



Solid-state Contactor Specifications

Bulletin Number 156

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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, http://www.rockwellautomation.com/global/certification/overview.page	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>. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

LISTEN.
THINK.
SOLVE.



Catalog Number Explanation

156	–	C1P	20	N	A	D	A
a		b	c	d	e	f	g

a	
Bulletin Number	
Code	Description
156	Solid-state Contactor

b	
No. of Poles	
Code	Description
C1P	Control 1 pole in 1-pole body
C2P	Control 2 poles in 3-pole body
C3P	Control 3 poles in 3-pole body

c	
Contactor Rating, AC-51 @ 40 °C (104°F)	
Code	Description
20	20 A
25	25 A
30	30 A
40	40 A
43	43 A
65	65 A
75	75 A
85	85 A

d	
Enclosure Type	
Code	Description
N	Open/None

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

f	
Control Voltage	
Code	Description
D	5...32V DC
B	20...275V AC; 24...190V DC

g	
Options	
Code	Description
D	24V DC fan control
A	90...250V AC fan control

Specifications—Single-phase Devices

Table 1 - Output Voltage

Attribute	Description	
	230V AC	600V AC
Operational Voltage Range	24...240V AC, +10%, -15% on max.	42...660V AC, +10%, -15% on max.
Blocking Voltage	800Vp	1200Vp
Internal Varistor	275V	625V

Table 2 - General Specifications

Attribute	Description
Short Circuit Current Rating	100 kA (UL508)
Latching voltage (across L1-T1)	20V
Operational frequency range	45...65 Hz
Power factor	> 0.5 @ V _{rated}
Touch Protection	IP20
Control input status	continuously ON Green LED, when control input is applied
Pollution degree	2 (non-conductive pollution with possibilities of condensation)
Overvoltage category	III (fixed installations)
Isolation	
Input to Output	4000V _{rms}
Input and Output to case	4000V _{rms}
Input to Fan/ Alarm Output/Input to Output	2500V _{rms} (Cat. No. 156-C1P85NCB)

Table 3 - Standards Compliance and Certifications

Standards Compliance	Certifications
EN 62314	UL508 Listed (E172877)
EN 60947-4-2	cUL Listed (E172877)
EN 60947-4-3	VDE 0660-109
	GL (156-C1P20, 156-C1P25, 156-C1P43)

Table 4 - Environmental Specifications

Attribute	Description
Operating Temperature ⁽¹⁾	-40...80 °C (-40...176 °F)—derate above 40 °C (104 °F)
Storage Temperature	-40...100 °C (-40...212 °F)
RoHS Compliance (2002/95/EC)	Yes
Vibration resistance	2G per axis (2...100 Hz) (per IEC60068-2-6, EN50155, EN61373)
Impact resistance	15/11 g/ms (per EN50155, EN61373)
Relative humidity	95% noncondensing @ 40 °C
UL flammability rating (housing)	UL 94 V0
GWIT & GWFI	conforms to EN 60335-1 requirements
Installation altitude	0...1000 m. Above 1000 m, derate linearly by 1% of FLC per 100 m up to maximum of 2000 m

(1) Operating temperature range for overtemperature protection is -30...70 °C (-22...158 °F)

Table 5 - Weights

Cat. No.	Approximate Weight [g (lbs)]
156-C1P20	260 (0.57)
156-C1P25	260 (0.57)
156-C1P43	515 (1.14)
156-C1P65	972 (2.14)
156-C1P85	1100 (2.43)

Table 6 - Output Specifications @ 25°C (unless otherwise specified)

Attribute	Description				
	156-C1P20	156-C1P25	156-C1P43	156-C1P65	156-C1P85
Rated operational current ⁽¹⁾					
AC-51 rating @ T _a = 25 °C	[A] 20	30	50	75	85
AC-51 rating @ T _a = 40 °C	[A] 20	25	43	65	85
AC-53a rating @ T _a = 40 °C	[A] 5	5	16	20	20
Number of motor starts (x:6, T _x :6 s, F:50%) at 40 °C ⁽²⁾	30	30	30	30	30
Min. operational current	[mA] 150	250	500	500	500
Rep. overload current - (Motor Rating) PF = 0.4... 0.5 UL508: T _{AMB} = 40 °C, t _{ON} = 1 s, t _{OFF} = 9 s, 50 cycles	[A] 51	51	126	168	168
Maximum transient surge current (I _{TSM}), t = 10 ms	[A _p] 325	600	1900	1900	1900
Maximum off-state leakage current at rated voltage	[mA] 3	3	3	3	3
I ² t for fusing (t = 10 ms) Minimum	[A ² s] 525	1800	18,000	18,000	18,000
Critical dv/dt @ T _{j init} = 40 °C	[V/μs] 1000	1000	1000	1000	1000

(1) See derating curves

(2) Overload current profile definition: x: multiple of AC53a rating, T_x: duration of current surge, F: duty cycle**Table 7 - Overtemperature Alarm Specifications**

Attribute	Description	
	156-C1P85NCD	156-C1P85NCB
Output type	PNP open collector	Potential Free
Normal state	Closed	Closed
Maximum current rating	[mA DC] 50	50
Rated voltage (EN61131-2: 2003) ^{(1) (2)} , U _a	[V DC] 24 -15%, +20%	24 -15%, +20%
Rated voltage, U _s	[V DC] 24 ± 10%	—
Fan rating, U _f	[V DC] —	24 ± 10%, 50 mA nominal
Alarm voltage drop		
Typical	[V DC] 2.8	1.8
Maximum	[V DC] 4	3.5
Visual Indication	Continuous Red LED	Continuous Red LED
Reverse polarity protection	[V DC] 24	24

(1) DC supply for alarm signal should be supplied from a Class 2 power source

(2) Maximum voltage to be applied between 11+ and 12- (U_a) terminals should be 35VDC maximum with reference to A2-

Table 8 - Input Specifications (A1, A2)

Attribute			Description	
			156-C1P...D	156-C1P...B
Control voltage range ^{(1) (2)}	156-C1P...NA	[V AC]	—	20...275
		[V DC]	3...32	24 (-10%)...190
	156-C1P...NC	[V AC]	—	20...275
		[V DC]	4...32	24 (-10%)...190
	156-C1P85NC	[V AC]	—	20...275
		[V DC]	5...32	24 (-10%)...190
Pick-up voltage	156-C1P...NA	[V DC]	3.0	20V AC/DC
	156-C1P...NC	[V DC]	3.8	—
	156-C1P85NC	[V DC]	5	20V AC/24V DC
Drop-out voltage		[V DC]	1	5V AC/DC
Maximum Reverse voltage		[V DC]	32	—
Response time pick-up			0.5 cycle + 500 μ s @ 24V DC	2 cycles @ 230V AC/110V DC
Response time drop-out			0.5 cycle + 500 μ s @ 24V DC	0.5 cycle + 40 ms @ 230V AC/110V DC
Input current @ 40 °C		[V DC]	See Figure 1	See Figure 2

(1) DC control to be supplied by class 2 power source according to UL1310

(2) For GL approved models control range for 156-C1P23... is 4...32V DC and for 156-C1P60... 5...32V DC

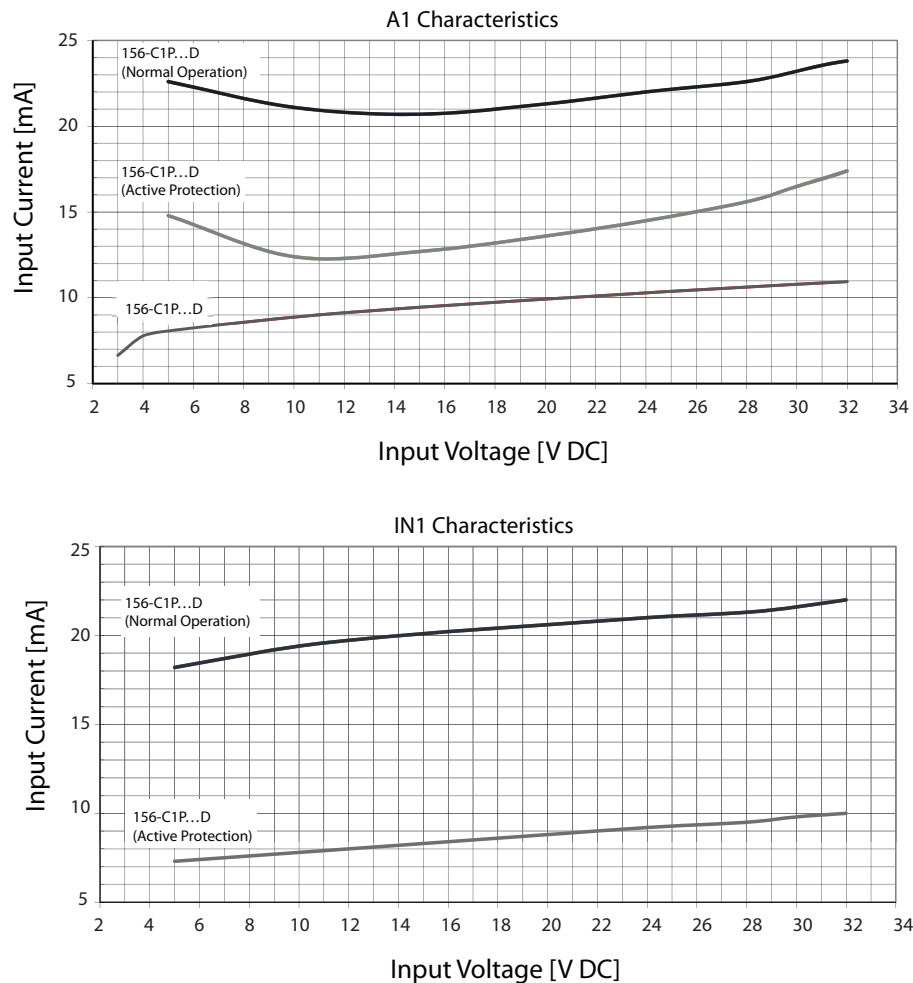
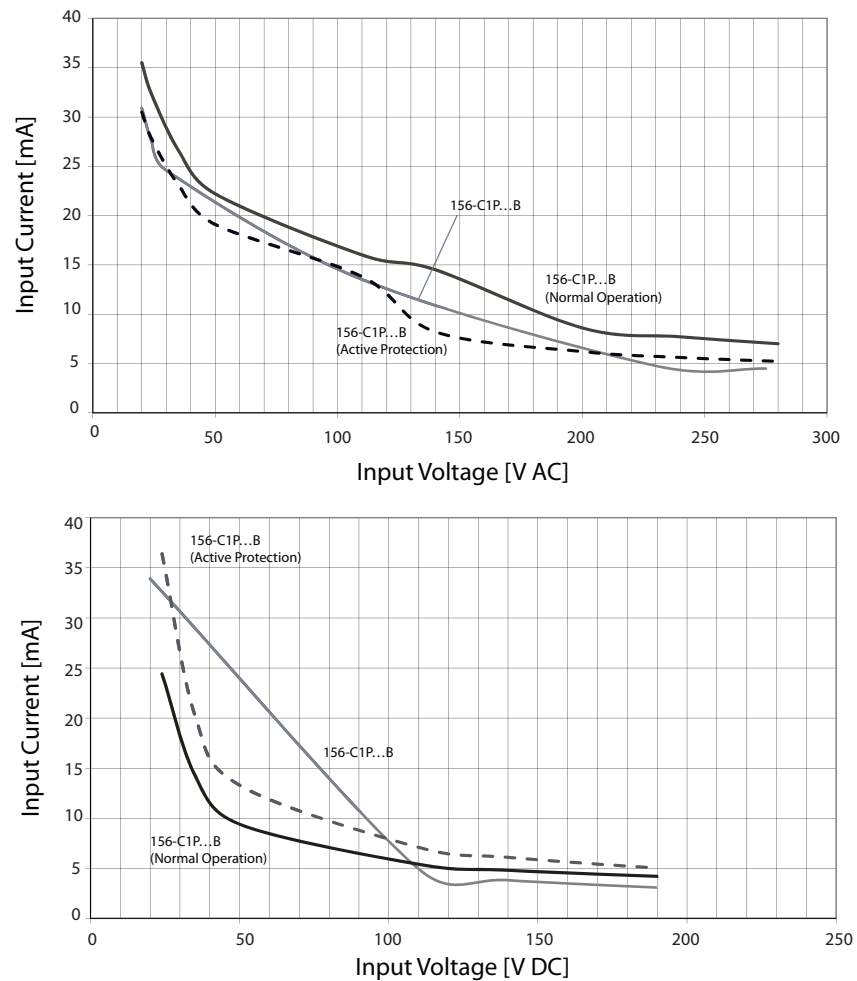
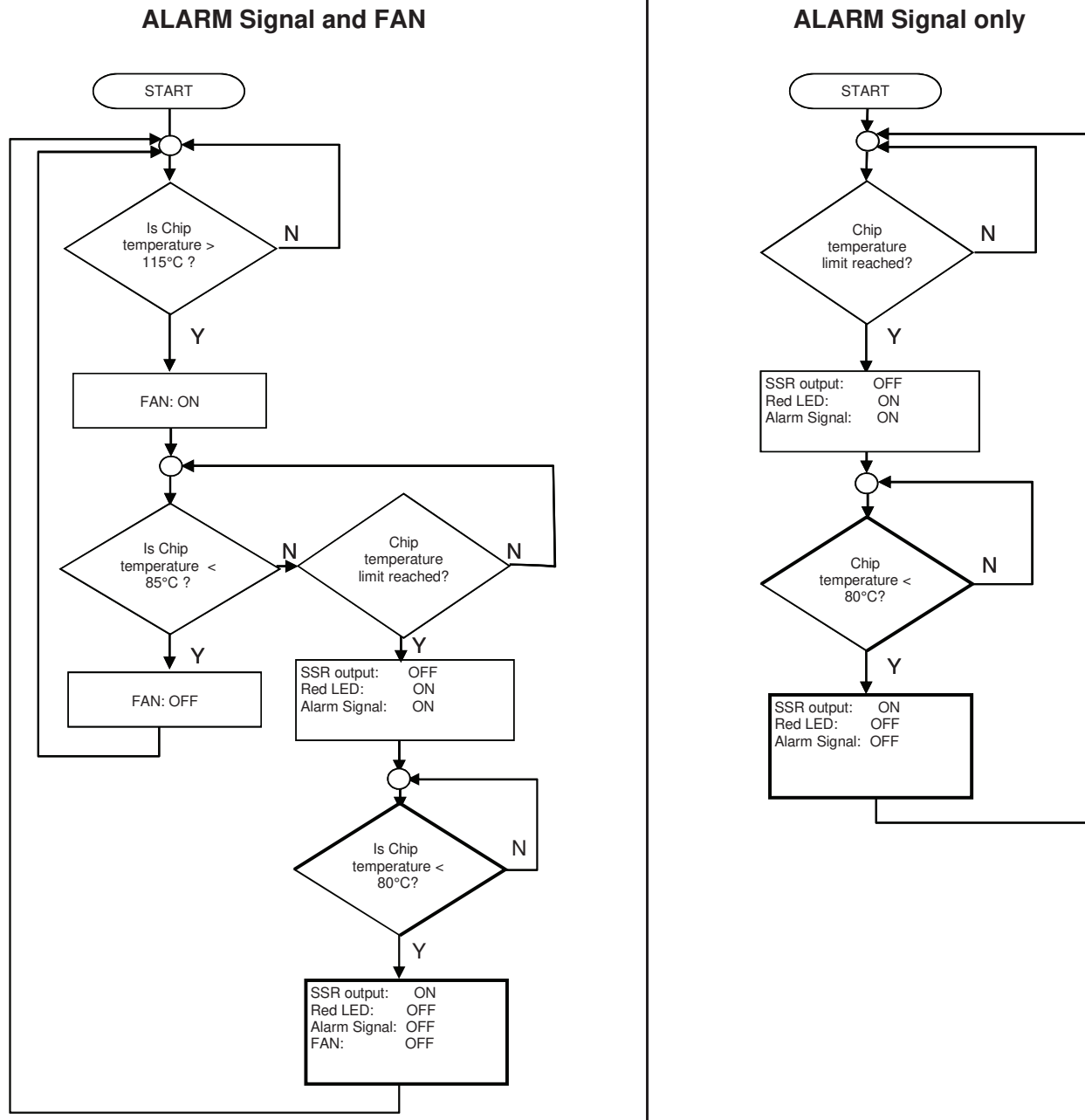
Figure 1 - 156-C1P...D Input Current vs. Input Voltage

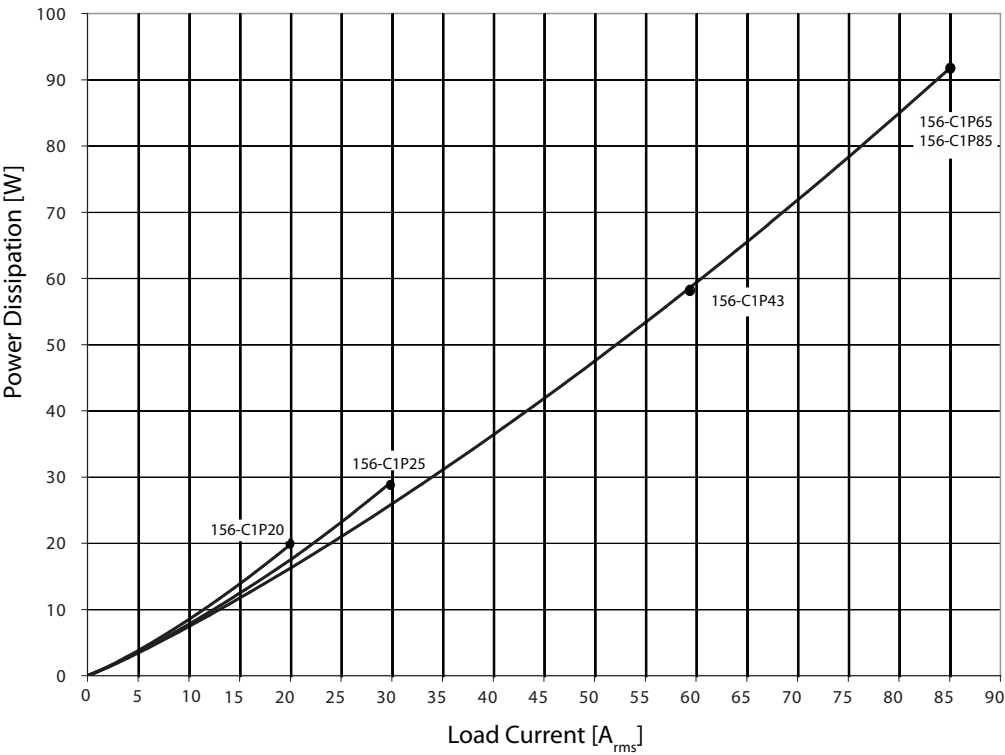
Figure 2 - 156-C1P...B A1 Input Current vs. Input Voltage**Table 9 - Motor Ratings: Hp (UL508) / kW (EN/IEC60947-4-2) @ 40 °C**

Cat. No.		Rated Voltage [V AC]				
		115	230	400	480	600
156-C1P20	[Hp]	1/3	1	2	3	3
	[kW]	0.18	0.37	0.75	1.1	1.5
156-C1P25	[Hp]	1/3	1	2	3	3
	[kW]	0.18	0.37	0.75	1.1	1.5
156-C1P43	[Hp]	1-1/2	3	5	7-1/2	10
	[kW]	0.56	1.5	2.2	3.7	4
156-C1P65	[Hp]	2	5	7-1/2	10	15
	[kW]	0.75	1.5	4	4	5.5
156-C1P85	[Hp]	2	5	7-1/2	10	15
	[kW]	0.75	1.5	4	4	5.5

Figure 3 - Detailed Overtemperature Alarm Procedure (for Cat. No. 156-C1P85NC)**NOTE:**

- Alarm condition resets whenever the voltage signal is removed from terminal A1 (+)
- If the voltage signal is not applied across A1(+) and A2(-) terminals, the overtemperature detection and functionality is lost (including fan operation and alarm signaling)
- It is necessary to supply IN2 and IN3 with 24V DC for fan operation.
- Alarm procedure follows 'Alarm signal only' flow since fan is continuously operating.
- Alarm condition automatically resets ONLY when power semiconductor temperature < 80°C
- Temperatures indicated are typical figures.

Figure 4 - Output Power Dissipation



Electromagnetic Compatibility

Table 10 - Electromagnetic Compatibility Ratings

Attribute	Standard Compliance	Attribute	Standard Compliance
EMC immunity	EN/IEC 61000-6-2	Electrical surge immunity (for devices with overtemperature protection)	EN/IEC 61000-4-5
Electrostatic discharge (ESD) immunity	EN/IEC 61000-4-2	Output, line to line, 1kV	Performance Criteria 1
Air discharge, 8kV	Performance Criteria 1	Output, line to earth, 2kV	Performance Criteria 1
Contact, 4kV	Performance Criteria 1	DC lines, line to line, 500V	Performance Criteria 2
Electrical fast transient (Burst) immunity	EN/IEC 61000-4-4	DC lines, line to earth, 500V	Performance Criteria 2
Output: 2kV, 5 kHz	Performance Criteria 1	Signal lines, line to line, 1kV	Performance Criteria 2
Input: 1kV, 5 kHz	Performance Criteria 1	Radiated radio frequency immunity	EN/IEC 61000-4-3
Electrical surge immunity (for devices without overtemperature protection)	EN/IEC 61000-4-5	10V/m, 80...1000 MHz	Performance Criteria 1
Output, line to line, 1kV	Performance Criteria 1	10V/m, 1.4...2.0 GHz	Performance Criteria 1
Output, line to earth, 2kV	Performance Criteria 1	3V/m, 2.0...2.7 GHz	Performance Criteria 1
Input, line to line, 1kV (A1, A2)	Performance Criteria 2	Conducted radio frequency immunity	EN/IEC 61000-4-6
Input, line to earth, 2kV (A1, A2)	Performance Criteria 2	10V/m, 0.15...80 MHz	Performance Criteria 1
EMC emission	EN/IEC 60947-4-3	Voltage dips immunity	EN/IEC 61000-4-11
Radio interference voltage emission (conducted)	EN/IEC 55011	0% for 10 ms/20 ms	Performance Criteria 2
0.15...30 MHz	Class A (Industrial) with filters - see Table 11	40% for 200 ms	Performance Criteria 2
	IEC/EN 60947-4-2, 60947-4-3 Class A (no filtering needed)	70% for 500 ms	Performance Criteria 2
		Voltage interruptions immunity	EN/IEC 61000-4-11
		0% for 5000 ms	Performance Criteria 2
		Radio interference field emission (radiated)	EN/IEC 55011
		30...1000 MHz	Class A (Industrial)

Table 11 - Filtering - EN / IEC 55011 Class A compliance

Cat. No.	Suggested Filter for Compliance ⁽¹⁾	Max. Heater Current [A]
156-C1P20NA	68 nF / 275 V / X1	20
156-C1P25NA	220 nF / 275V / X1	30
156-C1P20NC	100 nF / 760V / X1	20
156-C1P25NC	220 nF / 760V / X1	30
156-C1P62NC	330 nF / 760V / X1	40
156-C1P92NC	470 nF / 760V / X1	65

(1) Class A Compliance only. For Class B compliance, contact your local Rockwell Automation sales office or Allen-Bradley distributor.

Note:

- Control input lines must be installed together to maintain products' susceptibility to radio frequency interference.
- Use of AC solid-state contactors may, according to the application and the load current, cause conducted radio interferences. Use of mains filters 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 filter attenuation depends on the final application.
- Performance Criteria 1: No degradation of performance or loss of function is allowed when the product is operated as intended.
- Performance Criteria 2: During the test, degradation of performance or partial loss of function is allowed. However, when the test is completed, the product should return operating as intended by itself.
- Performance Criteria 3: Temporary loss of function is allowed, provided the function can be restored by manual operation of the controls.

Figure 5 - Filter Connection Diagrams

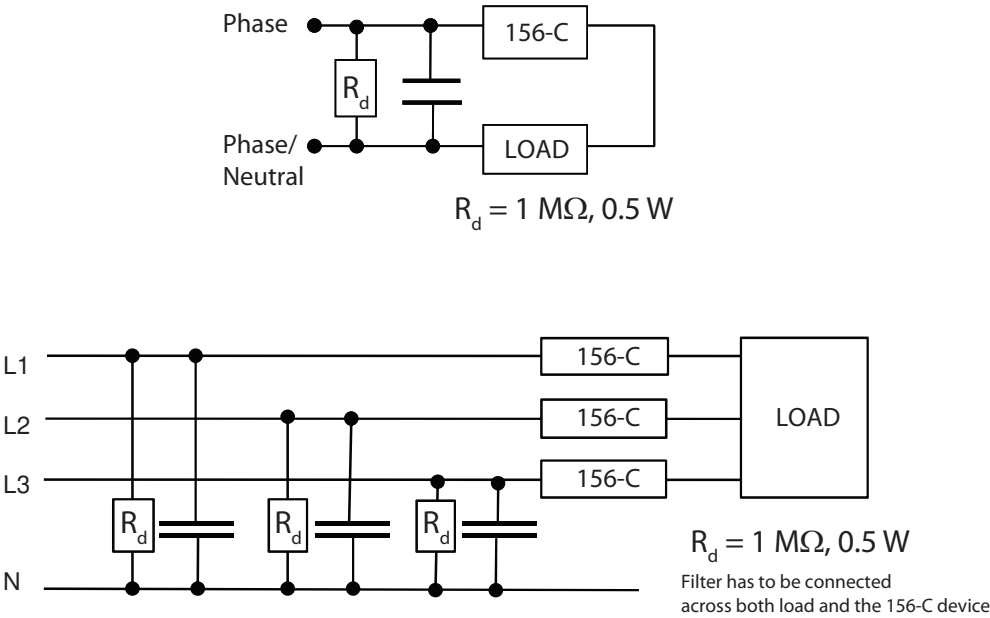
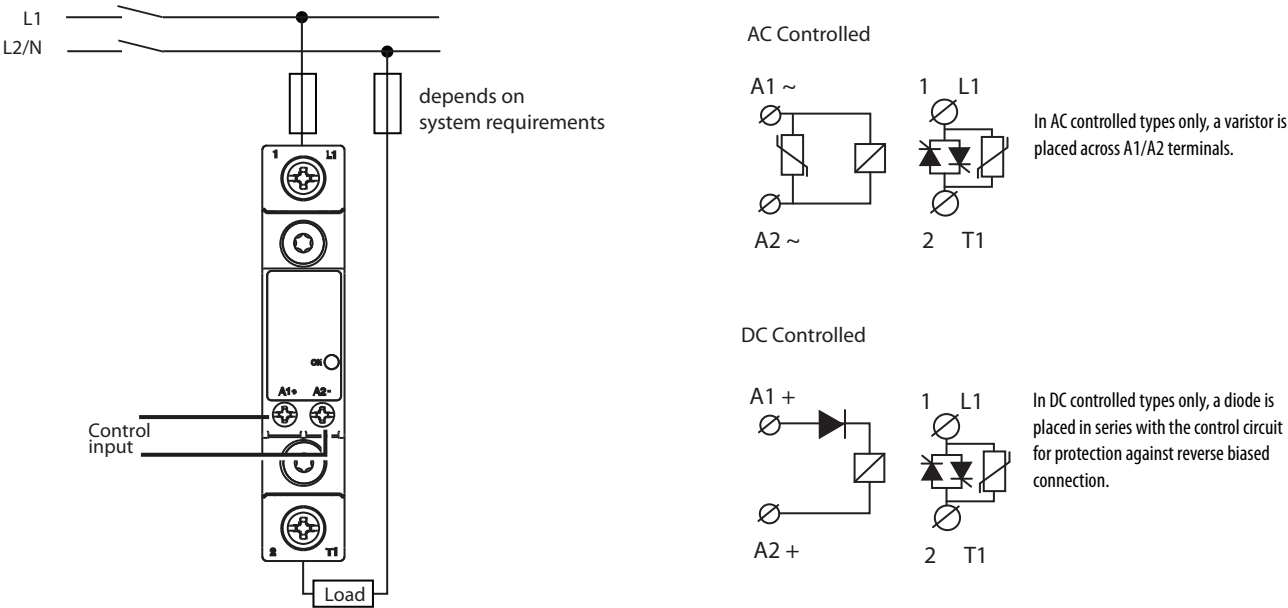
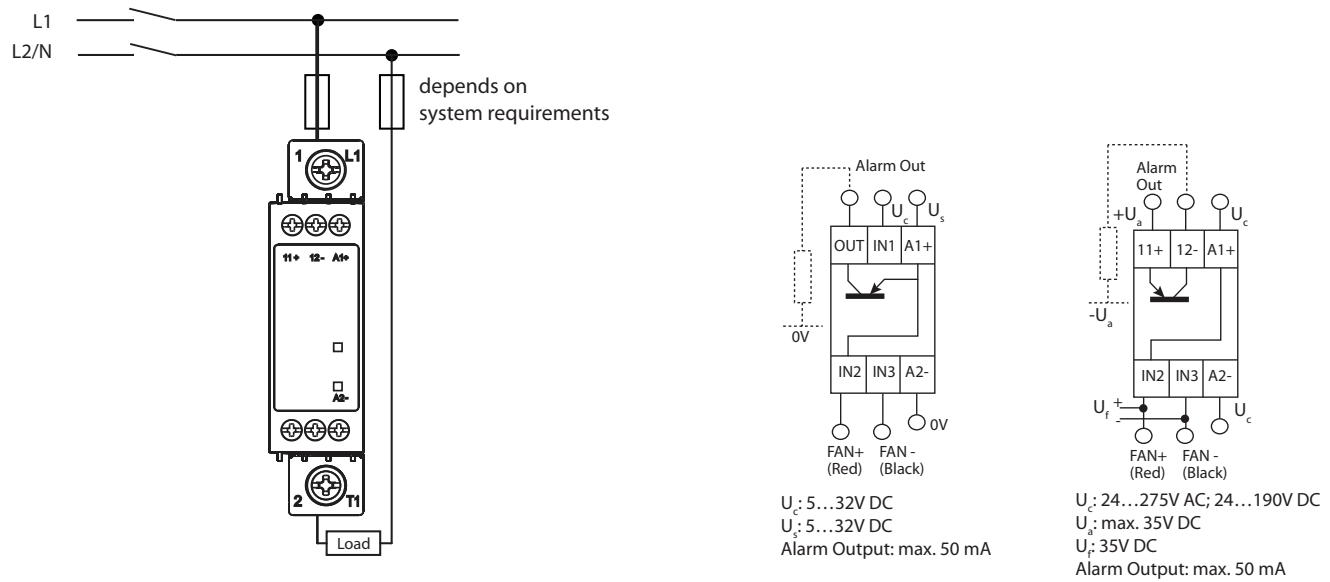


Figure 6 - Connection Diagram—No Overtemperature Protection



Terminal Label	Description
1/L1	Main connection
2/T1	Load connection
A1(+)	Positive control signal
A2(-)	Control ground

Figure 7 - Connection Diagram—With Overtemperature Protection**Table 12 - Power Connection (1/L1, 2/T1) Specifications**

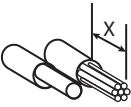
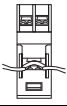
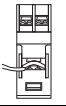
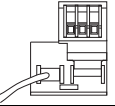
Attribute			Cat. Nos.		
			156-C1P20, -C1P25	156-C1P65, -C1P85	
Conductor			Use 75 °C copper (Cu) conductors		
Stripping Length (X)			12 mm		
Connection type			M4 screw with captivated washer		
Rigid Conductors (Solid & Stranded) UL/ cUL rated data					
		[mm ²]	(2) 2.5...6	2.5...6	2.5...25
		[AWG]	(2) 14...10	14...10	14...3
Flexible with end sleeve					
		[mm ²]	(2) 1.0...2.5 (2) 2.5...4	1.0...4	2.5...16
		[AWG]	(2) 18...14 (2) 14...12	18...12	14...6
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)
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 required when product is intended to be used in Class 1 applications according to EN/IEC 61140.		

Table 13 - Control Connection (A1+, A2-) Specifications

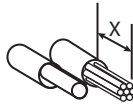
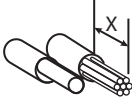
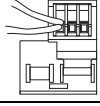
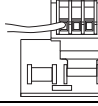
Attribute			Description	
Conductor			Use 60/75 °C copper (Cu) conductors	
Rigid Conductors (Solid & Stranded) UL/ cUL rated data				
		[mm ²]	(2) 1...2.5	1...2.5
		[AWG]	(2) 18...14	18...14
Flexible with end sleeve		[mm ²]	(2) 1...2.5	1...2.5
		[AWG]	(2) 18...14	18...14
Torque specifications			M3, Pozidriv 1 UL: 0.5 N•m (4.4 lb•in) IEC: 0.4...0.5 N•m (3.5...4.4 lb•in)	
Stripping Length (X)			8 mm	

Table 14 - Control Connection (A1(+), A2(-), IN1, IN2, IN3, 11(+), 12(-), OUT) Specifications

Attribute			Description	
Conductor			Use 60/75 °C copper (Cu) conductors	
Stripping Length (X)			6 mm	
Rigid Conductors (Solid & Stranded) UL/ cUL rated data				
		[mm ²]	(2) 1...2.5	1...2.5
		[AWG]	(2) 18...14	18...14
Flexible with end sleeve		[mm ²]	(2) 1...2.5	1...2.5
		[AWG]	(2) 18...14	18...14
Torque specifications			M3, Pozidriv 1 UL: 0.5 N•m (4.4 lb•in) IEC: 0.4...0.5 N•m (3.5...4.4 lb•in)	

Short Circuit Protection

Protection Co-ordination, Type 1 vs 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, 600 Volts maximum when protected by fuses. Tests at 100,000 A were performed with Class J fuses, fast acting; please refer to [Table 15](#) and [Table 16](#) for maximum allowed ampere rating of the fuse. Use fuses only.

Tests with Class J fuses are representative of Class CC fuses.

Table 15 - Type 1 Coordination Ratings (UL 508)

Cat. No.	Prospective Short Circuit Current [kA _{rms}]	Max. Fuse Size [A]	Fuse Class	Max. Rated Voltage [V AC]
156-C1P20	100	30	J or CC	600
156-C1P25	100	30	J or CC	600
156-C1P43	100	90	J	600
156-C1P65	100	90	J	600
156-C1P85	100	90	J	600

Table 16 - Type 2 Coordination Ratings (IEC/EN 60947-4-2/-4-3)

Cat. No.	Prospective Short Circuit Current [kA _{rms}]	Ferraz Shawmut		Siba		Max. Rated Voltage [V AC]
		Max. Fuse Size [A]	Fuse Part No.	Max. Fuse Size [A]	Fuse Part No.	
156-C1P20	10	25	6.9xx CP GRC 14x51 /25	32	50 142 06.32	600
	100	25	6.9xx CP GRC 14x51 /25	32	50 142 06.32	600
156-C1P25	10	40	6.9xx CP GRC 22x58 /40	32	50 142 06.32	600
	100	40	6.6xx CP URD 22x58 /40	32	50 142 06.32	600
156-C1P43	10	63	6.9xx CP URC 14x51 /63	80	50 194 20.80	600
	10	70	A70QS70-4	80	50 194 20.80	600
	100	63	6.9xx CP URC 14x51 /63	80	50 194 20.80	600
	100	70	A70QS70-4	80	50 194 20.80	600
156-C1P65	10	100	6.9xx CP GRC 22x58 /100	100	50 194 20.100	600
	10	100	A70QS100-4	100	50 194 20.100	600
	100	100	6.621 CP URGD 27x60 /100	100	50 194 20.100	600
	100	100	A70QS100-4	100	50 194 20.100	600
156-C1P85	10	125	6.621 CP URQ 27x60 /125	125	50 194 20.125	600
	10	125	A70QS125-4	125	50 194 20.125	600
	100	125	6.621 CP URQ 27x60 /125	125	50 194 20.125	600
	100	125	A70QS125-4	125	50 194 20.125	600

Table 17 - Power Output

Cat. No.	Housing Size W x H x D [mm]	Description								
		Rated Operating Current [A]			Min. Operating Current [mA]	Max. Repetitive Overload Current (AC _{rms}) t = 1 s	Non-repetitive Surge Current (AC _{rms}) Tj = 240 °C t = 10 ms	Max. Off-state Leakage Current @ Rated Voltage and Frequency Tj = 40 °C t = 10 ms [mA]	I ² t for Fusing t = 10 ms	Critical dV/dT Off-state
		AC51 @ 25 °C	AC51 @ 40 °C	AC53a @ 40 °C						
156-C1P20...	17.8 x 110 x 103	20	20	5	150	51	325	3	525	1000
156-C1P25...	17.8 x 110 x 103	30	25	5	250	51	600	3	1800	1000
156-C1P43...	35 x 110 x 141	50	43	13	500	126	1900	3	18000	1000
156-C1P65...	70 x 110 x 141	75	65	30	500	168	1900	3	18000	1000
156-C1P85...	70 x 130 x 168	85	85	30	500	168	1900	3	18000	1000

Table 18 - Type 2 Coordination with Bulletin 1492 Miniature Circuit Breakers, Single-Phase Contactors

Solid-state Contactor Cat. No. ⁽¹⁾	Miniature Circuit Breaker Cat. No.	Wire Cross Sectional area [mm ²]	Minimum length of Cu wire Conductor ⁽²⁾
156-C1P20	1492-SPM1B020	1.0	21.0
		1.5	31.5
156-C1P25	1492-SPM1B040	1.0	7.6
		1.5	11.4
		2.5	19.0
	1492-SPM1B060	1.0	5.2
		1.5	7.8
		2.5	13.0
		4.0	20.8
	1492-SPM1B100	1.5	12.6
		2.5	21.0
	1492-SPM1B130	2.5	25.0
		4.0	40.0
	1492-SPM2B130	2.5	19.0
		4.0	30.4
156-C1P43 156-C1P65 156-C1P85	1492-SPM1B160	2.5	3.0
		4.0	4.8
		6.0	7.2
	1492-SPM1B250	4.0	4.8
		6.0	7.2
		10.0	12.0
		16.0	19.2
	1492-SPM1B320	6.0	7.2
		10.0	12.0
		16.0	19.2

(1) A prospective current of 6 kA and a 230/200V power supply system is assumed for these specifications. For cables with different cross sections, consult Technical Support.

(2) Between the miniature circuit breaker and the load (including the return path, which goes back to the mains).

Application Diagrams

Applications for Non-motor Loads

Figure 8 - Single-phase Contactor, Line-Neutral/Line-Line Connection

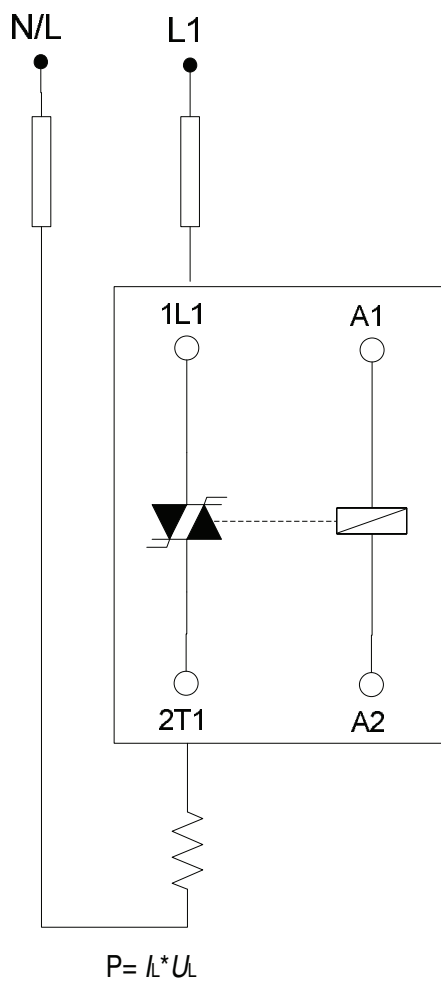


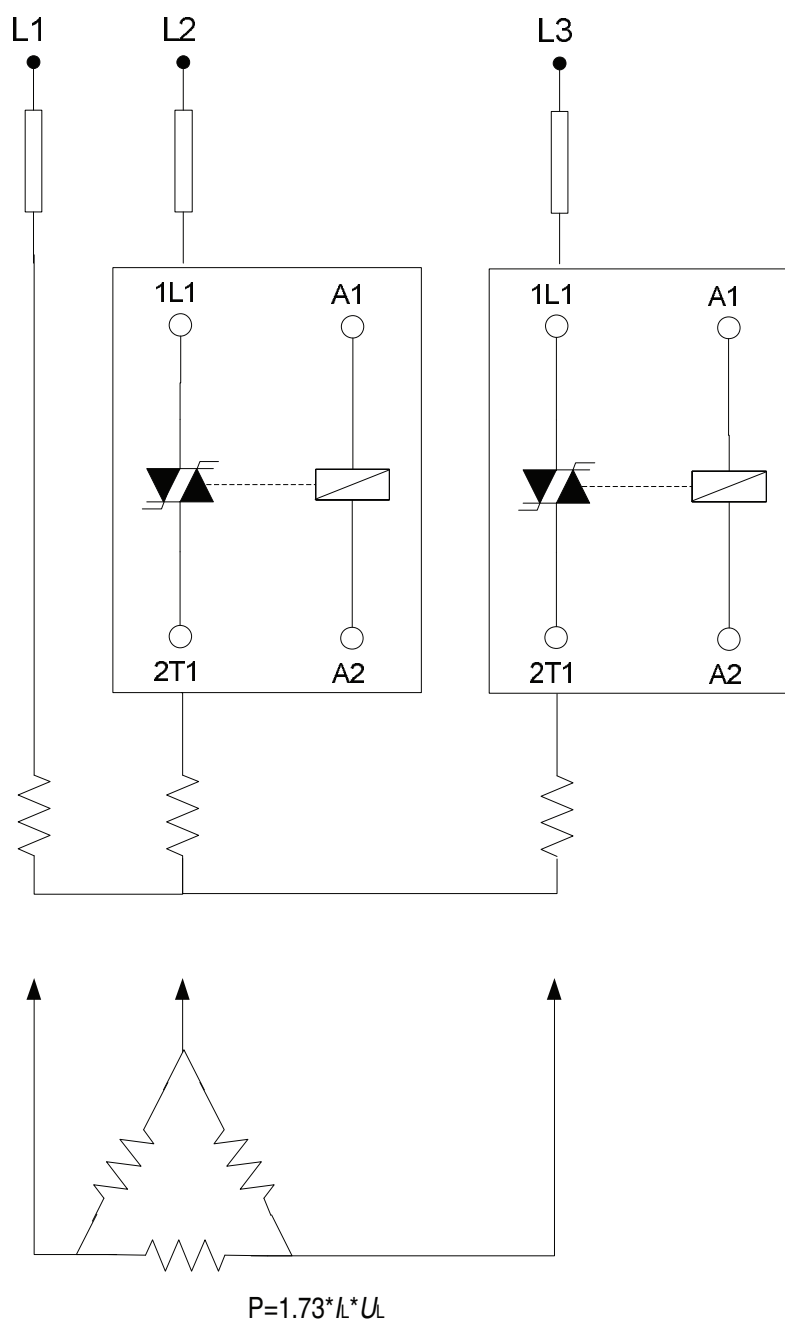
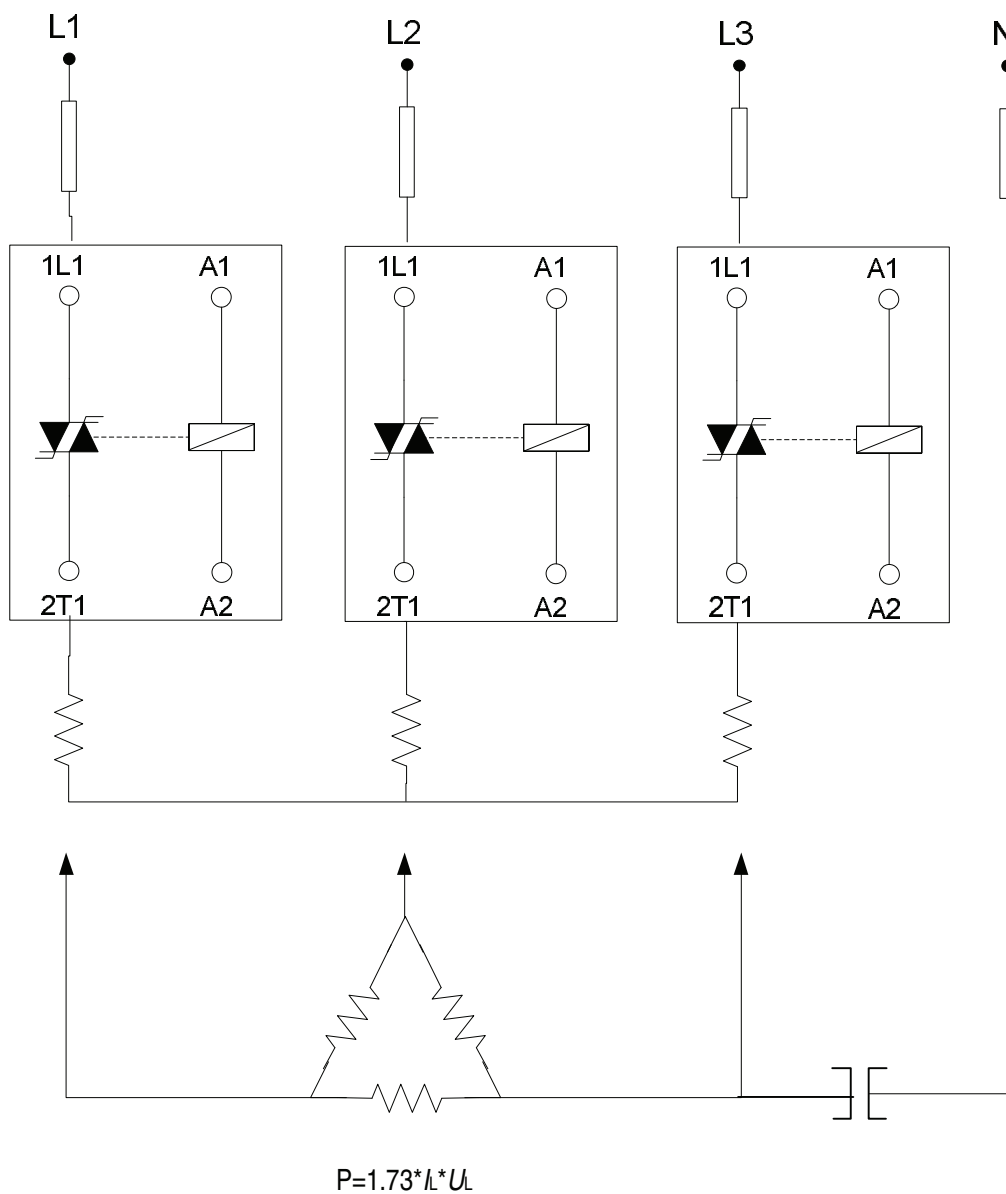
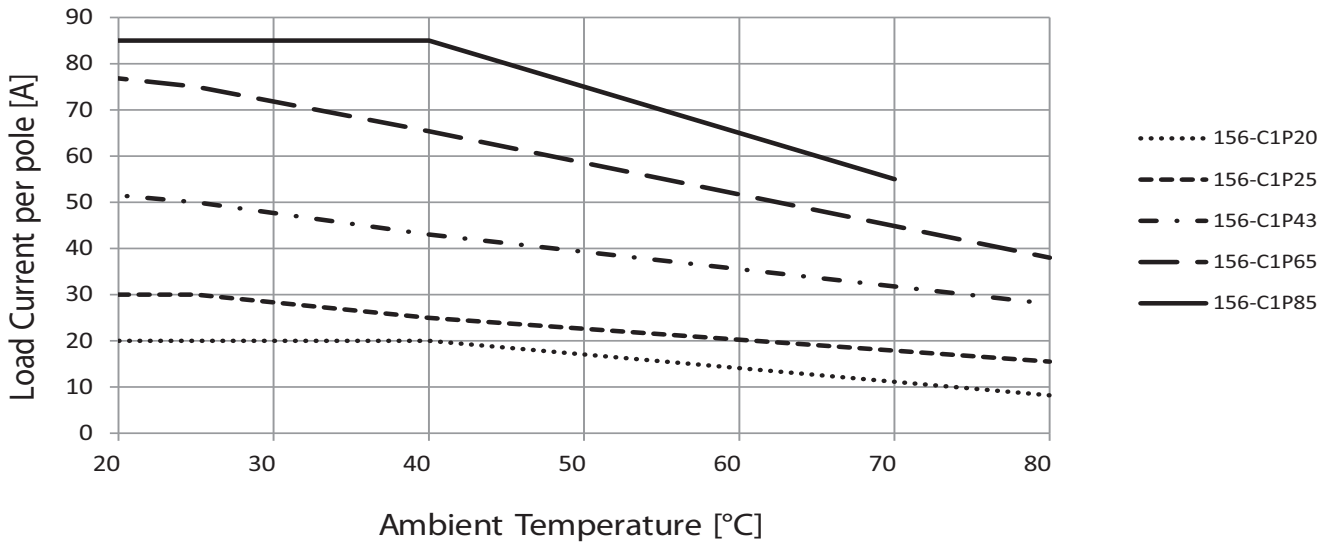
Figure 9 - Two Single-phase Contactors in Single Application, Delta and Star Connection

Figure 10 - Three Single-phase Contactors in 3-phase Application, Delta, Star, Star with Neutral Connection

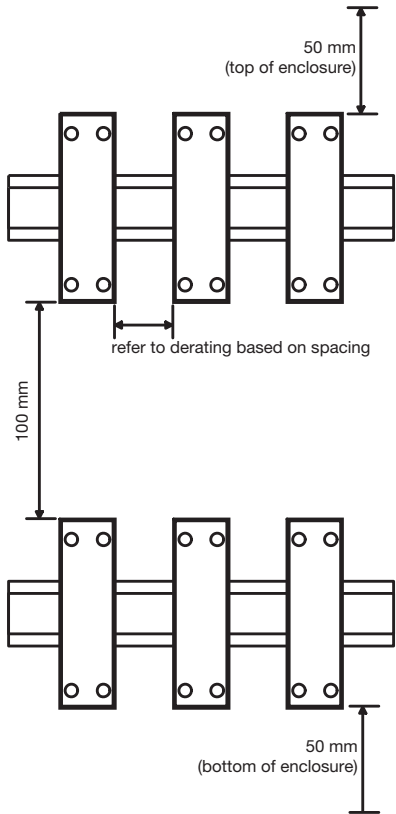


Load Curves

Load Versus Ambient Temperature Derating Curves



Recommended Contactor Spacings



Panel Mounting Load Derating vs. Spacing Curves

Figure 11 - 156-C1P20 Space Derating

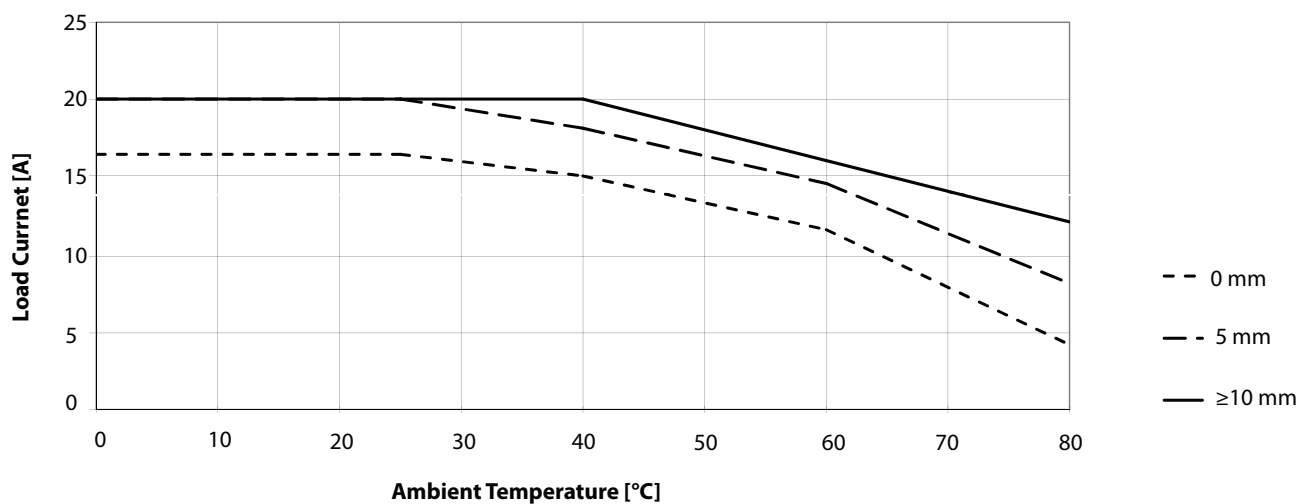


Figure 12 - 156-C1P25 Space Derating

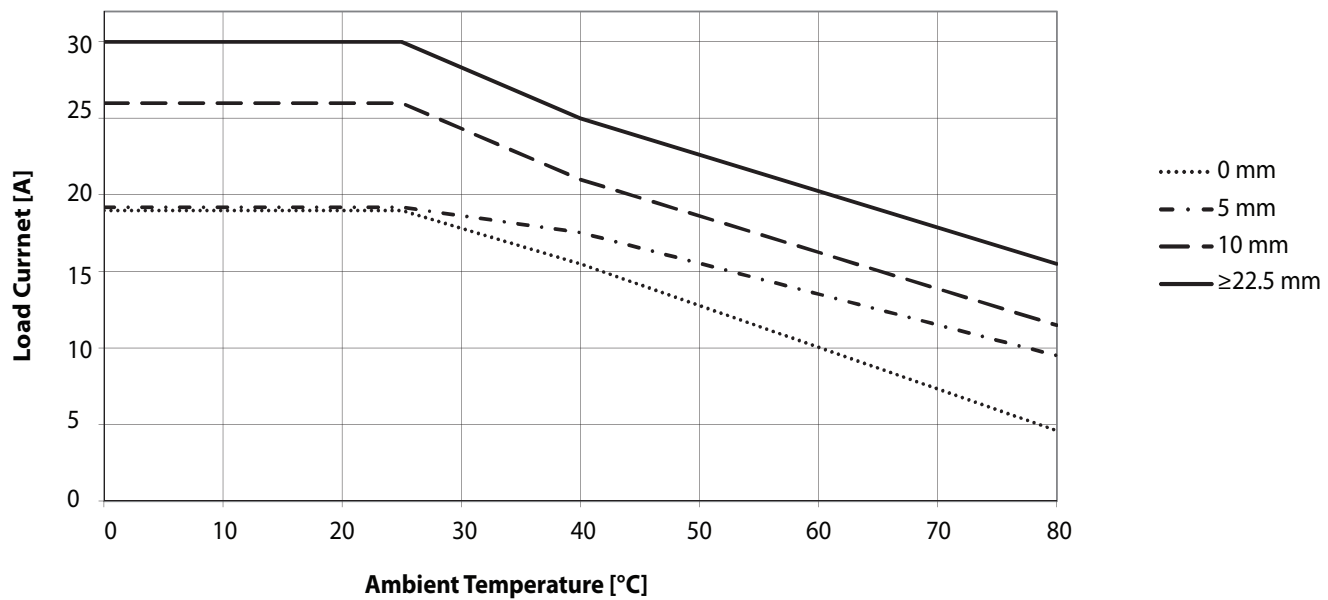


Figure 13 - 156-C1P43 Space Derating

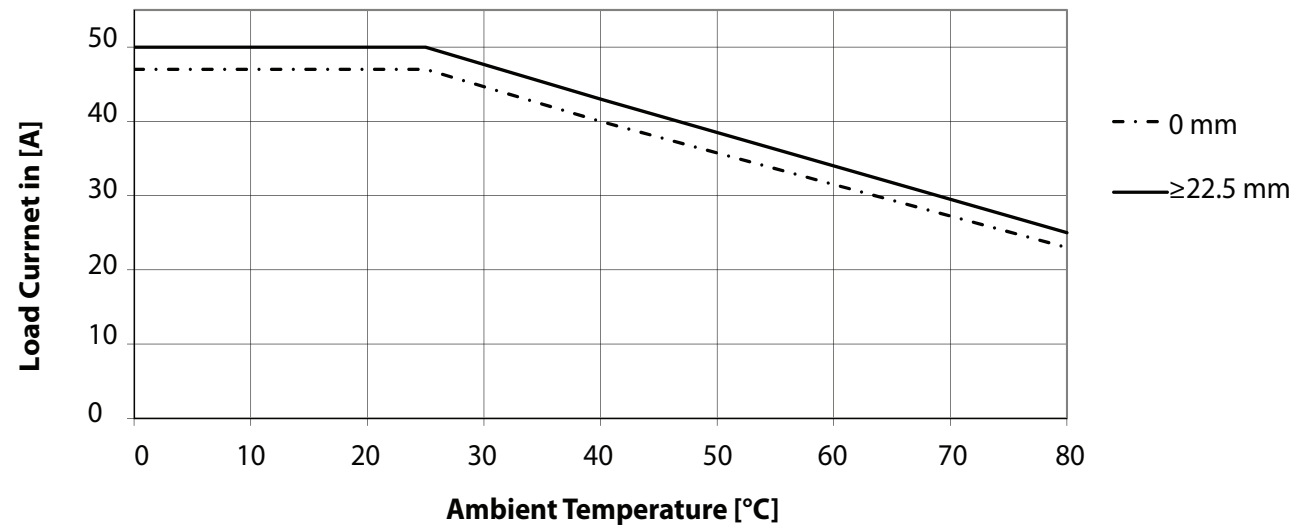
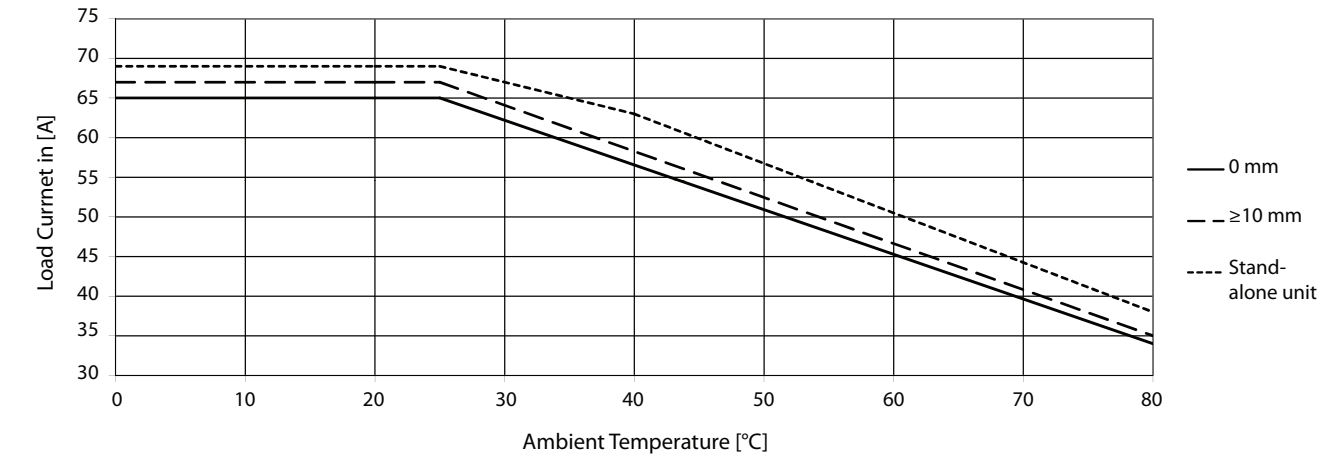
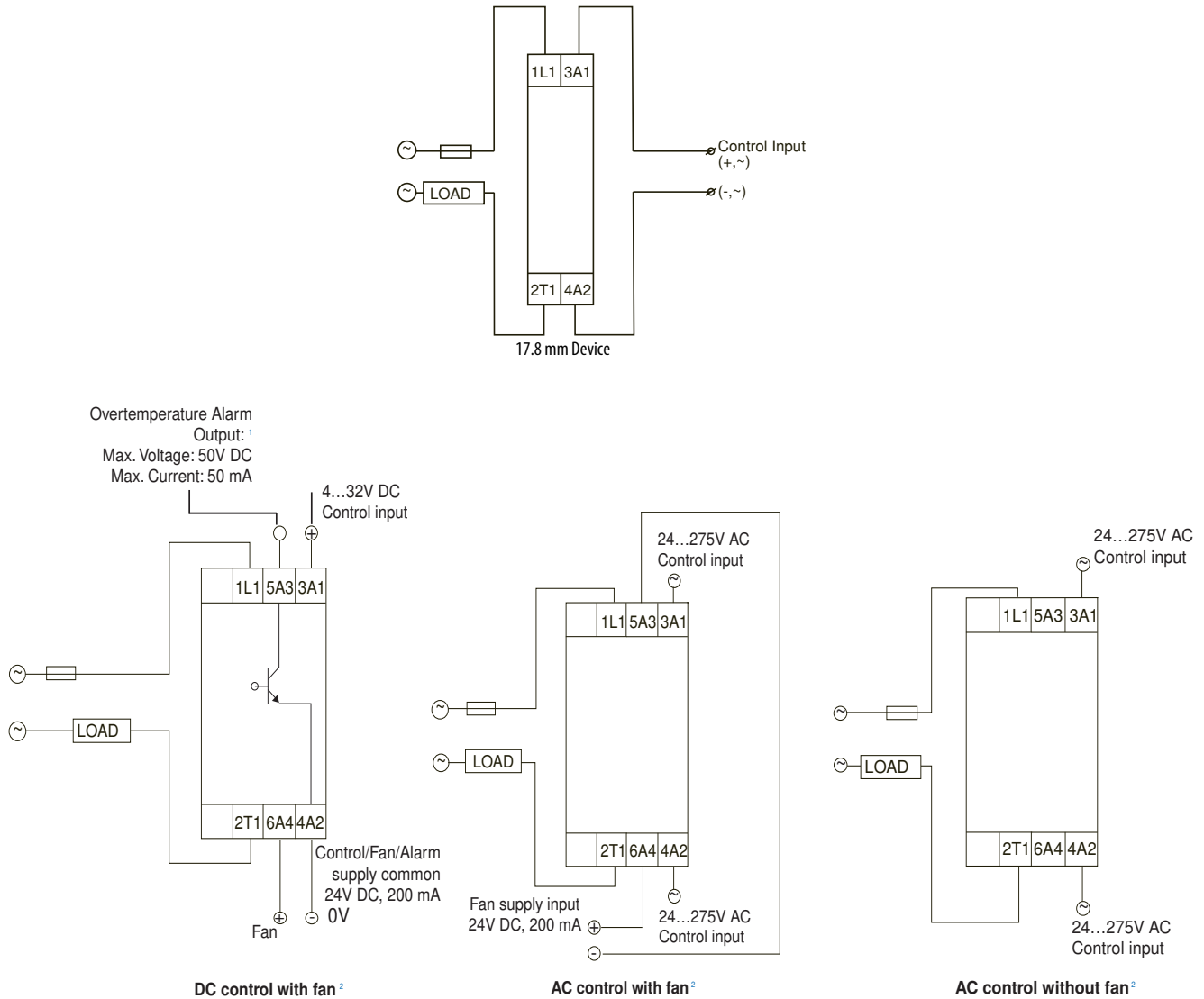


Figure 14 - 156-C1P65 Space Derating



Wiring Diagrams

Figure 15 - Cat. No. 156-C1P20, -C1P25 Contactors



1) Overtemperature alarm protection, cutout on 75 and 90 A units with 24V DC control.

2) Integrated fan comes with 75 and 90 A units. Fan must be wired to 24V DC source for contactor to operate.

Approximate Dimensions

Dimensions in millimeters (inches). Dimensions are not intended for manufacturing purposes.

Figure 16 - Cat. No. 156-C1P20..., -C1P25...

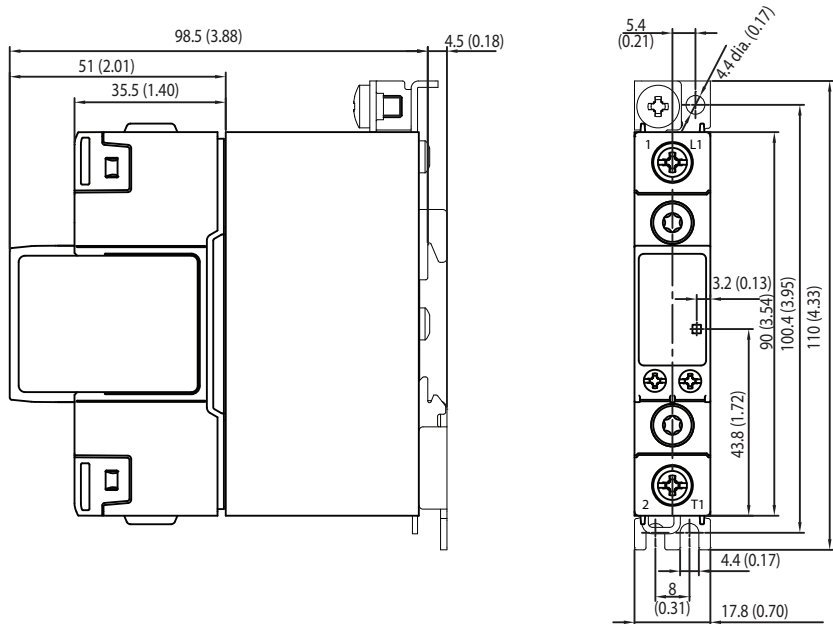
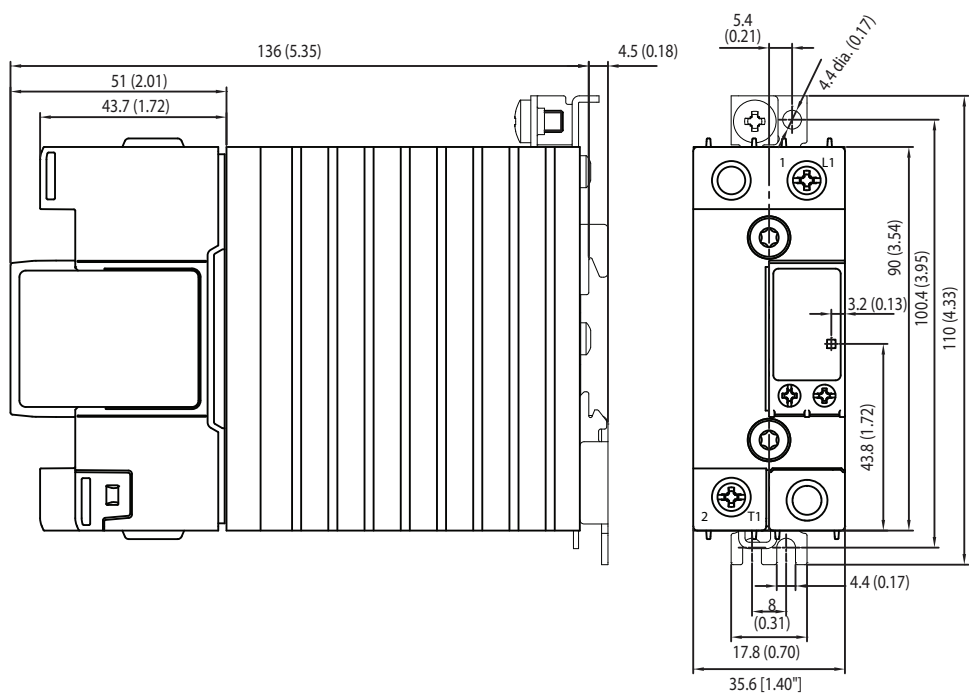


Figure 17 - Cat. No. 156-C1P43...



Notes:

Specifications—Dual- and Three-phase Devices

Table 19 - Output Voltage

Attribute	Description	
	230V AC	600V AC
Operational Voltage Range	42...220V AC, +10%, -15% on max.	42...600V AC, +10%, -15% on max.
Blocking Voltage	800Vp	1200Vp
Internal Varistor	275V	625V

Table 20 - General Specifications

Attribute	Description
Short Circuit Current Rating	100 kA (UL508)
Latching voltage (across each pole L-T)	<20V
Operational frequency range	45...65 Hz
Power factor	> 0.5 @ V_{rated}
CE Marking	Yes
Touch Protection	IP20
LED status indication	
Control ON	Green, full intensity
Supply ON	Green, full intensity
Load ON	Green, full intensity
Alarm ON	Red, full intensity (option with fan)
Pollution degree	2 (non-conductive pollution with possibilities of condensation)
Overvoltage category	III (fixed installations)
Isolation	
Input to Output	4000V _{rms}
Input and Output to case	4000V _{rms}

Table 21 - Standards Compliance and Certifications

Standards Compliance	Certifications
EN 60947-4-2	UL508 Listed (E172877)
EN 60947-4-3	cUL Listed (E172877), C22.2 No. 14-13

Table 22 - Environmental Specifications

Attribute	Description
Operating Temperature	
No fan	-40...80 °C (-40...176 °F)—derate above 40 °C (104 °F)
24V DC fan control	-40...70 °C (-40...158 °F)—derate above 40 °C (104 °F)
90...250V AC fan control	-40...60 °C (-40...140 °F)—derate above 40 °C (104 °F)
Storage Temperature	-40...100 °C (-40...212 °F)
Vibration resistance	2G per axis (2...100 Hz) (per IEC60068-2-6, EN50155, EN61373)
Impact resistance	15/11 g/ms (per EN50155, EN61373)
Relative humidity	95% non-condensing @ 40 °C
UL flammability rating (housing)	UL 94 V0
Installation altitude	0...1000 m. Above 1000 m, derate linearly by 1% of FLC per 100 m up to maximum of 2000 m

Table 23 - Weights

Cat. No.	Approximate Weight [g (lbs)]
156-C2P25	600 (1.32)
156-C2P40, 156-C3P25, 156-C3P30	850 (1.87)
156-C3P40	740 (1.63)
156-C2P75, 156-C3P65	980 (2.16)

Table 24 - Output Specifications @ 25°C (unless otherwise specified)

Attribute	Description							
	156-C2P25	156-C2P40	156-C2P75	156-C3P20	156-C3P25	156-C3P30	156-C3P40	156-C3P65
Rated operational current per pole ⁽¹⁾								
AC-51 rating @ T _a = 25 °C [A]	32	50	85	25	32	37	42	71
AC-51 rating @ T _a = 40 °C [A]	27	40	75	20	28	30	42	66
AC-53a rating @ T _a = 40 °C [A]	11.5	16.5	28	10	11	14	17	25
Number of motor starts (x:6, T _x :6 s, F:50%) at 40 °C ⁽²⁾	30	30	30	30	30	30	30	30
Min. operational current [mA]	250	400	500	250	250	400	400	500
Rep. overload current - (Motor Rating) UL508: T _{AMB} =40 °C, t _{ON} =1 s, t _{OFF} =9 s, 50 cycles [A]	61	107	154	61	84	107	107	154
Maximum transient surge current (I _{TSM}), t = 10 ms [A _p]	600	1150	1750	600	600	1150	1150	1750
Maximum off-state leakage current at rated voltage [mA]	5	5	5	5	5	5	5	5
I ² t for fusing (t = 10 ms) Minimum [A ² s]	1800	6600	15000	1800	1800	6600	6600	15000
Critical dv/dt (@ T _{j init} = 40 °C) [V/μs]	1000	1000	1000	1000	1000	1000	1000	1000

(1) See derating curves

(2) Overload current profile definition: x: multiple of AC53a rating, T_x: duration of current surge, F: duty cycle**Table 25 - Control Input (A1, A2)—Contactors without Fan**

Attribute	Description	
	156-C...D	156-C...A
Control Voltage Range, U _c	5...32V DC	20...275V AC/24 (-10%)...190V DC
Pick Up Voltage	4.8V DC	20V AC/DC
Drop Out Voltage	1.0V DC	5V AC/DC
Reverse Voltage	32V DC	—
Maximum Response Time	0.5 Cycle + 500 μs @24V DC	2 Cycles @ 230V AC/110V DC
Maximum Input Current @ 40 °C	see Figure 20	see Figure 21

Table 26 - Control Input (A1, A2)—Contactors with Fan

Attribute	Description	
	156-C3P40NCDD, 156-C3P65NCBA, 156-C3P65NCDD	156-C3P40NCBA, 156-C3P65NCBD
Control Voltage Range, U _c	5...32V DC	20...275V AC
Pick Up Voltage	4.8V DC	20V AC/DC
Drop Out Voltage	1.0V DC	5V AC/DC
Max. Reverse Voltage	32V DC	—
Maximum Response Time	1 Cycle + 500 μs @24V DC	5 Cycles @ 230V AC
Maximum Input Current @ 40 °C	see Figure 22	see Figure 23

Figure 20 - Cat. No. 156-C...D Input Current vs. Input Voltage

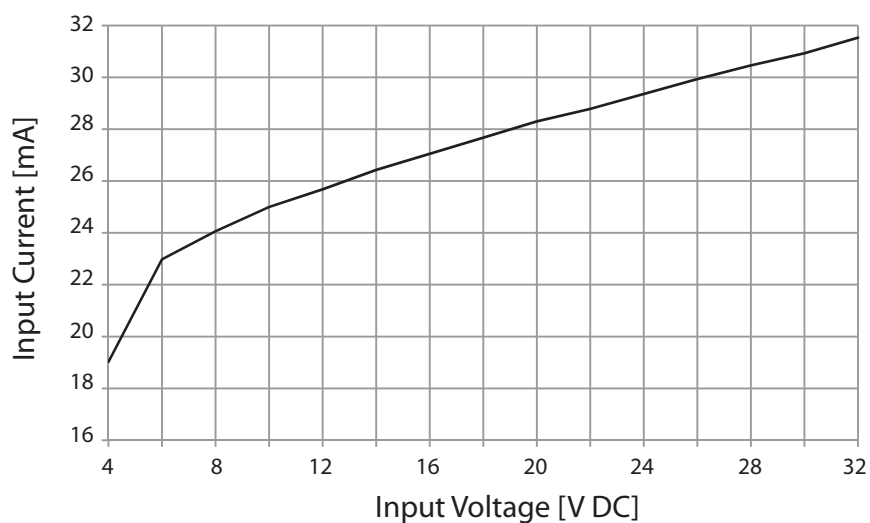


Figure 21 - Cat. No. 156-C...A Input Current vs. Input Voltage

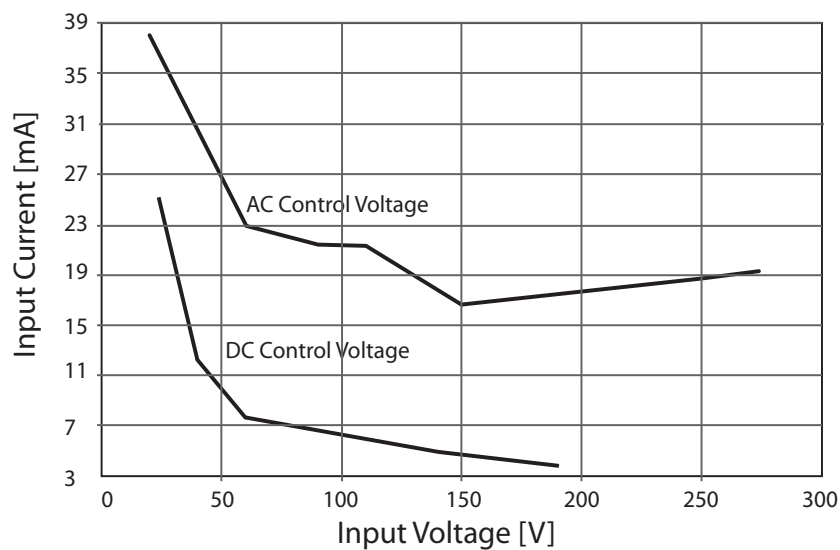


Figure 22 - Cat. Nos. 156-C3P40NCDD, 156-C3P65NCBA, and 156-C3P65NCDD Input Current vs. Input Voltage

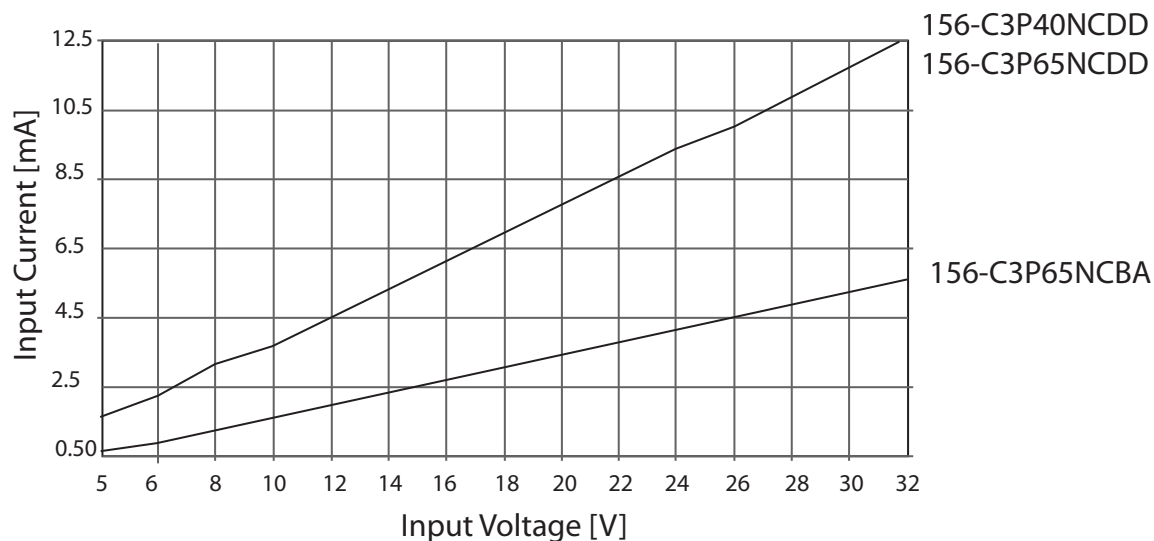


Figure 23 - Cat. Nos. 156-C3P40NCBA and 156-C3P65NCBD Input Current vs. Input Voltage

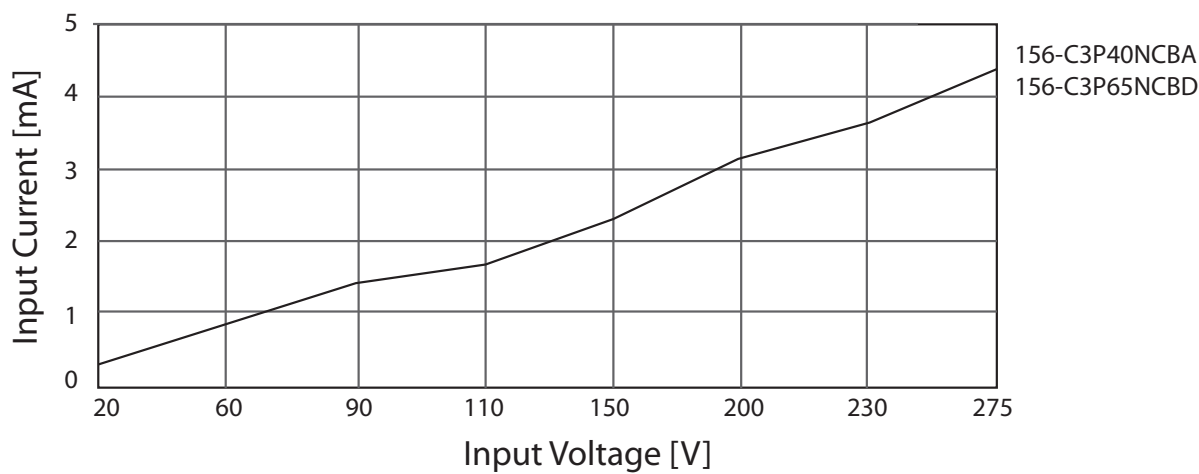


Table 27 - Supply Specifications

Attribute	Description	
	156-C3P40NCDD, 156-C3P65NCDD	156-C3P40NCBA, 156-C3P65NCBD, 156-C3P65NCBA
Supply Voltage Range, U _s	24 VDC, -15% / +20%	90...250 VAC
Reverse Protection	Yes	n/a
Surge Protection ⁽¹⁾	500V PC1 with integrated transil	L-L 1kV, L-E 2kV PC1 ⁽²⁾
Maximum Supply Current	150 mA	80 mA

(1) Refer to [Electromagnetic Compatibility on page 33](#) for further details
(2) When supplied from secondary circuit with short circuit limit of 1500 VA

Table 28 - Alarm Specifications (12, 11, 14) —for Versions with Fan

Attribute	Description	Contact Configuration
Output type	EMR, 1 Form C (SPDT) Normally closed (12-11) Normally open (14-11)	
Contact rating	2 A @ 250V AC/30V DC	
Isolation between open contacts	1000V AC	

Figure 24 - Output Power Dissipation—Dual-phase Devices

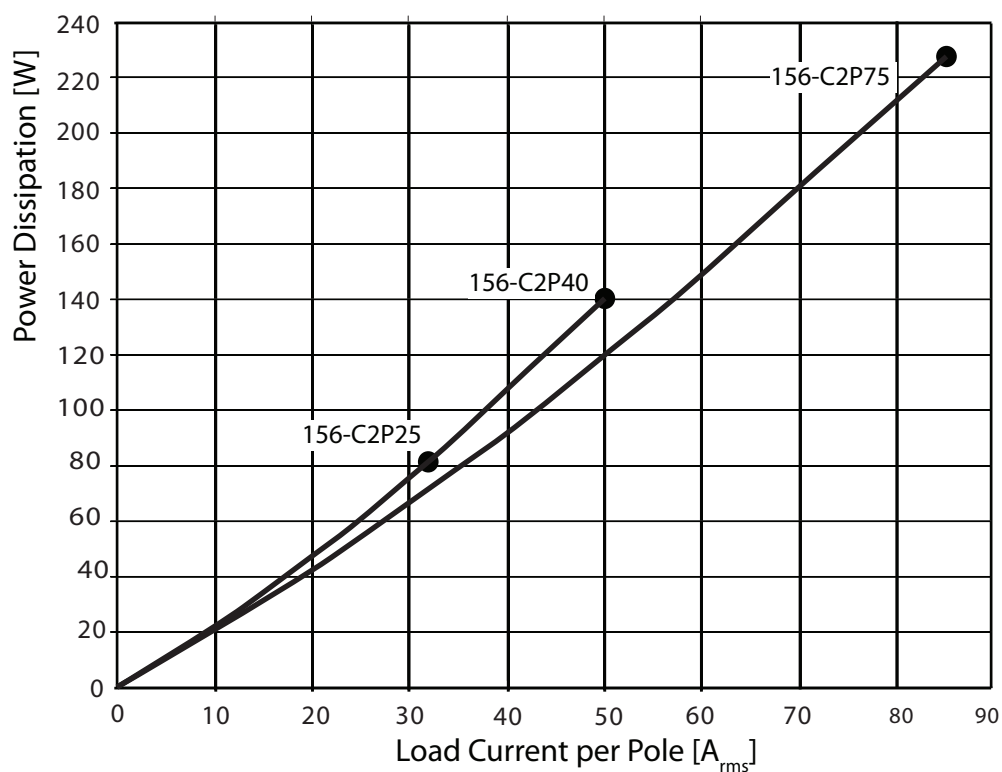
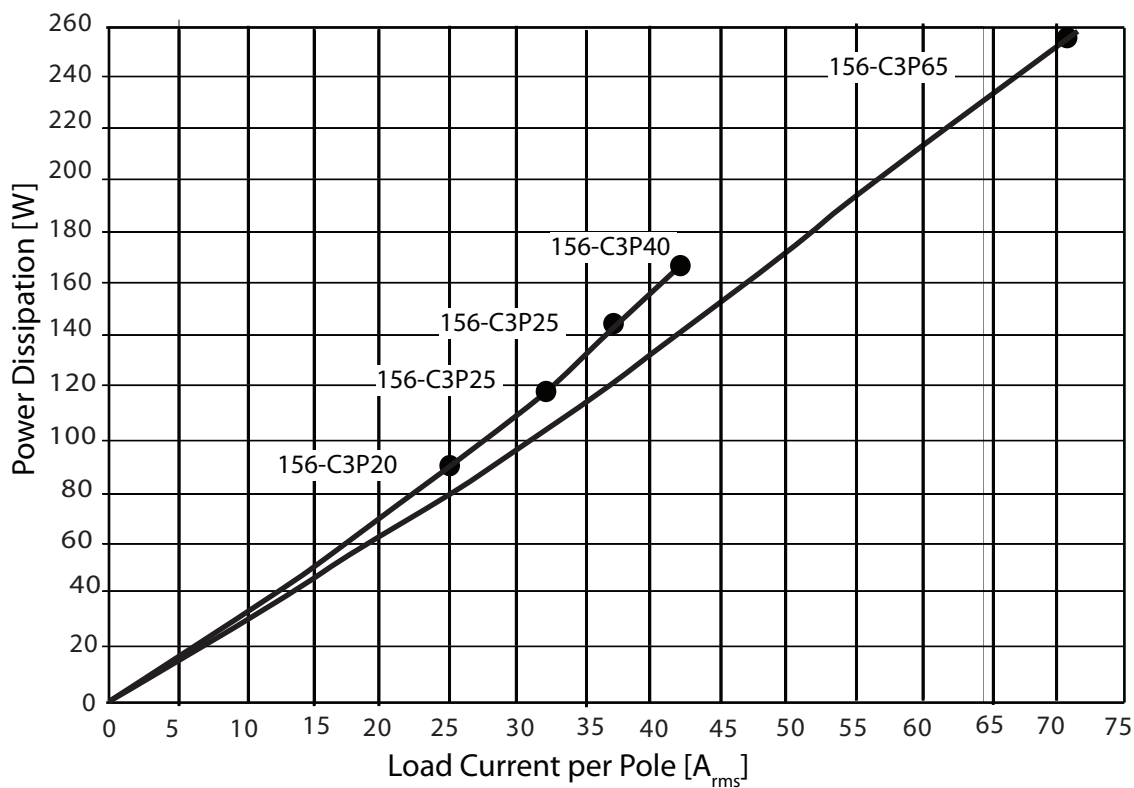


Figure 25 - Output Power Dissipation—Three-phase Devices



Current Derating

Figure 26 - Dual-phase Standalone Temperature Derating

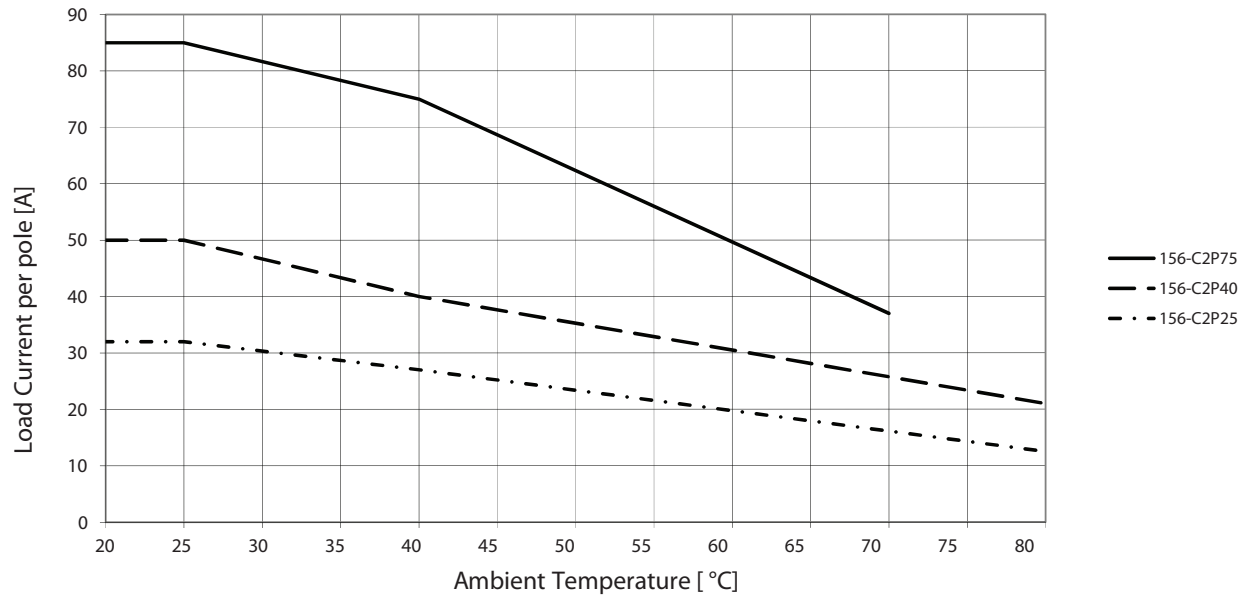


Figure 27 - Three-phase Standalone Temperature Derating

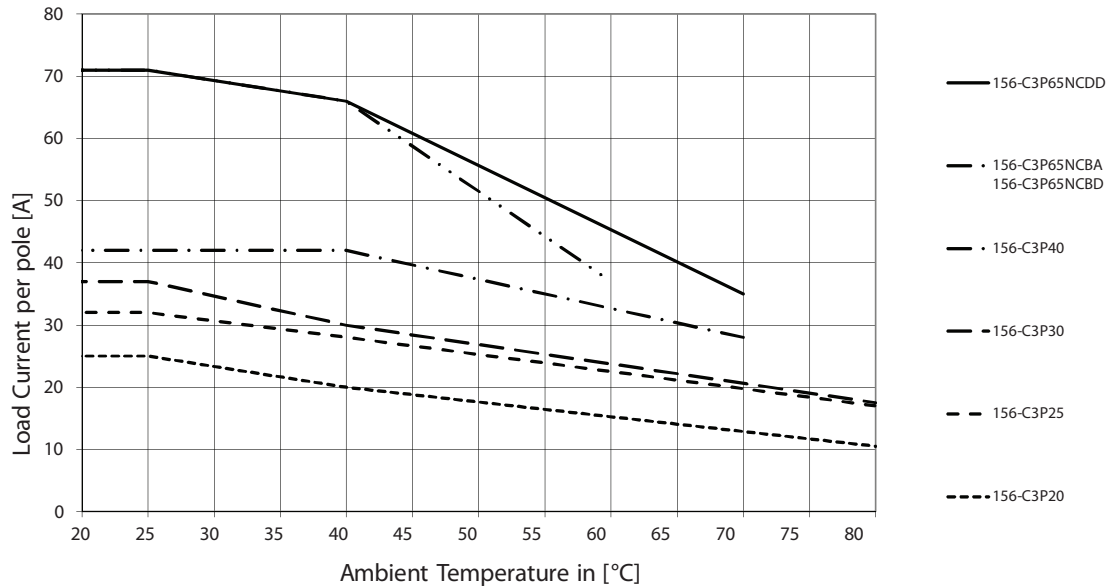


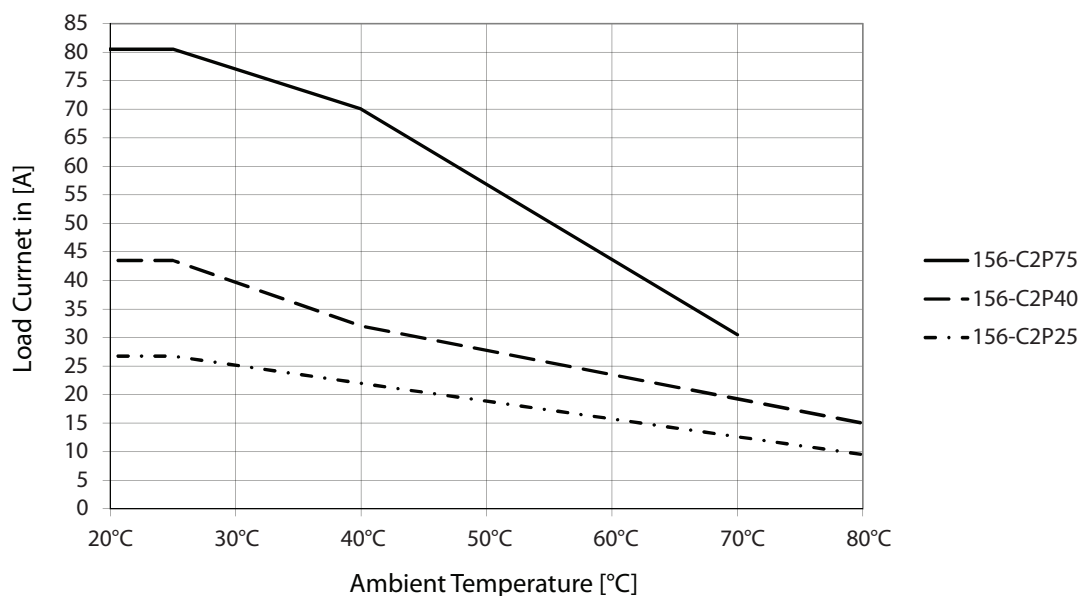
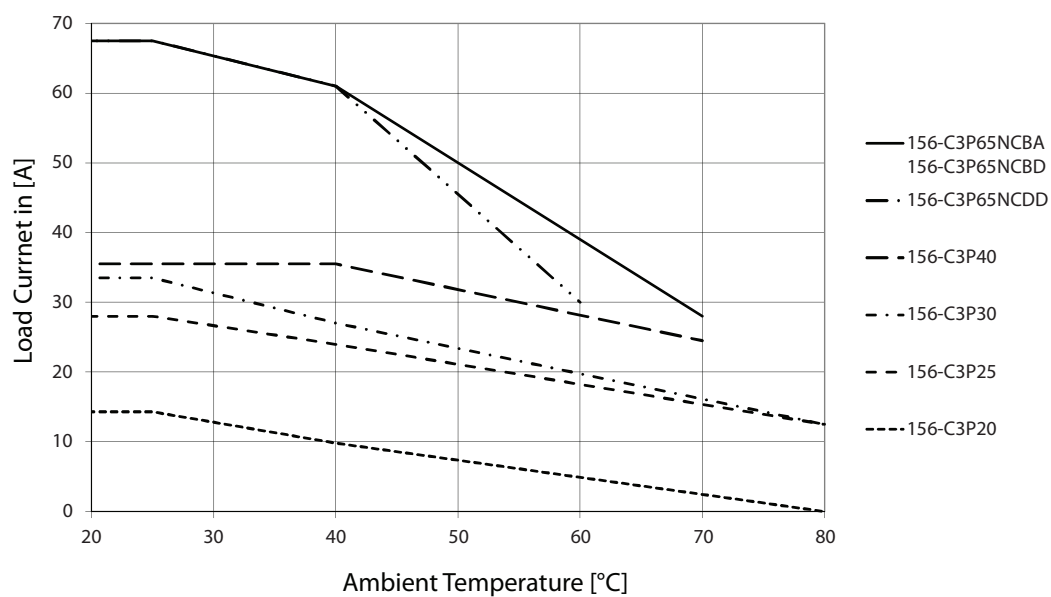
Figure 28 - Dual-phase 0 mm Spacing Temperature Derating**Figure 29 - Three-phase 0 mm Spacing Temperature Derating**

Table 29 - Motor Ratings: Hp (UL508) / kW (EN/IEC60947-4-2) @ 40 °C

Cat. No.		Rated Voltage [V AC]				
		115	230	400	480	600
156-C2P25	[Hp]	1-1/2	3	5	7-1/2	10
	[kW]	1.1	3.0	5.5	5.5	9.0
156-C2P40	[Hp]	3	5	10	10	15
	[kW]	1.5	4.0	7.5	9.0	11.0
156-C2P75	[Hp]	5	10	15	20	25
	[kW]	3.0	7.5	11.0	15.0	22.0
156-C3P20	[Hp]	1	3	5	7-1/2	10
	[kW]	0.75	2.2	4.0	5.5	7.5
156-C3P25	[Hp]	2	3	7-1/2	10	10
	[kW]	1.1	2.2	4.0	5.5	7.5
156-C3P30	[Hp]	2	5	10	10	15
	[kW]	1.5	3.0	5.5	7.5	11.0
156-C3P40	[Hp]	2	5	10	10	15
	[kW]	1.5	4.0	7.5	9.0	11.0
156-C3P65	[Hp]	3	10	15	20	25
	[kW]	3.0	5.5	11.0	15.0	20.0

Electromagnetic Compatibility

Table 30 - Electromagnetic Compatibility Ratings

Attribute	Standard Compliance	Attribute	Standard Compliance
EMC immunity	EN/IEC 61000-6-2	Radio interference voltage emission (conducted)	EN/IEC 55011
Electrostatic discharge (ESD) immunity	EN/IEC 61000-4-2	0.15...30 MHz	Class A (Industrial) with filters - see Table 31
Air discharge, 8kV	Performance Criteria 2	Radiated radio frequency immunity	EN/IEC 61000-4-3
Contact, 4kV	Performance Criteria 2	10V/m, 80...1000 MHz	Performance Criteria 1
Electrical fast transient (Burst) immunity	EN/IEC 61000-4-4	10V/m, 1.4...2.0 GHz	Performance Criteria 1
Output: 2kV, 5 kHz	Performance Criteria 1	10V/m, 2.0...2.7 GHz	Performance Criteria 1
Input: 1kV, 5 kHz	Performance Criteria 1	Conducted radio frequency immunity	EN/IEC 61000-4-6
Electrical surge immunity	EN/IEC 61000-4-5	10V/m, 0.15...80 MHz	Performance Criteria 1
Output, line to line, 1kV	Performance Criteria 1	Voltage dips immunity	EN/IEC 61000-4-11
Output, line to earth, 2kV	Performance Criteria 1	0% for 0.5/1cycle	Performance Criteria 2
Input, line to line, 1kV (A1, A2)	Performance Criteria 2	40% for 10 cycles	Performance Criteria 2
Input, line to earth, 2kV (A1, A2)	Performance Criteria 2	70% for 250 cycles	Performance Criteria 2
11, 12, 14, line to line, 1kV	Performance Criteria 1	Voltage interruptions immunity	EN/IEC 61000-4-11
11, 12, 14, line to earth, 2kV (versions with fan only)	Performance Criteria 1	0% for 5000 ms	Performance Criteria 2
EMC emission	EN/IEC 60947-4-3 ⁽¹⁾	Radio interference field emission (radiated)	EN/IEC 55011
		30...1000 MHz	Class A (Industrial)

(1) For conformance to EN/IEC 61000-6-4, an external capacitor class X1, 220nF, 275VAC is to be connected across the input control lines A1-A2 for AC control versions.

Note:

- Control input lines must be installed together to maintain products susceptibility to Radio Frequency Interference.
- Use of AC solid-state contactors may according to the application and the load current, cause conducted radio interferences. Use of mains filters may be necessary for cases where the user must meet E.M.C requirements. The capacitor values given inside the filtering specification tables are only indications, the filter attenuation depends 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 the user 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 40Ω, 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.

Performance Criteria Definitions:

- Performance Criteria 1 (Performance Criteria A): No degradation of performance or loss of function is allowed when the product is operated as intended.
- Performance Criteria 2 (Performance Criteria B): During the test, degradation of performance or partial loss of function is allowed. However, when the test is completed, the product should return operating as intended by itself.
- Performance Criteria 3 (Performance Criteria C): Temporary loss of function is allowed, provided the function can be restored by manual operation of the control.

Table 31 - Filtering - EN / IEC 55011 Class A compliance

Cat. No.	Suggested Filter for Compliance	Max. Heater Current [A]
156-C2P25NA	220nF / 275V /X1	25
156-C2P25NC	220nF / 760V /X1	25
156-C2P40NC	330nF / 760V /X1	40
156-C2P75NC	470nF / 760V /X1	65
156-C3P20NA	220nF / 275V /X1	25
156-C3P20NC	220nF / 760V /X1	25
156-C3P25NC	330nF / 760V /X1	25
156-C3P30NC	470nF / 760V /X1	30
156-C3P40NC	470nF / 760V /X1	40
156-C3P65NC	470nF / 760V /X1	65

Figure 30 - Filter Connection Diagrams

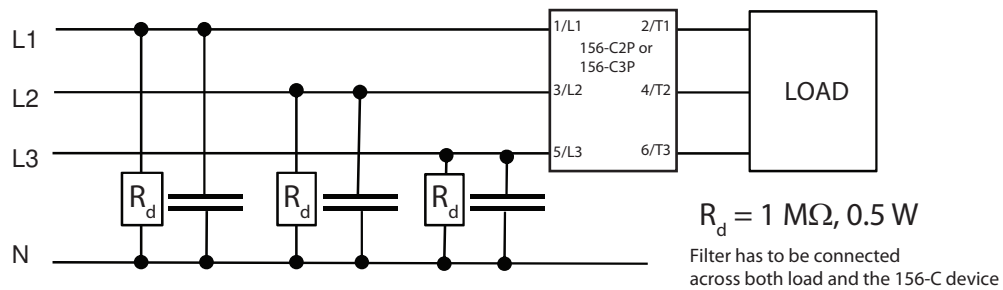
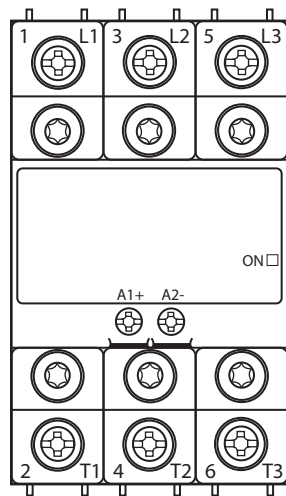
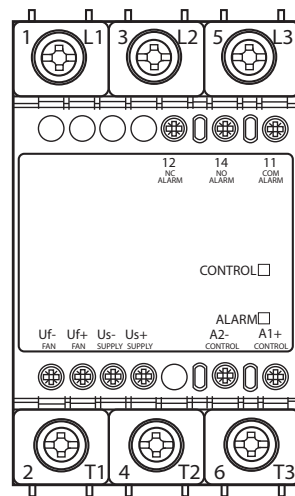


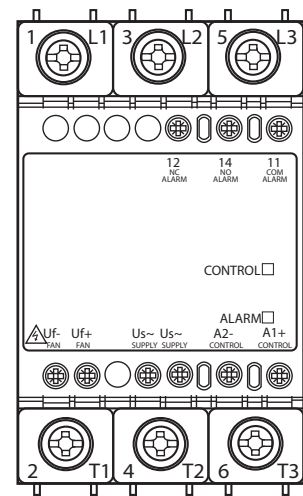
Figure 31 - Terminal Layout



Cat. Nos. 156-C2P25, 156-C2P40,
156-C3P20, 156-C3P25, 156-C3P30



Cat. Nos. 156-C2P75, 156-C3P40, 156-C3P65



Cat. Nos. 156-C3P40, 156-C3P65

Terminal Label	Description
1/L1, 2/L2, 3/L3	Main connections
2/T1, 4/T2, 6/T3	Load connections
A1(+)	Positive control signal
A2(-)	Control ground
Us(+)	External supply positive signal
Us(-)	External supply ground
Us(~)	AC external supply
Uf(+)	Fan supply positive signal (no connection by end user is required)
Uf(-)	Fan supply ground (no connection by end user is required)
12	Alarm EMR, normally closed
14	Alarm EMR, normally open
11	Alarm EMR, common terminal



SHOCK HAZARD: Connections to Uf+, Uf- are provided readily terminated by manufacturer. However, in case of needed user intervention on terminals Uf+, Uf- for Cat. Nos. 156-C3P40 and 156-C3P65, the mains supply has to be turned off first to avoid risk of electrical shock.

Table 32 - Power Connection (1/L1, 3/L2, 5/L3, 2/T1, 4/T2, 6/T3) Specifications

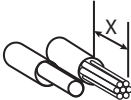
Attribute			Cat. Nos.			
			156-C2P25, 156-C3P20,-25		156-C2P40, -75, 156-C3P30, -40, -65	
Conductor			Use 75 °C copper (Cu) conductors			
Stripping Length (X)			12 mm		11 mm	
Connection type			M4 screw with captivated washer		M5 screw with box clamp	
Rigid Conductors (Solid & Stranded) UL/ cUL rated data						
			[mm ²]	(2) 2.5...6	2.5...6	2.5...25
			[AWG]	(2) 14...10	14...10	14...3
Flexible with end sleeve						
			[mm ²]	(2) 1.0...2.5 (2) 2.5...4	1.0...4	2.5...16
			[AWG]	(2) 18...14 (2) 14...12	18...12	14...6
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)	
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 device. PE connection required when product is intended to be used in Class 1 applications according to EN/IEC 61140.			

Table 33 - Control Connection Specifications

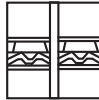
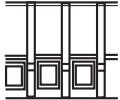
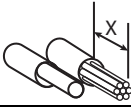
Attribute			Description		
			A1, A2 Connections		A1, A2, Us, Uf, 21, 22, 24 connections
Conductor			Use 75 °C copper (Cu) conductors		
					
Stripping Length (X)			8mm		
Connection Type			M3 screw with captivated washer		M3 screw with box clamp
Rigid Conductors (Solid & Stranded) UL/ cUL rated data		[mm ²]	(2) 0.5...2.5	0.5...2.5	1...2.5
		[AWG]	(2) 18...12	18...12	18...12
Flexible with end sleeve		[mm ²]	(2) 0.5...2.5	0.5...2.5	0.5...2.5
		[AWG]	(2) 18...12	18...12	20...12
Torque specifications			Pozidriv 1 UL: 0.5 N•m (4.4 lb•in) IEC: 0.5...0.6 N•m (4.4...5.3 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)

Figure 32 - Basic Connection Diagram

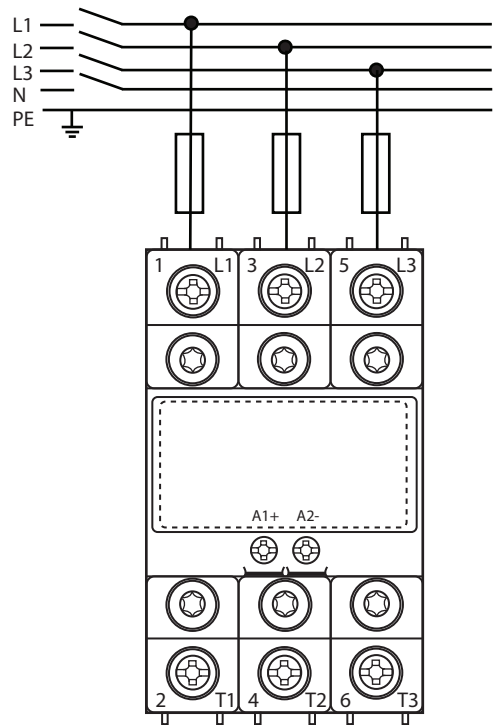


Figure 33 - Dual-phase Connections

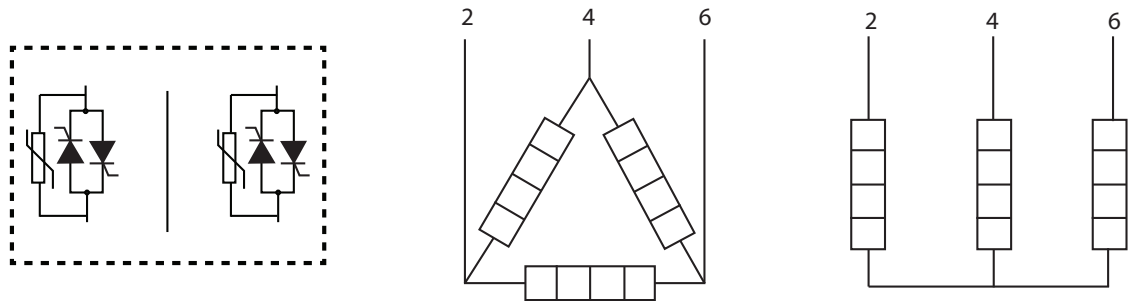


Figure 34 - Three-phase Connections

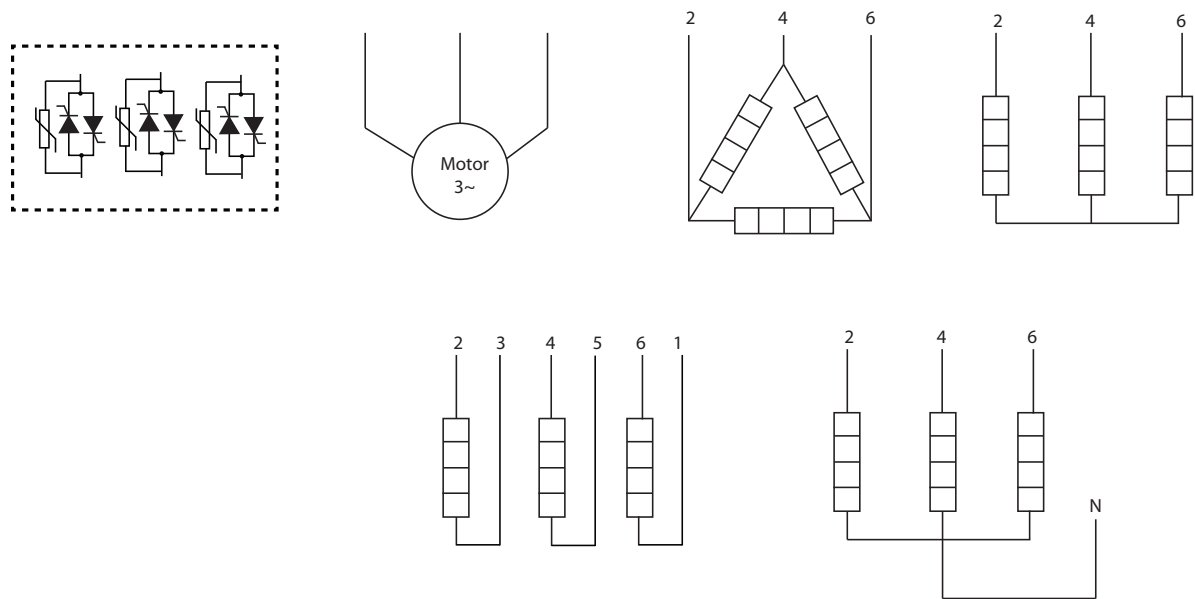
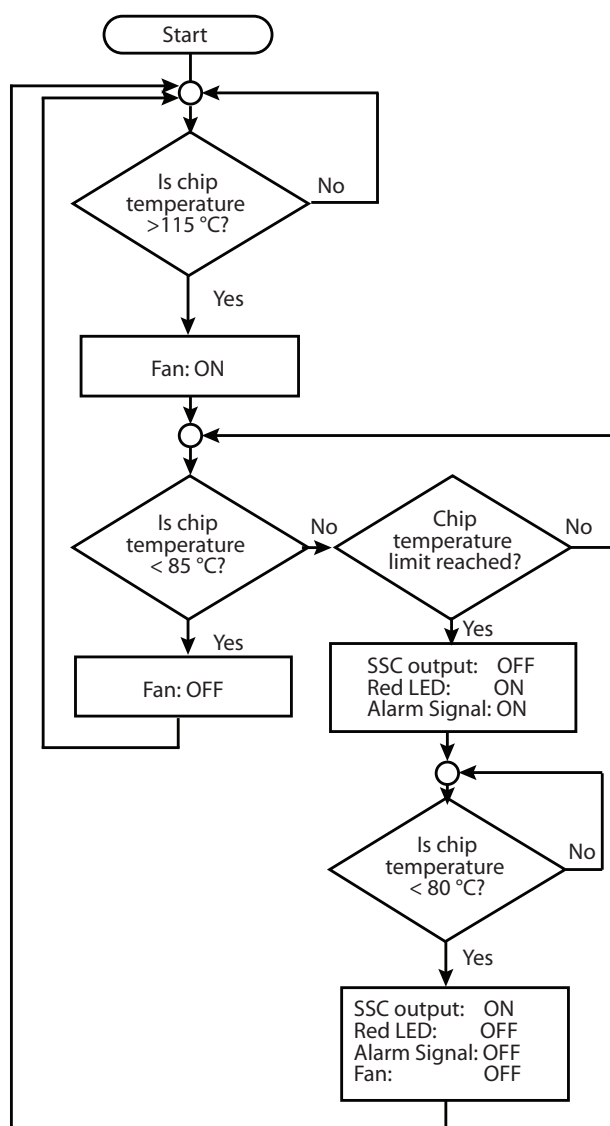


Figure 35 - Fan Operation for Versions with Integrated Fan**Table 34 - Red LED Alarm Indications**

Flashes	Description of Fault	Timing Diagram
2	Mains loss	
3	Load loss or SSR short circuit	
4	SSR open circuit	
Steady	SSR overtemperature	

Short Circuit Protection

Protection Co-ordination, Type 1 vs 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 [Table 35](#) are suitable for use on a circuit capable of delivering not more than 100,000 A_{rms} Symmetrical Amperes, 600 Volts maximum when protected by fuses. Tests at 100,000 A were performed with Class J fuses, fast acting; refer to [Table 35](#) and for maximum allowed ampere rating of the fuse. Use fuses only.

Tests with Class J fuses are representative of Class CC fuses.

Table 35 - Type 2 Coordination Ratings (IEC/EN 60947-4-2/ -4-3) for Motor Load Applications

Cat. No.	Prospective Short Circuit Current [kA _{rms}]	Ferraz Shawmut		Siba		Max. Rated Voltage [V AC]
		Max. Fuse Size [A]	Fuse Part No.	Max. Fuse Size [A]	Fuse Part No.	
156C-C2P25	100	40	A70QS40-4	32	50 142 06 32	600
156C-C2P40	100	60	A70QS60-4	63	50 194 20 63	600
156C-C2P75	100	100	A70QS100-4	125	50 196 20 125	600
156C-C3P20	100	40	A70QS40-4	32	50 142 06 32	600
156C-C3P25	100	40	A70QS40-4	32	50 142 06 32	600
156C-C3P30	100	40	A70QS40-4	40	50 194 20 40	600
156C-C3P40	100	50	A70QS50-4	50	50 194 20 50	600
156C-C3P65	100	100	A70QS100-4	125	50 196 20 125	600

Table 36 - Type 2 Coordination Ratings (IEC/EN 60947-4-2/ -4-3) for Heater Load Applications

Cat. No.	Prospective Short Circuit Current [kA _{rms}]	Ferraz Shawmut		Siba		Max. Rated Voltage [V AC]
		Max. Fuse Size [A]	Fuse Part No.	Max. Fuse Size [A]	Fuse Part No.	
156-C2P25	10	40	660 URC 14x51/40	32	50 142 06 32	600
	10	40	6.9xx gRC URD 22x58/40			600
	100	40	660 URD 22x58/40			600
	100	40	A70QS40-4			600
156-C2P40	10	63	6.9xx gRC URC 14x51/63	63	50 194 20 63	600
	100	63	6.9xx gRC URD 22x58/63			600
	100	60	A70QS60-4			600
156-C2P75	10	100	6.9xx gRC URD 22x58/100	125	50 196 20 125	600
	100	100	660 URQ 27x60/100			600
	100	100	A70QS100-4			600
156-C3P20	10	32	6.9xx gRC URC 14x51/32	32	50 142 06 32	600
	100	32	6.9xx gRC URC 14x51/32			600
	100	40	A70QS40-4			600
156-C3P25	10	40	660 URC 14x51/40	32	50 142 06 32	600
	10	40	6.9xx gRC URD 22x58/40			600
	100	40	660 URD 22x58/40			600
	100	40	A70QS40-4			600
156-C3P30	10	40	6.9xx gRC URC 14x51/40	40	50 194 20 40	600
	100	40	6.9xx gRC URC 14x51/40			600
	100	40	A70QS40-4			600
156-C3P40	10	63	6.9xx gRC URC 14x51/63	50	50 194 20 50	600
	100	63	6.9xx gRC URC 14x51/63			600
	100	50	A70QS50-4			600
156-C3P65	10	100	6.9xx gRC URC 22x58/100	125	50 196 20 125	600
	100	90	660 URD 22x58/90			600
	100	100	A70QS100-4			600

Table 37 - Power Output

Device Type	Cat. No.	Description									
		Housing Size W x H x D [mm]	Rated Operating Current [A]			Min. Operating Current [mA]	Max. Repetitive Overload Current (AC _{rms}) t = 1 s	Non-repetitive Surge Current (AC _{rms}) T _j = 240 °C t = 10 ms	Max. Off-state Leakage Current @ Rated Voltage and Frequency T _j = 40 °C t = 10 ms [mA]	I ² t for Fusing t = 10 ms	Critical dV/dT Off-state
			AC51 @ 25 °C	AC51 @ 40 °C	AC53a @ 40 °C						
Dual-phase	156-C2P25...	54 x 110 x 113	32	27	11	250	61	600	5	1800	1000
	156-C2P40...	72 x 110 x 121	50	40	16	400	107	1150	5	6600	1000
	156-C2P75...	72 x 141 x 137	85	75	28	500	154	1750	5	15000	1000
Three-phase	153-C3P20...	72 x 110 x 121	25	20	10	250	61	600	5	1800	1000
	153-C3P25...	72 x 110 x 121	32	28	11	250	84	600	5	1800	1000
	153-C3P30...	72 x 110 x 121	37	30	14	400	107	1150	5	6600	1000
	153-C3P40...	54 x 135 x 113	42	42	17	400	107	1150	5	6600	1000
	153-C3P65...	72 x 141 x 137	71	66	25	500	154	1750	5	15000	1000

Table 38 - Type 2 Protection with Bulletin 1492 Miniature Circuit Breakers, Dual- and Three-Phase Contactors

Solid-state Contactor Cat. No. ⁽¹⁾	Miniature Circuit Breaker Cat. No.	Wire Cross Sectional area [mm ²]	Minimum length of Cu wire Conductor ⁽²⁾
156-C2P25 156-C3P20	1492-SPM1B040	1.0	7.6
		1.5	11.4
		2.5	19.0
	1492-SPM1B060	1.0	5.2
		1.5	7.8
		2.5	13.0
		4.0	10.8
	1492-SPM1B100	1.5	12.6
		2.5	21.0
	1492-SPM1B130	2.5	25.0
		4.0	40.0
156-C2P40 156-C3P25 156-C3P30 156-C3P40	1492-SPM1B100	1.5	4.2
		2.5	7.0
		4.0	11.2
	1492-SPM1B160	2.5	13
		4.0	20.8
		6.0	31.2
156-C2P75 156-C3P65	1492-SPM1B160	2.5	3.1
		4.0	5.0
		6.0	7.5
	1492-SPM1B250	4.0	8.0
		6.0	12.0
		10.0	20.0
		16.0	32.0
	1492-SPM1B320	6.0	11.3
		10.0	18.8
		16.0	30.0

(1) A prospective current of 6 kA and a 230/200V power supply system is assumed for these specifications. For cables with different cross sections, consult Technical Support.

(2) Between the miniature circuit breaker and the load (including the return path, which goes back to the main if applicable).

Application Diagrams

Applications for Non-motor Loads

Dual-phase Contactors

Figure 36 - Dual-phase Contactor, Line-Neutral/Line-Line Connection

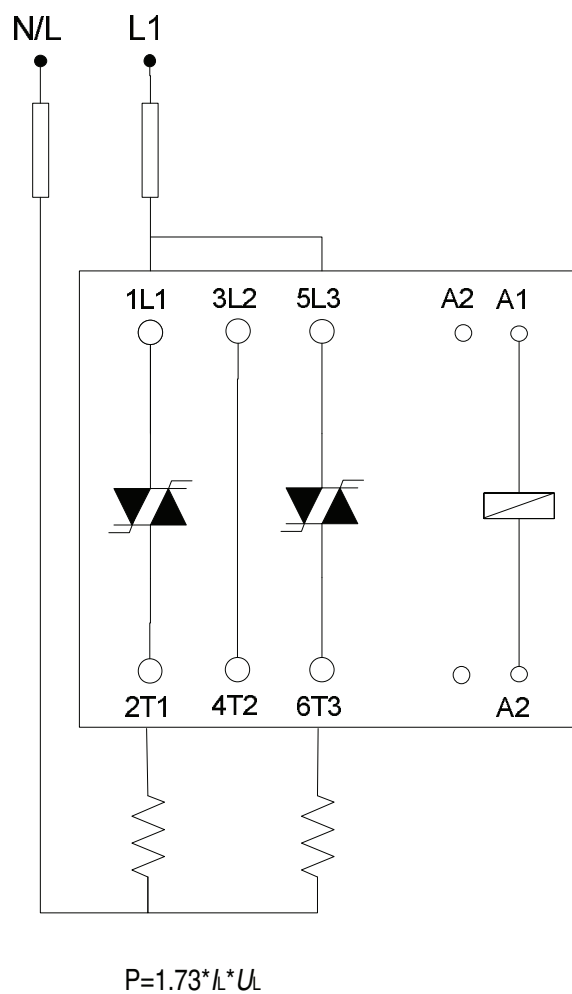
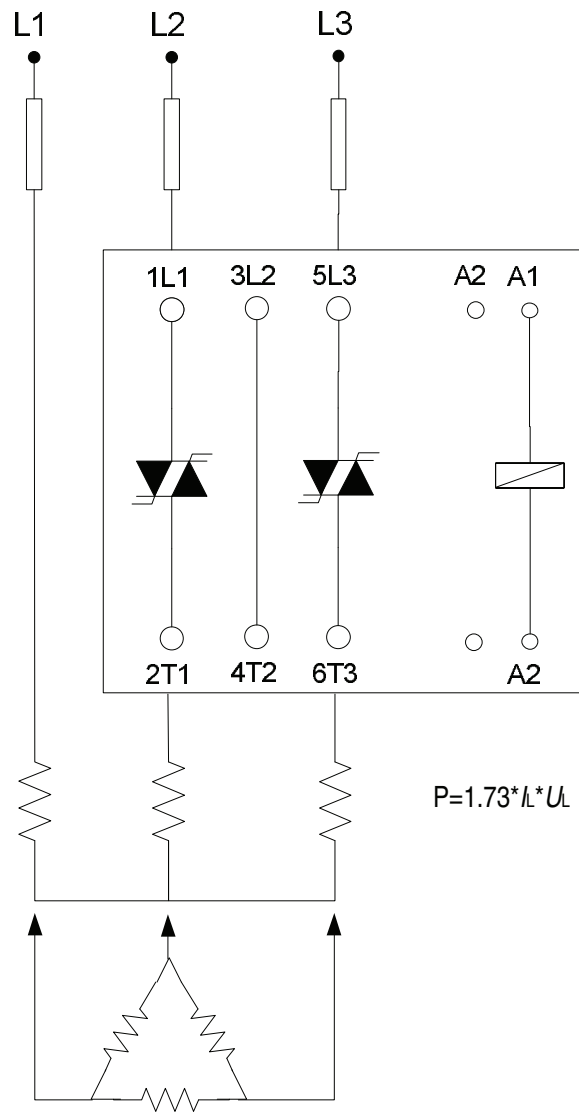
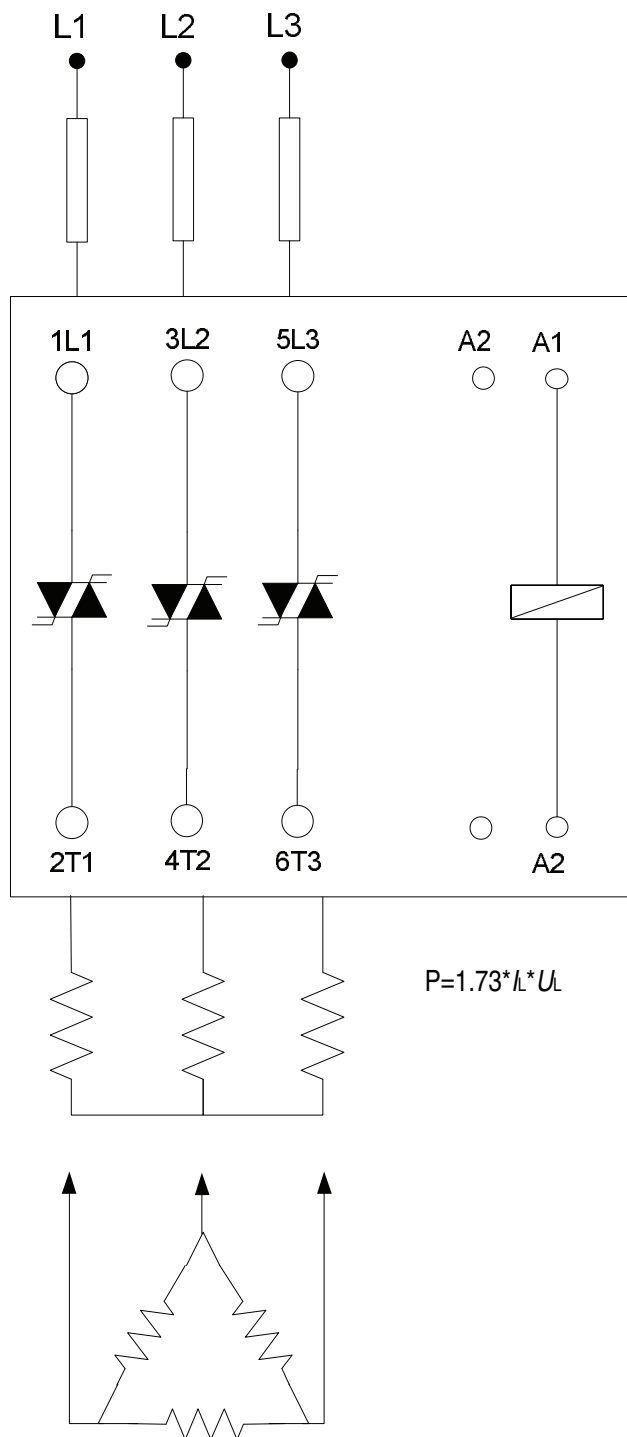
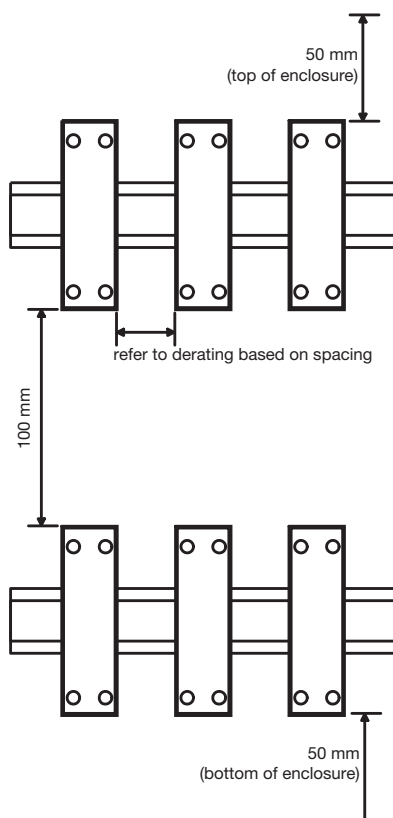


Figure 37 - Dual-phase Contactor in Three-phase Application, Delta and Star Connection

*Three-phase Contactors***Figure 38 - Three-phase Contactor, Delta and Star Connection**

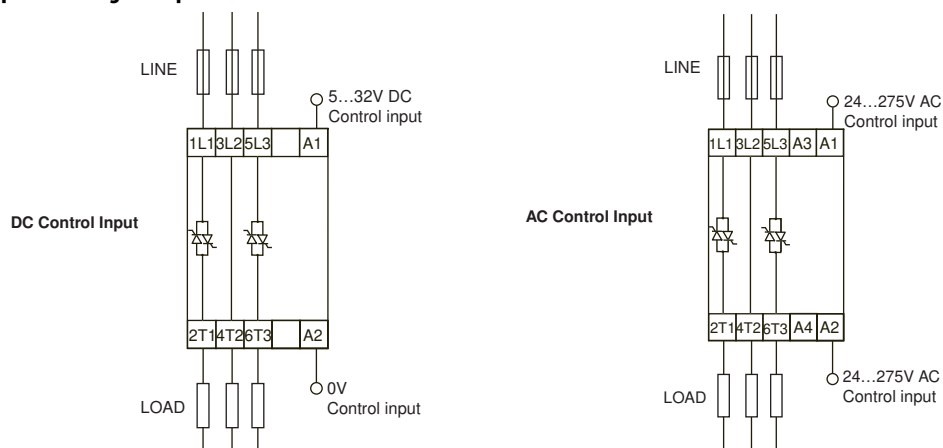
Recommended Contactor Spacings



Wiring Diagrams

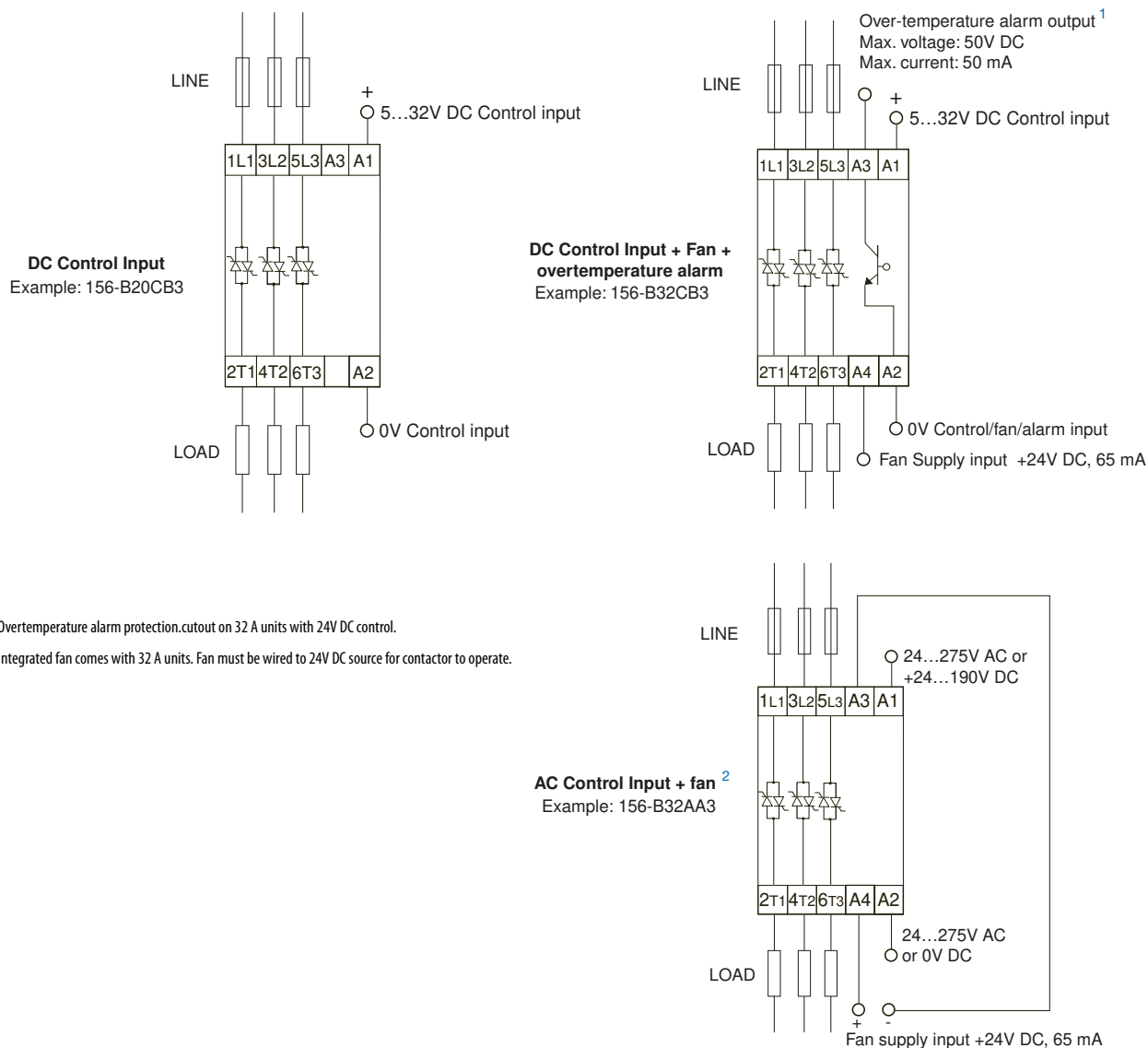
Dual-phase Devices

Figure 39 - Dual-phase wiring example



Three-phase Devices

Figure 40 - Three-phase wiring example



1) Overtemperature alarm protection, cutout on 32 A units with 24V DC control.

2) Integrated fan comes with 32 A units. Fan must be wired to 24V DC source for contactor to operate.

Approximate Dimensions

Dimensions in millimeters (inches). Dimensions are not intended for manufacturing purposes.

Dual-phase Devices

Figure 41 - Cat. No. 156-C2P25...

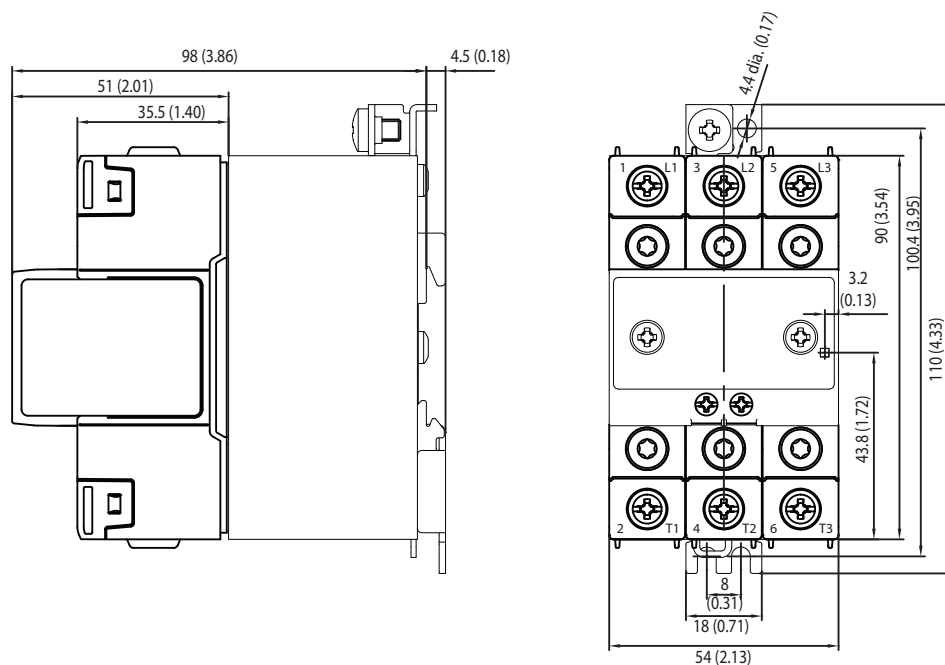
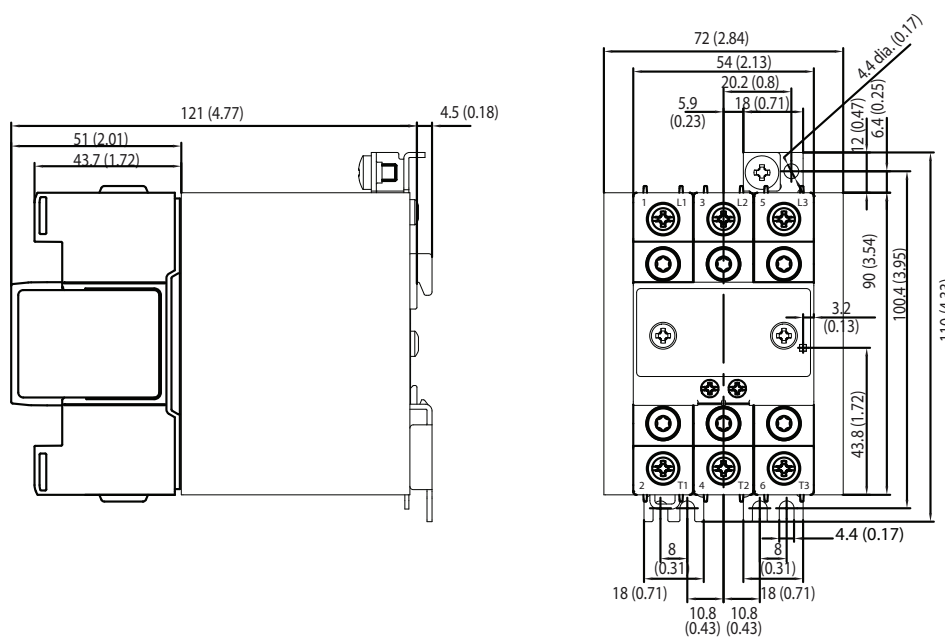
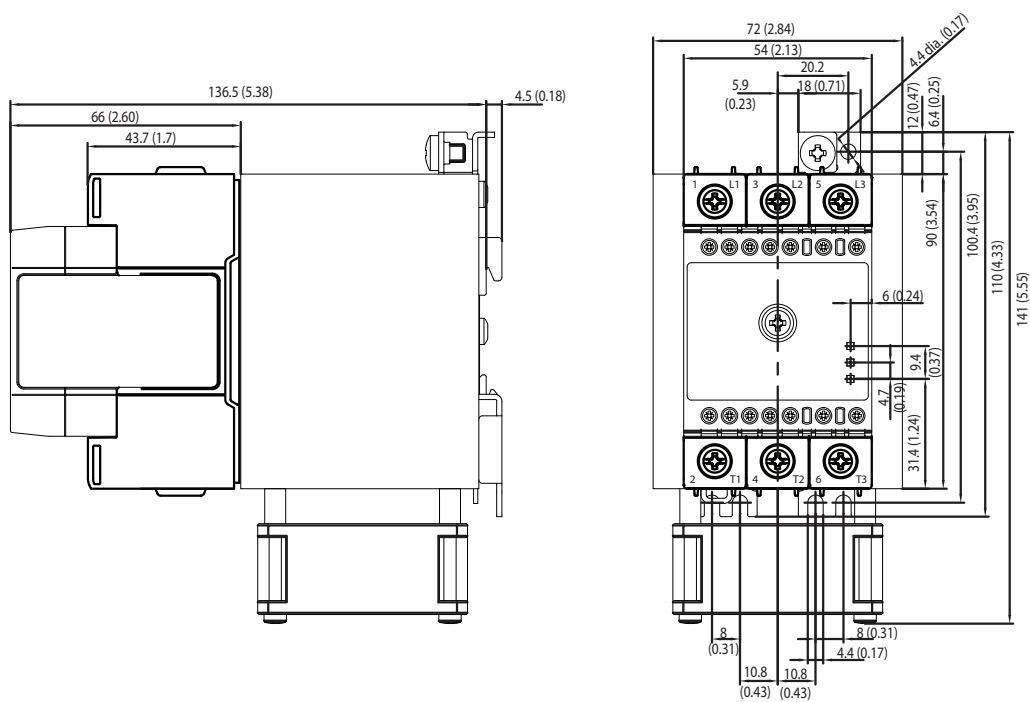


Figure 42 - Cat. No. 156-C2P40...



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