The benefits of using the Autoclass (AUC) feature in IEEE 802.3bt POE

Power Over Ethernet (POE) allows for power for networked devices to be transferring along with data over standard Ethernet Cat5e or greater cables.

The cost advantage of using a POE is huge. It requires a single installation of cable to carry both data and power and eliminates the need for network devices to be installed near to AC main supplies. Since it operates below 60 volts DC, it also eliminates the need for multiple installations of expensive AC protection devices like circuit breakers and provides for quick and easy re-location. It is operated within an internationally accepted and reliable system. Various elements in the system negotiate, provide, and monitor the power levels within system, and have built-in protection protocols.

In September 2018, the Institute of Electrical and Electronics Engineers (IEEE) ratified the new 802.3bt standard for POE which meets the demand for higher power of new generation network devices including CCTV, Wi-Fi Access Points, Thin-Client or Zero-Client computers, 5G equipment, etc.

In any POE system there are two elements. The Power Sourcing Equipment (PSE) like POE switches (endspans) and injectors (midspans) and the Powered Device (PD) which is the POE enabled equipment. The quantum of power provided by the PSE is determined by a set of POE “classes”. This is managed by a set of standardised protocols and handshakes between the PSE and the PD when they are connected.

The initial standard for POE, IEEE 802.3af provided for classes 0, 1, 2 and 3 via a Type 1 PSE which provided maximum power of 15.4 watts at the PSE and 12.95 watts at the PD. The next revision IEEE 802.3at introduced a Type 2 PSE and raised power levels to 30W at the PSE and 25.5W at the PD. Both these standards allowed for power to be supplied on only two pairs of the Ethernet cable. The new 802.3bt standard adds two new types of PSEs, Type 3 and Type 4, and four new classes, 5, 6, 7 and 8, and raises power levels up to 90W at the PSE and 71W at the PD. The new standard uses all four pairs of the cable to transfer power. The table below indicates the power levels of the three POE standards.

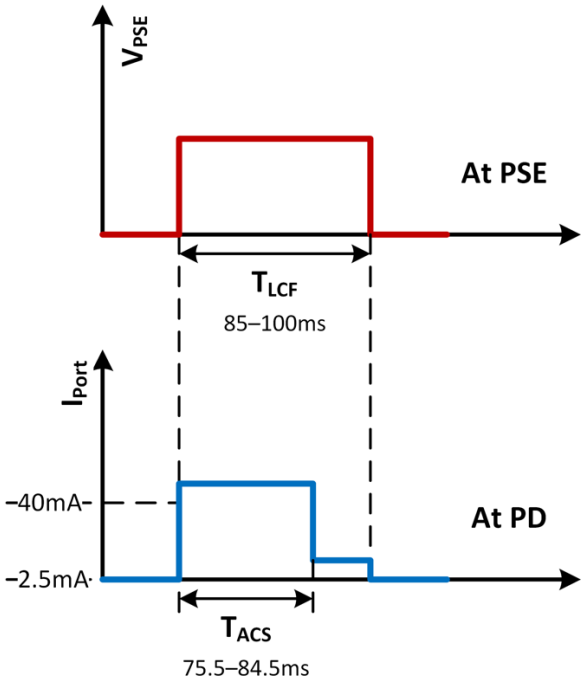
IEEE 802.3 Power levels and Classifications for POE Powered Devices

IEEE Standard	Common Name	PD Class	PD/PSE Type	PD Power[1]	PSE Power[2]	Wire pairs energised	AUC[3]
802.3af	POE	0	1	12.95W	15.4W	2	No Support
802.3af	POE	1	1	3.84W	4W	2	No Support
802.3af	POE	2	1	6.49W	7W	2	No Support
802.3af	POE	3	1	12.95W	15.4W	2	No Support
802.3at	POE+	4	2	25.5W	30W	2	No Support
802.3bt	POE++	5	3	38.25W	45W	4	Optional
802.3bt	POE++	6	3	51W	60W	4	Optional
802.3bt	POE+++	7	4	62W	75W	4	Optional
802.3bt	POE+++	8	4	71.3W	90W	4	Optional

While the new standard IEEE 802.3bt provides for a PSE output of 90W, it assures only 71.3W at the PD. This is based on a calculation of “maximum pair-set DC loop resistance” of 12.5 ohms which results in an assumption of 18.7W loss in a 100-meter-long Ethernet cable.

In the earlier standards if the DC loop resistance was lower, by using Cat6 or better, or shorter cable length, etc., the PSE would still allocate and reserve the maximum output power, even if the PD did not need it, thus wasting power budgets at the PSE. To overcome this potential waste, the new IEEE 802.3bt standard introduced an optional feature called Autoclass, commonly abbreviated to AUC which allows for the PD to communicate the maximum power it requires, thus optimising the power allocated by the PSE.

IEEE 802.3bt allows for the PD to indicate if it supports Autoclass by adjusting the classification current from Class 4 (40mA) to Class 0 (2.5mA) between 75.5ms and 84.5ms, but typical after 81ms. This critical timing will be detected only by an IEEE 802.3bt compliant Type 3 or Type 4 PSE.

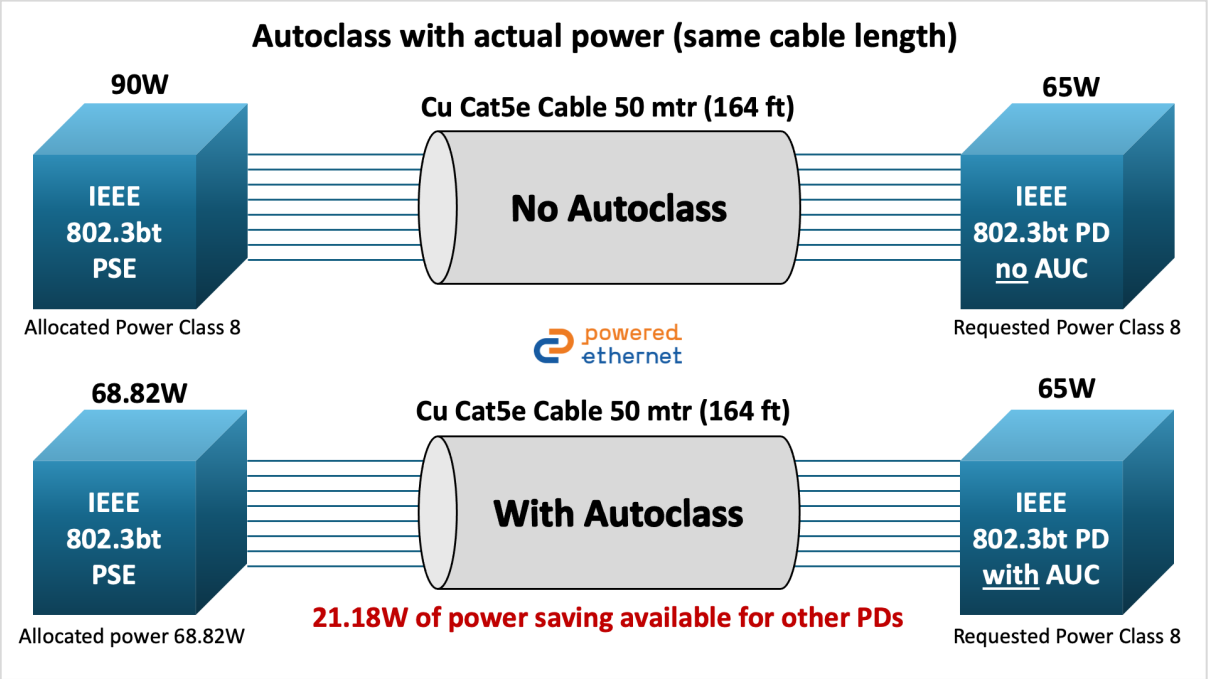


After this classification and system power-up, **it is critical that the PD draw the maximum power it requires during its operation**. Based on this power draw the PSE can determine, and allocate, the power the PD *actually needs*, thus optimising the power it provides across its multiple ports.

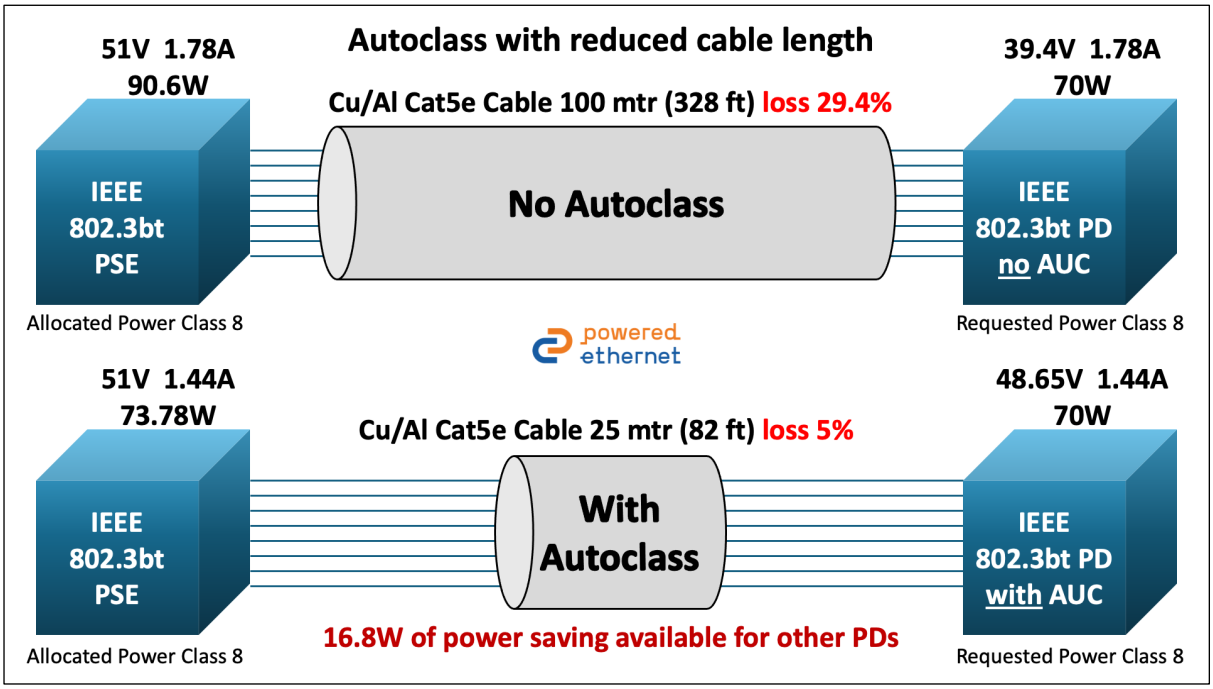
To illustrate the benefits of Autoclass optimisation, we have two examples. The first using good quality pure copper Cat5e Ethernet cable of the same length, the second using lower-cost Copper-Aluminium Ethernet cable of differing lengths.

<This area is deliberately blank>

In the image below, a PD requires 65W maximum power i.e. Power Class 8. The top half shows a Type-4 IEEE 802.3bt PSE reacting without Autoclass, while the bottom half shows the same PSE reacting with Autoclass. Without Autoclass enabled the PSE is required to allocate Class 8 i.e. 90W power against an actual requirement of only 68.82W, an additional 21.18W that the PD will never use. In an 8-port deployment using Autoclass can result in saving over 160W of power budget.



In next example, the image below shows a PD requiring 70W maximum power i.e. Power Class 8 in a network using lower cost Copper-Aluminium Cat 5e cable of differing lengths. The top half shows a Type 4 IEEE 802.3bt PSE reacting without Autoclass, while the bottom half shows the same PSE reacting with Autoclass. Without Autoclass enabled the PSE is required to allocate 90W power against an actual requirement of 73.78W, an additional PSE power allocation of 16.8W per port. Again, in an 8-port deployment using Autoclass results in saving more than 134W of power.



All of Infomart's® *PoweredEthernet*™ IEEE802.3bt POE PD modules like the Class 8 PEM9300BT series, the Class 6 PEM6300BT series, and the POE PD all-in-one boards like the PEB9300BT feature optional Autoclass, that will enable system designers to enable their products to economically and efficiently measure, budget, and allocate actual power requirements with IEEE 802.3bt compliant PSEs to deliver better features and higher value to their customers.

All of Infomart's® *PoweredEthernet*™ IEEE802.3bt POE PD products carry the suffix "BT".

Maintain Power Signature

All of Infomart's® *PoweredEthernet*™ IEEE802.3bt POE PD modules like the Class 8 PEM9300BT series, the Class 6 PEM6300BT series, and the POE PD all-in-one boards like the PEB9300BT also offer Maintain Power Signature (MPS) which is a new IEEE 802.3bt feature enabling ultra-low power stand-by current without risking POE PSE disconnection, and in-built wall-adapter support for robust redundancy.

All these features are available with minimal or zero use of external components for a better value proposition.

For more information, please contact our marketing team at

marketing@infomartgroup.com or visit us at www.poweredethernet.com