Reducing MPS duty cycle

For lower standby power

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Unchanged from 01/2014

Problem statement

- Deploying large numbers of PDs leads to unacceptably large standby power
- Standby power of a **powered** PD is lower bound for Type 1 & 2 to 75ms/325ms * 10mA * 57V = **132mW**
- With Energy Efficient Ethernet (and careful design of the rest of the system) we can design (lighting) PDs that would keep power & link for **<= 100mW**
- This means a current (at 57V) of 1.75mA, however MPS requires us to burn an additional 75ms/325ms * (10mA-1.75mA) * 57V = **108mW** bringing the minimum realistic total to **208mW.**
- For a 72000m2 office building (about 10000 luminaires) this 100mW MPS difference results in 2.5KW extra with lights off → 17.9MWh.
  This represents a significant extra cost (for what is only a small difference in standby behavior)

Unchanged from 01/2014

Proposal

- Change as little as possible → reduce the duty cycle of the MPS
- Keep $T_{MDPO(MAX)}$ the same as this relates to safety.

Parameter	Type 1 & 2 (.3at)		Type 3 (proposed)	
	PSE	PD	PSE	PD
$I_{HOLD(MAX)}$	10mA		10mA/20mA	
I_{PORT_MPS}		10mA		10mA/20mA
T_{MPS}	60ms	(75ms)	5ms	(7ms)
$T_{MPDO(MIN)}$	300ms	(250ms)	355ms	(318ms)
$T_{MPDO(MAX)}$	400ms		400ms	

- Duty cycle drops to 2.15% (PD), power 12mW or 25mW (depending on PSE count)

Unchanged from 01/2014

Compatibility with Type 1 & 2

	Type 1,2 PD	Type 3 PD
Type 1,2 PSE	Does not apply	Use Type 1,2 timing, PD must have identified PSE as Type 1 or 2
Type 3 PSE	PD will use Type 1,2 timing, PSE can use either timing scheme	Use Type 3 timing if PD identifies PSE as Type 3

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Addressed problems: filtered MPS pulse/noise

Problem: Short MPS pulse gets filtered by PD bulk capacitor combined with cable impedance.
Status: confirmed with spice simulation

Solutions:
Several vendors have solved this with multiple methods.
Eg. Maxim MAX5992A, TI TPS23752.

Addressed problems: IEC61000-4-5

Problem: Short MPS pulse can be cancelled out by interference from eg. Mains cable.

The IEC norm describes various pulses not exceeding 700uS in length. It seems unlikely that surges that do not affect the current MPS pulses would have a major effect on the proposed shorter pulses.

Proposed solution: For applications where this is a problem, send twice as many MPS pulses (or more) to increase resilience. For other applications, the consequence of hitting and completely erasing an MPS pulse by a surge means a power cycle (and software reboot).

Addressed problems: pair to pair imbalance

Problem: Cable imbalance requires higher MPS current

Proposal:

- 1 power channel architecture
  No correction needed, I_{HOLD} TBD (10mA or 20mA)

- 2 power channel architecture
  I_{HOLD} remains 10mA per power channel, PD responsible to draw sufficient current to satisfy I_{HOLD} on both channels. (I_{HOLD} * max_imbalance + margin)

Addressed problems: cost increase

Problem: Detecting shorter pulses increases cost

Proposal: vendors please quantify relative cost increase

Differential TCO of ***current MPS versus proposed*** is 1.8KWhr/year → 20.7KWhr over the lifetime of a single luminaire (11,5 year @ 50Khrs)
This is about equal to the cost of a multiport PSE IC.

It is very hard to satisfy the 0,5W Lighting standby requirement EC 1275/2008 (2005/32/EC).


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MPS amendments to IEEE Std 802.3™-2012 specification

Section 33.2.7 Power supply output

- Table 33-11: PSE output PI electrical requirements for all PD classes:
  Include parameters for Type 3
  - Item 17: DC MPS Current I_{HOLD}:
    Type 1/2: Min 5mA, Max 10mA for PSE
    Type 3: Min 5mA, Max 10mA for each power channel
  - Item 18: PD Maintain Power Signature dropout time limit T_{MPDO}:
    Type 1/2: Min. Value 0.300 (s)
    Type 3: Min Value 0.355(s)
    Max. Value 0.4 (s) for all types
  - Item 19: PD Maintain Power Signature time for validity T_{MPS}:
    Type 1/2: Min. Value 0.06(s)
    Type 3: Min. Value 0.005 (s)

NOTE
Type 1&2 refer to 802.3at compliance
Type 3 refers to 802.bt compliance

MPS amendments to IEEE Std 802.3™-2012 specification

Section 33.3.8 PD Maintain Power Signature:

- Table 33.19 PD Maintain Power Signature:
  Include parameters for Type 3
  - Item 1: Input current I_{port_MPS} :
    Min. 10mA per power channel (depending on the outcome of this proposal)
- Modify text:
  From :

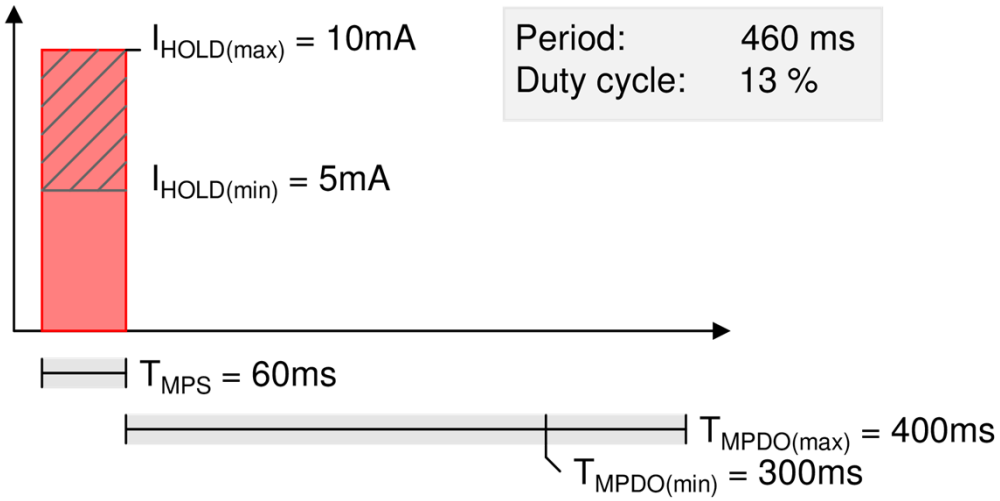
"a) Current draw equal to or above the minimum input current (I_{Port_MPS} min) as specified in Table 33–19 for a minimum duration of 75 ms followed by an optional MPS dropout for no longer than 250 ms"

Into (or similar):

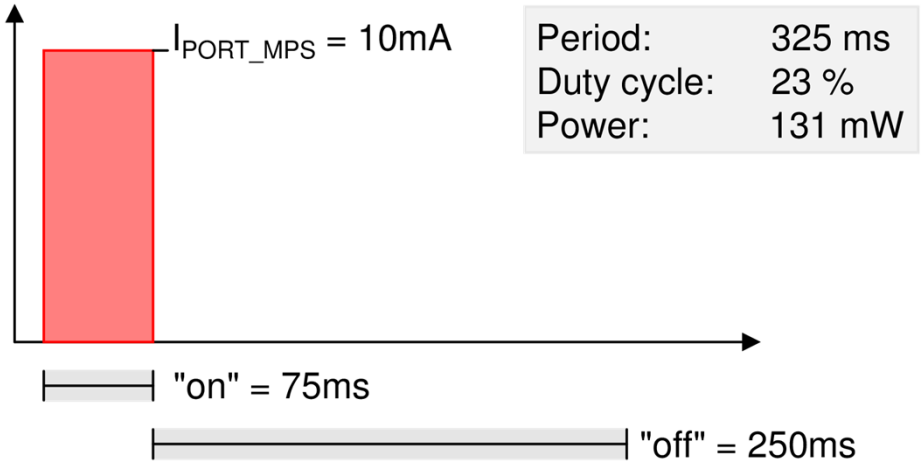
"a) Current draw equal to or above the minimum input current (I_{Port_MPS} min) as specified in Table 33–19 for a minimum duration of 75 ms (type 1&2) or 7 ms (type 3) followed by an optional MPS dropout for no longer than 250 ms (type 1&2) or 318 ms (Type 3)"

IEEE 802.3af & .3at MPS PSE & PD rules

PSE



PD



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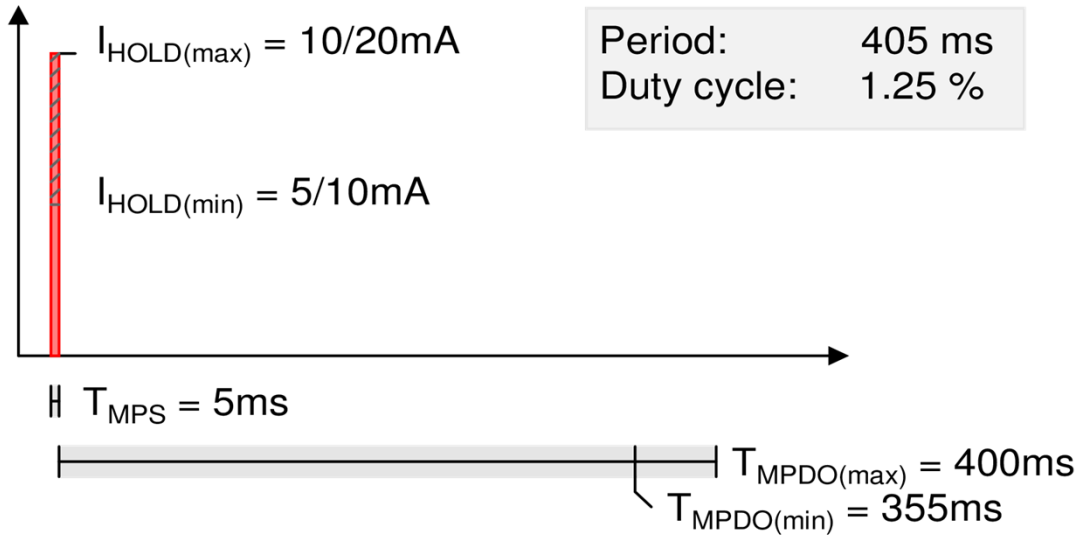
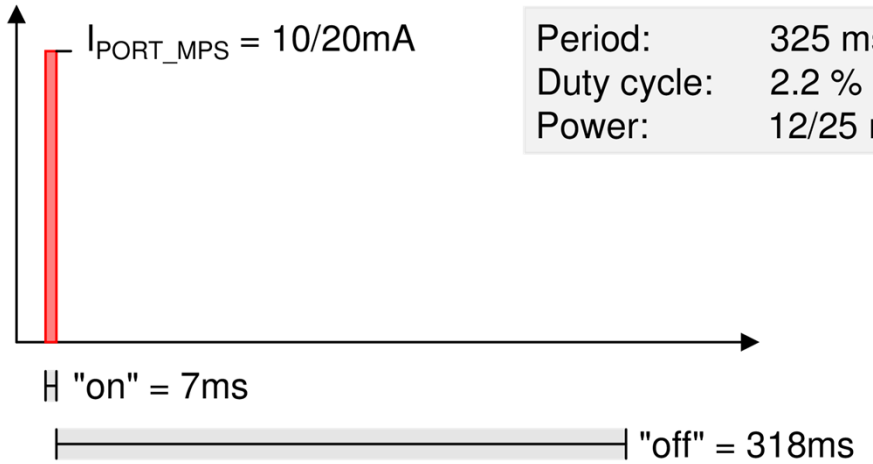
Proposed new MPS scheme

PSE



Period:	405 ms
Duty cycle:	1.25 %

PD



Period:	325 ms
Duty cycle:	2.2 %
Power:	12/25 mW

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