

How to Extend Ethernet Cable Reach to 150 Meters in Building Automation Designs



Reduction in cost of automation and increase in the knowledge base for automation technology has led to its expansion in a wide range of sectors, including building automation. Building automation is increasing the safety and comfort of those who occupy the space. Smart HVAC systems and security camera networks are deployed in most commercial spaces and expanding to residential spaces. Ethernet-based topologies are important in building automation because it provides a reliable communication channel that is not easily snooped and can support the growing bandwidth requirements of building automation end equipments. Ethernet is flexible in its use and has almost universal acceptance. This has allowed Ethernet communication to spread in automation technologies. With advancements in connected applications often used in smart buildings, use of Ethernet is expected to increase. [Figure 1](#) shows an example of building automation architecture that uses Ethernet for communication between various domains.

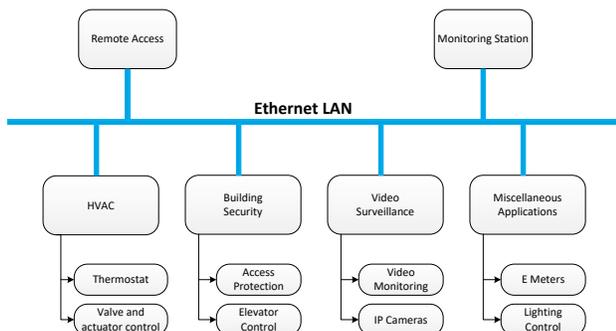


Figure 1. Building Automation Architecture Example

One of the most difficult engineering aspects of Ethernet based building automation is the extreme distances between nodes. IEEE defined a 100-m Physical Layer, but often times this is not enough to address building automation needs. Often times Ethernet end nodes like sensors and cameras are located physically far away from a central switch or monitoring station. In cases where distances are longer than 100-m, an Ethernet repeater is needed to boost the signal strength. This increases the complexity, cost, and dependencies in the system as

there is now an extra point of potential failure. Adding repeaters also slows the data transfer because instead of just accounting for the propagation delay of the cable, you also add the ingress and egress of two PHYs in series. The DP83825I is specifically designed to address applications where remote nodes are separated by large distances which can go beyond the maximum distance defined by IEEE specification.

DP83825I is the industry's smallest form factor 10/100Mbps Ethernet PHY with a footprint of 3mm x 3mm. It is also optimized to operate with power as low as 127mW during normal operation. [Figure 2](#) shows a high level block diagram of a typical DP83825I system. Small size, low power, and long cable reach makes the DP83825I a very attractive choice for Ethernet based building automation applications which have strict size and power restrictions while requiring communication over long distances. DP83825I can be used with any Ethernet MAC that supports RMI as shown in the system block diagram.

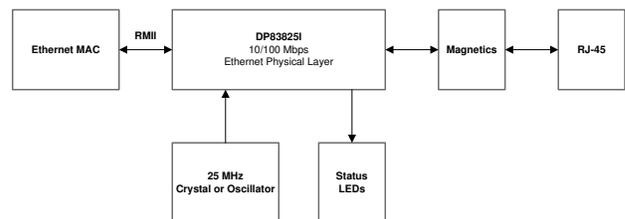


Figure 2. DP83825I System Block Diagram

DP83825I supports 150m communication distance on regular Cat5e Ethernet cable. This allows DP83825I systems to avoid using repeaters, reduce data path latency, and keep costs down. The small form factor allows designers to make compact Ethernet systems. [Figure 3](#) shows a comparison of IP camera network with and without DP83825I.

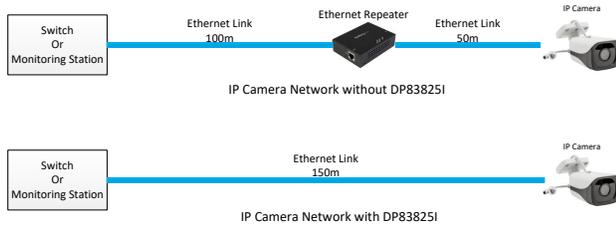


Figure 3. IP Camera comparison with and without DP83825I

The DP83825I's optimized voltage mode line driver and receiver compensates for signal degradation, enabling use of 150-m cable length while meeting IEEE requirements for Bit Error Rate. The voltage mode line driver schematic connection example is shown in Figure 4. As with any Ethernet PHY, there are some standard design requirements that need to be met for optimum device performance. The design requirements details for DP83825I long cable reach performance are mentioned in the product datasheet, SNLS638.

In conclusion, DP83825I offers size and performance advantages to help building automation Ethernet applications while complying with standard Ethernet system design requirements. Additional information can be found in the documents listed in Table 1. System design collateral like evaluation module and reference designs are also available as listed in Table 2.

Table 1. Adjacent Reference Documents

Literature Number	Details
SNLS638	DP83825I Data Sheet
SNLA290	Selection and specification of crystals for Texas Instruments ethernet physical layer transceivers

Table 2. Reference Evaluation Board

EVM Name	Details
DP83825EVM	Evaluation Module for DP83825I
TIDA-010046	DP8325I POE Reference Design

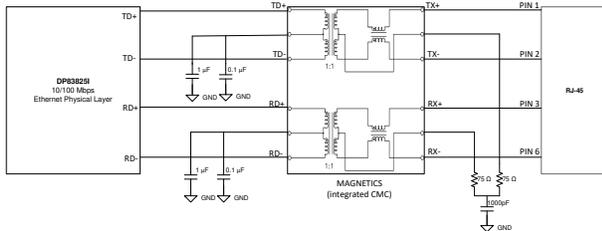


Figure 4. DP83825I MDI Connections

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