To: X3T9.2 Committee   X3T9.2/92-235

Re: Clarification of Synchronous Handshake

Date: December 8, 1992

1. Synchronous Data Transfer

Synchronous data transfer is optional and is only used in data phases. It shall be used in a data phase if a synchronous data transfer agreement has been established (see SCSI-3 Interlocked Protocol document). The agreement specifies the REQ/ACK offset and the minimum transfer period.

The initiator shall detect a REQ request after the transition of the REQ signal from false to true. The target shall detect an ACK response upon the assertion of the ACK signal.

The synchronous data transfer option allows the non-interlocked data transfers between the initiator and target after the first REQ request and before the REQ/ACK offset is reached. The target shall generate REQ requests independent of the ACK responses until the REQ/ACK offset is reached. The initiator shall generate ACK responses independent of the REQ requests until the number of ACK responses equals the number of REQ requests detected.

The REQ/ACK offset specifies the maximum number of **REQ requests** that can be sent by the target in advance of the number of **ACK responses** received from the initiator, establishing a pacing mechanism. If the number of **REQ requests** exceeds the number of **ACK responses** by the REQ/ACK offset, the target shall not assert the REQ signal until after the leading edge of the next **ACK response** is received. A requirement for successful completion of the data phase is that **the number of ACK responses be equal to the number of REQ requests.**

The target shall assert the REQ signal for a minimum of an assertion period. The target shall then wait at least the greater of a transfer period from the last transition of the REQ signal to true or a minimum of a negation period from the last transition of the REQ signal to false before again asserting the REQ signal.

~~The initiator shall send one pulse on the ACK signal for each REQ request received.~~ **The initiator shall issue an ACK response for each REQ request received**. The ACK signal may be asserted as soon as the leading edge of the corresponding **REQ request** has been received. The initiator shall assert the ACK signal for a minimum of an assertion period. The initiator shall wait at least the

greater of a transfer period from the last transition of the ACK signal to true or for a minimum of a negation period from the last transition of the ACK signal to false before asserting the ACK signal.

If the I/O signal is true (transfer to the initiator), the target shall first drive the data and parity signals to their desired values, wait at least one transmit setup time, then assert the REQ signals. The data and parity signals shall be held valid for a minimum of one transmit hold time after the assertion of the REQ signal. The target shall assert the REQ signal for a minimum of an assertion period. The target may then negate the REQ signal and change or release the data and parity signals. The initiator shall read the value on the data and parity signals within one receive hold time of the transition of the REQ signal to true. The initiator shall then respond with an **ACK response**.

If the I/O signal is false (transfer to the target), the initiator shall transfer one byte for each **REQ request** received. After receiving the leading edge of a **REQ request**, the initiator shall first drive the data and parity signals to their desired values, delay at least one transmit setup time, then assert the ACK signal. The initiator shall hold the data and parity signals valid for at least one transmit hold time after the assertion of the ACK signal. The initiator shall assert the ACK signal for a minimum of an assertion period. The initiator may then negate the ACK signal and may change or release the data and parity signals. The target shall read the value of the data and parity signals within one receive hold time of the transition of the ACK signal to true.

Some implementors have presumed that the leading edge of the first **REQ request** beyond the REQ/ACK offset agreement would not occur until after the trailing edge of the last **ACK response** within the agreement. Devices implemented with this understanding may be subject to data loss when in synchronous data transfer mode with devices that issue the leading edge of the next **REQ request**, at the boundary of the agreement, as soon as the leading edge of the last **ACK response** within the agreement is received. Implementors of initiators attaching such devices may ensure data integrity by restricting the synchronous offset agreement to values smaller than the maximum nominally offered by their device.