



# **PdMAEYE**

## **System Connectivity Guide**

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# PdMAEYE System Connectivity Guide

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# PdMAEYE System Connectivity Guide

## Definitions/Terms

- PdMAEYE System – describes the overall PdMAEYE monitoring system for electric motors and generators that is permanently installed at a customer’s industrial facility. The system is used to determine the “health” of electric motors and generators. See Figure 1 - PdMAEYE System Overview.
- PdMAEYE – is the term used for the data acquisition portion of the PdMAEYE Monitoring System. It consists of the PdMAEYE Base Module (Black Box) plus Signal Conditioning Modules (SCMs).
- PdMAEYE Control Computer - The PdMAEYE Control Computer is essentially the heart of the PdMAEYE Monitoring System. It controls the data flow of all requests and test data. The PdMAEYE Control Computer consists of computer hardware such as the PdMAEYE Control Computer and PdMAEYE Network Routers/Switches.

## **PdMAEYE System Getting Started**

### **Introduction**

The PdMAEYE allows facilities to test energized AC electric motors and generators, without opening the MCC or switchgear doors. The PdMAEYE uses Signal Conditioning Modules (SCMs) to condition the signal for input into the Data Acquisition system in the PdMAEYE Base Module. There are 4 SCM slots (ports) on the PdMAEYE Base Module in which each SCM has up to 3 channels for a total of 12 channels of acquisition.

Please review this entire document before installing and testing with the PdMAEYE.

# PdMAEYE System Connectivity Guide

## System Overview

This guide will provide an overview of installing and connecting the PdMAEYE System which consists of PdMAEYE(s), a PdMAEYE Control Computer and associated network hardware, PdMA Cloud, MCEGold® Software, and PdMAEYE Mobile Application. Figure 1 shows an overview of the PdMAEYE System. Connection to the PdMA Cloud can use any method of connecting to the internet such as Ethernet Cable, Wireless Wi-Fi, Cellular, etc.

Individual PdMAEYEs can be connected to the Local Area Network Router using Ethernet Cable or Wi-Fi Access Point hardware. When more than four PdMAEYEs are connected to the PdMAEYE Control Computer an additional POE Network Switch will be required (see Figure 1).

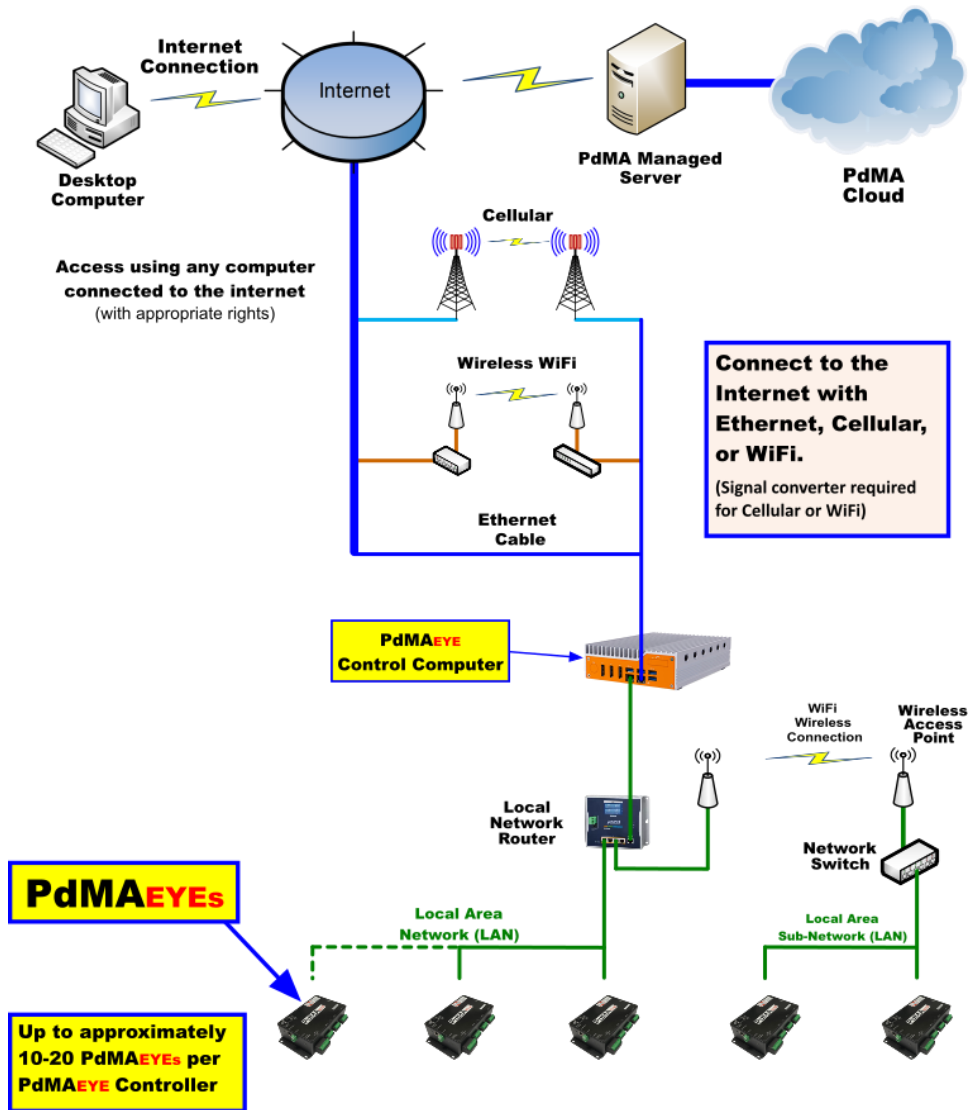


Figure 1 - PdMAEYE System Overview

# PdMAEYE System Connectivity Guide

## Connections

### PdMAEYE

The PdMAEYE is the data acquisition portion of the PdMAEYE System. It consists of four slots of Signal Conditioning Modules (SCMs) each with 3 channels for a total of 12 channels of data acquisition.

### Components

The PdMAEYE consists of the following components. The PdMAEYE comes with four SCMs (included) already installed.

1. PdMAEYE
2. Signal Conditioning Modules (SCMs) (Qty 4)
3. 12VDC, 1.5A Power Supply (Only Required if Ethernet POE Type 2 is not available)

### Location/Installation

For Location and Installation of the PdMAEYE refer to the PdMAEYE Installation Manual.

### Connections

1. Ensure the signal leads are connected to the SCMs as described in the PdMAEYE Installation Manual.
2. Connect the Ethernet LAN cable from the Network Router/Switch into the Ethernet Port of the PdMAEYE as shown in Figure 2.
3. If the external 12VDC, 1.5A Power Supply is required, plug it into the External DC Power Supply Port as shown in Figure 2.

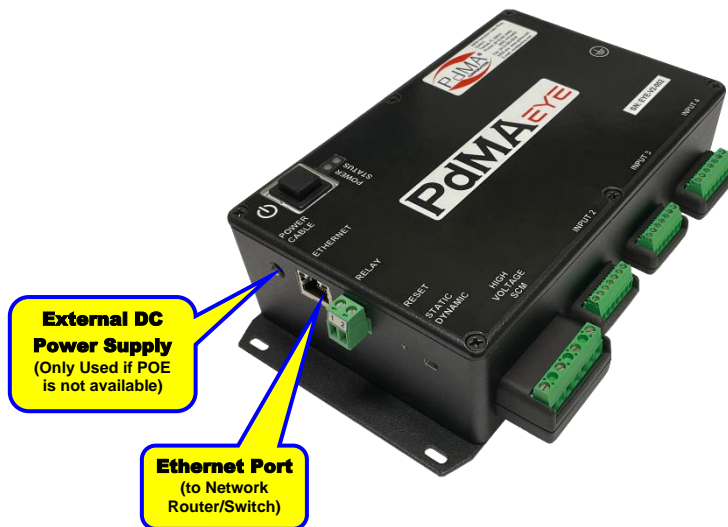


Figure 2 - Power Supply and Network Port

# PdMAEYE System Connectivity Guide

## Operation

### ON/OFF Button

Press the ON/OFF button to turn on or shutdown the PdMAEYE (see Figure 3).

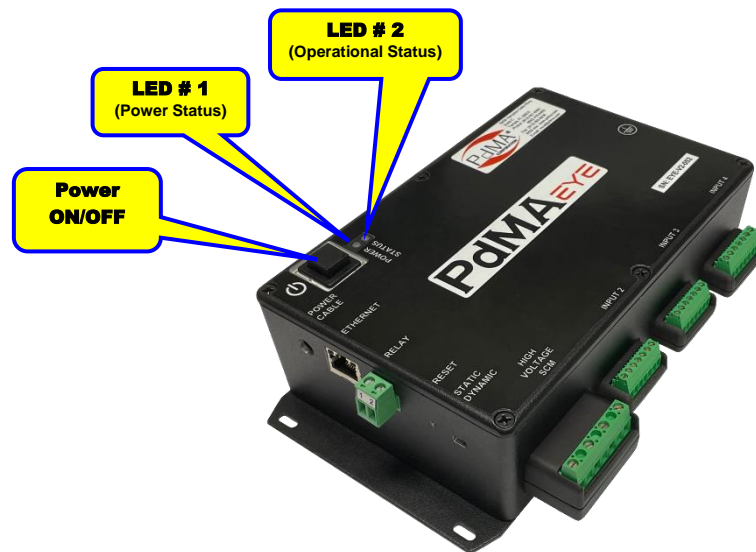
### Power and Operational Status Indicators

#### Normal Status (Green)

When the PdMAEYE is on and operating LED # 1 should be solid Green (Figure 3) and LED # 2 should indicate Normal Operational Status according to **Table 1**.

Indication	Color	Rate
Off	None	None
Booting	Green	On
Idle	Green	100ms on/900ms off
Capture Data	Green	250ms on/250ms off

*Table 1: Normal Status Indications*



*Figure 3 – Power Button and Operational Status Indicators*





# PdMAEYE System Connectivity Guide

## PdMAEYE Control Computer

The PdMAEYE Control Computer is a Fanless Industrial Computer which is the “heart” of the PdMAEYE System. The main purpose of the PdMAEYE Control Computer is to provide communications and data processing between the PdMAEYE and the PdMA Cloud. The PdMAEYE Control Computer and associated hardware will typically be located in or near the switchgear containing the PdMAEYEs.

The primary function of the PdMAEYE Control Computer is data processing and storage. The PdMAEYE Control Computer will process test data captured by the PdMAEYEs connected to it and locally store the test data for 96 hours on an internal Solid-State Drive. Upon analyzing the test data, the PdMAEYE Control Computer will generate and send any alarm or abnormal operational data to the PdMA Cloud and to the PdMAEYE Mobile Application. The PdMAEYE Control Computer can have up to approximately 10-12 PdMAEYEs connected to it.

## Components

You should find the following components in the PdMAEYE Control Computer box:

1. Computer
2. Computer Mounting Brackets (Supplied)
3. Computer Power Supply (Supplied)
4. Power Cord (Supplied)

## Location

### Computer

Review the following Dimensional drawings shown in Figure 5 and Figure 6 to aid in selecting a suitable location to mount the PdMAEYE Control Computer. When selecting a suitable location, ensure that there is enough room for adequate airflow around the computer. Additionally, the location should allow room to turn the computer power ON and for the Power Supply and the WAN & LAN Ethernet cables to be plugged in. See the Connections and PdMAEYE Control Computer Operation sections below for more information.

# PdMAEYE System Connectivity Guide

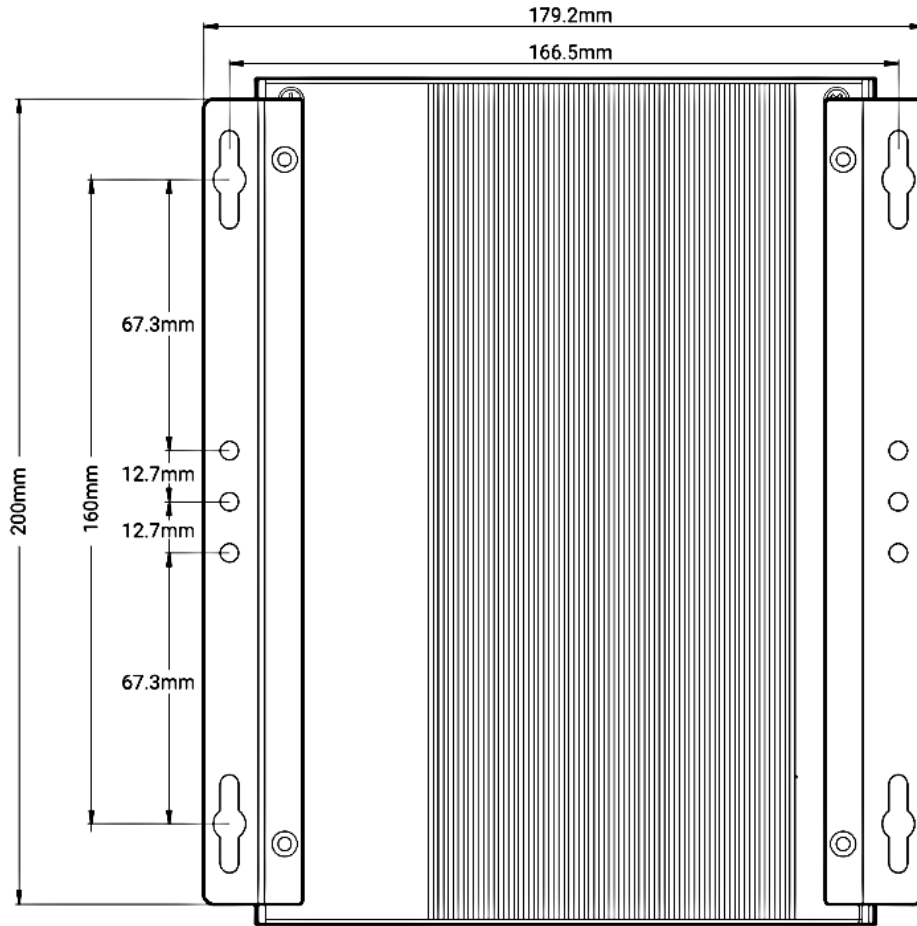


Figure 5 - Control Computer Top View

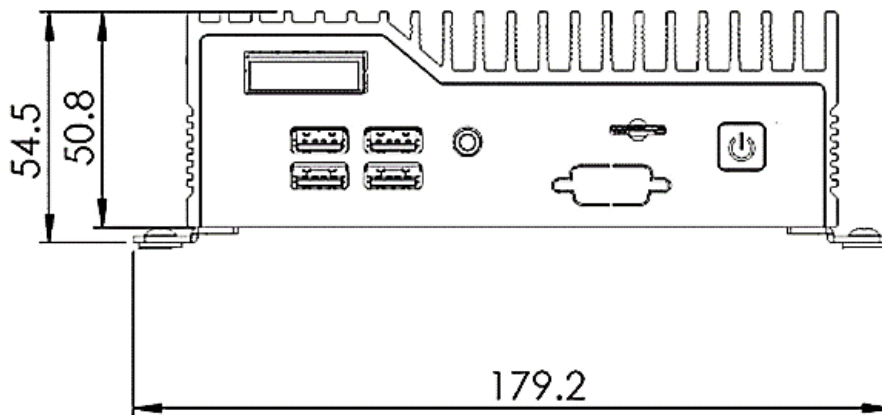


Figure 6 - Control Computer End View

# PdMAEYE System Connectivity Guide

## Power Supply

There are no mounting holes or brackets available for the computer power supply. You will have to determine a suitable mounting method such as wire ties, higher temperature rated Velcro, custom made bracket, etc. When finding a suitable location, ensure the power cord is plugged into the power supply. The Power Supply Dimensions are: 67 x 35 x 167 mm (2.64 x 1.38 x 6.57 in).

If possible, it's best to locate the power supply to one side of the computer rather than above or below. If it's not possible to locate it to one side or other, it would be best to mount it below the computer and ensure the computer is mounted with the fins vertically oriented.

## Mounting

After finding a suitable location to mount the PdMAEYE Control Computer and Power Supply, perform the following installation steps.

1. Attach wall mounting brackets to the chassis of the computer using the supplied M3 screws.
2. Using the 4 holes of the wall mounting brackets mount the PdMAEYE Control Computer to surface. The PdMAEYE Control Computer can be oriented in any direction, however, if possible, it's best to mount it with the cooling fins oriented vertically.
3. Attach the Power Supply using the method determined above.

## Connections

There are 3 connections to the control computer as shown in Figure 7; Power Supply, Internet, and Local Network Router.

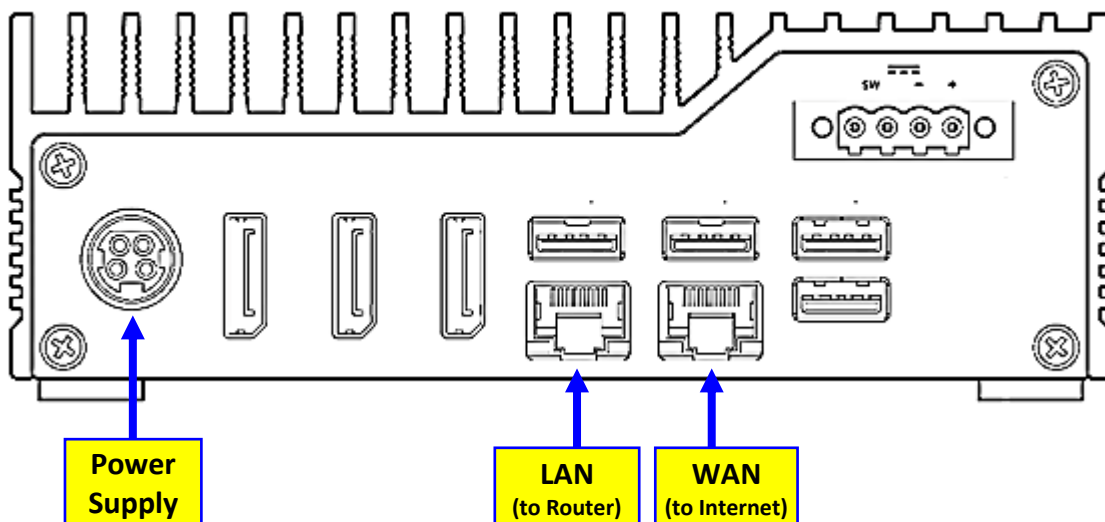


Figure 7 - Connections to the Control Computer

# PdMAEYE System Connectivity Guide

1. Connect the Ethernet Cable from the Computer port labeled “LAN” to the PdMA Network Router.
2. Connect the Ethernet Cable from the Internet to the port labeled “WAN”.
3. Connect the Computer Power Supply to the Power Input (4-Pin DIN) labeled “Power Supply”.

## PdMAEYE Control Computer Operation

The front power button can be used to turn the PdMAEYE Control Computer on and off. The power button shown in Figure 8 is a momentary contact button with a blue LED backlight used to display the status of the system. A single press while the system is on will initiate a graceful shutdown operation from the OS. Pressing and holding the button for 4 seconds while the system is running will cause a hard reset of the system. The system can be woken by a single press of the power button from any state. The LED backlight will indicate the system status. A solid blue light indicates that the system is powered in the S0 state. A flashing blue light indicates the system is in the sleep state. The LED is off in S5 and deep sleep states. Refer to the manufacturer’s manual for more information.

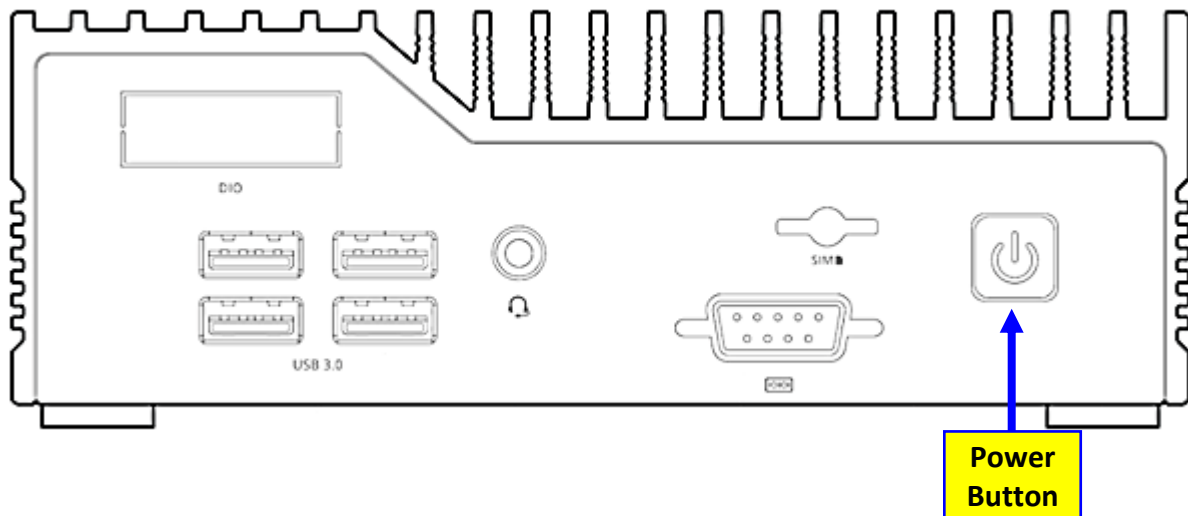


Figure 8 - Power Button

# PdMAEYE System Connectivity Guide

## UPS

A UPS (not supplied) is recommended to provide backup power for the PdMAEYE Control Computer, PdMAEYE Network Router, and PdMAEYEs. The UPS may be mounted where the PdMAEYE Control Computer and PdMA Network Router are located. The UPS should be at least 500 VA with 500 Joule Surge handling capability and the environmental ratings should be at least equal to or better than that of the PdMAEYE Control Computer.

## Local Network Router

The Local Network Router provides a Local Area Network (LAN) to connect the PdMAEYEs to the PdMAEYE Control Computer. Additionally, power to the PdMAEYEs is provided by the router using Type 2 POE ports. This router will handle up to four PdMAEYEs (see Figure 11). For installations that have more than four PdMAEYEs, see the Connections for 5-12 PdMAEYEs section.

## Components

You should find the following components with the Local Network Router:

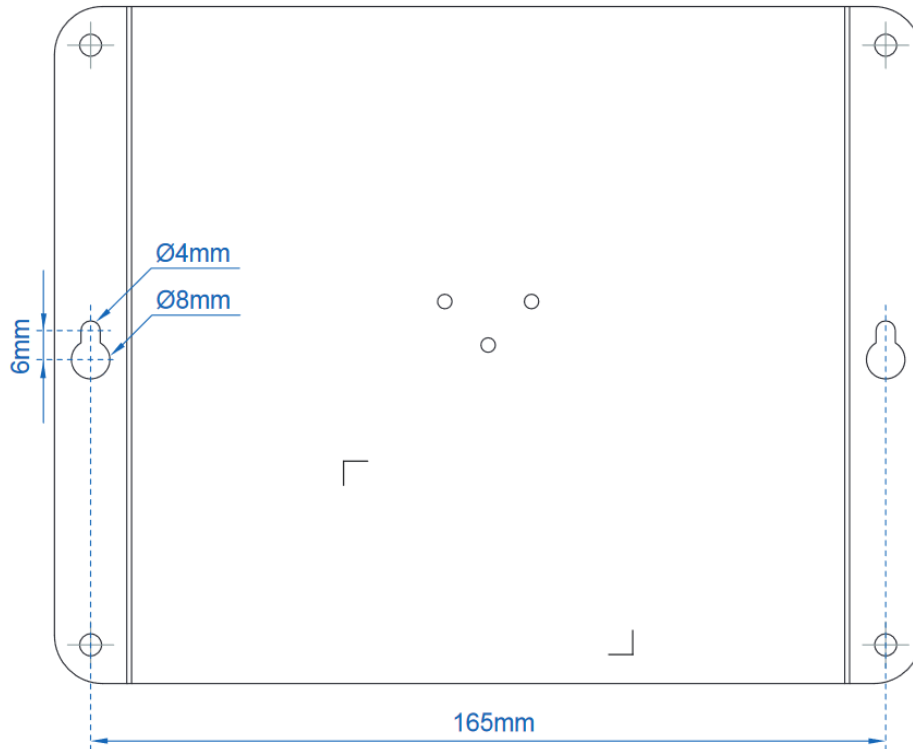
1. Network Router
2. Network Router Power Supply (Supplied)
3. Power Cord (Supplied)
4. Optional (for use with 5-12 PdMAEYEs)
  - a. Sub-Network Switch
  - b. Sub-Network Switch Power Supply (Supplied)
  - c. Power Cord (Supplied)

## Location

Review the Dimensional drawings shown in Figure 9 to aid in selecting a suitable location to mount the Local Network Router and the Router Power Supply. The Network Router Power Supply (without Power Cord) Dimensions are: 58 x 35 x 133 mm (2.3 x 1.4 x 5.2 inches). The location should allow for the Power Supply and the WAN & LAN Ethernet cables to be plugged into the Network Router. See the PdMAEYE Local Network Connection Diagrams section below for more information.

When selecting a suitable location, ensure that there is enough room for adequate airflow around the Network Router. If possible, it's best to locate the Power Supply to one side of the Network Router rather than above or below. If it's not possible to locate it to one side or the other, it would be best to mount the Power Supply below the Network Router.

# PdMAEYE System Connectivity Guide



*Figure 9 - Network Router Mounting Hole Dimensions*

## Mounting

### Network Router

The supplied network router is a wall mount device and is approximately 180 x 140 x 24.4 mm (7.1 x 5.5 x 0.9 inches) (W x D x H) and weighs approximately 738 g (1.6 pounds).

After finding a suitable location to mount the Local Network Router and Router Power Supply, perform the following installation steps.

1. Use the mounting hole dimensions shown in Figure 9 below as a guide, mount the Network Router to the surface. The Network Router can be oriented in any direction, however, if possible, it's best to mount it so the Touch Screen can be read.
2. Attach the Power Supply using the method determined above.

### Power Supply

There are no mounting holes or brackets available for the Network Router Power Supply. You will have to determine a suitable mounting method such as wire ties, higher temperature rated Velcro, custom made bracket, etc. When finding a suitable location, ensure the power cord is plugged into the power supply. The Power Supply (without Power Cord) Dimensions are: 58 x 35 x 133 mm (2.3 x 1.4 x 5.2 inches).

# PdMAEYE System Connectivity Guide

If possible, it's best to locate the power supply to one side of the computer rather than above or below. If it's not possible to locate it to one side or the other, it would be best to mount it below the Network Router.

## Sub-Network Switch (for use with 5-12 PdMAEYEs)

For installations that have 5-12 PdMAEYEs per PdMAEYE Control Computer, an additional 8 port Type 2 POE network switch will have to be used in conjunction with the PdMAEYE Network Router. Mount the Sub-Network Switch and its Power Supply using the same instructions as the Network Router.

## PdMAEYE Local Network Connection Diagrams

For connections to the Network Router refer to Figure 10 and to the appropriate section below (Connections for up to 4 PdMAEYEs or Connections for 5-12 PdMAEYEs).

1. Connect the Ethernet cable from the PdMAEYE Control Computer to the WAN Port on the Network Router.
2. Connect the Ethernet cable from each PdMAEYE to the LAN Ports on the Network Router.
3. Connect the Router Power Supply to the Power (48-54VDC) Jack on the Router.

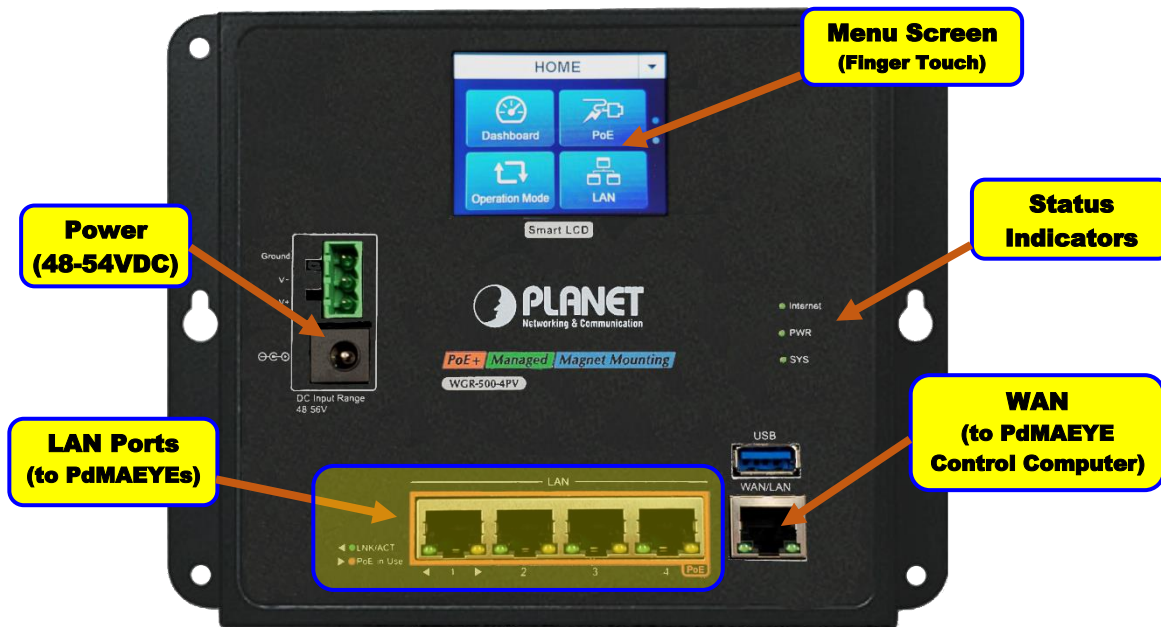


Figure 10 - Network Router



# PdMAEYE System Connectivity Guide

## Connections for up to 4 PdMAEYEs

The PdMAEYEs connect to LAN Ports 1 – 4 of the Router and the PdMAEYE Control Computer connects to the WAN Port of the Router (see Figure 11).

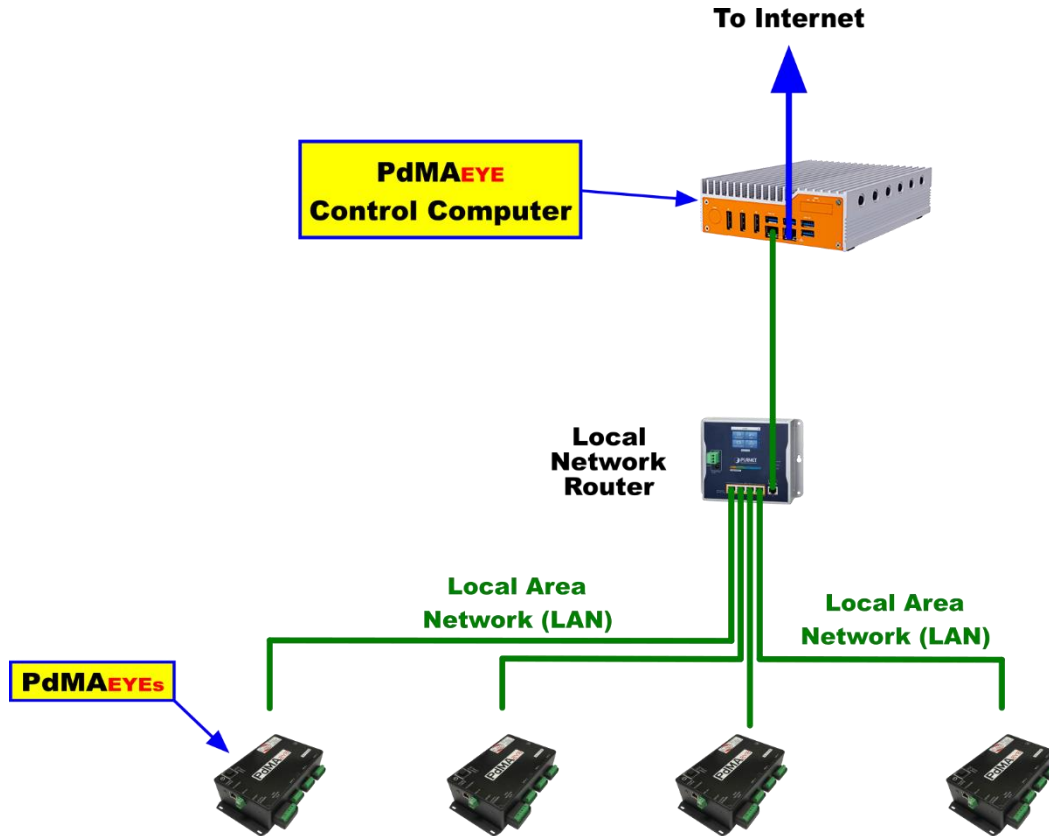


Figure 11 - Connections for 1-4 PdMAEYEs

# PdMAEYE System Connectivity Guide

## Connections for 5-12 PdMAEYEs

For installations that have 5-12 PdMAEYEs per PdMAEYE Control Computer, an additional 8 port Type 2 POE network switch will have to be used in conjunction with the PdMAEYE Network Router as shown in Figure 12. In this configuration, 3 PdMAEYEs will be connected to the PdMAEYE Network Router and the remaining 4 – 10 PdMAEYEs will be connected to the Network Switch

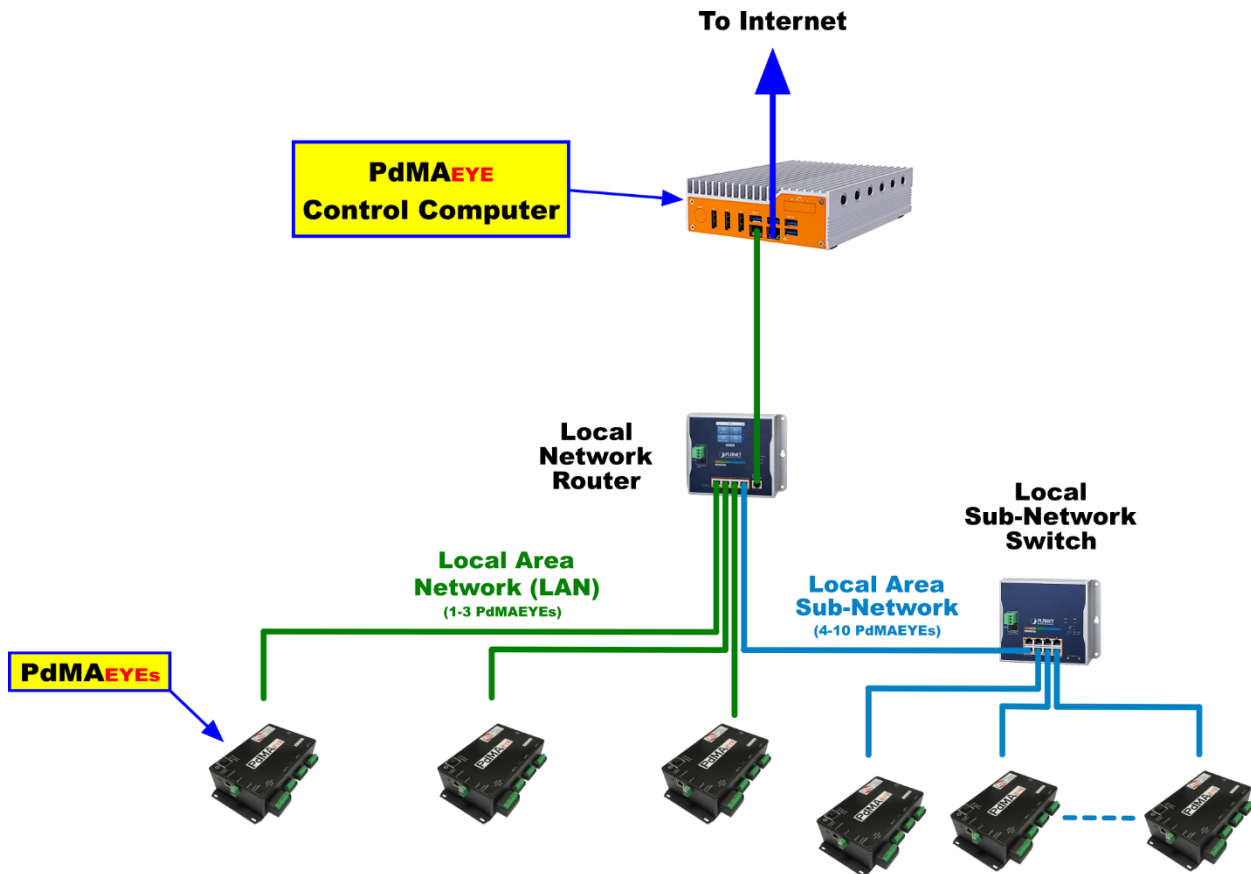


Figure 12 - Connections for 5-10 PdMAEYEs

## Network Router Operation

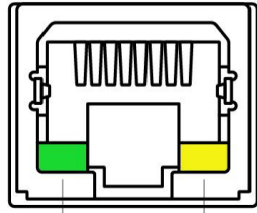
The Network Router has been pre-configured for ease of installation. When connected to power and the internet the Status Indicators should both be lit.

## Status Indicators

Standard Ethernet communication status LEDs located on each LAN port of the Network Router provide communication status according to the table shown in Figure 13.

# PdMAEYE System Connectivity Guide

LED	Color	State	Function
Link	-	Off	LAN link is not established
	Green	On	LAN link is established
		Blinking	LAN activity occurring
Speed	-	Off	10 Mb/s data rate
	Green	On	100 Mb/s data rate
	Yellow	On	1000 Mb/s data rate



Link LED (Green)      Speed LED (Green/Yellow)

LAN activity light description

**Figure 13 – LED Communication Status Guide**

# PdMAEYE System Connectivity Guide

## Outdoor Cellular Router (Optional)

In some cases, an Outdoor Cellular Router may be required for operation of the PdMAEYE System. Follow the instructions below for installation and connection of the Outdoor Cellular Router.

### Components

You should find the following components included with the Outdoor Cellular Router (see Figure 14 for pictures):

1. Computer
2. 1 x USA Outdoor 4G Router
3. 4 x Omni Antenna
4. 1 x 30-foot LAN Cable
5. 1 x 48V PoE Adapter
6. 1 x Mounting Set & Tools

#### 2.1 Package contents

- 1 x Outdoor MIMO 4G router
- 4 x Omni antenna
- 1 x 30-foot Outdoor LAN cable
- 1 x 48Volt PoE injector
- 1 x Mounting set and tool
- 1 x Cable gland



Figure 14 - Outdoor Cellular Router Components

### Preparation and Mounting

Follow the steps below to prepare the Outdoor Cellular Router for Preparation and Mounting.

#### 1. Insert SIM Card

# PdMAEYE System Connectivity Guide

Use the hex wrench to loosen 4 pieces of hexagon bolts and open the metallic case. Insert Standard SIM card into the SIM card slot. Make sure SIM card pins are facing down and notch is inside.



## 2. Install External Antennas

Install the “main” 4G antenna on the left base connector. Install another 4G antenna on the right connector. The Wi-Fi antenna is on the middle position. Twist the connector clockwise to fix antennas on the router.



# PdMAEYE System Connectivity Guide

## 2.2 Port, switch and indicator



### 3. Connect External Ethernet Cable

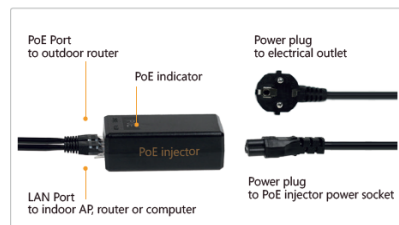
Connect the External Ethernet cable from the Cellular Router to the POE inserter (injector).

#### 3.6 PoE injector

Use the power cord to connect PoE injector to the electrical outlet. The green indicator on PoE injector will turn on.

There are two RJ45 ports on the PoE injector.

- Connect PoE port to the outdoor router via LAN cable.
- Connect LAN port to computer or router also via LAN cable.



# PdMAEYE System Connectivity Guide

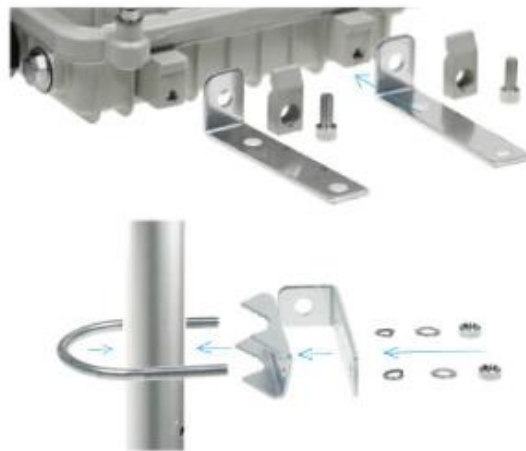
## 4. Connect Ethernet (LAN cable) to Cellular

Take apart the cable gland, and through the LAN cable. Plug the RJ45 connector into the router. Screw on the barrel screw, insert rubber stopper, and screw down the cap.



## 5. Install on a Pole

Clasp the pole with U-bolts and holders. Attach the L-shape brackets on the holders. Put spring washers, washers, and bolts on U-bolts then tighten the bolts.



# PdMAEYE System Connectivity Guide

## Installation of Hi-Gain Log-Periodic Antenna

In cases where the Cellular signal is weak, an additional antenna may be required. The Hi-Gain Log-Periodic Antenna will be sufficient for most installations. Follow the recommendations below:

- Used when cellular signal strength is weak in the area.
- Used ONLY when the signal strength is weak in the area and the included antennas will not pick up a signal from the nearest cell tower.
- Mount Antenna as high as possible especially if the Cell Tower is far away.
- Requires connecting cable between the “Hi-Gain” Log-Periodic Cellular Antenna and the Cellular Router.





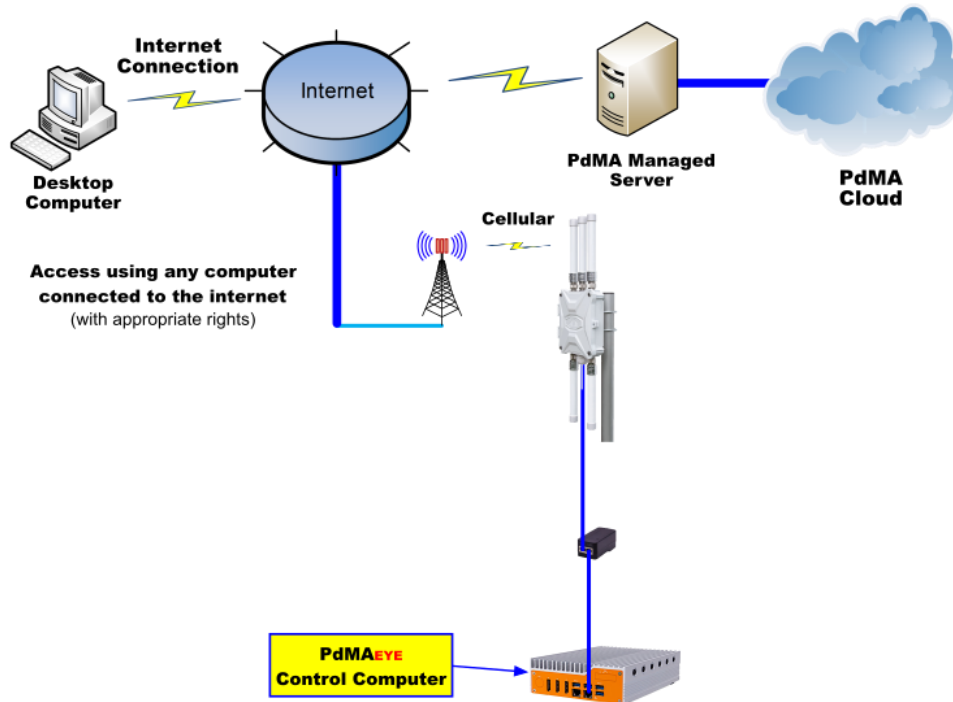
# PdMAEYE System Connectivity Guide

## Connections

Choose the installation below based on use of the High Gain Antenna.

### Cellular Router Only

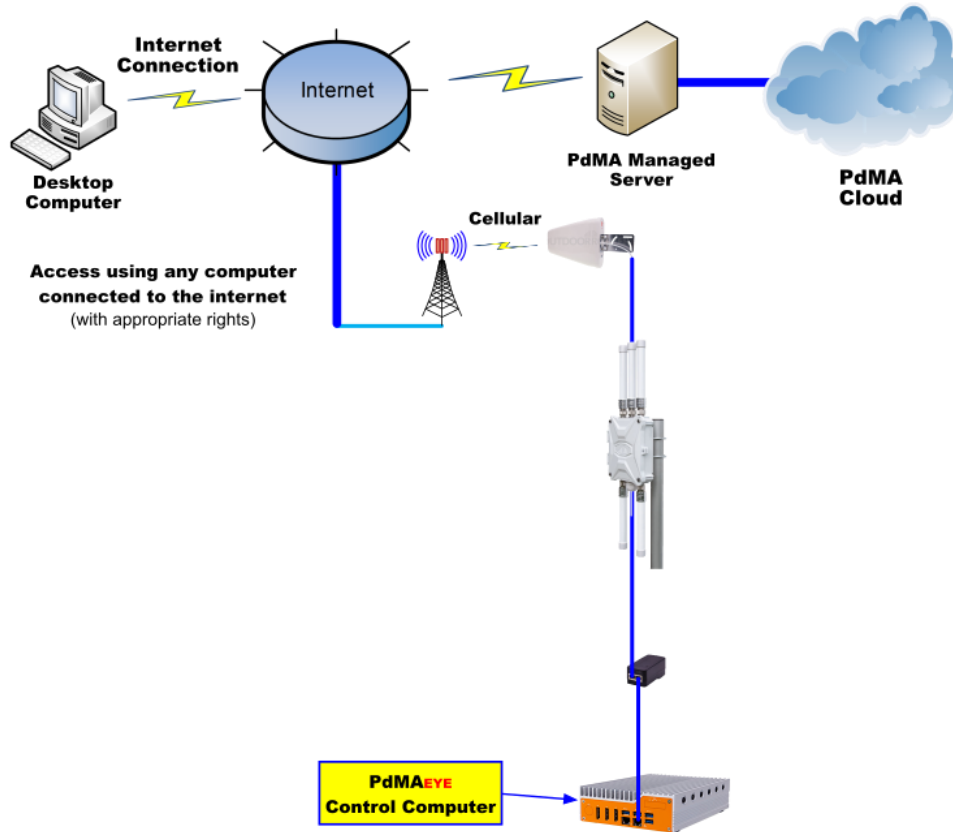
1. Connect Cellular to POE Inserter
2. Connect POE Inserter to PdMAEYE Control Computer



# PdMAEYE System Connectivity Guide

## Cellular Router with High Gain Antenna

1. Connect High Gain Antenna to Cellular Router
2. Connect Cellular to POE Inserter
3. Connect POE Inserter to PdMAEYE Control Computer



# PdMAEYE System Connectivity Guide

## Cellular Operation

Once Outdoor Router and accessories are installed, follow the guide below and ensure the Indicators on the Cellular Router show the appropriate indications as shown.

### 2.3 Indicator description

Indicator	Status	Description
PoE power	Red Off	Connected to PoE power source No input PoE power
System	Green Off	System is turn on Router is power off
Signal	Green flash Off	Has data flow through 3G/4G or Wi-Fi No data flow

# PdMAEYE System Connectivity Guide

## PdMAEYE System Updates

### Process of updating Firmware

1. PdMA will coordinate with the customer for the firmware update. Most firmware updates will be done automatically. In rare cases the hardware may need to be sent to PdMA for a firmware update.
2. When a firmware update is ready it will be downloaded to the PdMAEYE Controller.
3. The PdMAEYE Controller will secure the surveillance and scheduled tests.
4. The PdMAEYE Controller will send the firmware update to each PdMAEYE.
5. The PdMAEYE will automatically update to the new firmware.
6. Once all firmware on all PdMAEYEs is updated, the PdMAEYE Controller will resume operation as before.

### Process of Adding or Updating Hardware

1. PdMA will coordinate with the customer for adding new hardware or updating existing hardware.
2. Customer will install the new hardware.
3. Contact PdMA if there are any questions when commissioning the new hardware.
4. If any hardware must be returned to PdMA, PdMA will generate an RMA number and give instructions accordingly.

# **PdMAEYE System Connectivity Guide**

## **PdMAEYE System Hardware Calibration**

1. Calibration is only needed if a company requires an annual calibration.
2. Only the PdMAEYE Base Module requires calibration. New or Replacement Signal Conditioning Modules (SCMs) sent to the Field – DO NOT need calibration.
3. Calibration requires returning hardware to PdMA.

## **PdMAEYE System Recovery Scenarios**

### **Power Failure Recovery**

1. Self-Reboot – in the event of a power failure, the PdMAEYE System including the PdMAEYE Control Computer, Local Network Router/Switch, and the PdMAEYEs all have the ability to self-reboot.

### **Communication Loss**

1. Reconnect to all PdMAEYEs – should local network communications be lost for any reason to one or more PdMAEYEs, the PdMAEYE Control Computer will re-establish network communications.
2. Reconnect to MCEGold – should communications to Webservices be lost for any reason, the PdMAEYE Control Computer will re-establish communications.
3. PdMAEYEs that have lost network communications will indicate an Abnormal Status on LED # 2 as discussed in the section “Power and Operational Status Indicators”.

### **Situations From Which the PdMAEYE System Is Not Able to Recover**

1. A customer’s IT department closes ports which are needed for the system to operate.
2. A customer’s IT department closes internal access of the system to the internet.
3. A customer’s IT department re-assigns IP addresses without updating the system or working with PdMA Technical Support.