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SINAMICS V90

The performance-optimized and easy-to-use servo drive system

Fluitronic

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SINAMICS V90 and SIMOTICS S-1FL6

Optimized servo drive solution
for motion control applications

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Servo drive system

The performance-optimized, user-friendly servo drive system comprises a SINAMICS V90 servo drive and a SIMOTICS S-1FL6 servomotor. Different frame sizes and motor shaft heights cover a wide range of applications for operation on single- and three-phase line supplies. There are eight servo drive frame sizes and seven motor shaft heights with power ratings ranging from 0.05 to 7.0 kilowatts, to realize a wide range of applications, with the focus on dynamic motion and processing – for example positioning, transporting and winding. In addition to operation in the TIA Portal V14 with the new SIMATIC S7-1500 T-CPU Advanced Controller, the servo drive system is also suitable for use with the SIMATIC S7-1500 Advanced Controller and the SIMATIC S7-1200 Basic Controller.



Pulse train version (PTI)

PROFINET version (PN)

SINAMICS V90 servo drive

SINAMICS V90 can be integrated into a wide range of applications, either using the pulse train version (pulse/direction, analog, USS/Modbus RTU) or the product version with integrated PROFINET interface.

The SINAMICS V90 pulse train version features internal positioning, positioning with pulse train as well as speed and torque control modes. SINAMICS V90 PROFINET version is equipped with an integrated PROFINET interface for linking the drive to an automation system via PROFIdrive profile. With integrated real-time auto tuning and automatic suppression of machine resonances, the system automatically optimizes itself to achieve high dynamic performance and smooth operation.

SIMOTICS S-1FL6 servomotor

SIMOTICS S-1FL6 servomotors are naturally cooled, permanent-magnet synchronous motors where the heat is dissipated through the motor surface. The motors can be simply and quickly installed using the full thread and quick-release connectors. They have a 300 percent overload capability and can be combined with SINAMICS V90 servo drive to create a powerful servo system with a high degree of functionality.

Highlights of the SINAMICS V90 and SIMOTICS S-1FL6 servo drive system:

Optimized servo performance

- Advanced one-button tuning and real-time auto tuning enables machines to achieve a high dynamic performance
- Automatic suppression of machine resonances
- 1 MHz high-frequency pulse train input
- Different encoder types to address the requirements of your applications

Cost effective

- Integrated control modes: Pulse train positioning, internal positioning with traversing block or Modbus, speed and torque control modes
- Integrated internal positioning function
- Integrated braking resistor in all frame sizes
- Integrated holding brake switch (for the 400 V version), no external relay necessary

Easy to use

- Simple connection to a control system
- Easy, all from a single source
- Easy servo tuning and machine optimization
- Easy commissioning with SINAMICS V-ASSISTANT
- Parameter cloning
- Easy integration via PTI, PROFINET, USS, Modbus RTU

Reliable operation

- High-quality motor bearings
- All motors have IP65 degree of protection and are equipped with oil seal
- Integrated Safe Torque Off (STO)

Power, performance, typical applications

| SINAMICS V90 servo drive system 1AC/3AC 200 V... 240 V Low Inertia for high dynamic performance | | SINAMICS V90 servo drive system 3AC 380 V... 480 V High Inertia for smooth operational performance | |
|--|---|--|---|
| SINAMICS V90 servo drive | | SINAMICS V90 servo drive | |
| Line supply and power: | 1AC 200 V ... 240 V (–15%/+10%), 0.05 kW ... 0.75 kW 3AC 200 V ... 240 V (–15%/+10%), 0.05 kW ... 2 kW | Line supply and power: | 3AC 380 V ... 480 V (–15%/+10%), 0.4 kW ... 7 kW |
| Pulse train (PTI) version Control mode: | Positioning with pulse train, internal positioning, speed, torque | Pulse train (PTI) version Control mode: | Positioning with pulse train, internal positioning, speed, torque |
| PROFINET (PN) version Control mode: | Speed control via PROFINET with PROFIdrive profile** | PROFINET (PN) version Control mode: | Speed control via PROFINET with PROFIdrive profile** |
| Degree of protection: | IP20 | Degree of protection: | IP20 |
| SIMOTICS S-1FL6 servomotor | | SIMOTICS S-1FL6 servomotor | |
| 4 shaft heights: | 20 mm, 30 mm, 40 mm, 50 mm | 3 shaft heights: | 45 mm, 65 mm, 95 mm |
| Rated torque: | 0.16 Nm up to 6.37 Nm | Rated torque: | 1.27 Nm up to 33.40 Nm |
| Rated/max. speed: | 3000 rpm / 5000 rpm | Rated/max. speed: | 2000 rpm / 3000 rpm |
| Encoder: | Incremental encoder TTL 2500 ppr***; Absolute encoder single-turn 21-bit* | Encoder: | Incremental encoder TTL 2500 ppr; Absolute encoder 20-bit + 12-bit multi-turn |
| Degree of protection: | IP65, natural cooling | Degree of protection: | IP65, natural cooling |
| Additional advantages: | | Additional advantages: | |
| <p>High dynamic performance: High acceleration for shorter cycle times as a result of the very low moment of inertia</p> <p>High speed: Maximum speed up to 5000 rpm can increase machine productivity</p> <p>Compact size: The reduced motor length/height compared to High Inertia variants and compact drive size can address critical mounting requirements</p> | | <p>Smooth operation: Higher torque accuracy and low speed ripple as a result of the higher moment of inertia ensures a better product quality</p> <p>Robust design: High-quality metal connector and standard motor oil seal can withstand harsh environment</p> <p>Sufficient torque output: Wide range of rated torques up to 33.4 Nm</p> | |
| Application examples | | Application examples | |
| Electronic assembly industry, for example | <ul style="list-style-type: none"> • Pick and place machine • Stencil cutting machine • PCB assembly machine • IC handling machine • Chip sorting machine • Bonding machine | Metal forming machinery, for example | <ul style="list-style-type: none"> • Punching machine • Engraving machine • Edging press |
| Converting/printing industry, for example | <ul style="list-style-type: none"> • Labeling machine • Slitter machine • Laminating/coating machine • Screen printing machine | Converting/printing industry, for example | <ul style="list-style-type: none"> • Winders • Slitter machine • Laminating/coating machine • Screen printing machine • Wire drawing machine |
| Packaging industry, for example | <ul style="list-style-type: none"> • Filling and sealing machine • Blister machine (pharmaceutical packaging) • Bag packing machine | Packaging industry, for example | <ul style="list-style-type: none"> • Filling machine • Blister machine (pharmaceutical packaging) • Bag packing machine |
| Material handling machinery, for example | <ul style="list-style-type: none"> • Automatic palletizers | Material handling machinery, for example | <ul style="list-style-type: none"> • Storage and warehouse systems • Conveyor systems |

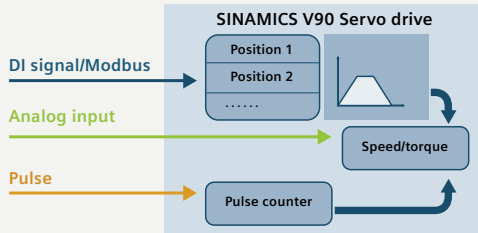
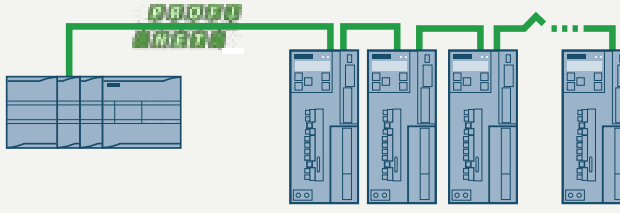
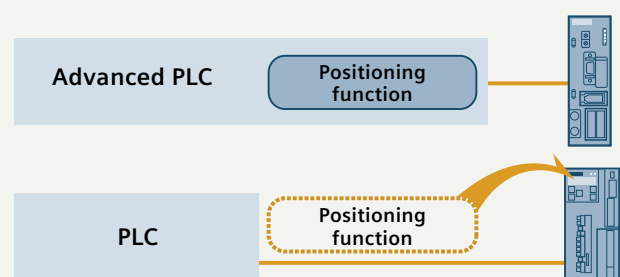
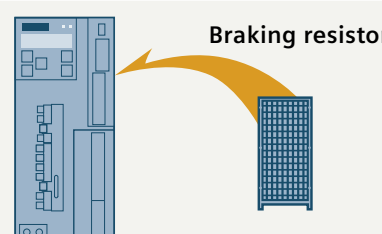
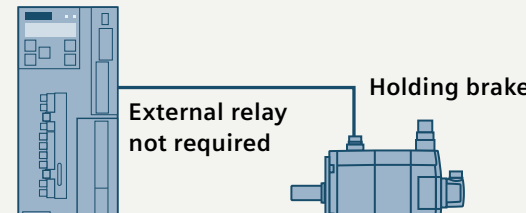
* Absolute encoder single-turn 21-bit available in the 2nd half of 2016

** Position and speed control in combination with a motion function (TO axis) of SIMATIC S7-1500 T-CPU / S7-1500 / S7-1200

*** For very low speed, high accuracy or high dynamic application TTL encoder is not recommended

Cost effective

Many integrated functions to reduce machine costs

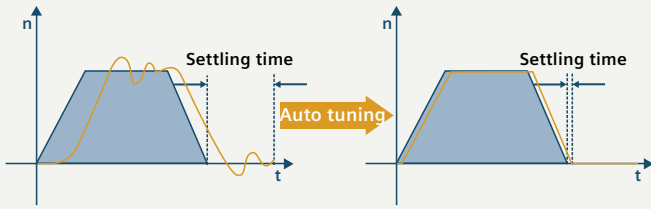
| | |
|---|---|
| <p>Integrated control modes</p>  | <p>Pulse train (PTI) <input checked="" type="checkbox"/> PROFINET (PN) <input type="checkbox"/></p> <p>Pulse train input position control mode (PTI), internal position control mode (IPos) with traversing block or Modbus, speed control mode and torque control are all integrated in the SINAMICS V90.</p> <p>The drive has various integrated control modes to address a wide range of applications.</p> |
| <p>Integrated PROFINET – the industrial Ethernet standard for automation</p>  | <p>Pulse train (PTI) <input type="checkbox"/> PROFINET (PN) <input checked="" type="checkbox"/></p> <p>SINAMICS V90 PROFINET version features a PROFINET interface, enabling real-time transmission of user/process data and diagnostic data with a single cable.</p> <p>This solution offers wide-ranging functions with reduced complexity.</p> |
| <p>Integrated positioning function</p>  | <p>Pulse train (PTI) <input checked="" type="checkbox"/> PROFINET (PN) <input type="checkbox"/></p> <ul style="list-style-type: none"> Positioning function is integrated in the drive. Target positions and respective speeds can be stored in the drive during commissioning or changed via communication. Absolute or relative positioning Rotary or linear axes Referencing in the drive <p>Point-to-point positioning possible using a PLC without positioning functionality.</p> |
| <p>Integrated braking resistor for all frame sizes</p>  | <p>Pulse train (PTI) <input checked="" type="checkbox"/> PROFINET (PN) <input checked="" type="checkbox"/></p> <p>All frame sizes have an integrated braking resistor to dissipate the regenerative power for fast braking.</p> <p>Most applications can be realized without an additional braking resistor.</p> |
| <p>Integrated holding brake switch (SINAMICS V90, 400 V version)</p>  | <p>Pulse train (PTI) <input checked="" type="checkbox"/> PROFINET (PN) <input checked="" type="checkbox"/></p> <p>Integrated holding brake switch – the brake can be directly connected to the drive when a motor with holding brake is used.</p> <p>Holding brake can be connected without requiring an external relay (only for SINAMICS V90, 400 V version).</p> |

Optimized servo performance

Quick, smooth and precise positioning

Advanced one-button tuning and real-time auto tuning

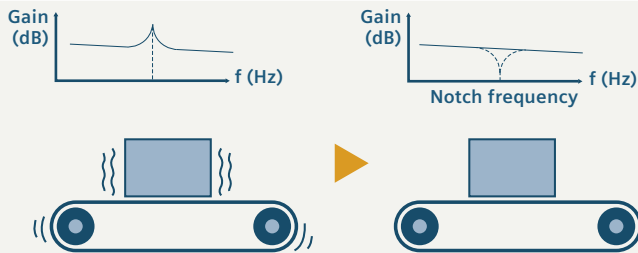
Pulse train (PTI) PROFINET (PN)



Control loop parameters are optimized automatically. One-button tuning can be used when commissioning. **This allows machines to achieve a high dynamic performance and smooth operation in a wide range of applications.**

Automatic suppression of machine resonances

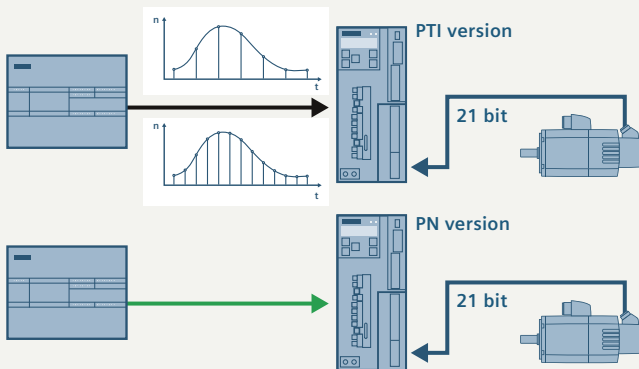
Pulse train (PTI) PROFINET (PN)



When this function is activated the drive identifies mechanical resonance frequencies and automatically suppresses these using a filter. Vibration and noise during operation are reduced. **This ensures a high dynamic response of the machine while reducing machine vibration levels.**

Sufficient encoder resolution and high data transfer rates

Pulse train (PTI) PROFINET (PN)



The encoder is available up to 21-bit resolution (approx. 2.1 billion pulses per motor rotation).

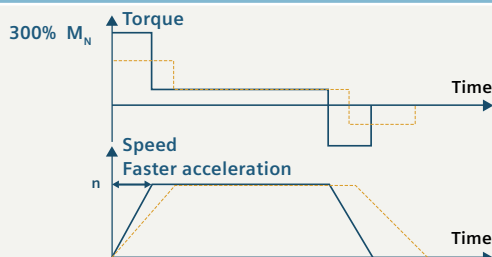
The command:

- Signaling rate up to 1 MHz (pulse train version)
- 100 Mbit/s transfer rate (PROFINET version)

Allows machines to achieve a high positioning accuracy with low speed ripple.

Optimized system performance

Pulse train (PTI) PROFINET (PN)



- 300% overload capability of drive and motor
- Low motor torque ripple
- Motor and drive are perfectly harmonized

Fast acceleration and braking while maintaining smooth operation to ensure high machine productivity.

Easy to use

Simple tuning and quick commissioning

Easy servo tuning and machine optimization Pulse train (PTI) PROFINET (PN)

Commissioning

Tuning

Optimizing

The system can be automatically optimized using the auto tuning function and automatic suppression of machine resonances.

Simply plug & play, no in-depth servo know-how required.

Easy commissioning using the SINAMICS V-ASSISTANT engineering tool Pulse train (PTI) PROFINET (PN)

Graphic user interface guides the user when setting application-specific parameters; intuitive drive and motor status check; integrated trace and measuring functionality.

SINAMICS V-ASSISTANT makes commissioning and diagnostics quick and easy.

<https://www.siemens.com/sinamics-v-assistant>

Simple connection to a control system Pulse train (PTI) PROFINET (PN)

PTI version

- 5 V differential pulse input
- 24 V single-ended pulse input
- RS 485 communication port

PN version

- PROFINET interface

- Two-channel pulse train for position setpoint, one exclusively for 5 V differential (RS 422 standard), one for 24 V single-ended signal (for pulse train version)
- Standard RS 485 interface supports USS and Modbus RTU (pulse train version)
- Industrial Ethernet standard PROFINET with PROFIdrive (PROFINET version)

Standard interface makes it easy to connect the drive with PLCs and motion controller.

Easy, all from a single source Pulse train (PTI) PROFINET (PN)

- Predefined drive/motor bundles and accessories, easy to select
- Tested with SIMATIC PLC / HMI and ready-to-run application examples for connecting a SINAMICS V90 drive to a controller
- Different application examples can be downloaded free of charge from the Online Support Portal (see also page 11)

Parameter cloning Pulse train (PTI) PROFINET (PN)

Commissioning

SINAMICS V90 servo drives are equipped with a standard SD card slot (400 V version) and a Micro SD card slot (200 V version), so that parameter settings can be easily transferred between drive devices.

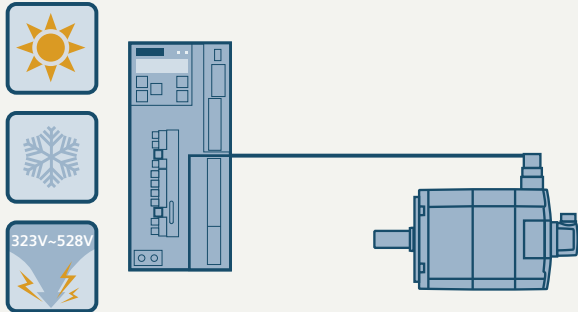
Efficient commissioning of machine series.

Reliable operation

Robust in design and a safe choice

Suitable for harsh environments

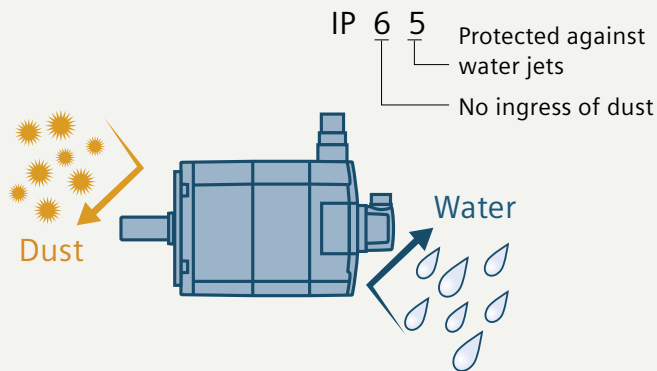
Pulse train (PTI) PROFINET (PN)



- Wide range of line voltages:
 - 200 V ... 240 V 1AC / 3AC (–15% / +10%)
 - 380 V ... 480 V 3AC (–15% / +10%)
- Coated PCB increases robustness of the drive to cope with harsh environments
- Motor is equipped with high-quality bearings

High degree of motor protection

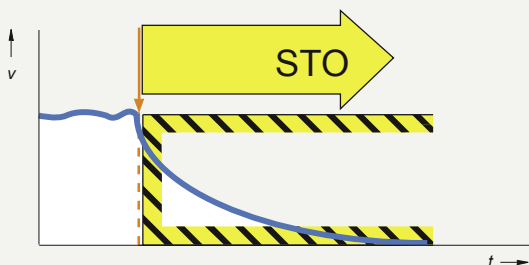
Pulse train (PTI) PROFINET (PN)



- SIMOTICS S-1FL6 motors have degree of protection IP65 as standard
- Oil seal at shaft end as standard
- High-quality metal motor connector (High inertia motors)

Integrated STO safety function (Safe Torque Off)

Pulse train (PTI) PROFINET (PN)



The STO function is a standard feature of all SINAMICS V90 servo drives. This function prevents the motor from moving unexpectedly and complies with safety standard SIL 2 according to EN 61508 resp. PL d, Cat 3 according to EN ISO 13849. This safety functionality can be realized without additional components (activation only via terminals of SINAMICS V90, not supported via PROFINET/PROFIsafe).



Integrated and innovative

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- Availability check and order tracking

Link to Internet page:

<https://mall.industry.siemens.com>

SINAMICS V-ASSISTANT

Easy-to-use engineering tool for commissioning and diagnostics



User task-centric design for prompted machine commissioning

A PC with installed SINAMICS V-ASSISTANT software tool can be connected to SINAMICS V90 via a standard USB port. It is used for setting parameters, test operation, troubleshooting – and has powerful monitoring functions.

SINAMICS V-ASSISTANT can be downloaded free of charge from the SINAMICS V90 Internet page.

Link to Internet page:

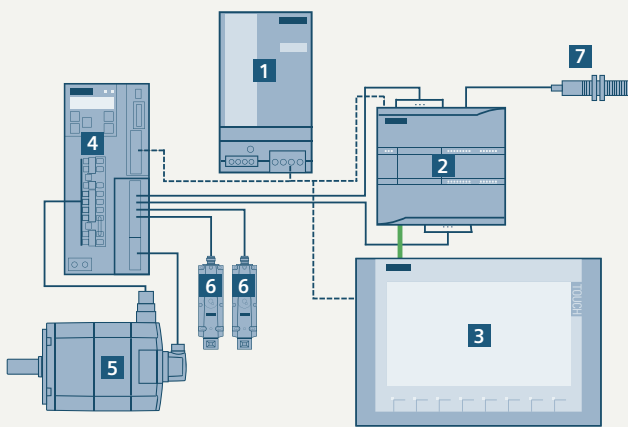
<https://siemens.com/sinamics-v90>

Complete motion control solutions from Siemens

SINAMICS V90 System and SIMATIC – Siemens offers comprehensive solutions from a single source for general motion control applications. We can provide you with highly efficient systems, especially through the optimum interaction between SIMATIC control technology and SINAMICS drive technology with our “SINAMICS Application Examples.”

| Siemens application examples comprise the following | Benefits for the customer |
|--|--|
| <ul style="list-style-type: none"> • Ready-to-run application example including wiring diagram and parameter description • Sample configuration to connect SINAMICS V90 drives to the appropriate SIMATIC controller – this includes hardware and software, a corresponding wiring example, installation instructions for the S7 project provided, drive parameterization and a HMI sample project | <ul style="list-style-type: none"> • An operational project is configured properly • A motor is quickly made operational • Basis for a customer-specific configuration • TIA advantages are optimally leveraged • Can be downloaded free of charge via the Online Support Portal: https://siemens.com/sinamics-applications |

Example: Positioning with SINAMICS V90 using pulse/direction interface and SIMATIC S7-1200 control via HMI



- 1 SITOP PSU100L power supply
- 2 SIMATIC S7-1200, CPU 1217C
- 3 KTP700 Basic
- 4 SINAMICS V90
- 5 SIMOTICS S-1FL6 servomotor
- 6 Mechanical limit switch
- 7 Inductive reference cam

Task
A SINAMICS V90 servo drive is to control a SIMOTICS S-1FL6 servomotor. A SIMATIC S7-1200 is to be used to select the following functions via a touch panel.

Solution
The SINAMICS V90 is controlled via the pulse/direction interface (PTI) of the SIMATIC S7-1200. Technology objects are employed along with the PLCopen motion control standard to control the axis. The move commands are entered at a SIMATIC Basic Panel, which communicates with the SIMATIC controller via Ethernet.

Link to Internet page:
<https://siemens.com/sinamics-applications>

Technical data – SINAMICS V90 servo drive

| Line supply | | 200 ... 240 V 1AC/3AC | | | | | | | |
|----------------------------|--|---|--|----------------------|------------------------|---|----------------------|----------------------|----------------------|
| Article No. | Pulse train: 6SL3210-5F PROFINET: 6SL3210-5F | B10-1UA0 B10-1UFO | B10-2UA0 B10-2UFO | B10-4UA1 B10-4UF1 | B10-8UA0 B10-8UFO | B11-0UA1 B11-0UF1 | B11-5UA0 B11-5UFO | B12-0UA0 B12-0UFO | |
| Max. motor power (kW) | | 0.1 | 0.2 | 0.4 | 0.75 | 1 | 1.5 | 2 | |
| Rated output current (A) | | 1.2 | 1.4 | 2.6 | 4.7 | 6.3 | 10.6 | 11.6 | |
| Max. output current (A) | | 3.6 | 4.2 | 7.8 | 14.1 | 18.9 | 31.8 | 34.8 | |
| Line supply | Voltage | 1/3AC 200 V ... 240 V (–15% / +10%) | | | | 3AC 200 V ... 240 V (–15% / +10%) | | | |
| | Frequency | 50 Hz / 60 Hz, (–10% / +10%) | | | | | | | |
| | Capacity (kVA) (1AC) | 0.5 | 0.7 | 1.2 | 2 | – | – | – | |
| | Capacity (kVA) (3AC) | 0.5 | 0.7 | 1.1 | 1.9 | 2.7 | 4.2 | 4.6 | |
| Cooling | | Natural cooling | | | | Fan cooling | | | |
| Frame size | | FSA* | | FSB | | FSC | | | |
| Dimensions WxHxD (mm) | | 45x170x170* | | 55x170x170 | | 80x170x195 | | 95x170x195 | |
| Weight approx. (kg) | | 1.07 | | 1.20 | | 1.94 | | 2.49 | |
| Line supply | | 380 ... 480 V 3AC | | | | | | | |
| Article No. | Pulse train: 6SL3210-5F PROFINET****: 6SL3210-5F | E10-4UA0 E10-4UFO | E10-8UA0 E10-8UFO | E11-0UA0 E11-0UFO | E111-5UA0 E111-5UFO | E12-0UA0 E12-0UFO | E13-5UA0 E13-5UFO | E15-0UA0 E15-0UFO | E17-0UA0 E17-0UFO |
| Max. motor power (kW) | | 0.4 | 0.75 | 1 | 1.75 | 2.5 | 3.5 | 5 | 7 |
| Rated output current (A) | | 1.2 | 2.1 | 3 | 5.3 | 7.8 | 11 | 12.6 | 13.2 |
| Max. output current (A) | | 3.6 | 6.3 | 9 | 15.9 | 23.4 | 33 | 37.8 | 39.6 |
| Line supply | Voltage | 3AC 380 V ... 480 V (–15% / +10%) | | | | | | | |
| | Frequency | 50 Hz / 60 Hz, (–10% / +10%) | | | | | | | |
| | Capacity (kVA) | 1.7 | 3 | 4.3 | 6.6 | 11.1 | 15.7 | 18 | 18.9 |
| Cooling | | Natural cooling | | | | Fan cooling | | | |
| Frame size | | FSAA | | FSA | | FSB | | FSC | |
| Dimensions WxHxD (mm) | | 60x180x20 | | 80x180x200 | | 100x180x220 | | 140x260x240 | |
| Weight approx. (kg) | | 1.45 | | 2.09 | | 2.73 | | 5.95 | |
| Control power supply | Voltage** | 24 V DC (–15% / +20%) | | | | | | | |
| | Current*** | 1.6 A (without holding brake) 3.6 A (with holding brake) | | | | | | | |
| Line supply system | | TN, TT, IT, TT earthed line | | | | | | | |
| Overload capacity | | 300% x rated current for 300 ms every 10 s | | | | | | | |
| Control system | | Servo control | | | | | | | |
| Braking resistor | | Integrated | | | | | | | |
| Ambient temperature | Operation | 0 °C to 45 °C: without power derating, 45 °C to 55 °C : with power derating | | | | | | | |
| | Storage | –40 °C to +70 °C | | | | | | | |
| Ambient humidity | Operation | <90% (no condensation) | | | | | | | |
| | Storage | 90% (no condensation) | | | | | | | |
| Pollution class | | 2 | | | | | | | |
| Vibration | Operation | Shock | Operational area II Peak acceleration: 5 g, 30 ms, 15 g, 11 ms Quantity of shocks: 3 per direction x 6 direction Duration of shock: 1 s | | | | | | |
| | | Vibration | Operational area II 10 Hz to 58 Hz: 0.075 mm deflection 58 Hz to 200 Hz: 1 g vibration | | | | | | |
| | Product packaging | Vibration | 2 Hz to 9 Hz: 3.5 mm deflection 9 Hz to 200 Hz: 1 g vibration Quantity of cycles: 10 per axis Sweep seed: 1 octave/min | | | | | | |
| Degree of protection | | IP20 | | | | | | | |
| Altitude | | ≤1000 m (without power derating); >1000 m and up to 5000 m (with power derating) | | | | | | | |
| Standards | | CE, KC, EAC, cULus, C-tick | | | | | | | |
| Interface | | SINAMICS V90 Pulse train version (PTI) | | | | SINAMICS V90 PROFINET version (PN) | | | |
| USB | | Mini USB | | | | Mini USB | | | |
| Pulse train input | | 2 channels, one exclusively for 5 V differential signal, one for 24 V single-end signal | | | | – | | | |
| Pulse train encoder output | | 5 V differential signal, A, B, Z phase | | | | – | | | |
| Digital inputs/outputs | | 10 inputs, NPN/PNP; 6 outputs, NPN | | | | 4 inputs, NPN/PNP; 2 outputs, NPN/PNP | | | |
| Analog outputs | | 2 analog outputs, output voltage range ±10 V, 10 bits | | | | – | | | |
| Communication | | USS/Modbus RTU (RS 485) | | | | PROFINET RT/IRT interface with 2 ports (RJ45 sockets) | | | |
| SD card slot | | Standard SD card with 400 V version, Micro SD card with 200 V version | | | | Standard SD card with 400 V version, Micro SD card with 200 V version | | | |
| Safety functions | | Safe Torque Off (STO) via terminal, SIL 2 | | | | Safe Torque Off (STO) via terminal, SIL 2 | | | |

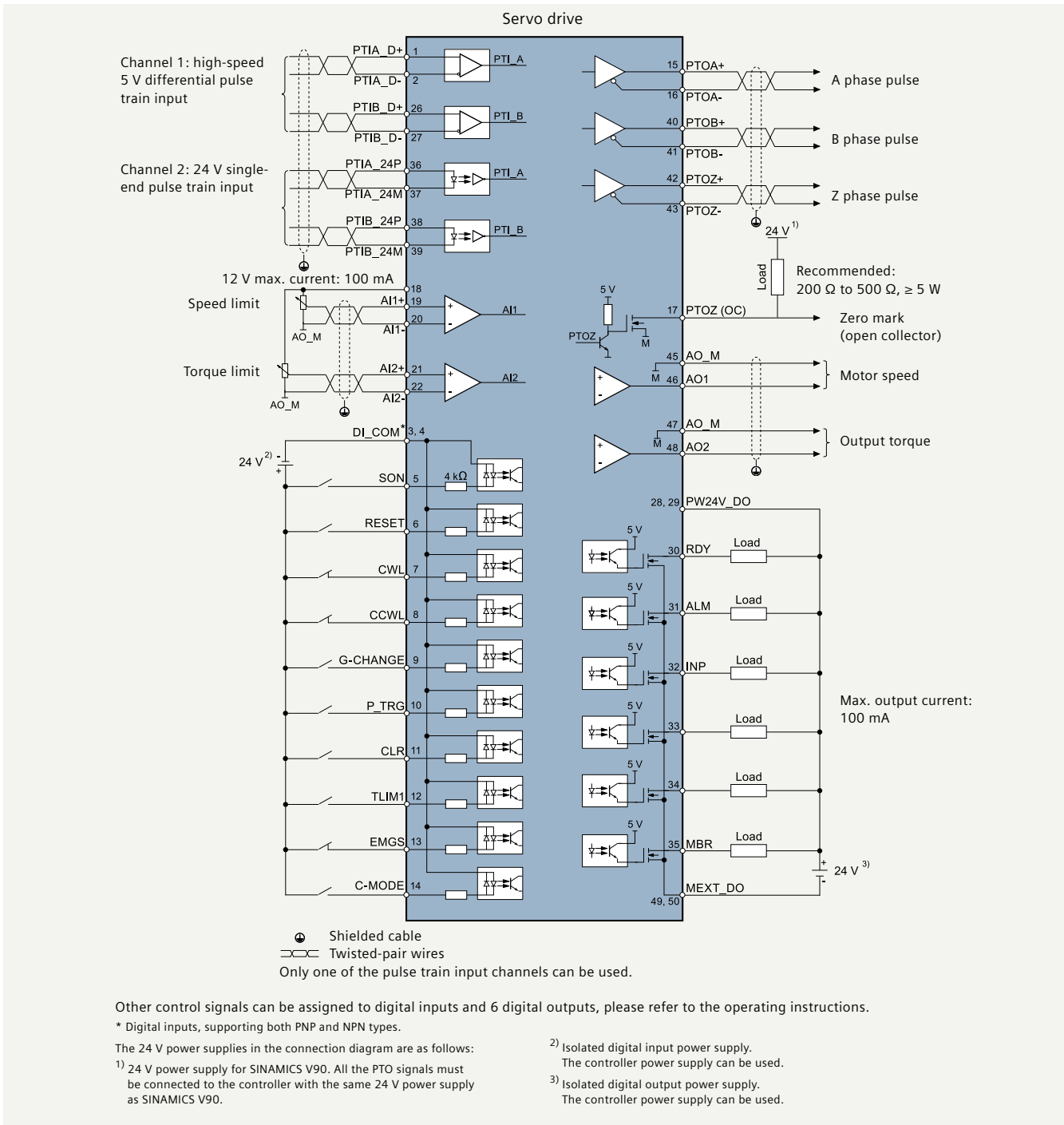
Control features – SINAMICS V90 servo drive

| Control modes | | SINAMICS V90 Pulse train version (PTI) | SINAMICS V90 PROFINET (PN) |
|---------------------------------------|----------------------|---|--|
| Control modes | | <ul style="list-style-type: none"> Pulse train input position control (PTI) Internal position control (IPos), setpoints selected using a combination of digital inputs, or Modbus/USS Speed control (S) Torque control (T) Compound controls, switches between position control, speed control, and torque control Jog using buttons on the integrated operator panel | <ul style="list-style-type: none"> Speed control mode: position and speed control in combination with a motion function (TO axis) of SIMATIC S7-1500/S7-1200 and PROFINET |
| Speed control | Speed input | External analog input or internal speed setpoint | PROFINET or internal speed setpoint |
| | Torque limit | External analog input or set using a parameter | PROFINET or set using a parameter |
| Pulse train input position control | Max. pulse frequency | <ul style="list-style-type: none"> Differential line driver (5 V), 1 MHz Optical coupler (24 V), 200 kHz | – |
| | Multiplying factor | Electronic gear ratio (A/B), A:1-65535, B:1-65535, 1/50<A/B<200 | – |
| | Torque limit | External analog input or set using a parameter | – |
| Torque control mode | Torque input | External analog input or internal torque setpoint | – |
| | Speed limit | Prevents speed limits from being violated, set using a parameter for analog input | Set using a parameter |
| Control features | | | |
| Real time auto tuning | | Estimates the machine characteristic and sets the closed-loop control parameters (gain, integral time, etc.) continuously in real time without any user intervention | |
| Resonance suppression | | Suppresses mechanical resonance, such as workpiece and foundation vibration | |
| One-button auto tuning | | Estimates the machine load inertia and mechanical characteristics with internal movement command (pre-configured in the SINAMICS V90). This feature can be initiated using the SINAMICS V-ASSISTANT engineering tool | |
| Gain switch and PI/P switch | | Switches between gains or from PI to P control using an external signal or internal operating conditions | – |
| Torque limit | | Limits motor speed using an external analog input or internal torque limit | Motor torque is internally limited |
| Travel to fixed stop | | – | Can be used to move an axis to a fixed stop at a specified torque without a signal fault |
| DI/DO parameterization | | Freely assigns the control signals to digital inputs and digital outputs | |
| External braking resistor | | An external braking resistor can be used when the internal braking resistor is not capable of handling the regenerative energy | |
| Measure machine | | The machine frequency characteristics are analyzed using SINAMICS V-ASSISTANT | |
| Parameter cloning and Firmware update | | Standard SD card with 400 V version, Micro SD card with 200 V version. Maximum supported capacity is 32 GB | |
| Safety functions | | Safe torque off (STO) via terminal, complies with safety standard SIL 2 according to EN 61508 resp. PL d, Cat 3 according to EN ISO 13849 (activation only via terminals of SINAMICS V90, not supported via PROFINET/PROFIsafe) | |
| Basic Operator Panel (BOP) | | Integrated, 6-digit / 7-segment display, 5 buttons | |
| Engineering PC tool | | SINAMICS V-ASSISTANT engineering tool exclusively for SINAMICS V90. SINAMICS V90 in combination with S7-1500 and STEP 7 Professional engineering via TIA Portal V14 possible. | |

- * SINAMICS V90 PROFINET 200 V version not available in frame size A (FSA).
The power range from 0.1 kW to 0.4 kW is covered with frame size B (FSB).
- ** When SINAMICS V90 controls a motor equipped with brake, the tolerance of the 24 V DC power supply must be –10% to +10% to comply with the voltage required by the brake.
- *** PROFINET version requires a 24 V DC supply with max. 1.5 A (without a holding brake), or 3.5 A (with a holding brake). Refer to the operating instructions for detailed information.
- **** SINAMICS V90 PROFINET 400 V version is available in the 2nd half of 2016

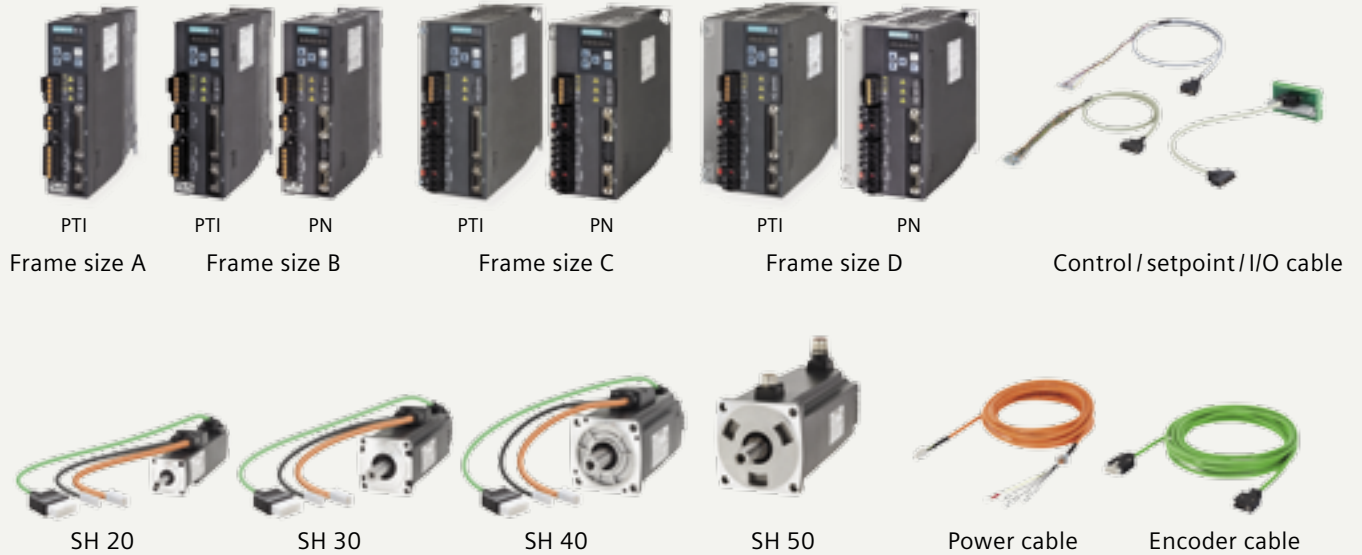
Connection diagram

Standard wiring for pulse train input (PTI) position control mode (for detailed information and connection diagrams for other control modes such as via PROFINET communication, please refer to the operating instructions). The diagram below provides a reference for selecting the drive type. When commissioning the selected servo drive system, establish the wiring connections according to the connection diagram and the instructions provided in the operating instructions.

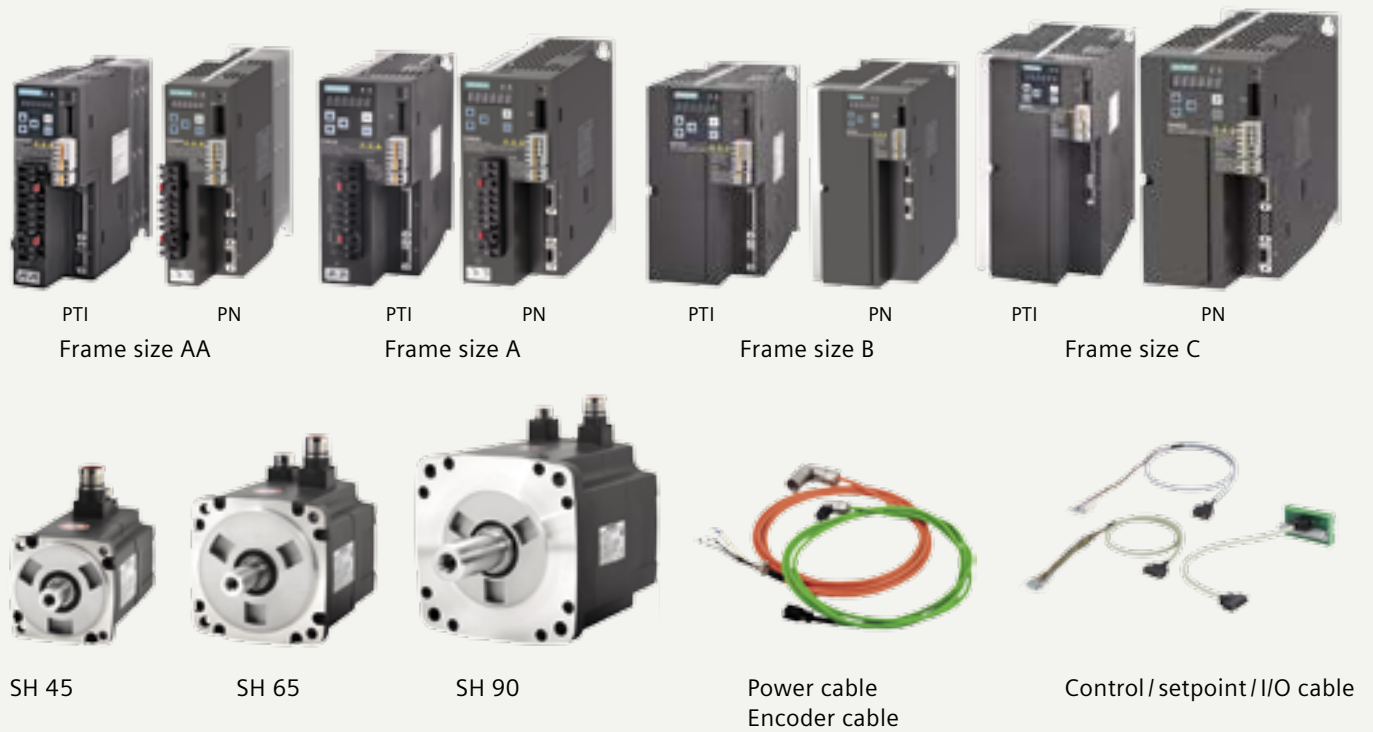


System at glance

SINAMICS V90 servo drive system
 1/3AC 200 ... 240 V Low Inertia (LI) for high dynamic performance



SINAMICS V90 servo drive system
 3AC 380 ... 480 V High Inertia (HI) for smooth operational performance



SINAMICS V90 servo drive

Pulse train version (PTI)

- RS 485 interface for MODBUS RTU/US5 to communicate with a PLC

SINAMICS PROFINET version

- 2 RJ45 connectors for PROFINET communication with a PLC

Status indicator

- RDY indicates servo ready/alarm state
- COM indicates communication with PC

Integrated operator panel

- 6 digits, 7-segment LED
- 5 buttons

High-quality connectors

Braking resistor

- If the internal braking resistor is not sufficient, disconnect DCP and R2, then connect DCP and R1 with an external braking resistor

Shield plate

- Easy shield connection to cables and improved EMC behavior

Standard mini USB socket

- To connect a PC with engineering tool

SD card slot

- To copy parameters
- Standard SD card slot (400 V version)
- Micro SD card slot (200 V version)

Safe Torque Off

Motor holding brake

(only for SINAMICS V90, 400 V version)

Control/status interface

Pulse train version Setpoint interface

- 50 pins
- Pulse train input
- Encoder emulation pulse output
- DI/DO, AI/AO
- Motor holding brake* (only for SINAMICS V90, 200 V version)

PROFINET version I/O interface

- 20 pins
- DI/DO
- Motor holding brake* (only for SINAMICS V90, 200 V version)

Motor encoder connector

* Motor holding brake signal (only for SINAMICS 200 V version). The SINAMICS V90, 200 V version requires an external relay to connect the motor holding brake.

SIMOTICS S-1FL6, High Inertia motor

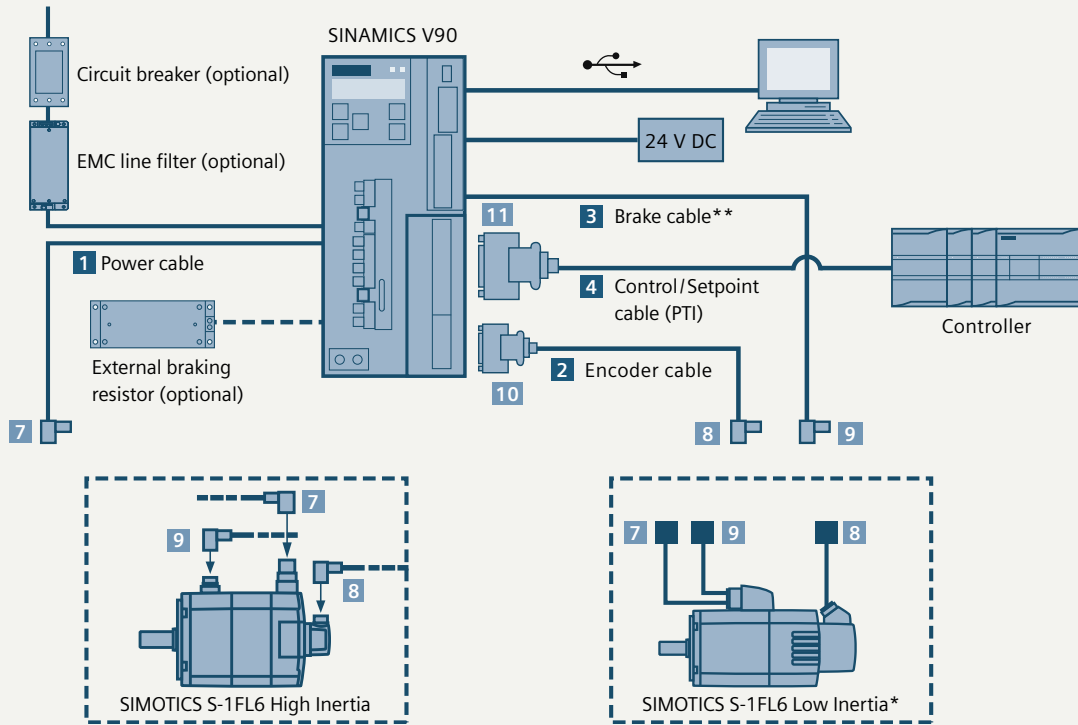
- High-quality metal connector
- Quick-release connector
- IP65 as standard for all motors
- High-quality bearings
- Shaft sleeve protection
- Oil seal with high wear resistance

SIMOTICS S-1FL6, Low Inertia motor

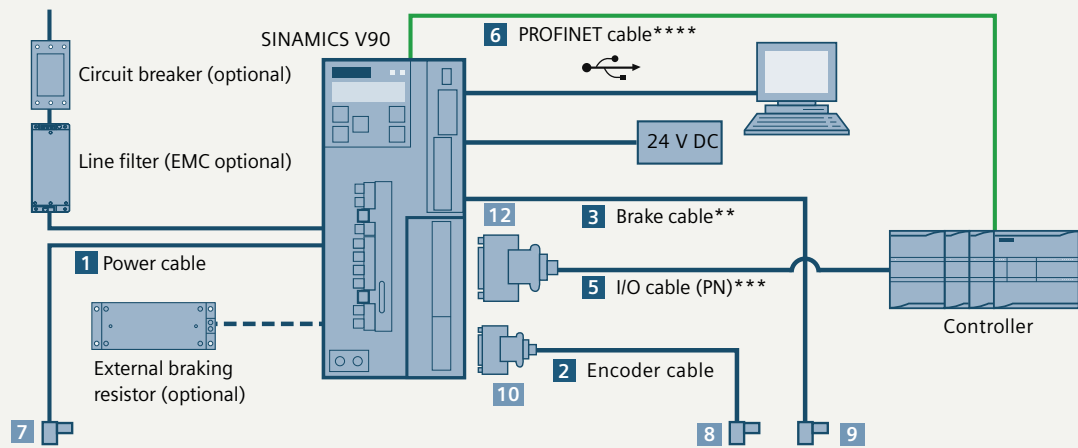
- Cost-efficient, compact cable
- IP65 as standard for all motors
- High-quality bearings
- Oil seal with high wear resistance

System connection diagram

System connection diagram for the SINAMICS V90 pulse train version



System connection diagram of SINAMICS V90 PROFINET version



| | | | |
|---|--|----|--|
| 1 | Power cable | 7 | Power connector (motor side) |
| 2 | Encoder cable | 8 | Encoder connector (motor side) |
| 3 | Brake cable | 9 | Brake connector (motor side) |
| 4 | Control/Setpoint cable (pulse train version) | 10 | Encoder connector (drive side) |
| 5 | I/O cable (PROFINET version) | 11 | Setpoint connector (Pulse train version) |
| 6 | PROFINET cable | 12 | I/O connector (PROFINET version) |

* SIMOTICS S-1FL6 Low Inertia motors SH20, SH30, SH40 use outlet connection concept.


** Brake cable connection shown here is for 400 V version only. The 200 V version requires an external relay to connect the motor brake cable. The relay has to be connected via the setpoint cable for the SINAMICS V90 pulse train version and via I/O cable for the SINAMICS V90 PROFINET version.

*** I/O cable is necessary for the brake control of the SINAMICS V90 PROFINET 200 V version, and for applications requiring additional DI/DO in addition to PROFINET communication.

**** For further information of PROFINET cable refer to http://automation.siemens.com/sc-static/catalogs/catalog/IK_PI_2015_en.pdf

SIMOTICS S-1FL6 Low Inertia for high dynamic performance

Motor

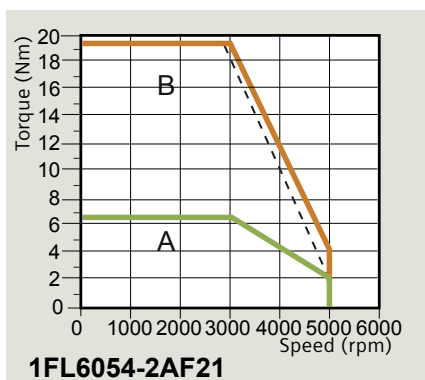
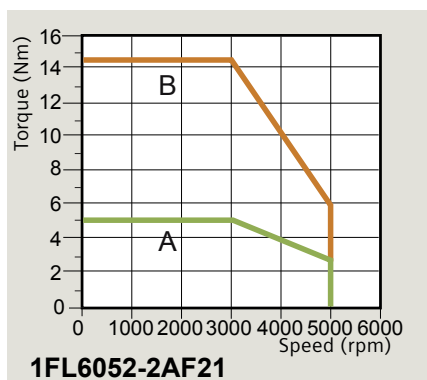
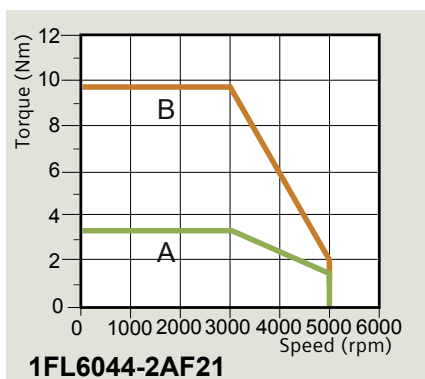
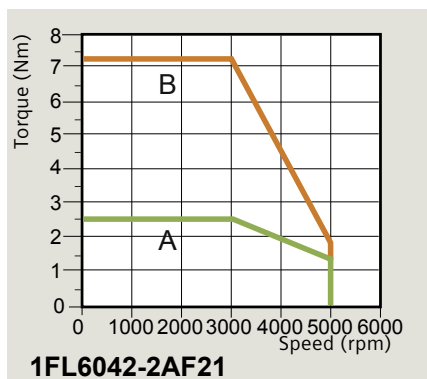
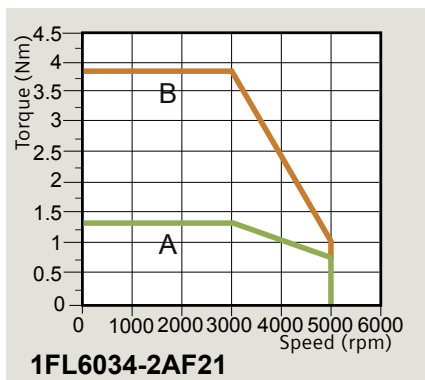
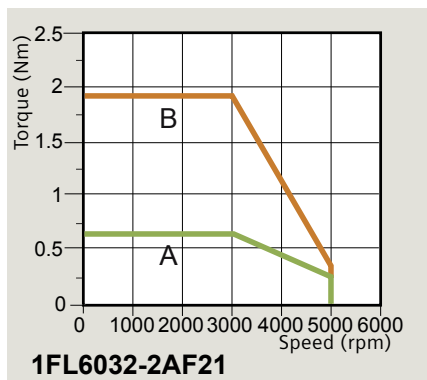
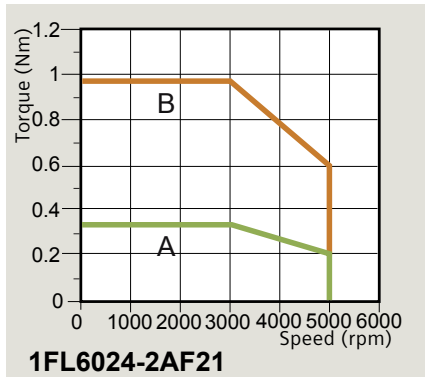
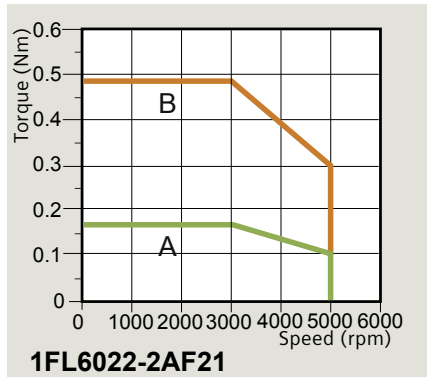
| Technical data | | | | | | | | |
|---|--|------------------|------------------|------------------|-----------------|----------------|---|----------------|
| Article number 1FL6 | 022-2AF | 024-2AF | 032-2AF | 034-2AF | 042-2AF | 044-2AF | 052-2AF | 054-2AF |
| Shaft height (SH) | 20 | | 30 | | 40 | | 50 | |
| Rated power (kW) ¹⁾ | 0.05 | 0.10 | 0.20 | 0.40 | 0.75 | 1.00 | 1.50 | 2.00 |
| Horsepower (HP) | 0.07 | 0.14 | 0.27 | 0.54 | 1.02 | 1.36 | 2.04 | 2.72 |
| Rated torque (Nm) | 0.16 | 0.32 | 0.64 | 1.27 | 2.39 | 3.18 | 4.78 | 6.37 |
| Rated speed (rpm) | 3000 | | | | | | | |
| Maximum torque (Nm) | 0.48 | 0.96 | 1.91 | 3.82 | 7.2 | 9.54 | 14.3 | 19.1 |
| Maximum speed (r/min) | 5000 | | | | | | | |
| Rated current (A) | 1.2 | 1.2 | 1.4 | 2.6 | 4.7 | 6.3 | 10.6 | 11.6 |
| Maximum current (A) | 3.6 | 3.6 | 4.2 | 7.8 | 14.2 | 18.9 | 31.8 | 34.8 |
| Torque constant (Nm/A) | 0.14 | 0.29 | 0.48 | 0.49 | 0.51 | 0.51 | 0.46 | 0.55 |
| Moment of inertia (10 ⁻⁴ kg·m ²) (with brake) | 0.031 (0.038) | 0.052 (0.059) | 0.214 (0.245) | 0.351 (0.381) | 0.897 (1.06) | 1.15 (1.31) | 2.04 (2.24) | 2.62 (2.82) |
| Thermal class | B (130 °C) | | | | | | | |
| Degree of protection | IP65 | | | | | | | |
| Recommended load to motor inertia ratio | Max. 30x | | | | Max. 20x | | Max. 15x | |
| Encoder types | Incremental encoder TTL 2500 ppr; Absolute encoder single-turn 21-bit (available in the 2nd half of 2016) | | | | | | | |
| Type of construction | IM B5 (IM V1 and IM V3) | | | | | | | |
| Weight (kg) (with brake) | 0.47 (0.70) | 0.63 (0.86) | 1.02 (1.48) | 1.46 (1.92) | 2.8 (3.68) | 3.39 (4.20) | 5.35 (6.76) | 6.56 (8.00) |
| Operating temperature | 0 ~ 40 °C (without any restrictions) | | | | | | 0 ~ 30 °C (without any restrictions) | |
| Operating humidity | 90% RH maximum (no condensation at 30 °C) | | | | | | | |
| Vibration severity grade | Grade A | | | | | | | |
| Radial runout tolerance | Class N | | | | | | | |
| Installation altitude | ≤ 1000 m (without power derating); > 1000 m and up to 5000 m (with power derating) | | | | | | | |
| Standards |  | | | | | | | |
| Holding brake data ²⁾ | | | | | | | | |
| Holding torque (Nm) | 0.32 Nm | | 1.27 Nm | | 3.18 Nm | | 6.37 Nm | |
| Rated voltage (V) | 24 V DC ± 10% | | | | | | | |
| Opening time (ms) | 35 | | 75 | | 105 | | 90 | |
| Closing time (ms) | 10 | | 10 | | 15 | | 35 | |
| Rated current (A) | 0.25 | | 0.3 | | 0.35 | | 0.57 | |

¹⁾ Rated torque, rated power and maximum torque listed in the table above allow a production tolerance of 10%.

²⁾ It is not permissible to use the holding brake for an emergency stop.

SIMOTICS S-1FL6 Low Inertia

Torque-speed characteristic when connected to SINAMICS V90



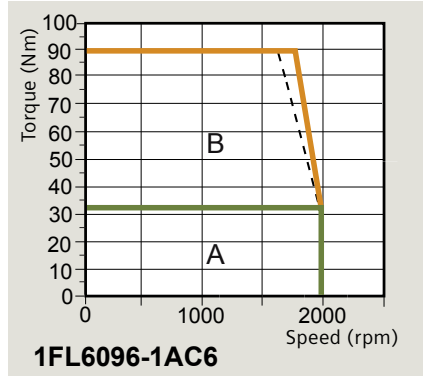
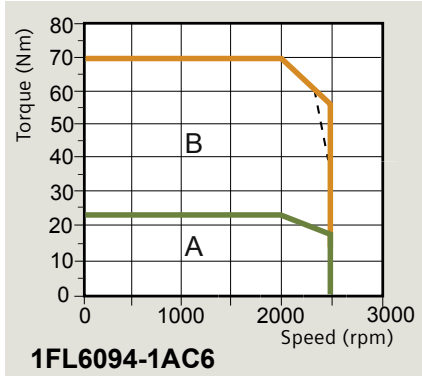
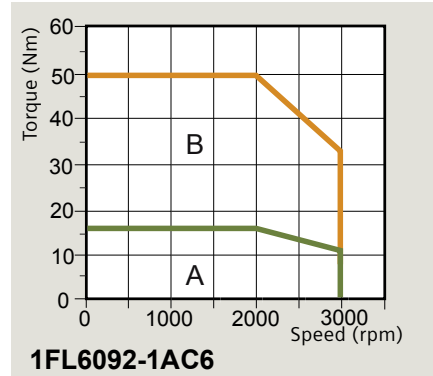
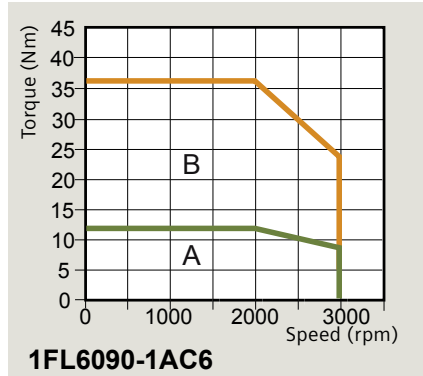
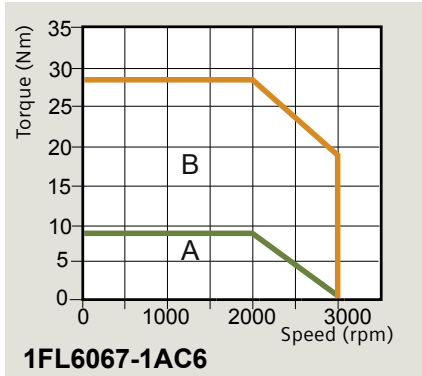
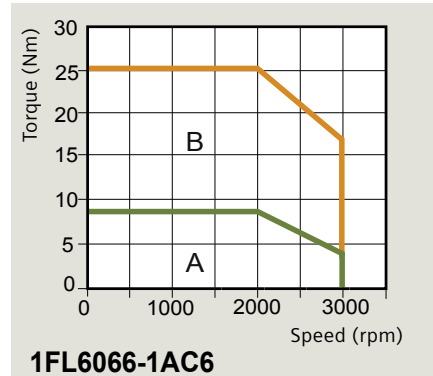
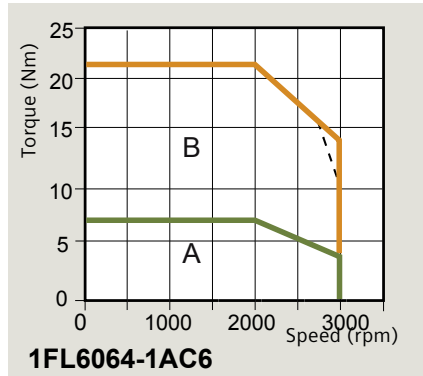
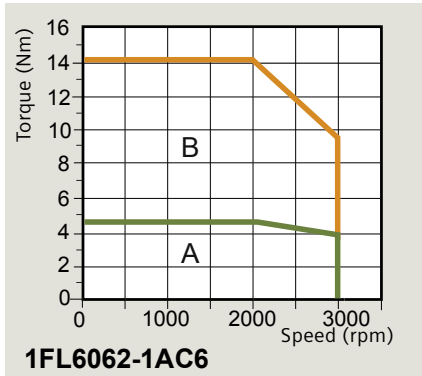
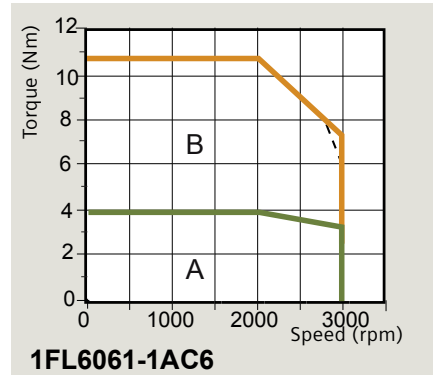
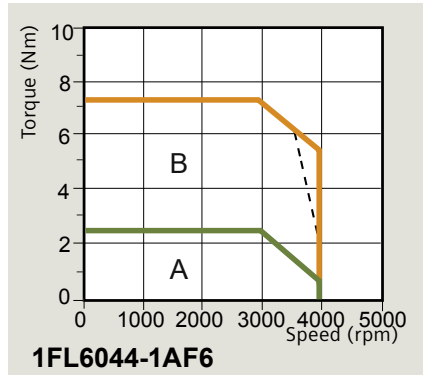
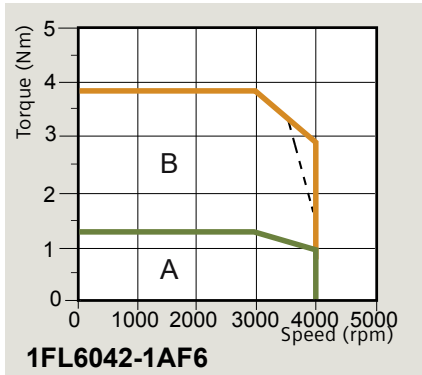
Notes:

- A: Continuous operating area
- B: Short-term operating area

- Supply voltage 220 V
- - - Supply voltage 198 V

SIMOTICS S-1FL6 High Inertia

Torque-speed characteristic when connected to SINAMICS V90




Notes:

- A: Continuous operating area
- B: Short-term operating area

- Supply voltage 400 V
- - - Supply voltage 380 V

SIMOTICS S-1FL6 High Inertia for smooth operation

Motor

| Technical data | | | | | | | | | | | |
|--|---|--------------|--------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|-----------------------|
| Article number 1FL6 | 042–1AF | 044–1AF | 061–1AC | 062–1AC | 064–1AC | 066–1AC | 067–1AC | 090–1AC | 092–1AC | 094–1AC | 096–1AC ²⁾ |
| Shaft height (SH) | 45 | | 65 | | | | 90 | | | | |
| Rated power (kW) ¹⁾ | 0.40 | 0.75 | 0.75 | 1.00 | 1.50 | 1.75 | 2.00 | 2.50 | 3.50 | 5.00 | 7.00 |
| Horsepower (HP) | 0.54 | 1.02 | 1.02 | 1.36 | 2.04 | 2.38 | 2.72 | 3.40 | 4.76 | 6.80 | 9.52 |
| Rated torque (Nm) ¹⁾ | 1.27 | 2.39 | 3.58 | 4.78 | 7.16 | 8.36 | 9.55 | 11.90 | 16.70 | 23.90 | 33.40 |
| Rated speed (rpm) | 3000 | | 2000 | | | | 2000 | | | | |
| Maximum torque (Nm) ¹⁾ | 3.8 | 7.2 | 10.7 | 14.3 | 21.5 | 25.1 | 28.7 | 35.7 | 50.0 | 70.0 | 90.0 |
| Maximum speed (rpm) | 4000 | | 3000 | | | | 3000 | | | 2500 | 2000 |
| Rated current (A) | 1.2 | 2.1 | 2.5 | 3.0 | 4.6 | 5.3 | 5.9 | 7.8 | 11.0 | 12.6 | 13.2 |
| Maximum current (A) | 3.6 | 6.3 | 7.5 | 9.0 | 13.8 | 15.9 | 17.7 | 23.4 | 32.9 | 36.9 | 35.6 |
| Torque constant (Nm/A) | 1.1 | 1.2 | 1.5 | 1.7 | 1.6 | 1.7 | 1.7 | 1.6 | 1.6 | 2.0 | 2.7 |
| Moment of inertia (10 ⁻⁴ kg·m ²) (with brake) | 2.7 (3.2) | 5.2 (5.7) | 8.0 (9.1) | 15.3 (16.4) | 15.3 (16.4) | 22.6 (23.7) | 29.9 (31.0) | 47.4 (56.3) | 69.1 (77.9) | 90.8 (99.7) | 134.3 (143.2) |
| Thermal class | B (130 °C) | | | | | | | | | | |
| Degree of protection | IP65 | | | | | | | | | | |
| Recommended load to motor inertia ratio | Max. 10x | | Max. 5x | | | | Max. 5x | | | | |
| Encoder types | Incremental encoder TTL 2500 ppr Absolute encoder 20-bit + 12-bit multi-turn | | | | | | | | | | |
| Type of construction | IM B5 (IM V1 and IM V3) | | | | | | | | | | |
| Weight (kg) ⁴⁾ (with brake) | 3.3 (4.6) | 5.1 (6.4) | 5.6 (8.6) | 8.3 (11.3) | 8.3 (11.3) | 11.0 (14.0) | 13.6 (16.6) | 15.3 (21.3) | 19.7 (25.7) | 24.3 (30.3) | 33.2 (39.1) |
| Operating temperature | 0 ~ 40 °C (without any restrictions) | | | | | | | | | | |
| Operating humidity | 90% RH maximum (no condensation at 30 °C) | | | | | | | | | | |
| Vibration severity grade | Grade A | | | | | | | | | | |
| Radial runout tolerance | N | | | | | | | | | | |
| Installation altitude | ≤ 1000 m (without power derating); > 1000 m and up to 5000 m (with power derating) | | | | | | | | | | |
| Standards |  | | | | | | | | | | |
| Holding brake data ³⁾ | | | | | | | | | | | |
| Holding torque (Nm) | 3.5 | | 12.0 | | | | 30.0 | | | | |
| Rated voltage (V) | 24 V DC ± 10% | | | | | | | | | | |
| Opening time (ms) | 60 | | 180 | | | | 220 | | | | |
| Closing time (ms) | 45 | | 60 | | | | 115 | | | | |
| Rated current (A) | 0.9 | | 1.5 | | | | 1.9 | | | | |

¹⁾ The rated torque, rated power and maximum torque listed in the table above allow for a production tolerance of 10%.

²⁾ For SIMOTICS S-1FL6 motors with brake, when the ambient temperature exceeds 30 °C, the power should be derated by 10%. Power derating is not required for other motors.

³⁾ It is not permissible to use the holding brake for an emergency stop.

⁴⁾ Motor weight with incremental encoder.

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SINAMICS V90

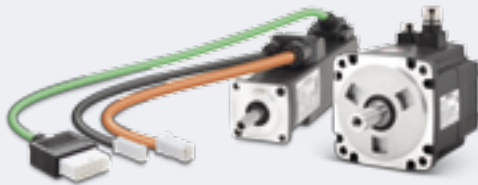
Step-by-step selection
and ordering information

[siemens.com/sinamics-v90](https://www.siemens.com/sinamics-v90)

SINAMICS V90 servo drive system

Step-by-step selection

1 Select your motor: SIMOTICS S-1FL6



1. Select your motor based on the control properties:

- **Low Inertia** motor for the highest dynamic performance in terms of speed and acceleration
- **High Inertia** motor for better load adaptation and optimum control quality in terms of torque and speed accuracy

2. Determine the motor power rating at the required torque and speed



- 3. Select encoder resolution
- 4. Select motor holding brake
- 5. Determine shaft type

2 Select your servo drive: SINAMICS V90



1. Select your servo drive based on the motor power rating and communication

| SIMOTICS S-1FL6 | | |
|---------------------------------|------------|--------------------|
| | Power (kW) | Article number |
| High perf. (Low Inertia) | 0.05 | 1FL6022-2AF21-1□□1 |
| | ... | ... |
| Smooth operation (High Inertia) | 2.00 | 1FL6054-2AF21-0□□1 |
| | 0.40 | 1FL6042-1AF61-0□□1 |
| | 7.00 | 1FL6096-1AC61-0□□1 |

| SINAMICS V90 | | | |
|---------------------------------|------------|---------------------|---------------------|
| | Power (kW) | Line supply voltage | Article number |
| High perf. (Low Inertia) | 0.05 | 230 V 1AC/3AC | 6SL3210-5FB10-1UC□□ |
| | ... | ... | ... |
| Smooth operation (High Inertia) | 2.00 | 230 V 3AC | 6SL3210-5FB12-0UC□□ |
| | 0.40 | 400 V 3AC | 6SL3210-5FE10-4UC□□ |
| | 7.00 | 400 V 3AC | 6SL3210-5FE17-0UC□□ |

3 Select your cables



1. Select your MOTION-CONNECT 300 connection system

- Power cable acc. to length and cross section
- Encoder cable acc. to length and encoder type
- Brake cable when motor holding brake is selected acc. to length

2. Control/setpoint cable to connect the drive to the PLC

4 Select your controller



1. Select your SIMATIC S7 controller

- Basic Controller SIMATIC S7-1200 or
- Advanced Controller SIMATIC S7-1500/1500 T-CPU



The optimum servo drive solution
SINAMICS V90
has now been configured!

SINAMICS V90 servo drive system

Step-by-step selection

Ordering information:

| 1 SIMOTICS S-1FL6 servomotor | | | | | | 2 SINAMICS V90 servo drive | | | |
|--|------------------|-------------------|-------------------|-------------------|---|----------------------------|----------------------------|------------------|------------------|
| | Rated Power (kW) | Rated torque (Nm) | Rated speed (rpm) | Shaft height (mm) | Article number | Rated power (kW) | Line supply voltage | Frame size | Article number |
| High dynamic performance (Low Inertia) | 0.05 | 0.16 | 3000 | 20 | 1FL6022-2AF21-1 | 0.10 | 200 ... 240 V 1AC / 3AC | FSA*** | 6SL3210-5FB10-1U |
| | 0.10 | 0.32 | 3000 | | 1FL6024-2AF21-1 | 0.20 | | | 6SL3210-5FB10-2U |
| | 0.20 | 0.64 | 3000 | 30 | 1FL6032-2AF21-1 | 0.40 | | FSB | 6SL3210-5FB10-4U |
| | 0.40 | 1.27 | 3000 | | 1FL6034-2AF21-1 | 0.75 | | | FSC |
| | 0.75 | 2.39 | 3000 | 40 | 1FL6042-2AF21-1 | 1.00 | 200 ... 240 V 3AC | FSD | 6SL3210-5FB11-0U |
| | 1.00 | 3.18 | 3000 | | 1FL6044-2AF21-1 | 1.50 | | | 6SL3210-5FB11-5U |
| | 1.50 | 4.78 | 3000 | 50 | 1FL6052-2AF21-0 | 2.00 | | | 6SL3210-5FB12-0U |
| | 2.00 | 6.37 | 3000 | | 1FL6054-2AF21-0 | | | | |
| Encoder type | | | | | Incremental encoder TTL 2500 ppr | | | A | |
| | | | | | Absolute encoder single-turn 21-bit* | | | M | |
| Smooth operation (High Inertia) | 0.40 | 1.27 | 3000 | 45 | 1FL6042-1AF61-0 | 0.40 | 380 ... 480 V 3AC | FSAA | 6SL3210-5FE10-4U |
| | 0.75 | 2.39 | 3000 | | 1FL6044-1AF61-0 | 0.75 | | | FSA |
| | 0.75 | 3.58 | 2000 | 65 | 1FL6061-1AC61-0 | 0.75 | | | 6SL3210-5FE11-0U |
| | 1.00 | 4.77 | 2000 | | 1FL6062-1AC61-0 | 1.00 | | FSB | 6SL3210-5FE11-5U |
| | 1.50 | 7.16 | 2000 | | 1FL6064-1AC61-0 | 1.50 | 6SL3210-5FE12-0U | | |
| | 1.75 | 8.4 | 2000 | | 1FL6066-1AC61-0 | 2.00 | | | |
| | 2.00 | 9.5 | 2000 | | 1FL6067-1AC61-0 | 2.50 | FSC | | 6SL3210-5FE13-5U |
| | 2.50 | 11.9 | 2000 | 90 | 1FL6090-1AC61-0 | 3.50 | | 6SL3210-5FE15-0U | |
| | 3.50 | 16.7 | 2000 | | 1FL6092-1AC61-0 | 5.00 | | 6SL3210-5FE17-0U | |
| | 5.00 | 23.9 | 2000 | | 1FL6094-1AC61-0 | 7.00 | | | |
| 7.00 | 33.4 | 2000 | | 1FL6096-1AC61-0 | | | | | |
| Encoder type | | | | | Incremental encoder TTL 2500 ppr | | | A | |
| | | | | | Absolute encoder 20-bit + 12-bit multi-turn | | | L | |
| Shaft type | | | | | Feather key, without holding brake | | | A | |
| feather key and holding brake | | | | | Feather key, with holding brake** | | | B | |
| | | | | | Plain shaft, without holding brake | | | G | |
| | | | | | Plain shaft, with holding brake** | | | H | |

* available in the 2nd half of 2016

** The SIMOTICS S-1FL6 Low Inertia motor requires an external relays to actuate the motor holding brake. See SINAMICS V90 operating instructions.

SINAMICS V90 pulse train (PTI) version **A**
 SINAMICS V90 PROFINET (PN) version **F**
 (V90 PROFINET version 400 V available in the 2nd half of 2016)

*** SINAMICS V90 PROFINET 200 V version is not available in frame size A (FSA). The power range from 0.1 kW to 0.4 kW is covered with frame size B (FSB).

| Recommended line-side components | | | | | | | | | | | |
|----------------------------------|----------------|---------------------------------------|--------------------|--|--------------------|------------------------|-----------------|--|--------------------|------------------------|-----------------|
| SINAMICS V90 | | Recommended line filter ¹⁾ | | Recommended fuse/circuit breaker – IEC-compliant | | | | Recommended fuse/circuit breaker to – UL-compliant | | | |
| Line supply voltage | Article number | Rated current | Article number | Fuse | Circuit breaker | Fuse | Circuit breaker | Fuse | Circuit breaker | Fuse | Circuit breaker |
| | 6SL3210-5F... | | | Rated current | Article number | Rated current, voltage | Article number | Rated current, voltage | Class | Rated current, voltage | Article number |
| 200 ... 240 V 1AC | B10-1 | 18 A | 6SL3203-0BB21-8VA0 | 6 A | 3NA3 801-2C | 2.8–4 A, 230/240 V | 3RV 2011-1EA10 | 6 A | Listed JDDZ | 2.8–4 A, 230/240 V | 3RV 2011-1EA10 |
| | B10-2 | | | 6 A | 3NA3 801-2C | 2.8–4 A, 230/240 V | 3RV 2011-1EA10 | 6 A | Listed JDDZ | 2.8–4 A, 230/240 V | 3RV 2011-1EA10 |
| | B10-4 | | | 10 A | 3NA3 803-2C | 5.5–8 A, 230/240 V | 3RV 2011-1HA10 | 10 A | Listed JDDZ | 5.5–8 A, 230/240 V | 3RV 2011-1HA10 |
| | B10-8 | | | 16 A | 3NA3 803-2C | 9–12.5 A, 230/240 V | 3RV 2011-1KA10 | 20 A | Listed JDDZ | 9–12.5 A, 230/240 V | 3RV 2011-1KA10 |
| 200 ... 240 V 3AC | B10-1 | 5 A | 6SL3203-0BE15-0VA0 | 6 A | 3NA3 801-2C | 2.8–4 A, 230/240 V | 3RV 2011-1EA10 | 6 A | Listed JDDZ | 2.8–4 A, 230/240 V | 3RV 2011-1EA10 |
| | B10-2 | | | 6 A | 3NA3 801-2C | 2.8–4 A, 230/240 V | 3RV 2011-1EA10 | 6 A | Listed JDDZ | 2.8–4 A, 230/240 V | 3RV 2011-1EA10 |
| | B10-4 | | | 10 A | 3NA3 803-2C | 2.8–4 A, 230/240 V | 3RV 2011-1EA10 | 10 A | Listed JDDZ | 2.8–4 A, 230/240 V | 3RV 2011-1EA10 |
| | B10-8 | | | 16 A | 3NA3 805-2C | 5.5–8 A, 230/240 V | 3RV 2011-1HA10 | 20 A | Listed JDDZ | 5.5–8 A, 230/240 V | 3RV 2011-1HA10 |
| | B11-0 | 12 A | 6SL3203-0BE21-2VA0 | 16 A | 3NA3 805-2C | 7–10 A, 230/240 V | 3RV 2011-1JA10 | 20 A | Listed JDDZ | 7–10 A, 230/240 V | 3RV 2011-1JA10 |
| | B11-5 | | | 25 A | 3NA3 810-2C | 10–16 A, 230/240 V | 3RV 2011-4AA10 | 25 A | Listed JDDZ | 10–16 A, 230/240 V | 3RV 2011-4AA10 |
| B12-0 | | | 25 A | 3NA3 810-2C | 10–16 A, 230/240 V | 3RV 2011-4AA10 | 25 A | Listed JDDZ | 10–16 A, 230/240 V | 3RV 2011-4AA10 | |
| 380 ... 480 V 3AC | E10-4 | 5 A | 6SL3203-0BE15-0VA0 | 6 A | 3NA3801-6 | 3.2 A, 690 V AC | 3RV 2021-1DA10 | 10 A | Listed JDDZ | 3.2 A, 600 V AC | 3RV 2021-1DA10 |
| | E10-8 | | | 6 A | 3NA3801-6 | 4 A, 690 V AC | 3RV 2021-1EA10 | 10 A | Listed JDDZ | 4 A, 690 V AC | 3RV 2021-1EA10 |
| | E11-0 | | | 10 A | 3NA3803-6 | 5 A, 690 V AC | 3RV 2021-1FA10 | 10 A | Listed JDDZ | 5 A, 690 V AC | 3RV 2021-1FA10 |
| | E11-5 | 12 A | | 6SL3203-0BE21-2VA0 | 10 A | 3NA3803-6 | 10 A, 690 V AC | 3RV 2021-1HA10 | 15 A | Listed JDDZ | 10 A, 690 V AC |
| | E12-0 | | 16 A | | 3NA3805-6 | 16 A, 690 V AC | 3RV 2021-4AA10 | 15 A | Listed JDDZ | 16 A, 690 V AC | 3RV 2021-4AA10 |
| | E13-5 | 20 A | 6SL3203-0BE22-0VA0 | 20 A | 3NA3807-6 | 20 A, 690 V AC | 3RV 2021-4BA10 | 25 A | Listed JDDZ | 20 A, 690 V AC | 3RV 2021-4BA10 |
| | E15-0 | | | 20 A | 3NA3807-6 | 20 A, 690 V AC | 3RV 2021-4BA10 | 25 A | Listed JDDZ | 20 A, 690 V AC | 3RV 2021-4BA10 |
| | E17-0 | | | 25 A | 3NA3810-6 | 25 A, 690 V AC | 3RV 2021-4DA10 | 25 A | Listed JDDZ | 25 A, 690 V AC | 3RV 2021-4DA10 |
| | | | | | | | | | | | |

3A ¹⁾ With one of the recommended line filters, EN 61008-3 category C2 can be reached in combination with SINAMICS V90, more information please refer to SINAMICS V90 Operating instruction – EMC instructions.

²⁾ When the internal braking resistor is not sufficient, select a standard braking resistor according to the table.

³⁾ 7 m cable length is only available for high inertia motors (3AC 400 V).

3 MOTION-CONNECT 300 cables between SINAMICS V90 servo drive and SIMOTICS S-1FL6 servomotor

| Power cable | Encoder cable | Brake cable |
|---|--|---|
| Article number | Article number | Article number |
| 6FX3002-5CK01-1 <input type="checkbox"/> <input type="checkbox"/> 0 | 6FX3002-2 <input type="checkbox"/> <input type="checkbox"/> 20-1 <input type="checkbox"/> <input type="checkbox"/> 0 | 6FX3002-5BK02-1 <input type="checkbox"/> <input type="checkbox"/> 0 |
| 6FX3002-5CK31-1 <input type="checkbox"/> <input type="checkbox"/> 0 | 6FX3002-2 <input type="checkbox"/> <input type="checkbox"/> 10-1 <input type="checkbox"/> <input type="checkbox"/> 0 | 6FX3002-5BL02-1 <input type="checkbox"/> <input type="checkbox"/> 0 |
| 6FX3002-5CL01-1 <input type="checkbox"/> <input type="checkbox"/> 0 | 6FX3002-2 <input type="checkbox"/> <input type="checkbox"/> 10-1 <input type="checkbox"/> <input type="checkbox"/> 0 | 6FX3002-5BL02-1 <input type="checkbox"/> <input type="checkbox"/> 0 |
| 6FX3002-5CL11-1 <input type="checkbox"/> <input type="checkbox"/> 0 | | |
| Length: 3 m | A D | A D |
| Length: 5 m | A F | A F |
| Length: 7 m ³⁾ | A H | A H |
| Length: 10 m | B A | B A |
| Length: 20 m | C A | C A |
| For incremental encoder TTL 2500 ppr | C T | |
| For absolute encoder single-turn 21-bit | D B | |
| Absolute encoder 20-bit + 12-bit multi-turn | | |

Cables between SINAMICS V90 servo drive and PLC

Article number
6SL3260-4NA00-1VB0
Control/setpoint cable, 1 m cable with connector (MDR 50-pin connector, free pins to controller side)

or

6SL3260-4NA00-1VA5
Control/setpoint cable 0.5 m cable with connectors on both sides and separate terminal block (MDR 50-pin connector, terminal block to controller side)

I/O cable between SINAMICS V90 drive and controller

Article number
6SL3260-4MA00-1VB0
I/O cable, 1 m cable with 20-pin MDR connector (free pins to controller side)

PROFINET cable

6GK1901-1BB10-2AA0
RJ45 data plug-in connector, with 180° (straight) cable outlet

6XV1840-2AH10
Standard bus cable (4-core), sold by meter, not assembled

6XV1871-5BH10
Preassembled cable, 1 m, with two RJ45 plug-180

Requirements for external braking resistor

| External braking resistor ²⁾ | | | | | |
|---|------------------|----------------|-----------------|-----------------|------------------|
| Line supply voltage | Frame size | Resistance (Ω) | Max. power (kW) | Rated power (W) | Max. energy (kJ) |
| 200 ... 240 V 1AC/3AC | FSA | 150 | 1.09 | 20 | 0.8 |
| | FSB | 100 | 1.64 | 21 | 1.23 |
| | FSC | 50 | 3.28 | 62 | 2.46 |
| | FSD, 1 kW | 50 | 3.28 | 62 | 2.46 |
| | FSD, 1.5 to 2 kW | 25 | 6.56 | 123 | 4.92 |
| 380 ... 480 V 3AC | FSAA | 533 | 1.2 | 30 | 2.4 |
| | FSA | 160 | 4 | 100 | 8 |
| | FSB | 70 | 9.1 | 229 | 18.3 |
| | FSC | 27 | 23.7 | 1185 | 189.6 |

Replacement parts

| | | |
|--|---------------------------------------|--------------------|
| Replacement connector kits (contains control connectors, power connectors) | for SINAMICS V90 400 V FSAA | 6SL3200-0WT00-0AA0 |
| | for SINAMICS V90 400 V FSA | 6SL3200-0WT01-0AA0 |
| | for SINAMICS V90 200 V FSA/FSB | 6SL3200-0WT02-0AA0 |
| | for SINAMICS V90 200 V FSC/FSD | 6SL3200-0WT03-0AA0 |
| Replacement fan | for SINAMICS V90 400 V FSB, 200 V FSD | 6SL3200-0WF00-0AA0 |
| | for SINAMICS V90 400 V FSC | 6SL3200-0WF01-0AA0 |

Connectors

| Connectors | Plug on | Article number | Packaging unit (pcs) |
|--|------------|---------------------------------------|----------------------|
| 50-pin MDR connector for setpoint cable | drive side | 6SL3260-2NA00-0VA0 | 30 |
| Encoder connector | drive side | 6FX2003-0SB14 | 30 |
| 20-pin MDR connector for I/O cable | drive side | 6SL3260-2MA00-0VA0 | 5 |
| Power connector | motor side | 6FX2003-0LL1 <input type="checkbox"/> | |
| Incremental encoder TTL 2500 ppr connector | motor side | 6FX2003-0SL1 <input type="checkbox"/> | |
| Brake connector | motor side | 6FX2003-0LL5 <input type="checkbox"/> | |
| Absolute encoder single-turn 21-bit Absolute encoder 20-bit + 12-bit multi-turn connector | motor side | 6FX2003-0DB1 <input type="checkbox"/> | |
| For SIMOTICS S-1FL6 motors with shaft heights of 45, 50, 65, 90 | | | 1 30 |
| For SIMOTICS S-1FL6 motors with shaft heights of 20, 30, and 40 | | | 2 5 |

SIMATIC S7 controller

4 SINAMICS V90 pulse train (PTI), USS/Modbus RTU version to SIMATIC controller

| SIMATIC S7-1200 Basic controller | | | Communication | |
|----------------------------------|--------------------|----------------------------------|--|--|
| CPU | Article number | Digital outputs | RS 485 communication for USS or Modbus RTU | Article number |
| CPU 1211C DC/DC/DC | 6ES7211-1□□□□-0XB0 | 4 DO with 100 kHz rest 30 kHz | CM 1241 RS 422/485 or CB 1241 RS 485 | 6ES7241-1CH32-0XB0 or 6ES7241-1CH30-0XB0 |
| CPU 1212C DC/DC/DC | 6ES7212-1□□□□-0XB0 | | | |
| CPU 1214C DC/DC/DC | 6ES7214-1□□□□-0XB0 | | | |
| CPU 1215C DC/DC/DC | 6ES7215-1□□□□-0XB0 | | | |
| CPU 1217C DC/DC/DC | 6ES7217-1□□□□-0XB0 | 4 DO with 1 MHz rest 100 kHz | | |
| Signal boards | | | Note: One SIMATIC S7-1200 CPU can control up to 4 SINAMICS V90 axes, while each axis requires 2 fast digital output for the pulse train interface. One SIMATIC S7-1200 CPU is only expandable with either a signal board or a communication board. | |
| CPU | Article number | Digital outputs | For detailed and further information about SIMATIC controllers please refer to the SIMATIC S7-1200 brochure, catalog or web page: http://siemens.com/simatic-s7-1200 | |
| SB 1222 DC 200 kHz | 6ES7222-1BD30-0XB0 | 4 x 24 V DC 200 kHz | | |
| SB 1222 DC 200 kHz | 6ES7222-1AD30-0XB0 | 4 x 5 V DC 200 kHz | | |
| SB 1223 DC/DC 200 kHz | 6ES7223-3BD30-0XB0 | 2 x 24 V DC 200 kHz | | |
| SB 1223 DC/DC 200 kHz | 6ES7223-3AD30-0XB0 | 2 x 5 V DC 200 kHz | | |

4 SINAMICS V90 PROFINET version to SIMATIC controller

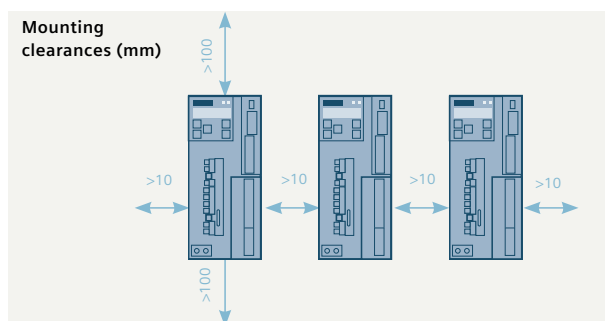
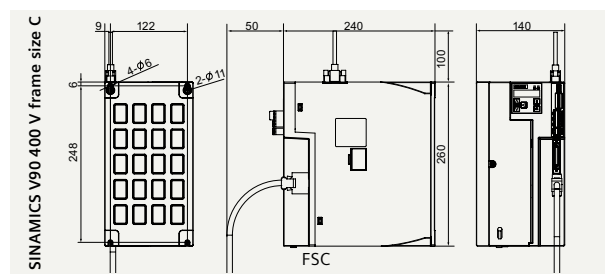
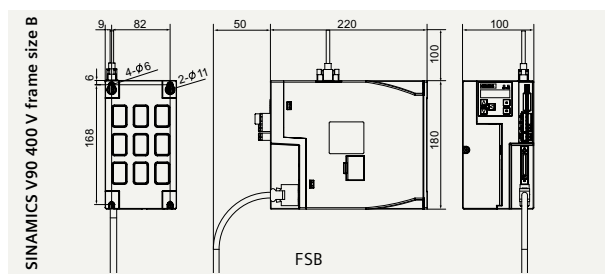
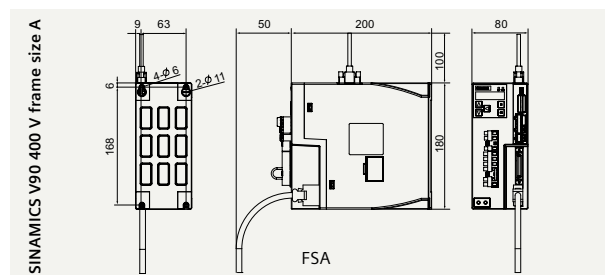
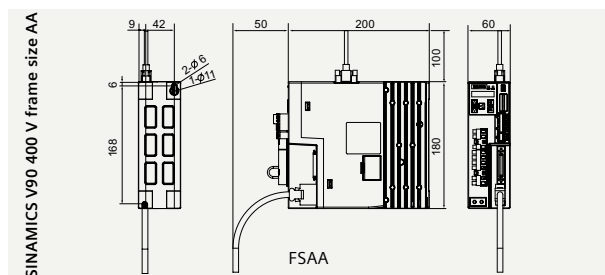
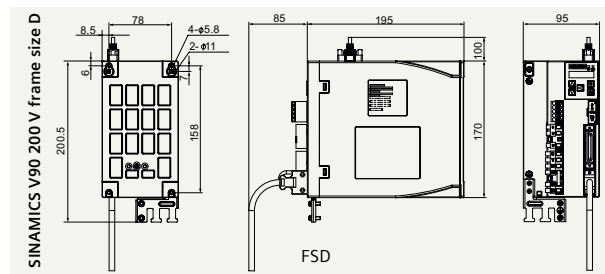
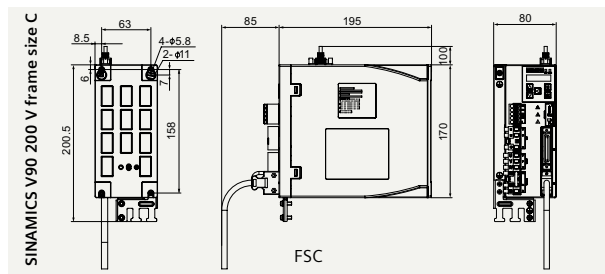
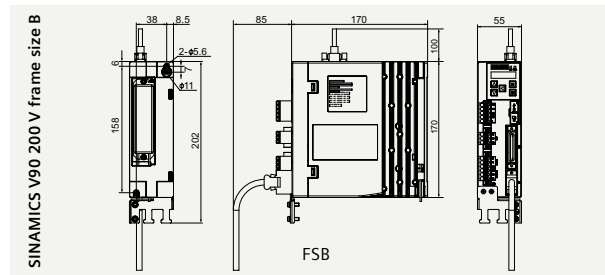
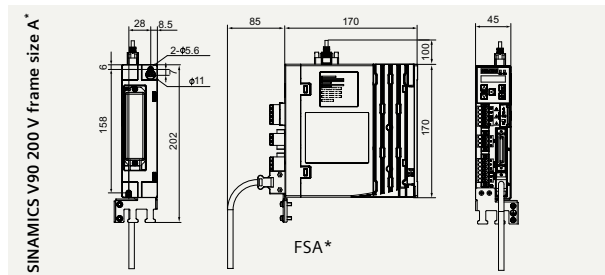
| SIMATIC S7-1500/1500 T for advanced motion control | | | | SIMATIC S7-1200 for basic motion control | |
|--|--------------------|--------------|--------------------|--|--------------------|
| Standard CPU | Article number | Failsafe CPU | Article number | CPU | Article number |
| S7-1511 | 6ES7511-1AK01-0AB0 | S7-1511F | 6ES7511-1FK01-0AB0 | 1211C DC/DC/DC | 6ES7211-1□□□□-0XB0 |
| S7-1513 | 6ES7513-1AL01-0AB0 | S7-1513F | 6ES7513-1FL01-0AB0 | 1212C DC/DC/DC | 6ES7212-1□□□□-0XB0 |
| S7-1515 | 6ES7515-2AM01-0AB0 | S7-1515F | 6ES7515-2FM01-0AB0 | 1214C DC/DC/DC | 6ES7214-1□□□□-0XB0 |
| S7-1516 | 6ES7516-3AN01-0AB0 | S7-1516F | 6ES7516-3FN01-0AB0 | 1215C DC/DC/DC | 6ES7215-1□□□□-0XB0 |
| S7-1517 | 6ES7517-3AP00-0AB0 | S7-1517F | 6ES7517-3FP00-0AB0 | 1217C DC/DC/DC | 6ES7217-1□□□□-0XB0 |
| S7-1518 | 6ES7518-4AP00-0AB0 | S7-1518F | 6ES7518-4FP00-0AB0 | | |
| Technology CPU | Article number | Failsafe CPU | Article number | For further information about PROFINET cables refer to http://automation.siemens.com/sc-static/catalogs/catalog/IK_PI_2015_en.pdf For further information about SIMATIC controllers please refer to the SIMATIC S7 catalog or web page: http://siemens.com/simatic | |
| S7-1511T | 6ES7511-1TK01-0AB0 | – | – | | |
| S7-1515T | 6ES7515-2TM01-0AB0 | – | – | | |
| S7-1517T | 6ES7517-3TP00-0AB0 | S7-1517TF | 6ES7517-3UP00-0AB0 | | |
| Note: Technology Objects: SINAMICS V90 as a PROFINET I/O device with PROFIdrive supports technology objects of S7-1200/S7-1500/S7-1500 T-CPU for speed and positioning control. Function blocks: SINAMICS V90 only supports SINA_SPEED (speed), SINA_POS (positioning) is NOT supported yet. | | | | | |

| Accessories | |
|--|--------------------|
| Training case SINAMICS V90 LI, 200 V (PTI, USS/Modbus RTU version) | 6AG1067-2AA00-OACO |
| SINAMICS SD card for SINAMICS V90 in 400 V version | 6SL3054-4AG00-2AA0 |

SINAMICS V90

Dimensions and mounting clearances

Dimension drawings (mm)



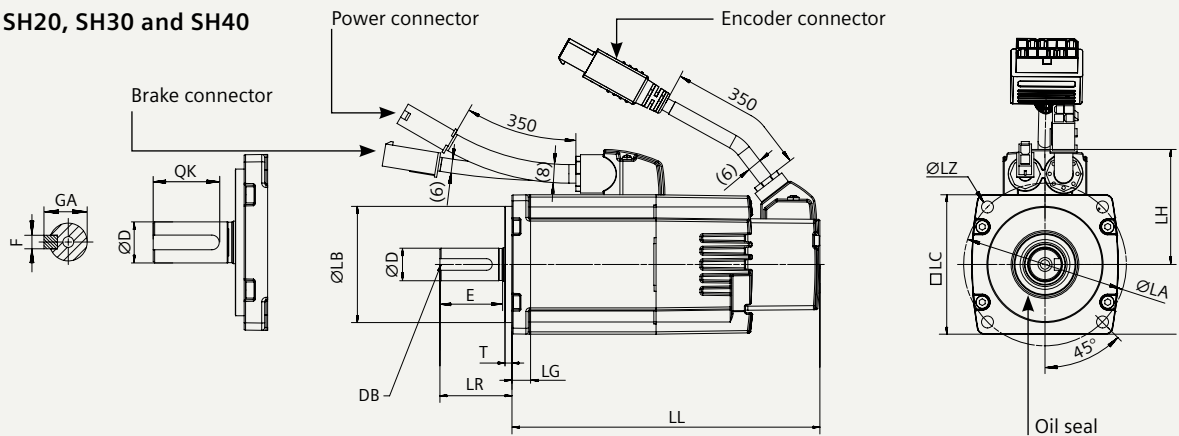
* SINAMICS V90 PROFINET 200 V version is not available in frame size A (FSA). The power range from 0.1 kW to 0.4 kW is covered with frame size B (FSB)

SIMOTICS S-1FL6 Low Inertia

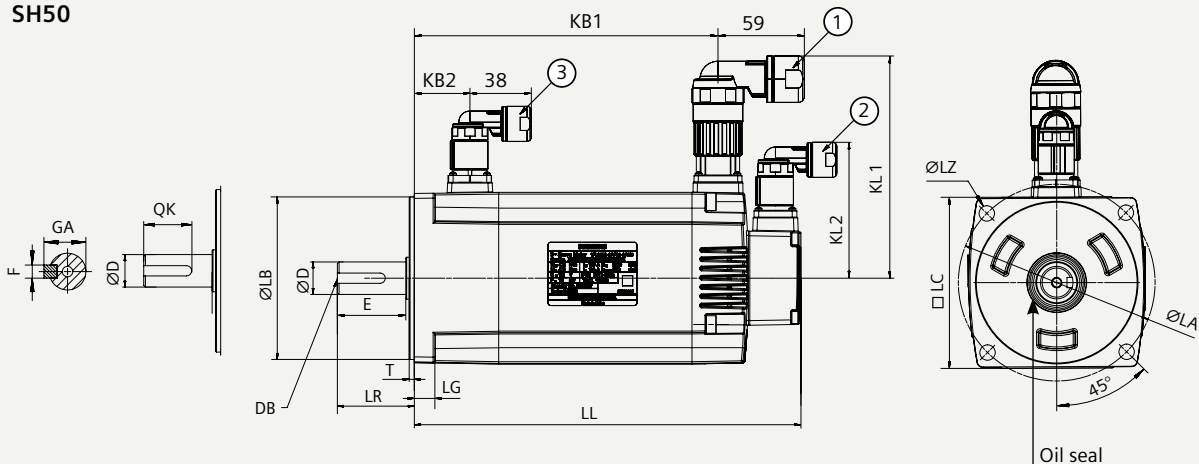
Dimension drawings (mm) SIMOTICS S-1FL6 Low Inertia servomotors

| Shaft height | | | | | | | | | | | | | | | Without brake | | With brake | | | | | |
|--------------|-------------|-----|-----|-----|----|----|----|-----|----|----|-------|----|------|------|---------------|-------|------------|-------|-------|------|-----|-----|
| | Type | LC | LA | LZ | LB | LH | LR | T | LG | D | DB | E | QK | GA | F | LL | KB1 | LL | KB1 | KB2 | KL1 | KL2 |
| 20 | 1FL6022-2AF | 40 | 46 | 4.5 | 30 | 40 | 25 | 2.5 | 6 | 8 | M3x8 | 22 | 17.5 | 9 | 3 | 86 | - | 119 | - | - | - | - |
| | 1FL6024-2AF | 40 | 46 | 4.5 | 30 | 40 | 25 | 2.5 | 6 | 8 | M3x8 | 22 | 17.5 | 9 | 3 | 106 | - | 139 | - | - | - | - |
| 30 | 1FL6032-2AF | 60 | 70 | 5.5 | 50 | 50 | 31 | 3 | 8 | 14 | M4x15 | 26 | 22.5 | 16 | 5 | 98 | - | 132.5 | - | - | - | - |
| | 1FL6034-2AF | 60 | 70 | 5.5 | 50 | 50 | 31 | 3 | 8 | 14 | M4x15 | 26 | 22.5 | 16 | 5 | 123 | - | 157.5 | - | - | - | - |
| 40 | 1FL6042-2AF | 80 | 90 | 7 | 70 | 60 | 35 | 3 | 8 | 19 | M6x16 | 30 | 28 | 21.5 | 6 | 139 | - | 178.3 | - | - | - | - |
| | 1FL6044-2AF | 80 | 90 | 7 | 70 | 60 | 35 | 3 | 8 | 19 | M6x16 | 30 | 28 | 21.5 | 6 | 158.8 | - | 198.1 | - | - | - | - |
| 50 | 1FL6052-2AF | 100 | 115 | 9 | 95 | - | 45 | 3 | 12 | 19 | M6x16 | 40 | 28 | 21.5 | 6 | 192 | 143.5 | 226 | 177.5 | 32.5 | 135 | 80 |
| | 1FL6054-2AF | 100 | 115 | 9 | 95 | - | 45 | 3 | 12 | 19 | M6x16 | 40 | 28 | 21.5 | 6 | 216 | 167.5 | 250 | 201.5 | 32.5 | 135 | 80 |

SH20, SH30 and SH40



SH50

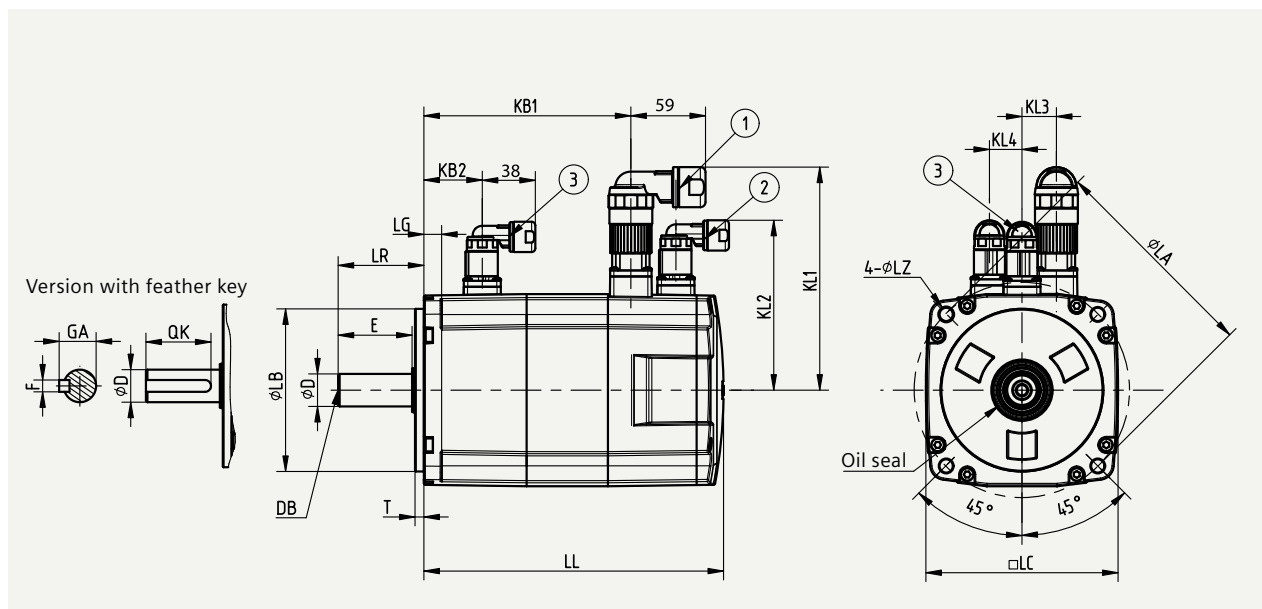


Note: ① Power connector, ② Incremental encoder connector, ③ Brake connector
 Connectors should be ordered separately, for ordering information please refer to section "Options" in this document.
 Outline dimensions of ② incremental encoder connector ③ brake connector are the same.

SIMOTICS S-1FL6 High Inertia

Dimension drawings (mm) SIMOTICS S-1FL6 High Inertia servomotors with incremental encoder

| Shaft height | Type | | | | | | | | | | | | | | Without brake | | | With brake | | | | | | |
|--------------|-------------|-----|-----|------|-------|----|---|----|----|--------|----|----|------|----|---------------|-------|-----|------------|-----|------|-----|-----|-----|-----|
| | | LC | LA | LZ | LB | LR | T | LG | D | DB | E | QK | GA | F | LL | KB1 | KB2 | LL | KB1 | KB2 | KL1 | KL2 | KL3 | KL4 |
| 45 | 1FL6042-1AF | 90 | 100 | 7 | 80 | 35 | 4 | 10 | 19 | M6x16 | 30 | 25 | 21.5 | 6 | 154.5 | 93.5 | - | 201 | 140 | 31.5 | 136 | 92 | - | - |
| | 1FL6044-1AF | 90 | 100 | 7 | 80 | 35 | 4 | 10 | 19 | M6x16 | 30 | 25 | 21.5 | 6 | 201.5 | 140.5 | - | 248 | 187 | 31.5 | 136 | 92 | - | - |
| 65 | 1FL6061-1AC | 130 | 145 | 9 | 110 | 58 | 6 | 12 | 22 | M8x16 | 50 | 44 | 25 | 8 | 148 | 85.5 | - | 202.5 | 140 | 39.5 | 158 | 115 | 23 | 22 |
| | 1FL6062-1AC | 130 | 145 | 9 | 110 | 58 | 6 | 12 | 22 | M8x16 | 50 | 44 | 25 | 8 | 181 | 118.5 | - | 235.5 | 173 | 39.5 | 158 | 115 | 23 | 22 |
| | 1FL6064-1AC | 130 | 145 | 9 | 110 | 58 | 6 | 12 | 22 | M8x16 | 50 | 44 | 25 | 8 | 181 | 118.5 | - | 235.5 | 173 | 39.5 | 158 | 115 | 23 | 22 |
| | 1FL6066-1AC | 130 | 145 | 9 | 110 | 58 | 6 | 12 | 22 | M8x16 | 50 | 44 | 25 | 8 | 214 | 151.5 | - | 268.5 | 206 | 39.5 | 158 | 115 | 23 | 22 |
| | 1FL6067-1AC | 130 | 145 | 9 | 110 | 58 | 6 | 12 | 22 | M8x16 | 50 | 44 | 25 | 8 | 247 | 184.5 | - | 301.5 | 239 | 39.5 | 158 | 115 | 23 | 22 |
| 90 | 1FL6090-1AC | 180 | 200 | 13.5 | 114.3 | 80 | 3 | 18 | 35 | M12x25 | 75 | 60 | 38 | 10 | 189.5 | 140 | - | 255 | 206 | 44.5 | 184 | 149 | 34 | 34 |
| | 1FL6092-1AC | 180 | 200 | 13.5 | 114.3 | 80 | 3 | 18 | 35 | M12x25 | 75 | 60 | 38 | 10 | 211.5 | 162 | - | 281 | 232 | 44.5 | 184 | 149 | 34 | 34 |
| | 1FL6094-1AC | 180 | 200 | 13.5 | 114.3 | 80 | 3 | 18 | 35 | M12x25 | 75 | 60 | 38 | 10 | 237.5 | 188 | - | 307 | 258 | 44.5 | 184 | 149 | 34 | 34 |
| | 1FL6096-1AC | 180 | 200 | 13.5 | 114.3 | 80 | 3 | 18 | 35 | M12x25 | 75 | 60 | 38 | 10 | 289.5 | 240 | - | 359 | 310 | 44.5 | 184 | 149 | 34 | 34 |



Note: ① Power connector, ② Incremental encoder connector, ③ Brake connector
Connectors should be ordered separately, for ordering information please refer to section "Options" in this document.

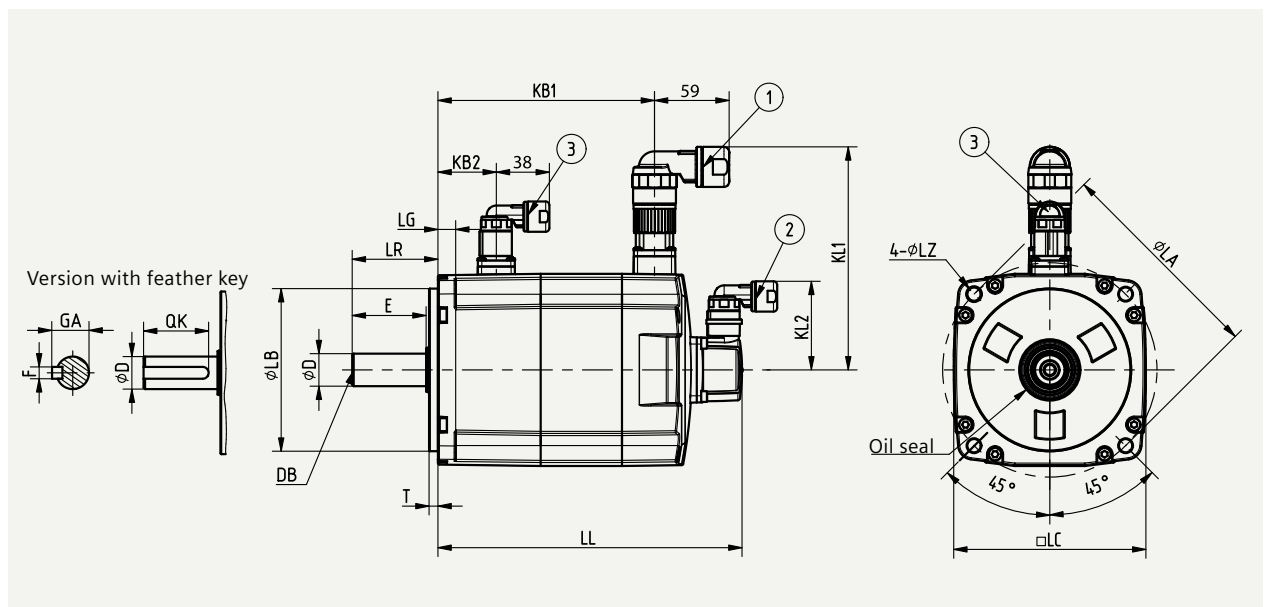
Outline dimensions of ② incremental encoder connector ③ brake connector are the same.

Shaft height 90 motor has M8 screws for eyebolts.

SIMOTICS S-1FL6 High Inertia

Dimension drawings (mm) SIMOTICS S-1FL6 High Inertia servomotors with absolute encoder

| Shaft height | Type | | | | | | | | | | | | | | Without brake | | | With brake | | | | | | |
|--------------|-------------|-----|-----|------|-------|----|---|----|----|--------|----|----|------|----|---------------|-----|-----|------------|-----|------|-----|-----|-----|-----|
| | | LC | LA | LZ | LB | LR | T | LG | D | DB | E | QK | GA | F | LL | KB1 | KB2 | LL | KB1 | KB2 | KL1 | KL2 | KL3 | KL4 |
| 45 | 1FL6042-1AF | 90 | 100 | 7 | 80 | 35 | 4 | 10 | 19 | M6x16 | 30 | 25 | 21.5 | 6 | 157 | 100 | - | 203.5 | 147 | 31.5 | 136 | 60 | - | - |
| | 1FL6044-1AF | 90 | 100 | 7 | 80 | 35 | 4 | 10 | 19 | M6x16 | 30 | 25 | 21.5 | 6 | 204 | 147 | - | 250.5 | 194 | 31.5 | 136 | 60 | - | - |
| 65 | 1FL6061-1AC | 130 | 145 | 9 | 110 | 58 | 6 | 12 | 22 | M8x16 | 50 | 44 | 25 | 8 | 151 | 92 | - | 205.5 | 147 | 39.5 | 158 | 60 | - | - |
| | 1FL6062-1AC | 130 | 145 | 9 | 110 | 58 | 6 | 12 | 22 | M8x16 | 50 | 44 | 25 | 8 | 184 | 125 | - | 238.5 | 180 | 39.5 | 158 | 60 | - | - |
| | 1FL6064-1AC | 130 | 145 | 9 | 110 | 58 | 6 | 12 | 22 | M8x16 | 50 | 44 | 25 | 8 | 184 | 125 | - | 238.5 | 180 | 39.5 | 158 | 60 | - | - |
| | 1FL6066-1AC | 130 | 145 | 9 | 110 | 58 | 6 | 12 | 22 | M8x16 | 50 | 44 | 25 | 8 | 217 | 158 | - | 271.5 | 213 | 39.5 | 158 | 60 | - | - |
| | 1FL6067-1AC | 130 | 145 | 9 | 110 | 58 | 6 | 12 | 22 | M8x16 | 50 | 44 | 25 | 8 | 250 | 191 | - | 304.5 | 246 | 39.5 | 158 | 60 | - | - |
| 90 | 1FL6090-1AC | 180 | 200 | 13.5 | 114.3 | 80 | 3 | 18 | 35 | M12x25 | 75 | 60 | 38 | 10 | 197 | 135 | - | 263 | 201 | 44.5 | 184 | 60 | - | - |
| | 1FL6092-1AC | 180 | 200 | 13.5 | 114.3 | 80 | 3 | 18 | 35 | M12x25 | 75 | 60 | 38 | 10 | 223 | 161 | - | 289 | 227 | 44.5 | 184 | 60 | - | - |
| | 1FL6094-1AC | 180 | 200 | 13.5 | 114.3 | 80 | 3 | 18 | 35 | M12x25 | 75 | 60 | 38 | 10 | 249 | 187 | - | 315 | 253 | 44.5 | 184 | 60 | - | - |
| | 1FL6096-1AC | 180 | 200 | 13.5 | 114.3 | 80 | 3 | 18 | 35 | M12x25 | 75 | 60 | 38 | 10 | 301 | 239 | - | 367 | 305 | 44.5 | 184 | 60 | - | - |



Note: ① Power connector, ② Absolute encoder connector, ③ Brake connector
 Connectors should be ordered separately, for ordering information please refer to section "Options" in this document.
 Outline dimensions of ② absolute encoder connector ③ brake connector are the same.
 Shaft height 90 motor has M8 screws for eyebolts.

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