Siemens Digital Industries Webinari

CP4: SIRIUS 3RW Soft starters

Današnji predavač

Bojan Janković

Responsibility

Sales Engineer

Industrial Controls

Low-Voltage Power Distribution

Electrical Installation Technology

Contact

bojan.jankovic@siemens.com

RC-RS DI PR & TS

Belgrade, Serbia

Siemens Digital Industries Webinari 1/2

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Datum	Tema	Predavač
14.04. / 19.05.	FA1: Motion Control	*Darko Živković, Jelena Đukić*
15.04. / 14.05.	FA2: Energy Management System	*Zoran Jovanović*
22.04. / 21.05.	FA3: Redundantni kontroleri serije S7-1500R/H	*Mirko Milovanović*
05.05. / 26.05.	FA4: WinCC Unified	*Mirko Milovanović*
15.04. / 13.05.	MC1: DT konfigurator	*Nenad Bakal, Pavle Dragišić*
23.04. / 22.05.	MC2: Sizer, large drives	*Miloš Marković, Pavle Dragišić*
06.05. / 26.05.	MC3: Sizer, motion drives	*Miloš Marković, Pavle Dragišić*
21.04. / 21.05.	CI1: Industrial Networks	*Jelena Đukić*

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Datum	Tema	Predavač
16.04. / 15.05.	PI1: PI Academy world	*Andrijana Popara, Miljan Miljanić, Marko Marić*
24.04. / 22.05.	PI2: PI workshop for specialist	*Andrijana Popara, Miljan Miljanić, Marko Marić*
08.05. / 29.05.	PI3: #New@PI	*Andrijana Popara, Miljan Miljanić, Marko Marić*
30.04. / 29.05.	AE1: Digitalna rešenja u procesnoj industriji	*Jelena Đukić, Marko Milenković*
29.04.	CP1: Control Panel Online Symposium	*Siemens worldwide webinar*
22.04. / 27.05.	CP2: Clever engineering in the control panel	*Tijana Džodžo*
28.04. / 12.05.	CP3: New series of signaling devices 3SU	*Tijana Džodžo*
21.04. / 20.05.	CP4: SIRIUS 3RW Soft starters	*Bojan Janković*
07.05. / 28.05.	DE1: Siemens Digital Enterprise	*Zoran Jovanović*

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SIRIUS
Hybrid

SIRIUS 3RW5 Soft Starters

As versatile as your application

siemens.com/softstarters

SIRIUS 3RW Soft Starters
When should we use Soft Starters?

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Pumping	Ventilating	Compressing	Conveying	Processing
				
• Water & waste water sewage • Cooling pump • Hydraulic press	• Air conditioning • Cooling Compressor • Tunnel ventilation	• Air compressor • Cooling compressor • Compressor in biogas plant	• Conveyor belt in cement factory • Conveyor belt in quarry • Reamer in biogas plant	• Stone crusher in quarry • Agitator in chocloate factory • Centrifuge in card board recycling plant

SIRIUS 3RW Soft Starters
It‘s all about starting up motors

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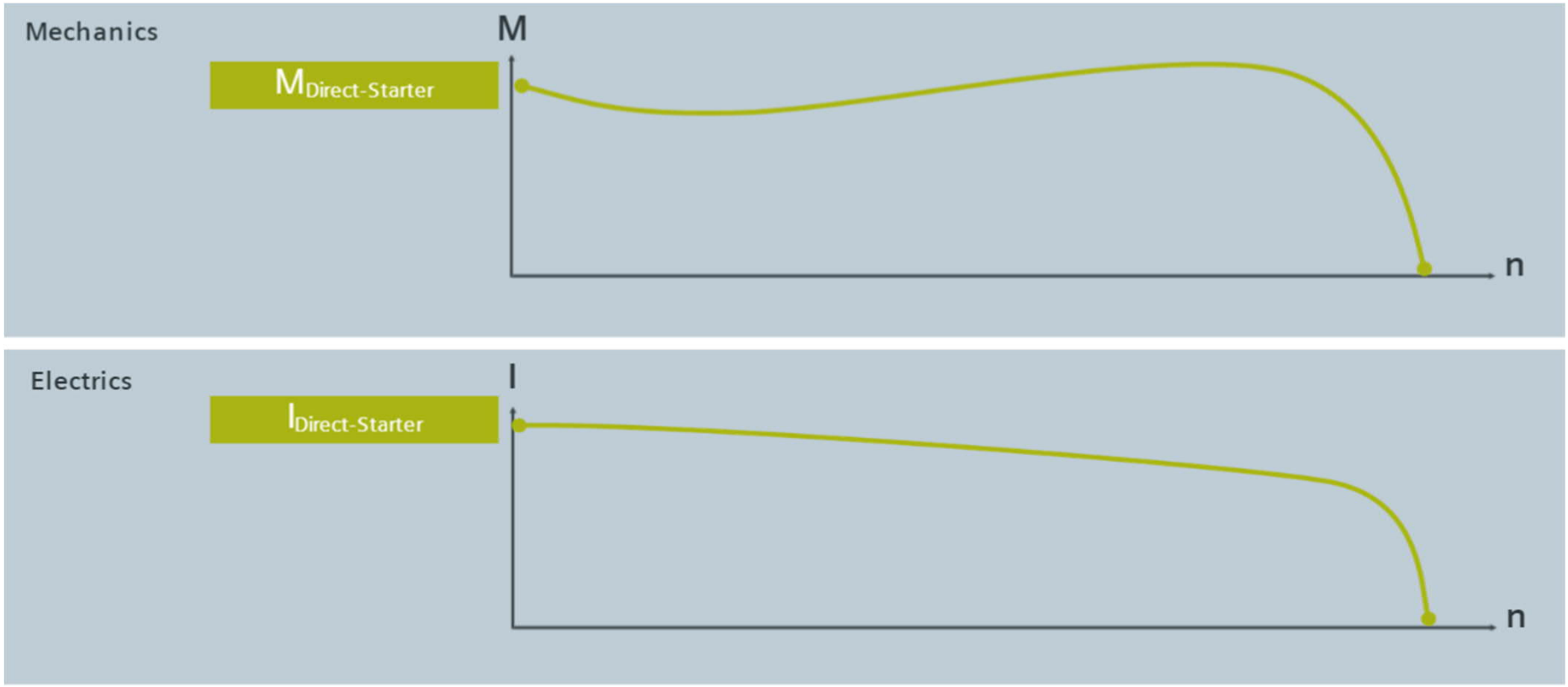

SIRIUS 3RW Soft Starters
It‘s all about starting up motors

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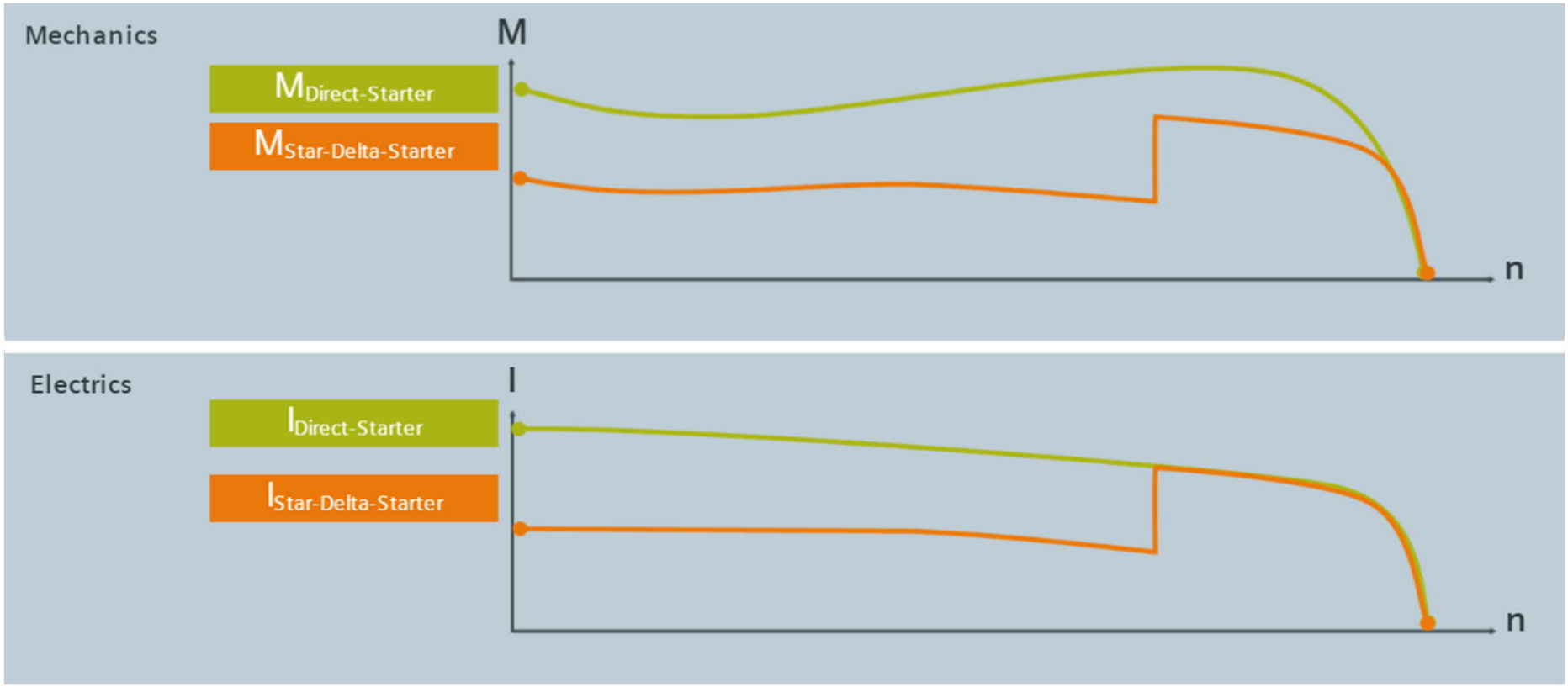

SIRIUS 3RW Soft Starters
It‘s all about starting up motors

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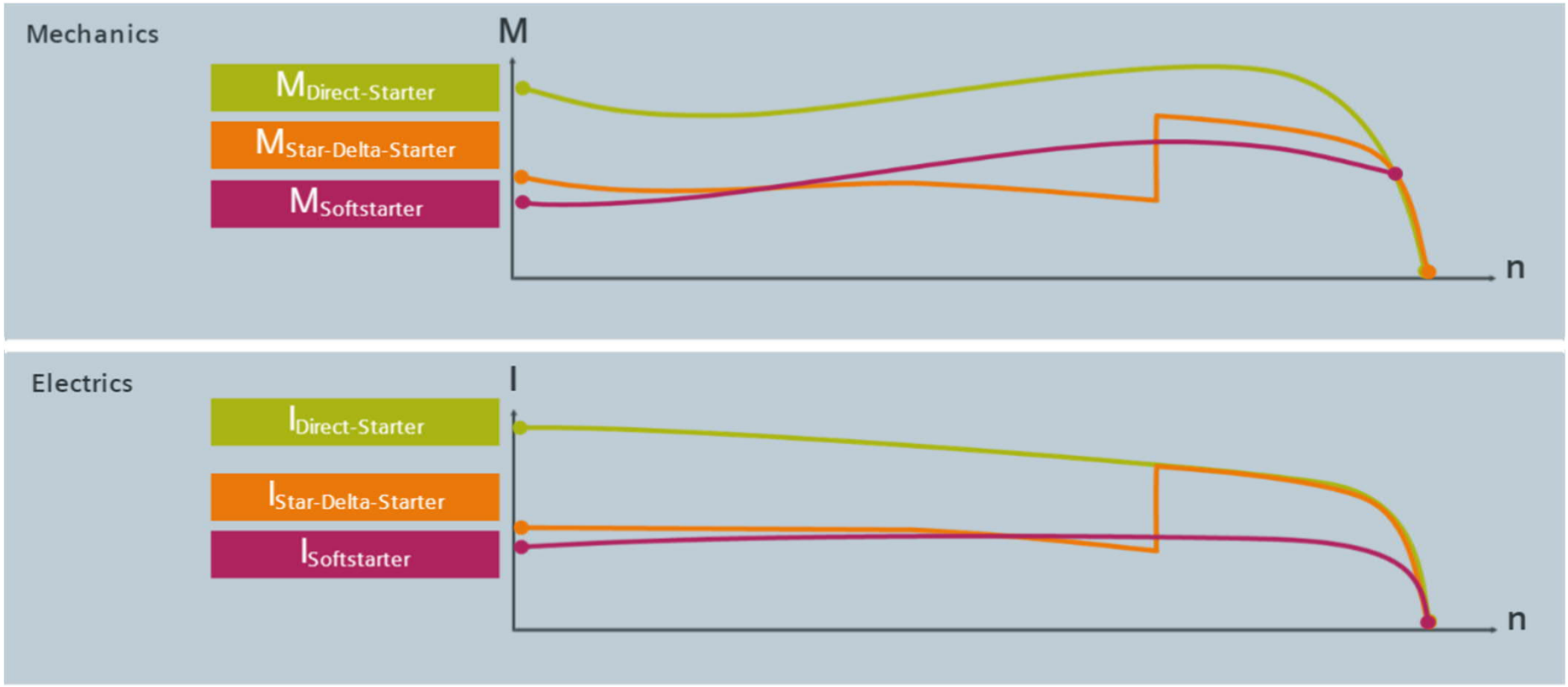

SIRIUS 3RW Soft Starters
Technology of Softstarters – 3 important topics

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Hybrid switching technology

2/3 phase control

Connection: Standard, inside-delta

SIRIUS 3RW Soft Starters
Technology of Softstarters – 3 important topics

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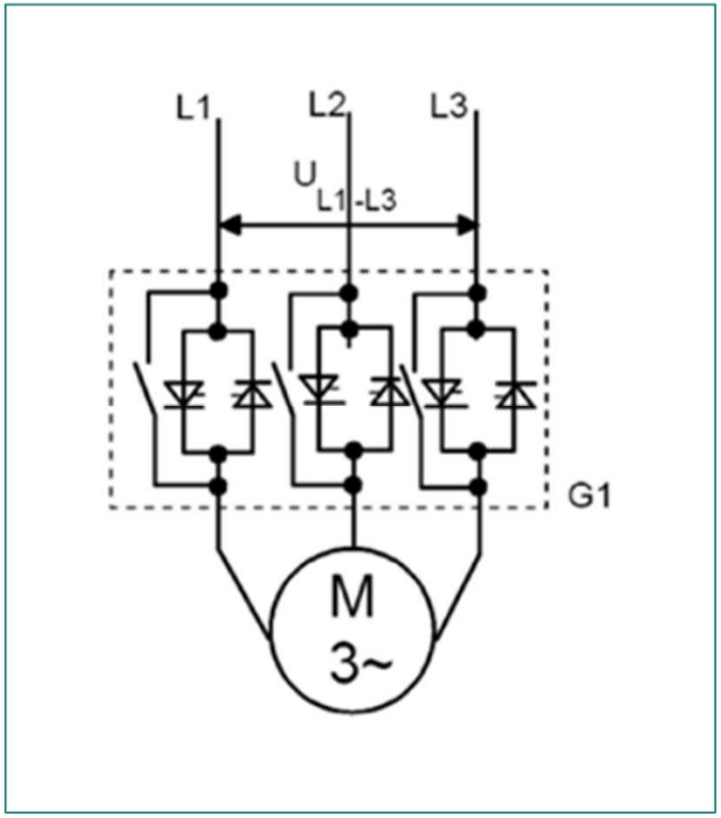
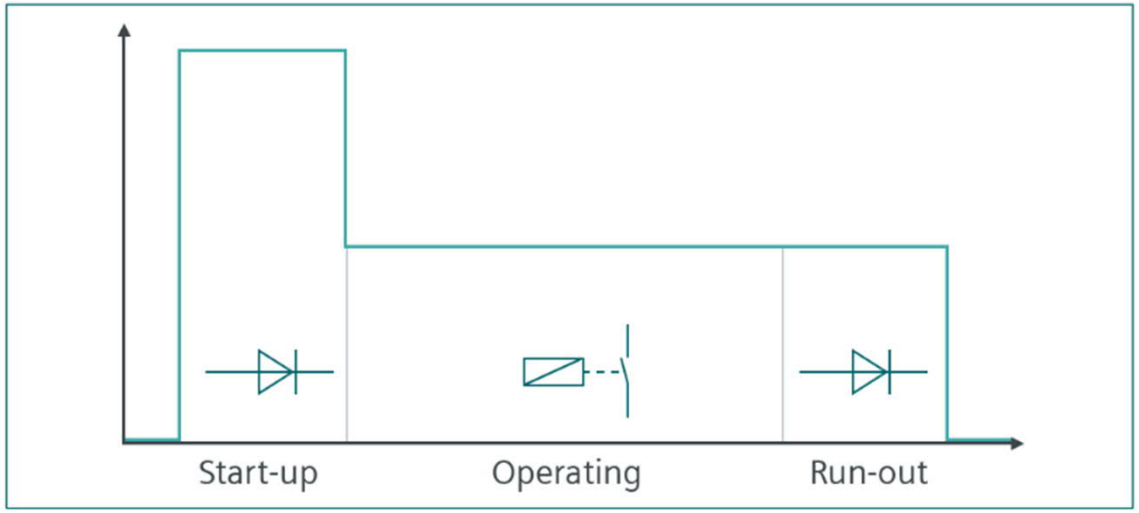
The hybrid switching technology is the core technology of our SIRIUS 3RW Soft Starter





The advantages of hybrid switching technology

- Lowest power dissipation and heat generation
- Compact and space-saving
- Optimum and reliable motor control

SIRIUS 3RW Soft Starters
Technology of Softstarters – 3 important topics

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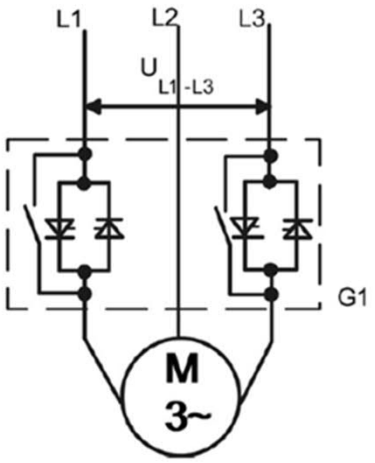
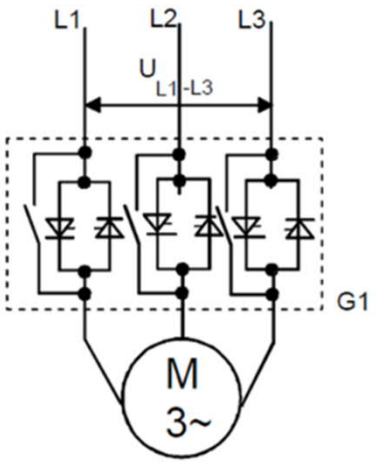
The difference between 2 and 3 phase controlled soft starters is essential for the application!

2-phase controlled	3-phase controlled
	
Compact and cost effective solution for applications with simple motor starting requirements	Perfect solution for applications with complex requirements with regard to motor startup/shutdown and motor control.

SIRIUS 3RW Soft Starters
Technology of Softstarters – 3 important topics

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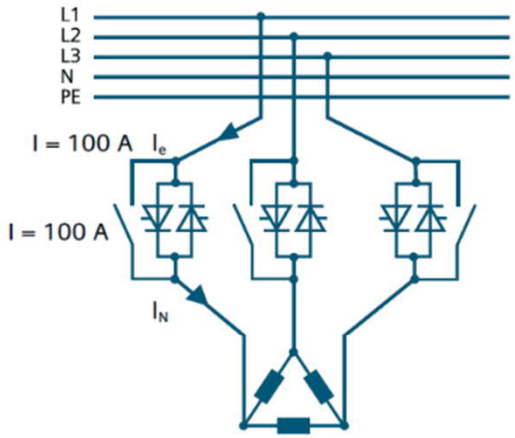
The inside-delta circuit increases the competitiveness when switching from star-delta to soft starters

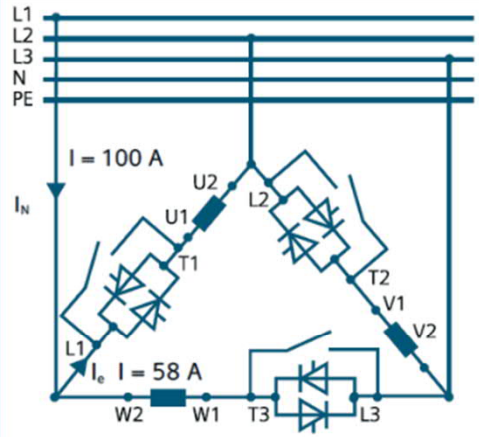
Standard circuit



Soft Starter selection according to rated motor current :

$I_{Soft\ Starter} = I_{motor}$

Inside-delta circuit



Soft starter selection according to rated motor current smaller by factor $1/\sqrt{3}$:

$I_{Soft\ Starter} = 1/\sqrt{3} * I_{Motor}$

- The use of a device smaller by a factor of $1/\sqrt{3}$ is possible, thus saving space/cost/wiring
- Perfect solution for removing star-delta starters
- Possible with all SIRIUS 3RW52 and SIRIUS 3RW55 soft starters (not possible with 2-phase controlled soft starters)

SIRIUS 3RW Soft Starters – Portfolio at a glance

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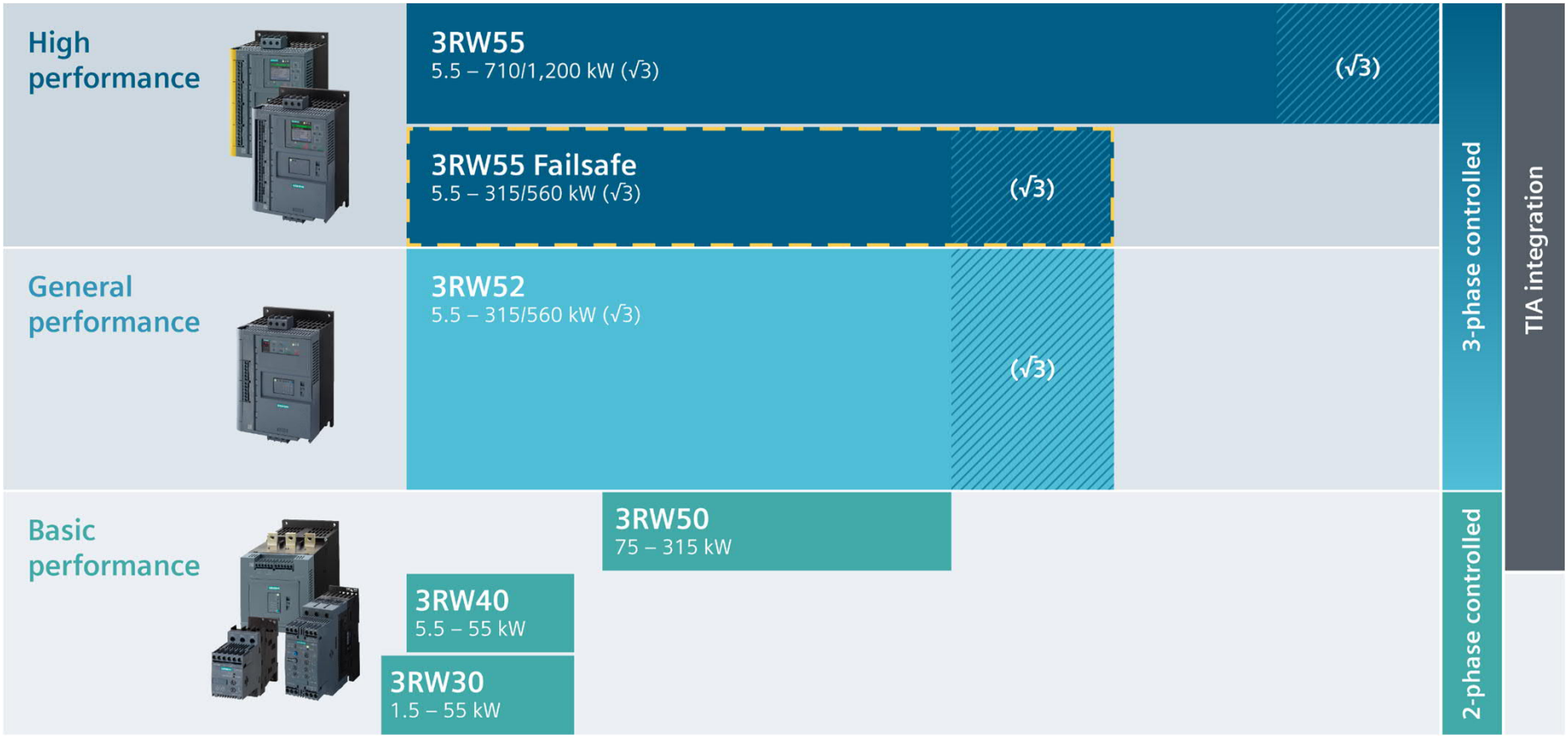

Pumping Ventilating Compressing Conveying Processing

SIRIUS 3RW5 Soft Starters
As versatile as your application

NEW

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	Basic (3RW30/40)	Basic (3RW50)	General (3RW52)	High (3RW55)
		TIA integration		
	2-phase controlled		3-phase controlled	
Pumping	Standard loads (CLASS 10E) / Heavy loads (CLASS 20E) Ramp-up time 1 … 20s			Heavy loads (CLASS 30E) Ramp-up time 1 … 360s
Ventilating				
Compressing				
Conveying				
Processing				

Complexity of motor starting, operation/monitoring and stopping is reflected in our portfolio with Basic, General and High Performance Soft Starters

SIRIUS 3RW55 Soft Starters
Motor overload trip classes according to IEC 60947-4-2

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Trip class	Tripping time t [s]
5	0,5 < t ≤ 5
10 A	2 < t ≤ 10
10	4 < t ≤ 10
20	6 < t ≤ 20
30	9 < t ≤ 30
---	---

Characteristic values

- Ambient temperature: 40° C
- A current occurs equal to 7,2 times the rated motor current. (= 6 times plus 20%)
- The tripping must not occur before the lower value of the tripping time but it shall occur latest after the higher value.

Trip class	Tripping time t [s]
5 E	3 < t ≤ 5
---	---
10 E	5 < t ≤ 10
20 E	10 < t ≤ 20
30 E	20 < t ≤ 30
40 E	30 < t ≤ 40

For example: What is the difference between the trip classes 10 A and 10 E ?

- Trip class 10 A: The tripping must not occur before 2 s but it shall occur latest after 10 s (therefore class 10).
- Trip class 10 E: The tripping must not occur before 5 s but it shall occur also latest after 10 s.

Customers benefit: Trips might come later with tolerance band “E” (e. g. class 10 E).
Notice: The more heavier a soft start in a customer's application is …
… the more better is using a soft starter with trip class 10 E instead of trip class 10 A.

SIRIUS 3RW30/40 Soft Starters
Basic Performance

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Top highlights

Feature / Function	Benefit
Voltage ramp and current limitation function (3RW40)	Protection of electric and mechanic
Hybrid-technology (integrated bypass contactor)	Less heat dissipation and temperature rise in the control cabinet, energy saving
Parameter assignment by only two parameters	Fast and easy commisioning
Compact design	Space and cost saving
Tested load feeder combinations possible with components from the SIRIUS modular system	Easy selection and design of electric components for motor control

SIRIUS 3RW50 soft starters
Basic performance

NEU

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Compact frame sizes due to:
- Hybrid switching technology
- 2-phase control

Fast and easy commissioning via rotary coding switches

Fieldbus communication optional, side mounting to the device

Device variants:
- Analog output or
- Thermistor motor protection

75 – 315 kW

Optional accessories for door mounting:
- Standard HMI or
- High-Feature HMI

3RW50

SIRIUS 3RW50 Soft Starters: Product variants
Analog output or thermistor motor overload protection

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Customer benefits

- Analog output
  - For current measuring output
  - Flexibility to choose from 4 – 20 mA or 0 – 10 V signal type
- Thermistor motor overload protection
  - Complete motor protection with the combination of the electronic motor overload protection
  - PTC thermistor or temperature switch (Klixon / Thermoclick) connection

How to use it

- Simply order the corresponding article number:
  - The 10th place in the order number defines the type:
    - 3RW5213-1AC04 → Analog output
    - 3RW5213-1AT04 → Thermistor motor overload protection
- Default scale according to the rated operational current of the device:
  - 4 mA → 0 % von Ie
  - 20 mA → 300 % von Ie
  - With High-Feature HMI: change in the scale and signal type possible
  - For the thermistor motor overload protection no parameterization is required

Sanftstarter SIRIUS 3RW5
Communication and HMI modules

NEU

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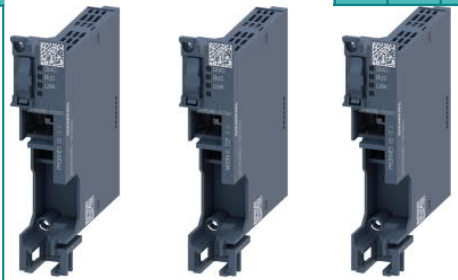
Communication

50	52	55
		✓

PROFINET-HF
(switched Ethernet)

50	52	55
✓	✓	✓



PROFINET-Std, EtherNet/IP, Modbus-TCP

50	52	55
✓	✓	✓

PROFIBUS

50	52	55
✓	✓	✓

Modbus-RTU

HMI

50	52	55
✓	✓	✓

HMI High-Feature

50	52	55
✓	✓	

HMI Standard

SIRIUS 3RW50 soft starters
Accessories

NEU

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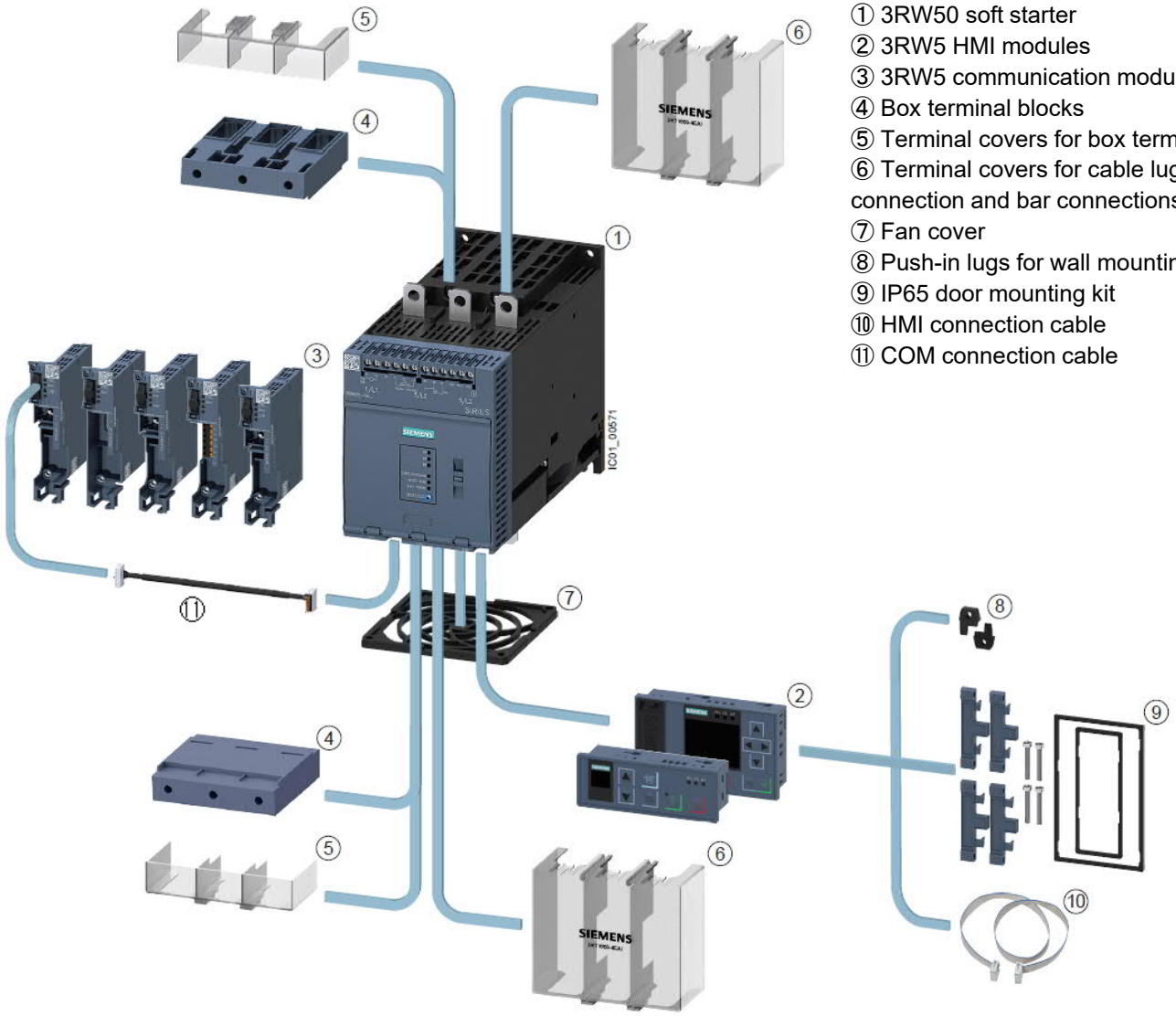

① 3RW50 soft starter
② 3RW5 HMI modules
③ 3RW5 communication modules
④ Box terminal blocks
⑤ Terminal covers for box terminals
⑥ Terminal covers for cable lug connection and bar connections
⑦ Fan cover
⑧ Push-in lugs for wall mounting
⑨ IP65 door mounting kit
⑩ HMI connection cable
⑪ COM connection cable

SIRIUS 3RW52 Soft Starters
General performance

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Product variants: analog output or thermistor motor overload protection

Easy and fast parameterization via rotary coding switches

Optional accessories: standard or high-feature HMI (operator panel) for mounting in the soft starter or in the cabinet door

5.5 – 315 kW (560kW inside delta)

Optional fieldbus communication

3RW52

SIRIUS 3RW52 Soft Starters
Accessories

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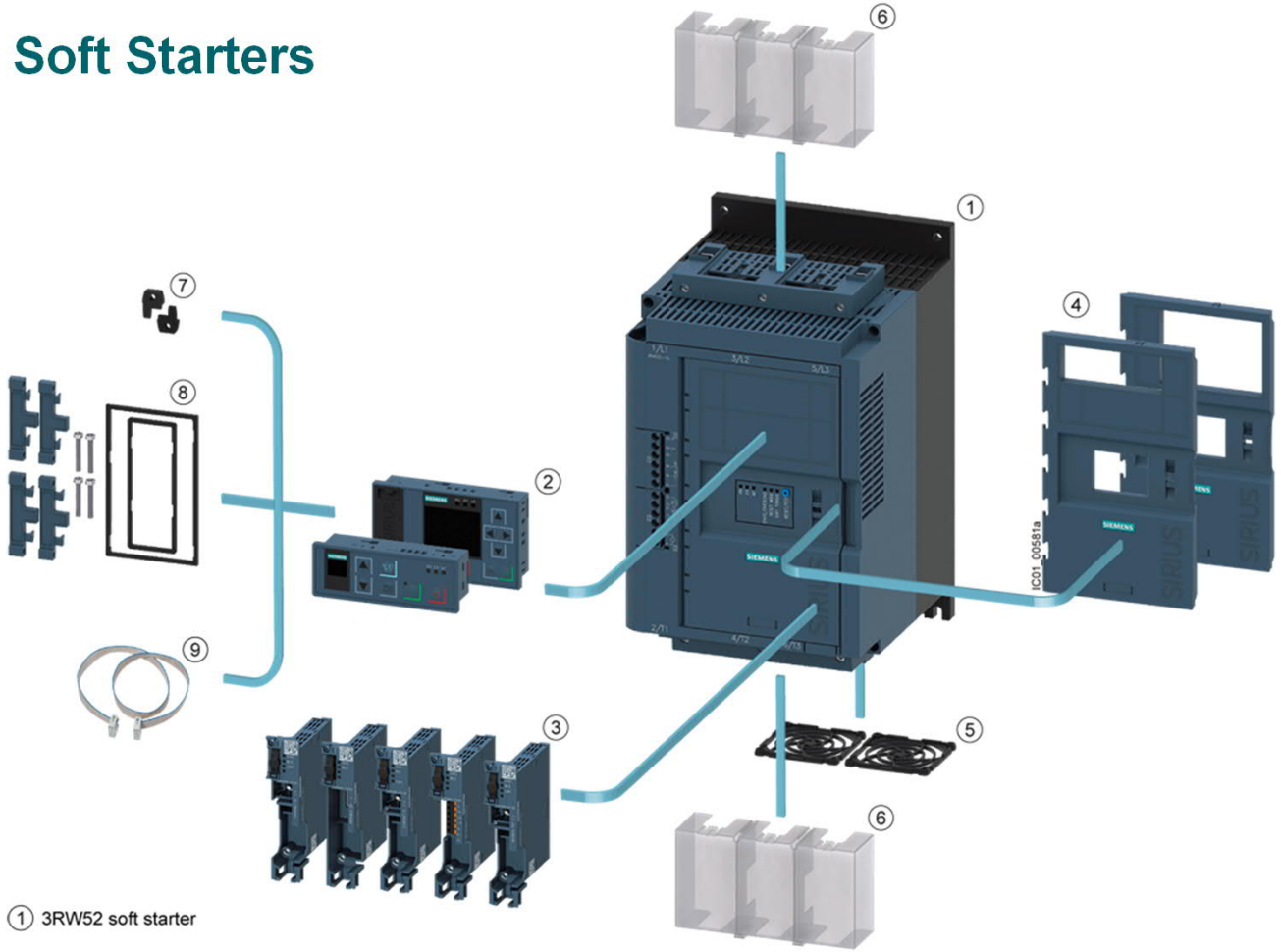

1 3RW52 soft starter

2 HMI modules
3 Communication modules
4 Hinged cover
5 Fan covers
6 Terminal covers

7 Push-in lugs for wall mounting
8 IP65 door mounting kit
9 HMI soft starter connection cable

SIRIUS 3RW52 Soft Starters: rotary knobs
Quick and easy parameterization

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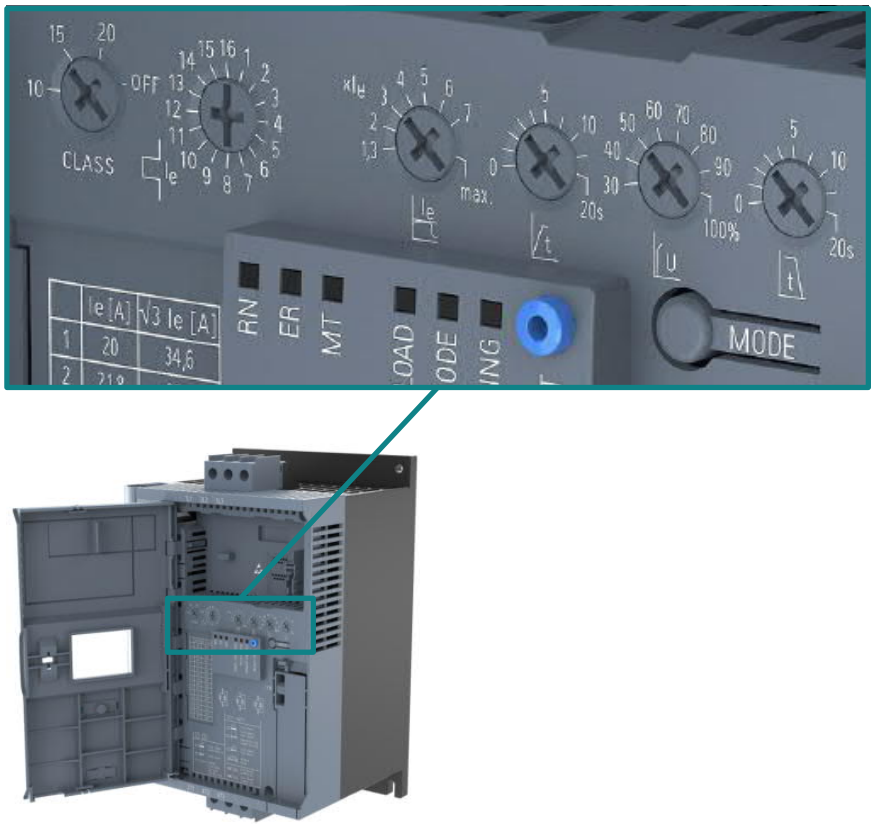
Customer benefits

- Time saving due to easy parameterization over rotary knobs
- Improved precision of operational current setting thanks to 16 position rotary knob
- Quick overview of the rated operational currents for standard and inside-delta connection
- Optional: in combination with either HMI, the user can view the actual setting in the display for fine adjustment

How to use it

- Just turn the rotary knob to the desired position between 1 and 16:
  - Read out from the table the correspondent current value according to the connection type you have (the closest value to the motor operational current)
- With the “MODE” button you can activate / deactivate the Soft Torque function and choose the Reset Mode.



SIRIUS 3RW52 Soft Starters
Overview of parameters

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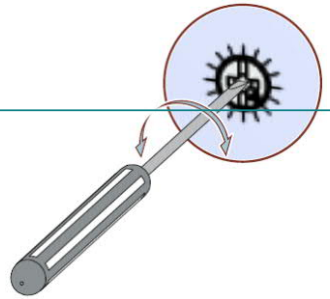

Parameters	Symbol	Setting range	Factory setting
Trip class for motor overload protection	CLASS	10A, 10E, 20E, OFF	10A
Rated operational current I_e of the motor[1)]	I_e	1 ... 16[2)]	16
Current limiting value as a multiple of the set rated operational current I_e of the motor	I_e	• 1.3 ... 7 x I_e • Max.	4 x I_e
Ramp-up time	t	• 0 ... 20 s • If parameter value "0" is set, the motor is switched on with a ramp-up time of approx. 100 ms.	10 s

Parameters	Symbol	Setting range	Factory setting
Starting voltage	U	30 ... 100 %	30 %
Ramp-down time	t	0 ... 20 s	0 s
SOFT TORQUE	SOFT TORQUE MODE	• Off (LED off) • On (LED on)	Off
RESET MODE	RESET MODE MODE	• Manual RESET (LED off) • Remote RESET (LED flashes green) • Auto RESET (LED lit green)	Manual RESET

1) The rated operational current I_e of the motor may, according to the standard, deviate by 20% from the rating plate specification of the manufacturer.

2) For meaning of scale, refer to laser-cut table on front panel of device.

SIRIUS 3RW52 Soft Starters - Getting Started

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SIRIUS 3RW55 Soft Starters
High performance

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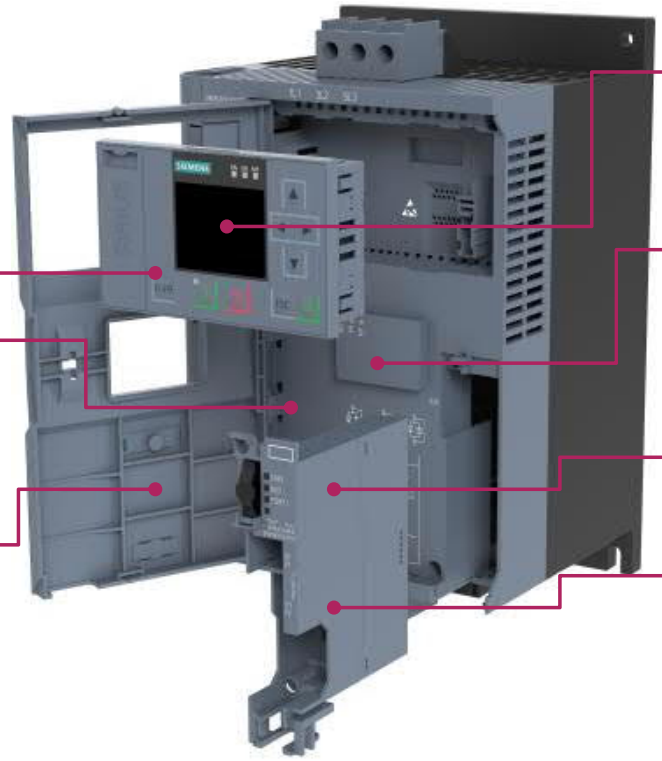

- Autoparameterization
- Pump-specific functions:
  Pump cleaning and stopping
- Reversing operation
- Condition Monitoring
- Increased IT security:
  User account management
- Optional communication modules
- Failsafe variant selectable

3RW55 Size 1

SIRIUS 3RW55 Failsafe soft starters – STO as a feature

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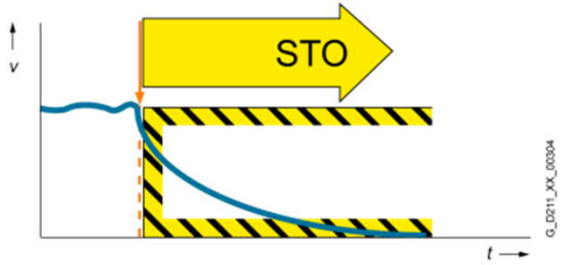
Functionality

- **STO (Safe Torque Off) for 3RW55**
  SIL1 according to IEC 61508
  Cat 2, PL c according to IEC 13849-1
  SILCL1 according to IEC 62061
- **F-DI: failsafe input for initiating the STO command**
- **F-RQ: relay output („41/42, NC“) for the feedback circuit (FB)**

STO (Safe Torque Off)

- Immediate power supply interruption to the actuator with uncontrolled stopping
- Safe restart interlock: prevents unexpected starting of the motor



SIRIUS 3RW55 Failsafe soft starters – Wiring examples

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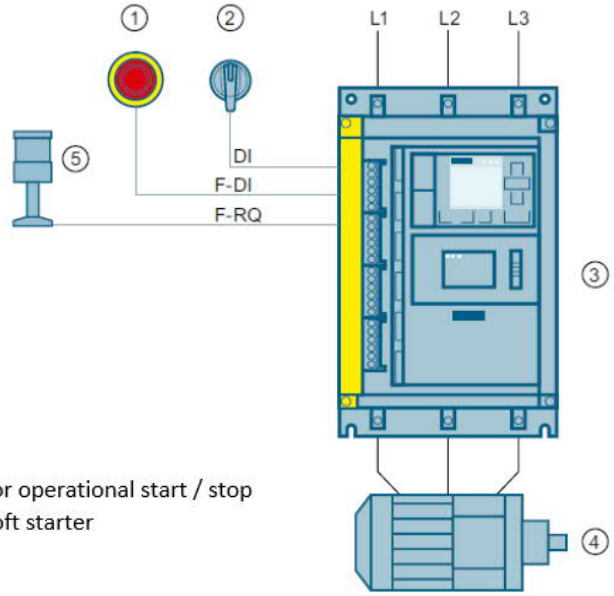
SIL 1 / PL c

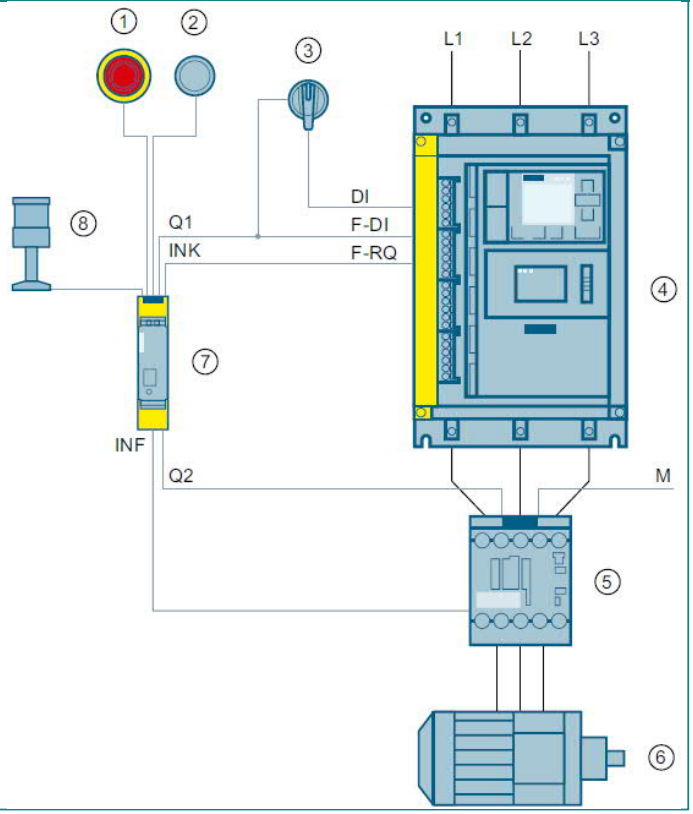


(1) Emergency stop
(2) Selector switch for operational start / stop
(3) 3RW55 failsafe soft starter
(4) Motor
(5) Signaling column

DI	Digital input
F-DI	Failsafe digital input
F-RQ	Failsafe relay output

SIL 3 / PL e

Example with coupling of the digital input DI with the failsafe digital input F-DI



(1) Emergency stop
(2) Push button for the failsafe release
(3) Selector switch for operational start / stop
(4) 3RW55 failsafe soft starter
(5) 3RT2 contactor
(6) Motor
(7) 3SK1 advanced safety relay
(8) Signaling column

DI	Digital input
F-DI	Failsafe digital input
F-RQ	Failsafe relay output
M	Mass
Q1	Failsafe output from 3SK1
Q2	Failsafe output from 3SK1
INK	Cascade circuit from 3SK1
INF	Feedback circuit 3SK1

3RW55 – Autoparameterization

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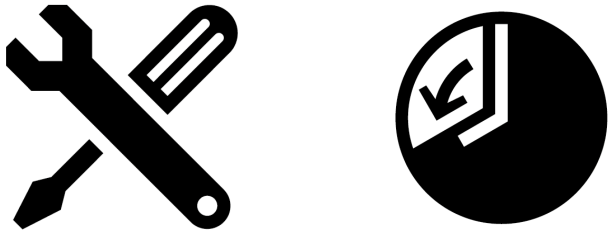
USP

Customer benefits

- Reduced complexity and parameterization time during commissioning
- The soft starter has a self-teaching function that selects the parameters in a way, so that the starting current of the application is maintained as low as possible in order to reach the desired ramp up time and guaranteeing a successful start.
- In case that the load characteristics change, the soft starter detects this during start up and the parameters are adjusted accordingly.



How to use it

- After setting up the language, date and time during the first power up, you can directly continue with the autoparameterization and activate it.
- Alternatively: Parameters → Soft starter → Parameter set 1 → Autoparameterization
- You can choose to enter only the desired starting time of the application or also an additional (optional) current limiting value.
- This function remains active, so that the best soft starter settings are guaranteed for the starting procedure.
- The autoparameterization has no effect in the stopping parameters. These settings need to be addressed by the user as a normal parameterization.

3RW55 – Autoparameterization

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3RW55 – Condition Monitoring (CM)

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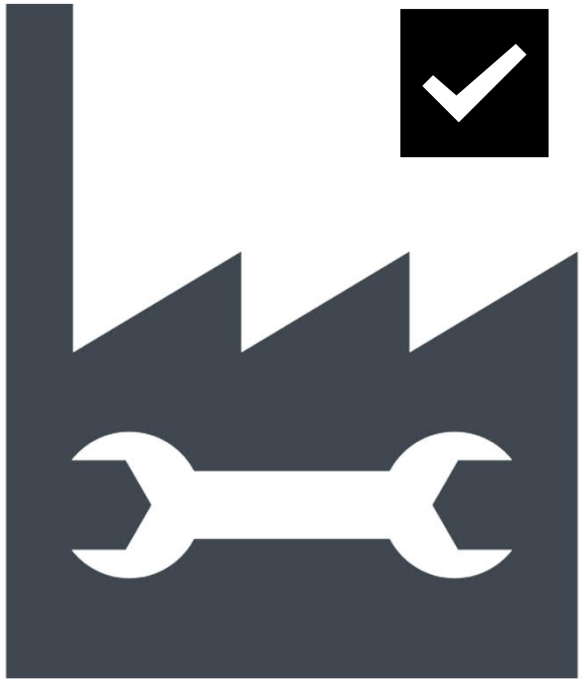
Customer benefits

- The CM function monitors the status of the complete application which is driven by the motor, in order to be able detect possible wear of the machine and plan a correspondent maintenance work in advance.
- With predictive maintenance, unplanned still stands can be avoided and a continuous operation can be ensured.
- Depending on each application, different warn and error limits can be set up, so that the user has enough time plan the maintenance works thus reducing the production costs.

How to use it

- **Power and current monitoring:** the complete consumption of the starter is monitored and analyzed and as soon as one set limit is reached, the soft starter detects it and reports it either as warning or error, with a clear text on the HMI, the yellow LED (HMI and soft starter) and/or over communication.
- **Switching frequency monitoring:** enables the user to monitor how many times the application has been switched on and off. Depending on the application, two different monitoring times can be set:
  - between 2 start commands
  - between a stop command and the next start command
- **Starting time monitoring:** the time that the application takes to start up, which is from giving the start command until the rated operational speed is reached (different from the ramp time)



3RW55 – Pump cleaning

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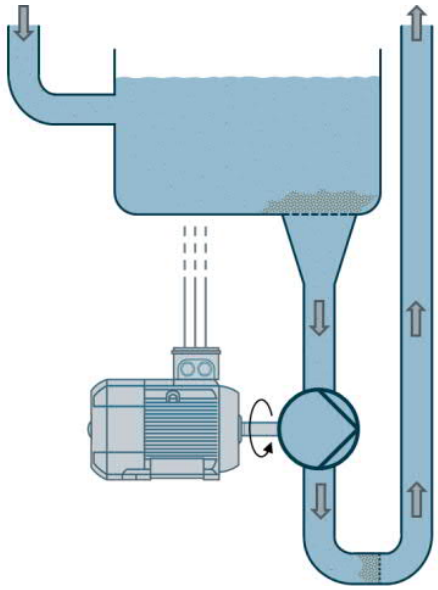
Customer benefits

- Enables the user to do maintenance and cleaning procedures in pumping systems:
  - Debris, tissue paper and other solids collect themselves in the impellors of the pumps, especially in sump pumps. These can be cleaned / removed with the pump cleaning function.
- The soft starter initiates a cleaning function, where the soft starter starts the motor forward for a couple of seconds and then the direction of rotation is changed to a backwards operation also for a coupe of seconds. This process is then repeated several times (user defined).
- The application runs then normally and maintenance costs can be saved.

How to use it

- You find the pump cleaning function as part of the condition monitoring functions.
- The user defines the number of cycles (1x forward + 1x backward) and the time of a half cycle.
- The same starting parameters of the soft starter for normal operation can be used for the pump cleaning function. If others are required, for example a stronger start, a second parameter set can be used.
- No additional hardware is required, since the backwards motion is done with the creep speed function (~$^1/_3$ of the torque). However, a stronger version (full torque) of the pump cleaning can be used when combining it with the reversing operation (reversing contactors required). See next slide.
- The user requires only to give a “start pump cleaning” command, everything else is done by the soft starter.



3RW55 – Pump cleaning

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3RW55 – Reversing operation (at full speed)

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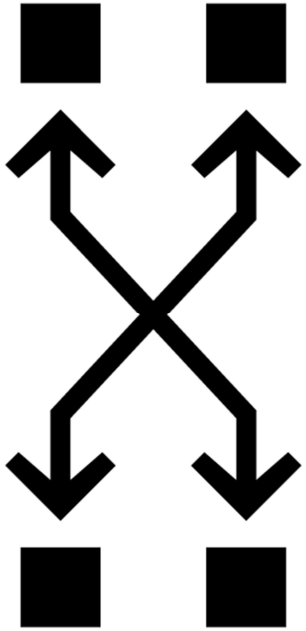
Customer benefits

- The reversing operation enables the user the possibility to drive the application forwards and backwards at full speed, with the combination of two external contactors (or reversing combination) without needing an external/additional control.
- The soft starter controls with the programmable outputs the two external contactors and monitors at the same time the direction of rotation of the motor.
- The user can alternatively use the creep speed mode, without using external contactors but with the consideration that the maximum speed and torque during backwards operation is limited to approximately $^1/_3$ of the rated values.

How to use it

- Two digital outputs require to be parameterized with the respective actions “Reversing contactor right” and “reversing contactor left” and wired to the correspondent contactor.
- After this set up, the command “Motor left” is available in the start button of the HMI and in the menu.
- The creep speed mode is activated in the same way as today, over the process image (HMI, digital input or communication).



SIRIUS 3RW5 Soft Starters
Technical data overview

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	3RW40 S0-S3	3RW40 S6-S12	3RW50 S6-S12
Rated current	12,5-106 A	134-432 A	143-570 A
Main voltage	200-480 V 400-600 V	200-460 V 400-600 V	200-480 V 200-600 V
Bypass system	integrated (hybrid switching technology)		
Number of controlled phases	2		
Connection type	standard		
Control voltage	24 V AC/DC 110 - 230 V AC	115 V AC 230 V AC	24 V AC/DC 110 - 250 V AC
Electronic motor overload protection	CLASS 10, 15, 20	CLASS 10, 15, 20	CLASS 10A, 10E, 20E
Thermal motor overload protection	thermistor, temperature switch (product variant)	---	thermistor, temperature switch (product variant)
Analog output	---		0-10 V, 4-20 mA (product variant)
Fieldbus protocol	---		PN-Std, PB, ETH-IP, MB-TCP, MB-RTU (acc.)
Communication modules (acc.)	---		Side mounting
Operator panel / display	---		HMI Standard / High-Feature
	---		Door mounting
PCB coating	All PCB's		

SIRIUS 3RW5 Soft Starters
Technical data overview

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	3RW44	3RW52	3RW55	3RW55 Failsafe
Rated current	29-1280 A	11-570 A	11-1280 A	11-570 A
Main voltage	200-480 V 400-600 V 400-690 V	200-480 V 200-600 V	200-480 V 200-690 V	200-480 V
Bypass system	integrated (hybrid switching technology)			
Number of controlled phases	3			
Connection type	standard, inside delta			
Control voltage	115 V AC 230 V AC	24 V AC/DC 110 - 250 V AC		
Electronic motor overload protection	CLASS 5, 10, 15, 20, 30	CLASS 10A, 10E, 20E	CLASS 10A, 10E, 20E, 30E	
Thermal motor overload protection	thermistor, temperature switch	thermistor, temperature switch (product variants)	thermistor, temperature switch	
Analog output	---	0-10 V, 4-20 mA (product variant)	0-10 V, 4-20 mA	
Fieldbus protocol	PB, PN-HF (accessories)	PN-Std, PB, MB-TCP, PN-HF, ETH-IP, MB-RTU (accessories)		
Communication modules (acc.)	plug-in module			
Operator panel / display	HMI	Std / High Feature HMI (acc.)	high-feature HMI	
	accessory for cabinet door	mounted in the soft starter / detachable for cabinet door		
PCB coating	all PCB's			

SIRIUS 3RW Soft Starters
What do you need to know and how to select?

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Main criteria

Environment
- Ambient temperature
- Site altitude

Motor
- Rated current/power
- Starting current factor (IE3/IE4)

Application
- Type of load (n/M-curve)
- Starting profile (ON-time, frequency)

Tools

- **Catalog IC 10 • 2020 - SIRIUS Industrial Controls**
- **STS Simulation Tool for Soft Starters as Desktop or Mobile version (iOS, Android) http://www.siemens.com/STS**
- **TIA Selection Tool, Soft Starter ES in TIA Portal V15**

SIRIUS 3RW Soft Starters
With STS, the correct selection of 3RW Soft Starters has never been so easy!

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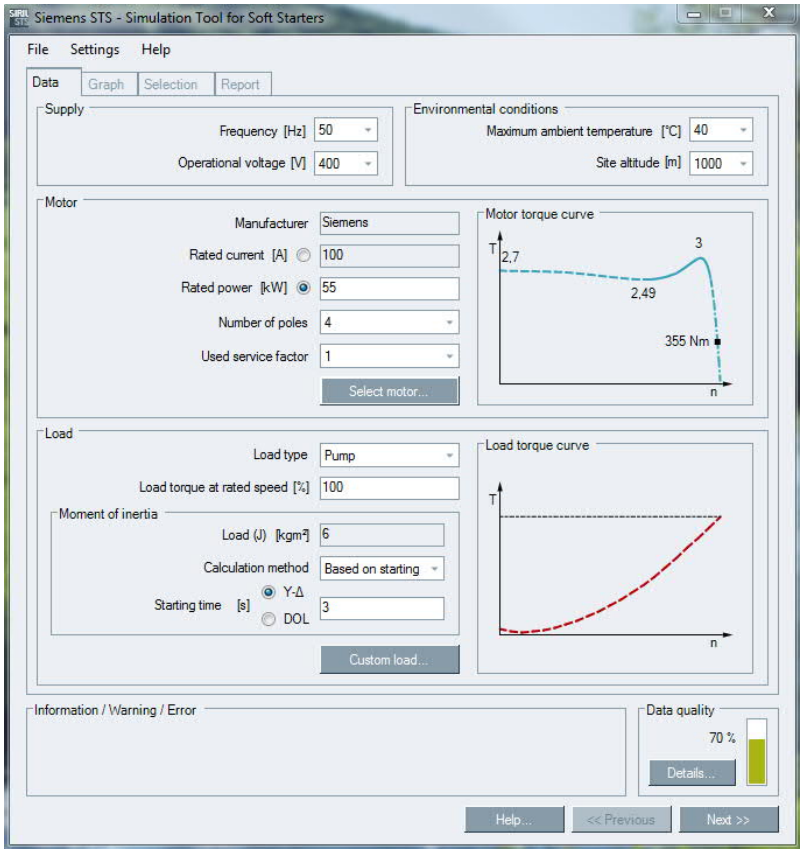

Use case and application

- Selection and simulation program for the 3RW Soft Starters
- Program for simulating soft starter applications, so that the adequate soft starter can be chosen under different considerations

Focus points and Innovations

- User-friendly interface with multilanguage support
- Up-to-date Siemens motor database up to 1250 kW, including IE3 motors
- Update capability (for new soft starters, motors or functions)
- Quick simulation with only a few basic inputs
- Immediate display of starting curves and diagrams with limit values
- Table view of possible soft starters suited for the given application
- Some NEW features with V2.0:
  - Possibility to create/edit custom loads with gears
  - Expansion of motor database up to 1200 kW motors
  - View of thermal load of the soft starter
  - Automatic online update

With Soft Starter ES we expand the functionality of the 3RW5 Soft Starters

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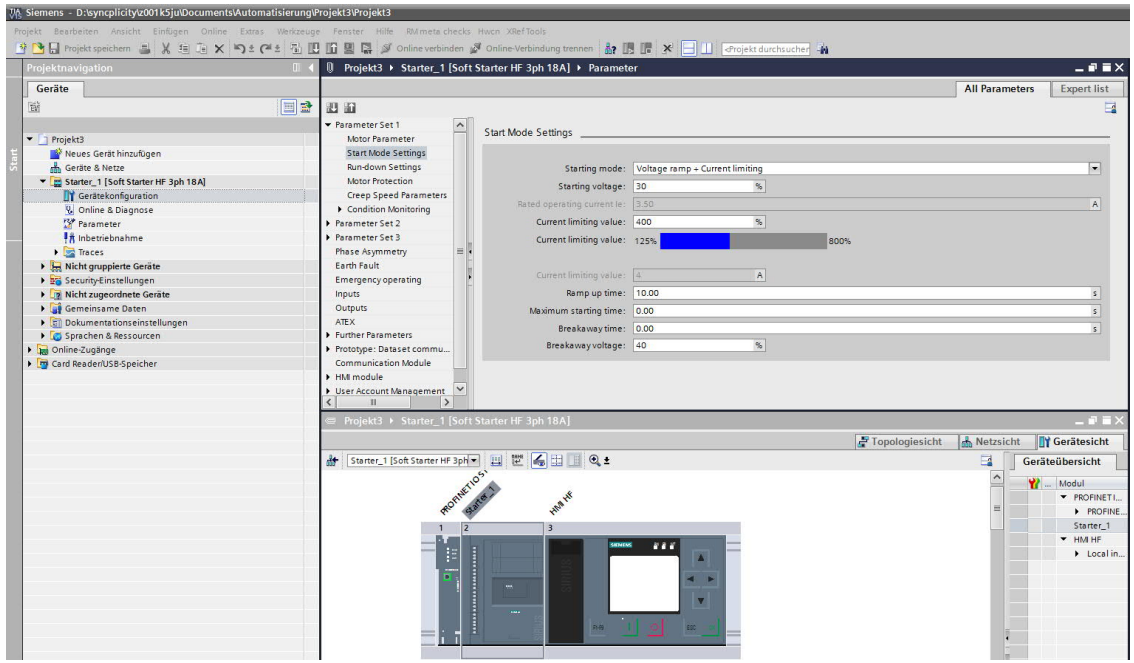
Soft Starter ES in TIA Portal V15

- TIA integration for simplest and standardized engineering
- Communication via PB, PN or local Ethernet interface
- Device and Engineering Trace for advanced analysis (also in real time): device messages, measured values, statistical data, logbook, drag pointer
- Easy parameterization and backup of projects
- User account management



Thank you for your attention!

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Bojan Janković
Sales Engineer
Siemens doo Beograd, Digital industries

Omladinskih brigada 90v
11070 Beograd

Tel: +381 60 8170 371

Email: bojan.jankovic@siemens.com

siemens.com/softstarters