PDU 5.0 Manual

Version 1.04

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Chapter 1. Introduction

Located at the heart of all European data center hubs, in the Czech Republic, our Power Distribution Units have been manufactured since 2008 using local components. Our mission is to engineer the most reliable Power Distribution Units (PDUs). We focus on refining and perfecting PDUs to meet demands of today's data centres, industrial facilities and any environment where reliable power distribution is critical. We recognise the unique nature of each project and underscore the importance of tailored solutions. Our intelligent energy meters and switching hardware are developed in-house at our advanced facility to align with the requirements of your data center or project, ensuring quality and precision, with a focus on efficiency and seamless integration into existing infrastructure.

We stand out with our customer-centric approach, offering custom-built PDUs to specification, whether you need one or one hundred units, at no extra cost. Our distinguishing factor lies in delivering PDUs and Inline meters with fast delivery times, even with a minimum order of just one unit. Our commitment to speed and efficiency ensures a rapid turnaround time, making us a one stop shop for PDU projects.

Beyond quality and service, we are commited to sustainability. We produce durable, high-quality PDUs that minimise waste and reduce environmental impact. Our efficient manufacturing process generates virtually no waste, with all by-products being recycled.

The CONTEG Power Distribution Unit is fully configurable and allows customers to connect a variety of power appliances. The PDU allows remote management through a number of protocols which allow users to monitor metered sockets and receive alarms on custom thresholds.

Our PDUs are known for reliably distributing power for many years and can be equipped with options such as alternating phase, different outlet options, circuit breakers, RCM, surge protection, plug types, cable inlet position, cable length, chassis color and many more.

While we strive to provide accurate and up-to-date information in this manual, please be aware that there may be occasional errors in the text and descriptions.

1.1. PDU 5.0

Developed in collaboration with over 40 datacenter operators, PDU 5.0 sets a new standard in PDU design. It's modular design features three ESD-safe, hot swappable module options:

Figure 1. a PDU 5.0 Communication module

One of the major changes in the concept of our previous generation and PDU 5.0 are three hot-swappable communication module variants; the replacement of the display by NFC connectivity and a LED ring for direct status information. As a result of the PDU 5.0 development the intelligence does not have to be limited by microcontroller hardware within a PDU anymore, but intelligent PDU 5.0's for existing environments also remain available. The ability to have the software centralised open up new features that were not possible before, with substantial increases in hardware performance as this approach requires only PDUs acting as data conduits.

- A PDU with Gateway module; A high performance data conduit for connecting to EnerTEG Platform, providing central intelligence while aggregating all PDUs with surrounding third party systems.
- A PDU with Controller module; Embedded intelligence and APIs in the form of EnerTEG Lite. Can be used as any other PDU. Connects to third party systems through for example SNMP.
- A PDU with Daisychain module; Daisy-chainable extension module for the Databus of either a PDU with a Gateway module or a Controller module.

> ℹ️ Each Controller module (with EnerTEG Lite) or Gateway module (EnerTEG Platform) equipped PDU can have have up to 100 PDUs total connected to it's Databus (that is including the Controller module or Gateway module PDU). This means that 100 PDU can be accessed in total using only one IP address.

Both the embedded EnerTEG Lite and EnerTEG Platform for desktop/server of our EnerTEG works for collecting, controlling and interpreting data from multiple PDUs and is one of the main improvements in PDU 5.0. EnerTEG Platform can also be described as a DCIM-Lite or advanced Power Monitoring System; an advanced but lightweight counterpart to a complex and expensive DCIM with real-time PDU support and monitoring.

Features

- A modern intuitive user-oriented interface.

- Exceptional performance level of the entire system.

- A hardware design and enclosure built from the ground up.

- A modular and scalable approach from hardware to software enables future expandability.

- CONTEG's revised Databus design provides fast access to up to 100 PDUs on a single IP address.

- Use only modules that the data centre really needs, with the ability to scale up easily.

- Most PDUs include costly and underutilized displays, we use NFC connectivity to not only reduce potential points of failure and lower overall costs, but to enhance the user experience in difficult to reach places.

- Our free to use NFC PDU Display App allows access and insight in individual PDUs.

- Toolless ESD-safe hot swappable Communication module in three variants. This ensures that a defective PDU can be replaced without the need to dismantle it. This allows for updates, replacement or maintenance without powering down the actual PDU. An upgrade or dowgrade path is available for a PDU to all (future) Communication modules available, they are interchangeable.

- The snap-on mechanism is equipped with a self-seeking connector which attaches a Communication module onto the PDU profile easily.

- PDU Display App; an NFC App. Monitor your PDU using a tablet or a smartphone through the use of our PDU Display App via NFC. The NFC connection provides direct access to detailed measurement data from the moment of scanning. Hold an NFC capable device near the NFC antenna on the module to retrieve the data. No need to read small displays in hard-to-reach places.

- The built-in LED ring around the edges of the PDU provides a visual indication of the status of the PDU, changing color and patterns to signal a status or alert situation.

- Two USB connectors for sensors and supported pheripherals. This means high data transfer speeds, plug-and-play convenience and a large optional pherepheral compatibility.

- Gigabit 1000mbit Ethernet on the Gateway module and Controller module; with the ability to add another network interface for redundancy.

- 2 redundant high-performance RJ45 Databus connectors for up to 100 PDUs total on a single IP address.

- Databus and Ethernet activity and status LEDs to provide extra information on the connection.

- A Non-blocking connector layout. There is never a need to disconnect a cable before another can be inserted in an adjacent port.

- Easy reset; reset the PDU by removing and reattaching the module.

- Modular design; new Communication module options designed in the future can be used to upgrade existing PDUs.
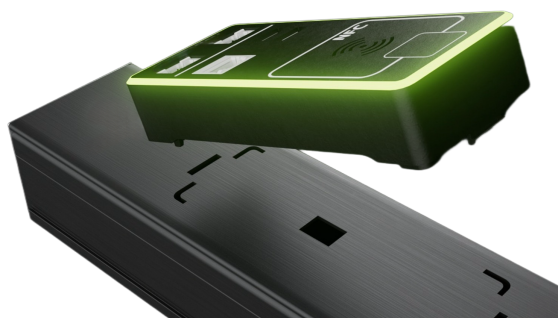

Figure 2. Hot Swappable Communication module

Usage examples

1. (Multiple) network ring(s) with a Gateway module PDU and multiple Daisychain module PDUs; Put a PDU in the network with a Gateway module, and equip the remaining PDUs with Daisychain modules. The PDUs with the Gateway modules serve as communication hub to the advanced EnerTEG Platform software, with Daisychain modules working together to transmit all data via the Gateway modules. This configuration is the most cost-effective and comprehensive, our most advanced PDU monitoring and management software option.

2. (Multiple) network ring(s) with Controller module PDUs and multiple Daisychain module PDUs on the databus; Put Controller module PDUs on the network and connect the remaining PDUs with Daisychain modules to the databus of Controller module PDUs. Each PDU with the Controller module acts as an intelligent but independent PDU with familiar APIs (running on EnerTEG Lite) as an individual communication hub, while the Daisychain modules collaborate to transmit all data to the Controller modules.

3. Each PDU equipped with a Gateway module; Equip each PDU in your server rack with a Gateway module. Each PDU integrates seamlessly with the EnerTEG Platform software without daisy-chaining, allowing monitoring and management through invividual connections via the centralized EnerTEG Platform software with the same benefits as option one.

4. Each PDU equipped with a Controller module; Equip each PDU in your server rack with a Controller module. Every PDU operates independently without daisy-chaining, each PDU has it's own EnerTEG Lite instance for intelligence and it's APIs for monitoring and management.

Figure 3. Usage impression

1.1.1. Controller module (EnerTEG Lite)

For datacenters preferring a traditional approach, the combination of a PDU with a Controller module provides a built-in solution where PDU intelligence, APIs and the web interface are embedded directly into the module. This combination runs the EnerTEG Lite version of our EnerTEG software. Network communication is possible by using the Gigabit ethernet port which integrates directly in (existing) DCIMS and power management solutions in data centres through a variety of interfaces.

Figure 4. PDU 5.0 Controller module

> **ⓘ** While EnerTEG offers all standard features and most APIs from our previous generation PDUs, it has many new and advanced features because of the EnerTEG Lite embedded software.

1.1.2. Gateway module (EnerTEG Platform)

Unlike traditional PDUs, which embed intelligence within each unit, the Gateway module PDU offers the opportunity to shift the intelligence to a central server or computer device with EnerTEG Platform installed. This approach optimises the hardware required within the PDU as it functions as a data conduit which significantly reduces cost. This opens up a new performance level and a feature-set that was not possible before and is not possible otherwise.

Figure 5. PDU 5.0 Gateway module

> **ⓘ** The performance is no longer limited by internal PDU hardware, and the seamless communication with any DCIM or similar solution is only improved further with full support of a wide array of API protocols.

The PDU has a Gigabit Ethernet connection. Because the Gateway module uses a safe and custom developed API language for communication, a PDU equipped with this module is compatible only with the EnerTEG Platform software solution.

1.1.3. Daisychain module (Expansion)

The Daisychain module enables easy expansion of the PDU 5.0 network via the Databus connections of a Gateway module or a Controller module PDU. PDUs with a Daisychain module therefore do not require an Ethernet port which saves up on costs. In a Databus ring configuration of up to 100 PDUs total, only one Gateway module or Controller module PDU is required to communicate, which saves up on IP address space.

Figure 6. PDU 5.0 Daisychain module

> ℹ️ A Daisychain module PDU shifts intelligence to a Controller module PDU with EnerTEG Lite or to an EnerTEG Platform instance via a Gateway module PDU, minimalizing component or resource overhead.

1.2. Safety Information and Precautions

This section contains basic safety information and precautions to take. The CONTEG PDUs are designed for continuous operation with the power distribution and the control over measuring and switching separated. This means that while updating or restarting or replacing the (communication module of the) PDUs, power distribution is not interrupted.

The CONTEG PDU has been designed for use in data centers where equipment has to meet very high demands, especially regarding reliability. The Intelligent PDU however may not be applied in surroundings where a malfunction in the PDU can have consequences for life support systems. Life support systems include any devices designated as "critical" by the U.S. FDA. Such systems are found not only in medical environments such as hospitals, but also on offshore platforms, in petrochemical plants, in air traffic control centers, etc.

A CONTEG intelligent PDU may not be opened by unauthorised personnel. In the event of malfunction or faults in the PDU, please refer to the warranty conditions. CONTEG, spol. s r.o. will not accept warranty claims if the PDU has been opened or alterations have been made.

- Please pay attention to the operation conditions before installation and operation of the CONTEG PDU.
- The CONTEG PDU has to be protected according to the valid installation guidelines. The rated value of the in-series protective device may not exceed the maximum value indicated on the product.
- The CONTEG PDU may not be used in: a humid environment, a seriously contaminated environment or outdoors.
- The manufacturer's warranty on the CONTEG PDU becomes invalid when the QC sticker on the side of the profile is broken.
- Before turning on the PDU for the first time, make sure that it has been allowed to acclimatise to the ambient temperature for at least 24 hours. Major temperature fluctuations can lead to the formation of condensation in the PDU if this guideline is not followed.
- Please keep in mind that the maximum allowed temperature for a metal enclosure is 70 °C for installation in a normal location and 90 °C for installation in a restricted access location.
- Fuses and automatic fuses in the PDUs are intended as short-circuit and overload safeties and NOT as disconnecting switches for rendering the PDU or plug sockets free of current.
- When PDUs are equipped with over-voltage protection it is required to inspect the over-voltage protection and the respective over current protection (when applicable) on a regular basis.

Chapter 2. Product Specifications

This chapter contains the product specification for our PDUs and the available software options.

2.1. PDU Main Specifications

Specification	Parameter
Product type	Rack PDU
Product range	• Basic (no power monitoring) • Basic Plus (upgradable to power monitoring) • Metered (power monitoring per phase and breaker) • Monitored (power monitoring per phase, breaker and outlet) • Switched (power monitoring per phase and breaker, switchable per outlet) • Managed (power monitoring per phase, breaker and outlet, switchable per outlet) • Inline Meter (power monitoring for existing basic PDUs)
Country of origin	Czech Republic
Registered WEEE code	230039411
HS code	85369095
Cable length	From 0.5 meter to 25 meter (standard 3 meter)
Cable specification	1P 16A 3G2.5 / 1P 32A3G6 / 3P 16A 5G2.5 / 3P 32A 5G6 / 3P 63A 5G10 Low smoke zero halogen
Cable plug / chassis input	• Input position is customisable (top, bottom, front or rear) • 1P 16A; IEC60309 1P+N+PE 6hr, CEE 7/3, C14, C20, BS 1363, Wieland GST18I3, T13, T23, Terminal connection, Phoenix QPD • 1P 32A; IEC60309 1P+N+PE 6hr, Terminal connection, Phoenix QPD • 3P 16A; IEC60309 3P+N+PE 6hr, Wieland GST18I5, Terminal connection, Phoenix QPD • 3P 32A; IEC60309 3P+N+PE 6hr, Terminal connection, Phoenix QPD • 3P 63A; IEC60309 3P+N+PE 6hr
Chassis length	Minimum 209mm up to maximum 2400mm
Chassis width	65mm
Chassis depth	52.5mm / 105mm
Net weight	Configuration dependent
Chassis	Anodised aluminium chassis with laser engraving. Optional personalised engraving, feed indication, logo, article number and more
Mounting position	Vertical 0U / Horizontal 1.5U
Chassis colour	Black / Red / Blue / Green / Yellow / Orange / Silver

Specification	Parameter
Outlet type	IEC Lock; C13; C19; Combi (C13, C15, C19, C21); IEC320 C13; IEC320 C19; CEE 7/3 Schuko; CEE 7/5 UTE; BS 1363; GST 18I3; T13; T23; IEC60309 16A 250V 1P+N+PE; Exit lead w/ IEC60309 1P/3P+N+PE 6hr
Outlet quantity	Basic & metered PDUs: up to 108 outlets; Monitored, Switched & Managed PDUs: up to 60 outlets
Circuit breaker options	Thermal, hydraulic magnetic, MCB or melt fuse
Dimensions communication module	25 mm x 55 mm x 135 mm
Warranty	2 years repair or replace, warranty can be extended to 3, 4 or 5 years
Number of units in package	Maximum 2 PCE in one cardboard packaging, optional bulk packaging or packaging-free delivery
Package dimensions	12cm x 32cm x depends on PDU length (HxWxL); packaging is always 20cm longer than the PDU length
Package weight	Configuration dependent

2.2. PDU Technical Specifications

Specification	Parameter
Input voltage	230 VAC (1 phase), 230 / 400 VAC (3 phase)
Input current	10A / 16A / 32A / 63A
Load capacity	1P 16A 3.7kVA, 1P 32A 7.4 kVA, 3P 16A 11.1kVA, 3P 32A 22.2kVA, 3P 63A 43.6kVA
Ambient air temperature	Minimum -5° Celsius to maximum 60° Celsius
Relative Humidity	Minimum 5% to maximum 95% non-condensing
Power Consumption	Maximum 5 Watt
Frequency	50/60 Hz
Wire Colours	L1 = Brown, L2 = Black, L3 = Grey, N (neutral) = Blue, PE = Yellow/Green
Outlet Controls	Power on sequencing with customizable delays, Last known state power-on, Remote switching of individual outlets or groups, Bi-stable latching relays, N-ZVS (Near-Zero Voltage Switching)
Optional Surge Protection	Dehn type 3 hot-swappable surge protection module
Optional Residual Current sensor	Optional residual current measurement, RCM type B - AC (mA) and DC (mA)
Sensor capabilities	Up to 32 sensors daisy-chained, 16 per USB-A port maximum
Warning	Operation of this equipment in a residential environment could cause radio interference

2.3. PDU Certifications and standards

Specification	Parameter
Accuracy	± 0.5% on inputs, branches and/or outlets (see separate accuracy statement)
EMC	EN55032 / CISPR 32, EN55035 / CISPR 35, EN61000-3-2 / IEC 61000-3-2, EN61000-3-3 / IEC 61000-3-3
CE Mark	2011/65/EU (RoHS Directive), 2014/35/EU (Low Voltage Directive), 2014/30/EU (EMC Directive), 2014/53/EU (RED)
ISO	ISO 9001 : 2015
Environment	Indoors IP20; Lead Free, Mercury Free, RoHS Exemption Information, Ecovadis

2.4. PDU Power Measurements

CONTEG PDUs can be fitted with several options to add intelligence. Intelligence can be found at three different levels

- Input/phase metering (not switchable)
- Branch metering - e.g.: a 32A single phase PDU is divided into two fused 16A branches (not switchable)
- Outlets (metering and/or switching options)

When metering is applied, the PDU is capable of measuring a number of quantities, either at the input, branches, outlets depending on the PDU configuration.

Measurement	Unit
Voltage	V
Voltage dip and peak	V
Current	A
Current Peak	A
Neutral current	A
Watts	W
Apparant Power	VA
Reactive Power	VAr
Energy	Wh
Apparant Energy	VAh
Residual current	mA
Total Harmonic Distortion	%
Crest factor	CF
Frequency	Hz
Power Factor	%

2.5. PDU Sensor Measurements

A PDU can be equipped with sensors; currently there are temperature, humidity and dry switch contact options available.

Measurement	Unit
Temperature	°C
Relative Humidity	%
Dry Switch Contacts (NO/NC)	0-1

2.6. PDU Outlet Switching

PDUs can be equipped with switchable outlets allowing the user to remotely switch outlets on and off using N-ZVS (Near-Zero Voltage Switching). The relais used for switching are bi-stable, this means that the relais does not require power to keep it in it's current state. The relais can only switch state when a correct switch command is sent.

If a PDU is equipped with switchable outlets, the option to set the power up/down behaviour of outlets on power loss can be configured. The following options are available:

- No switching on power up; At a power loss all outlets are switched off. At power up, all outlets are kept in the off state. This results in the PDU booting up while any power draw on connected devices is prevented.
- System-wide outlet delay; At power loss all outlets are switched off. At power up, all the outlets are set one by one to their last known state by respecting the fixed system-wide outlet delay.
- Individual outlet delay; At power loss, all outlets are switched off. At power up, all the outlets are set to their last known state, but delayed by the individual outlet delay plus fixed system-wide outlet delay
- No switching on power down; In this mode outlets are not switched in case of a power loss, they will be in the exact same state at power on as they were before the power loss.

For each switchable outlet, an individual outlet delay can be set in the PDU which will be used by the options where mentioned above.

2.7. PDU Branch Metering

The PDU may be equipped with branch metering. A branch can have multiple outlets. Each branch can optionally be equipped with a fuse. A PDU can be equipped with different options for branch metering. Branches are fully supported in PDU 5.0 and EnerTEG.

2.8. Communication module Connectivity

Type	Usage
1 Ethernet port	The Ethernet port (if available, depending on Communication module choice) is used to establish a network connection to either EnerTEG Platform or to existing power management software or a DCIM through the APIs of EnerTEG Lite.
2 Daisychain ports	The daisy chain ports can be used to daisy chain up to 100 PDUs on one IP address on the Databus.
2 USB ports	The USB ports are used for sensors and other pheripherals.
LED Ring	The LED ring gives direct insight in the current status of the PDU.
NFC Connectivity	The NFC connectivity is used as a local interface to the PDU using our PDU Display App.
Base Connector	The self-seeking base connector on the back of the module connects the communication module to the PDU.
2 Service ports	These ports on the back of the Communication module are for servicing the module (by CONTEG personnel only). Do not attempt to use these ports.

- The PDU can be reset by removing and reattaching the communication module

2.9. PDU Additional Features

On top of the specifications, connectivity and measurements; a list of features which are saved or processed withing a PDU. Check the PDU interfaces to see which and how these features, values and settings are available in that interface.

- PDU firmware updates through the use of EnerTEG Platform or EnerTEG Lite.
- Improved branch intelligence (if equipped): per branch the breaker type is retrievable, the maximum rating and also to which phase the branch belongs. It knows when it's tripped.
- Improved outlet intelligence: per outlet the outlet type is retrievable, the maximum rating, and also to which branch and phase the outlet belongs. And of course the on or off current state.
- If the outlets are switchable, they can be switched but also power cycled. There is a customizable delay per outlet for power cycling.
- Support for optional neutral current measurements.
- Support for optional residual current measurements.
- User configurable identification settings such as name and location.
- Input type and maximum rating is available.
- Outlet switching can be set on or off if a PDU is equipped with switchable outlets.

Settings are saved in the 'base' print within the PDU profile, this means that when a module is swapped or upgraded, the settings in the PDU are retained even after a new module is installed.

2.10. EnerTEG

EnerTEG is our Power Monitoring software for PDU 5.0. Depending on the type of Communication module mounted on the PDU, EnerTEG Platform or EnerTEG Lite is supported. Because EnerTEG Platform installed as a virtual machine on a server centralises all Gateway module PDUs, it has more advanced features compared to a Controller module PDU with the EnerTEG Lite software embedded on the Communication module; An increased amount of devices in the system is allowed, there is support for our third generation PDUs and more advanced reporting and system integration.

Overview

Feature	EnerTEG Platform	EnerTEG Lite
Maximum number of PDUs in system	10.000	100
Maximum number of Databus rings supported	1000	1
Maximum number of PDUs in one ring (single IP address)	100	100
Measurements refresh rate	Once/s	Once/5s
Auto discovery of new added Databus PDUs	Yes	Yes
Aggregation of measurements on room/row/rack level	Yes	Yes
Supports CONTEG generation 2 and 3 devices	Yes	No
Multiple roles and permissions	Yes	Yes
Configurable thresholds for all measurements (warnings/alerts)	Yes	Yes
Dashboarding	Advanced	Basic
Creation of reports	Advanced	Basic
Scheduling of reports	Yes	No
Export of data to files or database	Yes	Yes
Logging and auditing	Advanced	Basic
Back-up (configuration, log files)	Yes	Yes
Updating	Yes	Yes
PDU Communication module Compatibility	Gateway module	Controller module
Type of software	Virtual machine software	Embedded software on Controller module
Installation	Externally on server or computer	Embedded software on Controller module
Scalability	Supports up to 10.000 PDUs with performance limited only by the capabilities of the server / computer	Supports up to 100 PDUs and is limited to the capabilities of the Controller module hardware
DCIM integration	Full integration	Standard integration
Supported protocols	HTTP/HTTPS, REST API, SNMP V2C & V3 (including traps), SMTP, NTP, LDAP, SSH	HTTP/HTTPS, REST API, SNMP V2C & V3 (including traps), SMTP, NTP, LDAP, SSH

Feature	EnerTEG Platform	EnerTEG Lite
Security protocols	Strong password config, user & role management, Active Directory, LDAP/S integration, SSL/TLS 1.3, HTTPS	Strong password config, user & role management, Active Directory, LDAP/S integration, SSL/TLS 1.3, HTTPS
User management	Customizable roles, permissions and group management	Customizable roles, permissions and group management
Control and alerts	Configurable thresholds for all measurements on PDU and room/row/rack level	Configurable thresholds for all measurements on PDU and room/row/rack level
Threshold type	Fourfold: critical and warning thresholds, and upper and lower thresholds can be set across all PDUs / branches / outputs / inputs possible through an innovative rule-setting system, also configurable from system-wide to Data centre element level.	Fourfold: critical and warning thresholds, and upper and lower thresholds can be set across all PDUs / branches / outputs / inputs possible through an innovative rule-setting system, also configurable from system-wide to Data centre element level.
Alert notification	Optional E-mail dispatch of alerts or notifications	Optional E-mail dispatch of alerts or notifications
Real-time monitoring	All PDU measurement values	All PDU measurement values
Inputs, branches and outlets measurements	Voltage, voltage dip and peak, current, current peak, neutral current, watts, apparant power, reactive power, energy, apparant energy, residual current, total harmonic distortion, crest factor, frequency, power factor	Voltage, voltage dip and peak, current, current peak, neutral current, watts, apparant power, reactive power, energy, apparant energy, residual current, total harmonic distortion, crest factor, frequency, power factor
Data dashboarding	Advanced	Basic
Data logging and reporting	Advanced	Basic
PDU Monitoring and management	Multiple PDU (PDU 5.0 and generation 2/3) and their Databus rings	PDU 5.0 (Controller module) PDU plus up to 100 (Daisychain module) PDUs on the Databus
Environmental monitoring	Supports sensors for temperature, humidity	Supports sensors for temperature, humidity
Backup options	Configuration, log files	Configuration, log files
Updating functionality	Yes	Yes
Report creation	Reporting of all measured values in tabular and graphical form, optionally available as an Excel download.	Reporting of all measured values in tabular and graphical form, optionally available as an Excel download.
Scheduled reports	Yes	No
Data insight	Overviews with data of multiple PDUs, rooms, rows, racks, and also detailed views of PDU or inlet / branch & outlet specific measurements.	Overviews with data of multiple PDUs, rooms, rows, racks, and also detailed views of PDU or inlet / branch & outlet specific measurements.

2.11. Dehn overvoltage protection module

When a PDU is (optionally) equipped with a Dehn surge protection module, it will be connected in the normally closed position on the sensor connector. This has the effect that the first dry switch contact in the PDU will be closed. This is the expected behaviour; the contact will open when the protection fails. The status of the Dehn module can therefore be read via the PDU. If the dry switch is closed the module is OK, but if the dry switch is open the module needs to be replaced.

Chapter 3. Getting Started

Please use the information in the following section to inspect, install and connect the CONTEG PDU 5.0 and all optional mentioned accessories.

3.1. Package Contents

The CONTEG Intelligent PDUs are shipped in a cardboard box. Where applicable, dispose the packaging material in a responsible manner, in accordance with local regulations. All of the materials used for packaging can be recycled. Immediately after receipt, check whether you have received your order in a complete and undamaged state.

The following items are delivered for each PDU:

- Fixing materials: these can be attached to the PDU (19'' or table-mounting brackets), or are delivered separately if they have been ordered separately.
- The installation manual (one per shipment).

> ℹ️   The PDU User Manual can also be found online at https://www.conteg.com/

Each CONTEG PDU is individually tested according to the EN 50110 standard. Test reports with detailed test information are available on request (please contact our support department at presales@conteg.com).

CONTEG, spol. s r.o. aims to be a socially responsible corporation. Therefore, it makes great effort to minimise the impact of our products to our planet during production as well as during operation. Packaging consists of recyclable materials and CONTEG asks their customers to save them for future use or to dispose of them with applicable regulations.

3.2. Unpacking and First Inspection

After opening the cardboard box and removing the packaging material, the PDU should be checked visually. The PDU should not be put into operation if damage is detected in a way that safe and proper operation cannot be guaranteed. In such cases, please contact CONTEG, spol. s r.o.. Note that, in the case of PDUs that are equipped with an overvoltage protection, the overvoltage protection and the respective overcurrent protection (if applicable) must be inspected on a regular basis.

> ⚠️   The PDU may only be cleaned by wiping off the enclosure with a clean dry cloth.

3.3. Installation Requirements

Installation of our PDUs comes with the multiple requirements.

The following tools are needed to install the PDUs:

- Cage-nuts with bolts and washers.
- Suitable screwdriver.

Before installing and using the system, check whether the characteristics of the electrical system to which connection is to be made correspond to the product specifications.

- The CONTEG PDU 5.0 has been designed for connection to electrical systems that comply with IEC 60364.
- The voltage, maximum permitted current and the number of phases must be correct. This information can be viewed on our app using the NFC connection.
- The maximum permitted power must be taken into account with regard to the maximum length and the diameter of the connecting lead.
- The values and characteristics of the in-series protective devices must match the PDU and the protective elements included in it.
- The environmental factors must correspond to the product specifications.

3.4. Safety

This manual contains important safety instructions that should be followed during installation and operation of the PDU. Please read this manual carefully since there may be serious or fatal personal injury and damage to the equipment if the safety instructions, warnings and directions are not complied with. Also please save this document for future use.

- The PDU must be installed in a restricted access location.
- Socket-outlet must be installed near the equipment.
- Socket-outlet must be easily accessible.
- Installation by expert personnel only.
- After installation: default passwords MUST be changed.

> ⛔ Installation, maintenance and inspection of the CONTEG PDU 5.0 must be carried out by adequately trained persons according to EN 50110-1, with full observance of the specifications of EN 50110-1.

Chapter 4. Installation

4.1. Mounting the PDU

There is a broad variety of mounting options for CONTEG PDUs.

The following mounting accessories can be purchased from CONTEG

- C14/C20 plugs if C13/C19 outputs are used.
- Different types of attachment brackets.
  - 19" rack mounting brackets.
  - Toolless Mounts.
- Customer Specific solutions related tools.

Please check https://www.conteg.com/ for further details regarding the accessories.

4.1.1. Horizontal Mount

Each 19" rack bracket of a PDU has holes for horizontal mounting in 19" racks. The holes are positioned so that an appropriate fixing hole is always available for a PDU with a profile height of 1.5 U. Using one or two of the four holes allows mounting without wasting space.

Figure 7. Horizontal Mount

4.1.2. Vertical Mount

In case of a PDU for vertical mounting, the connection lead is fed through a hole in the upper, bottom or front face.

4.1.3. Toolless Mount

Figure 8. PDU Toolless Mount

'Toolless Mounts' are attachment points on the rear of the profile that allow the PDU to be hung in the cabinet without using tools. Toolless Mounting can be done as single PDU or double PDUs. In case of two parallel PDUs the overlapping brackets must be joined together using self-cutting screws in smaller holes on the standard bracket.

Figure 9. Toolless Mount

4.2. Connecting the PDU

This section provides the required information for connecting and powering up a PDU.

4.2.1. Ethernet

Connecting the PDU to a Local Area Network (LAN) provides communication through the Gigabit Ethernet network. Multiple PDUs can share the same ethernet connection by using the Databus. The RJ45 connector for the network cable must be plugged into the Ethernet port:

Connect the RJ45 Ethernet cable to the Ethernet port of the PDU and to the Ethernet connector of the LAN device; when properly connected and when both devices are powered on, the status LEDS will blink.

4.2.2. Daisychaining Multiple PDUs on the Databus

There are two RJ45 Databus ports available for daisychaining multiple PDUs on one IP address. The databus ports have no particular designation of communication direction (in or out). We therefore advise to connect the databus cables as seen in the schematic below. The Databus in the CONTEG PDU uses CAT5 patch cables. PDU 5.0s can support up to a total of 100 PDUs on the Databus.
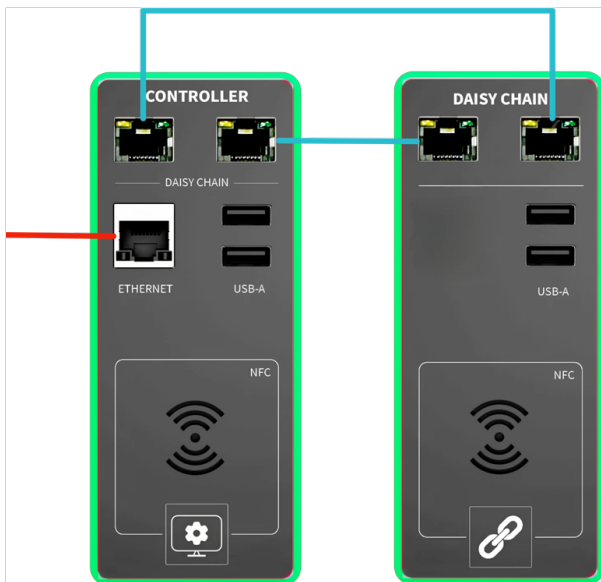
Figure 10. Daisychain Connection Scheme

Connect a twisted pair (category 5, e.g. Ethernet cable) between Databus port A of both PDUs and an identical cable between Databus port B of both PDUs to close the ring. Connect the network cable to the Ethernet port of the Controller module.

The entire Databus is hot-pluggable, so that PDUs can be added or removed at any time and the ring can also be "open". But it is recommended to close the ring before connecting power as it improves on ring redundancy.

4.2.3. Sensors and dry switch contacts

AdaptiveSensors continuously monitor the ambient conditions and ensure optimum operating conditions. The data can be integrated into other systems remotely or via potential-free contacts. A door handle control provides additional access protection to the racks. The sensors can be connected directly to the PDU, without additional control units, and support up to 32 sensors per PDU. A robust data protocol ensures reliable transmission over longer distances, while alarms are forwarded remotely or via potential-free outputs to detect critical conditions immediately.

AdaptiveSensors type	Temp	Temp/Hum	2 Input	4 Input 2 Output
Properties	· Temperature measurement	· Temperature measurement · Humidity measurement	· 2 digital input contacts for connecting a door contact · Also suitable for other devices (status monitoring)	· 4 digital input contacts · 2 output contacts · Use as potential-free outputs, alternatively to control a door handle (external power supply unit required)
Measuring range	0 °C–70 °C	0 °C–70 °C (Temp) 0–100 % rel. (Hum)	_	_
Measurement accuracy	+/- 1 %	+/- 1 % (Temp) +/- 5 % (Hum)	_	_

Figure 11. Sensors

- Continuous monitoring of temperature, humidity, door status and general IT components inside and outside the rack.
- The data can be integrated into other monitoring systems remotely (e.g. SNMP) or via potential-free contacts.
- Physical control through direct control of the door handles.
- Direct connection to the rack PDU without additional control units.

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- Connection of up to 32 sensors to each individual PDU.
- Reliable data transmission over lengthy bus connections.
- Forwarding of alarms additionally via potential-free outputs in order to recognise and address function-impairing situations.

> **ℹ** Compatible sensors are automatically recognized in the PDU; the interfaces are updated accordingly. Use CONTEG and compatible sensors only, also, do not connect CONTEG sensors to other devices.

4.3. Preparing the PDU for powerup

A PDU should be powered up with a module attached on first power-up.

4.3.1. Placing a Communication module

It is important before placing the module to look at the proper orientation and to prevent accidentally damaging the equipment. The Communication module is designed to fit in one way onto the PDU profile. The base connector is of the self-seeking kind and should enable the user to guide the module to proper placement during the Communication module installation. Always be gentle when placing a Communication module onto a PDU profile.

Communication module placement procedure

1. If not already assembled, unpack the Communication module.
2. Remove protective cover from PDU profile if required.
3. Grab the assembled Communication module with two hands.
4. Analyse the placement at the PDU profile and chack the back side of the Communication module to make sure it will be placed correctly.
5. Press with both hands the top and bottom of the Communication module enclosure while holding it above the PDU profile.
6. Guide the Communication module onto the PDU profile.
7. The Communication module clicks into place.
8. The Communication module is secure.

> **!** Always check if the Communication module is properly secured and has latched into place properly after placement procedures.

4.3.2. Removing a Communication module

There might be different reasons for removing or replacing a module, which include:

- Upgrading the PDU. A PDU can be upgraded between a Controller module, a Gateway module and a Daisychain module. The PDU will accept the module and keep it's settings and measurement data, this is saved in the PDU itself and not in the module.

- Resetting the PDU in case of an issue.

- In unfortunate case; Replacing a defect module with a new one.

When removing a Communication module, the module should detach without using a considerable amount of force. Always be gentle when disconnecting a Communication module to prevent any damage to the communication module or the PDU profile.

Communication module removal procedure
1. Press on the upper and low sides of the Communication module enclosure.
2. Make sure the snap-on mechanism does not keep the PDU attached to the PDU profile anymore.
3. Take the module gently off the PDU profile.
4. Package the Communication module to protect it from dust and scratches.

> A Communication module is equipped with it's own unique serial number which can be read through the software, but is also readable on a sticker on the back of the Communication module.

4.4. Powering the PDU

This section provides information about powering on the PDU and connecting to the EnerTEG user interface for the first time.

4.5. First startup

If a Communication module is attached to the PDU profile, the PDU can be supplied with power. Always check that the phases are connected correctly, improper connection of power leads can damage the PDU short-term or long-term. When the PDU receives power it will boot up. During the boot process the LED ring will show a blue color. In case of a Gateway module the LED ring remains blue after a boot, but changes to a green color when data is requested from the PDU by EnerTEG.

After the Controller module has booted succesfully, the LED ring will become green when EnerTEG Lite has booted and starts requesting data from the PDU. So in this case, if the LED ring does not become green in under a minute ({embedded_name should be booted by now}) there is a technical issue, in that case please contact presales@conteg.com. Now the PDU is ready for first use.

4.6. Initial configuration

4.6.1. Controller module

1. Connect the PDU with the Controller module to a LAN network.

2. Access the EnerTEG Lite software of the PDU by entering the IP address assigned by DHCP in a browser, use http://pdu5-[serial_number].local or 169.254.1.10 if DHCP is not available.

3. Login on the browser with default login (admin, admin).

4. Create a Data centre structure (room, row, rack) in EnerTEG (see chapter 'Data centre structure'), navigate to a rack and assign PDU(s) to the rack.

> **ℹ** To change the IP address of a Controller module, go to the general EnerTEG settings and click on Network ETH0. Set DHCP to off to start using a static IP address. Fill in the IPv4 address and a subnet prefix length. Save the changes and wait until the changes are processed.

> **ℹ** Should a Data centre structure not exist yet and the PDU is not assigned, it's still possible to add the PDU to an SNMP monitoring tool.

> **ℹ** If the IP address of the PDU is not known (the default is 169.254.1.10), the actual DHCP IP address can also be obtained via scanning the PDU with the mobile app. Download and install the PDU Display app. Use the app to obtain the PDU device info.

> **ℹ** EnerTEG Lite supports Link-Local address autoconfiguration. An address from the 169.254.0.0/16 block is automatically assigned if the DHCP does not respond. This is also supported by all operating systems such as Windows and Linux. EnerTEG Lite can then be accessed by navigating to http://pdu5-[serial_number].local (e.g. http://pdu5-119411.local).

4.6.2. Gateway module

The CONTEG EnerTEG Platform software for use with Gateway module PDUs is available as an "OVF" file for installation in a virtualization product.

1. After EnerTEG Platform has been installed and is running, create a Data centre structure (see chapter 'Data centre structure').

2. Connect the PDUs with Gateway modules to a network.

3. Go to EnerTEG Platform in a browser and login (administrator first login; user: admin, password: admin).

4. Go to the Settings menu.

5. Make sure to set the EnerTEG URL correctly to allow for PDU firmware updates.

6. In the Connections section of the Settings menu, PDUs can be added by clicking "Add new connection" to enter the menu.

7. Select the correct device type, use username and password: admin / admin (which is the default password).

8. Enter IP address of the Gateway module assigned by DHCP or use the 169.254.1.10 default IP address when DHCP is unavailable.

9. After clicking "Apply" the software will automatically adopt the Gateway module PDU and all daisy chained PDUs connected to it.

10. Navigate to a rack.

11. In the rack menu it's possible to assign PDUs to the rack by clicking on "Assign device to rack".

12. The rack menu will show a list of all unassigned PDUs. Assign as many PDUs as desired to the rack.

13. As soon as devices are assigned, values are calculated for the rack. The charts will start adding data but it may take at least one hour for the first data to arrive.

In case there is no DHCP server available, the IP of the Gateway module defaults to address 169.254.1.10. The Gateway module does currently not support Link-local addressing.

To change the IP address of the Gateway module, add it to EnerTEG. To change the IP address of a Gateway module, navigate to the Network ETH0 settings in the configuration menu of the PDU. Set DHCP to off, then enter a static IP address and a subnet prefix length. Save the changes and wait until the changes are processed.

Should a Data centre structure not exist yet and the PDU is not assigned, it's still possible to add the PDU to an SNMP monitoring tool.

If the IP address of the PDU is not known, the actual DHCP IP address can also be obtained via scanning the PDU with the mobile app. Download and install the PDU Display app. Use the app to obtain the PDU device info.

4.6.3. Daisychain module

1. Connect to another CONTEG Controller module or Gateway module PDU on the databus of the device via a standard network (UTP CAT5) cable.

2. The PDU is automatically recognized by the Controller module or Gateway module PDU.

3. As the Controller module or Gateway module is likely to be already known in EnerTEG (in case of a Gateway module, add it as a connection), the Daisychain module PDU can be used directly.

4. Assign the Daisychain module in EnerTEG to a rack.

Chapter 5. Interfaces

This is information about how to use the interfaces of the PDU

5.1. EnerTEG Lite (embedded on Controller module PDUs)

To use the EnerTEG Lite that is embedded within a Controller module PDU, an operational Ethernet connection is required from the PDU to the device that is used to access EnerTEG Lite.

> **ℹ** Due to the many features, APIs and options of this software interface, EnerTEG Lite has a separate manual which can be found on the CONTEG website.

5.2. EnerTEG Platform (for use with Gateway module PDUs)

To use the EnerTEG Platform in combination with Gateway module PDU(s), PDU Generation 2/3 or other supported devices, not only an operational Ethernet connection is required to the computer or server that will run EnerTEG Platform, but also an installation process.

> **ℹ** Due to the many features, APIs and options of this software interface, EnerTEG Platform has a separate manual which can be found on the CONTEG website.

5.3. LED Ring

In PDU 5.0, a visual feature is added to provide vital status information directly to the user. Users should be able to determine the status of a PDU and connected equipment in the blink of an eye. If there are (power) issues with the equipment in a rack or the PDU, the lightring can signal events / alerts visually. A multicolour lightring is embedded in the Communication module enclosure. This lightring can also be used as a location identifier for that specific PDU via the EnerTEG interface.

The light ring consists of four LEDs, which provide light to all sides of the enclosure. The LED light is transported to the light ring using light guides mounted inside the enclosure. The light guide transmits the light of each individual LED (that reside on the PCB) to the outside of the enclosure, creating a 'ring' of light around the enclosure.

> **ℹ** The four LEDs are RGB LEDs, which give the option to use multiple colours. The LEDs can be addressed individually within our firmware to create patterns which increases visual possibilities, including the option to individually power them on or off or to use a ramp up (and down) for the brightness.

5.3.1. Overview and purpose of the LED ring

State	LED color	Sub states
Startup	Bootloader	Startup
		Firmware update
	Application	RPi startup
		Configuration
		Internal databus setup
		Daisychain ring setup
		Ethernet setup
	Error (blink)	
Normal Operation	Normal Operation	Normal Operation
		Low load
		Medium Load
		High Load
		Switching
		USB state change
Events	Warning	Warning Unconfirmed
		Warning Confirmed
	Alarm	Alert Unconfirmed
		Alert Confirmed
	Error (blink)	Network connection lost (Controller/Bridge)
		Ring Connection lost (Daisychain)
		Hardware error
		Bootloader error
NFC	Communicating (blinking or rotating)	Communicating
	Error (blink) for 3 seconds	Error (blink)

Figure 12. LED ring status overview

5.4. Second Ethernet interface

A PDU Communication module can be equipped with a second Ethernet adapter via the USB port to supply an additional second Ethernet interface. This means that the PDU can be accessed from separated networks.

ℹ️ Currently, the only available interface on the second Ethernet adapter is Modbus.

❗ Only use Ethernet adapters supplied by CONTEG, as specific drivers for that Ethernet adapter need to be specifically implemented. On many operating systems USB devices are 'plug and play', generally meaning there is an extensive driver library available. As the USB ports on PDU 5.0 are connected to the internal microcontroller running a custom OS, each driver has to be implemented manually.

5.5. PDU Display App / NFC Interface

CONTEG PDU 5.0 Communication modules are all equipped with a NFC module, this provides the possibility to view the measurement data and settings of a PDU 5.0 via the PDU Display App. The PDU Display App was developed to replace the display that many PDUs in the field are equipped with. In PDU 5.0, there is no need for a fixed display on a PDU anymore, as those displays were not always used in practice what can make them a rather expensive feature. It's function, to display PDU measurement and configuration data is of course crucial, so we've moved that functionality to a new level using a modern approach, much more convenient with better display options. A server rack can contain a lot of equipment and experience a huge amount of airflow. The PDU may be mounted in a hard to reach position in a rack, which make it difficult to read on location. With our PDU Display App, only a short moment of scanning is required, which makes going through great lengths to read a display an experience of the past. Assessing PDU data in the field now has become a much improved user experience.

Figure 13. PDU Display App Using NFC

> ⚠️ When a scan is performed, a snapshot of the PDU measurements and settings is transferred from the PDU to the PDU Display App via NFC. There is no live connection with the PDU after the scan. To update the PDU data in the app, a new scan has to be performed.

5.5.1. Requirements and Installation

The PDU Display App will be available for Android and can be downloaded and installed via the Google Play App Store.

> ⚠️ NFC must be enabled in the connection settings on the phone for the PDU Display App to function correctly

Manual APK installation:

1. Contact CONTEG to download the PDU Display App APK file.
2. If you download the APK from a browser, it may find the APK to be a security risk.
3. Provide access by changing the settings to allow to install apps from unknown sources.
4. Install the app (the phone does not have to be in developer mode).
5. Make sure that NFC is enabled on the phone and launch the app.

5.5.2. Scanning a PDU

After the installation of the PDU Display App, launch the PDU Display App. Click on scan PDU.

Figure 14. Start scan on PDU Display App

Hold the phone on the NFC area marked of the PDU to transfer the required data to the PDU Display App.
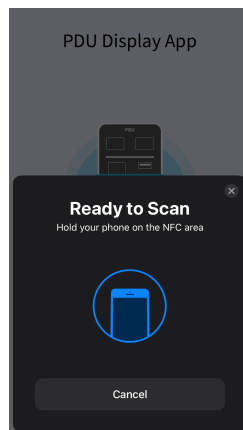

Figure 15. Ready for transmission on PDU Display App

As there is a significant amount of data sent in some cases, the connection might be improved when holding the phone still after holding it near the NFC field area.
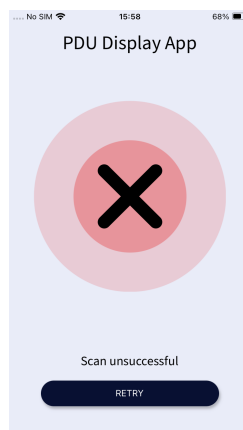

Figure 16. Scan failed on PDU Display App

When the PDU Display App indicates that the transfer has suceeded, the phone can be withdrawn from the NFC area and the PDU Display App can be used.

Figure 17. Scan success on PDU Display App

- In most cases, the NFC chip is located at the top of the phone, on the backside of the phone.
- Move the phone in an angle so the phone NFC antenna is in the middle of the NFC field on the communication module.
- The best connection can be achieved by holding the phone 0-3cm above the communication module NFC antenna.
- The most stable connection can be achieved by holding the phone at the same distance during the scan process.
- Moving it up and down during the scan process can lead to an increased chance of losing a packet during larger data transmissions.

 Most phones are fully compatible with the passthrough NFC mode that the PDU Display App uses.

5.5.3. Measurements

The user can view numerous measured values of the PDU in the PDU Display App. For Branches and for Outlets there is an overview and a detail view for the information per branch or per outlet. Important is that the data available in the app after a scan is the data that was measured near the moment of the scan, which is essentially a snapshot in time and not live data.
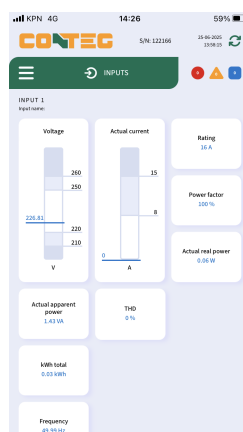

Figure 18. Inputs screen on PDU Display App

The PDU Display App shows (measurement) data on:

- Input(s), branches, outlets & totals
- Network configuration and device information

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Chapter 6. Technical Support and Warranty

6.1. Technical support

Please contact us in case there are questions regarding our products:

T: +420565300358
E-mail: presales@conteg.com
Website: https://www.conteg.com/

6.2. General terms and conditions

The general terms and conditions can be found at: https://www.conteg.com/general-business-terms-and-conditions