User's Manual

COBHAM

The most important thing we build is trust.

Standard Definition Messenger Transmitter
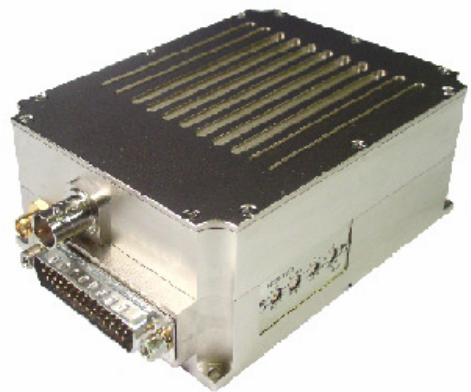
(SDMT-C)

(SDMT-S)

100-M0065X2D
05/29/09

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1.0 Acronyms

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

Name	Meaning
16 QAM	16-state Quadrature Amplitude Modulation
64 QAM	64-state Quadrature Amplitude Modulation
A/V	Audio/Video
AES	Advanced Encryption System (32 bit)
ABS	Messenger Basic Scrambling (8 bit)
ASI	Asynchronous Serial Interface
COFDM	Coded Orthogonal Frequency Division Multiplexing
CVBS/Y	Composite video/Luminance with S-video
C	Chroma video
D/C	Down-Converter
DDR	Digital Diversity Receiver
DVB-T	Digital Video Broadcasting-Terrestrial
FEC	Forward Error Correction
GUI	Graphical User Interface
I/O	Input/ Output
Kbaud	Kilobaud per second
Kbps	Kilobits per second
Mbps	Megabits per second
MDL	Messenger Digital Link
MDR	Messenger Digital Receiver
MDT	Messenger Digital Transmitter
MER	Modulation Error Rate
MPEG	Moving Picture Experts Group
MSR	Messenger Smart Receiver
NTSC	National Television System Committee
PAL	Phase Alternation Line
QPSK	Quadrature Phase Shift Keying
RF	Radio Frequency
RX	Receiver
SDI	Serial Digital Interface
SDML	Standard Definition Messenger Link
SDMT	Standard Definition Messenger Transmitter
S/N	Signal-to-Noise Ratio
THD	Total Harmonic Distortion
TX	Transmitter
VDC	Volts (Direct Current)

2.0 Introduction

GMS' Standard Definition Messenger Transmitter (SDMT-C) is one of the smallest and lowest power consumption DVD-T (Digital Video Broadcasting-Terrestrial) compliant COFDM (Coded Orthogonal Frequency Division Multiplexed) transmitter available. There are three SDMT models; the SDMT-C supports standard analog video and audio signals, the SDMT-S which adds an SDI interface, and the SDMT-A. The SMDT-A supports ASI Transport Stream inputs only. Note that the MPEG Encoder is removed on this model. These transmitters may be supplied as standalone products or may be configured in an optional Camera Box that is compatible with most professional cameras. Additionally, GMS offers a wide variety of companion products required to form a complete link.

A Standard Definition Messenger Link (SDML) is formed when one of the SDMT models is combined with one of GMS' Messenger Digital Receivers, one or two external Down-Converters, antennas, and a SD MPEG-2 decoder. The SDML uses a robust digital modulation system known as Coded Orthogonal Frequency Division Multiplexed (COFDM) that provides frequency diversity and powerful Forward Error Correction (FEC) algorithms. The SDML provides a robust wireless link that is effective against the multi-path interference experienced by analog systems, and provides crisp, clear pictures in the most difficult of terrains.

Additionally, the SDMT/DDR (Standard Definition Messenger Transmitter and Digital Diversity Receiver) combination in SP@ML mode can provide an end-to-end latency down to approx. 198ms without the introduction of any further MPEG encoding artifacts. This ensures that the picture you see is what is happening now – crucial for applications such as sports coverage, surveillance, and law enforcement, where personnel are reacting to real-time events.

This manual provides information on how to operate each of the SDMT models as well as pertinent technical information related to the overall system. Also, refer to model identifier (on-line document, 100-MNI0034) at GMS website, www.cobham.com/gms , for available frequency and power configurations along with available options.

2.1 Key System Features
- Component, S-Video & Composite with Optional SDI/ASI or ASI Only Interfaces
- Built in 4:2:0 MPEG-2 Video Encoder and MPEG-1 Layer II Audio Encoder
- Coded Orthogonal Frequency Division Multiplexed (COFDM) Modulation
- Output Frequency 0.36 to 6 GHz (In-Bands)
- Low Power Consumption
- Local and Remote Control Interfaces
- Rugged and Compact Portable Design

3.0 Theory of Operation

The SDMT accepts Composite, S-Video, Component video, SDI/ASI (optional) as well as up to two audio channels (Mic or line level). The video and audio are compressed (ASI data streams are passed through bypassing the MPEG encoder) according to MPEG specifications (Video MPEG-2 and Audio MPEG-1 layer II). The MPEG-2 supports 4:2:0 Chroma sampling, MP@ML and SP@ML profiles and maintains the original signal's video fidelity. The audio and video program element streams are multiplexed with basic service data to indicate the service name into a DVB compliant Transport Stream (TS).

The TS stream is then sent through a DVB-T compliant FEC encoder and COFDM modulator. This is output from the FPGA based modulator core as digital I/Q signals that are converted to Analog I/Q signals and applied to an I/Q Modulator. The LO that provides the carrier to this I/Q modulator comes from a low phase-noise programmable synthesizer. The modulated RF output of the I/Q modulator IC is sent through amplifier chain and ultimately output to the outside world. Programmable attenuators in the RF processing chain provide signal leveling.

The transmitter is microprocessor controlled. Normally the transmitter is controlled either through an RS-232 or USB interface via either GMS' MS Windows control SW or a simple command line interface. Local Frequency control is also available via rotary switches on the side of the housing.

4.0 Hardware Overview

There are two basic transmitter configurations for the SDMT:
1) The SDMT-C which accepts Composite, S-Video and Component Video,
2) The SDMT-S which accepts Composite, S-Video, Component Video, SDI and ASI inputs

In addition all two configurations of the SDMT can be mounted in an inline professional camera unit (this is an optional enclosure for mounting the SDMT for professional camera applications). The hardware for each configuration is shown below:

4.1   SDMT-C

"RF OUT" SMA Connector)

DB-44 Connector (I/O and Power)

SW100

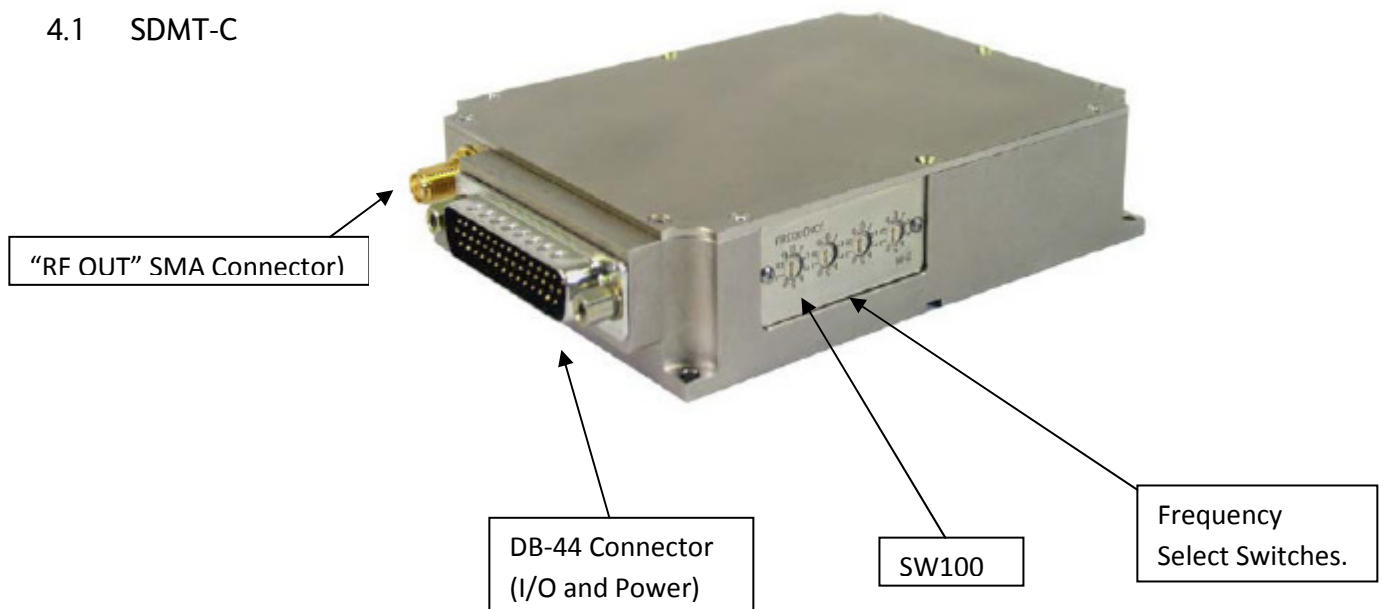Frequency Select Switches.

Figure 1 – SDMT-C Connectors

4.1.1   SDMT-C Connectors
    4.1.1.1   RF Output
        The SDMT uses a female SMA bulkhead connector for its 'RF Output' port.

Note: Transmitters should not be powered on without a load. Doing so could cause the output PA to stop working. A proper heat sink is also required.

4.1.1.2   I/O

The 'I/O' connector is a male, high-density DB-44. It is used to provide the interface for external power, audio, analog video, USB and RS-232 signals. The SDMT has a separate RS232 channel (labeled "Control" on the external breakout cable) for control and monitoring the unit. GMS SDMT Configurator software program (as explained in section 6) makes use of the RS232 control lines. The RS-232 channel utilizes a 3-wire configuration. The pin out for the I/O connector is shown in Table 1. NOTE: An additional RS232 channel (labeled "USER DATA") is currently provided with the external breakout cable. The "USER Data" RS232 channel is dedicated for low-rate data to be transmitted along with the audio and video.

The USB connector is an alternate method of interfacing to the PC if DB-9 connectors are not available.

Table 1 - I/O DB-44 Connector Pin Out

Pin	Signal	Notes
1	RS232 USER Data Tx	
2	RS232 USER Data Rx	
3	RS232 GND	
4	Not connected	
5	SDA	I$\hat{}$2 C bus
6	SCL	I$\hat{}$2 C bus
7	CVBS/Y	Dual use input. 1. **Composite video in**; 2. **Luminance in** (when used with S or Component Video). Must be selected with GMS Control Software or through the front panel of the in-line camera mount box
8	GND	GND for composite video
9	C/Pr	Dual use input. 1.**Chroma video** (when used with S-video); 2. **Pr** (red component when used with Component Video). Must be selected with GMS Control Software or through the front panel of the in-line camera mount box.
10	GND	GND for Chroma video/Pr component
11	Pb	Blue component when used with Component Video.
12	GND	GND for Pb component
13	GND	GND
14	11-15Vdc	Input power to unit
15	Not connected	
16	USB power, Reset	*+5V*
17	USB Data -	
18	USB Data +	
19	USB Gnd	
20-29	Not connected	
30	PA_Shut_DN	Provides a TTL signal [+3V} to enable an external PA.
31	RS232 Control Tx	

32	RS232 Control-Rx	
33	RS232 GND	
34-36	Not connected	
37	Audio right +	
38	Audio right -	
39	Audio right line opt.	Pin 39 is connected to pin 38 for audio right channel input impedance of 600 ohms, balance in (mic or line level)
40	Audio right GND	
41	Audio left +	
42	Audio left -	
43	Audio left line opt	Pin 43 is connected to pin 42 for audio left channel input impedance of 600 ohms; balance in (mic or line level).
44	Audio left GND	

4.1.2   Frequency Select Switches

There are four external rotary switches mounted into the chassis of the SDMT (see Figure 1 & 2). They are used to control RF frequency selection manually. Frequency selection can also be controlled through GMS control software; see section 6. The rotary switches can be disable or enable using GMS control software; refer to section 6.3.3.2 under Configuration/Special Setup/Others. The most significant switch (SW100) represents 1000MHz (0-9) units, the second switch (SW101) represents 100MHz (0-9) units, the third switch (SW102) represents 10MHz (0-9) units and the fourth switch (SW103) represents 1MHz (0-9) units. Hence the highest switch selection can be 9999MHz and the lowest is 0000MHz.

For example with the switches in the following positions, the frequency will read 2014MHz:

And with the switches in the following positions the frequency will read 924MHz:

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SW100

| 0 | 9 | 2 | 4 |

Note the following: if the switches are selected for a frequency outside the range of the frequency band of the SDMT: the transmitter will default to the high side of the frequency band if the switches are set for a frequency higher than the transmitter frequency band. It will default to the low side of the frequency band if the switches are set for a frequency lower than the transmitter frequency band.

4.2   SDMT-S

"RF OUT" SMA Connector)
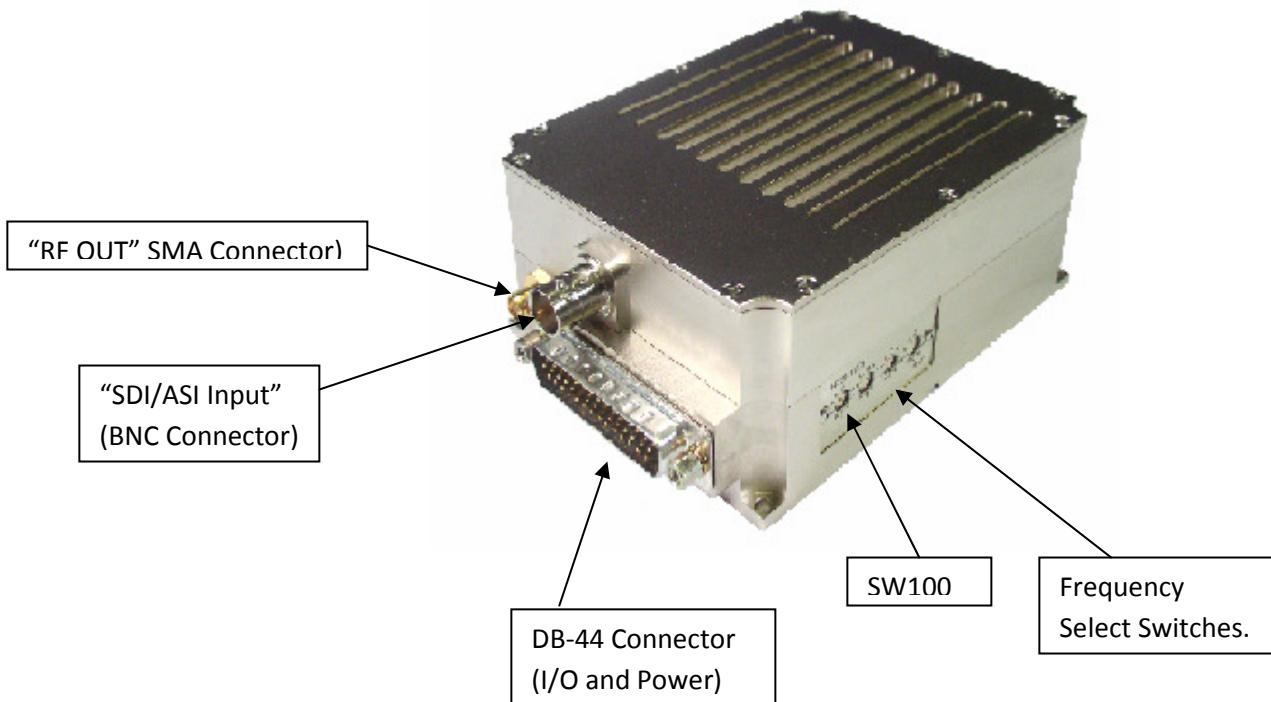
"SDI/ASI Input"
(BNC Connector)

DB-44 Connector
(I/O and Power)

SW100

Frequency
Select Switches.

Figure 2 – SDMT-S Connectors

4.2.1 SDMT-S Connectors

4.2.1.1　RF Output

The RF Output connector is the same as the SDMT-C. Refer to section 5.1.1.1 above for the description.

4.2.1.2　I/O

The I/O connector for the SDMT-S is the same as for the SDMT-C. Refer to section 5.1.1.2 and Table 1 above for the description and pin functions. For the SDMT-A the I/O connector is limited to only power, ground, USB connections and RS232 functions. Analog video input functions are not provided.

4.2.1.3　SDI/ASI BNC Input Connector

The BNC connector is provided for inserting SDI (Serial Data Interface) and ASI (Asynchronous Serial Interface) data. The SDMT-S can accept either SDI or ASI. The selection for which input data stream is accepted is made through the GMS PC Windows Control software. See section 6.

4.2.2 Frequency Select Switches

The frequency select switches are the same as the SDMT-C. See section 5.1.2 above for the operational description.

4.3　Inline Camera Unit (optional)

DB-15 Connector

Pr

Pb

Balance audio, A1&A2

BNC J2=Chroma C video input when used with S-video. When used with

BNC J7 = SDI or ASI input.

BNC J3, Y/COMP =Composite video input. When used with S or Component video

RF out

BNC J8 = Pb when used with Component video

Power "on/off" switch

Figure 3 - SDMT Inline Camera Unit

LCD panel with controls

4.3.1 SDMT Inline Camera Mount Connectors

There are four BNC connectors, two audio XLR, one DB-15 connector, one N type connector and one rocker on/off power switch located on the SDMT inline camera unit for interfacing the

RF, audio, video, power and RS-232 signals. An optional LCD control front panel is also available. Inline camera mount is shown in Figure 3.

4.3.1.1   RF Output
The SDMT in line camera enclosure uses a female N type connector (flange mount) for its 'RF Output' port.

Note: Transmitters should not be powered on without a load. Doing so could cause the output PA to stop working.

4.3.1.2   I/O
The 'I/O' connector is a female, DB-15. It is used to provide the interface for RS-232 signals (control and monitoring). GMS SDMT Configurator software program (as explained in section 6) makes use of the RS232 control lines, pins 2, 3 and 5 of the DB-15 connector. The RS-232 channel utilizes a 3-wire configuration. The pin out for I/O connector is shown in Table 2. A USB connection is also provided if RS232 port is not available.

Table 2 - I/O DB-15 Connector Pin Out

Pin	Signal	Notes
1	+12Vdc	
2	RS232-Rx (CTRL)	Relative to SDMT (i.e., control data is input on this pin)
3	RS232-Tx (CTRL)	Relative to SDMT (i.e., control data is output on this pin)
4	Not connected	
5	RS232-GND	Common ground for both RS232 Data and Control lines
6	Iˆ2C_D	
7	Iˆ2C_C	
8	USB Reset	*+5V*
9	USB Data -	
10	USB Data +	
11	USB GND	
12	Not connected	
13	RS232-Tx (DATA)	
14	RS232-Rx (DATA)	
15	RS232-GND	

4.3.1.3   Video Input
The SDMT in-line camera enclosure uses female BNC connectors for video input. Component, Composite or S-Video input is accepted (see section 6 for setting video input type). J3 BNC connector marked "Y/COMP" is a dual use input connector; a) Composite Video or b) Luminance when used with Component video. J2 BNC connector marked "C/Pr" is a dual use input connector; a) Chroma when used with S-Video or b) Pr,

the red component minus the luminance information used with Component Video. J8 BNC connector marked "Pb" is the blue component minus the luminance information used with Component Video. These video inputs are applicable to the SDMT-C and SDMT-S units.

4.3.1.4 Power Switch
An LED indicator rocker switch is provided for controlling power to the unit.

4.3.1.5 LCD Display
An optional LCD display with a front control panel is available for the inline camera mount unit. Many of the control functions which are normally handled through the software interface and a PC can now be accessed directly with the front control panel and displayed on the LCD such as changing frequencies, checking video lock status among many others.

4.3.1.6 SDI/ASI Input (optional)
A BNC connector is provided for Serial Digital Interface or Asynchronous Digital Interface input data streams. This input is only applicable to the SDMT-S unit.

5.0 Software Overview

Configuration, control and monitoring of the SDMT unit is accomplished by using GMS' optional (sold separately) MS Windows-based SDMT Configurator software program. This Graphical User Interface (GUI) program provides the end user with a straightforward way to interface with the SDMT. During normal operation, once a SDMT link is established, the SDMT Configurator GUI does not need to be active and can be disconnected from the SDMT.

5.1 System Requirements
The SDMT Configurator program has been developed and tested on Windows 2000, Windows XP and Windows NT. Although the SDMT Configurator program may work properly on other operating systems, only the Windows 2000, Windows XP and Windows NT environments have been used at GMS and no support or assistance can be provided concerning other operating systems.

5.2 Installation
The following instructions outline the installation process for the SDMT Configurator program:
1. Insert provided CD-ROM into computer.
2. Click on 'setup.exe' file. This will launch the GMS_SDMT Configurator Setup program and several initial setup files will begin to be copied onto the computer.
3. After the initial setup files are copied over, the GMS_SDMT Configurator Setup program will prompt the user to close any applications that are running. Once all other programs are exited, click on the 'OK' button.
4. The GMS_SDMT Setup program will prompt the user to click on the 'computer icon' button to begin installation. If desired, the user can change the destination directory from the default. Click on the 'computer icon' button.
5. The GMS_SDMT Setup program will then prompt the user to 'Choose Program Group'. If desired, the user can change the program group from the default. Click on the 'Continue' button.

6. After installing the SDMT Configurator program, it will display a window indicating that setup was completed successfully. Click 'OK'.

5.3 SDMT Configurator Functions

The SDMT Configurator program provides the user access to many different configuration, control and monitoring options. When the SDMT Configurator program is launched, the screen shown in Figure 4 is displayed. The user should first select the serial port their computer is connected to via the Serial Port Selector and Status region. If the selected serial port is valid, the gray-colored status box will show 'Ready. To configure a SDMT, select the 'SDMT' box in the Device Selector region. Once the 'SDMT' box is selected, the screen shown in Figure 5 is displayed. The SDMT Configurator program contains function buttons and all the configurable settings available on a SDMT. The following sections explain, in detail, the various options.
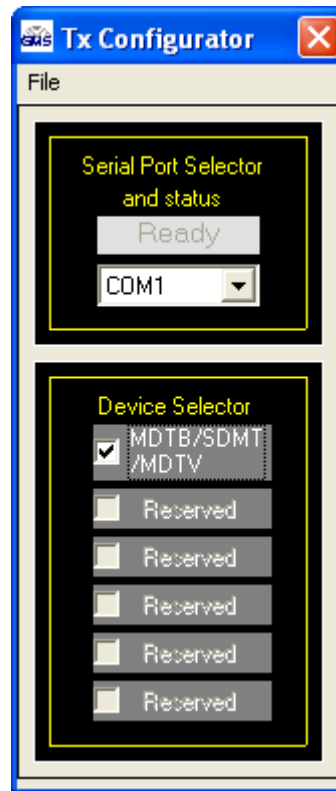

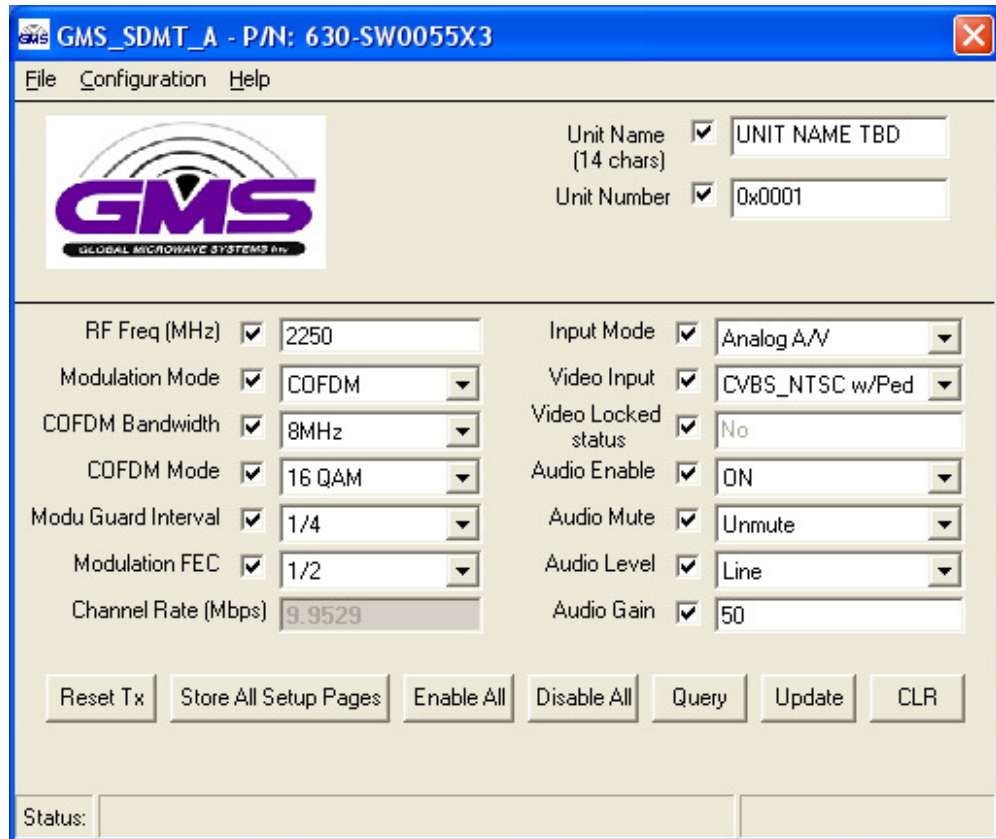**Figure 4 – SDMT Configurator Main Screen**

Figure 5 - SDMT Configurator Main Screen

5.3.1   Function Buttons

- "**Reset Tx Button**: Clicking on this button re-boots the transmitter to an initial known state. Note that it takes 30 seconds to fully initialize the transmitter.

- "**Store All Setup Pages" Button**: Clicking on this button will store all setup pages, even if they are not shown.

- "**Enable All" Button**: Clicking on this button enables all the check boxes on the screen. This operation is done to prepare all the fields to be written to (or read from). Alternatively, the end user can individually select a given field by using the mouse and clicking its corresponding check box

- "**Disable All" Button**: Clicking on this button disables all the check boxes on the screen. This operation is done to inhibit all the fields to be written to (or read from). Alternatively, the end user can individually deselect a given field by using the mouse and clicking its corresponding check box.

- "**Query" Button**: Clicking on this button performs a read operation on all the fields that have their check box enabled. Once clicked, all the selected fields will be read back reflecting their current configuration.

- **"Update" Button**: Clicking on this button performs a write operation on all the fields that have their check box enabled. Once clicked, all the selected fields will be written to with the value denoted in their respective field.

- **"CLR" Button**: Clicking on this button clears out all fields on the screen, regardless of whether the fields' check boxes are selected or not. This button proves useful when the end user wants to verify that a write operation has been correctly performed. An example scenario would be to 1) enable all fields, 2) change desired field(s), 3) perform a 'Update' (write) operation, 4) perform a 'CLR' operation and 5) perform a 'Query' operation. As a result of the 'Query' operation, the fields on the screen should all update to those values that were written during the 'Update' operation.

5.3.2   Field Definitions

There are several different fields that can be configured by the SDMT Configurator. The fields located in the main screen of Figure 5 and their associated values are defined in Table 3 below. Also noted in the table is whether the field is read, write-able or both

Table 3 - SDMT Field Definitions

Field	R/W	Description
Unit Name	R/W	Allows the user to assign a unique unit name to the MDT.
Unit Number	R/W	Allows the user to assign a unique unit number to the MDT
RF Freq (MHz)	R/W	RF output frequency. Desired frequency is entered in MHz (i.e., 1.296GHz would be entered as 1296). Default frequency step size is 500KHz. For S2 band it's 250KHz.
Modulation Mode	R/W	Modulation mode. Desired modulation mode is selected from the following values*: COFDM (default) Off (shuts off modulation) or I/Q CAL ON (puts unit in calibration mode).*
COFDM Bandwidth	R/W	**COFDM** transmit bandwidth. Desired bandwidth is selected from the following values: *6, 7 or 8 MHz.*
COFDM Mode	R/W	**COFDM** modulation type. Desired **COFDM** modulation type is selected from the following values: *QPSK, 16QAM* or 64QAM (only in ASI mode)
Mod Guard Interval	R/W	Modulation guard interval size. Desired modulation guard interval size is selected from the following values: *1/32, 1/16, 1/8 or ¼. (not all values available to SDMT-C and SDMT-S units, configuration type dependent).*
Modulation FEC	R/W	Modulation FEC (Forward Error Correction) rate. Desired modulation FEC rate is selected from the following values: *½, 2/3, ¾, 5/6, 7/8* (*not all values available to SDMT-C and SDMT-S units,*

Field	R/W	Description
		configuration type dependent.).
Channel Rate (Mbps)	R	Channel rate is displayed based on parameters selected such as COFDM mode, FEC and Guard Interval. Channel rate is limited to 15Mbps when Analog Video input or SDI input is selected.
Input Mode	R/W	Choice between Analog video (SDMT-C/S units), SDI, serial digital interface (SDMT-S units) or ASI, asynchronous digital interface (SDMT-S and SDMT-A units)
Video Input	R/W	Video input format. Desired video input format is selected from the following values: *PAL, NTSC w/ Pedestal, NTSC, S-video PAL, S-video NTSC, and Component Video. Some of these choices may or may not be shown in the pull down box depending on which user profile has been loaded.*
Video Locked Status	R	Analog video lock status. This read-only field indicates that the SDMT-C and SDMT-S has line-locked onto the analog video input signal [*not applicable when the "Input Mode" is set to either SDI or ASI*]
Audio Enable *	R/W	Analog audio encoder enable. Desired mode of operation of the audio encoder is selected from the following values: *Off or On.*
Audio Mute *	R/W	Choice between *mute* or *un-mute* audio stream
Audio Level *	R/W	Choice between *mic* or line *level* audio
Audio Gain *	R/W	Adjustable gain between 0- 100

- *Not applicable for embedded audio applications.*

5.3.3 Pull-Down Menu Definitions

There are several different pull-down menus that are included in the SDMT Configurator program. Each of these pull-down menus contains further user-configurable options or commands. The following sections describe these menus in detail.

5.3.3.1 File

This pull-down menu offers to exit the SDMT Configurator program. Alternatively the 'X' box in the upper right hand corner of the window can be used to exit the program. The "Store All Setup Pages" button on the main menu will save all parameters.

5.3.3.2 Configuration

This pull-down menu contains several different configuration options. These are outlined below:

➢ *Special Setup*

- o *Scrambling Mode (Option, this menu not available if option is not purchased) –* This pull down menu displays the following (see Figure 6A & 6B):
  - *OFF–* Scrambling (Encryption) turned off (disabled).

- **AES, *Never Store the key in the TX*** – Scrambling is turned on (Enabled). When scrambling is turned on, a key code (a series of 32 Hex characters) must be entered. Entering the key code is discussed in the following section (Scrambling Key). In this mode the key code is not stored in the transmitters memory. When power is removed the key code will be lost and must be re-entered when power is re-applied. The same key code must be entered in the DDPC of the MSR. See DDPC manual 100-M0070.
- **AES, *Store the key in the Tx*** – Scrambling is turned on (Enabled). In this mode the key is stored in the transmitters memory. When power is removed the key code will not be lost.
- **Query** – Clicking this button performs a read operation which will read back the current scrambling mode configuration.
- **Apply** – Clicking this button will perform a write operation of the selected mode.
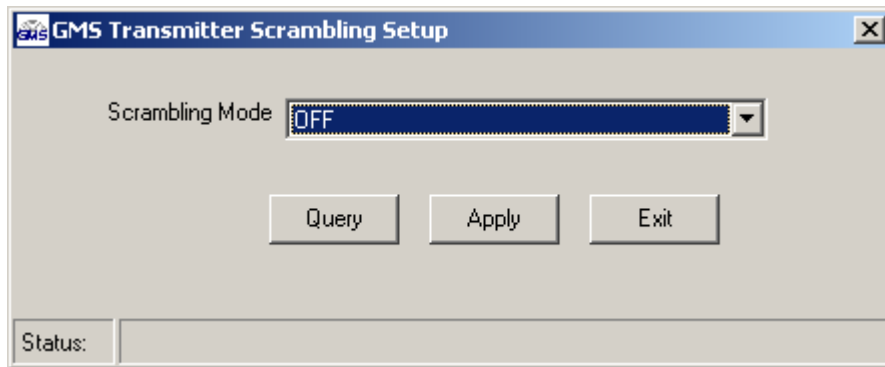- **Exit** – Exit the scrambling mode.
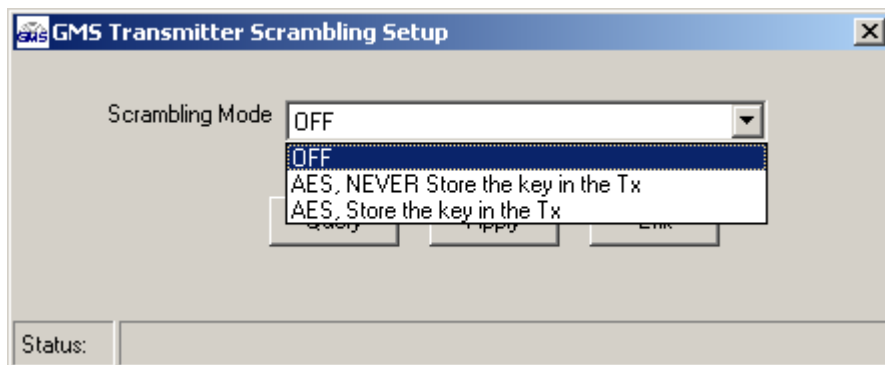

Figure 6A - Scrambling Mode Setup

Figure 6B - Scrambling Mode Setup

- *Scrambling Key (Option, **This menu not available if option not purchased))** – This menu displays the following (see Figure 7):

  - *Enter Scrambling Key from Keyboard – *The 32 character key code can be manually entered from the keyboard. The characters must be Hex numbers. When the numbers have been typed, use the *Apply* button to enter the code.
  - *Load Scrambling from a file – *The key code can be selected from a file. The *browser* button can be used to search thru the Directory for a file containing the key code. Once a path has been established it can be saved using the *Save Path* button. The *Load Key from File* is used to retrieve a key code from a file as specified by the path. Use the *Exit* key to close this window.
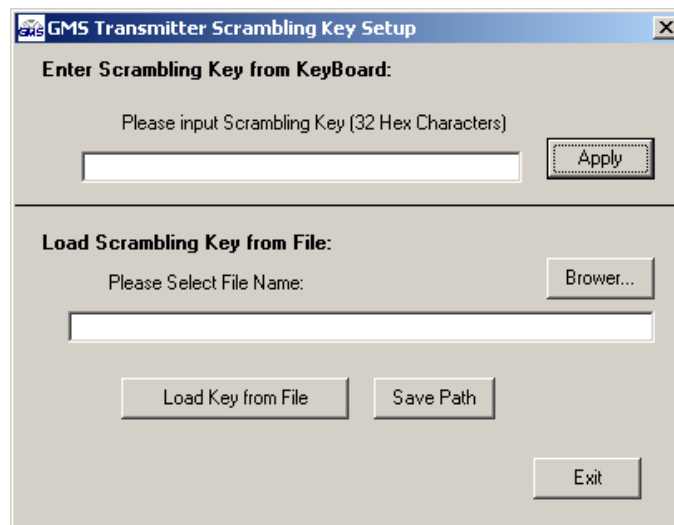

Figure 7 - Scrambling Key Setup

- *Others* (see figure 8)- This menu displays the following:

  - *RF Output attenuation – *The RF out can be attenuated in 0.5 or 1 dB increments up to defined max. Both increment step and max value are frequency band dependant.
  - *COFDM Spectrum Inversion - *choices include normal or inverted. The transmitter is configured with the receiver it ships with and the inversion mode shouldn't have to be changed. However if a different receiver is used, it may be necessary to change the inversion mode. Some receivers will accept either inversion mode. Check the parameters of the receivers to ensure the correct inversion mode is selected.
  - *RF Power Mode-*Can be used to put transmitter in a sleep mode, a low power mode where the encoder functions and many of the power regulators are shut down enabling a saving in current (approx. 40%) when transmitter is not active. The *OFF* state of the unit is displayed on

the main window (see figure 8A). To have the unit in the desired *RF Power Mode* on Power up, it is necessary to store settings in the *Others* window. If the settings are stored in the main page, the state of the *RF Power Mode* will not be saved.

- **Frequency switch** – choices offered are enabled or disabled. These are the four frequency select switches discussed under section 5.1.2. If disabled the switches will not respond to changes (frequency changes could still be accomplish by changing the "RF FREQ MHz" field in the GMS SDMT control software. Enabling them allows the frequency to be changed when the switches are moved. Factory default enables the switches. Keep in mind that you must click on the "Store All Setup Pages" button for any new selection to take place.

- **Video Profile** – Pull down box offers a choice between the SP@ML profile (default profile) and the MP@ML profile.

- **GOP Length**– Group of pictures size (1-19) can be adjusted by selecting various values from the pull down boxes.

➢ **Ctrl Port Baud Rate**- The control port baud rate menu allows different baud rates to be selected when attached to the PC RS232 port. 115200-baud rate is the default value. Some computers may need the baud rate adjusted for optimal communications

➢ **Factory Setup** – reserved for factory use and is password protected.
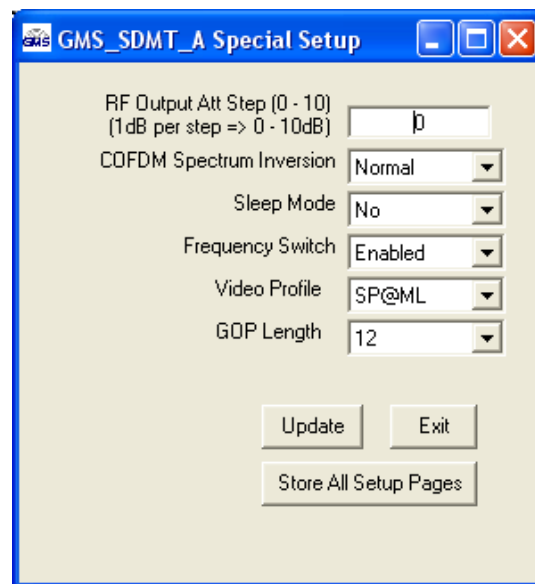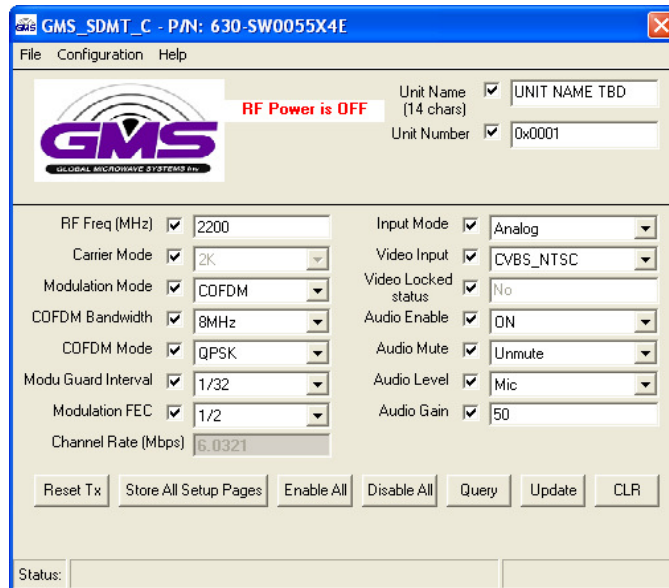

Figure 8 – Others Menu Screen

Figure 8A – RF Power Off

5.3.3.3   Help
This pull-down menu contains information about the SDMT firmware and the SDMT
Configurator software. This information is outlined below:

➢ *Channel Rate Guide*: This selection pulls up a table which displays the relationship
between the Modulation mode, Modulation Guard Interval and FEC mode in which the
channel rate (Mbps) is derived. Table values will change depending on which COFDM
Bandwidth is selected. See figure 9. Also keep in mind that all values may not be
available, they are SDMT configuration type dependant.
➢ *FW version*: This selection pulls up a window that displays the SDMT Software Version
date, the FPGA Version and Serial Number. See Figure 10.
➢ *About*: This selection pulls up a window that displays the Version Number of the GMS
SDMT Configurator program. See Figure 11.

Figure 9 - Channel Rate Guide

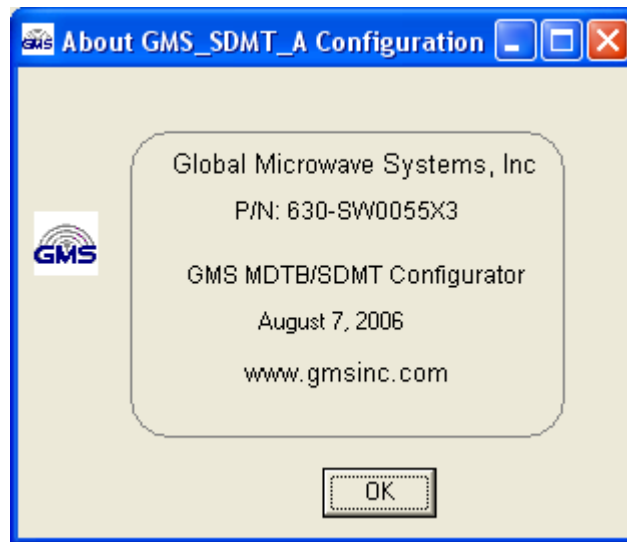| Modulation Mode	Guard> vFEC	1/32	1/16	1/8	1/4
QPSK	1/2	6.032	5.8546	5.5294	4.9764
QPSK	2/3	8.0427	7.8062	7.3725	6.6352
QPSK	3/4	9.0481	8.782	8.2941	7.4647
QPSK	5/6	10.0534	9.7577	9.2156	8.2941
QPSK	7/8	10.5561	10.2456	9.6764	8.7088
16QAM	1/2	12.0641	11.7093	11.0588	9.9529
16QAM	2/3	16.0855	15.6124	14.745	13.2705
16QAM	3/4	18.0962	17.564	16.5882	14.9294
16QAM	5/6	20.1069	19.5155	18.4313	16.5882
16QAM	7/8	21.1122	20.4913	19.3529	17.4176
64QAM	1/2	18.0962	17.564	16.5882	14.9294
64QAM	2/3	24.1283	23.4186	22.1176	19.9058
64QAM	3/4	27.1443	26.346	24.8823	22.3941
64QAM	5/6	30.1604	29.2733	27.647	24.8823
64QAM	7/8	31.6684	30.737	29.0294	26.1264

Figure 10 - FW Version

Figure 11 About

6.0 Getting Started

The standard SDMT kit includes the following items:

➢ SDMT unit (example GMS p/n SDMTCCBA0NXXX)
➢ SDMT full breakout cable (GMS p/n 780-C0224)
  (Power, A/V, Data, Control interfaces)

NOTE: Based on customer application GMS may deliver additional cables and antennas. Contact GMS for further information.

The SDMT is pre-configured by GMS prior to shipment (based on customer requirements), thus is ready to work "right out of the box".

6.1   Initial Checkout
Prior to installing a SDMT unit into the desired target environment, an initial checkout should be performed to ensure proper operation of the unit. The initial checkout consists of configuring a basic SDML (Standard Definition Messenger Link).

Figure 9 shows a basic interconnection configuration to establish a wireless SDML (NOTE: Receivers, down converters (D/C) units and their associated hardware are sold separately). As mentioned in section 4.0 the SDMT may be shipped as a stand-alone unit or mounted in an Inline Camera Mount box. SDMT stand-alone units require the use of GMS' breakout cable to provide power and the necessary interfacing to communicate to the transmitter. The Inline Camera Mount boxes require a +12 battery and most of the necessary communications can be done through the LCD front panel. The steps necessary to set up the configuration shown in Figure 12 are shown below; the differences between the Inline Camera Mount box and stand-alone unit are noted where applicable.
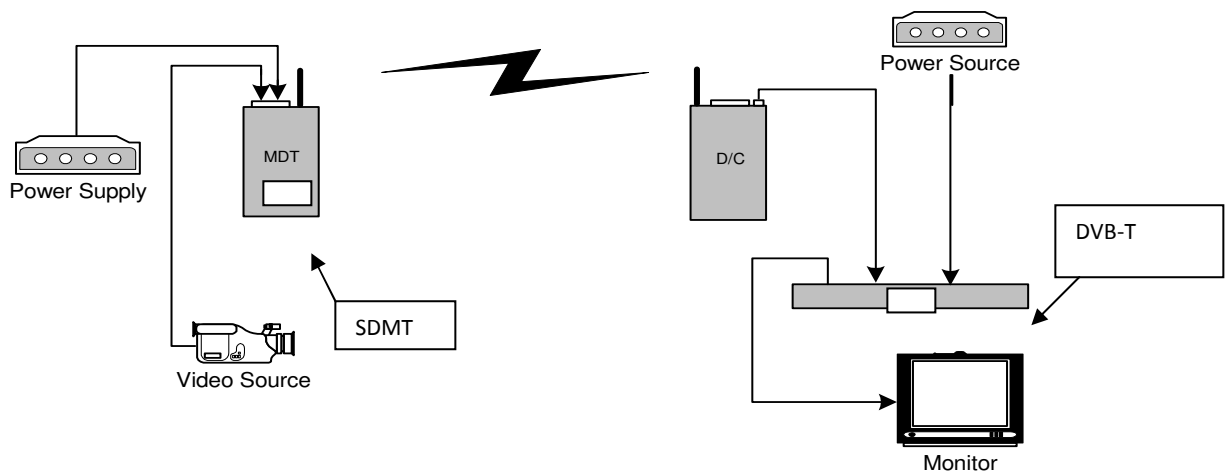
Figure 12 - Basic SDML Setup

1. Install omni-directional antennas onto the SDMT RF output port and Down- Converter (D/C) RF input port. ***Note: Transmitters should not be powered on without a load.** **Doing so could cause the output PA to stop working. A proper heat sink is also required.***
2. Attach the breakout cable (DB-44 end) to the SDMT unit (if unit is mounted in an Inline Camera Mount Box this step does not apply).
3. Attach a RF cable from the D/C IF output port to RF in port of the receiver.
4. Attach a composite video source to SDMT BNC video input cable (marked CVBS/Y) that is located on the breakout cable. S-video and Component video input are also available. If unit is mounted in an Inline Camera Mount Box then attach video to appropriate BNC video input connector
5. Attach a video cable from one of the BNC video output ports on the receiver to a video monitor.
6. To prepare to power the SDMT unit, attach the red and black wires from the breakout cable to +12V terminal and ground of power supply, respectively (if unit is mounted in an Inline Camera Mount box then attach +12 Volt battery). NOTE: The power supply (for the transmitter) needs to be able to provide at least 1 Amp of current at a nominal +12VDC input. If using a commercial DVB-T receiver follow the manufacturers's instructions for powering the unit.
7. Turn on the video source and video monitor equipment.
8. Apply power to the SDMT and the receiver unit (Inline Camera Mount boxes have power switches which must be turned on). Also ensure the down converter is powered (+12 Vdc to pin 1, GND to pin 3 of the DB-9 pin connector located on the bottom side of the D/C). If the down converter is installed in a camera mount box it will have a power switch on the side of the unit. Ensure the switch is turned to the "On" position.
9. After approximately 10 seconds, the link should be established and video provided by the source should be displayed on the monitor.

The initial checkout described above is simply to check the basic video operation of the SDMT unit. For further details on monitoring and controlling the SDMT using GMS' optional MS Windows-based SDMT Configurator software program, see Section 6.0.

7.0 Specifications

The following sections outline the overall specifications for the SDMT unit.

7.1 Video Encoding

Interfaces: SDI (optional), Component, Composite or S-Video Input
   Standards: NTSC or PAL
Compression Standard: MPEG-2 (per ISO/IEC 13818-2)
Profiles: MP@ML, SP@ML
Video Bit Rate: 3.7Mbps to 15Mbps (MP@ML)
Chrominance Profile: 4:2:0
Line Standard: 525 or 625
Horizontal Resolution: 704 pixels
Vertical Resolution: 576 (625 line) and 480 (525 line)
System Latency end to end delay: 198mS with SDMT/DDR combination in SP@ML mode.

7.2 Audio Encoding

Analog Audio: Dual, Line-Level or Mic-Level, Differential or Single-Ended, Clip Level 12dBm
Impedance: 600 Ohms input impedance (changeable to 2K Ohms)
Compression Standard: MPEG layer II
Audio Enable: On or Off
Bit Rates: 256Kbit/s/ch
Sampling Frequency: 32kHz, 44.1kHz or 48kHz
THD: < 0.1% maximum
Response: 20Hz to 12kHz, +/- 0.25dB
Crosstalk: >55dB minimum
S/N: >60dB RMS

7.3 Transport Stream

Standard: per ISO/IEC 13818-1
Packet Size: 188 byte
Bit Rate: Automatically set from active service settings.
ASI Input (optional): Allows MPEG2 transport stream to be inserted into the SDMT-A and SDMT-S units through the BNC connector

7.4 RS-232 Interfaces/RCU/USB

Control Port: 3-wire interface (Tx,Rx,Gnd)
USB 1.0
RCU A remote portable control unit is also available
In addition a "Data" RS232 channel is available dedicated for low-rate data to be transmitted along with the audio and video.

7.5 COFDM RF Output

Output Frequency: 0.36 to 6 GHz (In-Bands).

Frequency step size is 500 KHz for all bands except S2 (1999-2500MHz) which is 250 KHz.
Bandwidth: Selectable 6, 7 or 8 MHz
Output Power: Up to100mW (programmable) [200mW on some models]
Connector: **SMA-F**
Note: Transmitters should not be powered on without a load. Doing so could cause the output PA to stop working. A proper heat sink is also required.

7.6 Modulation
Modulation Type: COFDM w/ QPSK, 16 QAM (64 QAM available with SDMT-S and SDMT-A units when ASI input is selected).
FEC: ½, 2/3, ¾, 7/8 (not all available, SDMT configuration type dependent)
Guard Intervals: 1/32, 1/16, 1/8, ¼ (not all available, SDMT configuration type dependent)
Spurious: 50dBc
Number of COFDM Carriers: 2k
COFDM MER: > -45dB
Standard: DVB-T compliant

7.7 Power
SDMT (Frequency 0.36 to 6GHz In-Bands
DC Input Voltage Range: 9 to 15 VDC
Power Consumption: 8.5 Watts to 10.8watts (SDMT configuration type dependent)

7.8 Physical Dimensions (without mating connectors)
SDMT (Frequency 0.36 to 6GHz In-Bands)
SDMT-C unit
Size: 3.25 in. (W) x 4.5 in. (D) x 1.00 in. (H)
(8.26 cm x 11.43cm x 2.54cm)
Weight: 10.69 oz
(303.1 grams)
SDMT-S/A units
Size: 3.25 in. (W) x 4.5 in. (D) x 1.76 in. (H)
(8.26 cm x 11.43cm x 4.47cm)
Weight: 13.4 oz
(379.9grams)

7.9 Environmental
Operational Temperature: -10 to +70 °C
Humidity: Up to 100% (non-condensing)

7.10 SDMT Special Features
Video Only Mode
In applications where audio is not required, the audio channels can automatically be switched off. Bit rate is automatically switched over to the video channel in this situation.

Monochrome Video Mode (custom option, consult factory)
Surveillance applications often do not require chrominance data in the video. SDMT has been provided with a luminance (monochrome) only mode. When in this mode, bit rate is saved giving sharper monochrome pictures.

Security Option
The SDMT can optionally be provided with an Advanced Encryption System (AES) for protecting the signal in sensitive applications.

8.0 The D/C (Down Converter)/IF frequencies explained

8.1   IF Frequencies
- GMS' MDRs (Messenger Digital Receivers) and MSRs (Messenger Smart Receivers) are capable of receiving direct frequencies in the range of approximately 49 MHz to 861 MHz. If the transmitter is not in this range then a down-converter is used to convert the frequency to this range. The frequency from the down-converter is called the IF (intermediate frequency) which is fed to the receiver.

   Down-converters have a LO (local oscillator) which is mixed with the transmitter frequency (SDMT) and converts it to the IF frequency. MDRs need to know the LO (local oscillator) of the down-converter and is factory programmed with this information (MSRs also need the LO information but is not factory programmed with this information). The receiver then automatically calculates the IF frequency once the RF (transmitter frequency) is entered. Thus as the desired RF frequency is dialed in on the MDR (or MSR) the IF is taken care of automatically. For example, if the transmitter frequency (SDMT) is set for 2000 MHz, then the MDR can be set for 2000 MHz (it automatically calculates the IF frequency based on pre-programmed LO information of the down-converter). The IF frequency changes as the RF frequency changes; the LO remains constant.

   On non-GMS commercial digital receiver it may be necessary to program the receiver with the IF frequency directly. The user may have to do the simple math to arrive at the IF frequency so that it can be entered into the receiver. ***The down–converter LO must be known***. The math involve is as follows: " RF (transmitter frequency) – LO (local oscillator) = IF frequency". For example, it the transmitter is set for 2000 MHz and the LO of the down-converter is 2800 MHz then the IF frequency is -800 MHz (2000-2800MHz = -800). The receiver will need to be set to 800 MHz to receive the transmitter frequency of 2000 MHz. Each time the transmitter frequency is changed the IF must be re-calculated and entered into the receiver. It must also be mentioned, as you may have noticed, a negative LO may indicate the receiver wants the signal to be inverted. See section 6.3.3.2 for inverting the signal.

8.2   Local and Remote Power

   Customers may have the option of using remote or local power to power up a down converter depending on the receiver used. GMS' MDRs (Messenger Digital Receiver) and MSRs (Messenger Smart Receiver) can provide DC +12 volts to power the D/C remotely through the RF cables. Refer to GMS' MDRs or MSRs operating instructions for turning on the DC power for the D/C when using remote power.

   If the D/C is located relatively close to the receiver then using remote power makes sense. However, if the D/C is located at great distances away from the receiver there may be excessive DC voltage drop in the coax cable (due to cable resistances). If this is the case then local DC power should be considered as discussed below. If unsure of the DC voltage drop measure the DC voltage present (using a DMM) at the end of the coax cable run. The D/C normal operating voltage is approximately +12 Vdc but can operate down to +10 Vdc.

- Local power is provided by applying +12 Vdc to pin 1, GND to pin 3 of the DB-9 connector located on the bottom of the D/C. The +12 Volt power supply must be able to source at least 500 mA. The power switch (located on the side of the D/C) enables the user to control the 'ON'/'OFF' positions for local power. If using local power then ensure the remote power (if the receivers have this capability) is turned off.
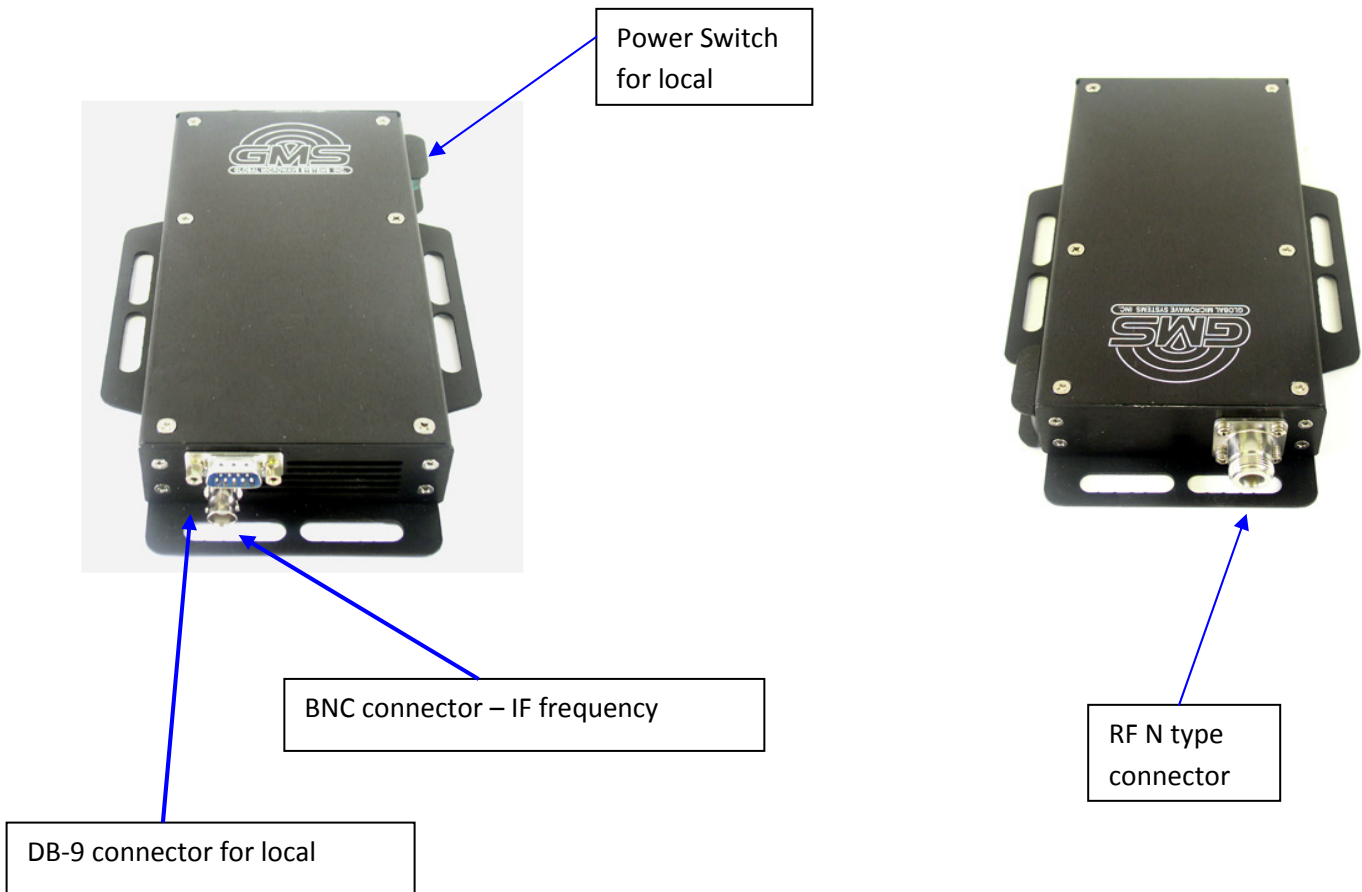
Power Switch for local

BNC connector – IF frequency

RF N type connector

DB-9 connector for local

Figure 13 - BDC Connectors

Table 4 - DB-9 Connector Pin Out for the D/C

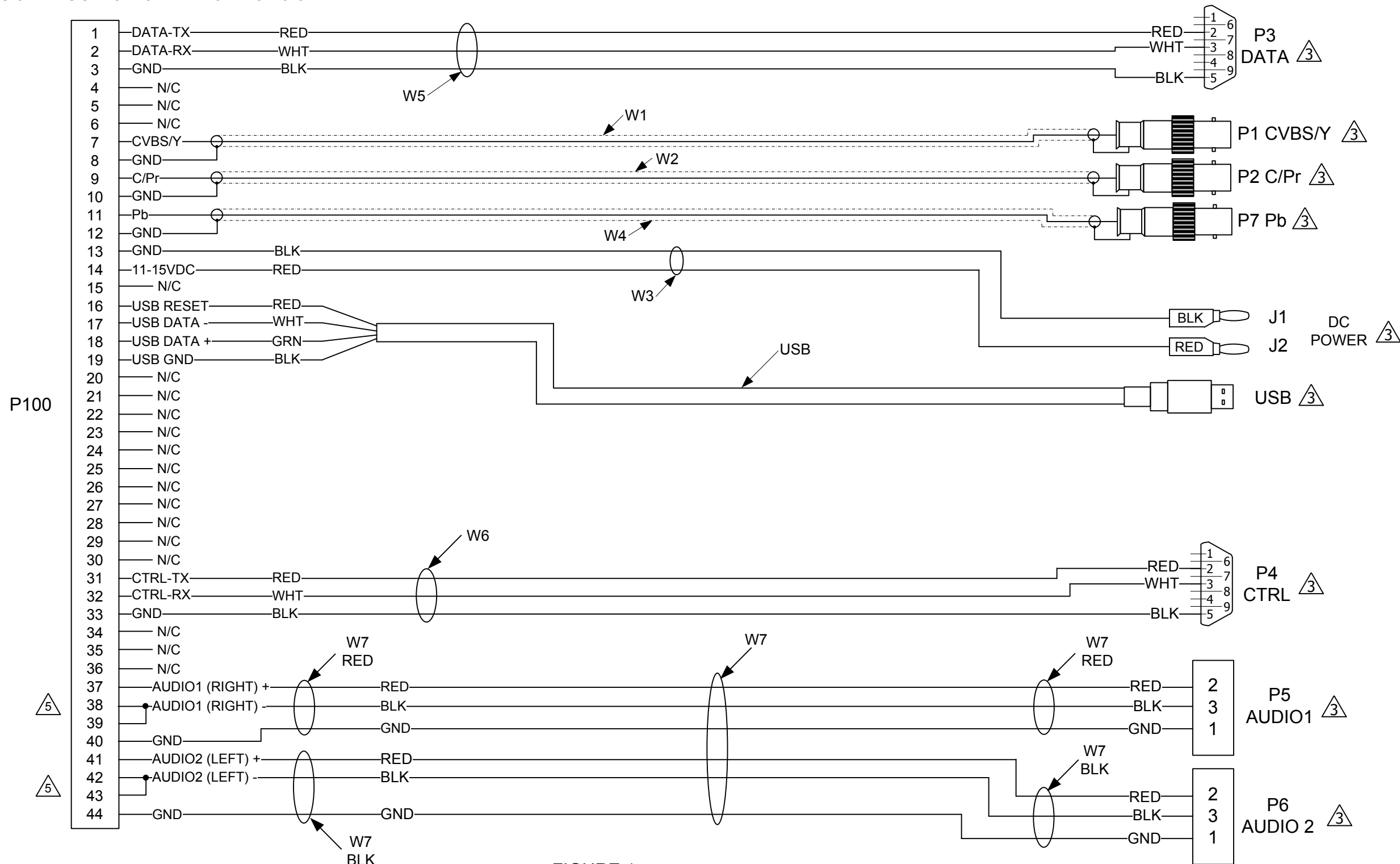| Pin	Signal	Notes
1	+12Vdc	Power supply must be able to source at least 500mA. Voltage should not drop below +10Vdc.
3	GND	Power ground
2, 4-9	NC	Not Connected

9.0 Cable Losses

9.1   Coax Cable
Cable losses must be taken into consideration if the D/C is located a great distance from the receiver. As mentioned above long cable runs can contribute to more resistance in the lines and also can contribute to signal attenuation because of the additional capacitance. Even when using a good coax cable such as RG59/U the attenuation of the signal can be significant. For example, RG59/U coax will drop approximately 2 dB per 100 feet at 50 MHz and 8 dB per 100 feet at 900 MHz. The intermediate frequency (IF) in this system can fall between 49 MHz to 850 MHz. An inline amplifier matching the cable losses should be considered if losses exceed 6dB

www.cobham.com/gms

NOTES:

1. REFERENCE BOM 780-C0224X2 FOR REFERENCE DESIGNATIONS (SHOWN AS [] ON DRAWING) AND PART DESCRIPTIONS .

2. LABEL FINAL CABLE ASSEMBLY WITH PART NUMBER 780-C0224X2 USING BEST COMMERCIAL METHOD.

3. LABEL CONNECTOR WITH REFERENCE DESIGNATOR AND DESCRIPTION AS SHOWN USING BEST COMMERCIAL METHOD. LABEL TO BE WITHIN 3.0 OF CONNECTOR.

4. REFERENCE MANUFACTURING INSTRUCTION 100-MI0112.

5. THIS CABLE IS SET-UP FOR BALANCED AUDIO ONLY.

REVISIONS				
ECO	REV	DESCRIPTION	DATE	APPROVED
E0355X1	X1	INITIAL RELEASE	01/19/04 SLP	
E0355X3	X2	Correct polarity marks of USB, pins17&18	11/9/05 TG	

FIGURE 1
CABLE WIRING
DIAGRAM

TOLERANCES	ENG/TECH	T. Giotta		DWG TITLE		
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES DO NOT SCALE DRAWING	DRAWN	SLP	**COBHAM** GMS Products	CABLE, MDT2-B EXTERNAL BREAKOUT FOR BROADCAST VERSION		
LINEAR X.X = ± 0.5 X.XX = ± 0.125 X.XXX = ± 0.020	ENG		SIZE **B**	DATE 11/9/05	DWG NO 100-C0224X2	REV X2
	PROD					
	QC		SCALE: NONE		SHEET 1 OF 5	