11.5 Port connection manager state machine

The port connection manager state machine operates independently for each port. A port which is capable of operation only in DS mode shall behave as specified in clause 4.4.4 of IEEE 1394a-2000. A port which is capable of operation in Beta mode, or both DS mode and Beta mode (a bi-lingual port) shall behave as specified in this clause. In all cases, while a port is in the active state its arbitration, data transmission, reception and repeat behaviors are specified by the state machines in clause 13. When a PHY port is in any state other than active it is permissible for it to lower its power consumption; the only functional component of a PHY that shall be active in all states is the physical connection detect circuitry or toning circuitry as appropriate.

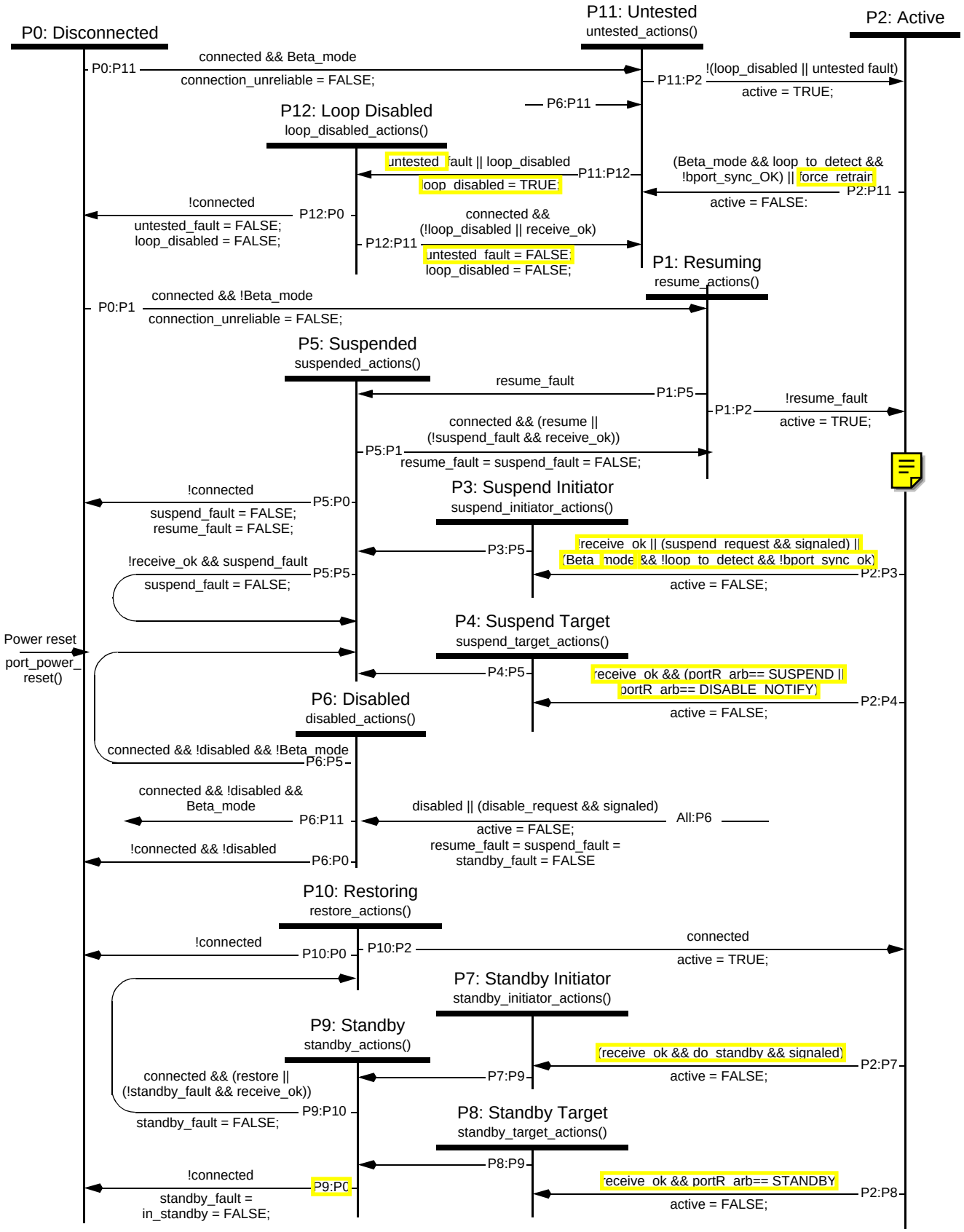

Figure 11-2—Port connection state machine

11.5.1 Port connection manager state machine notes

Power reset. A power reset of the PHY initializes each port as Disconnected.

Transition All:P6. This applies to a port in any of the P states (other than P6), and takes priority over other available transitions. The local link may immediately disable a port by setting the disabled bit to one. This transition may also be caused by a remote command packet, in which case the port, if active, shall transmit TX_DISABLE_NOTIFY before the port is disabled.

State P0: Disconnected. The generation of TpBias is disabled (DS mode) or continuous transmission is stopped (Beta mode) and the outputs are in a high-impedance state. The PHY may place most of the port's circuitry in a low-power consumption state. A port shall transmit tones and its signal detect and (if DS capable) connection detect mechanism shall be active even if other components of the PHY port are in a low-power state.

Transition P0:P11. When a port's connection detect circuitry signals that its peer PHY port is physically connected, the PHY port transitions to the Untested state.

State P1: Resuming. In Beta mode, the PHY commences transmission at the operating speed, and attempts to synchronize its receiver. The PHY port tests both the connection status and the presence of receive_ok to determine if normal operations may be resumed. If the port is connected, receive_ok is set and there are no other active ports, the PHY waits seven RESET_DETECT intervals before any state transitions. Otherwise, in the case of a boundary node with one or more active ports, the PHY waits three RESET_DETECT intervals before any state transitions. A detected bus reset overrides either of these waits, otherwise, when the wait elapses the PHY initiates a bus reset.

Transition P1:P2. If the PHY port did not fault during the resume handshake, it waits for bus reset to start and then transitions to the Active state.

Transition P1:P5. A resuming PHY port that faults during the resume handshake transitions to the Suspended state.

State P2: Active. The PHY port is fully operational, capable of transmitting or receiving and repeating arbitration signals or clocked data. While the port remains active, the behavior of this port and the remainder of the PHY are subject to the cable arbitration states specified in clause 13.

Transition P2:P3. Upon the loss of receive_ok or the receipt of a PHY remote command packet that sets the suspend variable to one, the PHY port leaves the Active state to start functioning as a Suspend Initiator. A loss of receive_ok is usually the result of a physical disconnection or the loss of power to the connected peer PHY port. If the transition is the result of a remote command packet, the PHY transmits a remote confirmation packet with the ok bit set to one. In the meantime, the suspend initiator has signaled TX_SUSPEND to its connected peer PHY.

Transition P2:P4. If an active port observes an RX_DISABLE_NOTIFY or RX_SUSPEND signal it becomes a Suspend Target and leaves the Active state.

State P3: Suspend Initiator. A Suspend Initiator waits for receive_ok to be zero. If RECEIVE_OK_HANDSHAKE elapses and the connected peer PHY has not driven TpBias low (DS mode) or ceased sending a valid signal (Beta mode), the suspend operation has faulted and the fault bit is set to one. In either case the Suspend Initiator first drives TpBias low for RECEIVE_OK_HANDSHAKE time if in DS mode and then places all outputs in a high-impedance state.

Transition P3:P5. Upon completion of the actions associated with this state, the PHY port unconditionally transitions to the Suspended state.

State P4: Suspend Target. A Suspend Target sets the suspend variable for all the other active ports, which in turn causes them to propagate the RX_SUSPEND signal as TX_SUSPEND. In the meantime the Suspend Target if in DS mode drives its TpBias outputs below 0.1 V and if in Beta mode ceases sending a valid signal in order to signal the Suspend Initiator

that RX_SUSPEND was detected. If in DS mode, the node waits a RECEIVE_OK_HANDSHAKE time to allow the connected peer PHY time to drive TpBias low, and then the Suspend Target disables the generation of TpBias. It then places the outputs in a high-impedance state.

Transition P4:P5. Upon completion of the actions associated with this state, the PHY port unconditionally transitions to the Suspended state.

State P5: Suspended. The PHY may place most of the port's circuitry in a low-power consumption state. The port shall maintain connectivity status by (Beta mode) transmitting tones and using its signal detect circuitry or (DS mode) using its connection detect circuit even if other components of the PHY port are in a low-power state.

Transition P5:P0. A Suspended PHY port that loses its physical connection to its peer PHY port transitions to the Disconnected state.

Transition P5:P1. Either of two conditions cause a Suspended PHY port to transition to the Resuming state: a) a nonzero value for the port's `resume` variable or b) the detection of receive_ok if the port's `suspend_fault` variable is zero. A port's `resume` variable may be set indirectly as the result of the resumption of other PHY ports.

Transition P5:P5. If the port entered the Suspended state in a faulted condition (i.e., receive_ok was still present), the fault is cleared if and when receive_ok is removed by the peer PHY.

State P6: Disable. While the port is in the Disabled state, the PHY may place most of the port's circuitry in a low-power consumption state. If the hard_disable flag is FALSE and the port was operating in DS mode, the connection detect circuit. shall be active even if other components of the PHY port are in a low-power state, if the port was operating in Beta mode, then it shall maintain connectivity information by toning. If the hard_disable flag is TRUE, then the port shall not engage in toning.

Transition P6:P0. If the disabled bit is zero and the PHY port is not physically connected to its peer PHY port it transitions to the Disconnected state.

Transition P6:P5. Otherwise, if the disabled bit is zero and the PHY port is connected and operating in DS mode, it transitions to the Suspended state.

Transition P6:P11. Otherwise, if the disabled bit is zero and the PHY port is connected and operating in Beta mode, it transitions to the Untested state.

Transition P2:P7. Upon the receipt of a PHY remote command packet that sets the `do_standby` variable to one, the PHY port leaves the Active state to start functioning as a Standby Initiator.

State P7:Standby initiator. A Standby Initiator waits for receive_ok to be zero. If RECEIVE_OK_HANDSHAKE elapses and the connected peer PHY has not ceased sending a valid signal, the standby operation has faulted and the standby_fault bit is set to one. In either case the Standby Initiator places all outputs in a high-impedance state.

Transition P2:P8. If an Active port observes a STANDBY signal it becomes a Standby Target and leaves the Active state.

State P8: Standby target. A standby target sets the `proxy` flag to indicate that it will proxy for the peer node. It ceases sending a valid signal in order to signal the standby initiator that STANDBY was detected. then places the outputs in a high-impedance state.

Transition P7:P9. Upon completion of the actions associated with this state, the PHY port unconditionally transitions to the Standby state.

Transition P8:P9. Upon completion of the actions associated with this state, the PHY port unconditionally transitions to the Standby state.

State P9: Standby. The PHY may place most of the port's circuitry in a low-power consumption state. The port shall maintain connectivity status by (Beta mode) transmitting tones and using its signal detect circuitry or (DS mode) using its connection detect circuit even if other components of the PHY port are in a low-power state

Transition P9:P10. Either of two conditions cause a PHY port in Standby to transition to the Restore state: a) a nonzero value for the port's `restore` variable or b) the detection of receive_ok if the port's `standby_fault` variable is zero as a result of failure to complete the previous suspend handshake. A port's restore variable may be set indirectly as the result of the resumption of other PHY ports.

State P10: Restore. The PHY commences transmission at the operating speed, and attempts to synchronize its receiver. The PHY port tests both the connection status and the presence of receive_ok to determine if normal operations may be restored. If `proxy` is set then the PHY arbitrates for the bus and sends a restore configuration packet on the port. When the peer PHY indicates that it is in phase (indicated by reception of appropriate arbitration requests) the restore operation is complete. If `proxy` is not set, then the PHY (necessarily a leaf node) awaits reception of the configuration packet and sets its phase variables appropriately.

Transition P10:P2. If the PHY port did not fault during the restore handshake, it transitions to the Active state

Transition P10:P9. A restoring PHY port that faults during the restore handshake transitions to the Standby state.

Transition P9:P0. A PHY port in Standby that loses its physical connection to its peer PHY port transitions to the Disconnected state.

State P11: Untested. In this state the port is a candidate for testing to ensure that a loop would not be formed by completing he connection. The port starts up, synchronizes with its peer, and exchanges loop test symbols with its peer. It also transmits an ATTACH_REQUEST when required to do so by the node-level loop free build mechanism, and reports any incoming ATTACH_REQUEST. It completes any attachment by waiting for or generating a reset as appropriate.

Transition P11:P2. On completion of an attachment, the port is marked as Active

Transition P11:P12. If the node-level loop free build mechanism determines that completing the connection would result in a loop, or if there is loss of synchronization during the loop-free build process (untested_fault), then the port transitions to the Loop Disabled state.

State P12: Loop Disabled. The port is disabled, but continues to tone and to use its signal detect circuitry to maintain connectivity status. A port remains in this state until a bus reset is detected, a resume signal is received from the peer port or until a disconnection is detected.

Transition P12:P11. A Loop Disabled port transitions to the Untested state when a bus reset is detected or a resume signal is received from the peer port.

Transition P12:P0. A Loop Disabled port transitions to the Disconnected state when disconnection is detected.

11.6 Standby/Restore

Standby is a term used to describe a low energy consumption mode of operation for port. If a node has only one active port, then this port can be placed in Standby. A node with a port in Standby does not participate in normal bus activity. The node to which it is connected (the "uncle") proxies on behalf of the node (the "nephew") during self_ID.

11.6.1 Characteristics of a standby candidate nephew node

Standby is a feature of Beta-mode operation only. A bus reset does NOT occur as part of entering or restoring from Standby. Other nodes on the bus of which the nephew node is a member are not aware of any status change of the nephew node. Its peer node - the "uncle" - shall "proxy" the self-ID packet subsequent to any bus reset on the active bus.