Software Porting Guide

HI-6130/31 to Mamba Family Remote Terminal Applications

Devices Supported

HI-6130, HI-6131,

HI-6132, HI-2130,

HI-6135, HI-6136

HI-6137, HI-6138

October 2016

REVISION HISTORY

Revision	Date	Description of Change
AN-574, Rev. New	10-12-16	Initial Release

Introduction

The Holt Mamba^{TM} family of Integrated Terminals offers customers the World's smallest MIL-STD-1553/1760 solution, providing a complete remote terminal interface between a host processor and MIL-STD-1553 data bus. The Mamba family communicates with the host via a 40MHz 4-wire serial peripheral interface (SPI). For a given device, any combination of the contained MIL STD-1553 functions can be enabled for concurrent operation. The following terminal devices allow users to optimize cost savings by only using the protocol modes they require, while allowing footprint compatible options for future upgradeability.

HI-6135 Remote Terminal

HI-6136 Remote Terminal and Monitor

HI-6137 Remote Terminal and Bus Controller

HI-6138 Remote Terminal, Bus Controller and Monitor

This application note will serve as a software porting guide to help users identify the minor software changes required to easily migrate applications written for HI-6130/11 series Remote Terminals to the new Mamba family.

Overview

The main differences between HI-6130/31 and Mamba Remote Terminals can be summarized as follows:

1. MIL-STD-1553 Operating Modes
   a. HI-6138 supports BC/RT/MT vs. BC/2x RTs/MT for HI-6130/31
   b. The Mamba family terminals support Simple Monitor Terminal (SMT) mode only, whereas the HI-6130/31 support both SMT and IRIG 106 Chapter 10 Monitor (IMT) mode.
2. Register Map - The HI-6130/31 and Mamba register maps are software compatible with a few minor exceptions.
   a. Mamba does not support RT2 or IMT monitor mode.
   b. One extra register was added (Master Configuration Register 2) to support new feature additions.
3. Memory Map
   a. Mamba has 8Kx17 SRAM w/ Parity vs. 32Kx16 with optional EDAC for HI-6130/31. (Note: RT Applications should never need more than 4K words.)
4. New Feature: MIL-STD-1760 Boot Up Option
5. SPI interface
   a. Maximum SPI Clock Frequency was increased to 40MHz.

Memory Map

In general, the Mamba family data structure locations and usage are identical to HI-6130/31 locations with the only difference being the user allocated data buffer locations and memory size. The Mamba family was designed to be software compatible to the HI-6130/31 family and many applications will run with no software changes or very minimal changes.

The Mamba family of terminals support BC/RT/MT operating modes and as such removed support for the second independent Remote Terminal (RT2) supported by HI-6130/31. In addition, the Mamba family only supports the Simple Monitor Terminal (SMT) mode and does not support the IRIG Monitor Terminal (IMT) mode. Therefore, the memory map and register map are slightly different.

The Mamba family has 8Kx17 words of SRAM with Parity vs. the 32Kx16 of the HI-6130/31 family. There is no optional Error Detection and Correction EDAC in the Mamba family other than parity. The reduced RAM size should not be a concern for any Remote Terminal application. Any RT applications should never need more than 4K words of SRAM. However for BC and/or MT applications, the user may need to investigate how much memory is used in the current HI-6130/31 application. If the amount of memory used is more than 8Kx17 then the user may need to investigate if the memory usage can be optimized. The Mamba family has a faster SRAM access time over the 40MHz SPI interface vs. the 20MHz interface on HI-6131 and therefore less data should need to be buffered on chip. The main SRAM data structures are summarized below.

Table 1 - HI-6130/31 vs. Mamba HI-6135/6/7/8 Family Memory Map

Data Structures	Holt HI-6130/31	Holt Mamba HI-6135/6/7/8	Comparison
Registers	0x0000-0x0050	0x0000-0x0051	Mamba has 82 locations vs. 81 locations in HI-6130/31.
BC Call Stack	0x0054-0x005B	0x0054-0x005B	Identical usage and memory offset.
MT Temporary Buffer A	0x005C-0x0085	0x005C-0x0085	Identical usage and memory offset.
MT Temporary Buffer B	0x0086-0x00AF	0x0086-0x00AF	Identical usage and memory offset.
MT Address List A	0x00B0-0x00B7	0x00B0-0x00B7	Identical usage and memory offset.
MT Address List B	0x00B8-0x00BF	0x00B8-0x00BF	Identical usage and memory offset.
BC General Purpose Queue	0x00C0-0x00FF	0x00C0-0x00FF	Identical usage and memory offset.
MT Message Filter Table	0x0100-0x017F	0x0100-0x017F	Identical usage and memory offset.
Interrupt Log Buffer	0x0180-0x01BF	0x0180-0x01BF	Identical usage and memory offset
RT Temporary Receive Buffer	0x01C0 - 0x01DF	0x01C0 - 0x01DF	Identical usage and memory offset
Illegalization Table	0x0200-0x02FF	0x0200-0x02FF	Identical usage and memory offset. For HI-6130/31 this is the RT1 Illegalization table.
Descriptor Table	0x0400-0x03FF	0x0400-0x05FF	Identical usage and memory offset. For HI-6130/31 this is the RT1 Descriptor table.
Host Allocated Subaddress Data Buffers	0x0800- 0x7FFF	0x0600-0x1FFF	Identical usage. Offset is different. Mamba has 8Kx17 SRAM. Typical RT applications need less than 4Kx16. Mamba has an additional 256 words of user memory available from 0x0300 to 0x03FF

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Register Map

Table 2 below shows the register map comparison between HI-6130/31 and the Mamba family of devices. Most registers and bit definitions are identical with the exception that Mamba only supports a single RT and Mamba does not support the IMT monitor mode.

Register	Address	Mode	HI-6120/21 Register Name	Mamba HI-6138 Register Name	Notes
0	0x0000	All	Master Configuration Register	Master Configuration Register 1	Identical
1	0x0001	All	Master Status and Reset Register	Master Status and Reset Register	Identical except Mamba does not support RT2
2	0x0002	RT	When TEST pin is logic 0, this is "RT1 Current Command Register" When TEST pin is logic 1, this is "Loopback Test Receive Data Register"	When TEST pin is logic 0, this is "Remote Terminal Current Command Register" When TEST pin is logic 1, this is "Loopback Test Receive Data Register"	Identical
3	0x0003	RT	RT1 Current Control Word Address Register	RT Current Control Word Address Register	Identical
4	0x0004	RT2	RT2 Current Command Register	Reserved	Mamba does not support RT2
5	0x0005	RT2	RT2 Current Control Word Address Register	Reserved	Mamba does not support RT2
6	0x0006	All	Hardware Pending Interrupt Register	Hardware Pending Interrupt Register	Identical
7	0x0007	BC	BC Pending Interrupt Register	BC Pending Interrupt Register	Identical
8	0x0008	MT	SMT/IMT Pending Interrupt Register	SMT Pending Interrupt Register	Identical except Mamba does not support IMT
9	0x0009	RT	RT1 & RT2 Pending Interrupt Register	RT Pending Interrupt Status Register	Mamba does not support RT2
10	0x000A	All	Interrupt Count & Log Address Register	Interrupt Count & Log Address Register	Identical
11-14	0x000B-0x000E	All	Memory Address Pointer Registers	Memory Address Pointer Registers	Identical
15	0x000F	All	Hardware Interrupt Enable Register	Hardware Interrupt Enable Register	Identical
16	0x0010	BC	BC Interrupt Enable Register	BC Interrupt Enable Register	Identical
17	0x0011	MT	SMT/IMT Interrupt Enable Register	SMT Interrupt Enable Register	Identical except Mamba does not support IMT

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Register	Address	Mode	HI-6120/21 Register Name	Mamba HI-6138 Register Name	Notes
18	0x0012	RT	RT1 & RT2 Interrupt Enable Register	RT Interrupt Enable Register	Identical except Mamba does not support RT2
19	0x0013	All	Hardware Interrupt Output Enable Register	Hardware Interrupt Output Enable Register	Identical
20	0x0014	BC	BC Interrupt Output Enable Register	BC Interrupt Output Enable Register	Identical
21	0x0015	MT	SMT/IMT Interrupt Output Enable Register	SMT Interrupt Output Enable Register	Identical except Mamba does not support IMT
22	0x0016	RT	RT1 & RT2 Interrupt Output Enable Register	RT Interrupt Output Enable Register	Identical except Mamba does not support RT2
23	0x0017	RT	RT1 Configuration Register	RT Configuration Register	Identical
24	0x0018	RT	RT1 Operational Status Register	RT Operational Status Register	Identical
25	0x0019	RT	RT1 Descriptor Table Base Address Register	RT Descriptor Table Base Address Register	Identical
26-31	0x001A	RT	RT1 1553 Status Word Bits Register	RT MIL-STD-1553 Status Word Bits Register	Identical
27	0x001B	RT	When TEST pin is logic 0, this address is "RT1 Current Message Information Word Register". When TEST pin is logic 1, this address is "RAM Self-Test Fail Address Register".	When TEST pin is logic 0, this address is "Remote Terminal Current Message Information Word Register". When TEST pin is logic 1, this address is "RAM Self-Test Fail Address Register".	Identical
28	0x001C	RT	RT1 Bus A Select Register	RT Bus A Select Register	Identical
29	0x001D	RT	RT1 Bus B Select Register	RT Bus B Select Register	Identical
30	0x001E	RT	RT1 Built-In Test (BIT) Word Register	RT BIT Word Register	Identical
31	0x001F	RT	When TEST pin is logic 0, this address is "RT1 Alternate Built-In Test (BIT) Word Register (0x001F)". When TEST pin is logic 1, this address is "Loopback Test Transmit Data Register (0x001F)".	When TEST pin is logic 0, this address is "Remote Terminal Alternate Built-In Test (BIT) Word Register (0x001F)". When TEST pin is logic 1, this address is "Loopback Test Transmit Data Register (0x001F)".	Identical
32-35	0x0020-0x0023	RT2	RT2 Registers	Reserved	Mamba does not support RT2

Register	Address	Mode	HI-6120/21 Register Name	Mamba HI-6138 Register Name	Notes
36	0x0024	RT2	When the AUTOEN input pin is logic 1 at rising edge of MR Master Reset and RAM or register initialization failure (RAMIF) occurs, this register is the "Memory Test Fail Address Register". Once execution starts this register address is the RT2 Current Message Info Word Register	When the AUTOEN input pin is logic 1 at rising edge of MR Master Reset and RAM or register initialization failure (RAMIF) occurs, this register is the "Memory Test Fail Address Register". This register holds the first encountered RAM / register address with data mismatch. There may be others. Once execution starts (or when not using auto initialization), this register has no function.	Identical except Mamba does not support RT2
37-39	0x0025-0x0027	RT2	RT2 Registers	Reserved	Mamba does not support RT2
40	0x0028	RT2	RT2 Alt. BIT Word Register. When TEST pin is logic 1, this address is "Self-Test Control Register".	When TEST pin is logic 0, this register has no function. When TEST pin is logic 1, this address is "Self-Test Control Register".	Identical except Mamba does not support RT2
41	0x0029	MT	SMT/IMT (Bus Monitor) Configuration Register	SMT Configuration Register	Identical except Mamba does not support IMT
42-46	0x002A-0x002E	IMT	IMT Registers	Reserved	Mamba does not support IMT
47	0x002F	MT	SMT/IMT Address List Start Address Register	SMT Address List Start Address Register	Identical except Mamba does not support IMT
48	0x0030	MT	SMT/IMT Next Message Buffer Address Pointer	SMT Next Message Buffer Address Pointer	Identical except Mamba does not support IMT
49	0x0031	MT	SMT/IMT Last Message Buffer Address Register	SMT Last Message Buffer Address Register	Identical except Mamba does not support IMT
50	0x0032	BC	BC Configuration Register	BC Configuration Register	Identical
51	0x0033	BC	Start Address Register for BC Instruction List	Start Address Register for BC Instruction List	Identical
52	0x0034	BC	BC Instruction List Pointer	BC Instruction List Pointer	Identical
53	0x0035	BC	BC Frame Time Remaining Register	BC Frame Time Remaining Register	Identical
54	0x0036	BC	BC Time to Next Message Register	BC Time to Next Message Register	Identical
55	0x0037	BC	BC Condition Code BC General Purpose Flag Register	BC Condition Code BC General Purpose Flag Register	Identical
56	0x0038	BC	BC General Purpose Queue Pointer Register	BC General Purpose Queue Pointer Register	Identical

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Register	Address	Mode	HI-6120/21 Register Name	Mamba HI-6138 Register Name	Notes
57	0x0039	All	Time Tag Counter Configuration Register	Time Tag Counter Configuration Register	Identical
58	0x003A	MT	SMT/IMT Time Tag Counter Low	SMT Time Tag Counter Low	Identical except Mamba does not support IMT
59	0x003B	MT	SMT/IMT Time Tag Counter Mid	SMT Time Tag Counter Mid	Identical except Mamba does not support IMT
60	0x003C	MT	SMT/IMT Time Tag Counter High	SMT Time Tag Counter High	Identical except Mamba does not support IMT
61	0x003D	MT	SMT/IMT Time Tag Utility Register Low	SMT Time Tag Utility Register Low	Identical except Mamba does not support IMT
62	0x003E	MT	SMT/IMT Time Tag Utility Register Mid	SMT Time Tag Utility Register Mid	Identical except Mamba does not support IMT
63	0x003F	MT	SMT/IMT Time Tag Utility Register High	SMT Time Tag Utility Register High	Identical except Mamba does not support IMT
64	0x0040	MT	SMT/IMT Time Tag Match Register Low	SMT Time Tag Match Register Low	Identical except Mamba does not support IMT
65	0x0041	MT	SMT/IMT Time Tag Match Register Mid	SMT Time Tag Match Register Mid	Identical except Mamba does not support IMT
66	0x0042	MT	SMT/IMT Time Tag Match Register High	SMT Time Tag Match Register High	Identical except Mamba does not support IMT
67	0x0043	BC	BC Time Tag Counter Low	BC Time Tag Counter Low	Identical
68	0x0044	BC	BC Time Tag Counter High	BC Time Tag Counter High	Identical
69	0x0045	BC	BC Time Tag Utility Register Low	BC Time Tag Utility Register Low	Identical
70	0x0046	BC	BC Time Tag Utility Register High	BC Time Tag Utility Register High	Identical
71	0x0047	BC	BC Time Tag Match Register Low	BC Time Tag Match Register Low	Identical
72	0x0048	BC	BC Time Tag Match Register High	BC Time Tag Match Register High	Identical
73	0x0049	RT	RT1 Time Tag Counter	RT Time Tag Counter	Identical
74	0x004A	RT	RT1 Time Tag Utility Register	RT Time Tag Utility Register	Identical
75-76	0x004B-0x004C	RT2	RT2 Time Tag Registers	Reserved	Mamba does not support RT2
77	0x004D	BC/RT	Extended Configuration Register	Extended Configuration Register	Identical
78	0x004E	All	Checksum Fail Address & EEPROM Lock/Unlock	Master Configuration Register 2	Checksum Fail Address is at 0x0051 in Mamba. Master Config Register 2 is new Mamba Register.

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Register	Address	Mode	HI-6120/21 Register Name	Mamba HI-6138 Register Name	Notes
79	0x004F	BC	BC Last Message Block Address	BC Last Message Block Address	Identical
80	0x0050	BC	Default location for BC WMI address pointer	Default location for BC WMI address pointer	Identical
81	0x0051	All	N/A	Checksum Fail Address & EEPROM Lock/Unlock	Checksum Fail Address is at 0x004E in HI-6130/31.

MIL-STD-1760 Startup

A MIL-STD-1760 RT must be able to respond on the bus within 150ms following power turn-on. Between power-on and 150ms, it is acceptable for the RT to respond with the "Busy" bit set in the RT Status Word. The HI-6130/31 devices may be configured to respond with BUSY status (global or specific subaddress) within 150ms by performing auto-initialization from a pre-programmed external serial EEPROM or by writing to two registers.

The Mamba family RT includes a dedicated pin to allow the RT to boot up in MIL-STD-1760 mode. In order to engage 1760 mode, the pin MODE1760 is asserted during a hardware reset. The pin status will be latched 200ns after the rising edge of Master Reset (the same time as the RT address). During 1760 mode, the device will respond to any valid command (with matching RT address) with the BUSY bit set in the status word. No data words will be transmitted and no interrupts or logging of data will occur. Mode 1760 operation may be confirmed by the host by reading Mode 1760 Status bit 7 in "Master Configuration Register 2 (0x004E)".

SPI Host Interface

The Mamba Family has increased the maximum SPI clock frequency to 40MHz. The supported SPI opcodes are identical between the two families.

Additional Resources

Demonstration/Evaluation Boards

The ADK-6138 or ADK-6138API evaluation boards provide sample software and a complete development environment that allows users to configure the RT and service messages from the Mamba family RT. These development kits provide example code written in ANSI 'C' and example applications and configuration code as well as many useful data structures and #defines.

RT Configuration GUI

Holt offers a Graphical User Interface (GUI) program that runs on Windows OS. The program is a wizard that guides user's through various configuration options. This includes everything needed to configure RT settings, Subaddresses, Mode Codes, Buffering Options, Legalization, and Interrupts. The GUI supports all versions of Holt MIL-STD-1553 Remote Terminals.

The GUI outputs 4 text files that can be cut and Pasted into ANSI 'C' software. The four output files include the following:

1. Register configuration with all required bits set or cleared as required.

2. Command Illegalization Table to define legal and illegal commands

3. Descriptor Table to define all user Data Buffering Options and Interrupt Conditions

4. A RAM Usage definition file that defines all user data buffers and their locations and size.

Documentation

1. HI-6138 Data sheet

2. ADK-6135/36/37/38 User's Guide