/ Perfect Welding / Solar Energy / Perfect Charging

COMMERCIAL SYSTEMS
WITH FRONIUS SOLUTIONS

Version 01 11/2021 KS

Solar Energy

WELCOME

We welcome you to the commercial systems training.
This document is for your reference and will help you should you have any questions later.

We wish you an enjoyable and successful training!

Solar Energy

For further information, please contact:
Technical Support, pv-support@fronius.com, Tel.: +43 (0) 7242 241 5670

Fronius International GmbH
Froniusplatz 1, 4600 Wels

COMMERCIAL SYSTEMS WITH FRONIUS SOLUTIONS

AGENDA

/ Overview - Fronius solutions for commercial systems	9:00
/ Plant design and choice of inverter	
/ Practice - Fronius Tauro	
/ System design, layouts and designing tools	
/ Data communication	
/ Lunch break	12:00 – 13:00
/ Installation – hints and tips	
/ Commissioning and settings	
/ Service and exchange of components, license management	
/ Commercial system with Fronius SnapINverter	till 16:00

FRONIUS PORTFOLIO FOR COMMERCIAL

Fronius Eco	Fronius Symo	Fronius Tauro	Fronius Tauro Eco
			
/ 25 – 27 kW / MPP-voltage: 580 – 850 V	/ 10 – 20 kW / MPP-voltage: 200 – 800 V	/ 50 kW / MPP-voltage: 400 - 870 V	/ 50 – 100 kW / MPP-voltage: 580 – 930 V

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FRONIUS TAURO ECO

POWER CLASS	50 / 100 kW
MPP-TRACKER	1
MPPT VOLTAGE RANGE	580 – 930 V
MAXIMUM DC-VOLTAGE	1000 V
WEIGHT	74 – 103 kg

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FRONIUS
TAURO STANDARD

POWER CLASS	50 kW
MPPT VOLTAGE RANGE	400 – 870 V
MPP-TRACKER	3

Fronius International GmbH / Fronius Tauro

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WHAT MAKES THE TAURO SO SPECIAL?

- Extremly robust: for unprotected outdoors
- Easy installation
- AC-Daisy Chaining option
- Cost reduction due to flexible system design
- System monitoring Hardware: On-board
- Easy, rapid service

6

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Tauro

PV plant design

7

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TOTAL COSTS

8

Fronius International GmbH / Tauro Product Presentation / 10.2019

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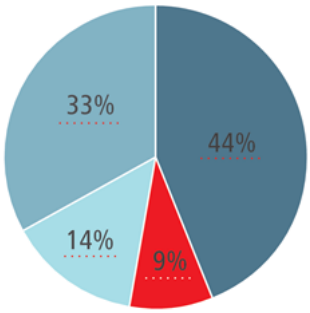
CAPEX CONSISTS OF:

PV module costs	Labour costs
BOS *(balance of system)* costs	Inverter costs

*Example of an 800 kWp system



PV modules Inverter
Labour BOS Cost

Inverter
just 9%*
of CAPEX costs

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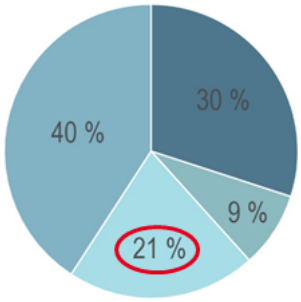
BALANCE OF SYSTEM COSTS CONSIST OF:

Mounting frame	AC/DC cabling & combiner
Cable trays	Mains connection



Racking system AC and DC cabling, AC and DC combiner boxes
Cable trays Mains connection

Greatest
savings potential!

PLANING APPROACH ON COMMERCIAL SYSTEMS

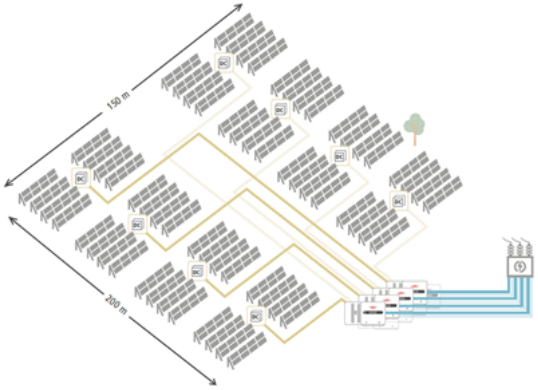
Classic

1. Choice of inverter – costs (Cent/Watt)
2. Choice of inverter power class
3. Selection of additional cost-effective components
4. Distance from the PV generator to the transformer

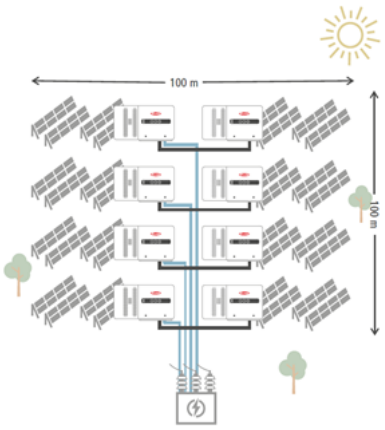
Tauro

COMPARISON - CENTRAL AND DECENTRAL

Central System Design



Decentral System Design



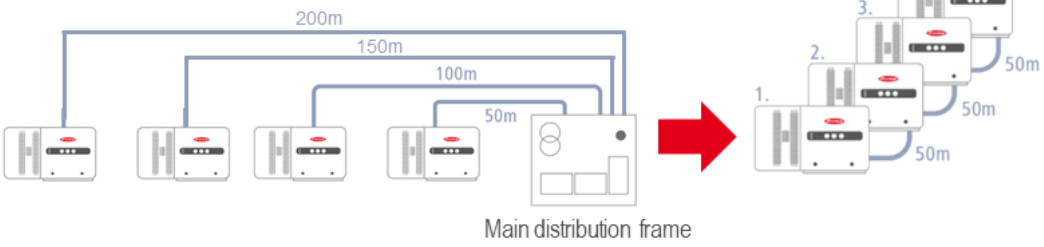
DIFFERENCES BETWEEN THE TOPOLOGIES:

Central – is characterized by:	Decentral – is characterized by:
/ All inverters centrally collected at one position / Easy transportation / access to all INV / Module strings are collected via DC combiner boxes and then connected to the INV via larger DC cables	/ Inverters are distributed across the PV-plant / Module strings are connected directly to the INV / No DC combiner boxes necessary

COST EFFECTIVE AC-CABELING

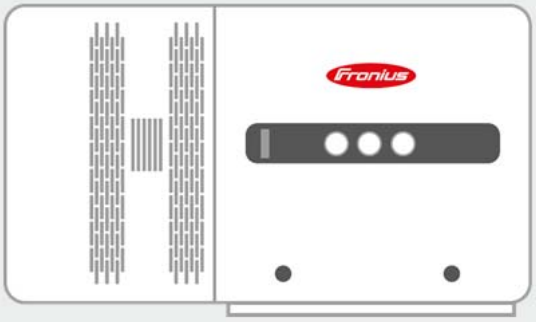
/ Lower cable costs due to interconnection of Tauro devices on the AC side.

/ Maximum 200kW interconnectable.
- / **2 x 100 kW Tauro**
- / **4 x 50 kW Tauro**



Fronius Tauro

Design
Options
Service



DESIGN FLEXIBILITY ON THE DC SIDE

Central System Design

„PRECOMBINED“ VERSION

- Integrated V-clamps on the DC side for cable cross sections up to 95mm²

Decentral System Design

„DIRECT“ VERSION

- Integrated MC4 plugs for direct connection of the module strings
- String fuses are integrated

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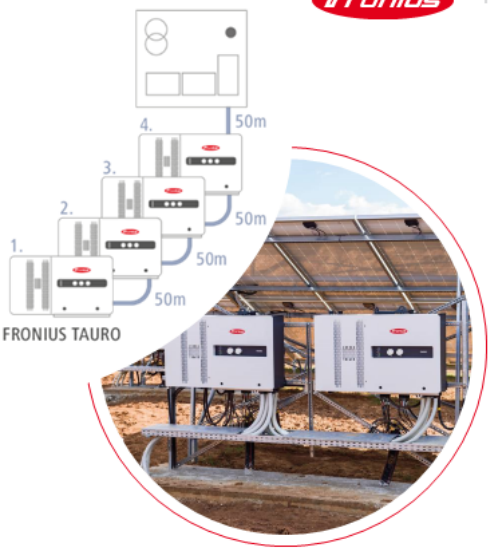
AC DAISY CHAINING

Unique system design with AC Daisy Chaining option



UP TO 200 kW
/ 2 x 100 kW Tauro / 4 x 50 kW Tauro

SAVING ON CABLE COSTS
/ Less AC cables necessary

LESS COMPONENTS NECESSARY
/ No AC combiner and just 1 AC disconnector *

OPTIONALLY INTEGRATED
/ Special AC connection area in the Tauro

*á 200 kW

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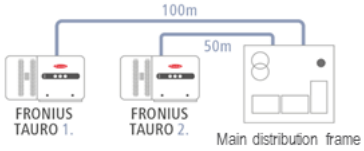
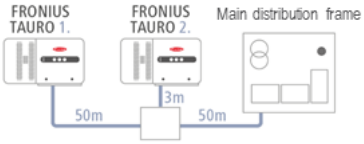
AC DAISY CHAINING

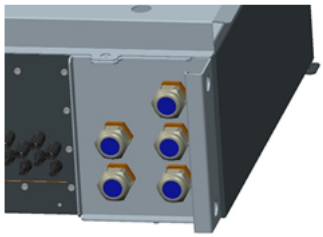
COMPARATIVE EXAMPLES

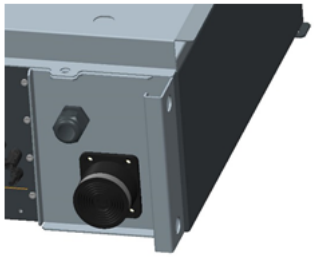
Installation without AC combiner	Installation with AC combiner	AC Daisy Chaining
		
Tauro directly connected (240/120 mm²)	120 mm² combiner| 240 mm² transformer	Tauro *AC Daisy Chained* (240 mm²)
2 AC disconnectors at transformer (160 A)	1 AC disconnector at transformer (320 A)	1 AC disconnector at transformer (320 A)

Maximum of 200kW AC can be interconnected.

FLEXIBLE CHOICE ON AC-CABLE

Low energy losses & maximum power
Cu & Al cabel possible

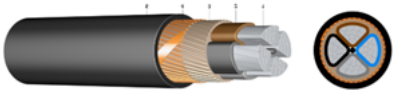




OPTION: SINGLE-CORE

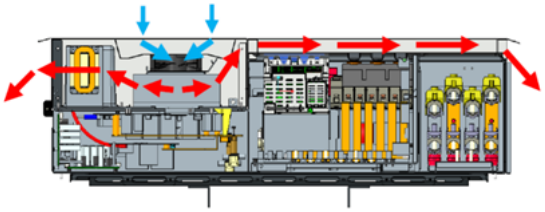
- 5 inputs
- Various sizes possible
- ø 10 mm - ø 28 mm
- Easy handling

OPTION: MULTI-CORE



- 1 input
- ø 16 mm – ø 61,4 mm
- 1 bunch of conductors

DOUBLE WALL AND ACTIVE COOLING SYSTEM



Maximum power despite heat

DOUBLE WALL SYSTEM
Front cover with double wall insulation

FULL PERFORMANCE UP TO 50°C
Later power derating

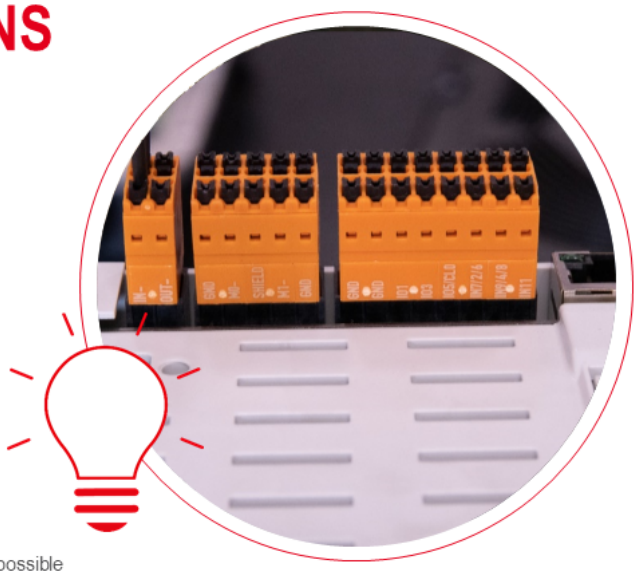
MAINTENANCE-FREE
No fan exchange necessary

No direct contact between cooling air and electronic components

BEST HEAT TRANSPORTATION
Active cooling combined with double wall concept

LONGER SERVICE LIFE
of components and the device intself

ADDITIONAL OPTIONS



ONLY FI TYP A NECESSARY
/ Up to 500€ cheaper compared to type B

SPD TYPE 1+2 FOR AC AND DC
/ Integrated as standard

AC-DISCONNECTOR*
/ Integrated into the device as an option.
(Not compatible with AC Daisy Chaining Option)

REMOTE CONTROL
/ 10 programmable digital I/Os integrated in the device.
(E.g. for ripple control signal)

*max. 120mm² cable possible

SERVICE

Faster and easier service

NO DEVICE REPLACEMENT REQUIRED
/ Replacement of power stage instead of whole device
(only one person necessary)

SIGNIFICANT TIME AND COST SAVINGS
/ Only 1 person and 1 journey required

MONITORING ADVANTAGES WITH FRONIUS SOLAR.WEB
/ System monitoring, remote update, performance comparison

Hardware Check

Tauro Eco device live

Layouts

Design flexibility

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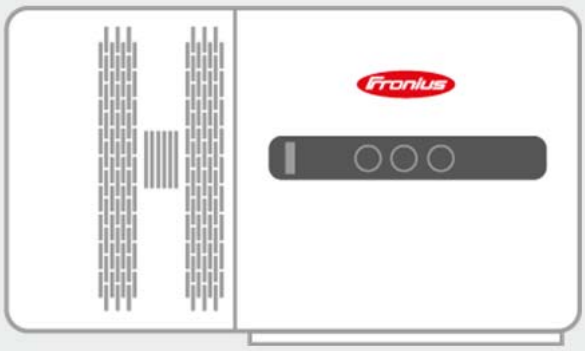
Fronius Tauro Eco

(D) Option



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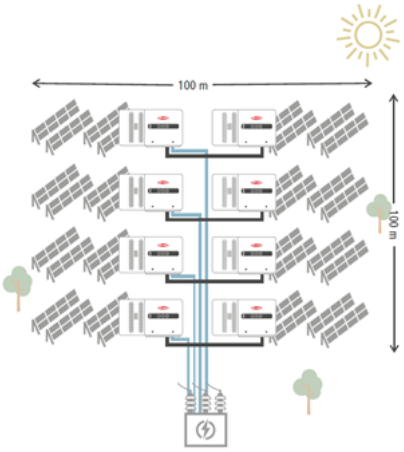
FRONIUS TAURO (D)

Decentral System Design

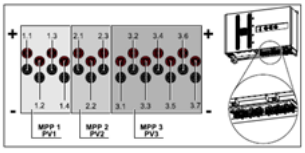


/ D for **direct DC connection**

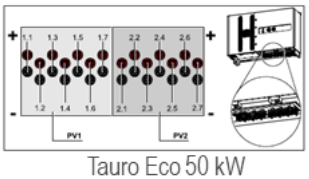
DC-CABLE CONNECTIONS

FRONIUS TAURO DIRECT (D)

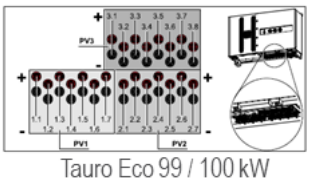
- Tauro / Tauro Eco 50 kW - **14 strings** | Tauro 99 / 100 - **22 strings**
- Direct connection of the strings to the inverter
- **MC4** plug
- Optional: **15 A / 20 A** fuses
- Correct dimensioning of the fuses
  - **Max. 10 A per string 15 A fuses** are possible
  - **Max. 12 A per string 20 A fuses** are necessary



Tauro 50 kW



Tauro Eco 50 kW

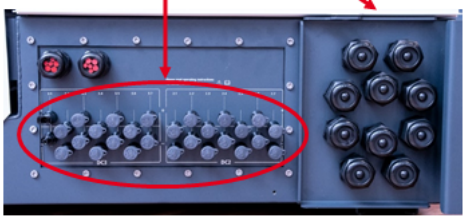


Tauro Eco 99 / 100 kW

OPTICAL DEVICE DIFFERENCES

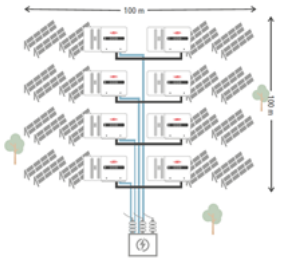
How do I visually recognize a Tauro Eco 50-3-D?

- 2x DC disconnector switches
- 14x MC4 plugs
- AC connection: AC-Daisy Chaining option
- 2x5 AC cable glands



WHAT DISTINGUISHES A "DIRECT" TOPOLOGY?

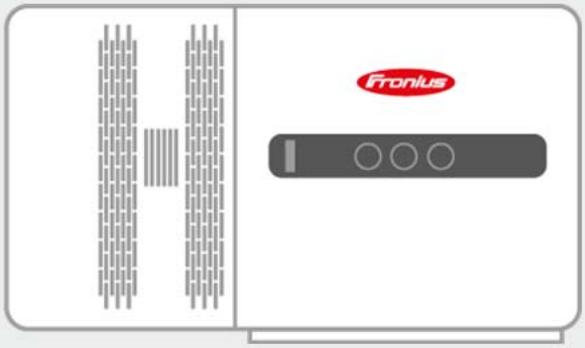
- The inverters are positioned **near the modules**.
- Long AC cables typically
- No additional components such as DC combiner boxes required



Cost advantage	Performance advantage	Further advantages
There are no costs for DC combiner boxes	High AC cable cross sections enable long AC cable lengths with low losses	Standard MC4 plugs allow a quick installation

Fronius Tauro Eco

(P) Option

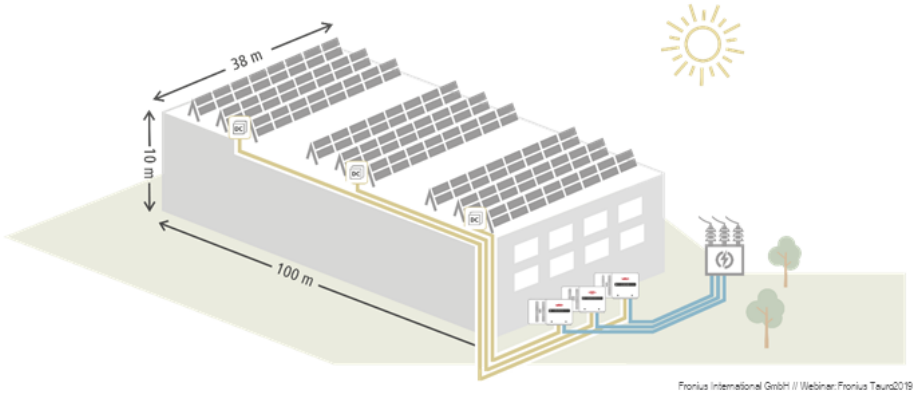


CENTRAL TOPOLOGY (P) - ROOFTOP

The inverters of the system **are placed near the feed-in point**.

/ Long DC cabling

/ Additional DC Connection Boxes and connection sets necessary



CENTRAL TOPOLOGY (P) - FREE FIELD

OPTICAL DEVICE DIFFERENCES

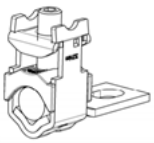
How do I visually recognize a Tauro Eco 100-3-P?

- 2x DC disconnector switches
- Integrated V-clamps: 2+ 2- connections (6x cable glands)
- AC connection: Single Core option
- 1x5 AC cable glands

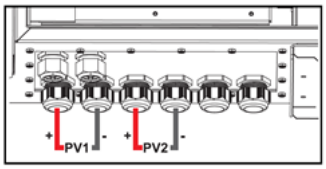
DC-CABLE CONNECTION

FRONIUS TAURO PRECOMBINED (P)

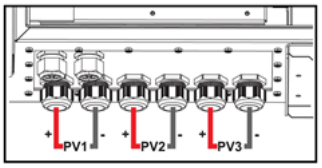
- Use of string collector boxes
- Cable cross section: **25-95 mm²**
- Torque 32 Nm



Tauro Eco 50 / 99 / 100 kW Precombined

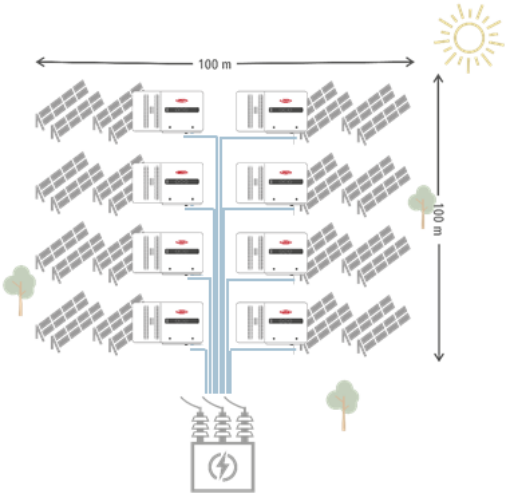


Tauro 50 kW Precombined



Layout examples

DECENTRAL FREE FIELD LAYOUT

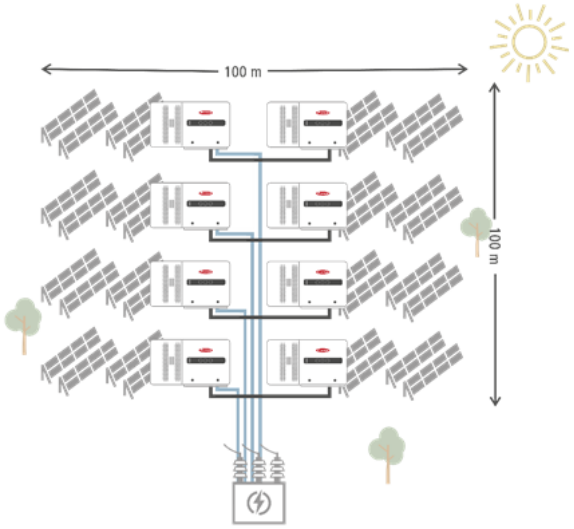


1MW PV-Installation (free field)

Advantages:

- No additional DC Combiner
- Easy planing (Standard design)

DECENTRAL FREE FIELD LAYOUT



1MW PV-Installation (free field)

/ Tauro D – with AC Daisy Chaining

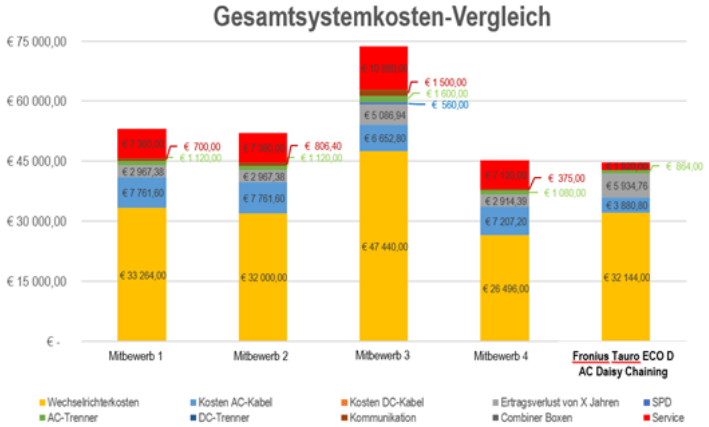
Advantages:

/ No additional DC Combiner

/ Shorter AC cable → lower cable costs

/ Less installation effort (cable laying,...)

EXAMPLE – DECENTRAL FREE FIELD LAYOUT



Berechnungsparameter: 20 Jahre Laufzeit, 0,08 EUR/kWh, 55m Distanz zur Hauptverteilung, 800 kWAC, 1500 kWh/a Standort Griechenland

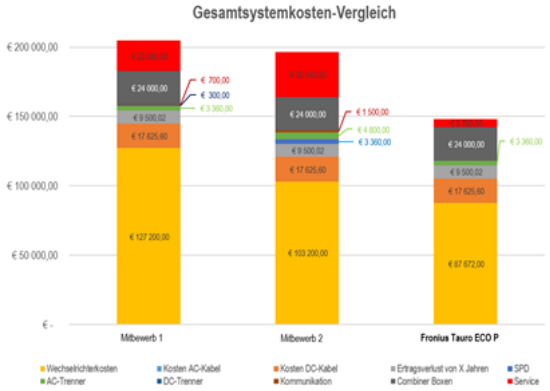
CENTRAL FREE FIELD LAYOUT

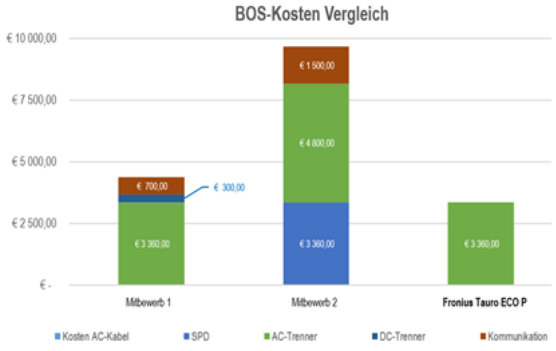
2MW PV-Installation (free field)

Advantages:

- Long DC cables (lower cable price & less power losses compared to AC cable)
- Easy access to all inverter for installation & commissioning, monitoring and service

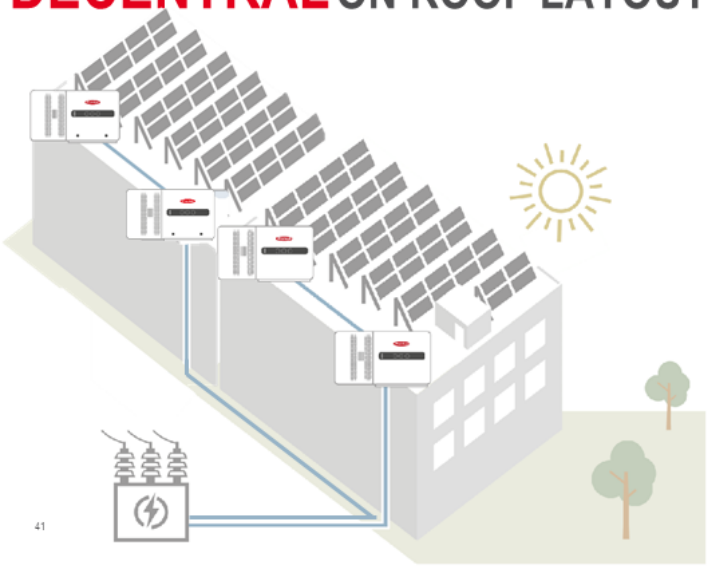
EXAMPLE – CENTRAL FREE FIELD LAYOUT





***Berechnungsparameter**: 20 Jahre Laufzeit, 500EUR DCCB, 0,08 EUR/kWh, 100m Distanz zur Hauptverteilung, 2400 kW AC, 1500 kWh/a Standort*

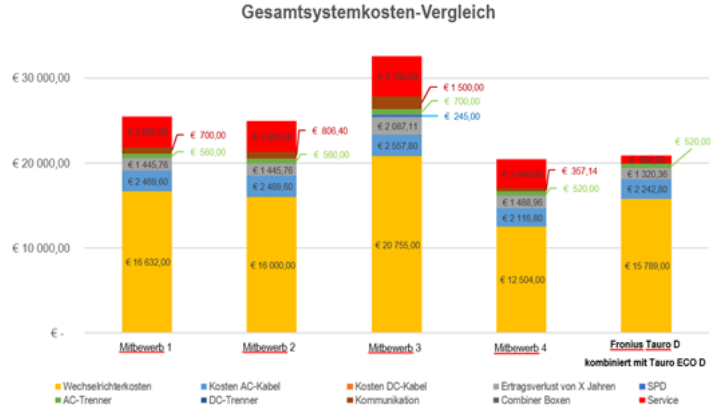
DECENTRAL ON ROOF LAYOUT



Fronius Tauro Eco + Tauro Direct

- 350kVA
- Because of on roof structures (Access hatch), shorter strings are necessary → Tauro Direct

EXAMPLE – DECENTRAL ON ROOF LAYOUT



***Berechnungsparameter**: 20 Jahre Laufzeit, 0,2 EUR/kWh, 35m Distanz zur Hauptverteilung, 350 kW AC, 500 EUR DCCB, 1200 kWh/a Standort Österreich, 1 Serviceeinsatz pro Inverter innerhalb von 20 Jahren*

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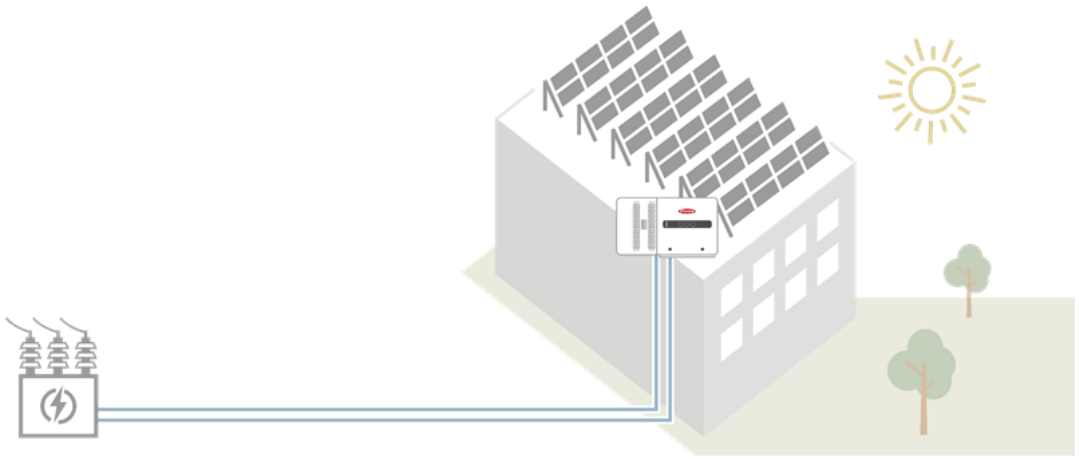
DECENTRAL ON ROOF LAYOUT



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Fronius International GmbH / Gewerbliche Anlagen mit Fronius Lösungen

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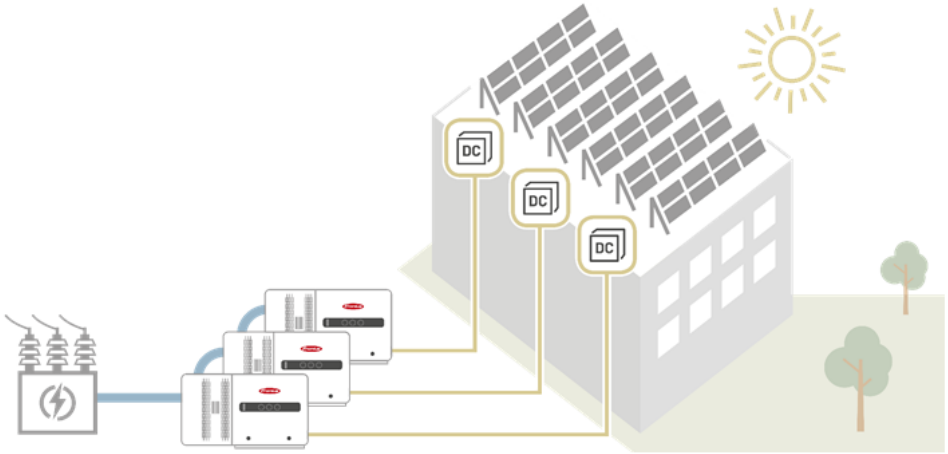
CENTRAL ON ROOF LAYOUT



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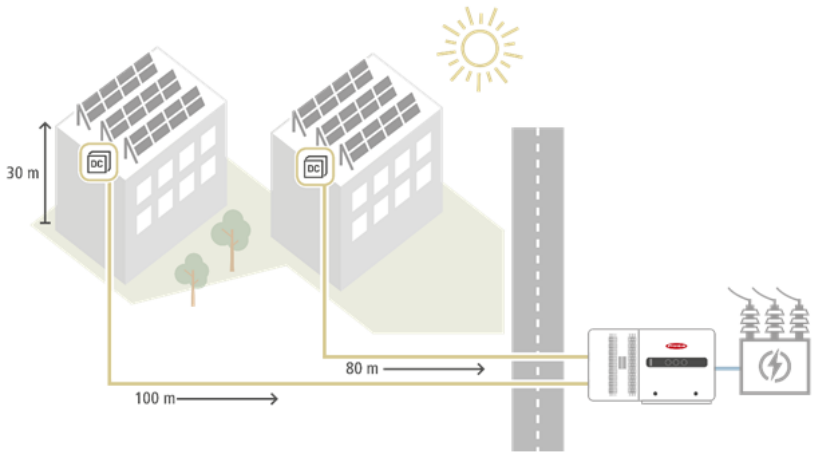
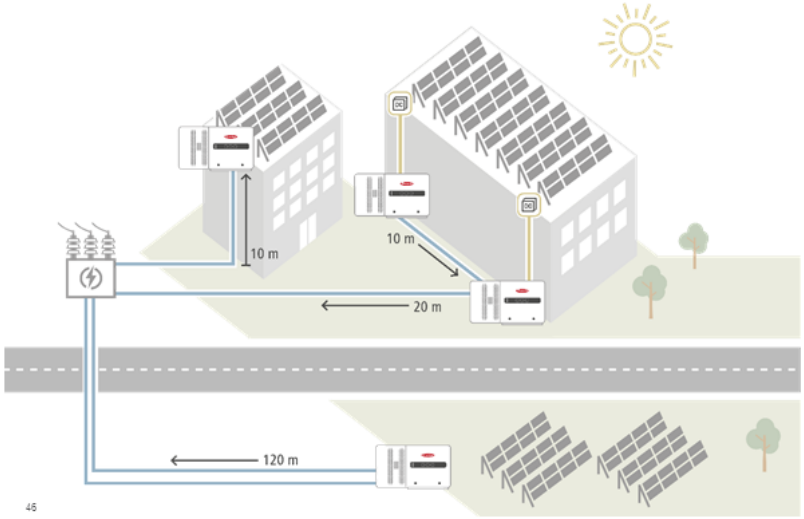
CENTRAL ON ROOF LAYOUT



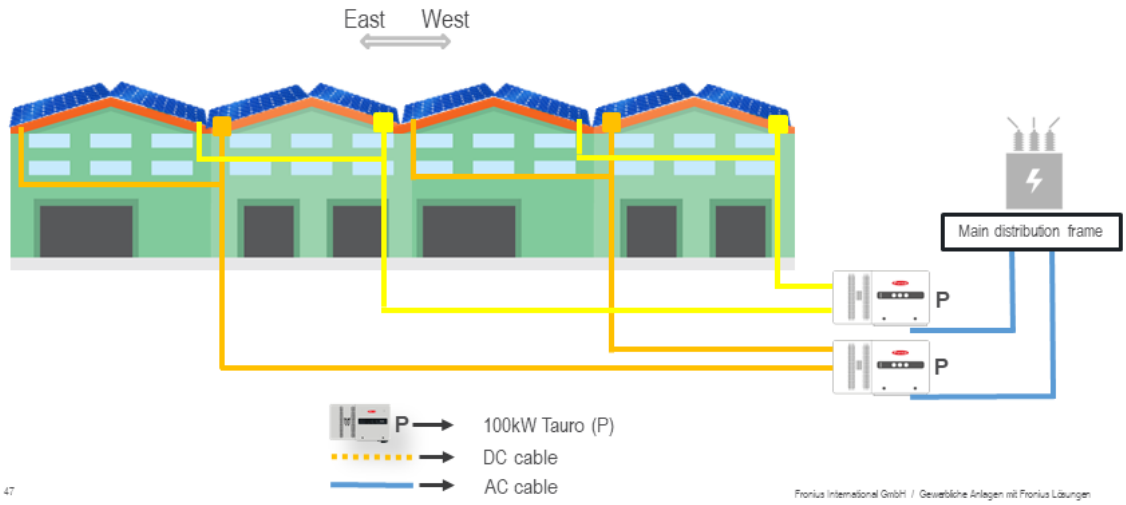
DECENTRAL/CENTRAL COMBINATION LAYOUT



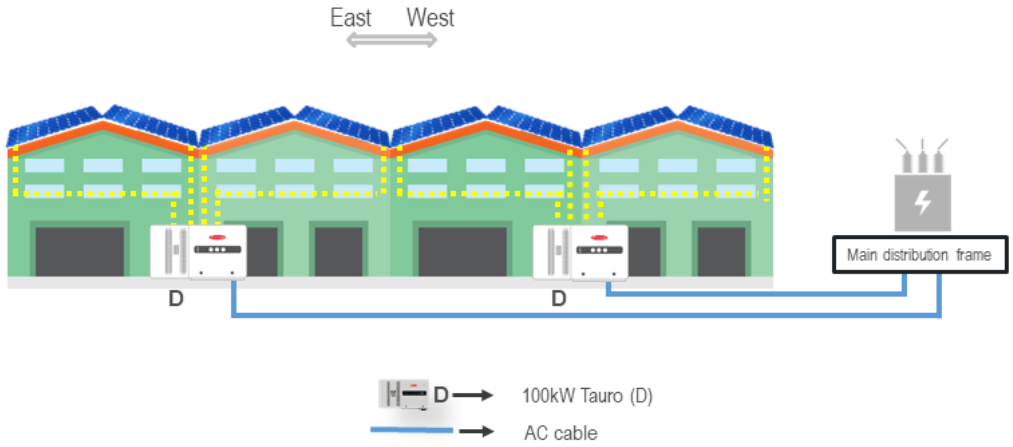
Fronius Tauro

- On-roof-installation
- AC-Daisy Chaining
- Double AC cabeling for long distances

CENTRAL – EAST/WEST SYSTEM

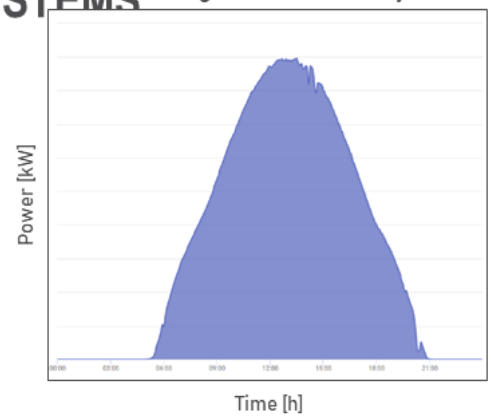


DECENTRAL – EAST/WEST SYSTEM



EAST/WEST ORIENTATION ON COMMERCIAL SYSTEMS

Higher self sufficiency - efficient use of space (higher PV power)



! Attention at shaded systems and steep inclination angles → use smaller devices and split up the PV generator !

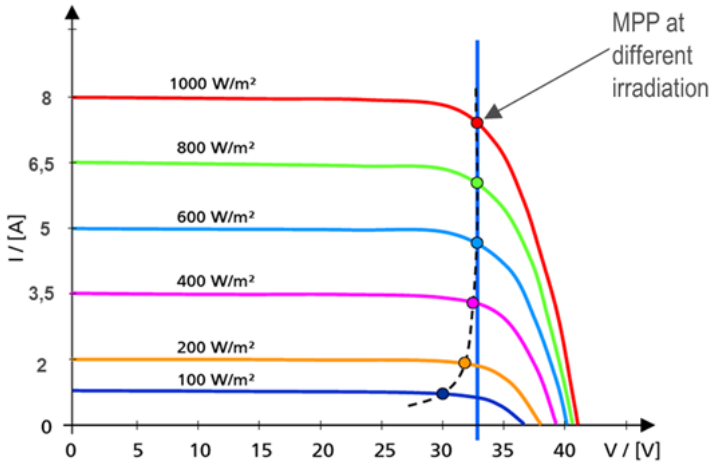
DESIGN RULES EAST/WEST

- Different orientated strings on only one MPPT:
  - Cost-effective inverter can be used (only 1 MPPT)
  - Overdimensioning possible
- Mismatching losses are minimal – can be neglected.

Design rules:

- Number and type of modules must be identical in all strings
- No shading
- All modules within the same string must have same inclination.

EAST/WEST – IMPACT ON POWER POINT



Cabeling options and power loss calculations

HOW ARE POWER LOSSES CALCULATED?

Formula for power loss:

$P = R*I^2$

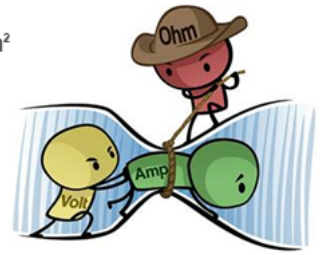
$R = p * l/A$

P = power (in W)
R = electrical resistance (in Ohm)
I = electrical current (in A)
p = specific resistance (in Ohm*mm²/m)
l = cable length (in m)
A = cable cross-section (in mm²

$P_{losses} = p * l * I^2/A$

Conclusion:

- The larger the cable cross section, the lower the losses.
- Losses are proportional to the cable cross section
- Double the current = 4 times the power losses



WHAT CABLE LENGTHS ARE POSSIBLE?

What is the maximum AC cable length that can be achieved with a 240mm² AC cable and a 100kW Tauro without having losses higher than 1%?

Answer:

Taking into account that the cable losses are <1%, a max. AC cable distance of 125m is possible.

Systems are usually designed for <3% power loss. However, there are no normative requirements that prohibit an interpretation >3%.

HOW HIGH ARE THE MONETARY LOSSES?

How much monetary losses does a 2MWp PV system have over 20 years on the AC cabeling? (with an average cable length of 125m)

LOSSES OVER 20 YEARS	AC-CROSS-SECTION
16.173,44 €	240 mm²
20.981,65 €	185 mm²
25.877,28 €	150 mm²
32.346,51 €	120 mm²
40.858,65 €	95 mm²

2MW, 8c/W, Austria

Up to
24.685 €
difference over 20 years

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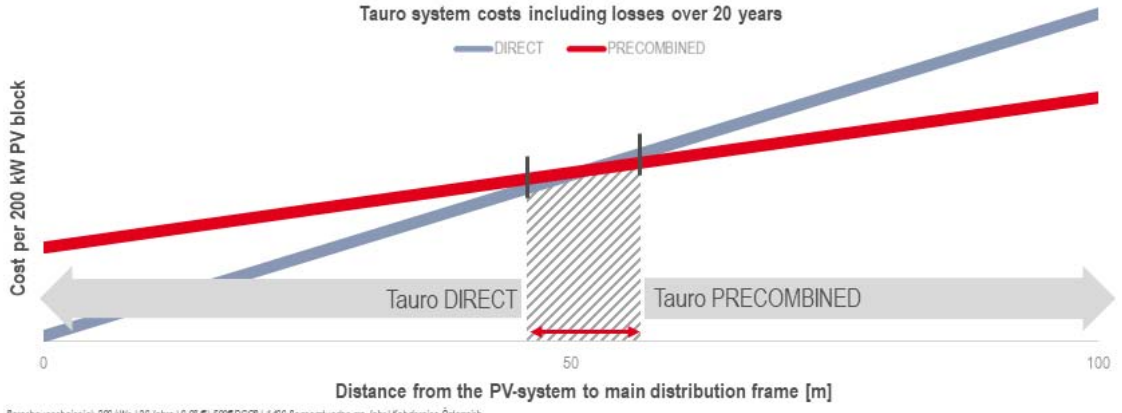
SELECT THE BEST TAURO OPTION FOR THE SYSTEM

Most profitable variant:
depending on distance between PV system and main distribution as well as component prices



Berechnungsbeispiel: 200 kWp | 20 Jahre | 0,08 €| 500€/DC/Œ | 1400 Sonnenstunden pro Jahr | Kabelpreise Österreich

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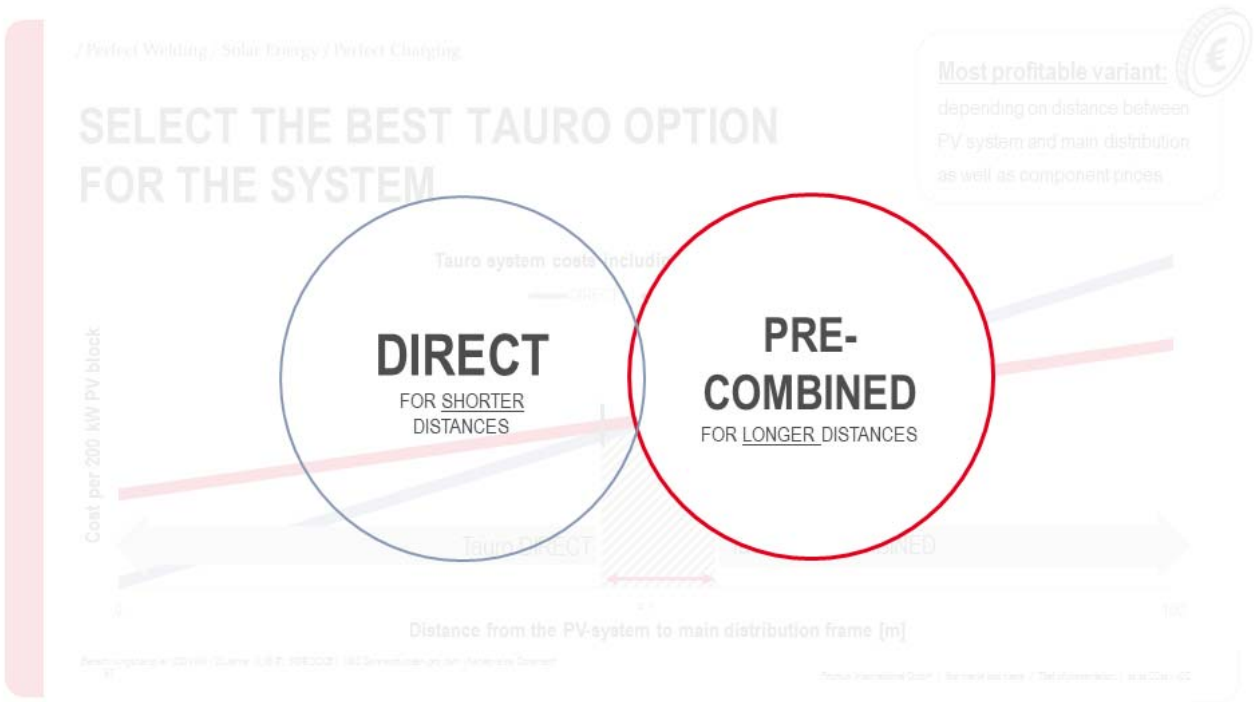


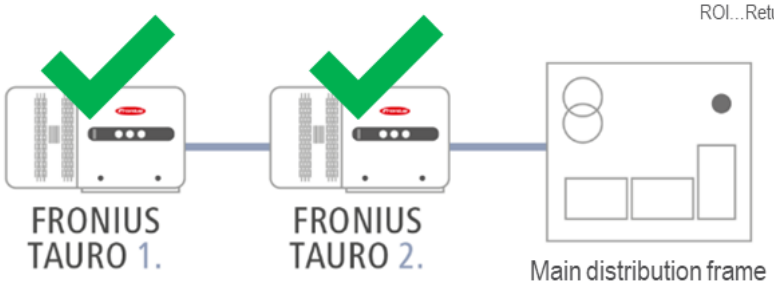
AC DAISY CHAINING...

… is always more profitable at the total cost level.

… is the best option to save on AC cable lengths.

… is a very interesting option when ROI is most important. → lower investment costs

ROI...Return on Investment



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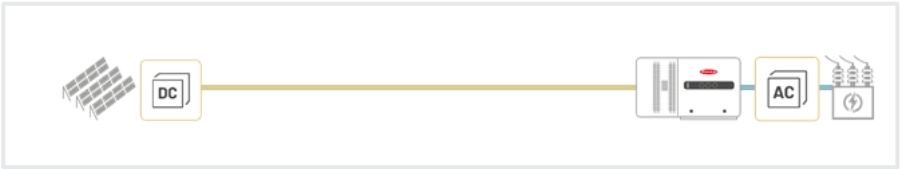
ADVANTAGES OF TAURO (D) OPTION

- / For decentral system design
- / String fuses integrated
- / Easy connection via pre-assembled MC4 plugs on the inverter
- / No DC combiner boxes required

ADVANTAGES OF TAURO (P) OPTION

- / For central system design
- / Less losses due to high DC voltages. (~700-800 V DC)
- / Long distances possible. (Al/Cu cable with max. 95 mm²)



CONCLUSIO

- Tauro (D) variant is ideal for **smaller systems** (**shorter cable distances**).
- Tauro (P) variant is ideal for **larger systems** (**larger cable distances**).
- Tauro is best for **fast ROI** (Return on Investment) - AC Daisy Chaining Option.
- Combinations of (P) and (D) variants possible for **maximum design flexibility**.

- **The Fronius Tauro can be flexibly integrated into any system.**

Design tools

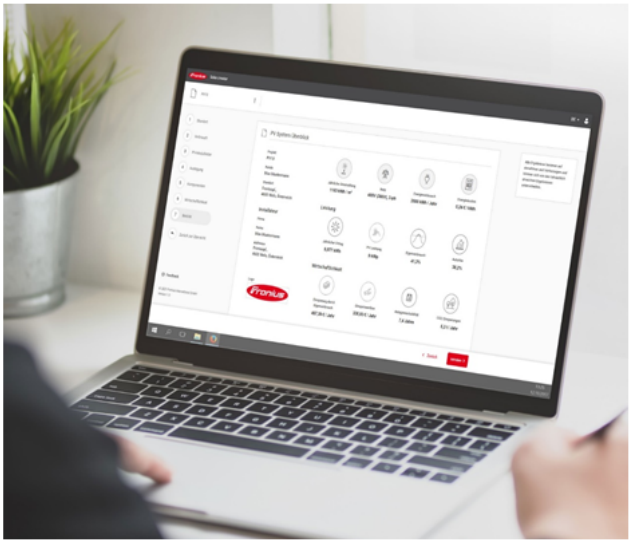
DESIGN TOOLS

- **Fronius Solar.configurator & Solar.creator** for basic designing with Fronius Tauro.
  - Calculation of all possible designs
- Next step: Modeling larger plants via e.g.: **PV*Sol**, **PVSyst**
  - Yield calculation, irradiation simulation for entire system possible.
  - **PV*Sol** and **PVSyst** actively maintained by Fronius. Inverter data always up to date.
  - If only external program is used for design, possible options could be overlooked. Reason: different programs use different inverter data for calculation.
  - Further programs can be used - PV-Scout, plan4solar, Polysun,…

FRONIUS CONFIGURATION - SOLAR.CREATOR

Solar.creator is a flexible and user-friendly configuration tool used for comprehensive design and simulation of photovoltaic systems in combination with electrical loads, battery systems and electric vehicles.

Creator.Fronius.com



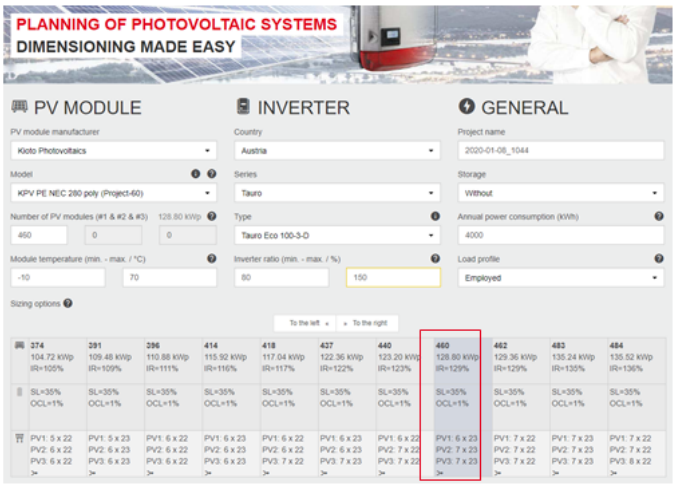
PRACTICAL PART

- Start the Fronius Solar.Creator via browser
- Login with Fronius credentials (same as on Solar.web)
- Design the system according to these parameters:
  - 512 panels (Jasolar JAM60S03-320/PR)
  - PV1, 512 modules, tilt 20°, orientation 180°, mounting open (free standing)

SOLAR.CONFIGURATOR

Design example:

- Tauro Eco 100-3-D
- 128,8 kWp
- 460 modules



SOLAR.CONFIGURATOR

/ Inverter details

Tauro Eco 100-3-D

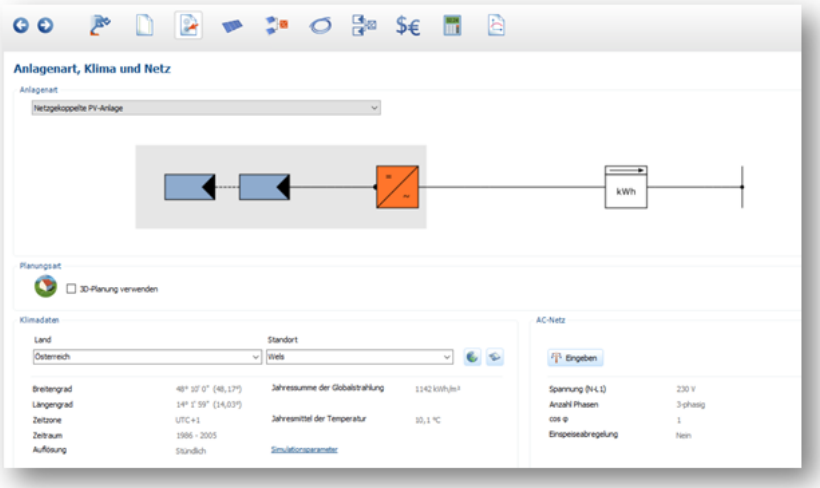
INPUT	
MPP voltage area	580 - 930 V
Max. input voltage	1,000 V
Max. input current	355 A
Max. DC power	150,000 W
Number of MPP trackers	1
Number of inputs	3
OUTPUT	
AC nominal output	100,000 W
AC max. output	100,000 VA
Min. cos φ	0.10
3-phase	✔
Euro. Effectiveness	98.2 %
Max. eff.	98.5 %
GENERAL	
Dimensions (H x W x D)	755x1,109x346 mm
Weight	109.0 kg
Protection type	IP 65
Ambient temperature	-40 - 65 °C

DATA SHEET

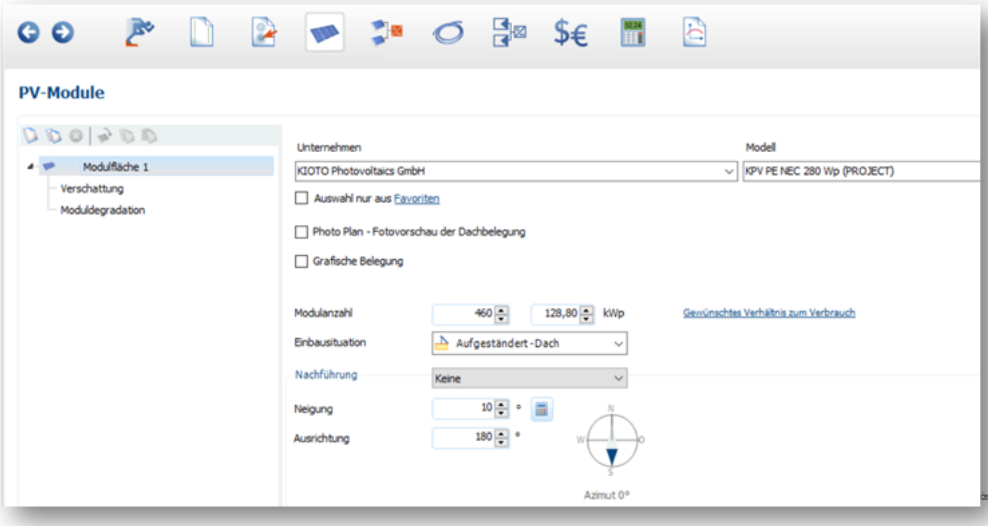
/ MPPT details

SUMMARY			
Inverter ratio	129%		
Pmpp at 25 °C	128.80 kWp		
Input	PV1: 6x23	PV2: 7x23	PV3: 7x23
MPPT DETAILS			
	PV1	PV2	PV3
String (str. x mod.)	6 x 23	7 x 23	7 x 23
Isc at 25 °C	55.80 A	65.10 A	65.10 A
Umpp at 70 °C	606.62 V	606.62 V	606.62 V
Uoc at -10 °C	991.09 V	991.09 V	991.09 V
Umpp at 25 °C	730.25 V	730.25 V	730.25 V
Pmpp at 25 °C	38.64 kWp	45.08 kWp	45.08 kWp
String fuses required	yes	yes	yes
String combiner required	no	no	no

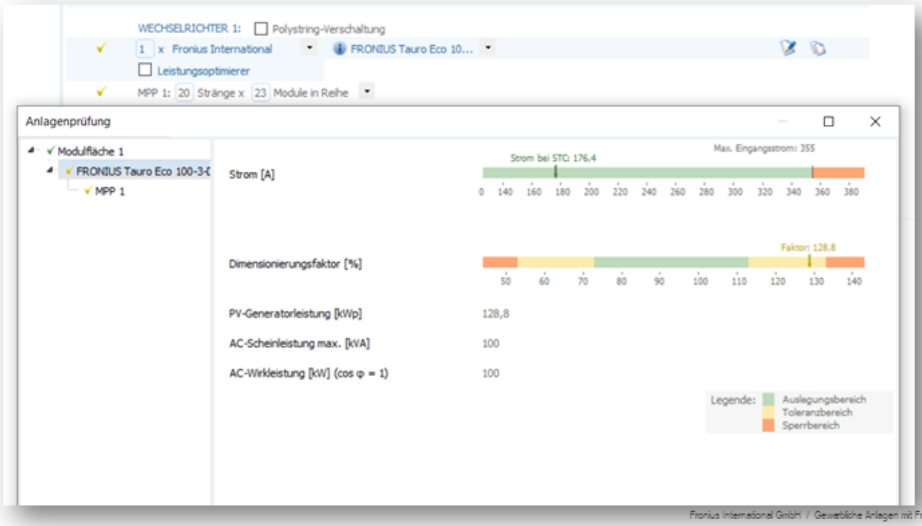
DIMENSIONING EXAMPLE IN PV*SOL



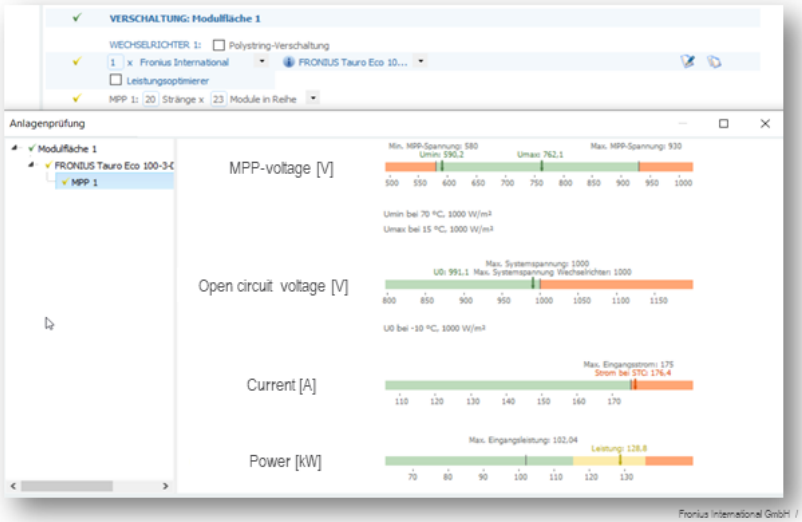
DIMENSIONING EXAMPLE IN PV*SOL



DIMENSIONING EXAMPLE IN PV*SOL



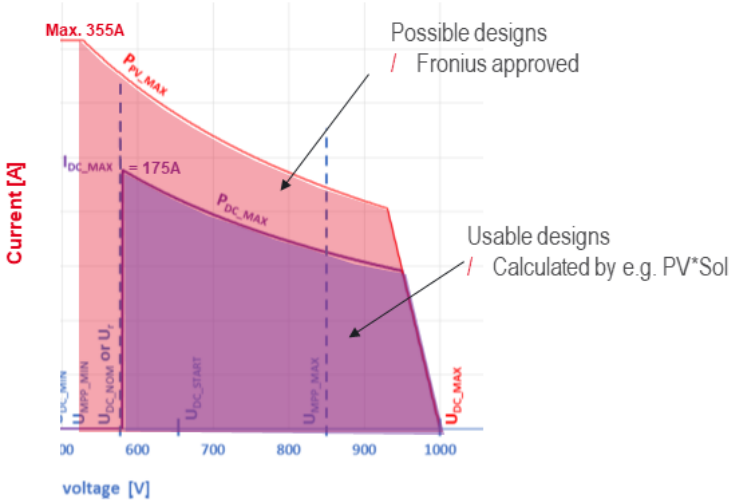
DIMENSIONING EXAMPLE IN PV*SOL



I/U DIAGRAM – TAURO OVERDIMENSIONING

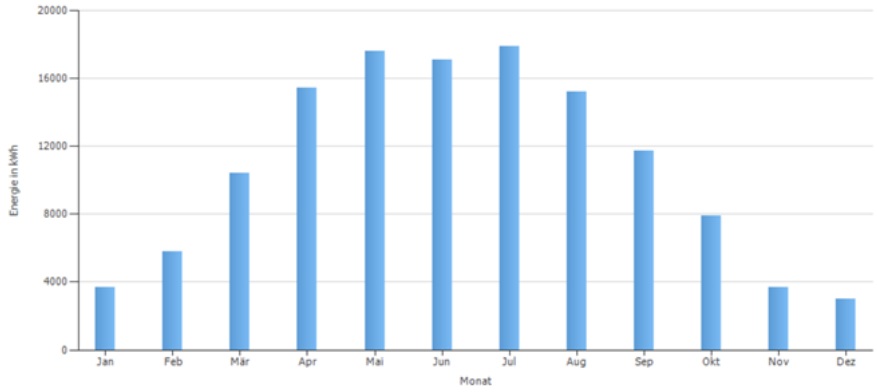
Pleas note:

- Different programs use different values for calculations.
- Use Fronius Solar.configurator for basic design of Fronius Tauro.
- Maximum module current only possible under STC.
- Due to oversizing, system is limited to 100kW anyway – I_{DC_MAX} not reached.



Wirtschaftlichkeit		Techn. Güte der PV-Anlage	
Gesamtkapitalrendite	11,48 %	PV-Generatorenergie (AC-Netz)	129 318 kWh/Jahr
Gesamtvergütung	29 281,33 €/Jahr	Spez. Jahresertrag	1 004,02 kWh/kWp
Kumulierter Cashflow	202 513,92 €	Anlagennutzungsgrad (PR)	83,4 %
Systemintegration			
Netzbezug	58 kWh/Jahr	Netzeinspeisung	129 318 kWh/Jahr

Yield calculation



DIMENSIONING
EXAMPLE IN PV*SOL

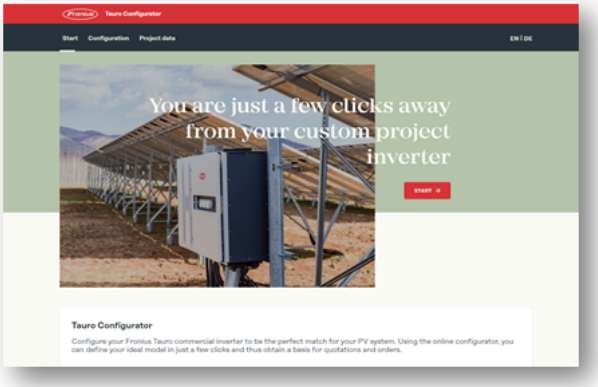
/ Detailed yield-/loss statement

Energy balance PV-system

Energiebilanz PV-Anlage			
Globalstrahlung horizontal	1 142,19	kWh/m²	
Abweichung vom Standardspektrum	-11,42	kWh/m²	-1,00 %
Bodenreflexion (Albedo)	1,72	kWh/m²	0,15 %
Ausrichtung und Neigung der Modulebene	71,32	kWh/m²	6,30 %
Abschattung	0,00	kWh/m²	0,00 %
Reflexion an Moduloberfläche	-66,81	kWh/m²	-5,55 %
Globalstrahlung auf Modul	1 137,00	kWh/m²	
	1 137,00	kWh/m²	
	x 748,36	m²	
	= 850 887,60	kWh	
PV Globalstrahlung	850 887,60	kWh	
Verschmutzung	0,00	kWh	0,00 %
STC Konversion (Modul-Nennwirkungsgrad 17,21 %)	-704 424,24	kWh	-82,79 %
PV Nennenergie	146 463,36	kWh	
Schwachlichtverhalten	-6 541,29	kWh	-4,47 %
Abweichung von der Nenn-Modultemperatur	-2 422,68	kWh	-1,73 %
Dioden	-687,50	kWh	-0,50 %
Mismatch (Herstellerangaben)	-2 736,24	kWh	-2,00 %
Mismatch (Verschaltung/Abschattung)	0,00	kWh	0,00 %
PV-Energie (DC) ohne Wechselrichter-Abregelung	134 075,65	kWh	
Unterschreitung der DC-Startleistung	-20,35	kWh	-0,02 %
Abregelung wegen MPP-Spannungsbereich	-1,31	kWh	0,00 %
Abregelung wegen max. DC-Strom	0,00	kWh	0,00 %
Abregelung wegen max. DC-Leistung	-157,63	kWh	-0,12 %
Abregelung wegen max. AC-Leistung/cos phi	-64,12	kWh	-0,05 %
MPP Anpassung	-40,15	kWh	-0,03 %
PV-Energie (DC)	133 792,10	kWh	
Energie am WR-Eingang	133 792,10	kWh	
Abweichung der Eingangs- von der Nennspannung	-371,88	kWh	-0,28 %
DC/AC-Wandlung	-2 795,80	kWh	-2,10 %
Standby-Verbrauch (Wechselrichter)	-57,06	kWh	-0,04 %
Kabelverluste Gesamt	-1 306,82	kWh	-1,00 %
PV-Energie (AC) abzgl. Standby-Verbrauch	129 260,54	kWh	
Netzeinspeisung	129 318,18	kWh	

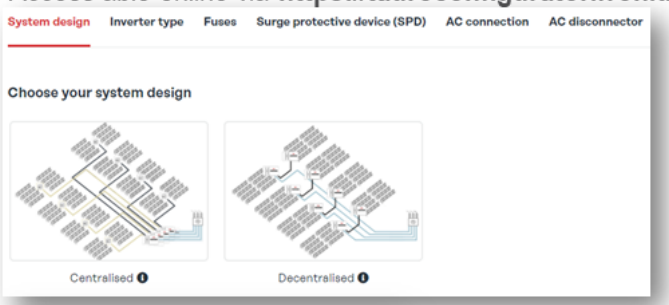
YOUR CUSTOMIZED PROJECT INVERTER

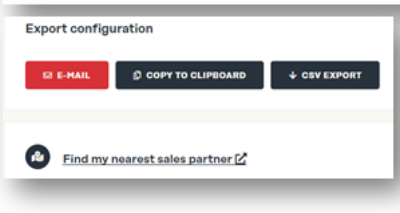
- Linked on our homepage
- And directly accessible here: **https://tauroconfigurator.fronius.com**

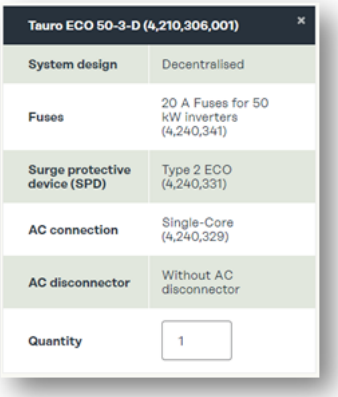


YOUR INDIVIDUAL PROJECT INVERTER

- Access able online via **https://tauroconfigurator.fronius.com**







/ Perfect Welding / Solar Energy / Perfect Charging

Data communication

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Fronius International GmbH / Gewerbliche Anlagen mit Fronius Ladungen

/ Perfect Welding / Solar Energy / Perfect Charging

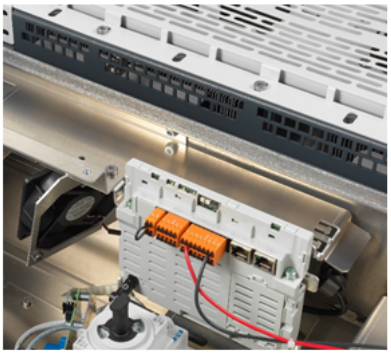
DATA COMMUNICATION

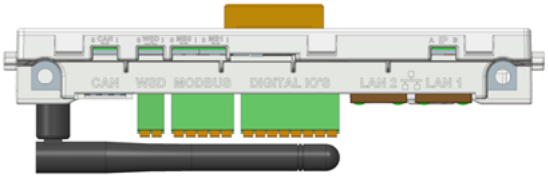
Pilot

- LED-status indicator
- Datalogger, Web-Server, WLAN/LAN-interface
- Visualization via Fronius Solar.web, Fronius Solar.web App

Numerous open interfaces

- 2 Ethernet / LAN: Modbus TCP SunSpec or Fronius Solar API JSON protocol
- 2 Modbus RTU (RS 485) – interfaces
- WSD-function
- Digital In- and Outputs (I/O's)





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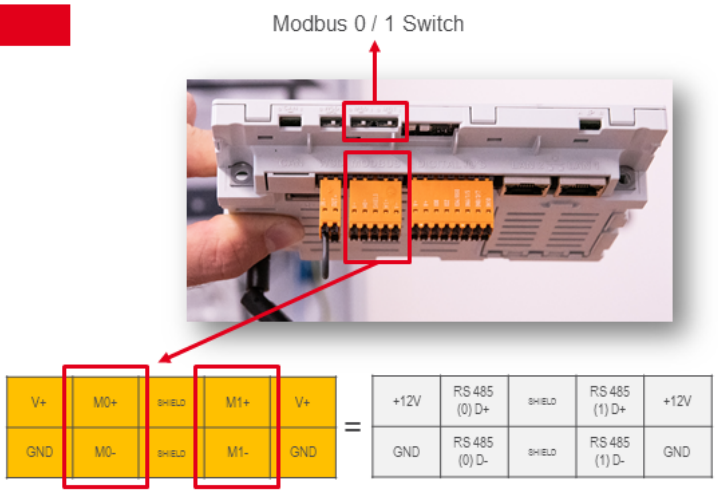
COMMUNICATION - PILOT

Modbus

- Push-in terminal (orange plug)
- **2 Modbus RTU (RS 485)** interfaces
- Fronius Smart Meter, Sunspec Interface

- Modbus 0 Switch
  - Position 0: terminating resistance off
  - Position 1: terminating resistance on
- Modbus 1 Switch
  - Position 0: terminating resistance off
  - Position 1: terminating resistance on



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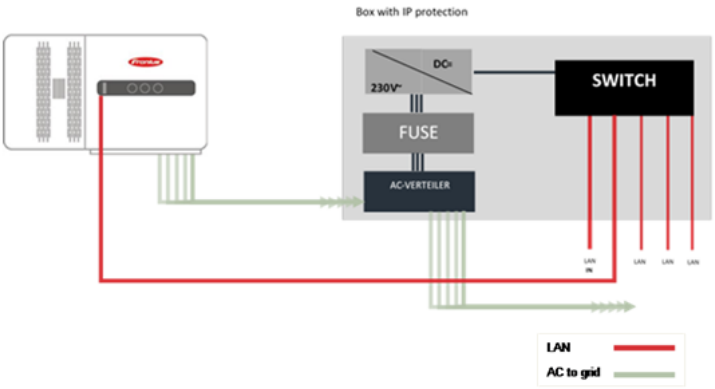
STANDARD ETHERNET SWITCH

Required materials

- Box with power supply and IP protection
- Standard ethernet switch



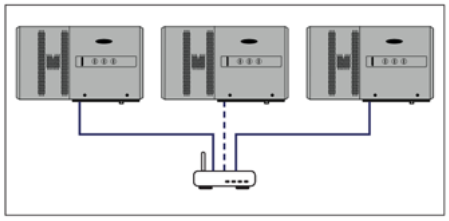
Fronius International GmbH / Fronius Tauro

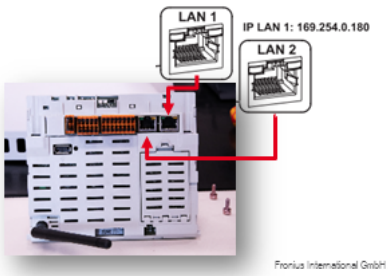
ETHERNET CABLING

Easy Communication setup

- / Parallel connection to one or more Ethernet switches
- / Standard Ethernet cable (Cat 5 or higher)
- / Standard Ethernet switch

- / Caution: Only use the LAN 1 interface on the communication unit (pilot) for connection to the network. LAN 2 is for internal use only.





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OUTDOOR SWITCH (WITHOUT POE)

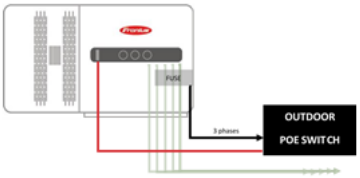
Required materials:

- / No box required
- / Power supply needed (available with POE)
- / Higher effort due to power supply
- / Different options to supply the switch

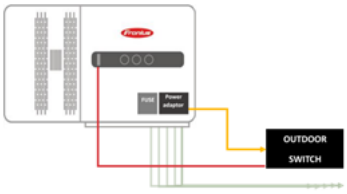
LAN
AC to grid
AC to device
DC

Supply via 12 V signal

Supply via AC area



Supply via AC with power adaptor

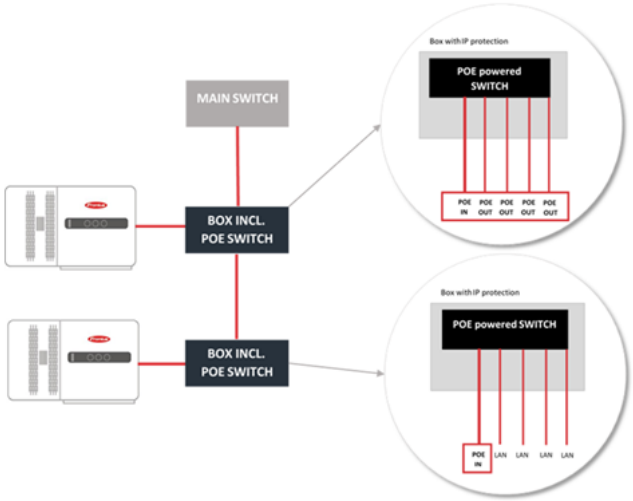


Fronius International GmbH / Fronius Tauro

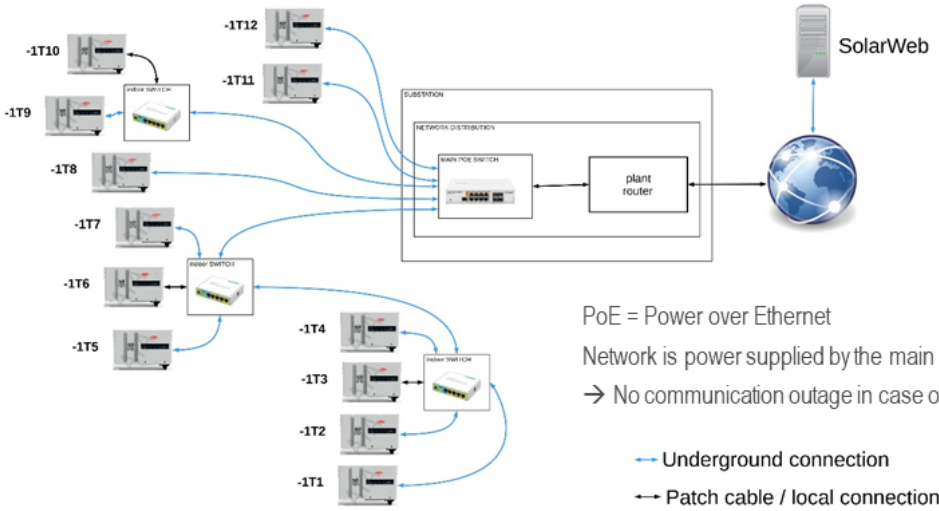
POE SWITCH

Required materials

- / Box with IP protection
- / Standard POE Ethernet switch



NETWORK POE EXAMPLE



PoE = Power over Ethernet

Network is power supplied by the main station.

→ No communication outage in case of a inverter failure.

Underground connection

Patch cable / local connection

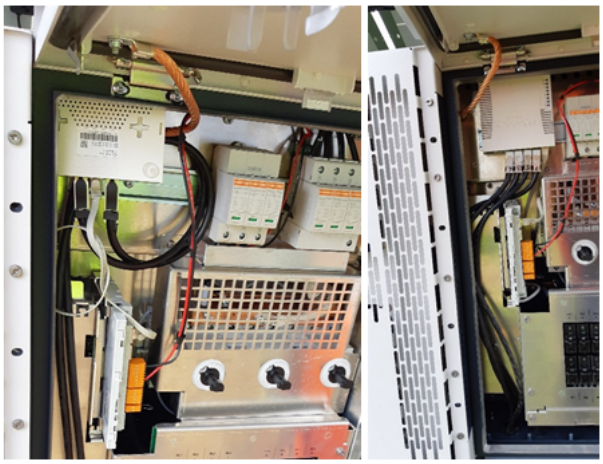
NETWORK POE EXAMPLE

Advantages:

/ In case there is a failure on one inverter, the rest of the system is still connected to the plant controller.

Used equipment in this example:

/ Mikrotik



FEED-IN MANAGEMENT & EXTERNAL CONTROL

If external controllability is required by the grid operator for a PV system with more than one Tauro device, a **Plant Controller** must be integrated into the system.

Controllers from *SolarLog*, *Meteocontrol* or *Gantner* are recommended.

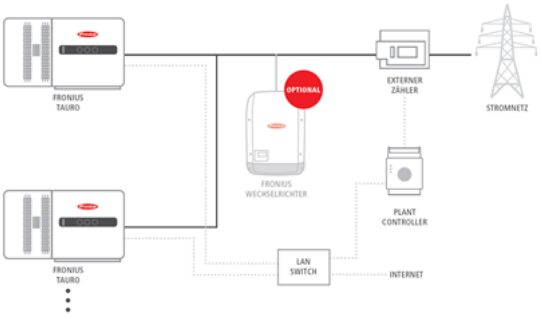
/ Possibility of central control and monitoring

/ Grid-compliant feed-in management

/ Communication with grid operator possible

/ Guaranteed safety functions (remote shutdown)

/ Secured data communication to the direct marketer



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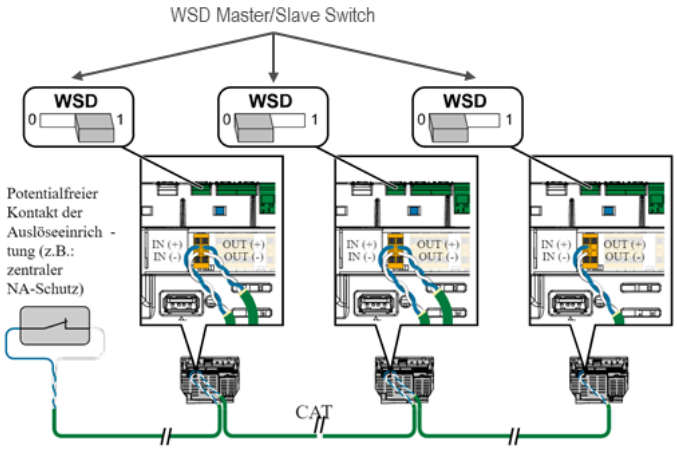
WSD – WIRED SHUT DOWN

- The WSD function interrupts the infeed of the inverter when the tripping device (switch) has beer activated.
- First inverter is set to Master (1) others on Slave (0).
- Emergency shutdown for entire system possible.

Max. 100m between inverters
Max. 28 devices per tripping device (switch)



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Fronius Tauro

Fronius Smart Meter

FRONIUS SMART METER

Bidirectional meter

- / Analysis and visualization of **consumption and production**
  - / Base for opimum monitoring via Fronius Solar.web
- / **Two-directional meter**
  - / Measuring consumption data
  - / Differs between self-consumption and grid connection

FRONIUS SMART METER TYPOLOGIES

50 kA-3

- / 3-phase grid
- / External current transformer

5kA-3

- / 3-phase grid
- / External current transformer
- / Touchscreen

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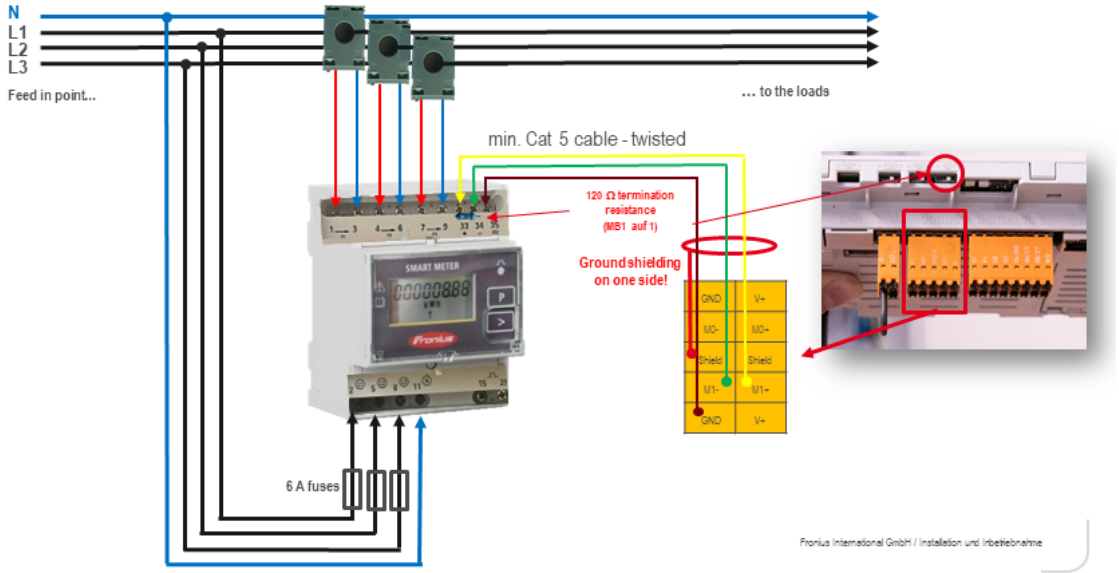
FRONIUS SMART METER 50KA - CABELING



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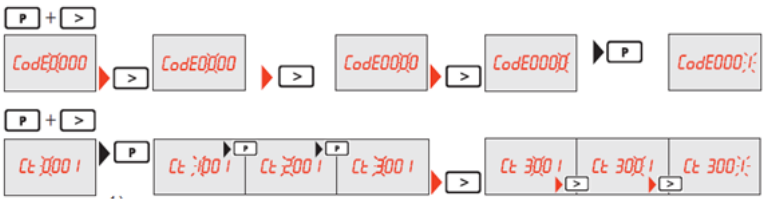
CONFIGURATION FRONIUS SMART METER 50 KA

Set the transformation ratio of the external current transformers



/ Code: 0001

/ Calculate transformation ratio primary (P) : secundary (S) = Ct factor

e.g. 15000 : 5 = 3000 → **to be set Ct factor**

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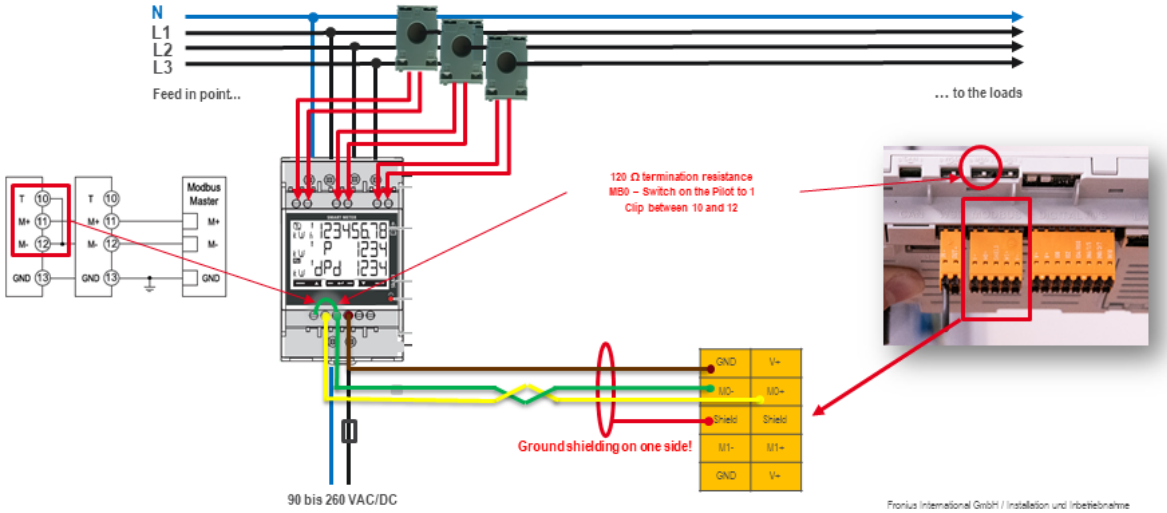
FRONIUS SMART METER TS 5KA-3 - CABELING



CONFIGURATION SMART METER TS 5KA-3

Set the transformation ratio of the external current transformers

/ Code: 2633

/ Calculate transformation ratio primary (P) : secundary (S) = Ct factor

e.g. 50 : 5 = 0010 → **to be set Ct factor**

Symbol	Name	Event	Function
	Up	1 x	Scroll one screen forward, increase the value by 1
	Down	1 x	Scroll one screen back, decrease the value by 1
	Enter	2 seconds	Call up settings, confirm value

SELECTION CRITERIA
FOR CURRENT TRANSFORMER

More information online at fronius.com

/ Primary current
Maximum current per phase. A current converter with a primary current greater than the maximum expected current per phase should be selected. The closer the expected current is to this value, the more precise the measurement will be.

/ Secondary current
1 - 5 A

/ Power
The Fronius Smart Meter needs 0.3 VA to carry out its measurements. Losses also occur on the outgoing and return leads. The power of the current converter must be greater than the sum total of the power of the Fronius Smart Meter and the leads. The higher the power, the better.

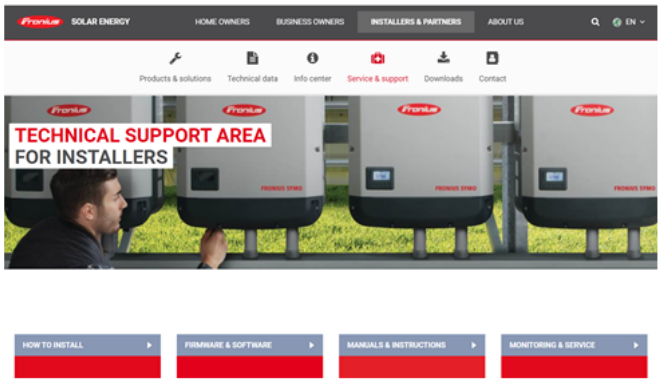
For example: Outgoing and return lead between Fronius Smart Meter and current converter (together):
2 x 0.5 m = 1 m length with a copper cable cross-section of 1.5 mm² -> 1 x 0.6 VA
Fronius Smart Meter self-consumption = 0.3 VA
Sum total = 0.9 VA
A current converter with a rating of 1 VA, 1.5 VA, 5 VA or higher is suitable here.

Line resistances at different cross-sections (copper wires)

Secondary current	Cross-section	Line resistances at different lead lengths (outgoing and return lead)				
[A]	[mm²]	0.5 m	1.0 m	2.5 m	5 m	10 m
5	1.5	0.3 VA	0.6 VA	1.5 VA	2.9 VA	5.8 VA
5	2.5	0.2 VA	0.4 VA	0.9 VA	1.8 VA	3.6 VA
5	4.0	-	-	0.6 VA	1.1 VA	2.2 VA

/ Accuracy class
Class 1 or better (Class 0.5, 0.2, etc.) is recommended. Class 1 is equivalent to a deviation of ± 1% of the secondary current at maximum power.

/ Assembly
Rigid or hinged. "Rigid" is usually cheaper with better power and accuracy values. "Hinged" can be installed in a system without interrupting the voltage.



CURRENT TRANSDUCER FROM FRONIUS

As soon as info on this is known enter data and order process

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Notes for cable selection

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Fronius International GmbH / Gewerbliche Anlagen mit Fronius Ladungen

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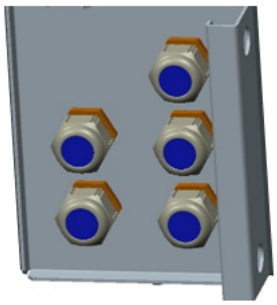
CABLE GLANDS – AC CONNECTION

Multi Core

- 1x Multi Core cable gland
  - ø 16 mm – ø 61,4 mm
- 1x cable gland M32 (earth cable)
  - ø 10 mm – ø 25 mm

Single Core



- 5x cable glands M40 for Single Core cable
  - ø 10 mm - ø 28 mm

AC Dasiy Chain

- 2x 5 cable glands M32 for AC Daisy Chaining option
  - ø 10 mm - ø 25 mm

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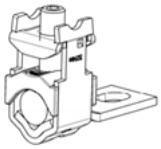
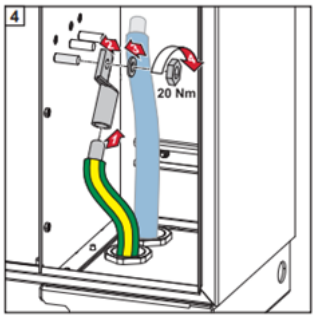
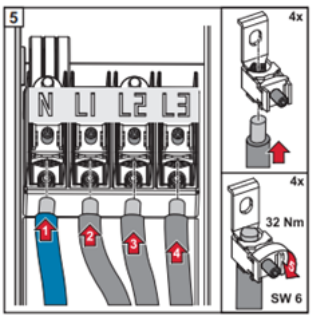
AC CONNECTION

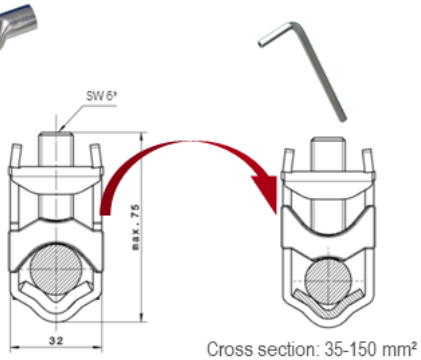


/ V-clamps for big cross-section connections from 35mm² up to 240 mm²

/ Cable lug only needed for grounding







Cross section: 35-150 mm²

Cross section: 185-240 mm²

CHOICE OF CABLE – AC CONNECTION

Attention! Use only the following cable types for connection with V-clamps:

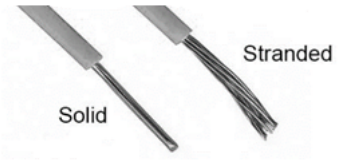
/ RE (solid round conductors)

/ SE (solid sector conductors)

/ RM (round stranded conductors)

/ SM (sector stranded conductors)

*fine-stranded cables only with use of ferrules.



re = solid round conductors

se = solid sector conductors

rm = round stranded conductors

sm = sector stranded conductors

CHOICE OF CABLE – AC CONNECTION

Powerclass	AC cable option	Cable dimension
Tauro Eco 50-3	Standard (Single core, multi core)	35 – 240 mm²
	AC-disconnector	35 – 240 mm²
	Daisy Chain Option	35 – 240 mm²
Tauro Eco 100-3	Standard (Single core, multi core)	70 – 240 mm²
	AC-disconnector	70 – 240 mm²
	Daisy Chain Option	70 – 240 mm²

OVERVIEW - DC CONNECTION

Direct

- String fuses integrated
- Number of strings (integrated MC4-plugs):
  - Tauro Eco 50.0 – 14 strings
  - Tauro Eco 100.0 – 22 strings
  - Tauro 50.0 – 14 strings

Precombined

- Cable connection from 25mm² up to 95mm²
- M32 cable gland ø10 - ø25mm
- Integrated V-clamp:
  - Tauro Eco 50.0/100.0 – 2+ 2- connections
  - Tauro 50.0 – 3+ 3- connections

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Service & component exchange

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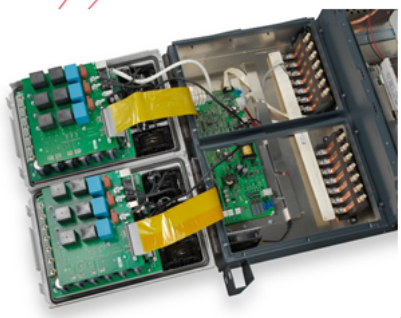
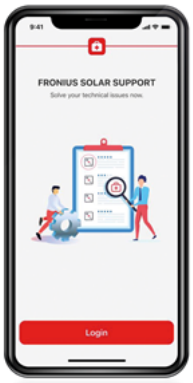
SERVICE PROCESS

1. **Call** Fronius TechSupport team or use **Fronius Solar.SOS**
2. **Read and announce device serial number**
3. **Clarification** of error cause
4. **Order exchange component**
5. **Execute exchange**
6. **Send back defective** component (DHL return delivery note)
7. **Credit note** or service lump sum in case of warranty

Attention: if the defective device is not returned – billing after 30 days



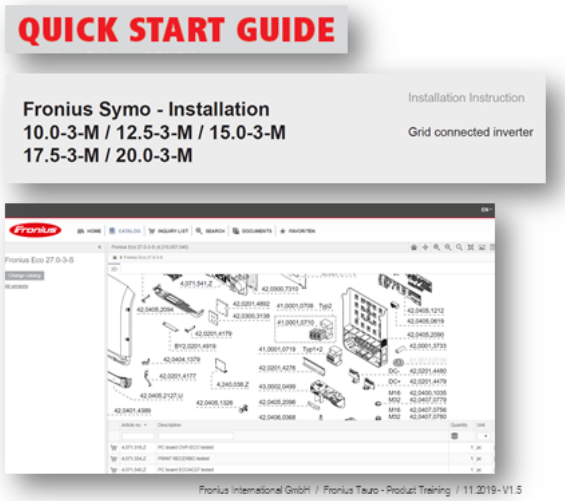
SOLAR.SOS



- / **Troubleshooting**
- / **Rapid ordering**
- / **Overview** – all cases, ordering status, etc.
- / **Manuals** – installation, operating instructions and video tutorials
- / **Automatic notification** regarding replacement components and **Messaging function** with technical support
- / Use a single account to **manage multiple accounts**

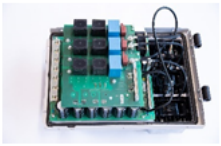
HELPFUL DOCUMENTS/LINKS

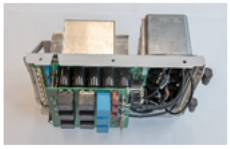
- / Quick Start Guide
  - / Delivered with the inverter
- / Operating instructions (online only)
- / Service instructions
- / Online exchange component catalog
  - / (spareparts.fronius.com)



SPARE PARTS - TAURO

/ Power stack





/ Pilot

/ Control-Board (FromoCont)

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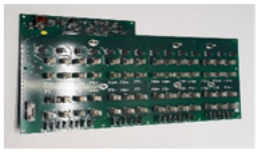
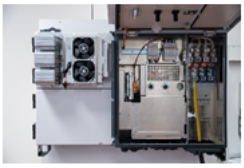
SPARE PARTS - TAURO

/ Fuse boards



/ Fan

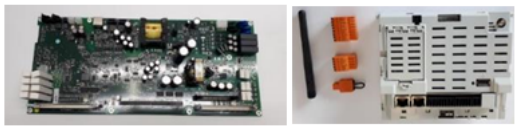
/ And all other parts
(Cover, closures, etc.)



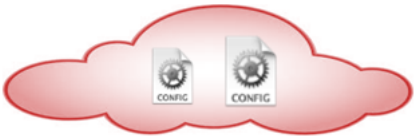
LICENSE MANAGEMENT

Defective inverter

Exchange component:



Control Board, Pilot



Inverter after component exchange

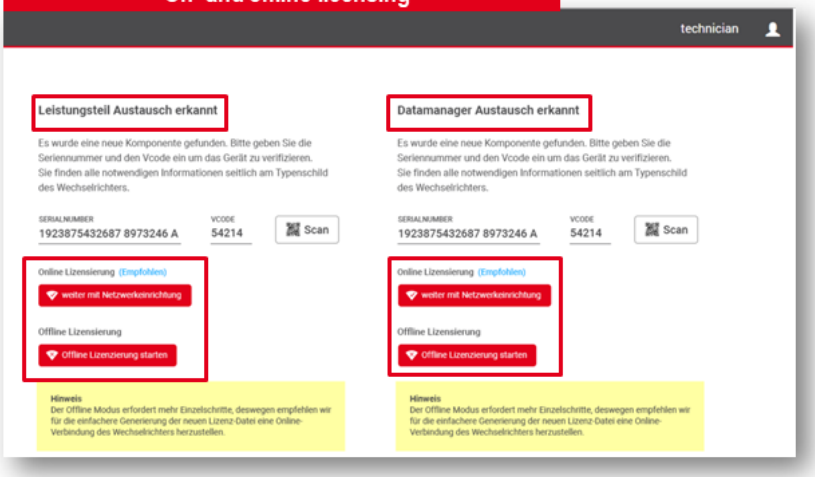
License exchange

LICENSE EXCHANGE

- When is a license exchange necessary?
  - Control Board exchange
  - Pilot exchange
- The pilot registers what type of exchange has been initiated and guides the user through the exchange process.
- 2 license exchange processes possible
  - Online exchange
    - The user only has to bring the device online, the exchange of the license will be handled automatically
  - Offline exchange
    - The user has to download the so called „service file" uploads it to a webpage, and gets the new license file to download.

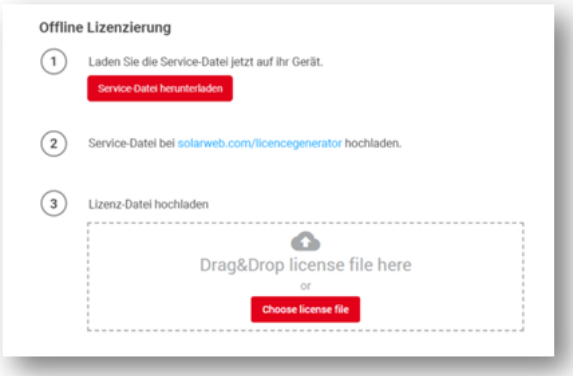
EXCHANGE PROCESSES - OVERVIEW

On- and offline-licensing

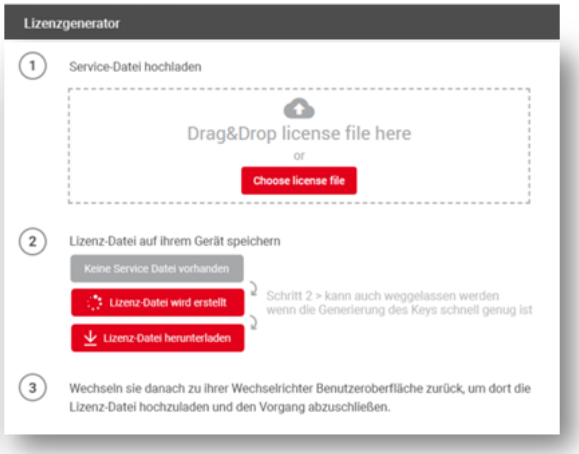


OFFLINE-LICENSING

/ Download service file from the inverter and upload it online



/ Generate licens file, download it and upload it to the inverter

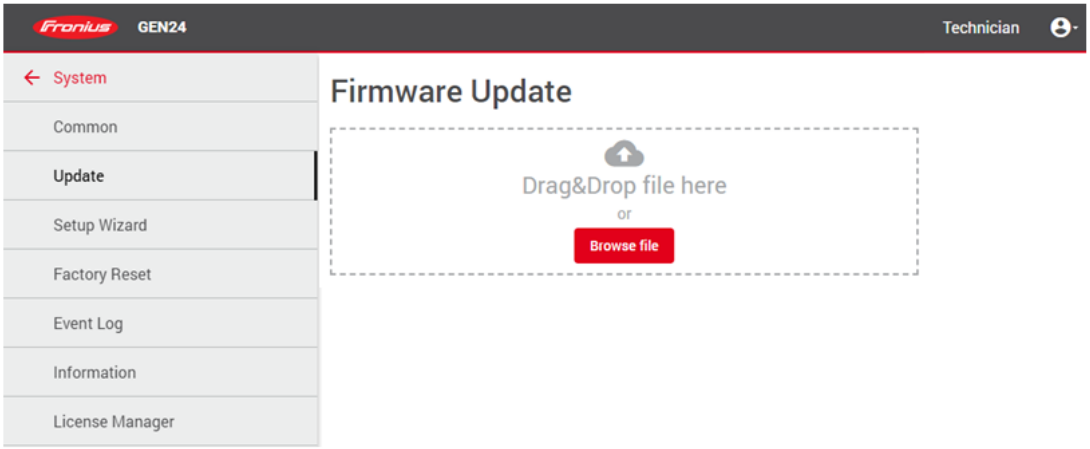


FRONIUS WARRANTY OPTIONS

- **2 years warranty plus** (Material, Service, Transport) from delivery on.
- **Warranty extensions** possible on Fronius Solar.web after product registration.
  - Option 1: **additional 3 years Fronius warranty Plus** (Material, Service, Transport)
  - Option 2: **additional 5 years Fronius warranty** (Material)

- **Up to 15 years** warranty in total possible.

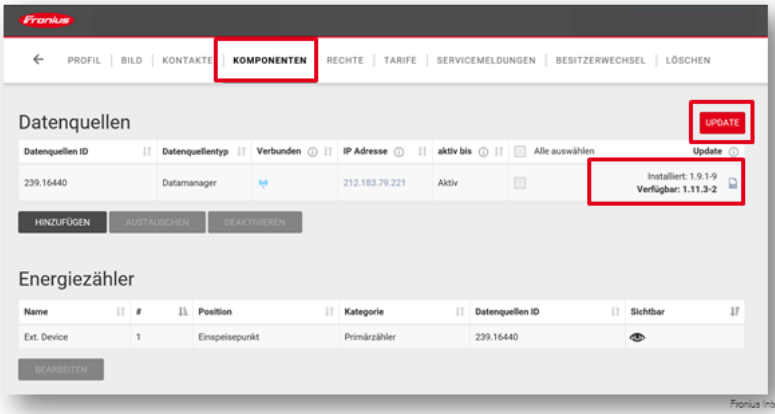
LOCAL SOFTWARE UPDATE



REMOTE UPDATE VIA FRONIUS SOLAR.WEB

No appointment or drive to the customer necessary!

/ Fronius Solar.web > settings > components > update



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REFERENCES

Greece, Kastoria

/ 1 MWp

/ 13 Fronius Tauro Eco 50 & 100-3-D devices

Fronius site in Pettenbach

/ Perfect Welding / Solar Energy / Perfect Charging

Commercial systems with Fronius SnapINverter

Fronius Symo & Eco

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SNAPINVERTER FOR COMMERCIAL

Symo 10.0-3 – 20.0-3-M

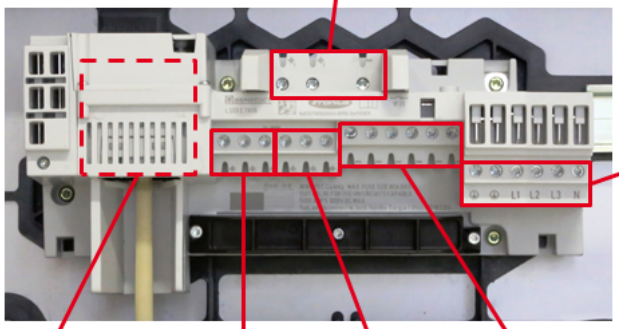
- 10.0 / 12.5 / 15.0 / 17.5 / 20.0 kW
- 2 MPP Tracker – 2 x 3 Strings
- 3-phase inverter
- DC input voltage range: 200 VDC – 1000 VDC
- High efficiency: 98,3 %
- Protection class IP66

Eco 25.0 - 27.0-3-S

- 25.0 / 27.0 kW
- 1 MPP Tracker – 1 x 6 Strings
- 3-phase inverter
- DC input voltage range: 580 VDC – 1000 VDC
- High efficiency: 98,3 %
- Protection class IP66

CABLE CONNECTION FRONIUS SYMO 10-20 KW

2,5 mm²-16mm² cable (DC u. AC)



Cable material: Copper & Aluminium (DC and AC)

OPTIONS

SPD

- Overvoltage protection
- Typ 1+2 or 2
- Symo 10-20/ Eco 25/27
- Single or Multi MPPT

DC Connector Kit

- In combination with string combiner
- 25mm² or 35mm²
- Symo 10-20/ Eco 25/27

String fuses

- When connecting more strings in parallel to Eco 25/27
- 15 A /1.000 V fuses

MC4 plugs

- Can be ordered preinstalled ex-factory
- Length: ~13cm

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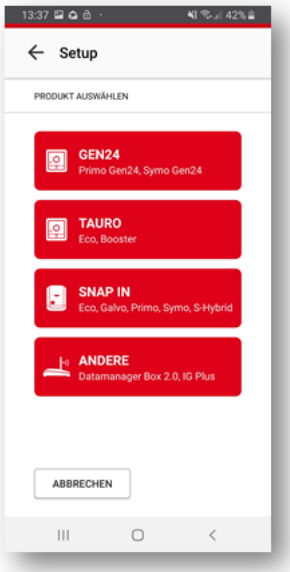
COMMISSIONING VIA APP

- Activate **WIFI Access Point** on the inverter display
- Start app and setup connection with inverter
- Follow the Setup Wizard



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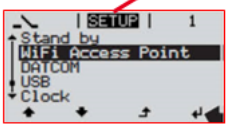
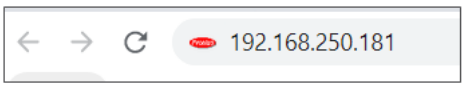
COMMISSIONING VIA BROWSER

- Activate **WIFI Access Point** on the display
- Connect with your laptop, tablet, or smartphone
- Open **Browser** - IP adress: 192.168.250.181
- Follow the **Setup Wizard**





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WIFI ACCESS POINT

How can I open the WiFi Access Point?

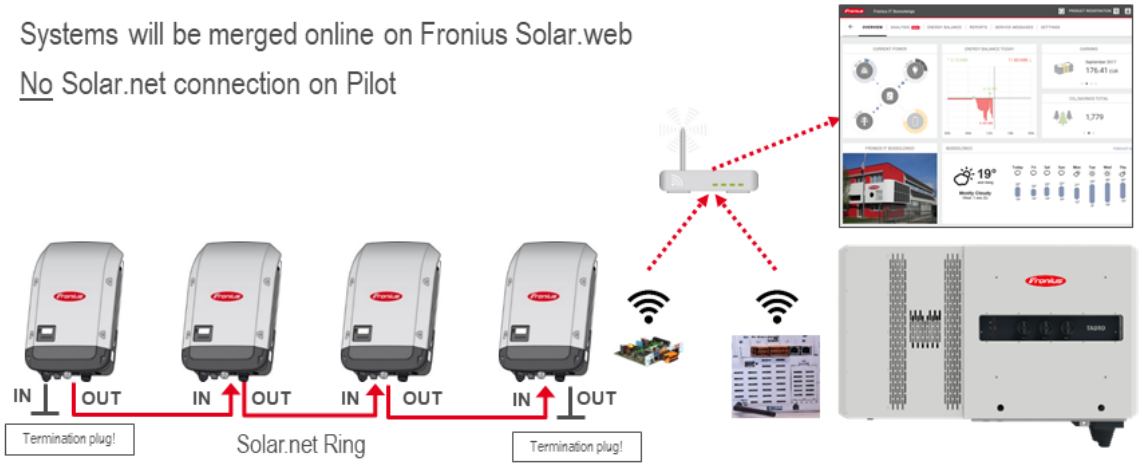
Setup -> Wifi Access Point -> activate

What to do, when the WiFi Access Point is not opening?

1. Wait a moment
2. Check Solar.Net-Ring
3. Check termination plugs
4. Protokol typ Solar.Net
5. IP-Switch on B

SYSTEM COMBINATION – SNAPINVERTER & TAURO

- Systems will be merged online on Fronius Solar.web
- No Solar.net connection on Pilot



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FSP

Fronius System Partner Program NEW

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THE FRONIUS SYSTEM PARTNERSHIP

- Supports your company in successful sales as well as in the implementation and support of Fronius system solutions
  - Exclusive access to Fronius marketing, consulting and service benefits
  - Lead in information and practical knowledge of our solutions
  - Differentiation compared to other installers – Fronius partner with expert knowledge

Fronius International GmbH / Installation und Inbetriebnahme

YOUR TEAM FRONIUS SOLAR ENERGY

Technische Anfragen	Trainings
☎ +43 (0) 7242 / 241 - 5670	☎ +43 (0) 7242 / 241 - 2980
🖷 +43 (0) 7242 / 241 - 95 5670	🖷 +43 (0) 7242 / 241 - 2240
✉ pv-support-austria@fronius.com	✉ pv-training@fronius.com

Vertrieb International	After Sales Service
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🖷 +43 (0) 7242 / 241 - 2240	🖷 +43 (0) 7242 / 241 - 6940
✉ pv-sales@fronius.com	✉ pv-service@fronius.com

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