

## WHITE PAPER

# 4PPoE: STANDARD SPECIFICATIONS FOR PLANNING AND INSTALLATION

The updated European Standard EN 50174-1/-2 incorporates a whole series of important innovations. This White Paper provides an overview.

The Power over Ethernet Standard governs the power supply of devices via data cables. Power over Ethernet (PoE) obviates the need for a separate power supply to connected devices, and helps to cut costs.

The first standard for PoE – IEEE 802.3af – with a maximum output of 15.4 watts was adopted back in 2003. Over the past few years the use of PoE devices has increased greatly in popularity, and so it became imperative to increase the available remote power supply output.

The standard current since 2018, IEEE 802.3bt for 4PPoE (4-pair PoE), had an output of up to 90 watts. European standard EN 50174-x was adjusted accordingly so that data networks could be designed to operate with PoE and 4PPoE.

### EN 50174 (10/2018)

EN 50174 is a series of standards for planning and implementing an installation in the field of structured premises cabling in accordance with EN 50173. The most recent version, published in 2018, contains important amendments and extensions compared with earlier versions. One of the most important innovations are the installation guidelines for 4PPoE-compliant cabling.

The standard is divided into three parts:

- Part 1: installation specification and quality assurance
- Part 2: installation planning and installation practices in buildings
- Part 3: installation planning and installation practices in the open

The first two parts will be examined in detail below.

The first part of the standard, EN 50174-1, corresponds to VDE 0800-174-1. But what is new?

### EN 50174-1: Technical specification

The technical specification of a planned cabling system must accurately describe the requisite transmission characteristics of the cabling to be installed. In particular the desired output of a remote power supply (PoE) must already be accurately defined at the planning stage.

### EN 50174-1: Definition of the RP Category

Even prior to the actual planning stage it must be established for which remote powering category or RP category the data network is to be designed. Here there is a choice between three power categories:

**RP1:** average current for all conductors does not exceed 212 mA [POE+] – for the use of individual PoE applications

**RP2:** average current for all conductors restricted to a fixed value between 212 mA and 500 mA – for more extensive PoE applications

**RP3:** current maximum 500 mA on all conductors – for 4PPoE on all links simultaneously

### EN 50174-1: Input for planning, installation and administration

Categories RP1, RP2 and RP3 have different requirements as regards the planning, installation and administration of remote powering systems:

RP1 needs to be administered by means of documentation – both during connection of the operating equipment as well as in the event of subsequent extensions. No additional input on planning and installation is necessary.

RP2 requires both extended planning and installation input as well as administration by documentation.

RP3 requires extended planning and installation input plus documentation. No additional input is necessary, however, in regular operation.

In all cases the data cabinets must be labelled accordingly.

### EN 50174-1: Summary

The operator must decide jointly with the planner whether or not PoE is to be implemented.

If the decision is “no”, planning takes place as previously (for example with Datwyler IT Infra’s data cable CU 7080 4P and KS-T Plus modules). Should the decision be “yes”, an RP category (RP1, RP2 or RP3) must be determined.

### Recommendations

If the latter decision is taken we recommend that the following be borne in mind:

1. As a rule the service life of a structured premises cabling system is 25 years, sometimes even more. It should be assumed that in future PoE applications will play an increasingly major role.
2. The administration for RP1 and RP2 in operation is very complex. An RP3-compatible installation, on the other hand, provides full capability – with no administrative input in operation.

### EN 50174-2: What is new?

The second part of EN 50174 describes the planning and evaluation of remotely powered installations, among other things in relation to the effects of raised temperatures which can occur when remote powering is used.

For RP3 installations this is covered in section 4.11.2.2. RP2 installations are covered in Annex C. RP1 installations do not require any specific planning or evaluation as regards raised temperatures; however the use of extendable remotely powered applications may be restricted.

Especially with the RP3 variant there are restrictions on the length of the transmission links – as a result of cable heating due to ambient temperature and due to the remote power supply.

### EN 50174-2: Calculations for RP3

The necessary bases of calculation are given in the standard and in the diagram below. The basis is Table 4 of EN 50174-2 – Influence of cable temperature ( $T_{global}$ ) on the (technology-independent) link length. It shows the installation link (Permanent Link, PL) for a total 10 metres of patch cable:

$T_{global}$ [°C]	20	25	30	35	40	50	60
Length PL [m]	90	88	87	85	83	76	70

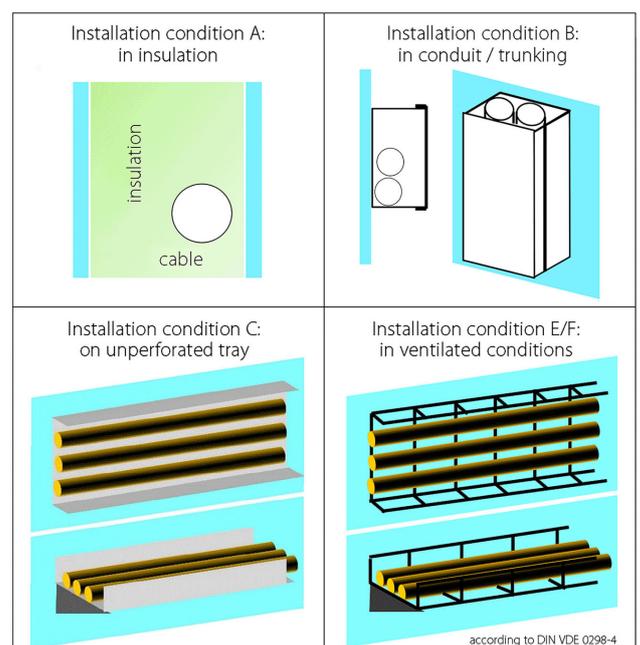
$T_{global}$  results from the length-dependent influences of the anticipated ambient temperature and the type of cable installation. The calculation is based on this formula:

$$T_{global} = \frac{1}{L} \times \sum_{n=1}^n (T_{ambient-n} + \Delta T_n) \times L_n$$

### EN 50174-2: Temperature of cable bundles, depending on installation conditions (Annex B)

EN 50174-2 also describes the possible installation conditions. Each section along a permanent link – from the panel to the data socket – must be evaluated with regard to the planned installation environment so as to ensure that the temperatures remain within the permissible limits.

These installation conditions are denoted by A, B, C and E/F – see the diagram below based on DIN VDE 0298-4:



**EN 50174-2: Temperature changes with different cable bundle sizes for an RP3 installation**

The table below shows the figures for calculating cable bundle temperature ( $\Delta T$ ).

This in turn is needed to calculate the total possible cable length. It is based on Table 5 of EN 50174-2 – Temperature changes with different bundle sizes depending on ohmic resistance and cable diameter (example for installation condition B = in conduit / trunking, see page 2).

		Installation condition B (in conduit / trunking)								
		Number of cables (N)	6	12	24	48	72	96	144	216
Cable R and D		$\Delta T$ in °C								
0.095 $\Omega/m$ 0.005 m	$\approx (0.8 \times N + \frac{0.12 \times \sqrt{N}}{D}) \times R$	6.0	9.0	13.0	19.5	25.0	29.5	38.0	**	
0.075 $\Omega/m$ 0.007 m		3.5	5.0	7.5	12.0	15.0	18.5	24.0	32.0	
0.065 $\Omega/m$ 0.0077 m		2.8	4.0	6.0	9.5	12.5	15.0	19.5	26.0	

**Conclusion**

In view of the 25 year-long service life of structured cabling, it is recommended that copper data networks be designed to RP3, the highest power category. The implementation of PoE devices

RP2 und RP3, with RP1 having the lowest requirements and RP3 the highest.

RP1 requires no special planning and only a low administrative input in operation. RP2 and RP3, however, require extensive planning and calculations.

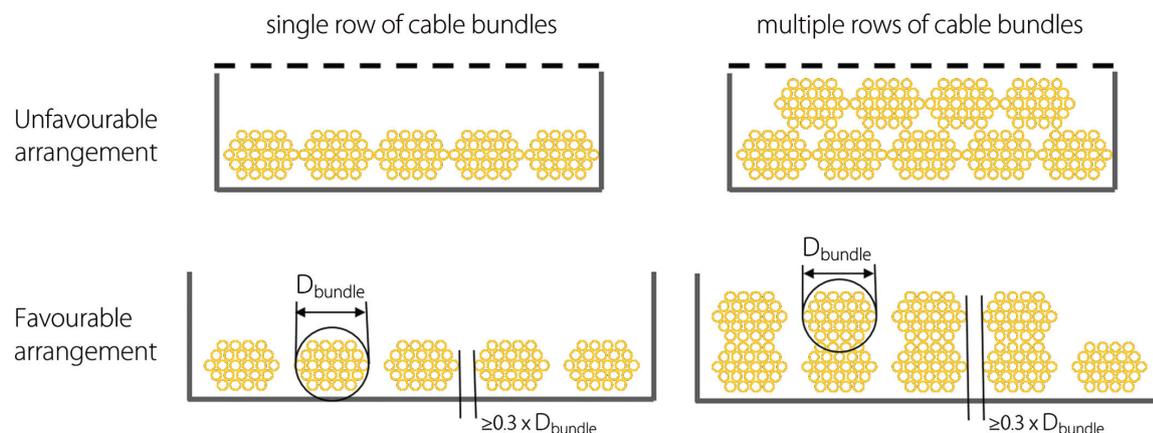
In RP3 installations in particular a large copper cross-section is advisable in order to avoid risking any reduction in the permissible lengths.

**EN 50174-2: Measures for reducing heat generation**

There are several possible ways of separating the cable bundles from each other in order to reduce the effects of heat during remote powering.

Appropriate instructions are given in section 6.4 of the standard.

The principle is illustrated in the images below:



is only a question of time. Planning is required by the standard for RP2 and RP3. But the planning input is not insignificant.

This means that practicable simplifications are desirable.

**Help in selecting cables**

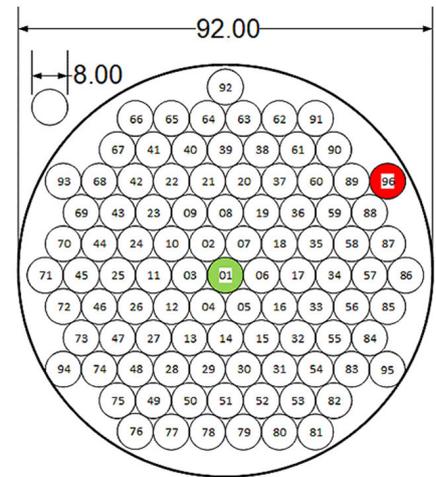
Datwyler IT Infra has created a table in order to simplify cable selection (see page 4). For dimensioning to RP3

**EN 50174-2: Summary**

The second part of the standard describes the requirements relating to the planning and installation of remote powering in buildings. There are three categories, RP1,

this table shows the range of the most important cable types for the permanent link – depending on ambient temperature and a realistic bundle size. This table takes

Ambient temperature [°C]		20	20	20	40	40	
Bundle size (see graphic)		1	24	96	24	96	
Cable type	CU 662	92	91	90	88	87	Length PL [m]
	CU 692	94	93	92	90	89	
	CU 7060	90	89	88	86	85	
	CU 7080	94	93	92	90	89	
	CU 7120	94	93	92	90	89	
	CU 7702	98	97	97	94	93	
	CU 7150	102	101	101	98	97	



account of short partial lengths with cable routing in a heat-insulated environment (e.g. in an insulated cavity wall). An individual calculation may be necessary for exclusive cable routing in an insulated environment.

### New icons

Based on this table Datwyler will provide its copper data cables with an additional icon on the website and in future publications. This icon gives the length for the Permanent Link for a bundle of 96 cables at an ambient

temperature of 40 °C (see the right-hand column of the table) under Category RP3 conditions.

Here, for example, are the four icons for the five shielded data cables in the table above left:

