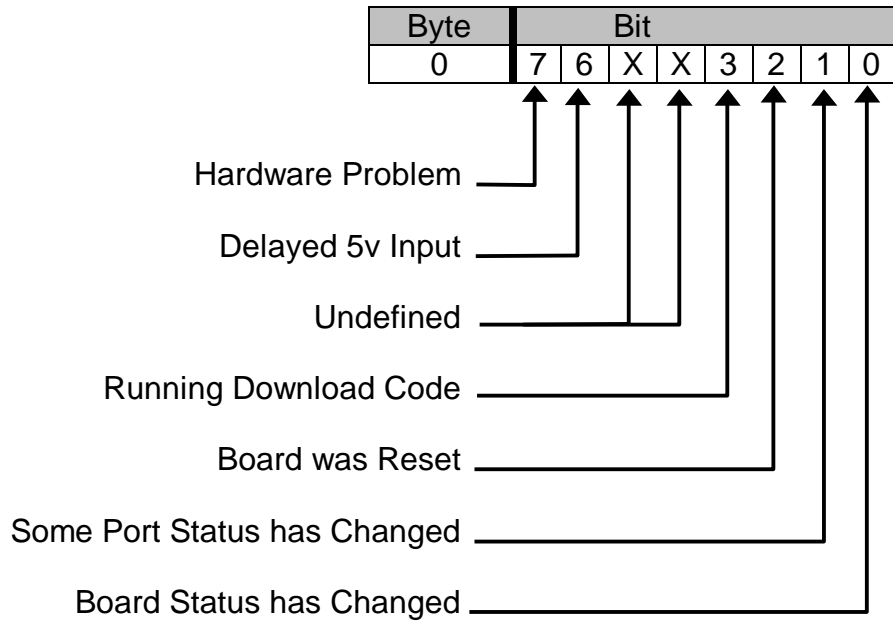
Load @vVVV With @rR,S,P Status 2 Byte 0-0;



Example: Load Variable 123 with the Incoming User Bits of the TCM in rack 0, slot 16, port 0.  
 LOAD @V123 WITH @R0,16,0 STATUS 2 BYTE 0-3;

**Board Status 0, Board Status Bits**

Load @vVVV With @rR,S Status 0 Byte 0-1;



**Board Status 1, Boot Firmware Version Number**

Load @vVVV With @rR,S Status 1 Byte 0-1;

Byte	Bit							
0	7	6	5	4	3	2	1	LSB
1	MSB	6	5	4	3	2	1	0

**Board Status 2, Download Firmware Version Number**

Load @vVVV With @rR,S Status 2 Byte 0-1;

Byte	Bit							
0	7	6	5	4	3	2	1	LSB
1	MSB	6	5	4	3	2	1	0

Example: Load variable 123 with the Download Version of the TCM in rack 0, slot 16

LOAD @V123 WITH @R0,16 STATUS 2 BYTE 0-1;

Variable @v123 will be filled with a value representing the version number of the downloaded firmware.

---

## 5.6 Application Example

---

There are several ways to use a TCM-4020, some explanations and examples follow.

---

### 5.6.1 Playing Cues Against SMPTE

At the configuration pass, all cues are set to INTERNAL source in the ICM's internal tables, regardless of the defined source. However, cues that are going to be set to a SMPTE source should, in fact, be marked in the source box as being SMPTE. This permits the firmware to gather some additional information about the cue that will be needed for later attempts to maintain cue synchronism [more later].

Cues may be moved among rates, or assigned to SMPTE sources. These changes can only be accomplished from within the affected cue. Any SMPTE source in any TCM in the rack may be specified, rx or tx, by referring to its rack, slot, port (TCM port 0 is rx, TCM port 1 is tx). Since a cue must belong to SOME rate, illegal requests will be converted to the default rate and internal source. RESET @q restores the default rate from the cue definition, and to internal source. STOP @q and PLAY @q don't. Note that there may be some interesting details concerning STOP and PLAY of cues while they are attached to a SMPTE source, and discussions of various scenarios may be needed.

## 5.7 SMPTE Cue Synchronization

---

Typical control statements in SMPTE-synchronized cues are as follows. The effects of these statements are described subsequently.

### Attach a cue to a SMPTE source

(It requires both these statements):

```
SET @q3 FRAME 01:01:00.00 ;  
SET @q3 RATE @r0,10,0 TIMEOUT 300 GOTO error ;
```

### Reattach the cue to an internal rate

(may also be used to switch ordinary cues among rates):

```
SET @q3 RATE 24 ;
```

To control a SMPTE cue *after* attaching it to a rate source:

```
WAIT 01:03:30.00 ;  
DELAY 150 ;
```

The two SET statements must be used together to 'connect' the cue to a SMPTE port. The SET RATE TIMEOUT GOTO statement causes the cue to begin to attempt to run in synchronism with the arriving SMPTE time code, and playing of the cue is actually suspended at this statement waiting for the SMPTE code value to satisfy the just-previous SET FRAME. Typically, the cue's author plans the show sequencing (for example, by seeking and playing a video player with the source SMPTE before issuing these SET statements) so that the incoming SMPTE will be less than the specified frame, and the cue will enter a 'SMPTE hold' state.

The SET RATE TIMEOUT GOTO statement forces specification of a timeout and an error label (abbreviated forms are not accepted by MP4). If the cue does not achieve synchronization within the timeout specified (always measured at a fixed 30 frames per second), then the cue will be restored to its default rate and control passed to the label specified. Note that if the timeout is specified as 0 (zero), there is NO TIMEOUT and the cue will wait forever for SMPTE code to arrive and satisfy the start condition. A reset from another cue will restore the cue operation in that case.



In the least problematical example, the author has succeeded in establishing correct startup conditions and SMPTE begins to arrive at the attached port, and its value reaches the specified frame before the timeout expires. At the frame in which the match occurs, the cue is played from the statement following the SET RATE TIMEOUT GOTO, and all statements are executed (as would be the case in a 'normal' cue) until the end of the cue is reached or a statement is encountered that suspends the cue activity. (The condition for match is that the arriving timecode is equal to or greater than the specifier, but not by more than four frames.)

The statements that may 'suspend' the cue (actually, return it to the 'SMPTE hold' state) are WAIT and DELAY. The WAIT and DELAY statements exactly parallel the way an internally paced cue would be controlled. The reason the SET FRAME command must be used in the attachment sequence is because, at that moment, the cue is on an internal clock, and the WAIT has a different effect than when the cue is attached to SMPTE.

After the arriving SMPTE code has reached the specified start frame, and the cue is 'playing', the WAIT and the DELAY statements are used to establish new 'SMPTE hold' waits for later frames in the arriving SMPTE. [Note that in 'internal' cues, DELAY pays no attention to the frame number, but it is treated differently in a cue attached to SMPTE.] The WAIT sets a new pickup frame and puts the cue back into the hold state. If a DELAY is used, the new pickup frame is calculated by adding the delay to the current SMPTE frame.

By working from hold to hold, then, a cue running on SMPTE code will maintain synchronism with the incoming timecode. The timeout is reset at each successful SMPTE frame, so that if SMPTE fails, the timeout will proceed and the error label will receive control.

The term 'successful' just used refers to a monotonic, not-too-jumpy continuation of frames. This is enforced, not in the cue handling, but in the port polling. The cue handler is simply not called if SMPTE is not arriving or is faulty. The ramifications to maintenance of the timeout may or may not be simple. Here is a discussion of a few points.

In the initial wait for SMPTE in a cue just switched, the SMPTE is expected to be earlier than the specified frame. If not, error handling (perhaps with a 'catch-up' algorithm) is needed. Otherwise, the cue idles, and the timeout runs down to its end, forcing the error exit; or, the arriving SMPTE passes the specified frame and the cue plays. If the cue plays in this case, the timeout is reset to its initial value.

During subsequent waits, it is conceivable that the wait to continue will be far in excess of the specified wait, and the purpose of the timeout becomes principally to detect SMPTE failure while waiting. So, a 15-minute hold might be specified; if SMPTE stops arriving after 5 minutes, the error transfer will happen timeout frames later. The method stated two paragraphs earlier will accomplish this, if the cue handler always restores the timeout value each time the cue is processed while in one of these subsequent (not initial) hold states.

*Example TEST CUE:*

```
(with TCM in slot 13 transmitting to TCM in slot 10)
top: DISPLAY "" ROW 0 COLUMN 0 ;
DISPLAY "" ROW 1 COLUMN 0 ;
DISPLAY "" ROW 2 COLUMN 0 ;
DISPLAY "Starting q003" ROW 0 COLUMN 0 ;
DELAY 30 ;
DISPLAY "Waiting SMPTE sync" ROW 0 COLUMN 0 ;
DELAY 10 ;
SEEK @r0,13,1 TO 01:00:55.00 ; TCM TC Source
SET @q3 FRAME 01:01:00.00 ;
SET @q3 RATE @r0,10,0 TIMEOUT 300 GOTO error ;
DISPLAY "" ROW 0 COLUMN 0 ;
DISPLAY "got SMPTE sync" ROW 0 COLUMN 0 ;
WAIT 01:01:20.00 ;
DISPLAY "after wait 1" ROW 1 COLUMN 0 ;
DELAY 30 ;
DISPLAY "after delay" ROW 2 COLUMN 0 ;
SET @q3 RATE 30 ;
DELAY 300 ;
GOTO top ;
error: DISPLAY "" ROW 0 COLUMN 0 ;
DISPLAY "TIMEOUT" ROW 3 COLUMN 0 ;
DELAY 5 ;
DISPLAY "" ROW 3 COLUMN 0 ;
GOTO top ;
```

Note that the intention is the SMPTE time code be controlled first, so that its source is reset and restarted at some value earlier than the times at which a cue is expected to lock.

## 5.8 Playing Animation Against SMPTE

'Animation scenes' in the ICM are referenced as @A0 through @511 and can be played against the internal clock at various rates, or against SMPTE code arriving at (or being generated by) a TCM. A form of the SET RATE command is used to attach and detach the scene from the SMPTE time code.

### *CONFIGURATION*

Although cues can be moved among the various legal rates, this is not possible for scenes, which will operate either at their default rate, or at a SMPTE rate if 'attached' to a TCM port, as described below. Legal scene rates are currently 12, 15, 24, 25, and 30 (there is no video rate for scenes, as there is for cues).

### NOTES:

The scene data is an animation file containing repeated sets of data values for a channel set. Each set of data is a 'frame' of animation data, and in the scene these are numbered from 0 through the size (in frames) of the show. These frames in the animation data are called here 'physical' frames, to emphasize their distinction from SMPTE time code, in which the individual code packets are often called 'SMPTE frames'. SEEKs are to 'physical' frames, regardless of scene rate.

A SMPTE frame is in time hh:mm:ss.ff format. The synchronization procedure will produce an offset from the current SMPTE time to a corresponding 'physical' frame in the animation file. As the file is played 'synchronously' to the arriving SMPTE, this offset will be constant, and is determined automatically from what 'physical' frame the scene is at when a PLAY command is issued, and the SMPTE passes the specified SMPTE TIME that was set up for the scene.

### *ATTACHMENT TO SMPTE*

The attachment procedure is:

SET @Aaaa RATE @R0,t,r SMPTETIME hh:mm:ss.ff ;

[ aaa is the 'scene', 0-511 ;

t is the slot of the TCM, r the TCM port (0 = Rx, 1 = Tx)]

This command does not immediately change any current operation of the scene, merely 'primes' it for a subsequent PLAY command. If the scene is currently playing against an internal source, or a different time code source, it will continue to play until a STOP, STEP, SEEK, or RESET command is given to it, or it runs to its normal termination (a scene reaching its end STOPS with the final frame of data). Any of these commands remove the scene from any previous SMPTE attachment, but continue to have the expected effect on the animation. i.e.:

- STOP holds the scene at the current 'physical' frame
- STEP stops the scene, but advances to the next 'physical' frame and holds
- SEEK stops the scene, but moves to the specified 'physical' frame and holds
- RESET stops the scene, but moves to the first frame and holds.

A user familiar with the procedure attaching a cue to SMPTE will note that this scene attachment provides no way to specify a timeout while waiting for the SMPTE to reach the SMPTETIME, nor for cessation of SMPTE after synchronization is started. If this check on the SMPTE source is desired, the user will need to lock a cue to the same source. For an example of this procedure see the section SMPTE VERIFICATION following this section.

*INITIATING THE SCENE AND SMPTE LOCK*

Once attached, the scene will continue operating as it was (as described above) and subject to ordinary control. To place the pending SET RATE SMPTE command into action, the scene must be set to the desired 'physical' frame and a PLAY command issued.

```
SEEK @Aaaa TO physframe ;    setup the scene frame for lock point
PLAY @Aaaa ;
```

The SEEK command is not absolutely required. Whatever 'frame' the scene is at when the PLAY command is issued will determine the 'offset' within the scene for synchronization against the SMPTE, and the scene will play from that point when the SMPTE lock is established. The scene's physical frame may be set before or after the SET RATE SMPTE command. Note that if a RESET command is used after the attachment to a SMPTE source, the attachment will be cancelled.

There is a consideration relating to SEEKing the ani to a desired starting point, about whether the sought frame is output immediately, or is not output until the SMPTE sync point is passed. A SEEK, RESET, or STEP command must have at least a single frame delay following it, before the PLAY command is issued, in order to have immediate effect. If the scene is PLAYed with no intervening delay after one of these commands, the new frame will not be distributed until SMPTE is satisfactorily matched.

After the PLAY command is issued, the scene is placed in a 'waiting SMPTE match' state, and then, when the appropriate SMPTE frame arrives, enters a 'playing SMPTE sync' state without further intervention. Any scene control commands (except another PLAY) that are issued before synchronization is achieved remove the scene from the attempted lock with the SMPTE source. After lock is achieved, any commands except PLAY remove the scene from the SMPTE lock and have their ordinary effect.

*DETACHMENT FROM SMPTE*

As described above, any ordinary scene control statement PLAY, STOP, STEP, SEEK, or RESET, will remove the connection to SMPTE and restore the scene to its normal rate, with the commands all having the effect you would expect at the time.

To remove the scene from SMPTE and reconnect to its normal rate, use one of the cue control statements listed above.

If the desire is that the scene immediately continue playing free simply use only a PLAY statement.

*SMPTE VERIFICATION*

The SET RATE SMPTE command that attaches the scene to a SMPTE source does not permit setting a timeout for successful achievement of synchronization. It is of course possible to verify SMPTE with the cue TIMEOUT check, provided the cue need not be doing other things, or if the subversion of the cue (to the GOTO label if SMPTE times out) can be tolerated:

```
[... in cue #20 ...]
SET @A0 RATE @R0,2,1 SMPTE 01:00:00.00 ;
RESET @A0 ;
PLAY @A0 ;
SET @Q20 FRAME 01:00:00.00 ;
```

```
SET @Q20 RATE @R0,2,1 TIMEOUT 450 GOTO NOSCENE ;  
WAITHERE: GOTO WAITHERE ;  
NOSCENE: DISPLAY "No SMPTE, ICM scene 0" ;
```

### *PLAYBACK AGAINST SMPTE*

The 'playing' of the scene is literally connected to the TCM/SMPTE data. The 'play-scene' operation is invoked ONLY when the TCM signals the ICM that data has changed in the port, and this happens at the rate that SMPTE arrives.

If, when the PLAY command is issued, the arriving SMPTE frame is already past the specified lock frame by more than four frames, the scene will not start. After the PLAY command is issued, the scene handler will wait until the arriving SMPTE frame matches (or is not more than four ahead of) the specified SMPTE TIME. At this time, the scene will be taken out of the 'wait for SMPTE' state, and placed in the 'playing SMPTE' state. The 'physical' frame will be adjusted (if necessary), and the data will be output (i.e., moved to the output block for distribution to net and modules).

Once started, a cessation of SMPTE data will cause the scene to stop playing for as long as satisfactory new frames are not available.

- If a new frame is less than the previous frame, the scene will not update.
- If a new frame is more than the previous frame, but not more than four frames distant, the scene will be instantly positioned to the corresponding physical frame, the data will be output.
- If the new frame is more than the previous frame, but more than four frames distant, the scene will advance four frames, be instantly positioned to the corresponding physical frame, the data will be output. This 'chase' will continue until the scene is recovered to synchronism with the arriving SMPTE time code.

### *TIME CODE CONSIDERATIONS & ERRORS*

#### SMPTE CODE IS MEANT TO BE CONTROLLED BEFORE LOCK IS ATTEMPTED:

Note that the intention is the SMPTE time code be controlled first, so that its source is reset and restarted at some value earlier than the times at which a scene is expected to lock.

#### SMPTE RATE IS MULTIPLE OF RECORDING RATE (1x or 2x)

This is the appropriate assignment, and other combinations described below represent errors in configuration by the show programmer. There is an animation frame for every SMPTE frame at the 24, 25, and 30 frame rates; or for every second SMPTE frame at the 12 and 15 frame rates.

#### SMPTE RATE IS DIFFERENT THAN RECORDING RATE (NOT 1x NOR 2x)

The TCM converts the arriving SMPTE frame information into a 32-bit integer frame number based on the rate that it determines for the SMPTE channel. Thus, the ICM can only assume that the rate matches correctly. Hence, a scene recorded at 30 frames, but played against a 24 frame SMPTE will play slow.

# 6 Section 6 – Appendix

The following pages contain technical briefs relating to this module. There are additional technical briefs on the ASI website and new briefs are added on an on-going basis. Please visit the website for updated information –

<http://www.Anitech-Systems.com>

Updated manuals are placed on the Web periodically. Please check to see if a more recent revision is available on the website. Revision numbers are located in the footer of the manual pages.

Also, a glossary of terms is in this section, for terms used by ASI as well as terms used in the Show Control Industry.

## 6.1 Saving Files from a Web Page without Displaying -

This is useful for retrieving a non-formatted page that is not intended for viewing:

### From Internet Explorer® Browser

- 1 - Saving files from a Web page.
  - A) To save a file without opening it:
    - 1) **Right**-click on the link for the item you want, a pop-up menu appears,
      - (a) Select, then Left-click **Save Target As**
      - (b) Enter the desired folder and filenames and select **Save**

### From Netscape® Communicator Browser

- 1 - Saving files without displaying them.
  - A) To save a file without viewing it:
    - 1) **Right**-click on the file's link to display a pop-up menu,
      - (a) Select, then Left-click **Save Link As**
      - (b) Enter the desired folder and filename and select **Save**

## 6.2 Power Specification for Continuous *Normal* Operation

---

The power usage and requirements for Media Pro® modules are depicted in the following table. It is important that ***both*** of the following considerations are evaluated for proper system configuration:

- ✓ The power usage of the modules does not exceed any *individual* maximum current and wattage.
- ✓ The sum of the modules do not exceed the supply *overall* maximum wattage.

### TCM-4020, PCB 11105-A

Voltage	Current Requirements (Amps)			Wattage Requirements (VA)		
	DC	Min	Typical	Max	Min	Typical
+ 5	0.275	0.350	0.425	1.38	1.75	2.1
+ 12	0.010	0.015	0.030	0.12	0.18	0.4
- 12	0.000	0.015	0.030	0.00	0.18	0.4
+ 24	0.000	0.000	0.000	0.00	0.00	0.0
				1.5	2.1	3.



## 6.3 TCM-4020 Firmware - Revision Level Relationships

The following section describes the relationship of the firmware revisions to the board layout revision of the TCM-4020. If the firmware version does not match, the instructions for downloading are included in this section. *Refer to section 2, figure 2-2 for the location of the board layout revision version.*

- 1- There are 2 revisions of the TCM-4020 PCB.
  - A- The version of the PCB can be identified by looking at the front side of the TCM-4020 module (component side), at the bottom edge of the module, in the center there is a silk screen: P/N 11105 rev ? .
    - 1) The first version is P/N 11105 rev 0 (circa April 1999).
    - 2) The second version is P/N 11105 rev A (circa August 1999).
  - B- If the silkscreen at the bottom center of the Module can not be read there are 2 other places the PCB revisions can be found –
    - 1) In PCB etch at the top edge of the Module.
    - 2) On the front and the back, near the faceplate.
- 2- The Firmware is different for each of these 2 revisions of the TCM-4020 PCB.
  - A- P/N 11105 rev A
    - 1) should use Boot TCM42B10 or Later.
    - 2) should use Firmware TCM42D10 or Later.
  - B- P/N 11105 rev 0
    - 1) should use Boot TCM42B00 or Later, (but less than B09)
    - 2) should use Firmware TCM42D00 or Later, (but less than D09)
  - C- If the wrong Boot is downloaded to either revision PCB, (ie: PCB rev A with firmware less than ver 10 is wrong *or* PCB rev 0 with firmware greater than ver 09 is wrong).
    - 1) The Module may work as expected if the Download firmware is the correct firmware for that revision of PCB, but the Boot is the wrong for that PCB.
      - a) The correct Boot Firmware can, and should be re-downloaded.
    - 2) The Module will have a blank display, or a display with garbage characters if the Download version is wrong.
      - a) The correct Download Firmware can, and should be re-downloaded.

3- Updating Firmware –

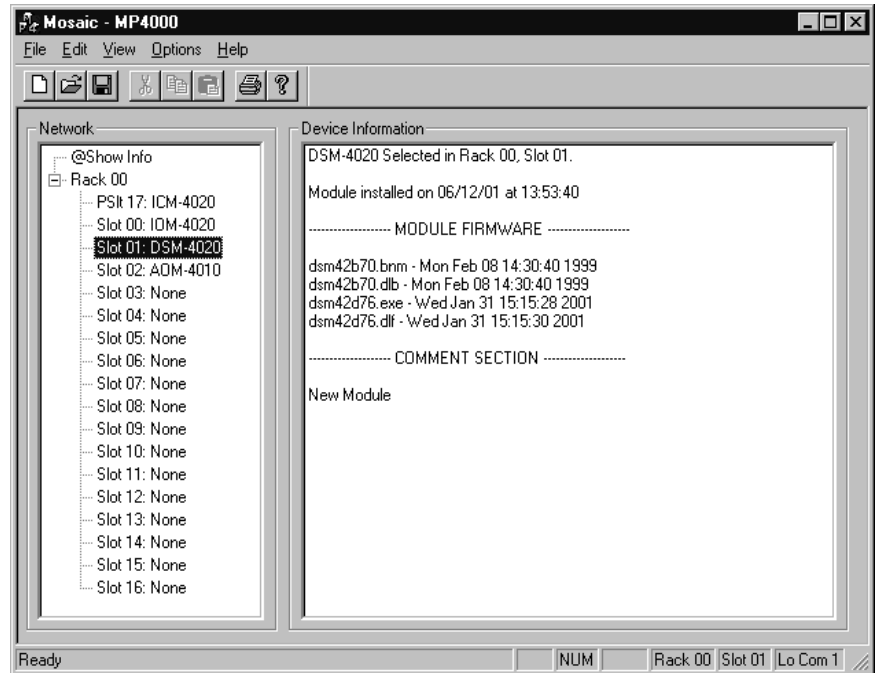
- A- In most cases it is only necessary to update the Download Firmware, and not necessary to update the Boot firmware.
- B- Most modules will not display firmware information when queried if they are running only the Boot, Nor will they verify the boot.
  - 1) If the programming of the Boot seemed successful, and the Module does not respond to version info requests, or verify the boot, proceed with programming the Download Firmware, then Verify both the download Firmware, and the Boot Firmware.
- C- Once the Download Firmware is running, the module should respond to the Firmware version requests, as well as be able to verify the Firmware.
  - 1) **NOTE:** It is imperative that once the programming of the Boot is started, that it NOT be interrupted (reset, turned off, unplug the comm cable, ...), or the module may become unusable (requiring a new Boot Flash to be installed).
  - 2) If you are not having success programming the firmware in a module, Put the Prog/Test/Run switch on the **ICM** in **Test** mode then try downloading the firmware.
  - 3) Putting the **ICM** front panel switch into **Test** position will stop Cues, and Animation from playing on that rack, and decrease communications to modules in that rack.

## 6.4 Downloading New Version of Firmware to a Module

There may be circumstances where the firmware version of a module may need to be upgraded in the field. The information in this section will describe the process of downloading a new version of firmware from the Anitech Systems website and installing it into the module.

### Verify Current Version –

- ✓ Open the MP4000 software.
- ✓ Click on the desired module.
- ✓ Module firmware versions are displayed in the Device Information section of the screen.



### Download Firmware Code From Website –

- ❖ Visit the Anitech Systems website ([www.anitech-systems.com](http://www.anitech-systems.com)).
  - Click on the Support link.
  - Scroll to the correct module type.
  - Highlight and select the Firmware column.
    - Select the correct module version.
      - Select the appropriate sub-file, this is dependant on the module revision level. (Refer to File Name Conventions in the Media Pro® 4000 manual, section 5.2.1, for a detailed explanation of firmware file names.)
      - When the file is selected, it needs to be saved to the disk. Since browsers vary, refer to the brief, "Saving Files from a WebPage without Displaying " in Section 6.1 of this manual.
        - ◆ Enter the Directory and Filename information on the pop-up Menu and press the Save button. The file will be saved to the disk.
- ❖ Also, carefully read the most recent ReadMeMP.txt. It is found on the website at the following address:
  - <http://anitech-systems.com/MP4000/manual/briefs/ReadMeMP.txt>
  - Exit the Website.

**Return to the MP4000 Software –**

➤ **Note:** Before attempting to download the firmware to a module, place the switch on the ICM front panel to the **Test** position. This will enable the rack to download faster and with minimal interference. Placing the switch in the test position affects the racks as described below:

- **Rack 0 (master)** – Allows the Rack to concentrate on the download information. Quits the cues and animation from running and stops the broadcast over the MP Net.
- **Other Racks (slaves)** – Still receives the information, but ignores it while the download is being performed.
- **NOTE:** When downloading to a slave rack over the MPNet, turn the **Rack 0 ICM** switch to the **Test** position in order to minimize interference and enable a successful download.

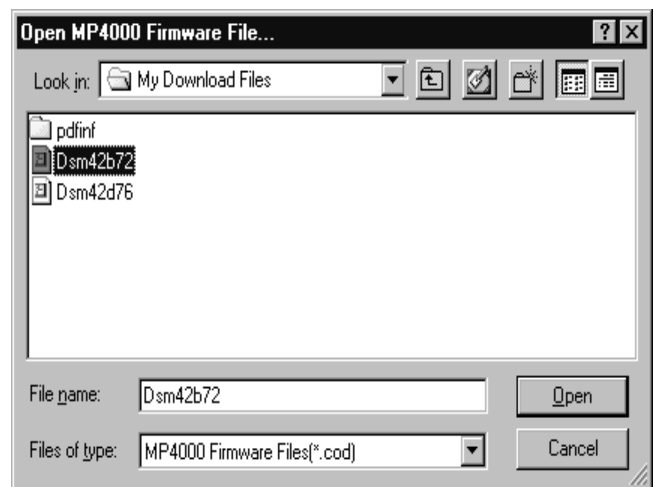
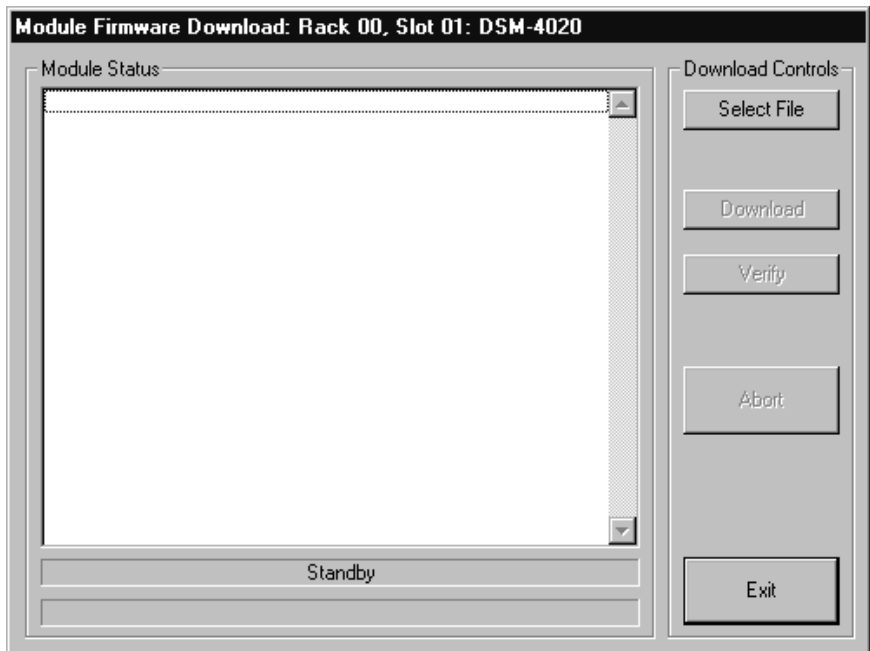
❖ Open the MP4000 software and select the **Showfile**.

❖ Highlight the module desired and left click. The module’s information is displayed in the **Device Information** section.

➤ Select **OPTIONS** from the Menu bar across the top of the MP4000 Menu screen.

- From the scroll down menu, highlight and select **MP4000 FIRMWARE**. The Download menu appears.

- In the **Download Controls** section of the menu, press the **Select File** button. A menu pops up for the selection of the file. Find the directory and filename, then double-click to select and open it.



## Install the firmware Code in the Module –

❖ The download screen reappears and displays the firmware information in the **Module Status** section of the screen.

❖ Be Certain to Read the **Description & Comment** sections of the firmware information for considerations and restrictions of use.

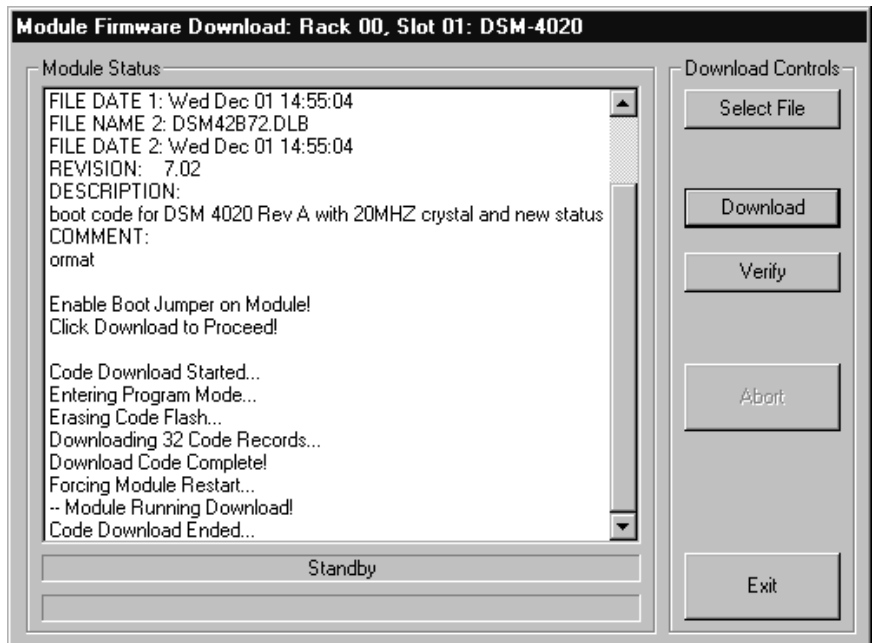
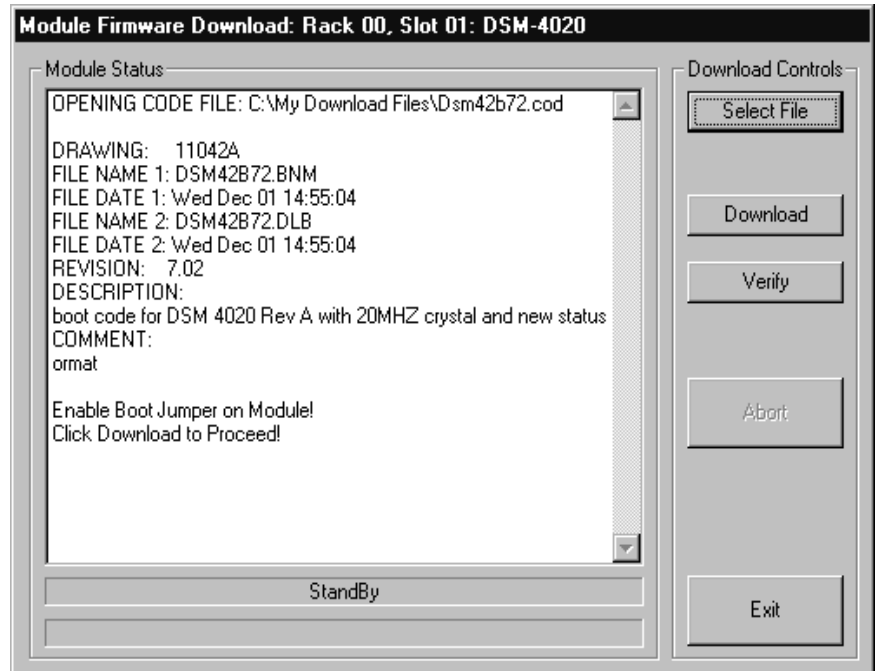
❖ Refer to the **ReadMeMP** file found on the Website.

❖ Press the **Download** button to proceed, or **Exit** to abort the operation.

- Once the **Download** has started, messages appear on the screen to detail the process that is taking place. When it is finished, **Code Download Ended** message is displayed.

❖ It is recommended to run a verify after the download on modules that have the option available. Press the **Verify** button and watch for the **Code Verify Ended** Message.

- If another download is necessary, then press the **Select File** button and repeat the download process for the next file needed.
- Press the **Exit** button to end the download process.



The new versions of the firmware will be displayed in the **Device Information** Pane of the **MP4000** menu.

## Glossary

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<b>ALIAS</b>	English representation contained within single quotes that references an object.
<b>.ani</b>	Extension used for Animation files.
<b>ASCII</b>	A numeric code used by computers to represent characters.
<b>BIT</b>	A single logical or physical resource that can be either ON (true, 1) or OFF (false, 0).
<b>COMMENT</b>	Text following a semicolon on an event line within a cue, it is used to annotate the cue.
<b>COMPLIANCE</b>	Additional feedback applied according to the equations in the firmware and parameters supplied by the user that tends to reduce the output signal.
<b>CONST</b>	Constant
<b>CONTACT CLOSURE</b>	Completes a circuit. A voltage is applied to a reference pin of a bit's connector. When the switch is closed, the voltage is returned on another wire to the same bit, completing the circuit. When the switch is closed, the I/O pin gets voltage.
<b>CUE</b>	A list of up to 512 EVENTS containing verb, object, token, and variable items.
<b>db</b>	Decibel
<b>E/S</b>	Emergency Stop
<b>EVENT</b>	A single line of verb, object, token and parameter items contained in a CUE.
<b>FET</b>	Field Effect Transistor - an electronically controlled switch.
<b>FLASH</b>	Fast, electrically erasable, and programmable in the circuit non-volatile memory devices.
<b>FW</b>	Firmware
<b>HMR</b>	Horizontal Module Rack
<b>HW</b>	Hardware

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<b>ICM</b>	Intelligent Controller Module
<b>I/O</b>	Input/Output
<b>IOM</b>	Input/Output Module
<b>JMP</b>	Push-on jumper, shunt - a small (approximately 1/4" x 1/8" thick) piece of plastic with a metal insert. The jumper is set by pushing it down over a pair of pins.
<b>KEY</b>	A piece of hardware that keeps a module from being plugged into a slot that is wired and keyed for a different kind of module.
<b>LABEL</b>	A name, followed by a colon on a line of a CUE, used for a forward or backward jump.
<b>LED</b>	Light Emitting Diode (indicator, light, lamp)
<b>MIDI</b>	Musical Instrument Digital Interface
<b>MPCL</b>	Media Pro® Control Language
<b>OBJECT</b>	Term used to reference a resource within the Media Pro® system.
<b>OFF</b>	False, 0, Open
<b>ON</b>	True, 1, Closed
<b>PARAMETER</b>	The item that follows a token. The list of parameters is in section 3 of the MP4000 User's Operation Manual.
<b>PLC</b>	Programmable Logic Controller
<b>PORT</b>	A resource on a module in case of the DSM. There are 2 ports.
<b>P-P</b>	Peak to Peak
<b>RACK</b>	A card cage containing Media Pro® 4000 Modules.
<b>RESOURCE</b>	A controllable device connected to or contained within the Media Pro® 4000 system.
<b>RMS</b>	Root Mean Squared
<b>SLOT</b>	A physical location in a RACK that contains a Media Pro® Module.

<b>SMPTE</b>	Refers to <b>Society of Motion Picture &amp; Television Engineers</b> , and the standard for timing signals set by this group.
<b>STRING</b>	A collection of alphanumeric characters contained in double quotes, used with the <b>DISPLAY</b> command.
<b>SW</b>	Software
<b>THD &amp; N</b>	Total harmonic distortion and noise
<b>TOKEN</b>	Reserved words for modifiers of the <b>VERBs</b> used in a cue event. The list of <b>TOKENs</b> is in section 3 of the MP4000 User's Operation Manual.
<b>TYPE</b>	The kind of <b>OBJECT</b> being referred to in a direct addressing statement. The list of <b>TYPEs</b> is in section 3 of the MP4000 User's Operation Manual.
<b>VAC</b>	Volts Alternating Current
<b>VARIABLE</b>	A 32-bit value that can contain a number used in a cue line. A variable may be assigned an <b>ALIAS</b> . There may be a maximum of 512 variables per system.
<b>VDC</b>	Volts Direct Current
<b>VERB</b>	Reserved words for the actions used in a <b>CUE EVENT</b> . The list of <b>VERBs</b> is in section 3 of the MP4000 User's Operation Manual.
<b>VMR</b>	Vertical Module Rack.
<b>.wav</b>	Extension used for <b>WAVE</b> files, contains sound data.
<b>Z-RAILS</b>	Two Z-shaped rails on the back of the rack, adjacent and parallel to the space for the I/O connectors on the Modules when the modules are inserted. The field connectors attach to the Z-rails.



