The HS488 Protocol

Publish Date: Sep 06, 2006

Overview

Normal transfer rates on the General-Purpose Interface Bus (GPIB) are on the order of 1 Mbyte/s. But with High-Speed 488 (HS488), you can achieve transfer rates up to 8 Mbytes/s!

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1. The High-Speed GPIB Handshake Protocol

National Instruments has developed the patented high-speed GPIB handshake protocol (called HS488) to increase the data transfer rate of a GPIB system. All devices involved in a data transfer must be HS488 compliant to use the HS488 protocol, but when non-HS488 devices are involved, the HS488 devices automatically use the standard IEEE 488.1 handshake to ensure compatibility. HS488 is a superset of the IEEE 488 standards. HS488 was accepted as an addition to the IEEE 488.1 standard in 2003.

2. IEEE 488 Handshake

The standard IEEE 488.1 three-wire handshake (shown in Figure 1) requires the Listener to unassert Not Ready for Data (NRFD), the Talker to assert the Data Valid (DAV) signal to indicate to the Listener that a data byte is available, and the Listener to unassert the Not Data Accepted (NDAC) signal when it has accepted that byte.

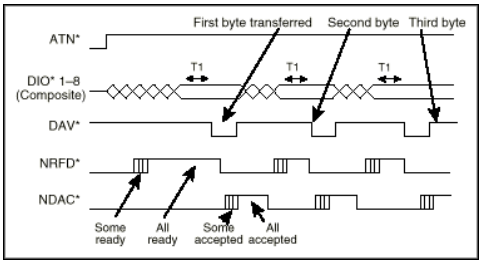

Figure 1. Normal IEEE 488.1 Handshake

A byte cannot transfer in less than the time it takes for the following events to occur:

- NRFD propagates to the Talker
- DAV signal propagates to all Listeners
- Listeners accept the byte and assert NDAC
- NDAC propagates back to the Talker
- Talker allows time for settling (T1) before asserting DAV again

3. HS488 Handshake

HS488 increases system throughput by removing propagation delays associated with the three-wire handshake. To enable the HS488 handshake, the Talker pulses the NRFD signal line after the Controller addresses all Listeners. If the Listener is HS488 capable, the transfer occurs using the HS488 handshake (shown in Figure 2).

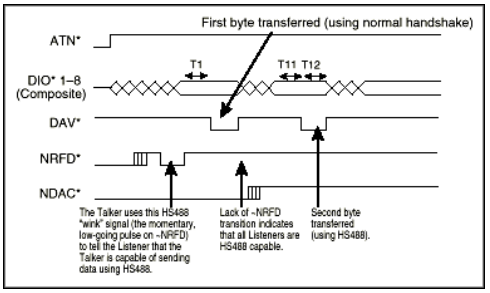

Figure 2. HS488 Handshake

Once HS488 is enabled, the Talker places a byte on the GPIB DIO lines, waits for a preprogrammed settling time, asserts DAV, waits for a preprogrammed hold time, unasserts DAV, and drives the next data byte on the DIO lines. The Listener keeps NDAC unasserted and must accept the byte within the specified hold time. A byte must transfer in the time set by the settling time and hold time, without waiting for any signals to propagate along the GPIB cable.

4. HS488 Data Transfer Flow Control

The Listener may assert NDAC to prevent more bytes from being transmitted temporarily, or assert NRFD to force the Talker to use the three-wire handshake. Through these methods, the Listener can limit the average transfer rate. However, the Listener must have an input buffer that can accept short bursts of data at the maximum rate, because by the time NDAC or NRFD propagates back to the Talker, the Talker may have already sent another byte.

NRFD propagates back to the talker, the talker may have already sent another byte.

The required settling and hold times are user configurable, depending on the total length of cable and number of devices in the system. Between two devices and 2 m of cable, HS488 can transfer data at up to 8 Mbytes/s. For a fully loaded system with 15 devices and 15 m of cable, HS488 transfer rates can reach 1.5 Mbytes/s.

HS488 Controllers always use the standard IEEE 488.1 three-wire handshake to transfer GPIB commands (bytes with Attention (ATN) asserted).

Related Links:

NI GPIB Home Page (http://www.ni.com/gpib)