Allen-Bradley

Starting Torque Controller Specifications

Bulletin 154

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, rok.auto/certifications.	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at http://www.rockwellautomation.com/global/literature-library/overview.page.

Product Overview

The Bulletin 154 Starting Torque Controller (STC™) is designed for low-horsepower single- and three-phase squirrel cage induction motors. It is designed to reduce system shock (electrical and mechanical) that is typically seen when directly starting on line voltage. Reduced system shock provides smoother starts and decreased downtime that is caused by shock- and vibration-related problems.

Because the STC is fully solid state, it does not come equipped with a bypass, and one is not required. the controller is designed to run on full load motor current. The STC turns on when line phases are energized. Control power is required, but it is not the signaling means to turn on the controller.

You can operate the STC with one or two control phases. There is more current reduction on two-phase controlled STC for the same torque ramp up setting of a one control phase STC. This results in longer ramp-up time and a lower starting torque. Starting current can be above 50% for two-phase controlled devices. The current is more balanced than it is with one-phase control.

The STC is rated for 120V single-phase motors up to 25 A. You can use the STC to control permanent split capacitor (PSC) single-phase motors. You can also use the STC for capacitor start and capacitor run (CSCR) single-phase motors.

Typical Applications

The STC is well suited for many applications that require a smooth start without any sudden starts. These applications include:

- Bridge cranes
- Trolleys
- Monorails
- Shrink wrap machines
- Overhead doors
- Material handling
- Compressors
- Fans and pumps
- Lifts
- Elevators
- Grinders
- Paint shakers
- Conveyors
- Aircraft hanger doors
- Car washes
- Isolation requirements

			
Bulletin	**154-SP1C**	**154-TP1C**	**154-TP2C**
Fully solid-state	✓	✓	✓
Switching	Single-pole	Single-pole	Double-pole
Phase voltage	Single	Three	Three
Operational voltage range	100…240V AC (- 15%, +10%)	200…600V AC (-15%, +10%)	200…600V AC (-15%, +10%)
Rated operational current	12/16/25 A, AC53a	12/16/25 A, AC53a	12/16/25 A, AC53a
Max. rated current	25 A, up to 600V AC	25 A, up to 600V AC	25 A, up to 600V AC
Control supply voltage	24V AC/DC, 100…240V AC	24V AC/DC, 100…240V AC	24V AC/DC, 100…240V AC
Integrated varistor (MOV) protection	✓	✓	✓
Snubber across switched phases	✓	✓	✓
Required electrical isolation	No	Yes	No
Adjustable start ramp time	0.5…5 s	0.5…5 s	0.5…5 s
Adjustable starting torque	0…80%	0…80%	0…80%
Status indication via light-emitting diode (LED)			
Supply			
Ramp	✓	✓	✓
Over-temperature alarm	✓	✓	✓
Soft start	✓	✓	✓
Soft Stop	—	—	—
Overload Relay Compatibility			
Solid-state	✓	✓	✓
Bimetal	✓	✓	✓
Auxiliary contacts	—	—	—
Certifications			
RoHS	✓	✓	✓
China RoHS	✓	✓	✓
c-UL-us Listed	✓	✓	✓
CE Marked	✓	✓	✓

Catalog Number Explanation

Examples that are given in this section are not intended to be used for product selection. Not all combinations produce a valid catalog number.

154	–	**SP1C**	**12**	**N**	**A**	**R**
a		b	c	d	e	f

a	
Bulletin Number	
Code	**Description**
154	Starting Torque Controller

b	
Type of Motor and Control	
Code	**Description**
SP1C	1-phase motor, one control phase
TP1C	3-phase motor, one control phase
TP2C	3-phase motor, two control phases

c	
Controller Rating	
Code	**Description**
12	12 A
16	16 A
25	25 A

d	
Enclosure Type	
Code	**Description**
N	Open/none

e	
Rated Voltage	
Code	**Description**
A	230V AC
C	600V AC

f	
Controller Rating	
Code	**Description**
R	24V AC, 24V DC
D	100…240V AC

Product Selection

The tables in this section list selection information for the STC. You will need to provide separate overcurrent protection. Upstream protection may be either a bimetal or solid-state (E1 Plus™) overload or a 140M Motor protection circuit breaker. You can also use downstream protection with a self-protected motor. A contactor is recommended but not required because other motor disconnecting means are available.

Single-phase Controllers with One Control Phase

Current Rating [A]	Rated Power @ 40 °C (104 °F)				Control Voltage	
	115V		230V		24V AC/DC	100…240V AC
	Hp	kW	Hp	kW	Cat. No.	Cat. No.
12	0.5	0.55	5	1.1	154-SP1C12NAR	154-SP1C12NAD
16	0.5	0.75	2	1.5	154-SP1C16NAR	154-SP1C16NAD
25	1	1.5	3	3	154-SP1C25NAR	154-SP1C25NAD

Three-phase Controllers with One Control Phase

Current Rating [A]	Rated Power @ 40 °C (104 °F)								Control Voltage	
	220V		400V		460V		575V		24V AC/DC	100…240V AC
	Hp	kW	Hp	kW	Hp	kW	Hp	kW	Cat. No.	Cat. No.
12	3	3	5	5.5	7.5	6.3	10	6.3	154-TP1C12NCR	154-TP1C12NCD
16	5	4	7.5	7.5	10	7.5	10	7.5	154-TP1C16NCR	154-TP1C16NCD
25	7.5	6.3	10	11	15	13	20	15	154-TP1C25NCR	154-TP1C25NCD

Three-phase Controllers with Two Control Phases

Current Rating [A]	Rated Power @ 40 °C (104 °F)								Control Voltage	
	220V		400V		460V		575V		24V AC/DC	100…240V AC
	Hp	kW	Hp	kW	Hp	kW	Hp	kW	Cat. No.	Cat. No.
12	3	3	5	5.5	7.5	6.3	10	6.3	154-TP2C12NCR	154-TP2C12NCD
16	5	4	7.5	7.5	10	7.5	10	7.5	154-TP2C16NCR	154-TP2C16NCD
25	7.5	6.3	10	11	15	13	20	15	154-TP2C25NCR	154-TP2C25NCD

Accessories

	Description	For Use With	Cat. No.
	Flexible Connection Module • Used for 2-component systems • Used for some 3-component systems	Bul.140M or Bul. 100-C to Bul. 154	140U-D-PF
	Replacement Fan	156-TP2C25	156-CRF40

Specifications

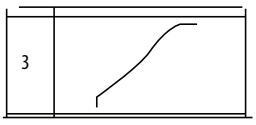
Table 1 - Output Voltage

Attribute	154-SP1C…	154-TP1C…	154-TP2C…
Rated Operational Voltage	100…240V AC_{rms} +10%, -15%	200…600V AC_{rms} +10%, -15%	200…600V AC_{rms} +10%, -15%
Blocking Voltage	1200V_p	1600V_p	1800V_p
Operational Frequency	50/60 Hz ±10%		
Rated Insulation Voltage	600V AC		
Varistor Protection	Across switched phases		

Table 2 - Control Voltage

Attribute	154-SP1C…, 154-TP1C…, 154-TP2C…
Control Voltage Range	
Control Voltage "R"	24V DC, -15% +20%; 24V AC, ±15%
Control Voltage "D"	90…265V AC
Isolation	
Input to Output	2.5kV_{rms}
Output to Case	4kV_{rms}
Input to Case	4kV_{rms}
Other circuits	to respect requirements as imposed by applicable standards (2x rated voltage + 1000V)

Table 3 - General Specifications

Attribute	154-SP1C…, 154-TP1C…, 154-TP2C…		
Starting Method			
Initial Torque Setting (via rotary knob)	10…80%		
Ramp-up time (via rotary knob)	0.5…5 s		
Ramp-down time (via rotary knob)	0 s (no setting required)		
Cooling Type	Natural convection		
Status Indication LEDs	**Green LED**	**Orange LED**	**Red LED[3]**
Power supply ON	On	Off	Off
Ramp-up	On	Flashing	Off
Fully ON	On	On	Off
Alarm wrong phase sequence[1]	Flashing	Off	Off
Alarm overtemperature[2]	On	Off	Flashing

(1) Phase Sequence detection is only available on the 154-TP2C devices. In case of an incorrect motor phase sequence error, the 154-TP2C output will remain OFF. User intervention is required to change the phase sequence.
(2) Available on 154-TP2C 25 A devices.
(3) Red LED is only available on 154-TP2C 25 A devices.

Table 4 - Output Specifications

Attribute	12 A Devices	16 A Devices	25 A Devices
Rated Operational Current @ 40 °C (104 °F)	12 A, AC53a	16 A, AC53a	25 A, AC53a
Utilization Category	AC53a:3.5-10:99-10		
Max. starts per hour	10	10	10
Min. Operational Current	250 mA	400 mA	400 mA
I^2t for fusing	1800 A @ 2 s	6600 A @ 2 s	6600 A @ 2 s

Table 5 - Housing Specifications

Attribute	Value
Material	PA66
Protection Category	IP20
Mounting	DIN Rail/Panel
Vibration Resistance (2…100 Hz, IEC 60068-2-6, IEC 50155, IEC 61373)	2g per axis
Impact Resistance (IEC 50155, IEC 61373)	15/11 g/ms
UL Flammability rating (for plastic)	UL 94 V0

Table 6 - Environmental Specifications

Attribute	Value
Operating Temperature	-40…60 °C (-40…140 °F)
Storage Temperature	-40…100 °C (-40…212°F)
Relative Humidity	<95% noncondensing
Installation Altitude	1000 m - derating of 1% per 100 m up to max. altitude of 2000 m
RoHS (2002/95/EC)	Compliant
Pollution Degree	2 (non-conductive pollution with possibilities of condensation)
Overvoltage/Installation Category	III (fixed installation)

Table 7 - Terminal Specifications

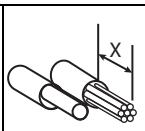
Attribute			Cat. Nos.			
			Cat. No. 154-SP1C12, -TP1C12, -TP2C12		154-SP1C16, -SP1C25, TP1C16, TP1C25, -TP2C16, -TP2C25	154-SP1C, -TP1C, -TP2C
Type of terminals						
Terminal Nos.			1/L1, 3/L2, 5/L3, 2/T1, 4/T2, 6/T3		1/L1, 3/L2, 5/L3, 2/T1, 4/T2, 6/T3	A1, A2, A3, A4
Conductor			Use 75 °C copper (Cu) conductors			
Stripping Length (X)			12 mm			8
Connection type			M4 screw with captivated washer		M5 screw with box clamp	M3 screw with box clamp
Rigid Conductors (Solid and Stranded) UL/c-UL rated data		[mm^2]	(2) 2.5…6	2.5…6	2.5…25	1…2.5
		[AWG]	(2) 14…10	14…10	14…3	18…12
Flexible with end sleeve		[mm^2]	(2) 1.0…2.5 (2) 2.5…4	1.0…4	2.5…16	0.5…2.5
		[AWG]	(2) 18…14 (2) 14…12	18…12	14…6	20…12
Flexible without end sleeve		[mm^2]	(2) 1.0…2.5 (2) 2.5…6	1.0…6	4…25	—
		[AWG]	(2) 18…14 (2) 14…10	18…10	12…3	—
Torque specifications			Pozidriv 2 UL: 2 N•m (17.7 lb•in) IEC: 1.5…2.0 N•m (13.3…17.7 lb•in)		Pozidriv 2 UL: 2.5 N•m (22 lb•in) IEC: 2.5…3.0 N•m (22…26.6 lb•in)	Pozidriv 1 UL: 0.5 N•m (4.4 lb•in) IEC: 0.4…0.5 N•m (3.5…4.4 lb•in)
Aperture for termination lug		[mm (in.)]	12.3 (0.48)		—	—
Protective Earth (PE) Connection			M5, 1.5 N•m (13.3 in•lb) Note: M5 PE screw not provided with SSR. PE connection is required when product is intended to be used in Class 1 applications according to EN/IEC 61140.			—

Figure 1 - Terminal Layout

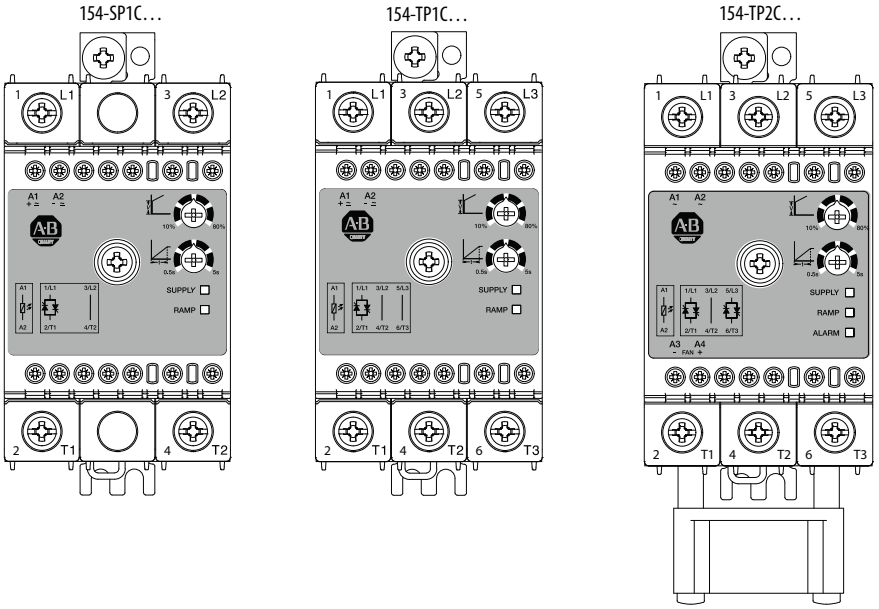


Figure 2 - Adjustment Dial

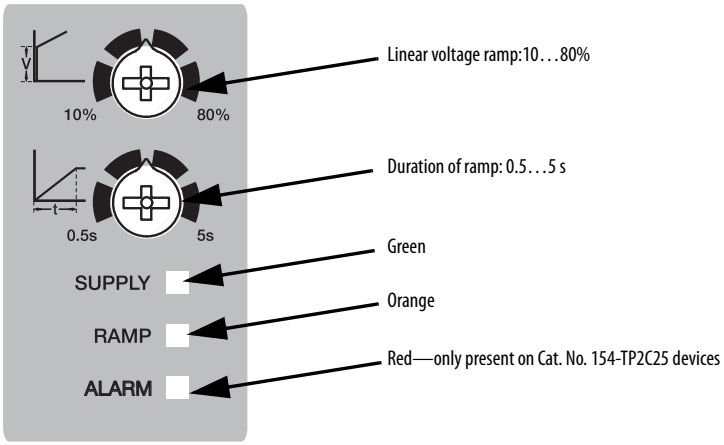


Table 8 - Electromagnetic Compatibility Ratings

Attribute	Value	Notes:
Immunity		
Electrostatic Discharge	IEC/EN 61000-4-2 4kV contact (PC2) 8kV Air Discharge (PC2)	
Radiated RF	IEC/EN 61000-4-3	
PC1 @ 10V/m	80…1000 MHz	
PC1 @ 10V/m	1.4…2.0 GHz	
PC1 @ 1V/m	2.0…2.7 GHz	
Fast Transients (Burst)	IEC/EN 61000-4-4	
Output		
PC1	2kV	
PC2	2kV/5 kHz	
Signal/Input		• Performance Criteria 1 (PC1): No degradation of performance or loss of function is allowed when the product is operated as intended. • Performance Criteria 2 (PC2): During the test, degradation of performance or partial loss of function is allowed. However when the test is complete the product should return operating as intended by itself. • Performance Criteria 3 (PC3): Temporary loss of function is allowed, provided the function can be restored by manual operation of the controls.
PC1	1kV	
PC2	1kV,5 kHz	
Voltage Surges	IEC/EN 61000-4-5	
Output, line to line	1kV, PC2	
Output, line to earth	2kV, PC2	
Input, line to line	1kV, PC2	
Input, line to earth	2kV, PC2	
Conducted RF	IEC/EN 61000-4-6 0.15…80 MHz (PC1 @ 10Vrms)	
Voltage Dips	0% for 10 ms (PC2) 0% for 20 ms (PC2) 40% for 200 ms (PC2) 70% for 500 ms (PC2)	
Voltage Interruptions	0% for 5000 ms (PC2)	
Emissions		
Wire conducted RF	IEC/EN 55011 0.15…30 MHz Class A (with external filtering)	
Radiated RF	IEC/EN 55011 30…1000 MHz Class A (with external filtering)	

Short-circuit Protection

This section provides information about the short-circuit ratings of the Starting Torque Contoller.

Protection Co-ordination, Type 1 versus Type 2:

Type 1 protection implies that after a short circuit, the device under test is no longer in a functioning state. In Type 2 co-ordination the device under test is still functional after the short circuit. In both cases, however the short circuit has to be interrupted. The fuse between enclosure and supply shall not open. The door or cover of the enclosure shall not be blown open. There shall be no damage to conductors or terminals and the conductors shall not separate from terminals. There shall be no breakage or cracking of insulating bases to the extent that the integrity of the mounting of live parts is impaired. Discharge of parts or any risk of fire shall not occur.

The product variants listed in the table hereunder are suitable for use on a circuit capable of delivering not more than 100,000 A rms Symmetrical Amperes, 600V maximum when protected by fuses. Tests at 100,000 A were performed with Class J, fast acting; see Table 9 and Table 10 for maximum allowed ampere rating of the fuse. Tests with Class J fuses are representative of Class CC fuses.

Table 9 - Type 1 Coordination (UL 508)

Cat. No.	Prospective Short-circuit Current [kA_{rms}]	Max. Fuse Size [A]	Class	Max. Voltage [V AC]
154-SP1C12NA	100	30	J or CC	600
154-SP1C16NA	100	30	J or CC	600
154-SP1C25NA	100	30	J or CC	600
154-TP1C12NA	100	30	J or CC	600
154-TP1C16NA	100	30	J or CC	600
154-TP1C25NA	100	30	J or CC	600
154-TP2C12NA	100	30	J or CC	600
154-TP2C16NA	100	40	J	600
154-TP2C25NA	100	40	J	600

Table 10 - Type 2 Coordination (EN/IEC 60947-4-2)

Cat. No.	Ferraz-Shawmut (Mersen)		Siba		Short-circuit Current [kA_{rms}]	Rated Voltage [V AC]
	Max. Fuse Size [A]	Fuse Part No.	Max. Fuse Size [A]	Fuse Part No.		
154-SP1C12NA	40	A70QS40-4	50	50 142 06 50	100	600
154-SP1C16NA	60	A70QS60-4	80	50 194 20 80	100	600
154-SP1C25NA	90	A70QS90-4	100	50 194 20 100	100	600
154-TP1C12NA	40	A70QS40-4	50	50 142 06 50	100	600
154-TP1C16NA	60	A70QS60-4	80	50 194 20 80	100	600
154-TP1C25NA	90	A70QS90-4	100	50 194 20 100	100	600
154-TP2C12NA	40	A70QS40-4	50	50 142 06 50	100	600
154-TP2C16NA	60	A70QS60-4	80	50 194 20 80	100	600
154-TP2C25NA	90	A70QS90-4	100	50 194 20 100	100	600

Load vs. Ambient Temperature Derating Curves

Figure 3 through Figure 5 show the current derating information.

Figure 3 - Current Derating—Cat. No. 154-SP1…Devices

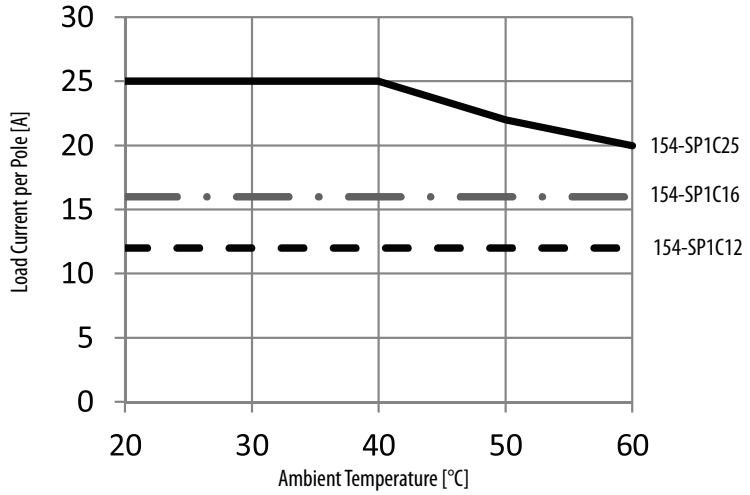


Figure 4 - Current Derating—Cat. No. 154-TP1…Devices

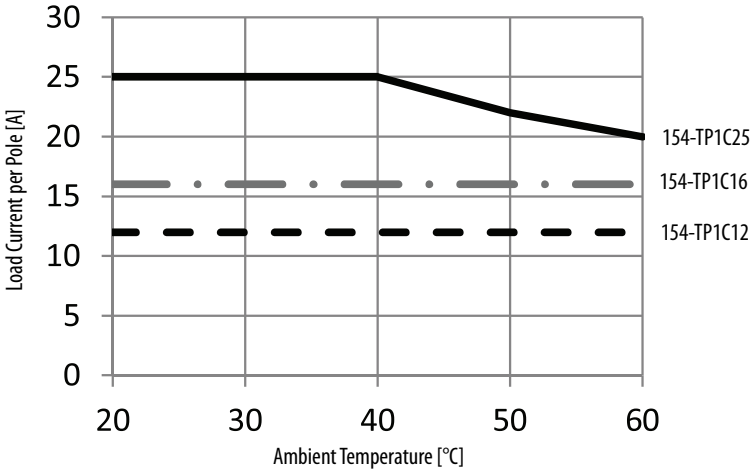
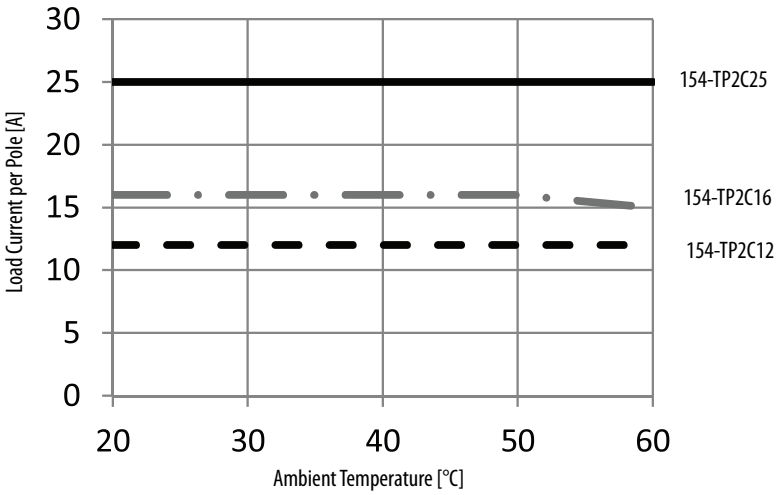


Figure 5 - Current Derating—Cat. No. 154-TP2…Devices



Output Power Dissipation Curves

Figure 6 through Figure 8 show the power dissipation information.

Figure 6 - Output Power Dissipation—Cat. No. 154-SP1C…Devices

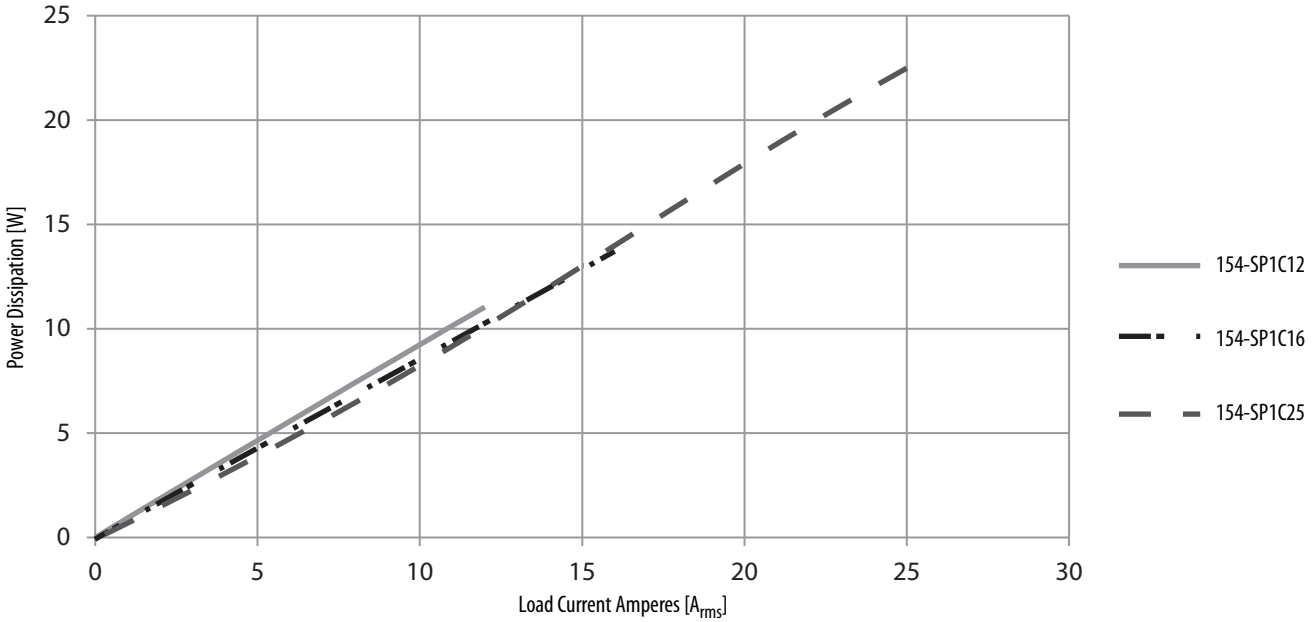


Figure 7 - Output Power Dissipation—Cat. No. 154-TP1C…Devices

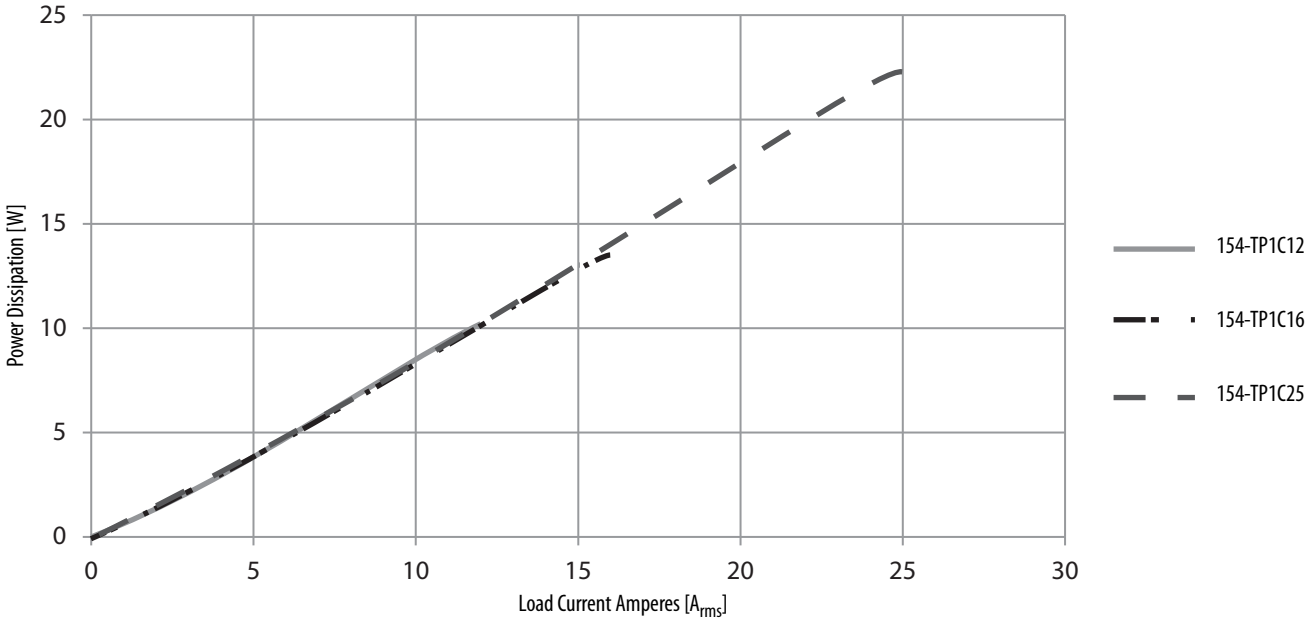
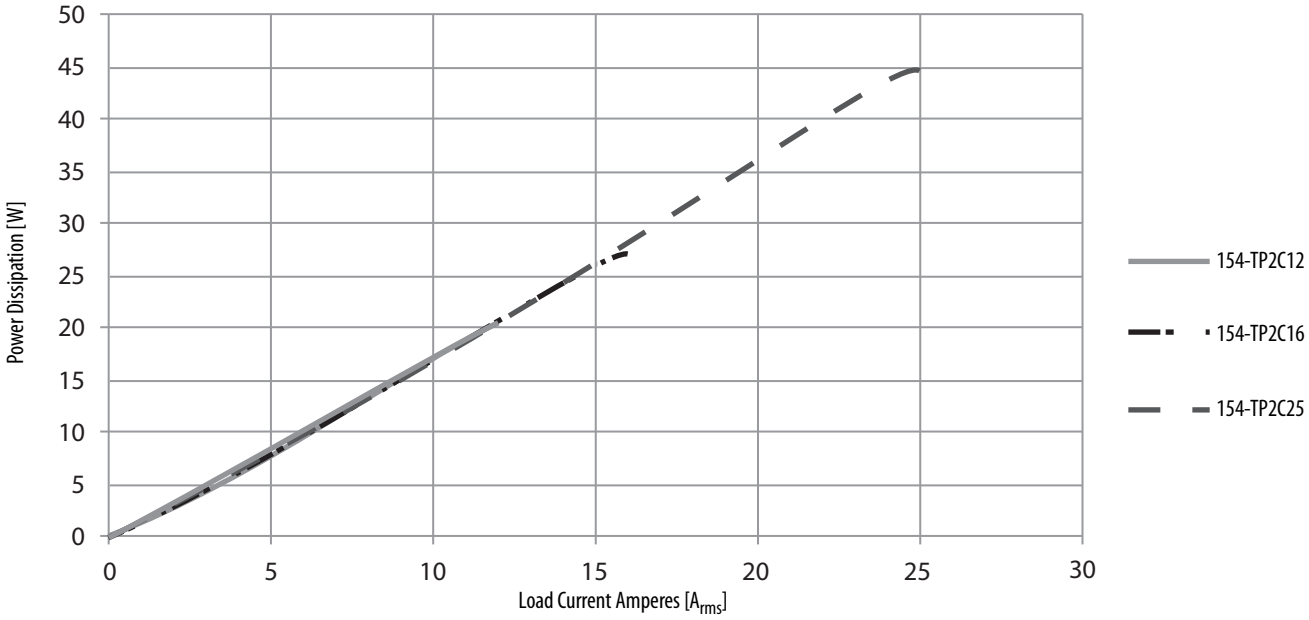


Figure 8 - Output Power Dissipation—Cat. No. 154-TP2C…Devices



Wiring Diagrams

The diagrams in this section depict wiring information for the Starting Torque Controller.

Figure 9 - Connection Diagram

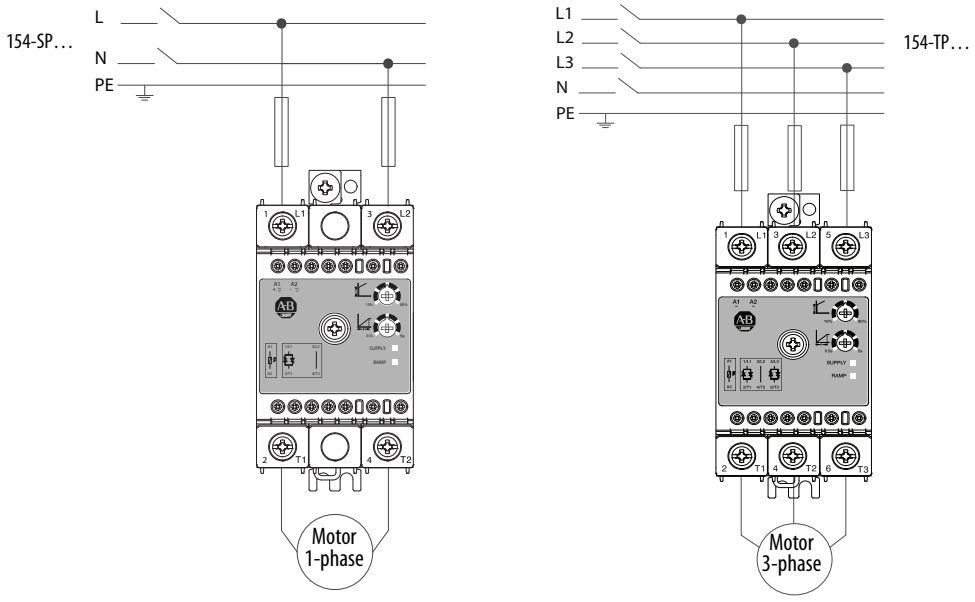


Figure 10 - Filter Connection Diagrams

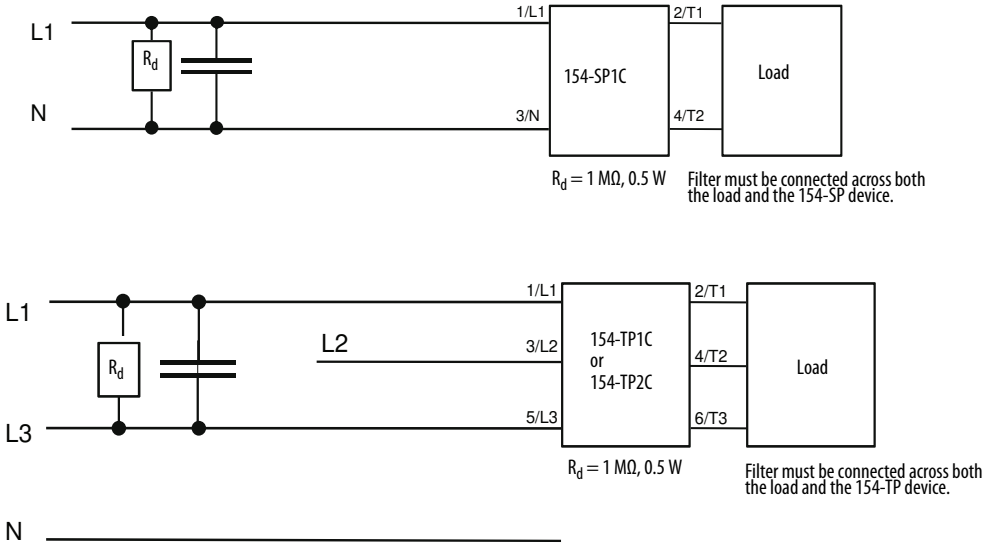
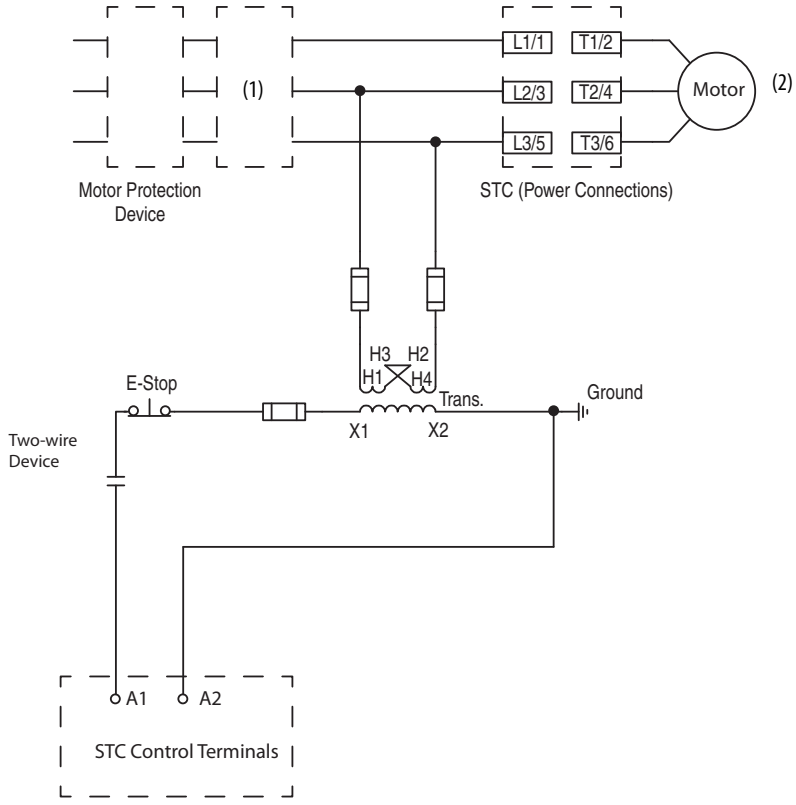
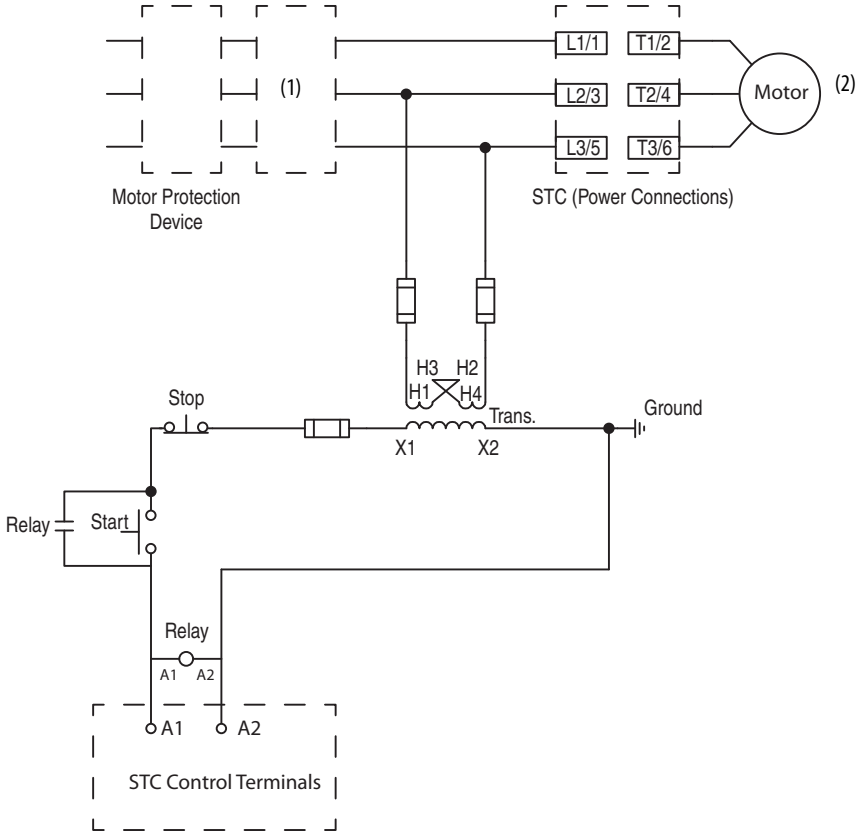


Figure 11 - Two-wire Configuration



(1) Cat. No. 154-TP1C requires electrical isolation.
(2) Customer supplied.

Figure 12 - Three-wire Configuration



(1) Cat. No. 154-TP1C requires electrical isolation.
(2) Customer supplied.

Table 11 - Filtering—EN/IEC Class A Compliance

Cat. No.	Suggested Filter for Compliance[1]	Max. Motor Current [A]
154-SP1C…	No filter required	up to 5 A
	10 nF/275V/X1	>5A…10 A
	100 nF/275V/X1	>10 A…25 A
154-TP1C… 154-TP2C…	No filter required	up to 5 A
	10 nF/760V/X1	>5A…10 A
	100 nF/760V/X1	>10 A…25 A

(1) The filter recommendations are for compliance to EN-5501 Class A.

You must take note of the following considerations when applying filters.

- Control input lines must be installed together to maintain products' susceptibility to Radio Frequency Interference.
- Use of AC solid-state devices may, according to the application and the load current, cause conducted radio interferences. Use of filters on mains may be necessary for cases where the user must meet E.M.C requirements. The capacitor values given inside the filtering specification tables should be taken only as indications, the attenuation will depend on the final application.
- This product has been designed for Class A equipment. Use of this product in domestic environments may cause radio interference, in which case you may be required to employ additional mitigation methods.
- Surge tests were carried out with the signal line impedance network. In case the line impedance is less than 40 Ω, it is suggested that AC supply is provided through a secondary circuit where the short circuit limit between conductors or between conductors and ground is 1500VA or less.

Approximate Dimensions

Dimensions are shown in millimeters (inches). Dimensions are not to be used for manufacturing purposes.

Figure 13 - Recommended Spacing

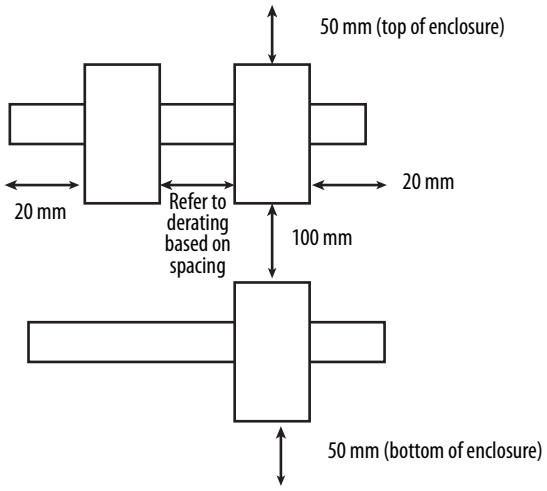


Table 12 - Derating Spacing Table

Ambient Temperature [°C (°F)]	Spacing [mm (in.)]	Load Current per Pole [AAC]								
		154-SP1			154-TP1			154-TP2		
		12 A	16 A	25 A	12 A	16 A	25 A	12 A	16 A	25 A
40 (104)	0 (0)	No Derating Required		20	No Derating Required		20	No Derating Required		
	20 (0.79)			22			22			
	50 (1.97)			23			23			
50 (122)	0 (0)	No Derating Required		17	No Derating Required		17	11	15	22
	20 (0.79)			19			19	No Derating Required		
	50 (1.97)			20			20			
60 (140)	0 (0)	12	15	15	11	15	15	10	14	20
	20 (0.79)	No Derating Required		17	No Derating Required		17	No Derating Required		
	50 (1.97)			18			18			

Figure 14 - Cat. No. 154-SP1C12

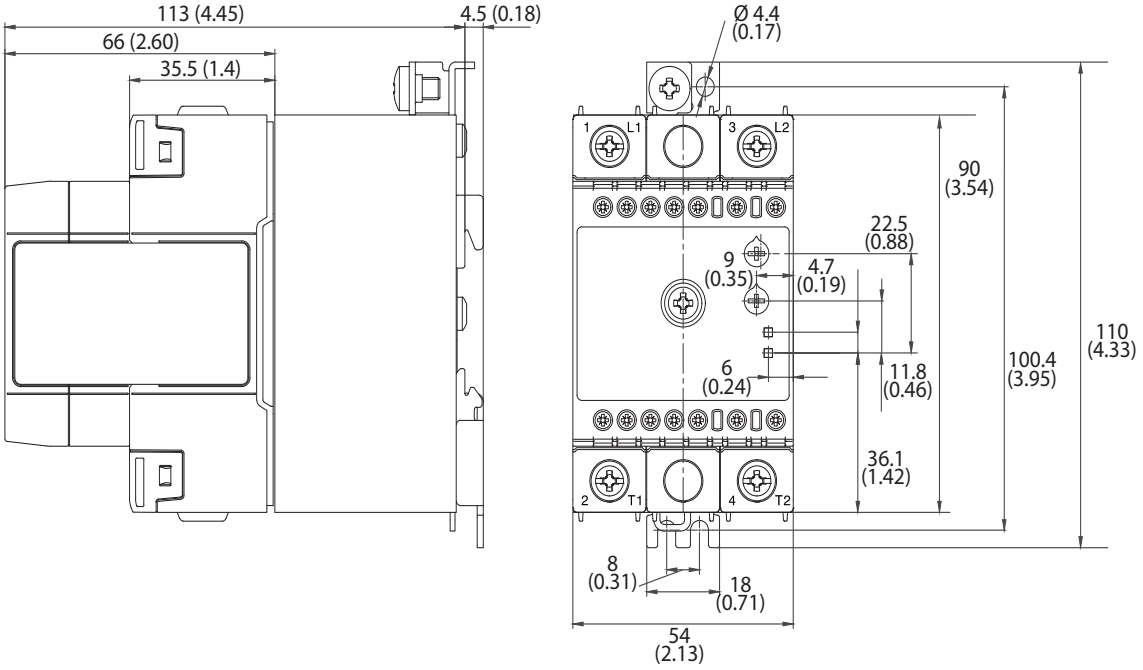


Figure 15 - Cat. No. 154-SP1C16, -SP1C25

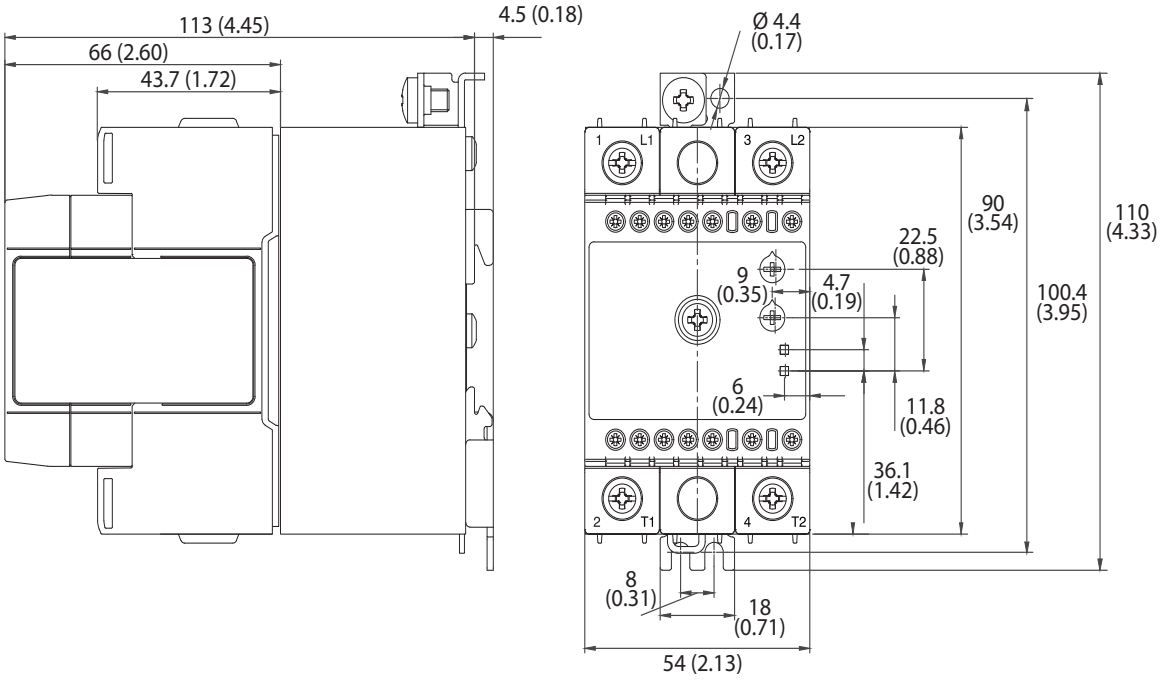


Figure 16 - Cat. No. 154-TP1C12, -TP2C12

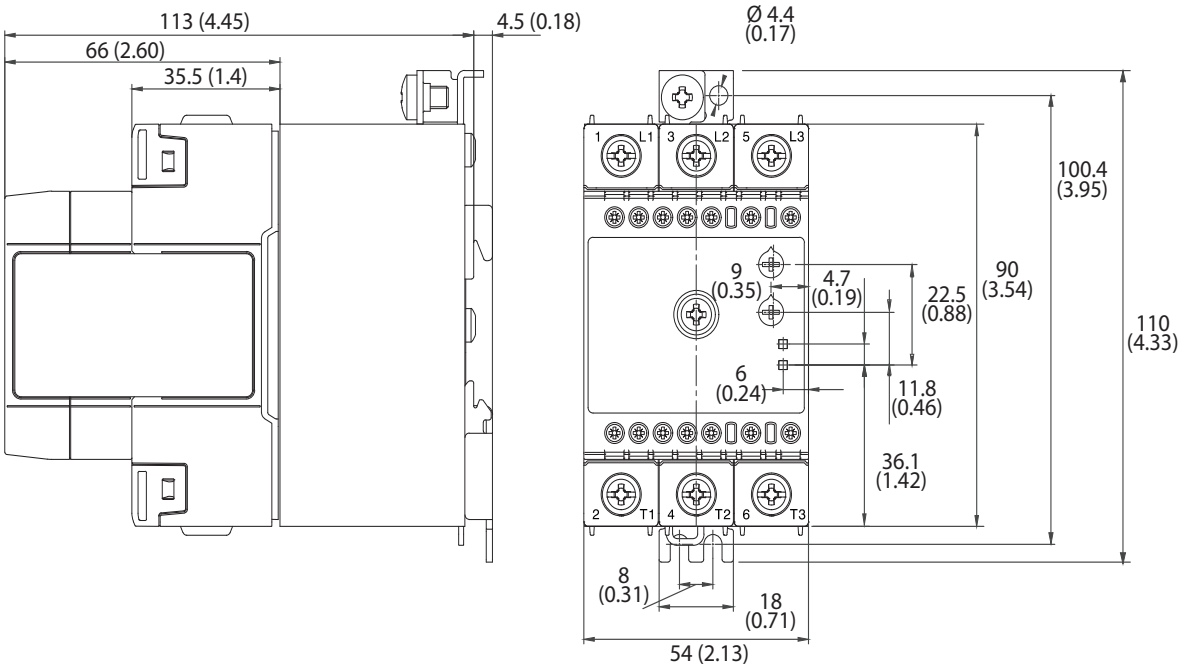


Figure 17 - Cat. No. 154-TP1C16, -TP1C25, -TP2C16

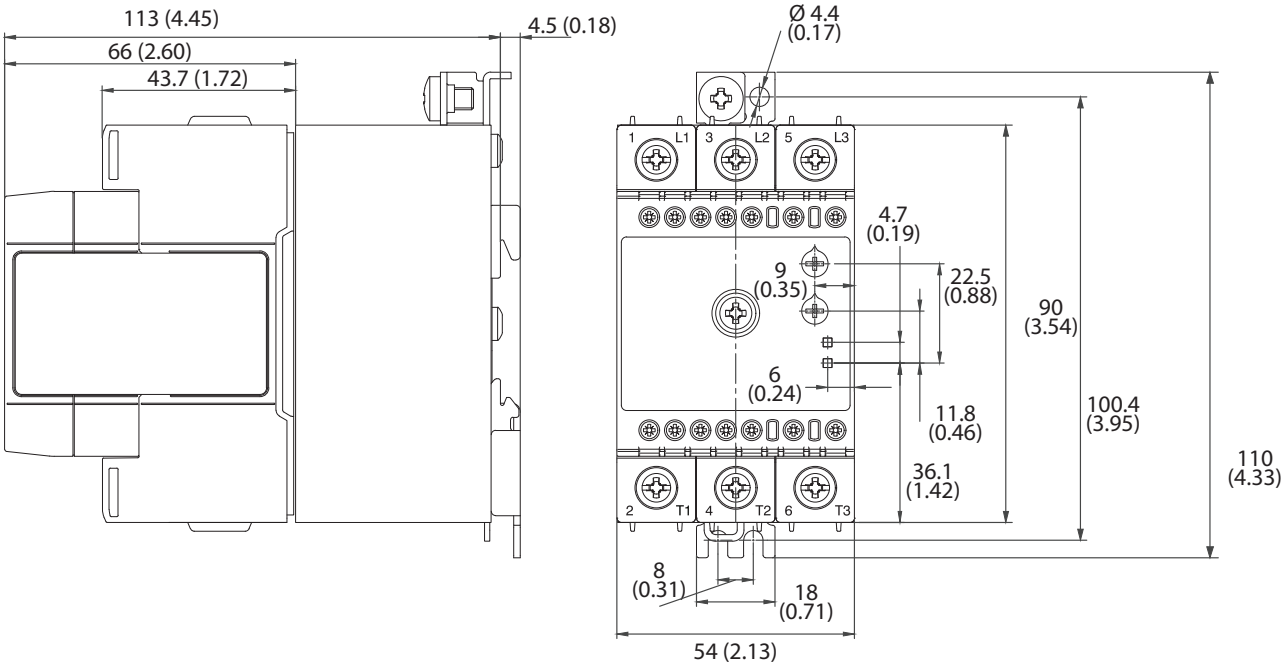
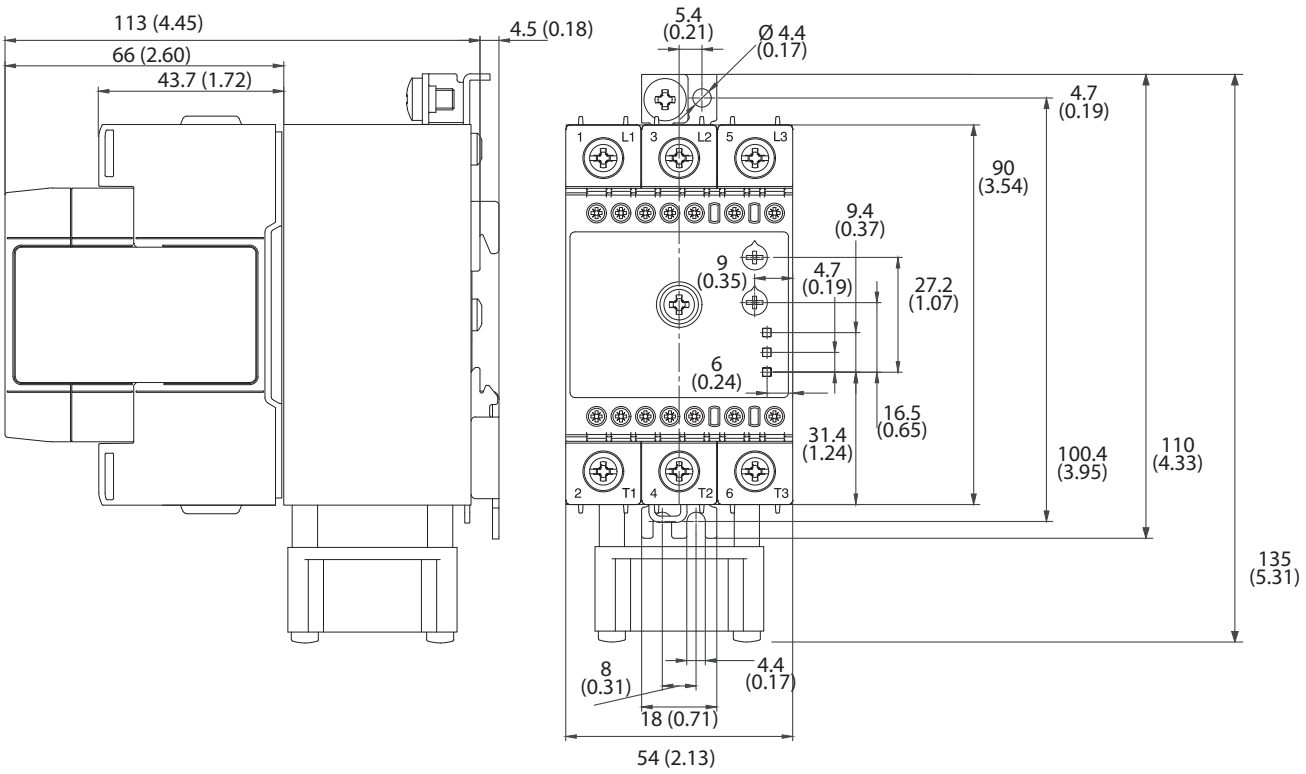


Figure 18 - Cat. No. 154-TP2C25



Notes:

Rockwell Automation Support

Use the following resources to access support information.

Technical Support Center	Knowledgebase Articles, How-to Videos, FAQs, Chat, User Forums, and Product Notification Updates.	www.rockwellautomation.com/knowledgebase
Local Technical Support Phone Numbers	Locate the phone number for your country.	www.rockwellautomation.com/global/support/get-support-now.page
Direct Dial Codes	Find the Direct Dial Code for your product. Use the code to route your call directly to a technical support engineer.	www.rockwellautomation.com/global/support/direct-dial.page
Literature Library	Installation Instructions, Manuals, Brochures, and Technical Data.	www.rockwellautomation.com/literature
Product Compatibility and Download Center (PCDC)	Get help determining how products interact, check features and capabilities, and find associated firmware.	www.rockwellautomation.com/global/support/pcdc.page

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Rockwell Automation maintains current product environmental information on its website at http://www.rockwellautomation.com/rockwellautomation/about-us/sustainability-ethics/product-environmental-compliance.page.

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