Application Note AN-007

1553A Protocol Applications

Publication No. AN-007 Rev. C

abaco SYSTEMS

Document History

Revision	Date	Description
A	2004	Original Release
B	2016	Rebranded to Abaco Systems
C	April 2019	Minor changes to formatting

Waste Electrical and Electronic Equipment (WEEE) Returns

Abaco Systems is registered with an approved Producer Compliance Scheme (PCS) and, subject to suitable contractual arrangements being in place, will ensure WEEE is processed in accordance with the requirements of the WEEE Directive.

Abaco Systems will evaluate requests to take back products purchased by our customers before August 13, 2005 on a case by case basis. A WEEE management fee may apply.

Contact Information

Abaco Website

You can find information regarding Abaco products on the following website:

LINK
https://www.abaco.com

Abaco Documents

This document is distributed via the Abaco website. You may register for access to documents via the website.

LINK
https://www.abaco.com/products/qvme-1553-interface
https://www.abaco.com/products/q104-1553-interface
https://www.abaco.com/products/qcp-1553-interface

Technical Support Contact Information

You can find technical assistance contact details on the website Support page.

LINK
https://www.abaco.com/support

Abaco will log your query in the Technical Support database and allocate it a unique Case number for use in any future correspondence.

Alternatively, you may also contact Abaco's Technical Support via:

LINK
avionics.support@abaco.com

1 • Introduction

Most MIL-STD-1553 systems use the 1553B protocol, but systems do still exist that use the older 1553A protocol or the MDC-A3818 protocol (used on F18). The purpose of this Application Note is to explain how to use Abaco Systems' products with the 1553A or MDC-A3818 protocols.

This Application Note assumes a basic knowledge of 1553. For information on the MIL-STD-1553 protocol refer to the "MIL-STD-1553 Tutorial" document available from Abaco Systems, Inc. Additional information can also be found in MIL-HDBK-1553A.

2 • Basic Differences between 1553A and 1553B

First, we will describe the significant differences between the 1553A, MDC-A3818, and 1553B protocols. We do not describe every difference between these protocols. For example, there are some differences with the waveforms used, coupler specifications, etc. that are not mentioned because they are not an issue with Abaco's products. If you need additional information, you should refer to the appropriate specification documents.

2.1 Remote Terminal Status Response Time

For 1553A and MDC-A3818, the status response time for a Remote Terminal is defined as *2-5 microseconds, measured as dead bus time*.

For 1553B, the status response time for a Remote Terminal is defined as *4-12 microseconds, measured from mid-parity to mid-sync*.

When we measure *mid-parity to mid-sync*, it effectively adds 2 microseconds to the *dead bus time*. Therefore, if we look at both of these in terms of *mid-parity to mid-sync*, the 1553A status response time is 4-7 microseconds and the 1553B status response time is 4-12 microseconds.

Basically, the 1553B protocol adds 5 microseconds to the maximum response time. The reason is that 1553B requires remote terminals to check for too many words as part of the message validation criteria. Many devices detect an extra word by looking for valid sync and 2 valid data bits, which takes 5 microseconds.

If your RT responds in less than 7 microseconds, no change is needed for 1553A protocol.

2.2 Remote Terminal Status Word Bits

The 1553A protocol defines only bits in the status word for *RT Address, Message Error, Terminal Flag,* and *Parity*. The remaining bits in the status word are not defined. The MDC-A3818 protocol allows you to define the remaining bits.

The 1553B protocol adds definition of status word bits for *Instrumentation, Service Request, Broadcast Command Received, Busy, Subsystem Flag,* and *Dynamic Bus Control Acceptance*.

For 1553A protocol, be sure that your RT has all the undefined bits set to ZERO.

2.3 Bus Controller Inter-message Gap Time

For 1553A and 1553B, the inter-message gap time is defined as *2 microseconds, measured as dead bus time, or 4 microseconds measured from mid-parity to mid-sync*.

For the MDC-A3818 protocol, the minimum inter-message gap time is defined as *10 microseconds, measured as dead bus time, or 12 microseconds measured from mid-parity to mid-sync*.

If you keep your inter-message gap time at or above 12 microseconds, mid-parity to mid-sync, then you are compatible with all of these protocols.

2.4 Broadcast Messages

The 1553A and MDC-A3818 protocols do not use broadcast messages. RT address 31 is used as a normal address.

The 1553B protocol uses RT address 31 for broadcast messages and does not use this address for an individual remote terminal.

For 1553A or MDC-A3818 protocols, you want to disable broadcast so that RT31 can be used as a normal RT address.

2.5 Mode Code Commands

The 1553A and MDC-A3818 protocols use Sub Address 0 for mode code commands. Sub Address 31 is used as a normal sub address. There is only one defined mode code for 1553A and MDC-A3818 – dynamic bus control. For 1553A, other mode codes are undefined. The MDC-A3818 protocol allows you to define the other mode codes.

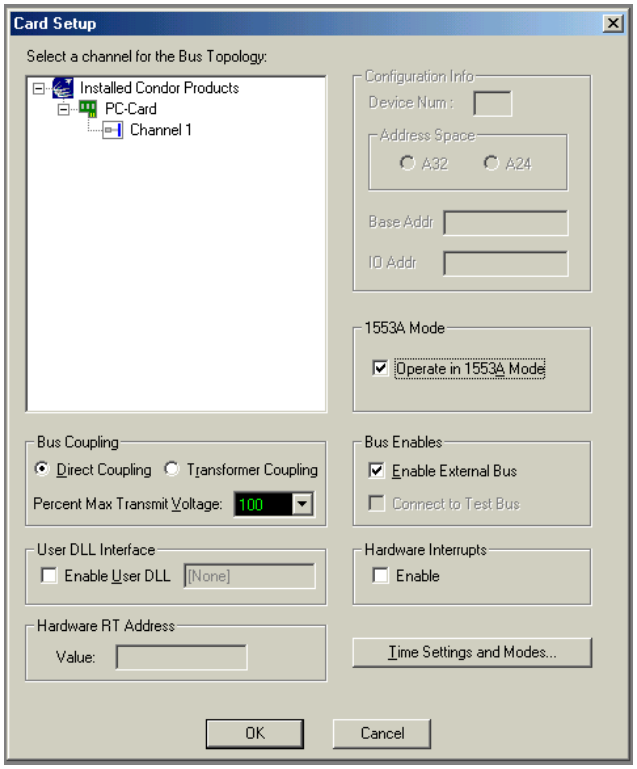
The 1553B protocol uses both Sub Address 0 and 31 for mode code commands. Mode codes are strictly defined in the 1553B protocol, which defines 15 mode code commands. The protocol does not allow use of the reserved or undefined mode codes.

For 1553A or MDC-A3818 protocols, you want to disable the use of Sub Address 31 for mode codes. You also want to enable the decoder to see all commands (not filter out undefined mode codes).

3 • Using the BusTools/1553 Analyzer GUI with 1553A

When using 1553A or MDC-A3818 protocols, you need to use *version 6.22 beta 2* or later of BusTools/1553*.

To configure the board for these protocols, you need to open the *Card Setup* window shown below:



Select the option for **Operate in 1553A Mode**. This disables RT31 broadcast, disables SA31 mode code, and enables the decoder to see all commands.

You can now use BusTools/1553 with a 1553A or MDC-A3818 protocol bus.

4 • Using the BusTools/1553-API with 1553A

Abaco provides two example programs for 1553A protocol applications (or MDC-A3818 applications). These are **Example_bm3a.c** (demonstrating bus monitoring) and **Example_bcrt1553a.c** (demonstrating Bus Controller and Remote Terminal).

4.1 Initialization for 1553A or MDC-A3818

The setup for 1553A or MDC-A3818 is the same for BC, RT, and BM applications.

1. During initialization, enable the decoder to see all commands by including 0x80 into the flag parameter, as shown below:

```
flag = 0x81;  // 1553A protocol, polled interrupts
status = BusTools_API_InitExtended(MY_CARD_NUM, MY_BASE_ADDR,
MY_IO_ADDR, &flag, MY_PLATFORM, MY_CARD_TYPE, MY_CARRIER, MY_SLOT,
MY_MAPPING);
```

2. Set Sub Address 31 as a normal sub address rather than mode code:

```
// Set SA31 as normal (not mode) subaddress.
status = BusTools_SetSa31(MY_CARD_NUM, 0);
```

3. Disable Broadcast for RT address 31:

```
// Disable BROADCAST (RT31).
status = BusTools_SetBroadcast(MY_CARD_NUM, 0);
```

4.2 Bus Monitor Applications

After initializing as shown above, the bus monitor will operate with 1553A or MDC-A3818 protocols. There are no other differences from a 1553B bus monitor application.

Refer to **Example_bm3a.c** for details.

4.3 Bus Controller Applications

In general, not much has to be done differently with a bus controller application after the 1553A initialization.

If you want to ensure compatibility with MDC-A3818 protocol, keep your inter-message gap times above 12 microseconds.

4.4 Remote Terminal Applications

Again, after the 1553A initialization, most of the setup is done.

You should clear status word bits for *Instrumentation, Service Request, Broadcast Command Received, Busy, Subsystem Flag,* and *Dynamic Bus Control Acceptance*. Keep these bits cleared to zero in your 1553A application.

You may use RT Address 31 and Sub Address 31 in your 1553A RT application.

If MDC-A3818 user-defined mode codes or status word bits are used in your system, you have to handle these in your RT simulation.

Abaco Systems Information Centers

Americas:
1-866-652-2226 (866-OK-ABACO)
or 1-256-880-0444 (International)

Europe, Middle East and Africa:
+44 (0)1327 359444

Additional Resources

For more information, please visit the Abaco Systems web site at:

www.abaco.com

Publication No. AN-007 Rev. C