Quantum™

T10/00-133r1

Ultra320 SCSI Calibration Protocol

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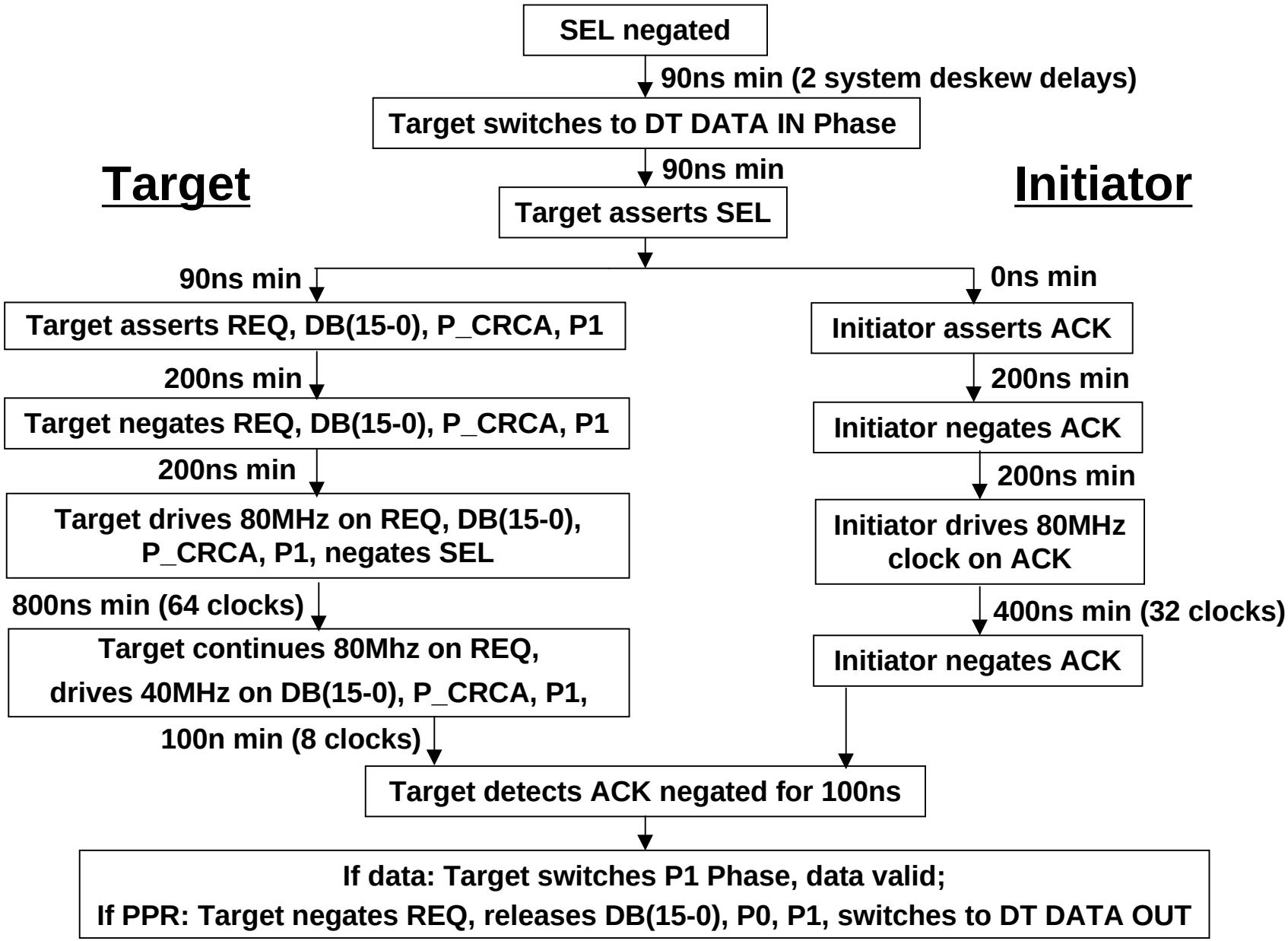
Training Protocol

- **The initiator selects when training will occur using a new field in the PARALLEL PROTOCOL REQUEST message.**
- **Training may occur:**
  - **1) At the beginning of every DT DATA phase,**
  - **2) Before the first DT DATA IN and DT DATA OUT phase for every nexus if information unit transfers are enabled, or**
  - **3) As a complete training sequence (DATA IN and DATA OUT) immediately after a PPR message.**
  - **Methods (1) and (2) are the simplest:**
    - **There is no need to remember all parameters for each I_T pair from one connection to the next.**
    - **It's easier for expanders.**
  - **Method (3) requires the least overhead.**
- **The target initiates a training pattern by switching to a DT DATA phase and then asserting SEL.**

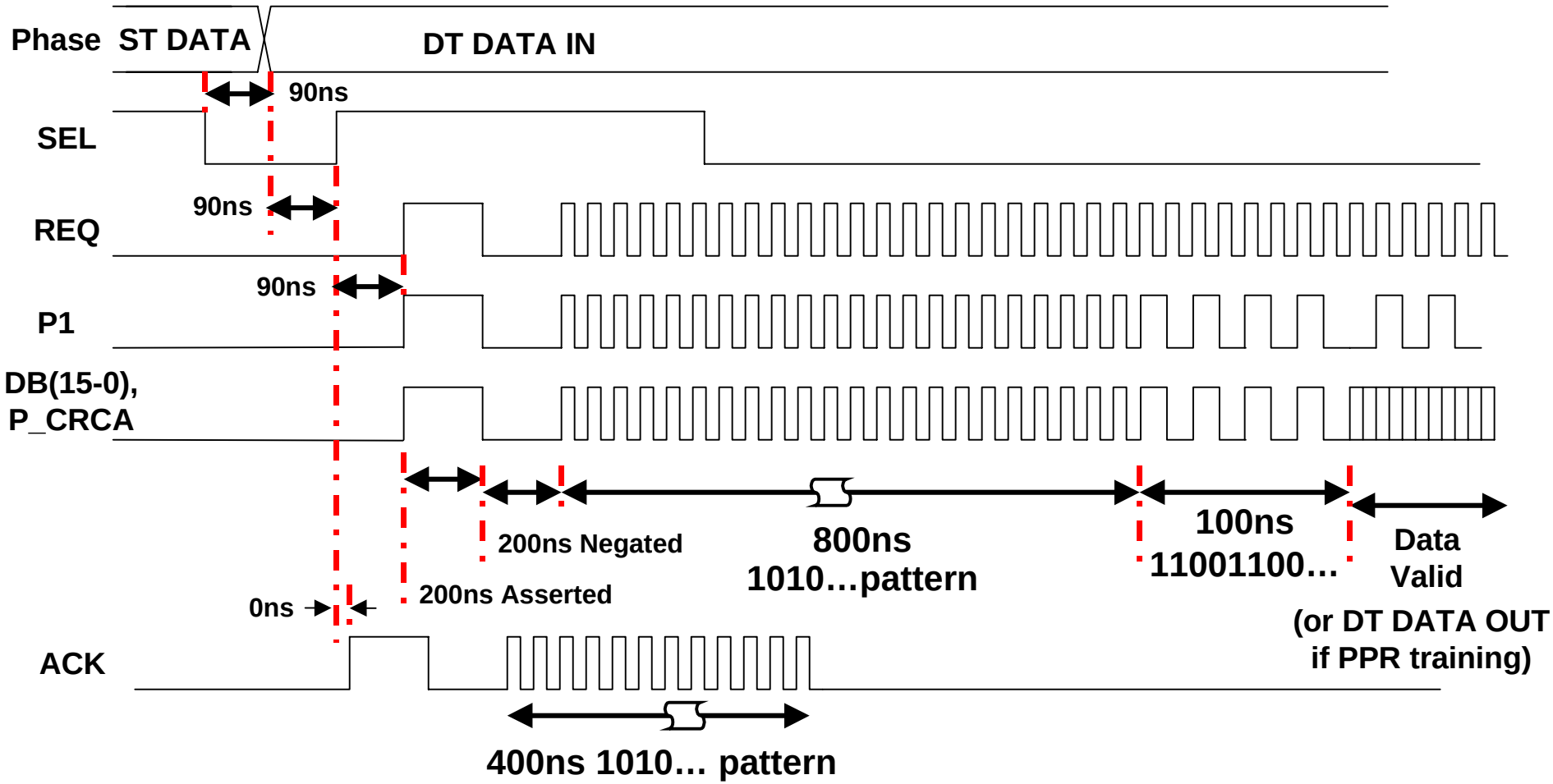
DATA IN Training

- The target transmits training patterns on REQ, DB(15-0), P_CRCA (a.k.a. P0), and P1.
- The initiator performs adaptive equalization on REQ, then applies the result to REQ, DB(15-0), P0, and P1
- The initiator performs skew compensation on DB(15-0), P0, and P1.
- The initiator transmits training patterns on ACK.
- The target performs adaptive equalization on ACK.
- If this sequence is to be followed by data, the target begins transferring data at the end of the sequence.
- If this sequence is to be followed by a DATA OUT training sequence, the target negates REQ, releases DB(15-0), P0, and P1 and switches to DT DATA OUT.

DATA IN Training Flow Diagram



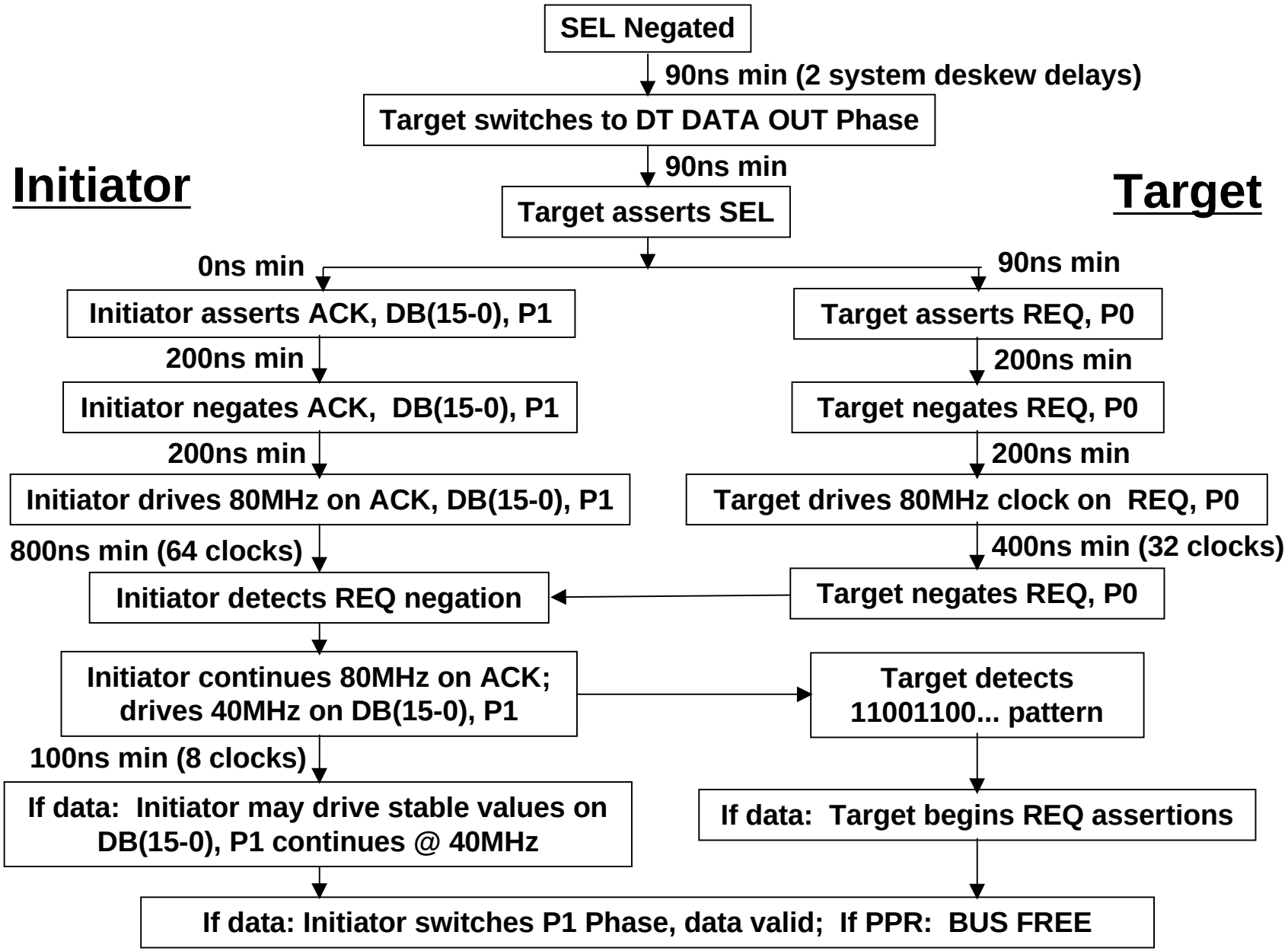
DATA IN Training Timing



DATA OUT Training

- The initiator transmits training patterns on ACK, DB(15-0), and P1.
- The target performs adaptive equalization on ACK, then applies the result to ACK, DB(15-0), and P1
- The target performs skew compensation on DB(15-0) and P1.
- The target transmits training patterns on REQ and P0.
- The initiator performs adaptive equalization on REQ.
  - At 80Mhz, REQ will not reach full amplitude in some configurations.
    - Equalization is necessary for reliable edge detection.
    - The Adaptive Equalization result is applied to P0 to enhance noise margin.
  - Skew compensation is avoided on P0 by requiring extra setup and hold margin when P0 transitions -- which is a rare event.
- If this sequence is to be followed by data, the target begins transmitting REQs, the initiator begins transferring data at the end of the sequence.
- If this sequence follows a DATA IN training sequence after a PPR, the target goes to BUS FREE.

DATA OUT Training Flow Diagram



DATA OUT Training Timing