

MPD Inrush and Power-On Baseline Text

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- ▶ Characteristics that drive forward-looking concepts and details:
 - Number of nodes (16)
 - Mixing Segment Loop Resistance (15Ω)
 - Gauge (23g)
 - Channel length (50m)
 - Connector resistance (58mΩ)
 - Compensation component resistance (355mΩ)

- ▶ Then choose:
 - MPSE minimum power on voltage
- ▶ Which determines:
 - Available power per node
- ▶ To Enable Specification of:
 - Voltage Stack-Up / Operating thresholds
 - Reset, Discovery, Type 0, Type 1
 - **And enable Objective 11**
 - Addition / Removal from powered mixing segment
- ▶ Author Clause 169:
 - **Inrush attributes**
 - Power on attributes
 - Discovery time, voltage, current attributes
 - Maintain Power Signature (MPS) attributes

► Purpose

- The MPD inrush state(s) aid the system in transition to the powered on state

► Requirements

- Do not turn on a PD load when it is powered at the wrong voltage
- MPD waits for some time (TBD) after a turn on threshold (TBD) has been crossed
 - Allow PSE to finish bringing system to full operating voltage
 - Prevent MPD loads from loading the system during PSE inrush
 - Simplifies requirements on MPSE Hotswap MOSFET
- MPDs measure system voltage at end of MPSE inrush time when MPSE output is stable
 - MPD remains off if connected to incorrect system type (wrong voltage range)
- If connected to correct system type, MPDs inrush their loads
- If connected to incorrect system type:
 - MPD interface IC does not apply power to MPD application load
 - MPD provides active indication to user
- Operating regions (Type1, Type0, Discovery) must be unique to facilitate addition of nodes to continuously operating mixing segment
 - Cannot rely on information from discovery to determine Type operating region

- ▶ System type power requirements
 - Update table 169-1 with proposed values

▶ MPD Updates

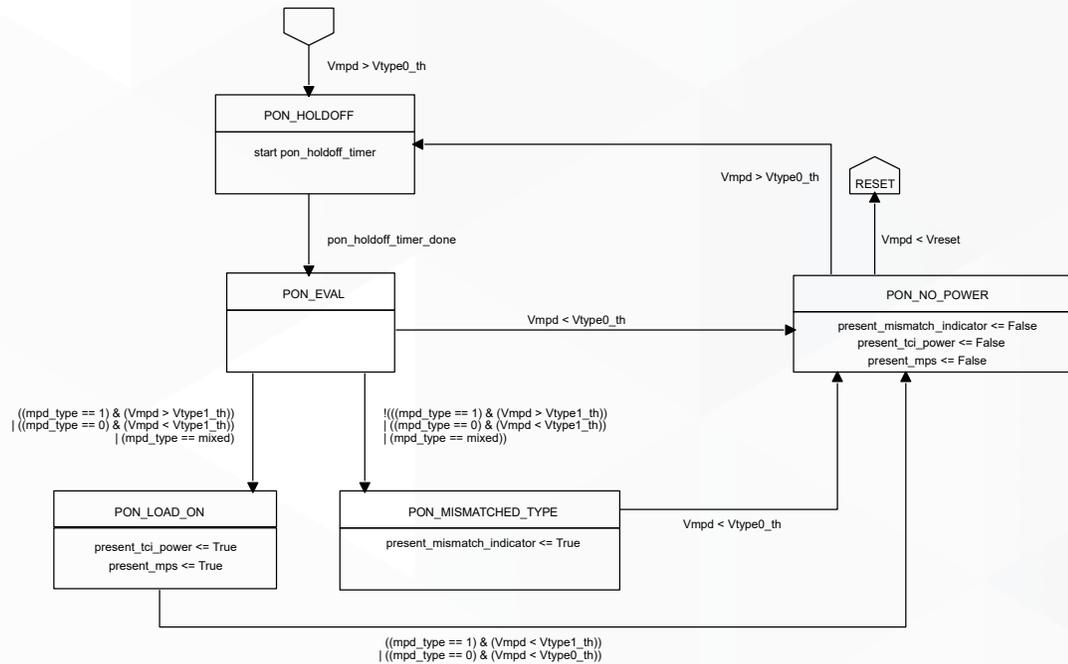
- Add inrush state machine
 - Added variables and timers
- Update Table 169-7 w/ power regions
 - Items 1, 2, 4, 5
- Update text in 169.5.7.1 MPD Inrush

Table 169-1—System Power Types

	24V Nominal MPSE	50V Max MPSE
System type	0	1
$V_{MPSE(max)}$ (V) ^a	30	50
$V_{MPSE(min)}$ (V)	26	45
$I_{PI(max)}$ (mA) ^b	TBD	TBD
$P_{Type(min)}$ (W) ^c	TBD	TBD
$V_{MPD(min)}$ (V)	18	34
$P_{MPD(max)}$ (W) ^d	0.75	2

- ▶ $V_{MPSE(MIN)}$ changed from 20,44 to 26,45
- ▶ $V_{MPD(MIN)}$ changed from TBD to 18,34
- ▶ $P_{MPD(MAX)}$ changed from TBD to 0.75,2

MPD Inrush / Power On State Machine



States	Description	State Actions
pon_holdoff	A State to allow power on voltage to settle on the mixing segment before MPDs begin inrush	start pon_holdoff_timer
pon_eval	Evaluation state at the end of pon_holdoff. MPD determines if TC3 interface voltage is compatible with MPD type.	
pon_mismatched_type	MPD has operating voltage applied, but it is not in the correct range for the load. MPD does not enable its load and provides active indication to the user that the MPD is connected to incompatible system type	present_mismatch_indicator <= TRUE
pon_load_on	Power is being delivered to the MPD load. Power is limited by MPD type.	present_TCI_power <= True, present_mps <= True
pon_no_power	Interface voltage has dropped below the level where power can be delivered. This may happen momentarily and not affect the node (depending on rectification and bulk cap) or it may cause the MPD to reset its application load. An MPD shall continue to operate through a power supply disruption of TBD time.	presentn_TCI_power <= False, present_mps <= False, present_mismatch_indicator <= False

Variables	
Vtype0_th	Threshold between discovery region and type 0 power region
Vtype1_th	Threshold between type0 power region and type 1 power region
Timers	
pon_holdoff_timer	A timer used to prevent inrush from starting after MPD voltage has crossed into the power on regions

- ▶ Update Table 169-7 w/ power regions
 - Items 1, 2, 4, 5

169.5.6 MPD Power

The power supply of the MPD shall operate within the characteristics in Table 169-7. The MPD may be capable of drawing power from a local power source. When a local power source is provided, the MPD may draw some, none, or all of its power from TC3.

Table 169-7 - MPD Power Supply Limits

Item	Parameter	Symbol	Unit	Min	Max	Type	Additional Information
1	Input Voltage	V_{Port_MPD}	V	18	30	0	
				34	50	1	
2	Input m power	P_{MPD}	W		0.75	0	
					2	1	
3	Inrush Current	I_{Inrush_MPD}	A	-	10mA	All	
4	MPD Type 0 Voltage threshold	V_{TYPE0_TH}	V	14	18	ALL	
5	MPD Type 1 Voltage Threshold	V_{TYPE1_TH}	V	30.1	24	ALL	
6	Inrush Backoff Time	$T_{Inrush_backoff}$	ms	10ms	TBD	All	
7	Inrush to operating state delay	T_{Delay}	ms	TBD	TBD	All	
8	MPD TC3 capacitance during POWER_ON	C_{Port}	uF	-	TBD	All	
9	MPD Current when connected to incompatible PSE type	$I_{MPD_DISABLED}$	uA	-	500	All	

169.5.7.1 MPD Inrush

An MPD shall not draw application level power from TC3 when it is connected to an incompatible system type. To determine whether the MPD is connected to a compatible MPSE type, the MPD shall not draw full operating power until V_{mpd} crosses V_{type0_th} and $T_{inrush_backoff}$ time has elapsed. After $T_{inrush_backoff}$ time has elapsed, if the TC3 voltage is in a range that is compatible with the MPD type, the MPD may begin drawing full operating power corresponding with the MPD system type.

If V_{mpd} is greater than V_{type0_th} , the $T_{inrush_backoff}$ time has elapsed, and V_{mpd} is not in a voltage range that is compatible with the MPD type, the MPD shall draw less than $I_{mpd_disabled}$ current and provide an active indication to the user that the MPD is connected to an incompatible MPSE.

This system meets the powering objectives of 802.3da

- ✓ Define performance characteristics of a mixing segment for 10Mb/s multidrop single balanced pair networks supporting up to at least 16 nodes, for up to at least 50m reach.
- ✓ Specify optional plug-and-play power distribution over the mixing segment
- ✓ Specify required electrical and mechanical characteristics for connection methods necessary to achieve communications and powering objectives that allows multiple connector types
- ✓ Specify device characteristics necessary to enable addition and/or removal of a node or set of nodes to a powered mixing segment with a bounded interruption