

# Using the TPS23861 and TPS23882B in Autonomous Mode Features and Benefits



Shri Mathavan

Texas Instruments Power over Ethernet (PoE) Power Sourcing Equipment (PSE) controllers offer four operating modes:

- Automatic (auto)
- Semi-auto
- Manual
- Autonomous

Each mode offers a different level of control.

Autonomous mode, supported by TI's TPS23861 and TPS23882B, a 4-port and 8-port PSE controller respectively, is a plug-and-play solution where there is no host or I<sup>2</sup>C communication required. The absence of a host controller means there is no need for software implementation and therefore no Port Power Management (PPM) features.

The main difference between auto and autonomous is the presence of the MCU; auto mode requires an MCU to initialize operation through I<sup>2</sup>C commands. As it has the same functionality as autonomous mode, auto mode is not included in Table 1. The option between the two is to offer design flexibility.

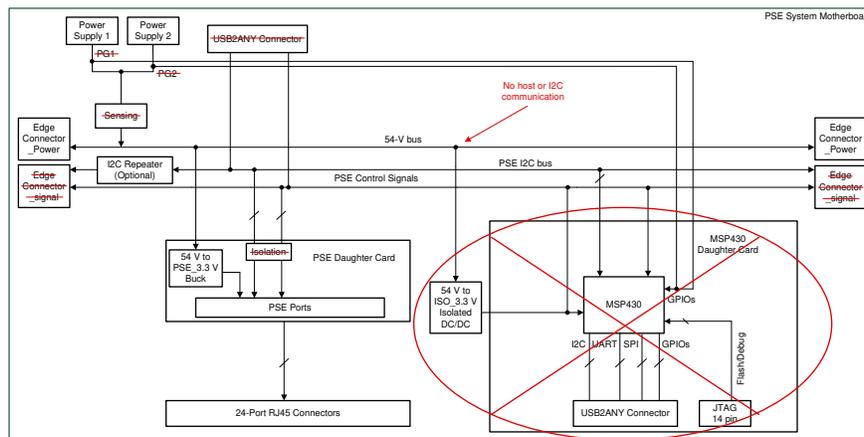
**Table 1. Operating Modes Comparison**

Operating Mode	MCU Required	PPM Features	Automatic Port Power-Up	Debug/Diagnostics
Autonomous			✓	
Semi-Auto	✓	✓		
Manual	✓			✓

Additionally, as shown in Table 1, semi-auto mode is capable of various PPM features to control the PSE; thus making it ideal for high port count systems. Manual mode's flexibility means it is most often used for debugging.

### BOM and Size Reduction

Autonomous mode grants an approximate 18% size reduction from the 8 x 14-inch PCB motherboard, Figure 1, of TI's 24-port Ethernet Switch EVM. Most significant is the removal of the MSP430 Daughter Card. Further, I<sup>2</sup>C communication is not required, which withdraws the need for isolation within the PSE Daughter card, and all signal-based communication such as the Power Good signals to the MCU, Edge Connector for PSE signals, and external current sensing circuit.



**Figure 1. Autonomous Mode Potential BOM/Size Savings**

## Autonomous Mode System Solutions

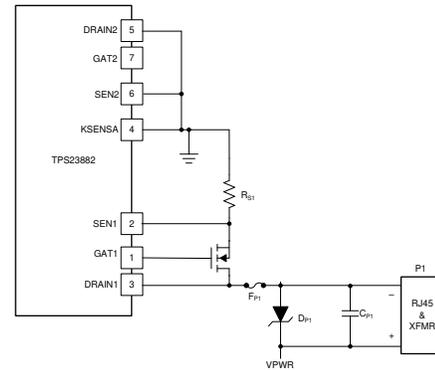
Autonomous mode's characteristic of predetermined port power is best suited for low port count solutions. One such design is a midspan injector. An injector will inject power onto an Ethernet cable coming from a non-PoE switch. By adding power to data, a midspan injector can connect these non-PoE switches with PoE compliant devices through a single Ethernet cable. End applications suited for this solution are Network Video Recorders (NVRs), Digital Video Recorders (DVRs), and Small office/home office (SOHO) business switches. Injectors do not require data layer classification, or Link Layer Discover Protocol (LLDP).

It is important to note that during power-up the TPS23861 autonomous mode allocates 30 W per port. For the TPS23882B autonomous mode, the resistance on the AUTO pin, [Table 2](#), determines power allocation for all ports. As a Type-3 2-pair solution, TPS23882B offers either the maximum Class 4, 30 W or lower Class 3, 15.4 W per port.

**Table 2. AUTO Pin Programming**

AUTO Pin	Autonomous Mode Configuration
Open/Floating	Disabled
124 k $\Omega$	2-pair 15.4 W
62 k $\Omega$	2-pair 30 W

For multiple channel PSE controllers with low port count injectors where a channel is not in use, the SENx should be grounded and GATx pin left open. Leave the DRAINx pin grounded as well. [Figure 2](#) shows an example of an unused PORT2.



**Figure 2. Unused PORT2 Connections**

## Power Reference Design Recommendations

It is essential to have a power supply that can support all ports at full power. Texas Instruments is a leader in power management and has an extensive list of available power supply reference designs. [Table 3](#) displays recommended TI Power Reference Designs for various injector solutions. TI recommends pairing these power reference designs with the [TPS23882B1EVM-008](#) daughter card and [BOOST-PSEMTHR8-097](#) motherboard to evaluate an IEEE802.3bt compliant autonomous mode PSE system solution.

**Table 3. Injector Power Supply Reference Designs**

Injector Port Count	Desired Output Power (W)	Power Reference Designs	Output Power (W)	Topology	Input Type
Single Port	15.4 W	<a href="#">PMP20199</a>	30.24 W	Flyback	AC
	30 W				
8-port	240 W (30 W per port)	<a href="#">PMP20367.1</a> + <a href="#">PMP20367.2</a>	302.5 W	PFC Boost + Half Bridge LLC	AC

## Conclusion

The introduction of autonomous mode means a much simpler system design. Operating modes auto, semi-auto, and manual offer more system control but their features can be extraneous. Key autonomous features such as operating without a microcontroller and being a plug-and-play solution, bolster a cost-efficient solution.

The [TPS23882B](#) and [TPS23861](#) data sheets and their respective [TPS23882B1](#) and [TPS23861](#) Evaluation Modules provide further details about the PSE Controller. TI's [Reference Design Library](#) can also be leveraged for more power supply reference designs to support an injector solution design.

## IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATA SHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to [TI's Terms of Sale](#) or other applicable terms available either on [ti.com](http://ti.com) or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products.

TI objects to and rejects any additional or different terms you may have proposed.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2022, Texas Instruments Incorporated