DS6 25–75 hp Model

DS6 100–150 hp Model

39.1 Solid-State Controllers

DS6 Soft Start Controller

Note: Supplement to Publication No. CA08102001E—Tab 39.

DS6 Line of Reduced Voltage Solid-State Soft Start Controllers

Contents

DS6 Soft Start Controller

Product Description

Eaton's DS6 line of reduced voltage solid-state soft start controllers is very compact, multi-functional, easy to install, and easy to commission. Designed to control the acceleration and deceleration of three-phase motors, the device is available for current ranges from 40 to 180 amperes.

Application Description

With its small size, it can easily fit in place of existing soft starters, wye-delta starters, or across-the-line NEMA® and IEC starters. This feature allows easy upgrades to existing systems. The product is designed to be wired in the three-phase line feeding the three motor input leads as is done for normal across-the-line starting. The starter uses silicon controlled rectifiers (SCRs) to ramp the voltage to the motor, providing smooth acceleration and deceleration of the load. After the motor is started, the internal run bypass contactor closes, resulting in the motor running directly across-the-line. Internal run bypass significantly reduces the heat generated as compared to non-bypass starters. The soft stop option allows for a ramp stop time that may be longer than the coast-to-stop time. An external overload protection is needed.

Features and Benefits

- Run bypass mode greatly reduces internal heating created by the power dissipation across the SCRs. The bypass contactor directly connects the motor to the line and improves system efficiency by reducing internal power losses
- Less heat minimizes enclosure size and cooling requirements, and maximizes the life of all devices in the enclosure
- LED displays device status and provides fault indication
- Variable ramp times and voltage control (torque control) settings provide unlimited starting configurations, allowing for maximum application flexibility
- Soft stop control suits applications where an abrupt stop of the load is not acceptable. Soft acceleration and deceleration reduces wear on belts, gears, chains, clutches, shafts, and bearings
- Minimizes the peak inrush current's stress on the power system
- Minimizes peak starting torque to diminish mechanical system wear and damage
- 24 Vdc control module enhances personnel and equipment safety

Protective Features

- Mains connection—The mains connection is monitored for an open condition and/or undervoltage
- Motor connection—The motor connection is monitored for an open condition
- SCR faults—SCR performance is monitored during the ramp cycle for proper operation
- Heat sink over/under temperature—High ambient temperatures, extended ramp times, and high duty cycle conditions may cause the DS6 to exceed its thermal rating. When temperature goes under 0°C, unit will trip as well. The DS6 is equipped with sensors that monitor the temperature of the device. The soft starter will trip in over/under temperature conditions, preventing device failure
- Bypass contactor—The DS6 can detect if the bypass contactor fails to close after the ramp start or opens while the motor is running. The DS6 will trip on a bypass dropout fault if either of these conditions occur. It also fails when bypass relay is closed when the start signal is applied
- 24 Vdc low voltage—If the control voltage falls below 20 Vdc at any time during operation, the unit will fault

Operation

Voltage Ramp Start

This start method provides a voltage ramp to the motor, resulting in a constant torque increase. This most commonly used form of soft start mode allows you to set the initial voltage value and the duration of the ramp to full voltage conditions.

Bypass contactor(s) close after ramp time has elapsed.

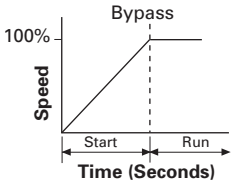
- Adjustable initial voltage 30–92% of full voltage
- Adjustable ramp time 1–30 seconds

Soft Stop

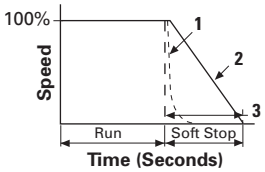
Allows for a controlled stopping of load. Used when a stop-time that is greater than the coast-to-stop time is desired. Often used with high friction loads where a sudden stop may cause system or product damage. Setting the soft stop time to a value of 0 turns off this feature.

- Soft stop time = 0–30 seconds

Start Ramp



Stop Ramp



1 = Coast to Stop (Speed)
2 = Soft Stop Ramp (Voltage)
3 = Soft Stop Time

Instructional Leaflets

Instruction Leaflet IL03901001E

Standards and Certifications

- IEC 60947-4-2
- EN 60947-4-2
- UL® listed
- CSA® certified
- CE marked
- C-Tick

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Product Selection

DS6 25–75 hp Model

DS6 Soft Start Controller—Horsepower Ratings

Rated Current (A)	Motor Power (hp) 200V	230V	460V	Maximum Allowable Breaker Size ①	Maximum Allowable Fuse Size ①	Recommended XTOB Overload	Recommended C396 Overload	Catalog Number	Price U.S. $ ⑤
40	10	10	30	HFD3150L	150 amp Class RK5	XTOB040DC1 ②	C396A2A045SELAX	**DS6-34DSX041N0-N**	885.71
52	15	20	40	HFD3200L	200 amp Class RK5	XTOB057DC1 ②	C396B2A075SELAX	**DS6-34DSX055N0-N**	952.38
65	20	25	50	HJD3250	200 amp Class RK5	XTOB065DC1 ②	C396B2A075SELAX	**DS6-34DSX068N0-N**	1,000.00
77	25	30	60	HKD3300	300 amp Class RK5	XTOB100GC1S	C396B2A110SELAX	**DS6-34DSX081N0-N**	1,185.71
96	30	30	75	HKD3350	350 amp Class RK5	XTOB100GC1S	C396B2A110SELAX	**DS6-34DSX099N0-N**	1,300.00
124	40	50	100	HKD3400	500 amp Class RK5	XTOB125GC1S	C396C2A150SELAX	**DS6-34DSX134N0-N**	1,661.90
156	50	60	125	HLD3450	500 amp Class RK5	XTOB160LC1 ③	C396A2A005SELAX ④	**DS6-34DSX161N0-N**	1,900.00
180	60	75	150	HLD3500	500 amp Class RK5	XTOB220LC1 ③	C396A2A005SELAX ④	**DS6-34DSX196N0-N**	2,095.23

DS6 100–150 hp Model

DS6 Soft Start Controller—kW Ratings According to IEC 60947-4-2

Rated Current (A)	Motor Power (kW) 230V	460V	Maximum Allowable Breaker Size ①	Maximum Allowable Fuse Size ①	Recommended XTOB Overload	Recommended C396 Overload	Catalog Number	Price U.S. $ ⑤
41	11	22	HFD3150L	150 amp Class RK5	XTOB057DC1 ②	C396A2A045SELAX	**DS6-34DSX041N0-N**	885.71
55	15	30	HFD3200L	200 amp Class RK5	XTOB057DC1 ②	C396B2A075SELAX	**DS6-34DSX055N0-N**	952.38
68	15	37	HJD3250	200 amp Class RK5	XTOB070GC1 ②	C396B2A075SELAX	**DS6-34DSX068N0-N**	1,000.00
81	22	45	HKD3300	300 amp Class RK5	XTOB100GC1S	C396B2A110SELAX	**DS6-34DSX081N0-N**	1,185.71
99	30	55	HKD3350	350 amp Class RK5	XTOB100GC1S	C396B2A110SELAX	**DS6-34DSX099N0-N**	1,300.00
134	30	75	HKD3400	500 amp Class RK5	XTOB150GC1S	C396C2A150SELAX	**DS6-34DSX134N0-N**	1,661.90
160	45	90	HLD3450	500 amp Class RK5	XTOB160LC1 ③	C396A2A005SELAX ④	**DS6-34DSX161N0-N**	1,900.00
196	55	110	HLD3500	500 amp Class RK5	XTOB220LC1 ③	C396A2A005SELAX ④	**DS6-34DSX196N0-N**	2,095.23

Notes

① Maximum values may be higher than allowed per NEC® 430.52 and UL 508A 31.1.
② XTOBXDIND Panel Mounting Adaptor must be used with this overload.
③ XTOBXTLL line and load lugs must be used with this overload.
④ C396CTK300 current transformer must be used with this overload.
⑤ Discount Symbol: **1CD1**.

Considerations

1. Either XTOB, C306 or C396 series or equivalent overload protection devices may be selected.
2. Contactor is optional for normal applications. It is recommended for mains isolation.

Power Supply

Eaton's ELC power supplies are recommended as a compact and low-cost source for 24 Vdc power. The light-weight, DIN rail mounted devices have a wide input voltage range, and robust screw terminals make these power supplies easy to install and use. These power supplies are available in 1A and 2A models.

Power Supply Selection

Description	Catalog Number	Price U.S. $
85–264V input and 24V output	**ELC-PS01**	54.50
380–480V input and 24V output	**PSS25F**	200.00

Technical Data and Specifications

DS6 Soft Start Controller

	Unit	DS6-34DSX041N0-N	DS6-34DSX055N0-N	DS6-34DSX068N0-N	DS6-34DSX081N0-N
General					
Standards		IEC/EN 60947-4-2	IEC/EN 60947-4-2	IEC/EN 60947-4-2	IEC/EN 60947-4-2
Certifications		UL/CE/C-Tick/CSA	UL/CE/C-Tick/CSA	UL/CE/C-Tick/CSA	UL/CE/C-Tick/CSA
Ambient temperature (operation)	°C	0 to 40°C, above 40°C de-rate linearly by 1% of rated current per Celsius to 60°C	0 to 40°C, above 40°C de-rate linearly by 1% of rated current per Celsius to 60°C	0 to 40°C, above 40°C de-rate linearly by 1% of rated current per Celsius to 60°C	0 to 40°C, above 40°C de-rate linearly by 1% of rated current per Celsius to 60°C
Ambient temperature (storage)	°C	–25 to +55°C	–25 to +55°C	–25 to +55°C	–25 to +55°C
Altitude		0–1000m, above 1000m de-rate linearly by 1% of rated current per 100m to a maximum of 2000m	0–1000m, above 1000m de-rate linearly by 1% of rated current per 100m to a maximum of 2000m	0–1000m, above 1000m de-rate linearly by 1% of rated current per 100m to a maximum of 2000m	0–1000m, above 1000m de-rate linearly by 1% of rated current per 100m to a maximum of 2000m
Installation		Vertical	Vertical	Vertical	Vertical
Protection degree		IP 20	IP 20	IP 20	IP 20
Protection against contact		Back of hand and finger-proof (from front face)	Back of hand and finger-proof (from front face)	Back of hand and finger-proof (from front face)	Back of hand and finger-proof (from front face)
Overvoltage category/ pollution degree		II/2	II/2	II/2	II/2
Shock resistance		8g/11 ms	8g/11 ms	8g/11 ms	8g/11 ms
Vibration resistance according to EN 60721-3-2		2M2	2M2	2M2	2M2
Dimensions (W x H x D)	mm	93 x 175 x 139	93 x 175 x 139	93 x 175 x 139	93 x 175 x 139
	in	3.66 x 6.89 x 5.47	3.66 x 6.89 x 5.47	3.66 x 6.89 x 5.47	3.66 x 6.89 x 5.47
Weight	kg	1.8	1.8	1.8	1.8
	lb	4.0	4.0	4.0	4.0
Main Circuit					
Rated operation voltage	V	200–460 Vac	200–460 Vac	200–460 Vac	200–460 Vac
Mains frequency	Hz	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz
Rated impulse withstand voltage	U_{imp} 1.2/ 50 µs	4 kV	4 kV	4 kV	4 kV
Rated operation current	I_e	40	52	65	77
Motor Power Ratings					
200V	hp	10	15	20	25
230V	hp	10	20	25	30
460V	hp	30	40	50	60
230V	kW	11	15	15	22
400V	kW	22	30	37	45
Overload cycle according to EN 60947-4-2		40A: AC53a; 3–5; 75–10	52A: AC53a; 3–5; 75–10	65A: AC53a; 3–5; 75–10	77A: AC53a; 3–5; 75–10
Wire Specifications					
Power terminals (box terminals)					
Single conductor	AWG	12–2/0	12–2/0	12–2/0	12–2/0
Terminal torque	lb-in	53–80	53–80	53–80	53–80
Control-signals					
Single conductor	AWG	16 min.	16 min.	16 min.	16 min.
Terminal torque	lb-in	3.5	3.5	3.5	3.5

DS6 Soft Start Controller (continued)

	Unit	DS6-34DSX099N0-N	DS6-34DSX134N0-N	DS6-34DSX161N0-N	DS6-34DSX196N0-N
General					
Standards		IEC/EN 60947-4-2	IEC/EN 60947-4-2	IEC/EN 60947-4-2	IEC/EN 60947-4-2
Certifications/marking		UL/CE/C-Tick/CSA	UL/CE/C-Tick/CSA	UL/CE/C-Tick/CSA	UL/CE/C-Tick/CSA
Ambient temperature (operation)	°C	0 to 40°C, above 40°C de-rate linearly by 1% of rated current per Celsius to 60°C	0 to 40°C, above 40°C de-rate linearly by 1% of rated current per Celsius to 60°C	0 to 40°C, above 40°C de-rate linearly by 1% of rated current per Celsius to 60°C	0 to 40°C, above 40°C de-rate linearly by 1% of rated current per Celsius to 60°C
Ambient temperature (storage)	°C	–25 to +55°C	–25 to +55°C	–25 to +55°C	–25 to +55°C
Altitude		0–1000m, above 1000m de-rate linearly by 1% of rated current per 100m to a maximum of 2000m	0–1000m, above 1000m de-rate linearly by 1% of rated current per 100m to a maximum of 2000m	0–1000m, above 1000m de-rate linearly by 1% of rated current per 100m to a maximum of 2000m	0–1000m, above 1000m de-rate linearly by 1% of rated current per 100m to a maximum of 2000m
Installation		Vertical	Vertical	Vertical	Vertical
Protection degree		IP 20	IP 20	IP 20	IP 20
Protection against contact		Back of hand and finger-proof (from front face)	Back of hand and finger-proof (from front face)	Back of hand and finger-proof (from front face)	Back of hand and finger-proof (from front face)
Overvoltage category/ pollution degree		II/2	II/2	II/2	II/2
Shock resistance		8g/11 ms	8g/11 ms	8g/11 ms	8g/11 ms
Vibration resistance according to EN 60721-3-2		2M2	2M2	2M2	2M2
Dimensions (W x H x D)	mm	93 x 175 x 139	108 x 215 x 178	108 x 215 x 178	108 x 215 x 178
	in	3.66 x 6.89 x 5.47	4.25 x 8.46 x 7.01	4.25 x 8.46 x 7.01	4.25 x 8.46 x 7.01
Weight	kg	1.8	3.7	3.7	3.7
	lb	4.0	8.16	8.16	8.16
Main Circuit					
Rated operation voltage	V	200–460 Vac	200–460 Vac	200–460 Vac	200–460 Vac
Mains frequency	Hz	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz
Rated impulse withstand voltage	U_{imp} 1.2/ 50 µs	4 kV	4 kV	4 kV	4 kV
Rated operation current	I_e	96	124	156	180
Motor Power Ratings					
200V	hp	30	40	50	60
230V	hp	30	50	60	75
460V	hp	75	100	125	150
230V	kW	30	30	45	55
400V	kW	55	75	90	110
Overload cycle according to EN 60947-4-2		96A: AC53a; 3–5; 75–10	124A: AC53a; 3–5; 75–10	156A: AC53a; 3–5; 75–10	180A: AC53a; 3–5; 75–10
Wire Specifications					
Power terminals (box terminals)					
Single conductor	AWG	12–2/0	12 AWG–350 kcmil	12 AWG–350 kcmil	12 AWG–350 kcmil
Terminal torque	lb-in	53–80	44–123	44–123	44–123
Control-signals					
Single conductor	AWG	16 min.	16 min.	16 min.	16 min.
Terminal torque	lb-in	3.5	3.5	3.5	3.5

DS6 Soft Start Controller (continued)

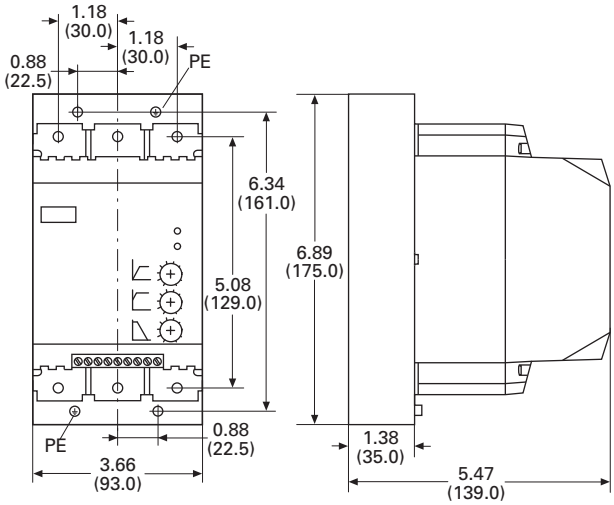
	Unit	DS6-34DSX041N0-N	DS6-34DSX055N0-N	DS6-34DSX068N0-N	DS6-34DSX081N0-N
Powerpart					
Rated impulse withstand voltage	U_{imp} 1.2/ 50 µs	4 kV	4 kV	4 kV	4 kV
Control Commands					
Supply voltage control board U_S					
Nominal voltage	Vdc	+24 Vdc +10%/–15%	+24 Vdc +10%/–15%	+24 Vdc +10%/–15%	+24 Vdc +10%/–15%
Nominal current ramp, TOR	mA	65	65	65	65
Current peak (closing shorting contactors)		600 mA/50 ms	600 mA/50 ms	600 mA/50 ms	600 mA/50 ms
Voltage to the control terminals (rated control voltage)					
DC driven		+24 Vdc +10%/–15%	+24 Vdc +10%/–15%	+24 Vdc +10%/–15%	+24 Vdc +10%/–15%
Input current at 24 Vdc	mA	14	14	14	14
Relay Outputs					
Number of relays		2 (TOR, ready)	2 (TOR, ready)	2 (TOR, ready)	2 (TOR, ready)
Maximum voltage	V	250 Vac, 60 Vdc	250 Vac, 60 Vdc	250 Vac, 60 Vdc	250 Vac, 60 Vdc
Maximum current	A	3 amps, resistive	3 amps, resistive	3 amps, resistive	3 amps, resistive
Soft Start Functions					
Ramp times					
Start ramp	s	1–30	1–30	1–30	1–30
Stop ramp	s	0–30	0–30	0–30	0–30
Initial voltage % line voltage		30–92%	30–92%	30–92%	30–92%

	Unit	DS6-34DSX099N0-N	DS6-34DSX134N0-N	DS6-34DSX161N0-N	DS6-34DSX196N0-N
Powerpart					
Rated impulse withstand voltage	U_{imp} 1.2/ 50 µs	4 kV	4 kV	4 kV	4 kV
Control Commands					
Supply voltage control board U_S					
Nominal voltage	Vdc	+24 Vdc +10%/–15%	+24 Vdc +10%/–15%	+24 Vdc +10%/–15%	+24 Vdc +10%/–15%
Nominal current ramp, TOR	mA	65	65	65	65
Current peak (closing shorting contactors)		600 mA/50 ms	600 mA/50 ms	600 mA/50 ms	600 mA/50 ms
Voltage to the control terminals (rated control voltage)					
DC driven		+24 Vdc +10%/–15%	+24 Vdc +10%/–15%	+24 Vdc +10%/–15%	+24 Vdc +10%/–15%
Input current at 24 Vdc	mA	14	14	14	14
Relay Outputs					
Number of relays		2 (TOR, ready)	2 (TOR, ready)	2 (TOR, ready)	2 (TOR, ready)
Maximum voltage	V	250 Vac, 60 Vdc	250 Vac, 60 Vdc	250 Vac, 60 Vdc	250 Vac, 60 Vdc
Maximum current	A	3 amps, resistive	3 amps, resistive	3 amps, resistive	3 amps, resistive
Soft Start Functions					
Ramp times					
Start ramp	s	1–30	1–30	1–30	1–30
Stop ramp	s	0–30	0–30	0–30	0–30
Initial voltage % line voltage		30–92%	30–92%	30–92%	30–92%

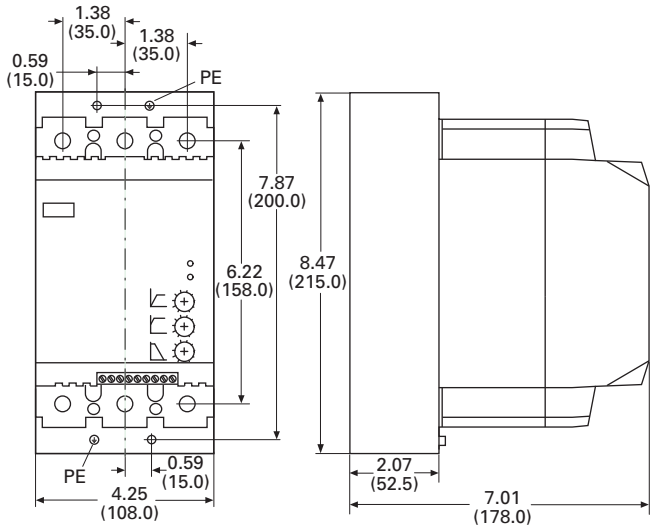
Dimensions

Approximate Dimensions in Inches (mm)

25–75 hp Models



100–150 hp Models



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Eaton's electrical business is a global leader in power distribution, power quality, control, and industrial automation products and services. Eaton's global electrical product lines, including Cutler-Hammer®, Moeller®, Powerware®, Holec®, MEM®, Santak®, and MGE Office Protection Systems™, provide customer-driven PowerChain Management® solutions to serve the power system needs of the data center, industrial, institutional, government, utility, commercial, residential, and OEM markets worldwide.

PowerChain Management solutions help enterprises achieve sustainable and competitive advantages through proactive management of the power system as a strategic, integrated asset throughout its life cycle. With Eaton's distribution, control, and power quality equipment; full-scale engineering services; and information management systems, the power system is positioned to deliver powerful results: greater reliability, operating cost efficiencies, effective use of capital, enhanced safety, and risk mitigation.

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