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Cable App

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The CableApp uses the correction factors defined in the tables IEC 60364-5-52. This allows the user to tailor a circuit rating for their given prescribed installation. These correction factors cover the following parameters: ambient temperature (air, and ground where appropriate), soil resistivity, depth, proximity of multiple circuits for ladder, tray, direct in ground and in ducts in the ground.

Rating Factor Type	Correction Table Reference in IEC 60364-5-52	Applicable Installation Method & Ratings Table(s)
Rating factors for ambient air temperatures other than 30°C Ambient.	Table B.52.14	Installation method A1, A2, B1, B2, C, F, G Tables: All
Rating factors for ambient ground temperatures other than 20°C Ambient.	Table B.52.15	Installation method D, Tables B.52.2 to B.52.5
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Rating factors for more than one circuit, cables buried directly in the ground.	Table B.52.18	Installation Method D2, Tables B.52.2 to B.52.5
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Calculations (for MV cables) (Top)

The CableApp uses the correction factors defined in the tables IEC 60502-2. This allows the user to tailor a circuit rating for their given prescribed installation. These correction factors cover the following parameters: ambient temperature (air, and ground where appropriate), soil resistivity, depth, proximity of multiple circuits for ladder, tray, direct in ground and in ducts in the ground.

Rating Factor Type	Correction Table Reference in IEC 60502-2
Rating factors for ambient air temperatures other than 30°C Ambient.	Table B.10
Rating factors for ambient ground temperatures other than 20°C Ambient.	Table B.11
Rating factors for cable buried direct in the ground other than 0.8m.	Table B.12
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Rating factors for Single-core cable buried direct in the ground for soil resistivities.	Table B.14
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Rating factors for Three-core cables buried direct in the ground for soil resistivities.	Table B.16
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Base Conditions (for LV cables) (Top)

The CableApp uses the base cable installation conditions as defined in IEC 60364-5-52.

Parameter	Condition
Ambient air temperature	30°C
Ambient ground temperature	20°C
Base installation depth (for cables installed in the ground)	0.7m
Base soil resistivity (for cables installed in the ground)	2.5 K.m/W

For LV cables, CableApp defines cable cross-section through voltage drop based on formula as below:

$$S = \frac{Const \cdot L \cdot I \cdot \cos\phi}{\gamma \cdot (\Delta U - Const \cdot 10^{-3} \cdot x/n \cdot L \cdot I \cdot sin\phi)}$$

Where,

S = conductor cross-sectional área
x = 0,08 ohm/km **(always)**
n = number of cores per phase
Φ = the angle Φ between voltage and current
γ = conductivity
L = installation length
Const = $\sqrt{3}$ with 3-phase and 2 with 1-phase current

Base Conditions (for MV cables) (Top)

The CableApp uses the base cable installation conditions as defined in IEC 60502-2.

Parameter	Condition
Ambient air temperature	30°C
Ambient ground temperature	20°C
Base installation depth (for cables installed in the ground)	0.8m
Base soil resistivity (for cables installed in the ground)	1.5 K.m/W

For MV cables, CableApp calculates voltage drop based on formula as below:

$\Delta U = \sqrt{3} \cdot L \cdot I/n \cdot (R_T \cdot \cos\phi + X \cdot \sin\phi)$

Where,

ΔU = voltage drop in V
L = length of the line in km
I = current in A
R_T = conductor resistance at the temperature (T) of the conductor in Ω/km
X = reactance of the line in Ω/km
N = number of conductors per phase

Energy Conscious Solution (Top)

The following information provides guidance in energy efficiency, and the calculation method used to provide the **Energy Conscious Solution** in the CableApp.

The calculation requires the end user to define some of the parameters used in the calculation, within the "**settings**" menu of the CableApp.

The potential savings should be considered as guidance only.

According to Joules Law, whenever a conductor carry's current, it will generate heat (thermal energy).

It can be demonstrated that the thermal energy of a cable corresponds to the following general expression:

$$E_p = n/c \cdot R \cdot L \cdot I^2 \cdot t/1000$$

Where:

E_p	energy generated (lost on the line) [kWh]
n	number of loaded conductors (2 for single-phase/dc or 3 for three-phase)
c	number of cables per phase
R	conductor resistance [Ω / km]
L	cable length [km]
I	line current [A]
t	time [h]

If the cross-sectional area (S) of a cable is increased, there will be a corresponding reduction in the resistance (R). When carrying the same current I, there will be a reduction in the energy lost (E_P). This energy saving can be quantified both as a cost saving in electricity bills and a reduction in CO_2 emissions.

The cable itself will be more expensive because it will have a higher cross-sectional area (S) but the installer will benefit from the following:

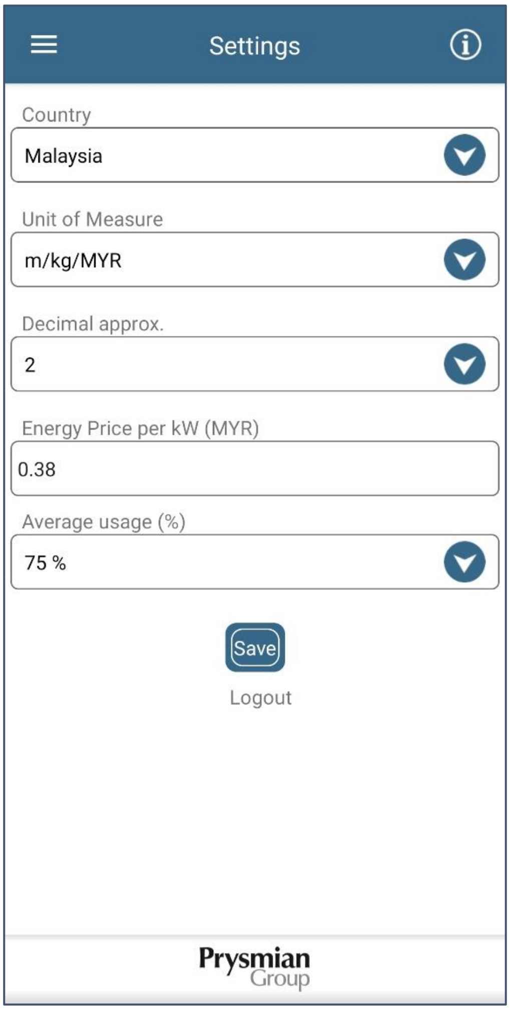
- Lower running costs, reduced energy bills.
- Reduced CO_2 emissions, therefore, an environmentally better proposition
- Extended design life for the cable because it is operating at a lower temperature.
- Standard design life is based on the cable being at its maximum load (maximum operating temperature) for every hour of that defined life in years.
- Improved short circuit capability - larger cross-sectional areas will carry higher currents in a fault condition.
- Potential to uprate the cable to carry higher loads in the future.

As a rule, cables do not carry the same current (I) continuously. For this reason, it is advisable to consider the mean square value of the current over time or at least to make an estimate.

The CableApp will offer by default the **average usage of load** (I ') equal to **75%** of I, but other values can be selected or defined by the user in the "**Settings**" of the CableApp

The value for Average usage can be changed in “Settings” menu. Typical value by application as below:

- 100% I
- 40% I (Residential)
- 60% I (Public place)
- 75% I (Industrial)
- Other %



Thus, the energy saved (**E_A**) by installing conductors of lower resistance (R_2) than (R_1) will be:

$E_A = n/c \bullet (R_1 - R_2) \bullet L \bullet (\%U \bullet I)^2 \bullet t/1000$

Having calculated the saved energy, the economic savings can be calculated and the savings in CO_2 emissions since we have defined the electricity tariffs (Energy Price) in **MYR/kWh** (in the "**settings**") and the approximate values of CO_2 emissions **kg per kWh** generated taking account of the country’s energy mix is defined by the CableApp.

Entering the value of the electricity rate and the value of CO_2 emissions per kWh will therefore give the savings achieved by installing cross-section conductors with a larger section.

Energy Price	0.38 MYR / kWh	(https://www.tnb.com.my/commercial-industrial/pricing-tariffs1/)
CO_2 Emissions	0.639 kg CO_2 / kWh	(http://www.seda.gov.my/statistics-monitoring/co2-avoidance/)

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