

DS7 Soft starter



Powering Business Worldwide

1.5 Key to part numbers

The soft starters of the DS7 series are assigned part numbers according to the following key to part numbers:

DS7 -	3	4	x	SX	yyy	N	0	- z	Explanation
									Instance: N = no option D = SmartWire-DT
									Degree of protection: 0 = IP00, IP20, NEMA 0
									EMC filter N = no filter
									Rated operational current I_e: Examples: 004 = 4 A 012 = 12 A 200 = 200 A
									Device version: SX = Standard soft starter with internal bypass relay
									Control voltage and Control signals: D = 24 V DC 0 = 24 V AC/DC 2 = 120/230 V AC
									Mains supply voltage: 4 = 400 V (200 – 480 V)
									Supply phases: 3 = three-phase incoming unit
									Soft starter series: Drives motor starter, Generation 7

Figure 5: DS7 key to part numbers

1.7 Technical data

1.7.1 Assigned motor outputs

The following motor outputs can be connected if using three-phase asynchronous motors and a load suitable for soft starters.

Table 4: Assigned rated motor outputs for three-phase asynchronous motors

Part no.	Soft starter's rated operational current		Assigned motor output ¹⁾ at				
	I_e (IEC) ²⁾	I_e (UL) ^{3), 4)}	230 V 50 Hz	400 V 50 Hz	200 V 60 Hz	230 V 60 Hz	460 V 60 Hz
	A	A	kW	kW	HP	HP	HP
DS7-34xSX004N0-...	4	4.2	0.75	1.5	¾	1	2
DS7-34xSX007N0-...	7	7.6	1.5	3	2	2	5
DS7-34xSX009N0-...	9	9.6	2.2	4	2	3	5
DS7-34xSX012N0-...	12	14	3	5.5	3	3	10
DS7-34xSX016N0-...	16	17.5	4	7.5	5	5	10
DS7-34xSX024N0-...	24	25.3	5.5	11	7½	7½	15
DS7-34xSX032N0-...	32	34	7.5	15	10	10	25
DS7-34xSX041N0-...	41	42	11	22	10	15	30
DS7-34xSX055N0-...	55	54	15	30	15	20	40
DS7-34xSX070N0-...	70	68	15	37	20	25	50
DS7-34xSX081N0-...	81	80	22	45	25	30	60
DS7-34xSX100N0-...	100	96	30	55	30	30	75
DS7-34xSX135N0-...	135	130	30	75	40	50	100
DS7-34xSX160N0-...	160	156	45	90	50	60	125
DS7-34xSX200N0-...	200	192	55	110	60	75	150

- 1) Motor shaft output for normal four-pole internally and surface cooled three-phase asynchronous motors (1500 rpm at 50 Hz or 1800 rpm at 60 Hz)
- 2) IEC: Mains voltage = Motor voltage (at load) 230 V, 400 V
- 3) Reduced overload current acc. to UL 508C
- 4) Mains voltage 208 V / 240 V / 480 V ↔ motor voltage 200 V / 230 V / 460 V

1.7.2 General data

Table 6: General Technical Data

General	
Product standard	IEC/EN 60 947-4-2
Approvals, certificates	CE, UL, CSA, CCC, Gost
Mounting position	vertical
Degree of protection	IP20 for the front and operator control and operating elements. IP20 on all sides in size 1 IP00 on all sides in size 2, 3, 4
Busbar tag shroud	Finger- and back-of-hand proof
Mechanical shock resistance	8 g/11 ms
Vibration resistance to EN 60721-3-2	2M2
Power section	
Rated operating voltage	200 - 480 V AC ± 10 %
Mains frequency	50/60 Hz ± 5 %
Overload cycle to EN 60947-4-2	AC53a: 3-5: 75-10
Minimum load current	0.5 A
Rated impulse withstand voltage U_{imp} 1.2/50 μ s	4 kV
Rated insulation voltage U_i	500 V
Overtoltage category/pollution degree	II/2
Control section (inclusive SmartWire-DT)	
Supply-/control voltage	depending on variant 24 V AC / 24 V DC (18 - 30 V ± 0 %) 120 - 230 V AC (98 - 264 V ± 0 %)
Mains frequency (with AC versions)	50/60 Hz ± 5 %
Rated impulse withstand voltage U_{imp}	2.5 kV
Rated insulation voltage U_i	300 V
Over voltage category	II
Soft start functions	
Ramp times	
Acceleration	1 - 30 s
Lag	0 (= free run-down), 1 - 30 s
Start voltage (= switch-off voltage)	30 - 100 %
Controlling and signalling	
Control inputs	depending on variant 2 with size 1 4 with size 2 5 with size 3, size 4
Relay	depending on variant 1 with size 1 (non-isolated) 2 with size 2, 3, 4 (potential-free)
LED	2 at DS7 without SWD (DS7-340..., DS7-342...) 3 at DS7 without SWD (DS7-34D...)

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1.14 Function

The mechanical apparatus of a drive unit controlled with a DS7 soft starter are therefore accelerated very smoothly. This has a positive effect on the lifespan, operating behavior and operating processes, and prevents any adverse effects such as

- Impacting of cog edges in the gearbox
- Pressure surge in pipe systems,
- Slipping of V belts or
- Jitter with conveyor systems.

The generalized phase control of the supply voltage is implemented on the DS7 soft starter by means of anti-parallel thyristors which are bridged for continuous operation by so-called bypass contacts (TOR signal) after a time controlled voltage change (t-Start) has elapsed.

The transition resistance of these bypass contacts is considerably lower than the transition resistance of the power semiconductors. This reduces the heat dissipation in the soft starter and extends the lifespan of the power semiconductors.

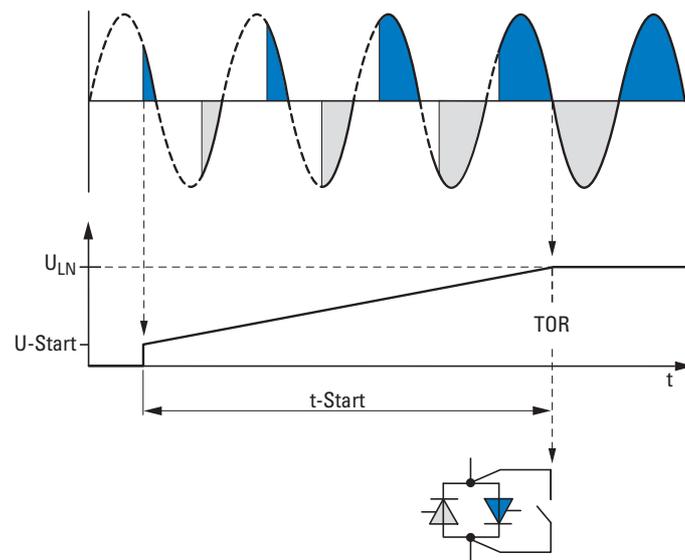


Figure 13: Generalized phase control of the supply voltage

U_{LN} = mains supply voltage

U-Start = start voltage

t-Start = Ramp time of the voltage change at start

TOR (Top of Ramp) = Signals the end of the set "t-Start" ramp time (output voltage U_2 = mains supply voltage U_{LN}).

Afterwards the internal bypass contacts are closed.

As well as the time-controlled startup of a motor, the DS7 soft starter also enables a time-controlled reduction of the motor voltage and thus a controlled stopping of the motor. This type of stop function is primarily used for pumps in order to prevent pressure waves (water impact). Jerky movements and therefore the wear on drive chains and drive belts as well as bearings and gears can be reduced.

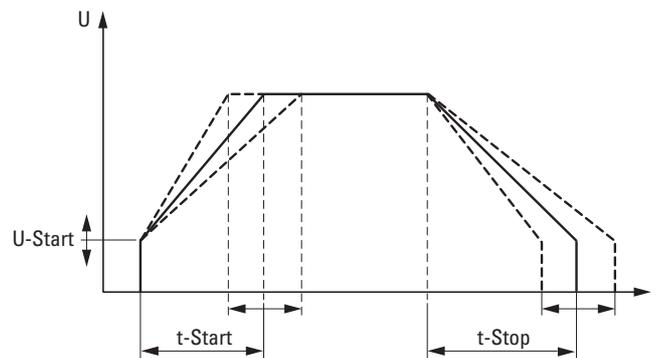


Figure 14: Time-based control of motor voltage with a soft starter



The acceleration time of a drive with a soft starter always depends on the load and the breakaway torques. The required breakaway torque can be set via the start voltage (U-Start). The ramp time (t-Start) for a linear voltage change should be as short as possible. The ramp time for the deceleration (t-Stop) must be greater than the load-dependent uncontrolled deceleration time of the machine.

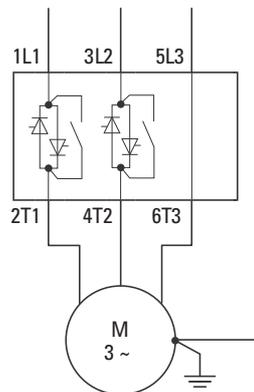
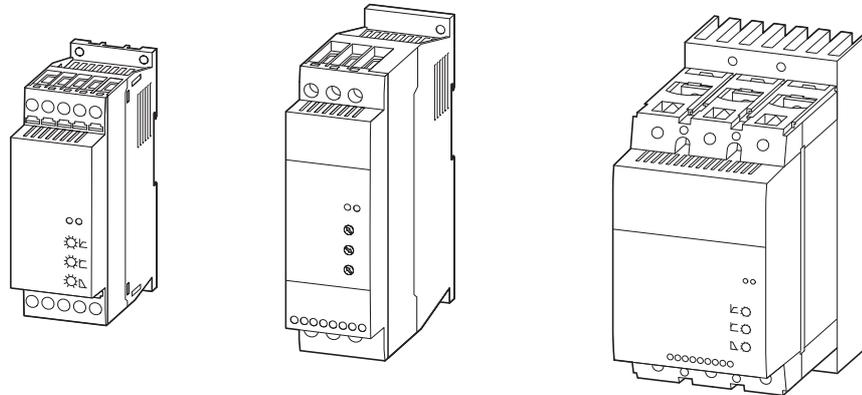
For the power semiconductors in the soft starter, the controlled deceleration presents a similar load as the startup: If, for example, the deceleration ramp is activated on a soft starter with a maximum of 10 permissible starts per hour, the number of permissible starts is reduced to 5 per hour (plus 5 stops within this hour).

The output voltage of the soft starter determines the torque of the motor. At machine startup it must therefore be ensured that the selected starting voltage (U-Start) is not too low. Otherwise this may cause the motor to overheat excessively before it starts up.

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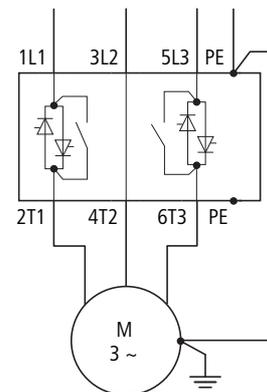
1.14 Function

The soft starters of the DS7 device series are two-phase controlled and are available in two variants in the power section (for size 1 and 2 or size 3 and 4).



Size 1 (4 to 12 A)

Size 2 (16 to 32 A)



Size 3 and 4 (41 to 200 A)

Figure 15: Designs and variants in the power section



In the case of conventional two-phase controlled soft starters, the physical conditions involved in their operation lead to DC components that in turn result in an elliptical rotating field being produced. This causes the motor to start up unevenly and the acceleration time is unnecessarily extended.

The asymmetrical thyristor trigger control that was developed and patented by Eaton (Moeller) for phase control (PCT/EP00/12938, 19.12.2000) prevents DC components and ensures optimum startup behavior. This control is integrated in the DS7 soft starters and is active during the start (t-Start) and stop ramp (t-Stop).